Programmable DC Electronic Load

PEL-2000B Series

USER MANUAL

ISO-9001 CERTIFIED MANUFACTURER

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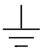
Table of Contents

SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow when operating the PEL-2000B series, and when keeping it in storage. Read the following before operating the PEL-2000B series to ensure your safety and to keep the PEL-2000B series in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the PEL-2000B series.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the PEL-2000B series or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal
	Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Safety Guidelines

General Guideline ⚠ CAUTION	• Do not place any heavy object on the PEL-2000B series. • Avoid severe impact or rough handling that leads to damaging the PEL-2000B series. • Do not discharge static electricity to the PEL-2000B series. • Do not block or obstruct the cooling fan vent openings. • Do not perform measurement at circuits directly connected to Mains (Note below). • Do not disassemble the PEL-2000B series unless you are qualified as service personnel. • The equipment is not for measurements performed for CAT II, III and IV. (Measurement categories) EN 61010-1 specifies the measurement categories and their requirements as follows. The PEL-2000B series falls under category I. • Measurement category IV is for measurement performed at the source of low-voltage installation. • Measurement category III is for measurement performed in the building installation. • Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation. • Measurement category I is for measurements performed on circuits not directly connected to Mains.
Power Supply ⚠ WARNING	• AC Input voltage range: 100-120Vac/ 200-240Vac (90-132Vac/ 180-250Vac) Frequency: 47~63Hz Power rating: PEL-2004B: 250VA Max PEL-2002B: 150VA Max • Connect the protective grounding conductor of the AC power cord to an earth ground, to avoid electrical shock.

Fuse	• Fuse type: T3.15A/250V
⚠ WARNING	• Make sure the correct type of fuse is installed before power up. • To avoid fire, only replace the fuse with the specified type and rating. • Disconnect the power cord before fuse replacement. • Make sure the cause of a fuse blowout is fixed before replacing the fuse.
Cleaning the PEL-2000B	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid. • Do not use chemicals or cleaners containing harsh material such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Temperature: 0°C to 40°C • Altitude: Up to 2000m • Transient Overvoltage on the main supply is 2500V. (Pollution Degree) EN 61010-1 specifies the pollution degrees and their requirements as follows. The PEL-2000B series falls under degree 2. Pollution refers to “addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity”. • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. • Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to

condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

Storage environment

- Location: Indoor
- Relative Humidity: < 80%
- Temperature: −10°C to 70°C

Disposal

Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

GETTING STARTED

This chapter describes the features and functions of the PEL-2000B series, including the front and rear panel appearance, panel installation and connection types. Use the Tutorial section for quick access to step by step instructions on the main functions.

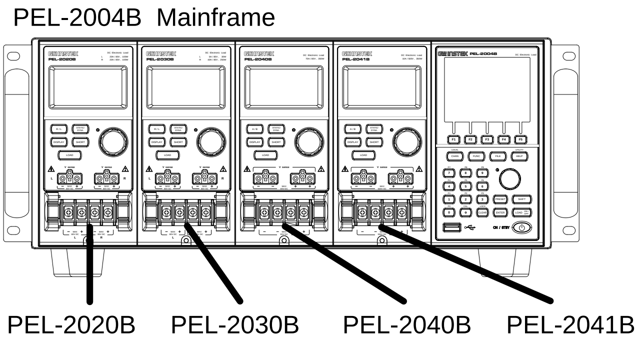
Main Features

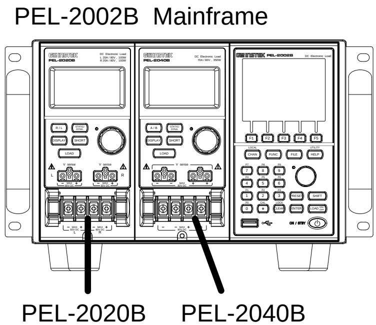
Description	The PEL-2002B and PEL-2004B are multichannel programmable DC electronic load mainframes. The PEL-2002B mainframe is able to hold 2 load modules, whilst the PEL-2004B is able to hold 4. The flexible module configuration allows the mainframes to either sink multiple loads independently or large loads when used in parallel. The PEL-2000B series support four operation modes: constant current (CC), constant voltage (CV and CV+CC), constant resistance (CR) and constant power (CP). Constant current and constant resistance mode can operate in either static or dynamic mode.
Feature Overview	• Flexible operation with removable load modules. • Multiple independent isolated channels. • High performance, up to 5 digit resolution. • High slew rate enabling a high response speed • High capacity when frame linked. • Different load module types can be used in the same mainframe. • Dedicated parallel mode. • Supports rack mount installation. • Supports frame link connections, with up to 4 slave units. • Color LCD display. • 120 different sets of programmable sequences. • Accurate load simulation using Sequences.

	• 4 panel setups. • USB flash drive support.
Interface	• USB • RS-232C/RS485 • LAN • GPIB (optional)

Series Overview

The PEL-2000B series comprises of two different Mainframes: the PEL-2002B and the PEL-2004B. The Mainframes differ by the number of load modules that can be accommodated. The PEL-2002B has two load module slots whilst the PEL-2004B has 4. There are 4 different load module models, the PEL-2020B, PEL-2030B, PEL-2040B and PEL-2041B.





The 4 different load module models each differ in the amount of current, voltage and power and the number of channels that the load module can accommodate. The procedures in this manual will be load module model independent unless specifically stated. Below is a table showing the basic differences between each load module model. For detailed specifications, please see page 302.

Load Module	Channels	Power (W) CH L/R (low/high range)	Current (A) Range Low/High	Voltage (V)
PEL-2020B (100Wx2)	2	100/100	2/20	0-80
PEL-2030B (30/(25/250W))	2	30/(25/250)	5/4/40	0-80
PEL-2040B	1	(35/350)	7/70	0-80
PEL-2041B	1	(35/350)	1/10	0-500

Package Contents and Accessories

The PEL-2000B electronic load has a number of standard and optional accessories that can be ordered. For more information please consult your authorized distributor for details.

Standard Accessories	Description
Power Cable	Mains power cable (region dependent) (18AWGx3C, 125V/ 10A, 1.8m)
CD ROM	Contains PEL-2000B series Electronic DC Load User Manual, Programming Manual and USB Driver
GTL-120	Load cables 2X red, 2X black (per load module)
GTL-121	Remote sense cables, 1X red, 1X black (per load channel)
PEL-003	3 sets for PEL-2004B; 1 set for PEL-2002B

Options	Description
PEL-2020B	Load Module
PEL-2030B	
PEL-2040B	
PEL-2041B	
PEL-001	GPIB interface

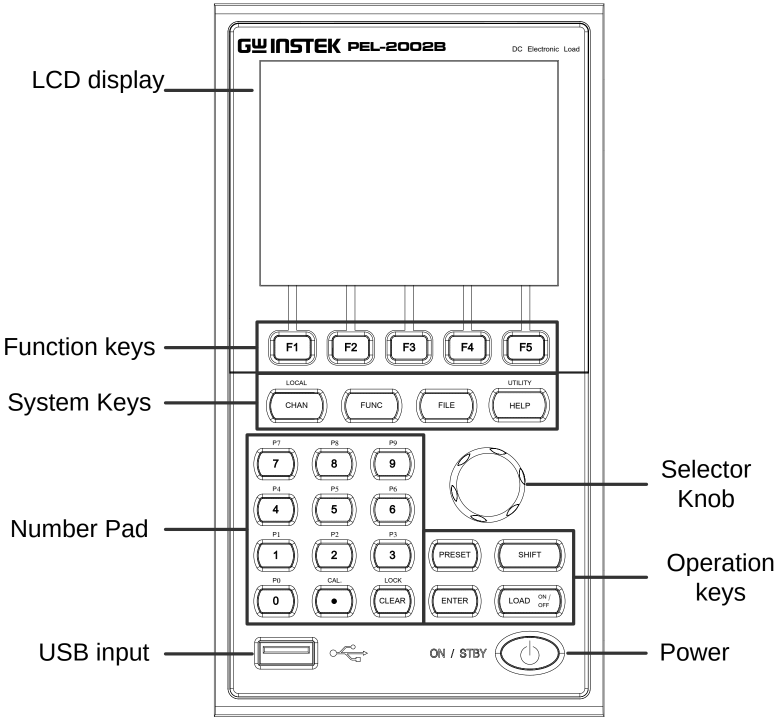
Optional Accessories	Description
PEL-003	Panel Cover
GTL-246	USB
GTL-248	GPIB cable
GTL-249	Frame link cable
GTL-259	RS232 cable with DB9 & RJ-45
GTL-260	RS485 cable with DB9 & RJ-45

Measurement Overview

The PEL-2000B series has a number of different operating modes that are completely configurable. All the modes have customizable Go/NoGo limits, range limits, timers, slew rates, alarms and protection limits. For parallel loads, there is a dedicated Parallel configuration mode. To make tests, Programs and Sequences can be created.

Function	Description
Constant Current Mode (CC)	In constant current mode, the load module will sink a constant amount of current, regardless of the voltage.
Constant Voltage Mode (CV)	Under constant voltage mode, the voltage remains unchanged, regardless of the current.
Constant Resistance Mode (CR)	In constant resistance mode, the resistance load will remain unchanged as the voltage and current remain proportional.
Constant Power Mode (CP)	In constant power mode, the load module will ensure the power consumed is constant.
Programmable Sequences (Prog.)	The load module supports programming sequences. With up to 120 different memory settings in 12 programs with 10 sequences.
Sequences (Seq.)	Used to create load profiles to accurately simulate a load. Sequences can be created for each channel.
Group Unit Mode	Group Unit Mode enables the PEL-2000B series mainframes to easily use load modules (of the same type/rating) in parallel. Parallel mode is used in conjunction with CC or CR modes. CP and CV mode cannot be used with this mode.

Front Panel Overview



LCD display	320 by 240, TFT LCD display.	
Function keys	F1 ~ F5	Assigned to the menu functions on the bottom of the display.
System Keys		CHAN/LOCAL is used to select the load channel. Combined with the shift key, Local is used to activate local control (during remote control via the interface or frame link connections).

LOCAL
CHAN

Brings up the Channel Menu.

SHIFT + CHAN (LOCAL)

Used to activate local control mode during remote control via the interface

FUNC

Used to access the Program, Sequence or OCP automation menu.

FILE

Used to access the File menu.

UTILITY
HELP

Brings up the Help menu and utility menu.

UTILITY
HELP

Provides help for the last function /key pressed.

SHIFT + HELP (UTILITY)

Activates the Utility Menu.

Number pad

Enter numerical values, or to save/recall presets (P0-P9).

P0
0

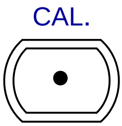
Number values.

PRESET + 0 (P0)

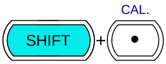
Preset numbers P0-P9.

CAL.
•

Decimal point and Calibration key



Decimal point.



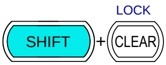
Activate calibration mode.

Note

Please note, calibration mode is not supported.
Please see your distributor for calibration needs.

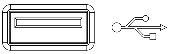
Clears current values. Alternative function locks the keys and the Selector knob.

Clears the current value.



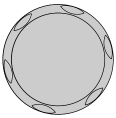
Locks all the keys and Selector knob.

USB Input

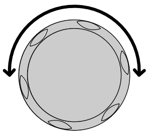


USB flash memory slot.

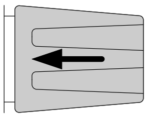
Selector Knob



Used to select operations and to increase/decrease values.



When turned left or right moves the cursor in menus or changes the selected item or value.



When pushed down, acts as the Enter key.

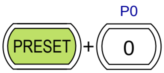
Operation Keys

Saves and recalls preset settings and values.

When pressed in combination with the number pad, Presets P0-P9 can be recalled or saved.

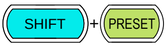
Inactive

Active. Used in combination with the number pad and/or shift key.



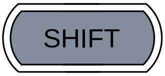
Press to recall a channel preset

Hold to save a channel preset

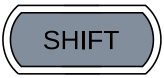


Press to recall all channel presets.

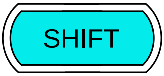
Hold to save all channel presets.



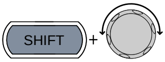
The shift key is used to access alternate functions assigned to select keys.
The shift key is also used to toggle between coarse and fine control mode when used in conjunction with the selector knob to adjust parameters.



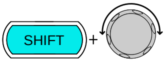
Inactive mode.



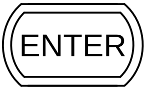
Active. When active the shift key can be used to access the Local and Utility menus.



Coarse control mode.



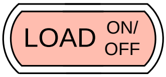
Fine control mode



Confirms selections.

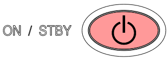
Turns the current load/channel on or off

Load is currently off. (unlit)

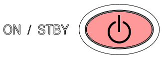


Load is currently on. (orange light)

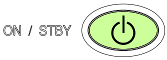
Power



Turns the unit on or into standby mode.

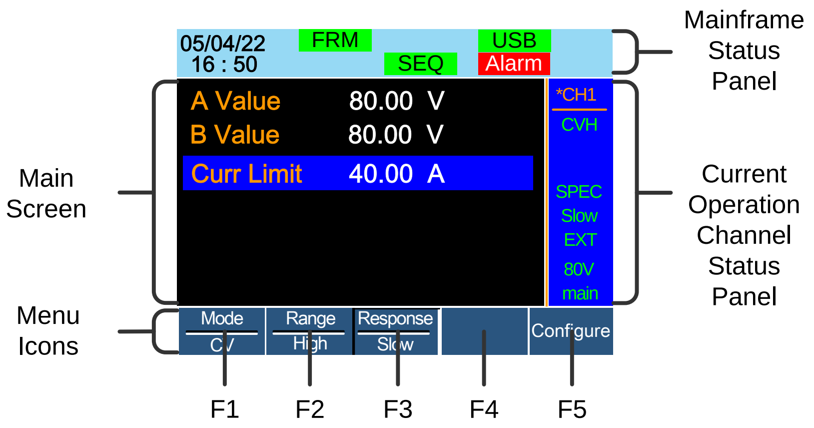


Standby mode.



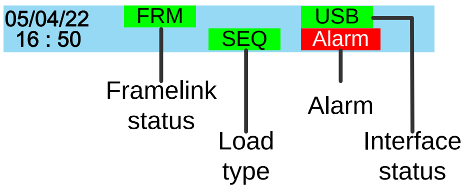
On.

Display Overview – Mainframe

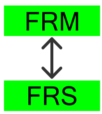


Mainframe Status Panel

The Mainframe Status Panel displays the status of the Mainframe interface, programs and alarm status.



Frame Link Status

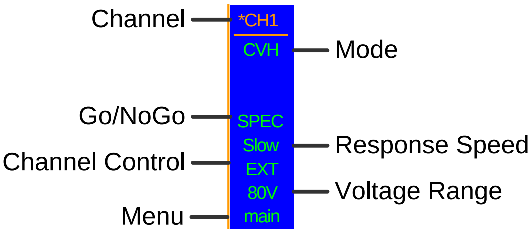


Indicates Frame Link is turned on and that the mainframe is set as either a master (FRM) or slave (FRS) unit.

Load Type	LOAD LOAD ↕ PROG PROG ↕ SEQ SEQ	The Load Type Icon indicates if a Sequence (SEQ) or Program (PROG) is turned on. If not then LOAD is displayed as default. When any Load type is running, their icon will turn orange.
Interface Status	RS232 ↕ GPIB ↕ USB ↕ LAN	The interface status icon displays which interface type is set.

Current Operation Channel Status Panel

The Current Operation Channel Status panel generally displays the status of the current channel.



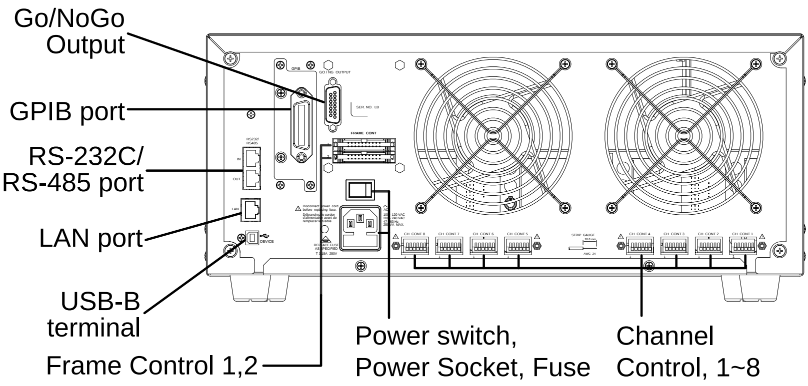
Channel	CH1~ CH8	Displays the current channel.
	*CHx	* = independent mode
	CHxS	S = Group channels Sync mode
	CHxP	P = Group channels Parallel mode
Mode	Displays the current mode.	
	CCL	CC Static Low Range
	CCH	CC Static High Range
	CCDL	CC Dynamic Low Range
	CCDH	CC Dynamic High Range
	CRL	CR Static Low Range
	CRH	CR Static High Range
	CRDL	CR Dynamic Low Range
	CRDH	CR Dynamic High Range
	CVL	CV Static Low Range
	CVH	CV Static High Range
	CPL	CP Low Range
	CPH	CP High Range
Go/NoGo	SPEC	If Go/NoGo is turned on, SPEC will be displayed.
Response Speed	Slow1/ Slow2/ Slow3 Fast	In CV mode the response speed will be shown, Slow or Fast.

Channel Control	EXT	When Channel Control is set to External, EXT will be displayed.
Voltage Range	Displays the voltage range of the current setting.	
Menu	Shows the current menu.	
	main	= Chan menu
	conf	= Chan→Configure menu
	s_edit	= Chan→Seq.Edit menu
	file s_loop	= File menu
		= Chan→Seq.Edit→Loop menu

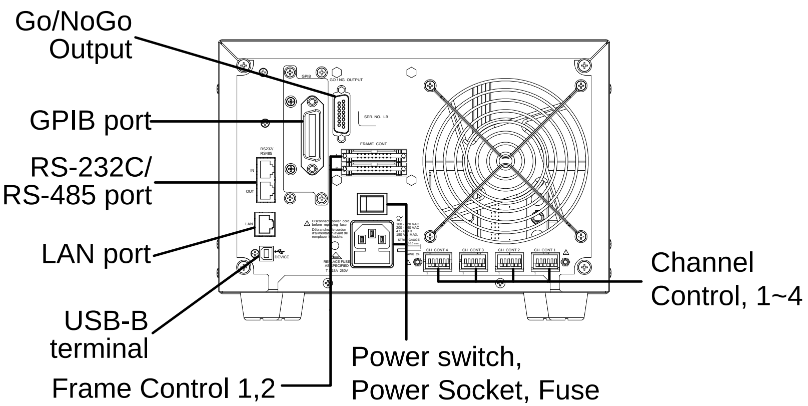
Main Screen	Main display screen.	
Menu Icons	F1~F5	Each Menu Icon is controlled by the F1~F5 function keys directly below.

Rear Panel Overview

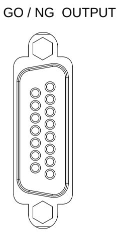
PEL-2004B



PEL-2002B



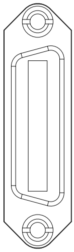
Go/NoGo Output



The Go/NoGo Output terminal outputs a pass (high)/fail (low) voltage for each channel.

See page 277, 59 for details.

GPIB port

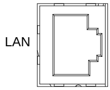


The GPIB port is used for remote control connections.

GPIB: 24-pin female

See pages 270 for remote control details.

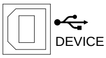
LAN port



Ethernet port for controlling the PEL-2000Bremotely.

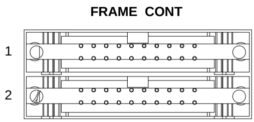
See pages 237 for remote control details.

USB-B (Device) port



The USB-B (device) port, like the RS232C/RS485/GPIB/LAN port is used for remote control.

Frame Control Port



The Frame Control port is used for Frame Link connections. Mainframes are daisy-chained together. There are two Frame control ports.

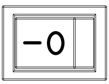
1: Slave

2: Master

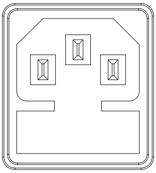
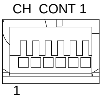
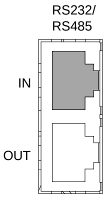
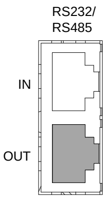
Connection type: MIL 20-pin connector.

For details about frame link connections see page 54, 274.

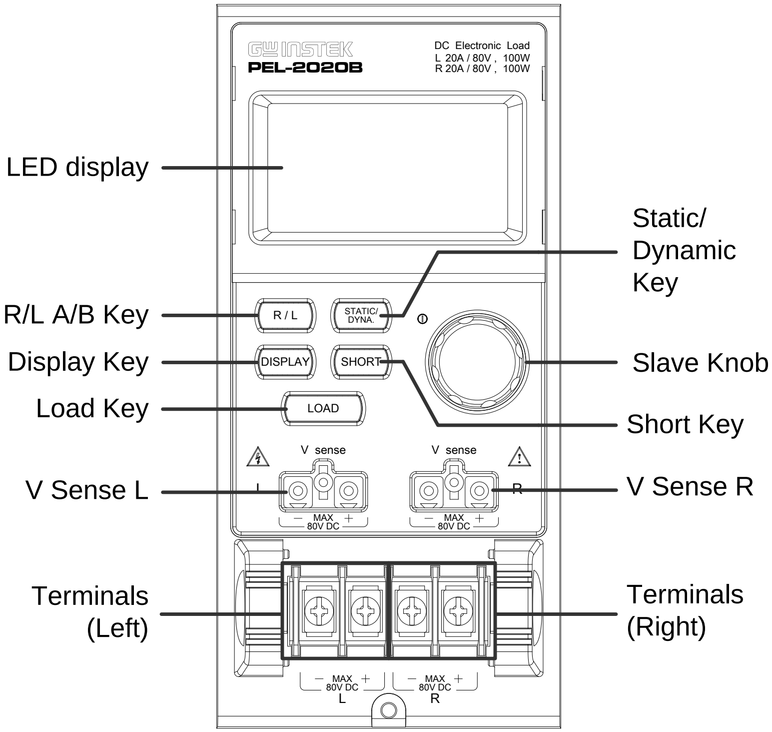
Power Switch



External Power Switch

Power Socket/ Fuse		The power supply socket accepts the AC mains Voltage. The fuse holder is located below the power socket. Power: 47~63Hz Fuse: T3.15A/250V For fuse replacement details see page 289.
Channel Control port (1~8)		Each channel has a dedicated Channel control port to enable external monitoring and control. The channel control port has 6 wire sockets that are screw-less and self clamping. Required wire gauge: 24 AWG For connection or specification details see pages 56 & 272.
Remote-IN port		Two different types of cables can be used for RS232 or RS485-based remote control. RS232-232: RS232 cable with DB9 connector kit. RS485-485: RS485 cable with DB9 connector kit.
Remote-OUT port		RJ-45 connector that is used to daisy chain power supplies with the Remote-IN port to form a communication bus.

Front Panel Overview – Load Module



LED display — 2x5 digit custom LED display.

Right/Left Key

or

A/B Key

The L/R key is used to switch between the right and left load channel on a dual channel load module. The A/B key is used to switch between A&B Values for single channel load modules.

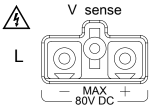
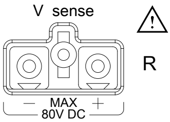
Display Key

Used to alternate the display output on the load module.

Current

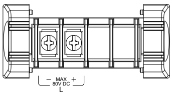
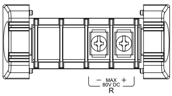
Voltage

<table>
<tr><td></td><td></td><td>Power</td></tr>
<tr><td></td><td></td><td>Load time</td></tr>
<tr><td>Load Key</td><td></td><td>Activates the load for the active channel. (Right or Left)(A or B)</td></tr>
<tr><td>Left Voltage Sense

Right Voltage Sense</td><td></td><td>The voltage sense terminals are used when precise measurement is needed. V Sense terminals are used to compensate for voltage drops across the main terminals caused by the resistance of the load wires.

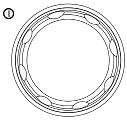
It is automatically activated when connected to a DUT.

The voltage difference between the DUT and load voltage should not exceed 2V, otherwise you will get incorrect measurement for the voltage. (applicable to all models)</td></tr>
<tr><td>Positive and Negative Terminals Left

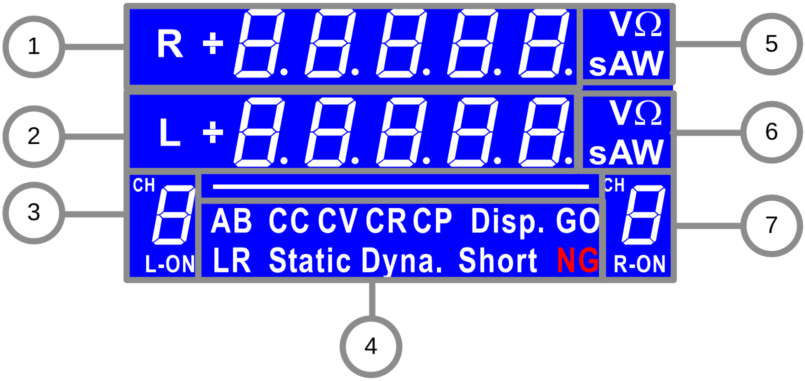
Positive and Negative Terminals Right</td><td></td><td>The terminals for both the left and right side of a load can draw differing amounts depending on the load module specifications.

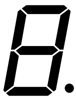
For 2 channel load modules, the left terminals are used for the 1st channel and the right terminals are used for the 2nd channel.

On single channel load modules, the left terminals are the lower (-) potential terminals, whilst the right terminals are the positive (+) potential terminals.</td></tr>
</table>

Static/Dynamic Selector Key		The STATIC/DYNA. Key manually switches the load from Static (manual) to Dynamic loads. Dynamic loads are only supported in CC and CR mode. For more information see page 61 & 64.
Slave Knob (Load)		The Slave Knob is used to edit and vary parameters for the active channel on the local load. Depending on the Mainframe setup, the Slave Knob will either only update the load (locally) or will update both the local module and the mainframe*. The Slave Knob can also be configured to display measured or set values on the local load module**. * For more information on “Knob Type”, see page 206. ** For more information on “Slave Knob”, see page 209.
Short Key		The SHORT key is used to manually short circuit the active channel on the local active load. The Short key can be set to enable or disable in the configure setting. Please refer to page 181 for details. Load on: Pressing or holding the SHORT key will short the load, depending on the short type selected.

LED Display Overview – Load Module



1 & 2 Channel Display			
	R or L	Left and right channel indicator.	
		5 digit display.	
3 & 7 Channel Number Indicator			Indicates the channel number (1-8).
		L-ON	Indicates if the load is active on the load module. (Dual channel load modules)
		ON	Indicates if the load is on for single channel load modules.

4

Mode Indicator

The Mode Indicator LEDs will indicate what the current mode or settings are on the active channel(s).

AB CC CV CR CP Disp. GO
LR Static Dyna. Short NG

A or **B**	Value A or B for a single channel load module. Applies to CR, CV, CP and CC static mode only.
CC	Constant Current Mode (CC) mode activated.
CV	Constant Voltage Mode (CV) mode activated.
CR	Constant Resistance Mode (CR).
CP	Constant Power Mode (CP).
Disp.	Display is shown on dual channel load modules when both left (L) and right (R) channel information is displayed. Press the Display button repeatedly to show information for both channels.
GO	Lights up when Go/NoGo is activated and the load passes (GO) the Go/NoGo limits.
L or **R**	L or R will light up when the left or right channel is selected.
Static	Lights up when in Static mode.
Dyna.	Lights up when in Dynamic mode.
Short	Lights up when a load is shorted.

	NG	Lights up when Go/NoGo is activated and the load fails (NG) the Go/NoGo limits.
5 & 6 Channel Unit Indicators	VΩ sAW	The Unit Indicators display the current unit. **V** Voltage **Ω** Resistance **A** Current **W** Power **s** Second

Installation

The installation chapter describes how to load the different load modules, install the optional GPIB card, the rack mount kit and how to determine each channel number.
If you need to move all installed device to another location, please disassembly the modules first, and then reassembly the modules after moving to the desired location.

Load Module Installation

WARNING

To avoid static electricity, please use appropriate anti-static work practices.

Note

If your Master is PEL-2004A/ PEL-2002A, the mainframe firmware version must be V3.01.UPG or above.

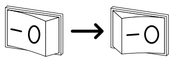
The firmware file and upgrade procedure can be downloaded on the GWInstek website.

Module installation

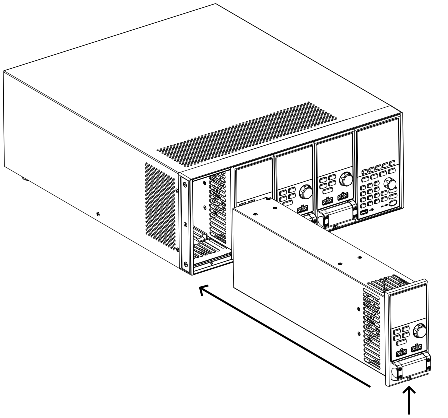
The PEL-2004B and PEL-2002B can accommodate 4 and 2 load modules, respectively. Module loads can have 1 or 2 channels. Installation of load modules is the same for both models.

Steps

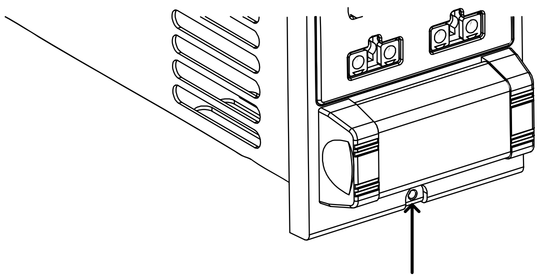
1. Ensure the mainframe is turned off from the rear panel.
   Disconnect the power cord.



2. Slide the module onto the rails of an empty load slot.

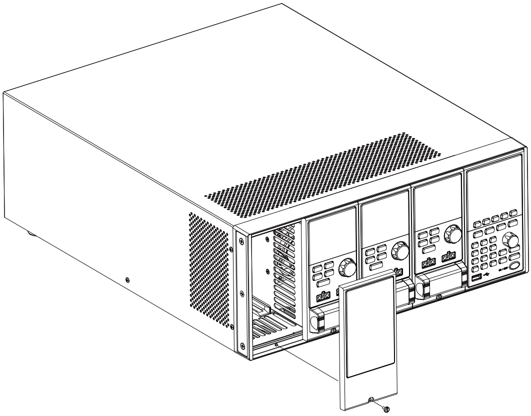


3. Use the supplied screw to fix the module to the load slot, located under the load terminals.

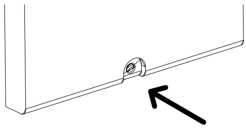


4. Install any additional modules as described above.

5. If there are any slots empty, install the supplied panel cover (part number: PEL-003). The panel cover will improve safety and increase air flow.



6. Use the supplied screws to fix the panel cover(s) over the load slot.

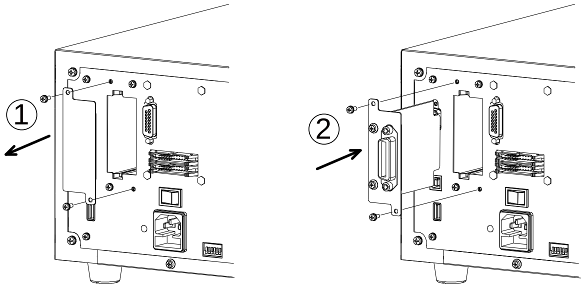


GPIB Installation

⚠ WARNING	To avoid static electricity, please use appropriate anti-static work practices.
GPIB Card installation	The PEL-2004B/PEL-2002B has GPIB as an option (part no. PEL-001).

Steps

1. Ensure the mainframe is disconnected from mains power.
2. Remove the screws from the GPIB cover plate and remove the cover plate from the rear panel.
3. Slide the GPIB card into the slot and push gently until the back plate is flush with the rear panel.



4. Use the screws that were removed from step 1 to secure the GPIB card.

Rack Mount Installation

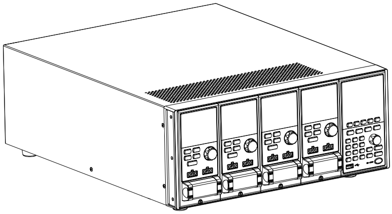
Background

The PEL-2004B can be used in a standard 19" rack mount enclosure with the optional rack mount kit (part no. 11EL-20040201). Each unit requires a rack height of 4U with a 1U space for ventilation top and bottom. The rear of the rack mount enclosure must be free of obstruction to allow heat to dissipate from the mainframe(s).

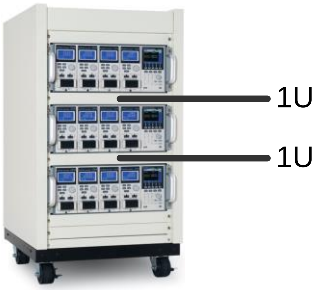
Steps

1. Screw the rack mount brackets as shown below using the supplied bolts.

PEL-2004B



2. Insert into a standard 19" rack enclosure with at least 1U of space top and bottom for ventilation.



Channel Number

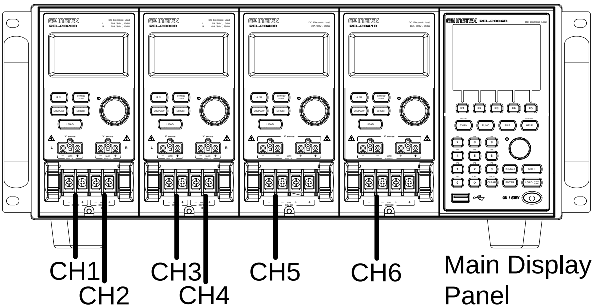
Description

The channel number for a module load is determined by which slot it occupies on the mainframe chassis. There can be 1 or 2 channels per slot, depending on the load module type.

The PEL-2002B has two slots; The PEL-2004B has 4 slots. Channel 1 is the farthest away from the main display panel and channel 8 (PEL-2004B) or channel 4 (PEL-2002B) is the closest to the main display panel.

Below the PEL-2004B has all 4 slots occupied with the PEL-2020B, PEL-2030B, PEL-2040B and 2135MH load modules (LM), respectively. The PEL-2020B & 2225ML have 2 channels per load module, the PEL-2040B & PEL-2041B have only 1. So the channel determination is:

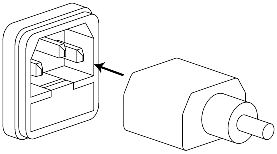
LM1: CH1, CH2; LM2: CH3, CH4; LM3: CH5; LM4: CH6.



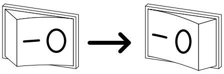
Power Up & Self Test

Panel operation

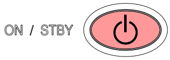
1. Connect the power cord to the power socket.



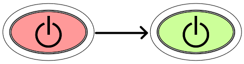
2. Turn the external power switch on.



3. Hold the power button on the front panel to turn on the power.



The power button turns green from red (standby).



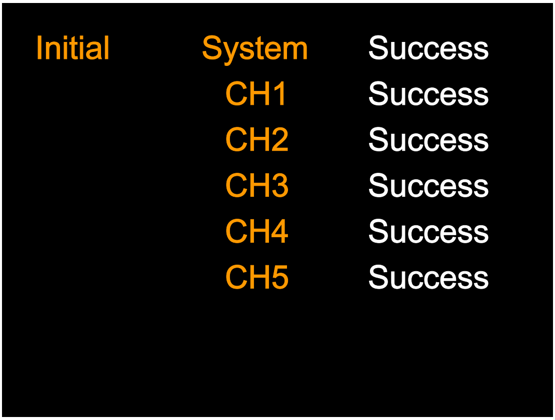
WARNING

Ensure that the power outlet has a ground socket. The power outlet will have a ground connection if it is a 3 socket type.

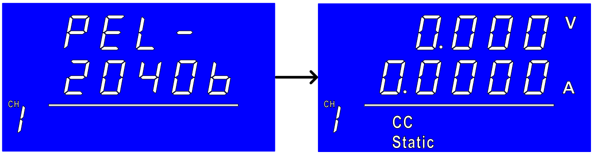
Upon turning on, the Mainframe will perform a self-test. The self-test checks the System, followed by any attached channels.

Note

When the firmware version of the mainframe and the slave are not identical, a message will appear on the mainframe.

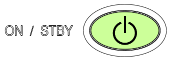


When the system check happens, the load modules will display each channel as it is checked, then display the current mode.

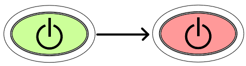


4. If any of the System checks fail, please power down the load and reinstall the appropriate load module(s).

5. To turn off the load, hold the power button for a few seconds.



The PEL-2000B mainframe will return to standby mode.



Load Connections

Precautions and Procedures

Introduction	The PEL-2000B series supports a number of different load configurations for flexible operation. • Single DUT, single load • Single DUT, parallel load • Multiple DUTs, multiple loads • Multiple DUTs, multiple mainframe loads • Single DUT, parallel mainframes The PEL-2000B series also supports a number of different control methods and interfaces. The connections used are described here: • Frame link • Channel control • Go/NoGo
Wire Gauge considerations	Before connecting the PEL-2000B series, wire gauge must be taken into account. Load wires must be large enough to resist overheating when a short-circuit condition occurs as well as maintain a good regulation. The size, polarity and length of a wire are all factors in determining if a wire will withstand short circuiting.

Wire Selection

Wires that are selected must be large enough to withstand a short circuit and limit voltage drops to no more than 2V per wire. Use the table below to help make a suitable selection.

AWG	Max Current A(Amp)
24	7.64
22	10.0
20	13.1
18	17.2
16	22.6
14	30.4
12	40.6
10	55.3

Load Line Inductance Considerations

When using the PEL-2000B series, voltage drop and voltage generated due to load line inductance and current change must be taken into account. Extreme changes in voltage may exceed the minimum or maximum voltage limits. Exceeding the maximum voltage limit may damage the PEL-2000B series.

To determine the voltage generated, the following equation can be used.

$E = L \times (\Delta I / \Delta T)$

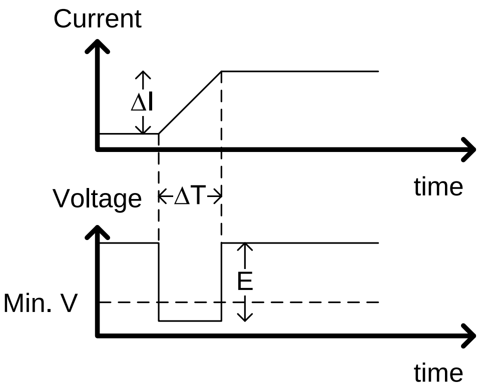
E= voltage generated

L=load line inductance

Δ I= change of current (A)

Δ T= time (us)

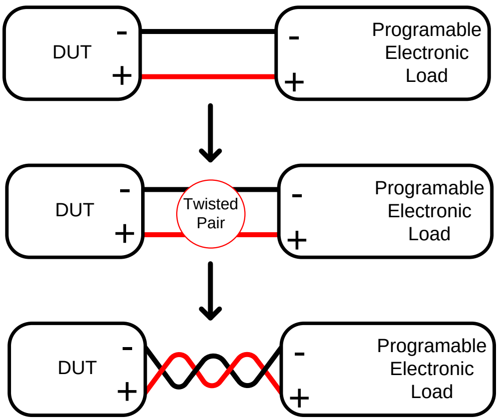
Load line inductance (L) can be approximated as 1uH per 1 meter of wire. ($\Delta I / \Delta T$) is the slew rate in A/us.



The diagram above shows how changes in current can affect voltage.

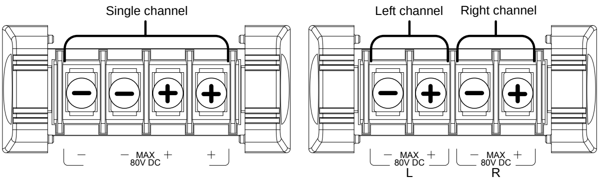
Limiting Load line inductance	Load line inductance can be reduced by ensuring load wires are as short as possible and by twisting positive and negative load wires together. Current change can be limited by limiting the slew rate when switching.

"Twisted pair" will be shown on any connection diagram where the load wires should be twisted together.

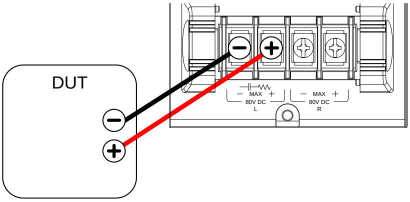


Load module considerations	The PEL-2000B series supports single and dual channel load modules.
	Single channel load modules have one bank of negative terminals and one bank of positive terminals. Each terminal pair has a 40A capacity. For higher loads, each terminal can be wired in parallel to increase capacity.
	Dual channel load modules have one bank of positive and negative terminals for each channel.

Single Channel Load Module | Dual Channel Load Module



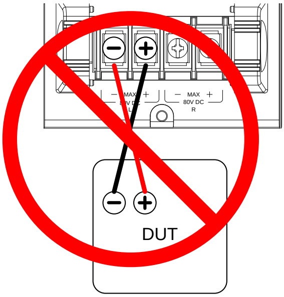
Connection	Follow the procedure below for all load connections.
CAUTION	Ensure that power is off from the load and the DUT before making any connections.
Steps	1. Carefully lift the terminal covers.
	2. Connect the positive (+) terminal on the load module to the high potential output of the DUT.
	3. Connect the negative (-) load terminal to the low potential output of the DUT.



4. Close the terminal cover securely. Ensure the wires are secured properly and that the wires are not exposed when the cover is in place.

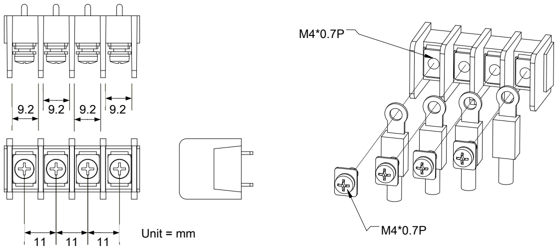
WARNING Ensure that the wires are tied or twisted together to prevent noise and inductance.

CAUTION Ensure the polarity is correct before proceeding with any connections. Using the wrong polarity could result in reverse voltage damage.



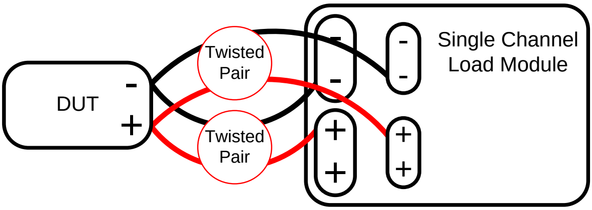
Ensure the input voltage doesn't exceed specifications. Exceeding the voltage specifications could result in damage to the instrument.

Terminal description and screw type

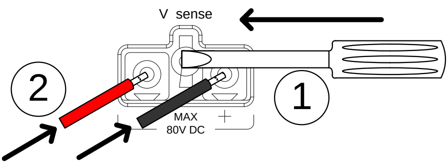


Remote (Sense) Connection

Background	The electronic load modules have two voltage sense contacts: Vsense +, Vsense -. Voltage sense can be used to help compensate for long cable length. The longer the cable, the higher the potential resistance and inductance, therefore a short cable is best. Twisting the cable can help reduce induced inductance and using the Vsense terminals compensates the voltage drop seen across the load leads, especially leads with higher resistance. This is useful when used in CV, CR or CP mode.
WARNING	Vsense + must have a higher potential than Vsense -.
Connection	The diagram below shows how a DUT can be connected using voltage sense. Note that the sense wires are also twisted pairs.



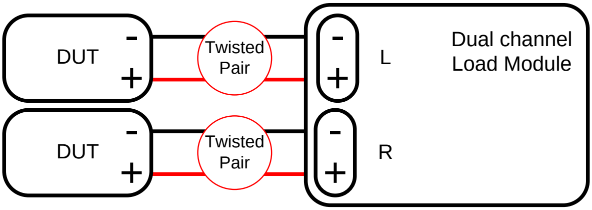
Note	The wire gauge for the sense wires should be no smaller than 16 gauge.
Input	The voltage sense terminals must use a wire gauge of 16 to 14 (Diameter 1.29mm ~ 1.63mm).
Remote Sense Terminal connection	The voltage sense terminals use a screw-less clamp connector. The clamp must be opened prior to inserting a wire. Use a small screwdriver to push the clamp release mechanism. Insert both wires then release the clamp mechanism.



Single Load Connections

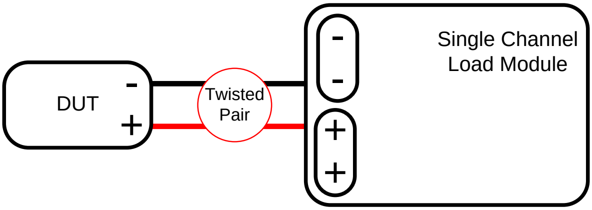
Dual Channel Load Module Connection

A dual channel load module can be used to sink two loads concurrently.



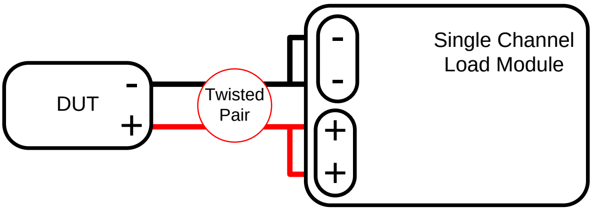
Single Channel Load Module Connection

On a single channel load module, the left terminals are both negative (-), whilst the right terminals are both positive (+). Note this also applies to the voltage sense terminals.



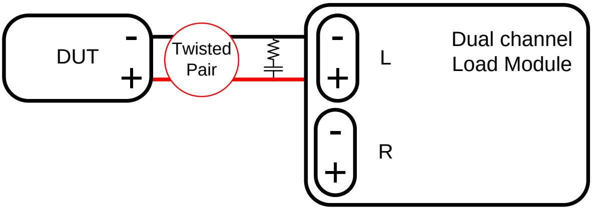
CAUTION

For loads exceeding 40A, both positive and both negative terminals must be used in parallel.



DC Connection

For purely DC operation, a resistor and capacitor can be connected in parallel to the electronic load to reduce oscillation. The capacitor and resistor values are dependent on the load settings. Ensure the capacitor ripple current is within allowable limits.



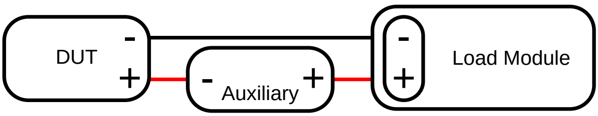
Low Voltage Connection

Using the load with low voltage loads is generally limited to over 1 volt (load module dependent). In order to support low voltage loads, an auxiliary power supply is needed to boost the voltage to a range suitable for the load.

Precautions:

- Take into account the combined power of the load and auxiliary power supply.
- Make sure the auxiliary power supply is able to provide enough current.
- Take into account any noise or irregularities from the auxiliary supply.

The diagram below shows a typical connection.



⚠WARNING

Using an auxiliary power supply may induce reverse current. The PEL-2000B series has reverse voltage protection. For details see the protection section on page 82.

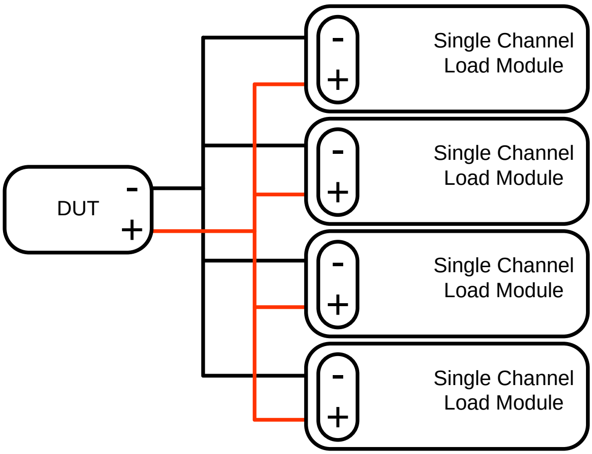
Parallel Load Connections

Parallel load modules

When the power output of a DUT exceeds the power rating of a channel or load module, the channel terminals, load modules or mainframes can be used in parallel to dissipate more power when used in CC or CR mode. Each channel will sink the amount of current specified. The total power sunk is the sum of all channels/modules. The amount of power can vary from each channel. For example if CH1 is 25A and CH2 is 20A, then the total current sunk is 45A. Parallel loads are supported for both static and dynamic loads (see page 80 for a description on parallel dynamic loading). Note that the same modules must be used when operating the parallel.

The PEL-2000B series also features a dedicated parallel configuration setting known as Group Unit. When Group Unit is turned on, load modules of the same type and rating to be used in parallel for CC and CR mode. See page 71 and 195 for more information.

Parallel load

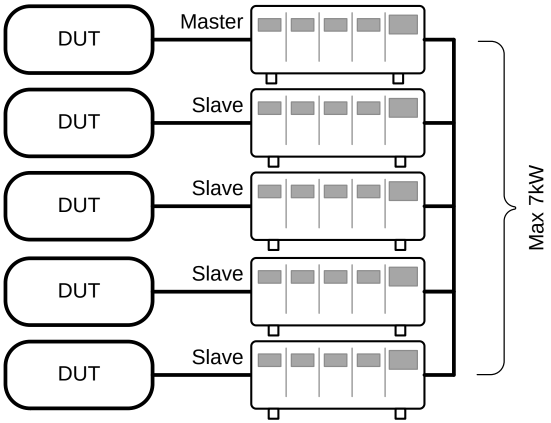


Note

Please note that the same load modules must be used in parallel.

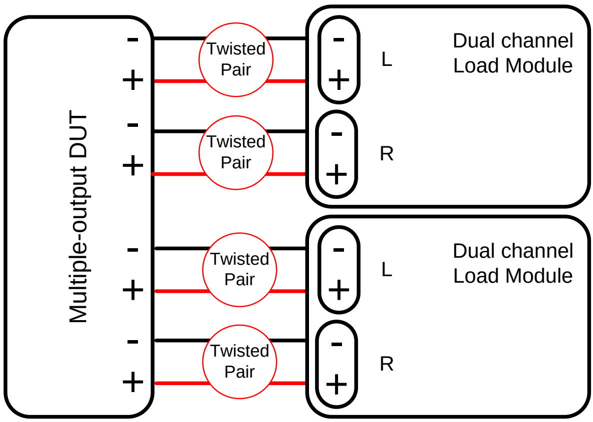
Parallel loads using frame link connections

The PEL-2000B series mainframes can also be connected in parallel. Please note, when using a frame link connection there is a delay between the master and the slave. Please see page 54 for details.



Multi-output power supply load

The PEL-2000B series is also able to sink a number of loads concurrently from multiple DUTs or sink a number of loads from the same DUT (i.e. multiple output power supply).

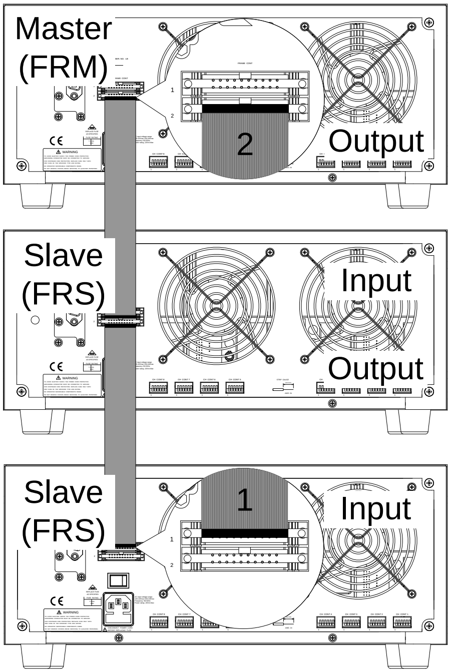


Frame Link Connection

Background

Frame link control involves connecting multiple mainframes using the frame link connections. Up to 4 slave mainframes can be connected to the master mainframe. The first mainframe (master) can be used to control the other slave frames. There is a delay time of 2μs between the master and first slave mainframe, and 4μs, 6μs, and 8μs to the second, third, and fourth slave mainframes, respectively. The connectors used are standard MIL 20-pin connectors. For pin arrangement, see page 274. The frame link cable (part no. GTL-249) is an optional accessory, see page 16 for details.

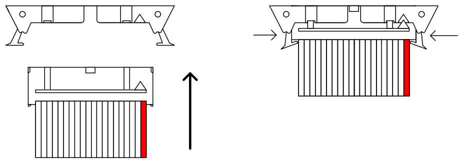
Frame Link Connection



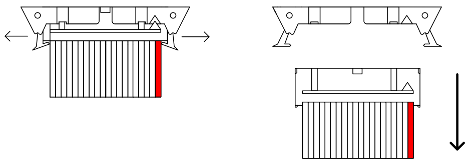
The first mainframe that is connected is the master frame; any additional frames are slave units. The ribbon cable connects to the master from connector 2, and the slave from connector 1. Each successive slave unit is connected in a cascading manner the same way.

Ensure the Mainframes are turned off before connecting the ribbon cables. Push the cable into the frame link connector. Ensure the arrows line up. The latches will close when the connection is complete. To remove, pull the latches out and connector will come out.

Insertion



Removal



WARNING

Ensure all the mainframes are off and disconnected from mains power before connecting.

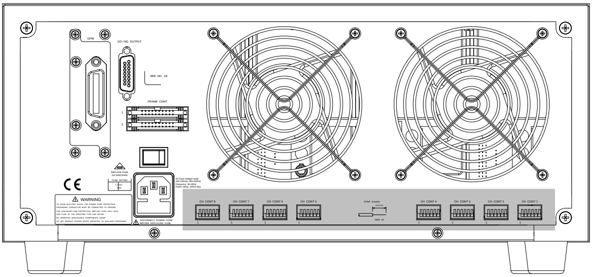
Channel Control Connection

Background

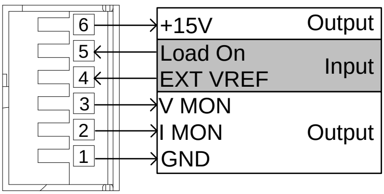
The Channel Control connecters are located on the rear panel of each mainframe. There are two channel control connectors for each load slot, one for each channel, if applicable. The channel control connector is used to externally:

- Turn on/off loads.
- Supply a reference voltage.
- Monitor the load input.

For further details on channel control and the interface see pages 87, 272.

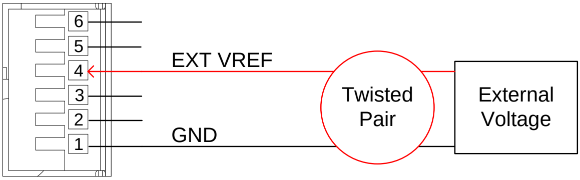


The Channel Control input/output pin layout is shown below.



External Voltage Connection

The external voltage reference input must be between 0~10V.



WARNING

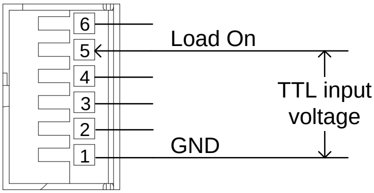
Ensure the external voltage reference is stable and has low noise. The External Voltage should be no more than 10V.

The input impedance of the EXT VREF pin is 500kΩ.

No more than 12 volts may be used as an external voltage. More than 12 volts may damage the load.

Load on connection

To turn a load on, an active low voltage (0-1V) must be applied across Load On (pin 5) and GND (pin 1), similarly an active high voltage (2.4-5V) must be applied to turn a load off. The Load On input must be TTL.

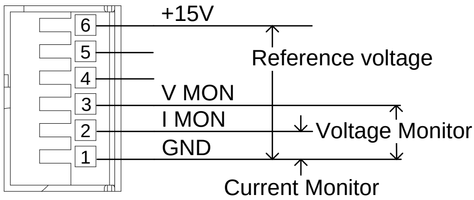


Voltage and Current Monitor Output

The Voltage Monitor Output (VMON) and Current Monitor Output (IMON) output the load input voltage and load input current as a percentage of rating current/voltage. Where 0 volts = 0% rating and 10 volts = 100% load input rating voltage or current.

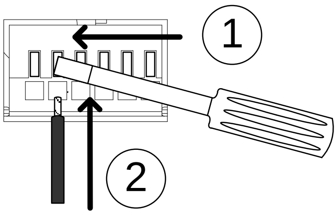
The voltage monitor output is across pins 1 & 3, and the current monitor output is across pins 1 & 2. Pin 6 outputs a +15V reference voltage.

Below shows the pin configuration of the voltage and current monitor outputs.



Connector Connection

The channel control connector is a screw less clamp connector. The internal clamp mechanism must be opened before a wire can be inserted. To open the internal clamp, push the button above the wire socket, to close, release the button. Ensure at least 10mm is striped from the wire. The diagram below shows the wire insertion procedure.



WARNING

All connections to the channel control connector must use a 24 AWG wire gauge.

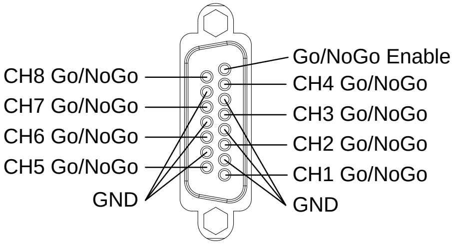
The output impedance of the V MON and I MON pins is 10kΩ.
The "+15V on pin6" used by customer application < 100mA Hold on 200mA.

Go/NoGo Connection

Background

The Go/NoGo port is a 15 socket port. Each channel has a dedicated line for a Go/NoGo output. The ports are open-collector with active high (30V) indicating a pass and active low (1.1V) as fail (an alarm). The Go/NoGo terminal is a DB-15 female.

For more details on the Go/NoGo interface see page 277.



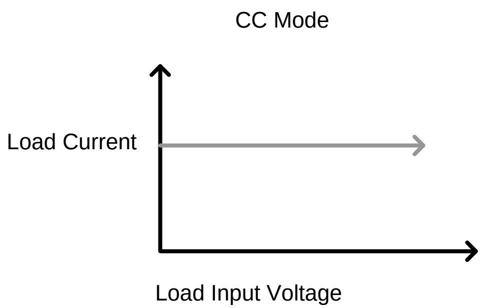
OPERATING DESCRIPTION

Operating Mode Description

There are four basic operating modes: constant current (CC), Constant Resistance (CR), Constant Voltage (CV/CV+CC) and Constant Power (CP). All channels operate using any of the modes. Each mode has a number of configurable options including slew rate, levels, protection modes, Go/NoGo and extensive save options.

Constant Current Mode

Background	In Constant Current Mode the load units will sink the amount of current programmed. Regardless of the voltage, the current will stay the same. There are two ranges in CC mode: High and Low. There are two main modes in CC mode: Static and Dynamic. Static mode can be used for stability tests and dynamic mode can be used to test transient load conditions. Go/NoGo is supported for both High and Low range as well as Static and Dynamic mode.



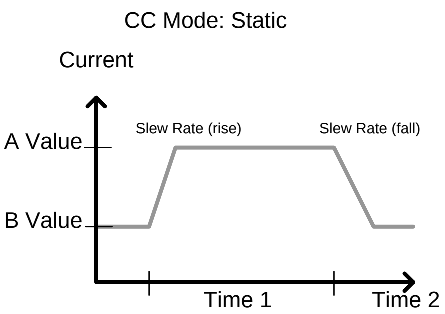
Range	There are two selectable ranges for constant current mode: high and low range. Low range has a higher resolution, but a lower range. If the current exceeds the Low Range, High range must be used.

Static Functions

Static mode tests the stability of the voltage output from a power source. Single channel load modules can have two 2 current levels A (A Value) & B (B Value). A & B have the same range. Pressing the A/B key on the module load will cycle through the A and B states. Alternatively, the mainframe can select A or B Value.

Dual channel load modules only have one current level (A Value) per channel in static mode.

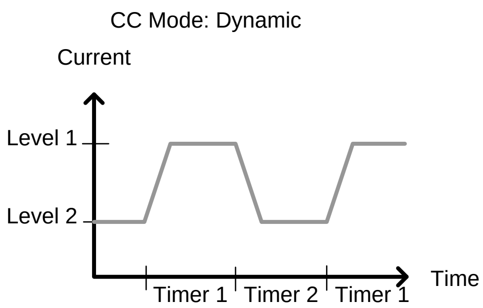
Static Mode: Single Channel Load module.



Dynamic Functions

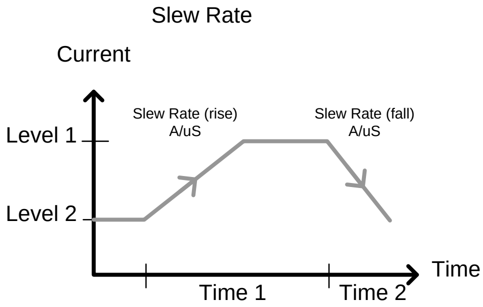
Dynamic load functions allow you to set load levels (Level1, Level2), load time (Timer1, Timer2), and the slew rate (rising, falling). Depending on the settings, the load will switch automatically between levels 1 and 2.

Dynamic loading can be used for charge discharge cycle testing etc.



Slew rate

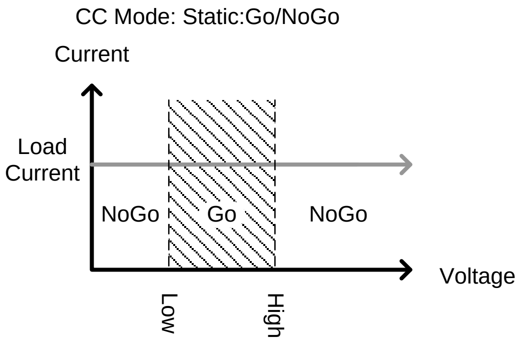
The slew rate is the rate at which the current will increase to a set level. There are two slew rates: rising slew rate & falling slew rate. In CC mode the slew rate is defined as A/uS.



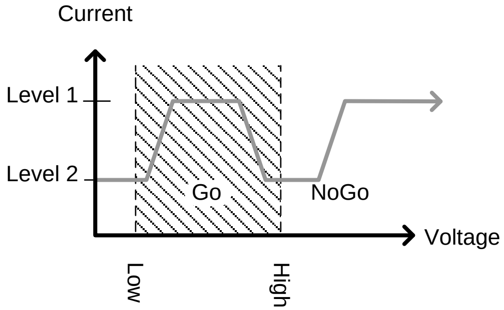
As can be seen above, the rising and falling slew rate need not be the same.

Go/NoGo

Using Go/NoGo, the Center, High and Low voltage limits can be set for both Static and Dynamic modes. A delay time of up to 1 second can also be set.



CC Mode: Dynamic:Go/NoGo



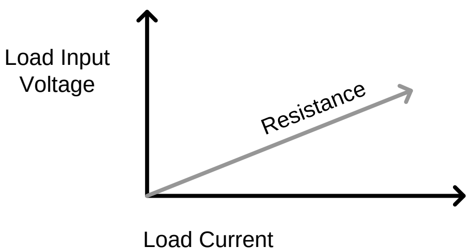
GO is specified as between the Low and High Go/NoGo limits. NoGo is specified as outside the Go/NoGo limits.

Constant Resistance Mode

Background

In Constant Resistance Mode the load units will linearly sink current and voltage to match a set resistance. CR mode has two different values (single load modules), two different ranges and rising and falling slew rates. Like CC mode, Constant resistance mode supports both dynamic and static loads. As with the other modes, Go/NoGo is supported.

CR Mode



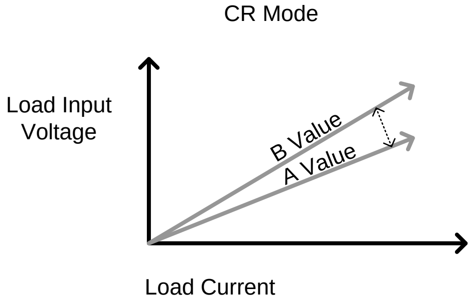
Resistance Range

There are two ranges: High and Low. The Low range is used for low voltage ranges, whilst the High range uses high voltage ranges. The current range always remains in High range, regardless of the selected resistance range.

Static Functions A/B range

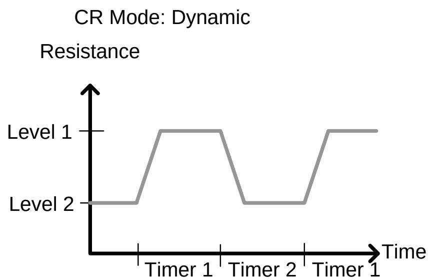
For static mode, single channel load modules have two resistance levels. A & B have the same range. The A/B key can be used to switch between these resistance levels. Dual channel load modules only have one resistance level, A Value.

Single Load Module

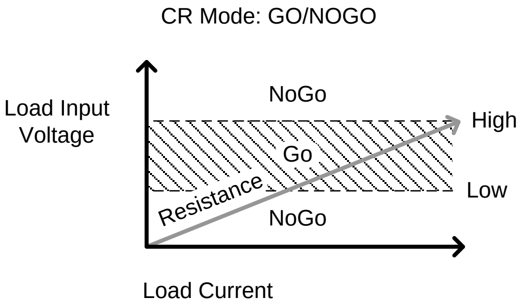


Dynamic Functions

CR mode supports Dynamic loading. Dynamic load has two resistance levels (Level 1&2), and two timers (Timer 1&2) to switch between the resistance levels. Rising and falling slew rates can be set to determine the speed at which the load switches between load levels.

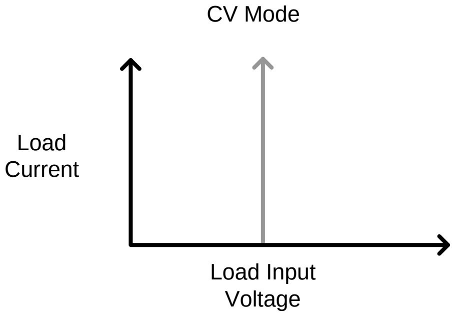


Slew Rate	The rising and falling slew rate (A/uS) determines the speed at which the load levels change from A to B Value (Static mode) or from Level1 to 2 (Dynamic mode) and vice versa.
Go/NoGo	Go/NoGo is also supported. Center, High and Low limits can be set as either percentages or voltage values. A delay time of up to 1 second can also be set.



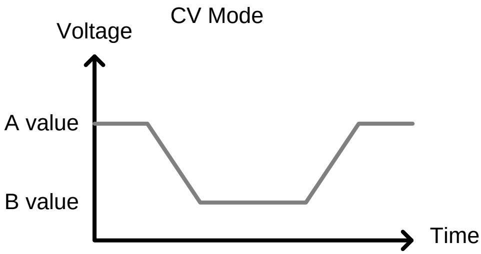
Constant Voltage Mode

Background	In Constant Voltage Mode the load units will sink current whilst keeping the voltage constant. Single channel load modules support 2 values (A Value, B Value) and have an adjustable cut-off current limit. Dual channel load modules only have A value. Response speed can also be set to fast (Fast) or slow (Slow). The response speed relates to the slew rate of the current response. Go/NoGo functionality is also supported either as a percentage or as a current value.



Voltage levels

Two voltage levels can be set: A & B (single channel load module).



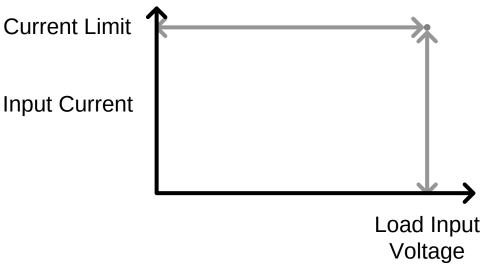
CV + CC

When using CV mode, a current limit can be set for CV + CC mode.

When the voltage input is greater than A Value (load voltage) then the channel will operate in CV mode if the input current is less than the current limit. When the input current exceeds the current limit, the channel will operate in CC mode.

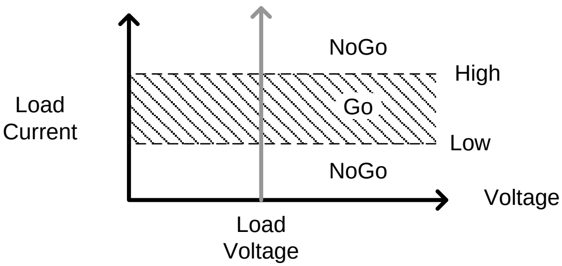
When the voltage input is less than A Value (load voltage) current stops flowing.

CV + CC Mode



Response Speed	Response speed can be set to fast, slow1, slow2 or slow3. Fast response and slow1 (slow2/slow3) response are determined by the load module specifications. Slow response speeds are suitable for large loads as quick current changes will induce induction which can cause large voltage drops. The PEL-2000B series will try to rectify any voltage drops. However if voltage drops are too large, they may cause the load to go into oscillation. Large voltage drops caused by line voltage induction may damage the machine.
Go/NoGo	Go/NoGo testing can be with either current (Ampere) values (High, Low) or percentage values (Center, High %, Low %). A delay time of up to 1 second can also be set.

CV Mode: GO/NOGO



Constant Power Mode

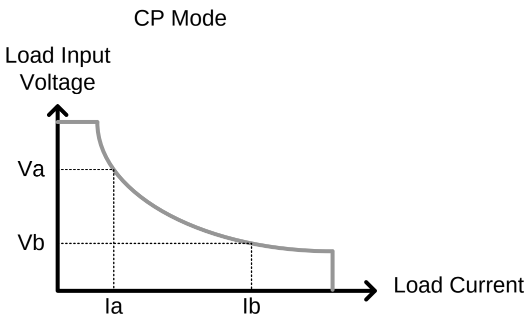
Background

In Constant Power Mode the load units will ensure a constant power load for the power supply.

Single channel load modules support 2 values (A Value, B Value) and have an adjustable cut-off current limit. Dual channel load modules only have A value.

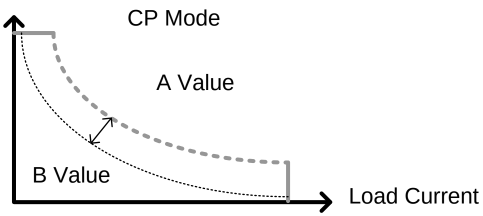
Constant power mode can operate in high or low range.

Go/NoGo functionality is also supported either as a percentage or as a current value.

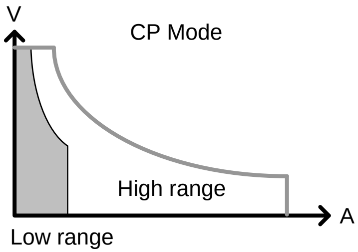


Power levels

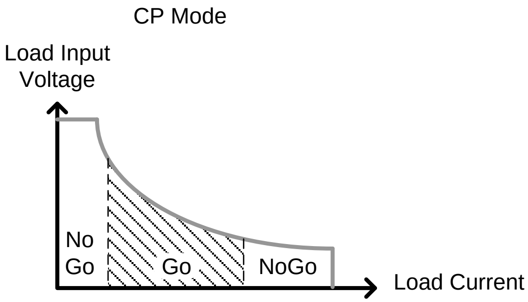
Two power levels can be set: A & B (single channel load module).



CP + CC	When using CP mode, a current limit can be set for CP + CC mode. When the constant power current is less than current limit, the channel will operate in CP mode. When the constant power current exceeds the current limit, the channel will operate in CC mode.
High/Low Range	There are two ranges: High and Low. The Low range is used for low power ranges, whilst the High range uses high power ranges.



Go/NoGo	Go/NoGo testing can set High and Low Current limits as a Value (in Amperes) or as a percentage. A delay time of up to 1 second can also be set.



Group Unit Mode

Background

The Group Unit menu allows load modules of the same type and rating to be configured as a single unit when used in parallel. This saves the hassle of configuring each channel individually.

Group Unit is only supported under CC and CR mode.

Group Unit has three configuration settings: Total Unit, Group Mode and Display Mode.

Total Unit

This configuration setting sets the number units that are to be used in parallel and enables or disables the Total Unit mode.

Group Mode

The Group Mode setting determines how the Current Levels/Resistance Values are set when used in parallel. There are two settings: Para and Sync.

The Para setting allows the all the parallelized load modules to be operated as a single large load module.

Sync mode allows the settings of a single unit to be synchronized across all the other parallelized load modules.

CC Example

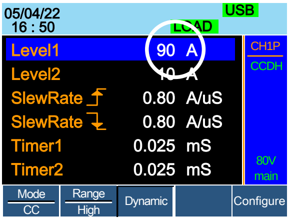
Consider 3 load modules set to CC mode in Parallel.

In CC mode the total current for all units is the sum of each unit.

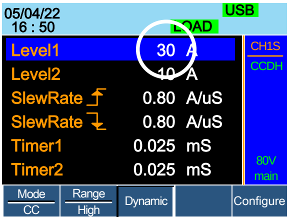
$$\text{Total}\, I = I_1 + I_2 + I_n$$

For example, to set a total load current of 90A, the Current Level setting in Para mode would be 90A, whilst it would be 30A in Sync mode.

Para mode



Sync Mode



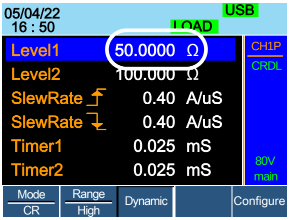
CR Example

When used in CR mode, the equation for equivalent resistance for all the parallel loads is:

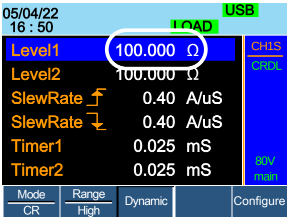
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_n}$$

For example, if 2 load modules have a set resistance of 100Ω each, the equivalent resistance of the load modules would be 50Ω. The Level setting in Para mode would be 50Ω and 100Ω in Sync mode.

Para mode



Sync Mode

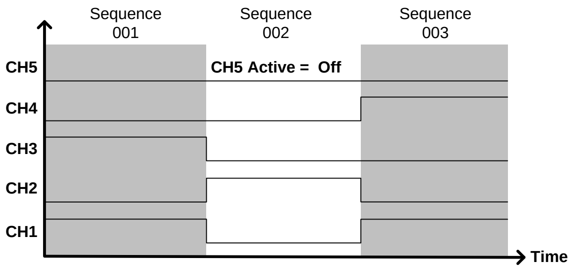


Display Mode

Display mode determines what units are displayed on the local load modules: V/I, V/W, I/W, S. The displayed units can only be controlled through this menu.

Run Program

Background	The Program function on the PEL-2000B series supports a total of 12 different programs at any one time with 10 sequences to each program. Up to 12 programs can be chained together. The Program function is able to create a number of Go/NoGo tests.
	Run Program is not supported in Group Mode (page 71).
Program Sequence	A program sequence is simply a single load test. A program is a battery of each of these tests run in succession. Each sequence loads the settings for each channel from Memory Data (Memory MXXX). The Memory Data stores settings such as the operating mode and range for each channel. Each sequence loads all channels at the same time, unless programmed otherwise. Sequences for each channel run synchronously.



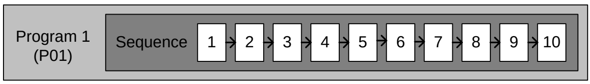
Each Sequence has a number of configuration options that apply to all the channels equally.

Sequence Item	Description
Memory	Loads the channel settings for each load module Range: M001~M120

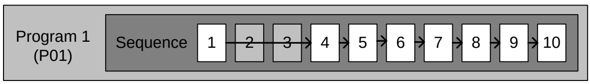
Run	Sets the running configuration for the current sequence. The sequence can be skipped, run or run manually only. Range: Auto | Skip | Manual
On-Time	Sets the Sequence Run On-Time Range: 0.1 ~ 60.0s
Off-Time	Sets the Sequence Off-Time Range: Off | 0.1 ~ 60.0s
Short-time	Sets whether the Short-Time for the sequence. Range: Off | 0.1s ~ On-time
P/F-Time	Sets the Pass/Fail time for the sequence Range: Off | 0.1 ~ (On-Time+Off-Time)-0.1s
Short Channel	Selects which channel will be shorted during the sequence Range: CH1 ~ CH8

Program

Sequences are run sequentially to create a Program. There are 10 Sequences in each Program.



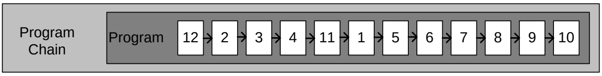
If less than 10 Sequences are desired for a Program, any additional Sequences can be skipped (not run).



Sequence 2 & 3 are skipped.

Program Chain

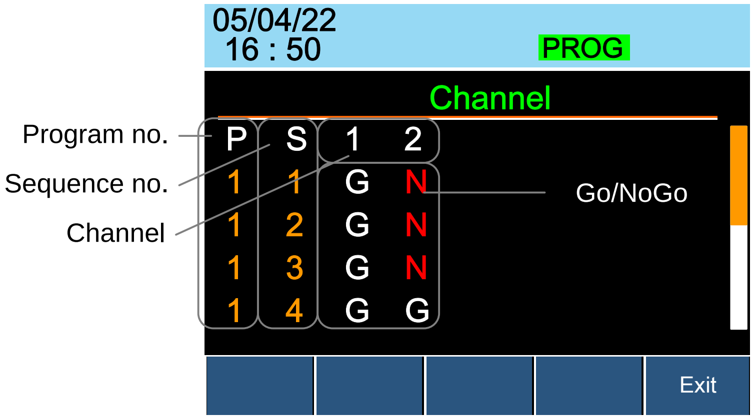
Any of the 12 programs can be chained together to create a Program Chain. Unlike Program Sequences, Program Chains need not be run sequentially in numerical order. Any program can be chained to any program. It is possible to chain programs into an infinite loop to continue a program indefinitely.



Above, a program chain running sequences out-of-order.

Go/NoGo Results

If Go/NoGo limits have been configured, the Pass/Fail results for each channel will be displayed for all the sequences and programs.



Sequence

Background

The Sequence function is used to create high resolution load simulations. Each Sequence can be configured to create a unique load profile to accurately simulate loads in real time. Sequences are only applicable for CC (Static) and CR (Static) modes.

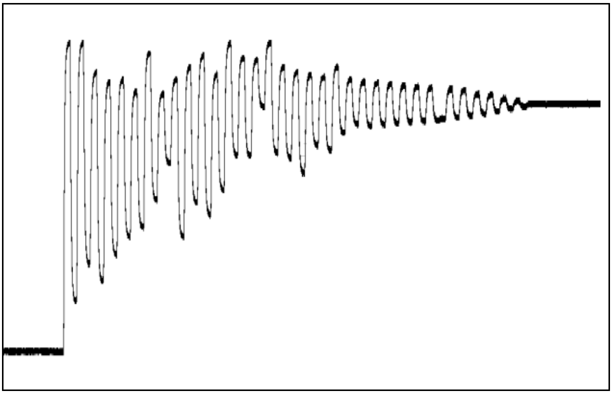
Note

Sequences are not to be confused with the sequences used to create a program. They are not the same and cannot be used interchangeably. Sequences (SEQ memory) cannot be used in Programs and Programs cannot load Sequences.

Load Profiling

The Sequence function is able to simulate a load to a high resolution. Each channel is able to change its load sink within 25us ~ 60000s per point independently. When used in parallel, multiple loads can be set concurrently to simulate the loads placed on multiple output power sources.

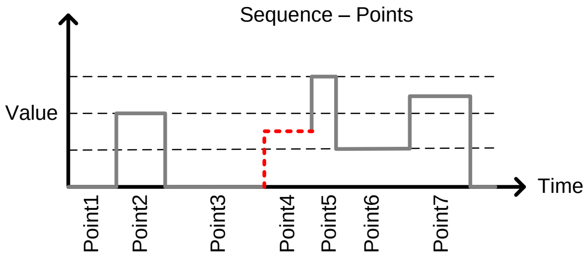
The diagram below shows the load profile of a DUT at start-up.



Points

Up to 120 points can be used with each Sequence. Each point can have a different duration, slew rate and value.

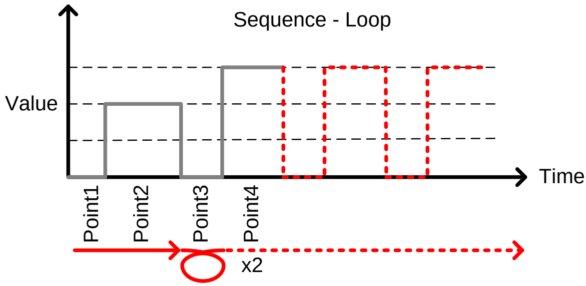
A new point can be inserted or deleted at any stage of a Sequence. Any new points that are inserted will have a value averaged from its neighbors as default.



A new point is inserted after Point 3.

Loop

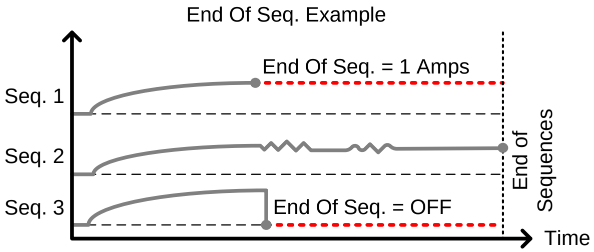
Sequences can be programmed to loop a number of times starting from any point in the sequence.



From Point3 the sequence is looped two times.

On End Of Seq. function

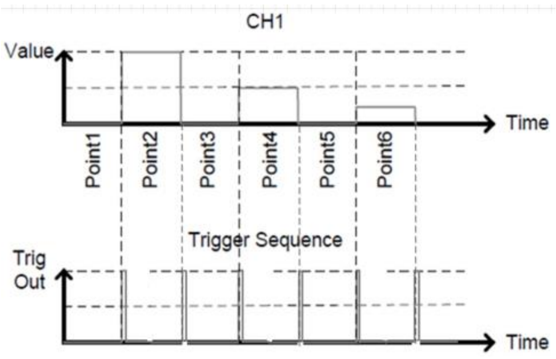
If more than one Sequence is programmed on the mainframe, the On End Of Seq. function will hold the load current (of the selected sequence) to a designated value until all the other sequences have finished running.



In the example above, Seq. 1 will hold the load current at 1A at the end of its sequence until the last sequence has finished. Seq. 2 is the longest sequence, and as such the End Of Seq. setting is not applicable. Seq. 3 is turned off after its sequence has finished (0 amps).

Trig Out

The Trigger Out function allows a trigger sequence signal to be output from a channel via PIN 4 on Frame Link connector 1 when using Sequences. The Trig Out function is used from the Channel Duration menu.



As can be seen above, a trigger sequence signal is output for every rising edge point.

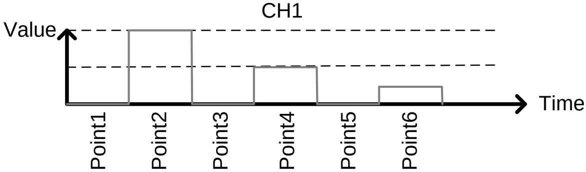
Trig In

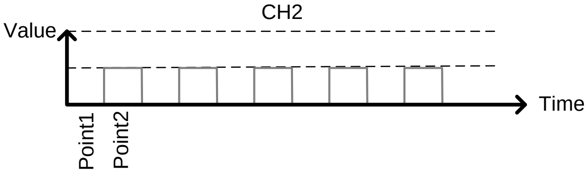
The Trigger In setting allows a sequence to start after a trigger (Trig Out) has been received via the frame link connector. The Trig In setting is used for frame linked mainframes.

Channel Duration Time Setting

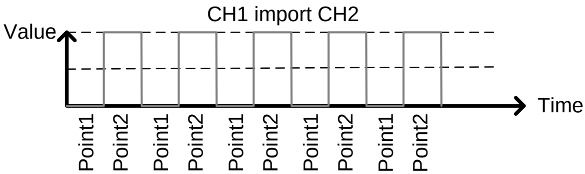
The Channel Duration Time Setting feature allows the point time duration of one Sequence to be imported by another Sequence. If the receiving sequence doesn't have enough points, more will be created (without values).

For example, the sequences for CH1 and CH2 are shown below. CH1 has a total of 6 points with long durations, whilst CH2 has only 2 points, looped 5 times. The points from CH2 are also significantly shorter in duration.





Below shows the resulting sequence when CH1 imports CH2. CH1 imports the duration time settings and number of points from CH2, but not the value data.

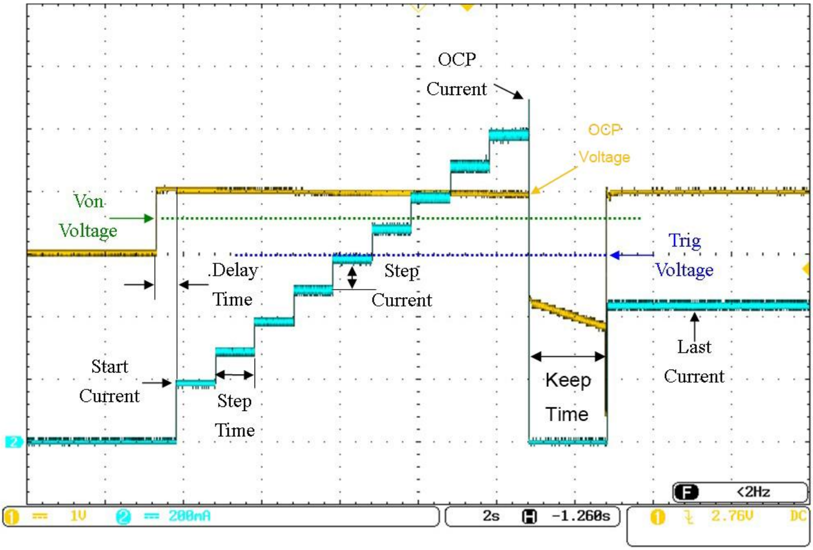


OCP Test Automation

Background	The OCP test function creates an automatic test to test the over current protection of power supply products. See page 167 for operation details.

This test will test to see when the over current protection of a power supply is tripped and return the measurements for the voltage and current when the over current protection was tripped. The PEL-2000B series also has a user-defined OCP setting in the event that the power supply OCP fails.

The diagram below shows an example of the OCP Test Automation function.



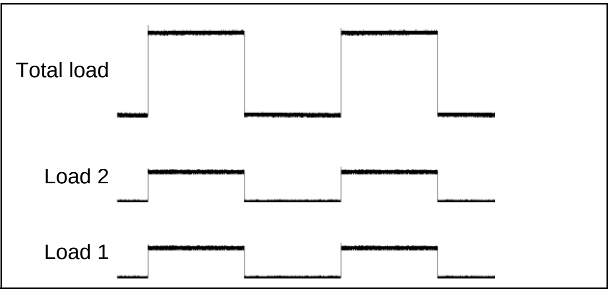
Parallel Dynamic Loading

Background

The PEL-2000B series of DC electronic loads support parallel dynamic loading. This simply means that when the load modules of a mainframe are connected in parallel and set to dynamic mode, they can perform dynamic tests synchronously following the same clock. Under dynamic mode, load current or resistance is pulsed between two preset levels. When used in parallel, higher powered outputs can be tested. This ability gives the PEL-2000B series the flexibility to perform dynamic tests over a wide range of power outputs.

For connection details see the Parallel Load Connections section on page 52.

The diagram below shows how two load modules are able to sink a higher load when used in parallel under dynamic mode.



Note

The same type of load modules must be used operated in parallel.

Configurations Description

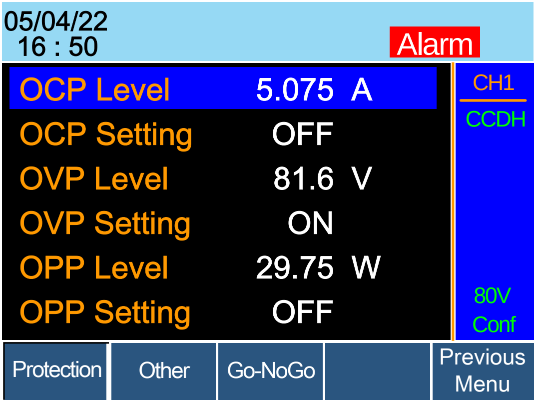
There are a number of different configurations for the PEL-2000B series including protection modes, operating configurations, and file system configurations. The Configuration Description section describes what the different configurations are used for and how they can be relevant to different operations.

Protection Modes

Background

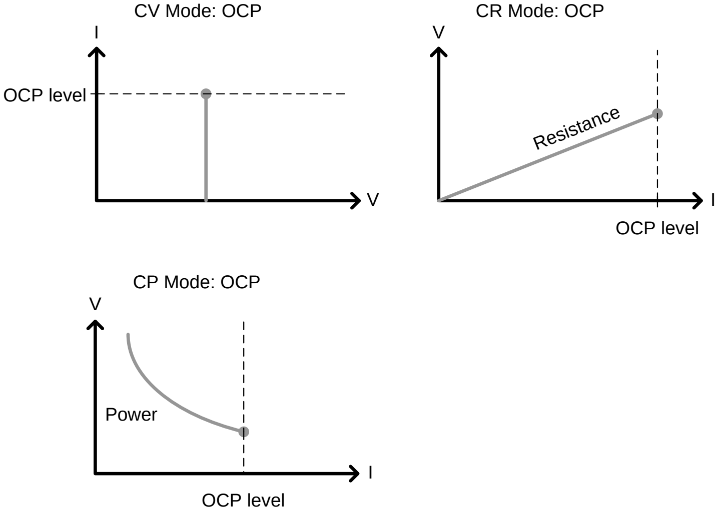
The PEL-2000B series include a number of protection modes: Over Current Protection, Over Voltage Protection, Over Power Protection, Under voltage protection and Constant Power Protection.

The protection modes are useful to protect both the load modules and the DUT(s). A buzzer can be set to notify when a protection setting has been tripped. When a protection feature is activated and has been tripped then the load unit will display an alarm. The Mainframe will also display an alarm. When an alarm has been tripped the load will stop sinking current/voltage. There are three Over load protection settings: ON, OFF and Clear.



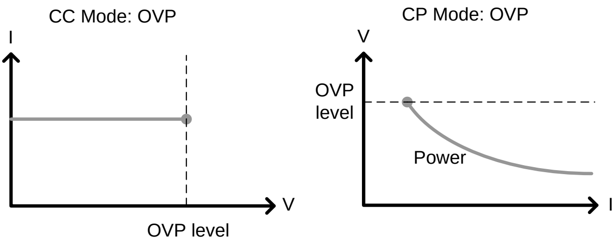
Over Current Protection

When a load unit is operating in CR, CV or CP mode, the unit may need over current protection to prevent excessive current being set. Over current protection stops the load from sinking more current than its recommended limit which can cause damage to the unit.



Over Voltage Protection

Over voltage protection is used to limit the amount of voltage sunk. If the OVP trips, the PEL-2000B series load will stop sinking voltage.



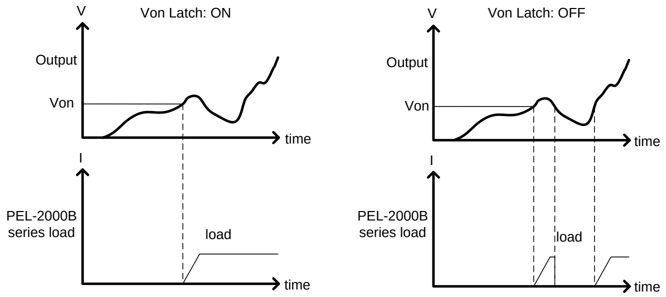
Over Power Protection

Over power protection is used to limit the amount of power sunk. When OPP is tripped power will cease to be sunk.

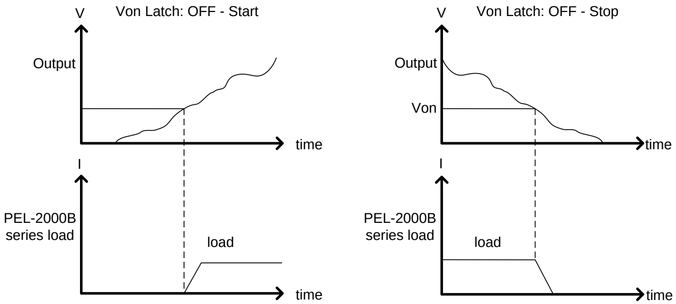
Reverse voltage Protection	Reverse voltage protection prevents reverse voltage damage to the PEL-2000B series up to the specified rating. When Reverse voltage protection has been tripped an alarm tone will sound until the reverse voltage is removed.
Under voltage Protection	Under voltage protection will turn off the load when the voltage drops below a set limit. UVP does not work when set to “CH CONT: External”.
Constant Power Protection	Constant power protection will prevent excessive power draw.

Operating Configurations

Background	There are number of operating configuration settings. Configuration settings are for the following: CC Vrange, Von Voltage, Von Latch, CH Cont, Independent, load D-Time, Response settings, Step resolution settings, Short settings.
CC Vrange	CC Vrange (page 178) is used to set the voltage range as High or Low for CC mode. CC voltage range is dependent on the load module specifications.
Von Voltage	Von Voltage is the voltage limit at which the load will start to sink current. There are two operation modes for Von Voltage: Von latched: ON and Von latched: OFF. Latched: ON will sink current when Von has been tripped, and will continue to sink current even if the voltage drops below the Von Voltage. Von Latched: OFF will sink current when Von has been tripped, but will stop sinking current when the voltage drops below the Von Voltage setting.



As can be seen in the diagram below, when Von-Latch is set to off, the load module will start to sink current when the Von-voltage limit has been tripped. It will stop sinking current when the output drops below the Von voltage limit.



CH CONT

Channel Control. When Channel control is activated (External) it can be used to monitor the voltage and current output of the load as well as turn loads on or off remotely from the Channel Control (CH CONT) connectors located on the rear panel.

For more information about channel control, see external voltage control on page 87.

Independent

The Independent setting will allow the load modules to be controlled independently from the mainframe.

Load D-Time	Load Delay time is used to delay activating a load (up to 10 seconds) after the load key has been pressed. However the Load D-Time setting will only work for loads that are initiated manually or when the PEL-2000B series mainframe is configured to Auto load (page 201) at run time.
Response	The Response setting sets the bandwidth of the load to 200Hz (normal) or 20kHz (fast). If the DUT voltage range is below 1V, set the normal bandwidth to 200Hz, and set the fast bandwidth to 20kHz. If the DUT voltage range is above 1V, set the normal or fast bandwidth to 20kHz. The Response setting is particularly important for limiting startup current.
Step Resolution	The current, resistance, voltage and power setting can have the step resolution configured for each channel. The step resolution refers to the step resolution of the *coarse adjustment* of these settings. The *fine adjustment* cannot be configured, see page 188 for details. For example if the step resolution for CCH (CC high range) is .5 A, then the resolution can be incremented in .5A steps; 8.0←→8.5←→9.0←→9.5

The step resolution parameters apply to the following:

CCH Step – CC high range

CCL Step – CC low range

CRH Step – CR high range

CRL Step – CR low range

CVH Step – CV high range

CVL Step – CV low range

CPH Step - CP high range

CPL Step - CP low range

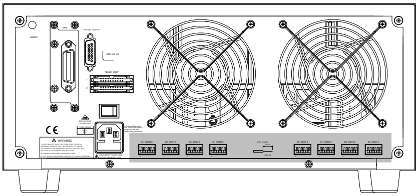
Step Resolution Range	The step resolution range is dependent on the load module and the range:
	Max resolution: Module dependent, see page 188
	Min resolution: Module dependent, see page 188
Short Key	When short mode is on, the load unit can simulate a short circuit.
	Shorting can be individually set for each channel when programming sequences.
	To initiate a short circuit manually, the short key is used. It can be used at any time during an operation. It will not affect the settings. After a short circuit has finished, the load unit will resume the previous operation.
	The short function can be set ON or OFF. When setting to ON, the short key is enabled. When setting to OFF, the short key is disabled.
	The short key can be set to toggle or hold. When pressed in toggle mode, shorts are toggled on and off. When pressed in hold mode, the key needs to be held to short the load.
	The Short Safety can be used to set the short operation mode. When setting to ON, the short

function must be used in the case of Load ON. When setting to OFF, the short function can be used directly.

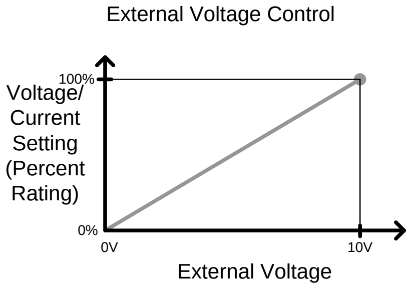
Note: A short circuit may trip a protection mode if too much current is sunk.

Channel Control

Background: External channel control is used with the Channel Control connectors. Each channel control connector can activate each load, monitor voltage and current and has an external voltage reference input. The voltage and current monitors output 0~100% of the rated current/voltage as a voltage of 0~10V.



External Voltage Reference: A voltage reference of 0-10V is used to represent 0-100% of the rating voltage/current of a load module. As seen below the external voltage reference and the rating voltage/current have a linear relationship. By varying the reference voltage between 0~10V the voltage/current setting will be changed accordingly.



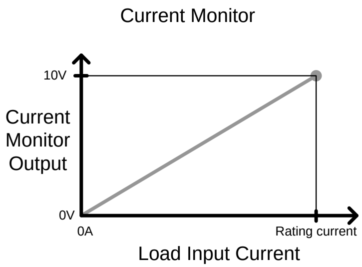
To determine the Percent Rating (voltage or current load input), use the following formula;

$$Load\ \ Input = \frac{External\ \ Voltage}{10(V)} \times Rating\ \ \ VorA$$

Where "Rating V or A" is the rating voltage/current of the load module.

Current Monitor

The load current input can be externally monitored using the IMON pin of a channel control connector. The IMON pin outputs a voltage of 0~10V to represent the input current as a percentage (0~100%) of rating current.



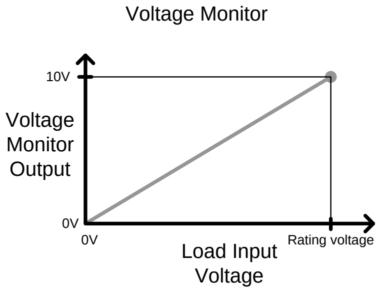
To determine the Current Monitor Output (IMON) , use the following formula;

$$IMON = \frac{Load\ input\ current}{Rating\ \ A} \times 10V$$

Where "Rating A" is the rating current of the load module.

Voltage Monitor

The input voltage, like the load input current can be externally monitored with the channel control connectors. The VMON pin of the channel control connector outputs a voltage of 0~10V to represent the load input voltage as a percentage (0~100%) of the rating voltage.



To determine the Voltage Monitor Output (VMON) , use the following formula;

$$VMON = \frac{Load\ input\ voltage}{Rating\ V} \times 10V$$

Where "Rating V" is the rating voltage of the load module.

Turning on the Load

A load is turned on when Load On input is set to On (active low). A load is turned off when the Load On input is set to Off (active high).

When a load is turned on from the channel control interface, the load can be turned off from the mainframe, local module and via remote control. However the opposite is not true; when a load is turned off using the channel control interface, the load cannot be turned on via the mainframe, local module or via remote control.

For connections and configurations, see pages 56 and 272 respectively.

Interface and System

Interface

Background

The PEL-2000B series support RS232/RS485, GPIB, LAN and USB remote frame control. Only one type of connection is supported at any one time. For more information on remote control please see your local distributor about the PEL-2000B series programming manual.

For connection options and configurations see the options below.

RS232 or RS485 configuration	Page 222
Configure RS232 or RS485 interface	Page 279
LAN configuration	Page 286
GPIB configuration	Page 227
GPIB pin configuration	Page 270
USB configuration	Page 224

File System

Background

The PEL-2000B series is able to save and recall a number of different data types for each channel:

Presets

Memory

Setup

SEQ (Sequence)

All data types can be saved and recalled to internal memory or saved to a USB flash drive.

	Each channel has its own dedicated memory for each data type. Thus files are saved/recalled for each channel and each data type.
Preset Data	Preset data can be saved into 10 memory slots for each channel. Preset data contains the mode, range, CV response speed and Go/NoGo settings.
	Internal Format: P0~P9
	External Format: 20X0X_XX.P
Preset Contents	Preset data contains the following data;
	CHAN: • Mode • Static/Dynamic • Range • CV response speed
	Go/NoGo: • SPEC Test • Entry Mode • High • Low • Center
Memory Data	Each channel can save up to 120 different Memory data types (M001~M120) into internal memory. Memory data contains general channel settings and is used when programming sequences. Memory data can be stored both internally and externally through the USB A port on the front panel of mainframe. Preset data and Memory data store the same contents.
	Internal Format: M001~M120
	External Format: 20X0X_XX.M
Memory Contents	Memory data contains the following data;
	CHAN: • Mode • Static/Dynamic • Range • CV response speed
	Go/NoGo: • SPEC Test • Entry Mode • High • Low • Center • Delay Time

SEQ Data	SEQ data contains Sequence data. SEQ data can only be saved to and from USB. SEQ refers to Sequence data, not Program sequences.		
	Internal Format	N/A (Internal buffer)	
	External Format	20X0X_XX.A	
SEQ Contents	SEQ data contains the following data;		
	Seq.Edit	• No. (Points) • Slew rate ↑ • Duration time	• Value • Slew rate ↓
	Loop	• Repeat • On End Load	• Start of Loop • CC Vrange
Setup Data	Setup data can be saved to 4 internal memory slots. Setup data contains Memory data, Program Sequence, Chain data, configuration settings and operation settings for every channel. Setup data can be saved to Internal memory or to USB.		
	Internal Format	Setup Memory 1~4	
	External Format	200X0_XX.S	
Setup Contents	Setup data contains the following data;		
	Program	• PROG • Memory • On-Time • P/F-Time • Short Channel	• SEQ (program sequence no.) • Run • Off-Time • Short-Time
	Chain	• Start	• Program Sequence (P01~P12)
	Run	• Active Channel (CH01~08)	
	CHAN	• Mode	• Static/Dynamic

	Go/NoGo	• Range • SPEC Test • High • Center	• CV response speed • Entry Mode • Low
Save: Internal memory	When saving data to internal memory, either the current channel or all the channel data can be saved. Not all data types can save the current channel or all the channel data.		

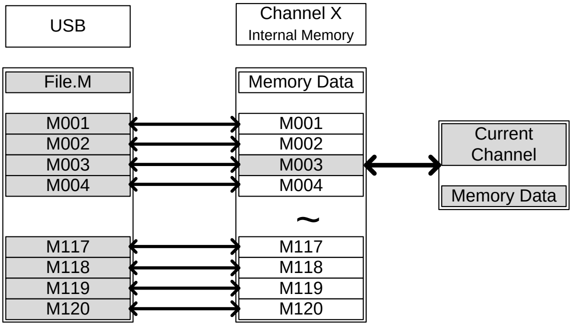
Data Type	Current Ch	All Ch
Preset	✓	✓
Memory	✓	✓
SEQ	✓ (single save)	–
Setup	–	✓

Save: External memory	Only SEQ, Memory and Preset data can be saved for a single channel to USB. All four data types (SEQ, Memory, Setup, Preset) can save all channels to USB.

Data Type	Current Ch	All Ch
Preset	✓	✓
Memory	✓	✓
SEQ	✓	✓
Setup	–	✓

Save/Recall USB

In order to save data from a single channel to USB, data must first be saved to the internal memory. After data is saved to internal memory, all the files can be saved to USB.

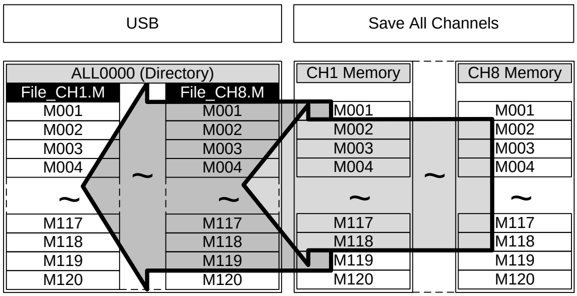


To recall saved files, the reverse is also true. Files must be recalled from the USB flash drive to internal memory. Then from internal memory the data can be recalled to each channel*.

*Excluding SEQ data.

Save/Recall All

The SEQ, Preset, Memory or Setup data can be saved from every channel into USB. SEQ, Preset and Memory data is saved into a directory (ALL0000-ALL0099) with a file for each channel, whilst Setup data is saved in a single file.



To recall saved files, the reverse is not true. Files must be recalled to each channel separately.

File Format

Current Channel	Filename format	
Memory data Preset data SEQ data	$\underbrace{2030}_{1}\underbrace{R}_{2}\_\underbrace{00}_{3}.\underbrace{M}_{4}$	1: PEL-2000B series Load module type: 2020 = PEL-2020B 2030 = PEL-2030B 2040 = PEL-2040B 2041 = PEL-2041B 2: Channel location or Voltage range of single channel model. R = Right L = Left 0 = Single channel or not used 3: Save file number: 0 ~99 Incremented after each consecutive save. 4: File extension M = Memory data P = Preset data A= SEQ data
All Channel	Directory Format	
	$\underbrace{ALL}_{1}\_\underbrace{0000}_{2}$	1: All Channel common directory name 2: Directory number: 0000 ~ 0099

All Channel

File Format

Memory data
Preset data
SEQ data

$\underbrace{2230}_{1}\underbrace{R}_{2}\_\underbrace{C1}_{3}.\underbrace{M}_{4}$

Setup Data

$\underbrace{2004}_{1}\underbrace{0}_{2}\_\underbrace{00}_{3}.\underbrace{S}_{4}$

1: PEL-2000B series Load module type:

2020 = PEL-2020B

2030 = PEL-2030B

2040 = PEL-2040B,

2041 = PEL-2041B

2: Channel, Voltage range of single channel model or Mainframe indication

R = Right

L = Left

0 = Single channel

3: Channel number:

C1 = CH1

C2 = CH2

Etc.

00 = All channels (Setup data)

4: File extension

M = Memory data

P = Preset data

A= SEQ data

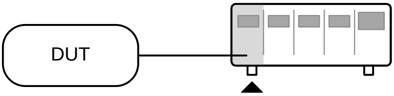
S= Setup data

TUTORIALS

Local loads

Local mode operation is useful to quickly test loads using the load module control panel rather than the mainframe control panel. Local load modules can be configured to operate independently to the mainframe. This can be useful when settings need to remain unchanged on the mainframe. Note however that the local modules cannot change the modes (CC, CV, CR, CP), only the values.

Group Unit mode is not supported for local module control.

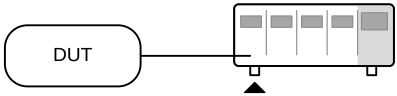


Step		Description	Details
1.	Setup	Ensure the channel load is set up as desired.	Pages 36, 44
2.	Channel selection	Ensure the correct channel or Value (A/B) is selected by using the R/L or A/B key.	Page 117
3.	Measurement Mode selection	If in CC or CR mode, Static or Dynamic mode can be selected.	CC Pages 118, 129 CR Pages 133, 135
4.	Run the Load	Press the LOAD key to start/end loading the device under test.	Page 119
Optional			
5.	Short configuration	Configure the SHORT settings.	Page 181
6.	Display	To change the display output, use the DISPLAY key.	Page 120
7.	Shorting the load	To short the load, use the SHORT key.	Page 120

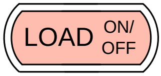
8.	Independent load	The local load modules can be set to independent load.	Page 185
9.	Independent control	Slave knobs can be configured to be independent to the mainframe.	Page 206
10.	Configure Slave Knob Settings	Display Measured or Set Values with the selector knob.	Page 209

Single Channel Load

Single channel loads are used to manually test a DUT quickly or to configure channel settings for Program Sequences using the mainframe panel.

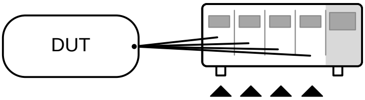


Step		Description	Details
1.	Setup	Choose the appropriate load module and make sure it is installed.	Page 36
2.	Connection	Connect the terminals to the DUT.	Page 44
3.	Channel selection	Select the load channel on the mainframe.	Page 123
4.	Measurement mode selection	Select measurement mode (CC, CV, CR, CP).	CC Page 125 CV Page 138 CR Page 131 CP Page 142
5.	Range selection	Set the range to high or low (CC, CR, CV and CP mode).	CC Page 125 CR Page 132 CP Page 145
6.	Mode selection	Choose Static or Dynamic mode (CC & CR mode only).	CC Pages 126, 129 CR Pages 133, 135
7.	Dynamic levels (CC,CR)	Set the dynamic levels, slew rate and timers. Applicable to CC & CR mode only.	CC Page 127 CR Page 133

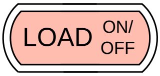
8.	Static Values (CC, CR, CV, CP)	Set the A(B) Value, slew rate (CC, CR) and current limit (CV, CP)	CC Page 129 CR Page 136 CV Page 139 CP Page 143
9.	Go/NoGo	Set the Go/NoGo configurations, if applicable.	Page 191
10.	Protection Modes	Configure the protection modes.	Page 174
11.	Run	Activate the load by pressing the load key.	
Optional			
12.	Configuration	There are number of configurations that apply to all channels. For details see the Configuration Tutorial.	Page 112

Parallel Load Modules

The Group Unit setting allows for a quick and easy parallel setup for load modules of the same type and rating. However, the Group Unit settings only apply for CC and CR modes.

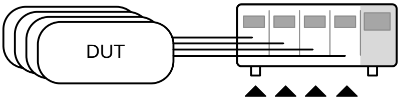


Step		Description	Details
1.	Setup	Choose the appropriate load modules and make sure they are installed. All load modules must be of the same type and rating.	Page 36
2.	Connection	Connect the terminals to the DUT.	Page 44
3.	Group Unit mode configuration	Enable Group Unit Mode and configure.	Page 195
4.	Measurement mode selection	Select measurement mode (CC, CR).	CC Page 125 CR Page 131
5.	Range selection	Set the range to high or low (CC, CR mode).	CC Page 125 CR Page 132
6.	Mode selection	Choose Static or Dynamic mode.	CC Pages 126, 129 CR Pages 133, 135
7.	Dynamic levels	For Dynamic mode, set the dynamic levels, slew rate and timers.	CC Page 127 CR Page 133
8.	Static Values	For Static mode, set the A(B) Value and slew rate.	CC Page 129 CR Page 136

9.	Go/NoGo	Set the Go/NoGo configurations, if applicable.	Page 191
10.	Protection Modes	Configure the protection modes.	Page 174
11.	Run	Activate the load by pressing the load key.	
Optional			
12.	Configuration	There are number of configurations that apply to all channels. For details see the Configuration Tutorial.	Page 112

Programming

When creating a Program Sequence or Chain, all channels are used at the same time unless programmed otherwise. Program Sequences use the channel settings stored from Memory Data. Program sequences are primarily used to perform a battery of pass/fail tests on DUTs.

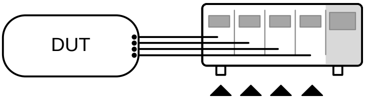


Step		Description	Details
1.	Setup	Choose the appropriate load module(s).	Page 36
2.	Connection	Connect the terminals to the DUT.	Page 44
3.	Channel selection	Select the load channel(s) on the mainframe.	Page 123
4.	Channel setup	See the "Single channel load" tutorial to configure a single channel. Do not activate the load.	Page 101
5.	Save channel	Save the configured channel.	Page 229
6.	Multiple channels	If multiple channels need to be configured, follow steps 1-5 for any remaining channels.	
7.	Program menu	Enter the Program menu.	Page 147
8.	Configure the sequence	Configure the program.	
9.	Save sequences	Save the Program in the FUNC →Program menu.	
10.	Program Chains	If required, Program chains can be created.	Page 150

11.	Save Program	Save the chain in the Chain menu.	
12.	Save Setup	Save everything to the internal Setup memory.	Page 237
13.	Run	Run the Program Sequence/Chain.	Page 153

Sequences

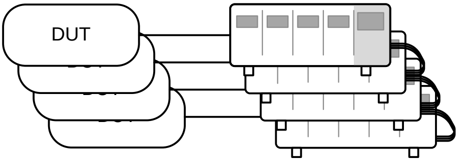
Sequences are used to accurately simulate loads. As each Sequence is independent, Sequences are ideally suited to test multiple output power sources.



Step		Description	Details
1.	Setup	Choose the appropriate load module(s).	Page 36
2.	Connection	Connect the terminals to the DUT.	Page 44
3.	Channel selection	Select a load channel with the mainframe.	Page 123
4.	Channel setup	Create a sequence.	Page 158
5.	Sequence loop	Create a sequence loop if necessary.	Page 160
6.	Multiple channels	If multiple channels need to be configured, follow steps 1-5 for any remaining channels.	
7.	Channel Duration menu	Edit the sequence channel duration information. Ensure that the channels containing Sequences are not set to OFF.	Page 162
8.	Trigger Settings	Set Trigger Out and In channels, if appropriate.	
9.	Run	Run the Sequence(s)	Page 165

Frame Link

Frame link connections are used connect up to four slave main frames to a master main frame. When using frame link connections it is possible to perform a number of operations in parallel under the control of the master unit.

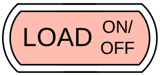
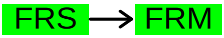
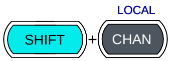


Step	Description	Details
1. Setup	Connect the mainframes together.	Page 54
2. Configure	Configure the Frame CONT to ON for all mainframes.	Page 204

At first both the master and slaves are independent. FRM (Frame Master) can be seen on the top panel of the each mainframe. When a mainframe is connected as a slave unit, the FRM icon will change to FRS (Frame Slave). The front panel keys are disabled on slave units when in slave mode (FRS).

Slave mode	FRM → FRS
Master/Independent	FRM

Step	Description	Details
3. Program	See the tutorial sections for programming or channel configuration.	Pages 101, 103

4. Run	Run the loads. To run the loads, press the LOAD key on the master mainframe. To stop, press again. When the LOAD key is pressed all loads will be active.	
Options		
5. Load Preset memory	Load preset memory on the mainframe and all frame-linked slaves.	Page 264
6. Load Setup Memory	Load setup memory on the mainframe and all frame-linked slaves	Page 263
7. Set slave to independent	Press shift + CHAN on the slave unit to enable local control on a slave unit. 	

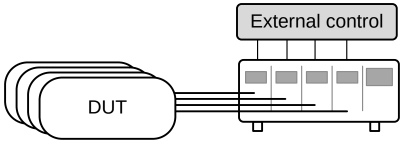
⚠ Note

When a load is run or memory is recalled from the master mainframe, the slave unit will return to mainframe control.

Ensure the same firmware is installed on both master and slave mainframes.

Channel Control

The Channel Control connectors on the rear panel can be used to control and monitor the status of up to 8 channels. For more information on channel control, see page 87.



Step	Description	Details
1. Setup	Ensure the load and PEL-2000B series mainframe is turned off.	
2.	Choose the appropriate load module(s).	Page 36
3. Connection	Connect the terminals to the DUT.	Page 44
4.	Connect the channel control connectors on the rear panel.	Page 56 & 272
5.	Turn on the PEL-2000B series mainframe and DUT (load).	
6. Configure	Select the Mode* and Range* via the front panel.	CC Pages 125, 125 CV Page 138
7.	Activate channel control for each channel that will be used for external control, i.e., set CH CONT to External.	Page 183

8.	Run	Run the load. Turn the load on by either outputting an active low signal to the appropriate channel control connector or control connector, or press the LOAD key on the load module or mainframe**.	Page 56 & 87
9.	Monitor	Use IMON and VMON to monitor the current and voltage of load outputs.	Page 87
10.	End	To turn the load off, output an active high signal to the channel control connector, or press the LOAD key on the load module or mainframe**.	

* Mode and Range cannot be configured via the Channel Control (CH CONT) interface. Mode and Range can only be configured via the front panel.

** The LOAD key cannot always be used to turn on/off the load. See page 87 for details.

General Configuration Options

There are number of different options for each channel. The different options are described below.

Options	Description	Details
1. CC Vrange	Configure the CC Voltage range from high or low.	Page 178
2. Von Voltage	Configure the Von Voltage settings.	Page 179
3. Short Settings	Configure the short key settings.	Page 181
4. CH CONT	Turn channel control on/off	Page 183
5. Independent load	Turn the load module control to dependent (via mainframe) or independent control.	Page 185
6. Delay Time	Configure the load delay time for each channel. (0-10 seconds).	Page 186
7. Clear All Protection	Clear all the Protection Alarms.	Page 177
8. Display	Adjust display settings.	Page 202
9. Control type	Configure the Knob control.	Page 206
10. Slave Knob Setting	Display Measured or Set values with the selector knob.	Page 209
11. Alarm	Configure alarm settings.	Page 207
12. Step resolution	Configure the step resolution. Applicable to CC high and low range, CR high and low range, CV high and low range and CP high and low rang.	Page 188
13. Response	Configure the Response setting.	Page 191

14.	Sound	Turn the sound on/off for the mainframe IU.	Page 202

OPERATION

The PEL-2000B series operation is described in the chapters below. The sections are broken down into small operations. For thorough examples on the operation of the load, please see the tutorial section on page 99.

Local Mode Operation

Each channel can be edited by its local load module. Depending on the configuration, local changes can be reflected on the mainframe. For this section all operations refer to knobs and buttons on the local load module panels, unless stated otherwise.

Selecting a Channel

Background

Each channel can be individually selected by using its load module panel. Changing channels on a load module only applies to dual channel load modules.

Single Channel Panel operation

Press any key on a load module to select its channel.

Dual Channel Panel Operation

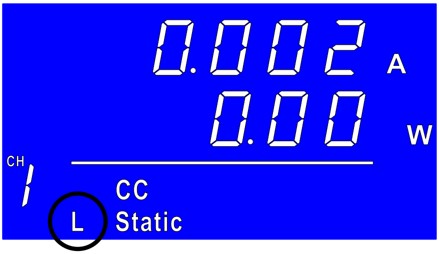
For dual channel load modules, press any key on a load module that has the desired channel. Press the R/L key to cycle between the channels on the load module. L or R will be displayed on the bottom left hand to indicate which channel (left or right side) is active on the load module.

LR

Note

On single channel modules, pressing the A/B key repeatedly will change the level from A or B when in Static mode.

Channels cannot be selected in Group Unit Mode.



Selecting Static/Dynamic

Background

Each load channel can be individually switched from Static to Dynamic using the local load module.

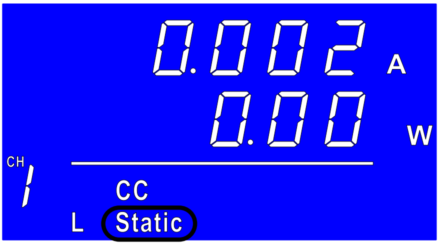
1. Select a channel on the load module. Page 117

Panel operation

2. Press the STATIC/DYNA. key to switch from dynamic to static mode and vice versa.

Note

All changes will be shown on the display and depending on the configuration, reflected on the mainframe.



Turning on the Load

Background

Loads can be individually selected to be turned on using local operation.

1. Select a channel on the load module. Page 117

Panel operation

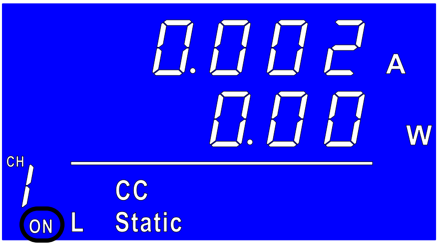
2. Press the LOAD key to turn on the load.

Note

When a channel load is activated, the load on symbol will be displayed under the channel number.

Range

L-ON	Left channel
R-ON	Right channel
ON	Single channel



Turning the load off

3. Press the LOAD key.

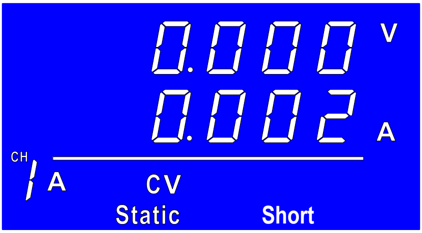
Shorting

Background — The Short Key is used to simulate a short circuit.

1. Configure the Short settings. Page 181
2. Select a channel on the load module. Page 117

Panel operation

3. Press the SHORT key to enter the shorting modes.



Shorting

4. a. Press the SHORT key (toggle mode).

Or

b. Hold the SHORT key (hold mode).

Note — The load cannot be shorted from the local load module in Group Unit mode.

Display Output View

Background — The DISPLAY key can be used to switch the display output to different views.

Panel operation

1. Press the DISPLAY key repeatedly to switch between the different views.

V Voltage

A	Current
W	Power
S	Load on time.

⚠ Note: The Display mode cannot be changed in Group Unit mode.

Editing CC/CR/CV/CP A/B Value

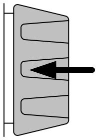
Background

The Slave Knob is used to edit the A Value or B Value (single channel load module) when in static mode. The Slave Knob can also operate in fine or coarse editing mode.

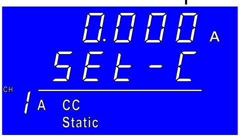
Panel Operation

1. Ensure the mode is in static mode. Page 118
2. Choose a channel (or choose A or B Value) by pressing the R/L or A/B key.

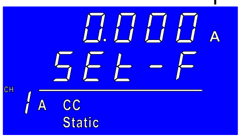
3. Press the Slave Knob to toggle between fine and coarse editing mode.
   SEt_C = coarse mode.
   SEt_F = fine mode.



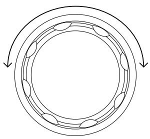
Fine mode example:



Coarse mode example:



4. Turn the Slave Knob to edit the A/B Value for the selected mode.



Note

When the Slave Knob is set to “Measure”, the slave knob must be pressed first to display the values on the load module display.

Editing the A/B Value is not possible with this method in Group Unit mode.

Mainframe Basic Operation

For the Mainframe Basic Operation section, all operations refer to the knobs and keys on the main configuration panel, unless otherwise stated.

Help Menu

Background

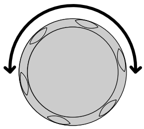
When any function key has been pressed or when a menu has been opened, the HELP key can be used to display a detailed description.

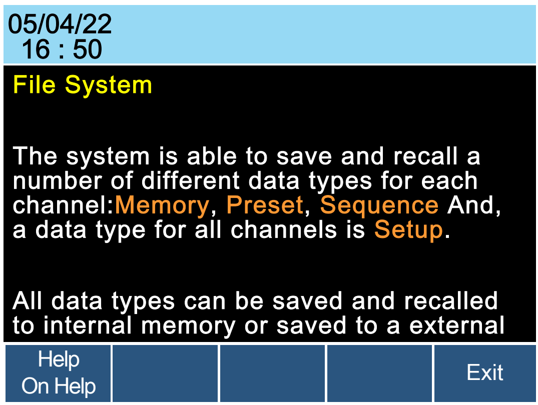
1. Press a function or system key on the front panel or open a menu.

Help Selection

2. Press the HELP key to display the built-in help.

3. Use the scroll wheel to scroll down if necessary.





A detailed description of the function or menu item is shown.

4. Press F5 to exit.

Channel Selection

Background

There are up to 2 channels per load module, depending on the model. The main display can be used to control each channel individually.

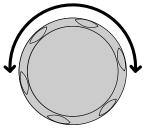
Note

When Group Unit Mode is enabled, channel selection is disabled. See page 117 for details.

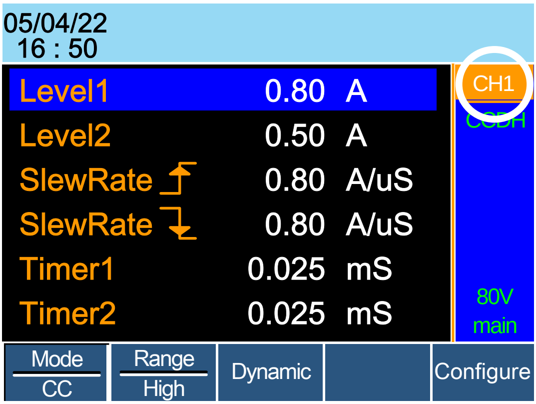
Mainframe Channel selection

5. Press the CHAN button.

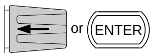
6. Select a channel by turning the Variable knob.



The channel selection appears highlighted in orange on the top right of the screen.



7. Press the Selector knob or Enter to confirm.

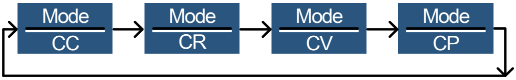


Select CC Mode

Background

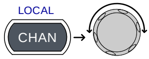
The PEL-2000B series loads operate in four different modes: Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV), and Constant Power (CP).

When a channel is active, the F1 key can be used to switch between each operating mode.



Panel Operation

1. Select a channel using the CHAN button and selector knob.



2. Press F1 repeatedly until CC mode is displayed in the display panel.

Note

Changing the operating mode will only affect the current (active) channel. Other channels will not be affected by any changes.

Select CC Range

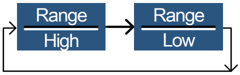
Background

Constant current mode can run in high and low range. Maximum range is dependent on the load module. Some models are only high range.

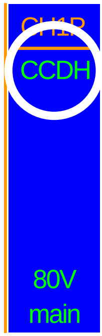
Ensure the menu is in CC Mode. See page 125.

Panel Operation

1. Press the F2 (Range) key repeatedly until High or Low range is selected. F2



The range will be reflected in both the bottom menu system and the Current Operation Channel Status panel.



CC Dynamic Low	CCDL
CC Dynamic High	CCDH
CC Static Low	CCL
CC Static High	CCH

Note

Changing the range will only affect the current (active) channel. Other channels will not be affected by any changes.

Not all load modules support dual ranges. If only one range is supported, it is usually high range.

Select CC Dynamic Mode

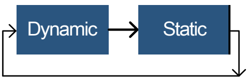
Background

Constant current mode can be set to dynamic or static mode. Dynamic mode is used to automatically set varying load rates.

Ensure the menu is in CC Mode. See page 125.

Panel Operation

1. Press the F3 key until Dynamic Range mode is selected. F3



Note Changing from static to dynamic mode will only affect the current (active) channel.

Editing CC Dynamic Parameters

Background

Dynamic Constant Current Mode has two operating current levels, slew rates and timers.

Slew rates determine the speed at which the load will change from one level to the next.

The timers determine how long the load module/channel will stay at level 1 or level 2.

Ensure the menu is in CC Dynamic Mode. See page 126.

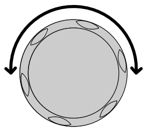
Parameters

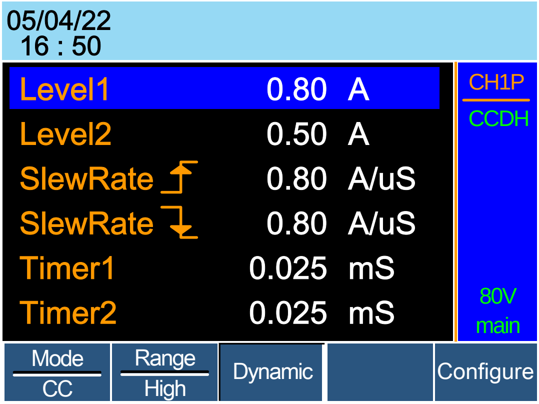
Level1	0 ~ Setting Max A
Level2	0 ~ Setting Max A
SlewRate ↑	Load module dependent
SlewRate ↓	
Timer1	0.025 ~ 30000.0 ms
Timer2	0.025 ~ 30000.0 ms

Note When used in Group Unit mode, the Level1 & Level2 range is the combined rating of all the units used in Group Unit mode.

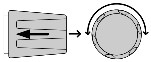
Panel Operation

1. Use the Selector knob to highlight Level1.



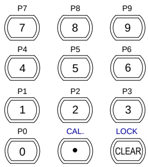


2. Press the Selector knob to edit the selected level, then turn to increase or decrease the value*.

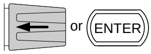


OR

Use the number pad to enter a number.



3. Press the Selector knob or Enter to confirm selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

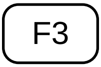
Level1 & Level2 can be set for both High and Low Range.

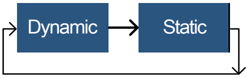
*Press Shift to toggle between coarse and fine adjustment when editing the Level1 and Level2 parameters. See page 188 for details.

Select CC Static Mode

Background	Constant current mode can be set to dynamic or static mode. Static mode is for manually varying the load for single channel load modules or to set a static load on dual channel modules.
	Ensure the menu is in CC Mode. See page 124.

Panel Operation	1. Press the F3 key until Static mode is selected.





Note	Changing from static to dynamic mode will only affect the current (active) channel.

Editing CC Static Parameters

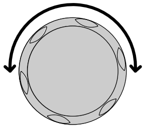
CC Values	When using a single channel load module, Static Constant Current Mode has two operating current values, A&B. If a dual channel load is used, only one current value is available per channel: A Value.
	If Group Unit Mode is enabled, an additional parameter, Switch Value, is available to switch from A Value to B Value.
	Ensure the menu is in CC Static Mode. See page 129.

Parameters	A Value	0 ~ Setting Max A
	B Value	0 ~ Setting Max A
	SlewRate	Load module dependent
	SlewRate	
	Switch Value	A/B (Group Unit Mode only)

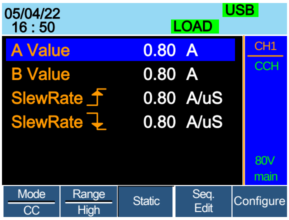
Note: When Group Unit Mode is enabled, the A Value & B Value range is the combined rating of all the units used in Group Unit Mode, see page 71.

Panel Operation

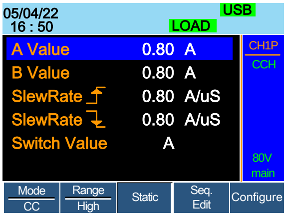
1. Use the Selector knob to highlight A Value.



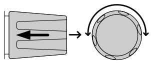
Single Channel Configuration



Group Unit Mode Configuration

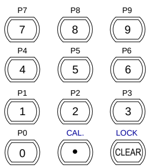


2. Press the Selector knob to edit the selected value, then turn to increase or decrease the value*.

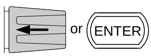


OR

Use the number pad to enter a number.



3. Press the selector knob or Enter to confirm selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

The last Value (A Value or B Value) that is set becomes the active setting. To swap between A Value and B Value, use the A/B keys on the local load module. This is not applicable to Group Unit mode.

For Group Unit mode, use the Switch Value parameter to switch between A and B Value.

A/B Value and rising/falling SlewRate can be set for both High and Low Range.

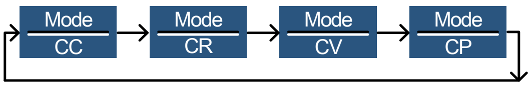
*Press Shift to toggle between coarse and fine adjustment when editing the A Value and B Value parameters. See page 188 for details.

Set to CR Mode

Background

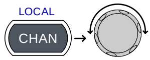
The PEL-2000B series load operates in four different modes, Constant Current (CC), Constant Voltage (CV), Constant Resistance (CR) and Constant Power (CP). Constant Resistance mode will maintain a constant resistive load, using variable current and voltage levels.

When a channel is active, the F1 key can be used to switch between each operating mode.

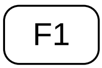


Panel Operation

1. Press the CHAN button and use the selector knob to select a channel.



2. Press F1 until CR mode is displayed in the display panel.



Note: Changing the operating mode will only affect the current (active) channel. Other channels will not be affected by any changes.

Select CR Range

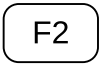
Background

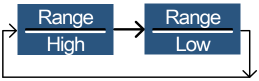
Constant Resistance mode can run in high and low range. Range is dependent on the load module.

Ensure the menu is in CR Mode. See page 131.

Panel Operation

1. Press the F2 (Range) key repeatedly until High or Low range is selected.





The range will be reflected in both the bottom menu system and the Current Operation Channel Status panel.

CR Static Low	CRL
CR Static High	CRH
CR Dynamic Low	CRDL
CR Dynamic High	CRDH

Note: Changing the range will only affect the current (active) channel. Other channels will not be affected by any changes.

All resistance values and slew rates are dependent on Range, i.e., A Value in low range can be different from A Value in high range.

Select CR Dynamic Mode

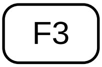
Background

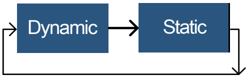
Constant Resistance mode can be set to dynamic or static mode. Dynamic mode is used to automatically set varying load rates.

Ensure the menu is in CR Mode. See page 131.

Panel Operation

1. Press F3 until Dynamic Range mode is selected.





Note

Changing from static to dynamic mode will only affect the current (active) channel.

Editing CR Dynamic Parameters

CR levels

Dynamic Constant Resistance Mode has two operating resistance levels, slew rates and timers.

Slew rates determine the speed at which the load will change from one level to the next.

The timers determine how long the load module/channel will stay at level 1 or level 2. See the CR operating description for details about slew rates and timers, page 64

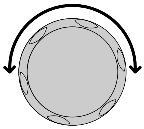
Ensure the menu is in CR Dynamic Mode. See page 133.

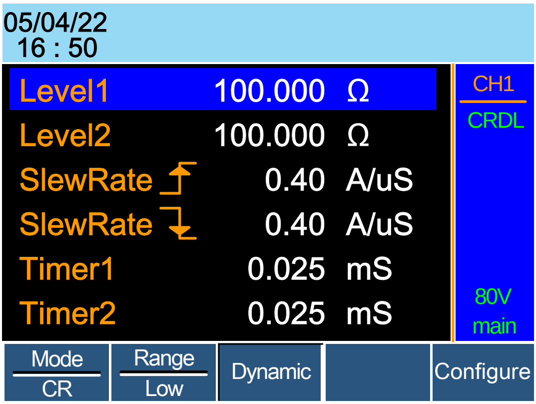
Parameters	Level1	Minimum ~ Rating Ω
	Level2	Minimum ~ Rating Ω
	SlewRate ↑	Load module dependent
	SlewRate ↓	
	Timer1	0.025 ~ 30000.0ms
	Timer2	0.025 ~ 30000.0ms

Note: When used in Group Unit Mode, the Level1 & Level2 range is the combined rating of all the units used in Group Unit Mode.

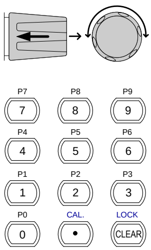
Panel Operation

1. Use the Selector knob to highlight Level1.





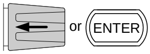
2. Press the Selector knob to edit the selected level, then turn to increase or decrease the value*.



OR

Use the number pad to enter a number.

3. Press the Selector knob or Enter to confirm selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

Level1 & Level2 can be set for both High and Low Range.

*Press Shift to toggle between coarse and fine adjustment when editing the Level1 and Level2 parameters. See page 188 for details.

Select CR Static Mode

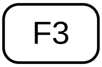
Background

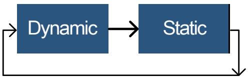
Constant Resistance mode can be set to dynamic or static mode. Static mode is for manually varying the load for single channel load modules or to set a static load on dual channel modules.

Ensure the menu is in CR Mode. See page 131.

Panel Operation

1. Press the F3 key until Static mode is selected.





Note

Changing from static to dynamic mode will only affect the current (active) channel.

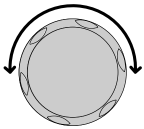
Editing CR Static Parameters

Background	Single channel load modules have two resistance levels, A Value & B Value. Dual channel load modules have only one resistance level per channel, A Value.
	When Group Unit Mode is enabled, an additional parameter, Switch Value, is available to switch from A Value to B Value.
	Ensure the menu is in CR Static Mode. See page 135.

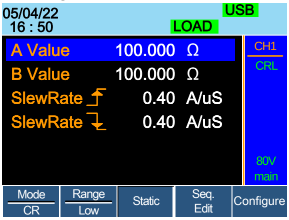
Parameters	A Value	Setting Min ~ Rating Ω
	B Value	Setting Min ~ Rating Ω
	SlewRate	Load module dependent
	SlewRate	
	Switch Value	A/B (Group Unit Mode only)
Note	When Group Unit Mode is enabled, the A Value & B Value range is the combined rating of all the units used in Group Unit Mode.	

Panel Operation

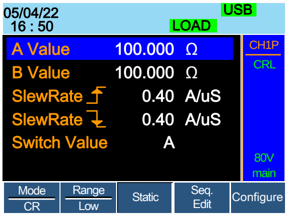
1. Use the Selector knob to highlight A Value.



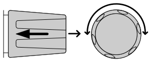
Single Channel Configuration



Group Unit Mode Configuration

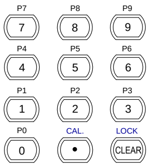


2. Press the Selector knob to edit A Value /B Value, then turn to increase or decrease the value*.

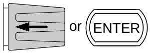
   

   OR

   Use the number pad to enter a number.

3. Press the selector knob or Enter to confirm selection.

4. Repeat steps 1-3 for B Value (if applicable), rising and falling SlewRate.

Note

The last Value (A Value or B Value) that is set becomes the active setting. To swap between A Value and B Value, use the A/B keys on the local load module (not applicable to Group Unit mode).

For Group Unit mode, use the Switch Value parameter to switch between A and B Value.

A/B Value and rising/falling SlewRate can be set for both High and Low Range.

*Press Shift to toggle between coarse and fine adjustment when editing the A Value and B Value parameters. See page 188 for details.

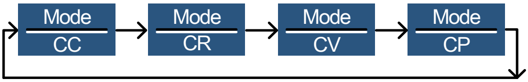
Select CV Mode

Background

The PEL-2000B series electronic load operates in four different modes, Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV), and Constant Power (CP).

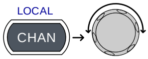
CV Mode cannot be used with the Group Unit mode.

When a channel is active, the F1 key can be used to switch between each operating mode.



Panel Operation

1. Press the CHAN button and use the selector knob to select a channel.



2. Press F1 until CV mode is displayed in the display panel.

Note

Changing the operating mode will only affect the current (active) channel. Other channels will not be affected by any changes.

Editing CV Parameters

Background

Constant Voltage mode can be set to a maximum limit (Curr Limit). Using the current limit enables limiting the current draw.

When using CV mode on single channel load modules, two voltage levels can be set, A Value and B Value. On a dual channel load module, only one voltage level can be set per channel: A Value.

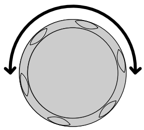
Ensure the menu is in CV Mode. See page 138.

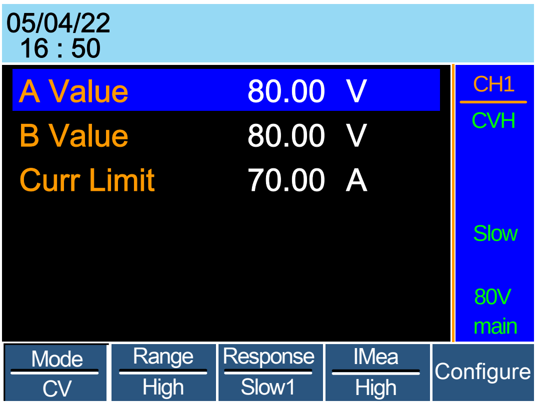
Parameters

A Value	0 ~ Setting Max V
B Value	0 ~ Setting Max V
Curr Limit	Load module dependent

Panel Operation

1. Use the Selector knob to highlight A Value.

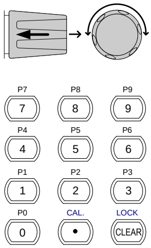




2. Press the Selector knob to edit the selected value, then turn to increase or decrease the value*.

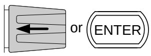
   OR

   Use the number pad to enter a number.



A Value 10.00 V

3. Press the selector knob or Enter to confirm selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

The last Value (A Value or B Value) that is set becomes the active setting. To swap between A Value and B Value, use the A/B keys on the local load module.

When setting the current limit, please ensure that the current limit is within the test device's limits.

A/B Value can be set for both High and Low Range.

*Press Shift to toggle between coarse and fine adjustment when editing the A Value and B Value parameters. See page 188 for details.

Select CV Range

Background

Constant Voltage mode can run in high and low range. Range is dependent on the load module.

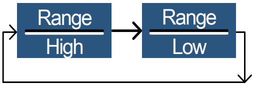
Ensure the menu is in CV Mode. See page 144.

Mode / CP	Range / Low			Configure

Panel Operation

1. Press the F2 (Range) key repeatedly until High or Low range is selected.

F2



The range will be reflected in both the bottom menu system and the Current Operation Channel Status panel.

CV High Range	CVH
CV Low Range	CVL

⚠ Note — Changing the range will only affect the current (active) channel. Other channels will not be affected by any changes.

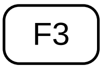
Select CV Response Speed

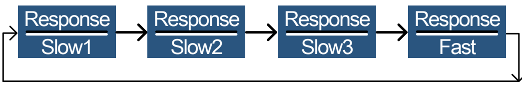
Background — Constant voltage mode has fast and slow response speeds. Quick current changes can induce line voltage, making it more difficult for the PEL-2000B series load to maintain a constant current. In these types of conditions, slow response speed is recommended.
Maximum current range is dependent on the load module type.

Ensure the menu is in CV Mode. See page 138.

Panel Operation

1. Press F3 (Response) to switch between Fast and Slow response speeds.

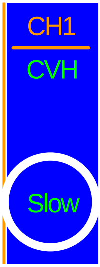




Response speed settings will be reflected in the Current Operation Channel Status panel.

CV Slow Response Slow

CV Fast Response Fast



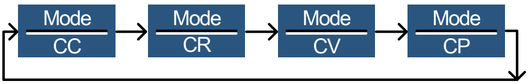
Note: Changing the response speed will only affect the current (active) channel. Other channels will not be affected by any changes.

Select CP Mode

Background: The PEL-2000B series electronic load operates in four different modes, Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV), and Constant Power (CP).

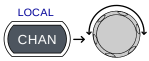
CP mode cannot be used with the dedicated Group Unit mode.

When a channel is active, the F1 key can be used to switch between each operating mode.

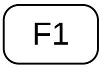


Panel Operation

1. Press the CHAN button and use the selector knob to select a channel.



2. Press F1 until CP mode is displayed in the display panel.



Note — Changing the operating mode will only affect the current (active) channel. Other channels will not be affected by any changes.

Editing CP Parameters

Background

Constant Power mode can be set to have a maximum limit (Curr Limit). Using the current limit enables limiting the current draw.

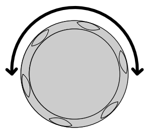
When using CP mode on a single channel load module, two power levels can be configured, A Value and B Value. On a dual channel load module, only one power level can be configured per channel: A Value.

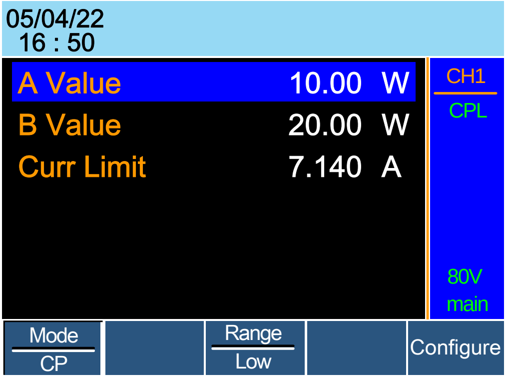
Ensure the menu is in CP Mode. See page 138.

Parameters	A Value	0 ~ Setting Max W
	B Value	0 ~ Setting Max W
	Curr Limit	Load module dependent

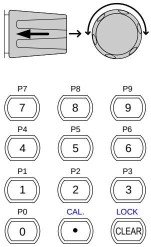
Panel Operation

1. Use the Selector knob to highlight A Value.





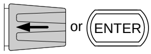
2. Press the Selector knob to edit the selected value, then turn to increase or decrease the value *.



OR

Use the number pad to enter a number.

3. Press the selector knob or Enter to confirm selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

The last Value (A Value or B Value) that is set becomes the active setting. To swap between A Value and B Value, use the A/B keys on the local load module.

A/B Value can be set for both High and Low Range.

When setting the current limit, please ensure that the current limit is within the test device's limits.

*Press Shift to toggle between coarse and fine adjustment when editing the A Value and B Value parameters. See page 188 for details.

Select CP Range

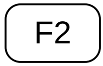
Background

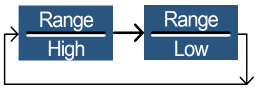
Constant Power mode can run in high and low range. The maximum range is dependent on the load module. Some models are only high range.

Ensure the menu is in CP Mode. See page 138.

Panel Operation

1. Press the F2 (Range) key repeatedly until High or Low range is selected.





The range will be reflected in both the bottom menu system and the Current Operation Channel Status panel.

CP High Range	CPH
CV Low Range	CPL

Note

Changing the range will only affect the current (active) channel. Other channels will not be affected by any changes.

Not all load modules support dual ranges. If only one range is supported, it is usually high range.

Creating a Program Sequence

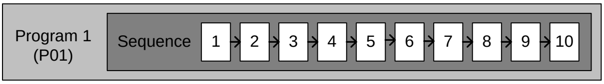
Background

The PEL-2000B series has a total of 12 different programs and 10 sequences to each program. That totals to 120 different configurations.

Each Sequence in each program uses the settings saved from Memory Data (Memory MXXX). Memory Data contains settings such as the mode and range for each channel. Different Sequences can use the same Memory Data repeatedly. Each Sequence loads all channels at the same time, unless programmed otherwise.

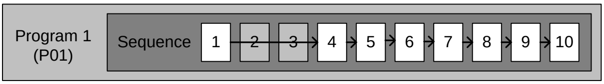
Sequence1	
CH1 M001	Run
CH2 M001	On-Time
CH3 M001	Off-Time
CH4 M001	Short-Time
CH5 M001	P/F-Time
CH6 M001	Short CH1
CH7 M001	~
CH8 M001	Short CH8

Sequences are run sequentially to create a Program. There are 10 Sequences in each Program.



If less than 10 Sequences are desired for a Program, any additional Sequences can be skipped (not run).

Sequence 2 & 3 are skipped.

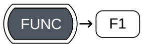


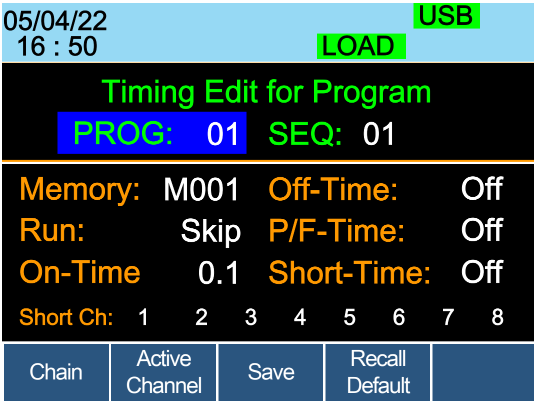
Parameters	Memory	M001~M120
	Run	Skip-Auto-Manual
	On-Time	0.1 ~ 60.0 seconds
	Off-Time	Off – 0.1 ~ 60.0 seconds
	P/F Time	Off – 0.1 ~ (On-Time+Off-Time)-0.1
	Short-Time	Off – 0.1 ~ On-Time
	Short Ch	Off – 1~ 8 (CH1~CH8)

Note: Before a program can be created, the settings for each sequence for every channel that is to be used in the program must first be pre-configured and saved into Channel Memory (MXXX).

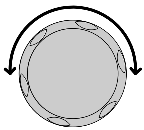
Sequence Settings

1. Press the FUNC key then F1 (Program) to access the Program menu.





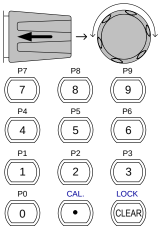
2. Use the Selector Knob to highlight PROG:.



3. Press the selector knob to edit PROG:, then turn to select the program number.

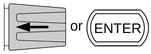
   OR

   Use the number pad to enter a program number.



   Program: 01 ~12

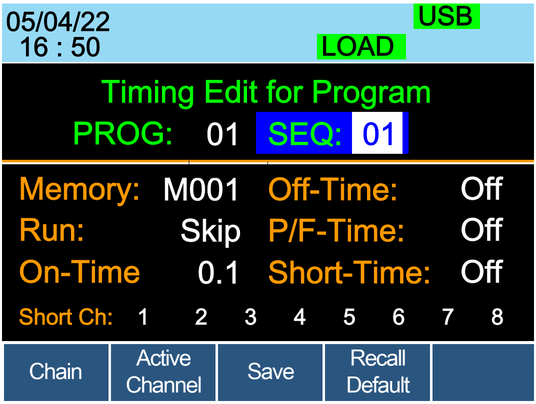
4. Press Enter or push the selector knob to confirm.



Repeat steps 2-4 to choose the sequence number (SEQ:).

   Sequence: 01 ~ 10

5. As sequences are executed sequentially, start at SEQ: 01.



6. Repeat steps 2-4 to configure the following for the current Program Sequence:

   Memory: M001 ~M120

      Choose which Memory data will be used for the sequence. M001 ~ M120

   Run: Skip – Auto - Manual

Choose whether to run the sequence in the program automatically, skip the sequence or manually start the sequence.

On-Time: 0.1 ~ 60.0 seconds

Determines how long the sequence will run for (seconds).

Off-Time: Off – 0.1 ~ 60.0 seconds

Sets how long the sequence will stay off for (in seconds) between each sequence. Assuming Short time is not set to OFF, Off-Time will always run after On-Time.

Short Time: Off – 0.1 ~ On-Time (seconds)

Determines how long a short circuit will last (seconds). However the shorting time cannot be longer than the On-time. Short Time will start at the same time as On-time.

P/F Time: Off – 0.1 ~ (On-Time+Off-Time)-0.1 (seconds)

The Pass(P)/Fail(F) Delay Time can be set to 0.1 seconds less than the total test time. The total test time is defined as:

On-Time + Off-Time (seconds)

If Go/NoGo is turned on but the pass fail time is off, then Go/NoGo test will continue, but there will not be a specified pass/fail time window.

Short Channel: Off – 1~ 8 (CH1~CH8)

Each channel can be individually set to simulate a short circuit (CH1~8) or can have shorting disabled (Off). When Short Channel is set to Off, the channel will ignore the execution of Short-Time.

7. Repeat the above steps for all ten sequences for the same (current) program.

Save Sequence

8. Press F3 (Save) to save all the sequence data for all of the program. F3

Note

Note the program data is not yet saved into Setup Memory. If you wish to save the Program to Setup Memory see page 238.

Recall Default

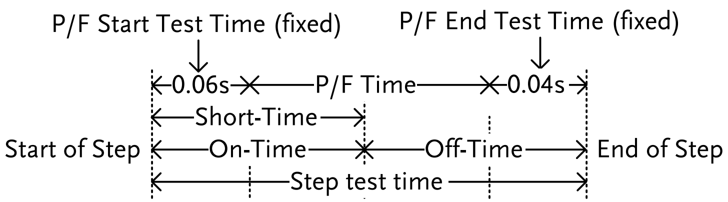
9. To recall the Default Program settings, press F4. F4

Note

If the Default is recalled, all data will be lost. This does not include the internal Setup Memory. To see the default settings, see page 299.

Timing Diagram for Single Step

Below is a timing diagram of a single step in a program.



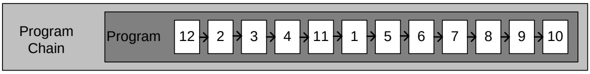
Program Chains

Background

On the PEL-2000B, there are up to 12 different programs containing 10 sequences.

If 10 sequences in a Program Sequence prove to be inadequate for testing, the PEL-2000B series can chain different programs together, effectively making a larger Program Sequence.

Unlike Program Sequences, Program Chains do not need to be run in numerical order. Up to 12 Program Sequences can be chained together

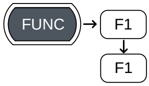


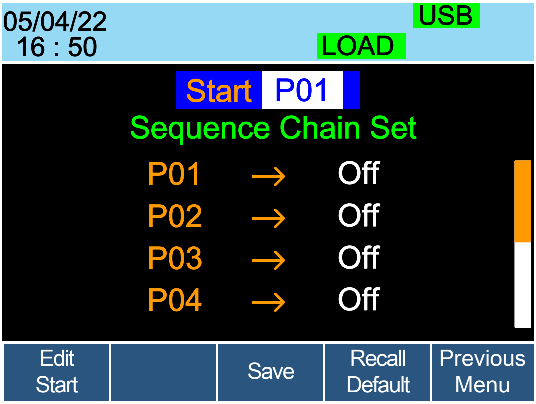
Panel operation

1. Create 1 or more Program Sequences. Page 142

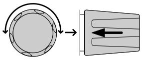
2. If Program Sequences were created in a different session, ensure the programs have been loaded from Setup Memory. Page 238

3. Press the FUNC key, then Program (F1), followed by Chain (F1).

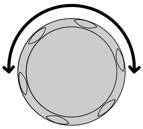




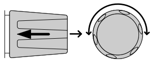
4. Press F1 (Edit Start) and use the selector knob to edit Start and confirm which Program Sequence (PXX) will start the program chain. Any Program (P01~P12) can be used to start a Program Chain.



5. Use the Selector knob to scroll down to P01 (Program 1).



6. Use the Selector knob to choose the program that will execute after P01 (P02~P12).



OR

Select (Off) to end the Program Chain after (P01).

OR

Select (P01) to execute after P01, this will create a continuously looping Program Chain.

P01 → Off – P01~P12

7. Repeat the above procedure to P02~P12 to complete the program chain.

The Program Chain ends at the first Program (PXX) that is followed by Off. It is possible to create continuously looping program chains.

Save Program Chain

8. Press F3 (Save) to save the program chain.

F3

⚠ Note

The Program Chain data is not yet saved into Setup Memory. If you wish to save the Program Chain to Setup Memory see page 236.

Recall Default

9. To recall the Default program chain, press F4.

F4

⚠ Note

If the Default is recalled, Start will revert to P01 and all program sequences will be set to Off.

Previous Menu

10. Press F5 (Previous Menu) to return the Sequence menu.

F5

Running a Program

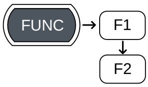
Background

Once a Program Chain/Program Sequence has been created, it can be executed. As Program Sequences apply to all the channels, any channels that don't need to be active (load off) can be programmed in the Active Channel menu. At Default, all channels are set to (load) Off.

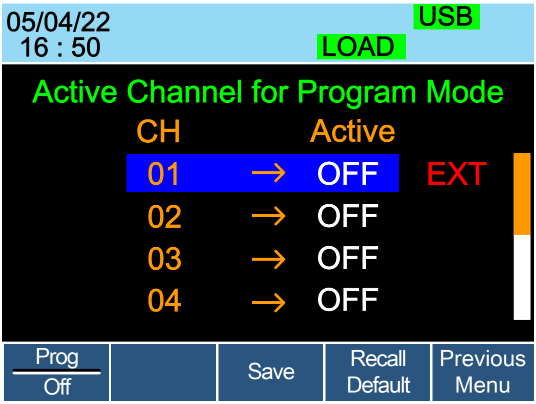
EXT will be shown next to any channels set to external channel control.

Panel operation

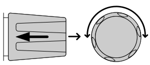
1. Create 1 or more Program Sequences. Page 142
2. Create a Program Chain. Page 150
3. Press the FUNC key, Program (F1) and Active Channel (F2).



Channel 1 (CH01) will be highlighted. Note CH1 has CH CONT set to External

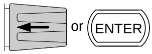


4. Edit the channel using the Selector knob.



CH 01~08: ON (activate channel) – OFF (not activated)

5. Press Enter or push the selector knob to confirm the selection.

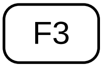


6. If needed, repeat steps 4-5 for the remainder of the channels.

Note If all channels are Active OFF, a program cannot be run as there will be no channels active.

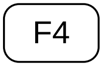
Save Program

7. To save press F3.



Recall Default

8. To recall default settings press F4



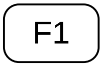
Note If the Default is recalled, all channels will revert to Active OFF.

Previous Menu

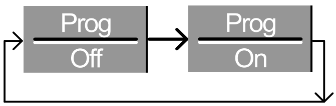
9. Press F5 (Previous Menu) to return to the Sequence menu.

Turn Program On/Off

10. Press F1 (Prog) to turn On or Off the current Program.



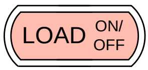
Pressing F1 will cycle from Program On to Off.



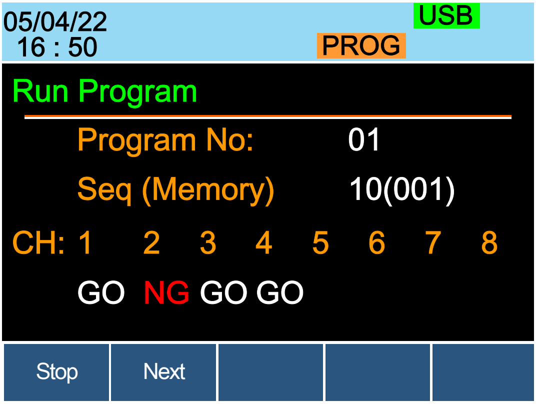
11. PROG will appear on the mainframe status panel when the program is turned on.

Run Program

12. Press the load key on the mainframe to start the Program.



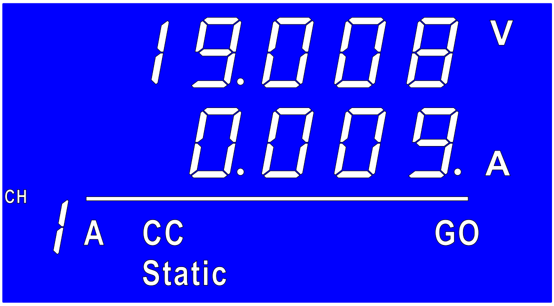
13. The Run Program screen appears, and the PROG icon turns orange.



As each sequence or program is completed the screen will update to display the active sequence/program. Notice that if a channel has been set up with Go/NoGo limits, a pass (GO) or fail (NG) will be displayed on the main display as well as the local load module display.

Note

If the Active = OFF for all the channels then "No Active Channel" will be displayed instead of channel numbers.



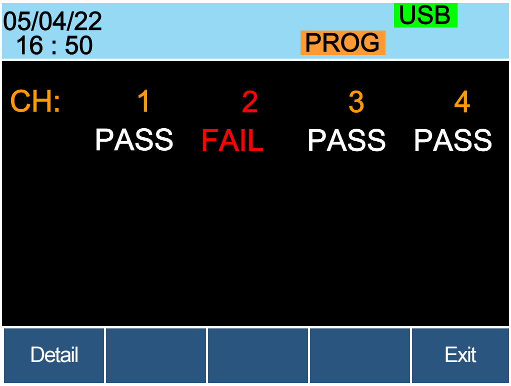
Each active load module will display the output as the program runs.

14. If Run was configured to manual in any of the program sequences, press F2 (Next) to continue the program sequence, otherwise the program will continue automatically.

F2

15. Press F1 (Stop) at any time to abort the program when it is running.

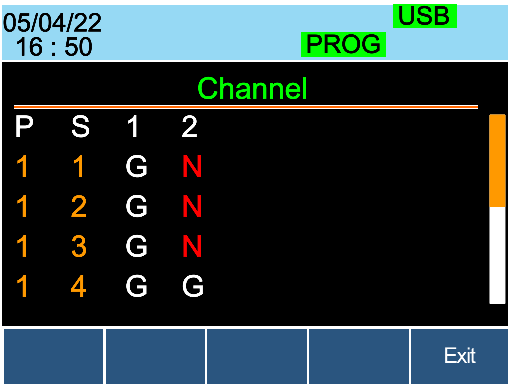
F1



When the program has finished, the physical channels that have run will be displayed, a PASS or FAIL will be displayed if Go/NoGo testing has been set.

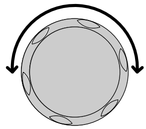
16. When the program has finished, press F1 to see any result details.

F1



The Program (P) and Sequence (S) numbers for the Program are displayed on the left hand side and the Go/NoGo (G/N) results are displayed on the right hand side for each channel in the program.

Use the Selector knob to scroll down to view the remainder of the list if necessary.



17. Press F5 to exit at any time.

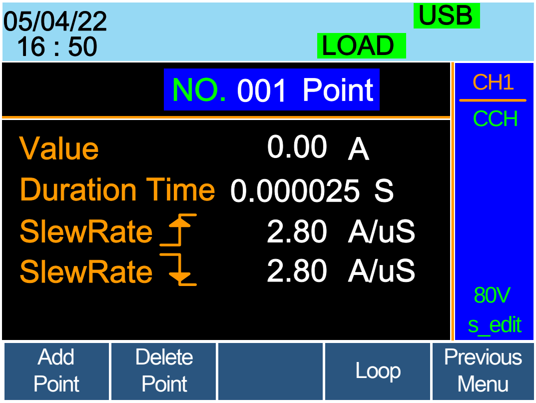
Upon exiting, the previous menu before running the program will load.

Edit Sequence

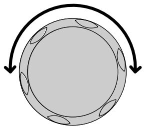
Background	The Sequence function can be configured to create a unique load profile to accurately simulate loads in real time for single or multiple loads. Sequence can only be used with CC static or CR static modes. For details see page 76.	
	Each Sequence is composed of a number of points with customizable current/resistance, slew rate and duration times. Each sequence can be looped an infinite amount of times. Sequences are only applicable for CC (Static) and CR (Static) modes.	
Note	The sequence function should not be confused with program sequences. They are not the same. Program sequences cannot be used with the Sequence function and vice versa.	

Parameters	Value	Setting Min ~ Setting Max Ω/A
	SlewRate (rising)	Load module dependent
	SlewRate (falling)	
	Duration Time	0.000025 ~ 60,000 seconds

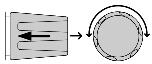
Panel operation	1. Choose a channel and mode.	Page 123, 125
	2. Press the CHAN key, F4 (Seq. Edit) to enter the Sequence Edit menu.	FUNC → F4



3. Use the Selector knob to highlight Value.



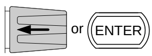
4. Press the Selector knob to edit the Value, then turn to increase or decrease the value.



OR

5. Use the number pad to enter a number.

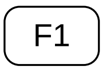
6. Press the Selector knob or Enter to confirm selection.



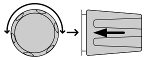
7. Repeat for rising and falling Slew Rate and Duration Time.

Add Point

8. To add an extra point after the current point, press Add Point (F1).



Range	001~120

Note	Add Point will insert a new point directly after the current point. The value of the current/resistance of the inserted point will be the average of the point before and after. All other settings will remain unchanged.
Delete Point	9. To delete the current point, press Delete Point (F2). F2
Edit previous point	10. Use the selector knob to change the current point number. 
	001 Point
Note	The Point number can only be changed if more points have already been added.
Save Sequence	11. Press Save (F3) to save the sequence. F3
Note	The save icon will only appear after a change has been made in the menu.

Create Sequence Loop

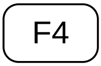
Background	Sequences can be looped a number of times. The loops can be started at any point in the sequence. The Start of Loop function determines which point will start each repeating loop. The On End of Seq. function will hold the load current (of the selected sequence) to a designated value until all the other sequences have finished running. CC Vrange sets the range in CC mode for Sequences. See page 76 for more details.

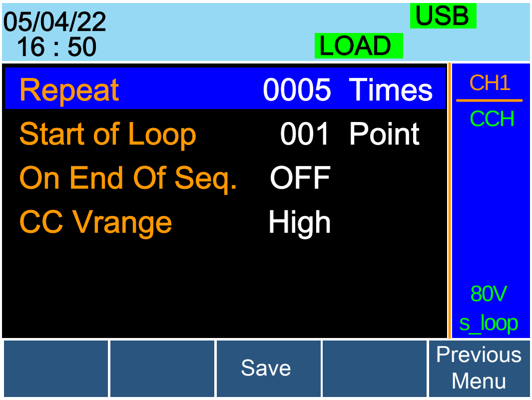
Ensure the menu is in the Seq. Edit menu and that a sequence has been created. See page 158

Parameters	Repeat	1~9999/Infinity (0)
	Start of Loop	001~ last point
	On End of Seq.	OFF / Setting Min ~ Setting Max
	CC Vrange (CC mode only)	High/Low

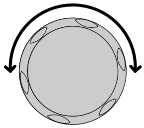
Panel operation

1. Press Loop (F4) to enter the Loop menu.

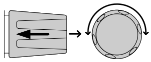




2. Use the Selector knob to highlight Repeat.

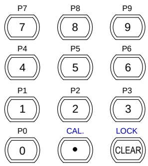


3. Press the Selector knob to edit Repeat, then turn to increase or decrease the value.



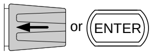
OR

4. Use the number pad to enter a number.



Select 0 to choose infinity.

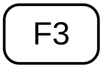
5. Press the Selector knob or Enter to confirm selection.



6. Repeat for the remaining parameters.

Save Loop

7. Press Save (F3) to save the loop.



Channel Duration Time Settings

Background

Each sequence can have the timing duration data of another sequence. For example CH1's sequence can import the timing duration settings of CH2's sequence.

This is useful to quickly compare two different loads to the same timing characteristics. See page 76 for more details.

Each channel's sequence can be turned off by configuring the channel Setting to OFF. If a channel uses the same channel number, i.e. CH 01 → 01, then the duration time settings will not be altered for that channel.

At least one channel must output a Trigger Sequence Signal via PIN4 of the first frame link connector (master) if a sequence is run. For more details see page 76.

The Trigger In signal is used to start any sequence that has TRIG set to IN. The trigger input signal is input via PIN4 of the first frame link connector (slave). For more details, see page 76.

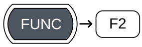
Any channels with channel control (CH CONT) set to external will be shown on the right side as EXT. See page 183 for details on setting channel control.

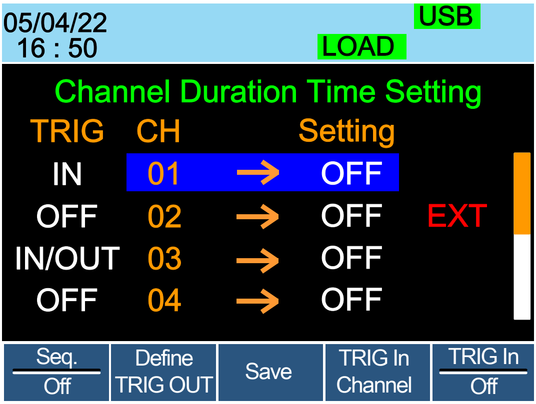
Parameter		
	CH 01~08 Setting	OFF ~ maximum channels
	CH 01~08 TRIG	IN , OUT , IN/OUT, OFF

Ensure at least one sequence has been created and saved. Page 158

Panel operation

1. Press FUNC, then Sequence (F2) to enter the Channel Duration Time menu.

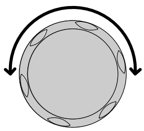




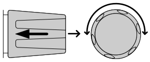
Note

CH3 is set to TRIG OUT, whilst CH1 & CH3 are set to TRIG IN. CH2 has no trigger settings and has CH CONT set to external.

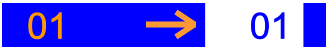
2. Use the Selector knob to highlight a channel.



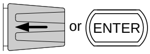
3. Press the Selector knob to edit the channel, and then turn to choose which channel's Duration Time Setting to import.



Range	Ch 01~08 / OFF



4. Press the Selector knob or Enter to confirm selection.



Trigger Out Channel

5. Press Define TRIG OUT (F2) if you want the currently selected channel to output the Trigger sequence signal.

One channel must be set as the TRIG OUT channel.

Trigger In Channel

6. Press TRIG In Channel (F4) to allow the current sequence to be triggered with the Input trigger.

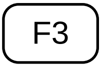
Trigger In On/Off

7. To turn the Input trigger source on, press Trig In (F5).

8. Repeat the above steps for any other remaining channels.

Save settings

9. Press Save (F3) to save the settings.



Run Sequence

Background

Like Programs, Sequences must be turned "ON" before they can be run.

When running a Sequence, the front panel function keys, number pad, operation keys and selector knob are disabled for the specific channel(s). The load module panel is also disabled (bar the display key) for the specific channel.

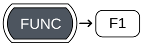
Channels that do not have a Sequence can still be edited by changing channels via the CHAN key or by using the local load module.

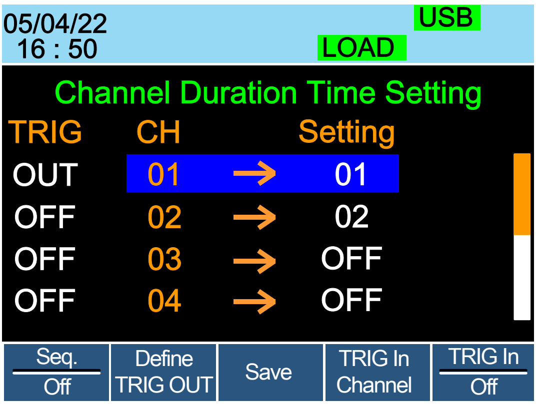
Ensure at least one Sequence has been created and saved. Page 158

Ensure the Channel Duration Time Settings have also been configured and that no Sequence (CH01~08) that you wish to run are set to OFF. Page 162

Panel operation

1. Press FUNC, then Sequence (F2) to enter the Channel Duration Time Setting menu.

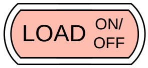




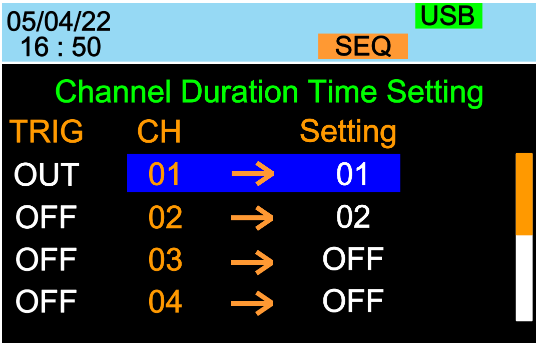
2. Press Seq. (F1) to turn on the Sequences.

3. SEQ will be displayed on the Mainframe Status panel.

4. Press the LOAD key to run all the Sequences. If a channel has TRIG set to IN, that channel will now wait for a trigger before running.



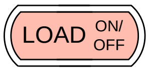
5. Run SEQ Mode will be displayed on the bottom of the display for the specific channels. On the Mainframe Status panel, SEQ will turn orange.



Run SEQ Mode

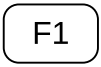
Stop the load

6. Press the LOAD key again or wait for the Sequence (if not infinitely looped) to end/stop the load.



Turn off SEQ

7. Press Seq. (F1) to turn OFF the Sequence(s) when the load is not running.

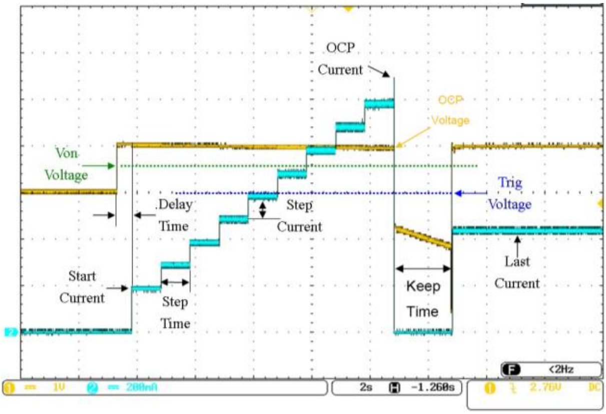


Note

All UI keys/knob will be disabled for all channels that run a Sequence, bar the function keys and R/L keys.

OCP Test Automation

Background	The OCP test function creates an automatic test to test the OCP of power supply products.	



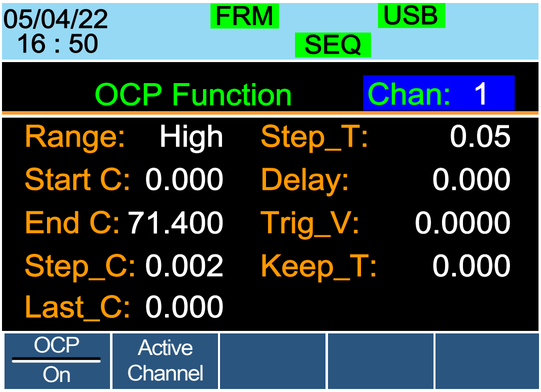
Parameters	Active Channel	Applies the setting to the load channel.
	Range	High(CC Mode High) or Low(CC Mode Low)
	Start Current(Start C)	Starting current value for the test.
	End Current(End C)	The current value that will end the test. The value must be higher than the OCP value of the DUT you are testing. This parameter is used as a fail-safe for if the over current protection of the DUT fails.
	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. (0 ~ 160S)
Trig Voltage(Trig_V)	Sets the voltage trigger level needed see whether the power supply OCP has been triggered. When the power supply OCP has been triggered, its voltage output will drop. The voltage trigger level is used to test to see if the voltage output has been drop.
Keep Time(Keep_T)	Set the how long to enter the Last Current after detect the OCP.(0~160S)

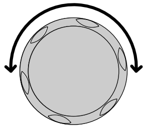
Note: This mode can only be used under CC mode.

Panel operation

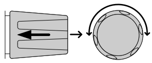
1. Press the FUNC key, F4 (OCP) to enter the OCP Test Automation menu. FUNC → F4



2. Use the Selector knob to highlight the parameter you want to edit.

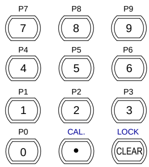


3. Press the Selector knob to edit the parameter, then turn to increase or decrease the value.

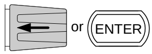


OR

Use the number pad to enter a number.



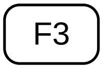
4. Press the Selector knob or Enter to confirm selection.

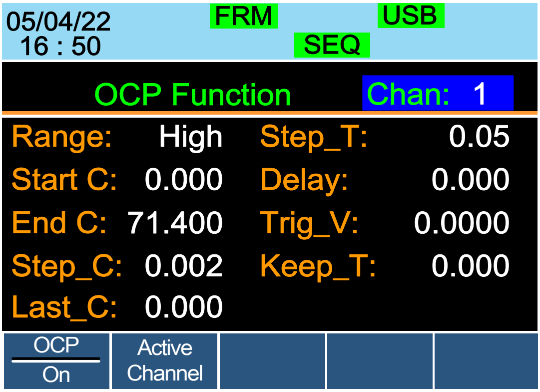


5. Repeat steps 2 -4 for all the parameters.

Save the OCP Test Automation Settings

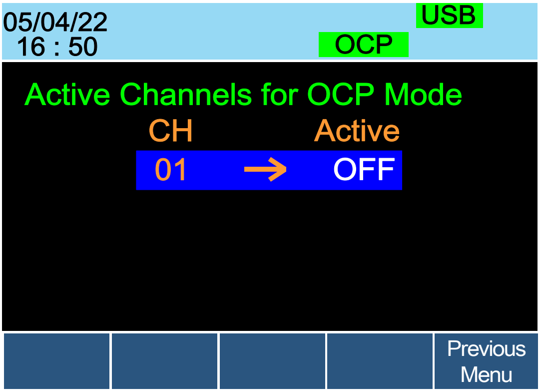
6. Press Save (F3) to save the OCP Test Automation settings.

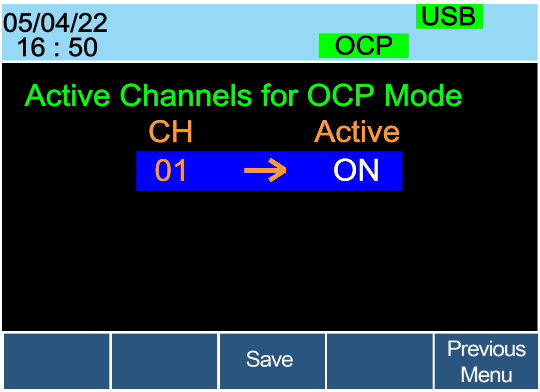




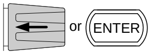
Select Active Channel

7. To select the load channels for the test, press Active Channel (F2). F2



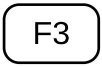


8. Use the selector knob to Enter key to turn the Active value to ON.



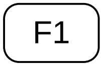
Save the OCP Test Automation Channel

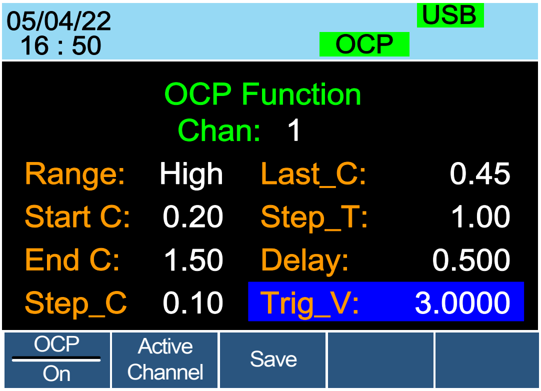
9. Press Save (F3) to save the OCP test automation channel.



10. Press Previous Menu (F5) to return to the OCP Test Automation menu.

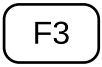
11. Press OCP (F1) to turn OCP to ON.





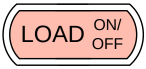
Save the OCP Test Automation Parameters

12. Press Save (F3) to save the OCP test automation parameters.

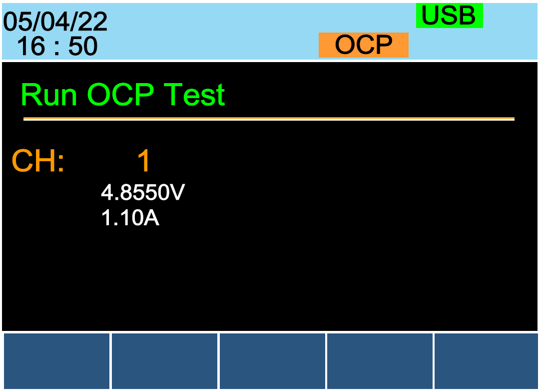


Start the OCP Test Automation

13. Press the Load key to start to OCP Test Automation.



Test Results

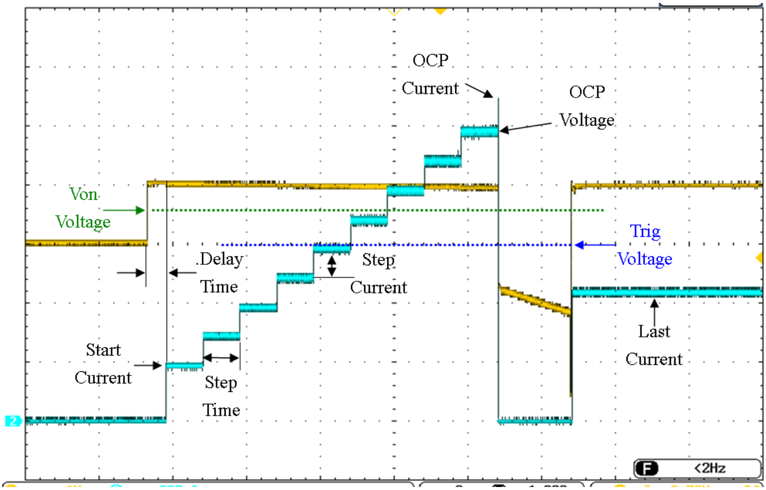


Voltage Reading: The voltage of the DUT before the OCP was triggered.

Current Reading: The current of the DUT before the OCP was triggered.

Note: In addition to the setting the OCP test parameters as described above, the VON voltage settings must also be set according to the output characteristics of the DUT.

An OCP Test Automation example using actual current and voltage waveforms.



Channel Configuration

The Channel Configuration chapter describes the configuration options for individual channels. Any configuration settings that are changed only apply to the current channel, other channels will not be changed.

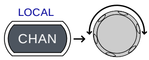
Accessing the Configuration Menu

Background

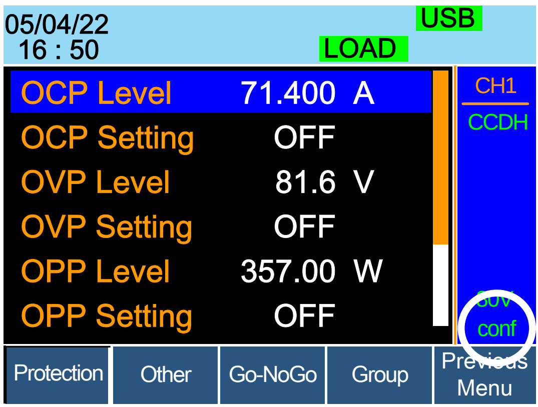
The configuration menu is used to access instrument settings and properties as well as set the protection levels for each channel.

Panel operation

1. Select the channel to be configured by pressing the CHAN key and using the Selector knob.



2. Press the F5 (Configure) key to enter the configuration (Protection) menu.



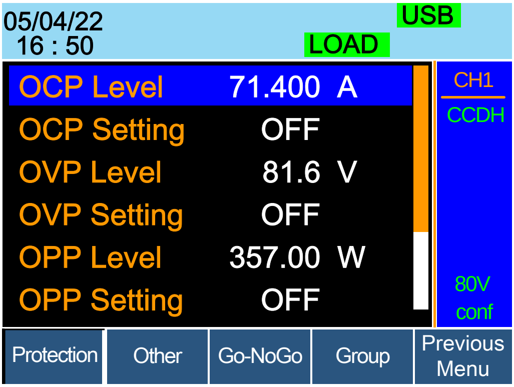
Setting (OCP/OVP/OPP/UVP)

Background	Over Protection is used to set the voltage, current or power limit. In the event that the current, voltage or power exceeds the over protection settings, the load module display will show an error message and beep an alarm. When tripped, Under Voltage Protection (UVP) will turn off the load. UVP trips when the load voltage drops below a set limit. Only when the protection settings are set to On (XXP Setting -On) will the protection modes be active. All protection settings can be set to 2% higher than specification rating.

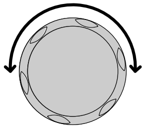
Parameters	OCP Level	1.25% Rating A ~ 102% Rating A
	OCP Setting	ON/OFF/Clear
	OVP Level	1.25% Rating V ~ 102% Rating V (0.5% Rating V ~ 102% Rating V for PEL-2041B)
	OVP Setting	ON/OFF/Clear
	OPP Level	PEL-2020B : 1W ~ 102W PEL-2030B(L) : 0.9W ~ 30.6W PEL-2030B(R) : 1.25W ~ 255W PEL-2040B : 1.75W ~ 357W PEL-2041B : 1.75W ~ 357W
	OPP Setting	ON/OFF/Clear
	UVP Level	OFF ~ current using operating voltage range of slave module.
	UVP Setting	Clear
	Protection Clear	All

Panel operation

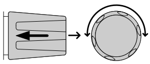
Ensure the menu is the configuration menu. See page 173.



1. Use the Selector knob to highlight OCP Level.

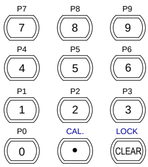


2. Press the Selector knob to edit the selected level, then turn to increase or decrease the value.

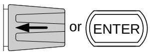


OR

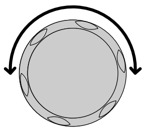
3. Use the number pad to enter a number.



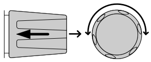
4. Press the Selector knob or Enter to confirm selection.



5. Use the Selector knob to highlight OCP Setting.



6. Use the selector knob to turn ON, OFF or CLEAR the OCP Setting.



7. Repeat steps 1-5 for :

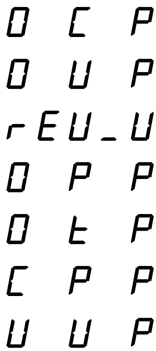
OCP Level	OPP Setting
OVP Level	UVP Level
OVP Setting	UVP Setting
OPP Level	

Clearing an Alarm

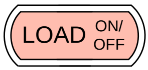
When any of the protection settings are tripped, Alarm will be shown on the Mainframe Status Panel and an alarm tone will sound by default.

On the local load module, the protection setting that has been tripped will be displayed.

OCP
OVP
REV*
OPP
OTP*
CPP*
UVP



8. Turn the load off by pressing the Load key and turn off the load input.



9. Change the XXP Setting to Clear to clear the alarm.

Note

*REV, OTP and CPP cannot be cleared using this method, the Protection Clear function must be used instead, see page 177.

See pages 59 and 277 to output alarms via the Go/NoGo output terminal.

The configuration settings only apply to the current channel.

Protection Clear

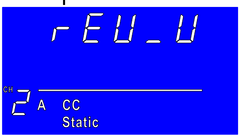
Background

When any of the protection circuits have been tripped, the Protection Clear function can be used to reset the alarms.

Alarm will be shown on the Mainframe Status Panel and an alarm tone will sound by default when any of the protection settings are tripped.

On the local load module, the protection setting that has been tripped will be displayed.

Example: Reverse voltage protection



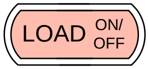
OCP	O C P
OVP	O U P
REV	r E U _ U
OPP	O P P
OTP	O t P
CPP	C P P

UVP 

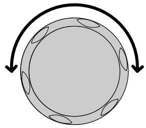
Panel operation

Ensure the menu is in the configuration menu. See page 173.

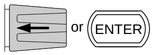
1. Turn the load off by pressing the load key if necessary.



2. Use the selector knob to scroll down to Protection Clear.



3. Press the Selector knob or Enter to clear all.



Note

The configuration settings only apply to the current channel, other channels will not be affected.

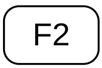
Setting the CC Voltage Range

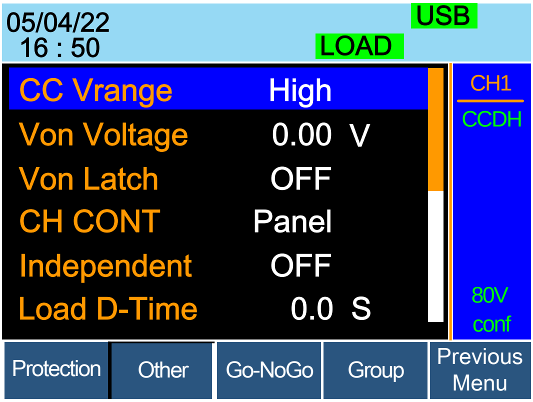
Background	The Constant Current Voltage range can be set to high or low.
Parameter	CC Vrange High/Low

Panel operation

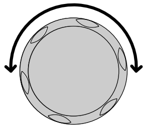
Ensure the menu is in the configuration menu. See page 173.

1. Press the F2 (Other) key to enter the other menu.

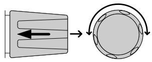




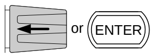
2. Use the Selector knob to highlight CC Vrange.



3. Press the Selector knob to edit CC Vrange, then turn to increase or decrease the range.



4. Press the Selector knob or Enter to confirm selection.



Note: The configuration settings only apply to the current channel.

Adjusting the Von Voltage and Latch

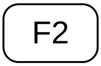
Background: The Von Voltage is the voltage point at which the load module will start to sink current. When Von latch is set to ON, the load will continue to sink current after being tripped, even if the voltage drops below the Von Voltage level. The step resolution of Von Voltage is load module dependent.

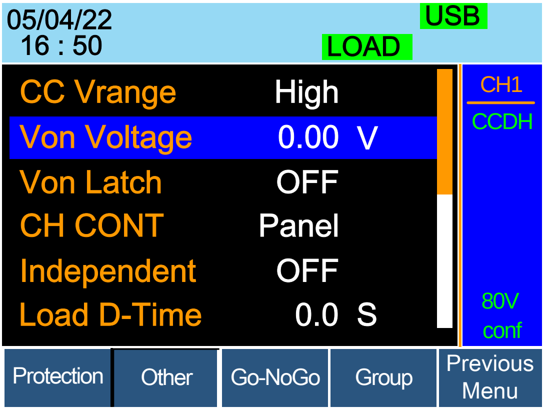
Parameters	Von Voltage	0.0~Rating volts
	Von Latch	ON/OFF

Panel operation

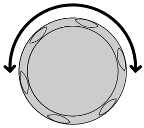
Ensure the menu is in the configuration menu. See page 173.

1. Press the F2 (Other) key to enter the other menu.

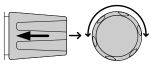




2. Use the Selector knob to highlight Von Voltage.

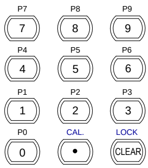


3. Press the Selector knob to edit the selected value, then turn to increase or decrease the value.

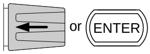


OR

Use the number pad to enter a number.



4. Press the Selector knob or Enter to confirm selection.



5. Repeat steps 3 to 5 to turn Von Latch ON or OFF

For details about Von and Latch settings please see page 84.

Note — The configuration settings only apply to the current channel, other channels will not be affected.

Configuring the Short settings

Background — The Short Key option is used to simulate a short circuit.

The Short Function option is used to set whether short function is enabled or disabled.

The Short key option can be configured to toggle (press SHORT on the load module to toggle ON or OFF) or to Hold (the SHORT key is held to short the load.

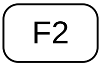
The Short Safety option can be used to set whether short function enabled depends on Load ON or not. When setting to ON, short function enabled only when Load ON mode is enabled. When setting to OFF, short function directly enabled independent of Load ON mode.

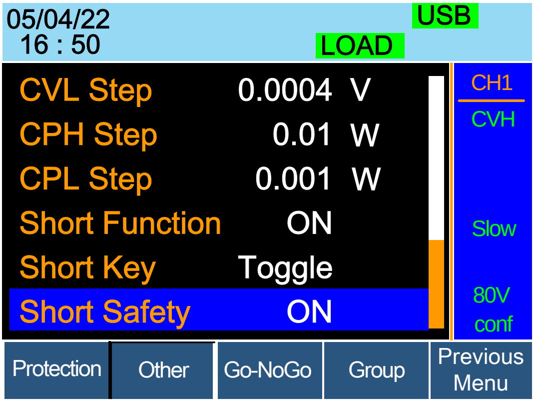
Parameter		
	Short Function	ON/OFF
	Short Key	Hold/Toggle
	Short Safety	ON/OFF

Panel operation — Ensure the menu is in the configuration menu. See page 173.

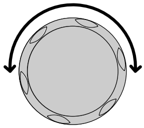
Protection	Other	Go-NoGo	Group	Previous Menu

1. Press the F2 (Other) key to enter the other menu.

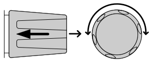




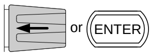
2. Use the Selector knob to highlight Short Function.



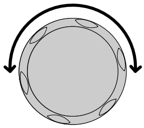
3. Press the Selector knob to edit the selected setting, turn to change the setting.



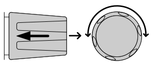
4. Press the Selector knob or Enter to confirm selection.



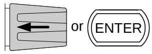
5. Use the Selector knob to highlight Short Key.



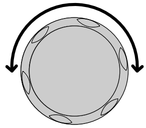
6. Press the Selector knob to edit the selected setting, turn to change the setting.



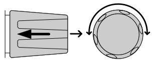
7. Press the Selector knob or Enter to confirm selection.



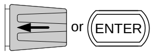
8. Use the Selector knob to highlight Short Safety.



9. Press the Selector knob to edit the selected setting, turn to change the setting.



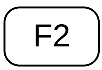
10. Press the Selector knob or Enter to confirm selection.

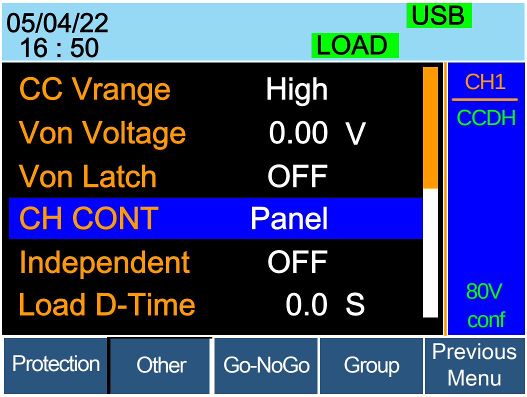


Configuring Channel Control

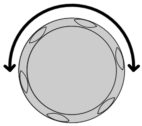
Background	When Channel Control (CH CONT) is set to External, it will disable editing the active channel load. Instrument buttons and knobs can still be used to access the menu for the active channel or to edit other channels that do not have channel control active. This prevents settings on the active channel from being changed on the local machine. See pages 56 & 87 for details.
Parameter	CH CONT Panel/External
Panel operation	Ensure the menu is in the configuration menu. See page 173.

1. Press the F2 (Other) key to enter the other menu.

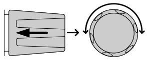




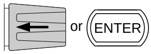
2. Use the Selector knob to highlight CH CONT.



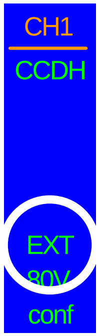
3. Press the Selector knob to edit the selected setting, turn to change the setting from Panel to External.



4. Press the Selector knob or Enter to confirm selection.



Channel control is now activated. To turn Channel Control off, CH CONT must be set to Panel again. When Channel Control is active, EXT will be displayed on the side panel for the active channel.



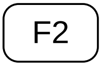
Note

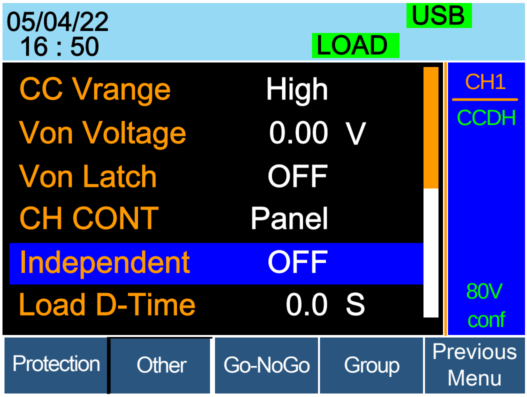
Channel Control can only be activated on the active channel; other channels will not be affected.

Configuring the Independent Setting

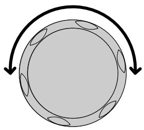
Background	The Independent setting allows a channel to be load independent from the mainframe. What this means is that a load module with Independent set to ON can only load from the local load module. If the LOAD ON/OFF key is pressed from the mainframe, the channel with Independent set to ON will be unaffected by the mainframe, except when running a program.
Parameter	Independent ON/ OFF
Panel operation	Ensure the menu is in the configuration menu. See page 173.

1. Press the F2 (Other) key to enter the other menu.

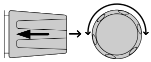




2. Use the Selector knob to highlight Independent.

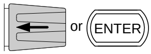


3. Press the Selector knob to edit the selected setting, turn to change the setting.



Independent	OFF

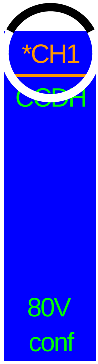
4. Press the Selector knob or Enter to confirm selection.



Note

When a channel has been set to independent, an asterisk (*) will be shown next to the channel number indicator in the Current Operation Channel Status panel.

The configuration settings only apply to the current channel, other channels will not be affected.



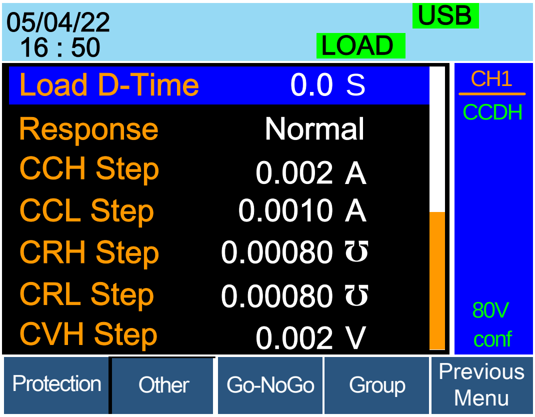
Configuring the Load Delay Time

Background	The mainframe can delay loading a channel by up to 10 seconds. However the Delay Time is only applicable for manual loading. Delay Time is not applicable to Programs or Sequences.
Parameter	Load D-Time 0~10 S
Panel operation	Ensure the menu is the configuration menu. See page 173.

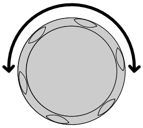
Protection	Other	Go-NoGo	Group	Previous Menu

1. Press the F2 (Other) key to enter the other menu.

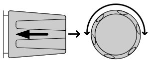
F2



2. Use the Selector knob to highlight Load D-Time.

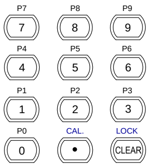


3. Press the Selector knob to edit the selected setting, turn to change the setting.

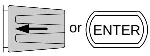


OR

Use the number pad to enter a number.



4. Press the Selector knob or Enter to confirm selection.



Note

The Delay Time only applies to the current channel; other channels will not be affected.

Delay time only applies when the load is manually turned on or during start up with the Auto Load On setting (page 201).

Configuring Step Resolution

Background

The CC, CR, CV and CP step resolution settings can be edited in the configuration menu. These step resolution settings directly correspond to the step resolution of the coarse adjustment when setting the CC, CR, CV and CP parameters.

The minimum and maximum step resolution that can be set for each channel is dependent on the load module. For more information on step resolution see page 84.

Step Resolution		Minimum*1	Maximum*2	Unit
PEL-2020B	CCH Step	HR/20000	HR/2	Amperes A
	CCL Step	LR/20000	LR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/40000	HR/2	Voltage V
	CVL Step	LR/40000	LR/2	Voltage V
	CPH Step	HR/10000	HR/2	Watt W
	CPL Step	LR/10000	LR/2	Watt W
PEL-2030B (L)	CCH Step	HR/40000	HR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/40000	HR/2	Voltage V
	CVL Step	LR/40000	LR/2	Voltage V
	CPH Step	HR/30000	HR/2	Watt W

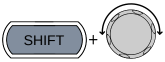
PEL-2030B (R)	CCH Step	HR/40000	HR/2	Amperes A
	CCL Step	LR/40000	LR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/40000	HR/2	Voltage V
	CVL Step	LR/40000	LR/2	Voltage V
	CPH Step	HR/25000	HR/2	Watt W
	CPL Step	LR/25000	LR/2	Watt W
PEL-2040B	CCH Step	HR/35000	HR/2	Amperes A
	CCL Step	LR/35000	LR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/40000	HR/2	Voltage V
	CVL Step	LR/40000	LR/2	Voltage V
	CPH Step	HR/35000	HR/2	Watt W
	CPL Step	LR/35000	LR/2	Watt W
PEL-2041B	CCH Step	HR/20000	HR/2	Amperes A
	CCL Step	LR/20000	LR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/50000	HR/2	Voltage V
	CVL Step	LR/50000	LR/2	Voltage V
	CPH Step	HR/35000	HR/2	Watt W
	CPL Step	LR/35000	LR/2	Watt W

*1 HR = High range rated value, LR = Low range rated value.
*2 Maximum value = HR (LR)/2 * 1.02.

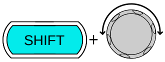
Note

Use the Shift key to toggle between coarse and fine adjustment mode when editing the CC, CR, CV and CP values with the Selector knob on the main display. The fine adjustment resolution varies between the function and load module used.

Coarse mode:



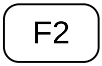
Fine mode:

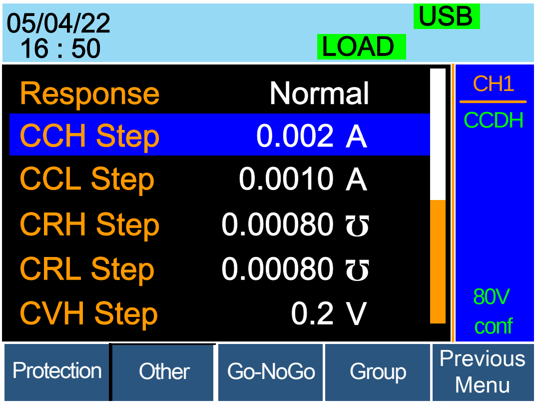


Panel operation

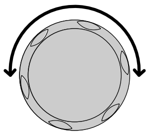
Ensure the menu is the configuration menu. See page 173.

1. Press the F2 (Other) key to enter the other menu.





2. Use the Selector knob to scroll down to highlight CCH Step.



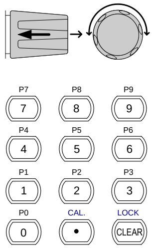
Note

CCH Step is off-screen when entering Other menu.

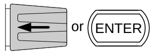
3. Press the Selector knob to edit the selected setting, turn to change the setting.

   OR

   Use the number pad to enter a number.



4. Press the Selector knob or Enter to confirm selection.



5. Repeat steps 2-4 to edit the step resolution of:

CCL Step	CVH Step	CPH Step
CRH Step	CVL Step	CPL Step
CRL Step		

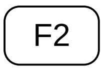
Note: The Step resolution settings only apply to the active channel, other channels will not be affected.

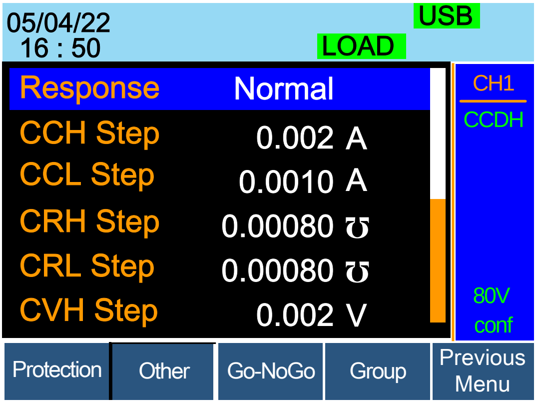
Configuring Response Time

Background	The Response time setting is used to limit current draw when input voltage less than 1V. The Response setting sets the bandwidth of the load to Fast (20kHz) or as Normal (200Hz).	
Parameters	Response	Normal, Fast

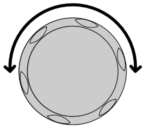
Panel operation: Ensure the menu is the configuration menu. See page 173.

1. Press the F2 (Other) key to enter the other menu.



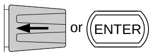


2. Use the Selector knob to scroll down to highlight Response.



Note: Response is off-screen when entering Other menu.

3. Press the Selector knob or Enter to confirm selection.



Note: The Response settings only apply to the active channel, other channels will not be affected.

Go/NoGo

Background

Go/NoGo mode is used to set threshold limits. When a load is within the limit(s) it is considered to be “Go”, when the load has exceeded the limit it is considered to be “NoGo”.

Go/NoGo limits can be set as either absolute values (Entry Mode set to “Value”) or as a percentage offset from a nominal (Center) value (Entry Mode set to “Percent”).

Go/NoGo can be used in both high and low ranges, as well as CC, CV, CR and CP Modes. The Go/NoGo status can be read using the rear Go/NoGo output.

A delay time can also be imposed for up to 1 second.

⚠ Note: Any Go/NoGo configuration only applies to the current channel with the same mode and range.

Parameters

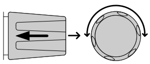
Entry Mode	Value	Percent
CC Mode	High: V	High: %
CR Mode	Low: V	Low: %
		Center: V
CV Mode	High: A	High: %
CP Mode	Low: A	Low: %
		Center: A
Delay Time	0.0~1.0 seconds	
SPEC Test	ON/OFF	

Panel Operation

Ensure the menu is in the Configuration menu. See page173.

Choose Absolute/ Percentage limits

1. Press (F3) Go-NoGo to access the Go/NoGo menu. F3
2. Use the selector knob to edit Entry Mode.

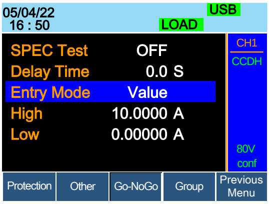


3. Choose Value for absolute limits or Percent for percentage offset limits.

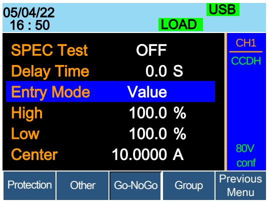
Or

4. The menu changes according to the selection.

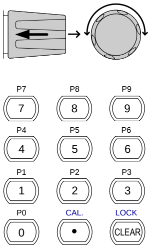
Value



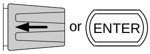
Percent



5. Use the Selector knob and number pad to edit Delay time, High, Low and Center (Percent mode only).

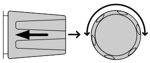


6. Press the selector knob or Enter to confirm each value.



Turn Go/NoGo On/Off

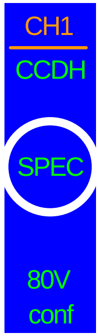
7. Use the Selector knob to edit Spec Test.



8. Choose ON to turn on Go/NoGo.

9. Choose OFF to turn off Go/NoGo.

When SPEC test is set to ON, SPEC will be displayed in the Current Operation Channel Status panel.



Group Unit

Background

The Group Unit menu allows load modules of the same type and rating to be configured as a single unit when used in parallel. Up to 4 load modules can be used in this mode.

Operating the PEL-2000B series load modules in Group Unit mode is almost identical to using the load modules separately. The only difference is that the channel configuration only needs to be setup for channel 1 and not individually for each channel.

There are two mode types: Para and Sync. The Para setting allows the all the parallelized load modules to be operated as a single large load module. Sync mode allows the settings of a single unit to be synchronized across all the other parallelized load modules.

The Display Mode will determine which parameters are displayed on the local load modules.

Note	Only CC or CR mode can be used in Group Unit. For the single channel load modules, PEL-2040B and PEL-2041B are fully support these two modes (Para, Sync) of group function. The PEL-2030B does not support group function. The dual channel of PEL-2020B does support group function partially. It can support to group 2 units of same module under the Sync mode only. That means the PEL-2020B can be 2chx100W or 1chx200W. Ensure the same firmware used for both units.
Parameters	Total Unit: 2/3/4/OFF Group Mode: Para/Sync Display Mode: V,I /V,W/I,W/S
Note	If "Total Unit: 2" is set on a 4-channel mainframe, the modules of channels 3 and 4 won't be set to the group unit function.

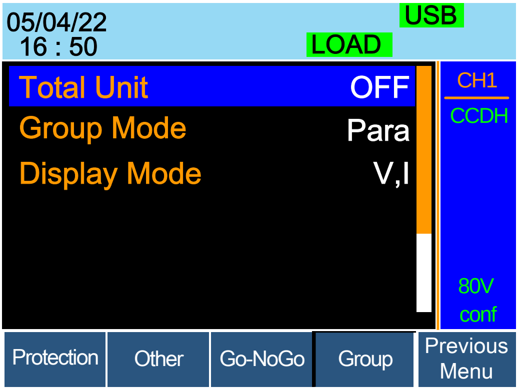
Panel Operation

1. Ensure current channel is selected Page 124 as the active channel.
2. Ensure the menu is in the Configuration menu. See page 173.

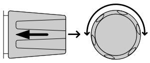
Protection	Other	Go-NoGo	Group	Previous Menu

Parallel Setup

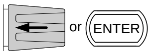
3. Press (F4) Group to access the Group menu. F4



4. Use the Selector knob to change Total Unit from the OFF setting to the number of parallel units.

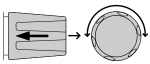


5. Press the selector knob or Enter to confirm.



Parallel Mode

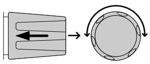
6. To change the type of mode, use the Selector knob to edit Group Mode.



7. Choose Para to operate the units as a single large load module, or choose Sync to synchronize the load settings across each parallel unit.

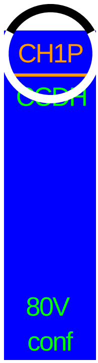
Display Mode

8. Use the selector knob to change the display settings on the local load modules.



9. Choose from V, I / V, W / I,W or S.

When Para Unit is active, an indicator will be displayed on the screen. The indicator depends on the Group Mode. P will be displayed for Para Mode and S will be displayed for Sync Mode.

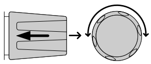


CHXP	Para Mode
CHXS	Sync Mode

The PEL-2000B is now ready to operate in Parallel Mode.

Turn Parallel Mode Off

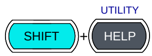
10. To disable Parallel Mode, use the selector knob to change Total Unit to OFF.

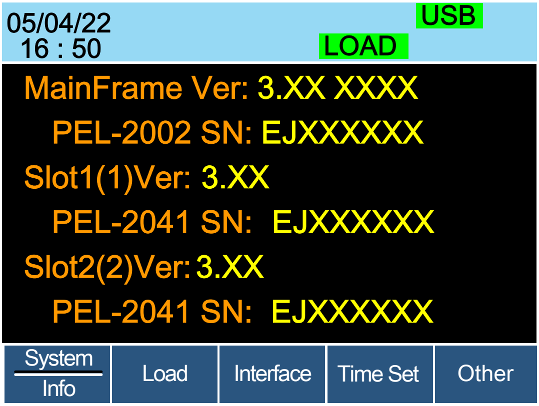


Mainframe Configuration

The Mainframe Configuration chapter describes configuration settings that apply to all channels and general interface settings.

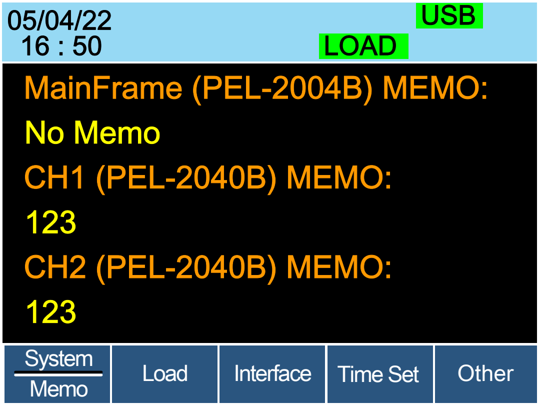
Accessing System Information

Background	The System Information displays the mainframe and load module(s) serial numbers.	
Parameters	MainFrame Ver:	Mainframe firmware version.
	PEL-200X SN:	Mainframe Serial number.
	SlotX(Y)Ver:	The version number of the Xth load module occupying the Xth slot with channel number Y.
	PEL-20XX SN:	The serial number and module model of the Xth load module
	Y designates the channel of each installed load module. For example if dual channel load modules are installed, then Ch (1,2) will be used for the firmware and serial number.	
Panel operation	1. Press the Shift Key then the Help key to access the Utility menu/System Info menu.	



Note

If you have set Memo through command, you can see the Memo information by pressing System Info (F1) once again. (Please refer to the chapter contains commands ":MEMo" and ":CHANnel:MEMo" in the programming manual for details)



Accessing the Load Menu

Background

The PEL-2000B series is able to automatically start loading from the last program or load setting.

If Auto Load On is set to Load, the last load setup used before the machine was reset will automatically start to load upon startup.

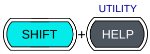
If Program is set as the Auto Load On configuration, the last program executed will start upon the next start up.

Parameters

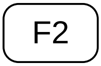
Auto Load	ON/OFF
Auto Load On	Load/Program

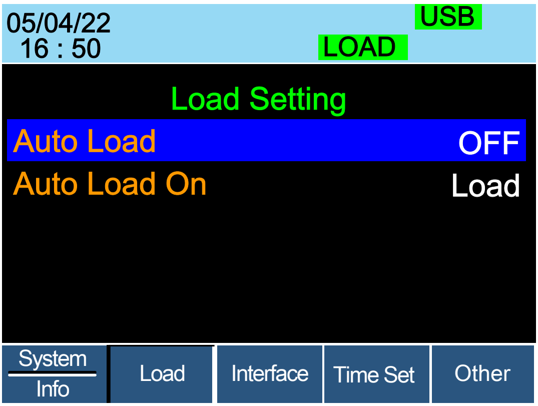
Panel operation

1. Press the Shift Key then the Help key to access the Utility menu.

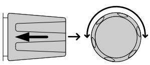


2. Press F2 (Load).

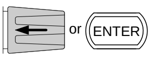




3. Press the Selector knob, then turn to choose Auto Load.



4. Press the Selector knob or Enter to confirm selection.



5. Scroll to Auto Load On and choose Load or Program for the next time the PEL-2002B starts up.

Adjusting the Speaker

Background

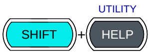
The PEL-2000B series has an internal speaker for both the mainframe and load modules. The speaker function turns On/Off the sound for the UI (key presses and scrolling). The speaker setting will not alter the sound for protection alarms or Go/NoGo alarms.

Parameter

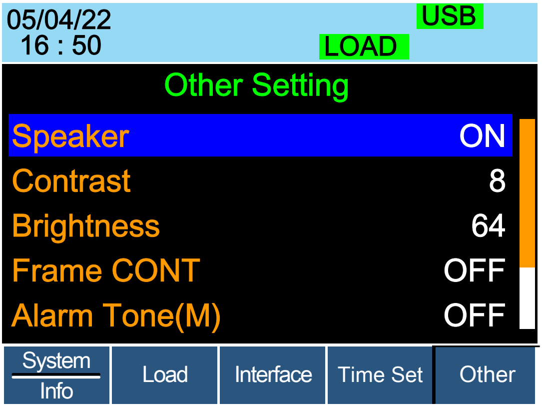
Speaker ON/OFF

Panel operation

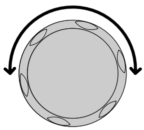
1. Press the Shift Key then the Help key to access the Utility menu.



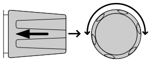
2. Press F5 (Other Menu).



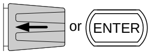
3. Use the Selector knob to highlight Speaker.



4. Press the Selector knob to edit Speaker, then turn to change from On to Off and vice versa.



5. Press the Selector knob or Enter to confirm selection.

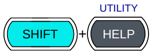


Adjusting the Display Settings

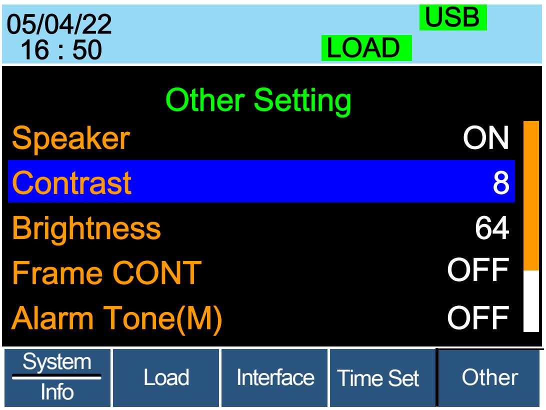
Background	The PEL-2000B series has a TFT LCD display. The display brightness and contrast can be controlled via the utility menu.			
Parameters	Brightness	50~90	50(low)	90(bright)
	Contrast	3~13	3(low)	13(high)

Panel operation

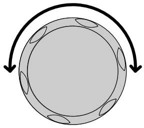
1. Press the Shift Key then the Help key to access the Utility menu.



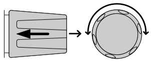
2. Press F5 (Other Menu).



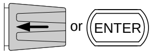
3. Use the Selector knob to highlight Contrast.



4. Press the Selector knob to edit contrast, then turn to increase or decrease the value.



5. Press the Selector knob or Enter to confirm selection.



6. Repeat steps 3-5 for the Brightness.

Adjusting the Frame Control

Background

Frame control is used to control a number of different frame linked mainframes (slaves) with a master mainframe. For information on frame control, frame control interface and connection see pages 54 & 274.

⚠ Note

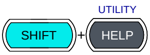
When using frame control, ensure the same firmware is installed in both master and slave units.

Parameters	Frame CONT	ON/OFF

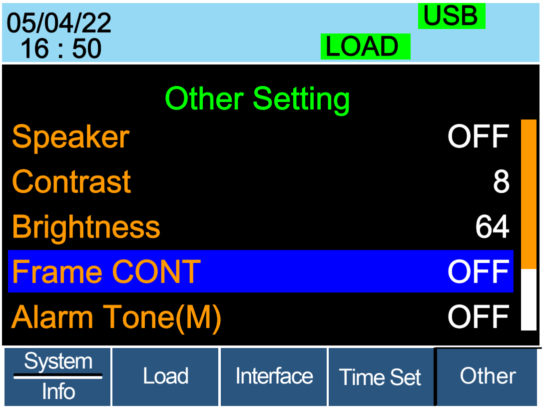
Panel operation

1. Connect the mainframes using a frame link connection. Page 54.

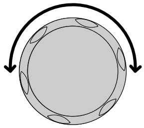
2. On the master mainframe, press the Shift Key then the Help key to access the Utility menu.



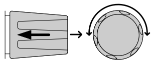
3. Press F5 (Other Menu).

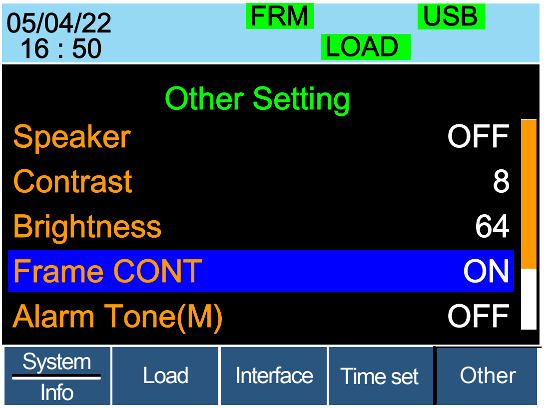


4. Use the Selector knob to highlight Frame CONT.



5. Press the Selector knob to edit, then turn to turn Frame CONT (frame control) ON or OFF.





When Frame CONT is set to ON the mainframe will display FRM (Master) or FRS (Slave) on the top of the display.

6. Repeat the above steps for any connected slave mainframe units.

Frame control is now ready for both master and slave mainframes.

Adjusting the Knob Control Type

Background

The mainframe control knob can be set to "Update" or "Old" mode.

When setting to Update mode, rotating the mainframe knob will change the setting value of load module at the same time.

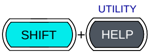
When setting to Old mode, rotating the mainframe knob won't change the setting value of load module unless pressing the knob or Enter key.

Parameter

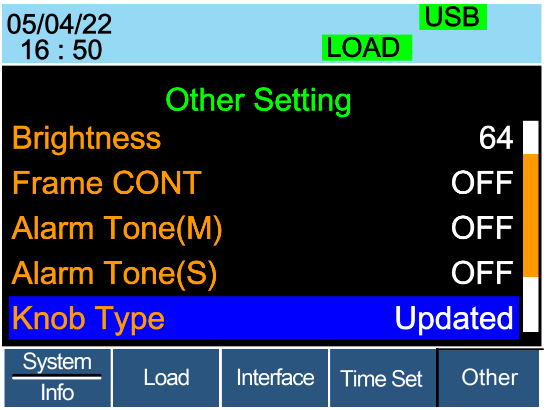
Knob Type Updated/Old

Panel operation

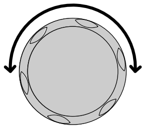
1. Press the Shift Key then the Help key to access the Utility menu.



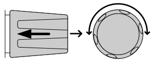
2. Press F5 (Other Menu).



3. Use the Selector knob to move the cursor down to Knob Type (below the initial screen).

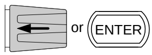


4. Press the Selector knob to highlight Knob Type, then turn to change to Old/Updated.



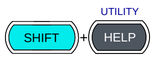
Knob Type Updated

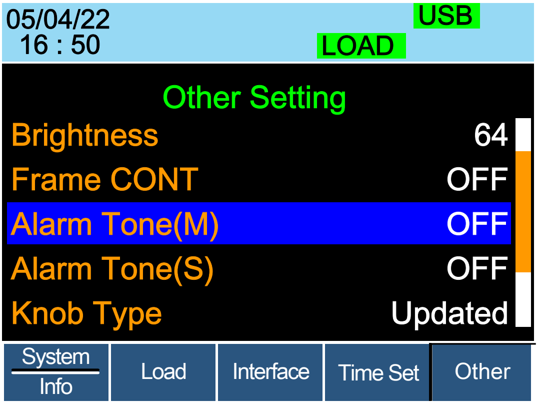
5. Press the Selector Knob or Enter to confirm selection.



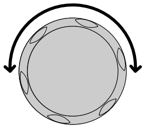
Configuring Alarm Sound

Background	The PEL-2000B series has two different types of alarms, one located on the mainframe (Alarm Tone M) and one for each load module (Alarm Tone S). Alarm Tone (M)/(S) can individually be set ON or OFF.
Parameter	Alarm Tone(M) ON/OFF Alarm Tone(S) ON/OFF
Panel operation	1. Press the Shift Key then the Help key to access the Utility menu. 2. Press F5 (Other Menu).

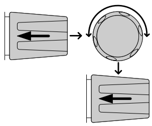




3. Use the selector knob to highlight Alarm Tone(M)

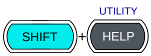


4. Press the Selector knob to select the master alarm (Alarm Tone (M)), turn to edit and press to confirm selection.

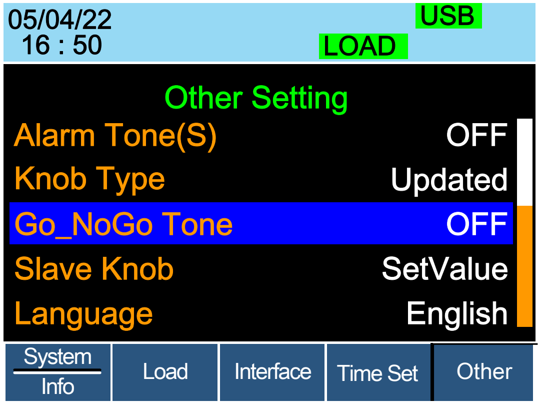


5. Repeat the steps to edit the slave alarm (Alarm Tone(S)).

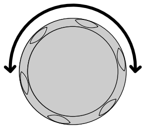
Configuring Go/NoGo Alarm Sound

Background	When any Go/NoGo limits are tripped from any channel, a tone can be set as an alarm. The Go_NoGo tone alarm settings apply to all channels.
Parameter	Go_NoGo Tone ON/OFF
Panel operation	1. Press the Shift Key then the Help key to access the Utility menu. 

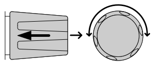
2. Press F5 (Other Menu).



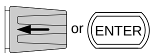
3. Use the Selector knob to move the cursor down to Go_NoGo Tone (below the initial screen).



4. Press the Selector knob to highlight Go_NoGo Tone, then turn to change to ON/OFF.



5. Press the Selector Knob or Enter to confirm selection.



Adjusting Slave Knob Settings

Background

Channel loads can be edited using the local load module or the Mainframe. When using the slave knob to edit a load, the load module display can be set to two different types: SetValue and Measured.

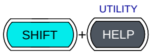
When a load is ON, SetValue will always display the set value (A Value, B Value) on the local load module display whilst "Measure" will show the actual measured value when editing the load. These settings apply to all channels.

The "Measure" setting can be temporarily disabled by pressing the Slave Knob to display the "SetValue" instead of the "Measure" value in the local load module display.

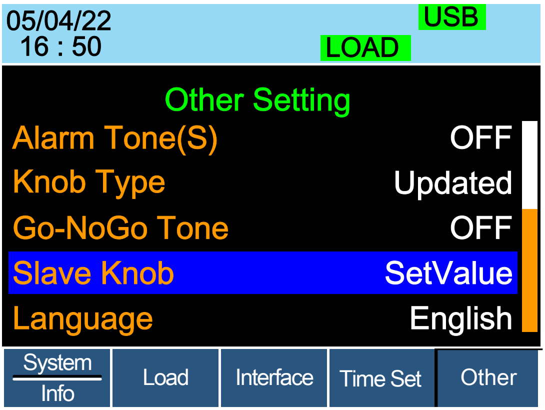
Parameter	Slave Knob	Measure/SetValue

Panel operation

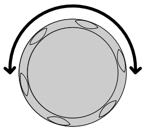
1. Press the Shift Key then the Help key to access the Utility menu.



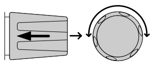
2. Press F5 (Other Menu).



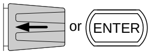
3. Use the Selector knob to move the cursor down to Slave Knob (below the initial screen).



4. Press the Selector Knob to highlight Slave Knob, then turn to change to Measure/SetValue.



5. Press the Selector Knob or Enter to confirm selection.



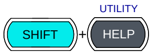
View Language Settings

Background

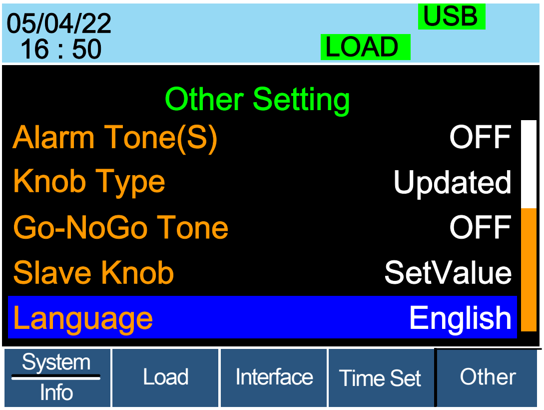
The language settings can be viewed in the Utilities menu.

Panel operation

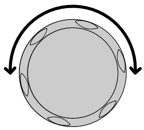
1. Press the Shift Key then the Help key to access the Utility menu.



2. Press F5 (Other Menu).



3. Use the Selector knob to move the cursor down to Language (below the initial screen).



Adjusting the High Resolution

Background

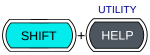
ON: When there is difference between the measured value of voltage, current or power which displayed on the module panel and the setting value, the system will fine tune the load value so that the measured value close to the setting value. The system will perform and complete this action after loading is on in one second.

OFF: The system won't perform any action when there is difference between the measured value of voltage, current or power which displayed on the module panel and the setting value.

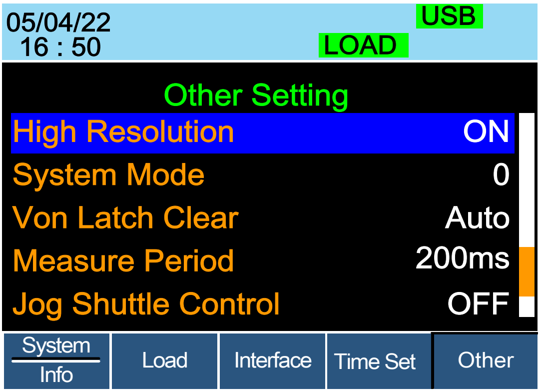
Parameter	High Resolution	ON/OFF

Panel operation

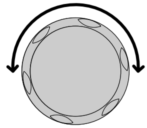
1. Press the Shift Key then the Help key to access the Utility menu.



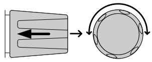
2. Press F5 (Other Menu).



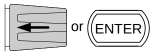
3. Use the Selector knob to highlight High Resolution.



4. Press the Selector knob to edit High Resolution, then turn to change from ON to OFF and vice versa.



5. Press the Selector knob or Enter to confirm selection.

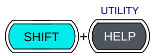


Adjusting the System Mode

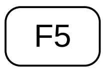
Background	1: When any command is received, the Master panel will automatically enter the Remote fast mode. 0: The Master panel won't automatically enter the Remote fast mode.
Note	For details about remote mode fast/normal, please refer to command :UTILity:REMote:MODE in the programming manual.
Parameters	System Mode 0/1

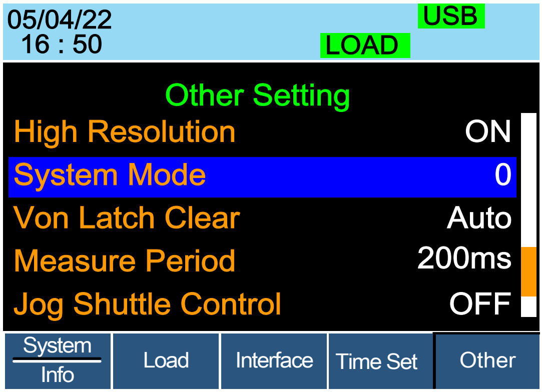
Panel operation

1. Press the Shift Key then the Help key to access the Utility menu.

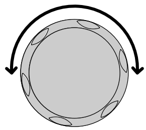


2. Press F5 (Other Menu).

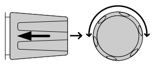




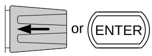
3. Use the Selector knob to highlight System Mode.



4. Press the Selector knob to edit System Mode, then turn to change from 0 to 1 and vice versa.



5. Press the Selector knob or Enter to confirm selection.

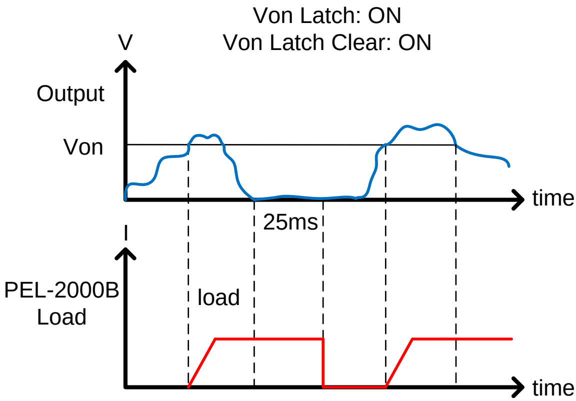


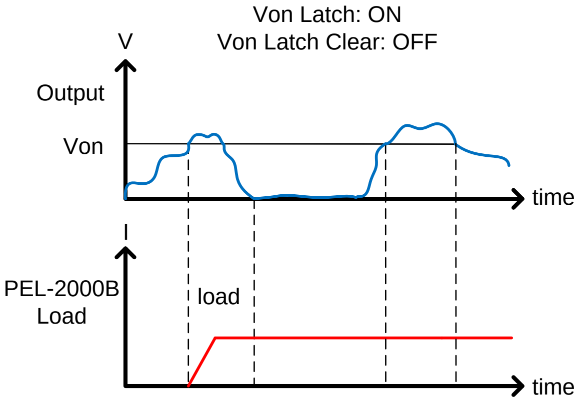
Adjusting the Von Latch Clear

Background

Auto: Load starts when the terminal voltage of module is higher than Von value. The system stops loading when the terminal voltage of module is close to 0V for more than 25ms and system is under the state of detecting Von again.

Manual: The load starts when the terminal voltage of module exceeds the Von setting value. Loading keep going even if the terminal voltage of module close to 0V.



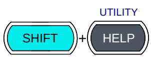


⚠ Note	This feature is only available when Von Latch is set to ON.

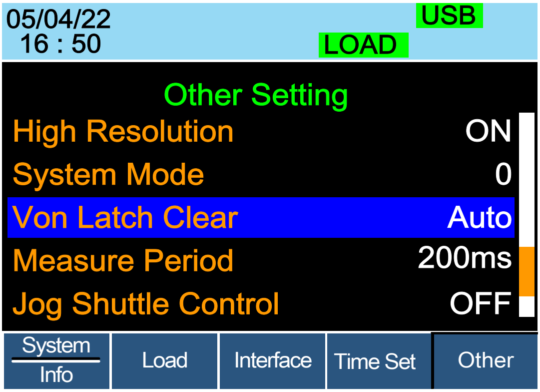
Parameters — Von Latch Clear — Auto/Manual

Panel operation

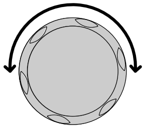
1. Press the Shift Key then the Help key to access the Utility menu.



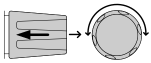
2. Press F5 (Other Menu).



3. Use the Selector knob to highlight Von Latch Clear.



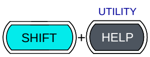
4. Press the Selector knob to edit Von Latch Clear, then turn to change from Auto to Manual and vice versa.



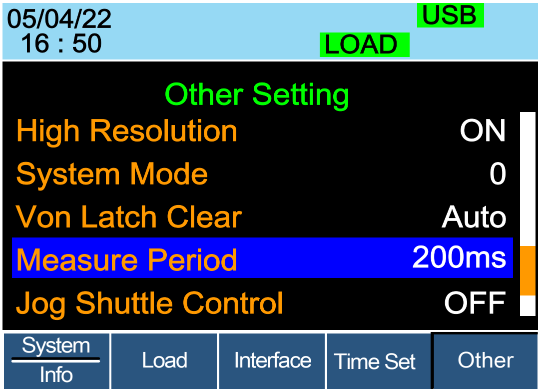
5. Press the Selector knob or Enter to confirm selection.

Adjusting the Measure Period

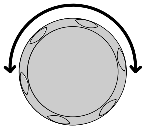
Background	You can select a measure sample rate through this setting. 200ms or 20ms are available for voltage and current sampling rate.	
Parameter	Measure Period	200ms/20ms
Panel operation	1. Press the Shift Key then the Help key to access the Utility menu.	



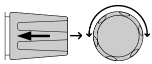
2. Press F5 (Other Menu).



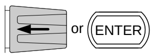
3. Use the Selector knob to highlight Measure Period.



4. Press the Selector knob to edit Measure Period, then turn to change from 200ms to 20ms and vice versa.



5. Press the Selector Knob or Enter to confirm selection.

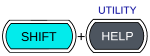


Adjusting the Jog Shuttle Control

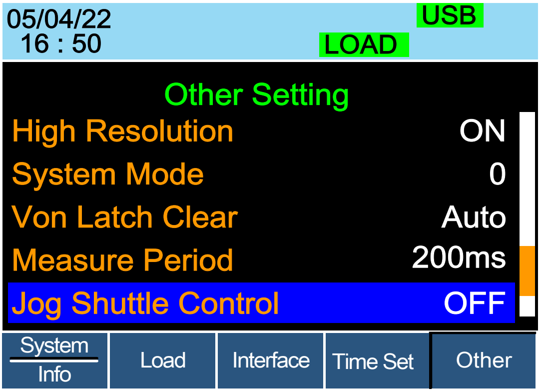
Background	ON: After this setting is enabled, the settings value will be adjusted by slave knob in Jog Shuttle mode when you adjust the setting value. The interval value is adjusted according to the knob speed. OFF: If this setting is disabled, the settings value will be adjusted by slave knob in the form of fixed compartment when you adjust the setting value.
Parameter	Jog Shuttle Control ON/OFF

Panel operation

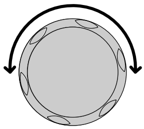
1. Press the Shift Key then the Help key to access the Utility menu.



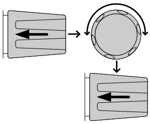
2. Press F5 (Other Menu).



3. Use the selector knob to highlight Jog Shuttle Control



4. Press the Selector knob to edit Jog Shuttle Control, then turn to change from OFF to ON and vice versa.



5. Press the Selector knob or Enter to confirm selection.

Adjusting the RVP Load Off

Background

ON: When RVP is detected, Alarm will display on the screen and stop loading.

OFF: When RVP is detected, Alarm will display on the screen but loading is kept on.

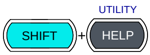
Note

This setting applies to all channels. But each channel independently detects RVP and performs the action of emitting alarm and stopping load.

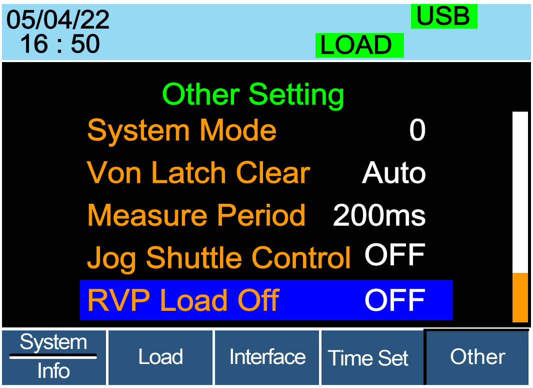
Parameter	RVP Load Off	ON/OFF

Panel operation

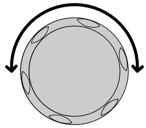
1. Press the Shift Key then the Help key to access the Utility menu.



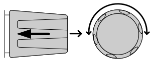
2. Press F5 (Other Menu).



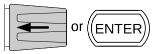
3. Use the Selector knob to highlight RVP Load Off.



4. Press the Selector knob to edit RVP Load Off, then turn to change from OFF to ON and vice versa.



5. Press the Selector Knob or Enter to confirm selection.



Setting the Date and Time

Description

The date and time settings are used to time-stamp files when saving files.

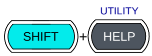
- The date is shown on top of the display.

Parameters

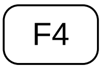
Month	1~12
Day	1~31
Year	1990~2038
Hour	0~23
Minute	0~59

Panel operation

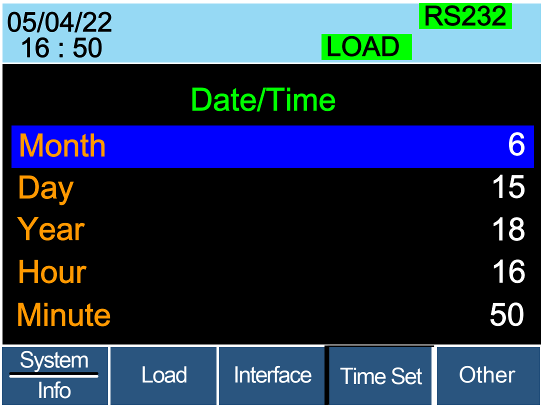
1. Press the Shift Key then the Help key to access the Utility menu.



2. Press F4 (Date/Time Menu).



Settings: Month, Day, Year, Hour, Minute


05/04/22
16 : 50
RS232
LOAD
Date/Time
Month 6
Day 15
Year 18
Hour 16
Minute 50
System
Info
Load
Interface
Time Set
Other

Interface Configuration (settings)

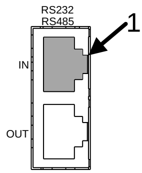
The Interface Configuration chapter describes configuration settings that apply when using the PEL-2000B mainframe with a remote connection. There are three interface options for remote control: RS232 or RS485, GPIB, LAN and USB. Only one interface can be used at a time. For more details about remote control and interface connections, see the Interface section on page 269.

Configuring RS232 or RS485 Connection

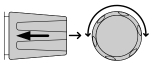
Background	When using UART (RS232 or RS485) a number of parameters need to be set. These include Baud rate, Data Bits, Stop Bit, Parity and Address [This is available when Mode is RS485]. When setting RS232/RS485 parameters, ensure they match that of the host machine.
Parameters	Connector: RJ-45 Baud Rate: 2400/4800/9600/19200/38400/57600/115200 Data Bits: 7bits/8bits Stop Bit: 1Bit/2Bits Parity: None/Odd/Even Address: 0 ~ 30 [This is available when Mode is RS485]
UART mode	RS232 / RS485 (Switchable)

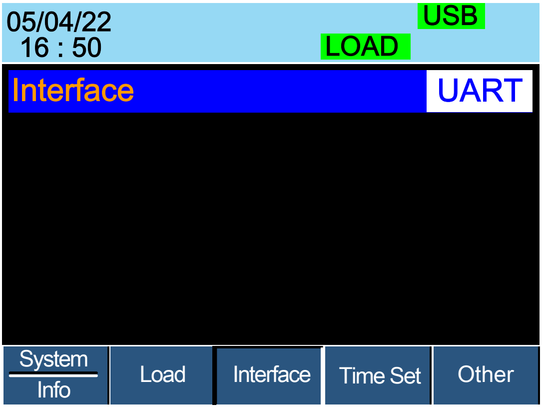
Operation

1. Connect an RS232 or RS485 series cable from the PC to the Remote IN port on the real panel.
2. Connect the other end of the cable to the PC.



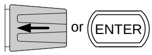
3. If the Interface is not UART, use the Selector knob to edit Interface.



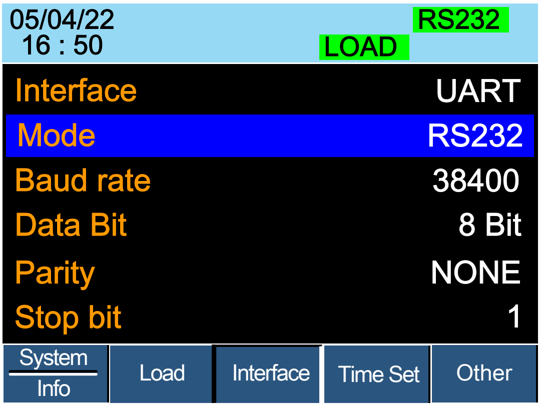


4. Choose RS232.

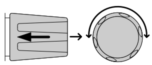
5. Press the Selector knob to confirm.



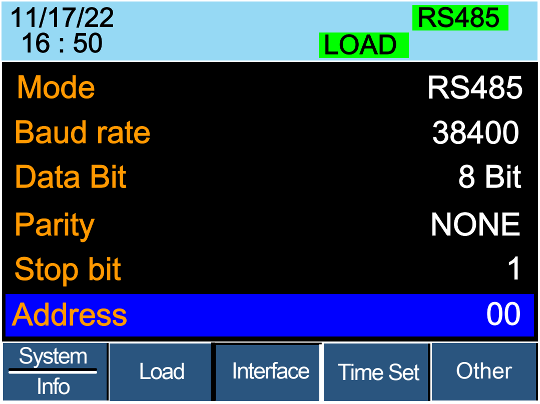
6. The RS232 Menu appears.



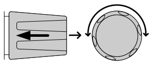
7. Use the Selector knob to edit Baud rate, Stop Bit and Parity.



8. Choose RS485 and the RS485 Menu appears.



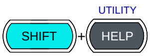
9. Use the Selector knob to edit Baud rate, Data Bit, Stop Bit, Parity and Address.



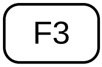
Note	The Baud Rate, Data Bits, Stop Bit, Parity and Address must match that of the host machine.
	For RS232 or RS485 function check, please refer to the section "RS232 or RS485, LAN and USB CDC function check" on page 229.

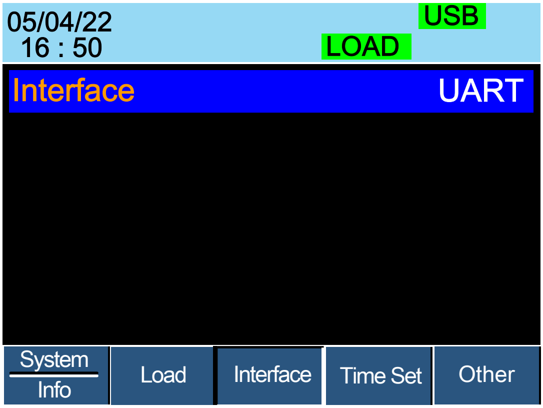
Configuring USB Connection

Background	Of the three interface options, USB is the easiest to use.	
USB connection	PC side connection	Type A, host
	PEL-2000B side connector	Type B, device
	Speed	1.1/2.0(full speed)
Panel operation	1. Press the Shift Key then the Help key to access the Utility menu.	

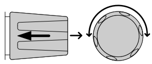


2. Press F3 (Interface Menu).



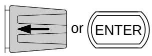


3. If the Interface mode is not USB, use the Selector knob to edit Interface.

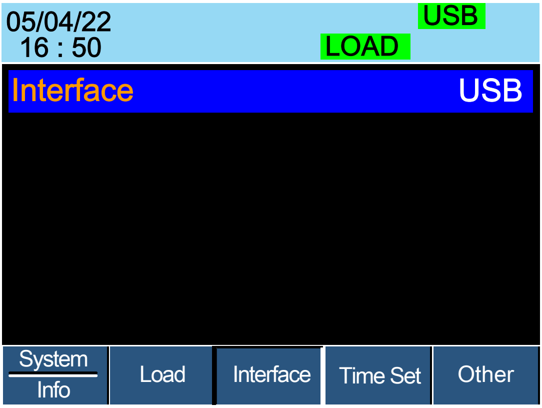


4. Choose USB.

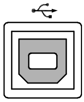
5. Press the Selector knob to confirm.



6. The Interface will become USB.



7. Connect the USB cable to the USB-B slave port on the rear.



8. When the PC asks for the USB driver, select gw_pel2k.inf

Note

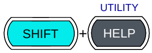
For USB CDC function check, please refer to the section “RS232 or RS485, LAN and USB CDC function check” on page 229.

Configuring the GPIB Address

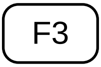
Background	When using GPIB, an address must be specified.
Parameters	Address 01~30

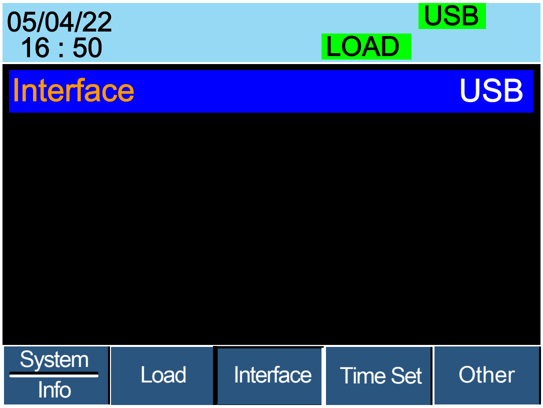
Panel operation

1. Press the Shift Key then the Help key to access the Utility menu.

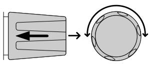


2. Press F3 (Interface Menu).

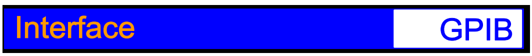




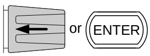
3. If the Interface mode is not GPIB, use the Selector knob to edit Interface.



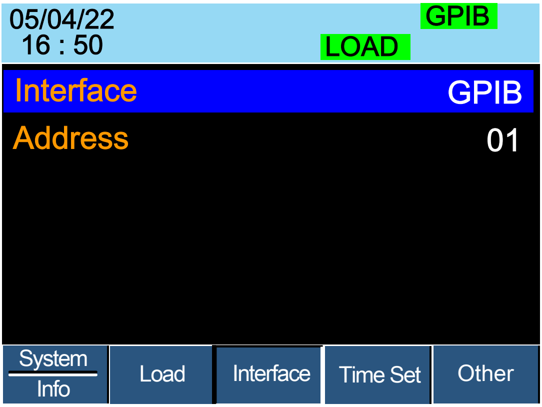
4. Choose GPIB.



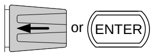
5. Press the Selector knob or Enter to confirm selection.



6. The GPIB menu appears.



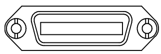
7. Use the selector knob to edit the GPIB address.



8. Edit the GPIB address.

Range 1 ~ 30

9. Connect the GPIB cable to the rear panel port: 24-pin female connector.



GPIB constraints

- Maximum 15 devices altogether, 20m cable length, 2m between each device
- Unique address assigned to each device
- At least 2/3 of the devices turned On
- No loop or parallel connection

Note

The GPIB Address must match that of the host machine.

For GPIB function check, please refer to the section “GPIB function check” on page 232.

RS232 or RS485, LAN and USB CDC Function Check

Background	To test the RS232 or RS485, LAN and USB CDC functionality, National Instruments Measurement and Automation Explorer can be used.
Requirements	Operating System: Windows XP, 7, 8, 10
Note	Functionality check can only be performed after the cable connection has been completed and the PEL-2000B interface has been set.

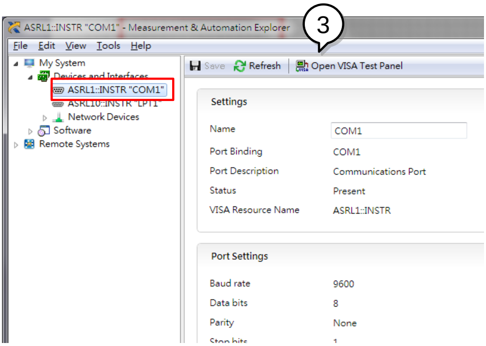
Functionality check

1. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press:

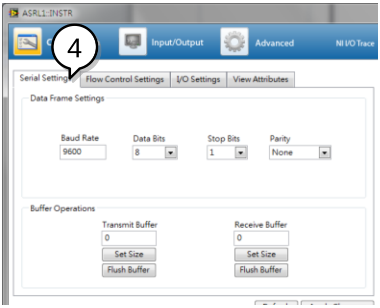
   Start>All Programs>National Instruments>Measurement & Automation

2. From the Configuration panel access, **My System>Devices and Interfaces,** select the corresponding port which is connected to PEL-2000B via USB, RS232 or RS485 or LAN interface.

3. In this example (NI MAX Version 18.0.0f0), we assume that PEL-2000B series is connected COM 1(ASRL1), after selecting the ASRL1::INSTR “COM1”, click the Open VISA Test Panel.



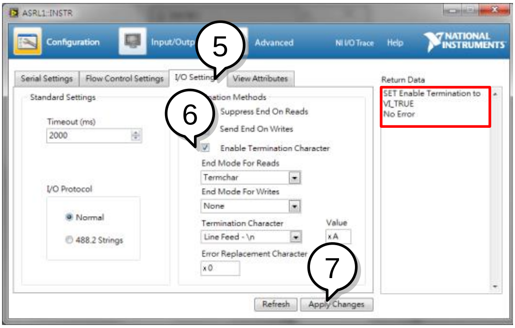
4. In the ASRL Settings page. You can see the information of Serial Settings.



5. Click on I/O Settings.

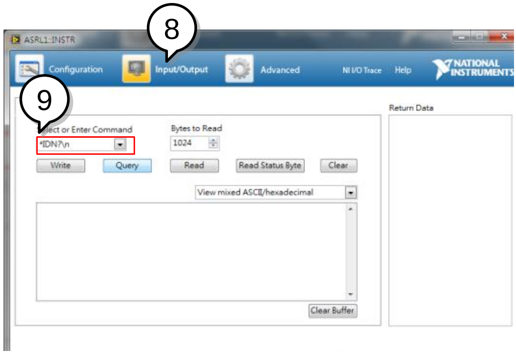
6. Make sure the *Enable Termination Character* check box is checked, and the terminal character is \n (Value: xA).

7. Click *Apply Changes*.



8. Click the *Input/Output* icon.

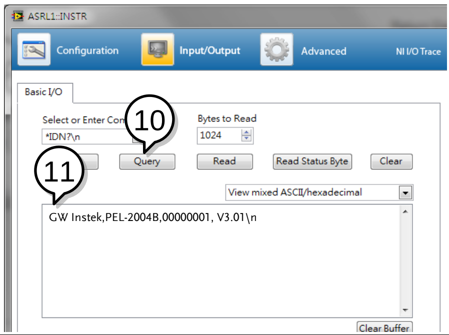
9. Enter *IDN?\n in the *Select or Enter Command* dialog box if it is not already.



10. Click the *Query* button.

11. The *IDN?\n query will return the Manufacturer, model name, serial number and firmware version in the dialog box.

GW Instek,PEL-2000B,00000001, V3.01\n



Note

The COM port corresponding to the USB CDC will exist until the USB driver is well installed. If you want to do the USB CDC function check, the VISA resource name should be changed to the COM port which is occupied by the USB CDC protocol as a virtual com port in your system.

GPIB Function Check

Background	To test the GPIB functionality, National Instruments Measurement and Automation Explorer can be used.
Requirements	Operating System: Windows XP, 7, 8, 10
Functionality check	Please use the National Instruments Measurement & Automation Controller software to confirm GPIB functionality.

Operation

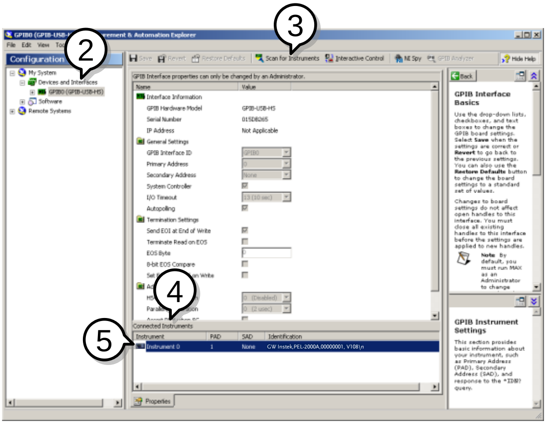
1. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press:

   Start>All Programs>National Instruments>Measurement & Automation

2. From the Configuration panel access;

   My System>Devices and Interfaces>GPIB0

3. Press the *Scan for Instruments* button.
4. In the *Connected Instruments* panel the PEL-2000B should be detected as *Instrument 0* with the address the same as that configured on the PEL-2000B.
5. Double click the *Instrument 0* icon.



6. Click on *Communicate with Instrument*.

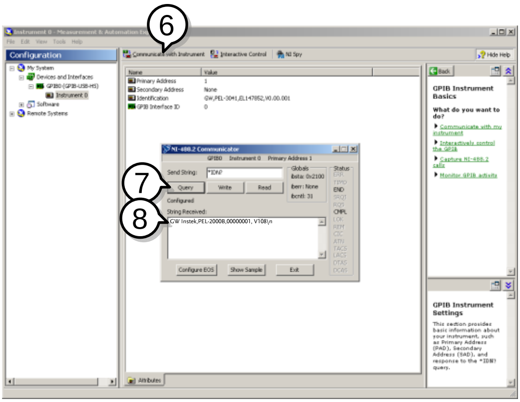
7. In the *NI-488.2 Communicator* window, ensure **IDN?* is written in the *Send String*: text box.

   Click on the *Query* button to send the **IDN?* query to the instrument.

8. The *String Received* text box will display the query return:

   GW Instek,PEL-2000B,xxxxx, xxx

   (manufacturer, model, serial number, version)



9. The function check is complete.

Saving/Recalling Channels

Background

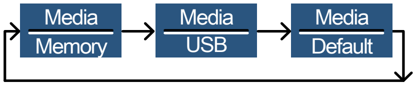
The PEL-2000B series can save data for up to 120 different channel configurations. Each channel is represented by 120 memory slots using the onboard memory.

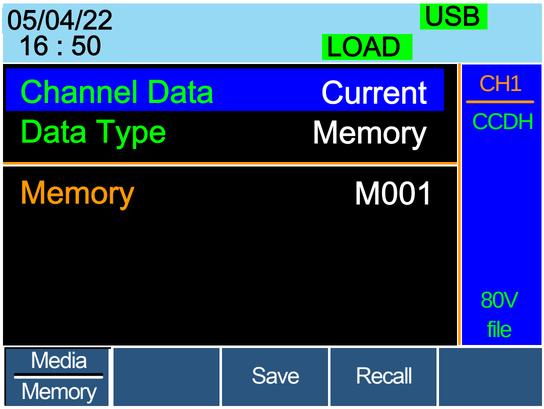
Memory is used in program sequences or for individual channel setups. For further details on memory, see page 91.

Panel operation

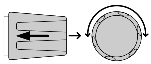
1. Press the File key.

2. Press F1 repeatedly until the Media Memory menu appears.



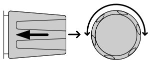


3. Use the Selector Knob to edit Channel Data and Data Type.



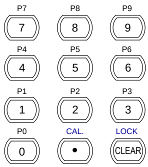
4. Choose Current or All and Memory.

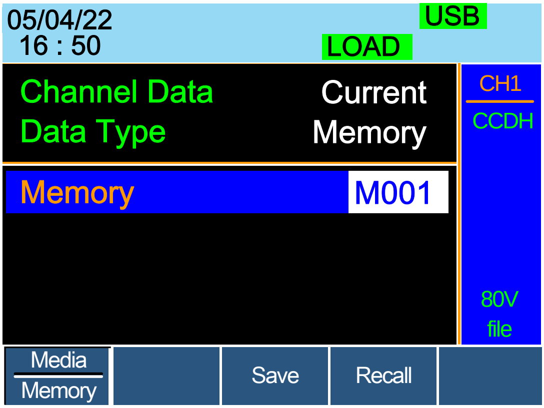
5. Press the Selector knob to edit Memory (M001-M120)



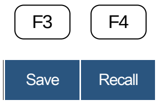
OR

Use the number pad to enter a number.





6. Press F3 to Save or F4 to Recall the memory settings.



7. A message will indicate when a save has been successful

Memory No 001 Save OK

Note: The display will revert to the channel menu after recalling memory.

Saving/Recalling Preset memory

Background

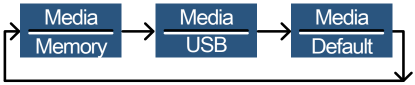
The PEL-2000B series can store up to 10 presets for each channel. The presets can be saved or recalled either individually for each channel (Channel Data: Current) or at the same time (Channel Data: All), using the All option.

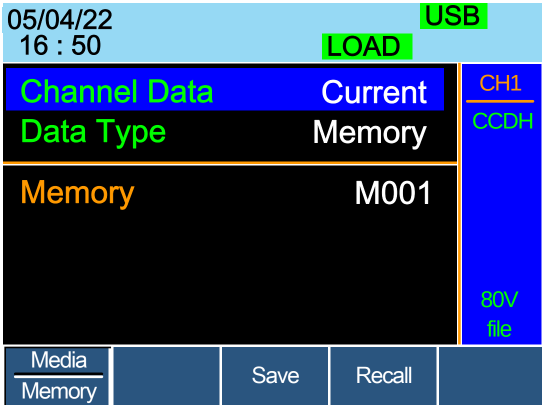
For further details on memory, see page 91.

Panel operation

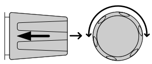
1. Press the File key.

2. Press F1 repeatedly until the Media Memory menu appears.





3. Use the Selector Knob to edit Channel Data and Data Type.



4. To save or recall only the active channel, choose Current and Preset. To save or recall all the presets choose All and Preset.

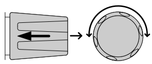
Save / Recall Current Channel

Channel Data	Current
Data Type	Preset

Save / Recall All Channels

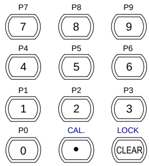
Channel Data	All
Data Type	Preset

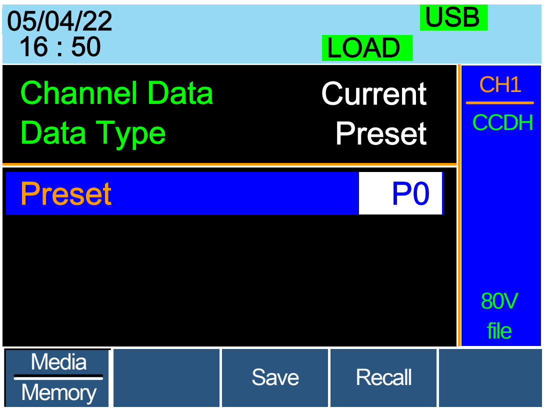
5. Press the Selector knob to edit Preset (P0-P9)



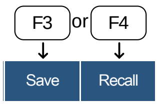
OR

Use the number pad to enter a number.





6. Press F3 to Save or F4 to Recall the Presets.



7. A message will be displayed when the save is complete.

Preset P0 Save OK

Note

The display will revert to the channel menu after recalling memory.

Saving/Recalling Setup Memory

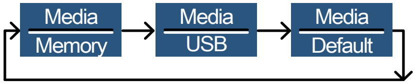
Background

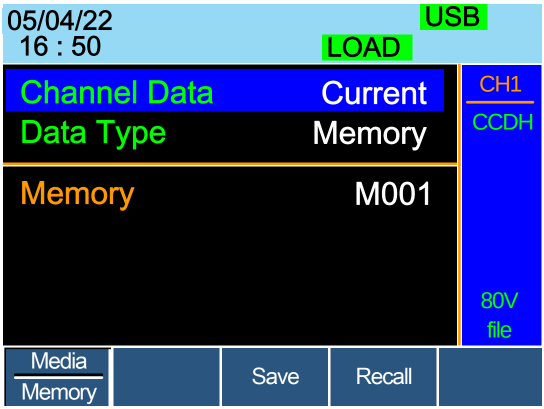
The PEL-2000B series can store up to 4 different setups using the onboard memory. Each setup can be saved from the file menu. Using Setup Memory, each channel will be saved. For further details on memory, see page 91.

Panel operation

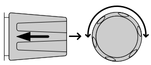
1. Press the File key.

2. Press F1 repeatedly until the Media Memory menu appears.



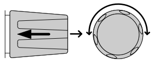


3. Use the Selector Knob to edit Channel Data and Data Type.



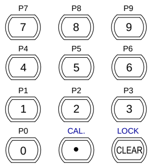
4. Choose All and Setup.

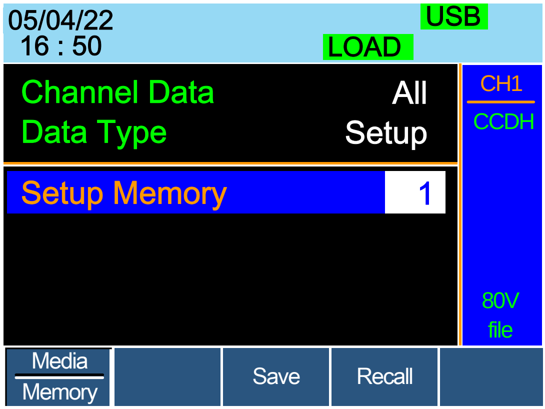
5. Press the Selector knob to edit Setup Memory (1~4)



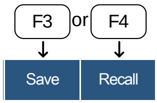
OR

Use the number pad to enter a number.





6. Press F3 to Save or F4 to Recall the Setup Memory.



7. A message will be displayed when the save/recall is complete.

Setup Memory 1 Save OK

Setup Memory 1 Recall OK

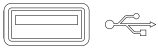
Setting the Default USB Path/File

Background

When saving files to a USB memory stick the files will be saved into the root directory if a file path has not been set.

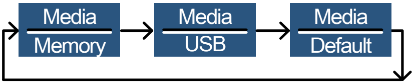
Panel operation

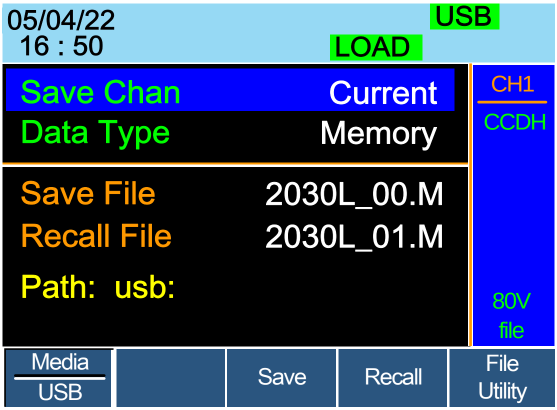
1. Insert a USB flash drive into the front panel USB slot.



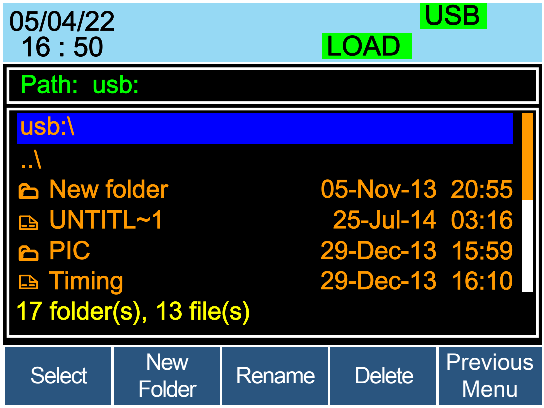
2. Press the File key.

3. Press F1 repeatedly until the Media USB menu appears.





4. Press F5 (File Utility).



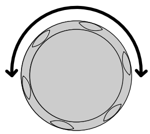
The top section (window) shows the current USB path.

There are 4 options:

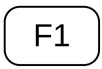
- **Select;** Selects the current USB path as the default file path to save. (Step 5)
- **New Folder;** Creates a new folder (Step 7)
- **Rename;** Renames the current folder/path (Step 13)
- **Delete;** deletes the current file/path name. (Step 20)

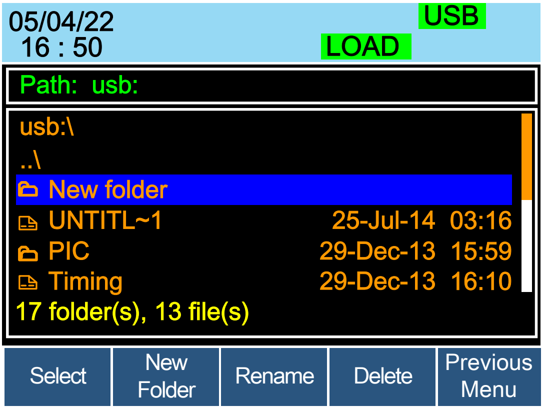
Select Default Path

5. Use the Selector knob to highlight the new path directory



6. Press F1 (Select) to select the new default directory path.

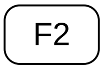




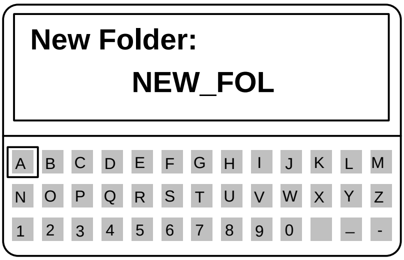
The new path will be shown in the upper Path box in green.

Create New Folder

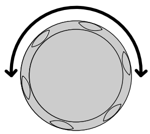
7. To create a new directory, Press F2(New Folder)



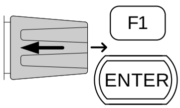
The On-Screen keyboard (OSK) appears. The directory has an 8 character size limit.



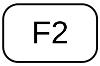
8. Use the Selector knob to scroll left and right through the keys.



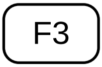
9. When a key is highlighted, use the selector knob, F1 or Enter to confirm a key entry.



10. Use F2 (Back Space) to delete any previous entries/mistakes.



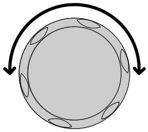
11. Press F3 (Save) to save the directory name.

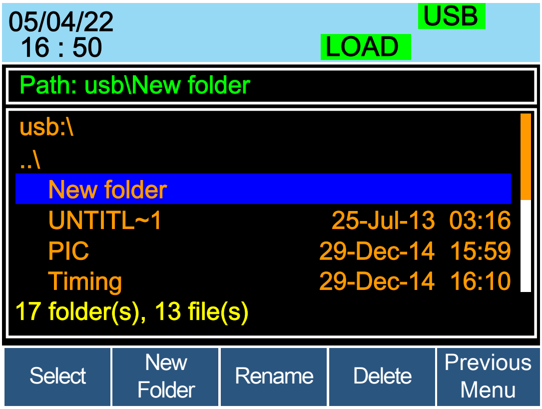


12. Press F5 (Previous menu) to continue to the previous menus

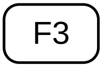
Rename Folder

13. Use the Selector knob to highlight the file/directory that needs to be renamed.

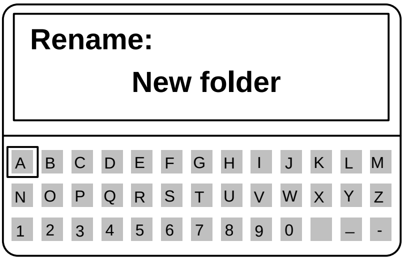




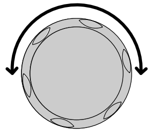
14. Press F3 (Rename)



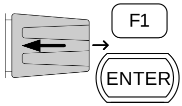
The On Screen Keyboard appears



15. Use the Selector knob to scroll left and right through the keys.

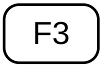


16. When a key is highlighted, use the selector knob, F1 or Enter to confirm a key entry.



17. Use F2 (Back Space) to delete any previous entries/mistakes.

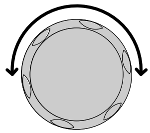
18. Press F3 (Save) to save the directory name.



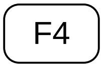
19. Press F5 (Previous menu) to continue to the previous menus

Delete File Name

20. Use the Selector knob to highlight a file/directory.



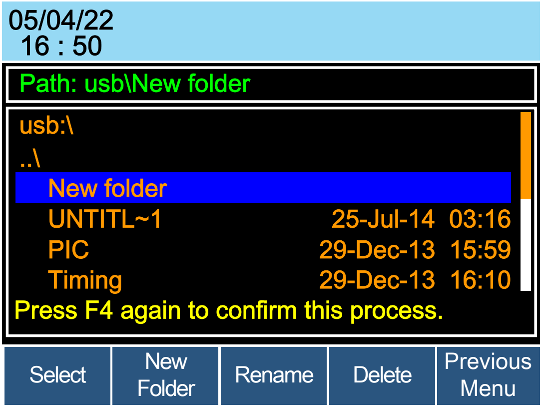
21. Press (F4) Delete.



Note

If there is any content in the folder, you cannot delete it and the message **Error! This folder may be not empty!** will be displayed on the screen.

22. To confirm deletion, press F4 again.



Saving Setups to USB Memory

Background

Setup data contains all the channel data including Memory, Presets and Program Sequences.

There are four setups in internal memory. When saving to USB, all four setups will be saved. Conversely, when recalled, all four setups will be recalled to main memory.

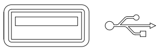
The file extension *.S is used for Setup data only.

Parameters

Save File	200X0_XX.S

Panel operation

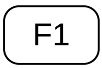
1. Insert a USB flash drive into the front panel USB slot.

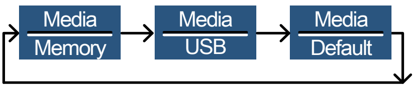


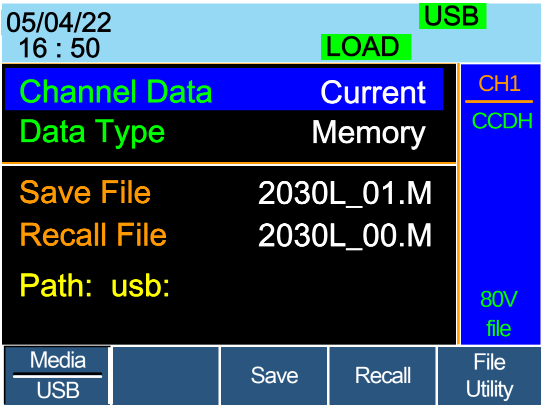
2. Ensure the USB path has been set. Page 240.

3. Press the File key.

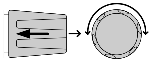
4. Press F1 repeatedly until the Media USB menu appears.



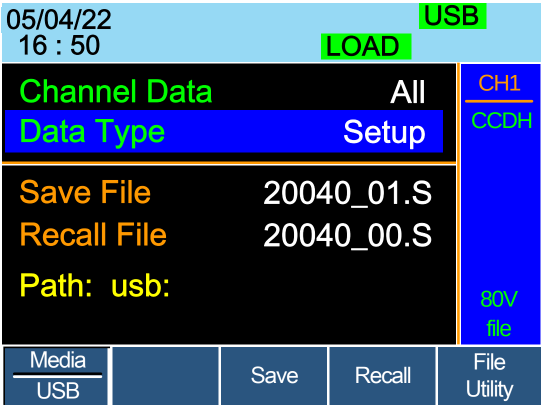




5. Use the Selector Knob to edit Save Chan and Data Type.



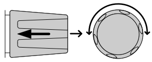
6. Choose All and Setup.



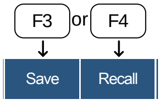
The screen will update to only show Setup files (*.S) that are available to save/recall in the root directory. Press F5 (File Utility) to select the directory to save.

Save/ Recall Setups to USB

7. Use the Selector Knob to edit Save File or Recall File. Rotating the selector knob will scroll through all the available setup files (*.S).



8. Choose a file name.
9. Press F3 (Save) to save the setup data or F4 (Recall) to recall the setup data.



10. A screen message will appear when the save/recall has completed.

20040_01.S Save Ok
20040_00.S Recall Ok

Note

Setups can only be saved if they have been saved to internal memory first. For details on how to save to internal memory see page 238.

Saving/Recalling Memory Data to USB

Background

There are two options to save or recall Memory data to a USB flash drive:

Save Chan Current: Saves the active Channel's Memory data (M001~M120) into the root directory (20XXX_XX.M). Press F5 (File Utility) to select the directory to save.

Save Chan All: Every channel's Memory data (CH1 M001~120 ~ CH8 M001~M120) will be saved into a directory (ALL00XX) as separate files for each channel (P0X0X_C1.M ~ P0X0X_C8.M).

Recall File: Recalls the selected file to the active channel's Memory. It is not possible to update all the channels at once, only one channel at a time can be recalled.

The file extension *.M is used for Memory data only.

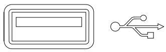
For more information about the file structures see, page 91.

Parameters

Save Channel Data: All	Directory ALL0000 ~ ALL0099 File: P0X0X_CX.M
Save Channel Data: Current	File: 20XXX_XX.M
Recall Channel Data: Current	File: 20XXX_XX.M

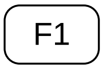
Panel operation

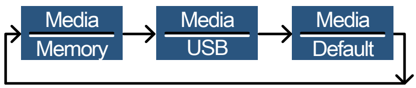
1. Insert a USB flash drive into the front panel USB slot.

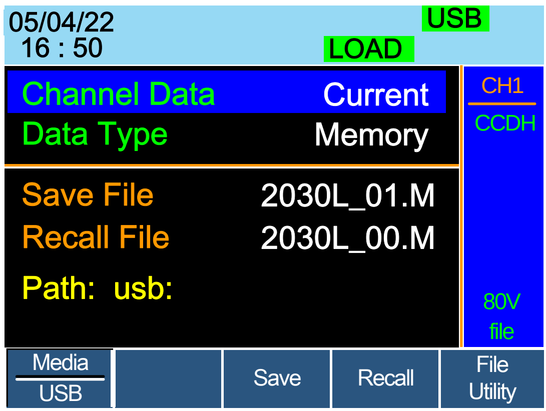


2. Ensure the USB path has been set. Page 240.
3. Press the File key.

4. Press F1 repeatedly until the Media USB menu appears.

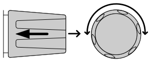




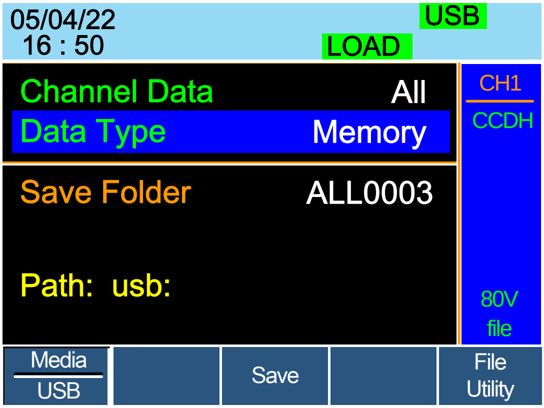


Save all Channels

5. Use the Selector knob to edit Save Chan and Data Type.

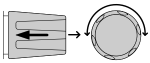


6. Choose All, and Memory



The screen updates to show Save Folder. Note it is not possible to recall all channels at once, only save.

7. Use the Selector Knob to edit Save Folder.

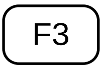


8. Choose a directory name (ALL0000 ~ ALL0099).

Note

Any used directories will not be available. It is not possible to over-write older directories. They must be deleted first.

9. Press F3 (Save)

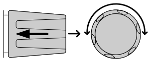


10. A screen message will be displayed when complete.

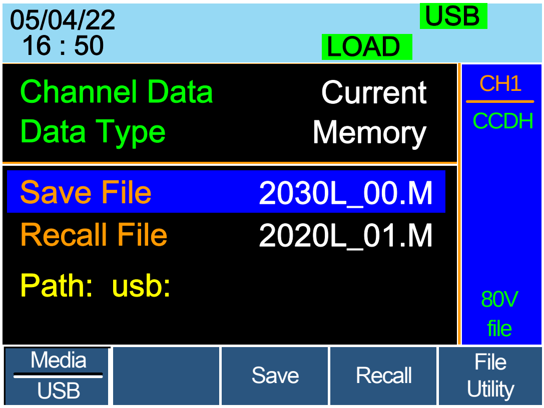
ALL0003 Save Ok

Save /Recall File

11. Use the Selector Knob to edit Save Chan and Data Type.



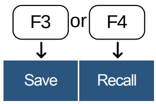
12. Choose Current and Memory.



13. Use the selector knob to edit Save or Recall File.

14. Choose a file name.

15. Press F3 (Save) to save or F4 (Recall) to recall the current channel memory.



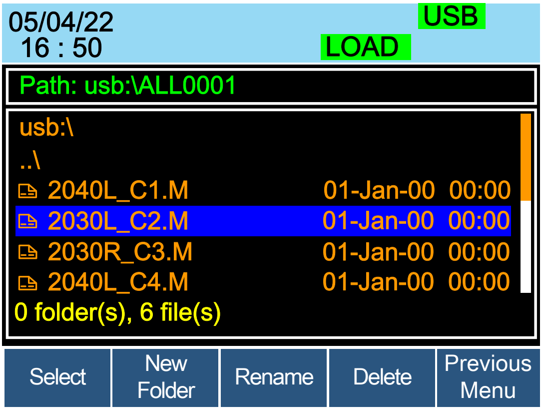
16. A save or recall message will be displayed when complete.

2030L_00.M Save Ok
2030L_00.M Recall Ok

Recall File from USB path

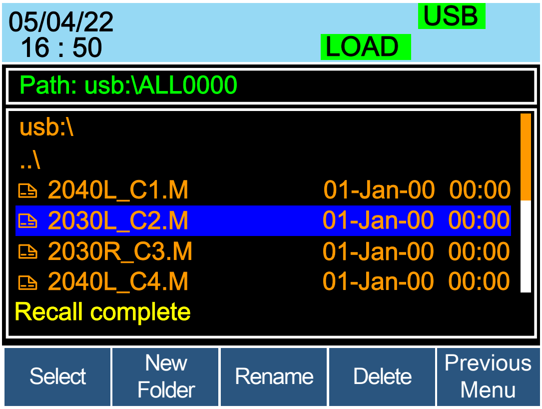
17. Press F5 (File Utility).

18. Use the selector knob to select path for saving memory. usb:\ALLXXXX\File: 2XXXX_XX.M



19. Press the selector knob, Enter or F1

20. A recall message will be displayed when complete.



Note: Remember only data that has been saved to internal memory will be saved to USB. Only the active channel will be saved.

If you try to recall data that originated from a different load module than the active channel, an error message will appear. The filename must reflect the active channel's load module type.

Machine Type Error

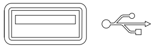
Saving/Recalling Presets to USB

Background	There are two options to save or recall Channel Presets to a USB flash drive: Save Chan Current: Saves the active Channel's Presets (P0~P9) into the root directory (20XXX_XX.P). Press F5 (File Utility) to select the directory to save. Save Chan All: Every channel's Presets (CH1 P0~P9 ~ CH8 P0~P9) will be saved into a directory (ALL00XX) as separate files for each channel (P0X0X_C1.P ~ P0X0X_C8.P) Recall: Recalls the selected file to the active channel's Presets (P0~P9). It is not possible to update all the channels at once, only one channel at a time can be recalled. The file extension *.P is used for channel Presets only. For more information about the file structures see page 91.

Parameter	Save Channel Data: All	Directory: ALL0000 ~ ALL0099 File: P0X0X_CX.P
	Save Channel Data: Current	File: 20XXX_XX.P
	Recall Channel Data: Current	File: 20XXX_XX.P

Panel operation

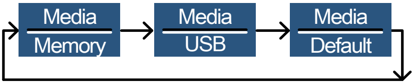
1. Insert a USB flash drive into the front panel USB slot.

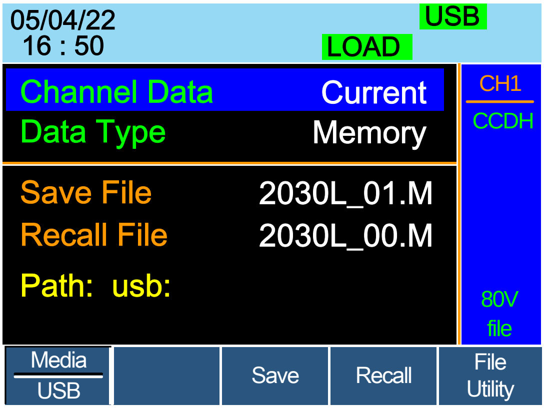


2. Ensure the USB path has been set. Page 240.

3. Press the File key.

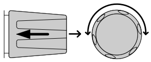
4. Press F1 repeatedly until the Media USB menu appears.



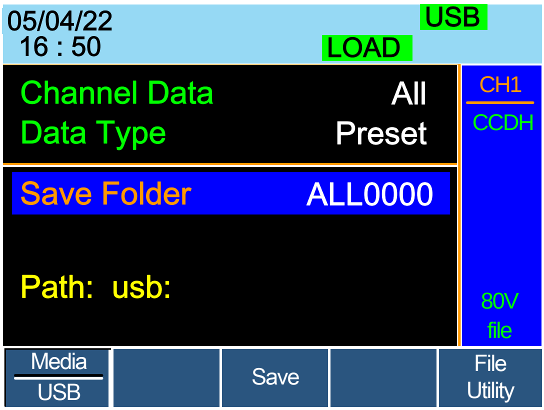


Save all Channel Presets

5. Use the Selector knob to edit Save Chan and Data Type.

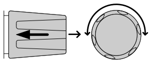


6. Choose All, and Preset



The screen updates to show Save Folder. Note it is not possible to recall all presets at once, only save.

7. Use the Selector Knob to edit Save Folder.



8. Choose a directory name (ALL0000 ~ ALL0099).

Save Folder ALL0000

Note: Any used directories will not be available. It is not possible to over- write older directories. They must be deleted first.

---

9. Press F3 (Save)

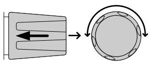
F3

10. A screen message will be displayed when the save is complete.

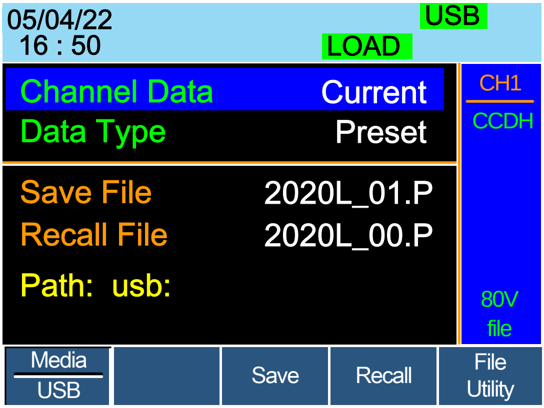
ALL0001 Save Ok

Save/Recall Preset (current channel)

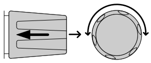
11. Use the Selector Knob to edit Save Chan and Data Type.



12. Choose Current and Preset.

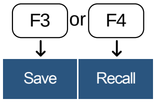


13. Use the selector knob to edit Save File or Recall file.



14. Choose a file name.

15. Press F3 (Save) to save or F4 (Recall) to recall the Channel Presets.

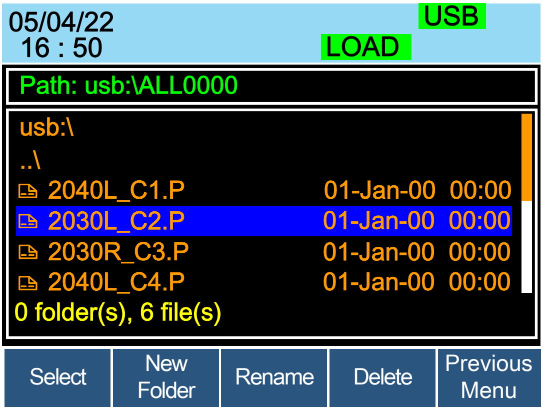


16. A message will be displayed when the save or recall has completed.

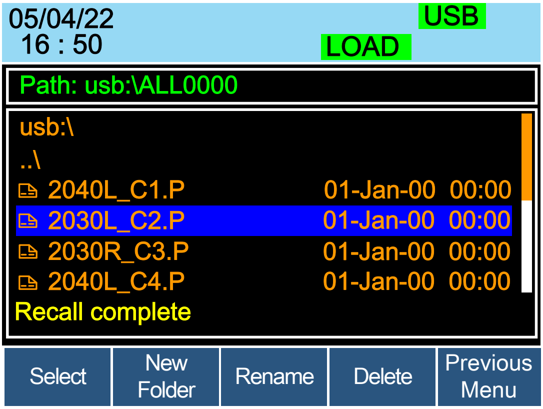
2020L_01.P Save Ok
2020L_01.P Recall Ok

Recall File from USB path

17. Press F5 (File Utility).
18. Use the selector knob to select path for saving preset. usb:\ALLXXXX\File: 20XXX_XX.P



19. Press the selector knob, Enter or F1.
20. A recall message will be displayed when complete.



Note

Remember only data that has been saved to internal memory will be saved to USB. Only the active channel presets will be saved.

If you try to recall data that originated from a different load module than the active channel, an error message will appear. The filename must reflect the active channel's load module type.

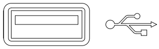
Machine Type Error

Saving/Recalling Sequences to USB

Background	There are two options to save or recall Sequences to a USB flash drive. Sequences can either be saved from all channels or from the current channel only. Save All: Every channels' sequences will be saved into a directory (ALL00XX) as separate files for each channel (20XXX_C1.A~ 20XXX_C8.A). Save Current: The current channel's sequence will be saved into the root directory (20XXX_XX.A). Press F5 (File Utility) to select the directory to save. Recall: Sequences can only be recalled for the current channel. It is not possible to recall all channels' Sequences at once. The file extension *.A is used for Sequences only. For more information about the file structures see page 91.
Parameters	Save Channel Data: All — Directory: ALL0000 ~ ALL0099 File: 20XXX_CX.A Save Channel Data: Current — File: 20XXX_XX.A Recall Channel Data: Current — File: 20XXX_XX.A

Panel operation

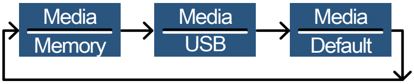
1. Insert a USB flash drive into the front panel USB slot.

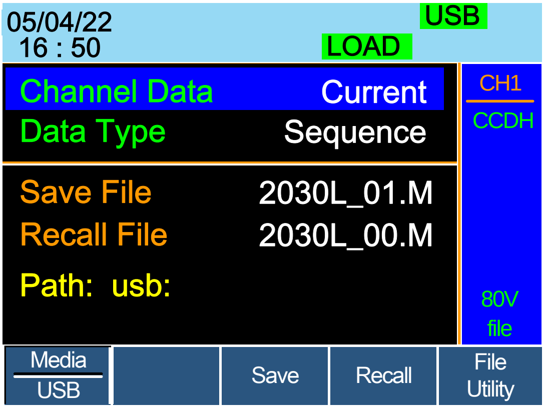


2. Ensure the USB path has been set. Page 240.

3. Press the File key.

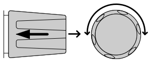
4. Press F1 repeatedly until the Media USB menu appears.



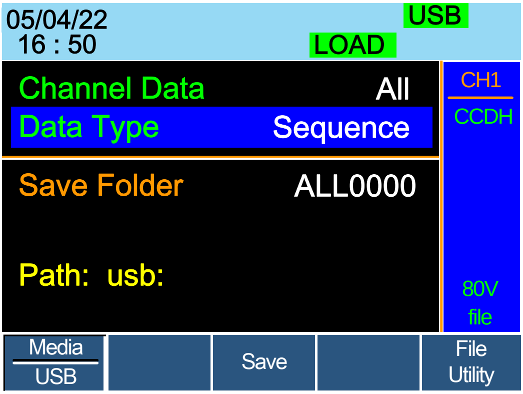


Save all Channel SEQ

5. Use the Selector knob to edit Save Chan and Data Type.

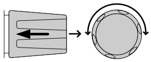


6. Choose All, and Sequence



The screen updates to show Save Folder. Note it is not possible to recall all Sequence data at once, only save.

7. Use the Selector Knob to edit Save Folder.



8. Choose a directory name (ALL0000~ALL0099).

Save Folder ALL0000

Note

Any used directories will not be available. It is not possible to over-write older directories. They must be deleted first.

---

9. Press F3 (Save)

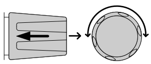
F3

10. A screen message will be displayed when saving.

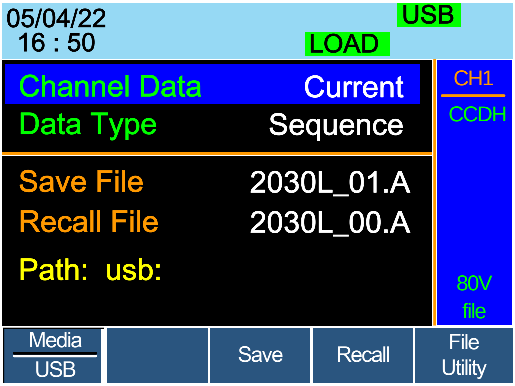
Save All Chan in ALL0000

Save/Recall SEQ (current channel)

11. Use the Selector Knob to edit Save Chan and Data Type.



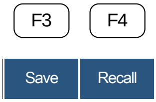
12. Choose Current and Sequence.



13. Use the selector knob to edit Save File or Recall File.

14. Choose a file name.

15. Press F3 (Save) to save or F4 (Recall) to recall the current channel's sequence.



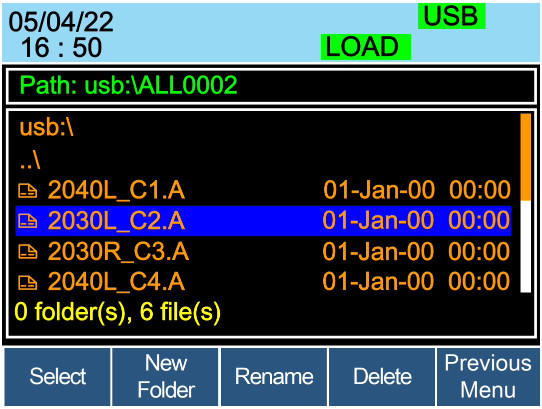
16. A message will be displayed when the file is saved/recalled.

2030L_01.A Save OK
2030L_01.A Recall OK

Recall File from USB path

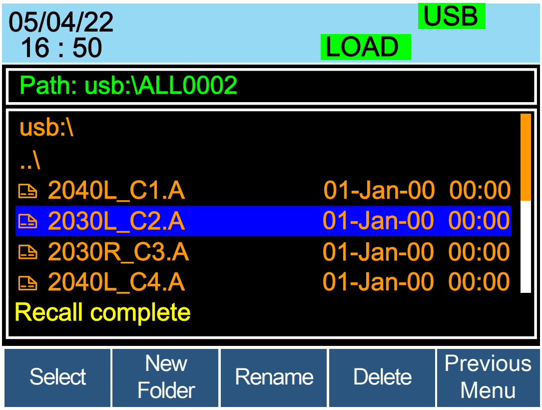
17. Press F5 (File Utility).

18. Use the selector knob to select path for saving sequence. usb:\ALLXXXX\File: 20XXX_XX.A



19. Press the selector knob, Enter or F1.

20. A recall message will be displayed when complete.



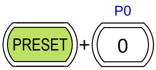
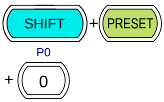
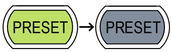
Note

Remember a sequence must first be saved to (internal) buffer before it can be saved to USB.

If you try to recall data that originated from a different load module than the active channel, an error message will appear. The filename must reflect the active channel's load module type.

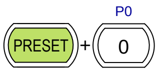
Machine Type Error

Quick Preset Recall/Save

Background	The PEL-2000B series mainframes have up to 10 Channel Presets (P0~P9). Quick recalling or saving presets will only be applicable to the active channel. For example, P1 on CH1 is not the same as P1 on CH2.	
Parameter	Presets P0 ~ P9 (current channel)	
Panel Operation	1. Remove any USB devices from the front panel.	
	2. Select the channel you want to save Channel Presets to.	Page 123.
Save Current Channel Preset	3. To save a Channel Preset, press the Preset key and hold one of the number keys (0-9) for a short time until a beep is heard. 0 = P0 1= P1 etc.	
Save All Channel Presets	4. To save All Channel Presets, press the Shift key, the Preset key and hold one of the number keys (0-9) for a short time until a beep is heard. 0 = P0 1= P1 etc.	
	5. Press the Preset key again to deactivate it.	
	The Preset will be saved to the one of 10 presets depending on the number pressed.	

Recall Current Channel Preset

6. Press the Preset key and one of the number keys.

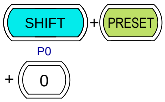


   0 = P0
   1= P0 etc.

   Only the current Channel preset will be recalled.

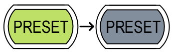
Recall All Channel Presets

7. Press the Shift key, the Preset key and one of the number keys.



   0 = P0
   1= P0 etc.

8. Press the Preset key again to deactivate it.



Recall Setup Memory (Frame link).

Background

A master mainframe can command all mainframes (master and slave) to recall setup memory from their internal memory. No setup data will be recalled from the master mainframe to the slave units.

Parameter

Setup memory 1~4.

Panel Operation

1. On the Master mainframe, follow the procedure for recalling setup memory for all channels. Page 237

All mainframes will update setup memory upon recall.

Note

It is necessary to save setup data before recalling both master and slave. If the setup data is not saved first, there will be no value change after recalling.

Recall Preset Memory (Frame link)

Background

A master mainframe can command all units to recall preset memory from their internal memory. Only the first three preset memories (P0~P2) can be recalled.

Channel presets can be recalled via the file menu or using the quick recall feature using the number pad.

Parameters

Presets P0 ~ P2 (current channel)

Panel Operation: Quick Keys

1. Remove any USB devices from the front panel.
2. On the master mainframe, press the Shift and Preset key. SHIFT + PRESET
3. Press one of the number keys (0-2). P0 0

   0 = P0
   1= P1 etc

The screen will flash momentarily when the presets are recalled.

Panel Operation: File menu

4. On the master mainframe follow the procedure to recall preset memory for all channels. Page 236

The screen will flash momentarily when the presets are recalled.

⚠ Note

It is necessary to save preset data before recalling both master and slave. If preset data is not saved first, the value after recalling will be the factory default setting.

Recall Factory/User's Defaults

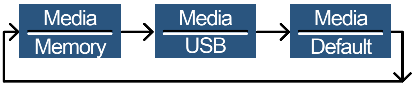
Background

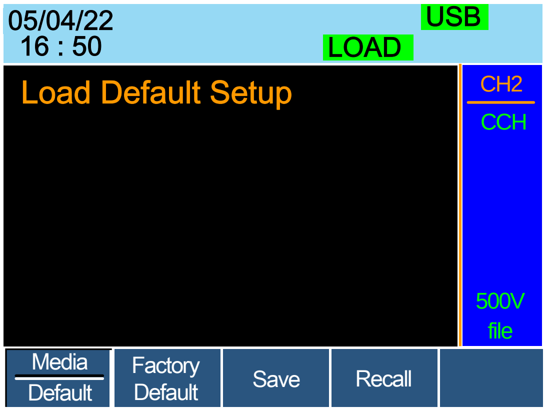
The Factory/User's defaults can be saved or recalled at any time. For details on the factory defaults please see the default settings in the appendix, page 299

Panel Operation

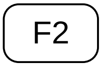
1. Press the File key.

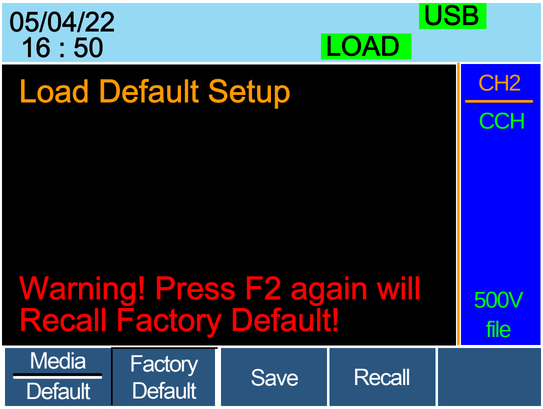
2. Press F1 repeatedly until the Media Default menu appears.



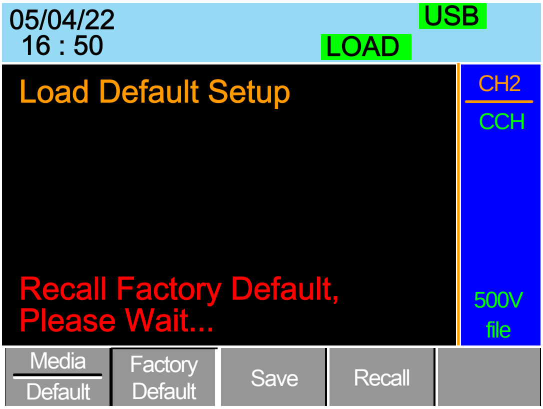


3. Press Factory Default (F2) to recall the factory default settings.



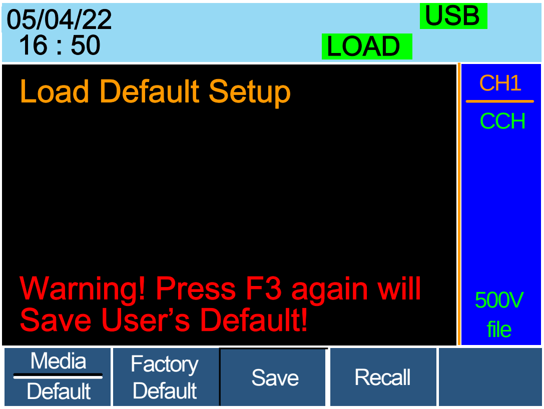


4. Press F2 again to ensure recall factory default setting F2



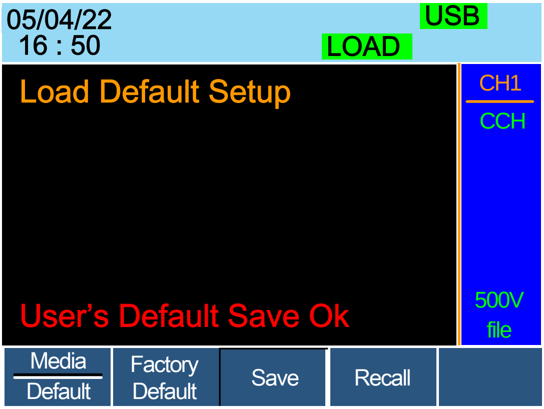
5. Wait a short time for the settings to be recalled.

6. Press Save (F3) to save the user's default. F3

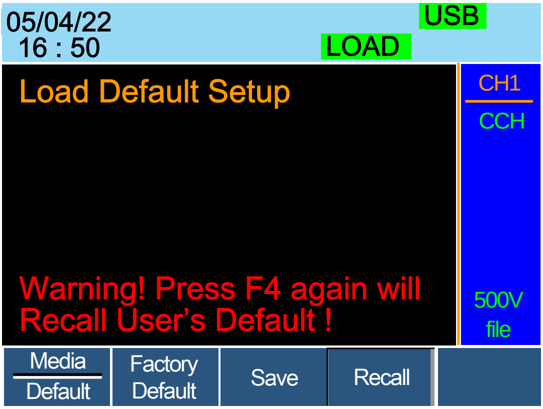


7. Press Save (F3) again to ensure save the user's default. F3

8. Wait a short time for the settings to be saved.

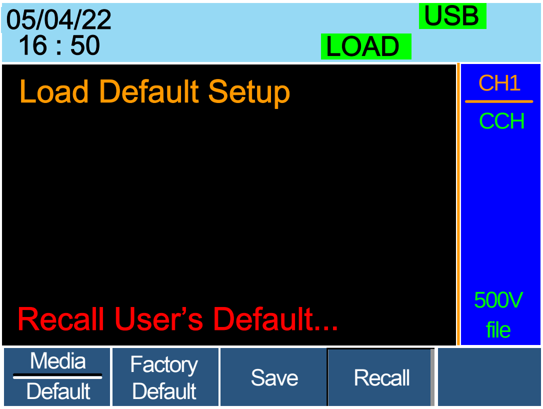


9. Press Recall (F4) to recall the user's default. F4



10. Press Recall (F4) to ensure recall the user's default F4

11. Wait a short time for the settings to be saved.



INTERFACE

The Interface chapter details the pin configuration of the RS232 or RS485, LAN, GPIB, Frame Link, Channel Control and Go/NoGo interfaces.

Interface Configuration

Configure GPIB interface

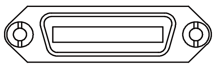
Interface function codes

The interface function codes for the Electronic Load are listed as the following table.

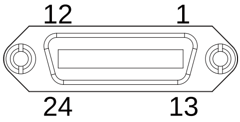
Code	Interface function
SH1	Source Handshake capability
AH1	Acceptor Handshake capability
T5	Talker (basic talker, serial poll, unaddressed to talk on LAG)
L4	Listener (basic listener, unaddressed to listen on LAG)
SR1	Service Request capability
RL0	No Remote/Local capability
PP0	No Parallel Poll capability
DC1	Device Clear capability
DT0	No Device Trigger capability
C0	No Controller capability
E1	Open collector bus drivers
TE0	No Extended Talker capability
LE0	No Extended Listener capability

Connection

Connect the GPIB cable to the rear panel port: 24-pin female connector.



Pin assignment



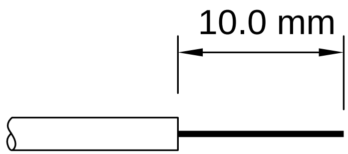
Pin1	Data line 1	Pin13	Data line 5
Pin2	Data line 2	Pin14	Data line 6
Pin3	Data line 3	Pin15	Data line 7
Pin4	Data line 4	Pin16	Data line 8
Pin5	EOI	Pin17	REN
Pin6	DAV	Pin18	Ground
Pin7	NRFD	Pin19	Ground
Pin8	NDAC	Pin20	Ground
Pin9	IFC	Pin21	Ground
Pin10	SRQ	Pin22	Ground
Pin11	ATN	Pin23	Ground
Pin12	Shield (screen)	Pin24	Signal ground

GPIB constraints

- Maximum 15 devices altogether, 20m cable length, 2m between each device
- Unique address assigned to each device
- At least 2/3 of the devices turned On
- No loop or parallel connection

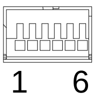
Configure Channel Control interface

Channel control configuration	Connector	Screwless connector.
	Wire Gauge	22-28 AWG (24 AWG recommended).
	Wire connection	10 mm strip gauge for connection.



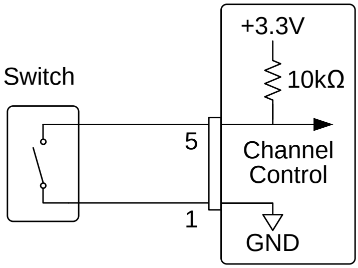
	Input	0-10V.

Pin Assignment

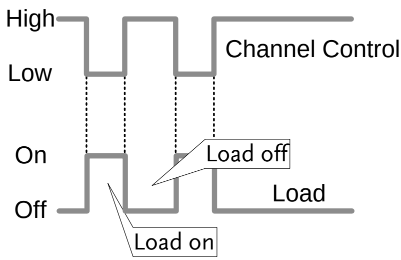


1 GND	Negative potential of the load input terminal.
2 I MON (OUTPUT)	Load input current monitor; where 0V = 0% of input current and 10V = 100% of input current.
3 V MON (OUTPUT)	Load input voltage monitor; where 0V = 0% of input voltage and 10V = 100% of input voltage.
4 Ext Voltage ref (INPUT)	External voltage reference; Where 0V=0% of rating voltage/current and 10V = 100% of rating voltage/current. The external voltage reference is for CC and CV mode.

	5 Load On	Load On Input. Load on = Active low. Load off = Active high. (Pin 5 of the connector is internally pulled up to 3.3V with a 10kΩ resistor when the switch is open. Thus when the switch is open, pin 5 is logically high. When the switch is closed, pin 5 is pulled down to the GND ground level, making pin 5 logically low)



The Load On/Off determines whether the external switch is closed (low) or open (high)

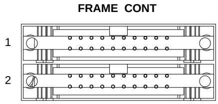


	6 +15V	Internal power output. Max 50mA.
Channel Control Interface Constraints	Mode/Range	Mode and Range configuration is only selected via the front panel.

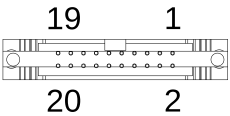
Configure Frame Link Interface

Connection

Connect the Frame link cable (MIL 20 pin connector) to the rear panel port: 20-pin male connector.



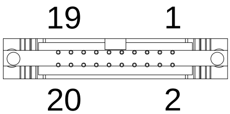
Pin assignment (Frame link connector 1)



Pin number	Pin name	Description
Pin1	A	Input, Recall Preset memory 0 (All channels)
Pin2	B	Input, Recall Preset memory 1 (All channels)
Pin3	C	Input, Recall Preset memory 2 (All channels)
Pin4	TRIG_IN	Trigger input
Pin5	MEM_1	Input, Recall Setup memory 1 (All channels)
Pin6	MEM_2	Input, Recall Setup memory 2 (All channels)
Pin7	MEM_3	Input, Recall Setup memory 3 (All channels)
Pin8	MEM_4	Input, Recall Setup memory 4 (All channels)
Pin9	Enable	Input, Enable Load (On/Off), recall Preset memory (0-2) and Setup memory (1-4)

Pin10	Load On/Off	Input, Load On/Off
Pin11	N.C	No connection
Pin12	N.C	No connection
Pin13	N.C	No connection
Pin14	N.C	No connection
Pin15	Load Status	Output, load on status.
Pin16	Alarm Status	Output, alarm activated.
Pin17	+5V	Power source output, +5V, 100mA.
Pin18	N.C	No connection.
Pin19	GND	Ground
Pin20	GND	Ground

Pin assignment (Frame link connector 2)



Pin number	Pin name	Description
Pin1	Sync._A	Output, Sync signal, Recall Preset memory 0 (All channels)
Pin2	Sync._B	Output, Sync signal, Recall Preset memory 1 (All channels)
Pin3	Sync._C	Output, Sync signal, Recall Preset memory 2 (All channels)
Pin4	TRIG_OUT	Trigger output

Pin5	Sync._MEM_1	Output, Sync signal, Recall Setup memory 1 (All channels)
Pin6	Sync._MEM_2	Output, Sync signal, Recall Setup memory 2 (All channels)
Pin7	Sync._MEM_3	Output, Sync signal, Recall Setup memory 3 (All channels)
Pin8	Sync._MEM_4	Output, Sync signal, Recall Setup memory 4 (All channels)
Pin9	Sync._Enable	Output, Sync signal, Enable Load (On/Off), recall Preset memory (0-2) and Setup memory (1-4)
Pin10	Sync._Load On/Off	Output, Sync signal, Load On/Off
Pin11	N.C	No connection
Pin12	N.C	No connection
Pin13	N.C	No connection
Pin14	N.C	No connection
Pin15	Load Status	Output, load on status.
Pin16	Alarm Status	Output alarm activated.
Pin17	N.C	No connection
Pin18	+5V	Power source output, +5V, 100mA
Pin19	GND	Ground
Pin20	GND	Ground

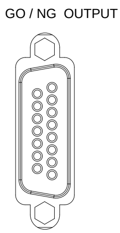
Explanation	• Input: active low (0-1V) active high (4-5V)
⚠ Note	Input type is internally pulled up to 5V with a 10kΩ resistor.
	• Output: high (floating) low (0-1V)
⚠ Note	Output type is internally Open collector outputs, maximum 30VDC with 1.1V saturation voltage (100mA).
	• When Enable (pin9) is on (active low), the following is disabled from the mainframe: Load On/Off (pin 10) activating loads and recalling preset (pin 1-3) or setup memory (pin 5-8).
Frame Link constraints	• Maximum 5 (1 master + 4 slave units) devices can be linked altogether with a maximum cable length of 30cm for each cable. • All the connected devices must be turned on. • No loop or parallel connections

Configure Go/NoGo Interface

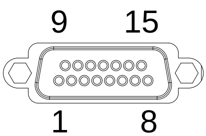
Connection

Use a DSUB (DB-15 Female) connector to connect to the Go/NoGo port.

The Go/NoGo port is an output only port.



Pin assignment

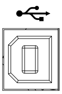


	Pin1	Ch1_GO/NG	Pin9	Ch5_GO/NG
	Pin2	GND	Pin10	GND
	Pin3	Ch2_GO/NG	Pin11	Ch6_GO/NG
	Pin4	GND	Pin12	GND
	Pin5	Ch3_GO/NG	Pin13	Ch7_GO/NG
	Pin6	GND	Pin14	GND
	Pin7	Ch4_GO/NG	Pin15	Ch8_GO/NG
	Pin8	GO/NG_Enable		

Connection Type	Open collector output maximum 30VDC with 1.1V saturation voltage (100mA).	
	30 V DC (high)	Pass (Go) or SPEC Test: OFF
	1.1 V DC (low)	Fail (NoGo)

USB Interface Connection

Connection	For USB remote connection, use the USB-B port on the mainframe front panel.

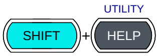


RS232 or RS485 Interface Configuration

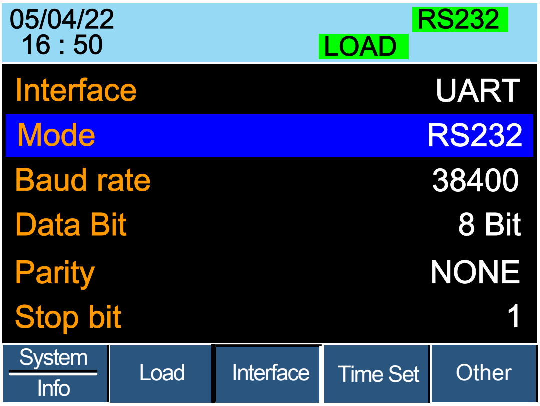
RS232 or RS485 configuration	Connector	RJ45
	Baud rate	2400/4800/9600/19200/38400/57600 /115200
	Data bits	7bits/8bits
	Stop bit	1bit/2bits
	Parity	None, Odd, Even
	Address	0 ~ 30 [This is available when Mode is RS485]

Panel operation

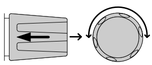
1. Press the Shift Key then the Help key to access the Utility menu.



2. Press the Shift Key then the Help key to access the Utility menu.



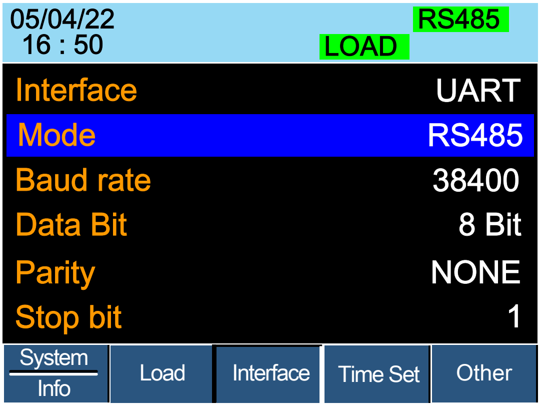
3. If the interface is not set to RS232, use the selector knob to change the interface to RS232.



4. Edit the Baud rate, Stop bit and parity.

Baud rate	2400, 4800, 9600, 19200, 38400, 57600,115200
Stop Bit	1,2
Parity	None, Odd, Even

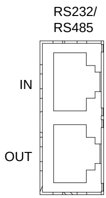
5. Use the selector knob to change the interface to RS485



6. Edit the Baud rate, Stop bit and parity.

Baud rate	2400, 4800, 9600, 19200, 38400, 57600,115200
Stop Bit	1,2
Parity	None, Odd, Even
Data Bits	7bits, 8bits
UART Address	0 ~ 30

7. Connect the RS-232C to RJ45 cable to the rear panel port: RJ45 female connector.



Terminal application

Invoke a terminal application such as MTTTY (Multi-Threaded TTY).

- For RS-232C, set the COM port, baud rate, stop bit, data bit, and parity accordingly.

To check the COM port No. for RS-232C, see the Device Manager in the PC. For Win XP, Control panel → System → Hardware tab.

8. Ensure the terminal application has the following settings;

   Baud rate – as per PEL-2000B settings

   Com Port – as per PC settings (Device Manager)

   Parity – None

   Data bits – 8

   Stop bits – None

Functionality check

Run this query command via the terminal.

*idn?

This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format.

GW, PEL-2002B/2004B, 00000001, V3.01

Set the UART settings

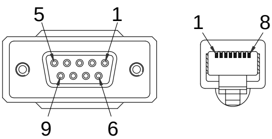
Overview

The PEL-2000B series uses the IN & OUT ports for UART communication coupled with RS232 (GW Instek Part number: GTL-259) or RS485 adapters (GW Instek part number: GTL-260).

The pin outs for the adapters are shown below.

RS232 cable with DB9 & RJ-45 shielded connectors from GTL-259 connection kit

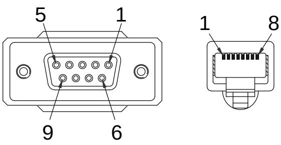
DB-9 Connector		Remote IN Port		Remarks
Pin No.	Name	Pin No.	Name	
Housing	Shield	Housing	Shield	
2	RX	7	TX	Twisted pair
3	TX	8	RX	
5	SG	1	SG	



Connection diagram

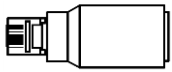
RS485 cable with DB9 & RJ-45 shielded connectors from GTL-260 connection kit

DB-9 Connector		Remote IN Port		Remarks
Pin No.	Name	Pin No.	Name	
Housing	Shield	Housing	Shield	
9	TXD -	6	RXD -	Twisted pair
8	TXD +	3	RXD +	
1	SG	1	SG	
5	RXD -	5	TXD -	Twisted pair
4	RXD +	4	TXD +	



Connection diagram

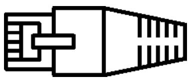
Diagram of Intermediate connector



Intermediate connector from GTL-259 or GTL-260 connection kit.

Intermediate connector					
8 Pin (Male)			8 Pin (Female)		
Pin No.	Name		Pin No.	Name	Remarks
Housing	Shield	↔	Case	Shield	
1	SG	↔	1	SG	
6	TXD -	↔	6	TXD -	Internal paralleled by 120 ohm
3	TXD +	↔	3	TXD +	
5	RXD -	↔	5	RXD -	Internal paralleled by 120 ohm
4	RXD +	↔	4	RXD +	

Diagram of End terminal connector

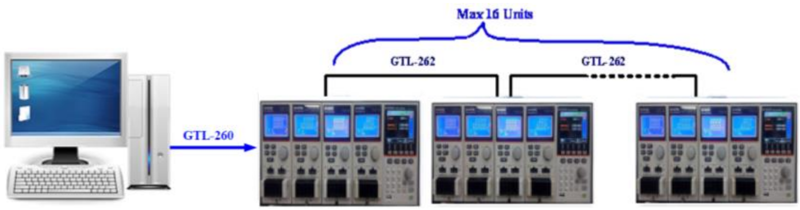


End terminal connector from GTL-259 or GTL-260 connection kit.

End terminal connector	
8 Pin Connector	
Pin No.	Remarks
3	Internal shorted
7	
4	Internal shorted
8	

Multiple Unit Connection

The PEL-2000B can have up to 16 units daisy-chained together using the 8 pin connectors (IN OUT ports) on the rear panel. The first unit in the chain is remotely connected to a PC using RS485. Each subsequent unit is daisy-chained to the next using a RS485 local bus. The OUT port of the first unit must be connected to intermediate connector and the OUT port of the last unit must be connected to end terminal connector.

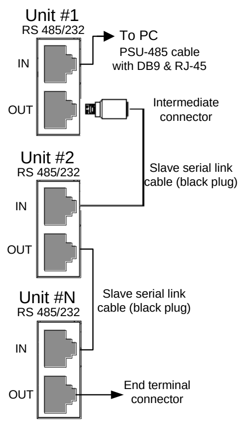


Each unit is assigned a unique address and can then be individually controlled from the host PC.

Operation

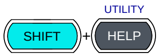
1. Connect the first unit's IN port to a PC using RS485 serial cable. Use the serial cables supplied in the GTL-260 connection kit.
2. Plug in intermediate connector to the OUT port on the first unit then using the slave serial link cable (black plug) to connect intermediate connector to the IN port of the second unit.

   Terminate the OUT port of the last unit with the end terminal connector included in the GTL-260 connection kit.



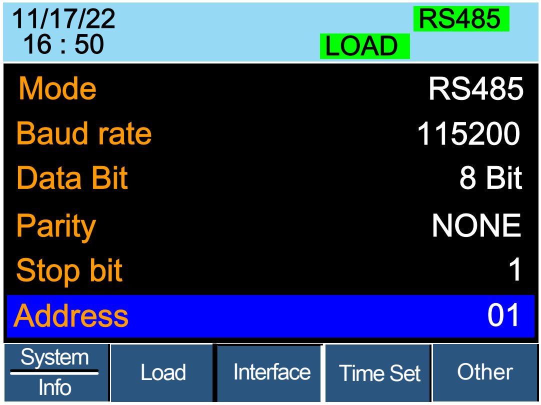
3. Power up all units.

4. Press the Shift Key then the Help key to access the Utility menu.



5. Press F3 and set the *Interface* setting to UART> *Mode* and set the Mode to *RS485*.

6. Set the addresses and mode of all units using UART menu. It must be a unique address identifier and mode select is RS485.

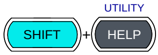


7. Multiple units can be operated using SCPI commands now. See the programming manual or see the function check below for usage details.

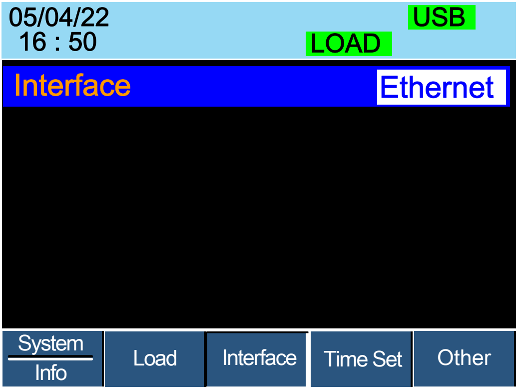
LAN Interface Configuration

Panel operation

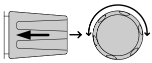
1. Press the Shift Key then the Help key to access the Utility menu.



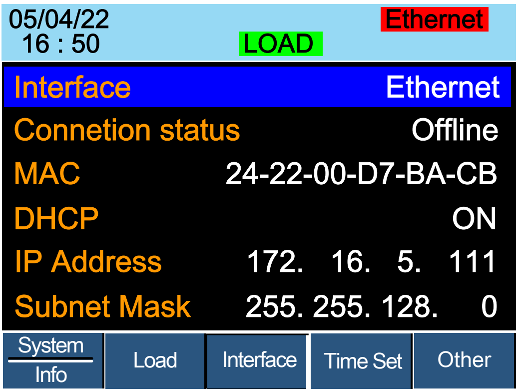
2. Press F3 (Interface Menu).



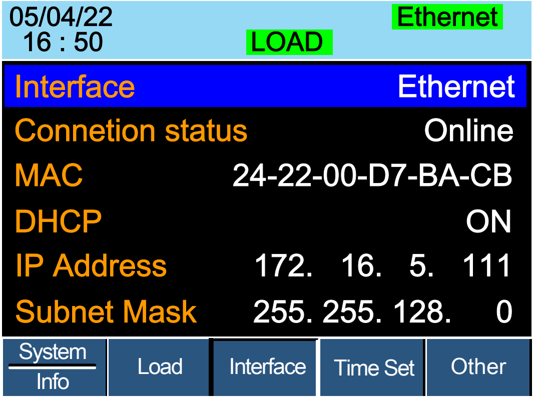
3. If the interface is not set to Ethernet, use the selector knob to change the interface to Ethernet.



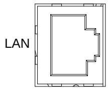
4. Choose Ethernet. Confirm that connection status turn form Offline to Online



5. Check if indicator "Ethernet" turns in green and connection status becomes online status.



6. Connect the LAN RJ45 connector to the RJ45 female socket on the rear panel.



FAQ

Q1. The load voltage indicated on the load module is below expected.

A1. Ensure the load leads are as short as possible, twisted and use the appropriate wire gauge. Ensure that voltage sense is used, this can help alleviate the voltage drop across the load the leads.

Q2. When I try to start a program sequence, it will not run. "No Active Channel" is displayed.

A2. Ensure the channel(s) is activated (not set to OFF) in the FUNC→Program→Active Channel menu.

Q3. When trying to save to USB, the USB memory stick is unresponsive.

A3. Try restarting the PEL-2000B mainframe. If this fails to solve the problem, ensure the USB memory is cleanly formatted.

Q4. When I try to clear an alarm, it doesn't work.

A4. Before clearing an alarm or using the Protection Clear All function, the DUT must be turned off. After the DUT is off, the alarm(s) can be cleared.

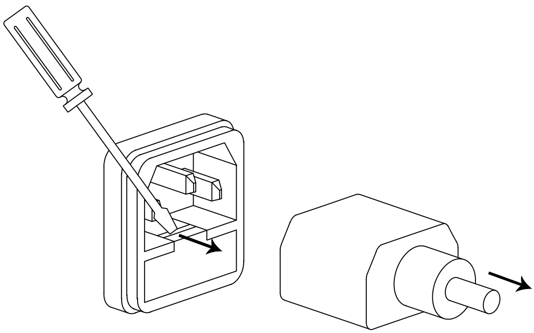
For more information, contact your local dealer.

APPENDIX

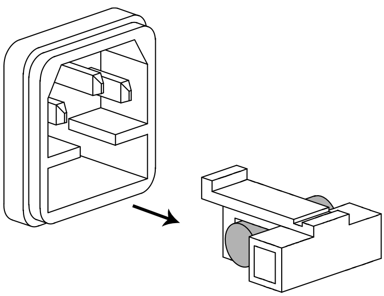
Fuse Replacement

Step

1. Turn off the power at the wall socket and rear panel. Remove the power cord.
2. Remove the fuse socket using a minus driver.



3. Replace the fuse in the holder.



Rating T3.15A, 250V

Firmware Update

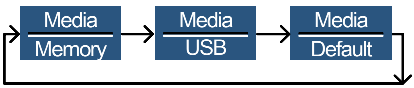
Background

The PEL-2000B firmware can be easily updated using a USB memory stick. For the latest firmware please see your local GW Instek distributor

File Name	File: P2KAXXXX.P2K
⚠ Note	Copy the firmware file (*.P2K) into the root directory of a USB stick before proceeding with the firmware update.
⚠ WARNING	Do not turn the power off or remove the USB memory when the firmware is being read or upgraded.
⚠ Note	If your Master is PEL-2004A/ PEL-2002A, the mainframe firmware version must be V3.01.UPG or above. The firmware file and upgrade procedure can be downloaded on the GWInstek website.

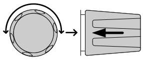
Panel operation

1. Insert a USB flash drive into the front panel USB slot.
2. Press the File key. FILE
3. Press F1 repeatedly until the Media USB menu appears. F1



4. Press F5 (File Utility). F5

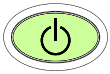
5. Use the selector knob to scroll down to the firmware file (*.P2K) and press the selector knob, Enter or F1.



6. Press F1 to confirm the firmware upgrade.

7. Wait for the firmware upgrade to finish, a message will be displayed upon completion.

8. Turn the power Off.

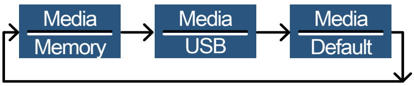


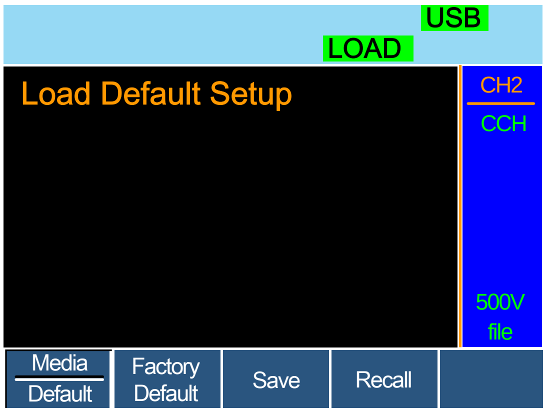
Recall Factory Default

9. Turn the power On.

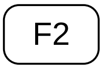
10. Press the File key.

11. Press F1 repeatedly until the Media Default menu appears.

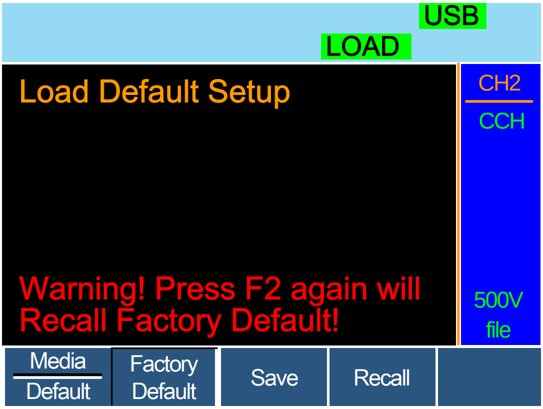




12. Press Factory Default (F2) to recall the factory default settings.

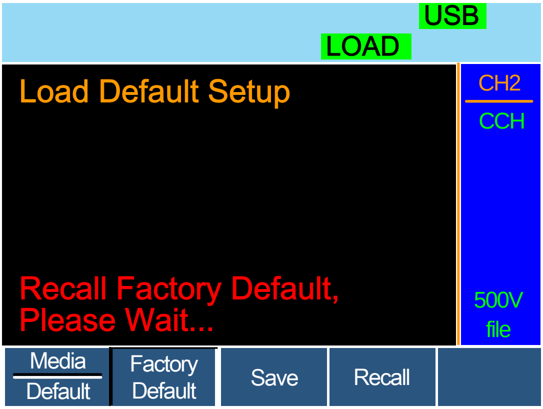


13. Firmware updating process is complete and you can use the device now.



14. Press F2 again to ensure recall factory default setting

F2



15. Wait a short time for the settings to be recalled.

Calibration

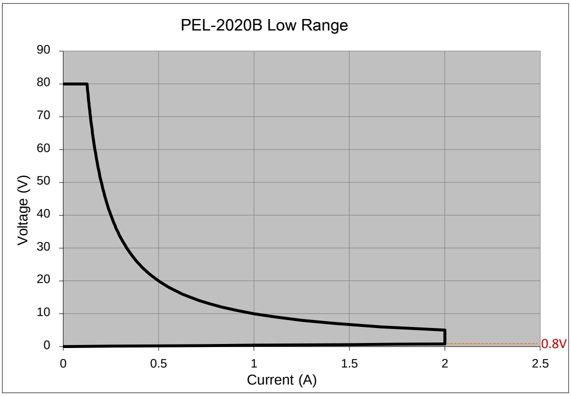
Background

The PEL-2000B series load modules should be calibrated at least on a yearly basis.

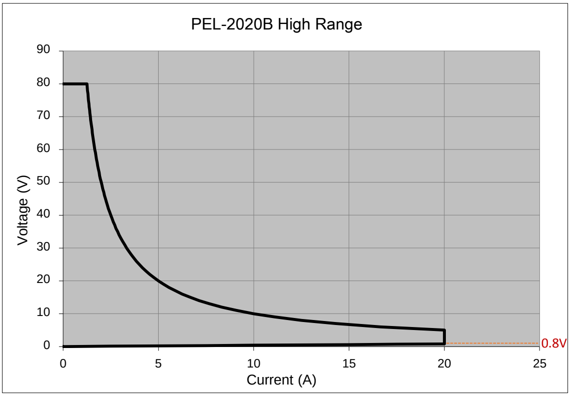
GW Instek does not support End-User calibration. Please see your distributor for calibration details.

Range Chart

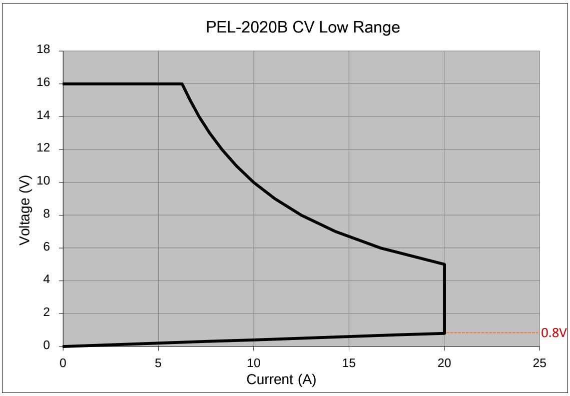
PEL-2020B Low Range 10W



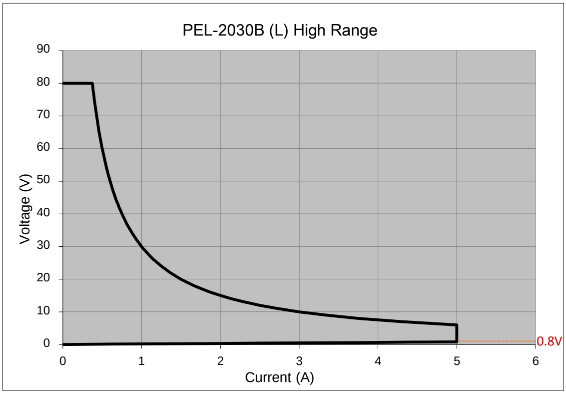
PEL-2020B High Range 100W



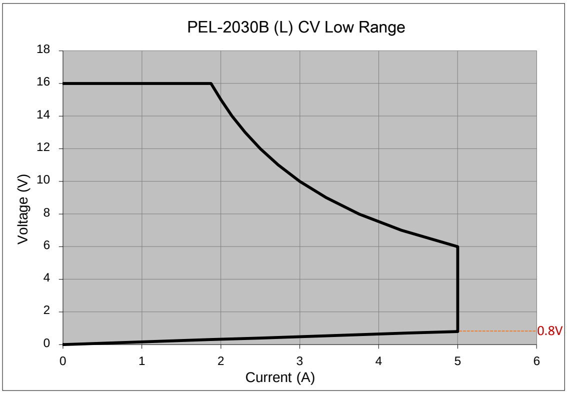
PEL-2020B CV Low Range



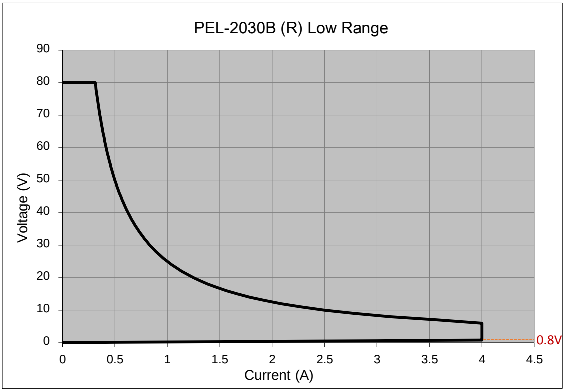
PEL-2030B (L)
High range 30W



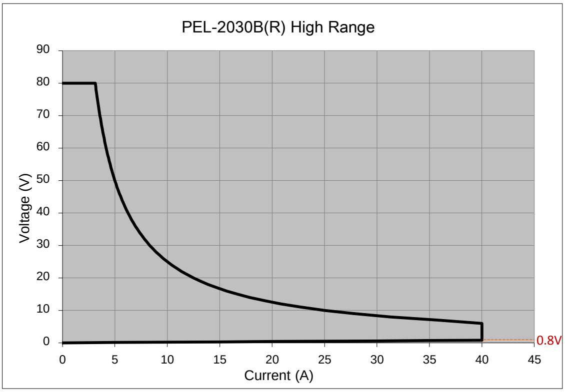
PEL-2030B (L)
CV Low Range



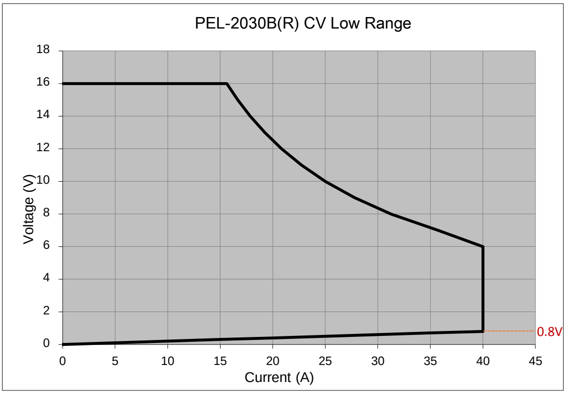
PEL-2030B (R)
Low Range 25W



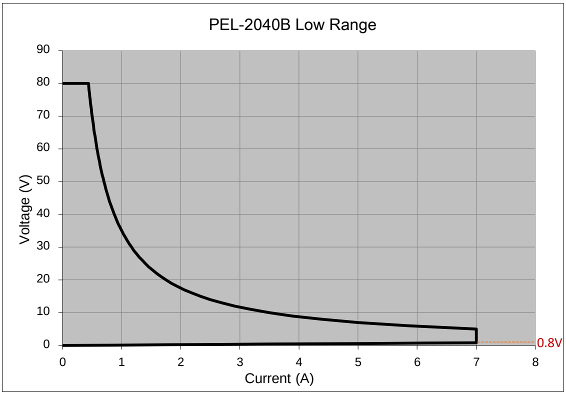
PEL-2030B (R) High Range 250W



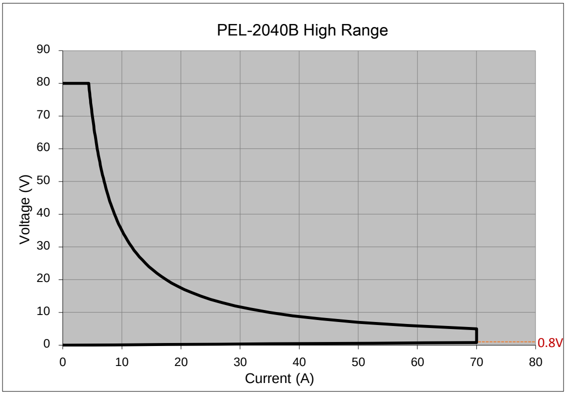
PEL-2030B (R) CV Low Range



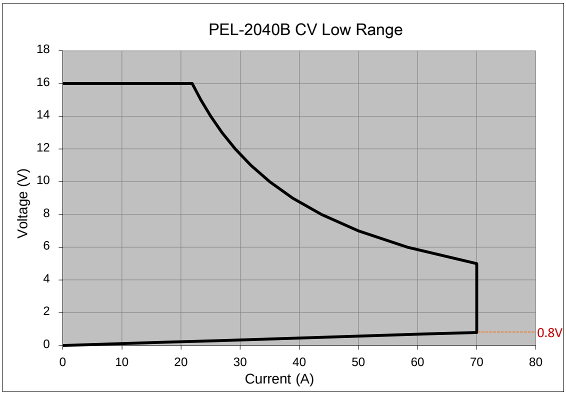
PEL-2040B Low Range 35W



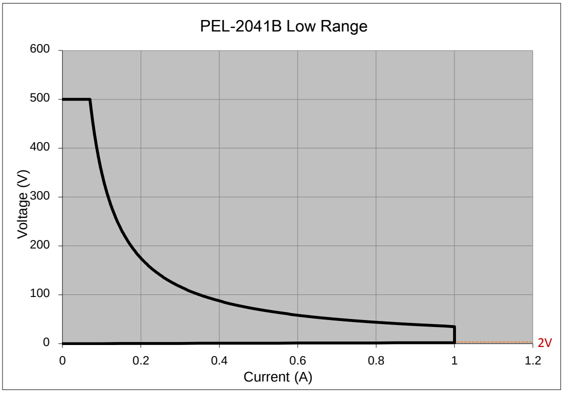
PEL-2040B High Range 350W



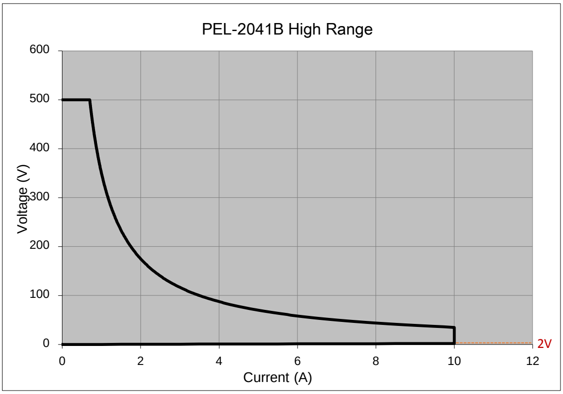
PEL-2040B CV Low Range



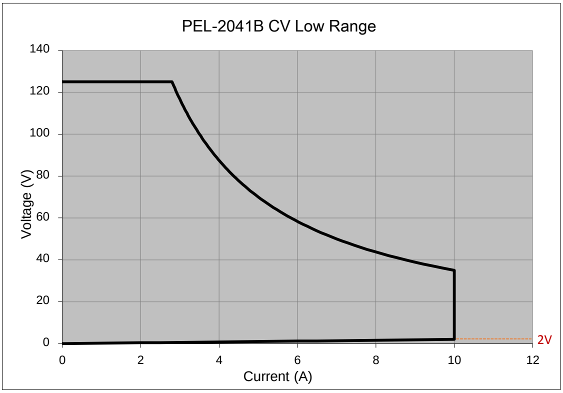
PEL-2041B Low Range 35W



PEL-2041B High Range 350W



PEL-2041B CV Low Range



Default Settings

Menu Item		
CC Mode	Range: High	Mode: Static
	A/B Value: Min A	Rising Slew Rate: Max
	Falling Slew Rate: Max	
CR Mode	Range: High	Mode: Static
	A/B Value: Max Ω	Rising Slew Rate: Max
	Falling Slew Rate: Max	
CV Mode	Range: High	Response: Slow
	A/B Value: Max V	I Meas: High
	Curr Limit: Max A	
CP Mode	Range: High	A/B Value: Min W
	Curr Limit: Max A	
CHAN-Protection	OCP Level: Max	OCP Setting: OFF
	OVP Level: Max	OVP Setting: OFF
	OPP Level: Max	OPP Setting: OFF
	UVP Level: OFF	UVP Setting: Clear
	Protection Clear: All	
CHAN- Other	CC Vrange: High	Von Voltage: 0V
	Von Latch: OFF	CH CONT: Panel
	Independent: OFF	Load D-Time: 0.0s
	Response: Fast	CCH Step: Min
	CCL Step: Min	CRH Step: Min
	CRL Step: Min	CVH Step: Min
	CVL Step: Min	CPH Step: Min
	CPL Step: Min	Short Function: ON
	Short Key: Toggle	Short Safety: ON

CHAN-Group	Total Units: OFF	Group Mode: Para
	Display Mode: V,I	
CHAN- Seq. Edit	NO.: 001	Value: Min
	Rising/Falling SlewRate: Max	Duration Time: 0.000025s
CHAN- Seq. Edit - Loop	Repeat: Infinity Times	Start of Loop: 001 Point
	On End Of Seq.: OFF A (CC mode) OFF Ω/OFF KΩ (CR mode)	CC Vrange: High
CHAN-Go/NoGo	SPEC Test: OFF	Delay Time: 0.0 s
	Entry Mode: Value	High: Max
	Low: Min	
FUNC- Program	PROG: 01	SEQ: 01
	Memory: M001	Run: Skip
	On-Time: 0.1	Off-Time: Off
	P/F-Time: Off	Short-Time: Off
	Short Channel: All channels	
FUNC- Program Chain	Start: P01	P01~P12→: Off
FUNC- Program-Active Channel	CH 01~08: Active: OFF	Prog: Off
FUNC- Sequence	Seq.: Off	TRIG In: Off
	TRIG: CH1: OUT	TRIG: CH2~08: OFF
	Setting: CH01~CH08: OFF	
FUNC- OCP	OCP: Off	Chan: 1
	Range: High	Start C: Min
	End C: Setting Range Max	Step_C: Min
	Last_C: Min	Step_T: Min
	Delay: Min	Trig_V: Min

	Keep_T: Min	
FUNC- OCP-Active Channel	CH 01~08: Active: OFF	
FILE- Memory	Channel Data: Current Memory: M001	Data Type: Memory
FILE- USB	Channel Data: Current Save File: No File	Data Type: Memroy Recall File: No File
UTILITY- Load	Auto Load: OFF	Auto Load On: Prog
UTILITY - Interface	USB	
UTILITY - Other	Speaker: OFF Brightness: 70 Alarm (M): ON Knob Type: Updated Slave Knob: SetValue High Resolution: ON Von Latch Clear: Auto Jog Shuttle Control: OFF	Contrast: 8 Frame CONT: OFF Alarm (S): OFF Go_NoGo Tone: OFF Language: English System Mode: 0 Measure Period: 200ms RVP Load Off: OFF

Specifications

The specifications apply when the PEL-2000B series is powered on for at least 30 minutes to warm-up to a temperature of 25°C ± 5°C, unless specified otherwise.

	PEL-2002B	PEL-2004B
MODULE SLOTS	2	4
GENERAL		
Operating Environment		
Temperature	0°C to 40°C	
Relative Humidity	0 to 85% RH	
Altitude	Up to 2000m	
Location	Indoor, no direct sunlight, dust free, almost non conductive pollution.	
Storage Environment		
Temperature	-10°C to 70°C	
Relative Humidity	< 90% RH	
Location	Indoor	
Power Supply	AC input voltage range: 100-120Vac / 200-240Vac (90-132Vac / 180-250Vac) Frequency: 47~63Hz Power rating: PEL-2004B: 250VA Max PEL-2002B: 150VA Max Transient overvoltage on the main supply is 2500V.	
Fuse	T3.15A/250V	
Pollution degree	2	
Measurement Category	1	
Rear panel USB class	USB 2.0 full speed (CDC-ACM)	
Weight	Approx. 17.1kg (Full modules)	Approx. 28.4kg (Full modules)

	PEL-2020B (100Wx2)	
RANGE	Low	High
CURRENT	0~2A	0~20A
VOLTAGE	0~80V	
MIN.OPERATING VOLTAGE(dc)Typ.)	0.4V at 2A 0.2V at 1A	0.8V at 20A 0.4V at 10A

STATIC MODE		
CONSTANT CURRENT MODE		
Operating Range	0~2A	0~20A
Setting Range	0~2.04A	0~20.4A
Resolution	0.1mA	1mA
Accuracy	±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S).
CONSTANT RESISTANCE MODE		
Operating Range	0.075Ω~300Ω(100W/16V) 3.75Ω~15kΩ(100W/80V)	
Setting Range	0.075Ω~300Ω(100W/16V) 3.75Ω~15kΩ(100W/80V)	
Resolution*2	0.333ms(100W/16V) 6.667μs(100W/80V)	
Accuracy*3	300Ω: ±(0.2%set + 0.1S) 15kΩ: ±(0.1%set + 0.01S)	
CONSTANT VOLTAGE + CONSTANT CURRENT MODE		
Operating Range	1~16V	1~80V
Setting Range	0~16.32V	0~81.6V
Resolution	0.4mV	2mV
Accuracy	±(0.05%set + 0.1%F.S.)	
Current Setting Range	0~2.04A	0~20.4A
Resolution	0.1mA	1mA
Accuracy	±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S.*1)
CONSTANT POWER + CONSTANT CURRENT MODE		
Operating Range	1~10W	1~100W
Setting Range	0~10.2W	0~102W
Resolution	1mW	10mW
Accuracy	±(0.5%set + 0.5%F.S.*1)	±(0.5%set + 0.5%F.S.)
Current Setting Range	0~2.04A	0~20.4A
Resolution	0.1mA	1mA
Accuracy	±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S.*1)

NOTE : *1 F.S. = Full scale of H Range
*2 S (Siemens) is the unit of conductance, equal to one reciprocal ohm.
*3 Accuracy must be calculated in conductivity units.

DYNAMIC MODE		
T1&T2	0.025ms ~ 10ms / Res: 1μs 10ms ~ 30s / Res: 1ms	
Accuracy	1us / 1ms ± 100ppm	
CONSTANT CURRENT MODE		
Slew Rate	0.32 ~ 80mA/μs	3.2 ~ 800mA/μs
Slew Rate Resolution	0.32mA/μs	3.2mA/μs
Slew Rate Setting Accuracy	±(10% + 15μs)	
Current Setting Range	0~2.04A	0~20.4A
Current Resolution	0.1mA	1mA
Current Accuracy	±0.4% F.S.	
CONSTANT RESISTANCE MODE		
Slew Rate	3.2 ~ 800mA/μs	
Slew Rate Resolution	3.2mA/μs	
Slew Rate Setting Accuracy	±(10% + 50μs)	
Resistance Setting Range	0.075Ω~300Ω(100W/16V) 3.75Ω~15kΩ(100W/80V)	
Resistance Resolution	0.333ms(100W/16V) 6.667μs(100W/80V)	
Resistance Accuracy	300Ω: ±(0.5%set + 0.1S) 15kΩ: ±(0.5%set + 0.01S)	

MEASUREMENT		
VOLTAGE READBACK		
Range	0~16V	0~80V
Resolution	0.32mV	1.6mV
Accuracy	±(0.025% read + 0.025% F.S.)	
CURRENT READBACK		
Range	0~2A	0~20A
Resolution	0.04mA	0.4mA
Accuracy	±(0.05% read + 0.05% F.S.*2)	
POWER READBACK		
Range	0~10W	0~100W
Accuracy	±(0.1% read + 0.1% F.S.*1)	

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

*2 F.S. = Full scale of H Range

PROTECTIVE		
Over Power Protection		
Range	1~102W	
Resolution	0.5W	
Accuracy	±(2% set + 0.25% F.S.)	
Over Current Protection		
Range	0.25~20.4A	
Resolution	0.05A	
Accuracy	±(2% set + 0.25% F.S.)	
Over Voltage Protection		
Range	1~81.6V	
Resolution	0.2V	
Accuracy	±(2% set + 0.25% F.S.)	
Over Temperature Protection	≒85°C	
Rated Power Protection(CPP)		
Value	110W	
Accuracy	±5%set	
GENERAL		
SHORT CIRCUIT		
Current(CC)	≒2.2/2A	≒22/20A
Voltage(CV)	≒0V	
Resistance(CR)	≒3.75Ω	≒0.075Ω
Input Resistance (Load OFF)	500kΩ(Typical)	
Temperature Coefficient	100ppm/°C	
Weight	Approx. 3.8kg	

	PEL-2030B (30W/250W)		
RANGE	High	Low	High
CURRENT	0~5A	0~4A	0~40A
VOLTAGE		0~80V	
MIN.OPERATING VOLTAGE(dc)	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
STATIC MODE			
CONSTANT CURRENT MODE			
Operating Range	0~5A	0~4A	0~40A
Setting Range	0~5.1A	0~4.08A	0~40.8A

Resolution	0.125mA	0.1mA	1mA
Accuracy	±(0.1%set + 0.1%F.S.)	±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S.)

CONSTANT RESISTANCE MODE

Operating Range	0.3Ω ~1.2kΩ (30W/16V) 15Ω ~60kΩ (30W/80V)	0.0375Ω ~150Ω(250W/16V) 1.875Ω ~7.5kΩ(250W/80V)
Setting Range	0.3Ω~1.2kΩ (30W/16V) 15Ω~60kΩ (30W/80V)	0.0375Ω ~150Ω(250W/16V) 1.875Ω ~7.5kΩ(250W/80V)
Resolution*2	83.333μs (30W/16V) 1.666μs (30W/80V)	0.666ms(250W/16V) 13.333μs(250W/80V)
Accuracy*3	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)

CONSTANT VOLTAGE + CONSTANT CURRENT MODE

Operating Range	1~16V	1~80V	1~16V	1~80V
Setting Range	0~16.32V	0~81.6V	0~16.32V	0~81.6V
Resolution	0.4mV	2mV	0.4mV	2mV
Accuracy	±(0.05%set + 0.1%F.S.)		±(0.05%set + 0.1%F.S.)	
Current Setting Range	0~5.1A		0~4.08A	0~40.8A
Resolution	0.125mA		0.1mA	1mA
Accuracy	±(0.1%set + 0.2%F.S.)		±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S.*1)

CONSTANT POWER + CONSTANT CURRENT MODE

Operating Range	1~30W	1~25W	1~250W
Setting Range	0~30.6W	0~25.5W	0~255W
Resolution	1mV	1mV	10mV
Accuracy	±(0.5%set + 0.5%F.S.)	±(0.5%set + 0.5%F.S.*1)	
Current Setting Range	0~5.1A	0~4.08A	0~40.8A
Resolution	0.125mA	0.1mA	1mA

Accuracy	±(0.1%set + 0.2%F.S.)	±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S.*1)

NOTE : *1 F.S. = Full scale of H Range
*2 S (Siemens) is the unit of conductance, equal to one reciprocal ohm.
*3 Accuracy must be calculated in conductivity units.

DYNAMIC MODE			
T1&T2	0.025ms ~ 10ms / Res: 1μs 10ms ~ 30s / Res: 1ms		
Accuracy	1us / 1ms + 100ppm		
CONSTANT CURRENT MODE			
Slew Rate	0.8 ~ 200mA/μs	0.64 ~160mA/μs	6.4 ~ 1600mA/μs
Slew Rate Resolution	0.8mA/μs	0.64mA/μs	6.4mA/μs
Slew Rate setting Accuracy	±(10% + 15μs)		
Current Setting Range	0~5.1A	0~4.08A	0~40.8A
Current Resolution	0.125mA	0.1mA	1mA
Current Accuracy	±0.4% F.S.		
CONSTANT RESISTANCE MODE			
Slew Rate	0.8 ~ 200mA/μs	6.4 ~ 1600mA/μs	
Slew Rate Resolution	0.8mA/μs	6.4mA/μs	
Slew Rate Setting Accuracy	±(10% + 50μs)		
Resistance Setting Range	0.3Ω~1.2kΩ (30W/16V) 15Ω~60kΩ (30W/80V)	0.0375Ω ~150Ω(250W/16V) 1.875Ω ~7.5kΩ(250W/80V)	
Resistance Resolution	83.333μs (30W/16V) 1.666μs (30W/80V)	0.666ms(250W/16V) 13.333μs(250W/80V)	
Resistance Accuracy	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)	

MEASUREMENT

VOLTAGE READBACK				
Range	0~16V	0~80V	0~16V	0~80V
Resolution	0.32mV	1.6mV	0.32mV	1.6mV
Accuracy	±(0.025% read + 0.025% F.S.)			
CURRENT READBACK				
Range	0~5A		0~4A	0~40A
Resolution	0.1mA		0.08mA	0.8mA
Accuracy	±(0.05% read + 0.05% F.S.*2)			
POWER READBACK				
Range	0~30W		0~25W	0~250W
Accuracy	±(0.1% read + 0.1% F.S.*1)		±(0.1% read + 0.1% F.S.*1)	

NOTE : *1 Power F.S. = Vrange F.S. x Irange F.S.
*2 F.S. = Full scale of H Range

PROTECTIVE

Over Power Protection		
Range	0.9~30.6W	1.25~255W
Resolution	0.15W	1.25W
Accuracy	±(2%set + 0.25%F.S.)	
Over Current Protection		
Range	0.0625~5.1A	0.5~40.8A
Resolution	0.0125A	0.1A
Accuracy	±(2%set + 0.25%F.S.)	
Over Voltage Protection		
Range	1~81.6V	
Resolution	0.2V	
Accuracy	±(2%set + 0.25%F.S.)	
Over Temperature Protection	≒85°C	
Rated Power Protection(CPP)		
Value	33W	275W
Accuracy	±5%set	

GENERAL

SHORT CIRCUIT				
Current(CC)	≒5.5/5A		≒4.4/4A	≒44/40A
Voltage(CV)	≒0V			
Resistance(CR)	≒15Ω	≒0.3Ω	≒1.875Ω	≒0.0375Ω
Input Resistance (Load OFF)	500kΩ(Typical)			

Temperature Coefficient	100ppm/°C
Weight	Approx. 3.8kg

	PEL-2040B		PEL-2041B	
RANGE	Low	High	Low	High
CURRENT	0~7A	0~70A	0~1A	0~10A
VOLTAGE	0~80V		0~500V	
MIN.OPERATING VOLTAGE(dc)Typ.)	0.4V at 7A 0.2V at 3.5A	0.8V at 70A 0.4V at 35A	1V at 1A 0.5V at 0.5A	2V at 10A 1V at 5A

STATIC MODE				
CONSTANT CURRENT MODE				
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.*1)	±(0.1%set + 0.2%F.S.)	±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S.)
CONSTANT RESISTANCE MODE				
Operating Range	0.025Ω~100Ω(350W/16V) 1.25Ω~5kΩ(350W/80V)		1.25Ω~5kΩ(350W/125V) 50Ω~200kΩ(350W/500V)	
Setting Range	0.025Ω~100Ω(350W/16V) 1.25Ω~5kΩ(350W/80V)		1.25Ω~5kΩ(350W/125V) 50Ω~200kΩ(350W/500V)	
Resolution*2	1mS(350W/16V) 20µS(350W/80V)		20µS(350W/125V) 0.5µS(350W/500V)	
Accuracy*3	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	1~16V	1~80V	2.5~125V	2.5~500V
Setting Range	0~16.32V	0~81.6V	0~127.5V	0~510V
Resolution	0.4mV	2mV	2.5mV	10mV
Accuracy	±(0.05%set + 0.1%F.S.)		±(0.05%set + 0.1%F.S.)	
Current 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.*1)	±(0.1%set + 0.2%F.S.*1)	±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S.*1)
CONSTANT POWER + CONSTANT CURRENT MODE				
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.*1)	±(0.5%set + 0.5%F.S.)	±(0.5%set + 0.2%F.S.*1)	±(0.5%set + 0.5%F.S.)
Current 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.*1)	±(0.1%set + 0.2%F.S.*1)	±(0.1%set + 0.1%F.S.*1)	±(0.1%set + 0.2%F.S.*1)

NOTE : *1 F.S. = Full scale of H Range
*2 S (Siemens) is the unit of conductance, equal to one reciprocal ohm.
*3 Accuracy must be calculated in conductivity units.

DYNAMIC MODE

T1&T2	0.025ms~10ms/Res: 1µs 10ms ~ 30s / Res: 1ms			
Accuracy	1us / 1ms ± 100ppm			

CONSTANT CURRENT MODE

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 Setting Accuracy	±(10% + 15us)			
Current Setting Range	0~7.14A	0~71.4A	0~1.02A	0~10.2A
Current Resolution	0.2mA	2mA	0.05mA	0.5mA
Current Accuracy	±0.4% F.S.		±0.4% F.S.	

CONSTANT RESISTANCE MODE

Slew Rate	0.01 ~ 2.8A/µs	1.6 ~ 400mA/µs
Slew Rate Resolution	0.01A/µs	1.6mA/µs
Slew Rate Setting Accuracy	±(10% + 50µs)	
Resistance Setting Range	0.025Ω~100Ω(350W/16V) 1.25Ω~5kΩ(350W/80V)	1.25Ω~5kΩ(350W/125V) 50Ω~200kΩ(350W/500V)
Resistance Resolution	1ms(350W/16V) 20µSs(350W/80V)	20µs(350W/125V) 0.5µs(350W/500V)
Resistance Accuracy	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	0~125V	0~500V
Resolution	0.32mV	1.6mV	2.5mV	10mV
Accuracy	±(0.025% read + 0.025% F.S.)			
CURRENT READBACK				
Range	0~7A	0~70A	0~1A	0~10A
Resolution	0.14mA	1.4mA	0.02mA	0.2mA
Accuracy	±(0.05% read + 0.05% F.S.*2)			
POWER READBACK				
Range	0~35W	0~350W	0~35W	0~350W
Accuracy	±(0.1% read + 0.1% F.S.*1)			

NOTE : *1 Power F.S. = Vrange F.S. x Irange F.S.
*2 F.S. = Full scale of H Range

PROTECTIVE		
Over Power Protection		
Range	1.75~357W	
Resolution	1.75W	
Accuracy	±(2%set + 0.25%F.S.)	
Over Current Protection		
Range	0.875~71.4A	0.125~10.2A
Resolution	0.175A	0.025A
Accuracy	±(2%set + 0.25%F.S.)	
Over Voltage Protection		
Range	1~81.6V	2.5~510V
Resolution	0.2V	1.25V
Accuracy	±(2%set + 0.25%F.S.)	
Over Temperature Protection	≒85°C	
Rated Power Protection(CPP)		
Value	385W	
Accuracy	±5%set	

GENERAL				
SHORT CIRCUIT				
Current(CC)	≒7.7/7A	≒77/70A	≒1.1/1A	≒11/10A
Voltage(CV)	≒0V			
Resistance(CR)	≒1.25Ω	≒0.025Ω	≒50Ω	≒1.25Ω

Input Resistance (Load OFF)	500kΩ(Typical)
Temperature Coefficient	100ppm/°C
Weight	Approx. 3.8kg

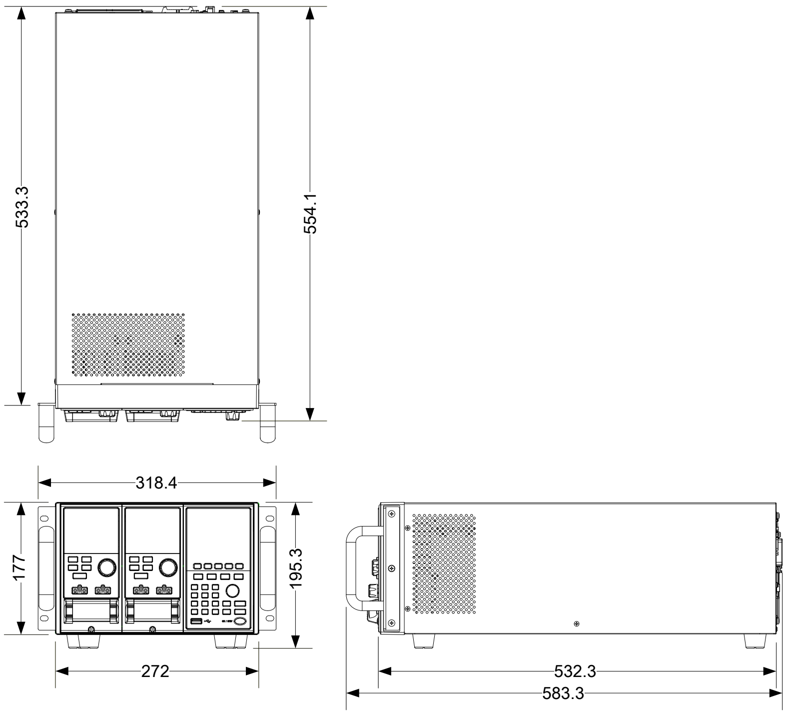
⚠Note

If your Master is PEL-2004A/ PEL-2002A, the mainframe firmware version must be V3.01.UPG or above.

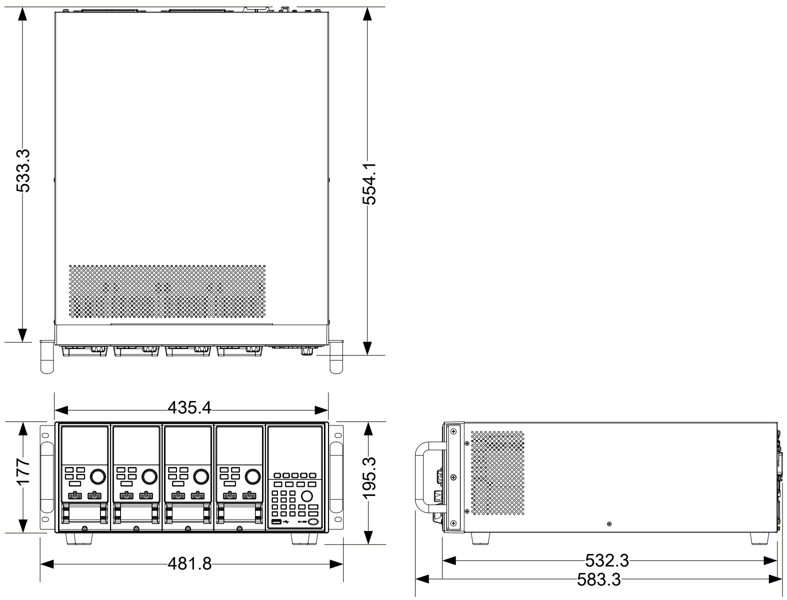
The firmware file and upgrade procedure can be downloaded on the GWInstek website.

Dimensions

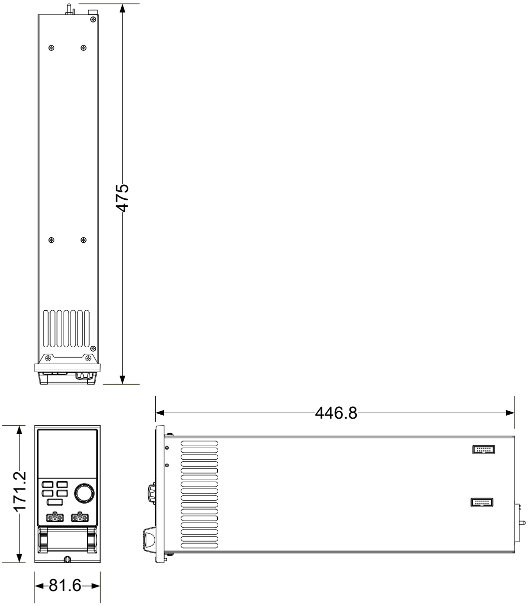
PEL-2002B



PEL-2004B



PEL-2020B/PEL-2030B/PEL-2040B/PEL-2041B



Certificate Of Compliance

We

GOOD WILL INSTRUMENT CO., LTD.

declare that the CE marking mentioned product

satisfies all the technical relations application to the product within the scope of council:

Directive: EMC; LVD; WEEE; RoHS

The product is in conformity with the following standards or other normative documents:

◎ **EMC**	
EN 61326-1	Electrical equipment for measurement, control and laboratory use –– EMC requirements
Conducted & Radiated Emission EN 55011 / EN 55032	Electrical Fast Transients EN 61000-4-4
Current Harmonics EN 61000-3-2 / EN 61000-3-12	Surge Immunity EN 61000-4-5
Voltage Fluctuations EN 61000-3-3 / EN 61000-3-11	Conducted Susceptibility EN 61000-4-6
Electrostatic Discharge EN 61000-4-2	Power Frequency Magnetic Field EN 61000-4-8
Radiated Immunity EN 61000-4-3	Voltage Dip/ Interruption EN 61000-4-11 / EN 61000-4-34
◎ Safety	
EN 61010-1 :	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

INDEX

Programmable DC Electronic Load

PEL-2000B Series

PROGRAMMING MANUAL

GW INSTEK PART NO. Version 1.0

ISO-9001 CERTIFIED MANUFACTURER

The information in this manual was correct at the time of printing. However, Good Will continues to improve products and reserves the right to change specifications, equipment, and maintenance procedures at any time without notice.

Good Will Instrument Co., Ltd.
No. 7-1, Jhongsing Rd., Tucheng City, Taipei County 236, Taiwan.

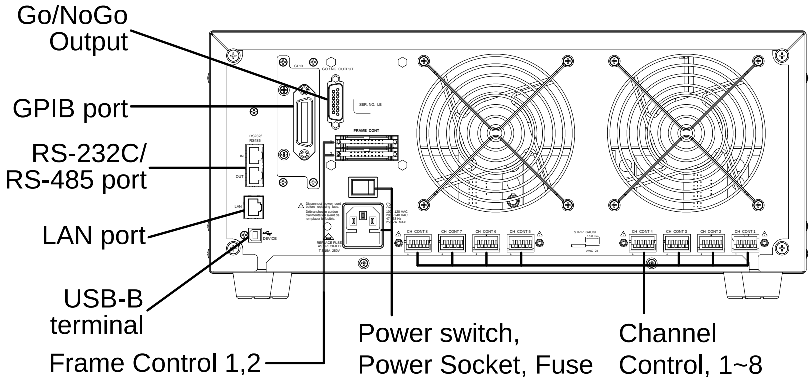
Table of Contents

INTERFACE OVERVIEW

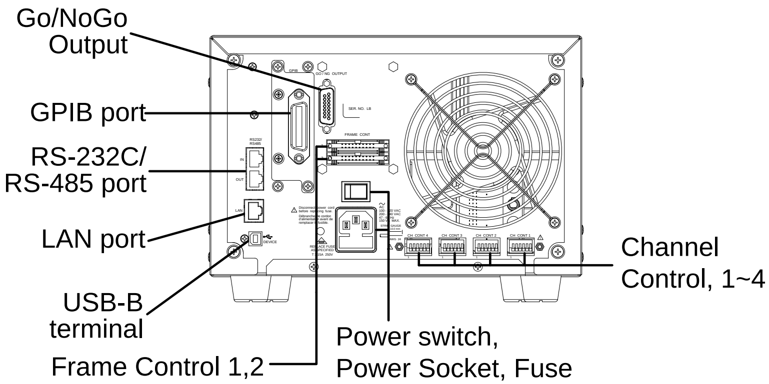
This manual describes how to use the PEL-2000B's remote command functionality and lists the command details. The Overview chapter describes how to configure the PEL-2000B USB/RS232 or RS485/LAN/GPIB remote control interface.

Rear Panel Overview

PEL-2004B



PEL-2002B

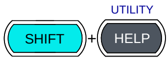


Configuring the USB Interface

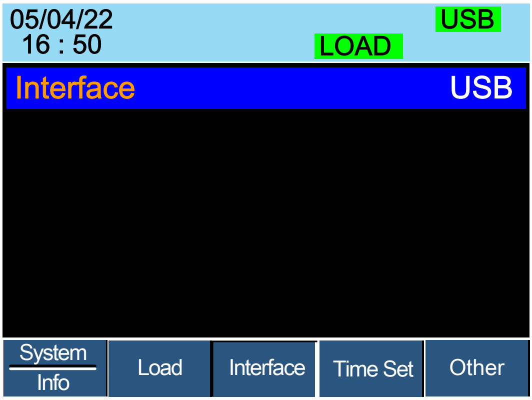
USB connection	PC side connector	Type A, host
	PEL-2000B side connector	Type B, device
	Speed	1.1/2.0 (full speed)

Panel operation

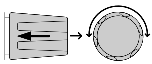
1. Press the Shift Key then the Help key to access the Utility menu.



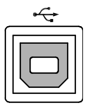
2. Press F3 (Interface Menu).



3. If the interface is not USB, use the selector knob to choose USB.



4. Connect the USB cable to the USB-B slave port on the rear.



5. When the PC asks for the USB driver, select gw_pel2k.inf

6. On the PC, activate a terminal application such as MTTTY (Multi-Threaded TTY). To check the COM port No., see the Device Manager in the PC. For Windows XP, select Control panel → System → Hardware tab.

7. Run this query command via the terminal application.
   *idn?
   This command should return the manufacturer, model number, serial number, and firmware version in the following format.
   GW, PEL-2002B/2004B, 00000001, V3.01

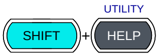
8. Configuring the command interface is completed. Refer to the other chapters for more details.

RS232 or RS485 Interface Configuration

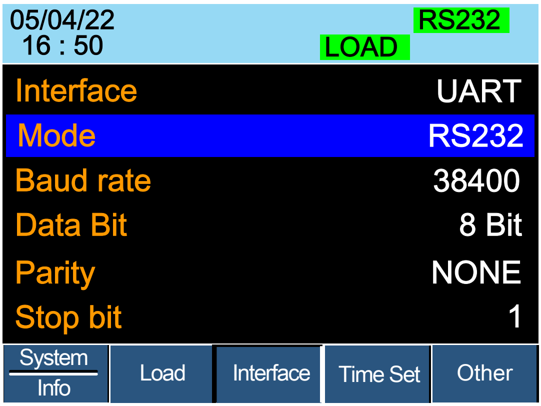
RS232 or RS485 configuration	Connector	RJ45
	Baud rate	2400/4800/9600/19200/38400/57600 /115200
	Data bits	7bits/8bits
	Stop bit	1bit/2bits
	Parity	None, Odd, Even
	Address	0 ~ 30 [This is available when Mode is RS485]

Panel operation

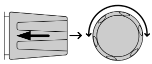
1. Press the Shift Key then the Help key to access the Utility menu.



2. Press the Shift Key then the Help key to access the Utility menu.



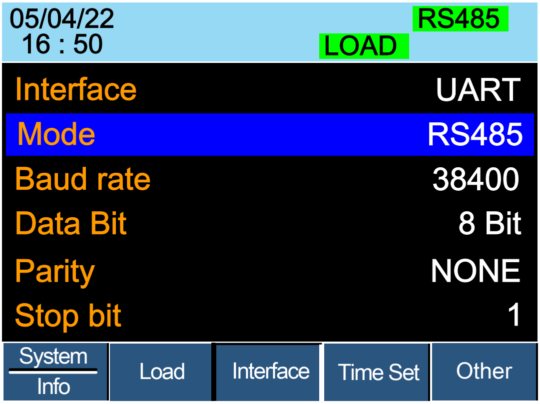
3. If the interface is not set to RS232, use the selector knob to change the interface to RS232.



4. Edit the Baud rate, Stop bit and parity.

Baud rate	2400, 4800, 9600, 19200, 38400, 57600,115200
Stop Bit	1,2
Parity	None, Odd, Even

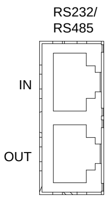
5. Use the selector knob to change the interface to RS485



6. Edit the Baud rate, Stop bit and parity.

Baud rate	2400, 4800, 9600, 19200, 38400, 57600,115200
Stop Bit	1,2
Parity	None, Odd, Even
Data Bits	7bits, 8bits
UART Address	0 ~ 30

7. Connect the RS-232C to RJ45 cable to the rear panel port: RJ45 female connector.



Terminal application

Invoke a terminal application such as MTTTY (Multi-Threaded TTY).

- For RS-232C, set the COM port, baud rate, stop bit, data bit, and parity accordingly.

To check the COM port No. for RS-232C, see the Device Manager in the PC. For Win XP, Control panel → System → Hardware tab.

8. Ensure the terminal application has the following settings;

   Baud rate – as per PEL-2000B settings

   Com Port – as per PC settings (Device Manager)

   Parity – None

   Data bits – 8

   Stop bits – None

Functionality check

Run this query command via the terminal.

*idn?

This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format.

GW, PEL-2002B/2004B, 00000001, V3.01

Set the UART settings

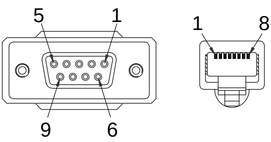
Overview

The PEL-2000B series uses the IN & OUT ports for UART communication coupled with RS232 (GW Instek Part number: GTL-259) or RS485 adapters (GW Instek part number: GTL-260).

The pin outs for the adapters are shown below.

RS232 cable with DB9 & RJ-45 shielded connectors from GTL-259 connection kit

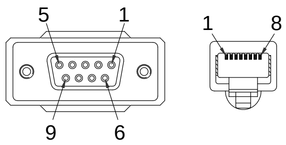
DB-9 Connector		Remote IN Port		Remarks
Pin No.	Name	Pin No.	Name	
Housing	Shield	Housing	Shield	
2	RX	7	TX	Twisted pair
3	TX	8	RX	
5	SG	1	SG	



Connection diagram

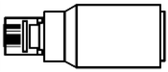
RS485 cable with DB9 & RJ-45 shielded connectors from GTL-260 connection kit

DB-9 Connector		Remote IN Port		Remarks
Pin No.	Name	Pin No.	Name	
Housing	Shield	Housing	Shield	
9	TXD -	6	RXD -	Twisted pair
8	TXD +	3	RXD +	
1	SG	1	SG	
5	RXD -	5	TXD -	Twisted pair
4	RXD +	4	TXD +	



Connection diagram

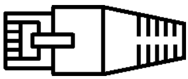
Diagram of Intermediate connector



Intermediate connector from GTL-259 or GTL-260 connection kit.

Intermediate connector					
8 Pin (Male)			8 Pin (Female)		
Pin No.	Name		Pin No.	Name	Remarks
Housing	Shield	↔	Case	Shield	
1	SG	↔	1	SG	
6	TXD -	↔	6	TXD -	Internal paralleled by 120 ohm
3	TXD +	↔	3	TXD +	
5	RXD -	↔	5	RXD -	Internal paralleled by 120 ohm
4	RXD +	↔	4	RXD +	

Diagram of End terminal connector

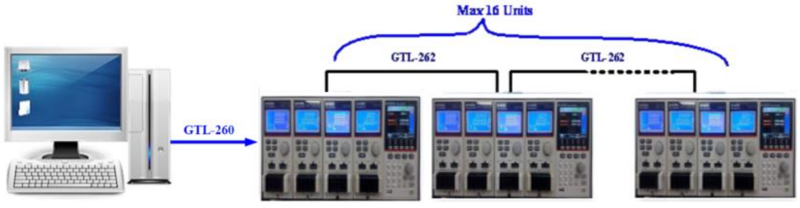


End terminal connector from GTL-259 or GTL-260 connection kit.

End terminal connector	
8 Pin Connector	
Pin No.	Remarks
3	Internal shorted
7	
4	Internal shorted
8	

Multiple Unit Connection

The PEL-2000B can have up to 16 units daisy-chained together using the 8 pin connectors (IN OUT ports) on the rear panel. The first unit in the chain is remotely connected to a PC using RS485. Each subsequent unit is daisy-chained to the next using a RS485 local bus. The OUT port of the first unit must be connected to intermediate connector and the OUT port of the last unit must be connected to end terminal connector.



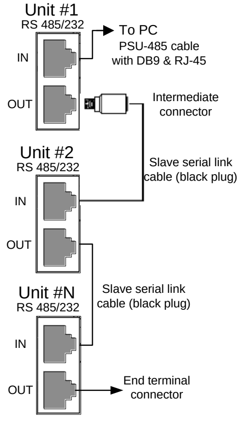
Each unit is assigned a unique address and can then be individually controlled from the host PC.

Operation

1. Connect the first unit's IN port to a PC using RS485 serial cable. Use the serial cables supplied in the GTL-260 connection kit.

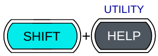
2. Plug in intermediate connector to the OUT port on the first unit then using the slave serial link cable (black plug) to connect intermediate connector to the IN port of the second unit.

   Terminate the OUT port of the last unit with the end terminal connector included in the GTL-260 connection kit.



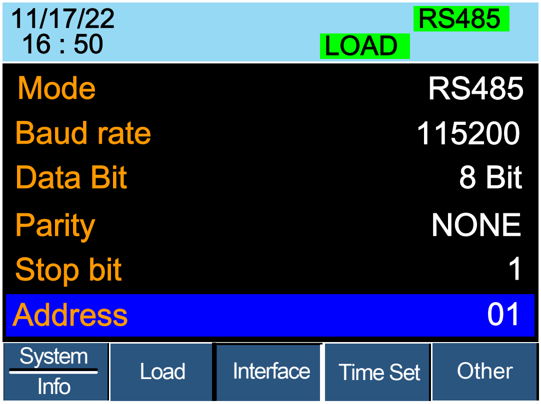
3. Power up all units.

4. Press the Shift Key then the Help key to access the Utility menu.



5. Press F3 and set the *Interface* setting to UART> *Mode* and set the Mode to *RS485*.

6. Set the addresses and mode of all units using UART menu. It must be a unique address identifier and mode select is RS485.

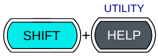


7. Multiple units can be operated using SCPI commands now. See the programming manual or see the function check below for usage details.

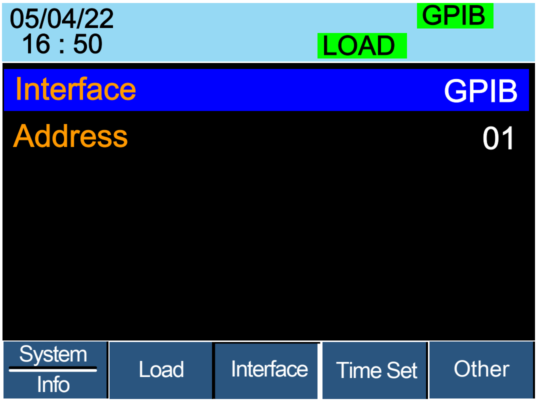
GPIB Interface Configuration

Panel operation

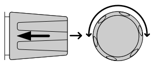
1. Press the Shift Key then the Help key to access the Utility menu.



2. Press F3 (Interface Menu).



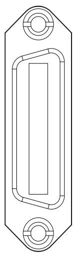
3. If the interface is not set to GPIB, use the selector knob to change the interface to GPIB.



4. Edit the GPIB address.

   Range 1 ~ 30

5. Connect the GPIB cable to the rear panel port: 24-pin female connector



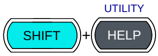
GPIB constraints

- Maximum 15 devices altogether, 20m cable length, 2m between each device
- Unique address assigned to each device
- At least 2/3 of the devices turned On
- No loop or parallel connection

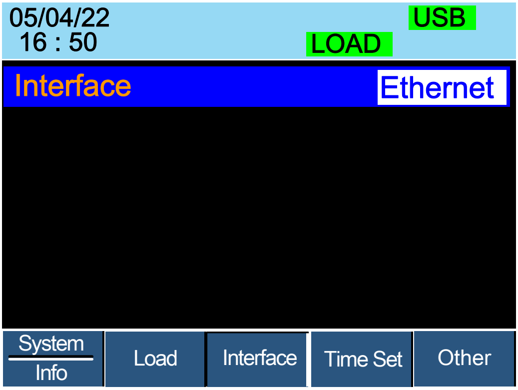
LAN Interface Configuration

Panel operation

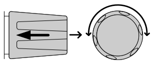
1. Press the Shift Key then the Help key to access the Utility menu.



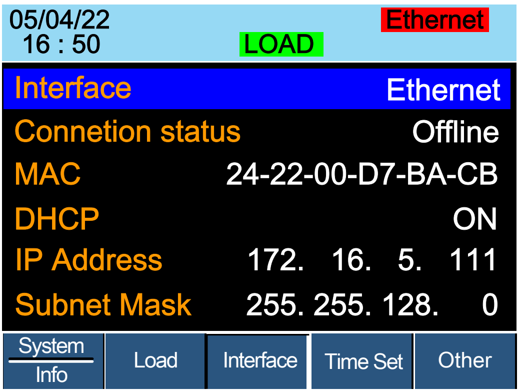
2. Press F3 (Interface Menu).



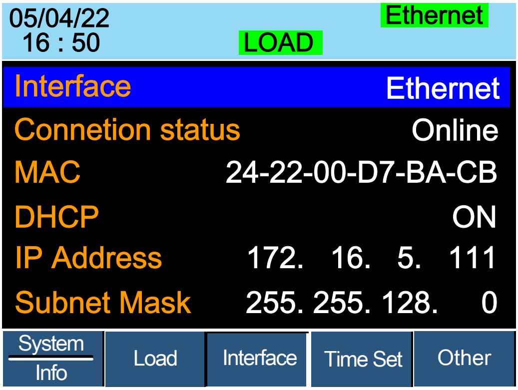
3. If the interface is not set to Ethernet, use the selector knob to change the interface to Ethernet.



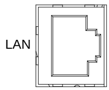
4. Choose Ethernet. Confirm that connection status turn form Offline to Online



5. Check if indicator "Ethernet" turns in green and connection status becomes online status.



6. Connect the LAN RJ45 connector to the RJ45 female socket on the rear panel.



COMMAND OVERVIEW

The Command overview chapter lists all the PEL-2000B commands and command queries .The command syntax section shows you the basic rules you have to apply when using commands.

Command Syntax

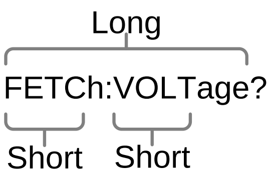
Compatible standard	• IEEE488.2, 1992 (fully compatible) • SCPI, 1994 (partially compatible)
Command types	There are a number of different instrument commands and queries. A command sends instructions or data to the electronic load and a query receives data or status information from the electronic load.

Command Types

Simple	A single command with/without a parameter
Example	*OPC
Compound	Two or more commands separated by a colon (:) with/without a parameter
Example	UTILITY:SOUND 1
Query	A query is a simple or compound command followed by a question mark (?). A parameter (data) is returned.
Example	UTILITY:SOUND?

Command forms

Commands and queries have two different forms, long and short. The command syntax is written with the short form of the command in capitals and the remainder (long form) in lower case.



The commands can be written in capitals or lower-case, just so long as the short or long forms

	are complete. An incomplete command will not be recognized.		
	Below are examples of correctly written commands.		
	LONG	FETCh:VOLTage? fetch:voltage?	FETCH:VOTAGE?
	SHORT	FETC:VOLT?	fetc:volt?
Square Brackets	Commands that contain squares brackets indicate that the contents are optional. The function of the command is the same with or without the square bracketed items, as shown below.		
	Example: :LOAD[:STATe] = =	 :LOAD:STATe :LOAD	
Command format	$\underbrace{\text{:PROGram:CHAin}}_{1}\underbrace{\ }_{2}\underbrace{\text{<NR1>}}_{3}\underbrace{\text{LF}}_{4}$	1: command header 2: single space 3: parameter 4: message terminator	

Parameter	Type	Description	Example
	<Boolean>	Boolean logic	0, 1
	<NR1>	integers	0, 1, 2, 3
	<NR2>	decimal numbers	0.1, 3.14, 8.5
	<NR3>	floating point	4.5e-1, 8.25e+1
	<NRf>	any of NR1, 2, 3	1, 1.5, 4.5e-1
	<NRf+>	NRf type including MIN (minimum) and MAX (maximum) limits of the parameter.	1, 1.5, 4.5e-1 MAX, MIN

	<aard>	Arbitrary ascii characters.
	<block data>	IEEE-488.2 binary block data. The block data is comprised of five parts: #216<16_bytes_data><NL> a b c d e a. Initialization character (#) b. Digit length (in ASCII) of the number of bytes c. Number of bytes d. Binary data e. New line character
Message terminator	LF∧END	line feed code (hexadecimal 0A) with END message
	LF	line feed code
	<dab>∧END	last data byte with END message

⚠ Note — In case of setting the parameter which is less than setting resolution, the setting value will round down to a smaller value which closed to the setting value.

⚠ Note — The receiving buffer size of this unit is 40k Bytes. Do not send the IEEE-488.2 binary block data to this unit at once data transformation. It may cause an unexpected error.

List of Commands in Functional Order

COMMAND DETAILS

The Command details chapter shows the detailed syntax, equivalent panel operation, and example for each command. For the list of all commands, see page22 for details. Before programming the PEL-2000B electronic load, please become familiar with the Status registers, detailed on page 186.

Common commands

*CLS

Status Command

Description	Clears: Channel Status Register Channel Summary Register Questionable Status Register Standard Events Register Operation Status Register Error Queue When the *CLS command follows a program message terminator <nl>, the following is cleared: Output Queue See page 186 for details.
Syntax	*CLS
Example	*CLS

*ESE

Status Command

Description	The Standard Event Status Enable command determines which events in the Standard Event Status Event register can set the Event Summary Bit (ESB) of the Status Byte register. Any bit positions set to 1 enable the corresponding event. Any enabled events set bit 5 (ESB) of the Status Byte register. See page 194 for details.			
Syntax	*ESE <NRf>			
Parameter	<NRf>	Bit(s) Set	<NRf>	Bit(s) Set
	1	OPC	32	CME
	8	DDE	64	~
	16	EXE	128	~
Example	*ESE 40		Sets CME and DDE events in the Standard Event Status Event Register.	
Query Syntax	*ESE?			
Return Parameter	<NR1>	Bit(s) Set	<NR1>	Bit(s) Set
	1	OPC	32	CME
QYE	8	DDE	64	~
	16	EXE	128	~
Example	*ESE? 32		Returns the settings in the Standard Event Status Enable Register. Here CME is enabled.	

*ESR?

Status Command

Description	Reads the Standard Event Status Register. This command also clears the Standard Event Status Register. Page 193 for details.

Query Syntax	*ESR?			
Return Parameter	<NR1>	Bit(s) Set	<NR1>	Bit(s) Set
	1	OPC	32	CME
	8	DDE	64	~
	16	EXE	128	~
Example	*ESR? 48		The return value is the status reading of the standard Event Status Register.	

*IDN?

System Command

Description	Returns the load generator identification.			
Query Syntax	*IDN?			
Return Parameter	<aard>	Data	<aard>	Data
	GW	Manufacturer	00000001	Serial No.
	PEL-2004A	Model	V3.01	Firmware Version
Example	*IDN? GW, PEL-2002B/2004B, 00000001, V3.01		Returns the mainframe identification string.	

*OPC

Status Command

Description	This command sets the OPC (Operation Command Bit) bit (bit 0) of the Standard Event Status Register after the mainframe has completed all pending operations. See page 193 for details.			
Syntax	*OPC			
Example	*OPC		Sets the OPC bit.	
Query Syntax	*OPC?			
Return Parameter	<NR1>	Operation	<NR1>	Operation

	0	Pending	1	Complete
Query Example	*OPC? 1		All pending operations are completed.	

*RCL

Status Command

Description	The Recall Instrument State command restores the instrument settings from a previously saved memory setting.	
Syntax	*RCL <NR1>	
Parameter	<NR1>	Recall Memory Setting
	1~120	1~120
Example	*RCL 1	Recalls Setting memory 1

*RDT?

System Command

Description	Returns the load module type in each channel in order from 1~8. If no frame is present a 0 is returned.	
Query Syntax	*RDT?	
Return Parameter	<aard>	Occupied Channel
	2020L	PEL-2020B left channel
	0	Empty channel
Query Example	*RDT? 0,0,2020L,2020R,0,0,0,0	Channels 1-2 and 5-8 are empty; 3-4 is occupied by the PEL-2020B load module.

*RST

Status Command

Description	Resets the mainframe by forcing the ABORt, *CLS, and LOAD:PROT:CLE command.
Syntax	*RST

Example	*RST

*SAV

All Channels

Description	Saves the data memory into the specified save slot.	
Syntax	*SAV <NR1>	
Parameter	<NR1>	Save slot
	1~120	1~120
Example	*SAV 2	Saves data memory to save slot 2

*SRE

Status Command

Description	The Service Request Enable Command determines which events in the Status Byte Register are allowed to set the MSS (Master summary bit) Any bit that is set to "1" will cause the MSS bit to be set. See page 195 for details.			
Syntax	*SRE <NR1>			
Parameter	<NR1>	Bit(s) Set	<NR1>	Bit(s) Set
	4	CSUM	32	ESB
	8	QUES		
Example	*SRE 12		Sets bits CSUM and QUES in the Service Request Enable register.	
Query Syntax	*SRE?			
Return Parameter	<NR1>	Bit(s) Set	<NR1>	Bit(s) Set
	4	CSUM	32	ESB
	8	QUES		

Example	*SRE? 32	Returns settings of the Service Request Enable Register. Here ESB is returned.

*STB?

Status Command

Description	Reads the Status Query Byte Register. The *STB? command does not clear the register. If the Master Summary Status bit (MSS) is set, it indicates that there is a reason for a service request.
Query Syntax	*STB

Return Parameter

<NR1>	Bit(s) Set	<NRf>	Bit(s) Set
2	ERR	32	ESB
4	CSUM	64	MSS
8	QUES		

Query Example	*STB? 36	Returns status of a byte query in the Status Byte Register. Here CSUM and ESB are returned.

*TST?

Status Command

Description	Performs a system self-test and returns 0 if all tests passed. 1 is returned if a test failed.
Query Syntax	*TST?

Return Parameter

<NR1>	Test result	<NR1>	Test result
0	Pass	1	Fail

Example	*TST? >0

Abort Subsystem

:ABORt

All
Channel Command

Description	Turns all electronic loads to OFF.
Syntax	:ABORt
Example	:ABORt

Channel Subsystem

:CHANnel[:LOAD]

Channel Specific Command

Description	Selects the channel that the channel specific commands use. This command will not change the channel in the display screen.	
Syntax	:CHANnel[:LOAD] <NR1>	
Parameter	<NR1>	Channel selected
	1~8	CH1 ~ CH8
	MAX	CH8
	MIN	CH1
Example	:CHAN 1	Sets channel 1 as the specific channel.
	:CHAN:LOAD 1	Sets channel 1 as the specific channel.
Query Syntax	:CHANnel? [LIST]	
Return Parameter	<NR1>	Current specific channel
	1~8	CH1 ~ CH8
	LIST	Lists available channels
Query Example	:CHAN? LIST 1, 2	Channel 1 and 2 are available.

:CHANnel:ACTive

Channel Specific Command

Description	This command is for compatibility with other instruments only and has no action.	
Syntax	:CHANnel ACTive {ON|1|OFF|1}	
Parameter	ON/1	Enabled
	OFF/0	Disabled
Example	:CHAN:ACT ON	Enables the specific channel.

:CHANnel:SYNCon

Channel Specific Command

Description	Turns independent mode on or off for the channel.	
Syntax	:CHANnel:SYNCon {ON|1|OFF|0}	
Parameter	ON/1	ON
	OFF/0	OFF
Example	:CHAN:SYNC ON	Enables the current channel to receive synchronized commands (synchronized commands is :RUN and Abort).
Query Syntax	:CHANnel:SYNCon?	
Return Parameter	<NR1>	Sync Status
	0	Independent mode is OFF
	1	Independent mode is ON
Query Example	:CHAN:SYNC? 0	Independent mode is set to OFF for the channel.

:CHANnel:SYNCon:ALL

All Channels

Description	Turns independent mode on or off for all the channels.	
Syntax	:CHANnel:SYNCon:ALL{ON|1|OFF|0}	
Parameter	ON/1	ON for all channels
	OFF/0	OFF for all channels
Example	:CHAN:SYNC:ALL ON	Enables all channel to receive synchronized commands (synchronized commands is :RUN and Abort).

:CHANnel:ID?

Channel Specific Command

Description	Queries the load module identity.			
Query Syntax	:CHANnel:ID?			
Return Parameter	<aard>	Data	<aard>	Data
	GW	Manufacturer	00000001	Serial No.
	PEL2020R	Channel load id	V3.01	Firmware Version.
Query Example	:CHAN:ID? GW, PEL2020R, 00000001, V3.01		Returns the load module identification string.	

:CHANnel:DISPlay

Channel Specific Command

Description	Sets or queries which channel is active on the mainframe display.	
Syntax	:CHANnel:DISPlay <NR1>	
Parameter	<NR1>	Channel displayed
	1~8	CH1 ~ CH8

	MAX	Last channel
	MIN	First channel
Example	:CHAN:DISP 1	Sets to the active channel on the display to ch1.
Query Syntax	:CHANnel:DISPlay? [MAX|MIN]	
Return Parameter	<NR1>	Channel displayed
	1~8	CH1 ~ CH8
	MAX/MIN	Returns the allowable maximum or minimum.
Query Example	:CHAN:DISP? 1	Channel 1 is currently active on the display.

:CHANnel:MEMO

Channel Specific Command

Description	Creates or returns the "memo" that is displayed in the "System Information" screen in the Utility Menu. This memo only applies to this specific channel. The memo will replace the serial number information in the "System Information" screen.	
Syntax	:CHANnel:MEMO <string>	
Parameter/ Return parameter	<string>	String containing memo.
Example	:CHAN:MEMO "this is a memo"	Sets to the memo to "this is a memo".
Query Syntax	:CHANnel:MEMO?	
Query Example	:CHAN:MEMO? this is a memo	Returns the memo message.

:MEMO?

Channel Specific
Query

Description	Creates or returns the “memo” that is displayed in the “System Information” screen in the Utility Menu. This memo applies to the mainframe. The memo will replace the serial number information in the “System Information” screen.	
Syntax	:MEMO <string>	
Parameter/ Return parameter	<string>	String containing memo.
Example	:MEMO “this is a memo”	Set the memo to “this is a memo”
Query Syntax	:MEMO?	
Query Example	:MEMO? this is a memo	Returns the memo message.

CONFIGURE Subsystem

:CONFigure:VOLTage:ON

Channel Specific Command

Description	Sets Von (voltage on value). The allowable Von values are channel and load module specific.	
Syntax	:CONFigure:VOLTage:ON <NRf>[MV|V|KV]	
Parameter	<NRf>[MV|V|KV]	Von
	3	3 volts

	30MV	30 millivolts
	30V	30 volts
Example	:CONF:VOLT:ON 30MV	Set Von to 30 millivolts.
Query Syntax	:CONFigure:VOLTage:ON?	
Return Parameter	<NR2> 1 unit = 1 volt	Von value (volts)
	1	1 volts
Query Example	:CONF:VOLT:ON? 0.03	Von is set as 30 millivolts (0.03 volts).

⚠ Note

The resolution is depended on the selected voltage range. For more details, please refer to PEL-2000B user manual.

For example, the 500V version will have another 125V voltage range.

Vrange	Resolution(V)
500	2
125	0.2
80	0.32
16	0.064

:CONFigure:VOLTage:RANGe

Channel Specific Command

Description	Sets Voltage range for CC mode.

⚠ Note

If the Von voltage set in the Voltage Range high exceeds the range of Low Range, it is automatically corrected to the maximum value of the Low Range when the Voltage Range is switched to low.

For commands on voltage range, please refer to the table below.

Voltage Range: High/Low commands

CV mode	High	: MODE CVH
	Low	: MODE CVL

CR mode	High Low	: MODE CRH : MODE CRL
CC mode	High Low	: CONF:VOLT:RANG H : CONF:VOLT:RANG L
CP mode	High Low	: CONF:VOLT:RANG H : CONF:VOLT:RANG L

Syntax	:CONFigure:VOLTage:RANGe <NRf>[V]|L|H	
Parameter	<NRf>[V] , L, H	Range
	16	Low range*
	80V	High range*
	L	Low range
	H	High range
	*Load module dependent, PEL-2020B shown.	
Example	:CONF:VOLT:RANG L	Sets the range to Low for the channel.
Query Syntax	:CONFigure:VOLTage:RANGe?	
Return Parameter	<NR2>	Range
	16	Low PEL-2020B, 2030B, 2040B
	125	Low PEL-2041B
	80	High PEL-2020B, 2030B, 2040B
	500	High PEL-2041B
Query Example	:CONF:VOLT:RANG? 500	Returns the voltage range. In this case high for the PEL-2041B.

:CONFigure:VOLTage:LATch

Channel Specific Command

Description	Turn Von Latch on or off for the specific channel.	
Syntax	:CONFigure:VOLTage:LATch{OFF|0|ON|1}	
Parameter	{OFF|0|ON|1}	Von Latch
	OFF/0	Off
	ON/1	On
Example	:CONF:VOLT:LAT 1	Sets Von latch to ON.
Query Syntax	:CONFigure:VOLTage:LATch?	
Return Parameter	<NR1>	Von latch status
	0	Latched Off
	1	Latched On
Query Example	:CONF:VOLT:LAT?	Von latch is set to ON.
	1	

:CONFigure:AUTO:LOAD

All channels

Description	Configures the load generator for Auto Load On or Off at start up.	
Syntax	:CONFigure:AUTO:LOAD {OFF|0|ON|1}	
Parameter	{OFF|0|ON|1}	Auto Load
	OFF/0	Off
	ON/1	On
Example	:CONF:AUTO:LOAD ON	Configures Auto Load to On
Query Syntax	:CONFigure:AUTO:LOAD?	
Return Parameter	<NR1>	Auto Load Status
	0	Off
	1	On

Query Example	:CONF:AUTO:LOAD? 1	Auto load is On.

:CONFigure:AUTO:MODE

All channels

Description	Configures the Auto Load mode as (run) Program or Load.	
Syntax	:CONFigure:AUTO:MODE PROGRAM/0, LOAD/1	
Parameter	PROGRAM/0, LOAD/1	Auto Load Mode
	PROGRAM/0	PROGRAM
	LOAD/1	LOAD
Example	:CONF:AUTO:MODE 1	Configures Auto Load to LOAD
Query Syntax	:CONFigure:AUTO:MODE?	
Return Parameter	<NR1>	Auto Load Type Status
	0	PROGRAM MODE
	1	LOAD MODE
Query Example	:CONF:AUTO:MODE? 1	Auto load mode is to LOAD mode.

:CONFigure:SOUNd

Channel Specific Command

Description	Sets the keyboard operating and knob rotating make a sound.	
Syntax	:CONFigure:SOUNd {OFF|0|ON|1}	
Parameter	OFF/0	Off
	ON/1	On
Example	:CONF:SOUND ON	Configures the sound on.
Query Syntax	:CONFigure:SOUNd?	
Return Parameter	<NR1>	SOUND Status

	0	Off
	1	On
Query Example	:CONF:SOUN? 0	Sound is off for all channel and mainframe.

:CONFigure:REMote — All Channels

Description	Turns remote control on or off for all interfaces.	
Syntax	:CONFigure:REMOTE {OFF|0|ON|1}	
Parameter	OFF/0	Off
	ON/1	On
Example	:CONF:REM 1	Turns Remote control on.

:CONFigure:ALARm:MASTer — All Channels

Description	Sets the alarm sound of mainframe.	
Syntax	:CONFigure:ALARm:MASTer{OFF|0|ON|1}	
Parameter	OFF/0	Off
	ON/1	On
Example	:CONF: ALAR:MAST ON	Configures the alarm sound on for mainframe.
Query Syntax	:CONFigure:ALARm:MASTer?	
Return Parameter	<NR1>	Alarm sound status of mainframe
	0	Off
	1	On
Query Example	:CONF: ALAR:MAST? 0	Alarm sound is off for the mainframe.

:CONFigure:ALARm:SLAVe — All Channels

Description	Sets the alarm sound of slave module.	
Syntax	:CONFigure:ALARm:SLAVe{OFF|0|ON|1}	
Parameter	OFF/0	Off
	ON/1	On
Example	:CONF: ALAR:SLAV ON	Configures the alarm sound on for all slave modules.
Query Syntax	:CONFigure:ALARm:SLAVe?	
Return Parameter	<NR1>	Alarm sound status of all slave modules
	0	Off
	1	On
Query Example	:CONF: ALAR:SLAV? 0	Alarm sound is off for all of the slave modules.

:CONFigure:SAVE — All Channels

Description	This command is for compatibility with other instruments only and has no action.	
Syntax	:CONFigure:SAVE	
Example	:CONF:SAVE	Saves the configuration data for all channels into internal memory.

:CONFigure:LOAD — System Command

Description	Configures the load module selector knob as OLD or Updated.
Syntax	:CONFigure:LOAD {OLD|0|UPDATED|1}

Example	:CONF:LOAD UPDATED	Sets the load module selector knob as Updated.
Parameter	OLD/0	Old
	UPDATED/1	Updated
Example	:CONF:LOAD OLD	Configuration type set as OLD.
Query Syntax	:CONFigure:LOAD?	
Return Parameter	<NR1>	Configuration type
	0	Old
	1	Updated
Query Example	:CONF:LOAD? 0	Sets the load module selector configuration type as OLD.

:CONFigure:PROTection:CURRent:STATe

Channel Specific Command

Description	Sets the current protection for the specific channel on or off. The current protection can also be cleared.	
Syntax	:CONFigure:PROTection:CURRent:STATe {OFF|0|ON|1|CLEAR|2}	
Parameter	CLEAR/2	Cleared
	OFF/0	Off
	ON/1	On
Example	:CONF:PROT:CURR:STAT 1	Turns on current protection.
Query Syntax	: CONFigure:PROTection:CURRent:STATe?	
Return Parameter	<NR1>	Current Protection
	0	Off
	1	On
	2	Clear
Query Example	:CONF:PROT:CURR:STAT? 1	Current protection is turned on.

:CONFigure:PROTection:CURRent:LEVel

Channel Specific Command

Description	Sets the current protection level for the current/specific channel.	
Syntax	:CONFigure:PROTection:CURRent:LEVel <NRf>[A]|MIN|MAX	
Parameter	<NRf>	Current Protection Level
	.3	300mA
	0.3A	300mA
	300MA	300mA
	MIN	Sets to the minimum level

	MAX	Sets the current limit to the maximum level
Example	:CONF:PROT:CURR:LEV MAX	Sets the current limit to 20.40A (PEL2020B)
Query Syntax	:CONFigure:PROTection:CURRent:LEVel? [MIN|MAX]	
Return Parameter	<NRf> 1 unit = 1 amp	Current protection level
	1	1 amp.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CONF:PROT:CURR:LEV? 0.30	Current protection level is at 300mA.
Note	The range of current protection level depends on the current using operating current range of slave module. The detail specifications of current protection range could be found “Over Current Protection” in the specification of user manual.	

:CONFigure:PROTection:VOLTage:STATe

Channel Specific Command

Description	Sets the voltage protection for the current/specific channel on or off. The voltage protection can also be cleared.	
Syntax	:CONFigure:PROTection:VOLTage:STATe {OFF|0|ON|1|CLEAR|2}	
Parameter	CLEAR/2	Clear
	OFF/0	Off
	ON/1	On
Example	:CONF:PROT:VOLT:STAT 1	Turns on voltage protection.
Query Syntax	:CONFigure:PROTection:VOLTage:STATe?	

Return Parameter	<NR1>	Voltage Protection state
	0	Off
	1	On
	2	Clear
Query Example	:CONF:PROT:VOLT:STAT? 0	Voltage protection is currently off.

:CONFigure:PROTection:VOLTage:LEVel

Channel Specific Command

Description	Sets the voltage protection level for the current/specific channel.	
Syntax	:CONFigure:PROTection:VOLTage:LEVel <NRf>[V]|MIN|MAX	
Parameter	<NRf>	Voltage Protection Level
	30	30 volts
	30V	30 volts
	MIN	Sets to the minimum level
	MAX	Sets the voltage limit to the maximum level
Example	:CONF:PROT:VOLT:LEV MAX	Sets the voltage limit to 81.6V (PEL2020B)
Query Syntax	:CONFigure:PROTection:VOLTage:LEVel? [MIN|MAX]	
Return Parameter	<NRf> 1 unit = 1 volt	Voltage protection level
	1.00	1.00 volts.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CONF:PROT:VOLT:LEV? 81.6000	Voltage protection level is at 81.6V.

Note	The range of voltage protection level depends on the current using operating voltage range of slave module. The detail specifications of voltage protection range could be found "Over Voltage Protection" in the specification of user manual.

:CONFigure:PROTection:POWer:STATe

Channel Specific Command

Description	Sets the power protection for the current/specific channel on or off. The power protection can also be cleared.	
Syntax	:CONFigure:PROTection:POWer:STATe {OFF|0|ON|1|CLEAR|2}	
Parameter	CLEAR/2	Cleared
	OFF/0	Off
	ON/1	On
Example	:CONF:PROT:POW:STAT 1	Turns on power protection.
Query Syntax	: CONFigure:PROTection:POWer:STATe?	
Return Parameter	<NR1>	Power Protection
	0	Off
	1	On
	2	Clear
Query Example	:CONF:PROT:POW:STAT? 1	Power protection is currently on.

:CONFigure:PROTection:POWer:LEVel

Channel Specific Command

Description	Sets the power protection level for the current/specific channel.
Syntax	:CONFigure:PROTection:POWer:LEVel <NRf>[W]|MIN|MAX

Parameter	<NRf>	Power Protection Level
	200	200Watts
	200W	200Watts
	MIN	Sets to the minimum level
	MAX	Sets the power limit to the maximum level
Example	:CONF:PROT:POW:LEV MAX	Sets the power limit to 102W (PEL2020B)
Query Syntax	:CONFigure:PROTection:POWEr:LEVel? [MIN|MAX]	
Return Parameter	<NRf>	Power protection level
	1 unit = 1 watt	Returns the power protection level in Watts.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CONF:PROT:POW:LEV? 75	Power protection level is at 75 watts.
Note	The range of power protection level depends on the current using operating power range of slave module. The detail specifications of power protection range could be found "Over Power Protection" in the specification of user manual.	

:CONFigure:PROTection:UVP:CLEar

All Channel Command

Description	Clears the under voltage protection status.	
Syntax	:CONFigure:PROTection:UVP:CLEar	
Example	:CONF:PROT:UVP:CLE	Clears the under voltage protection.

:CONFigure:PROTection:UVP:LEVel

Channel Specific Command

Description	Sets the under voltage protection level for the current/specific channel.	
Syntax	:CONFigure:PROTection:UVP:LEVel <NRf>[W]|MIN|MAX	
Parameter	<NRf>	UVP Level
	20	20 Volts
	20V	20 Volts
	MIN	Sets to the minimum level (OFF)
	MAX	Sets the voltage limit to the maximum level
Example	:CONF:PROT:UVP:LEV MIN	Sets the UVP limit to OFF
Query Syntax	:CONFigure:PROTection:UVP:LEVel? [MIN|MAX]	
Return Parameter	<NRf>	Power protection level
	1 unit = 1 volt	Returns the UVP level as volts.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CONF:PROT:UVP:LEV? 75	UVP level is at 75 volts.
Note	The range of under voltage protection level depends on the current using operating voltage range of slave module. And the MIN(0) will disable the under voltage protection. The detail specifications of voltage protection range could be found in the specification of user manual.	

:CONFigure:RESPonse

Channel Specific Command

Description	Sets or queries the response rate for the specific channel.

Syntax	:CONFigure:RESPonse {NORMAL|0|FAST|1}	
Parameter	NORMAL/0	Normal
	FAST/1	Fast
Example	:CONF:RESP 0	Response set to normal.
Query Syntax	: CONFigure:RESPonse?	
Return Parameter	<NR1>	Response
	0	Normal
	1	Fast
Query Example	:CONF:RESP? 1	Response is Fast.

:CONFigure:RESEt

Channel Specific Command

Description	Recalls the original factory default settings.
Syntax	:CONFigure:RESEt
Example	:CONF:RESE

:CONFigure:GROup:UNITs

Channel Specific Command

Description	Sets or queries the number load modules that can be used in the group mode.	
Syntax	CONFigure:GROup:UNITs<NRf>|MIN|MAX	
Parameter	<NRf>	Number of units
	MIN	Sets to the minimum number
	MAX	Sets to the maximum number
Example	CONF:GRO:UNIT 2	Sets the parallel mode to 2 units.
Query Syntax	CONFigure:GROup:UNITs? [MIN|MAX]	
Return Parameter	<NR1>	Returns the number of units
	MAX/MIN	Returns the allowable maximum and minimum.

Query Example	: CONF:GRO:UNIT? 2	2 units are set for the parallel mode.

Note	The PEL-2040B and PEL-2041B are fully support group mode(Para/Sync) The PEL-2030B does not support group function. The dual channel of PEL-2020B does support group function partially. It can support to group 2 units under the Sync mode only. That means the PEL-2020A can be 2chx100W or 1chx200W.

:CONFigure:GROup:MODE

Channel Specific Command

Description	Sets or queries the parallel mode.	
Syntax	:CONFigure:GROup:MODE {SYNC|0|PARALLEL|1}	
Parameter	SYNC, 0	Sync mode
	PARALLEL, 1	Parallel mode
Example	:CONF:GRO:MODE 0	Sets the parallel mode to SYNC.
Query Syntax	:CONFigure:GROup:MODE?	
Return Parameter	0	Sync mode
	1	Parallel mode
Query Example	:CONF:GRO:MODE? 0	The parallel mode is currently set to SYNC.

Note	The para setting allows the all the parallelized load modules to be operated as a single large load module. Sync mode allows the settings of a single unit to be synchronized across all the other parallelized load modules. The major difference is that the Para mode calculates the total amount of current on the screen of the Mainframe, and the Sync mode does not.

The PEL-2040B and PEL-2041B are fully support group mode (Para/Sync). The PEL-2030B does not support group function.

The dual channel of PEL-2020B does support group function partially. It can support to group 2 units under the Sync mode only. That means the PEL-2020A can be 2chx100W or 1chx200W.

Utility Subsystem

:UTILity:AUTO:LOAD

System Command

Description	Sets the mainframe to auto mode. Upon startup the mainframe will turn loads/programs on.	
Syntax	:UTILity:AUTO:LOAD {OFF|0|ON|1}	
Parameter	OFF/0	Turns auto loading off
	ON/1	Turns auto loading on
Example	:UTIL:AUTO:LOAD 1	Turns auto loading on
Query Syntax	:UTILity:AUTO:LOAD?	
Return Parameter	<NR1>	Auto load status
	0	Auto loading is off
	1	Auto loading is on

Query Example	:UTIL:AUTO:LOAD? 1	The main frame is currently configured to auto load.

:UTILity:AUTO:MODE

System Command

Description	Sets the mainframe auto mode as load or program. Upon startup the mainframe can automatically turn on loads or automatically run the last program.	
Syntax	:UTILity:AUTO:MODE {PROGRAM|0|LOAD|1}	
Parameter	PROGRAM/0	Sets the auto load mode to program
	LOAD/1	Sets the auto load mode to load.
Example	:UTIL:AUTO:MODE 1	Auto load mode is set to load.
Query Syntax	:UTILity:AUTO:MODE?	
Return Parameter	<NR1>	Auto load mode
	0	Program
	1	Load
Query Example	:UTIL:AUTO:MODE? 0	Auto load mode is set to Program.

:UTILity:SOUNd

System Command

Description	Sets the keyboard operating and knob rotating make a sound.	
Syntax	:UTILity:SOUNd {OFF|0|ON|1}	
Parameter	OFF/0	Off
	ON/1	On
Example	:UTIL:SOUNd ON	Configures the sound on.
Query Syntax	:UTILity:SOUNd?	
Return Parameter	<NR1>	SOUND Status

	0	Off
	1	On
Query Example	:UTIL:SOUN? 0	Sound is off for all channel and mainframe.

:UTILity:REMote

System Command

Description	Turns the remote control on or off.	
Syntax	:UTILity:REMote {OFF|0|ON|1}	
Parameter	OFF/0	Turns Remote control off
	ON/1	Turns remote control on
Example	:UTIL:REM 1	Turns remote control on.
Query Syntax	:UTILity:REMote?	
Return Parameter	<NR1>	Remote mode
	0	Off
	1	On
Query Example	:UTIL:REM? 1	Always under remote mode.

:UTILity:REMote:MODE

System Command

Description	Sets the remote mode to fast or normal. When in fast mode, the panel interface is deactivated with an interface time of no more than 10ms. Normal mode has an interface time of 30~130ms. In normal mode the panel interface continues to update the screen in real-time.	
Syntax	:UTILity:REMote:MODE {NORMAL|0|FAST|1}	
Parameter	NORMAL/0	NORMAL
	FAST/1	FAST
Example	:UTIL:REM:MODE 1	Turns remote mode to fast.

Query Syntax	:UTILity:REMote:MODE?	
Return Parameter	<NR1>	Remote mode
	NORMAL/0	NORMAL
	FAST/1	FAST
Query Example	:UTIL:REM:MODE? 1	Remote mode is under fast mode.

:UTILity:TIME

System Command

Description	Sets the date and time on the mainframe.		
Syntax	:UTILity:TIME [aard]		
Parameter	[aard]		
	“201511131300” $\text{“}\underbrace{2015}_{1}\underbrace{1113}_{2}\underbrace{1300}_{3}\text{”}$	1	Year
		2	Month/Day
		3	Time (24 hours)
Example	:UTIL:TIME “201501031343” Sets the time to 1:00 pm, January 3rd, 2015.		
Query Syntax	:UTIL:TIME?		
Return Parameter	[aard]		
	2015/11/13/13:00 $\underbrace{2015/}_{1}\underbrace{11/13/}_{2}\underbrace{13:00}_{3}$	1	Year
		2	Month/Day
		3	Time (24 hours)
Query Example	:UTIL:TIME? 2015/11/13/13:00	The date is November 13th, 2015. The time is 1:00 pm.	

:UTILity:LOAD

System Command

Description	Sets the knob control style. The load module control knobs can be set to operate independently (OLD style) to the mainframe or with the mainframe (UPDATED).	
Syntax	:UTILity:LOAD {OLD|0|Updated|1}	
Parameter	OLD/0	Old
	UPDATED/1	Updated
Example	:UTIL:LOAD 1	Set the knob style to update.
Query Syntax	:UTILity:LOAD?	
Return Parameter	<NR1>	Knob style
	0	Old
	1	Updated
Query Example	:UTIL:LOAD? 1	The knob style is set to Updated.

:UTILity:IDENtify

System Command

Description	The outer display screen of mainframe will be flashing for help identify which mainframe is under control. This command will have no function while the system is under remote fast mode. (:UTIL:REM:MODE 1)	
Syntax	:UTILity:IDENtify {OFF|0|ON|1}	
Parameter	OFF/0	Turns message off
	ON/1	Turns message on
Example	:UTIL:IDEN 1	Turns the message on.

:UTILity:FRAMe

System Command

Description	Turns Frame Link on or off.	
Syntax	:UTILity:FRAMe {OFF|0|ON|1}	
Parameter	{OFF|0|ON|1}	Frame Link
	OFF/0	off
	ON/1	on
Example	:UTIL:FRAM 1	Turns Frame Link on.
Query Syntax	:UTILity:FRAMe?	
Return Parameter	<NR1>	Frame Link
	0	Off
	1	On
Query Example	:UTIL:FRAM? 0	Frame Link is on.

:UTILity:HIGH:RESolution

System Command

Description	ON: When there is difference between the measured value of voltage, current or power which displayed on the module panel and the setting value, the system will fine tune the load value so that the measured value close to the setting value. The system will perform and complete this action after loading is on in one second. OFF: The system won't perform any action when there is difference between the measured value of voltage, current or power which displayed on the module panel and the setting value.	
Syntax	:UTILity:HIGH:RESolution{OFF|0|ON|1}	
Parameter	OFF/0	Set High Resolution to off
	ON/1	Set High Resolution to on

Example	:UTIL:HIGH:RES 0	Set High Resolution to off.
Query Syntax	:UTILity:HIGH:RESolution?	
Return Parameter	<NR1>	Remote mode
	0	Off
	1	On
Query Example	:UTIL:HIGH:RES? 0	High Resolution is set to off.

:UTILity:SYSTem:MODE

System Command

Description	1: When any command is received, the Master panel will automatically enter the Remote fast mode. 0: The Master panel won't automatically enter the Remote fast mode.	
Syntax	:UTILity:SYSTem:MODE {OFF|0|ON|1}	
Parameter	OFF/0	Set System Mode to 0
	ON/1	Set System Mode to 1
Example	:UTIL:SYST:MODE 0	Set System Mode to 0.
Query Syntax	:UTILity:SYSTem:MODE?	
Return Parameter	<NR1>	System mode
	0	Off
	1	On
Query Example	:UTIL:SYST:MODE? 0	System Mode is set to 0.

:UTILity:VOLTage:LATCh:CLEar

System Command

Description	Auto: Load starts when the terminal voltage of module is higher than Von value. The system stops loading when the terminal voltage of module is close to 0V for more than 25ms and system is under the state of detecting Von again. Manual: The load starts when the terminal voltage of module exceeds the Von setting value. Loading keep going even if the terminal voltage of module close to 0V.	
Syntax	:UTILity:VOLTage:LATCh:CLEar{AUTO|0|MANUAL|1}	
Parameter	AUTO/0	Set Voltage Latch Clear to auto
	MANUAL/1	Set Voltage Latch Clear to manual
Example	:UTIL:VOLT:LATC:CLE 0	Set Voltage Latch Clear to auto.
Query Syntax	:UTILity:VOLTage:LATCh:CLEar?	
Return Parameter	<NR1>	Remote mode
	0	AUTO
	1	MANUAL
Query Example	:UTIL:VOLT:LATC:CLE? 0	Voltage Latch Clear is set to auto.

:UTILity:MEASure:PERiod

System Command

Description	You can select a measure sample rate through this setting, 200ms or 20ms are available for voltage and current sampling rate.	
Syntax	:UTILity:MEASure:PERiod{NORMAL|0|FAST|1}	
Parameter	NORMAL/0	Set Measure Period to 200ms
	FAST/1	Set Measure Period to 20ms
Example	:UTIL:MEAS:PER 0	Set Measure Period to 200ms

Query Syntax	:UTILity:MEASure:PERiod?	
Return Parameter	<NR1>	Remote mode
	0	NORMAL
	1	FAST
Query Example	:UTIL:MEAS:PER? 0	Measure Period is set to 200ms.

:UTILity:JOG:SHUTTLE:CONTrol

System Command

Description	ON: After this setting is enabled, the settings value will be adjusted by slave knob in Jog Shuttle mode when you adjust the setting value. The interval value is adjusted according to the knob speed. OFF: If this setting is disabled, the settings value will be adjusted by slave knob in the form of fixed compartment when you adjust the setting value.	
Syntax	:UTILity:JOG:SHUTTLE:CONTrol{OFF|0|ON|1}	
Parameter	OFF/0	Set Jog Shuttle Control to OFF
	ON/1	Set Jog Shuttle Control to ON
Example	:UTIL:JOG:SHUTTLE:CONT 0	Set Jog Shuttle Control to OFF.
Query Syntax	:UTILity:JOG:SHUTTLE:CONTrol?	
Return Parameter	<NR1>	Remote mode
	0	OFF
	1	ON
Query Example	:UTIL:JOG:SHUTTLE:CONT? 0	Jog Shuttle Control is set to OFF.

:UTILity:RVP:LOAD:OFF

System Command

Description	ON: When RVP is detected, Alarm will display on the screen and stop loading. OFF: When RVP is detected, Alarm will display on the screen but loading is kept on.	
Syntax	:UTILity:RVP:LOAD:OFF{OFF|0|ON|1}	
Parameter	OFF/0	Set RVP Load Off to OFF
	ON/1	Set RVP Load Off to ON
Example	:UTIL:RVP:LOAD:OFF 0	Set RVP Load Off to OFF.
Query Syntax	:UTILity:RVP:LOAD:OFF?	
Return Parameter	<NR1>	Remote mode
	0	OFF
	1	ON
Query Example	:UTIL:RVP:LOAD:OFF? 0	RVP Load Off is set to OFF.

Current Subsystem

:CURRent:STATic:RECall

Channel Specific Command

Description	Sets or queries whether A Value or B Value is the currently active value in CC static mode.	
Syntax	:CURRent:STATic:RECall {A|0|B|1}	
Parameter	A/0	A
	B/1	B
Example	:CURR:STAT:REC 1	Makes B Value the active value.
Query Syntax	:CURRent:STATic:RECall?	
Return Parameter	<NR1>	Value
	0	A
	1	B

Query Example	:CURR:STAT:REC? 0	A Value is active.

:CURRent:STATic:L1/L2

Channel Specific Command

Description	Sets the A/B Value for constant current static mode, where L1 is A Value and L2 is B Value. The command is range dependent. If the current range is Low, then the command will only apply to the low range settings. When setting the A/B value, the device will be switched to CC mode by using this command.	
Syntax	:CURRent:STATic:L1|L2 <NRf+>[A]	
Parameter	<NRf+>[A]	
	L1 1	Sets A Value to 1 Amp.
	L2 2	Sets B Value to 2 Amps.
	L1 1A	Sets A Value to 1 Amp.
	L1 MIN	Sets A Value to the minimum level for the specific channel.
	L1 MAX	Sets A Value to the maximum Level for the specific channel.
Example	:CURR:STAT:L1 1	Sets A Value to 1 amp for the current range
Query Syntax	:CURRent:STATic:L1?/L2? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Current
	1 unit = 1 amp	Returns the current of the A Value (L1) or B Value (L2).
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CURR:STAT:L2? MAX 10.2	Returns the maximum current allowed for the channel. (PEL-2020B)

Query Example	:CURR:STAT:L2? 2	Returns the current setting (2 A) for B Value.

:CURRent:STATic:RISE/FALL

Channel Specific Command

Description	Sets the slew rate for constant current static mode. The command is range dependent. If the current range is Low, then the command will only apply to the low range settings. When setting the A/B value, the device will be switched to CC mode by using this command.	
Syntax	:CURRent:STATic:RISE/FALL <NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate
	RISE/FALL 0.078A/uS	Sets the rising/ falling slew rate to 0.078A/uS
	RISE/FALL 1	Sets the rising/ falling slew rate to 1A/uS
	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.
Example	:CURR:STAT:RISE .01	Sets the rising slew rate to 0.01A/uS.
Query Syntax	: CURRent:STATic:RISE/FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit=1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CURR:STAT:RISE? MIN 0.078	The Minimum value for the rising slew rate is 0.078 A/uS for the specific channel.

Query Example	:CURR:STAT:RISE? 0.16800	The rising slew rate is 0.168 A/uS for the specific channel.

:CURRent:STATic:LOW:AVALue/BVALue

Channel Specific Command

Description	Sets the low range A/B Value for constant current static mode.	
Syntax	:CURRent:STATic:LOW:AVALue/BVALue<NRf+>[A]	
Parameter	NRf+[A]	
	AVALue 1	Sets A Value to 1 Amp. (Low range only)
	BVALue 2	Sets B Value to 2 Amps. (Low Range only)
	AVALue 1A	Sets A Value to 1 Amp. (Low range only)
	AVALue MIN	Sets A Value to the minimum level for the specific channel.
	AVALue MAX	Sets A Value to the maximum Level for the specific channel.
Example	:CURR:STAT:LOW:AVAL 1	Sets low range CC static mode A Value to 1 amp.
Query Syntax	:CURRent:STATic:LOW:AVALue/BVALue? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Current
	1 unit = 1 amp	Returns the current of the A or B Value.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CURR:STAT:LOW:BVAL? MAX 2	Returns the maximum current allowed for the channel. (PEL-2020B)

:CURRent:STATic:LOW:RISE/FALL

Channel Specific Command

Description	Sets the low range rising/falling slew rates.	
Syntax	:CURRent:STATic:LOW:RISE/FALL<NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate
	RISE/FALL 0.078A/uS	Sets the rising/falling slew rate to 0.078A/uS
	RISE/FALL 1	Sets the rising/falling slew rate to 1A/uS
	RISE/FALL MIN	Sets to the slowest rising/falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/falling slew rate.
Example	:CURR:STAT:LOW:RISE .001	Sets the rising slew rate to 0.001A/uS.
Query Syntax	: CURRent:STATic:LOW:RISE/FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit=1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CURR:STAT:LOW:RISE? MIN 0.078	For low range CC mode, the Minimum value for the rising slew rate is 0.078 A/uS for the specific channel.

:CURRent:STATic:HIGH:AVALue/BVALue

Channel Specific Command

Description	Sets the high range A/B Value for constant current static mode.	
Syntax	:CURRent:STATic:HIGH:AVALue/BVALue<NRf+>[A]	
Parameter	NRf+[A]	

	AVALue 10	Sets A Value to 10 Amps. (high range only)
	BVALue 20	Sets B Value to 20 Amps. (high range only)
	AVALue MIN	Sets A Value to the minimum level for the specific channel.
	A Value MAX	Sets A Value to the maximum Level for the specific channel.
Example	:CURRent:STATic:HIGH :AVALue 10	Sets high range CC static mode A Value to 10 amps.
Query Syntax	:CURRent:STATic:HIGH:AVALue/BVALue?[MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Auto load mode
	MAX/MIN	Returns the allowable maximum and minimum.
	1 unit= 1 amp	Returns the current of the A or B Value.
Query Example	:CURR:STAT:HIGH:BVALue? MAX 20.4000	Returns the maximum current allowed for the channel in high range mode. (PEL-2020B)

:CURRent:STATic:HIGH:RISE/FALL

Channel Specific Command

Description	Sets the high range rising/falling slew rate.	
Syntax	:CURRent:STATic:HIGH:RISE/FALL<NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate
	RISE/FALL 0.8A/uS	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL 1	Sets the rising/ falling slew rate to 1A/uS
	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.

	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.
Example	:CURR:STAT:HIGH:RISE 1.1	Sets the rising slew rate to 1.1A/uS.
Query Syntax	:CURRent:STATic:HIGH:RISE/FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit=1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CURR:STAT:HIGH:RISE? MAX 0.8000	For high range CC mode, the maximum value for the rising slew rate is 0.8000 A/uS for the specific channel.

:CURRent:DYNamic:L1/L2

Channel Specific Command

Description	Sets the current levels (Level 1 & 2) for CC dynamic mode. The command is range dependent. If the current range is Low, then the settings will only apply to low range. When setting the A/B value, the device will be switched to CCD mode by using this command.	
Syntax	:CURRent:DYNamic:L1/L2<NRf+>[A]	
Parameter	NRf+[A]	Current
	L1 1	Sets L1 to 1 Amp.
	L2 2	Sets L2 to 2 Amps.
	L2 2A	Sets L2 to 2 Amps.
	L1/L2 MIN	Sets L1 or L2 to the minimum level for the specific channel.
	L1/L2 MAX	Sets L1 or L2 to the maximum Level for the specific channel.

Example	:CURR:DYN:L1 10	In CC dynamic mode, Set L1 (level 1) to 10 amps.
Query Syntax	:CURRent:DYNamic:L1/L2? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Current
	MAX/MIN	Returns the allowable maximum and minimum.
	1 unit= 1 amp	Returns the current of L1/L2, or the maximum or minimum current allowed.
Query Example	:CURR:DYN:L2? 2.0400	Returns current for the specific channel.

:CURRent:DYNamic:RISE/FALL

Channel Specific Command

Description	Sets the rising/falling slew rate for CC dynamic mode for the specific channel and range. When setting the A/B value, the device will be switched to CCD mode by using this command.	
Syntax	:CURRent:DYNamic:RISE/FALL<NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate
	RISE/FALL 0.8A/uS	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL 1	Sets the rising/ falling slew rate to 1A/uS
	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.
Example	:CURR:DYNA:RISE 1.1	Sets the rising slew rate to 1.1A/uS.
Query Syntax	:CURRent:DYNamic:RISE/FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate

	1 Unit=1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum or minimum.
Query Example	:CURR:DYN:FALL? MIN 0.0003	Shows the minimum allowable value for the falling slew rate as 0.0003 A/uS for the specific channel and range.

:CURRent:DYNamic:T1/T2

Channel Specific Command

Description	Sets the timers T1 or T2 for CC dynamic mode for the specific channel and range. When setting the A/B value, the device will be switched to CCD mode by using this command.	
Syntax	:CURRent:DYNamic:T1/T2<NRf+>[S|ms]	
Parameter	<NRf+>[S]	Time
	T1/T2 0.1S	Sets the T1/T2 time to 0.1 seconds.
	T1/T2 1	Sets T1/T2 to 1 second.
	T1/T2 MIN	Sets the T1/T2 to the minimum value.
	T1/T2 MAX	Sets the T1/T2 time to the maximum time
Example	:CURR:DYNA:T1 .1S	Sets the T1 time to 100 milliseconds for the specific channel.
Query Syntax	: CURRent:DYNamic:T1/T2? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Time
	1 Unit=1 second	Returns T1/T2 time.
	MAX/MIN	Returns the allowable maximum and minimum.

Query Example	:CURR:DYN:L:T1? 2.5	Returns the T1 time of 2.5 seconds.
	:CURR:DYN:T1? MIN 0.000025	Returns the minimum T1 time allowable for the specific channel and range.

:CURRent:DYNamic:LOW:L1/L2

Channel Specific Command

Description	Sets the low range current levels (Level 1 & 2) for CC dynamic mode.	
Syntax	:CURRent:DYNamic:LOW:L1/L2 <NRf+>[A]	
Parameter	NRf+[A]	Current
	L1 1	Sets L1 to 1 Amp. (low range only)
	L2 2	Sets L2 to 2 Amps. (low Range only)
	L2 2A	Sets L2 to 2 Amps. (low Range only)
	L1/L2 MIN	Sets L1 or L2 to the minimum level for the specific channel.
	L1/L2 MAX	Sets L1 or L2 to the maximum Level for the specific channel.
Example	:CURR:DYN:LOW:L1 10	In low range CC dynamic, Set L1 (level 1) to 10 amps.
Query Syntax	:CURRent:DYNamic:LOW:L1/L2? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Current
	1 unit= 1 amp	Returns the current of L1/L2, or the maximum or minimum current allowed.
	MAX/MIN	Returns the allowable maximum and minimum.

Query Example	:CURR:DYN:LOW:L2? 2.0400	Returns current for the specific channel.

:CURRent:DYNamic:LOW:RISE/FALL

Channel Specific Command

Description	Sets the low range rising/falling slew rate for CC dynamic mode for the specific channel.	
Syntax	:CURRent:DYNamic:LOW:RISE/FALL<NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate
	RISE/FALL 0.8A/uS	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL 1	Sets the rising/ falling slew rate to 1A/uS
	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.
Example	:CURR:DYNA:LOW:RISE 1.1	Sets the rising slew rate to 1.1A/uS.
Query Syntax	: CURRent:DYNamic:LOW:RISE/FALL?[MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit=1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum or minimum.
Query Example	:CURR:DYN:LOW:FALL? MIN 0.0003	For low range dynamic CC mode, the minimum allowable value for the falling slew rate is 0.0003 A/uS for the specific channel.

:CURRent:DYNamic:LOW:T1/T2

Channel Specific Command

Description	Sets the low range timers T1 or T2 for CC dynamic mode for the specific channel.
Syntax	:CURRent:DYNamic:LOW:T1/T2<NRf+>[S/ms]

Parameter		
	<NRf+>[S/ms]	Time
	T1/T2 0.1S	Sets the T1/T2 time to 0.1 seconds.
	T1/T2 1	Sets T1/T2 to 1 second.
	T1/T2 MIN	Sets the T1/T2 to the minimum value.
	T1/T2 MAX	Sets the T1/T2 time to the maximum time

Example	:CURR:DYNA:LOW:T1 .1S	Sets the T1 time to 100 milliseconds for the specific channel.
Query Syntax	: CURRent:DYNamic:LOW:T1/T2? [MIN|MAX]	

Return Parameter		
	<NR2> [MAX|MIN]	Time
	1 Unit=1 second	Returns T1/T2 time.
	MAX/MIN	Returns the allowable maximum and minimum.

Query Example		
	:CURR:DYN:LOW:T1? 2.5	Returns the T1 time of 2.5 seconds.
	:CURR:DYN:LOW:T1? MIN 0.000025	Returns the minimum T1 time allowable for the specific channel.

:CURRent:DYNamic:HIGH:L1/L2

Channel Specific Command

Description	Sets the high range current levels (Level 1 & 2) for CC dynamic mode.
Syntax	:CURRent:DYNamic:HIGH:L1/L2<NRf+>[A]

Parameter	NRf+[A]	
	L1 10	Sets L1 to 10 Amps. (High range only)
	L2 20	Sets L2 to 20 Amps. (High Range only)
	L1/L2 MIN	Sets L1 or L2 to the minimum level for the specific channel.
	L1/L2 MAX	Sets L1 or L2 to the maximum Level for the specific channel.
Example	:CURR:DYN:HIGH:L1 10	In high range CC dynamic mode, Set L1 (level 1) to 10 amps.
Query Syntax	:CURRent:DYNamic:HIGH:L1/L2? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Return value
	1 unit= 1 amp	Returns the current of Level 1/ 2 (L1/L2).
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CURR:DYN:HIGH:L2? MAX 20.4000	Returns the maximum current allowed for the channel. (PEL-2020A)

:CURRent:DYNamic:HIGH:RISE/FALL

Channel Specific Command

Description	Sets the high range rising/falling slew rate for CC dynamic mode for the specific channel.	
Syntax	:CURRent:DYNamic:HIGH:RISE/FALL<NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate
	RISE/FALL 0.8A/uS	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL 1	Sets the rising/ falling slew rate to 1A/uS

	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.
Example	:CURR:DYNA:HIGH:RISE 1.1	Sets the rising slew rate to 1.1A/uS.
Query Syntax	: CURRent:DYNamic:HIGH:RISE/FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit = 1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CURR:DYN:HIGH:FALL? MAX 0.8	For high range dynamic CC mode, the maximum value for the falling slew rate is 0.8 A/uS for the specific channel.

:CURRent:DYNamic:HIGH:T1/T2

Channel Specific Command

Description	Sets the timers T1 or T2 for CC dynamic mode for the specific channel in high range.	
Syntax	:CURRent:DYNamic:HIGH:T1/T2<NRf+>[S|ms]	
Parameter	<NRf+>[S]	Time
	T1/T2 0.1S	Sets the T1/T2 time to 0.1 seconds.
	T1/T2 1	Sets T1/T2 to 1 second.
	T1/T2 MIN	Sets the T1/T2 to the minimum value.
	T1/T2 MAX	Sets the T1/T2 time to the maximum time
Example	:CURR:DYNA:HIGH:T1 10S	Sets the high range T1 time to 10 seconds for the specific channel.

Query Syntax	:CURRent:DYNamic:HIGH:T1/T2? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Time
	1 Unit=1 second	Returns T1/T2 time.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:CURR:DYN:HIGH:T1? 2.5	Returns the T1 time of 2.5 seconds.
	:CURR:DYN:HIGH:T1? MIN 0.000025	Returns the minimum T1 time allowable for the specific channel.

FETCH Subsystem

:FETCh:VOLTage?

Channel Specific
Status Command

Description	This query returns the real-time voltage of the load module input for the specific channel.	
Syntax	:FETCh:VOLTage? <NR2>	
Parameter	<NR2> 1 unit = 1 volt	Voltage
	8	8 volts
Query Example	:FETC:VOLT? 11.2	The specific channel has a voltage of 11.2 volts at the input.

:FETCh:CURRent?

Channel Specific
Status Command

Description	This query returns the real-time current of the load module input for the specific channel.	
Syntax	:FETCh:CURRent? <NR2>	
Parameter	<NR2> 1 unit= 1 amp	
	1	1 amp
Query Example	:FETC:CURR? 1.2	The specific channel has a current of 1.2 amps at the load module input.

:FETCh:POWer?

Channel Specific Status Command

Description	This query returns the real-time power of the load module input for the specific channel.	
Syntax	:FETCh:CURRent? <NR2>	
Parameter	<NR2> 1 unit= 1 watt	
	1	1 amp
Query Example	:FETC:POW? 1.2	The specific channel is at 1.2 watts.

:FETCh:STATus?

Status Command

Description	This query returns the status of the load module. The returned value is the bit weight of the Channel Status Register. See page 186 for details.			
Syntax	:FETCh:STATus? <NR1>			
Parameter	<NR1>	Condition	<NR1>	Condition
	1	OC	16	OT
	2	OV	32	G/N
	4	OP	64	UVP
	8	RV	128-65535	Not Used
Query Example	:FETC:STAT? 2		Over voltage (OV) protection has been triggered for the specific channel.	

:FETCh:ALLVoltage?

All Channel Status Command

Description	This query returns the voltage values of all the load modules/channels in order from 1-8 (PEL-2004B)/1-4 (PEL2002B).
Syntax	:FETCh:ALLVoltage?

Parameter	<aard>	
	CH1,CH2,CH3,CH4,CH5, CH6,CH7,CH8	Returns all the voltage values from all the channels, 1-8(PEL-2004B)/1-4(PEL-2002B).
Query Example	:FETC:ALLV?	Channel 1 and 2 have voltages of 2.5 and 3 volts respectively. Channels 3-6 and 8 have no voltage and channel 7 is 5.5 volts
	2.5000, 3.0000, 0.0000, 0.0000, 0.0000, 0.0000, 5.500, 0.0000	

:FETCh:ALLCurrent?

All Channel Status Command

Description	This query returns the current values of all the load modules/channels in order from 1-8 (PEL-2004B)/1-4 (PEL2002B).	
Syntax	:FETCh:ALLCurrent? <aard>	
Parameter	<aard>	
	CH1,CH2,CH3,CH4,CH5, CH6,CH7,CH8	Returns all the current values from all the channels, 1-8 (PEL-2004B)/1-4 (PEL-2002B).
Query Example	:FETC:ALLC?	Channels 1 to 6 have no current. Channels 7 & 8 have 1.2 and 3.56 amps, respectively.
	0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 1.2000, 3.5600	

:FETCh:ALLPower?

All Channel Status Command

Description	This query returns the power values of all the load modules/channels in order from 1-8 (PEL-2004B)/1-4 (PEL2002B).	
Syntax	:FETCh:ALLPower? <aard>	
Parameter	<aard>	

	CH1,CH2,CH3,CH4,CH5, CH6,CH7,CH8	Returns all the power values from all the channels, 1-8(PEL-2004B)/1-4 (PEL-2002B).
Query Example	:FETC:ALLP? 0.0000, 0.0000, 10.200, 5.5000	Channels 1 to 2 have no power. Channels 3 & 4 have 10.2 and 5.5 watts, respectively.

LOAD Subsystem

:LOAD[:STATe]

Channel Specific Command

Description	This command turns the electronic load on/off for the specific channel.	
Syntax	:LOAD[:STATe] {ON|1|OFF|0}	
Parameter	ON/1	Load On
	OFF/0	Load Off
Example	:LOAD ON	Turns the specific channel load on.
Query Syntax	:LOAD[:STATe]?	
Return Parameter	<NR1>	Load module
	1	Load is On
	0	Load is Off
Query Example	:LOAD? 1	Turns the specific channel load on.

:LOAD:SHORt[:STATe]

Channel Specific Command

Description	This command shorts the electronic load on/off for the specific channel.
Syntax	:LOAD:SHORt[:STATe]{ON|1|OFF|0}

Parameter	ON/1	Shorting is On
	OFF/0	Shorting is Off
Example	:LOAD:SHOR ON	Short circuits the load module channel.
Query Syntax	:LOAD:SHORt[:STATe]?	
Return Parameter	<NR1>	Short Load module
	1	Shorting is activated
	0	Shorting is deactivated
Query Example	:LOAD:SHOR? 0	Shorting is deactivated on the specific channel.

:LOAD:SHORt:KEY

Channel Specific Command

Description	The SHORT key can be set to Toggle or Hold mode.	
Syntax	:LOAD:SHORt:KEY {TOGGLE|1|HOLD|0}	
Parameter	TOGGLE/1	Sets the SHORT key to toggle mode
	HOLD/0	Sets the SHORT key to hold mode
Example	:LOAD:SHOR:KEY 1	Set the SHORT key to toggle.
Query Syntax	:LOAD:SHORt:KEY?	
Return Parameter	<NR1>	Mode
	1	Toggle mode is active
	0	Hold mode is active
Query Example	:LOAD:SHOR:KEY? 0	Hold mode is active for the specific channel.

:LOAD:PROTection?

Channel Specific Command

Description	Returns the protection levels for electronic load
Query Syntax	:LOAD:PROTection?

Query Example	:LOAD:PROT?	Clears the Channel Status Register.			
Return Parameter	<NR1>	Condition	<NR1>	Condition	
	1	OC	16	OT	
	2	OV	32	G/N	
	4	OP	64	UVP	
	8	RV	128-65535	Not Used	
Query Example	:LOAD:PROT? 0	Returns the status of the Channel Status Register. Here 0 is returned indicating no protection settings have been tripped.			

:LOAD:PROTection:CLEar

Channel Specific Command

Description	This command clears the Channel Status Register for the specific channel. See page 186 for details.	
Syntax	:LOAD:PROTection:CLEar	
Example	:LOAD:PROT:CLE	Clears the Channel Status Register.

:LOAD:TIME?

Channel Specific Command

Description	This command displays the total load on time. If the load is on, the load time when the command was issued is displayed.	
Query Syntax	:LOAD:TIME?	
Return Parameter	<NR1>1unit = 1 second	Load on time
	2.2	2.2 seconds
Query Example	:LOAD:TIME? 5.1	Returns the load on time as 5.1 seconds.

:LOAD:DELay

Channel Specific Command

Description	Sets or queries the load delay time for the specific channel.	
Syntax	:LOAD:DELay<NRf>[S]	
Parameter	<NRf>[S]	Time
	0.1S	Sets the delay time to 0.1 seconds.
Example	:LOAD:DEL 0.1s	Sets the delay time to 0.1s.
Query Syntax	:LOAD:DEL?	
Return Parameter	<NR2>	Delay time in seconds.
Query Example	:LOAD:DEL? 0.10000	Returns the delay time for the current channel.

:LOAD:TYPE

All Channels

Description	Sets or queries which load type is the active type.	
Syntax	:LOAD:TYPE {LOAD|0|PROGRAM|1|SEQUENCE|2}	
Parameter	LOAD/0	Normal load
	PROGRAM/1	Program
	SEQUENCE/2	Sequence
Example	:LOAD:TYPE: 1	Program is active.
Query Syntax	:LOAD:TYPE?	
Return Parameter	<NR1>	Type
	0	Normal load
	1	Program
	2	Sequence
Query Example	:LOAD:TYPE? 0	The normal load type is active

Measure Subsystem

:MEASure:VOLTage?

Channel Specific Command

Description	This query returns the measured voltage of the specific channel.	
Query Syntax	:MEASure:VOLTage? <NR2>	
Return Parameter	<NR2> 1 unit = 1 volt	Voltage at the load input
	0.5000	0.5000 volts
Query Example	:MEAS:VOLT? 8.5600	A voltage of 8.56 volts is measured at the specific channel load input.

:MEASure:CURRent?

Channel Specific Command

Description	This query returns the measured current of the specific channel.	
Query Syntax	:MEASure:CURRent? <NR2>	
Return Parameter	<NR2> 1 unit = 1 amp	Current at the load input
	1.0000	1.0000 amps
Query Example	:MEAS:CURR? 1.5	A current of 1.5 amps is measured at the specific channel load input.

:MEASure:POWer?

Channel Specific Command

Description	This query returns the measured power of the specific channel.	
Query Syntax	:MEASure:POWer? <NR2>	
Return Parameter	<NR2> 1 unit = 1 watt	Power at the load input
	1.0000	1.0000 watts
Query Example	:MEAS:POW? 1.5	1.5 watts is measured at the specific channel load input.

:MEASure:INPut

Channel Specific Command

Description	This command is for compatibility with other instruments only and has no action.	
Syntax	:MEASure:INPut {LOAD|0| UUT|1}	
Parameter	LOAD/0	Disabled
	UUT/1	Enabled
Example	:MEAS:INP 0	Disable voltage sense.
Query Syntax	:MEASure:INPut? <NR1>	
Return Parameter	<NR1>	Voltage Sense
	0	Disabled
	1	Enabled
Query Example	:MEAS:INP? 1	Returns the voltage input status. Voltage sense is enabled.

:MEASure:SCAN

Channel Specific Command

Description	This command allows the mainframe to scan all the load modules' voltage\current\power.
Syntax	:MEASure:SCAN {OFF|0|ON|1}

Parameter	OFF/0	Disabled
	ON/1	Enabled
Example	:MEAS:SCAN 0	Disable scanning.
Query Syntax	:MEASure:SCAN? <NR1>	
Return Parameter	<NR1>	Scan
	0	Disabled
	1	Enabled
Query Example	:MEAS:SCAN? 1	Returns the scanning status. Here scanning is enabled.

:MEASure:ALLVoltage?

All Channel Command

Description	This query measures the voltage values of all the load modules/channels in order from 1-8 (PEL-2004B)/1-4 (PEL2002B).	
Query Syntax	:MEASure:ALLVoltage? <aard>	
Query Parameter	<aard> 1 unit = 1 volt	
	CH1,CH2,CH3,CH4, CH5,CH6,CH7,CH8	Returns all the voltage values from all the channels, 1-8(PEL-2004B)/1-4(PEL-2002B).
Query Example	:MEAS:ALLV? 2.5000, 3.0000, 0.0000, 0.0000, 0.0000, 0.0000, 5.500, 0.0000	Channel 1 and 2 have voltages of 2.5 and 3 volts respectively. Channels 3-6 and 8 have no voltage and channel 7 is 5.5 volts

:MEASure:ALLCurrent?

All Channel Command

Description	This query returns the current measured of all the load modules/channels in order from 1-8 (PEL-2004B)/1-4 (PEL2002B).
Query Syntax	:MEASure:ALLCurrent? <aard>

Query Parameter	<aard> 1 unit = 1 amp	
	CH1,CH2,CH3,CH4, CH5,CH6,CH7,CH8	Returns all the current values from all the channels, 1-8(PEL-2004A)/1-4(PEL-2002A).
Query Example	:MEAS:ALLC? 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 1.2000, 3.5600	Channels 1 to 6 have no current. Channels 7 & 8 have 1.2 and 3.56 amps, respectively.

:MEASure:ALLPower?

All Channel Command

Description	This query returns the power measured of all the load modules/channels in order from 1-8 (PEL-2004B)/1-4 (PEL2002B).	
Query Syntax	:MEASure:ALLPower? <aard>	
Query Parameter	<aard> 1 unit = 1 watt	
	CH1,CH2,CH3,CH4, CH5,CH6,CH7,CH8	Returns all the power values from all the channels, 1-8(PEL-2004B)/1-4(PEL-2002B).
Query Example	:MEAS:ALLP? 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 1.5000, 3.2000	Channels 1 to 6 have no power. Channels 7 & 8 have 1.5 and 3.2 watts, respectively.

MODE Subsystem

:MODE

Channel Specific Command

Description	This command sets the operating mode of the specific channel. Some modes are load module dependent.	
Syntax	:MODE {CCL|CCH|CCDL|CCDH|CRL|CRH|CRDL|CRDH|CPL|CPH|CVL|CVH}	
Parameter	CCL	CC static mode, low range
	CCH	CC static mode, high range
	CCDL	CC dynamic mode, low range
	CCDH	CC dynamic mode, high range
	CRL	CR static mode, low range
	CRH	CR static mode, high range
	CRDL	CR dynamic mode, low range
	CRDH	CR dynamic mode, high range
	CPL	CP static mode, low range
	CPH	CP static mode, high range
	CVL	CV static mode, low range
	CVH	CV static mode, High range
Example	:MODE CCL	Set the specific channel to low range constant current static mode.
Query Syntax	:MODE?	
Return Parameter	CCL	CC static mode, low range
	CCH	CC static mode, high range
	CCDL	CC dynamic mode, low range
	CCDH	CC dynamic mode, high range
	CRL	CR static mode, low range

	CRH	CR static mode, high range
	CRDL	CR dynamic mode, low range
	CRDH	CR dynamic mode, high range
	CPL	CP static mode, low range
	CPH	CP static mode, high range
	CVL	CV static mode, low range
	CVH	CV static mode, High range
Query Example	:MODE? CCH	The specific channel is currently set to CC static mode, high range.

OCP Test Automation Commands

:OCP:EDIT:CHANnel?

Channel Specific Command

Description	Sets or queries which channel is used to apply the OCP Test Automation parameters. Also see page 104 for setting the active channel.	
Syntax	:OCP:EDIT:CHANnel <NR1>	
Parameter	<NR1>	1-8
Example	:OCP:EDIT:CHAN 1	Sets channel 1 as the chosen channel.
Query Syntax	:OCP:EDIT:CHANnel?	
Return Parameter	<NR1>	1-8
Query Example	:OCP:EDIT:CHAN? 1	Channel 1 is the chosen channel.

:OCP:CHANnel:RANGe

Channel Specific Command

Description	Sets or queries the channel range. High (CC Mode High) or Low(CC Mode Low)	
Syntax	:OCP:CHANnel:RANGe{LOW|0|HIGH|1}	
Parameter	LOW/0	CC Mode Low range
	HIGH/1	CC Mode High range
Example	:OCP:CHAN:RANG 0	Sets the range to LOW.
Query Syntax	:OCP:CHANnel:RANGe?	
Return Parameter	0	CC Mode Low range
	1	CC Mode High range
Query Example	:OCP:CHAN:RANG? 0	The range is CC Mode Low.

:OCP:CHANnel:STARt

Channel Specific Command

Description	Sets or queries the starting current value.	
Syntax	:OCP:CHANnel:STARt {<NRf>[A]|MIN|MAX}	
Parameter	<NRF>[A]	The current value in Amps.
	MAX	The maximum current value.
	MIN	The minimum current value.
Example	:OCP:CHAN:STAR MIN	Set the start current to the minimum.
Query Syntax	:OCP:CHANnel:STARt?[MIN|MAX]	
Return Parameter	<NR2>	Returns the starting current in Amps.
Query Example	:OCP:CHAN:STAR? MIN 1.5	Returns the minimum starting current.

:OCP:CHANnel:END

Channel Specific Command

Description	Sets the ending current value for the test. The value must be higher than the DUT OCP value.	
Syntax	:OCP:CHANnel:END{<NRf>[A]|MIN|MAX}	
Parameter	<NRF>[A]	The current value in Amps.
	MAX	The maximum current value.
	MIN	The minimum current value.
Example	:OCP:CHAN:END MIN	Set the ending current to the minimum.
Query Syntax	:OCP:CHANnel:END?	
Return Parameter	<NR2>	Returns the ending current in Amps.
Query Example	:OCP:CHAN:END? 10.0	Returns the ending current.

:OCP:CHANnel:STEP:CURRent

Channel Specific Command

Description	Sets the current step resolution for the OCP Test Automation.	
Syntax	:OCP:CHANnel:STEP:CURRent {<NRf>[A]|MIN|MAX}	
Parameter	<NRF>[A]	The current value in Amps.
	MAX	The maximum current value.
	MIN	The minimum current value.
Example	:OCP:CHAN:STEP :CURRent MIN	Set the step resolution to the minimum value.
Query Syntax	:OCP:CHANnel:STEP:CURRent?	
Return Parameter	<NR2>	Returns the current step resolution in Amps.
Query Example	:OCP:CHAN:STEP:CURR? 0.5	Returns the step resolution.

:OCP:CHANnel:LAST

Channel Specific Command

Description	Queries or sets the current value for after the DUT OCP protection has been activated.	
Syntax	:OCP:CHANnel:LAST {<NRf>[A]|MIN|MAX}	
Parameter	<NRF>[A]	The current value in Amps.
	MAX	The maximum current value.
	MIN	The minimum current value.
Example	:OCP:CHAN:LAST MAX	Set the current value to the maximum value.
Query Syntax	:OCP:CHANnel:LAST?	
Return Parameter	<NR2>	Returns the current value in Amps.
Query Example	:OCP:CHAN:LAST? 3.0	Returns the current value.

:OCP:CHANnel:STEP:TIME

Channel Specific Command

Description	Queries or sets how long the step time is for the OCP Test Automation.	
Syntax	:OCP:CHANnel:STEP:TIME {<NRf>[S]|MIN|MAX}	
Parameter	<NRF>[S]	The step time in seconds (50mS~1600S).
	MAX	The maximum step time.
	MIN	The minimum step time.
Example	:OCP:CHAN:STEP:TIME MIN	Set the step time to the maximum value.
Query Syntax	:OCP:CHANnel:STEP:TIME?	
Return Parameter	<NR2>	Returns the step time in seconds.
Query Example	:OCP:CHAN:STEP:TIME? 10.0	Returns the step time.

:OCP:CHANnel:DELay

Channel Specific Command

Description	Queries or sets the test delay time for the OCP Test Automation function.	
Syntax	:OCP:CHANnel:DELay {<NRf>[S]|MIN|MAX}	
Parameter	<NRF>[S]	The delay time in seconds (5mS~160S).
	MAX	The maximum delay time.
	MIN	The minimum delay time.
Example	:OCP:CHAN:DEL MAX	Set the delay time to the maximum value.
Query Syntax	:OCP:CHANnel:DELay?	
Return Parameter	<NR2>	Returns the delay time in seconds.
Query Example	:OCP:CHAN:DEL? 5.0	Returns the delay time.

:OCP:CHANnel:TRIGger

Channel Specific Command

Description	Queries or sets the voltage trigger for when the power supply OCP has been triggered.	
Syntax	:OCP:CHANnel:TRIGger {<NRf>[V]|MIN|MAX}	
Parameter	<NRF>[V]	The trigger voltage level.
	MAX	The maximum trigger voltage.
	MIN	The minimum trigger voltage.
Example	:OCP:CHAN:TRIG MAX	Set the trigger voltage level to the maximum value.
Query Syntax	:OCP:CHANnel:TRIGger?	
Return Parameter	<NR2>	Returns the trigger voltage level in volts.
Query Example	:OCP:CHAN:TRIG? 5.0	Returns the trigger level.

:OCP:CHANnel:ACTive

Channel Specific Command

Description	Queries or sets which bit(s) are the active channel for the OCP Test Automation function. More than one channel can be activated based on the bit weight of the parameter.			
Syntax	:OCP:CHANnel:ACTive{<NR1>0~255}			
Parameter	<NR1> (BIT WEIGHT)	Channel number	<NR1> (BIT WEIGHT)	Channel number
	1	1	16	5
	2	2	32	6
	4	3	64	7
	8	4	128	8
Example	:OCP:CHAN:ACT 3	Activates channel 1 and 2.		
Query Syntax	:OCP:CHANnel:ACTive?			

Return Parameter	<NR1> (BIT WEIGHT)	Channel number	<NR1> (BIT WEIGHT)	Channel number
	1	1	16	5
	2	2	32	6
	4	3	64	7
	8	4	128	8

Query Example	:OCP:CHAN:ACT? 8	Returns channel 4 as the active channel.

:OCP:STATus? — Query

Description	Queries the status of the OCP Test Automation function. Queries which bit(s) are the status of channel for the OCP Test Automation function. More than one channel can be query based on the bit weight of the parameter.
Query Syntax	:OCP:STATus?{<NR1>0~255}

Return Parameter	<NR1> (BIT WEIGHT)	Channel number	<NR1> (BIT WEIGHT)	Channel number
	1	1	16	5
	2	2	32	6
	4	3	64	7
	8	4	128	8

Query Example	:OCP:STAT? 1	The test has ended

:OCP:SAVE — Channel Specific Command

Description	Saves the current COP Test Automation parameters.
Syntax	:OCP:SAVE

:OCP:RESult? Query

Description	Returns the OCP Test Automation results.	
Query Syntax	:OCP:RESult?	
Query Example	:OCP:RES? Ch1 OCP Voltage, Ch1 OCP Current, Ch2 OCP Voltage, Ch2 OCP Current, Ch3 OCP Voltage, Ch3 OCP Current, Ch4 OCP Voltage, Ch4 OCP Current, Ch5 OCP Voltage, Ch5 OCP Current, Ch6 OCP Voltage, Ch6 OCP Current, Ch7 OCP Voltage, Ch7 OCP Current, Ch8 OCP Voltage, Ch8 OCP Current	This is an example of the results that are returned for the PEL-2004B.

:OCP:RUN Command

Description	Turns the OCP Test Automation function on or off.	
Syntax	:OCP:RUN { 0 | OFF| 1 | ON }	
Parameter	0/OFF	Turn off.
	1/ON	Turn on.
Example	:OCP:RUN OFF	Turn the test off.

:OCP:KEEP Command

Description	Sets or queries how long the keep time is for the OCP Test Automation.	
Syntax	:OCP:CHANnel:KEEP{<NRF>[S]|MIN|MAX}	
Parameter	<NRF>[S]	The keep time in seconds (0S~160S).
	MaX	The maximum keep time.

	MIN	The minimum keep time.
Example	OCP:KEEP :MAX 160	Set the step time to the maximum value.
Query Syntax	:OCP:KEEP?	
Return Parameter	<NR2>	Keep the step time in seconds.
Query Example	OCP:KEEP? 5.0	Keep the step time.

Program Subsystem

:PROGram:STATe

Program Number Specific

Description	Sets or queries the state of the program function.	
Syntax	:PROGram:STATe {ON|OFF|PAUSE|CONTINUE|NEXT}	
Query Syntax	:PROGram:STATe? {ON,STOP|ON,PAUSE|ON, RUN|OFF}	
Parameter	ON	Turn program on. The command ":RUN" can be used to active the program. And, the command ":ABORt" can be used to abort the program.
	OFF	Turn program off. The system will return back to normal operation.

	PAUSE	Program pause. This command is available for any mode on sequence mode of program.
	NEXT	Next step in the program. This command is available only for the current sequence mode of program set to manual and the execution time of current sequence is out.
	CONTINUE	Program continue. This command is available for any mode of the program sequence under "PAUSE" event.
Return Parameter	ON, STOP	Program is on, stopped
	ON, PAUSE	Program is paused
	ON, RUN	Program is running
	OFF	Program is off
Example	:PROGram:STATe ON Turns "Program" on.	
Query example	:PROGram:STATe? >OFF "Program" is off.	

:PROGram:FILE

Program Number Specific

Description	Sets the program number.	
Syntax	:PROGram:FILE <NR1>	
Parameter	<NR1>	Program number
	1~12	Number 1~12
Example	:PROG:FILE 5	Sets the program number to 5.
Query Syntax	:PROGram:FILE?	
Return Parameter	<NR1>	Mainframe Scanning

	1-12	Returns the current program number
Query Example	:PROG:FILE? 5	The set program number is 5.

:PROGram:SEQuence

Program Number Specific

Description	Sets the Sequence number for the current program number.	
Syntax	:PROGram:SEQuence <NR1>	
Parameter	<NR1>	Sequence number
	1~10	Number 1~10
Example	:PROG:SEQ 1	Sets the sequence number to 1 for the current program number.
Query Syntax	:PROGram:SEQuence?	
Return Parameter	<NR1>	Mainframe Scanning
	1-10	Returns the current sequence number
Query Example	:PROG:SEQ? 1	The set sequence number is 1.

:PROGram:MEMory

Program Number Specific

Description	Sets the memory number used for the current program/sequence.	
Syntax	:PROGram:MEMory <NR1>	
Parameter	<NR1>	Memory number
	1~120	Number 1~120
Example	:PROG:MEM 1	Sets the memory number to 001.
Query Syntax	:PROGram:MEMory?	
Return Parameter	<NR1>	Mainframe Scanning
	1-120	Returns the current program number

Query Example	:PROG:MEM? 1	The memory number for the current program/sequence is 001.

:PROGram:SEQuence:SHORt:CHANnel

Program Number Specific

Description	Simulates short circuits for load channels for the current sequence number.
Syntax	:PROGram:SEQuence:SHORt:CHANnel<NR1>

Parameter

<NR1> (BIT WEIGHT)	Channel number	<NR1> (BIT WEIGHT)	Channel number
1	1	16	5
2	2	32	6
4	3	64	7
8	4	128	8

Example	:PROG:SEQ:SHOR:CHAN 12	Simulates a short circuit for channels 3 and 4.
Query Syntax	:PROGram:SEQuence:SHORt:CHANnel?<NR1>	

Return Parameter

<NR1> (BIT WEIGHT)	Short Channel number	<NR1> (BIT WEIGHT)	Short Channel number
1	1	16	5
2	2	32	6
4	3	64	7
8	4	128	8

Query Example	:PROG:SEQ:SHOR:CHAN? 12	Returns channels 3 and 4 are set as shorted for the program sequence.

:PROGram:SEQuence:SHORt:TIME

Program Number Specific

Description	Sets the short time (seconds) for the current program sequence.

Syntax	:PROGram:SEQuence:SHORt:TIME<NRf>[S]	
Parameter	<NRf>[S]	Short Time
	0.0	0 seconds = OFF
	0.1~60	0.1~60 seconds
	0.1~60S	0.1~60 seconds
Note	The short time value must equal to or small than on time setting value.	
Example	:PROG:SEQ:SHOR:TIME 0.5	The short time for the program sequence is set to .5 seconds
Query Syntax	:PROGram:SEQuence:SHORt:TIME? <NR2>	
Return Parameter	<NR2> 1 unit = 1 second	Short Time
	0.0~60	Returns the short time for the program sequence.
Query Example	:PROG:SEQ:SHOR:TIME? 5	The short time for the program sequence is 5 seconds.

:PROGram:SEQuence:MODE

Program Number Specific

Description	Sets the program sequence to Auto, Manual or Skip mode.	
Syntax	:PROGram:SEQuence:MODE{MANUAL|AUTO|SKIP}	
Parameter	MANUAL	Manual mode: program sequence is run manually
	AUTO	Auto mode: program sequence is run automatically
	SKIP	Skip mode: current program sequence is skipped.

Example	:PROG:SEQ:MODE AUTO	The current program sequence is set to Automatic mode.
Query Syntax	:PROGram:SEQuence:MODE?	
Return Parameter	MANUAL	Manual mode: program sequence is run manually under this mode. User may use the command ":PROG:STAT NET" to execute the next program sequence.
	AUTO	Auto mode
	SKIP	Skip mode
Query Example	:PROG:SEQ:MODE? AUTO	The current program sequence is set to AUTO.

:PROGram:ACTive

Program Number Specific

Description	Activates or selects the active load modules.				
Syntax	:PROGram:ACTive <NR1>				
Parameter	<NR1> (BIT WEIGHT)	Active Channel	<NR1> (BIT WEIGHT)	Active Channel	
	1	1	16	5	
	2	2	32	6	
	4	3	64	7	
	8	4	128	8	
Example	:PROG:ACT 4		Activates channel three.		
Query Syntax	:PROGram:ACTive? <NR1>				
Return Parameter	<NR1> (BIT WEIGHT)	Active Channel	<NR1> (BIT WEIGHT)	Active Channel	
	1	1	16	5	
	2	2	32	6	
	4	3	64	7	

	8	4	128	8

Query Example	:PROG:ACT? 12	Channels 3 and 4 are active.

:PROGram:CHAin

Program Number Specific

Description	Chains the current program number to a specified program number.	
Syntax	:PROGram:CHAin <NR1>	
Parameter	<NR1>	Program
	1-12	1-12
	0	No chain/End chain
Example	:PROG:CHA 6	Chains the current program number to program number 6
Query Syntax	:PROGram:CHAin? <NR1>	
Return Parameter	<NR1>	Program
	1-12	1-12
	0	No chain/End chain
Query Example	:PROG:CHA? 6	Returns the program number the current program is chained to.

:PROGram:ONTime

Program Number Specific

Description	Sets the on-time for the program number. 0.1~60 seconds.	
Syntax	:PROGram:ONTime <NRf>[S]	
Parameter	<NRf>[S]	Program On Time
	0.1-60	0.1~60 seconds
	0.1-60s	0.1~60 seconds
Example	:PROG:ONT 10S	Set the on-time for the current program number to 10 seconds.

Query Syntax	:PROGram:ONTime? <NR2>	
Return Parameter	<NR2>	Program On Time
	0.1-60	0.1~60 seconds
Query Example	:PROG:ONT? 10	Returns the on-time for the current program number in seconds.

:PROGram:OFFTime

Program Number Specific

Description	Sets the off-time for the program number. 0.1~60 seconds.	
Syntax	:PROGram:OFFTime <NRf>[S]	
Parameter	<NRf>[S]	Program Off Time
	0.0	0 seconds = OFF
	0.1~60	0.1~60 seconds
	0.1~60S	0.1~60 seconds
Example	:PROG:OFFT 10S	Set the off-time for the current program number to 10 seconds.
Query Syntax	:PROGram:OFFTime? <NR2>	
Return Parameter	<NR2> I unit = 1 second	Program Off Time
	0.0~60	0.0~60 seconds
Query Example	:PROG:OFFT? 10	Returns the off-time for the current program number in seconds.

:PROGram:RUN

All Channel Command

Description	Runs the current program number when set to on, and when set to off will allow all the program/ sequence data to be programmed.	
Syntax	:PROGram:RUN {OFF|0|ON|1}	
Parameter	OFF/0	OFF
	ON/1	ON

Example	:PROG:RUN 1	Runs the program.

:PROGram:SAVE

All Channel Command

Description	Saves the current program to memory.	
Syntax	:PROGram:SAVE	
Example	:PROG:SAVE	Saves the program to memory.

:PROGram:PFTime

Program Number Specific

Description	Sets the P/F-Time (pass/fail time) for the current program sequence in seconds.	
Syntax	:PROGram:PFTime <NRf>[S]	
Parameter	<NRf>[S]	P/F Time
	0.0	0 seconds = OFF
	0.1~119.9	0.1~119.9 seconds
	0.1~119.9S	0.1~119.9 seconds
Example	:PROG:PFT 0.5	Sets the P/F-Time to .5 seconds
Query Syntax	:PROGram:PFTime? <NR2>	
Return Parameter	<NR2> 1 unit = 1 second	Short Time
	0.0~119.9	Returns the P/F-Time for the program sequence.
Query Example	:PROG:PFTime? 5	The P/F-Time is 5 seconds.

:PROGram:CHAin:STARt

Program Number Specific

Description	Sets or queries which program number is used as the “start” program in a program chain.	
Syntax	:PROGram:CHAin:STARt<NR1>	
Parameter	<NR1>	Program number

	1-12	1~12
Example	:PROG:CHA:STAR 1	Set program #1 to start the chain.
Query Syntax	:PROGram:CHAin:STARt?<NR1>	
Return Parameter	<NR1>	Program number
	1-12	1~12
Query Example	:PROG:CHA:STAR? 5	Program #5 starts the chain.

Resistance Subsystem

:RESistance[:STATic]:L1/L2

Channel Specific Command

Description	Sets A/B Value for constant resistance mode, where L1 is A Value and L2 is B Value. This command only applies to current mode (static). When setting the A/B value, the device will be switched to CR mode by using this command.	
Syntax	:RESistance[:STATic]:L1/L2<NRf+>[OHM]	
Parameter	NRf+[OHM]	Resistance
	L1 10	Sets A Value to 10 ohms
	L2 20	Sets B Value* to 20 ohms
		*Single Channel
	L1 MIN	Sets A Value to the minimum level for the specific channel.

	L1 MAX	Sets A Value to the maximum level for the specific channel.
Example	:RES:L1 10	Sets CR static mode A Value to 10 ohms, depending on the specific range
Query Syntax	:RESistance[:STATic]:L1/L2? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Resistance
	1 unit = 1 ohm	Returns the resistance of the A or B Value.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:RES:L1? MAX 300	Returns the maximum resistance allowed for the channel. (PEL-2020A)

:RESistance[:STATic]:RISE/FALL

Channel Specific Command

Description	Sets the rising/falling slew rate for CR mode. The command applies to the current mode (static/dynamic) and the current range (High/Low). When setting the A/B value, the device will be switched to CR mode by using this command.	
Syntax	:RESistance[:STATic]:RISE/FALL <NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew rate
	RISE/FALL 0.8A/uS	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL .8	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.

Example	:RES:RISE 0.1	Sets the rising slew rate to 0.1A/uS.
Query Syntax	:RESistance:RISE/FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit = 1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:RES:RISE? MAX 0.8000	Returns the maximum value for the rising slew rate (0.8 A/uS).

:RESistance:STATic:RECall

Channel Specific Command

Description	Sets or queries whether A Value or B Value is the currently active value in CR static mode.	
Syntax	:RESistance:STATic:RECall {A|0|B|1}	
Parameter	A/0	A
	B/1	B
Example	:RES:STAT:REC 1	Makes B Value the active value.
Query Syntax	:RES:STATic:RECall?	
Return Parameter	<NR1>	Value
	0	A
	1	B

:RESistance:STATic:LOW:AVALue/BVALue

Channel Specific Command

Description	Sets the low range A/B Value for constant resistance static mode.	
Syntax	:RESistance:STATic:LOW:AVALue/BVALue <NRf+>[OHM]	
Parameter	NRf+[OHM]	Resistance

	AVALue 10	Sets A Value to 10 ohms. (Low range only)
	BVALue 20	Sets B Value to 20 ohms. (Low range only)
	AVALue MIN	Sets A Value to the minimum level for the specific channel.
	AVALue MAX	Sets A Value to the maximum level for the specific channel.
Example	:RES:STAT:LOW:BVAL 10	Sets low range CR static mode B Value to 10 ohms.
Query Syntax	:RESistance:STATic:LOW:AVALue/BVALue?	
Return Parameter	<NR2> [MAX|MIN]	Resistance
	1 unit = 1 ohm	Returns the resistance of the A or B Value.
Query Example	:RES:STAT:LOW:AVAL? MAX 300	Returns the maximum resistance allowed for the channel. (PEL-2020A)

:RESistance:STATic:LOW:RISE/FALL

Channel Specific Command

Description	Sets the low range rising/falling slew rate.	
Syntax	:RESistance:STATic:LOW:RISE/FALL<NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew rate
	RISE/FALL 0.8A/uS	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL .8	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.

Example	:RES:STAT:LOW:RISE 0.1	Sets the rising slew rate to 0.1A/uS.
Query Syntax	:RESistance:STATic:LOW:RISE/FALL?[MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit =1 amp/uS	Returns the slew rate.
	MAX, MIN	Returns the allowable maximum and minimum.
Query Example	:RES:STAT:LOW:RISE? MAX 0.8000	For low range CR mode, the maximum value for the rising slew rate is 0.8 A/uS for the specific channel.

:RESistance:STATic:HIGH:AVALue/BVALue

Channel Specific Command

Description	Sets the high range A/B Value for constant resistance static mode.	
Syntax	:RESistance:STATic:HIGH:AVALue/BVALue <NRf+>[OHM]	
Parameter	NRf+[OHM]	
	AVALue 10	Sets A Value to 10 ohms. (high range only)
	BVALue 20OHM	Sets B Value to 20 ohms. (high range only)
	AVALue MIN	Sets A Value to the minimum level for the specific channel.
	AVALue MAX	Sets A Value to the maximum level for the specific channel.
Example	:RES:STAT:HIGH:BVAL 10	Sets high range CR static mode B Value to 10 ohms.
Query Syntax	:RESistance:STATic:HIGH:AVALue/BVALue? [MAX|MIN]	

Return Parameter	<NR2> [MAX|MIN] 1 unit= 1 ohm	Resistance Returns the resistance of the A or B Value.
Query Example	:RES:STAT:HIGH:BVAL? MAX 15000.0	Returns the maximum resistance allowed for the channel for B Value. (PEL-2020B)

:RESistance:STATic:HIGH:RISE/FALL

Channel Specific Command

Description	Sets the high range rising/falling slew rate.	
Syntax	:RESistance:STATic:HIGH:RISE/FALL<NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew rate
	RISE/FALL 0.8A/uS	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL 0.5	Sets the rising/ falling slew rate to 0.5A/uS
	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.
Example	:RES:STAT:HIGH:RISE 1.1	Sets the rising slew rate to 1.1A/uS.
Query Syntax	:RESistance:STATic:HIGH:RISE/FALL?[MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit=1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:RES:STAT:HIGH:RISE? MIN 0.8000	For high range CR mode, the minimum value for the rising slew rate is 0.8 A/uS for the specific channel.

:RESistance:DYNamic:L1/L2

Channel Specific Command

Description	Sets the current levels (Level 1 & 2) for CR dynamic mode. When setting the A/B value, the device will be switched to CRD mode by using this command.	
Syntax	:RESistance:DYNamic:L1/L2 <NRf+>[OHM]	
Parameter	NRf+[OHM]	Resistance
	L1 1	Sets L1 to 1 ohms.
	L2 2	Sets L2 to 2 ohms.
	L2 2A	Sets L2 to 2 ohms.
	L1/L2 MIN	Sets L1 or L2 to the minimum level for the specific channel.
	L1/L2 MAX	Sets L1 or L2 to the maximum level for the specific channel.
Example	:RES:DYN:L1 10	In CR dynamic mode, Set L1 (level 1) to 10 ohms.
Query Syntax	:RESistance:DYNamic:L1/L2?[MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Resistance
	MAX/MIN	Returns the allowable maximum and minimum
	1 unit = 1 ohm	Returns the current of L1/L2, or the maximum or minimum current allowed.
Query Example	:RES:DYN:L2? 2.0400	Returns current for the specific channel.

:RESistance:DYNamic:RISE/FALL

Channel Specific Command

Description	Sets the rising/falling slew rate for CR dynamic mode for the specific channel and range. When setting the A/B value, the device will be switched to CRD mode by using this command.	
Syntax	:RESistance:DYNamic:RISE/FALL<NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate
	RISE/FALL 0.8A/uS	Sets the rising/ falling slew rate to 0.8A/uS
	RISE/FALL 1	Sets the rising/ falling slew rate to 1A/uS
	RISE/FALL MIN	Sets to the slowest rising/ falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/ falling slew rate.
Example	:RES:DYNA:RISE 1.1	Sets the rising slew rate to 1.1A/uS.
Query Syntax	:RESistance:DYNamic:RISE/FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit =1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:RES:DYN:FALL? MIN 0.0003	Shows the minimum allowable value for the falling slew rate as 0.0003 A/uS for the specific channel.

:RESistance:DYNamic:T1/T2

Channel Specific Command

Description	Sets the timers T1 or T2 for CR dynamic mode for the specific channel and range. When setting the A/B value, the device will be switched to CRD mode by using this command.	
Syntax	:RESistance:DYNamic:T1/T2<NRf+>[S|ms]	
Parameter	<NRf+>[S]	Time
	T1/T2 0.1S	Sets the T1/T2 time to 0.1 seconds.
	T1/T2 1	Sets the T1/T2 time to 1 second.
	T1/T2 MIN	Sets the T1/T2 time to the minimum value.
	T1/T2 MAX	Sets the T1/T2 time to the maximum value.
Example	:RES:DYN:T1 .1S	Sets the T1 time to 100 milliseconds for the specific channel.
Query Syntax	:RESistance:DYNamic:T1/T2?[MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Time
	1 unit = 1 second	Returns the T1/T2 time.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:RES:DYN:T1? 2.5	Returns the T1 time of 2.5 seconds.
	:RES:DYN:T1? MIN 0.000025	Returns the minimum T1 time allowable for the specific channel and range.

:RESistance:DYNamic:LOW:L1/L2

Channel Specific Command

Description	Sets the low range resistance levels (Level 1 & 2) for CR dynamic mode.	
Syntax	:RESistance:DYNamic:LOW:L1/L2 <NRf+>[OHM]	
Parameter	NRf+[OHM]	Ohms
	L1 10	Sets L1 to 10 ohms. (low range only)
	L2 20OHM	Sets L2 to 20 ohms. (low range only)
	L1/L2 MIN	Sets L1 or L2 to the minimum level for the specific channel.
	L1/L2 MAX	Sets L1 or L2 to the maximum level for the specific channel.
Example	:RES:DYN:LOW:L1 10	In low range CR dynamic mode, Set L1 (level 1) to 10 ohms.
Query Syntax	:RESistance:DYNamic:LOW:L1/L2?[MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Resistance
	1 unit = 1 ohm	Returns the resistance of L1/L2.
Query Example	:RES:DYN:LOW:L2? MAX 300	Returns the maximum resistance allowed for the channel. (PEL-2020A)

:RESistance:DYNamic:LOW:RISE/FALL

Channel Specific Command

Description	Sets the low range rising/falling slew rate for CR dynamic mode for the specific channel.	
Syntax	:RESistance:DYNamic:LOW:RISE/FALL <NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate

	RISE/FALL 0.8A/uS	Sets the rising/falling slew rate to 0.8A/uS
	RISE/FALL .1	Sets the rising/falling slew rate to 0.1A/uS
	RISE/FALL MIN	Sets to the slowest rising/falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/falling slew rate.
Example	:RES:DYNA:LOW:RISE 0.1	Sets the rising slew rate to ~ 0.1A/uS.
Query Syntax	:RESistance:DYNamic:LOW:RISE/FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit =1 amp/uS	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:RES:DYN:LOW:FALL? MIN 0.8000	For low range dynamic CR mode, the minimum value for the falling slew rate is 0.8 A/uS for the specific channel.

:RESistance:DYNamic:LOW:T1/T2

Channel Specific Command

Description	Sets the timers T1 or T2 for CR dynamic mode for the specific channel in low range.	
Syntax	:RESistance:DYNamic:LOW:T1/T2<NRf+>[S|ms]	
Parameter	<NRf+>[S]	Time T1/T2
	T1/T2 0.1S	Sets the T1/T2 time to 0.1 seconds.
	T1/T2 1	Sets the T1/T2 time to 1 second.
	T1/T2 MIN	Sets the T1/T2 time to the minimum value.

	T1/T2 MAX	Sets the T1/T2 time to the maximum value.
Example	:RES:DYNA:LOW:T1 10S	Sets the T1 time to 10 seconds for the specific channel.
Query Syntax	:RESistance:DYNamic:T1/T2? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Time T1/T2
	1 Unit =1 second	Returns T1/T2 time.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:RES:DYN:LOW:T1? 2.5	Returns the T1 time of 2.5 seconds.
	:CURR:DYN:LOW:T1? MIN 0.000025	Returns the minimum T1 time allowable for the specific channel.

:RESistance:DYNamic:HIGH:L1/L2

Channel Specific Command

Description	Sets the high range resistance levels (Level 1 & 2) for CR dynamic mode.	
Syntax	:RESistance:DYNamic:HIGH:L1/L2 <NRf+>[OHM]	
Parameter	NRf+[OHM]	Resistance
	L1 10	Sets L1 to 10 ohms. (high range only)
	L2 20OHM	Sets L2 to 20 ohms. (high range only)
	L1/L2 MIN	Sets L1 or L2 to the minimum level for the specific channel.
	L1/L2 MAX	Sets L1 or L2 to the maximum level for the specific channel.

Example	:RES:DYN:HIGH:L1 10	In high range CR dynamic mode, Set L1 (level 1) to 10 ohms.
Query Syntax	:RESistance:DYNamic:HIGH:L1/L2? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Resistance
	1 unit = 1 ohm	Returns the resistance of Level 1/ 2 (L1/L2).
Query Example	:RES:DYN:HIGH:L2? MAX 15000.0	Returns the maximum resistance allowed for the channel. (PEL-2020B)

:RESistance:DYNamic:HIGH:RISE/FALL

Channel Specific Command

Description	Sets the high range rising/falling slew rate for CR dynamic mode for the specific channel.	
Syntax	:RESistance:DYNamic:HIGH:RISE/FALL <NRf+>[A/uS]	
Parameter	<NRf+>[A/uS]	Slew Rate
	RISE/FALL 0.8A/uS	Sets the rising/falling slew rate to 0.8A/uS
	RISE/FALL 1	Sets the rising/falling slew rate to 1A/uS
	RISE/FALL MIN	Sets to the slowest rising/falling slew rate.
	RISE/FALL MAX	Sets to the fastest rising/falling slew rate.
Example	:RES:DYN:HIGH:RISE 1.1	Sets the rising slew rate to 1.1A/uS.
Query Syntax	:RESistance:DYNamic:HIGH:FALL? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	Slew rate
	1 Unit =1 amp/uS	Returns the slew rate.

	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:RES:DYN:HIGH:FALL? MAX 0.8000	For high range dynamic CR mode, the minimum value for the falling slew rate is 0.8 A/uS for the specific channel.

:RESistance:DYNamic:HIGH:T1/T2

Channel Specific Command

Description	Sets the timers T1 and T2 for high range dynamic CR mode.	
Syntax	:RESistance:DYNamic:HIGH:T1/T2 <NRf+>[S|ms]	
Parameter	<NRf+>[S]	Timer T1/T2
	T1/T2 0.1S	Sets the T1/T2 time to 0.1 seconds.
	T1/T2 1	Sets the T1/T2 time to 1 second.
	T1/T2 MIN	Sets the T1/T2 time to the minimum value.
	T1/T2 MAX	Sets the T1/T2 time to the maximum value.
Example	:RES:DYNA:HIGH:T1 10S	Sets the high range T1 time to 10 seconds for the specific channel.
Query Syntax	:RESistance:DYNamic:HIGH:T1/T2? [MIN|MAX]	
Return Parameter	<NR2> [MAX|MIN]	T1/T2 time.
	1 Unit =1 second	Returns T1/T2 time.
	MAX/MIN	Returns the allowable maximum and minimum.

Query Example	:RES:DYN:HIGH:T1? 2.5	Returns the T1 time of 2.5 seconds.
	:RES:DYN:LOW:T1? MIN 0.000025	Returns the minimum T1 time allowable for the specific channel.

RUN Subsystem

:RUN

All Channel Command

Description	Turns on all the electronic loads.	
Syntax	:RUN	
Example	:RUN	Turns on all electronic loads.

SHOW Subsystem

:SHOW[:DISPlay] dual channel

Channel Specific Command

(Dual channel module)

Description	Sets the display mode of the load module of the specific channel.	
Syntax	:SHOW:DISPlay {LVI|LVW|LIW|RVI|RVW|RIW|LRV|LRI|LRW|LRS|LIRV|LVRI}	
Parameter	LVI	Left channel, voltage/current
	LVW	Left channel, voltage/power
	LIW	Left channel, current/power
	RVI	Right channel, voltage/current
	RVW	Right channel, voltage/power
	RIW	Right channel, current/power
	LRV	Left and right channel voltage
	LRI	Left and right channel current
	LRW	Left and right channel power
	LRS	Left and right channel load on time
	LIRV	Left channel current, right channel voltage
	LVRI	Left channel voltage, right channel current
Example	:SHOW:DISP LVI	Show the left channel voltage and current on the load module display.

:SHOW[:DISPlay] single channel

Channel Specific Command

(Single channel module)

Description	Sets the display mode of the load module of the specific channel.
Syntax	:SHOW:DISPlay {VI|VW|IW|S}
Parameter	VI Voltage/current VW Voltage/power IW Current/power S Load on time
Example	:SHOW:DISP VI Shows voltage and current on the load module display.

SPECIFICATION Subsystem

:SPECification:UNIT

Channel Specific Command

Description	Sets the Go/NoGo (specification) units as percentages or values.	
Syntax	:SPECification:UNIT {PERCENT|0|VALUE|1}	
Parameter	PERCENT/0	Percentages
	VALUE/1	Values
Example	:SPEC:UNIT PERCENT	Sets the Go/NoGo limits as percentages
Query Syntax	:SPECification:UNIT? <NR1>	
Return Parameter	<NR1>	Go/NoGo Unit
	0	Percent
	1	Value
Query Example	:SPEC:UNIT? 0	The Go/NoGo (specification) units are set as percent.

:SPECification[:PASS]?

Channel Specific Command

Description	Displays if the Go/NoGo (specification) limit has passed/failed for the current channel used.	
Query Syntax	:SPECification[:PASS]?	
Return Parameter	<NR1>	Go/NoGo Specification
	0	Fail
	1	Pass
Query Example	:SPEC:PASS? 0	Go/NoGo has failed
Query Example	:SPEC? 0	Go/NoGo has failed

:SPECification[:PASS]:CHANnel/ ALLChannel/VOLTage/CURRent?

Channel Specific Command

Description	Queries if the voltage, current, current channel or all channels have passed/failed the Go/NoGo (specification) limits. VOLTage→CC, CR mode, CURRent→CV, CP mode	
Query Syntax	:SPECification[:PASS]:CHANnel/ALLChannel/VOLTage/CURRent?	
Return Parameter	<NR1>	Go/NoGo Specification
	0	Fail
	1	Pass
Query Example	:SPEC:PASS:VOLT? 0	The test has exceeded the Go/NoGo voltage limits.
Query Example	:SPEC:VOLT? 0	The test has exceeded the Go/NoGo voltage limits.

:SPECification:VOLTage:H/L/C

Channel Specific Command

Description	Sets the high (H), low (L) and center (C) Go/NoGo voltage limit specifications. Applicable to CC and CR mode only. The high (H) setting value must be greater than or equal to center (C) and the center (C) setting value will be greater than or equal to low (L).	
Syntax	:SPECification:VOLTage:{H|L|C}<NRf+>[V]	
Parameter	<NRf+>[V] 1 unit = 1 volt	Go/NoGo voltage limit
	1	1 volt
	1V	1 volt
Example	:SPEC:VOLT:H 2V	Sets the Go/NoGo high voltage limit to 2 volts.
Query Syntax	:SPECification:VOLTage:{H|L|C}?	
Return Parameter	<NR2>	Go/NoGo voltage
	1 unit = 1 volt	Returns the limit voltage
Query Example	:SPEC:VOLT:H?	The voltage limit is 2 volts.
	2.000	

:SPECification:CURRent:H/L/C

Channel Specific Command

Description	Sets the high (H), low(L) and center (C) Go/NoGo current limit specifications. Applicable to CV and CP mode only. The high (H) setting value must be greater than or equal to center (C) and the center (C) setting value will be greater than or equal to low (L).	
Syntax	:SPECification:CURRent:{H|L|C}<NRf+>[A]	
Parameter	<NRf+>[A] 1 unit = 1 amp	Go/NoGo current limit
	1	1 amp
	1A	1 amp

Example	:SPEC:CURR:H 1A	Sets the Go/NoGo high current limit to 1 amp.
Query Syntax	:SPECification:CURRent:{H|L|C}?	
Return Parameter	<NR2>	Go/NoGo voltage
	1 unit = 1 amp	Returns the limit current
Query Example	:SPEC:CURR:H? 5.120	The current limit is 5.12 amps.

:SPECification:TEST:

Channel Specific Command

Description	Turns the Go/NoGo specification (SPEC) limits on/off.	
Syntax	:SPECification:TEST {OFF|0|ON|1}	
Parameter	OFF/0	OFF
	ON/1	ON
Example	:SPEC:TEST OFF	Turn Go/NoGo SPEC off for the specific channel.
Query Syntax	:SPECification:TEST?	
Return Parameter	<NR1>	Go/NoGo SPEC status
	0	Off
	1	On
Query Example	:SPEC:TEST? 1	Go/NoGo SPEC limits is on.

:SPECification:DELay

Channel Specific Command

Description	It is “Delay Time” setting and query commands.	
Syntax	:SPECification:DELay <NR2>[S]	
Parameter	<NR2>[S]	Time
	5	Set Delay time to 5 seconds.

Example	:SPECification:DELay 0.5	Set Delay time to 0.5 seconds.
Query Syntax	:SPECification:DELay?	
Return Parameter	<NR2>[S]	Time
	1unit =1 second	Set Delay time to 1 second.
Query Example	:SPECification:DELay? 1	Returns the delay time in seconds.

STATUS Subsystem

:STATus:CHANnel:CONDition?

Channel Specific Command

Description	Returns the status of the Channel Status Condition Register. The returned value is the bit weight of the Channel Status Condition Register. See page 189 for details.			
Query Syntax	:STATus:CHANnel:CONDition?<NR1>			
Return Parameter	<NR1>	Condition	<NR1>	Condition
	1	OC	16	OT
	2	OV	32	G/N
	4	OP	64	UVP
	8	RV	128~65535	Not Used
Query Example	:STAT:CHAN:COND? 3		Indicates OC and OV conditions are true.	

:STATus:CHANnel:ENABle

Channel Specific Command

Description	Sets which events are enabled in the Channel Status Enable register. The mask values are the bit weights of the Channel Status Enable Register. See page 189 for details.
Syntax	:STATus:CHANnel:ENABle <NR1>

Parameter

<NR1>	Event	<NR1>	Event
1	OC	16	OT
2	OV	32	G/N
4	OP	64	UVP
8	RV	128~65535	Not Used

Example	:STAT:CHAN:ENAB 12	Events OP (Bit 3) and RV (Bit 4) are enabled in the Channel Status Enable register.
Query Syntax	:STATus:CHANnel:ENABle? <NR1>	

Return Parameter

<NR1>	Event	<NR1>	Event
1	OC	16	OT
2	OV	32	G/N
4	OP	64	UVP
8	RV	128~65535	Not Used

Query Example	:STAT:CHAN:ENAB? 4	The OP event is enabled.

:STATus:CHANnel:EVENt?

Channel Specific Command

Description	Returns the status of the Channel Status Event register for the specific channel. The Channel Status Event register is cleared upon reading.
Query Syntax	:STATus:CHANnel:EVENt? <NR1>

Return Parameter	<NR1>	Event	<NR1>	Event
	1	OC	16	OT
	2	OV	32	G/N
	4	OP	64	UVP
	8	RV	128~65535	Not Used

Query Example	:STAT:CHAN:EVEN? 1	An over current (OC) event occurred since the last time the Channel Status Event register was read.

:STATus:CHANnel:NTRansition/ PTRansition

Channel Specific Command

Description	Determines whether a negative transition (NTR 1→0) or positive (PTR 0→1) transition in the Channel Status Condition register will set the corresponding event in the Channel Status Event register. The mask values are the bit weights of the Channel Status PTR/NTR filters. See page 189 for details.
Syntax	:STATus:CHANnel:NTRansition/PTRansition<NR1>

Parameter	<NR1>	Condition	<NR1>	Condition
	1	OC	16	OT
	2	OV	32	G/N
	4	OP	64	UVP
	8	RV	128~65535	Not Used

Example	:STAT:CHAN:NTR 12	OP (Bit 3) and RV (Bit 4) are set as negative transitions.
	:STAT:CHAN:PTR 1	OC (Bit 1) is set as a positive transition.

Query Syntax	:STATus:CHANnel:NTRansition/PTRansition?<NR1>			
Return Parameter	<NR1>	Event	<NR1>	Event
	1	OC	16	OT
	2	OV	32	G/N
	4	OP	64	UVP
	8	RV	128~65535	Not Used
Query Example	:STAT:CHAN:NTR? 4		OP is set as a negative transition.	

:STATus:CSUMmary:ENABle

Channel Specific Command

Description	Determines which channels in the Channel Summary Register group can set the CSUM bit of the Status Byte Register. The mask values are the bit weights of each corresponding channel in the Channel Summary Enable Register. See page 191 for details.			
Syntax	:STATus:CSUMmary:ENABle <NR1>			
Parameter	<NR1>	Event	<NR1>	Event
	1	CH1	16	CH5
	2	CH2	32	CH6
	4	CH3	64	CH7
	8	CH4	128	CH8
Example	:STAT:CSUM: 3		Events from channel 1 and 2 are enabled	
Query Syntax	:STATus:CSUMmary:ENABle? <NR1>			
Return Parameter	<NR1>	Event	<NR1>	Event
	1	CH1	16	CH5
	2	CH2	32	CH6
	4	CH3	64	CH7
	8	CH4	128	CH8

Query Example	:STAT:CSUM:ENAB? 4	Only the events from channel 3 can set the CSUM bit in the Status Byte Register.

:STATus:CSUMmary:EVENt?

Channel Specific Command

Description	Returns the status of the Channel Summary Event register. The Channel Summary Event register is cleared upon reading.
Query Syntax	:STATus:CSUMmary:EVENt? <NR1>

Return Parameter

<NR1>	Event	<NR1>	Event
1	CH1	16	CH5
2	CH2	32	CH6
4	CH3	64	CH7
8	CH4	128	CH8

Query Example	:STAT:CSUM:EVEN? 4	An event from channel 3 occurred since the last time the Channel Summary Event register was read.

:STATus:QUEStionable:CONDition?

Channel Specific Command

Description	Returns the status of the Questionable Status Condition register for the specific channel. See page 191 for details.
Query Syntax	:STATus:QUEStionable:CONDition? <NR1>

Return Parameter

<NR1>	Condition	<NR1>	Condition
1	OC	16	OT
2	OV	32	G/N
4	OP	64	UVP
8	RV	128~65535	Not used

Query Example	:STAT:QUES:COND? 2	OV (overvoltage) error.

:STATus:QUEStionable:ENABle

Channel Specific Command

Description	Sets which events are enabled in the Questionable Status Enable register. The mask values are the bit weights of the events. See page 191 for details.
Syntax	:STATus:QUEStionable:ENABle <NR1>

Parameter

<NR1>	Event	<NR1>	Event
1	OC	16	OT
2	OV	32	G/N
4	OP	64	UVP
8	RV	128~65535	Not used

Example	:STAT:QUES:ENAB 12	Events OP (Bit 3) and RV (Bit 4) are enabled in the Questionable Status Enable register.
Query Syntax	:STATus:QUEStionable:ENABle? <NR1>	

Return Parameter

<NR1>	Event	<NR1>	Event
1	OC	16	OT
2	OV	32	G/N
4	OP	64	UVP
8	RV	128~65535	Not used

Query Example	:STAT:QUES:ENAB? 4	The OP event is enabled.

:STATus:QUEStionable[:EVENt]?

Channel Specific Command

Description	Returns the status of the Questionable Status Event register. The Questionable Status Event register is cleared upon reading.

Query Syntax	:STATus:QUEStionable[:EVENt]? <NR1>			
Return Parameter	<NR1>	Event	<NR1>	Event
	1	OC	16	OT
	2	OV	32	G/N
	4	OP	64	UVP
	8	RV	128~65535	Not used
Query Example	:STAT:QUES:EVEN? 1		An over current (OC) event occurred since the last time the Questionable Status Event register was read.	

:STATus:QUEStionable:NTRansition/PTRansition

Channel Specific Command

Description	Determines whether a negative transition (NTR 1→0) or positive (PTR 0→1) transition in the Questionable Status Condition register will set the corresponding event in the Questionable Status Event register. The mask values are the bit weights of the Questionable Status PTR/NTR filters. See page 191 for details.			
Syntax	:STATus:QUEStionable:NTRansition/PTRansition <NR1>			
Parameter	<NR1>	Condition	<NR1>	Condition
	1	OC	16	OT
	2	OV	32	G/N
	4	OP	64	UVP
	8	RV	128~65535	Not used
Example	:STAT:QUES:NTR 5		OC (Bit 1) and OP (Bit 3) are set as negative transitions.	

	:STAT:CHAN:PTR 2	OV (Bit 2) is set as a positive transition.
Query Syntax	:STATus:QUEStionable:NTRansition/PTRansition? <NR1>	

Return Parameter	<NR1>	Event	<NR1>	Event
	1	OC	16	OT
	2	OV	32	G/N
	4	OP	64	UVP
	8	RV	128~65535	Not used

Query Example	:STAT:QUES:NTR? 4	Returns which conditions (OP) have negative transitions.

:STATus:PREset

Channel Specific Command

Description	The status preset command resets the Enable registers and NTR/PTR registers from the Channel Status and Questionable Status Register groups.

Preset	Register	Preset
	Channel Status Enable	All bits set to 1
	Channel Status PTR	All bits set to 1
	Channel Status NTR	All bits set to 0
	Questionable Status Enable	All bits set to 0
	Questionable Status PTR	All bits set to 1
	Questionable Status NTR	All bits set to 0

Syntax	:STATus:PREset
Example	:STAT:PRE

Voltage Subsystem

:VOLTage:L1/L2

Channel Specific Command

Description	Sets the voltage of A Value or B Value in CV mode, where L1 is A Value and L2 is B Value. When setting the A/B value, the device will be switched to CV mode by using this command.	
Syntax	:VOLTage:L1/L2<NRf+>[V]	
Parameter	<NRf+>[V]	Voltage
	10	10 volts
	10V	10 volts
	MIN	Sets the voltage to the minimum value for the channel
	MAX	Sets the voltage to the maximum value for the channel
Example	:VOLT:L1 10V	Sets A Value to 10 volts for the specific channel
	:VOLT:L2 MAX	Sets B Value to the maximum allowed voltage for the specific channel.
Query Syntax	:VOLTage:L1/L2? [MAX|MIN]	

Return Parameter	<NR2> 1 unit = 1 volt	Voltage
	10	Returns the voltage of the specific channel.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:VOLT:L1? 5	A Value is set to 5 volts.
	:VOLT:L1? MAX 81.6000	Returns the maximum settable voltage.

:VOLTage:RECall

Channel Specific Command

Description	Sets or queries whether A Value or B Value is the currently active value in CV mode.	
Syntax	:VOLTage:RECall {A|0|B|1}	
Parameter	A/0	A
	B/1	B
Example	:VOLT:REC 1	Makes B Value the active value.
Query Syntax	:VOLTage:RECall?	
Return Parameter	<NR1>	Value
	0	A
	1	B

:VOLTage:AVALue/BVALue

Channel Specific Command

Description	Sets the voltage of A Value or B Value in CV mode. When setting the A/B value, the device will be switched to CV mode by using this command.	
Syntax	:VOLTage:AVALue/BVALue<NRf+>[V]	
Parameter	<NRf+>[V]	Voltage
	10	10 volts

	10V	10 volts
	MIN	Sets the voltage to the minimum value for the channel
	MAX	Sets the voltage to the maximum value for the channel
Example	:VOLT:AVAL 10V	Sets A Value to 10 volts for the specific channel
	:VOLT:BVAL MAX	Sets B Value to the maximum allowed voltage for the specific channel. (single channel only)
Query Syntax	:VOLTage:AVALue/BVALue? [MAX|MIN]	
Return Parameter	<NR2> 1 unit = 1 volt	Voltage
	10	Returns the voltage of the specific channel.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:VOLT:AVAL? 5	A Value is set to 5 volts.
	:VOLT:AVAL? MAX 81.6000	Returns the maximum settable voltage.

:VOLTage:LOW:CURRent

Channel Specific Command

Description	Sets the current limit in CV mode. When setting the A/B value, the device will be switched to CV mode by using this command.	
Syntax	:VOLTage:LOW:CURRent<NRf+>[A]	
Parameter	<NRf+>[A]	Current limit
	1	1 Amp
	1A	1 Amp
	MIN	Sets the current limit to the minimum value for the channel

	MAX	Sets the current limit to the maximum value for the channel
Example	:VOLT:LOW:CURR 1A	Sets the current limit to 1 Amp for the specific channel.
	:VOLT:LOW:CURR MAX	Sets the current limit to the maximum limit for the specific channel.
Query Syntax	:VOLTage:LOW:CURRent? [MAX|MIN]	
Return Parameter	<NR2> 1 unit = 1 amp	Current limit
	1	Returns the current limit of the specific channel.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:VOLT:LOW:CURR? 5	The current limit is 5 amps for the specific channel.

:VOLTage:HIGH:CURRent

Channel Specific Command

Description	Sets the current limit in CV mode. When setting the A/B value, the device will be switched to CV mode by using this command.	
Syntax	:VOLTage:HIGH:CURRent<NRf+>[A]	
Parameter	<NRf+>[A]	Current limit
	1	1 Amp
	1A	1 Amp
	MIN	Sets the current limit to the minimum value for the channel
	MAX	Sets the current limit to the maximum value for the channel
Example	:VOLT:HIGH:CURR 1A	Sets the current limit to 1 Amp for the specific channel.

	:VOLT:HIGH:CURR MAX	Sets the current limit to the maximum limit for the specific channel.
Query Syntax	:VOLTage:HIGH:CURRent? [MAX|MIN]	
Return Parameter	<NR2> 1 unit = 1 amp	Current limit
	1	Returns the current limit of the specific channel.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:VOLT:HIGH:CURR? 5	The current limit is 5 amps for the specific channel.

:VOLTage:MODE

Channel Specific Command

Description	Set the constant voltage response time for the specific channel.	
Syntax	:VOLTage:MODE {SLOW|0|FAST|1}	
Parameter	SLOW/0	Slow response time for PEL-2000A
	FAST/1	Fast response time for PEL-2000A/B
	SLOW2	Slow1 response time for PEL-2000B
	SLOW3	Slow2 response time for PEL-2000B
	SLOW4	Slow3 response time for PEL-2000B
Example	:VOLT:MODE SLOW	Sets the response time to SLOW for the specific channel.
	:VOLT:MODE 1	Sets the response time to FAST for the specific channel.
Query Syntax	:VOLTage:MODE? <NR1>	
Return Parameter	<NR1>	Response Time
	0	Slow
	1	Fast

Query Example	:VOLT:MODE? 0	The specific channel is set to SLOW response time.

:VOLTage:LOW:AVALue/BVALue

Channel Specific Command

Description	Sets the low voltage A/B value for constant voltage mode.	
Syntax	:VOLTage:LOW:AVALue/BVALue<NRf+>[V]	
Parameter	<NRf+>[V]	
	AVALue 1	Sets A Value to 1 volt.
	BVALue 1V	Sets B Value to 1 volt.
	AVALue MIN	Sets A Value to the minimum level for the specific channel.
	AVALue MAX	Sets A Value to the maximum level for the specific channel.
Example	:VOLTage:LOW:AVAL 1	Sets A Value to 1 volts for the specific channel
Query Syntax	:VOLTage:LOW:AVALue/BVALue? [MAX|MIN]	
Return Parameter	<NR2> [MAX/MIN]	Current
	1 unit = 1 volt	Returns the voltage of the A or B Value.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:VOLTage:LOW:BVAL? MAX 5	Returns the maximum voltage allowed for the channel/range.

:VOLTage:HIGH:AVALue/BVALue

Channel Specific Command

Description	Sets the high voltage A/B value for constant voltage mode.

Syntax	:VOLTage:HIGH:AVALue/BVALue<NRf+>[V]	
Parameter	<NRf+>[V]	
	AVALue 1	Sets A Value to 1 volt.
	BVALue 1V	Sets B Value to 1 volt.
	AVALue MIN	Sets A Value to the minimum level for the specific channel.
	AVALue MAX	Sets A Value to the maximum level for the specific channel.
Example	:VOLTage:HIGH:AVAL 1	Sets A Value to 1 volts for the specific channel
Query Syntax	:VOLTage:HIGH:AVALue/BVALue?[MAX|MIN]	
Return Parameter	<NR2> [MAX/MIN]	Current
	1 unit = 1 volt	Returns the voltage of the A or B Value.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:VOLTage:HIGH:BVAL? MAX 2	Returns the maximum voltage allowed for the channel/range.

:VOLTage:IMEasure

Channel Specific Command

Description	Sets the current measurement range of constant voltage mode for the specific channel.	
Syntax	:VOLTage:IMEasure{L|0|H|1}	
Parameter	L/0	Low range of current measurement.
	H/1	High range of current measurement.
Example	:VOLTage:IME L	Sets the current measurement range to Low for the specific channel.

	:VOLTage:IME 1	Sets the current measurement range to High for the specific channel.
Query Syntax	:VOLTage:IMEasure?<NR1>	
Return Parameter	<NR1>	The current measurement range of constant voltage mode for the specific channel.
	0	Low
	1	High
Query Example	:VOLT:IME? 0	The specific channel is set to low range for current measurement.

Power Subsystem

:POWer:L1/L2

Channel Specific Command

Description	Sets the A/B Value for constant power mode, where L1 is A Value and L2 is B Value. The command is range dependent. If the current range is Low, then the command will only apply to the low range settings. When setting the A/B value, the device will be switched to CP mode by using this command.	
Syntax	:POWer:L1|L2 <NRf+>[W]	
Parameter	<NRf+>[W]	
	L1 1	Sets A Value to 1 Watt.
	L2 2	Sets B Value to 2 Watts.
	L1 1W	Sets A Value to 1 Watt.
	L1 MIN	Sets A Value to the minimum level for the specific channel.
	L1 MAX	Sets A Value to the maximum Level for the specific channel.
Example	:POW:L1 1	Sets A Value to 1 watt
Query Syntax	:POW:L1?/L2? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Current

	1 unit = 1 watt	Returns the power of the A Value (L1) or B Value (L2).
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:POW:L2? MAX 357.000	Returns the maximum power allowed for the channel. (PEL-2040B)

:POWer:CURRent

Channel Specific Command

Description	Sets the current limit for constant power mode. The command is range dependent. If the current range is Low, then the command will only apply to the low range settings. When setting the A/B value, the device will be switched to CP mode by using this command.	
Syntax	:POWer:CURRent<NRf+>[A]	
Parameter	<NRf+>[A]	
	1	Sets the current limit to 1A.
	1A	Sets the current limit to 1A.
	MIN	Sets the current limit to the minimum level for the specific channel.
	MAX	Sets the current limit to the maximum level for the specific channel.
Example	:POW:CURR 1	Sets the current limit to 1A.
Query Syntax	:POW:CURRent? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Current
	1 unit = 1 amp	Returns the current limit.
	MAX/MIN	Returns the allowable maximum and minimum.

Query Example	:POW:CURR? 7.0	Returns the current limit for the specific channel.

:POWer:RECall

Channel Specific Command

Description	Sets or queries whether A Value or B Value is the currently active value in CP mode.	
Syntax	:POWer:RECall {A|0|B|1}	
Parameter	A/0, B/1	Value
	A/0	A
	B/1	B
Example	:POW:REC 1	Makes B Value the active value.
Query Syntax	:POWer:RECall?	
Return Parameter	<NR1>	Value
	0	A
	1	B
Query Example	:POW:REC? 0	A Value is active.

:POWer:LOW:AVALue/BVALue

Channel Specific Command

Description	Sets the low range A/B Value for constant power mode.	
Syntax	:POWer:LOW:AVALue/BVALue<NRf+>[W]	
Parameter	NRf+[W]	
	AVALue 1	Sets A Value to 1 watt.
	BVALue 1W	Sets B Value to 1 watt.
	AVALue MIN	Sets A Value to the minimum level for the specific channel.
	AVALue MAX	Sets A Value to the maximum Level for the specific channel.

Example	:POWer:LOW:AVAL 1	Sets A Value to 1 watt for the low range.
Query Syntax	:POWer:LOW:AVALue/BVALue? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Current
	1 unit = 1 watt	Returns the power of the A or B Value.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:POWer:LOW:BVAL? MAX 2	Returns the maximum power allowed for the channel/range.

:POWer:LOW:CURRent

Channel Specific Command

Description	Sets the current limit for constant power mode for the low range only.	
Syntax	:POWer:LOW:CURRent <NRf+>[A]	
Parameter	<NRf+>[A]	
	1	Sets the current limit to 1A.
	1A	Sets the current limit to 1A.
	MIN	Sets the current limit to the minimum level for the specific channel.
	MAX	Sets the current limit to the maximum level for the specific channel.
Example	:POW:CURR 1	Sets the current limit to 1A.
Query Syntax	:POW:LOW:CURRent? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Current
	1 unit = 1 amp	Returns the current limit.
	MAX/MIN	Returns the allowable maximum and minimum.

Query Example	:POW:LOW:CURR? 7.0	Returns the current limit for the specific channel.

:POWer:HIGH:AVALue/BVALue

Channel Specific Command

Description	Sets the high range A/B Value for constant power mode.	
Syntax	:POWer:HIGH:AVALue/BVALue<NRf+>[W]	
Parameter	NRf+[W]	
	AVALue 1	Sets A Value to 1 watt.
	BVALue 1W	Sets B Value to 1 watt.
	AVALue MIN	Sets A Value to the minimum level for the specific channel.
	AVALue MAX	Sets A Value to the maximum Level for the specific channel.
Example	:POWer:HIGH:AVAL 1	Sets A Value to 1 watt for the high range.
Query Syntax	:POWer:LOW:AVALue/BVALue? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Current
	1 unit = 1 watt	Returns the power of the A or B Value.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:POWer:HIGH:BVAL? MAX 2	Returns the maximum power allowed for the channel/range.

:POWer:HIGH:CURRent

Channel Specific Command

Description	Sets the current limit for constant power mode for the high range only.
Syntax	:POWer:HIGH:CURRent<NRf+>[A]

Parameter	<NRf+>[A]	
	1	Sets the current limit to 1A.
	1A	Sets the current limit to 1A.
	MIN	Sets the current limit to the minimum level for the specific channel.
	MAX	Sets the current limit to the maximum level for the specific channel.
Example	:POW:HIGH:CURR 1	Sets the current limit to 1A.
Query Syntax	:POW:HIGH:CURRent? [MAX|MIN]	
Return Parameter	<NR2> [MAX|MIN]	Current
	1 unit = 1 amp	Returns the current limit.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:POW:HIGH:CURR? 7.0	Returns the current limit for the specific channel.

SYSTEM Subsystem

:SYSTem:ERRor? System Command

Description	The System Error command returns all the system errors. Please see the Error codes section for a full description. (page 164)	
Query Syntax	:SYSTem:ERRor?	
Return Parameter	<character string> $\underbrace{-102,}_{1}\ \underbrace{\text{"Syntax error"}}_{2}$	Error 1 Error code number 2 Error code description
Query Example	:SYST:ERR? -102, "Syntax error"	Returns the next error in the Error Queue.

:SYSTem:VERSion? System Command

Description	The system version command returns the SCPI version: year and SCPI version of that year.	
Query Syntax	:SYSTem:VERSion?	
Return Parameter	<NRf> 2008.0	Year/ version

:SYSTem:SETup

System Command

Description	Sets or returns the system setup for the current settings using block data. See the command syntax on page 19 for more details.	
Syntax	:SYSTem:SETup <block data>	
Parameter	<block data>	System setup data
Example	:SYST:SET <block data>	Loads the system setup using block data.
Query Syntax	:SYSTem:SETup?	
Return Parameter	<block data>	Returns the system setup as block data.
Query Example	:SYST:SET? #<digits><byte count><data><NL>	Returns the system settings as block data.

:SYSTem:KLOCk?

System Command

Description	Enables or disables the front panel key lock.	
Syntax	:SYSTem:KLOCk{OFF|ON|0|1}	
Query Syntax	:SYSTem:KLOCk?	
Parameter	0/OFF	Panel keys are unlocked.
	1/ON	Panel keys are locked.
Return Parameter	0	<Boolean> Panel keys are unlocked.
	1	<Boolean> Panel keys are locked.

:SYSTem:KEYLock:MODE? System Command

Description	Set or queries the key lock mode.	
Syntax	:SYSTem:KEYLock:MODE{0|1}	
Query Syntax	:SYSTem:KEYLock:MODE?	
Parameter/Return Parameter	0	Panel lock: allow load off.
	1	Panel lock: allow load on/off.

Memory Subsystem

:MEMory:SAVE:PREset

Channel Specific Command

Description	Saves preset data for the specific channel to internal memory slots P0~P9.	
Syntax	:MEMory:SAVE:PREset: <NR1>	
Parameter	<NR1>	Preset no.
	0~9	P0~P9
Example	:MEM:SAVE:PRE 0	Saves the preset settings to (P0).

:MEMory:SAVE:PROGram

Channel Specific Command

Description	Saves the specific channel into memory.	
Syntax	:MEMory:SAVE:PROGram<NR1>	
Parameter	<NR1>	Memory number
	001~120	M001~M120

Example	:MEM:SAVE:PROG 100	Saves the channel to Memory M100.

:MEMory:SAVE:ALLPreset

All Channels

Description	Saves preset data to internal memory for all channels.	
Syntax	:MEMory:SAVE:ALLPreset: <NR1>	
Parameter	<NR1>	Preset no.
	0~9	P0~P9
Example	:MEM:SAVE:ALLP 0	Saves the preset settings to (P0) for all channels.

:MEMory:SAVE:SETup

All Channels

Description	Saves setup data for all channels to internal memory slots S1~S4.	
Syntax	:MEMory:SAVE:SETup: <NR1>	
Parameter	<NR1>	Setup data
	1~4	S1~S4
Example	:MEM:SAVE:SET 1	Saves the setup data to S1 (applicable to all channels).

:MEMory:RECall:PREset

Channel Specific Command

Description	Recalls preset data for the specific channel from internal memory slots P0~P9.	
Syntax	:MEMory:RECall:PREset: <NR1>	
Parameter	<NR1>	Preset no.
	0~9	P0~P9

Example	:MEM:REC:PRE 0	Recalls the preset settings from (P0).

:MEMory:RECall:PROGram

Channel Specific Command

Description	Recalls memory data to the current channel.	
Syntax	:MEMory:RECall:PROGram <NR1>	
Parameter	<NR1>	Memory number
	001~120	M001~M120
Example	:MEM:REC:PROG 100	Recalls the memory M100 for the current channel.

:MEMory:RECall:ALLPreset

All Channels

Description	Recalls preset data from internal memory for all channels.	
Syntax	:MEMory:RECall:ALLPreset: <NR1>	
Parameter	<NR1>	Preset no.
	0~9	P0~P9
Example	:MEM:REC:ALLP 0	Recalls the preset settings from (P0) for all channels.

:MEMory:RECall:SETup

All Channels

Description	Recalls setup data for all channels from internal memory slots S1~S4.	
Syntax	:MEMory:RECall:SETup: <NR1>	
Parameter	<NR1>	Setup data
	1~4	S1~S4
Example	:MEM:REC:SET 1	Recalls the setup data from S1 (applicable to all channels).

Example	:MEM:REC:1	Recalls memory data S1 to the current channel.

:MEMory:FILE:PRESet

System Command

Description	Sets or returns the preset settings using block data. See the command syntax on page 19 for more details on block data.	
Syntax	:MEMory:FILE:PREset <block data>	
Parameter	<block data>	Preset data
Example	:MEM:FILE:PRE <block data>	Loads the preset settings block data.
Query Syntax	:MEMory:FILE:PREset?	
Return Parameter	<block data>	Returns the preset settings as block data.
Query Example	:MEM:FILE:PRE? #<digits><byte count><data><NL>	Returns the preset settings as block data.

:MEMory:FILE:PROGram

System Command

Description	Sets or returns the program data using block data. See the command syntax on page 19 for more details on block data.	
Syntax	:MEMory:FILE:PROGram <block data>	
Parameter	<block data>	Program data
Example	:MEM:FILE:PROG <block data>	Loads the program data using block data.
Query Syntax	:MEMory:FILE:PROGram?	
Return Parameter	<block data>	Returns the program data as block data.

Query Example	:MEM:FILE:PROG? #<digits><byte count><data><NL>	Returns the program data as block data.

:MEMory:FILE:SETup

System Command

Description	Sets or returns the setup data using block data. See the command syntax on page 19 for more details on block data.	
Syntax	:MEMory:FILE:SETup <block data>	
Parameter	<block data>	Setup data
Example	:MEM:FILE:SET <block data>	Loads the setup data using block data.
Query Syntax	:MEMory:FILE:SETup?	
Return Parameter	<block data>	Returns the setup data as block data.
Query Example	:MEM:FILE:SET? #<digits><byte count><data><NL>	Returns the setup data as block data.

:MEMory:FILE:SEQuence

System Command

Description	Sets or returns the sequence data using block data. See the command syntax on page 19 for more details on block data.	
Syntax	:MEMory:FILE:SEQuence <block data>	
Parameter	<block data>	Sequence data
Example	:MEM:FILE:SEQ <block data>	Loads the sequence data using block data.
Query Syntax	:MEMory:FILE:SEQuence?	
Return Parameter	<block data>	Returns the sequence data as block data.

Query Example	:MEM:FILE:SEQuence? #<digits><byte count> <data><NL>	Returns the sequence data as block data.

SEQuence Subsystem

:SEQuence:STATe

Channel Specific Command

Description	Turns on/off the Sequence Function mode.	
Syntax	:SEQuence:STATe {OFF|0|ON|1}	
Parameter	ON/1	Turn sequence mode on
	OFF/0	Turn sequence mode off
Example	:SEQuence:STATe 1	Turn sequence on
Query Syntax	:SEQuence:STATe?	
Return Parameter	ON,STOP	Sequence is on, stopped
	ON,RUN	Sequence is on, running
	OFF	Sequence is off

Query Example	:SEQuence:STATe? ON,STOP	Sequence is on, stopped.

:SEQuence:EDIT:POINt

Channel Specific Command

Description	Sets the current point in the sequence. The SEQuence:END command should first be used to set the number of points.	
Syntax	:SEQuence:EDIT:POINt <NR1>	
Parameter	<NR1>	Points
	1~last point	1~ last point.
Example	:SEQ:EDIT:POIN 3	Sets the point to number 3.
Query Syntax	:SEQuence:EDIT:POINt?	
Return Parameter	<NR1>	Points
	1~last point	Returns the current point.
Query Example	:SEQ:EDIT:POIN? 3	The current point is 3.

:SEQuence:END

Channel Specific Command

Description	Sets the number of points in the sequence.	
Syntax	:SEQuence:END <NR1>	
Parameter	<NR1>	Points
	1~120	1~120
Example	:SEQ:END 5	Sets the max number of points to 5.
Query Syntax	:SEQuence:END?	
Return Parameter	<NR1>	Points
	1~120	1~120
Query Example	:SEQ:END? 5	There are 5 points in the sequence.

:SEQuence:END:LOAD

Channel Specific Command

Description	Sets or queries the value of On End Load.	
Syntax	:SEQuence:END:LOAD <NRf+>[MAX|MIN]	
Parameter	<NRf+>	current value(CC), resistance value(CR).
	0	On End Load = Off.
	MIN/MAX	Maximum or minimum value.
Example	:SEQuence:END:LOAD 1.000	Sets the value of On End Load to 1.000
Query Syntax	:SEQuence:END:LOAD?	
Return Parameter	0	On End Load is Off
	<NRf>	On End Load value
Query Example	:SEQuence:END:LOAD? 1,000	On End Load value is 1.000.

:SEQuence:POINt:RESistance

Channel Specific Command

Description	Sets the resistance value for the current point. CR mode only.	
Syntax	:SEQuence:POINt:RESistance <NRf>[OHM]|MIN|MAX	
Parameter	<NRf>[OHM], MIN, MAX	Resistance value
	100	100Ω
	100 OHM	100Ω
	MAX/MIN	Maximum or minimum value.
Example	:SEQ:POIN:RES 100	Sets the resistance to 100.
Query Syntax	:SEQuence:POINt:RESistance? [MAX|MIN]	
Return Parameter	<NR1>	Resistance Value

	1 unit = 1 ohm	Returns the resistance value.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:SEQ:POIN:RES? 100	The resistance value is 100 ohm.

:SEQuence:POINt:CURRent

Channel Specific Command

Description	Sets the current value for the current point. CC mode only.	
Syntax	:SEQuence:POINt:CURRent <NRf>[A]|MIN|MAX	
Parameter	<NRf>[A], MIN, MAX	Current value
	10	10A
	100 A	100A
	MAX/MIN	Maximum or minimum value.
Example	:SEQ:POIN:CURR 1	Sets the current to 1.
Query Syntax	:SEQuence:POINt::CURRent? [MAX|MIN]	
Return Parameter	<NR1>	Current Value
	1 unit = 1 A	Returns the current value.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:SEQ:POIN:CURR? 1	The current value is 1 amp.

:SEQuence:POINt:RISE/FALL

Channel Specific Command

Description	Sets the rising and falling slew rates for the current point.	
Syntax	:SEQuence:POINt:RISE/FALL<NRf>[A/us]|MIN|MAX	
Parameter	<NRf>[A/us], MIN, MAX	Slew rate
	1.2	1.2A/us

	1.2 A/us	1.2A/us
	MAX/MIN	Maximum or minimum value.
Example	:SEQ:POIN:RISE .3 A	Sets the rising slew rate to 0.3 A/us
	:SEQ:POIN:FALL .4 A	Sets the falling slew rate to 0.4 A/us
Query Syntax	:SEQuence:POINt:RISE/FALL? [MAX|MIN]	
Return Parameter	<NR1>	Slew Rate
	1 unit = 1 A/us	Returns the slew rate.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:SEQ:POIN:RISE? 0.30000	Returns the rising slew rate (0.3 A/us).
	:SEQ:POIN:FALL? 0.40000	Returns the falling slew rate (0.4 A/us).

:SEQuence:POINt:TIME

Channel Specific Command

Description	Sets the duration time of the current point in seconds (for CC mode and CR mode only).	
Syntax	:SEQuence:POINt:TIME<NRf>[S]|MIN|MAX	
Parameter	<NRf>	Duration Time
	0.000025~60000	0.000025~60000 seconds
	0.000025~60000S	0.000025~60000 seconds
	MIN	0.0001seconds
	MAX	60,000 seconds
Example	:SEQ:POIN:TIME 10	Sets the point duration time to 10 seconds.
Query Syntax	:SEQuence:POIN:TIME? [MAX|MIN]	

Return Parameter	<NR2>	Point
	0.0001~60000	Returns the point duration time.
	MAX/MIN	Returns the allowable maximum and minimum.
Query Example	:SEQ:POIN:TIME? 0.00100	The point duration time is 0.001 seconds.

:SEQuence:REPeat

Channel Specific Command

Description	Sets the number of times the sequence can be repeated (looped).	
Syntax	:SEQuence:REPeat <NR1>	
Parameter	<NR1>	Repeat setting
	1~9999	1~9999
	0	Infinite repeats
Example	:SEQ:REP 10	Repeat 10 times
	:SEQ:REP 0	Repeat infinitely
Query Syntax	:SEQuence:REPeat?	
Return Parameter	<NR1>	Repeat setting
	1~9999	1~9999
	0	Infinite
Query Example	:SEQ:REP? 10	Repeats the sequence 10 times

:SEQuence:VOLTage:RANGe

Channel Specific Command

Description	Sets the sequence CC voltage range.	
Syntax	:SEQuence:VOLTage:RANGe {<NRf>[V]|L|H}	
Parameter	<NRf>[V] , L, H	Range
	16	Low range*

	80V	High range*
	L	Low range
	H	High range
	*Load module dependent, PEL-2020B shown.	
Example	:SEQ:VOLT:RANG L	Sets the range to Low for the channel.
Query Syntax	:SEQuence:VOLTage:RANGe?	
Return Parameter	<NR2>	Range
	16	Low PEL-2020B, 2030B, 2040B
	125	Low PEL-2041B
	80	High PEL-2020B, 2030B, 2040B
	500	High PEL-2041B
Query Example	:SEQ:VOLT:RANG? 500	Returns the voltage range. In this case high for the PEL-2041B.

:SEQuence:LOOP:STARt

Channel Specific Command

Description	Determines from which point to start repeating (looping) the sequence from when using the SEQuence:REPeat command.	
Syntax	:SEQuence:LOOP:STARt <NR1>	
Parameter	<NR1>	Start loop from
	1~last point	1st~ last point.
Example	:SEQ:LOOP:STAR 2	Loop from point 2.
Query Syntax	:SEQuence:LOOP:STARt?	
Return Parameter	<NR1>	Point
	1~last point	Returns the point that the loop will start from.
Query Example	:SEQ:LOOP:STAR? 2	The loop starts at point 2.

:SEQuence:CHANNel:TIME

Channel Specific Command

Description	Sets which channel duration time the specific channel will use.	
Syntax	:SEQuence:CHANNel:TIME <NR1>	
Parameter	<NR1>1~ max channels	Duration Time Settings
	0	OFF
	1	Use channel 1
	2	Use channel 2
Example	:SEQ:CHAN:TIME 3	Set the specific channel to use the channel duration time of channel 3.
Query Syntax	:SEQuence:CHANNel:TIME?	
Return Parameter	<NR1>	Point
	1~ max channels	Returns the channel duration time that the specific channel is using.
Query Example	:SEQ:CHAN:TIME? 2	The specific channel is using the channel duration setting of channel 2.

:SEQuence:RUN

Channel Specific Command

Description	Turns the sequence On/Off.	
Syntax	:SEQuence:RUN {OFF|0|ON|1}	
Parameter	OFF/0	Off
	ON/1	On
Example	:SEQ:RUN ON	Run the sequence.

:SEQuence:SAVE

Channel Specific Command

Description	Saves the sequence for the specific channel.	
Syntax	:SEQuence:SAVE	
Example	:SEQ:SAVE	Saves the sequence.

:SEQuence:TRIGger:IN

Channel Specific Command

Description	Turns the trigger input on/off for sequences. See the :SEQuence:TRIGger:IN:CHANnel command to set which channels this command applies to.	
Syntax	:SEQuence:TRIGger:IN {OFF|0|ON|1}	
Parameter	OFF/0	Off
	ON/1	On
Example	:SEQ:TRIG:IN 0	Trigger IN is on.
Query Syntax	:SEQuence:TRIGger:IN?	
Return Parameter	<NR1>	Trigger IN
	0	Off
	1	On
Query Example	:SEQ:TRIG:IN? 1	Trigger IN is on.

:SEQuence:TRIGger:OUT

Channel Specific Command

Description	Turns the trigger output on for the selected channel for sequences.	
Note	One channel must be set for trigger out.	
Syntax	:SEQuence:TRIGger:OUT <NR1>|MIN|MAX	
Parameter	<NR1>	Channel number
	MAX	Sets TRIG OUT to the last channel

	MIN	Sets TRIG OUT to the first channel
Example	:SEQ:TRIG:OUT 1	Sets TRIG OUT to CH1.
Query Syntax	:SEQuence:TRIGger:OUT?	
Return Parameter	<NR1>	Channel number
	MAX/MIN	Last or first channel.
Query Example	:SEQ:TRIG:OUT? 1	CH1 is set to TRIG OUT.

:SEQuence:TRIGger:IN:CHANnel

Channel Specific Command

Description	Selects which channels are turned on/off with the :SEQuence:TRIGger:IN command. The bit weight of the <NR1> value determines which channels are used.			
Syntax	:SEQuence:TRIGger:IN:CHANnel<NR1>			
Parameter	<NR1>	Channel	<NR1>	Channel
	1	CH1	32	CH 6
	2	CH2	64	CH 7
	4	CH3	128	CH 8
	8	CH 4	256~65535	Not used
	16	CH 5		
Example	:SEQ:TRIG:IN:CHAN 9		Sets TRIG IN to CH1 and CH4.	
Query Syntax	:SEQuence:TRIGger:IN:CHANnel?			
Return Parameter	<NR1>	Channel	<NR1>	Channel
	1	CH1	32	CH 6
	2	CH2	64	CH 7
	4	CH3	128	CH 8
	8	CH 4	256~65535	Not used
	16	CH 5		
Query Example	:SEQ:TRIG:IN:CHAN? 24		Sets TRIG IN to CH4 and CH5.	

GLOBal Subsystem

:GLOBal:CONFigure:VOLTage:RANGe — Global Command

Description	Sets the CC Voltage range high or low. This command applies to all channels.	
Syntax	:GLOBal:CONFigure:VOLTage:RANGe{L|H}	
Parameter	L	Low range
	H	High range
Example	:GLOB:CONF:VOLT:RANG L	Sets the range to low.

:GLOBal:LOAD:SHORt — Global Command

Description	Shorts all the input terminals.	
Syntax	:GLOBal:LOAD:SHORt{OFF|0|ON|1}	
Parameter	{OFF|0|ON|1}	SHORT
	OFF/0	Off
	ON/1	On
Example	:GLOB:LOAD:SHOR 1	Short on.
Note	This command is valid only when the “LOAD ON”. Otherwise, it will get “-200, Execution error”. All channels must be LOAD ON to be set to 1.	

:GLOBal:MODE

Global Command

Description	Sets the mode for all the load modules in the mainframe.	
Syntax	:GLOBal:MODE {CCL|CCH|CCDL|CCDH|CRL|CRH|CRDL|CRDH|CVL|CVH|CPL|CPH}	
Parameter	CCL	CC static mode, low range
	CCH	CC static mode, high range
	CCDL	CC dynamic mode, low range
	CCDH	CC dynamic mode, high range
	CRL	CR static mode, low range
	CRH	CR static mode, high range
	CRDL	CR dynamic mode, low range
	CRDH	CR dynamic mode, high range
	CVL	CV static mode, low range
	CVH	CV static mode, high range
	CPL	CP static mode, low range
	CPH	CP static mode, high range
Example	:GLOBal:MODE CCL	Set the specific channel to low range constant current static mode.

:GLOBal:LOAD:[STATe]

Global Command

Description	This command turns the electronic load on/off for all channels.	
Syntax	:GLOBal:LOAD:[STATe]{OFF|0|ON|1}	
Parameter	OFF/0	Turns the electronic load OFF for all channels.
	ON/1	Turns the electronic load ON for all channels.
Example	:GLOB:LOAD 0	Turns the electronic load OFF for all channels.

Command Error Codes

Description	The PEL-2000B series has a number of specific error codes. Use the SYSTem:ERRor command to recall the error codes.	
	-102	Syntax error. An unrecognized command or data type was encountered.
	-109	Missing parameter The command header requires more parameters than was received.
	-122	Data out of range The data is outside the allowed range.
	-128	Numeric data not allowed The command does not accept numerical data/parameters
	-200	Execution error Generic execution error.
	-144	Character Data too long The character data contains more than twelve characters
	-151	Invalid String The string data received is invalid
	-148	Character data not allowed The command does not accept character data
	-138	Suffix not allowed A command does not accept suffixes/the suffix type.
	-222	Data out of range

STATUS REGISTERS

To program the PEL-2000B series effectively, the Status Register structure needs to be understood. This chapter explains in detail the structure of the status registers.

Status Register Overview

Description

The status registers are used to determine the status of the electronic load. The status registers maintain the status of the protection conditions, load conditions and channel conditions of the load modules.

The PEL-2000B series have a number of register groups:

Channel Status Registers (one for each channel)

Channel Summary Registers

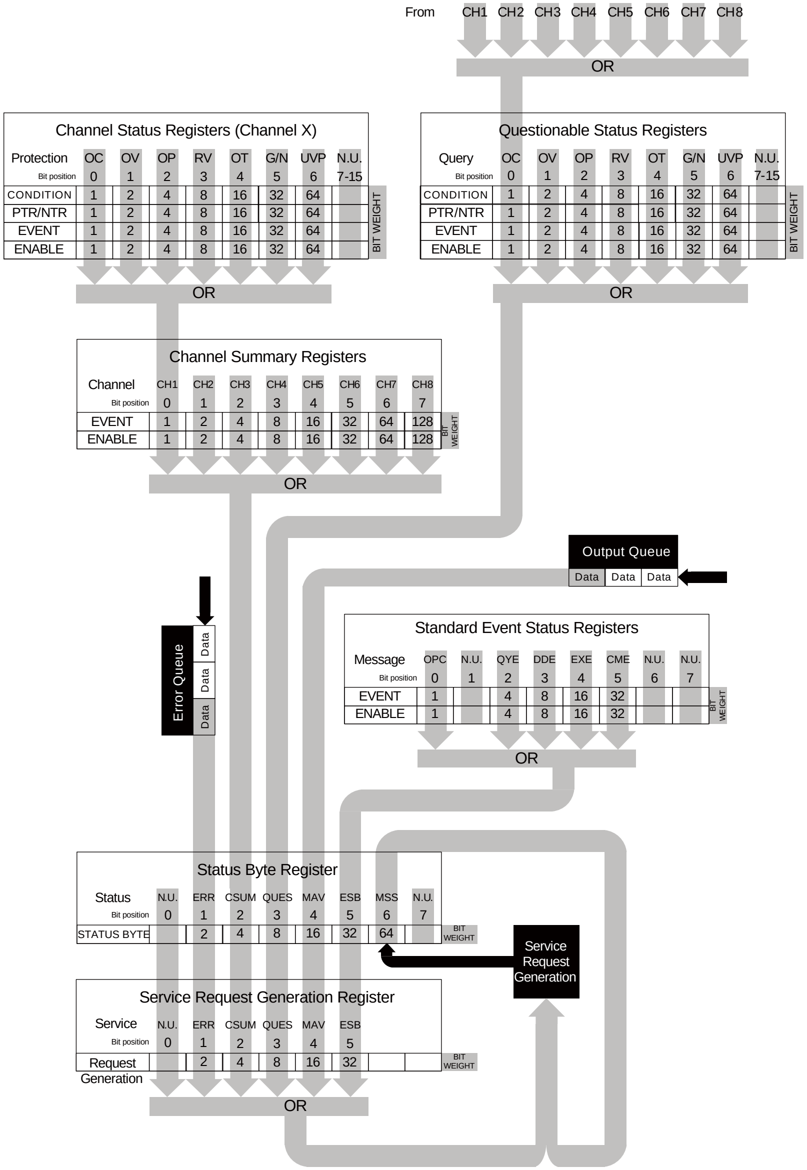
Questionable Status Registers

Standard Event Status Registers

Status Byte Register

Service Request Generation Register

The structure of the status registers is shown on the next page.


From CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8
OR
Channel Status Registers (Channel X)
Protection OC OV OP RV OT G/N UVP N.U.
Bit position 0 1 2 3 4 5 6 7-15
CONDITION 1 2 4 8 16 32 64
PTR/NTR 1 2 4 8 16 32 64
EVENT 1 2 4 8 16 32 64
ENABLE 1 2 4 8 16 32 64
BIT WEIGHT
OR
Questionable Status Registers
Query OC OV OP RV OT G/N UVP N.U.
Bit position 0 1 2 3 4 5 6 7-15
CONDITION 1 2 4 8 16 32 64
PTR/NTR 1 2 4 8 16 32 64
EVENT 1 2 4 8 16 32 64
ENABLE 1 2 4 8 16 32 64
BIT WEIGHT
OR
Channel Summary Registers
Channel CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8
Bit position 0 1 2 3 4 5 6 7
EVENT 1 2 4 8 16 32 64 128
ENABLE 1 2 4 8 16 32 64 128
BIT WEIGHT
OR
Output Queue
Data Data Data
Error Queue
Data Data Data
Standard Event Status Registers
Message OPC N.U. QYE DDE EXE CME N.U. N.U.
Bit position 0 1 2 3 4 5 6 7
EVENT 1 4 8 16 32
ENABLE 1 4 8 16 32
BIT WEIGHT
OR
Status Byte Register
Status N.U. ERR CSUM QUES MAV ESB MSS N.U.
Bit position 0 1 2 3 4 5 6 7
STATUS BYTE 2 4 8 16 32 64
BIT WEIGHT
Service Request Generation
Service Request Generation Register
Service N.U. ERR CSUM QUES MAV ESB
Bit position 0 1 2 3 4 5
Request Generation 2 4 8 16 32
BIT WEIGHT
OR

Channel Status

Description

Each channel has a dedicated Channel Status Register group. These registers show if any errors or faults have occurred to a specific channel.

The Channel Status Register group consists of: the Condition, EVENT and ENABLE registers as well as PTR/NTR (positive and negative transition) filters.

Channel Status Registers								
Bit Position	7-15	6	5	4	3	2	1	0
Condition	0	UVP	G/N	OT	RV	OP	OV	OC
PTR/NTR	0	UVP	G/N	OT	RV	OP	OV	OC
EVENT	0	UVP	G/N	OT	RV	OP	OV	OC
ENABLE	0	UVP	G/N	OT	RV	OP	OV	OC
Bit weight		64	32	16	8	4	2	1

Protection Bits

OC If an over current condition occurs the OC bit (bit 0) is set.

The OC bit can be cleared only with the :LOAD:PROTection:CLEar command if the over current condition is invalid.

OV If an over voltage condition occurs, the OV bit (bit 1) will be set.

The OV bit can be cleared only with the :LOAD:PROTection:CLEar command if the over voltage condition is invalid.

OP If an over power condition occurs, the OP bit (bit 2) is set.

The OP bit can be cleared only with the :LOAD:PROTection:CLEar command if the over power condition is invalid.

	RV	If a reverse voltage condition occurs the RV bit (bit 3) is set. The RV bit is automatically cleared after the reverse voltage is removed.
	OT	When the internal temperature exceeds 85˚C the OT bit will be set. The OT bit is automatically cleared after the temperature goes below 85˚C.
	G/N	The Go/NoGo bit is set when Go/NoGo limits have been exceeded, when Go/NoGo SPEC has been enabled.
	UVP	If the under voltage condition occurs the UVP bit is set.
Condition Register	The condition register indicates the status of the electronic load. The condition register can only be changed by a change in the condition of the electronic load. Reading the condition register does not change the state of the condition register.	
PTR/NTR Register	The PTR/NTR (Positive/Negative transition) register determines the type of transition conditions that will trigger an event. Only the Channel Status Register and Questionable Status Register can be transition programmed.	
	Positive Transition	0→1
	Negative Transition	1→0
Event Register	The Event Register indicates if an event has been triggered according to the transition settings from the PTR/NTR Register.	
Enable Register	The Enable register determines which status event(s) are enabled. Any status events (OC, OV, OP, RV, OT, G/N, UVP) that are enabled will set the corresponding channel bit in the Channel Summary Event Register.	

Channel Summary

Description

The Channel Summary Registers consolidate the channel status of all 4/8 channels, depending on the electronic load.

Channel Summary Registers								
Bit Position	7	6	5	4	3	2	1	0
EVENT	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
ENABLE	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
Bit weight	128	64	32	16	8	4	2	1

Event Register

If an event has been enabled and set in the Channel Status Registers, then the corresponding channel bit will be set in the Channel Summary Event Register. If the Event Register is read, it will be cleared to 0.

Enable Register

The Enable Register is used to determine which channel events will be used to set the CSUM bit of the Status Byte Register.

Questionable Status

Description

The Questionable Status Registers will show if any faults or errors have occurred. The Questionable Status Registers have the same events as the Channel Status Registers.

Questionable Status Register								
Bit Position	7-15	6	5	4	3	2	1	0
Condition	0	UVP	G/N	OT	RV	OP	OV	OC
PTR/NTR	0	UVP	G/N	OT	RV	OP	OV	OC
EVENT	0	UVP	G/N	OT	RV	OP	OV	OC
ENABLE	0	UVP	G/N	OT	RV	OP	OV	OC
Bit weight		64	32	16	8	4	2	1

Bit Summary	OC	Over Current
	OV	Over voltage
	OP	Over Power
	RV	Reverse Voltage
	OT	Over Temperature
	G/N	Go/NoGo
	UVP	Under Voltage Protection
Condition Register	The Questionable Status Condition Register indicates the status of the electronic load. If a bit is set in the Condition register (OC, OV, OP, RV) indicates that the event is true. Reading the condition register does not change the state of the condition register.	
PTR/NTR Register	The PTR/NTR (Positive/Negative transition) register determines the type of transition conditions will set the corresponding bit in the Event Registers. Only the Channel Status Register and Questionable Status Register can be transition programmed.	
	Positive Transition	0→1
	Negative Transition	1→0
Event Register	The PTR/NTR Register will dictate the type of transition conditions will set the corresponding bits in the Event Register. If the Event Register is read, it will be cleared to 0.	
Enable Register	The Enable Register is used to determine which channel events will be used to set the QUES bit of the Status Byte Register.	

Output Queue

Description

The Output queue stores output messages in a FIFO buffer until read. If the Output Queue has data, the MAV bit in the Status Byte Register is set.

Output Queue							
← Data out	Data1	Data2	Data3	Data4	Data5	DataN	← Data in

Standard Event Status

Description

The Standard Event Status Registers indicate any programming errors that occur. The Standard Event Status Register group comprises of the Event and Enable registers.

Standard Event Status Registers								
Bit Position	7	6	5	4	3	2	1	0
EVENT	0	0	CME	EXE	DDE	QUE	0	OPC
ENABLE	0	0	CME	EXE	DDE	QUE	0	OPC
Bit weight	128	64	32	16	8	4	2	1

Error Bits

OPC	The operation complete bit is set when all selected pending operations are complete. This bit is set in response to the *OPC command.
QUE	The query error bit is set when there is an error reading the output queue. This can be caused by trying to read the output queue when there is no data in it.
DDE	The Device Dependent Error indicates a memory error/lost memory or failure of the self-test.
EXE	The Execution bit indicates an execution error due to one of the following

		• Illegal command parameter • Parameter out of range • Invalid parameter Command didn't execute due to an overriding operation condition.
	CME	The Command Error bit is set when a syntax error has occurred. The CME bit can also be set when a <GET> command is received within a program message. (Group Execute Trigger) as defined in IEEE 488.1.
Event Register	The Event Register will be set to 0 when read.	
Enable Register	The Enable Register determines which events will set the ESB Bit (bit 5) in the Status Byte Register.	

Status Byte Register

Description

The Status Byte register consolidates the status events of all the status registers. The Status Byte register can be read with the *STB? query or a serial poll and can be cleared with the *CLS command.

Status Byte Register								
Bit Position	7	6	5	4	3	2	1	0
Condition	0	MSS	ESB	MAV	QUES	CSUM	ERR	0
Bit weight	128	64	32	16	8	4	2	1

Status Bits	CSUM	The CSUM bit is set when an Enabled event has occurred on a channel. The Channel Condition, Channel Event and Channel Summary Event Registers all determine if the CSUM bit is set.
	QUES	The Questionable bit is set when a questionable event has occurred.

ESB	The Event Status bit is set if an enabled event in the Standard Event Status Event Register has occurred.
ERR	The ERR bit is set when there is a message in the error queue.
MSS & RQS	The Master Summary Status is used with the *STB? query. When the *STB? query is read the MSS bit is not cleared. The Request Service bit is cleared when it is polled during a serial poll.

Service Request Register

Description

The Service Request Generation Register determines which events in the Status Byte Register will generate Service Requests. It is essentially the Status Byte Enable Register. The bit events are the same as the Status Byte Register, minus the MSS/RQS bit.

Service Request Generation Register(Status Byte Enable)								
Bit Position	7	6	5	4	3	2	1	0
Condition	0	0	ESB	MAV	QUES	CSUM	ERR	0
Bit weight	128	64	32	16	8	4	2	1