

High power DC electronic load

PEL-9000 S series

Programming manual

MATRIX TECHNOLOGY INC.

Version 1.0

1 Overview of Programming

1.1 Command syntax

Instructions are divided into public commands and specific commands, which are further divided into simple instructions, compound instructions, and inquiry instructions. General instructions belong to simple instructions. For RS232 communication, instructions are terminated with the <nl> symbol (hexadecimal 0x0A).

Instruction classification

Instruction data consists of one or more subject words (instruction mnemonics).

Subject verb

The subject word, which is an instruction mnemonic, is composed of ASCII characters. It is categorized into long and short subject words. Typically, a long subject word is a complete English word, while a short subject word is an abbreviation of the long subject word, usually consisting of the first 3-4 letters or an abbreviation of a term that represents a specific function. This manual specifies that the first few characters of the subject word are capitalized to form its abbreviation. We strive to use English words that align with the instructions' functions. For example, when asking for the voltage measurement, you would say: "MEASure: VOLTage?" The system can accept both long and short subject words, but all subject words in a single instruction must be consistent in form.

Simple instruction

Simple instructions include only a subject word followed by the Parameters of the instruction. When connecting Parameters, the Parameters are separated from the subject word with a space.

Example TRIG, compound instruction

A compound instruction consists of two or more subjects separated by a colon:. The last subject is usually an optional Parameter for the instruction, which is used in the same way as above.

Example CONF: VOLT: RANG High, asking for instructions

The query instruction consists of a simple or compound command with an appeal, but the last subject of the instruction is?.

Example: MEAS: VOLT?

digital representation

Symbol	Description	Example
NR1	The number has no decimal point.	123, 0123
NR2	The number has a decimal point.	123., 12.3, 0.123, .123
NR3	Numbers have a decimal point and an exponent.	1.23E+3, 1.23E-3
NRf	Flexible decimal formats, including NR1 or NR2 or NR3.	123, 12.3, 1.23E+3

Table 1-1 shows the instruction data numbers

Delimiter

Delimiter	Description	Example
Blank space	Used to separate Parameters from the preceding subject word	CONFigure : REMote ON
:	Used to separate the subject word, indicating that the preceding subject word is at a higher level in the instruction tree	CONF:VOLT:ON 5 <nl>
;	Separates two different instructions. Used when a sequence of instructions contains more than one instruction	RES:RISE 100;I1 400 <nl>

Table 1-2 Command data delimiter

2 Command Set

General commands

Defined by the IEEE488.2 standard. Each command begins with "*"

General

command

Clear status

syntax

*CLS

*IDN?

Query the instrument ID

*RCL <NRf>

Redeploy the instrument status and use it in conjunction with *SAV

*RST

reSet operation

*SAV <NRf>

Save the instrument status

General

command

phrases

*CLS

Clear Status (Clear Status Command)

Description This command clears the following actions:

1. Clear the problem status event cache
2. Clear the cache of standard event status events
3. Clear the status bit
4. Clear the error

queue syntax *CLS

Parameter None

*IDN?

Identity recognition query

This query requires the electronic load to identify itself.

Query syntax *IDN?

Return Parameter

<aard> Query

example *IDN?

String information

MATRIX manufacturer

MATRIX manufacturer

PEL9000S model	PEL9000S model
12345678	12345678 Serial number
01.00	01.00 Software version

Send back the example MATRIX, PEL9000S,12345678,01.00

***RCL Recall Instrument State Command**

Description The command returns the status of the electronic load stored in a specific location within memory by the SAV command (see SAV).

Syntax *RCL <NRf>

Parameter 1 to 100

Example *RCL 10

***RST ReSet Command**

Description This command enforces an ABORt, *CLS, LOAD: PROT:CLE command.

Syntax *RST

Parameter None

***SAV**

Save Command (storage command)

Description This command stores the current status of the electronic load in a specific location in memory.

*SAV <NRf>

Syntax 1 to 100

Parameter *SAV 10

example

Specific commands

According to the SCPI specification, specific instructions are designed for a series of high-power electronic load products. Currently, the subsystems of Configure, Current, Fetch, Load, Measure, Mode, Power, Resistance and Voltage are supported.

CONFigure subsystem

CONFigure

:AUTO

:LOAD

:DISPlay

:KEY

:SAVE

:SOUNd

:VOLTage

:LATCh

:RESet

:ON

:POLarity

:RANGe

CONFigure:AUTO:LOAD

Description Whether the load module is Set to perform Auto Load On at startup.

Syntax CONFigure: AUTO: LOAD <NR1 | CHAR>

Parameter 0 | OFF, 1 | ON

Example CONF: AUTO: LOAD ON Auto Load On is started at startup.

CONF: AUTO: LOAD OFF Turn off Auto Load On when starting up.

Query syntax CONFigure: AUTO: LOAD?

Return Parameter 0 | 1

Query example CONF: AUTO: LOAD?

Return example 0 (OFF)

Returns the Auto Load On state.

CONFigure:KEY

Description Set the pattern for input data

Syntax CONFigure: KEY <NR1 | CHAR>

Parameter 0 | HOLD, 1 | NEXT

Example CONF: KEY 1 Set the next pattern for input data

CONF: KEY HOLD Set the pause mode of input data

Query syntax CONFigure: KEY?

Return Parameter 0 | 1

Query example CONF: KEY? Returns the execution category of the input data pattern.

Example of return 0 (NEXT)

CONFigure:SAVE

Description: Store the CONFigure Setting value for use at the next startup.

Syntax CONFigure: SAVE

Parameter None
Example CONF: SAVE

CONFigure:SOUNd

Description Set the buzzer sound ON/OFF.
Syntax CONFigure: SOUNd <NR1 | CHAR>

Parameter 0 | OFF, 1 | ON

Example CONF: SOUN 0
CONF:SOUN OFF

Query syntax CONFigure: SOUNd?

Return Parameter 0 | 1

Query example CONF: SOUN? Return the sound control status of the buzzer.

Return example 0 (OFF)

CONFigure:VOLTag:e:LATCh

Description Set the action category of Von.
Syntax CONFigure: VOLTag:e: LATCh <NR1 | CHAR>

Parameter 0 | OFF, 1 | ON

Example CONF: VOLT: LATC 1 Set the action category of Von to lock.
CONF: VOLT: LATC OFF Set the action category of Von to non-locking.
(Details see the description earlier in this manual.)

Query syntax CONFigure: VOLTag:e: LATCh?

Return Parameter 0 | 1

Query example CONF: VOLT: LATC? Return the action category of Von.

Return example 0 (OFF)

CONFigure:VOLTag:e:LATCh:RESet

Description ReSet Von signal.
Syntax: CONFigure: VOLTag:e: LATCh: RESet

Parameter None

Example CONF: VOLT: LATC: RES

CONFigure:VOLTag:e:ON

Description Set the voltage to start loading to on.
Syntax CONFigure: VOLTag:e: ON <NRf> [suffix]
Parameter Valid voltage file bits, please refer to individual specifications.

Example CONF: VOLT: ON 1 Set Von=1V.
CONF: VOLT: ON 300mV Set Von=300mV.

Query syntax CONFigure: VOLTag:e: ON?

Return Parameter <NR2> [Unit=Voltage]

Query example CONF: VOLT: ON? Return Von value Setting.

See Example 3.5 for a return

CONFigure:VOLTag:e:POLarity

Description Set the voltage display polarity.

Syntax CONFigure:VOLTag:e:POLarity

Parameter 0 | MINUS, 1 | PLUS,

example CONF:VOLT:POL 0 The Set voltage is displayed as negative.
CONF:VOLT:POL PLUS The Set voltage is displayed as positive.

Query Syntax CONFigure:VOLTag:e:POLarity?

Returns	0 1	
Parameters		
Query examples	CONF: VOLT:POL?	The polarity is displayed in the return.
Send back examples	0 (MINUS)	

CONFigure:VOLTage:RANGe

Description: Set the voltage measurement position under the constant current mode.

Syntax CONF: VOLTage: RANGe <NR1 | CHAR>

Parameter 0 | L, 1 | H

Example CONF: VOLT: RANG 1 Set the full range to High.

CONF: VOLT: RANG L Set the full gear to Low.

Query syntax CONF: VOLTage: RANGe?

Return Parameter 0 | 1

Query example CONF: VOLT: RANG? Return voltage file bits.

Example of a return (H)

Current subsystem

CURRent

:STATic

:L1

:L2

:RISE

:FALL

:DYNamic

:L1

:L2

:RISE

:FALL

:T1

:T2

CURRent:STATic

Description Select the A and B state Settings for load in constant current mode.

Syntax CURRent: STATic <NR1 | CHAR>

Parameter 0 | B, 1 | A.

Example CURR: STAT 0 Select the static Setting B for the constant current mode.

CURR: STAT A selects the static Setting A for the constant current mode.

CURRent:STATic:L1/L2

Description Set the static load current to a constant current mode.

Syntax CURRent: STATic: L1 <NRf+>[suffix]

CURRent:STATic:L2 <NRf+>[suffix]

Parameter Valid gear values are shown in the individual specifications.

Example CURR: STAT: L1 20 Set the Set current = 20A to the static load I1.

CURR: STAT: L2 10 Set the Set current = 10A to the static load I2.

CURR: STAT: L1 MAX Set current = maximum value for static load I1.

CURR: STAT: L2 MIN Set the Set current to the minimum value for the static load I2.

Query syntax CURRent: STATic:L1?

CURRent:STATic:L12?
CURRent:STATic:L1? MAX
CURRent:STATic:L2? MIN

Return Parameter <NR2> [Unit=A]

Query example CURR: STAT:L1? Return the Set current value of static load I1.

See Example 3.12 for a return example

CURRent:STATic:RISE/FALL

Description Set the current slope of the static mode Setting.

Syntax CURRent: STATic: RISE <NRf+>[suffix]

CURRent: STATic: FALL <NRf+> [suffix]

Parameter The valid gear value, see individual specifications.

Example CURR: STAT: RISE 2.5 Set the rise slope to 2.5A/μS for static state load.

	CURR:STAT:FALL 1A/μS	Set the decreasing slope to 1A/μS for static load.
Query	CURRent:STATic:RISE?	
Syntax	CURRent:STATic:FALL?	
	CURRent:STATic:RISE? MAX	
	CURRent:STATic:FALL? MIN	
Returns Parameters	<NR2> [Unit=A/μS]	
Query examples	CURR:STAT:RISE?	Returns the rising slope of the static load.
Send back examples	2.5	

CURRent:DYNamic:L1/L2

Description The dynamic load current is Set in the constant current mode.

Syntax CURRent: DYNamic: L1 <NRf+>[suffix]

CURRent: DYNamic: L2 <NRf+>[suffix]

Parameter The valid gear value is shown below.

Refer to individual specifications for details.

Example CURR: DYN: L1 20 Set dynamic load Parameter I1 = 20A.

CURR: DYN: L2 10 Set dynamic load Parameter I2 = 10A.

CURR: DYN: L1 MAX Set the dynamic load Parameter I1 = maximum value.

CURR: DYN: L2 MIN Set the dynamic load Parameter I2 to the minimum value.

Query syntax CURRent: DYNamic: L1?

CURRent:DYNamic:L2?

CURRent:DYNamic:L1? MAX

CURRent:DYNamic:L2? MIN

Return Parameter <NR2> [Unit=A]

See example 35.6 for a return

CURRent:DYNamic:RISE/FALL

Description Set the current slope of the constant current dynamic mode.

Syntax CURRent: DYNamic: RISE <NRf+>[suffix]

CURRent: DYNamic: FALL <NRf+>[suffix]

Parameter The valid gear value, see individual specifications.

Example CURR: DYN: RISE 2.5 Set the rise slope to 2.5A/μS.
 CURR: DYN: FALL 1A/μS Set the slope of decline to 1A/μS.
 CURR: DYN: RISE MAX Set the slope of rise to the maximum dynamic load.
 CURR: DYN: FALL MIN Set the slope of decline to the minimum value of dynamic load.
 Query syntax CURRent: DYNamic: RISE?
 CURRent:DYNamic:FALL?
 CURRent:DYNamic:RISE? MAX
 CURRent:DYNamic:FALL? MIN
 Return Parameter <NR2> [Unit=A/μS]
 Query example CURR: DYN: RISE? Return the rising slope of the dynamic load.
 See Example 2.5 for a return

CURRent:DYNamic:T1/T2

Description Set the periodic Parameter T1 or T2 for dynamic load.
 Syntax CURRent: DYNaic: T1 <NRf+>[suffix]
 CURRent:DYNamic:T2 <NRf+>[suffix]
 Parameter Valid gear values are shown in the individual specifications.
 Example CURR: DYN: T1 10mS The dynamic cycle T1 is Set to 10mS.
 CURR: DYN: T2 2S Set the dynamic cycle T2 = 2S.
 CURR: DYN: T1 MAX Set the dynamic cycle from T1 to maximum.
 CURR: DYN: T2 MIN Set the dynamic cycle T2 to the minimum value.
 Query syntax CURRent: DYNaicT1?
 CURRent:DYNamic:T2?
 CURRent:DYNamic:T1? MAX
 CURRent:DYNamic:T2? MIN
 Return Parameter <NR2> [Unit=Sec]
 Query example CURR: DYN:T1? Return the dynamic cycle Parameter T1.
 Example of return 0.15

LOAD subsystem

LOAD

[:STATe]
:SHORT
[:STATe]
:KEY
:PROTection
:CLEar
:SAVE

LOAD[:STATe]

Description	LOAD command enables or disables the electronic load.	
Syntax	LOAD[:STATe] <NR1 CHAR >	
Parameter	0 OFF, 1 ON	
example	LOAD ON	Enable the electronic load.
	LOAD OFF	Disable the electronic load.
Query Syntax	LOAD[:STATe]?	
Returns	0 1	

Parameters

Query examples LOAD? Returns whether the electronic load is enabled.
Send back examples 1 (ON)

LOAD:SHORT[:STATe]

Description Enable or disable short circuit simulation.

Syntax LOAD:SHORT[STATe]<NR1|CHAR>

Example LOAD: SHOR 1 enables short circuit simulation.

LOAD: SHOR OFF Disable short circuit simulation.

Parameter 0 | OFF, 1 | ON

Query syntax LOAD: SHORT: [STATe]?

Return Parameter 0 | 1

Query example LOAD: SHOR? Return the short circuit simulation state.

Send back 1 (ON)

examples

LOAD:SHORT:KEY

Description Set the short circuit key mode of the electronic load.

Syntax LOAD:SHORT:KEY <NR1 | CHAR >
0 | HOLD, 1 | TOGGLE

Parameter example

LOAD:SHOR:KEY TOGGLE

Set the short circuit key mode to switch.

LOAD:SHOR:KEY 0

Set the short circuit key mode to pause.

Query Syntax LOAD:SHORT:KEY?

Returns

0 | 1

Parameters

Query examples LOAD:SHOR:KEY?

Return the short circuit key mode of the electronic load.

Send back examples 1 (TOGGLE)

examples

LOAD:PROTection?

Description This command returns the status of the electronic load.

Query Syntax LOAD:PROTection?

Returns

<NR1>

Parameters

Bit site	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
state	0	0	0	0	0	0	0	0	0	0	0	OT	RV	OP	OV	OC
Specific gravity												16	8	4	2	1

Query example LOAD: PROT? Returns the status of the electronic load.

Return example 0

LOAD:PROTection:CLEAr

Description This command reSet the state of the electronic load.
 Syntax LOAD: PROTection: CLEAN
 Parameter Valid gear values are shown in the individual specifications.
 Example load: PROT: CLE

LOAD:SAVE

Description This command stores the current state of the electronic load as a default.
 Syntax LOAD: SAVE
 Parameter None
 Parameter LOAD: SAVE

MEASure subsystem

MEASure

:CURRent
:INPut
:POWer
:RESistance
:STATus
:VOLTage

MEASure:CURRent?

Description Returns the real-time measured current of the electronic load output.
 Query MEASure:CURRent?
 Syntax
 Returns <NR2> [Unit=Amper]
 Parameters
 Query MEAS:CURR?
 examples
 Send back 3.15
 examples

MEASure:INPut

Description Select the input end of the electronic load to measure the voltage.
 Syntax MEASure:INPut <NR1 | CHAR>
 Parameter 0 | LOAD, 1 | UUT; 2 | AUTO
 Example MEAS:INP UUT
 MEAS:INP LOAD
 Query MEASure: INPut? Sends the return to the Set input port
 Syntax
 Returns 0 | 1 | 2
 Parameters
 Query MEAS:INP?
 Examples
 Send back 0 (LOAD)
 Examples

MEASure:RESistance?

Description Returns the real-time measured resistance of the electronic load output.
 Query MEASure:RESistance?
 Syntax

Returns <NR2> [Unit=OHM]
 Parameters
 Query MEAS:RES?
 examples
 Send back 8.12
 examples

MEASure:STATus?

Description Returns the real-time status of the electronic load.
 Query MEASure:STATus?
 Syntax
 Returns <NR1>
 Parameters

Bit site	15	14	13	12	11	10	9	8
State	×	PR	RS	FF	×	×	×	SP
Specific gravity	×	16384	8192	4096	×	×	×	256
Bit site	7	6	5	4	3	2	1	0
State	PF	ST	LD	OT	RV	OP	OV	OC
Specific gravity	128	64	32	16	8	4	2	1

Query example MEAS: STAT? Read back the real-time status of the load.
 Example 4. Backward transmission

MEASure:POWer?

Description: Return the real-time measured power output of the electronic load.
 Query syntax MEASure: POWer?
 Return Parameter <NR2> [Unit=Watt]
 Query example MEAS: POW?
 See Example 8.12 for a return example

MEASure:VOLTage?

Description: Return the real-time measured voltage of the electronic load output.
 Query syntax MEASure: VOLTage?
 Return Parameter <NR2> [Unit=Voltage]
 Query example MEAS: VOLT?
 See Example 8.12 for a return example

**MODE subsystem
 MODE**

Description This command Set the operating mode of the electronic load.
 Syntax MODE <NR1 | CHAR
 Parameter 0 | CCL, 1 | CCH, 2 | CCDL, 3 | CCDH, 4 | CRL, 5 | CRH,
 6 | CVL, 7 | CVH 8 | CPL, 9 | CPH,
 MODE CPL Set the CP mode to the lowest position.
 Mode 5 Set the CR mode to the high position.
 Query syntax MODE? Returns the operating mode of the electronic load.
 Return Parameter <NR1>
 Search example MODE?

POWer subsystem

POWer

:L1
:L2
:RISE
:FALL

POWer

Description Select the A and B static Settings for the load in the constant power mode.

Syntax POWer <NR1 | CHAR>

Parameter 0 | B, 1 | A

Example POW 0 Selects the static Setting B for the constant power mode.

POWer:L1/L2

The fixed power mode that Set the static load current is defined.

Grammatical POWer: L1 <NRf+>[suffix]

POWer: L1 <NRf+>[suffix]

For valid Parameter values, refer to the individual specifications.

Example POW: L1 20 Set the power to 20W for the static load P1.

POW: L2 10 Set the power to 10W for the static load P2.

POW: L1 MAX Set power = maximum value for static load P1.

POW: L2 MIN Set power = minimum value for static load P2.

Query syntax POWer: L1?

POWer:L2?

POWer:L1? MAX

POWer:L2? MIN

Return Parameter <NR2> [Unit=Watt]

Query example POW: L1? Return the power value Set by static load P1.

See Example 3.12 for a return example

POWer:RISE/FALL

Description Set the current slope of the constant power static mode.

Syntax POWer: RISE <NRf+>[suffix]

POWer:FALL <NRf+>[suffix]

Parameter Valid gear values are shown in the individual specifications.

Example POW: RISE 2.5 Set the rise slope to 2.5A/μS for static load.

POW: FALL 1A/μS Set the fall slope to 1A/μS and apply static load.

Query syntax POWer: RISE?

POWer:FALL?

POWer: RISE? MAX

POWer: FALL? MIN

Return Parameter <NR2> [Unit=A/μS]

Query example POW: RISE? Return the rising slope of the static load.

See Example 2.5 for a return

The Resistance subsystem

RESistance

:L1
:L2
:RISE
:FALL

RESistance

Description Select the A and B static Settings for the load in the fixed resistance mode.

Syntax RESistance <NR1 | CHAR>

Parameter 0 | B, 1 | A

Example RES 0 Select the static Setting B for the fixed resistance mode.

RESistance:R1/R2

Description Set the static resistance threshold for the Set resistance mode.

Syntax RESistance: L1 <NRf+>[suffix]

RESistance:L2 <NRf+>[suffix]

Parameter Valid gear values are shown in the individual specifications.

Example RES: L1 20 OHM Set the resistance to 20 ohms for load R1.

RES: L2 10 OHM Set the resistance to 10 ohms for load R2

RES: L1 MAX Set resistance = maximum R1 value for load R1.

RES: L2 MIN Set resistance = minimum R2 value for load R2.

Query syntax RESistance: L1?

RESistance:L2?

RESistance:L1? MAX

RESistance:L2? MIN

Return Parameter <NR2> [Unit=OHM]

Query example RES: L1? Return the load resistance Set by R1.

Send back example 10

RESistance:RISE/FALL

Description Set the resistance slope of the resistor.

Syntax RESistance: RISE <NRf+>[suffix]

RESistance:FALL <NRf+>[suffix]

Parameter Valid gear values are shown in the individual specifications.

Example RES: RISE 2.5 Set the CR rise slope to 2.5A/μS.

RES:FALL 1A/μS Set the CR slope to 1A/μS.

RES: RISE MAX Set the CR rise slope to maximum programmable value.

RES: FALL MIN Set the CR fall slope to minimum programmable value.

Query syntax RESistance: RISE?

RESistance:FALL?

RESistance:RISE? MAX

RESistance:FALL? MIN

Return Parameter <NR2> [Unit=OHM]

Query example RES:RISE? Return CR slope of rise.

See Example 2.5 for a return

The VOLTage subsystem

VOLTage

:CURRent

:L1
:L2
:MODE

VOLTage

Description Select the A and B static Settings for the load in the fixed voltage mode.

Syntax VOLTage <NR1 | CHAR>

Parameter 0 | B, 1 | A.

Example VOLT 0 selects the static Setting B for the constant voltage mode.

VOLTage:CURRENT

Description Set the current limit for the Set voltage mode.

Syntax VOLTage: CURRENT <NRf+>[suffix]

Parameter Valid gear values are shown in the individual specifications.

Example VOLT: CURR 3 Set the load current 3A limit in the constant voltage mode

VOLT: CURR MAX Set the load current limit to the maximum value in the
constant voltage mode

VOLT: CURR MIN Set the pull-load current limit to a minimum value in the
constant voltage mode

Query syntax VOLTage: CURRENT?

Return Parameter <NR2> [Unit=Ampere]

VOLT: CURR? Query example

Example 3 for feedback

VOLTage:L1/L2

Description Set the voltage of the static load in the constant voltage mode.

Syntax VOLTage: L1 <NRf+>[suffix]

VOLTage:L2 <NRf+>[suffix]

Parameter Valid gear values are shown in the individual specifications.

Example VOLT: L1 8V Set the load V1 voltage to 8V.

VOLT: L2 24V Set load V2 voltage to 24V.

VOLT: L1 MAX Set the load voltage to the maximum value of V1.

VOLT: L2 MIN Set the load and V2 voltage to the minimum value.

Query syntax VOLTage: L1?

VOLTage:L2?

VOLTage:L1? MAX

VOLT:L2? MIN

Return Parameter <NR2> [Unit=Voltage]

Query example VOLT: L1? Set the return load voltage to V1.

Return example 0

VOLTage:MODE

Description Set the response speed of the Set voltage mode.

Syntax VOLTage: MODE <NR1 | CHAR>

Parameter 0 | SLOW, 1 | FAST

Example VOLT: MODE 1

VOLT:MODE SLOW

Query syntax VOLTage: MODE?

Return Parameter 0 | 1

Query example VOLT: MODE?

Send back example 0 (SLOW)