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1. Intro

Intro

2. SOURCE subsystem

The SOURce subsystem controls the input state, mode, levels and protections. These are the primary functions and basic operation of the electronic load.

2.1. [SOURce:]INPut subsystem

The INPUT subsystem controls the ON/OFF state, mode and general protection settings.

2.1.1. [SOURce:]INPut[:STATe]

Syntax [SOURce:]INPut[:STATe] {<bool>}
[SOURce:]INPut[:STATe]?

Description This command enables or disables the input. The enabled state is ON (1); the disabled state is OFF (0). The state of a disabled output is a condition of highest impedance.

Self-test operation initiated by [*TST?](#) command will put the input into disable state.

Execution of the INP ON command on the channel which has one or more protection tripped (OCP, OVP, OPP, OTP or Reverse Polarity) will generate an error.

Use INPut:PROTection:CLEar command to clear all tripped protections.

Parameters	Name	Type	Range	Default
	<bool>	Boolean	ON OFF 0 1	OFF

Return The query command returns 0 if the output is OFF, and 1 if the output is ON.

Usage example Set and check output on:

```
INP ON
INP ?
1
```

Errors

Related Commands *TST
INPut:PROTection:CLEar
[SOURce:]VOLTage:SENSe[:SOURce]

2.1.2. [SOURce:]INPut:MODE

Syntax [SOURce:]INPut:MODE {<mode>}
[SOURce:]INPut:MODE?

Description This command programs the input mode. The mode can only be changed when the input state is off.

The modes are:

- Constant Current (CC)
- Constant Voltage (CV)
- Constant Power (CP)
- Constant Resistance (CR)
- Volt Meter (DVM)
- Short inputs (SHORT)

*RST resets the mode to CC.

Parameters	Name	Type	Range	Default
	<mode>	Discrete	CC CV CR CP DVM SHORT	CC

Return Query the input mode presently active.

Usage example
 INP:MODE?
 CC

 INP:MODE CP
 POWER 10
 INP 1
 FETCH:POW?
 10

Errors

Related Commands
 INP
 *RST
 *TST

2.1.3. [SOURce:]INPut:PROTection:CLEAr

Syntax [SOURce:]INPut:PROTection:CLEAr

Description This command clears the general protection status and the clears the individual states of OCP, OVP, OTP, OPP, Reverse Polarity and Sense Error error states.

Return The command doesn't return anything.

Usage example
 INP:PROT:CLEAr

Errors

Related Commands

2.1.4. [SOURCE:]INPut:PROTection:TRIPped

Syntax [SOURCE:]INPut:PROTection:TRIPped?
[SOURCE:]INPut:PROTection:TRIPped:REVerse[:POLarity]?

Description The TRIPped? query returns the general protection state. If any of OCP, OVP, OTP, OPP, Reverse polarity or Sense error are triggered during ON state the general protection is set and the load is turned off.

The TRIPped:REVerse query returns the state of the reverse polarity error state. This state is only triggered if reverse polarity is detected when the state is ON.

Return This query returns 0 if a protection is not set, or 1 when it was not detected.

Usage example INP:PROT:TRIP?
1

Errors

Related Commands [SOURCE:]INPut:PROTection:CLEAr

2.1.5. [SOURCE:]INPut:PROTection:WDOG

Syntax [SOURCE:]INPut:PROTection:WDOG {<bool>}
[SOURCE:]INPut:PROTection:WDOG?

Description This command enables or disables the SCPI activity watchdog. The SCPI activity watchdog implements a safeguard against a fault situation when SCPI connection with a host computer is lost and prevents the load from staying in the ON state in this situation.

If the SCPI watchdog triggers the protection state is set and the load is turned of.

The SCPI watchdog has two distinct ways to determine if the SCPI connection is still active:

- Based on *any* SCPI activity received
- Based on explicit PET commands

Parameters	Name	Type	Range	Default
	<bool>	Boolean	ON OFF 0 1	OFF

Return No return

Usage example Set the SCPI watchdog type to PET, timeout to 10 seconds and activate the watchdog and pet the watchdog for the first time.

```
INP:WDOG:TYP PET
INP:WDOG:DEL 10
INP:WDOG 1
INP:WDOG:PET
```

Related Commands [SOURCE:]INPut:PROTection:WDOG:CLEAr
[SOURCE:]INPut:PROTection:WDOG:DELay
[SOURCE:]INPut:PROTection:WDOG:PET
[SOURCE:]INPut:PROTection:WDOG:TYPE

2.1.6. [SOURCE:]INPut:PROTection:WDOG:CLEAr/TRIPped?

Syntax	[SOURCE:]INPut:PROTection:WDOG:CLEAr [SOURCE:]INPut:PROTection:WDOG:TRIPped?
Description	This command clears the latched protection status that disables the output when a SCPI watchdog timeout is reached. Note the watchdog is NOT turned off and will trigger again if activity or PET commands are not detected within the set delay. The query returns whether the SCPI watchdog condition is set.
Usage example	The following command clears the SCPI watchdog status: INP:WDOG:CLE
Related Commands	[SOURCE:]INPut:PROTection:WDOG [SOURCE:]INPut:PROTection:TYPE [SOURCE:]INPut:PROTection:DELaY

2.1.7. [SOURCE:]INPut:PROTection:WDOG:DELaY

Syntax	[SOURCE:]INPut:PROTection:WDOG:DELaY {<delay>} [SOURCE:]INPut:PROTection:WDOG:DELaY?			
Description	This command set the SCPI watchdog timeout delay in seconds. The query returns the current set delay in seconds.			
Parameters	Name	Type	Range	Default
	<delay>	Integer	0-3600	10
Return	The query command returns the number of seconds the delay is set to, independent of the status of the watchdog.			
Usage example	INP:WDOG:DEL 5 INP:WDOG:DEL? 5			
Related Commands	INP:WDOG			

2.1.8. [SOURCE:]INPut:PROTection:WDOG:PET

Syntax	[SOURCE:]INPut:PROTection:WDOG:PET
Description	This command clears the SCPI watchdog inactivity timer.
Return	None
Usage example	INP:PROT:WDOG:PET

2.1.9. [SOURce:]INPut:PROTection:WDOG:TYPe

Syntax [SOURce:]INPut:PROTection:WDOG:TYPe {<wdogType>}
[SOURce:]INPut:PROTection:WDOG:TYPe?

Description This command set the SCPI watchdog type to one of:

- **Activity:** The SCPI watchdog timer is reset on reception of any SCPI command line
- **PET:** The SCPI watchdog timer is only reset on the reception of the INPut:WDOG:PET command.

Parameters	Name	Type	Range	Default
	<wdogType>	Discrete	ACTivity PET	ACT

Return The type of SCPI watchdog type. ACT for Activity or PET for PET.

Usage example Set the SCPI watchdog type to PET, set the delay to 5s, activate the SCPI watchdog:
INP:WDOG:TYP PET
INP:WDOG:DEL 5
INP:WDOG 1

Send the PET command at least once every 5 seconds:

INP:WDOG:PET
INP:WDOG:PET

Disable the SCPI watchdog when the critical routine is finished or when the remote program ends:

INP:WDOG 1

Errors

Related Commands [SOURce:]INPut:WDOG

2.2. CURRENT subsystem**2.2.1. [SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]**

Syntax [SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] {<current>}
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]?

Description This command sets the desired current level in CC mode. The allowed range depends on the current range selected.

The query returns the set current level.

Parameters	Name	Type	Range	Default
	<current>	NR2	0.0-10.0	0.1
	<low range>	NR2	0.0-1.0	0.1

Return Returns the set current level as float in Amperes.

Usage example Set the mode to CC, set the current level to 1.5A and turn the load on:
INP:MODE CC
CURR 1.5
INP 1

Errors

Related Commands [SOURce:]INPut:MODE
[SOURce:]CURRent:RANGe

2.2.2. [SOURce:]CURRent:PROTection[:LEVel]

Syntax [SOURce:]CURRent:PROTection[:LEVel] {<current>}
[SOURce:]CURRent:PROTection[:LEVel]?

Description This command sets the desired over current protection (OCP) level. The allowed range depends on the current range selected.

The query returns the set current protection level.

Parameters	Name	Type	Range	Default
	<current>	NR2	0.0-10.0	0.1
	<low range>	NR2	0.0-1.0	0.1

Return Returns the set OCP level as float in Amperes.

Usage example Set the OCP level to 2.0A:
CURR:PROT 1.5

Errors

Related Commands [SOURce:]INPut:PROT:CLEAR
[SOURce:]CURRent:RANGe

2.2.3. [SOURce:]CURRent:RANGe

Syntax [SOURce:]CURRent:RANGe {<currentRange>}
[SOURce:]CURRent:RANGe?

Description This command sets the desired current range. The range can be specified explicitly as low (L) or high (H) or given as a number. In case of a number the range is set to fit the number.

Setting the current range is only allowed when the state is OFF.

The query returns the set current range (L or H).

Parameters	Name	Type	Range	Default
	<currentRange>	Discrete NR2	LOW HIGH 0-10.0	HIGH

Return Returns the set current range.

Usage example Set the current range to LOW (because 0.5 fits within low range):
CURR:RANGE 0.5

Errors

Related Commands [SOURce:]INPut:PROT:CLEAR
[SOURce:]CURRent
[SOURce:]INPut[:STATe]

2.3. POWER subsystem

2.3.1. [SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude]

Syntax [SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude] {<power>}
[SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude]?

Description This command sets the desired power level in constant power (CP) mode in Watts.

The query returns the set current level.

Parameters	Name	Type	Range	Default
	<power>	NR2	0.0-125.0	10.0

Return Returns the set power level as float in Watts.

Usage example Set the mode to CC, set the current level to 1.5A and turn the load on:
INP:MODE CP
POW 50
INP 1

Errors

Related Commands [SOURce:]INPut:MODE

2.3.2. [SOURce:]POWer:PROTection[:LEVel]

Syntax [SOURce:]POWer:PROTection[:LEVel] {<power>}
[SOURce:]POWer:PROTection[:LEVel]?

Description This command sets the desired over power protection (OPP) level in Watts. The protection will trigger if the set level is exceeded for the over power delay amount of time.

The query returns the set power protection level in Watts.

Parameters	Name	Type	Range	Default
	<power>	NR2	0.0-125.0	20

Return Returns the set OPP level as float in Watts.

Usage example Set the OPP level to 50W:
POW:PROT 50

Errors

Related Commands [SOURce:]INPut:PROT:CLEAR
[SOURce:]POWer:DELaY

2.3.3. [SOURce]:POWer:PROTection:DELaY[:TiME]

Syntax [SOURce]:POWer:PROTection:DELaY[:TiME] {<delay>}
[SOURce]:POWer:PROTection:DELaY[:TiME]?

Description This command sets the over power delay time in seconds. This is the time the set power level has to be exceeded without interruption before the over power protection is triggered.

The query returns the set power protection delay in seconds.

Parameters	Name	Type	Range	Default
	<delay>	NR1	1-600	20

Return NR1

Usage example Set the mode to CC, a current of 1A and set OPP to 5W with a delay of 10s and turn the load on:

```
INP:MODE CC
CURR 1
POW:PROT 5
POW:PROT:DEL 10
INP 1
```

Errors

Related Commands [SOURce:]INPut:PROT:CLEAR
[SOURce:]POWer:PROTection[:LEVel]

2.4. RESISTANCE subsystem**2.4.1. [SOURce]:RESistance[:LEVel][:IMMediate][:AMPLitude]**

Syntax [SOURce]:RESistance[:LEVel][:IMMediate][:AMPLitude] {<resistance>}
[SOURce]:RESistance[:LEVel][:IMMediate][:AMPLitude]?

Description This command sets the desired resistance level in constant resistance (CR) mode in Ohm.

The query returns the set resistance level in Ohm.

Parameters	Name	Type	Range	Default
	<resistance>	NR2	0.1-100000.0	1000.0

Return Returns the set resistance level as float in Ohms.

Usage example Set the mode to CR, set the resistance level to 100Ω and turn the load on:

```
INP:MODE CR
RES 100
INP 1
```

Errors

Related Commands [SOURce:]INPut:MODE

2.5. VOLTAGE subsystem

2.5.1. [SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]

Syntax [SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] {<voltage>}
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]?

Description This command sets the desired voltage level in CV mode. The allowed range depends on the voltage range selected.

The query returns the set voltage level.

Parameters	Name	Type	Range	Default
	<voltage>	NR2	0.0-80.0	10.0
	<low range>	NR2	0.0-10.0	3.3

Return Returns the set voltage level as float in Amperes.

Usage example Set the mode to CV, set the voltage level to 5V and turn the load on:
INP:MODE CV
VOLT 5
INP 1

Errors

Related Commands [SOURce:]INPut:MODE
[SOURce:]VOLTage:RANGe

2.5.2. [SOURce:]VOLTage:PROTection[:LEVel]

Syntax [SOURce:]VOLTage:PROTection[:LEVel] {<voltage>}
[SOURce:]VOLTage:PROTection[:LEVel]?

Description This command sets the desired over voltage protection (OVP) level. The allowed range depends on the voltage range selected.

The query returns the set voltage protection level.

Parameters	Name	Type	Range	Default
	<voltage>	NR2	1.0-85.0	40.0
	<low range>	NR2	1.0-10.5	10.5

Return Returns the set OVP level as float in Volts.

Usage example Set the OVP level to 20V:
VOLT:PROT 20

Errors

Related Commands [SOURce:]INPut:PROT:CLEAR
[SOURce:]VOLTage:RANGe

2.5.3. [SOURce:]VOLTage:RANGe

Syntax [SOURce:]VOLTage:RANGe {<voltageRange>}
[SOURce:]VOLTage:RANGe?

Description This command sets the desired voltage range. The range can be specified explicitly as low (L) or high (H) or given as a number. In case of a number the range is set to fit the number.

Setting the voltage range is only allowed when the state is OFF.

The query returns the set voltage range (L or H).

Parameters	Name	Type	Range	Default
	<voltageRange>	Discrete NR2	LOW HIGH 0-80.0	HIGH

Return Returns the set voltage range.

Usage example Set the voltage range to LOW (because 5 fits within low range):
VOLT:RANGE 5

Errors

Related Commands [SOURce:]INPut:PROT:CLEAR
[SOURce:]VOLTage
[SOURce:]INPut[:STATe]

3. CAPACITY subsystem

The SOURce:CAPacity subsystem controls the capacity measurements and limits. Capacity measurements are accumulated measurements over time (e.g. mAh, Wh) when the load is turned on.

3.1.1. [SOURce]:CAPacity[:STATe]

Syntax [SOURce]:CAPacity[:STATe] {<bool>}
[SOURce]:CAPacity[:STATe]?

Description This command enables or disables the capacity measurements and limits when the load is in the ON state. Capacity measurement always stops when the load is in the OFF state.

When this state is OFF the capacity limits are also not enforced.

Parameters	Name	Type	Range	Default
	<bool>	Boolean	ON OFF 0 1	ON

Return The query command returns 0 if the measurement state is disabled, and 1 if the measurement state is enabled, independent of the state of the load.

Usage example Set capacity measurement status to enabled and check it:

```
CAP 1
CAP?
1
```

Errors

Related Commands [SOURce:]INPut

3.1.2. [SOURce]:CAPacity:LIMit[:ENable]

Syntax [SOURce]:CAPacity:LIMit[:ENable] {<bool>}
[SOURce]:CAPacity:LIMit[:ENable]?

Description This command enables or disables the capacity threshold limits checks. When one of the limits is reached the load is turned OFF and the limit protection is set.

The query returns whether the capacity limit check is enabled or disabled.

*RST resets the mode to ON

Parameters	Name	Type	Range	Default
	<bool>	Boolean	ON OFF 0 1	ON

Return

Usage example CAP?
1

Errors

Related Commands

3.1.3. [SOURce]:CAPacity:LIMit:CLEar/TRIPped?

Syntax	[SOURce]:CAPacity:LIMit:CLEar [SOURce]:CAPacity:LIMit:TRIPped?
Description	This command clears the capacity limit protection if set. The query returns whether the capacity limit is set (tripped).
Return	The query returns 1 when a capacity limit is reached, 0 otherwise.
Usage example	CAP 1 CAP:LIM 1 CAP:LIM? 0
Errors	
Related Commands	[SOURce]:CAPacity:LIMit

3.1.4. [SOURce]:CAPacity:ZERO

Syntax	[SOURce]:CAPacity:ZERO
Description	This command set all capacity measurements to 0.
Return	None
Usage example	CAP:ZERO
Errors	
Related Commands	[SOURce]:INPut:CAPacity 1

3.1.5. [SOURce]:CAPacity:LIMit*:STOP

- Syntax** [SOURce]:CAPacity:LIMit:AH[:STOP] {<AhStop>}
[SOURce]:CAPacity:LIMit:AH[:STOP]?
[SOURce]:CAPacity:LIMit:TIME[:STOP] {<TimeStop>}
[SOURce]:CAPacity:LIMit:TIME[:STOP]?
[SOURce]:CAPacity:LIMit:VOLTage[:STOP] {<VoltStop>}
[SOURce]:CAPacity:LIMit:VOLTage[:STOP]?
[SOURce]:CAPacity:LIMit:WH[:STOP] {<WhStop>}
[SOURce]:CAPacity:LIMit:WH[:STOP]?
Description These commands set the capacity limits for Ah, Time, Voltage and Wh. For Ah, Time and Wh these limit specify a max value. If any of these values is exceeded the capacity limit state is set. The voltage is specified as a minimum (under voltage). If the voltage drops below the given value the capacity limit it triggered.

The queries return the set limit of the corresponding value

Parameters	Name	Type	Range	Default	Unit
	<AhStop>	NR2	0.001-3600.0	10.0	Ah
	<TimeStop>	Integer	1-864000	86400	s
	<VoltStop>	NR2	0.5-80	3.0	V
	<WhStop>	NR2	0.001-3600	10	Wh

- Return** The request return the set values for the corresponding limit.
Usage example Set the capacity limit to max. 100mAh, max. 1 hour, max. 250mWh and min. 3.1V and activate the capacity limit enforcement and the capacity measurements.

```
CAP:LIM:AH 0.1
CAP:LIM:TIM 3600
CAP:LIM:WH 0.25
CAP:LIM:VOLT 3.1
CAP:LIM 1
CAP 1
```

Related Commands**3.1.6. [SOURce]:INPut:PROTection:WDOG:CLEAr/TRIPped?**

- Syntax** [SOURce]:INPut:PROTection:WDOG:CLEAr
[SOURce]:INPut:PROTection:WDOG:TRIPped?
Description This command clears the latched protection status that disables the output when a SCPI watchdog timeout is reached. Note the watchdog is NOT turned of and will trigger again if activity or PET commands are not detected within the set delay.

The query returns whether the SCPI watchdog condition is set.

- Usage example** The following command clears the SCPI watchdog status:

```
INP:WDOG:CLE
```

- Related Commands** [SOURce]:INPut:PROTection:WDOG
[SOURce]:INPut:PROTection:TYPE
[SOURce]:INPut:PROTection:DELay

3.1.7. [SOURce]:INPut:PROTection:WDOG:DELaY

Syntax [SOURce]:INPut:PROTection:WDOG:DELaY {<delay>}
[SOURce]:INPut:PROTection:WDOG:DELaY?

Description This command set the SCPI watchdog timeout delay in seconds.

The query returns the current set delay in seconds.

Parameters	Name	Type	Range	Default
	<delay>	Integer	0-3600	10
Return	The query command returns the number of seconds the delay is set to, independent of the status of the watchdog.			
Usage example	INP:WDOG:DEL 5 INP:WDOG:DEL? 5			
Related Commands	INP:WDOG			

3.1.8. [SOURce]:INPut:PROTection:WDOG:PET

Syntax [SOURce]:INPut:PROTection:WDOG:PET

Description This command clears the SCPI watchdog inactivity timer.

Return None

Usage example INP:PROT:WDOG:PET

3.1.9. [SOURce]:INPut:PROTection:WDOG:TYPe

Syntax [SOURce]:INPut:PROTection:WDOG:TYPe {<wdogType>}
[SOURce]:INPut:PROTection:WDOG:TYPe?

Description This command set the SCPI watchdog type to one of:

- **Activity:** The SCPI watchdog timer is reset on reception of any SCPI command line
- **PET:** The SCPI watchdog timer is only reset on the reception of the INPut:WDOG:PET command.

Parameters	Name	Type	Range	Default
	<wdogType>	Discrete	ACTivity PET	ACT

Return The type of SCPI watchdog type. ACT for Activity or PET for PET.

Usage example Set the SCPI watchdog type to PET, set the delay to 5s, activate the SCPI watchdog:

```
INP:WDOG:TYP PET
INP:WDOG:DEL 5
INP:WDOG 1
```

Send the PET command at least once every 5 seconds:

```
INP:WDOG:PET
INP:WDOG:PET
```

Disable the SCPI watchdog when the critical routine is finished or when the remote program ends:

```
INP:WDOG 1
```

Errors

Related Commands [SOURce]:INPut:WDOG

4. FETCH subsystem

The FETCH subsystem reads the last measured values. It doesn't trigger any measurements or clears any values.

4.1.1. FETCH[:SCALar]:*[:DC]?

Syntax `FETCH[:SCALar]:CURRent[:DC]?`
`FETCH[:SCALar]:VOLTag[:DC]?`
`FETCH[:SCALar]:POWer[:DC]?`

Description These queries return the last measured current (A), voltage (V) or power (W) measurements. Measurements are averaged over the set number of line power cycles.

Return Float

Usage example Fetch the last measured current value:

```
FETCH:CURR?  
  
1.02
```

Errors

Related Commands [SENSe:]NPLCycles

4.1.2. FETCH[:SCALar]:*[:DC]:STATistics?

Syntax `FETCH[:SCALar]:CURRent[:DC]:STATistics? <stat>`
`FETCH[:SCALar]:VOLTag[:DC]:STATistics? <stat>`
`FETCH[:SCALar]:POWer[:DC]:STATistics? <stat>`

Description These queries return one or all of the statistical values of current (A), voltage (V) or power (W) measurements over the reported number amount of measurements (count). Without parameters all stats of the measurement are returned in the order min,max,avg and count.

Parameters	Name	Type	Range	Default
	<stat>	Discrete	MIN MAX AVG COUNT	all

Return Float or comma separated floats. The count is an integer.

Usage example Fetch the statistics of current:

```
FETCH:CURR:STAT?  
  
0.97,1.12,1.01,123
```

Errors

Related Commands [SENSe:]NPLCycles
[SENSe:]CURRent:STATistics[:ON]
[SENSe:]CURRent:STATistics:CLEAR
[SENSe:]VOLTag:STATistics[:ON]
[SENSe:]VOLTag:STATistics:CLEAR
[SENSe:]POWer:STATistics[:ON]
[SENSe:]POWer:STATistics:CLEAR

4.1.3. FETCh[:SCALar]:VOLTage:REVerse[:POLarity]?

Syntax	FETCh[:SCALar]:VOLTage:REVerse[:POLarity]?
Description	This query returns true if the last detected status of the reverse polarity detection circuit was positive (polarity reversed) or not (normal polarity).
Return	1 = reverse polarity, 0 = no reverse polarity
Usage example	FETCH:VOLT:REV? 0
Errors	
Related Commands	

4.1.4. FETCh:CAPacity?

Syntax	FETCh:CAPacity?
Description	This queries returns the last measured set of capacity values in the order Ah, Wh, time.
Return	Comma separated array
Usage example	FETCH:CAP? 0.121, 0.232, 63
Errors	
Related Commands	[SOURce]:CAPacity[:ON]

5. MEASURE subsystem

The MEASURE subsystem waits for the start of a new averaging measurement cycle and returns the measured value. It doesn't not trigger a new measurement but waits for a new measurement to take place.

5.1.1. MEASure[:SCALar]:*[:DC]?

Syntax	MEASure[:SCALar]:CURRENT[:DC]? MEASure[:SCALar]:VOLTage[:DC]? MEASure[:SCALar]:POWer[:DC]?
Description	These queries wait for a new measurement of current (A), voltage (V) or power (W). Measurements are averaged over the set number of line power cycles.
Return	Float
Usage example	Get a new measurement of the current value: MEAS:CURR? 1.02
Errors	
Related Commands	[SENSe:]NPLCycles

6. SENSE subsystem

The SENSE subsystem controls how measurements are performed.

6.1.1. [SENSe:]NPLCycles

Syntax [SENSe:]NPLCycles {<number>}
[SENSe:]NPLCycles?

Description This command set the number of power line cycles (50Hz or 60Hz) all measurement will be averaged over.

Parameters	Name	Type	Range	Default
	<number>	NR1	1-100	25

Return The query command returns the current number of power line cycles used to average measurements.

Usage example Set power line frequency to 50Hz and the averaging to 10, resulting in an averaging period of 200ms (5 measurement per second):

```
PLFREQ 50  
NPLC 10
```

Errors

Related Commands [SENSe:]PLFreq

6.1.2. [SENSe:]PLFreq

Syntax [SENSe:]PLFreq {<PLFreq>}
[SENSe:]PLFreq?

Description This command set the power line frequency used. This is used to match the measurement averaging on this frequency to cancel out power line interference as much as possible.

Parameters	Name	Type	Range	Default
	<PLFreq>	Discrete	50 60	50

Return

Usage example Set the power line frequency used for averaging measurements to 50Hz:
PLFREQ 50

Errors

Related Commands [SENSe:]NPLCycles

6.1.3. [SENSe]:*:STATistics[:ON]

Syntax [SENSe]:CURREnt:STATistics[:ON] {<bool>}
 [SENSe]:CURREnt:STATistics[:ON]?
 [SENSe]:VOLTage:STATistics[:ON] {<bool>}
 [SENSe]:VOLTage:STATistics[:ON]?
 [SENSe]:POWEr:STATistics[:ON] {<bool>}
 [SENSe]:POWEr:STATistics[:ON]?

Description These commands toggle the active tracking of statistics (min, max, avg and count) of different measured values. Statistics can be turned on or off independently for the different measurement. When turned off the values will be held. Turning ON will continue to add to the existing measurements.

The queries returns whether the statistics are ON (1) or OFF (0) for the corresponding measurement.

Parameters	Name	Type	Range	Default
	<bool>	Boolean	ON OFF 1 0	0

Return The request returns 1 for ON and 0 for OFF.

Usage example Turn on capacity statistics measurements for current:
 CURR:STAT ON

Related Commands [SENSe]:*:STATistics:CLEAR
 FETCh:[SCALAR:]*[:DC]:STATistics?

6.1.4. [SENSe]:*:STATistics:CLEAr

Syntax [SENSe]:CURREnt:STATistics:CLEAr
 [SENSe]:VOLTage:STATistics:CLEAr
 [SENSe]:POWEr:STATistics:CLEAr

Description This command clears the statistics for the corresponding measurement. All values are set to 0.

Usage example The following command clears the current statistics:
 CURR:STAT:CLE

Related Commands [SENSe]:*:STATistics[:ON]
 FETCh:[SCALAR:]*[:DC]:STATistics?

6.1.5. [SENSe]:VOLTage:REMOte

Syntax [SENSe]:VOLTage:REMOte {<bool>}
[SENSe]:VOLTage:REMOte?

Description This command enables or disables the remote voltage sensing port. Remote sensing can only be changed if the state of the load is OFF.

The query returns the current status of remote sensing.

Parameters	Name	Type	Range	Default
	<bool>	Boolean	ON OFF 1 0	OFF

Return The query command returns 1 if remote sensing is ON and 0 if remote sensing is OFF.

Usage example Turn remote voltage sensing on:
VOLT:REM 1

Related Commands

6.1.6. [SENSe]:VOLTage:REMOte:ERRor[:TRIPped]?

Syntax [SENSe]:VOLTage:REMOte:ERRor[:TRIPped]?

Description This query returns whether a remote voltage sensing was triggered when the load was on. This causes a protection status.

Return 1 if a remote voltage sensing error was detected, 0 otherwise

Usage example

Errors None

Related Commands [SENSe]:VOLTage:REMOte
[SOURce:]INPut:PROTection:CLEar

7. SYSTEM subsystem

The SYSTEM subsystem controls generic system settings.

7.1.1. SYSTem:BEEP

Syntax SYSTem:BEEP [<duration>]

Description This command triggers the system beeper for the given duration in ms. If no value is specified the set duration (default 300ms) is used.

Parameters	Name	Type	Range	Default
	<duration>	NR1	0-2500	300

Return None

Usage example
Beep for 0.5s:
SYST:BEEP 500

Errors

Related Commands SYSTem:BEEP:DURation

7.1.2. SYSTem:BEEP:DURation

Syntax SYSTem:BEEP:DURation <duration>
SYSTem:BEEP:DURation?

Description This command set beeper duration for all following beeper activation without an explicit duration specified.
The query returns the current set duration.

Parameters	Name	Type	Range	Default
	<duration>	NR1	0-3500	300

Return Duration in milliseconds.

Usage example
Set the beeper duration to 0.1s for all following beeps and beep:
SYST:BEEP 100
SYST:BEEP

Errors

Related Commands SYSTem:BEEP

7.1.3. SYSTem:BEEP:ON:*

Syntax `SYSTem:BEEP:ON:PROTection {<bool>}`
 `SYSTem:BEEP:ON:PROTection?`
 `SYSTem:BEEP:ON:CAPacity {<bool>}`
 `SYSTem:BEEP:ON:CAPacity?`
 `SYSTem:BEEP:ON:POLarity {<bool>}`
 `SYSTem:BEEP:ON:POLarity?`
 `SYSTem:BEEP:ON:SENSe {<bool>}`
 `SYSTem:BEEP:ON:SENSe?`
 `SYSTem:BEEP:ON:ENCOder {<bool>}`
 `SYSTem:BEEP:ON:ENCOder?`

Description These commands toggle whether the system beeper sounds in certain situations or not. By default all are ON.

The queries return the current status if the beeper sound configuration is ON (1) or OFF (0).

There are different settings for:

- PROTection: Beep when protection state is triggered or not.
- CAPacity: Beep when the capacity limit state is triggered or not.
- POLarity: Beep when a reverse polarity situation occurred or not.
- SENSe: Beep when a sense error occurs.
- ENCOder: Beep shortly when encoder is rotated or not.

Parameters	Name	Type	Range	Default
	<bool>	Boolean	ON OFF 1 0	1

Return The request returns 1 for ON and 0 for OFF.

Usage example Turn off beeper sound on encoder movement:
 `SYST:BEEP:ON:ENC OFF`

Related Commands

7.1.4. SYSTem:FAN:MODE

Syntax `SYSTem:FAN:MODE {<fanmode>}`
 `SYSTem:FAN:MODE?`

Description This command set the FAN mode. The modes are AUTO and MANUAL. In auto mode the fan speed is automatically set based on the measured temperature of the heatsink according to a lookup table. In manual mode the Fan speed is fixed based to a given percentage.
 The query returns the currently set fan mode.

Parameters	Name	Type	Range	Default
	<fanmode>	Discrete	AUTO MAN	AUTO

Usage example Set the fan mode to manual and the speed to maximum:

`SYST:FAN:MODE MAN`
`SYST:FAN:SPEED 100`

Related Commands `SYSTem:FAN:SPEED`
 `SYSTem:FAN:RPM?`
 `SYSTem:TEMPerature?`

7.1.5. SYSTem:FAN:SPEED

Syntax SYSTem:FAN:SPEED {<speed>}
SYSTem:FAN:SPEED?

Description This command set the FAN speed percentage when the fan is in manual mode. The query returns the currently set fan speed.

Parameters	Name	Type	Range	Default
	<speed>	NR1 Discrete	0 to100,MIN MAX DEF	50

Usage example Set the fan mode to manual and the speed to maximum (100%):

```
SYST:FAN:MODE MAN
SYST:FAN:SPEED 100
```

Related Commands SYSTem:FAN:MODE

7.1.6. SYSTem:FAN:RPM?

Syntax SYSTem:FAN:RPM?

Description This query returns the last measured rpm of the specified fan. If no fan is specified the rpm of the heatsink fan is returned.

Note: fan option is not implemented yet. Query always returns the heatsink fan RPM.

Return The query command returns the last measured rpm value as integer.

Usage example

Related Commands SYSTem:FAN:MODE
SYSTem:FAN:SPEED

7.1.7. SYSTem:TEMPerature?

Syntax SYSTem:TEMPerature?

Description This query returns the last measured temperature at the heatsink.

Return Temperature in degree Celsius

Usage example SYST:TEMP?
24.3

Errors None

Related Commands

7.1.8. SYSTem:TEMPerature:PROTection[:LEVel]

Syntax `SYSTem:TEMPerature:PROTection[:LEVel] {<temp>}`
`SYSTem:TEMPerature:PROTection[:LEVel]?`

Description This command sets the desired over temperature protection (OTP) level in degree Celsius. The protection will trigger if the set level is exceeded for the over temperature delay amount of time.

The query returns the set temperature protection level in degrees Celcius.

Parameters	Name	Type	Range	Default
	<temp>	NR2 Discrete	10.0 to 110.0, MIN MAX DEF	80

Return Returns the set OTP level as float in degree Celcius

Usage example Set the OTP level to 50°C:
`SYST:TEMP:PROT 50`

Errors

Related Commands `[SOURce:]INPut:PROT:CLEAR`
`SYSTem:TEMPerature:DELay`

7.1.9. SYSTem:TEMPerature:PROTection:DELay[:TIME]

Syntax `SYSTem:TEMPerature:PROTection:DELay[:TIME] {<delay>}`
`SYSTem:TEMPerature:PROTection:DELay[:TIME]?`

Description This command sets the over temperature delay time in seconds. This is the time the set temperature level has to be exceeded without interruption before the over power protection is triggered.

The query returns the set temperature protection delay in seconds.

Parameters	Name	Type	Range	Default
	<delay>	NR1 Discrete	1 to 600, MIN MAX DEF	20

Return NR1

Usage example Set the OTP level to 50°C and trigger after 10seconds:
`SYST:TEMP:PROT 50`
`SYST:TEMP:PROT:DEL 10`

Errors

Related Commands `[SOURce:]INPut:PROT:CLEAR`
`SYSTem:TEMPerature:PROTection[:LEVel]`

8. CALibration subsystem

The CALibration subsystem handles all calibration related functionality.

8.1. CALibration[:MODE]

Syntax `CALibration[:MODE] {<bool>}`
`CALibration[:MODE]?`

Description This command enables or disables the calibration mode. All other calibration commands are only valid when in calibration mode.

If calibration mode exits, a *RST is executed.

Parameters	Name	Type	Range	Default
	<bool>	Boolean	ON OFF 0 1	OFF

Return The query command returns 0 if the calibration mode is OFF, and 1 if the calibration mode is ON.

Usage example Enter calibration mode:
`CAL 1`

Errors

Related Commands

8.2. CALibration:INIT:EEPROM

Syntax `CALibration:INIT:EEPROM`

Description This command initializes the EEPROM with a default set of uncalibrated data.

ALL EXISTING CALIBRATION DATA WILL BE ERASED FROM THE EEPROM

This is needed before individual calibration data set can be written to the EEPROM. Typically this is only done once during initial calibration of the device.

Note: This command takes several seconds to execute and the SCPI interface will not respond during this period.

Parameters	Name	Type	Range	Default
	<mode>	Discrete	CC CV CR CP DVM SHORT	CC

Return None

Usage example `CAL:INIT:EEPROM`

Errors

Related Commands `CALibration[:MODE]`

8.3. CALibration:TYPE

Syntax `CALibration:TYPE {<caltype>}`
`CALibration:TYPE?`

Description This command select the range to be calibrated.

Parameters	Name	Type	Range	Default
	<caltype>	Discrete	IMONH IMONL UMONH UMONL ISETH ISETL USETH USETL VONH VONL OCPH OCPL OVPH OVPL	-

Return The command doesn't return anything.

Usage example Enter calibration mode and switch to calibrating IMONLow range.

```
CAL 1
CAL:TYPE IMONL
```

Errors

Related Commands `CALibration[:MODE]`
`CALibration:POInt`
`CALibration:SET`

8.4. CALibration:POInt

Syntax `CALibration:POInt {<calpoint>}`
`CALibration:POInt?`
`CALibration:POInt:MAX?`

Description This command selects the calibration point within the active calibration range (type).
In current implementation there are 2 calpoints per range.

The POInt query returns the currently active calibration point.
The MAX query returns the maximum datapoints in this range. In current implementation this is always 2.

Return This query returns 0 if a protection is not set, or 1 when it was not detected.

Usage example Enter calibration mode, switch to calibrating IMONLow range and select first datapoint:

```
CAL 1
CAL:TYPE IMONL
CAL:POINT 1
```

Errors

Related Commands `CALibration[:MODE]`
`CALibration:POInt`
`CALibration:SET`

8.5. CALibration:SET

Syntax CALibration:SET {<setpoint>}
CALibration:SET?

Description This command sets the ‘set’ point within a datapoint. For ranges that read values this is the value that is externally applied as a reference. For ranges that set values this is the raw value that is put into the DAC (rounded to an integer).

The query returns the current set point.

Parameters	Name	Type	Range	Default
	<setpoint>	Float	Depends on range	-

Return Returns the set value of the datapoint as a float.

Usage example Enter calibration mode, switch to calibrating UMONLow range, select first datapoint and set the set point to the externally applied voltage of 1.1V:

```
CAL 1
CAL:TYPE UMONL
CAL:POINT 1
CAL:SET 1.1
```

Related Commands CALibration[:MODE]
CALibration:POInt

8.6. CALibration:ADC?

Syntax CALibration:ADC? {<ADClimit>}

Description Query the ADC min or max values for this calibration point. This is only applicable for ranges with and ADC (current and voltage monitoring).

Parameters	Name	Type	Range	Default
	<ADClimit>	Discrete	MIN MAX	-

Returns ADC value as an integer.

Usage example Enter calibration mode, switch to calibrating UMONLow range, select first datapoint and query the maximum value of the ADC:

```
CAL 1
CAL:TYPE UMONL
CAL:POINT 1
CAL:ADC? MAX
8388607
```

Related Commands

8.7. CALibration:MEASure

Syntax	CALibration:MEASure CALibration:MEASure?
Description	<p>Perform a calibration measurement.</p> <p>For range that measures values: The ADC value is read.</p> <p>For ranges that set values directly with a DAC: The DAC value is set. The real value should be read externally and set with CAL:SET.</p> <p>For ranges that set values to a trigger level: A search is started to find the DAC value corresponding to the externally applied level. The applied level should be set with SET.</p> <p>After the measure function, the calibration values for this range can be stored in the EEPROM with CAL:SAVE.</p> <p>The result from the measurement can be obtained with the MEASure? query.</p>
Return	The query command returns the measured value (from the ADC or DAC).
Usage example	<p>Enter calibration mode, switch to calibrating UMONLow range, select first datapoint, set the set point to the externally applied voltage of 1.1V and perform a calibration measurement:</p> <pre> CAL 1 CAL:TYPE UMONL CAL:POINT 1 CAL:SET 1.1 CAL:MEAS </pre>
Related Commands	

8.8. CALibration:MEASure:RUNning?

Syntax	CALibration:MEASure:RUNning?
Description	Query returns whether a cal:meas command is currently executing.
Return	Boolean. 1 = calibration measurement is running, 0 = no calibration measurement is running.
Usage example	<pre> CALibration:MEASure:RUNning? 1 </pre>

8.9. CALibration[:TYPE]:SAVE**Syntax** `CALibration[:TYPE]:SAVE`**Description** This command saves the currently active datapoints for the active range to the EEPROM.**Return** None**Usage example** Enter calibration mode, switch to calibrating UMONLow range, select first datapoint, set the set point to the externally applied voltage of 1.1V and perform a calibration measurement:

```

CAL 1
CAL:TYPE UMONL
CAL:POINT 1
CAL:SET 1.1
CAL:MEAS

```

Switch to second point, set point to externally applied voltage of 9.51V and perform a calibration measurement:

```

CAL:POINT 2
CAL:SET 9.5
CAL:MEAS

```

Save the set and measured values for point 1 and point 2 of UMONL to the EEPROM:

```

CAL:SAVE

```

Errors**Related
Commands****8.10. CALibration[:TYPE]:RESET****Syntax** `CALibration[:TYPE]:RESET`**Description** This command resets the values for this calibration range to the values stored in the EEPROM.**Return** None.**Usage
example****Errors****Related
Commands**