# The control commands summary of equipment in SinBerBEST BIMG Test-Bedding (continued 1)

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## Chapter 3: The control of PV simulator for DC/AC-Source

The PV simulator(s) in the SinBerBEST BIMG Test-Bedding is AMETEK‘s TerraSAS, which now is coupled with 380 V DC Bus to supply the DC power for the BIMG Test-Bedding and also can be switched to 380 V AC Bus to supply the AC power. By manufacturer’s original design, there can be more than one PV simulator(s) working together, and all of the PV simulators are remotely controlled by a computer which is assigned as the PV simulator’s management computer. The BIMG server actually communicates with the computer to remote control these PV simulators in sub-set of SCPI standard.

## Initialization commands of PV Simulator(s)

Before the PV simulator starts to work, the first thing to do for the remote controller (the BIMG server) is to initialize the PV simulator(s). The initialization may categorize into the following subsystems:

### (i) PI Curve Management Subsystem

Every PV module (or panel) follows a specific VI curve in certain irradiance condition. Therefore the PV simulator to simulate a PV module (or panel) must indicate its relevant VI curve to follow. As the PV simulator can simulate a number of PV modules (or panels) simultaneously, the management PC needs a pool to store VI curves so that the curve in the pool can be indicated to a simulating PV module (or panel). The commands in curve management subsystem are for the curve pool management.

It should be reminded that the PI curve to be indicated to the simulating PV modules (or panels) must be in the pool of VI curves. That means that the relevant PI curve must be read (or add) and loaded to the pool before the indication.

### The command summary of Curve Management Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| CURVe:READFile <file name> | Loads a photovoltaic curve from a disk file to the pool of PV curves. (the disk file must exist and in [\\root\TerraSas\Curves](file:///\\root\TerraSas\Curves) folder.  e.g. CURV:READF “Sunpower 315 (96 cells)” |
| CURVe:VIparms <Voc>, <Isc>  CURVe:VIparms? | Sets VOC and ISC for the curve being added to the pool of PV curves. |
| CURVe:MPPparms <Vmp>,<Imp>  CURVe:MPPparms? | Sets VMP and IMP for the curve being added to the pool of PV curves. |
| CURVe:FORMfactor <form factor>  CURVe:FORMfactor? | Computes VMP and IMP from the supplied form factor. The allowed range is 0.5 to 0.95. This overwrites any previously entered VMP, IMP parameters. |
| CURVe:BETAparms <Beta V>,<Beta P>  CURVe:BETAparms? | Sets the voltage and power temperature coefficients, expressed in percent values per degree Kelvin. Some manufacturers report the voltage coefficient in mV/ºK. Divide by VOC to obtain a percentage. Allowed range is -1.99 to 1.99. |
| CURVe:KFactor <voltage>,<irradiance>  CURVe:KFactor? | Sets the irradiance correction factor by entering parameters V1 and E1. See "Photovoltaic curve > Create" for more details. The voltage must be equal to or less than VOC. The irradiance must be between 100 and 800 W/m2. |
| CURVe:ADD <name> | Adds a previously characterized photovoltaic curve to the pool of PV curves and creates a disk file into the [\\root\TerraSas\Curves](file:///\\root\TerraSas\Curves) folder, with file name <name>.crv. |
| CURVe:DELEte <name> | Removes the indicated curve from the pool of PV curves. The corresponding disk file is **not** deleted. Disk files can only be deleted manually, using Windows Explorer. |
| CURVe:CATalog? | Returns the list of curve names currently loaded in the pool of PV curves. If there are no curves loaded, "C.0" is returned. Multiple entries are separated by a comma. |

**Example:**

CURV:READF "Sunpower 230 (72 cells)" will load the curve file <Sunpower 230 (72 cells).crv> from the \\root\TerraSas\Curves folder.

### (ii) Irradiance Profile Management Subsystem

The power output of the PV module (or panel) is the function of the irradiance that effects on the PV module (or panel). Therefore the PV simulator to simulate a PV module (or panel) must indicate a profile that indicates the irradiance effecting on the PV modules (or panels) with time duration. The management PC needs a pool to store irradiance profiles so that the irradiance profile in the pool can be indicated to a simulating PV modules (or panels). The commands in the profile subsystem are for the irradiance profile pool management.

It should be reminded that the irradiance profile to be indicated to the simulating PV modules (or panels) must be in the pool of irradiance profiles for a dynamic simulation. That means that the relevant irradiance profile must be read and loaded to the pool before the indication.

### The command summary of Irradiance Profile Management Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| PROFile:READFile <file name> | Loads an irradiance profile from a disk file. (the disk file must exist and in [\\root\TerraSas\Profiles](file:///\\root\TerraSas\Profiles) folder. |
| PROFile:DELEte <name> | Removes the indicated irradiance profile from the pool of irradiance profile. The corresponding disk file is not affected. |
| PROFile:CATalog? | Returns the list of irradiance profile names currently loaded in the pool of irradiance profiles and their duration. The format returned is <profile name>.<length in seconds>. Multiple entries are separated by a comma. If there are no profiles loaded, "P.0" is returned. |

**Example:**

PROF:READF "Sunny day" will load the profile file <Sunny day.irtp> from the \\root\TerraSas\Profiles folder

### (iii) Array Management Subsystem

Normally, the PV simulator can simulate an array of PV modules (or panels). The PV simulator to simulate an array of PV modules (or panels) must define the structure of the array, such as the number of modules and strings, and load the array to the pool of arrays. Then the management PC can be able to indicate which VI curve and which irradiance profile the array follows. The commands in array management subsystem are for the array pool management.

It should be reminded that the array of the simulating PV modules (or panels) to be indicated must be in the pool of arrays. That means that the array of the simulating PV modules (or panels) must be added to the pool before the indication.

### The command summary of Array Management Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| ARRAy:SIZE <modules>,<strings>  ARRAy:SIZE? | Defines an array size. The maximum number of modules in an array is 100. |
| ARRAy:ADD <name> | Creates an array and adds it to the pool of arrays. The array size must have been previously defined. After creation, the new array is selected and ready to be indicateed curves and profiles. |
| ARRAy:SELect <name>  ARRAy:SELect? | Selects the indicated array. All subsequent curve and profile indicatements refer to the currently selected array. |
| ARRAy:MODule#:STRing#:CURVe <name>  ARRAy:MODule#:STRing#:CURVe? | Indicates a curve to the selected array module(s). If the curve name is blank, curve zero is indicateed. If the module number is zero, all modules in the string are indicateed the same curve. If the string number is zero, the curve is indicateed to the selected module on all strings. If both numbers are zero, the curve is indicateed to all modules within the array. |
| ARRAy:MODule#:STRing#:PROFile <name>  ARRAy:MODule#:STRing#:PROFile? | Indicates a profile to the selected array module(s). If the profile name is blank, no profile is indicateed. If the module number is zero, all modules in the string are indicateed the same profile. If the string number is zero, the profile is indicateed to the selected module on all strings. If both numbers are zero, the profile is indicateed to all modules within the array. |
| ARRAy:MULTiplier <value>  ARRAy:MULTiplier? | Programs the currently selected array with the specified current multiplier. Accepted range is an integer between 1 and 1000. The default value is 1, which is indicateed when a new array is created. |
| ARRAy:DELEte <name> | Removes the indicated array from the graphic pool. If the array was selected, the selection is cancelled (ARRAy:SELE? returns "A.0"). If the array was indicateed to one or more output channels, indicatement is cleared and curve zero is executed. |
| ARRAy:CATalog? | Returns the list of array names currently loaded in the graphic pool and their size. The format returned is <array name>.<modules>.<strings>. Multiple entries are separated by a comma. If there are no arrays loaded, "A.0" is returned. |

**Example:**

ARRA:SIZE 3,1

ARRA:ADD "Test 1"

ARRA:SIZE 4,2

ARRA:ADD "Test 2"

ARRA:CAT?

Test 1.3.1,Test 2.4.2

### (iv) Source Selecting Subsystem

To start a simulation, the management PC should indicate which PV curve, array and irradiance level (irradiance profile for dynamic simulation) etc. to be selected in the simulation.

### The command summary of Source Selecting Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| [SOURce:]CURVe <name> [,(@chanlist)]  [SOURce:]CURVe? [(@chanlist)] | The indicated curve is executed on the selected channels. If the name is blank, curve 0 is executed.  Returns the curve name for the selected channels. If no curve was assigned, returns "C.0". Multiple entries are separated by a comma. |
| [SOURce:]IRRadiance <irradiance> [,(@chanlist)]  [SOURce:]IRRadiance? [(@chanlist)] | The programmed irradiance is executed on the selected channels. Acceptable range is 0 to 1999 W/m2. |
| [SOURce:]TEMPerature <temperature> [,(@chanlist)]  [SOURce:]TEMPerature? [(@chanlist)] | The programmed temperature is executed on the selected channels. Acceptable range is -100 to +100 °C. |
| [SOURce:]PROFile <name> [,(@chanlist)]  [SOURce:]PROFile? [(@chanlist)] | The indicated irradiance profile is sent to the selected channels. Execution starts when a trigger command is received. If one or more channels in the list are executing a profile, error 16 is generated.  Returns the profile name for the selected channels. If no profile is assigned, returns "P.0". Multiple entries are separated by a comma. |
| [SOURce:]PROFile:OFFSet <value> [,(@chanlist)]  [SOURce:]PROFile:OFFSet? [(@chanlist)] | Sets the starting time (offset) of the irradiance profile for the selected channels. |
| [SOUR:]VOLT:PROT[:LEV] <value> [,(@chanlist)]  [SOURce:]VOLTage:PROT[:LEVel]? [(@chanlist)] | Sets the overvoltage protection threshold on the selected channels |
| [SOURce:]ARRAy <name> [,(@chanlist)]  [SOURce:]ARRAy? [(@chanlist)] | The indicated array is executed on the selected channels. If the name is blank, array execution is terminated and curve 0 is executed.  Returns the array name for the selected channels. If no array was assigned, returns "A.0". Multiple entries are separated by a comma. |
| SOURce#:ARRAy:MODule#:STRing#:IRRadiance <irradiance>  SOURce#:ARRAy:MODule#:STRing#:IRRadiance? | The indicated array module(s) on the selected channel are programmed with the specified irradiance level. If the module number is zero, all modules in the string are programmed. If the string number is zero, the selected module is programmed on all strings. If both numbers are zero, all modules within the array are programmed. Acceptable range is 0 to 1999 W/m2. |
| SOURce#:ARRAy:MODule#:STRing#:TEMPerature <temperature>  SOURce#:ARRAy:MODule#:STRing#:TEMPerature? | The indicated array module(s) on the selected channel are programmed with the specified temperature level. If the module number is zero, all modules in the string are programmed. If the string number is zero, the selected module is programmed on all strings. If both numbers are zero, all modules within the array are programmed. Acceptable range is -100 to +100 °C. |
| SOURce#:ARRAy:MODule#:STRing#:DIOde {YES|NO}  SOURce#:ARRAy:MODule#:STRing#:DIOde? | The indicated array module(s) on the selected channel are programmed with the specified bypass diode option. If the module number is zero, all modules in the string are programmed. If the string number is zero, the selected module is programmed on all strings. If both numbers are zero, all modules within the array are programmed.  Returns the diode option state (YES or NO) for the selected channel and array module. |
| SOURce#:ARRAy:MODule#:STRing#:RESistance <resistance>  SOURce#:ARRAy:MODule#:STRing#:RESistance? | The indicated array module(s) on the selected channel are programmed with the specified forward resistance. If the module number is zero, all modules in the string are programmed. If the string number is zero, the selected module is programmed on all strings. If both numbers are zero, all modules within the array are programmed. Acceptable range is 0 to 100 kohms. |
| SOURce#:ARRAy:EXECut | The array is calculated and the resulting IV curve is executed on the selected channel. |

### (v) Output Management Subsystem

The output subsystem is to control the PV simulator’s output relay.

### The command summary of Output Management Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| OUTPut[:STATe] {ON|OFF} [,(@chanlist)] | Turns on or off the output on the selected channels |
| OUTPut[:STATe]? [(@chanlist)] | Returns the output state of the selected channels. Multiple entries are separated by a comma. |
| OUTPut:PROTection:CLEar [(@chanlist)] | Resets the overvoltage protection latch on the selected channels. |

**Example:**

OUTPut:STATe ON, (@1) will turn on the output relay of PV Simulator in channel 1.

## Measurement commands of PV Simulator(s)

The commands in the Measurement subsystem are used for monitoring the operating status of PV simulators in simulation.

### The command summary of Measurement Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| MEASure[:SCALar]:CURRent[:DC]? [(@chanlist)] | Returns the average DC current present on the selected channels. Multiple entries are separated by a comma. |
| MEASure[:SCALar]:CURRent:AC? [(@chanlist)] | Returns the peak-to-peak AC current component present on the selected channels. Multiple entries are separated by a comma. |
| MEASure[:SCALar]:VOLTage[:DC]? [(@chanlist)] | Returns the average DC voltage present on the selected channels. Multiple entries are separated by a comma. |
| MEASure[:SCALar]:VOLTage:AC? [(@chanlist)] | Returns the peak-to-peak AC voltage component present on the selected channels. Multiple entries are separated by a comma. |
| MEASure[:SCALar]:POWer[:DC]? [(@chanlist)] | Returns the True RMS power delivered by the selected channels. Multiple entries are separated by a comma. |
| MEASure[:SCALar]:MPPaccuracy? [(@chanlist)] | Returns the Maximum Power Point tracking accuracy, expressed as the ratio between the True RMS power and the Maximum Power Point, in percent value. Multiple entries are separated by a comma. |
| MEASure[:SCALar]:MPPTRecovery? | Returns the last measured MPPT recovery time on all enabled channels in the format:  <leading chan a>,<trailing chan a>,<leading chan b>,< trailing chan b>,....,<leading channel n>,< trailing chan n>. All values are in seconds. |
| MEASure[:SCALar]:ENERgy[:DC]? [(@chanlist)] | Returns the energy delivered by each selected channel since the last reset, in kWh.  See command SENSe:ENERgy:RESet [(@chanlist)] to reset the reading.  Multiple entries are separated by a comma. |

## System management commands of PV Simulator(s)

The commands in the System Management Subsystem are used for setting up the PV simulation system.

### The command summary of System Management Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| SYSTem:ERRor? | Returns the next error code and error message in the queue. If the queue is empty, returns “0,No errors”. |
| SYSTem:REMote  SYSTem:REMote?  SYSTem:LOCal | Places the system in remote mode, disabling local user interaction with the graphical interface.  Returns “1” if the system is in remote mode, “0” otherwise.  Places the system in local mode, enabling local user interaction with the graphical interface. |
| SYSTem:CHANnel[:COUNt]? | Returns the number of PV simulators in the system. Note that channel and PV simulators count may differ when channels are grouped. See "System>Channels grouping setup" for details. |
| SYSTem:CHANnel:SERial? [(@chanlist)] | Returns the serial number of the PV simulators for the selected channels. Multiple entries are separated by a comma. A dead channel reports "0". |
| SYSTem:CHANnel:MAXVoltage? [(@chanlist)] | Returns the maximum voltage capability of the selected channels. Multiple entries are separated by a comma. |
| SYSTem:CHANnel:MAXCurrent? [(@chanlist)] | Returns the maximum current capability of the selected channels. Multiple entries are separated by a comma. |
| SYSTem:CHANnel:MAXOVervoltage? [(@chanlist)] | Returns the maximum voltage protection setting of the selected channels. Multiple entries are separated by a comma. |
| SYSTem:VERSion? | Returns the SCPI language version number. |
| SYSTem:GROup:CATalog? | Returns output channel groups configuration. |
| SYSTem:GROup:DELEte:ALL | Deletes all previously entered group definitions. Should be sent first when redefining groups. |
| SYSTem:GROup:DEFine:PARallel <group>, (@chanlist)  SYSTem:GROup:PARallel? <group> | Defines a group of channels wired in parallel. The maximum group number is half the number of PV simulators in the system.  Returns the channel list associated with the group definition. Multiple entries are separated by a comma. If the group does not exist, "G.0" is returned. |
| SYSTem:GROup:DEFine:SERies <group>, (@chanlist)  SYSTem:GROup:SERies? <group> | Defines a group of channels wired in series. The maximum group number is half the number of PV simulators in the system.  Returns the channel list associated with the group definition. Multiple entries are separated by a comma. If the group does not exist, "G.0" is returned. |
| SYSTem:GROup:SETup | Configures all output channels with all previously defined groups, after validating all entries. |

## Other commands of PV Simulator(s)

There are also a number of commands that are summarized as follows:

### The command summary of Common Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| **\*CLS** | Clears the error queue, the Standard Events Register and all No Operation Pending flags. |
| **\*ESR?** | Returns the contents of the Standard Events Register in decimal format. |
| **\*IDN?** | Returns product and version information. |
| **\*RST** | Resets the system. The following tasks are performed:   * Suspends processing further commands until the system is reset and ready to accept commands   Stops all dynamic simulations   * Terminates datalogging and closes the file * Terminates triggered measurements * Terminates all pending operations * Deletes all curves, profiles and arrays * Resets all channels to curve zero, no profile * Opens all output relays * Resets all channels to default irradiance and temperature * Clears the error queue, the Standard Events Register and all No Operation Pending flags.   System Configuration, System Settings and Channels Grouping are not affected. |
| **\*WAI** | Suspends processing further commands until all pending operations are completed. |
| **STATus:OPERation:CONDition? [(@chanlist)]** | Returns the operating status of the selected channels. If the channel list is omitted, bit positions marked with X are reported for the system level status. For example, if one or more channels are executing a profile, bit 6 will be set. Multiple entries are separated by a comma.   |  |  |  |  | | --- | --- | --- | --- | | **BIT POSITION** | **DECIMAL VALUE** | **SYST** | **DESCRIPTION** | | 0 | 1 | X | Interlock or emergency switch active | | 1 | 2 | X | Overvoltage protection tripped | | 2 | 4 | X | Overtemperature protection active | | 3 | 8 | X | Communication loss (offline) | | 4 | 16 | X | Dead channel (offline when TerraSAS started) | | 5 | 32 | X | Clipping (voltage or current exceeds maximum) | | 6 | 64 | X | Profile execution is running | | 7 | 128 | | Profile execution is paused | | 8 | 256 | | Channel is a member of a parallel-wired group | | 9 | 512 | | Channel is a member of a series-wired group | | 10 | 1024 | X | Datalogging in progress | | 11 | 2048 | X | Triggered measurement in progress | | 12 | 4096 | | Future use | | 13 | 8192 | | Future use | | 14 | 16384 | | Future use | | 15 | 32768 | | Future use | |

### The command summary of Sense Subsystem

|  |  |
| --- | --- |
| **COMMAND SERISES** | **EXPLANATION** |
| SENSe:DLOG:TINTerval <value>  SENSe:DLOG:TINTerval? | Sets the datalogging interval. Acceptable values are between 0.05 and 3600 seconds. Values are rounded to the nearest 0.05s multiple. |
| SENSe:DLOG:NAME <name>  SENSe:DLOG:NAME? | Sets the datalogging file name. If left blank, a name is automatically generated as follows: <Data log YYYY-MM-DD-HH-MM-SS-mmm>. The disk file is created and data logging will start when a trigger command is received. If the selected file name already exists on disk, its contents are replaced with the new data. After this command is executed, datalogging is placed into an "armed" condition that can only be triggered or aborted. No other changes are allowed.  Returns the active datalog file name. If no open file exists, returns "D.0" |
| SENSe:DLOG:ENABle [(@chanlist)]  SENSe:DLOG:ENABle? [(@chanlist)] | Enables datalogging on the selected channels. |
| SENSe:DLOG:DATA (numlist)  SENSe:DLOG:DATA? | Selects the data items that will be logged, according to the table below.   |  |  | | --- | --- | | **Parameter** | **Description** | | 1 | Time stamp | | 2 | DC Voltage | | 3 | DC Current | | 4 | RMS Power | | 5 | AC Voltage | | 6 | AC Current | | 7 | MPP Accuracy | | 8 | Energy | |
| SENSe:PROFile:SPeed <value> [,(@chanlist)]  SENSe:PROFile:SPeed? [(@chanlist)] | Sets the irradiance profile execution speed for the selected channels. Accepted range is 1 to 100. |
| SENSe:PROFile:LOOP {ON|OFF} [,(@chanlist)]  SENSe:PROFile:LOOP? [(@chanlist)] | Sets profile execution in loop mode on the selected channels. When the end of the profile is reached, execution restarts from the offset time index. |
| SENSe:AVERage {OFF|4|8|20|40|80|200|400} [,(@chanlist)]  SENSe:AVERage? [(@chanlist)] | Sets the measurement averaging period for the selected channels, in milliseconds. Low voltage (80V) PV simulators are limited to 80ms, high voltage (600/1000V) accept the full range. |
| SENSe:Pgain <value> [,(@chanlist)]  SENSe:Pgain? [(@chanlist)] | Sets the proportional gain coefficient for the selected channels. Acceptable values are 0 to 0.9999. |
| SENSe:Igain <value> [,(@chanlist)]  SENSe:Igain? [(@chanlist)] | Sets the integral gain coefficient for the selected channels. Acceptable values are 0 to 0.9999. |
| SENSe:Dgain <value> [,(@chanlist)]  SENSe:Dgain? [(@chanlist)] | Sets the derivative gain coefficient for the selected channels. Acceptable values are 0 to 0.9999. |
| SENSe:MPPTRecovery:CURVe <name>  SENSe:MPPTRecovery:CURVe? | Sets the curve name to be used for the maximum power point recovery time measurement. Name validation performed at the time the measurement is started (see TRIGger:MPPTRecovery[:IMMediate] command). This command does not load the curve file from disk. |
| SENSe:MPPTRecovery:PROFile <name>  SENSe:MPPTRecovery:PROFile? | Sets the profile name to be used for the maximum power point recovery time measurement. Name validation performed at the time the measurement is started (see TRIGger:MPPTRecovery[:IMMediate] command). This command does not load the profile file from disk. |
| SENSe:MPPTRecovery:TRIGger <leading edge>,<trailing edge>  SENSe:MPPTRecovery:TRIGger? | Sets the trigger point for leading and trailing edge measurements, referred to the irradiance profile timing scale. Acceptable values are 0 to 100,000. Additional validation performed at the time the measurement is started (see TRIGger:MPPTRecovery[:IMMediate] command) |
| SENSe:MPPTRecovery:MAXimum <leading edge>,<trailing edge>  SENSe:MPPTRecovery:MAXimum? | Sets the maximum recovery time expected for leading and trailing edge measurements. Acceptable values are 0 to 100,000. Additional validation performed at the time the measurement is started (see TRIGger:MPPTRecovery[:IMMediate] command) |
| SENSe:MPPTRecovery:VALue <leading edge>,<trailing edge>  SENSe:MPPTRecovery:VALue? | Sets the desired MPP accuracy after recovery for leading and trailing edge measurements. Acceptable values are 50 to 100. |
| SENSe:MPPTRecovery:TOLerance <leading edge>,<trailing edge>  SENSe:MPPTRecovery:TOLerance? | Sets the desired MPP accuracy tolerance after recovery for leading and trailing edge measurements. Acceptable values are 0.1 to 20. |
| SENSe:MPPTRecovery:ENABle [(@chanlist)]  SENSe:MPPTRecovery:ENABle? [(@chanlist)] | Enables maximum power point recovery time measurement on the selected channels. |
| SENSe:ENERgy:RESet [(@chanlist)] | Resets the energy reading of each selected channel. |

**Note: all of commands in this document are summarized from TerraSAS User Manual, so detailed command explains please reference the manual.**

### Appendix

For better understanding how to control the PV simulator system working, there are listed some examples as follows:

**(Note: please consult with the hardware engineer before using the examples in real environment.)**

**[SETUP SYSTEM]**

**\*rst**

**\*idn?**

**syst:chan:count?**

**syst:chan:maxv? (@1)**

**syst:chan:maxc? (@1)**

**syst:chan:maxov? (@1)**

**syst:chan:ser? (@1)**

**syst:err?**

**[LOAD ONE CURVE AND TWO PROFILES]**

**curv:readf "Sunpower 230 (72 cells)"**

**prof:readf "Fast ramp"**

**prof:readf "Irradiance test"**

**syst:vers?**

**syst:curv:cat?**

**syst:prof:cat?**

**sour:curv "Sunpower 230 (72 cells)",(@1)**

**syst:err?**

**[START STATIC SIMULATION]**

**sour:volt:prot:lev 55,(@1);lev? (@1)**

**outp on,(@1);\*wai;:outp? (@1)**

**sour:irr 800,(@1,2);temp 50,(@1,2)**

**sour:irr? (@1)**

**sour:temp? (@1)**

**sens:aver 80,(@1);aver? (@1)**

**sens:p 0.01,(@1);i 0.02,(@1);d 0.03,(@1)**

**sens:p? (@1)**

**sens:i? (@1)**

**sens:d? (@1)**

**syst:err?**

**[START PROFILE EXECUTION]**

**sour:prof "Irradiance test",(@1)**

**sour:prof:offs 50,(@1)**

**sour:prof:offs? (@1)**

**sens:prof:sp 1,(@1);sp? (@1)**

**sens:prof:loop on,(@1);loop? (@1)**

**trig (@1)**

**stat:oper:cond? (@1);**

**stat:oper:cond?**

**syst:err?**

**[STOP PROFILE EXECUTION]**

**abor (@1);\*wai;:stat:oper:cond? (@1)**

**:stat:oper:cond?**

**syst:err?**

**[MEASURE VDC,VAC,IDC,IAC,POW,MPP,ENER]**

**meas:volt:dc? (@1)**

**meas:volt:ac? (@1)**

**meas:curr:dc? (@1)**

**meas:curr:ac? (@1)**

**meas:pow? (@1)**

**meas:mpp? (@1)**

**meas:ener? (@1)**

**syst:err?**

**[CREATE AND ADD NEW CURVE]**

**curv:vi 12,5;vi?**

**curv:mpp 10.73,4.47;mpp?;form?**

**curv:kf 11.16,200;kf?**

**curv:beta -0.25,-0.29;beta?**

**curv:add "Test\_script"**

**syst:err?**

**[ADD AND CONFIGURE TWO ARRAYS]**

**arra:size 3,1**

**arra:size?**

**arra:add "Test 1"**

**arra:size 4,2**

**arra:size?**

**arra:add "Test 2"**

**arra:sel?**

**arra:mult 2**

**arra:mult?**

**arra:mod0:str0:curv "Sunpower 230 (72 cells)"**

**arra:mod0:str1:prof "Irradiance test"**

**arra:mod1:str1:curv ""**

**arra:mod1:str1:prof ""**

**arra:sel "Test 1"**

**arra:sel?**

**arra:mod0:str0:curv "Test\_script"**

**arra:cat?**

**syst:err?**

**[DELETE ONE ARRAY]**

**arra:dele "Test 2"**

**arra:cat?**

**syst:err?**

**[INDICATE ARRAY TO OUTPUT CHANNEL]**

**arra "Test 1",(@1)**

**arra? (@1)**

**sour1:arra:mod0:str0:irr 1000**

**sour1:arra:mod1:str1:irr 200.5**

**sour1:arra:mod1:str1:temp 50.5**

**sour1:arra:mod1:str1:dio no**

**sour1:arra:mod1:str1:res 1.2**

**sour1:arra:mod1:str1:irr?**

**sour1:arra:mod1:str1:temp?**

**sour1:arra:mod1:str1:dio?**

**sour1:arra:mod1:str1:res?**

**syst:err?**

**sour1:arra:exec**

**syst:err?**