



PROGRAMMING MANUAL

Function/Arbitrary Waveform Generator

MODEL: 4050B Series (4053B, 4054B, 4055B)

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1.1. About Commands & Queries

This section lists and describes the remote control commands and queries recognized by the instrument. All commands and queries can be executed in either local or remote state.

The description for each command or query, with syntax and other information, begins on a new page. The name (header) is given in both long and short form, and the subject is indicated as a command or query or both. Queries perform actions such as obtaining information, and are recognized by the question mark (?) following the header.

1.3.1 How they are listed

The descriptions are listed in alphabetical order according to their short form.

1.3.2 How they are described

In the descriptions themselves, a brief explanation of the function performed is given. This is followed by a presentation of the formal syntax, with the header given in Upper-and-Lower-Case characters and the short form derived from it in ALL UPPER-CASE characters. Where applicable, the syntax of the query is given with the format of its response.

1.3.3 When can they be used?

The commands and queries listed here can be used for 4050 Series arbitrary/function waveform generators.

1.3.4 Command Notation

The following notation is used in the commands:

< > Angular brackets enclose words that are used placeholders, of which there are two types: the header path and the data parameter of a command.

:= A colon followed by an equals sign separates a placeholder from the description of the type and range of values that may be used in a command instead of the placeholder.

{ } Braces enclose a list of choices, one of which one must be made.

[] Square brackets enclose optional items.

... An ellipsis indicates that the items both to its left and right may be repeated a number of times.

1.2. Table of Commands & Queries

Short	Long Form	Subsystem	Function
*IDN	*IDN	SYSTEM	Get identification from device.
*OPC	*OPC	SYSTEM	Get or set the OPC bit (0) in the Event Status Register (ESR).
*CLS	*CLS	SYSTEM	Clear all the status data registers.
*ESE	*ESE	SYSTEM	Get or set the Standard Event Status Enable register (ESE).
*ESR	*ESR	SYSTEM	Reads and clears the contents of the Event Status Register (ESR).
*RST	*RST	SYSTEM	Initiate a device reset. The *RST recalls the default setup.
*SRE	*SRE	SYSTEM	Set or get the bit settings of the Service Request Enable Register (SRE).
*STB	*STB	SYSTEM	Read the contents of the 488.2 defined status register (STB), and the Master Summary Status (MSS).
*TST	*TST	SYSTEM	Perform an internal self-test and the response indicates whether the self-test has detected any errors.
CHDR	COMM_HEADER	SIGNAL	Sets or gets the command returned format
OUTP	OUTPUT	SIGNAL	Set or get output state.
BSWV	BASIC_WAVE	SIGNAL	Set or get basic wave parameters. Turns on or off channel signal.
ARWV	ARBWAVE	SYSTEM	Change arbitrary wave type.
MDWV	MODULATEWAVE	SIGNAL	Set or get modulate wave parameters.
SWWV	SWEEPWAVE	SIGNAL	Sets or gets sweep parameters.
BTWV	BURSTWAVE	SIGNAL	Set or get burst wave parameters.
PACP	PARACOPY	SIGNAL	Copies parameters from one channel to the other.
SYNC	SYNC	SIGNAL	Set or get in-phase signal.
NBFM	NumBer_ForMat	SYSTEM	Sets or gets data format.
SCFG	SYSTEM_CONFIG	SYSTEM	Changes system load data of power on.
BUZZ	BUZZER	SYSTEM	Set or get buzzer State.
SCSV	SCREEN_SAVE	SYSTEM	Sets or gets screen save state.
ROSC	ROSCILLATOR	SIGNAL	Set or get clock source.
FCNT	FREQCOUNTER	SIGNAL	Sets or gets frequency counter parameters.
INVT	INVERT	SIGNAL	Set or get output signal phase state.
COUP	COUPLING	SIGNAL	Sets or gets coupling parameters.
VOLTPRT	VOLTPRT	SYSTEM	Sets or gets state of over-voltage protection.
STL	STORELIST	SIGNAL	Lists all stored waveforms.

WVDT	WVDT	SIGNAL	Sets and gets arbitrary wave data.
VKEY	VIRTUALKEY	SYSTEM	Sets the virtual keys.
HARM	HARMonic	SIGNAL	Sets or gets harmonic information.
CMBN	CoMBiNe	SIGNAL	Sets or gets wave combine information.
SYST:COMM: LAN:IPAD	SYSTEM:COMMU NICATE: LAN:IPADDRESS	SYSTEM	The Command can set and get system IP address.
SYST:COMM: LAN:SMAS	SYSTEM:COMMU NICATE: LAN:SMASK	SYSTEM	The Command can set and get system subnet mask.
SYST:COMM: LAN:GAT	SYSTEM:COMMU NICATE: LAN:GATEWAY	SYSTEM	The Command can set and get system Gateway.

1.3. IEEE 488.2 Common Command Introduction

IEEE standard defines the common commands used for querying the basic information of the instrument or executing basic operations. These commands usually start with "*" and the length of the keywords of the command is usually 3 characters.

1.3.1 IDN

DESCRIPTION The *IDN? Query causes the instrument to identify itself. The response comprises manufacturer, model number, serial number, software version and firmware version.

QUERY SYNTAX *IDN?

RESPONSE FORMAT *IDN ,<device id>,<model>,<serial number>, <software>, <version>, <firmware version>

<device id>: ="BK Precision" is used to identify instrument.

<model>:= A model identifier less than 14 characters.

<serial number>:= A nine- or 10-digit decimal code .

<software version>:= A serial numbers about software version.

<firmware version>:= two digits giving the major release level followed by a period, then one digit giving the minor release level followed by a period and a single-digit update level (xx.y.z).

EXAMPLE 1 Reads version information.

*IDN?

return:

*IDN BK Precision,4050B,00-00-00-13-22,1.01.01.10R1,20.234.3.

1.3.2 OPC

DESCRIPTION The *OPC (Operation Complete) command sets to true the OPC bit (bit 0) in the standard Event Status Register (ESR).

The *OPC? query always responds with the ASCII character 1 because the device only responds to the query when the previous command has been entirely executed.

QUERY SYNTAX *OPC?

RESPONSE FORMAT *OPC 1

1.3.3 CLS

DESCRIPTION The *CLS command clears all the status data registers.

COMMAND SYNTAX *CLS

EXAMPLE The following command causes all the status data registers to be cleared:
*CLS

1.3.4 ESE

DESCRIPTION The *ESE command sets the Standard Event Status Enable register (ESE). This command allows one or more events in the ESR register to be reflected in the ESB summary message bit (bit 5) of the STB register. The *ESE? query reads the contents of the ESE register.

COMMAND SYNTAX *ESE <value>
<value> := 0 to 255.

QUERY SYNTAX *ESE?

RESPONSE FORMAT *ESE <value>

EXAMPLE The following instructions allows the ESB bit to be set if a user request (URQ bit 6, i.e. decimal 64) and/or a device dependent error (DDE bit 3, i.e. decimal 8) occurs. Summing these values yields the ESE register mask $64+8=72$.
*ESE?
Return:
*ESE 72

RELATED COMMANDS *ESR

1.3.5 ESR

DESCRIPTION The *ESR? query reads and clears the contents of the Event

Status Register (ESR). The response represents the sum of the binary values of the register bits 0 to 7.

QUERY SYNTAX	*ESR?
RESPONSE FORMAT	*ESR <value> <value> := 0 to 255
EXAMPLE	The following instruction reads and clears the content of the ESR register: *ESR? Return: *ESR 0
RELATED COMMANDS	*CLS, *ESE

1.3.6 RST

DESCRIPTION	The *RST command initiates a device reset. The *RST recalls the default setup.
COMMAND SYNTAX	* RST
EXAMPLE	This example resets the signal generator: *RST

1.3.7 SRE

DESCRIPTION	The *SRE command sets the Service Request Enable register (SRE). This command allows the user to specify which summary message bit(s) in the STB register will generate a service request. A summary message bit is enabled by writing a '1' into the corresponding bit location. Conversely, writing a '0' into a given bit location prevents the associated event from generating a service request (SRQ). Clearing the SRE register disables SRQ interrupts. The *SRE? query returns a value that, when converted to a binary number represents the bit settings of the SRE register. Note that bit 6 (MSS) cannot be set and it's returned value is always zero.
COMMAND SYNTAX	*SRE <value> <value> := 0 to 255

QUERY SYNTAX	*SRE?
RESPONSE FORMAT	*SRE <value>
EXAMPLE	<p>The following instruction allows a SRQ to be generated as soon as the MAV summary bit (bit 4, i.e. decimal 16) or the INB summary bit (bit 0, i.e. decimal 1) in the STB register, or both are set. Summing these two values yields the SRE mask $16+1 = 17$.</p> <p>*SRE? Return: *SRE 17</p>

1.3.8 STB

DESCRIPTION	<p>The *STB? query reads the contents of the 488.2 defined status register (STB), and the Master Summary Status (MSS).</p> <p>The response represents the values of bits 0 to 5 and 7 of the Status Byte register and the MSS summary message.</p> <p>The response to a *STB? query is identical to the response of a serial poll except that the MSS summary message appears in bit 6 in place of the RQS message.</p>
QUERY SYNTAX	*STB?
RESPONSE FORMAT	<p>*STB <value> <value> := 0 to 255</p>
EXAMPLE	<p>The following reads the status byte register:</p> <p>*STB? Return: *STB 0</p>
RELATED COMMANDS	*CLS, *SRE

1.3.9 TST

DESCRIPTION	<p>The *TST? query performs an internal self-test and the response indicates whether the self-test has detected any errors. The self-test includes testing the hardware of all channels.</p> <p>Hardware failures are identified by a unique binary code in the returned <status> number. A "0" response indicates that no failures occurred.</p>
-------------	---

QUERY SYNTAX	*TST?
RESPONSE FORMAT	*TST <status> <status> : = 0 self-test successful
EXAMPLE	The following causes a self-test to be performed: TST? Return(if no failure): *TST 0
RELATED COMMANDS	*CAL

1.3.10 CHDR

DESCRIPTION	This Command is used to change query command return format. SHORT parameter is return short format. LONG parameter is return long format. Off is that command header and parameter unit will not return.
COMMAND SYNTAX	Comm_HeaDeR <parameter> <parameter>:= {SHORT, LONG, OFF}
QUERY SYNTAX	Comm_HeaDeR?
RESPONSE FORMAT	SYNC <parameter>
EXAMPLE 1 CHDR LONG	Set query command format to long.
EXAMPLE 2	Read query command format. CHDR?
return:	COMM_HEADER LONG

1.4. Output Command

DESCRIPTION Enable or disable the output of the [Output] connector at the front panel corresponding to the channel. The query returns ON or OFF and "LOAD", "PLRT" parameters.

COMMAND SYNTAX <channel>:OUTPut <parameter>
<channel>:={C1, C2}
<parameter >:= {a parameter from the table below}

Parameters	Value	Description
ON	---	Turn on
OFF	---	Turn off
LOAD	<load>	Value of load (default unit is ohm)
PLRT	<NOR, INVT>	Value of polarity parameter

< load>:= {please see the note below.}

QUERY SYNTAX <channel>: OUTP(OUTPut)?

RESPONSE FORMAT <channel>: OUTP <load>

EXAMPLE

Turn on channel one.
C1: OUTP ON

Read channel one output state.
C1: OUTP?
Return:
C1: OUTP ON, LOAD, HZ, PLRT, NOR

Set the load to 50.
C1: OUTP LOAD, 50

Set the load to HZ.
C1: OUTP LOAD, HZ

Set the polarity normal.
C1: OUTP PLRT, NOR

Set the polarity inverted.

1.5. Basic Wave Command

DESCRIPTION Set or get basic wave parameters. If Wave Combine is turned on, it is not possible to set the wave to square because combining a square waveform is not possible.

COMMAND SYNTAX

```
<channel>:BaSic_WaVe <parameter>
<channel>:={C1, C2}
<parameter>:= {a parameter from the table below}
```

Parameters	Value	Description
WVTP	<type>	Type of wave
FRQ	<frequency>	Value of frequency. If wave type is Noise or DC, you can't set this parameter.
PERI	<period>	Value of period. If wave type is Noise or DC, you can't set this parameter.
AMP	<amplitude>	Value of amplitude. If wave type is Noise or DC, you can't set this parameter.
OFST	<offset>	Value of offset. If wave type is Noise or DC, you can't set this parameter.
SYM	<symmetry>	Value of symmetry. Only when wave type is Ramp, you can set this parameter.
DUTY	<duty>	Value of duty cycle. Only when wave type is Square and Pulse, you can set this parameter.
PHSE	<phase>	Value of phase. If wave type is Noise or Pulse or DC, you can't set this parameter.
STDEV	<standard deviation >	Value of Noise wave standard deviation. Only when wave type is Noise, you can set this parameter.
MEAN	<mean>	Value of Noise wave mean. Only when wave type is Noise, you can set this parameter.

Note: if the command doesn't set basic wave type, the parameter will set parameters to current device wave type by default.

where:

```
<type>:={SINE, SQUARE, RAMP, PULSE, NOISE, ARB ,DC}
<frequency>:= {Default unit is "Hz". Value depends on the model.}
<amplitude>:= {Default unit is "V". Value depends on the model.}
```

<offset>:= {Default unit is "V". Value depends on the model.}
 <duty>:= {0% to 100%. Value depends on frequency.}
 <symmetry> :={ 0% to 100%}
 <phase>:= {0 to 360,if you set 400,it will set 40 (400-360)}
 < standard deviation >:= {Default unit is "V". Value depends on the model.}
 <mean>:= {Default unit is "V". Value depends on the model.}
 <width>:= {Max_width < (Max_duty * 0.01) * period and Min_width >
 (Min_duty * 0.01) * period.}
 <rise>:= {Value depends on the model.}
 <fall>:= {Value depends on the model.}
 <delay>:= {Unit is S. Maximal is Pulse period, minimum value is 0.}
 <bandwidth switch >:= {ON,OFF}
 <bandwidth value>:= {value between 20MHz and 120MHz}

QUERY SYNTAX

<channel>: BaSic_WaVe?
 <channel>:={C1, C2}

RESPONSE

<channel>:BSWV<type>,<frequency>,<amplitude>,<offset>,<duty>,
 <symmetry>,<phase>,<variance>,<mean>,<width>,<rise>,<fall>,<delay>.

EXAMPLE 1

change channel one current wave type to ramp.
 C1:BSWV WVTP,RAMP

EXAMPLE 2

Changes current signal frequency of channel one to 2000 Hz.
 C1: BSWV FRQ, 2000

EXAMPLE 3

set current signal amplifier of channel one.
 C1: BSWV AMP, 3

EXAMPLE 4

reads channel basic wave parameters from device.
 C1:BSWV?
 Return:
 C1:BSWV WVTP, SINE,FRQ,100HZ,PERI,0.01S,AMP,2V, OFST,0V,HLEV,1V,
 LLEV,-1V,PHSE,0

RELATED COMMANDS

ARWV, BTWV, CFG, CPL, MDWV, SWWV

1.6. Arbitrary Wave Command

DESCRIPTION

Sets and gets arbitrary wave type.

COMMAND SYNTAX

<channel>:ArbWaVe INDEX,<value1>

<channel>:ArbWaVe NAME,<value2>

<channel>:={C1, C2}

<value1>: the table below shows what the index number and its corresponding waveform name.

< value2>: For user-defined waveforms, this is the name of the waveform. It is case-sensitive.

Index	Name	Index	Name	Index	Name	Index	Name
0	StairUp	50	RoundHalf	100	LFPulse	150	SquareDuty16
1	StairDn	51	RoundsPM	101	Tens1	151	SquareDuty18
2	StarUD	52	BlaseiWave	102	Tens2	152	SquareDuty20
3	Ppulse	53	DampedOsc	103	Tens3	153	SquareDuty22
4	Npulse	54	SwingOsc	104	Airy	154	SquareDuty24
5	Trepezia	55	Discharge	105	Besselj	155	SquareDuty26
6	Upramp	56	Pahcur	106	Bessely	156	SquareDuty28
7	Dnramp	57	Combin	107	Dirichlet	157	SquareDuty30
8	ExpFal	58	SCR	108	Erf	158	SquareDuty32
9	ExpRise	59	Butterworth	109	Erfc	159	SquareDuty34
10	LogFall	60	Chebyshev1	110	Erfclnv	160	SquareDuty36
11	LogRise	61	Chebyshev2	111	Erflnv	161	SquareDuty38
12	Sqrt	62	TV	112	Laguerre	162	SquareDuty40
13	Root3	63	Voice	113	Legend	163	SquareDuty42
14	X^2	64	Surge	114	Versiera	164	SquareDuty44
15	X^3	65	Radar	115	Weibull	165	SquareDuty46
16	Sinc	66	Ripple	116	LogNormal	166	SquareDuty48
17	Gaussian	67	Gamma	117	Laplace	167	SquareDuty50
18	Dlorentz	68	StepResp	118	Maxwell	168	SquareDuty52
19	Haversine	69	BandLimited	119	Rayleigh	169	SquareDuty54
20	Lorentz	70	CPulse	120	Cauchy	170	SquareDuty56
21	Gauspuls	71	CWPulse	121	CosH	171	SquareDuty58
22	Gmonopuls	72	GateVibr	122	CosInt	172	SquareDuty60
23	Tripuls	73	LFMPulse	123	CotH	173	SquareDuty62
24	Cardiac	74	MCNoise	124	CscH	174	SquareDuty64
25	Quake	75	AM	125	SecH	175	SquareDuty66
26	Chirp	76	FM	126	SinH	176	SquareDuty68
27	Twotone	77	PFM	127	SinInt	177	SquareDuty70
28	SNR	78	PM	128	TanH	178	SquareDuty72
29	Hamming	79	PWM	129	ACosH	179	SquareDuty74
30	Hanning	80	EOG	130	ASecH	180	SquareDuty76
31	Kaiser	81	EEG	131	ASinH	181	SquareDuty78
32	Blackman	82	EMG	132	ATanH	182	SquareDuty80
33	Gausswin	83	Pulseilogram	133	ACscH	183	SquareDuty82

34	Triangle	84	ResSpeed	134	ACotH	184	SquareDuty84
35	BlackmanH	85	ECG1	135	Bartlett	185	SquareDuty86
36	Bartlett-Hann	86	ECG2	136	BohmanWin	186	SquareDuty88
37	Tan	87	ECG3	137	ChebWin	187	SquareDuty90
38	Cot	88	ECG4	138	FlattopWin	188	SquareDuty92
39	Sec	89	ECG5	139	ParzenWin	189	SquareDuty94
40	Csc	90	ECG6	140	TaylorWin	190	SquareDuty96
41	Asin	91	ECG7	141	TukeyWin	191	SquareDuty98
42	Acos	92	ECG8	142	SquareDuty01	192	SquareDuty99
43	Atan	93	ECG9	143	SquareDuty02	193	demo1_375pts
44	Acot	94	ECG10	144	SquareDuty04	194	demo1_16kpts
45	Square	95	ECG11	145	SquareDuty06	195	demo2_3kpts
46	SinTra	96	ECG12	146	SquareDuty08	196	demo2_16kpts
47	SineVer	97	ECG13	147	SquareDuty10		
48	AmpALT	98	ECG14	148	SquareDuty12		
49	AttALT	99	ECG15	149	SquareDuty14		

Note: Index is only available for built-in waves and Name is only available for user defined wave.

QUERY SYNTAX <channel>:ARWV (ARbWaVe)?
 <channel>:={C1, C2}

RESPONSE FORMAT <channel>:ARWV <index>

EXAMPLE 1 Set StarUp arbitrary wave output by index.
 ARWV INDEX, 2

EXAMPLE 2 Reads system current wave.
 ARWV?
 Return:
 ARWV INDEX,2,NAME,stairup

EXAMPLE 3 Set Atan arbitrary wave output by name.
 ARWV NAME, ATAN

RELATED COMMANDS BSWV

1.7. Modulate Wave Command

DESCRIPTION Set or get modulated wave parameters.

COMMAND SYNTAX

<channel>:MoDulateWaVe<parameter>

<channel>:={C1, C2}

<parameter>:= {a parameter from the table below. }

Parameters	Value	Description
STATE	<state>	Turn on or off modulation. Note: if you want to set or read other parameters of modulation, you must set STATE to ON at first.
AM, SRC	<src>	AM signal source.
AM, MDSP	<mod wave shape>	AM modulation wave. Only when AM signal source is set to INT, you can set the parameter.
AM, FRQ	<AM frequency>	AM frequency. Only when AM signal source is set to INT, you can set the parameter.
AM, DEPTH	<depth>	AM depth. Only when AM signal source is set to INT, you can set the parameter.
DSBAM, SRC	<src>	DSBAM signal source.
DSBAM, MDSP	<mod wave shape>	DSBAM modulation wave. Only when AM signal source is set to INT, you can set the parameter.
DSBAM, FRQ	<DSB-AM frequency>	DSBAM frequency. Only when AM signal source is set to INT, you can set the parameter.
FM, SRC	<src>	FM signal source.
FM, MDSP	<mod wave shape>	FM modulation wave. Only when FM signal source is set to INT, you can set the parameter.
FM, FRQ	<FM frequency>	FM frequency. Only when FM signal source is set to INT, you can set the parameter.
FM, DEVI	<FM frequency deviation >	FM frequency deviation. Only when FM signal source is set to INT, you can set the parameter.
PM, SRC,	<src>	PM signal source.
PM, MDSP	<mod wave shape>	PM modulation wave. Only when PM signal source is set to INT, you can set the parameter.
PM, FRQ	<PM frequency>	PM frequency. Only when PM signal source is set to INT, you can set the parameter.
PWM, FRQ	<PWM frequency>	PWM frequency. Only when carrier wave is PULSE wave, you can set the parameter.
PWM, DEVI	<PWM dev>	Duty cycle deviation. Only when carrier wave is PULSE wave, you can set the parameter.
PWM, MDSP	<mod wave shape>	PWM modulation wave. Only when carrier wave is PULSE wave, you can set the parameter.
PWM, SRC	<src>	PWM signal source.
PM, DEVI	<PM phase offset>	PM phase deviation. Only when PM signal source is set to INT, you can set the parameter.
ASK, SRC	<src>	ASK signal source.

ASK, KFRO	<ASK key frequency>	ASK key frequency. Only when ASK signal source is set to INT, you can set the parameter.
FSK, KFRO	<FSK key frequency>	FSK key frequency. Only when FSK signal source is set to INT, you can set the parameter.
FSK, HFRO	<FSK hop frequency>	FSK hop frequency.
FSK, SRC	<src>	FSK signal source.
PSK, KFRO	<FSK key frequency>	PSK key frequency. Only when PSK signal source is set to INT, you can set the parameter.
PSK, SRC	<src>	PSK signal source.
CARR, WVTP	<wave type>	Carrier wave type.
CARR, FRQ	<frequency>	Value of carrier frequency.
CARR, AMP	<amplitude>	Value of carrier amplitude.
CARR, OFST	<offset>	Value of carrier offset.
CARR, SYM	<symmetry>	Value of carrier symmetry. Only ramp can set this parameter.
CARR, DUTY	<duty>	Value of duty cycle. Only square and pulse can set this parameter.
CARR, PHSE	<phase>	Value of carrier phase.
CARR, RISE	<rise>	Value of rise time. Only Pulse can set this parameter.
CARR, FALL	<fall>	Value of fall time. Only Pulse can set this parameter.
CARR, DLY	<delay>	Value of carrier delay. Only PULSE can set this parameter.

Note: If Carrier wave is Pulse or Noise, the modulation waveform cannot be set. To set AM, FM, PM, CARR and STATE the first parameter have to be one of them.

where:

- <state>:= {ON,OFF}
- <src>:= {INT,EXT}
- <mod wave shape>:= {SINE, SQUARE, TRIANGLE, UP RAMP, DNRAMP, NOISE, ARB}
- <am frequency>:= {Default unit is "Hz". Value depends on model}
- <depth>:= {0% to 120%}
- <fm frequency>:= {Default unit is "Hz". Value depends on model}
- <fm frequency deviation > := { 0 to carrier frequency, Value depends on the difference between carrier frequency and bandwidth frequency.}
- <pm frequency > := {Default units are in "Hz". Value depends on model}
- <pm phase offset>:= {0° to 360°}
- <pwm frequency>:= {0Hz to 4kHz }
- <pwm dev>:= { Default unit is "%",value depends on carrier duty cycle}
- <ask key frequency>:= Default units are in "Hz". Value depends on

model}
 <fsk frequency>:={Default units are in "Hz". Value depends on model}
 <fsk jump frequency>:= { the same with basic wave frequency}
 <wave type>:={SINE ,SQUARE, RAMP, ARB, PULSE }
 <frequency>:= { Default units are in "Hz". Value depends on model}
 <amplitude>:={Default units are in "Volts". Value depends on model}
 <offset>:={ Default unit is "V".}
 <duty>:={0% to 100 %}
 <symmetry>:={ 0% to 100%}
 <rise>:= {Value depends on the model.}
 <fall>:= {Value depends on the model.}
 <delay>:= {Default unit is "S".}

QUERY SYNTAX <channel>:MoDulateWaVe?
 <channel>:={C1, C2}

RESPONSE FORMAT <channel>:MoDulateWaVe <parameter>
 <parameter>:={return all parameter of the current modulation wave parameters.}

EXAMPLE 1 Set channel one modulation type to AM.
 C1:MDWV AM

EXAMPLE 2 Set modulation shape to AM, and set AM modulating wave shape to sine wave.
 C1:MDWV AM, MDSP, SINE

EXAMPLE 3 Reads channel one modulate wave parameters that STATE is ON.
 C1:MDWV?
 Return:
 C1:MDWV
 STATE,ON,AM,MDSP,SINE,SRC,INT,FRQ,100HZ,DEPTH,100,CARR,WVTP
 ,RAMP,FRQ,1000HZ,AMP,4V,OFST,0V,SYM,50

EXAMPLE 4 Reads channel one modulate wave parameters that STATE is OFF.
 C1:MDWV?
 Return:
 C1:MDWV STATE,OFF

EXAMPLE 5 Set channel one Fm frequency to 1000HZ
 C1:MDWV FM, FRQ, 1000HZ

EXAMPLE 6 Set the value of channel one carrier wave shape to SINE.
C1:MDWV CARR,WVTP,SINE

EXAMPLE 7 Set the Value of channel one carrier wave frequency to 1000Hz.
C1:MDWV CARR,FRQ,1000

RELATED COMMANDS ARWV, BTWV, SWWV, BSWV

1.8. Sweep Wave Command

DESCRIPTION Set or get sweep wave parameters.

COMMAND SYNTAX <channel>: SWEEPWAve) <parameter>
<channel>:={C1, C2}
<parameter>:= {a parameter from the table below. }

Parameters	Value	Description
STATE	<state>	Turn on or off sweep wave. Note if you want to set or read sweep wave parameters, you must first enable sweep mode.
TIME	<time>	Value of sweep time
STOP	<stop frequency>	Value of stop frequency
START	<start frequency>	Value of start frequency
TRSR	<trigger src>	Trigger source
TRMD	<trigger mode>	Value of trigger output. If TRSR is EXT, the parameter is invalid.
SWMD	<sweep mode >	Sweep way
DIR	<direction>	Sweep direction
EDGE	<edge>	Value of edge. Only TRSR is EXT, the parameter is valid.
MTRIG	<manual trigger>	Make the device once manual trigger. The parameter is valid only when TRSR is set to MAN.
CARR,WVTP	<wave type>	Value of carrier wave type.
CARR,FRQ	<frequency>	Value of frequency.
CARR,AMP	<amplifier>	Value of amplifier.
CARR,OFST	<offset>	Value of offset.
CARR,SYM	<symmetry>	Value of symmetry.
CARR,DUTY	<duty>	Value of duty cycle. Only Square can set this parameter.
CARR,PHSE	<phase>	Value of phase.

Note: If Carrier wave is Pulse or Noise, enabling sweep is not allowed. If you want to set

CARR and STATE, the first parameter has to be one of them.

where:

- <state>:= {ON, OFF}
- <time>:= { Default unit is "S". Value depends on the model.}
- <stop frequency> :={ the same with basic wave frequency}
- <start frequency> :={ the same with basic wave frequency}
- <trigger src>:= {EXT, INT, MAN}
- <trigger mode>:= {ON, OFF}
- <sweep mod>:= {LINE, LOG}
- <direction>:= {UP, DOWN}
- <edge>:={RISE, FALL}
- <wave type>:={SINE ,SQUARE, RAMP, ARB}
- <frequency> :={ Default unit is "Hz". Value depends on the model.}
- <amplitude> :={ Default unit is "V". Value depends on the model.}
- <offset> :={ Default unit is "V", Value depends on the model.}
- <duty>:= {0% to 100 %.}
- <symmetry>:={ 0% to 100%}

QUERY SYNTAX <channel>:SWEEPWaVe?
 <channel>:= {C1, C2}

RESPONSE FORMAT <parameter>:= {return all parameter of the current sweep wave
 parameters.}

EXAMPLE 1 Set channel one sweep time to 1 S.
 C1:SWWV TIME, 1S

EXAMPLE 2 Set channel one sweep stop frequency to 1000hz.
 C1: SWWV STOP, 1000HZ

EXAMPLE 3 Read channel one sweep parameters of which STATE is ON.
 C2: SWWV?
 Return:
 C2: SWWV STATE, ON, TIME, 1S, STOP, 100HZ, START, 100HZ, TRSR,
 MAN,TRMD, OFF, SWMD, LINE, DIR, UP, CARR, WVTP, SQUARE,
 FRQ, 1000HZ, AMP, 4V, OFST, 0V, DUTY, 50, PHSE, 0

EXAMPLE 4 Reads channel two modulate wave parameters that STATE is OFF.
 C2:SWWV?
 Return:
 C2:SWWV STATE,OFF

1.9. Burst Wave Command

DESCRIPTION Set or get burst wave parameters.

COMMAND SYNTAX <channel>:BursTWaVe <parameter>
 <channel>:={C1, C2}
 <parameter>:= {a parameter from the table below.}

Parameters	Value	Description
STATE	<state>	Enable or disable burst wave. Note if you want to set or read burst wave parameters you must first enable burst mode.
PRD	<period>	When carrier wave is NOISE wave, this cannot be set. When GATE is selected, you cannot set this. This can be set only when trig source is IN (internal).
STPS	<start phase>	When carrier wave is NOISE or PULSE wave, you can't set it.
GATE_NCYC	<gate ncycle>	When carrier wave is NOISE, you can't set it.
TRSR	<trigger>	When carrier wave is NOISE wave, you can't set it. When NCYC was chosen you can set it.
DLAY	<delay>	When carrier wave is NOISE wave, you can't set it. When NCYC was chosen you can't set it.
PLRT	<polarity>	When GATE was chosen you can set it. When carrier wave is NOISE, it is the only parameter.
TRMD	<trig mode>	When carrier wave is NOISE wave, you can't set it. When NCYC was chosen you can set it. When TRSR is set to EXT, you can't set it.
EDGE	<edge>	When carrier wave is NOISE wave, you can't set it. When NCYC is selected and TRSR is set to EXT, you can set it.
TIME	<circle time>	When carrier wave is NOISE wave, you can't set it. When NCYC is selected, you can set it.
MTRIG		When TRSR's parameter be chosen to

		MAN, that it can be set.
CARR,WVTP	<wave type>	Value of carrier wave type.
CARR,FRQ	<frequency>	Value of frequency.
CARR,AMP	<amplifier>	Value of amplifier.
CARR,OFST	<offset>	Value of offset.
CARR,SYM	<symmetry>	Value of symmetry.
CARR,DUTY	<duty>	Value of duty cycle. Only Square can set this parameter.
CARR,PHSE	<phase>	Value of phase.
CARR,RISE	<rise>	Value of rise edge. Only when carrier is Pulse, the Value is valid.
CARR,FALL	<fall>	Value of fall edge. Only when carrier is Pulse, the Value is valid.
CARR,STDEV	<standard deviation >	Value of standard deviation. Only when carrier is Noise, the Value is valid.
CARR,DLY	<carr delay>	Value of carrier wave delay. This is valid only when the carrier wave is pulse.
CARR,MEAN	<mean>	Value of carrier wave mean. This is valid only when the carrier wave is noise.

Note: If you want to set CARR and STATE, the first parameter has to one of them

where:

<state>:= {ON, OFF}
 <period>:= {Default unit is "S". Value depends on the model.}
 <start phase>:= {0 to 360}
 <gate ncycle>:= {GATE, NCYC}
 <trigger source>:= {EXT, INT, MAN}
 <delay>:= {Default unit is "S", Value depends on the model.}
 <polarity>:= {NEG, POS}
 <trig mode >:= {RISE, FALL, OFF}
 <edge>:= {RISE, FALL}
 <circle time> := { Value depends on the Model ("INF" means infinite).}
 <wave type>:= {SINE ,SQUARE, RAMP, PULSE, NOISE, ARB}
 <frequency> := { Default unit is "HZ". Value depends on the model.}
 <amplitude>:= {Default unit is "V". Value depends on the model.}
 <offset>:= {Default unit is "V". Value depends on the model.}
 <duty>:= {0% to 100%.}
 <symmetry> := { 0% to 100%}
 <phase>:= {0 to 360}
 < standard deviation >:= {Default unit is "V". Value depends on the
 model.}
 <mean>:= {Default unit is "V". Value depends on the model.}
 <width > := { Max_width < (Max_duty * 0.01) * period and Min_width >
 (Min_duty * 0.01) * period.}
 <rise>:= {Value depends on the model.}

<fall>:= {Value depends on the model.}
<delay>:= {Default unit is "S".}

QUERY SYNTAX

<channel>:BurstWaVe? <parameter>
<parameter>:=<period>.....

RESPONSE FORMAT

<channel>:BTWV <type>|<state>|<period>.....

EXAMPLE 1

Set channel one burst wave period to 1S.
C1:BTWV PRD, 1

EXAMPLE 2

Set channel one burst wave delay to 0S
C1:BTWV DLAY, 0

EXAMPLE 3

Reads burst wave parameters of channel two when STATE is ON.
C2: BTWV?
Return:
C2:BTWV
STATE,ON,PRD,0.01S,STPS,0,TRSR,INT,TRMD,OFF,TIME,1,DLAY,2.4e-07
S,,GATE_NCYC,NCYC,CARR,WVTP,SINE,FRO,1000HZ,AMP,4V,OFST,0V,P
HSE,0

EXAMPLE 4

Reads burst wave parameters of channel two when STATE is OFF.
C2: BTWV?
Return:
C2: BTWV STATE,OFF

1.10. Parameter Copy Command

DESCRIPTION Copies parameters from one channel to another.

COMMAND SYNTAX PAraCoPy <destination channel>, <src channel>
<destination channel>:= {C1, C2}
<src channle>:= {C1, C2}

Note: the parameters C1 and C2 must be set to device together.

EXAMPLE 1 Copy parameters from channel one to channel two.
PACP C2,C1

RELATED COMMANDS ARWV, BTWV, MDWV, SWWV, BSWV

1.11. Sync Command

DESCRIPTION Set signal output from rear panel in phase with forward.

COMMAND SYNTAX <channel>:SYNC <parameter>
<channel>:={C1,C2}
<parameter>:= {ON,OFF}

QUERY SYNTAX <channel>:SYNC?

RESPONSE FORMAT <channel>:SYNC <parameter>

EXAMPLE 1 Turn on sync function of channel one.
C1:SYNC ON

EXAMPLE 2 Reads channel one sync state.
C1:SYNC?
Return:
C1:SYNC OFF

1.12. Number Format Command

DESCRIPTION Sets or gets number format.

COMMAND SYNTAX NumBer_ForMat <parameter>
<parameter> := { a parameter from the table below.}

Parameters	Value	Description
PNT	<pnt>	Point format
SEPT	<sept>	Separator format

Where:

<pnt> := {Dot, Comma}.

<sept> := { Space, Off, On}.

QUERY SYNTAX NumBer_ForMat?

RESPONSE FORMAT NBFM <parameter>

EXAMPLE 1 Set point format to DOT.
NBFM PNT, DOT

EXAMPLE 2 Set Separator format to ON.
NBFM SEPT,ON

EXAMPLE 3 Read number format.
NBFM?
Return:
NBFM PNT, DOT, SEPT, ON

1.13. Configuration Command

DESCRIPTION Changes system load data of power on.

COMMAND SYNTAX Sys_CFG<parameter>
<parameter>:= {DEFAULT, LAST}

QUERY SYNTAX Sys_CFG?

RESPONSE FORMAT SCFG <parameter>

EXAMPLE 1 Set system load data of power on to last time data.
SCFG LAST

1.14. Buzzer Command

DESCRIPTION	Turns on or off buzzer.
COMMAND SYNTAX	BUZZer <parameter> <parameter>:= {ON,OFF}
QUERY SYNTAX	BUZZer?
RESPONSE FORMAT	BUZZ <parameter>
EXAMPLE 1	Turns on buzzer. BUZZ ON

1.15. Screen Save Command

DESCRIPTION	Turns on or off Screen Save.
COMMAND SYNTAX	SCreen_SaVe <parameter> <parameter>:= {OFF,1,5,15,30,60,120,300, Units are minutes}
QUERY SYNTAX	SCreen_SaVe?
RESPONSE FORMAT	SCSV <parameter>
EXAMPLE 1	Set screen save time 5 minutes. SCSV 5

1.16. Clock Source Command

DESCRIPTION	Set or get signal oscillator resource.
COMMAND SYNTAX	ROSCillator <parameter> <parameter>:= {INT, EXT }
QUERY SYNTAX	ROSCillator?

RESPONSE FORMAT ROSC <parameter>

EXAMPLE 1 Uses system clock source.

ROSC INT

1.17. Frequency Counter Command

DESCRIPTION Sets or gets frequency counter parameters.

COMMAND SYNTAX FreqCouNter <parameter>
 <parameter>:= {a parameter from the table below}

Parameters	Value	Description
STATE	<state>	State of frequency counter.
FRQ	<frequency>	Value of frequency. Can't be set.
PW	<position width>	Value of positive width. Can't be set.
NW	<negative width>	Value of negative width. Can't be set.
DUTY	<duty>	Value of duty cycle. Can't be set.
FRQDEV	<freq deviation>	Value of freq deviation. Can't be set.
REFQ	<ref freq>	Value of reference freq.
TRG	<triglev>	Value of trigger level.
MODE	<mode>	Value of mode.
HFR	<HFR>	State of HFR.

where: < state >:={ON, OFF}
 <frequency>:= {Default unit is "Hz". Value range depends on the model.}
 < mode >:={AC, DC}
 <HFR>:={ON, OFF}

QUERY SYNTAX FreqCouNter?

RESPONSE FORMAT FCNT < state ><frequency><duty><ref freq><triglev><position width><
 negative width>
 <freq deviation><mode><HFR>

EXAMPLE 1 Turn frequency counter on:
FCNT STATE,ON

EXAMPLE 2 Set reference freq to 1000Hz:
FCNT REFQ,1000

EXAMPLE 3

Query frequency counter information:

FCNT?

Return:

FCNT STATE,ON,FRQ,10000000HZ,DUTY,59.8568,REFQ,
1e+07HZ,TRG,0V,PW,5.98568e-08S,NW,4.01432e-08S,FRQDEV,0ppm,MODE,
AC,HFR,OFF

1.18. Invert Command

DESCRIPTION Sets or gets polarity of current channel.

COMMAND SYNTAX <channel>:INVerT <parameter>
<channel>:={C1, C2}
<parameter>:= {ON, OFF}

QUERY SYNTAX <channel>: INVT (INVerT)?
<channel>:={C1, C2}

RESPONSE FORMAT <channel>:INVerT <parameter>

EXAMPLE 1

Set C1 ON:

C1: INVT ON

EXAMPLE 2

Read the polarity of channel one.

C1: INVT?

Return:

C1: INVT ON

Note: The <channel> is a selectable parameter. If channel is not set, default is current channel.

1.19 Coupling Command

DESCRIPTION Sets or gets channel coupling parameters. You can only set coupling value when trace switch off.

COMMAND SYNTAX COUPling <parameter>
<parameter>:= {a parameter from the table below}

Parameters	Value	Description
TRACE	<trace>	Trace switch
FDEV	<frq_dev>	Value of f frequency deviation.

PDEV	<pha_dev>	Value of position phase deviation.
FCOUP	<fcoup>	Value of frequency coupling switch
FRAT	<frat>	Value of frequency coupling ratio
PCOUP	<pcoup>	Value of phase coupling switch
PRAT	<prat>	Value of phase coupling ratio
ACOUP	<acoup>	Value of amplitude coupling switch
ARAT	<arat>	Value of amplitude coupling ratio
ADEV	<adev>	Value of amplitude coupling deviation

where:

- <trace>:={ON, OFF}
- < state >:={ON, OFF}
- < bsch >:={CH1, CH2}
- < frq_dev >:={ Default unit is "Hz", value range depends on the model}
- < pha_dev >:={ Default unit is "°" value range depends on the model }
- <fcoup>,<acoup>,<pcoup>:={ON, OFF}
- <frat>,<prat>,< arat >:={a ratio value. value range depends on the model }
- <adev>:={ a deviation value. value range depends on the model }

QUERY SYNTAX COUPling?

EXAMPLE 1 Set 4050B coupling state on
COUP STATE,ON

EXAMPLE 2 Set 4050B frequency deviation value 5Hz
COUP FDEV,5

EXAMPLE 3 Set 4050B amplitude coupling ratio
COUP ARAT,2

EXAMPLE 4 Query 4050B coupling information.
COUP?
Return:
COUP\STRACE,OFF,FCOUP,ON,PCOUP,ON,ACOUP,ON,FDEV,5HZ,
PRAT,1,ARAT,2\n

1.20 Voltage Overload Command

DESCRIPTION Sets or gets state of over-voltage protection.

COMMAND SYNTAX VOLTprt <parameter>
<parameter>:={ON, OFF}

QUERY SYNTAX	VOLTPRT?
RESPONSE FORMAT	VOLTPRT <parameter>

1.21 Store list command

DESCRIPTION	This command is used to read the device wave data name. If the store unit is empty, the command will return an "EMPTY" string.
QUERY SYNTAX	StoreList? BUILDIN, USER
RESPONSE FORMAT	STL M0, SINE, M1, noise, M2, STAIRUP....
EXAMPLE 1	Read device memory saved arbitrary data. STL? Return: STL M0, SINE, M1, noise, M2, STAIRUP....
EXAMPLE 2	Read built-in wave data. STL? BUILDIN Return: STL M0, Sine, M1, Noise, M10, ExpFal, M11, ExpRise....
EXAMPLE 3	Read wave data defined by user. STL? USER Return: STL WVNM,sinec_8M,sinec_3000000,sinec_1664000,ramp_8M,sinec_2000000, sinec_50000,square_8M,sinec_5000,wave1,square_1M

1.22 Get arbitrary wave data command

DESCRIPTION	This command changes the user defined memory unit arbitrary wave data.
COMMAND SYNTAX	WaVe_DaTa <address>,<parameter> <channel>:={C1, C2} <address>:= {M0-M196}

1.19. Virtual key command

DESCRIPTION The Command is used to send simulate a operation of pressing key on front panel

COMMAND SYNTAX VKEY (VirtualKEY) VALUE,<value>,STATE,<state>
 <value>:= {a parameter from the table below.}
 <state>:=<0,1>("1" is effective to virtual value, and "0" is useless)

EXAMPLE VKEY VALUE,15, STATE,1
 VKEY VALUE,KB_SWEEP, STATE,1

KB_FUNC1	28	KB_NUMBER_4	52
KB_FUNC2	23	KB_NUMBER_5	53
KB_FUNC3	18	KB_NUMBER_6	54
KB_FUNC4	13	KB_NUMBER_7	55
KB_FUNC5	8	KB_NUMBER_8	56
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KB_STORE_RECALL	70	KB_KNOB_RIGHT	175
KB_NUMBER_0	48	KB_KNOB_LEFT	177
KB_NUMBER_1	49	KB_KNOB_DOWN	176
KB_NUMBER_2	50	KB_HELP	12
KB_NUMBER_3	51	KB_CHANNEL	72

1.20. Harmonic Command

DESCRIPTION Sets or gets harmonic information. The channel basic wave must be sine.

COMMAND SYNTAX

```
<channel>:HARM(HARMonic) HARMSTATE,<value1>, HARMTYPE  
, < value2>, HARMORDER,< value3>, <parameter>, <value4>,  
HARMPHASE, < value5>
```

```
<value1>:= <ON, OFF>
```

```
<value2>:= <EVEN, ODD,ALL>
```

```
< value3>:= {an integer value.}
```

```
<parameter> :=< HARMAMP, HARMDBC>
```

```
< value4>:= {an integer value.}
```

```
< value5>:= {an integer value.}
```

QUERY SYNTAX

```
<channel>: HARM (HARMonic)?
```

```
<channel>:={C1, C2}
```

EXAMPLES

Set the channel one harmonic switch on.

```
C1: HARMHARMSTATE, ON
```

Get the channel one harmonic information.

```
C1: HARM?
```

Return:

```
C1:HARM HARMSTATE, ON,HARMTYPE, EVEN,HARMORDER, 2,  
HARMAMP, OV, HARMPHASE, 0
```

1.23 Waveform Combining Command

DESCRIPTION

Sets or gets waveform combining information.

COMMAND SYNTAX

```
<channel>:_CoMBiNe <parameter>
```

```
<channel>:={C1, C2}
```

```
<parameter>:= {ON, OFF}
```

QUERY SYNTAX

```
<channel>: CoMBiNe?
```

```
<channel>:={C1, C2}
```

EXAMPLES

Turn on the waveform combining of channel one.

C1:CMBN ON

Query the waveform combining state of channel two.

C2:CMBN?

Return:

C2:CMBN OFF

1.24 IP Command

DESCRIPTION The Command can set and get system IP address.

COMMAND SYNTAX SYSTem:COMMUnicate:LAN:IPADdress <parameter1>.<parameter2>.<parameter3>.<parameter4>

Where:

<parameter1>:={a integer value between 1 and 223}

<parameter2>:={a integer value between 0 and 255}

<parameter3>:={a integer value between 0 and 255}

<parameter4>:={a integer value between 0 and 255}

QUERY SYNTAX SYSTem:COMMUnicate:LAN:IPADdress?

EXAMPLES Set IP address to 10.11.13.203

SYSTem: COMMUnicate: LAN:IPADdress 10.11.13.203

Get IP address.

SYST:COMM:LAN:IPAD?

Return:

"10.11.13.203"

1.25 Subnet Mask Command

DESCRIPTION The Command can set and get system subnet mask.

COMMAND SYNTAX SYSTem:COMMUnicate:LAN:SMASk <parameter1>.<parameter2>.<parameter3>.<parameter4>

Note:

<parameter1>:={a integer value between 0 and 255}

<parameter2>:={a integer value between 0 and 255}

<parameter3>:={a integer value between 0 and 255}

<parameter4>:={a integer value between 0 and 255}

QUERY SYNTAX

SYSTem:COMMunicate:LAN:SMASk?

EXAMPLES

Set subnet mask to 255.0.0.0

SYSTem:COMMunicate:LAN:SMASk 255.0.0.0

Get subnet mask

SYSTem:COMMunicate:LAN:SMASk?

Return:

"255.0.0.0"

1.26 Gateway Command

DESCRIPTION

The Command can set and get system Gateway.

COMMAND SYNTAX

SYST:COMM:LAN:GAT(SYSTem:COMMunicate:LAN:GATeway)

<parameter1>.<parameter2>.<parameter3>.<parameter4>

Note:

<parameter1>:={a integer value between 0 and 223}

<parameter2>:={a integer value between 0 and 255}

<parameter3>:={a integer value between 0 and 255}

<parameter4>:={a integer value between 0 and 255}

QUERY SYNTAX

SYSTem:COMMunicate:LAN:GATeway?

EXAMPLES

Set Gateway to 10.11.13.5:

SYSTem:COMMunicate:LAN:GATeway 10.11.13.5

Get gateway:

SYSTem:COMMunicate:LAN:GATeway?

Return:

"10.11.13.5"

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*IDN	*IDN
*OPC	*OPC
*CLS	*CLS
*ESE	*ESE
*ESR	*ESR
*RST	*RST
*SRE	*SRE
*STB	*STB
*TST	*TST

A

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------	---------

B

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BTWV	BURSTWAVE
BUZZ	BUZZER

C

CHCP	CHANNEL_COPY
CHDR	COMM_HEADER
CMBN	CoMBiNe
COUP	COUPLING

D

DCWV	DC_WAVE
------	---------

F

FCNT	FREQCOUNTER
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H

HARM	HARMonic
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I

INVT	INVERT
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M

MDWV	MODULATEWAVE
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N

NBFM	NumBer_ForMat
------	---------------

O

OUTP	OUTPUT
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P

PACP	PARACOPY
------	----------

R

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S	
SCFG	SYSTEM_CONFIG
SCSV	SCREEN_SAVE
STL	STORE_LIST
SWWV	SWEEP
SYNC	SYNC
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SYST:COMM:LAN:SMAS	SYSTEM:COMMUNICATE:LAN:SMASK
SYST:COMM:LAN:GAT	SYSTEM:COMMUNICATE:LAN:GATEWAY
V	
VKEY	VIRTUALKEY
VOLTPRT	VOLTPRT
W	
WVDT	WAVE_DATA