Random &
Sinusoidal
Jitter Injector

RJI12G

Remote Control Software Operation Manual & Command Reference

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ARTEK INC.

General

This software package includes Graphical User Interface and a set of remote control commands for controlling RJI12G, Random& Sinusoidal Jitter Injector via USB interface. Full Control

1. Installation

This section explains how to install and to start up the software.

- ✓ Requirements
- ✓ Installation
- ✓ Setup USB and COM Port
- ✓ Start up

1-1 Requirements

- MS-Windows XP, Vista or 7

- USB 2.0 Port and USB Cable

- 100MB available hard drive space

1-2 Installation

1) Insert the installation CD-ROM into your PC, then auto run will start up the setup program.

2) In case Auto run does not start, run "setup.exe" from the CD-ROM.

3) Follow the instruction.

1-3 Setup

Configuring USB and COM Port

Your PC recognizes RJI12G as one of the COM Ports via USB, where a specific COM Port number is to be assigned for RJI12G. The software communicates with RJI12G via the COM port.

Upon installing the software first time, you are required to configure the software to specify the COM Port number.

Follow the procedure below.

1) Turn on the RJI12G

2) Connect the USB Cable with your PC

3) Start "Device Manager" to verify the COM Port number

    a. Go to Control Panel – System – XXX - Device Manager

    b. At PORT (COM and LTC) section, you will find "RANDOM JITTER INJECTOR (COM XX)". Remember this XX COM port number.

4) Start the GUI by starting Program, "RJI12SET" under "Artek".

5) At the left-bottom of the GUI, Click "Com port no" button for open a dialog box.

6) Enter the COM port number that you find in the "Device Manager" and Press OK.

7) Click "Connect" button to start Communication. Once the communication established, you will see the following button at left-bottom of GUI.
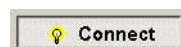
In case of Error

- No RJI12G at Device Manager
    - Check if RJI12G is powered ON
    - Disconnect and reconnect the USB Cable
- In case you see "unknown device" in the Device Manager
    - Try to update the driver specifying CD drive as the driver location

1-4 Start up and Shut Down

Once you set up the software as above described, you just start the RJI12SET" under "Artek". The communication is automatically established.

When shutting dow, follow as 1) Close the GUI or disconnect the USB Cable and 2) Turn off the RJI12G.

2. Understanding Structure

This section explains the RJI12G's operation structure, parameter directions and options. Understanding this section helps all the future operations.

- ✓ Jitter Mode and Bypass Mode
- ✓ Parameter settings and Phrases
- ✓ Control Panel Operation
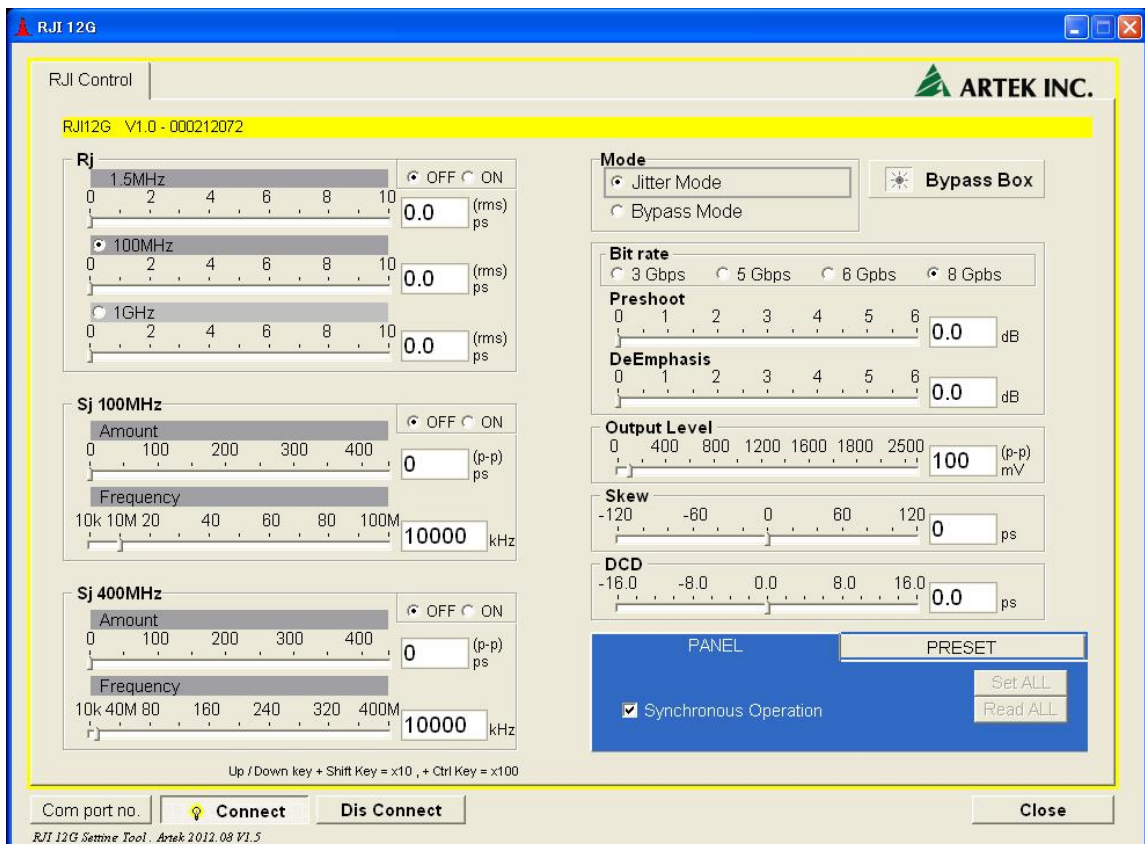
2-1 Jitter Mode & Bypass Mode (Optional)

Bypass Mode is optionally integrated with RJI12G. Remember all the signal conditioning are to be done in JITTER mode.

- Jitter Mode: All the signal conditionings are available

- Bypass Mode: Signal conditionings are NOT available.

  Input Signal is bypassed jitter circuity though to Output

  All the following explanations are for Jitter Mode.

2-2 Parameter Setting & Options

Parameters on GUI does not always equal to the current hardware setting nor those of preset tables. The following illustration explains the control phrases and parameter directions.
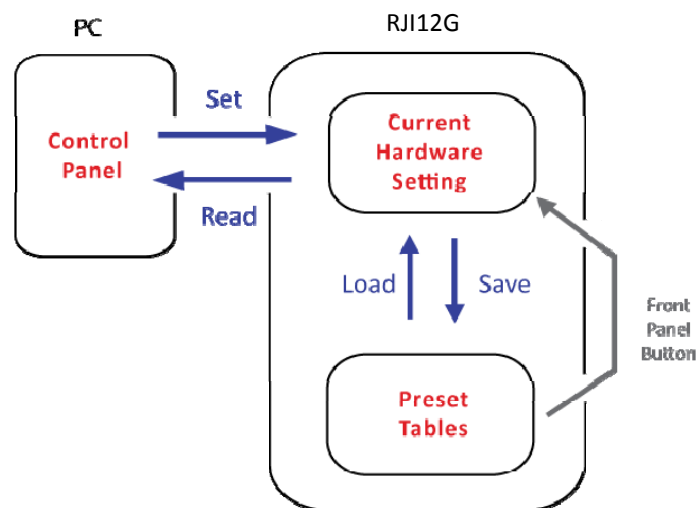

Parameters Direction

- Set: Sends and sets GUI paramter to RJI12G

- Read: Read the current RJI12G settings (parameters) into GUI

- Load: Loads and sets preset table paramteres into RJI12G

- Save: Saves the current RJI12G settings (parameters) into Preset table.

2-3 Control Panel Operation and Preset Operation

The GUI operation can be done by entering each parameters or loading a preset table.
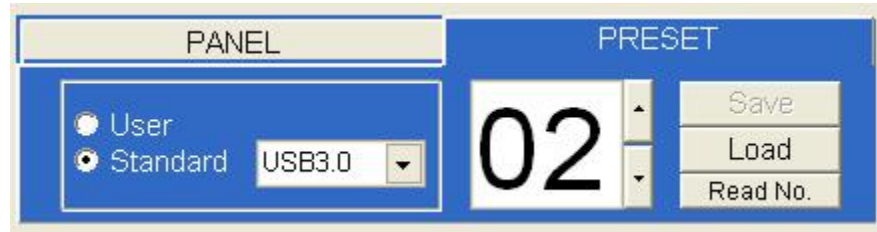
- **PANEL**   Select this item for entering each parameters in GUI

    ✓ Checking "**Synchronous Operation**" box makes real-time setting.

    ✓ "**Set ALL**" button is for sending all the parameters in GUI to RJI12G at a time. Only available when synchronous operation is not ON.

    ✓ "**Read All**" button is for reading all the current setting at RJI12G into GUI.

- **PRESET**   Select this item for preset table manipulation.

    ✓ "**Load**" button is for loading the paramters from the specified preset table into RJI12G's current settings.

    ✓ "**Read**" button reads the parameters from the specified preset table directly into GUI but it does not set RJI12G.

    ✓ "**User**" and "**Standard**" are for preset table type. Refer to the details in section "4. PRESET".

3. GUI Parameters

This section explains the each GUI parameters. Refer to Main Unit Manual for detailed characteristics of each function.

- ✓ Random Jitter
- ✓ Sinusoidal Jitter
- ✓ De-Emphasis
- ✓ Output Level
- ✓ Intra-pair Skew

3-1 Random Jitter

Rj amount is controllable individually for three (3) bandwidth as follows,

- 10KHz – 1.5MHz

- 1.5MHz – 100MHz

- 1.5MHz – 1GHz

in the range of;

- 0.5ps-rms to 10.0ps-rms

- not greater than 440ps-pp in total including Sj

The following three combinations are available.

#1: Rj = 0 for all bandwidth

#2: 10KHz-1.5MHz & 1.5MHz – 100MHz

#3: 10KHz – 1.5MHz & 1.5MHz – 1GHz

For setting at GUI,
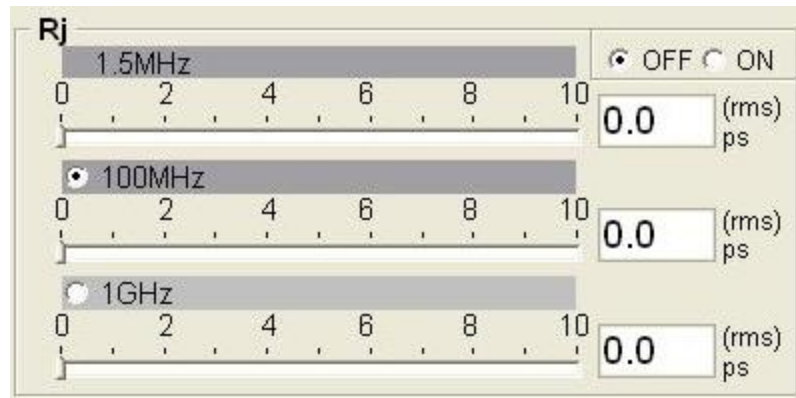
- #1: All RJ =0
  - ✓ Select "**OFF**" radio button

- #2: 10KHz-1.5MHz & 1.5MHz – 100MHz
  - ✓ Select "**ON**" radio button
  - ✓ Select "**100**" radio button
  - ✓ Adjust Rj amount for each bandwidth

- #3: 10KHz – 1.5MHz & 1.5MHz – 1GHz
  - ✓ Select "**ON**" radio button
  - ✓ Select "**1G**" radio button
  - ✓ Adjust Rj amount for each bandwidth

3-2 Sinusoidal Jitter

There are two (2) individual Sinusoidal jitter generators are integrated and always multiplexed.

Sj amount is controllable in the range of;

- 0 – 440ps within a range of Tj<=440ps

at the **resolution** of;

- 1 ps

For the **frequency ranges** of;

- F1: 10KHz – 100MHz
- F2: 10KHz – 400MHz

at the **resolution** of;

- 1KHz

For setting at GUI,
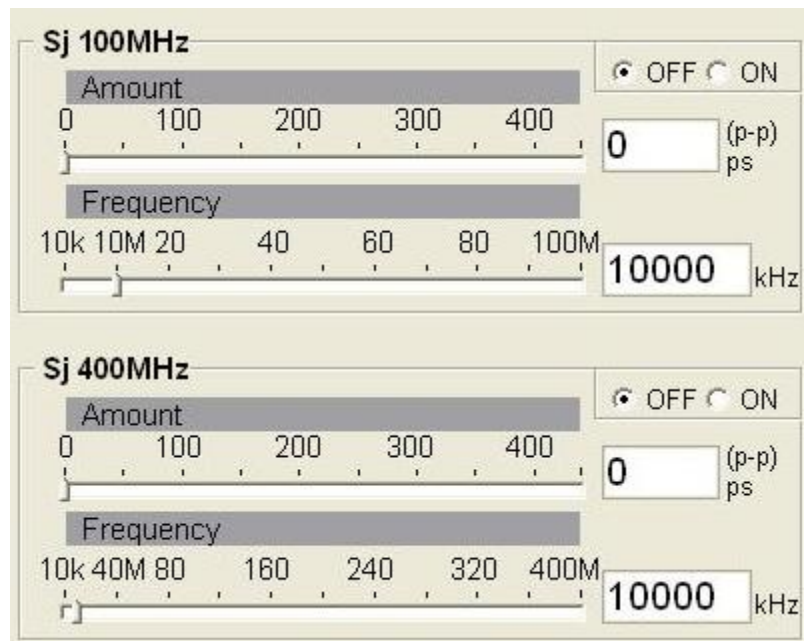
- Select "**OFF**" radio button for Sj = 0
- Select "**ON**" radio button for specifying Sj amount and Sj Frequency

3-3 De-Emphasis & Pre-shoot

De-emphasis and Pre-shoot are added with the following conditions

- 2 Taps De-Emphasis and Pre-Shoot

- The peak at the leading edge and attenuation at trailing edge for de-empphasis, and the attenuation at the leading edge and the peak at the trailing edge for Pre-shoot.

- Bit Rate to be specified for De-emphasis and Pre-shoot width.
  - ✓ Specifying Bit Rate is effective only for de-emphasis width

- Amount of De-emphasis and Pre-shoot is up to 6.0 dB at 0.1dB resolution.
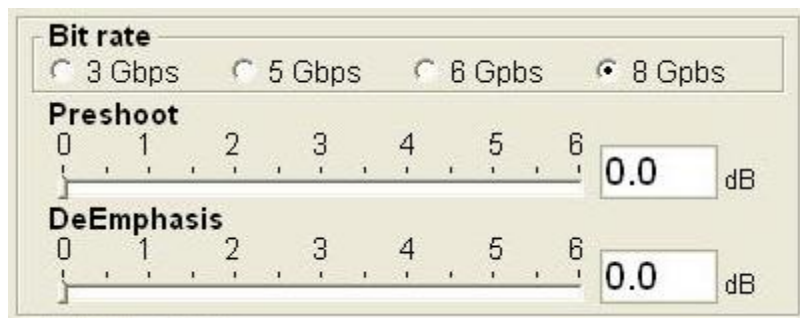
For setting at GUI,

- Select the target bit rate
- Adjust the de-emphasis and pre-shoot amount in dB

3-4 Output Level

Output Level is adjustable in the range of;

> 200m – 2.5Vpp Differential

at the resolution of;

> 10mV
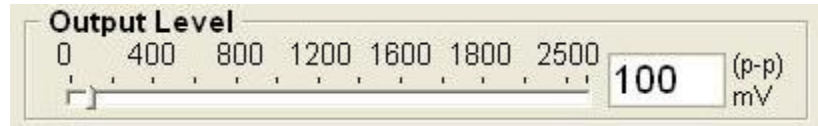
For setting at GUI,

- Adjust the slide bar or enter the amount in mV.

3-5 Skew

Intrapair skew is adjustable in the range of;

> -120ps to 120ps

at the resolution of;

> 1ps

For setting at GUI,

> Adjust the slide bar or enter the amount in ps.

3-6 Duty Cycle Distortion (DCD)

Duty Cycle Distortion is adjustable in the range of;

-8ps to 8ps

at the resolution of;

1ps
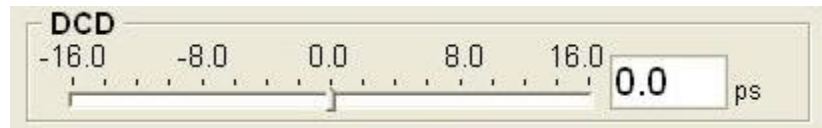
- Although +/- 16ps can be set in GUI, only +/- 8ps is availbale
- Positive (+) values stands for "wider width" at HIGH level in the OUTPUT(+) signal.

4. Preset

This section explains the detailed preset operations.

- ✓ Preset Table Structure
- ✓ Preset Operation
- ✓ Factory Default Preset

4-1 Preset Structure

A preset table contains all parameters such as RJ amount, SJ frequency, Output level, De-emphasis, DCD and Skew control. You can save your own settings as a preset table, and recalling (loading) a preset table sets all the parameters at once.

The preset tables are categorized into two major categories, 'User Definition' and 'Factory Default'. The 'User definition' is where you store your own settings as up to 100 tables. The 'Factory Default' tables contain the definitions given by the standards such as CTS (compliance Test Spec) from USB3, PCI Express and SATA. If you want to apply changes to the factory default, read a table into GUI, change them and store as a user definition table.

Display LCD on the RJI12G's front panel shows the legend of the preset category.

Category	Legend	Table number Range	Description
User Definition	#	0 – 99	User area
Factory Default	U	0 – 99	USB 3.0
	S	0 – 99	SATA Gen 1 / Gen 2 / Gen 3
	P	0 – 99	PCI Express 3.0

❖ Refer to section "2-3 Control Panel Operation and Preset Operation" for preset operation under GUI.

4-2 Preset Operation

The following illustration shows the locations and directions paremeters.

Remember the parameters on GUI do not always equal to the current hardware setting nor those in the preset tables.
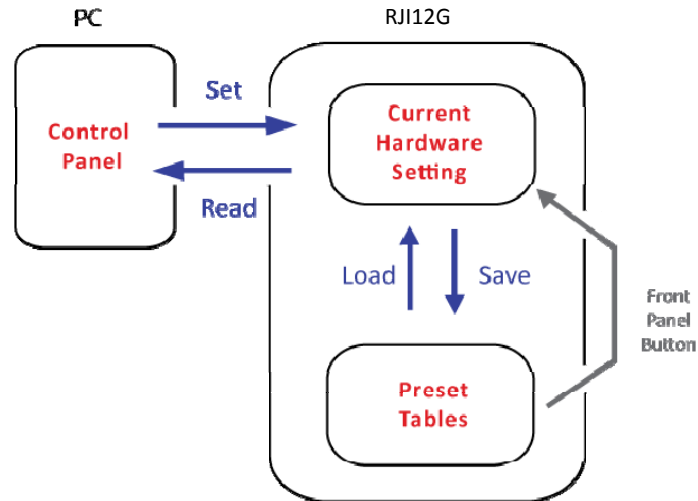
Parameters Direction

- Set: Sends and setsGUI parameter to RJI12G

- Read: Read the current RJI12G settings (parameters) into GUI

- Load: Loads and sets preset table parameters into RJI12G

- Save: Saves the current RJI12G settings (parameters) into Preset table.

4-3 Factory Default Preset

The factory default preset is prepared for user convenience. Most of the presets are from Compliance Test Specifications provided by the each standard organization such as USB, PCI Express and SATA.

❖ Refer to the additional Preset Table Reference for details of factory defaults.

5. Remote Command Reference

This section describes about the remote command format and structures.

- ✓ Command Format
- ✓ Command List
- ✓ Command Description

5-1 Command Format

Syntax

The command is to be followed by space and parameter and comma and carriage return.

Command (space) Parameter, Parameter,,,,Parameter <CR>

Response

The command returns one of the followings;

OK	when succeeds
ER	when syntax error
NG	when fails
<value>	returns current set value when no parameter is specified

Example

SA1 440<CR>	specifies Sj#1 amount as 440ps
SA2 <CR>	returns currently specified Sj#2 amount in ps

5-2 Command List

PAS   switches between Jitter mode and Bypass mode

BTR   specifies data bit rate

RBW   specifies Rj bandwidth

RON   turns on / off random jitter

RA0   specifies Rj amount for 0 – 1.5MHz bandwidth

RA1   specifies Rj amount for 1.5M – 100MHz bandwidth

RAG   specifies Rj amount for 1.5M – 1GHz bandwidth

SO1   turns on/off Sinusoidal jitter #1 (1.5MHz – 100MHz)

SO2   turns on/off Sinusoidal jitter #2 (1.5MHz – 400MHz)

SA1   specifies Sj #1 amount

SA2   specifies Sj #2 amount

SC1   specifies Sj #1 frequency

SC2   specifies Sj #2 frequency

OLV   specifies output swing level

DEH   specifies de-emphasis level

PRS   specifies pre-shoot level

SKW   specifies intra-pair skew

DCD   specifies DCD amount

SVP   saves settings into EEPROM

LDP   loads settings from EEPROM

GPN   obtains current preset number

LOC   sets lock mode on

VER   obtains version information

5-3 Command Description

PAS

Switches between Jitter mode and Bypass mode.

❖ Parameter

ON	Bypass mode ON
OFF	Bypass mode OFF

❖ Example

PASS OFF	jitter mode on

BTR

Specifies data rate for de-emphasis width calculation.

❖ Parameter

3	3Gbps
5	3Gbps
6	6Gbps
8	8Gbps

❖ Example

BTR 3	sets the calculation factor for de-emphasis width for the data rate of 3Gbps

Note: This command only effects to the de-emphasis and pre-shoot width.

RBW

Specifies Rj bandwidth.

- ❖ Parameter

    100   applies 1.5MHz – 100MHz bandwidth

    1G   applies 1.5MHz – 1GHz bandwidth

- ❖ Example

    RBW 100   sets 2nd Rj bandwidth as 1.5M-100MHz

- ❖ Note   1st bandwidth 10KHz-1.5MHz is also ON

RON

Turns on / off random jitter.

- ❖ Parameter

    ON   injects random jitter

    OFF   does not injects random jitter

- ❖ Example

    RON ON   sets random jitter ON

RA0

Specifies Rj amount for 10KHz – 1.5MHz bandwidth at 0.1ps resolution.

- ❖ Parameter

    <value>   10 times of jitter amount in ps

                   value range: 5 – 100 (0.5ps – 10.0ps)

- ❖ Example

    RA0 100   sets Rj amount as 10.0ps for 10K-1.5MHz bandwidth

RA1

Specifies Rj amount for 1.5M – 100MHz bandwidth at 0.1ps resolution.

❖ Parameter

<value> 10 times of jitter amount in ps,

     value range: 5 – 100 (0.5ps – 10.0ps)

❖ Example

RA1 100 sets Rj amount as 10.0ps for 1.5M-100MHz bandwidth

RAG

Specifies Rj amount for 1.5M – 500MHz bandwidth at 0.1ps resolution.

❖ Parameter

<value> 10 times of jitter amount in ps

     value range: 5 – 100 (0.5ps – 10.0ps)

❖ Example

RAG 100 sets Rj amount as 10.0ps for 1.5M-1GHz bandwidth

SO1

Turns ON / OFF sinusoidal jitter #1 for 1.5MHz – 100MHz.

❖ Parameter

ON   injects sinusoidal jitter

OFF   does not injects sinusoidal jitter

❖ Example

SO1 ON injects sinusoidal jitter

SO2

Turns ON / OFF sinusoidal jitter #2 for 1.5MHz – 400MHz.

- ❖ Parameter

    ON   injects sinusoidal jitter

    OFF   does not injects sinusoidal jitter

- ❖ Example

    SO2 ON   injects sinusoidal jitter

SA1

Specifies Sinusoidal jitter#1 amount in ps at the resolution of 1ps.

- ❖ Parameter

    <value>   Jitter amount in ps

                    value range: 0-440

- ❖ Example

    SA1 200   sets Sj #1 amount as 200ps

SA2

Specifies Sinusoidal jitter#2 amount in ps at the resolution of 1ps.

- ❖ Parameter

    <value>   Jitter amount in ps

                    value range: 0-440

- ❖ Example

    SA2 200   sets Sj #2 amount as 200ps

SC1

Specifies Sinusoidal jitter #1 frequency in KHz at 1KHz resolution.

- ❖ Parameter

  <value>   Sinusoidal jitter frequency in KHz

                    value range: 10 – 100000 (10KHz – 100MHz)

- ❖ Example

  SC1 35000   sets Sj #1 Frequency as 35MHz

SC2

Specifies Sinusoidal jitter #2 frequency in KHz at 1KHz resolution.

- ❖ Parameter

  <value>   Sinusoidal jitter frequency in KHz

                    value range: 10 – 400000 (10KHz – 400MHz)

- ❖ Example

  SC2 35000   sets Sj #2 Frequency as 35MHz

OLV

Specifies output swing level in mV at 1mV resolution.

- ❖ Parameter

  <value>   Output level in mV (differential)

                    value range: 0 - 2500 (0 – 2.5Vpp differential)

- ❖ Example

  OLV 1500   sets the output level as 1.5Vpp differential

                    (750mV single end)

DEH

Specifies de-emphasis amount in dB at 0.1dB resolution

- ❖ Parameter

      <value>   10 times of desired de-emphasis amount in dB

                           value range: 0 – 60 (0 – 6.0dB)

- ❖ Example

      DEH 28   sets de-emphasis amount as 2.8dB.

PRS

Specifies pre-shoot amount in dB at 0.1dB resolution

- ❖ Parameter

      <value>   10 times of desired de-emphasis amount in dB

                           value range: 0 – 60 (0 – 6.0dB)

- ❖ Example

      PRS 28   sets de-emphasis amount as 2.8dB.

SKW

Specifies the intra-pair skew in ps.

- ❖ Parameter

      <value>   skew amount in ps

                           value range: -120 - 120 (-120ps - +120ps)

- ❖ Example

      SKW -80   sets skew amount as -80ps

DCD

Specifies Duty Cycle Distortion (DCD) amount in ps at 1ps resolution

- ❖ Parameter

  <value>　　　DCD amount in ps

  　　　　　　　value range: -8 to +8

- ❖ Example

  DCD 8　　　　sets DCD amount as +8ps

- ❖ Remarks

  Positive(+) value makes the HIGH level of OUTPUT(+) signal wider.

SVP

Saves settings into preset table.

- ❖ Parameter 1

  #　　　　　　　into user area

- ❖ Parameter 2

  <value>　　　Preset table number

  　　　　　　　value range: 0 – 99

- ❖ Example

  SVP # 46　　　saves the current settings into user preset table #46.

LDP

Loads the specified preset table data and sets RJI12G.

- ❖ Parameter 1

U	USB3.0 Preset Table
S	SATA Preset Table
P	PCI Express Preset Table
#	User defined Preset Table

- ❖ Parameter 2

  | <value> | Preset Table Number |
  | | value range: 0 – 99 |

- ❖ Example

  | LDP U 36 | Loads USB 3.0 Preset table #36 and sets RJI12G. |

GPN

Obtains current preset number.

- ❖ Parameter

- ❖ Example

  | GPN | returns U, 12 when current preset table is USB #12. |

LOC

Sets lock mode on

- ❖ Parameter   none

VER

obtains version information

- ❖ Parameter   none

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