Evaluation Kit Operation Manual Rev.2

For DSA (Digital Step Attenuator) / DVGA (Digital Variable Gain Amplifier)

1. Introduction

This operation manual describes how to control the DSA(Digital Step Attenuator)/DVGA(Digital Variable Gain Amplifier) Evaluation board(EVB) using an Evaluation Control Interface board(EVCI). This Kit can be used to test and evaluate the various RF performance of the DSA/DVGA and is ideal for the functionality of the DSA and hardware development for RF system.

The DSA/DVGA Evaluation Board (EVB) is based on a combination of RF board and integrated interface board with FT232RL. and provides access to the USB ports as well as the SPI communication pins. This board was designed as a validation platform with maximum functionality. Where possible we've also designed for RF measurement environmental diversity but the primary goal of this system was control for DSA/DVGA.

2. Test Kit

The Kit should contain
1. BeRex DSA/DVGA RF Board (Evaluation Board – EVB)
2. Evaluation Control Interface board (EVCI Rev.2)
3. USB Cable
4. GUI & USB Driver(Web download)

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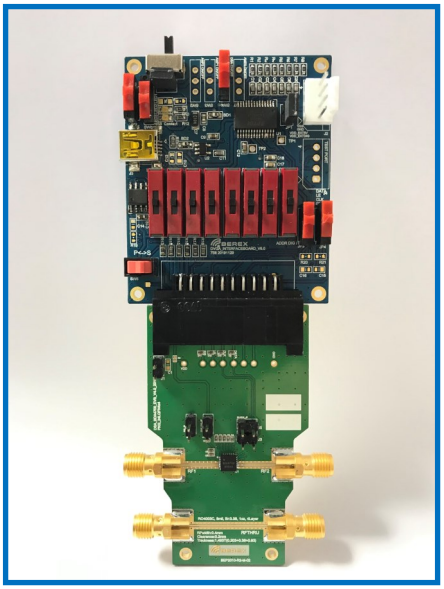
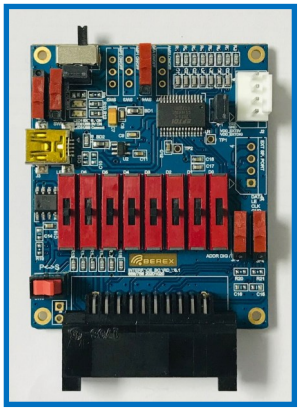


< Figure 1. The Evaluation Board Kit Rev.2 >

3. Evaluation Control Interface Board Overview

EVCI board allows the user to send SPI commands to the device under test by using a PC running the Windows™ operating system. The EVCI Board is responsible for interpreting commands from the USB and supplying the EVB with the appropriate control data on the 20-pin connector. And It supports direct parallel mode and serial mode at the same time, and provides the option of selecting External power and USB power according to user's environment.

< Figure 2. The EVCI Board Rev.2 >



Switches provide flexibility of supplying voltage to the EVB either through USB or external power supply. Figure 2 shows the default orientation of the Switches on EVCI.

Default Switch Setting.

1. Use VDD EXT 5V
2. Use VDD_DIGITAL USB 5V
3. Addr_DIG 0V or PUP1,2 set Reference Loss
4. P/S mode to serial

Table 1. EVCI Rev.2 supported products

Part Number	Part Description	Support Interface Type
BVA303/BVA303B	DVGA	Latched Parallel, in Direct Parallel, Serial(6bit)
BVA304/BVA305B	DVGA	Latched Parallel, in Direct Parallel, Serial(6bit)
BVA305/BVA305B	DVGA	Latched Parallel, in Direct Parallel, Serial(6bit)
BVA518/BVA518B	DVGA	Latched Parallel, in Direct Parallel, Serial(6bit)
BVA2140/BVA2140B	DVGA	Serial(6bit)
BDA4601	DSA	Latched Parallel, in Direct Parallel, Serial(6bit)
BDA4620	DSA	Latched Parallel, in Direct Parallel, Serial(6bit)
BDA4630	DSA	Latched Parallel, in Direct Parallel, Serial Addressable(6bit)
BDA4700	DSA	Latched Parallel, in Direct Parallel, Serial(7bit)
BDA4710	DSA	Latched Parallel, in Direct Parallel, Serial Addressable(7bit)
BVA3143	DVGA	Serial(7bit)
BVA3144	DVGA	Serial(7bit)

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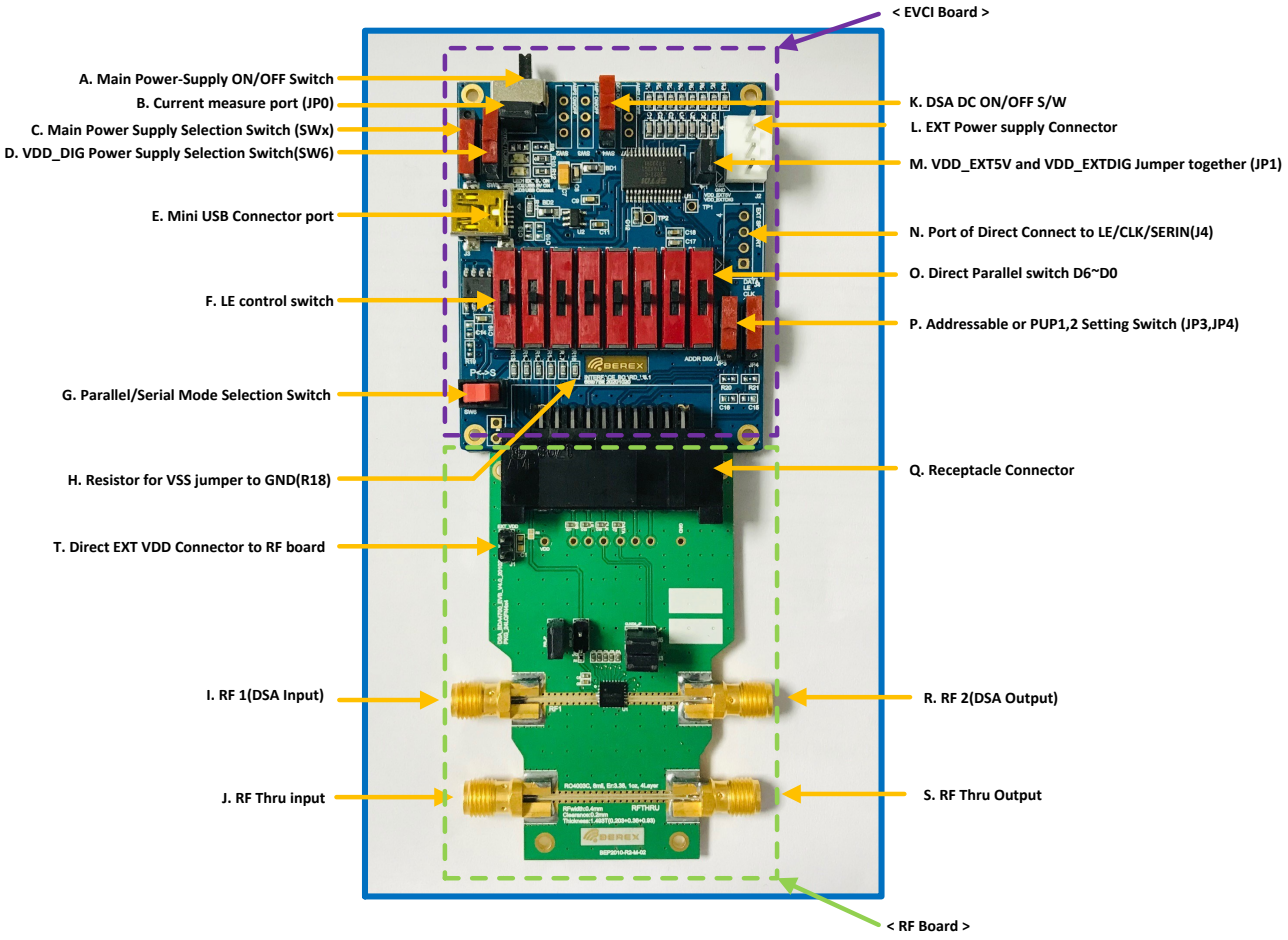
Overview

The Evaluation Control Interface (EVCI) Board is an evaluation platform for the FT232RL UART IC based interface board. Evaluation Board is support the USB2.0 interface and the Direct Parallel mode with SP3T switch manually. and supports the Functional option for USB power supply or user direct power supply.

< Figure 3. Evaluation Board Kit Rev.2 Assembly >



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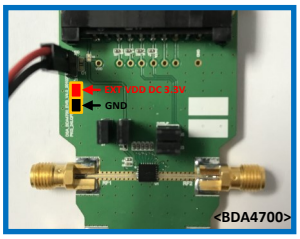
4. EVCI Setting and Environment Configuration for DSA

4-1. DSA/DVGA EVB Power Up option (VDD DC drive to DSA/DVGA)

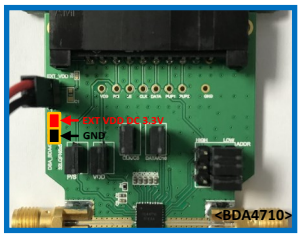
4-1-1. EXT DC Voltage applied to RF board directly (recommend)

- Directly connect DC cable to RF board and supply power to DSA or DVGA.

<Figure 4. EXT DC_VDD to RF board directly >



<BDA4700>



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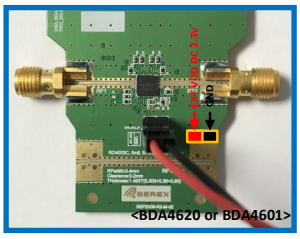
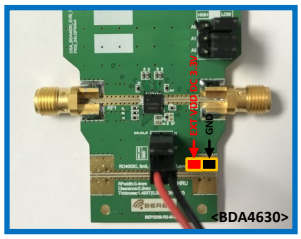


<BDA4620 or BDA4601>

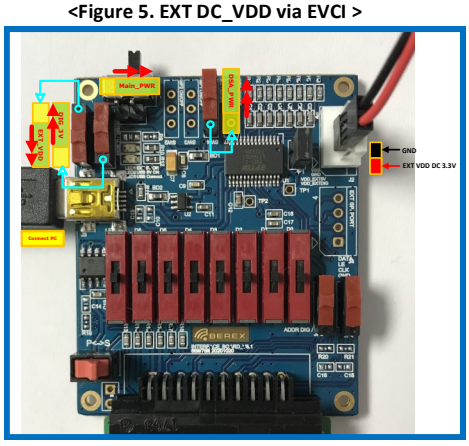


<BDA4630>

4-1-2. EXT DC Voltage applied to RF board via EVCI

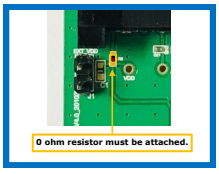
- Directly connect DC cable to EVCI and supply power to DSA or DVGA.

<Figure 5. EXT DC_VDD via EVCI >



A. DC cable connect to EXT Power Supply Connector(3~5V)
B. Operate the direction of the EXT_VDD switch lower side.
C. Operate the direction of the DIG_3V switch Lower side. (supply 3V with USB)
D. Operate the direction of the DSA_VDD switch Upper side.
E. Operate the direction of the Main_PWR switch Right side.

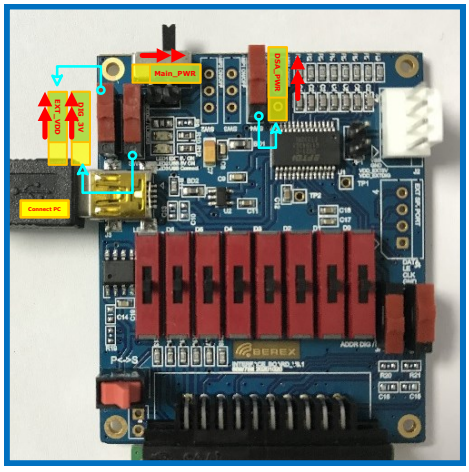
F. This solution to supply power, RF board need to attach 0 ohm Resistor



4-1-3. USB DC Voltage applied to RF board via EVCI

- Use USB 5V power and supply power to DSA or DVGA.

<Figure 6. USB_5V via EVCI >



A. Operate the direction of the EXT_VDD switch Upper side. (supply MainDC with USB)
B. Operate the direction of the DIG_3V switch Lower side. (supply 3V with USB)
C. Operate the direction of the DSA_VDD switch Upper side.
D. Operate the direction of the Main_PWR switch Right side.

E. This solution to supply power, RF board need to attach 0 ohm Resistor

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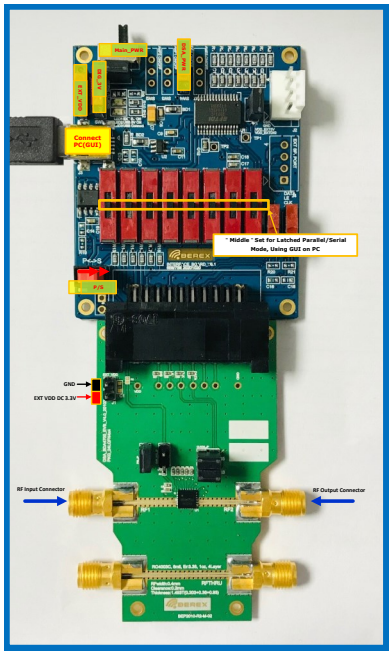
4. EVCI Setting and Environment Configuration

4-2. EVCI Setting for BDA4700 to Serial mode or Parallel mode



<Figure 7. Serial Control mode with BDA4700 >

Evaluation board Kit Introduction

BDA4700/BDA4710/BDA4620/BDA4630 Evaluation Kit is made up of a combination of an RF board and an interface board

DSA Evaluation INTERFACE board is assembled with a SP3T switches(D1~D6,LE), SP2T mechanical switch (P/S), and several header & switch.
Users can freely select EXT VDD or USB5V to supply power to the DSA.

Evaluation Board Programming Using USB Interface

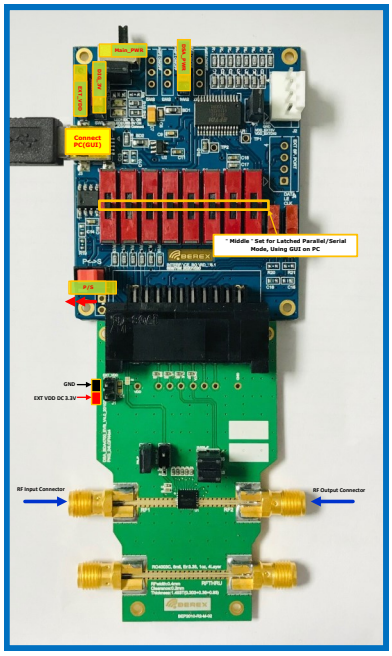
In order to evaluate the DSA performance, the Application Software has to be installed on your computer. And The DSA application software GUI supports Latched Parallel and Serial modes. software can be downloaded from BeRex's website

4-2-1. Supply DC Voltage to RF board (refer to page.4)

- EXT DC Voltage applied to RF board directly (recommend)
- EXT DC Voltage applied to RF board via EVCI
- USB DC Voltage applied to RF board via EVCI

4-2-2. Serial Control Mode (refer to Figure 7)

- Connect USB cable (J3) to EVCI port directly to PC
- Set the direction of P<->S Switch to S direction (P/S Logic HIGH)
- Set the D0~D6, LE switch to the middle position.
- Operate the 0~31.75dB attenuation state in GUI and then control the DSA



<Figure 8. Latched Parallel Control mode with BDA4700 >

4-2-3. Latched Parallel Control Mode (refer to Figure 8)

- Connect USB cable (J3) to EVCI port directly to PC
- Set the direction of P<->S Switch to P direction (P/S Logic LOW)
- Set the D0~D6, LE switch to the middle position.
- Operate the 0~31.75dB attenuation state in GUI and then control the DSA

4-2-4. Direct Parallel Control Mode

- Set the direction of P<->S Switch to P direction (P/S Logic LOW)
- Set LE switch to the High Position
- For the setting to attenuation state, D0~D6 switches can be combined in manually program, refer to Table 3.

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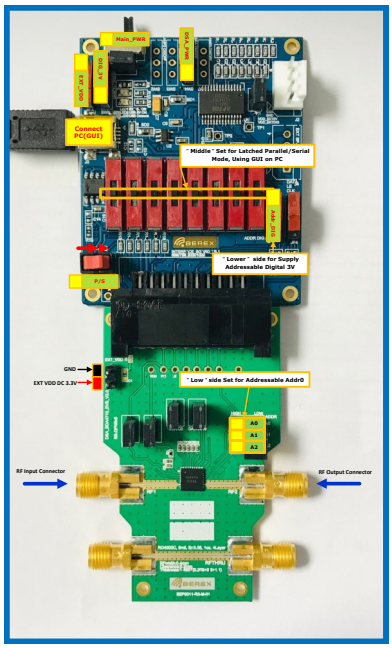
4. EVCI Setting and Environment Configuration

4-3. EVCI Setting for BDA4710 to Serial mode or Parallel mode



<Figure 9. Serial Control mode with BDA4710 >

4-3-1. Supply DC Voltage to RF board (refer to page.4)

- EXT DC Voltage applied to RF board directly (recommend)
- EXT DC Voltage applied to RF board via EVCI
- USB DC Voltage applied to RF board via EVCI

4-3-2. Serial Control Mode (refer to Figure 9)

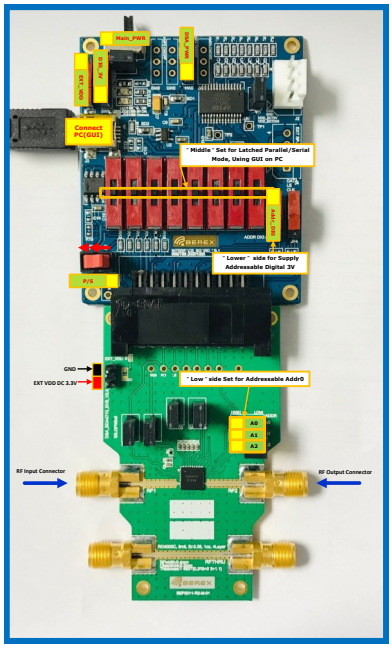
- Set the Address Jumper (A0, A1, A2) to HIGH or LOW(set Addr0~7)
- Connect USB cable (J3) to EVCI port directly to PC
- Set the direction of P<->S Switch to S direction (P/S Logic HIGH)
- Set the D0~D6, LE switch to the middle position.
- Operate the 0~31.75dB attenuation state in GUI and then control the DSA

4-3-3. Latched Parallel Control Mode (refer to Figure 10)

- Connect USB cable (J3) to EVCI port directly to PC
- Set the direction of P<->S Switch to P direction (P/S Logic LOW)
- Set the D0~D6, LE switch to the middle position.
- Operate the 0~31.75dB attenuation state in GUI and then control the DSA

4-3-4. Direct Parallel Control Mode

- Set the direction of P<->S Switch to P direction (P/S Logic LOW)
- Set LE switch to the High Position
- For the setting to attenuation state, D0~D6 switches can be combined in manually program, refer to Table 3.



<Figure 10. Latched Parallel Control mode with BDA4710 >

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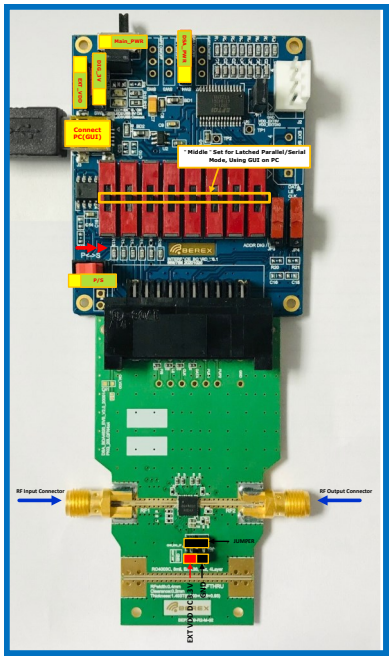
4. EVCI Setting and Environment Configuration

4-4. EVCI Setting for BDA4620 and BDA4601 to Serial mode or Parallel mode



<Figure 11. Serial Control mode with BDA4620 >

4-4-1. Supply DC Voltage to RF board (refer to page.4)

- EXT DC Voltage applied to RF board directly (recommend)
- EXT DC Voltage applied to RF board via EVCI
- USB DC Voltage applied to RF board via EVCI

4-4-2. Serial Control Mode (refer to Figure 11)

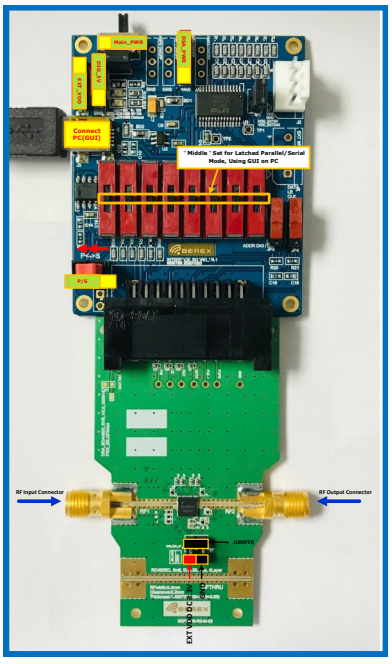
- Connect USB cable (J3) to EVCI port directly to PC
- Set the direction of P<->S Switch to S direction (P/S Logic HIGH)
- Set the D0~D6, LE switch to the middle position.
- Operate the 0~31.5dB attenuation state in GUI and then control the DSA

4-4-3. Latched Parallel Control Mode (refer to Figure 12)

- Connect USB cable (J3) to EVCI port directly to PC
- Set the direction of P<->S Switch to P direction (P/S Logic LOW)
- Set the D0~D6, LE switch to the middle position.
- Operate the 0~31.5dB attenuation state in GUI and then control the DSA

4-4-4. Direct Parallel Control Mode

- Set the direction of P<->S Switch to P direction (P/S Logic LOW)
- Set LE switch to the High Position
- For the setting to attenuation state, D1~D6 switches can be combined in manually program, refer to Table 3.



<Figure 12. Latched Parallel Control mode with BDA4620 >

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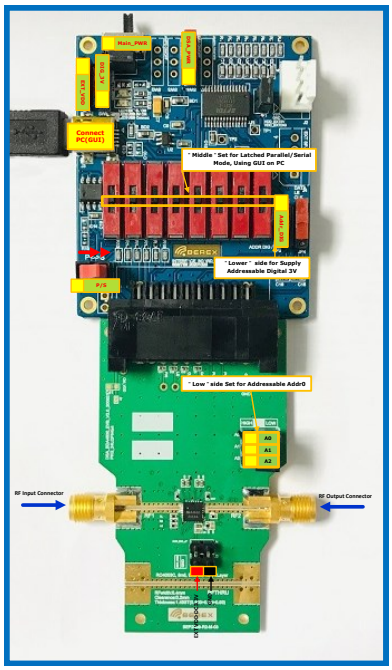
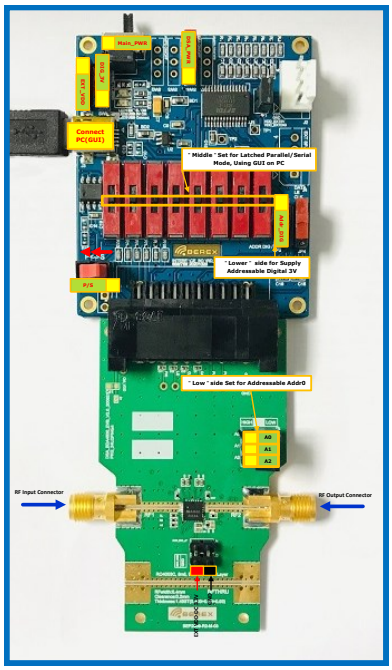
4. EVCI Setting and Environment Configuration

4-5. EVCI Setting for BDA4630 to Serial mode or Parallel mode



<Figure 13. Serial Control mode with BDA4630 >



<Figure 14. Latched Parallel Control mode with BDA4630 >

4-5-1. Supply DC Voltage to RF board (refer to page.4)

- EXT DC Voltage applied to RF board directly (recommend)
- EXT DC Voltage applied to RF board via EVCI
- USB DC Voltage applied to RF board via EVCI

4-5-2. Serial Control Mode (refer to Figure 13)

- Set the Address Jumper (A0, A1, A2) to HIGH or LOW(set Addr0~7)
- Connect USB cable (J3) to EVCI port directly to PC
- Set the direction of P<->S Switch to S direction (P/S Logic HIGH)
- Set the D0~D6, LE switch to the middle position.
- Operate the 0~31.5dB attenuation state in GUI and then control the DSA

4-5-3. Latched Parallel Control Mode (refer to Figure 14)

- Connect USB cable (J3) to EVCI port directly to PC
- Set the direction of P<->S Switch to P direction (P/S Logic LOW)
- Set the D0~D6, LE switch to the middle position.
- Operate the 0~31.5dB attenuation state in GUI and then control the DSA

4-5-4. Direct Parallel Control Mode

- Set the direction of P<->S Switch to P direction (P/S Logic LOW)
- Set LE switch to the High Position
- For the setting to attenuation state, D1~D6 switches can be combined in manually program, refer to Table 3.

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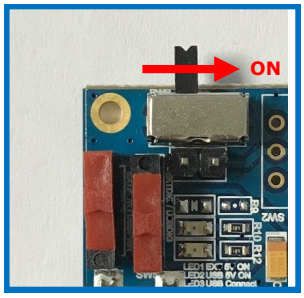
5. EVCI Board Functional Description

5-1. Main Power-Supply ON/OFF Switch

- Main Power-Supply ON/OFF Switch can be set to use main power supply setting ON/OFF

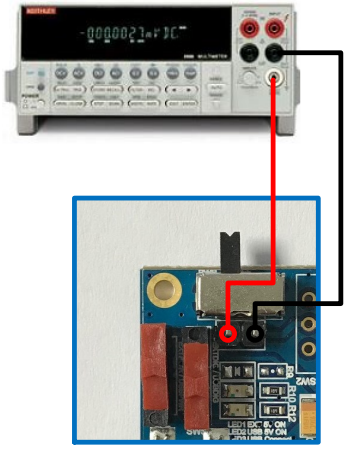
<Figure 15. Main Power set-up>



Main Power Switch direction
- RIGHT : ON
- LEFT : OFF

5-2. Current Measure Port (JP0)

<Figure 16. Main Power set-up>

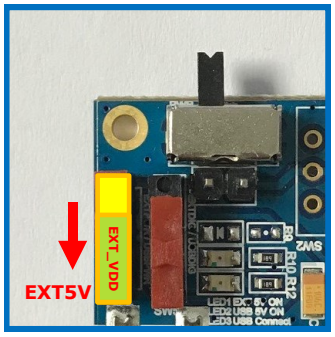


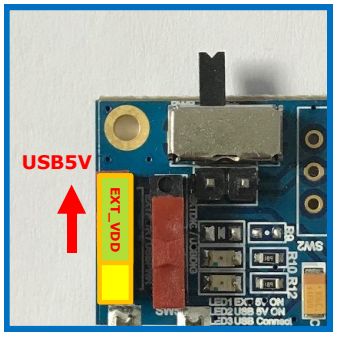
- This port can be used for one purposes
  1. Use the Jumper, it is possible to send a power to the main chip by Interface board directly
  2. No use Jumper and connect the cable to multimeter port, user can verify the current consumption

5-3. Main Power Supply Selection Jumper (JP2)

- This Switch provide flexibility of supplying voltage to the interface board either through USB or external power supply (Default EXT5V)
- EXT VDD Switch '**Low**' position shown below supplies the VDD_EXT5V from **EXT Power supply Connector** to "SW1" main power supply on/off switch directly
- EXT VDD Switch '**High**' position shown below provides 5V from the **USB** to "SW1" main power supply on/off switch directly
  (in this case, if you can't use external power supply, this mode will be supply the power to the device but it can cause voltage drop)

<Figure 17. Main Power Supply Selection Jumper>





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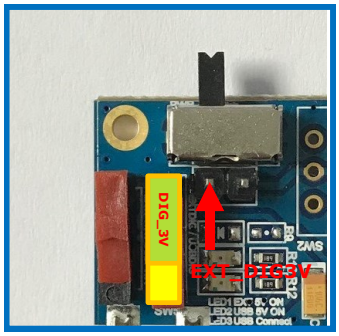
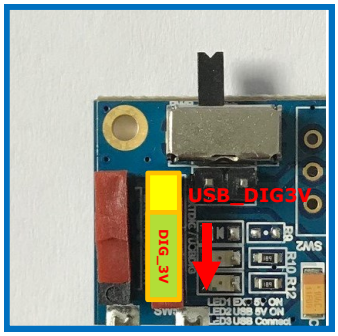
5. EVCI Board Functional Description

5-4. DIG Power Supply Selection Jumper (SW5)

- This jumper control which one use digital power supply USB or EXT5V using interface board (Default: USB)
- DIG_3V(SW5) - '**High**' Position : Digital power supply set to use VDD_EXTDIG power supply
  (in this case, there aren't any USB connection and user want to use parallel mode)
- DIG_3V(SW5) - '**Low**' Position : Digital power supply set to use USB 5V power supply (in this case, connected USB and user control by GUI)

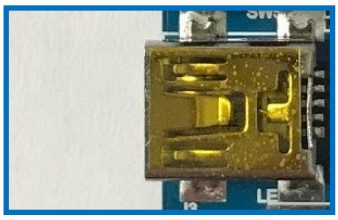
<Figure 18. DIG Power Supply selection Jumper>





5-5. Mini USB Connector port(J3)

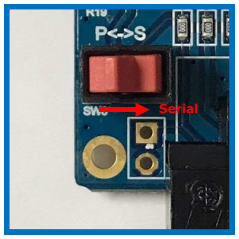
<Figure 19. USB Port>



- Connect this connector of USB cable to EVCI Board. This supplies voltage to the Interface board and remote control

5-6. Parallel/Serial mode selection(SW6, P/S)

<Figure 20. P/S Switch>



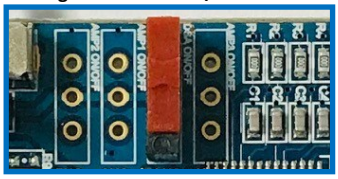
- This switch control to serial mode or parallel mode/Latched parallel mode
- Left direction (←) : Parallel mode and Latched Parallel mode.
- Right direction (→) : Serial mode

5-7. Resistor for VSS jumper to GND(R18)

- This Resistor(0ohm) is shorted to GND to enable using the internal negative voltage generator.
- If you want to provide external negative power supply with –3.3V typical, R18 resistor must be removed and directly provide negative power supply from EXT power supply connector(J2, pin4)

5-8. Separate Power supply ON/OFF Switch to DSA, AMP1, AMP2(SW2,SW3,SW4)

<Figure 21. DSA ON/OFF Switch>



- Each switch can be on/off the internal device independently of the chip
- SW4: DSA ON/OFF (upper direction is way to DSA DC Power ON)

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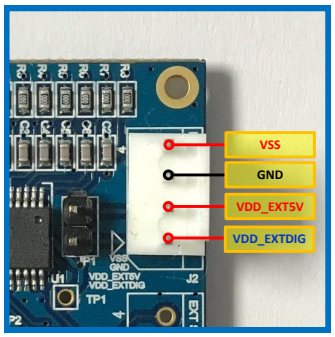
5. EVCI Board Functional Description

5-9. EXT Power supply Connector (J2)

- This connector is directly connected an main external power supply and independently it can be supplied to the external digital power (VDD_EXTDIG) and VSS

<Figure 22. EXT Power supply >

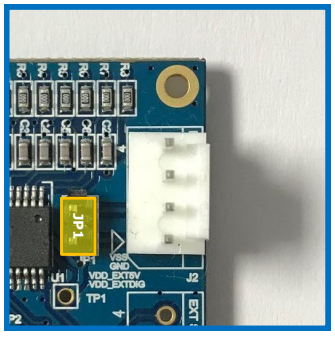


<Pin Description>

1. **VSS :** VSS is the external negative power supply with –3.3V typical. To simplify the test set-up, it can also be shorted to GND with Resistor R18 to enable using the internal negative voltage generator
2. **GND :** Ground
3. **VDD_EXT5V :** VDD_EXT5V is the positive DC voltage power supply 5V typical
4. **VDD_EXTDIG :** VDD_EXTDIG is the positive DC voltage power supply for control signals with 5V typical (but actual voltage supply to digital control is 3V), and it can be connected to VDD_EXT5V with jumper on JP1 to simplify the test set-up

5-10. VDD_EXT5V and VDD_EXTDIG Jumper together (JP1)

<Figure 23. EXT Power supply >



- This jumper can be provided with the main power supply(VDD_EXT5V) to the digital power supply (VDD_EXTDIG), when connected

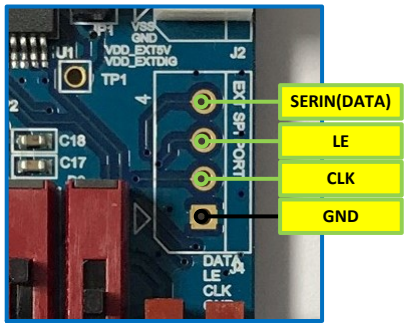
notice: If this jumper is connected, it can result in an increase total consumption current. and suggest this jumper when you can not use USB connection. (ex. Only parallel mode)

5-11. Port of Direct Connect to LE/CL/DATA (J4)

- This port can be used for two purposes

1. By directly connecting the DATA/CLK/LE at this port, it is possible to send a control signal to the main chip by user' MCU
2. By directly connecting the DATA/CLK/LE at this port, user can verify the control signal that sent to the main chip (ex: use oscilloscope)

<Figure 24. EXT SPI PORT>



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4. EVCI Board Functional Description

5-12. Direct Parallel Control Switch (LE, D0~D6)

- Set the D0~D6 and LE mechanical control switches on board to support Direct Parallel, Latched Parallel, or Serial mode

a. **Serial or Latched Parallel mode**(using GUI application software on PC)

- Place D0~D6 and LE at the **middle position** to support Latched Parallel and Serial modes with GUI application software and proper position of P/S switch

b. **In Direct Parallel mode**(Using SP3T switch on EVCI board without PC)

- D0~D6 can be set to **"HIGH"** or **"LOW"** to manually program the attenuation state while LE is connected to "HIGH" without using the USB Interface and GUI application software

<Figure 25. Direct Parallel Control Switch>

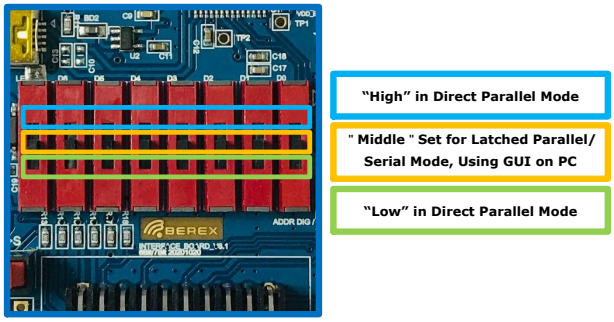


Table 2. SP3T Switch Descriptions for Parallel mode

SW	6bit	7bit
D0	-	0.25dB
D1	0.5dB	0.5dB
D2	1dB	1dB
D3	2dB	2dB
D4	4dB	4dB
D5	8dB	8dB
D6	16dB	16dB
LE	Latch enable	Latch enable

Table 3. Truth Table for the Parallel Control Word

LE	D6	D5	D4	D3	D2	D1	D0	P/S	Attenuation State
High	Low	Low	Low	Low	Low	Low	Low	Low (<-)	Reference Loss
High	Low	Low	Low	Low	Low	Low	High	Low (<-)	0.25dB
High	Low	Low	Low	Low	Low	High	Low	Low (<-)	0.5dB
High	Low	Low	Low	Low	High	Low	Low	Low (<-)	1dB
High	Low	Low	Low	High	Low	Low	Low	Low (<-)	2dB
High	Low	Low	High	Low	Low	Low	Low	Low (<-)	4dB
High	Low	High	Low	Low	Low	Low	Low	Low (<-)	8dB
High	High	Low	Low	Low	Low	Low	Low	Low (<-)	16dB
High	High	High	High	High	High	High	Low	Low (<-)	31.5dB(6bit)
High	High	High	High	High	High	High	High	Low (<-)	31.75dB(7bit)

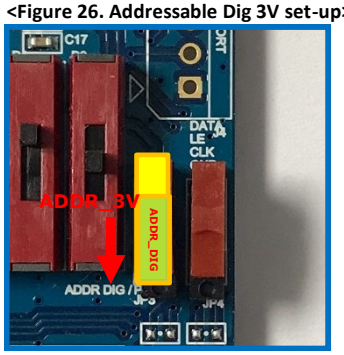
Note: 1. Not all 128 possible combinations of C0.25-C16 are shown in table

5-13. Addressable DIG or Power-UP selector Switch

- This Switch can be used for two purposes

1. The JP3 switch can be configured to supply Addressable Digital 3V to the DSA (BDA4710, BDA4630). Refer to figure 9,13
2. The JP3,JP4 Switch set to use PUP(Power UP) control setting(BDA4601). This Feature exists for both the Serial and Parallel modes of operation, and allows a known attenuation state to be established before an initial serial or parallel control word is provided.

<Figure 26. Addressable Dig 3V set-up>



<Figure 27. PUP set-up>

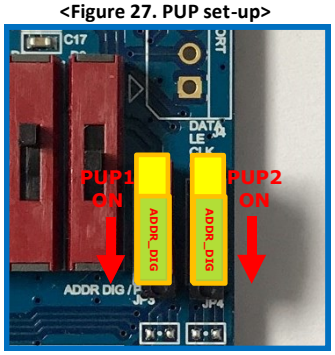


Table 4. Parallel PUP Truth Table (BDA4601 only)

Attenuation state	P/S	LE	PUP1	PUP2
31.5 dB	LOW	LOW	HIGH	HIGH
16 dB	LOW	LOW	HIGH	LOW
8 dB	LOW	LOW	LOW	HIGH
Reference Loss	LOW	LOW	LOW	LOW
Defined by C0.5-C16	LOW	HIGH	Don't Care	Don't Care

HOW to set the PUP

1. Position the P/S switch to Parallel mode
2. Set the "LE" Switch to "Low"
3. Set Switches of PUP1 (JP3) and PUP2 (JP4) to be "HIGH" at low position as you need (refer to Table 4)
4. Provide external power supply (turn on the Main Pwr)

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6. Evaluation Control Interface board(EVCI) GUI

The EVCI GUI application runs on a MS-Windows compatible PC. Once software is downloaded on to
the PC, make sure to unzip the folder and one must have one files, another one folder (EVCI GUI and Driver folder) in the unzipped folder. The latest version of EVCI GUI software is available on BeRex Website under specific product page.

6-1. EVCI GUI Using Sequence A

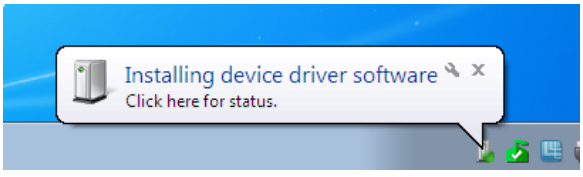
(FTDI Driver installation)

1. Connect the USB Cable to EVCI
2. Confirm the pop-up in window as shown Figure15. (Found New Hardware Wizard or Installing device driver software window will pop up)
3. Pop-up window click
4. Select "No, not this time" and click on the "Next" button to continue (Figure 16)
5. Confirm the word " USB SERIAL CONVERTER"
6. Select "Search for the best driver in these locations" and check box of " include this location in the search"

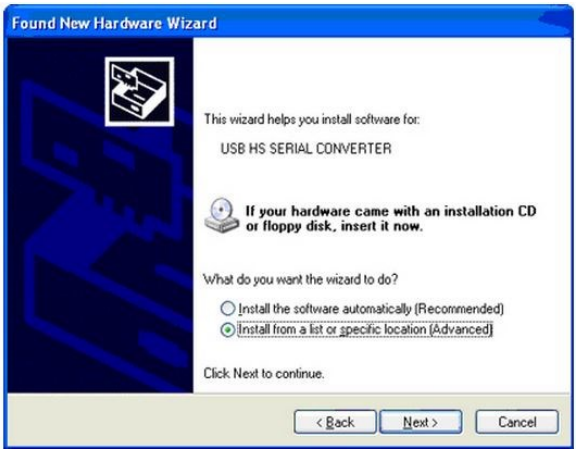
Then click on the "Browse" button and browse to the location you upzipped the USB drivers to in the previous step (CDM v2.12.28 WHQL certified folder, http://www.ftdichip.com/Drivers/VCP.htm)

7. Select the file "**FTDIBUS.INF**"
8. Windows will install the first driver

< Figure 28. USB Serial Converter Driver Installation for windows 8 and 7 >

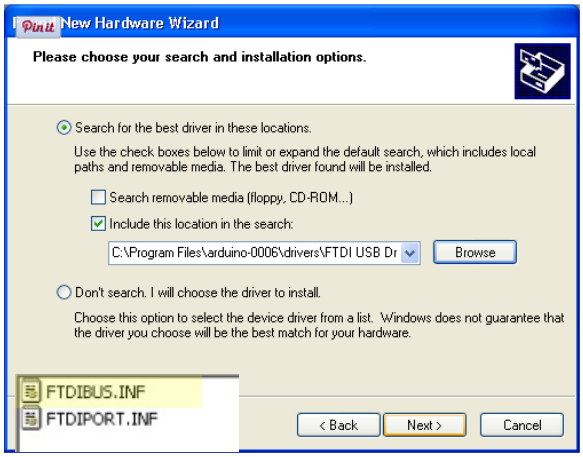


< Figure 29. USB Serial Converter Driver installation 1. >



< Figure 30. USB Serial Converter Driver installation 2. >

< Figure 31. USB Serial Converter Driver installation 3. >



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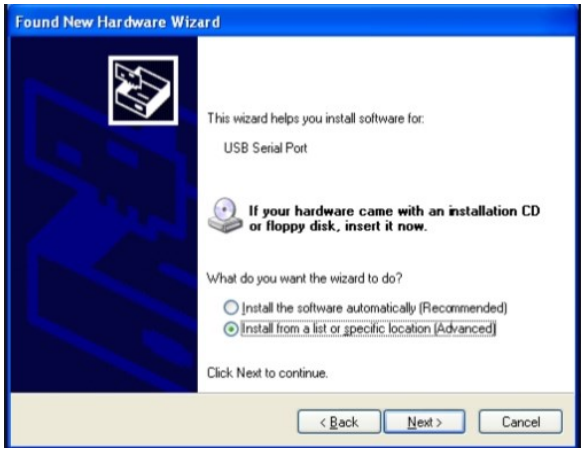
6. Evaluation Control Interface board(EVCI) GUI

6-2. EVCI GUI Using Sequence B

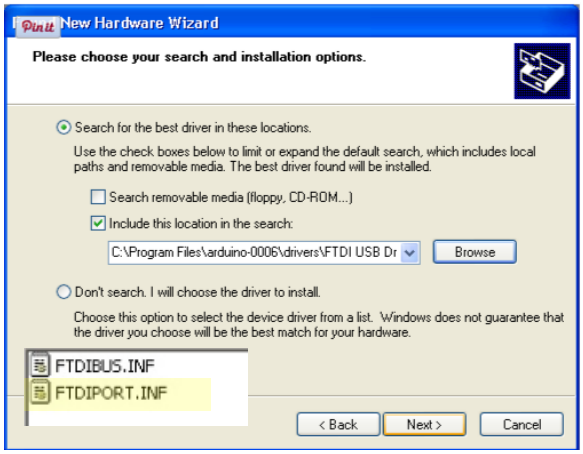
(FTDI Driver installation)

1. The wizard will search for the driver and then tell you that a "USB Serial Port"
2. Pop-up window click
3. Confirm the word " USB SERIAL PORT" and Click "Next"
4. Select "Search for the best driver in these locations" and check box of " include this location in the search"
5. Then click on the "Browse" button and browse to the location you upzipped the USB drivers to in the previous step(CDM v2.12.28 WHQL certified folder)
6. Select the file "**FTDIPORT.INF**"
7. Windows will install the second driver. and then complete

< Figure 32. USB Serial Port Driver installation 1. >



< Figure 33. USB Serial Port Driver installation 2. >



< Figure 34. USB Serial Port Driver installation 3. >

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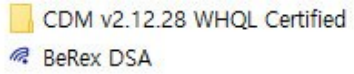
6. Evaluation Control Interface board(EVCI) GUI

6-3-1. EVCI GUI Using Sequence C

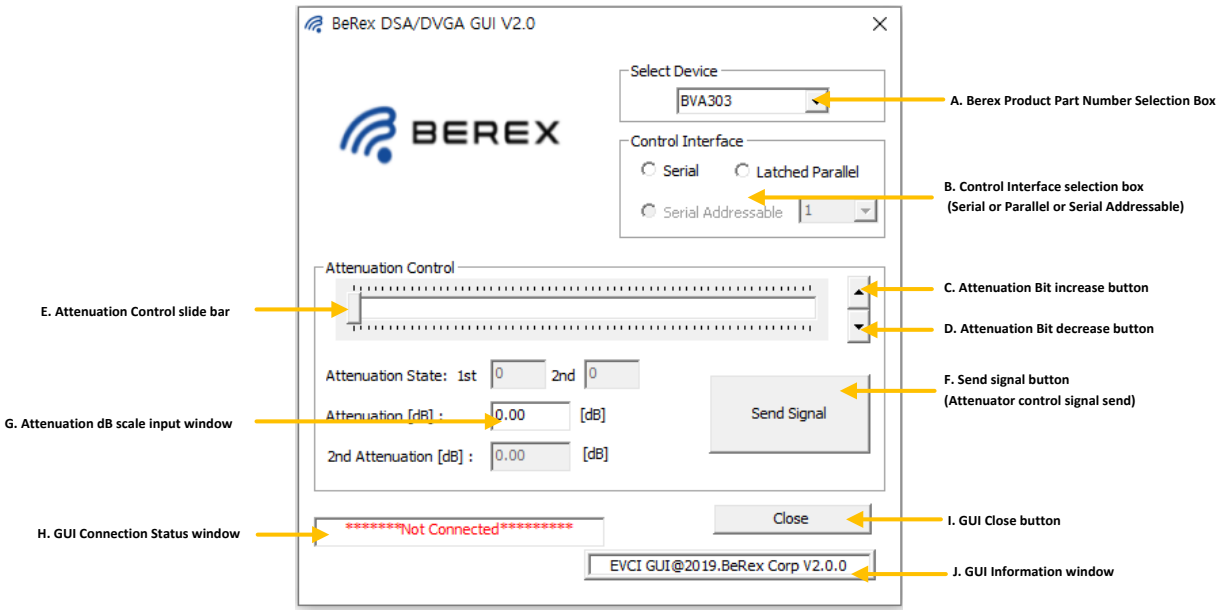
(FTDI Driver installation)

1. Double Click "BeRex EVCI GUI V1" Icon
2. Running GUI and Control!

< Figure 35. USB Serial Port Driver installation 1. >



< Figure 36. BeRex EVCI GUI window>



6-3-2. EVCI GUI Using Sequence C

(GUI Control)

1. Select Device Part Number (Figure.36 A)
2. Select control interface "Serial" or "Serial Addressable" or "Parallel"
3. Setting the Attenuation Control through Attenuation control slide bar or Attenuation Bit increase/decrease button as you wish(Figure.36 C,D,E)
4. Or input the number in Attenuation [dB] input window(Figure.36 G)
5. Press button "Send signal" and then activate Attenuator in Device

Note: If the EVCI board is not connected when the application software is launched, the message " **Not connected** " will appear at the GUI Connection status window

Contact Information

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