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User manual for the set-up and operation of the DA7210/11 evaluation board and control software

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#### 1 Introduction

The DA7210/11 evaluation board has been produced to allow measurement, evaluation and programming of the DA7210/11 ultra-low power audio codec evaluation board and control software. The evaluation PCB is supplied together with a DVD ROM containing documentation and driver files.

The driver software uses a simple graphical user interface (GUI), allowing the DA7210/11 device to be controlled via a USB port of a PC. An additional GUI is available to control the highly configurable filter paths within the DA7210/11; including general purpose, five-band equaliser and high pass filters

The board has a number of jumper links to allow configuration of the board and to provide measurement test points.

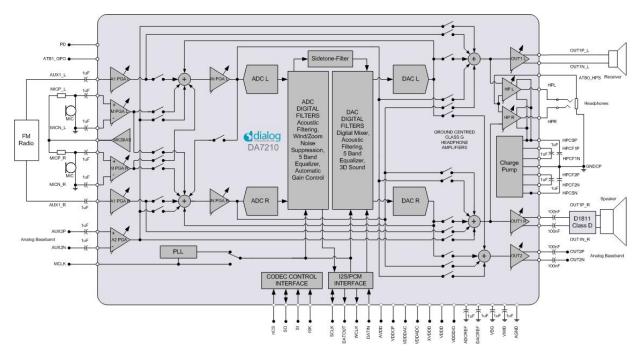


Figure 1 DA7210/11 Block Diagram

The accompanying software requires a PC operating Windows 2000/XP with a USB1.1 or USB2 interface. The software will run under Vista if the default installation location is changed to 'C:\Dialog Semiconductor\'

The DA7210/11 device plus the USB Interface consume approximately 5mA in the standby state. The evaluation board and software are not guaranteed to operate in a USB hub. See the section on Power Supplies below.

The control software permits configuration of the device using either pre-prepared templates or individual write and read operations to all control registers

#### 2 Hardware

There are three options available when using the DA7210/11 evaluation mainboard, Figure 2:

1. A miniboard containing the DA7210 in a CSP 49-pin package connected to evaluation board 44-179-93-02-C via jumpers J28, J30, J36 and J38, Figure 3. This board can also be used standalone or in conjunction with a customer development system.

- 2. A miniboard containing the DA7211-00 in a 36-pin CSP package connected to evaluation board 44-179-93-02-B via jumpers J28, J30, J36 and J38, Figure 4. This board can also be used standalone or in conjunction with a customer development system.
- 3. A miniboard containing the DA7211-01 in a 36-pin CSP package connected to evaluation board 44-179-93-02-E via jumpers J28, J30, J36 and J38,. This board can also be used standalone or in conjunction with a customer development system.

A USB-I2C bridge is used for communication with the device, and there are number of external active components to reduce the requirement for external equipment.

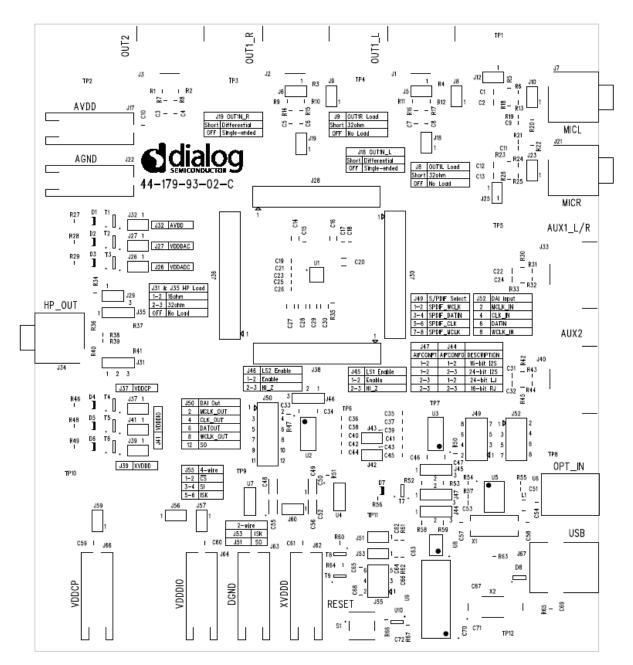
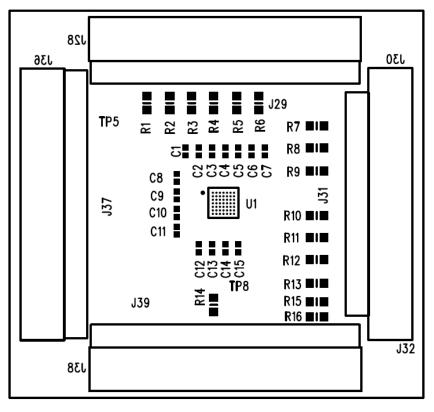
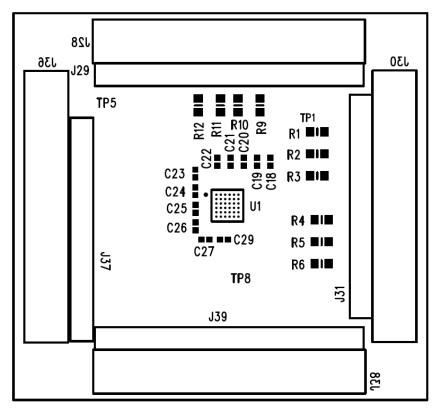
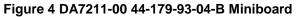


Figure 2 Evaluation Board 44-179-93-02-C Mainboard



#### Figure 3 DA7210 44-179-93-04-C Miniboard





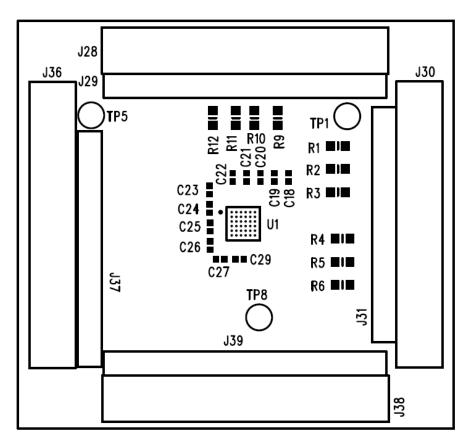


Figure 5 DA7211-01 44-179-93-04-E Miniboard

The passive components needed for noise decoupling or charge pump operation have been placed as close as possible to the DUT pins to ensure optimum operational performance.

Gerber data for the board is available on request.

#### 2.1 **Power Supplies**

The board is intended to be supplied by power supplies in the range  $+1.8V_{dc}$  to  $+2.5V_{dc}$  (nominal). The power supplies are connected via 4mm sockets: AVDD, VDDCP, VDDDAC, VDDADC, VDDDIO, DGND and AGND. LEDs D1 to D6 will illuminate when the power supplies are correctly connected.

Some devices on the board will be powered from the  $+5V_{dc}$  or  $+3.3V_{dc}$  supply produced by the USB interface module.

For demonstration purposes the  $+5V_{dc}$  USB supply can be connected to regulator, U9, to produce  $+1.8V_{dc}$  capable of supplying all of the DUT the power supply pins. This configuration allows complete DUT operation using just USB and TOSLINK connections only, but maximum headphone power output will be limited when using +1.8V VDDDCP power supply.

#### 2.2 Jumpers and Link Positions

Header	Link Position	Function	Notes
J5		OUT1_L speaker connection	External connection
J6		OUT1_R speaker connection	External connection
10	On	OUT1_L 32Ω load selected	
J8	Off	OUT1_L no load	
10	On	OUT1_R 32Ω load selected	
J9	Off	OUT1_R no load	
J10		MIC_L differential connection	External connection
14.0	On	MICN_L single-ended input	
J12	Off	MICN_L differential input	
14.0	On	OUT1N_L differential output	
J18	Off	OUT1N_L single-ended output	
140	On	OUT1N_R differential output	
J19	Off	OUT1N_R single-ended output	
J23		MIC_R differential connection	External connection
105	On	MIC_R single-ended input	
J25	Off	MIC_R differential input	
100	Short link	Short VDDADC current measurement point	
J26	DMM link	VDDADC current measurement point	N/A for DA7211
107	Short link	Short VDDDAC current measurement point	
J27	DMM link	VDDDAC current measurement point	— N/A for DA7211
100	On	Headphone sense ground connected	Should be disconnected
J29	Off	Headphone sense ground disconnected	for DA7211
104	1-2	HPL 16Ω load selected	
J31	2-3	HPL 32Ω load selected	
J32	Short link	Short AVDD current measurement point	

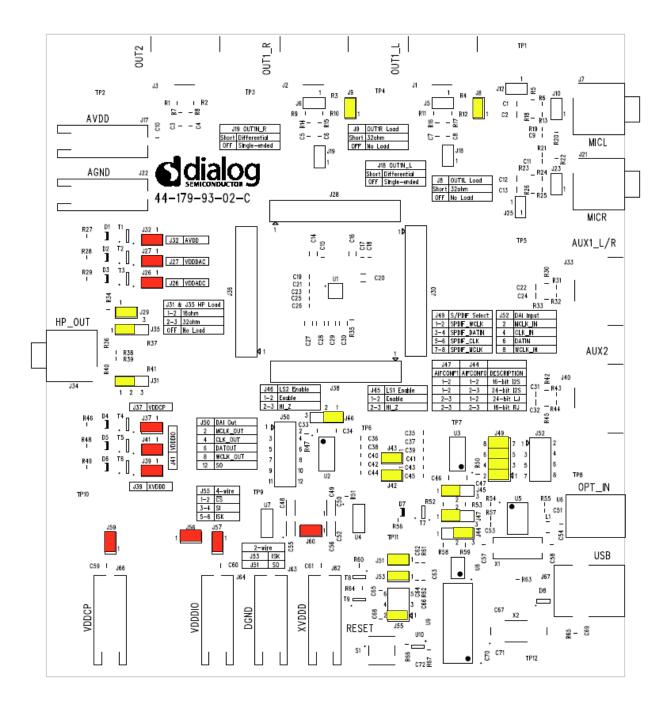
	DMM link	AVDD current measurement point	
	1-2	HPR 16Ω load selected	
J35	2-3	HPR 32Ω load selected	
	Short link	Short VDDCP current measurement point	
J37	DMM link	VDDCP current measurement point	
	Short link	Short XVDDD current measurement point	
J39	DMM link	XVDDD current measurement point	N/A for DA7211
144	Short link	Short VDDDIO current measurement point	
J41	DMM	VDDDIO current measurement point	N/A for DA7211
140	On	WCLK slave mode	
J42	Off	WCLK master mode	
140	On	CLK slave mode	
J43	Off	CLK master mode	
	1-2 / 1-2	16-bit I2S mode	
J44 /	1-2/2-3	24-bit I2S mode	J44 and J47 must both be set for correct
J47	2-3 / 1-2	24-bit left justified mode	S/PDIF receiver DAI format and word length
	2-3 / 2-3	16-bit right justified mode	
145	1-2	DAI input level shift enable	
J45	2-3	DAI input level shift high impedance	
140	1-2	DAI output level shift enable	
J46	2-3	DAI output level shift high impedance	
140	On	S/PDIF receiver +5V supply enabled	
J48	Off	S/PDIF receiver +5V supply disabled	
	1-2	SPDIF word clock	
140	3-4	SPDIF bit clock	Short links only if no
J49	5-6	SPDIF data	sources are connected to J52
	7-8	SPDIF master clock	

	1-2	MCLK output	
	3-4	CLK output	
J50	5-6	DATOUT output	External connections
	7-8	WCLK output	
	11-12	SO output	
154	On	Control interface 2-wire ISK selected	Short only if J55 links
J51	Off	Control interface 2-wire ISK de-selected	are removed
	1-2	DAI MCLK input	
150	3-4	DAI CLK input	Short only if J49 links
J52	5-6	DAI DATIN input	are removed
	7-8	DAI WCLK input	
150	On	Control interface 2-wire SO selected	Short only if J55 links
J53	Off	Control interface 2-wire SO de-selected	removed
	1-2	Control interface 4-wire nCS selected	
J55	3-4	Control interface 4-wire SI de-selected	Short only if J51 and J53 links removed
	5-6	Control interface 4-wire ISK selected	
J56	On	XVDDD connected to VDDCP	
120	Off	XVDDD disconnected from VDDCP	
157	On	XVDDD connected to VDDDIO	
J57	Off	XVDDD disconnected from VDDDIO	
150	On	VDDCP connected to AVDD	
J59	Off	VDDCP disconnected from AVDD	
160	On	REG_+1.8V supply connected	
J60	Off	REG_+1.8V disconnected	

#### **Table 1 Jumpers and Link Positions**

The evaluation board can be set up to run solely from the +5V USB supply as the source for all board supplies. It is necessary to remove all external power supplies and to add jumpers J56, J57, J59 and J60 for this operation, which is the default configuration for the board.

The digital audio interface jumpers are set to receive a TOSLINK input and should be removed to accept other external clocks at J52. Figure 9 shows the extra links required to enable the onboard supplies.





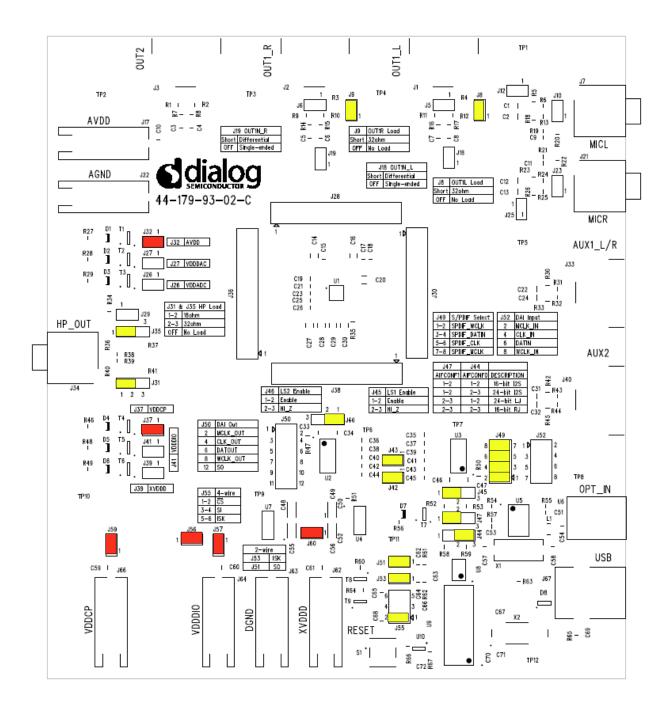


Figure 7 DA7211-00 Default Link Locations

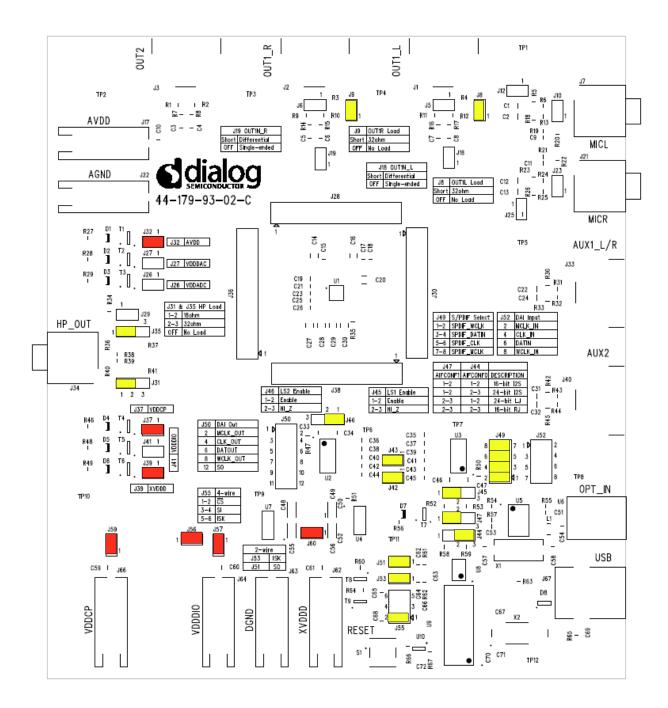


Figure 8 DA7211-01 Default Link Locations

Figure 9 shows the locations of the jumper links when using the DA7210 with external power supplies to AVDD J66, VDDCP J17, XVDDD J62 and VDDDIO J64. The digital audio interface jumpers are set to receive a TOSLINK input and should be removed to accept other external I2S clocks at J52.

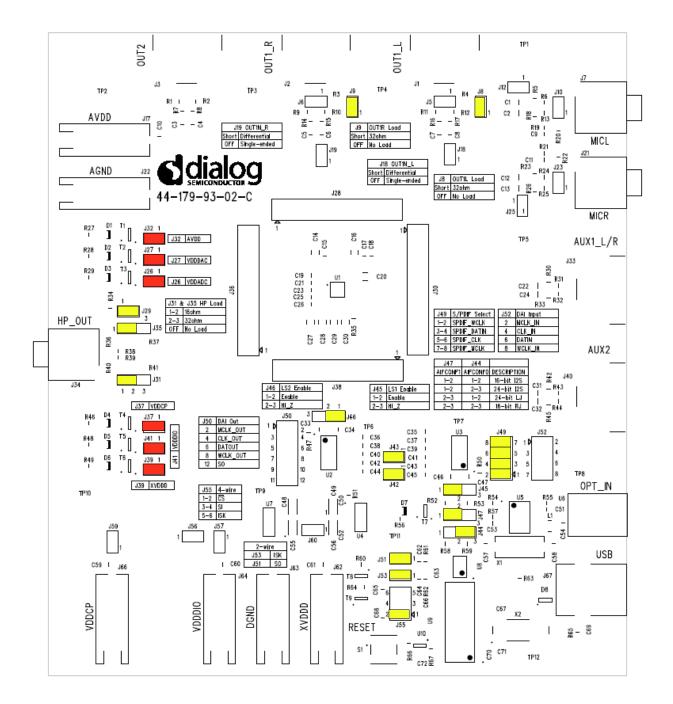


Figure 9 External Power Supply Jumper Configuration

#### 3 Evaluation Board Features

#### 3.1 USB Interface

The USB Interface is used here for the following purposes:

- As a source of I2C and SPI control signals.
- To provide a discrete signal to the power down pin *PD* (DA7210 only).
- To provide level shifting voltages.
- To allow standalone operation of the evaluation board using the +5 $V_{dc}$  USB power supply only.

The USB control signal device is powered by the USB bus cable via a fixed  $+3.3V_{dc}$  regulator.

The USB interface control signals can be isolated from rest of the evaluation board by removing J51, J53 and J55 described in Table 1. Removing these jumpers will allow external signal access to the DA7210 control interface. The USB interface can also be used to supply the power supplies to the DUT on the evaluation board.

The USB Interface implements multi-mastering on its I2C interface, permitting concurrent operation with any other multi-mastering controller. This allows the software to control a DA7210/11 device which is already part of the users system, and under control of the system processor.

#### 4 Control Software

#### 4.1 Installation

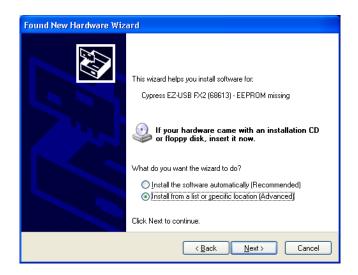
Insert the DVD-ROM containing the software into the controlling PC. If the installation does not start automatically, run the program 'setup.exe' from the DVD-ROM containing the software. An automated script will install the program to your PC. By default, the directory 'C:\ProgramFiles\Dialog Semiconductor\Audio\DA7210 Rev x.x' will be used.

As Windows Vista imposes limitiations on the 'C: \Program Files' directory, change this default to 'C: \Dialog Semiconductor\Audio\DA7210 Rev x.x' when prompted.

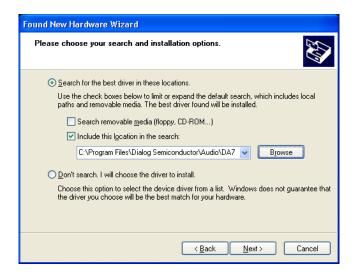
Plug in the USB cable, and Windows will detect the USB device. It will prompt for the drivers, which should be automatically located on the root directory of the DVD-ROM. The setup file is *''dlgezusb.inf'* and the following description explains how to install the driver.



Select No, not this time and press Next >



Select Install from a list or specific location (Advanced) and press Next >



Select Browse and locate the folder

C:\Program Files\Dialog Semiconductor\Audio\DA7210\_11 Rev x.x

Found N	lew Hardware Wizard		
Pleas	e select the best match for your hardware fi	rom the list	belo <del>w</del> .
¢4	Cypress EZ-USB FX2 (68613) - EEPROM mis	ssing	
	Description	Version	Manufacturer
	Cypress EZ-USB FX2 (68613) - EEPROM missing	Unknown	Dialog Semicondu
	Cypress EZ-USB FX2 (68613) · EEPROM missing	Unknown	Dialog Semicondu
<	: <u>) </u>		>
4	This driver is not digitally signed! Tell me why driver signing is important		ut Cross
	< <u>B</u> ac	k <u>N</u> e	ext > Cancel

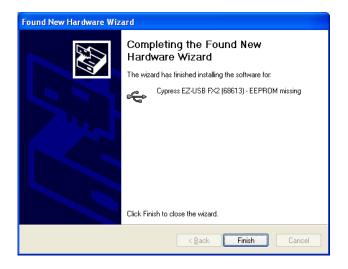
Select dlgezusb.inf and press Next >



#### Press Continue Anyway



Select Browse and locate C:\Program Files\Dialog Semiconductor\Audio\DA7210\_11 Rev x.x then press OK



#### Select Finish

If you are using Windows XP, you may get a message saying that a USB2 device is attached to a USB1.1 port. This can safely be ignored.

To uninstall the software please use the Windows '*Add/Remove Programs*' function that can be found under '*Start->Settings->Control Panel*'.

#### 4.2 Set-up Files

#### 4.2.1 Text File

The DUT registers can written to by submitting a text file containing the register values; Figure 10 shows an example file. Only the data in the first three columns is required: register, data, R/W; other comments, such as those shown in the example, will be ignored. Lines of text that do not follow register write entries should be preceded by // in order that the line is ignored when reading the text file.

The text file can be created by saving the first three columns of the template spreadsheet file above as a text file or can be created from scratch; it is only necessary for the text file to contain the registers required for set up all others can be omitted.

To add a delay in the file the register value is entered as *Delay* followed by the delay time require in milliseconds. The example in Figure 10 shows a 100ms delay added as the third entry.

D DA	IC_H	IPLR CI	ass G.	bat - Not	epad	<b>→</b>	
<u>F</u> ile ļ	<u>E</u> dit	F <u>o</u> rmat	<u>V</u> iew	Help			
	_ CL/I g	-		<u>⊓</u> eip ⊂lass /₩	G Mode Funct PAGEC CONTR STATL START RESERV MIC_L MIC_R AUX1_ AUX1_ AUX1_ AUX1_ AUX2  IN_GA INMI> ADC_E ADC_E ADC_E ADC_E DAC_F	:ion ) (OL JS :UP2 :UP3 /ED	
17 <		DC	0		DAC_S	SEL	× >

#### Figure 10 Text Set-up File

A selection of text files can be found on the DVD containing the register control software setup files.

#### 4.2.2 Spreadsheet File

The register settings can be prepared using a spreadsheet file template provided, Figure 11, and saved as a tab delimited text file like Figure 10. The only bits that can be altered on the spreadsheet are the individual register bits in columns G to N and the R/W bit in column O. If any of these bits are set to 1 the bit will be highlighted in green on the register map. If the bit default setting is 1 and the bit value is changed to 0 then the register map bit will be highlighted in grey. This highlighting allows easy visual reference to the register changes from the default settings.

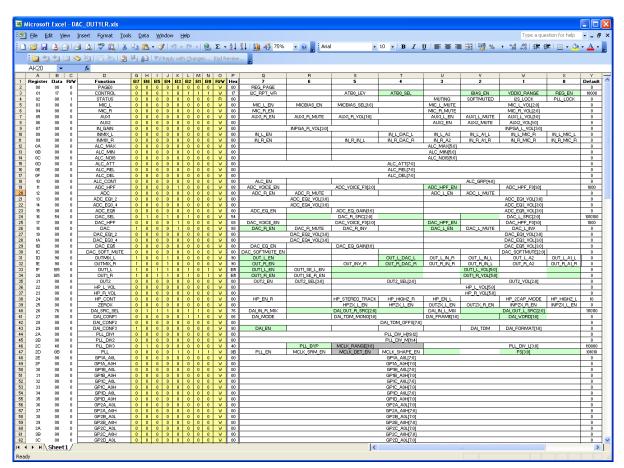


Figure 11 Spreadsheet Set-up File

#### 4.3 Control Panels

Run the DA7210/11 program by clicking the shortcut on the appropriate item in the Start menu. The best setting for the PC display size is 1024x768 pixels or above. Font size on the PC display should be Normal (95dpi). It is important to note that a display size other than the recommended setting may affect the way in which the panels appear.

#### 4.3.1 Front Panel

The front panel allows selection of a number of methods for programming the registers of the DUT.

- Submit a text file template, which allows register sequencing and time delays to be added.
- Select register map page 0 for individual register read/write access.
- Select register map page 1 for individual register write access.
- Select general purpose filters register map for individual register write access.
- Open a panel to access the volume control registers for real time volume control.
- Direct read/write access to a single register.

DA7210/11 Rev 2.3 - Control Panel Selection	→
Register Map Page 0       Set device page 0 registers         Register Map Page 1       Set device page 1 registers	Register © Setting
Filter Coefficients       Set filter coefficient registers         Volume Controls       Volume Controls	€ 0 R/W Select Write Submit
Submit register settings from text file File Submit .txt	 
Save present register settings to spreadsheet File Save .xls	
Reset       Reset all registers to default values         2-wire       Control Interface Mode         Enabled       Powerdown	

#### Figure 12 Front Panel

Any file path required can be opened using the '...' button to the right of the corresponding text box, but it must then be submitted or saved using the submit button to the left of the corresponding text box.

It is possible to save the present register settings by selecting a spreadsheet file by locating the filename path using the '*Save present register setting to spreadsheet*' box. This function will not read back the device registers, but will only output the values shown on Page 0 and Page 1 of the GUI.

The front panel also contains a reset button, a device power down button and 2-wire/4-wire control selection.

#### 4.3.2 Register Map Page 0

The page 0 register map panel allows read/write access to single bits or to the hex value of a single register; both can be submitted individually.

Register	R/W	B7	86 B	5 B	4 B3	B2	B1 B0	Hex	Submit	FUNCTION	7	6	5	4	3	2	1	0	DEFAUL
0x00	W	0	0 0	1 0	1 0	0	0 0	0	· ·	PAGE0	REG_PAGE				•	•	•	•	0
0x01	W	0	0 0	1 1	0	0	0 0	10	· · ·	CONTROL	WRITE_MODE		ATB1_LEV	ATB1_SEL	NOISE_SUP	BIAS_EN	VDDIO_RANGE	REG_EN	10000
0x02	B	0	0 0	1 0	0 1	0	0 0	0		STATUS					MUTING	SOFTMUTED	128 LOCK	PLL LOCK	0
0x03	W	0	0 0	1 0	1 0	0	0 0	0		STARTUP1	SC CLK DIS			SC OVERRIDE				SC MST EN	0
0x04	W	0	0 0	1 0	1 0	0	0 0	0	· · ·	STARTUP2				ST	ARTUP2[6:0]				0
0x05	W	0	0 0	1 0	1 0	0	0 0	0	· · ·	STARTUPS				ST	ARTUPS[6:0]				0
0x06	W	0	0 0	1 0	1 0	0	0 0	0	· · ·	RESERVED				RESERVED					0
0x07	W	0	0 0	1 0	1 0	0	0 0	0	· ·	MIC_L	MIC_L_EN	MICBIAS_EN	MICBIAS	_SEL[1:0]	MIC_L_MUTE		MIC_L_VOL[2:0]		0
0x08	W	0	0 0	1 0	1 0	0	0 0	0	· ·	MIC_R	MIC_R_EN	MIC_R_MUTE MIC_R_VOL[2:0]							0
0x09	W	0	0 0	1 1	0	0	0 0	10	· · ·	AUX1_L	AUX1_L_EN	AUX1_L_VOL[6:0]							10000
0x0A	W	0	0 0	1 1	0	0	0 0	10	· ·	AUX1_R	AUX1_R_EN		AUX1_R_VOL[5:0]						
0x0B	W	0	0 0	1 0	1 0	0	0 0	0	· ·	AUX2					AUX2_EN	AUX2_MUTE	AUX2_VC	DL[1:0]	0
0x0C	W	0	0 0	1 0	1 0	0	0 0	0	· ·	IN_GAIN		INPGA_	R_VOL[3:0]			INPGA_L	_VOL[3:0]		0
0x0D	W	0	0 0	1 0	1 0	0	0 0	0	_ · _ ]	INMIX_L	IN_L_EN					IN_L_SEL[4:0]			0
0x0E	W	0	0 0	1 0	1 0	0	0 0	0	· · )	INMIX_R	IN_R_EN				IN_R_SEL	_[5:0]			0
0x0F	W	0	0 0	1 0	1	0	0 0	8	]	ADC_HPF	ADC_VOICE_EN		ADC_VOICE_F0[2	:0]	ADC_HPF_EN		ADC_HPF_	F0[1:0]	1000
0x10	W	0	0 0	1 0	1 0	0	0 0	0		ADC	ADC_R_EN	ADC_R_MUTE			ADC_L_EN	ADC_L_MUTE		ALC_EN	0
0x11	W	0	0 0	1 0	1 0	0	0 0	0	I	ADC_EQ1_2		ADC_EC	2_VOL[8:0]			ADC_EQ1	1_VOL[3:0]		0
0x12	W	0	0 0	1 0	1 0	0	0 0	0		ADC_EQ3_4		ADC_EC	4_VOL[8:0]			ADC_EQ	3_VOL[3:0]		0
0x13	W	0	0 0	1 0	1 0	0	0 0	0	- I	ADC_EQ5	ADC_EQ_EN		ADC_EQ_	_GAIN[1:0]		ADC_EQ	5_VOL[3:0]		0
0x14	W	0	0 0	1 0	1	0	0 0	8	- I	DAC_HPF	DAC_VOICE_EN							_F0[1:0]	1000
0x15	W	0	0 0	1 1	0	0	0 0	10	· · ·	DAC_L	DAC_L_INV	C_L_INV DAC_L_GAIN[6:0]							10000
0x16	W	0	0 0	1 1	0	0	0 0	10	· · ·	DAC_R	DAC_R_INV	NV DAC_R_GAIN[6:0]							10000
0x17	W	0	1 (	1 1	0	1	0 0	54	· ·	DAC_SEL	DAC_R_EN		DAC_R_SRC[2:0	1	DAC_L_EN		DAC_L_SRC[2:0]		101010
0x18	W	0	1 (	1 0	1 0	0	0 0	40	· ·	SOFT_MUTE	SOFT_MUTE	RAMP_EN					MUTE_RATE[2:0]		100000
0x19	W	0	0 0	1 0	1 0	0	0 0	0	_ · _ ]	DAC_EQ1_2		DAC_EC	2_VOL[8:0]			DAC_EQ	1_VOL[3:0]		0
0x1A	W	0	0 0	1 0	1 0	0	0 0	0	· · ·	DAC_EQ3_4		DAC_EC	4_VOL[3:0]			DAC_EQ	3_VOL[3:0]		0
0x1B	W	0	0 0	1 0	1 0	0	0 0	0	· ·	DAC_EQ5	DAC_EQ_EN					DAC_EQ	5_VOL[3:0]		0
0x1C	W	0	0 0	1 0	1 0	0	0 0	0	· ·	OUTMIX_L	OUT_L_EN	OUT_L_INV				UT_L_SEL[4:0]			0
0x1D	W	0	0 0	1 0	1 0	0	0 0	0	· ·	OUTMIX_R	OUT_R_EN	OUT_R_INV			C	UT_R_SEL[4:0]			0
0x1E	W	0	0 1	1	0	1	0 1	35	· ·	OUT1_L	OUT1_L_EN	OUT1_L_SE			OUT1_L_V	OL[5:0]			110101
0x1F	W	0	0 1	1	0	1	0 1	35	. I	OUT1_R	OUT1_R_EN	OUT1_R_SE			OUT1_R_V	OL[5:0]			110101
0x20	W	0	0 0	1 0	0	0	1 1	3		OUT2	OUT2_EN		OUT2_S	EL[8:0]			OUT2_VOL[2:0]		11
0x21	W	0	0 0	1	0	0	0 0	10		HP_L_VOL		HP_L_INV			HP_L_VO	L[5:0]			10000
0x22	W	0	0 0	1	0	0	0 0	10	_ · _ ]	HP_R_VOL		HP_R_INV			HP_R_VO				10000
0x23	W	0	0 0	1 0	0	0	1 0	2		HP_CFG	HP_R_EN	HP_MODE	STEREO_TRACK	HP HIGHZ R	HP L EN	HP_SENSE_EN	HP_2CAP_MODE	HP_HIGHZ_L	10
0x24	W	0	0 0	1 0	0	0	0 0	0		ZEROX	HFZX R EN	HPZX_L_EN	OUTZX R EN	OUTZX_L_EN	INZX_R_EN	INZX L_EN	A1ZX R EN	A1ZX L EN	0
0x25	W	0	1 1	1	0	1	1 0	76	· · · · · · · · · · · · · · · · · · ·	DAI_SRC_SEL	DALIN_R_MIX		DALOUT R SRC[2	2:0]	DAI_IN_L_MIX	D/	U OUT L SRC[2:	0]	111011
0x26	W	0	0 0	1 0	0	0	0 0	0	· · ]	DAI_CFG1	DAI_MODE			DAI_TDM_MONO	DAI_FR	AME[1:0]	DAI_WOR	RD[1:0]	0
0x27	W	0	0 0	1 0	0	0	0 0	0		DAI_CFG2		-		DAI_TDM_OFF	S[7:0]				0
0x28	W	0	0 0	1 0	1	0	0 0	8		DAI_CFG3	DAI_EN	1			DAI_OE	DAI_TDM	DALFORM	AT[1:0]	1000
0x29	W	0	0 0	1 0	0	0	0 0	0	_ · _ ]	PLL_DIV1		-		PLL_DIV_H[1	9:12]				0
0x2A	W	0	0 0	1 0	1 0	0	0 0	0		PLL_DIV2				PLL_DIV_M					0
0x2B	W	0	0 0	1 1	0	0	0 0	10	· · ·	PLL_DIV3		PLL_BYP	MCLK_R	AN GE[1:0]		PLL_D	V_L[3:0]		10000
				_	1 1	-	1 0	A		PLL	PLL EN		MOLK_DET_EN		-		[3:0]		1010

Figure 13 Register Map Page 0

To select readback of an individual register click on the R/W bit of the required register and select R. To read the value press the submit button of the same row.

Register	R/W	B7	B6	B5	B4	BЗ	B2	B1	BO	Hex	Submit	FUNCTION	7
0x00	W	0	0	0	0	0	0	0	0	0	· )	PAGE0	REG_P/
0x01	W	0	0	0	1	0	0	0	0	10		CONTROL	WRITE_N
0x02	R	0	0	0	0	0	0	0	0	0		STATUS	
0x03	W	0	0	0	0	0	0	0	0	0	_ · _ ]	STARTUP1	SC_CLK
0x04	W	0	0	0	0	0	0	0	0	0		STARTUP2	
0x05	W	0	0	0	0	0	0	0	0	0		STARTUP3	
0x06		0	0	0	0	0	0	0	0	0	_ · _ ]	RESERVED	
0x07	<ul><li>✓ W</li></ul>		0	0	0	0	0	0	0	0		MIC_L	MIC_L
0x08	R		0	0	0	0	0	0	0	0		MIC_R	MIC_R
0x09	W	0	0	0	1	0	0	0	0	10	<u> </u>	AUX1_L	AUX1_L
0x0A	W	0	0	0	1	0	0	0	0	10		AUX1_R	AUX1_F
0x0B	W	0	0	0	0	0	0	0	0	0		AUX2	
0x0C	W	0	0	0	0	0	0	0	0	0		IN_GAIN	
0x0D	W	0	0	0	0	0	0	0	0	0	<u> </u>	INMIX_L	IN_L_
0x0E	W	0	0	0	0	0	0	0	0	0	<u> </u>	INMIX_R	IN_R_

Figure 14 Selecting Individual Register Readback

A pop up window will then appear displaying the readback value of the register, Figure 15.

Register Readback Value (Hex)	×
Reg 0x6 = 0	
QK	

Figure 15 Readback Pop-up Window

To select readback of all Page 0 register simultaneously press the read all button at the base of the R/W column. This will write the register readback values to a spreadheet file at the following location: *C:\Program Files\Dialog Semiconductor\Audio\DA7210\_11 Rev x.x \Page0\_Readback\_Values.xls* 

🐱 Regis	ster Map	Pag	ge (	)							→	
UNLO		•			•			•	•	•		00
0x21	W	0	0	1	1	0	1	0	1	35	<u> </u>	HP_L
0x22	W	0	0	1	1	0	1	0	1	35	<u> </u>	HP_R
0x23	W	1	0	1	0	1	1	1	0	AE		HP
0x24	W	1	1	0	0	0	0	0	0	CO	$\Box$ · $\Box$	ZEF
0x25	W	0	1	1	1	0	1	1	0	76		DAL SF
0x26	W	0	0	0	0	0	1	1	0	6		DAI_
0x27	W	0	0	0	0	0	0	0	0	0		DAI_
0x28	W	1	0	0	0	0	0	0	0	80		DAI_
0x29	W	0	0	0	0	0	0	0	0	0		PLL_
0x2A	W	0	0	0	0	0	0	0	0	0	<u> </u>	PLL_
0x2B	W	0	1	0	1	0	0	0	0	50		PLL_
0x2C	W	0	0	0	0	1	0	1	1	В	<u> </u>	PI
	Read All										Submit All	Reset

Figure 16 Readback All Registers

#### 4.3.3 Register Map Page 1

The page 1 register map panel allows access to single bits or to the hex value of a single register; both can be submitted individually. Readback from Page 1 registers is limited, but individual register readback can be selected in the same way as Page 1 where available.

Disabled Page 1 Enable (4-wire mode only) Reset Table									de	only	B	eset Table			-							
													FUNCTION	7	6	5	4	3	2	1	0	DEFAULT
0x80	W	0		0	0	0	0	0	0	0	0	· ·	PAGE1	REG_PAGE								0
0x81	R	0		0	0	1	0	0	0	1	11		CHIP_ID		MRC[3:0]				MMRC[8:0]			10001
0x82	R	0		0	1	0	1	1	0	0	2C		INTERFACE		F_BASE_ADDR[2:0]		NCS_FOL	RW_POL	CPHA	CPOL	OTP_FUSED	101100
0x83	W	0	)	1	0	0	0	0	0	0	40		ALC_MAX		ALC_MERGE				ALC_NAX[5:0]			1000000
0x84	W	0		0	0	0	0	0	0	0	0		ALC_MIN						ALC_MIN[5:0]			0
0x85	W	0		0	0	0	0	0	0	0	0		ALC_NOIS						ALC_NOI8[5:0]			0
0x86	W	0		0	0	0	0	0	0	0	0	· ·	ALC_ATT				ALC_ATT[7:0]					0
0x87	W	0		0	0	0	0	0	0	0	0	· ·	ALC_REL				ALC_REL[7:0]					0
0x88	W	0		0	0	0	0	0	0	0	0		ALC_DEL				ALC_DEL[7:0]					0
0x8A	W	1		0	0	0	1	0	1	1	8B		A_HD_JNLOCK				HIDDEN(7:0)					10001011
0x8B	W	1		0	1	1	0	1	0	0	B4	· ·	A_TST_UNLOCK				TEST[7:0]					10110100
0x90	W	0		0	0	0	0	0	0	0	0		A_PLL1								VCORST_EN	0
0x95	W	0	)	0	0	0	0	0	0	0	0		A_ACC0					ADC_T2				0
0x96	W	0		0	0	0	0	1	1	1	7		A_DAC0						VMD_EUFF_EN2	VMID_BLFF_EN'	VMID_BUFF_EN2	111
0xA7	W	0	)	1	1	1	1	1	1	0	7E		A_CP_MODE		VDC_EN	VDD/2_EN	VDD/8_EN	VDD/4_EN	HP_LVL_DET	DAC_LVL_DET	YOL_LVL_DET	1111110
0xB7	W	0		0	0	0	0	0	0	0	0		A BGAP			DIGREG_CNTL1	DIGREG CNTLO					0

Figure 17 Register Map Page 1

#### 4.3.4 GP Filters Register Map

The general purpose filters register map panel allows access to the hex value of a single register; all registers are submitted after changes. All registers may also be reset using the *Reset Filters* button.

Filter Coefficient	ts						
2E GP1A_A0L 3 2F GP1A_A0H 3 30 GP1B_A0L 3, 31 GP1B_A0H 3 32 GP2A_A0L 3 33 GP2A_A0L 3 34 GP2B_A0L 3 35 GP2B_A0H 3 36 GP1C_A0L 4 37 GP1C_A0H 4	9 GP1D_A0H A GP2C_A0L B GP2C_A0H C GP2D_A0L D GP2D_A0H E GP1A_A1L F GP1A_A1H 0 GP1B_A1L	43 GP2A_A1H 44 GP2B_A1L 45 GP2B_A1H 46 GP1C_A1L 47 GP1C_A1H 48 GP1D_A1L 49 GP1D_A1H 44 GP2C_A1L	4D GP2D_A1H 4E GP1A_A2L 4F GP1A_A2H 50 GP1B_A2L 51 GP1B_A2H 52 GP2A_A2L 53 GP2A_A2H 54 GP2B_A2L	57 GP1C_A2H 58 GP1D_A2L 59 GP1D_A2H 54 GP2C_A2L 58 GP2C_A2H 50 GP2D_A2L 50 GP2D_A2H 55 GP1A_B1L	61 GP18_B1H 62 GP2A_B1L 63 GP2A_B1H 64 GP2B_B1L 65 GP2B_B1H 66 GP1C_B1L 67 GP1C_B1H 68 GP1D_B1L	6B GP2C_B1H 6C GP2D_B1L 6D GP2D_B1H 6E GP1A_B2L 6F GP1A_B2H 70 GP1B_B2L 71 GP1B_B2H 72 GP2A_B2L	75 GP28_B2H 76 GP1C_B2L 77 GP1C_B2H 78 GP1D_B2L 79 GP1D_B2H 79 GP1D_B2H 7A GP2C_B2L 78 GP2C_B2H 7C GP2D_B2L
FILTER COEFFICIE			<b>0x4B</b> ‡0	<b>0x55</b> 🗘 0	0x5F 🗘 0	<b>0x69</b> 🗘 0	<b>0x73</b> ‡0
			0x4C 🗘 0	0x56 🗘 0	0x60 🗘 0		0x74 🗘 0
0x2F 🗘 0	<b>x39 🗘</b> 0	<b>0x43</b> 🗘 0	<b>0x4D</b> 🗘 0	<b>0x57</b> 🗘 0	<b>0x61</b> 🗘 0	<b>0x6B</b> 🗘 0	0x75 🗘 0
0x30 🗘 0 0	<b>хЗА 🗘</b> О	<b>0x44</b> 🗘 0	<b>0x4E</b> 🗘 0	<b>0x58</b> 🗘 0	<b>0x62</b> 🗘 0	<b>0x6C</b> 🗘 0	<b>0x76</b> 🗘 0
0x31 🗘 0 0	<b>хЗВ 🗘</b> О	<b>0x45</b> 🗘 0	<b>0x4F</b> 🗘 0	<b>0x59</b> 🗘 0	<b>0x63</b> 🗘 0	<b>0x6D</b> 🗘 0	0x77 🗘 0
0x32 🗘 0 0	<b>x3C 🗘 0</b>	<b>0x46</b> 🗘 0	<b>0x50 🗘</b> 0	0x5A 🗘 0	<b>0x64</b> 🗘 0	<b>0x6E</b> 🗘 0	<b>0x78</b> 🗘 0
0x33 🗘 0 0	<b>x3D</b> ‡ 0	<b>0x47</b> 🗘 0	<b>0x51 🗘</b> 0	<b>0x5B ‡</b> 0	<b>0x65</b> 🗘 0	<b>0x6F</b> 🗘 0	0x79 🗘 0
0x34 🗘 0 0:	<b>хЗЕ 🗘 0</b>	<b>0x48</b> 🗘 0	<b>0x52 🗘</b> 0	<b>0x5C</b> 🗘 0	<b>0x66</b> 🗘 0	<b>0x70</b> 🗘 0	0x7A 🗘 0
0x35 🗘 0 0:	<b>x3F</b> 🗘 0	<b>0x49</b> 🗘 0	<b>0x53</b> 🗘 0	<b>0x5D</b> ‡ 0	<b>0x67</b> 🗘 0	<b>0x71</b> 🗘 0	0x7B 🗘 0
0x36 🗘 0 0:	x <b>40</b> 🗘 0	<b>0x4A</b> 🗘 0	<b>0x54</b> 🗘 0	<b>0x5E</b> 🗘 0	<b>0x68</b> 🗘 0	<b>0x72</b> 🗘 0	0x7C 🗘 0
Submit Filters R	Reset Filters	GP1AB/2AB - 0	<b>x7D ‡</b> 34	GP1CD/2CD -	0x7E 🗘 75	GP Enable - 0x7l	

Figure 18 Filter Coefficients Set-up Panel

An alternative 'RT Filters' GUI is available that allows easy submission of any of the DAC or ADC filters paths present within the DA7210/11. This is contained on the installation DVD within the distribution kit.

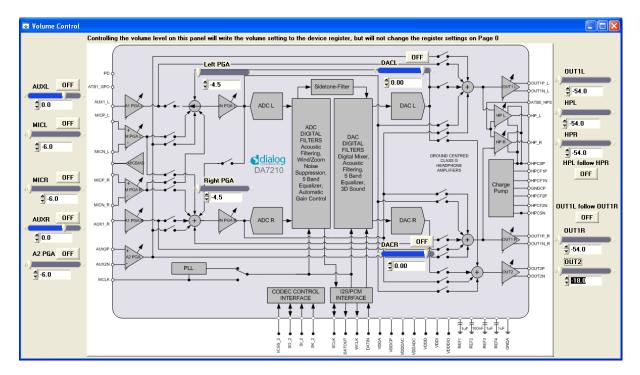
#### 4.3.5 Volume Control Panel

The *Volume Control* panel allows real time changes to any of the analogue input or output PGAs within the DUT. Muting is also possible where this function exists.

Gain controls are available to the following PGAs:

- AUX\_L and AUX\_R
- MIC\_L and MIC\_R
- A2 PGA
- Left and Right Input PGAs
- OUT1\_L and OUT1\_R
- HPL and HPR
- OUT2

It is possible to change the headphone and OUT1 gain control registers as stereo pairs by simultaneously selecting the *HPL follow HPR* and *OUT1L follow OUT1R* buttons.



**Figure 19 Volume Control Panel** 

#### 5 RT Filters GUI

The RT filters GUI allows easy control of all the filter options within the DA7210/11 device through USB control. This includes general purpose filters, five-band equalisers and voice filters for ADC and DAC.

The *Filter Setup* page makes it possible to design the required filter response for all of the general purpose filter bi-quad IIR paths available in the DA7210/11.

#### 5.1 Software Installation

The set-up file for the RT Filters control software can be found on the accompanying DVD in the folder *DA7210 RT Filters Rev x.x* 

Double click setup.exe file and the install will begin.

🐙 DA7210 Realtime Filters Rev1_0	
It is strongly recommended that you exit all programs before running this installer. Applications that run in the background, such as virus-scanning utilities, might cause the installer to take longer than average to complete.	
Please wait while the installer initializes.	
	]
	<u>C</u> ancel

Do not change the installation directory or necessary license files will not be accessible.

u DA7210 Realtime Filters Rev1_0	
Destination Directory Select the primary installation directory.	
All software will be installed in the following location(s). To install software into a different location(s), click the Browse button and select another directory.	
Directory for DA7210 Realtime Filters Rev1_0 C:VProgram Files\DA7210 Realtime Filters Rev1_0\ Bro	wse
Directory for National Instruments products C:\Program Files\National Instruments\ Bro	wse
<pre></pre>	<u>C</u> ancel

Select I accept the License Agreement and press Next>>

🐺 DA7210 Realtime Filters Rev1_0
License Agreement You must accept the license(s) displayed below to proceed.
NATIONAL INSTRUMENTS SOFTWARE LICENSE AGREEMENT
INSTALLATION NOTICE: THIS IS A CONTRACT. BEFORE YOU DOWNLOAD THE SOFTWARE AND/OR COMPLETE THE INSTALLATION PROCESS, CAREFULLY READ THIS AGREEMENT. BY DOWNLOADING THE SOFTWARE AND/OR CLICKING THE APPLICABLE BUTTON TO COMPLETE THE INSTALLATION PROCESS, YOU CONSENT TO THE TERMS OF THIS AGREEMENT AND YOU AGREE TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT WISH TO BECOME A PARTY TO THIS AGREEMENT AND BE BOUND BY ALL OF ITS TERMS AND CONDITIONS, CLICK THE APPROPRIATE BUTTON TO CANCEL THE INSTALLATION PROCESS, DO NOT INSTALL OR USE THE SOFTWARE, AND RETURN THE SOFTWARE WITHIN THIRTY (30) DAYS OF RECEIPT OF THE SOFTWARE, INCLUDING ALL ACCOMPANYING WRITTEN MATERIALS, ALONG WITH THEIR CONTAINERS) TO THE PLACE YOU OBTAINED THEM. ALL RETURNS SHALL BE SUBJECT TO NI'S THEN CURRENT RETURN POLICY.
1. <u>Definitions</u> , As used in this Agreement, the following terms have the following meanings:
• accept the License Agreement
I do not accept the License Agreement.
<< <u>B</u> ack <u>N</u> ext>> <u>C</u> ancel

Press Next>>

🦉 DA7210 Realtime Filters Rev1_0				
Start Installation Review the following summary before continuing.				
Adding or Changing ● DA7210 Realtime Filters Rev1_0 Files				
Click the Next button to begin installation. Click the Back button to change the installation settings.				
Save File << Back Next >> Cancel				

Allow the application to install. If Labview run-time files have not been installed on the target computer previously, the installation may take a few minutes.

DA7210 Realtime Filters Rev1_0		
Installation Complete		
The installer has finished updating your system.		
	<< Back Next >>	<u>F</u> inish

When installation is complete press Finish

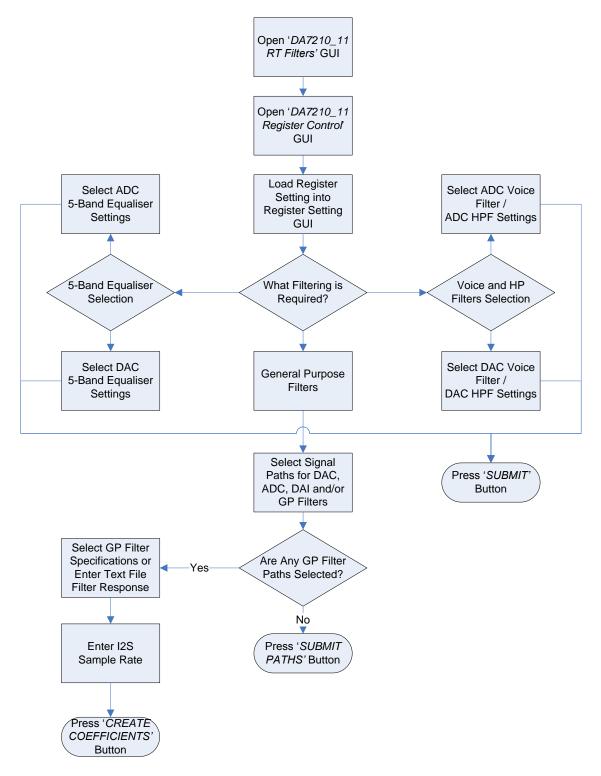
#### 5.2 Control Panels

#### 5.2.1 Running the Interface and USB Initialisation

The *RT Filters Rev x.x* GUI can be used in conjunction with the *DA7210\_11 Register Control* Software Rev x.x to set up the DA7210/11 device registers. In order to allow both interfaces to access the DA7210/11 simultaneously it is necessary to initialise the *RT Filters* GUI first before opening the *DA7210\_11 Register Control Software*.

The flowchart in Figure 20 details the start-up procedure when using the DA7210 Register Control GUI and RT Filter GUI in conjunction with each other.

On starting-up the *RT Filters* application the interface will be running. Once the coefficients are calculated the interface will stop and the registers writes will be submitted to the DA7210/11. To start the interface running again, press the white arrow situated below the *Operate* drop down menu on the top row; this will turn to black and the interface is running again ready for new selections.



#### Figure 20 RT Filter Setup Flowchart

#### 5.3 Filter Setup Panel

The *Filter Setup* panel makes it possible to design desired filter responses through any of the general purpose filter banks, using the filter specification selections.

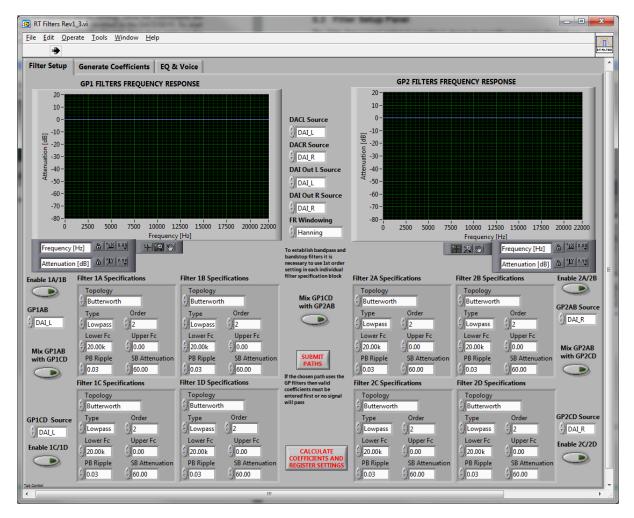


Figure 21 Filter Setup Panel

The Filter Setup panel controls the following realtime filter path selections:

- DACL and DACR input sources
- Enabling GP1AB, GP1CD, GP2AB and/or GP2CD
- GP1AB, GP1CD, GP2AB and GP2CD input sources
- Mixing of GP1AB and GP1CD, GP1CD and GP1CD or GP2AB and GP2CD

For each of the filter specifications blocks the following settings are available:

- Topology Butterworth, Chebyshev, Inverse Chebyshev, Elliptic, Bessel
- Type lowpass, highpass, bandpass, bandstop
- Order order 2 should be used lowpass and highpass filters and order 1 for bandpass and bandstop filters only
- Lower Fc lower frequency cut-off
- Upper Fc upper frequency cut-off
- PB Ripple passband ripple level
- SB attenuation sideband attenuation level

Pressing the *Submit Paths* button allows real-time selection of the filter path set-up while the interface is running.

The resultant coefficients from the selected filter responses can be calculated and submitted to the DA7210/11 by pressing the *Calculate Coefficients and Register Settings* button. The coefficients sent to the DA7210/11 are displayed on the *Coefficients* panel.

**Important:** Be aware that if any of the general purpose filter paths are selected and no coefficients have been entered, then the DA7210/11 will be unable to pass the signal to the selected output.

#### 5.4 Coefficients Tab

The *Generate Coefficients* panel displays the forward and reverse coefficients for all of the general purpose filters and lists the register writes submitted to the DA7210/11. Here it is also necessary to enter the sample rate of the digital audio interface, so that the correct coefficient values are created; failure to do so will result either in zero entries or incorrect coefficient values.

The Calculate Coefficients and Register Settings button will perform the same action as the button of the same name on the Filter Setup panel.

The forward and reverse coefficients can be saved to file by selecting *Output Coefficients* button and by selecting a valid output file path. The spreadsheet file must already exist for the register values to be output.

•								
Setup Ge	enerate Coefficients	EQ & Voice						
Reg 0x2D - 0	x3C Reg 0x3D - 0x	4C Reg 0x4D - 0x	5C Reg 0x5D - 0x6	C Reg 0x6D - 0x7C	Fo	orward and	Reverse Coeffic	cients
1A_AOL 0	GP1A_A1L 0	GP1A_A2L 0	GP1A_B1L 0	GP1A_B2L 0				
A_A0H 0	GP1A_A1H 0	GP1A_A2H 0	GP1A_B1H 0	GP1A_B2H 0	GP1A Fwd	0	0	0
1B_AOL 0	GP1B_A1L 0	GP1B_A2L 0	GP1B_B1L 0	GP1B_B2L 0	GP1A Rev GP1B Fwd	0	0	0
.B_A0H 0	GP1B_A1H 0	GP1B_A2H 0	GP1B_B1H 0	GP1B_B2H 0	GP1B Rev	0	0	0
2A_AOL 0	GP2A A1L 0	GP2A A2L 0	GP2A B1L 0	GP2A_B2L 0	GP1C Fwd	0	0	0
A_A0H 0	GP2A_A1H 0	GP2A_A2H 0	GP2A_B1H 0	GP2A_B2H 0	GP1C Rev	0	0	0
2B AOL 0	GP2B A1L 0	GP2B A2L 0	GP2B_B1L 0	GP2B_B2L 0	GP1D Fwd	0	0	0
B AOH 0	GP2B_A1H 0	GP2B_A2L 0 GP2B_A2H 0	GP2B_BIL 0	GP2B_B2H 0	GP1D Rev	0	0	0
					GP2A Fwd	0		0
1C_AOL 0	GP1C_A1L 0	GP1C_A2L 0	GP1C_B1L 0	GP1C_B2L 0	GP2A Rev	0	0	0
.C_A0H 0	GP1C_A1H 0	GP1C_A2H 0	GP1C_B1H 0	GP1C_B2H 0	GP2B Fwd	0		
1D_AOL 0	GP1D_A1L 0	GP1D_A2L 0	GP1D_B1L 0	GP1D_B2L 0	GP2B Rev	0		
D_AOH 0	GP1D_A1H 0	GP1D_A2H 0	GP1D_B1H 0	GP1D_B2H 0	GP2C Fwd	0		
2C_AOL 0	GP2C_A1L 0	GP2C_A2L 0	GP2C_B1L 0	GP2C_B2L 0	GP2C Rev	0	0	0
C_A0H 0	GP2C_A1H 0	GP2C_A2H 0	GP2C_B1H 0	GP2C_B2H 0	GP2D Fwd	0	0	0
2D_AOL 0	GP2D_A1L 0	GP2D_A2L 0	GP2D_B1L 0	GP2D_B2L 0	GP2D Rev	0	0	0
D_A0H 0	GP2D_A1H 0	GP2D_A2H 0	GP2D_B1H 0	GP2D_B2H 0				
Outou	t Coefficients Registers						I2C Device	Catura
	to Spreadsheet Path		COE	LCULATE Sample FFICIENTS REGISTER 48000	e Rate (Fs)		IZC Device	setup
_				ETTINGS				
	t Coefficients			ant: Frequency response o			Slave	Address
Output Coefficients to Spreadsheet Path 및 Coefficients to Spreadsheet Path			Fs/2 wi	Fs/2 will show a valid filter profile, but will not create valid				
				ens			120 5	peed 2 3 100kHz
Input Coefficients Path         GPF_SRC1         GPF_SRC2         DSP_CFG           nput Coefficients from Spreadsheet         Reg 0x7D         54         Reg 0x7F         0								

Figure 22 Coefficients Panel

It is also possible to input coefficients to the device from spreadsheet by selecting *Input Coefficients* button and by selecting a valid input file path. Three forward and two reverse coefficients are required, an example is found in Figure 23.

🔀 🛃 🖓 - 🖓 - 📮 Coeffic 🗖 🗖 💌 🏹						
0	ile Hoi	Insi Pag F	For [  A			
ľ	- <i>•</i> •	<u>A</u> 3	≣ %	A		
Pas	ste 🦼	Font Align	ment Num	ber Styles	<٢	
Clip	board 🗔					
	C15	+	0	f <sub>x</sub>	~	
	А	В	С	D		
1	0.950995	-1.83422	0.893054			
2	-1.83422	0.84405				
3	0.995615	-1.99121	0.995606			
4	-1.99121	0.991221				
5	0.999332	-1.99854	0.999215			
6	-1.99854	0.998546				
7	0.999359	-1.9985	0.999159			
8	-1.9985	0.998518				
9	0.99922	-1.99738	0.998209			
10	-1.99738	0.997429				
11	0.999375	-1.99826	0.998921			
12	-1.99826	0.998296				
13						
14 Coefficients Inpuil 4						

Figure 23 Input Coefficient Spreadsheet Example

Another facility on the *Generate Coefficients* panel allows the register values to be output to spreadsheet by selecting the *Output Coefficient Registers* button and by selecting a valid output file path. The spreadsheet file must already exist for the register values to be output.

The I2C device address and access speed can also be entered here.

#### 5.5 Five-band Equaliser and Voice Filter Panel

The EQ & Voice panel contains the controls for selection of the ADC and DAC five-band equalisers and for the voice filters. These registers can be submitted real-time while the interface is running by pressing the *Submit* button.

😰 Realtime Filter Writes.vi		
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Filter Setup Coefficients EQ & Voice		
Filter Setup Coefficients EQ & Voice	VOICE_F0 Reg 0x11 12dB ADC_EQ1_VOL 12dB ADC_EQ2_VOL Reg 0x12 12dB ADC_EQ3_VOL 12dB ADC_EQ3_VOL 12dB ADC_EQ3_VOL 12dB ADC_EQ4_VOL	
Tab Control		🛛
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Figure 24 Five-band Equaliser and Voice Filter Panel