1. General Description

The AKD4490-A is an evaluation board for the AK4490 (new generation Premium 32-bit 2ch DAC). It integrates differential output low pass filters, allowing quick evaluation with digital audio interface.

## Ordering Guide

AKD4490-A -- Evaluation Board for the AK4490  
(Control software is included in this package.)

2. Function

- 10-pin Header for Serial Control
- Low Pass Filters (LPF) for Pre-amplifier Outputs
- Digital Audio Interface (AK4115)

Figure 1. AKD4490-A Block Diagram (Note 1)

Note 1. Circuit schematics are attached at the end of this document.
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4. Evaluation Board

**Board Diagram**

![Board Diagram](image)

**Description**

1. Connectors for Power Supply and GND
   (REG(+15V), REG(-15V), AVDD, DVDD, VDDL, VDDR, VREFHL, VREFHR, AGND, DGND)
   Connectors for power supply and the ground
   Refer to the "Power Supply Line Settings" for details.

2. SPDIF Input Connectors (J9/BNC Connector, PORT4/Optical Connector)
   Input a SPDIF signal to the AK4115.
   Set the JP9 jumper pin to “BNC” side when using the J9 (BNC Connector) jack.
   Set the JP9 jumper pin to “OPT” side when using the PORT4 (Optical Connector).

3. Analog Output Terminals (J1 / J3, BNC Connector)
   Single-ended Analog Output Connector

4. Analog Differential Output Terminals (J12 / J13, XLR Connector)
   Differential Analog Output Connector

---

Figure 2. AKD4490-A board diagram
(5) EXT PORT (PORT2)
10-pin Header for External Interfacing
External digital audio devices are interfaced to this port.
Set the JP5, JP6, JP7 and JP8 jumper pins to “EXT” side when using the PORT2 (EXT).

<table>
<thead>
<tr>
<th>Pin</th>
<th>I/O</th>
<th>Function</th>
<th>Pin</th>
<th>I/O</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>MCLK</td>
<td>2</td>
<td>P</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>I</td>
<td>BICK</td>
<td>4</td>
<td>P</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>I</td>
<td>SDTO</td>
<td>6</td>
<td>P</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>I</td>
<td>LRCK</td>
<td>8</td>
<td>P</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>I</td>
<td></td>
<td>10</td>
<td>P</td>
<td>GND</td>
</tr>
</tbody>
</table>

Table 1. PORT2 (EXT) Pin Assignments

(6) AK4115 (U7)
The AK4115 is a digital audio transceiver.
It is used when evaluating sound quality of the AK4490 by SPDIF signals.

(7) µP-IF PORT (PORT3)
10-pin Header for the USB I/F board
Connect the USB I/F board for IBM-AT compatible computers to this port for a connection to a USB port of a PC.
Refer to the “■ Serial Control Mode” for details.

(8) Slide Switches (SW1 / SW2 / SW10)
Setting switches for the AK4490 and the AK4115.
Upside is “H” (ON) and Downside is “L” (OFF).
Refer to “■ Jumper Pin and DIP Switch Settings” for details.
5. Operation Sequence

■ Power Supply Line Settings

(1) In case of using the regulators:
For the DVDD, AVDD, VDDL and VDDR power supply lines. < Default >

Set up the jumper pins.

Set up the power supply lines.

<table>
<thead>
<tr>
<th>Name</th>
<th>Color</th>
<th>Voltage</th>
<th>Content</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>REG (+15V)</td>
<td>Red</td>
<td>+10~+15V</td>
<td>For regulators, and plus power supply of the op-amp</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>REG (-15V)</td>
<td>Blue</td>
<td>-10~-15V</td>
<td>Minus power supply of the op-amp</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>VREFHL</td>
<td>Green</td>
<td>+10~+15V</td>
<td>VREFHL of AK4490</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>VREFHR</td>
<td>Green</td>
<td>+10~+15V</td>
<td>VREFHR of AK4490</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>DVDD</td>
<td>Orange</td>
<td>Open</td>
<td>DVDD of AK4490</td>
<td>Must be “Open”.</td>
</tr>
<tr>
<td>AVDD</td>
<td>Orange</td>
<td>Open</td>
<td>AVDD of AK4490</td>
<td>Must be “Open”.</td>
</tr>
<tr>
<td>VDDL</td>
<td>Orange</td>
<td>Open</td>
<td>VDDL of AK4490</td>
<td>Must be “Open”.</td>
</tr>
<tr>
<td>VDDR</td>
<td>Orange</td>
<td>Open</td>
<td>VDDR of AK4490</td>
<td>Must be “Open”.</td>
</tr>
<tr>
<td>AGND</td>
<td>Black</td>
<td>0V</td>
<td>Analog ground</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>DGND</td>
<td>Black</td>
<td>0V</td>
<td>Digital ground</td>
<td>Must be connected.</td>
</tr>
</tbody>
</table>

Table 2. Connection of the power supply. (Note 2)

Note 2. Each power supply line should be distributed separately from the power supply unit.
(2) In case of using the power supply connectors;
For the DVDD, AVDD, VDDL and VDDR power supply lines.

Set up the jumper pins.

![Figure 4. jumper pins setting](image)

Set up the power supply lines.

<table>
<thead>
<tr>
<th>Name</th>
<th>Color</th>
<th>Voltage</th>
<th>Content</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>REG (+15V)</td>
<td>Red</td>
<td>+10~+15V [Typ: +15V]</td>
<td>For regulators, and plus power supply of the op-amp</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>REG (-15V)</td>
<td>Blue</td>
<td>-10~+15V [Typ: -15V]</td>
<td>Minus power supply of the op-amp</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>VREFHLD</td>
<td>Green</td>
<td>+10~+15V [Typ: +15V]</td>
<td>VREFHL of AK4490</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>VREFHR</td>
<td>Green</td>
<td>+10~+15V [Typ: +15V]</td>
<td>VREFHR of AK4490</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>DVDD</td>
<td>Orange</td>
<td>+2.7~+3.6V [Typ: +3.3V]</td>
<td>DVDD of AK4490</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>AVDD</td>
<td>Orange</td>
<td>+2.7~+3.6V [Typ: +3.3V]</td>
<td>AVDD of AK4490</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>VDDL</td>
<td>Orange</td>
<td>+4.75~+5.25V [Typ: +5V]</td>
<td>VDDL of AK4490</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>VDDR</td>
<td>Orange</td>
<td>+4.75~+5.25V [Typ: +5V]</td>
<td>VDDR of AK4490</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>AGND</td>
<td>Black</td>
<td>0V</td>
<td>Analog ground</td>
<td>Must be connected.</td>
</tr>
<tr>
<td>DGND</td>
<td>Black</td>
<td>0V</td>
<td>Digital ground</td>
<td>Must be connected.</td>
</tr>
</tbody>
</table>

Table 3. Connection of the power supply. (Note 2)
**Evaluation Mode**

(1) Evaluation with a DIR (COAX) < Default >

The J9 (COAX) jack is used in this mode. The DIR (AK4115) generates MCLK, BICK, LRCK and SDATA from the input data of the J9 (COAX) connector.
Set the JP9 (RX-SEL) jumper pin to “BNC”, and set the JP5 (MCLK), JP6 (BICK), JP8 (LRCK) and JP7 (SDTO) jumper pins to “DIR”.

Set up the jumper pins.

![Jumper Pin Settings with DIR](image1)

Figure 5. Jumper Pin Settings with DIR

(2) Evaluation with a DIR (OPTICAL)

The PORT4 (OPTICAL) is used in this mode. The DIR (AK4115) generates MCLK, BICK, LRCK and SDATA from the input data of the PORT4 (OPTICAL) connector.
Set the JP9 jumper pin to “OPT”, and set the JP5 (MCLK), JP6 (BICK), JP8 (LRCK) and JP7 (SDTO) jumper pins to “DIR”.

Set up the jumper pins.

![Jumper Pin Settings with DIR](image2)

Figure 6. Jumper Pin Settings with DIR

(3) In the case that all interface clocks including the master clock are inputs externally (PORT 2 )

Input all interface clocks including the master clock to the PORT2 (EXT).
Set JP5 (MCLK), JP6 (BICK), JP8 (LRCK) and JP7 (SDTO) jumper pins to “EXT”.

Set up the jumper pins.

![Jumper Pin Settings with External Clocks](image3)

Figure 7. Jumper Pin Settings with External Clocks
# Jumper Pin and DIP Switch Settings

(1) Jumper Pin Settings

**Sub Board**

- **JP10 (PS1)**: SMUTE/CSN pin input select
  - SMUTE: This setting is for Parallel Control Mode. < Default >
  - CSN: This setting is for Serial Control Mode.

- **JP11 (PS2)**: SD/CCLK/SCL pin input select
  - SD: This setting is for Parallel Control Mode. < Default >
  - CCLK/SCL: This setting is for Serial Control Mode.

- **JP12 (PS3)**: SLOW/CDTI/SDA pin input select
  - SLOW: This setting is for Parallel Control Mode. < Default >
  - CDTI/SDA: This setting is for Serial Control Mode.

- **JP13 (PS4)**: SSLOW/WCK pin input select
  - H: The SSLOW pin is set to “H” in Parallel Control Mode.
  - L: The SSLOW pin is set to “L” in Parallel Control Mode. < Default >
  - OPEN: It can be an input pin header for a WCK signal when the AK4490 is in Serial Control Mode and the external digital filter I/F is used.

- **JP14 (DZFL)**: DIF0/DZFL pin connection select
  - SHORT: This setting is for Parallel Control Mode. < Default >
  - OPEN: This setting is for Serial Control Mode.

- **JP15 (DZFR)**: DIF1/DZFR pin connection select
  - SHORT: This setting is for Parallel Control Mode. < Default >
  - OPEN: This setting is for Serial Control Mode.
(2) DIP Switch Setting

Upside is ON (“H”), and Downside is OFF (“L”).

**Main Board**

[SW1]: Setting of the AK4115

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>ON (“H”)</th>
<th>OFF (“L”)</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OCKS1</td>
<td>Master Clock setting for AK4115</td>
<td></td>
<td>H</td>
</tr>
<tr>
<td>2</td>
<td>OCKS0</td>
<td>Refer to Table 7</td>
<td></td>
<td>L</td>
</tr>
</tbody>
</table>

Table 4. SW1 Setting

[SW2]: Setting of the AK4490-1

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>ON (“H”)</th>
<th>OFF (“L”)</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>Not Used</td>
<td>Should always be OFF (“L”) side.</td>
<td>L</td>
</tr>
<tr>
<td>2</td>
<td>I2C</td>
<td>I2C-Bus Control Mode</td>
<td>3-wire Serial Control Mode</td>
<td>L</td>
</tr>
</tbody>
</table>

(Note 3)

Table 5. SW2 Setting

Note 3. The I2C pin is valid when SW10 (7 pin/PSN) is set to “L” (Serial Control Mode).

**Sub Board**

[SW10]: Setting of the AK4490-2

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>ON (“H”)</th>
<th>OFF (“L”)</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SMUTE</td>
<td>Mute “ON”</td>
<td>Mute “OFF”</td>
<td>L</td>
</tr>
<tr>
<td>2</td>
<td>SD</td>
<td>Digital Filter Setting</td>
<td></td>
<td>H</td>
</tr>
<tr>
<td>3</td>
<td>SLOW</td>
<td>Refer to Table 8</td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>4</td>
<td>DIF0</td>
<td></td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>5</td>
<td>DIF1</td>
<td>Audio I/F Format for AK4490</td>
<td></td>
<td>H</td>
</tr>
<tr>
<td>6</td>
<td>DIF2 /CAD0</td>
<td>CAD0 pin= “H”</td>
<td>CAD0 pin= “L”</td>
<td>L</td>
</tr>
<tr>
<td>7</td>
<td>PSN</td>
<td>Parallel Control Mode</td>
<td>Serial Control Mode</td>
<td>H</td>
</tr>
<tr>
<td>8</td>
<td>DEM0</td>
<td>De-emphasis Control</td>
<td></td>
<td>H</td>
</tr>
<tr>
<td>9</td>
<td>DEM1</td>
<td>Refer to Table 10</td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>10</td>
<td>ACKS /CAD1</td>
<td>Auto Setting Mode</td>
<td>Manual Setting Mode</td>
<td>L</td>
</tr>
</tbody>
</table>

Table 6. SW10 Setting
Table 7. Master Clock Setting

<table>
<thead>
<tr>
<th>Mode</th>
<th>OCKS1</th>
<th>OCKS0</th>
<th>MCKO1</th>
<th>fs (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>L</td>
<td>L</td>
<td></td>
<td>256fs</td>
</tr>
<tr>
<td>1</td>
<td>L</td>
<td>H</td>
<td></td>
<td>256fs</td>
</tr>
<tr>
<td>2</td>
<td>H</td>
<td>L</td>
<td></td>
<td>512fs</td>
</tr>
<tr>
<td>3</td>
<td>H</td>
<td>H</td>
<td></td>
<td>128fs</td>
</tr>
</tbody>
</table>

Table 8. Digital Filter Setting

<table>
<thead>
<tr>
<th>SD</th>
<th>SLOW</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>L</td>
<td>Sharp roll-off filter</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>Slow roll-off filter</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>Short delay sharp roll-off filter</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>Short delay slow roll-off filter</td>
</tr>
</tbody>
</table>

Table 9. AK4414 Audio I/F Format

<table>
<thead>
<tr>
<th>Mode</th>
<th>DIF2 pin</th>
<th>DIF1 pin</th>
<th>DIF0 pin</th>
<th>Input Format</th>
<th>BICK</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>16-bit LSB justified</td>
<td>≥ 32fs</td>
</tr>
<tr>
<td>1</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>20-bit LSB justified</td>
<td>≥ 48fs</td>
</tr>
<tr>
<td>2</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>24-bit MSB justified</td>
<td>≥ 48fs</td>
</tr>
<tr>
<td>3</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>24-bit I²S Compatible</td>
<td>≥ 48fs</td>
</tr>
<tr>
<td>4</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>24-bit LSB justified</td>
<td>≥ 48fs</td>
</tr>
<tr>
<td>5</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>32-bit LSB justified</td>
<td>≥ 64fs</td>
</tr>
<tr>
<td>6</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>32-bit MSB justified</td>
<td>≥ 64fs</td>
</tr>
<tr>
<td>7</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>32-bit I²S Compatible</td>
<td>≥ 64fs</td>
</tr>
</tbody>
</table>

Table 10. De-emphasis Control

<table>
<thead>
<tr>
<th>DEM1</th>
<th>DEM0</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>L</td>
<td>44.1kHz</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>OFF</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>48kHz</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>32kHz</td>
</tr>
</tbody>
</table>
### Digital Filter Mode setting in parallel control mode

<table>
<thead>
<tr>
<th>Digital Filter Mode</th>
<th>Pin Settings</th>
<th>Board Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SSLOW pin</td>
<td>JP13 (PS4)</td>
</tr>
<tr>
<td>Sharp roll-off filter</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Slow roll-off filter</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>Short delay sharp roll-off filter</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>Short delay slow roll-off filter</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>Super slow roll-off filter</td>
<td>H</td>
<td>x</td>
</tr>
</tbody>
</table>

---

--- Selected Position
[x] --- Don’t Care

Table 11. Digital Filter Mode setting in parallel control mode

### Power-up

Upside is ON (“H”), and Downside is OFF (“L”).

[SW3](PDN): DAC Reset control. It must be set to “H” during operation.

After power-up, the AKD4490-A must be reset once.

To reset the AKD4490-A, set the SW3 toggle switch to “L” and power down the AK4490 and the AK4115. Then, release the power-down by setting back the SW3 to “H”.

---

<KM115901>
■ Serial Control Mode

The AKD4490-A should be connected to a PC (IBM-AT compatible) via a USB control box (AKDUSBIF-B) included in this package. The USB control box is connected to a PC with a USB cable and the AKD4490-A with a 10-pin flat cable. (Note 4, Note 5)

Note 4. The AKD4490-A accepts only one AKDUSBIF-B at one time. It does not operate if two or more AKDUSBIF-Bs are connected.
Note 5. Connect the 10pin Flat Cable as the red line of the cable is connected to the 1 pin of the 10pin Header of the board.

![Figure 8. AKDUSBIF-B Connection](image)

![Figure 9. AKDUSBIF-B](image)
Set up the jumper pins.

Other settings.

<table>
<thead>
<tr>
<th>Serial Control Mode</th>
<th>SW10 (No.7: PSN)</th>
<th>SW2 (No.2: I2C)</th>
<th>Control Software (Control I/F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-wire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I²C-Bus</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 12. Serial control mode setting

When using this evaluation board in serial control mode, settings of the CAD1 pin and the CAD0 pin on the board must match the Chip Address settings of the control software.

Table 13. “Chip Address” setting

**Evaluation Board and Control Software Settings**

1. Set up the evaluation board as needed, according to the previous terms.
2. Connect the evaluation board to a PC with USB cable.
3. USB control is recognized as HID (Human Interface Device) on PC. When it is not recognized properly, please reconnect the evaluation board to PC.
4. Insert the CD-ROM labeled “AKD4490-A Evaluation Kit” into the CD-ROM drive.
5. Access the CD-ROM drive and double-click the icon “akd4490-A.exe” to open the control program.
6. Begin evaluation by following the procedure below.

[Supported OS]
Windows XP / Vista / 7 (32bit) (XP compatible mode is recommended for Vista / 7)
64bit OS is not supported.

![Control Program Window](image)

**Figure 11. Control Program Window**
■ Operation Overviews

Register map is controlled by this control software.

Frequently used buttons, such as the register initializing button “Write Default”, are located outside of the switching tab window. Refer to the “Dialog Boxes” section for details of each dialog box setting.

![Figure 12. Control Buttons in Main Window](image)

1. [Port Reset]: Reset connection to PC
   Click this button after the control software starts up and the evaluation board is connected to the PC via USB cable.

2. [Write Default]: Register Initialization
   Use this button to initialize the registers when the device is reset by a hardware reset.

3. [All Write]: Execute write command for all registers displayed.

4. [All Read]: Execute read command for all registers displayed. (Note 6)

5. [Save]: Save current register settings to a file.

6. [Load]: Execute data write from a saved file.

7. [All Reg Write]: [All Reg Write] dialog box pops up.

8. [Data R/W]: [Data R/W] dialog box pops up.

9. [Sequence]: [Sequence] dialog box pops up.

10. [Sequence(File)]: [Sequence(File)] dialog box pops up.

Note 6. The [All Read] button is only valid when the interface mode for register control is in I^2C bus control mode.
### Tab Functions

#### 1. [REG] Tab: Register Map

This tab is for register read and write.

Each bit on the register map is a push-button switch.
Button Down indicates “1” and the bit name is shown in red (when read-only the name is shown in dark red).
Button Up indicates “0” and the bit name is shown in blue (when read-only the name is shown in gray).

Grayed out registers are Read-Only registers. They cannot be controlled.

The registers which are not defined on the datasheet are indicated as “---”.

![Figure 13. REG Window](image_url)
[Write] button: Data Write Dialog

Select the [Write] button located on the right of the each corresponding address when changing two or more bits on the same address simultaneously.

Click the [Write] button for the register pop-up dialog box shown below.

When the checkbox next to the register is checked, the data will become “1”. When the checkbox is not checked, the data will become “0”. Click [OK] to write the set values to the registers, or click [Cancel] to cancel this setting.

![Figure 14. Register Set Window](image)

[Read] button: Data Read (Only in I²C-bus Control Mode)

Click the [Read] button located on the right of the each corresponding address to execute a register read.

The current register value will be displayed in the register window as well as in the upper right hand DEBUG window.

Button Down indicates “1” and the bit name is shown in red (when read only the bit name is shown in dark red).

Button Up indicates “0” and the bit name is shown in blue (when read only the bit name is shown in gray)
■ Dialog Boxes

1. [All Reg Write]: All Register Write dialog box

Click [All Reg Write] button in the main window to open register setting file window shown below. Register setting files saved by [SAVE] button may be applied.

![All Register Write]

Figure 15. [All Reg Write] Window

- [Open (left)]: Select a register setting file (*.akr).
- [Write]: Execute register write with selected setting file.
- [Write All]: Execute register write with all selected setting files. Selected files are executed in descending order.
- [Help]: Open help window.
- [Save]: Save register setting file assignment. File name is “*.mar”.
- [Open (right)]: Open saved register setting file assignment “*.mar”.
- [Close]: Close dialog box and finish process.

~ Operating Suggestions ~

1. Files saved by [Save] button and opened by [Open] button on the right of the dialog “*.mar” should be stored in the same folder.

2. When register settings are changed by [Save] button in the main window, re-read the file to reflect new register settings.
2. [Data R/W]: Data R/W Dialog Box

Click the [Data R/W] button in the main window for data read/write dialog box. 
Data is written to the specified address.

![Data Read/Write Dialog Box]

Figure 16. [Data R/W] Window

- **[Address] Box**: Input data write address in hexadecimal numbers.
- **[Data] Box**: Input writes data in hexadecimal numbers.
- **[Mask] Box**: Input masks data in hexadecimal numbers. 
  This value “ANDed” with the write data becomes the input data.
- **[Write]**: Write data generated from Data and Mask value is written to the address specified in “Address” box. (Note 7)
- **[Read]**: Read data from the address specified in “Address” box. (Note 8)
- **[Close]**: Close dialog box and finish process. 
  Data write will not be executed unless [Write] is clicked.

**Note 7.** The register map will be updated after executing the [Write] command.
**Note 8.** The [Read] button is only valid when the interface mode for register control is in I²C bus control mode.
3. **[Sequence]: Sequence Dialog Box**

Click the [Sequence] button in the main window for Sequence dialog box. Register sequence may be set and executed.

![Sequence Window](image)

*Figure 17. [Sequence] Window*

**~ Sequence Setting ~**

Set register sequence according to the following process.

1. **Select a command**

   Use [Select] pull-down box to choose commands. Corresponding input boxes will be valid.

   *Selection of the "Select" combo box*
   - **No_use**: Not using this address
   - **Register**: Register write
   - **Reg(Mask)**: Register write (Masked)
   - **Interval**: Take an interval
   - **Stop**: Pause the sequence
   - **End**: End the sequence
2. Input Sequence

[Address]: Data Address  
[Data]: Write Data  
[Mask]: Mask

This value “ANDed” with the write data becomes the input data.  
When Mask = 0x00, current setting is hold.  
When Mask = 0xFF, the 8bit data which is set in the [Data] box is written.  
When Mask = 0x0F, lower 4bit data which is set in the [Data] box is written.  
Upper 4bit is hold to current setting.

[Interval]: Interval Time

Valid boxes for each process command are shown below.

* No_use : None  
* Register : [Address], [Data], [Interval]  
* Reg(Mask) : [Address], [Data], [Mask], [Interval]  
* Interval : [Interval]  
* Stop : None  
* End : None

~ Control Buttons ~

Functions of Control Buttons are shown below.

[Start] button : Execute the sequence.  
[Help] button : Open a help window.  
[Save] button : Save sequence settings as a file. The file name is “*.aks”.  
[Open] button : Open a sequence setting file “*.aks”.  
[Close] button : Close the dialog box and finishes the process.

Stop Sequence

When “Stop” command is selected in the sequence, the process is paused at this step. It is resumed by clicking the [Start] button. The process starts from the step shown in [Start Step] box. This step number returns to “1” when the sequence is executed until the end. Input arbitrary step number to the [Start Step] box to start the process from the middle of sequence.

The process sequence can be restarted from the beginning by writing “1” to the [Start Step] box and click the [Start] button during the process.
4. [Sequence(File)]: Sequence(File) Dialog

Click the [Sequence(File)] button to open sequence setting file dialog box shown below. Files saved in the “Sequence setting dialog” can be applied in this dialog.

![Sequence by *.aks file](image)

Figure 18. [Sequence (File)] Window

- [Open (left)] button: Select a sequence setting file (*.aks)
- [Start ] button: Execute the sequence by the setting of selected file.
- [Start All] button: Execute sequence with all selected setting files.
  Selected files are executed in descending order.
- [Help] button: Open help window.
- [Save] button: Save register setting file assignment. File name is “*.mas”.
- [Open (right)] button: Open saved sequence setting file assignment “*. mas”.
- [Close] button: Close dialog box and finish process.

~ Operating Suggestions ~

1. Files saved by [Save] button and opened by [Open] button on the right of the dialog “*.mas” should be stored in the same folder.
2. When “Stop” command is selected in the sequence, the process is paused at this step and a message shown below pops up. The sequence is resumed by clicking “OK” button.

![Sequence Pause Window](image)

Figure 19. Sequence Pause Window
## Measurement Results

### Measurement condition
- **Measurement unit**: Audio Precision SYS-2722
- **MCLK**: 512fs (44.1 kHz), 256fs (96 kHz), 128fs (192 kHz)
- **BICK**: 64fs
- **fs**: 44.1kHz, 96kHz, 192kHz
- **Bit**: 24bit
- **Power Supply**: AVDD= DVDD=3.3V, VDDL/R=VREFH/R=5V
- **Pass**: Internal DIR (AK4115) → AK4490 → BNC Connector
- **Control Mode**: Parallel Control Mode, ACKS pin = "H"
- **Temperature**: Room Temperature
- **Operational Amplifiers**: LME49710NA

### fs=44.1kHz

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Input signal</th>
<th>Measurement filter</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/(N+D)</td>
<td>1kHz, 0dB</td>
<td>20kHz LPF</td>
<td>Lch     / Rch</td>
</tr>
<tr>
<td>DR</td>
<td>1kHz, -60dB</td>
<td>A-weighted</td>
<td>117.5 dB / 117.8 dB</td>
</tr>
<tr>
<td>S/N</td>
<td>“0” data</td>
<td>20kHz LPF</td>
<td>Lch     / Rch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A-weighted</td>
<td>117.8 dB / 117.9 dB</td>
</tr>
</tbody>
</table>

### fs=96kHz

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<th>Parameter</th>
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<tbody>
<tr>
<td>S/(N+D)</td>
<td>1kHz, 0dB</td>
<td>40kHz LPF</td>
<td>Lch     / Rch</td>
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<tr>
<td>DR</td>
<td>1kHz, -60dB</td>
<td>A-weighted</td>
<td>115.0 dB / 114.8 dB</td>
</tr>
<tr>
<td>S/N</td>
<td>“0” data</td>
<td>40kHz LPF</td>
<td>Lch     / Rch</td>
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<tr>
<td></td>
<td></td>
<td>A-weighted</td>
<td>115.0 dB / 114.9 dB</td>
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</table>

### fs=192kHz

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Input signal</th>
<th>Measurement filter</th>
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<tbody>
<tr>
<td>S/(N+D)</td>
<td>1kHz, 0dB</td>
<td>40kHz LPF</td>
<td>Lch     / Rch</td>
</tr>
<tr>
<td>DR</td>
<td>1kHz, -60dB</td>
<td>A-weighted</td>
<td>115.0 dB / 114.9 dB</td>
</tr>
<tr>
<td>S/N</td>
<td>“0” data</td>
<td>40kHz LPF</td>
<td>Lch     / Rch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A-weighted</td>
<td>115.0 dB / 114.6 dB</td>
</tr>
</tbody>
</table>
[Plots]

fs = 44.1 kHz

AKM

AK4490 THD+N vs. Input Level
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=512fs, fs=44.1kHz

Figure 20. THD+N vs. Input Level

AKM

AK4490 THD+N vs. Input Frequency
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=512fs, 44.1kHz

Figure 21. THD+N vs. Input Frequency
fs = 44.1 kHz

AKM

AK4490 Linearity
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=512fs, fs=44.1kHz

Figure 22. Linearity

AKM

AK4490 Frequency Response
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=512fs, fs=44.1kHz

Figure 23. Frequency Response
fs = 44.1 kHz

Figure 24. Crosstalk

Figure 25. FFT (0dBFS Input)
fs = 44.1 kHz

AKM

AK4490 FFT (-60dBFS Input)
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=512fs, fs=44.1kHz

![Figure 26. FFT (-60dBFS Input)](image)

AKM

AK4490 FFT (No Signal Input)
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=512fs, fs=44.1kHz

![Figure 27. FFT (No Signal Input)](image)
fs = 44.1 kHz

AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=512fs, fs=44.1kHz

Figure 28. Out of Band Noise
fs = 96 kHz

**AKM**

**AK4490 THD+N vs. Input Level**
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=256fs, fs=96kHz

Figure 29. THD+N vs. Input Level

**AKM**

**AK4490 THD+N vs. Input Frequency**
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=256fs, 96kHz

Figure 30. THD+N vs. Input Frequency
**fs = 96 kHz**

**Figure 31. Linearity**

**Figure 32. Frequency Response**
fs = 96 kHz

AKM

AK4490 Crosstalk
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=256fs, fs=96kHz

Figure 33. Crosstalk

AKM

AK4490 FFT (0dBFS Input)
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=256fs, fs=96kHz

Figure 34. FFT (0dBFS Input)
fs = 96 kHz

AKM
AK4490 FFT (-60dBFS Input)
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=256fs, fs=96kHz

Figure 35. FFT (-60dBFS Input)

AKM
AK4490 FFT (No Signal Input)
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=256fs, fs=96kHz

Figure 36. FFT (No Signal Input)
fs = 96 kHz

AKM

AK4490 FFT (0dBFS Input)
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=256fs, fs=96kHz

Figure 37. FFT (Notch)
fs = 192 kHz

Figure 38. THD+N vs. Input Level

Figure 39. THD+N vs. Input Frequency
fs = 192 kHz

AKM

**AK4490 Linearity**

AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=128fs, fs=192kHz

---

Figure 40. Linearity

---

**AK4490 Frequency Response**

AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=128fs, fs=192kHz

---

Figure 41. Frequency Response

---
fs = 192 kHz

AKM

AK4490 Crosstalk
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=128fs, fs=192kHz

Figure 42. Crosstalk

AKM

AK4490 FFT (0dBFS Input)
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=128fs, fs=192kHz

Figure 43. FFT (0dBFS Input)
fs = 192 kHz

AKM

AK4490 FFT (-60dBFS Input)

AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=128fs, fs=192kHz

Figure 44. FFT (-60dBFS Input)

AKM

AK4490 FFT (No Signal Input)

AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=128fs, fs=192kHz

Figure 45. FFT (No Signal Input)
fs = 192 kHz

AKM

AK4490 FFT (0dBFS Input)
AVDD=DVDD=3.3V, VDDL/R=VREFHL/R=5V, MCLK=128fs, fs=192kHz

Figure 46. FFT (Notch)
### 8. Revision History

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<th>Date (y/m/d)</th>
<th>Manual Revision</th>
<th>Board Revision</th>
<th>Reason</th>
<th>Page</th>
<th>Contents</th>
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<tr>
<td>14/01/14</td>
<td>KM115900</td>
<td>0</td>
<td>First Edition</td>
<td>-</td>
<td>Change of description: “Power Supply Connections” “Serial Control Mode”</td>
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<td>16/03/01</td>
<td>KM115901</td>
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<td>Change</td>
<td>5-6 12-13</td>
<td>Change of circuit diagram: R205 and R207: “10ohm” -&gt; “0ohm” U8 and C69: “Mount” -&gt; “Un mount”</td>
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<td>Addition</td>
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<td>“Digital Filter Mode setting in parallel control mode” was added.</td>
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<td>Delete</td>
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<td>Modification</td>
<td>1, 24, 29, 34</td>
<td>Update: Figure. 1, Figure. 20, Figure. 29 and Figure. 38</td>
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