Evaluating Low-Frequency Noise of Operational Amplifiers

General Description

The EVAL-KW4502Z is a demonstration board for evaluating the low-frequency noise of three general operational amplifiers (op amp): (1) low-power op amp, (2) low-noise, bipolar op amp, and (3) low-noise, zero-drift op amp.

The EVAL-KW4502Z uses ADA4510-2, which is a high precision, low offset voltage, low-noise, rail-to-rail input and output operational amplifier, as it can operate in low voltage supplies like ±5V that can be provided by the ADALM2000 Active Learning Module.

The EVAL-KW4502Z accommodates LT1782, ADA4077, and ADA4522 in a thin small outline transistor (TSOT), standard small outline package (SOIC), and mini small outline package (MSOP), respectively.

Full specifications on the LT1782, ADA4077, and ADA4522 are available on the Analog Devices, Inc. website.

Features

- Enables Quick Measurement of Low-Frequency Noise (0.1Hz to 10Hz)
- Evaluates Low-Power, Low-Noise, and Zero-Drift Amplifiers
- Accommodates 5-Lead TSOT, 8-Lead SOIC, and 8-Lead MSOP Packages
- Easy plugin into ADALM2000 Active Learning Module

Evaluation Kit Contents

- EVAL-KW4502Z evaluation board
- 2-Pin Mini Jumper Short Circuit Cap

Equipment Needed

- ADALM2000 Active Learning Module
- USB-A to Micro-USB Cable
- Computer

Software Needed

- Scopy Software

Documents Needed

- ADA4510 Data sheet
- LT1782 Data sheet
- ADA4077 Data sheet
- ADA4522 Data sheet

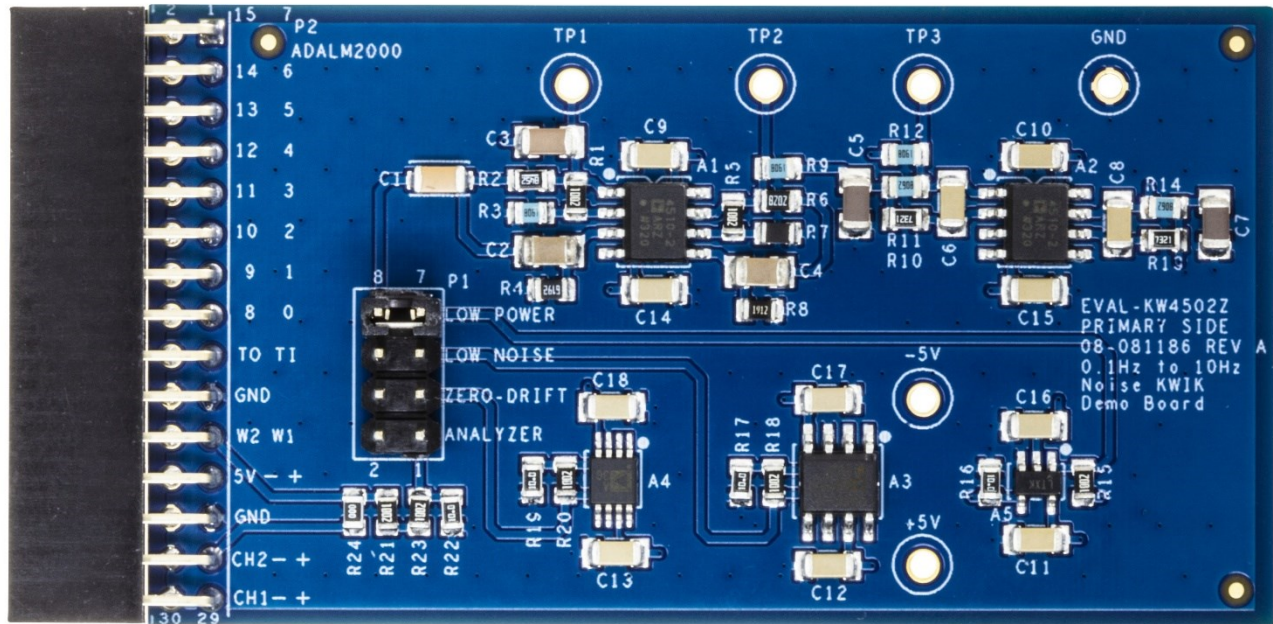TECHNICAL SUPPORT

EVAL-KW4502Z Board Photo
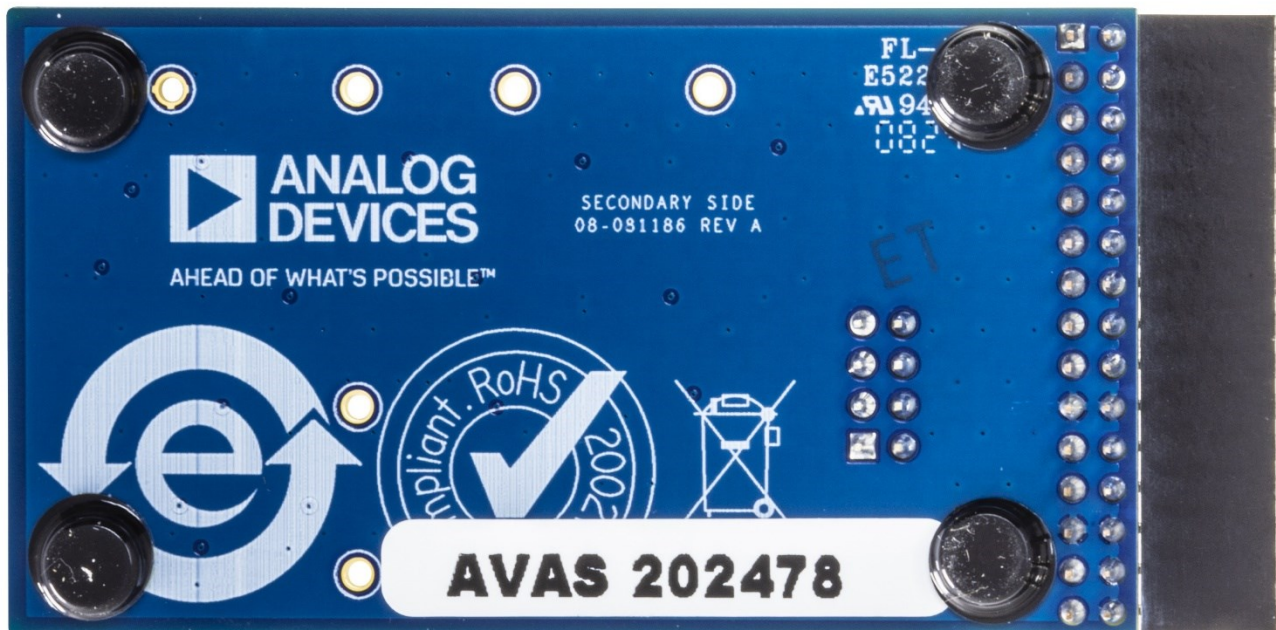

Figure 1. EVAL-KW4502Z Top View

Figure 2. EVAL-KW4502Z Bottom View

Getting Started

Software Installation

The ADALM2000 driver and Scopy software are necessary to use the ADALM2000 device and control it through the computer.

The quick start procedure for starting the ADALM2000 can be found on the *Wiki Tools*. It also includes some common troubleshooting tips.

Hardware Integration

1. Plug in a micro-USB cable to the connectivity port as shown in *Figure 3*, connecting the laptop/computer to the ADALM2000.

Figure 3. ADALM2000

2. Open the Scopy software to establish a connection between the laptop/computer and the ADALM2000.
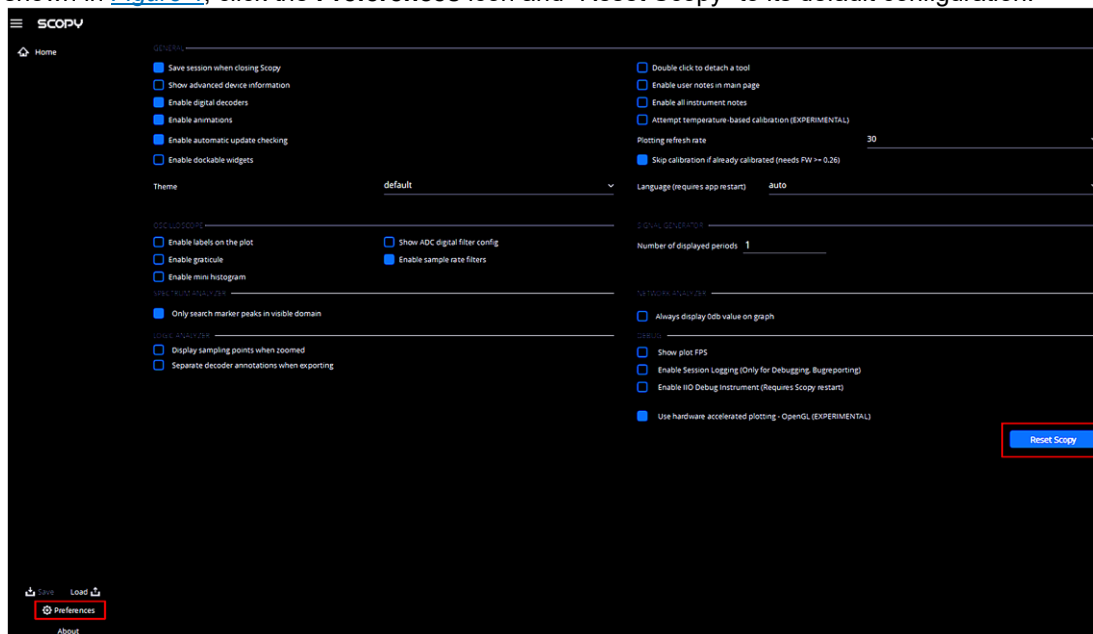3. As shown in *Figure 4*, click the **Preferences** icon and "Reset Scopy" to its default configuration.

Figure 4. Resetting Scopy to Factory Default Settings

4. As shown in *Figure 5*, click the **ADALM2000** icon, then click the **Connect** button to begin connecting. The device is successfully connected when the **Connect** button is replaced with the **Disconnect** button.
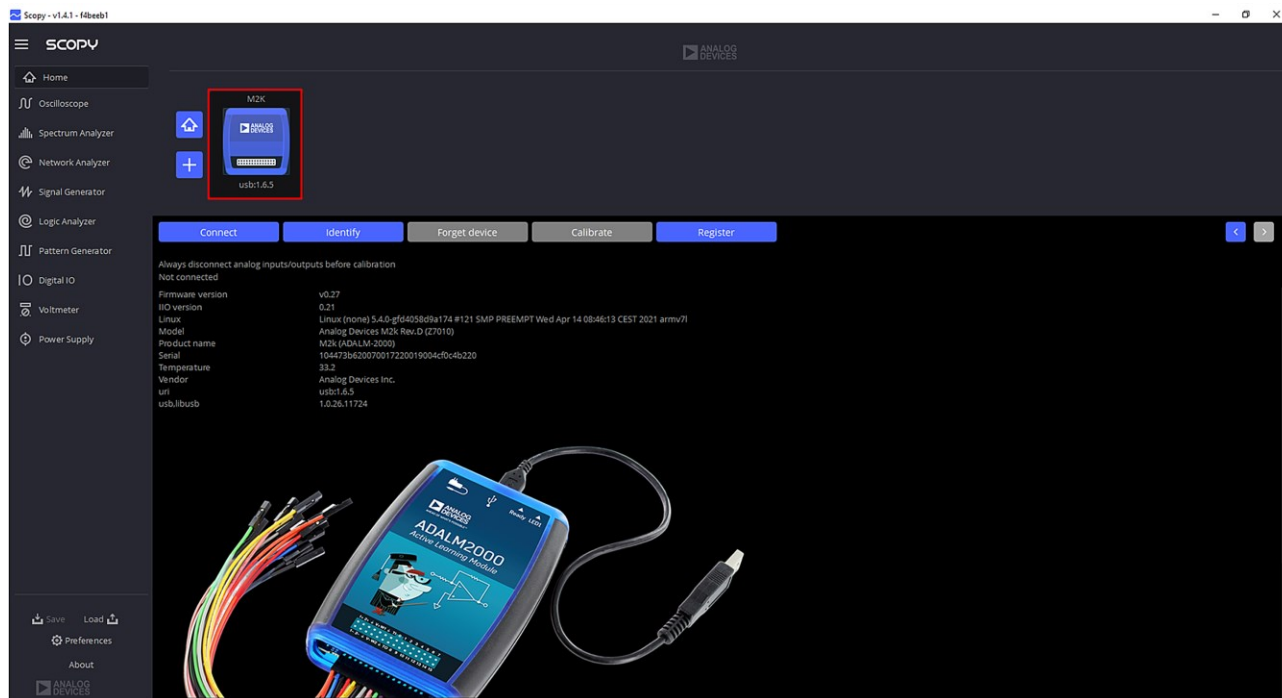
Figure 5. ADALM2000 Connection Icon

5. Connect the EVAL-KW4502Z top side with the top side of the ADALM2000 aligning their pinouts as shown in *Figure 6*.
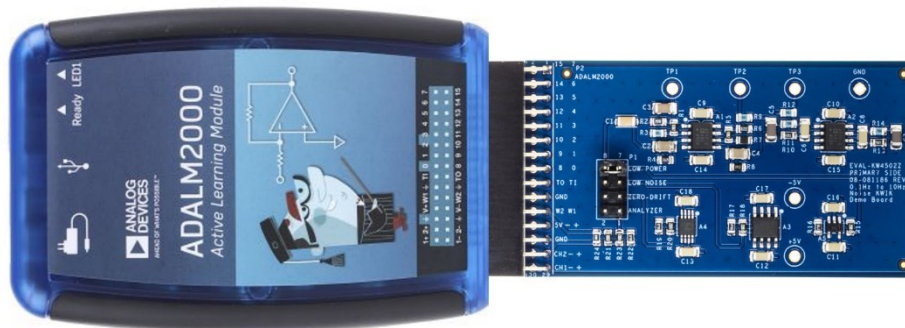

Figure 6. EVAL-KW4502Z with ADALM2000

Jumper Settings

The EVAL-KW4502Z output is reconfigurable based on jumper configuration. By default, the jumper cap (see *Figure 7*) is set in the analyzer, but it can be set either to zero-drift or low noise or low power to measure their low-frequency noise.

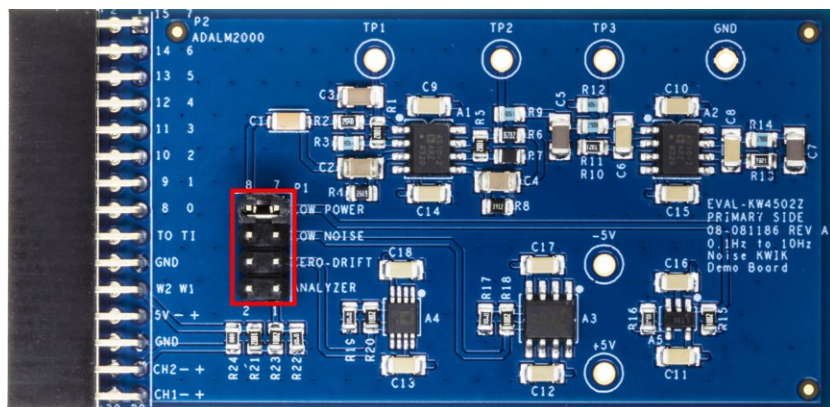*Figure 7. Jumper Settings*

Output

The ADALM2000 is a multifunction device that includes an oscilloscope among its capabilities. The oscilloscope is used to visualize and analyze the 0.1Hz to 10Hz of the chosen amplifier based on the jumper configuration.

In the **Oscilloscope** tab, configure Channel 1 to set the time per division to 625ms/div and volts per division to 200mV/div. Click the **Run** button in the upper right to start the sweep of the oscilloscope and wait for the output to settle to a stable value. The filter requires approximately 1 minute to settle.
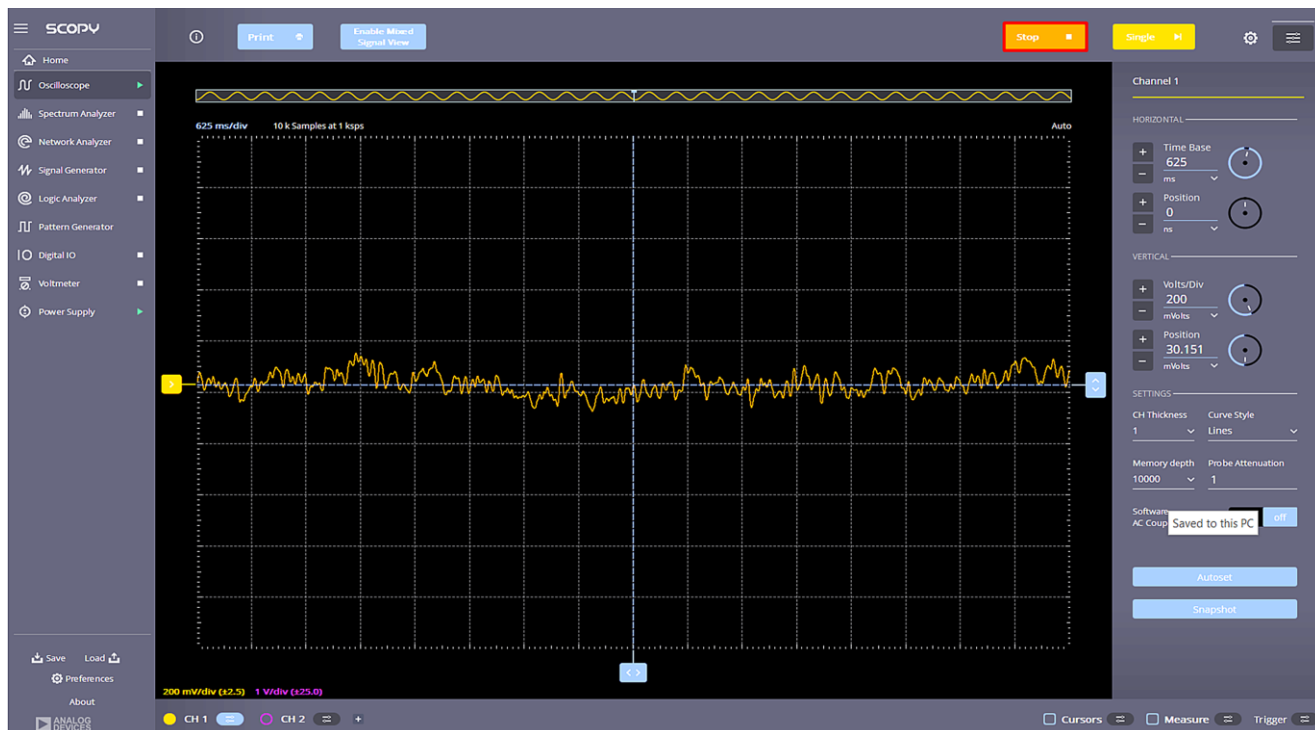

Figure 8. EVAL-KW4502Z Sample Output

EVAL-KW4502Z Schematic

Figure 9. EVAL-KW4502Z Schematic Diagram

Bill of Materials

Item	Quantity	Reference Designator	Part Description	Manufacturer	Manufacturer Part Number
4	2	A1, A2	IC-ADI PRECISION, RAIL-TO-RAIL INPUT AND OUTPUT OP AMP WITH DIGITRIM	ANALOG DEVICES	ADA4510-2ARZ
5	1	A3	IC-ADI LOW OFFSET AND DRIFT, HIGH PREC AMP	ADI	ADA4077-1BRZ
6	1	A4	IC-ADI 55V EMI ENHANCED, ZERO-DRIFT, ULTRA-LOW NOISE RAIL-TO-RAIL OUTPUT OPAMP	ANALOG DEVICES	ADA4522-1ARMZ-R7
7	1	A5	IC-ADI OP-AMP SINGLE MICROPOWER, R-R I/O	ANALOG DEVICES	LT1782HS5#TRPBF
8	1	C1	CAP CER 8.2μF 10V 10% X7R 1206	KEMET	C1206C825K8RACTU
9	12	C6, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18	CAP CER 0.1μF 50V 10% X7R 1206	AVX	12065C104KAT2A
10	2	C2, C4	CAP CER 100μF 10V 20% X7R 1206	SAMSUNG	L31A107MPKNNWE
11	1	C3	CAP CER 15μF 25V 20% X5R 1206 LOW ESR	TDK	C3216X5R1E156M160AB
12	2	C5, C7	CAP CER 2.2μF 50V 10% X7R 1206	AVX CORPORATION	12065C225KAT2A
13	1	P1	CONN-PCB 8POS MALE HDR UNSHROUDED 0.635MM SQ POST DOUBLE ROW 5.84mm MATING POST, 2.54mm SOLDER TAIL, 2.54mm PITCH	SAMTEC INC.	TSW-104-07-G-D
14	1	P2	CONN-PCB 30POS SOCKET STRIP F 2.54mm SOLDER RA THRU-HOLE	SULLINS	PPPC152LJBN-RC
15	7	R1, R5, R15, R18, R20, R21, R23	RES SMD 10kΩ 1% 1/4W 0805 AEC-Q200	KOA SPEER ELECTRONICS, INC.	RK73H2ARTTD1002F
16	2	R10, R13	RES SMD 7.32kΩ 1% 1/8W 0805 AEC-Q200	PANASONIC	ERJ-6ENF7321V
17	2	R11, R14	RES SMD 80.6kΩ 1% 1/4W 0805 AEC-Q200	KOA SPEER ELECTRONICS, INC.	RK73H2ATTD8062F
18	3	R3, R9, R12	RES SMD 8.06kΩ 1% 1/4W 0805 AEC-Q200	KOA SPEER ELECTRONICS, INC.	RK73H2ATTD8061F
19	4	R16,R17,R19,R22	RES SMD 10Ω 1% 1/4W 0805	STACKPOLE ELECTRONICS, INC.	RNCP0805FTD10R0
20	1	R2	RES SMD 84.5kΩ 0.1% 1/4W 0805 AEC-Q200	PANASONIC	ERJPB6B8452V

21	1	R24	RES SMD 0Ω JUMPER 1/8W 0805 AEC-Q200	PANASONIC	ERJ-6GEY0R00V
22	1	R4	RES SMD 61.9kΩ 1% 1/4W 0805 HIGH POWER SULFUR RESISTANT	STACKPOLE ELECTRONICS, INC.	RNCP0805FTD61K9
23	1	R6	RES SMD 82kΩ 0.1% 1/8W 0805	YAGEO	RT0805BRD0782KL
24	1	R7	RES SMD 2.87kΩ 1% 1/8W 0805 AEC-Q200	VISHAY	CRCW08052K87FKEA
25	1	R8	RES SMD 19.1kΩ 1% 1/4W 0805 SULFUR RESISTANT	STACKPOLE ELECTRONICS, INC.	RNCP0805FTD19K1

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGE NUMBER
0	6/24	Initial Release	—

Notes