FEATURES
General-purpose PLL evaluation board excluding VCO, loop filter, and TCXO
Contains ADF4002 400 MHz frequency synthesizer IC
Accompanying software allows complete control of synthesizer functions from a PC

EVALUATION KIT CONTENTS
EV-ADF4002SD1Z board
CD that includes
Self-installing software that allows users to control the board and exercise all functions of the device
Electronic version of the ADF4002 data sheet
Electronic version of the UG-108 user guide

ADDITIONAL EQUIPMENT
PC running Windows XP or more recent version
SDP-S board (system demonstration platform, serial only)
T-package VCO
0805 resistors and capacitors
Spectrum analyzer
Oscilloscope (optional)

DOCUMENTS NEEDED
ADF4002 data sheet

REQUIRED SOFTWARE
Analog Devices Int-N software (Version 7 or higher)
ADIsimPLL

GENERAL DESCRIPTION
This board is designed to allow the user to evaluate the performance of the ADF4002 frequency synthesizer for phase-locked loops (PLLs). Figure 1 shows the board, which contains the footprint for an ADF4002 synthesizer, an SMA connector for the reference input, power supplies, and an RF output. There is also a footprint for a loop filter and a VCO on board.

The evaluation kit also contains software that is compatible with Windows® XP and later versions to allow easy programming of the synthesizer.

This board requires an SDP-S (system demonstration platform-serial) board (shown in Figure 1, but not supplied with the kit). The SDP-S allows software programming of the ADF4002 device.
TABLE OF CONTENTS

Features .............................................................................................. 1
Evaluation Kit Contents ................................................................. 1
Additional Equipment ....................................................................... 1
Documents Needed ........................................................................ 1
Required Software ........................................................................ 1
General Description ......................................................................... 1
Evaluation Board .............................................................................. 1
Revision History ............................................................................... 2
Quick Start Guide ............................................................................. 3
Evaluation Board Hardware ............................................................ 4
Power Supplies .................................................................................. 4
Input Signals.................................................................................... 4
Output Signals .................................................................................. 4
Default Operation and Jumper Selection Settings ......................... 5
System Demonstration Platform (SDP) ........................................... 5
Evaluation Board Setup Procedure ................................................. 6
Software Installation ........................................................................ 6
Evaluation Board Software ............................................................. 10
Evaluation and Test .......................................................................... 12
Evaluation Board Schematics and Artwork .................................... 13
Ordering Information ....................................................................... 20
Bill of Materials ............................................................................... 20
Related Links ................................................................................... 21

REVISION HISTORY

12/11—Rev. 0 to Rev. A
Changes to Features and General Description Sections and
Figure 1 .............................................................................................. 1
Added Evaluation Kit Contents, Additional Equipment,
Documents Needed, and Required Software Sections .......... 1
Added Quick Start Guide Section ..................................................... 3
Deleted Figure 3; Renumbered Sequentially......................... 3
Replaced Hardware Description Section with Evaluation Board
Hardware Section ............................................................................. 4
Changes to Power Supplies Section and Output Signals Section .... 4
Added Default Operation and Jumper Selection Settings
Section and System Demonstration Platform (SDP) Section .... 5
Added Table 1; Renumbered Sequentially ................................. 5
Added Evaluation Board Setup Procedure Section ................. 6
Added Figure 3 and Figure 4; Renumbered Sequentially ......... 6
Added Figure 5 to Figure 9 .............................................................. 7
Added Figure 10 to Figure 14 ......................................................... 8
Added Figure 15 to Figure 16 ........................................................ 9
Replaced Software Description Section with Evaluation Board
Software Section ............................................................................. 10
Changes to Figure 17 ...................................................................... 10
Added Figure 18 ............................................................................. 11
Added Evaluation and Test Section, Figure 19, and
Figure 20 .......................................................................................... 12
Changed Schematics Heading to Evaluation Board Schematics
and Artwork .................................................................................... 13
Changes to Figure 21 ...................................................................... 13
Changes to Figure 22 ...................................................................... 14
Added Figure 23 ............................................................................. 15
Added Figure 24 ............................................................................. 16
Added Figure 25 ............................................................................. 17
Added Figure 26 ............................................................................. 18
Added Figure 27 ............................................................................. 19
Changes to Table 2 .......................................................................... 20

9/10—Revision 0: Initial Version
QUICK START GUIDE

Follow these steps to quickly evaluate the ADF4002 device:

1. Solder the VCO (T-package compatible).
2. Solder the loop filter components (design with ADIsimPLL™).
3. Connect the reference frequency to J11.
4. Install the system development platform (SDP) drivers.
5. Install the Int-N software.
6. Connect the SDP-S motherboard to the PC and to the EV-ADF4002SD1Z.
7. Follow the hardware driver installation procedure.
8. Connect the power supplies to banana connectors (6 V to 12 V).
9. Run the Int-N software.
10. Select the SDP board and the ADF4002 device in the Select Device and Connection tab of the software front panel window.
11. Click the Main Controls tab. Update all registers.
12. Connect the spectrum analyzer to J2.
13. Measure the results.
EVALUATION BOARD HARDWARE

The evaluation board requires the use of an SDP-S motherboard to program the device. This is not included and must be purchased separately. The EV-ADF4002SD1Z schematics are shown in Figure 21, Figure 22, and Figure 23.

POWER SUPPLIES

The board is powered from external banana connectors. The voltage can vary between 6 V and 12 V. The power supply circuit provides 3.0 V to the ADF4002 VDD and allows the user to choose either 3.0 V or 5 V for the ADF4002 VP. The default settings are 3.0 V for the ADF4002 VDD and 5 V for the ADF4002 VP. Note that VDD should never exceed 3.3 V. This can damage the device.

External power supplies can be used to directly drive the device. In this case, the user must insert SMA connectors as shown in Figure 2.

INPUT SIGNALS

The necessary reference input can be sourced from an external generator. A low noise, high slew rate reference source is best for achieving the stated performance of the ADF4002. This reference source can be connected to Connector J11. If preferred, the edge mount connector, J5, can be inserted and used instead. A third option is to solder a footprint-compatible TCXO to Footprint Y2. To use this option, connect 0 Ω links to R16 and R14.

Digital SPI signals are supplied through the SDP connector, J1. Using the SDP-S platform is recommended. The SDP_B can also be used, but Resistor R57 must be removed on the SDP-B board. Some additional spurious low frequencies may appear if the SDP-B connector is used.

OUTPUT SIGNALS

All components necessary for LO generation can be inserted on board. The PLL is made up of the ADF4002 synthesizer, a passive loop filter, and the VCO. The package containing the VCO must be a T-package (or similar). A low-pass filter must be inserted between the charge pump output and the VCO input. In this case, the user must insert the relevant parts as shown in Figure 2. The VCO output is available at RFOUT through a standard SMA connector, J2. The MUXOUT signal can be monitored at Test Point T8 or at SMA Connector J3.
DEFAULT OPERATION AND JUMPER SELECTION SETTINGS

This board is shipped without a TCXO, low-pass filter, or a VCO. Users must insert suitable components to complete a PLL. Link positions are outlined in Table 1.

Table 1. Link Positions and Function

<table>
<thead>
<tr>
<th>Link</th>
<th>Position</th>
<th>Options</th>
<th>Description</th>
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<tbody>
<tr>
<td>LK1</td>
<td>A</td>
<td>R1A</td>
<td>Not used</td>
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<tr>
<td></td>
<td>B</td>
<td>RSET</td>
<td>Normal operation</td>
</tr>
<tr>
<td>LK2</td>
<td>A</td>
<td>GND</td>
<td>Hardware power-down</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>VDD</td>
<td>Normal operation</td>
</tr>
<tr>
<td>LK3 (Vcc)</td>
<td>A</td>
<td>5V</td>
<td>Not used</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>3V</td>
<td>Normal operation</td>
</tr>
<tr>
<td>LK4 (Vvco)</td>
<td>A</td>
<td>5V</td>
<td>VCO supply 5 V</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>3V</td>
<td>VCO supply 3 V</td>
</tr>
<tr>
<td>LK5 (Vr)</td>
<td>A</td>
<td>5V</td>
<td>Vr supply 5 V</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>3V</td>
<td>Vr supply 3 V</td>
</tr>
</tbody>
</table>

SYSTEM DEMONSTRATION PLATFORM (SDP)

The system demonstration platform (SDP) is a series of controller boards, interposer boards, and daughter boards that can be used for easy low cost evaluation of Analog Devices, Inc., components and reference circuits. It is a reusable platform whereby a single controller board can be reused in various daughter board evaluation systems.

Controller boards connect to the PC via USB 2.0 and provide a range of communication interfaces on a 120-pin connector. The pinout for this connector is strictly defined. This 120-pin connector’s receptacle is on all SDP daughter boards, component evaluation boards, and Circuits from the Lab™ reference circuit boards. There are two controller boards in the platform: the SDP-B, which is based on the Blackfin® ADSP-BF527, and the SDP-S, which is a serial interface only controller board. The SDP-S has a subset of the SDP-B functionality.

Interposer boards route signals between the SDP 120-pin connector and a second connector. When the second connector is also a 120-pin connector, the interposer can be used for signal monitoring of the 120-pin connector signals. Alternatively, the second connector allows SDP platform elements to be integrated into a second platform, for example, the BeMicro SDK. More information on the SDP can be found at www.analog.com/sdp.
SOFTWARE INSTALLATION

Use the following steps to install the SDP drivers and Int-N software.

1. Install the SDP drivers by double-clicking `SDPDrivers.exe` and following the relevant installation instructions. See the UG-291 for further instructions on installation of the SDP-S platform or the UG-277 if the SDP-B platform is used.

2. Install the Analog Devices Int-N software by double-clicking `ADI_Int-N_Setup.msi`.
   - If you are using Windows XP, follow the instructions in the Windows XP Software Installation Guide section (see Figure 3 to Figure 7).
   - If you are using Windows Vista or Windows 7, follow the instructions in the Windows Vista and Windows 7 Software Installation Guide section (see Figure 8 to Figure 12).
   - Note that the software requires Microsoft Windows Installer and Microsoft .NET Framework 3.5 (or higher). The installer connects to the Internet and downloads Microsoft .NET Framework automatically. Alternatively, before running the `ADI_Int-N_Setup.msi`, both the installer and .NET Framework can be installed from the CD provided.

3. Connect your SDP board (black) or USB adapter board (green) by USB. If you are using an SDP board, the drivers install automatically, and you are ready to run the software.
   - If you are using a USB adapter board on Windows XP, follow the steps in the Windows XP Driver Installation Guide section (see Figure 13 to Figure 16).
   - On Windows Vista or Windows 7, the drivers install automatically.

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### Windows XP Software Installation Guide

1. Click **Next**.

2. Choose an installation directory and click **Next**.
3. Click Next.

4. Click Continue Anyway.

5. Click Close.
3. Click **Next**.

![Figure 10. Windows Vista/7 Int-N Software Installation, Confirm Installation](image)

4. Click **Install**.

![Figure 11. Windows Vista/7 Int-N Software Installation, Start Installation](image)

5. Click **Close**.

![Figure 12. Windows Vista/7 Int-N Software Installation, Installation Complete](image)

---

**Windows XP Driver Installation Guide**

1. Choose **Yes, this time only** and click **Next**.

![Figure 13. Windows XP USB Adapter Board Driver Installation, Found New Hardware Wizard](image)

2. Click **Next**.

Note that Figure 14 may list *Analog Devices RFG.L Eval Board* instead of *ADF4xxx USB Adapter Board*.

![Figure 14. Windows XP USB Adapter Board Driver Installation, Installation Options](image)
3. Click **Continue Anyway**.

4. Click **Finish**.
EVALUATION BOARD SOFTWARE

The control software for the EV-ADF4002SD1Z accompanies the EV-ADF4002SD1Z on a CD. To install the software, see the Software Installation section.

To run the software, click the ADI PLL Int-N file on the desktop or in the Start menu.

On the Select Device and Connection tab, choose your device and your connection method, and click Connect.

Confirm that SDP board connected, ADF4xxx USB Adapter Board connected, or Analog Devices RFG.L Eval Board connected is displayed at the bottom left of the window (see Figure 17). Otherwise, the software has no connection to the evaluation board.

Note that, when connecting the board, it takes about 5 sec to 10 sec for the status label to change.

Under the File menu, the current settings can be saved to, and loaded from, a text file.

Figure 17. Software Front Panel Display—Select Device and Connection
The **Main Controls** tab controls the PLL settings (see Figure 18). Use the **Reference Frequency** text box to set the correct reference frequency and the reference frequency divider. The default reference on the software window is at 10 MHz.

Use the **RF Settings** section to control the output frequency. You can type the desired output frequency in the **RF VCO Output Frequency** text box (in megahertz).

In the **Registers** tab, you can manually input the desired value to be written to the registers.

In the **Sweep and Hop** tab, you can make the device sweep a range of frequencies or hop between two set frequencies.

In the **Latches/Registers** section at the bottom of the window, the values to be written to each register are displayed. If the background on the text box is green, the value displayed is different from the value actually on the device. Click **Write R Counter Latch** or **Write N Counter Latch** to write that value to the device.

![Software Front Panel Display—Main Controls](image-url)

**Figure 18. Software Front Panel Display—Main Controls**
EVALUATION AND TEST

To evaluate and test the performance of the ADF4002, use the following procedure:

1. Ensure that a VCO and loop filter are inserted on the board. Use ADIsimPLL to generate the loop filter component values.

2. Install the SDP-S software drivers. Connect the evaluation board to a PC using the supplied USB cable. Follow the hardware driver installation procedure that appears.

3. Connect the SDP-S connector to the EV-ADF4002SD1Z.

4. Connect a reference signal to J11 (or J5, if an edge mount connector is inserted).

5. Connect a spectrum analyzer to Connector J2.

6. Run the Int-N software.

7. Select the SDP board and the ADF4002 device in the Select Device and Connection tab of the software front panel window.

8. In the software window, set the VCO center frequency (Figure 19 uses a 400 MHz VCO). Set the PFD frequency as defined in ADIsimPLL, and program the reference frequency to equal that supplied to Connector J11 (or the TCXO). See Figure 20 for the suggested setup.

9. Measure the output spectrum. Figure 19 shows a 400 MHz output.

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**Figure 19. Spectrum Analyzer Display**

**Figure 20. Typical Evaluation Setup**
EVALUATION BOARD SCHEMATICS AND ARTWORK

Figure 21. Evaluation Board Schematic (Page 1)

Rev. A | Page 13 of 24
Figure 22. Evaluation Board Schematic (Page 2)
Figure 23. Evaluation Board Schematic (Page 3)

LE2 to synchronise two ADF4350 boards.

Board ID EEPROM (24LC08) must be on I2C bus 0, address is at user discretion.

Main I2C bus [Connected to blockfill SW – Pull up resistors not required].

W2R: Use this pin to power the SEP requires 4-7V 200mA.
Figure 24. Layer 1 (Component Side)
Figure 25. Layer 2 (Ground Plane)
Figure 27. Layer 4 (Solder Side)
## ORDERING INFORMATION

### BILL OF MATERIALS

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Description</th>
<th>Manufacturer/Part No.</th>
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<td>C1, C2, C3</td>
<td>Capacitor, 0805</td>
<td>User supplied</td>
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<td>C4, C6, C10</td>
<td>Capacitor, 0402, 0.1 μF, 16 V</td>
<td>AVX CM105X7R104K16AT</td>
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<td>C8, C12</td>
<td>Capacitor, Case A, 22 μF, 6.3 V</td>
<td>AVX TAJA226K006R</td>
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<tr>
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<td>SD103C, 6.2 V</td>
<td>ON Semiconductor MBR0520LT1G</td>
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<td>Avago HSMS-C170</td>
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<td>Hirose FX8-120S-SV(21)</td>
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<td>U4</td>
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<td>Microchip 24LC32A-I/MS</td>
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<td>Y1</td>
<td>VCO19V-XXXXXT</td>
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<td>Y2</td>
<td>Low profile/temperature compensated crystal oscillator, OSC_TCXO, 10 W</td>
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## RELATED LINKS

<table>
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<th>Resource</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADF4002</td>
<td>Product Page, Phase Detector / PLL Frequency Synthesizer</td>
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<tr>
<td>ADP3300</td>
<td>Product Page, High Accuracy anyCAP® 50 mA Low Dropout Linear Regulator</td>
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</table>
I2C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.