

**Analog Devices, Inc.
ADuC703x Flash Programming via LIN
LIN Windows Serial Downloader (LINWSD)**

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Purpose

The purpose of this document is to describe the *LIN Windows Serial Downloader (LINWSD)* application, which enables the programming of the ADuC7032 Series device's integrated Flash/EE.

This is a draft document and is subject to change.

It is assumed that the user is familiar with the ADuC7032 hardware.

Overview

The ADuC7032 series of microconverters from Analog Devices Inc. support the programming of the device's integrated Flash/EE via LIN [1]. This feature is targeted towards automotive applications where the ADuC7032 can be integrated into a *LIN network cluster* as a *LIN slave node*, thereby enabling the device to be programmed as required without the need to physically dismount the electronic control unit (ECU) that houses the ADuC7032 device.

This document describes a Windows-based option for programming the ADuC7032 device via LIN. This incorporates the use of a *LIN Dongle*, which connects an ADuC7032 Series device to the PC via USB (Universal Serial Bus).

The LINWSD application adheres to the ADuC7032 Series LIN download protocol requirements specification [1].

Introduction

This document provides the user with a simple step-by-step procedure on how to program the ADuC7032 using the LINWSD Windows-based LIN downloader application.

Setup

This section describes the setup of the required hardware components. Connect the LIN Dongle to the PC, on which the LINWSD application has been installed, via a USB cable (see also “Installing the driver for the ADuC7032 LIN Dongle” on page 5 of the document). The LIN dongle is then connected to the ADuC7032 device’s LIN interface. The hardware interconnection is illustrated in figure 1.

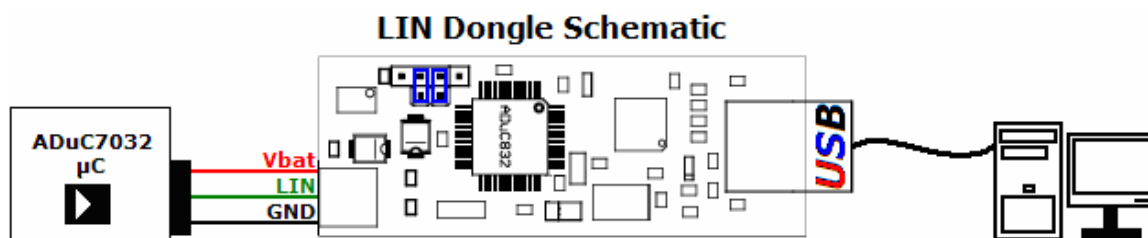


Figure 1 - Hardware setup for ADuC7032 LIN programming using the LINWSD

LINWSD

The LIN downloader application for the ADuC7032 Series devices is implemented by an executable file - *LINWSD.exe*.

Installing the LINWSD application

Unzip the file *LINWSD.zip*, which contains *LINWSD.exe* and its corresponding files, to the desired installation directory. Make note of this directory for future reference.

Create a shortcut to the LINWSD application on the desktop.



LIN Dongle

The *ADuC7032 LIN Dongle* is connected to the PC via a USB connection (Cable type: USB-A to USB-B).

Installing the driver for the ADuC7032 LIN Dongle

For first time connection the appropriate driver must be installed for the *ADuC7032 LIN Dongle*. Prior to connecting the LIN Dongle to the ADuC7032 device, connect the dongle hardware to an available USB port on the PC via the USB cable. The user will be prompted with the Microsoft Windows “*Found New Hardware Wizard*”, as shown in Figure 2.

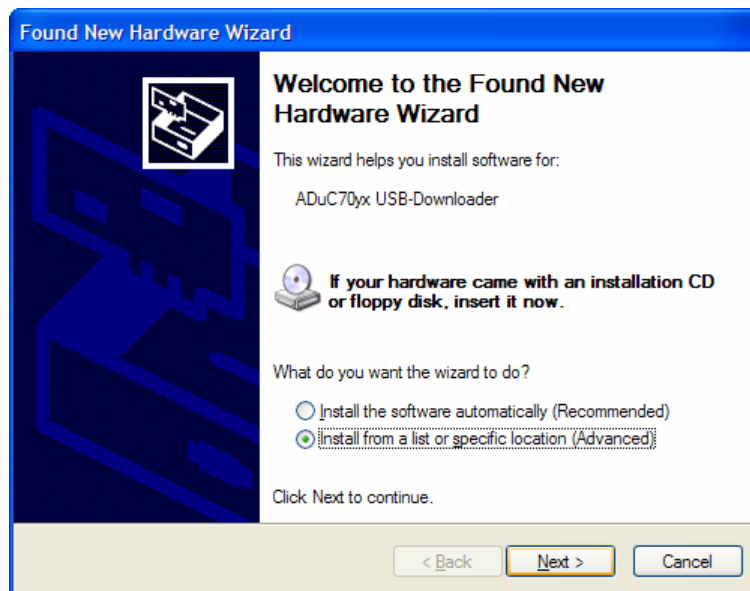


Figure 2 - Found New Hardware Wizard application

Select the ‘*Install from a list or specific location (Advanced)*’ radio button and click ‘*Next >*’.

The subsequent “...choose your search and installation options” screen is shown in Figure 3.

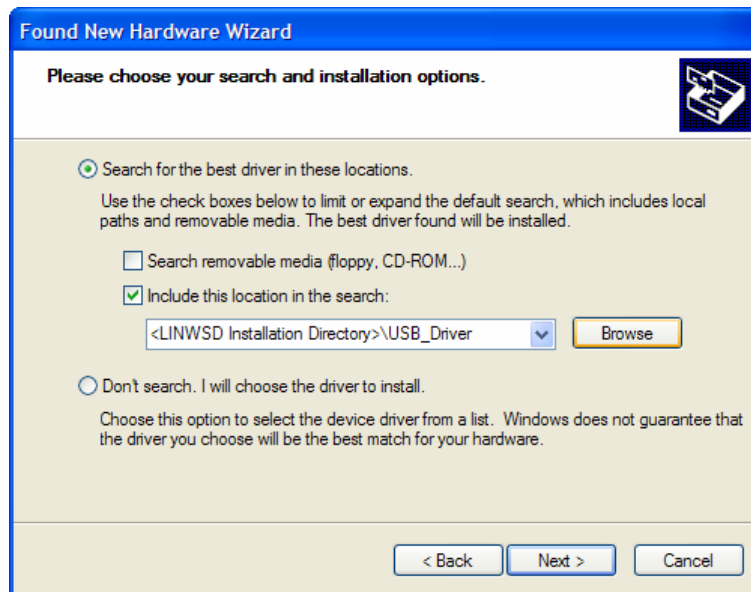


Figure 3 - Installing the LIN dongle driver [Screenshot 2]

Select the 'Search for the best driver in these locations' radio button and click 'Browse'. Browse to the installation directory (i.e. the location where the original *LINWSD.zip* file has been extracted to) and select the folder named 'USB_Driver'. This folder directory contains the driver required for successful installation of the ADuC7032 LIN Dongle. Click 'Next >'.

If prompted with the hardware installation warning shown in Figure 4, click 'Continue Anyway'.

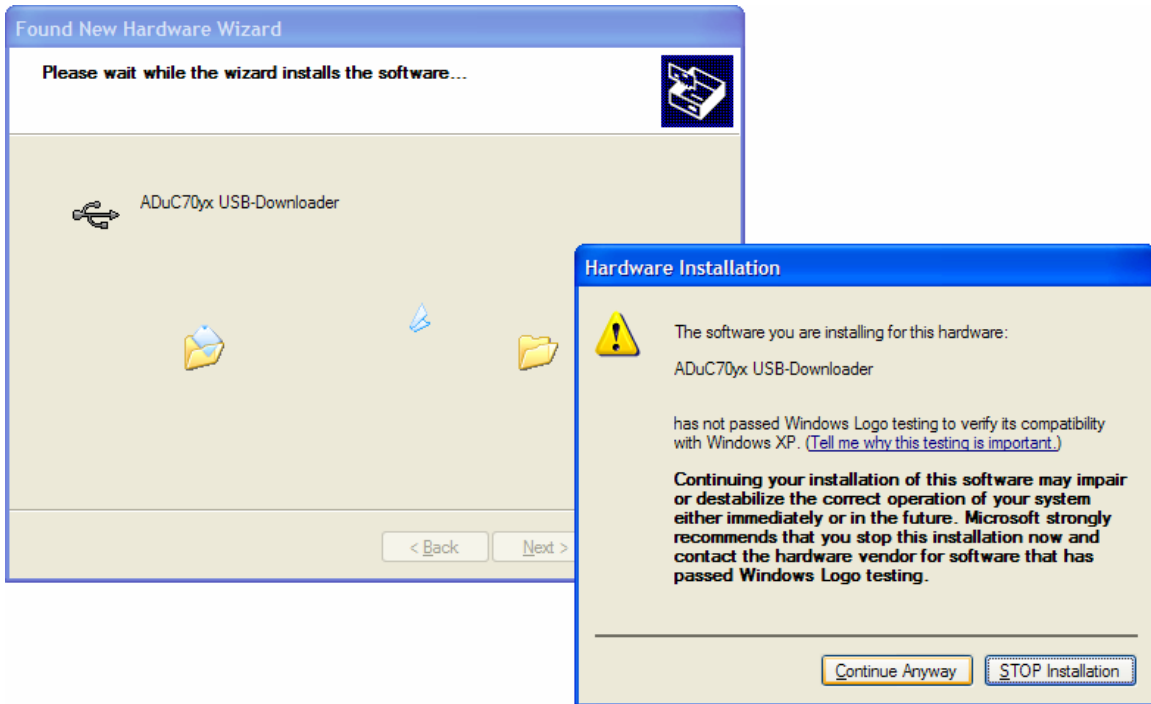


Figure 4 - Installing the LIN dongle driver [Screenshot 3]

When the window illustrated in Figure 5 appears, the installation of the LIN Dongle driver has been completed. Click 'Finish' to close the wizard.

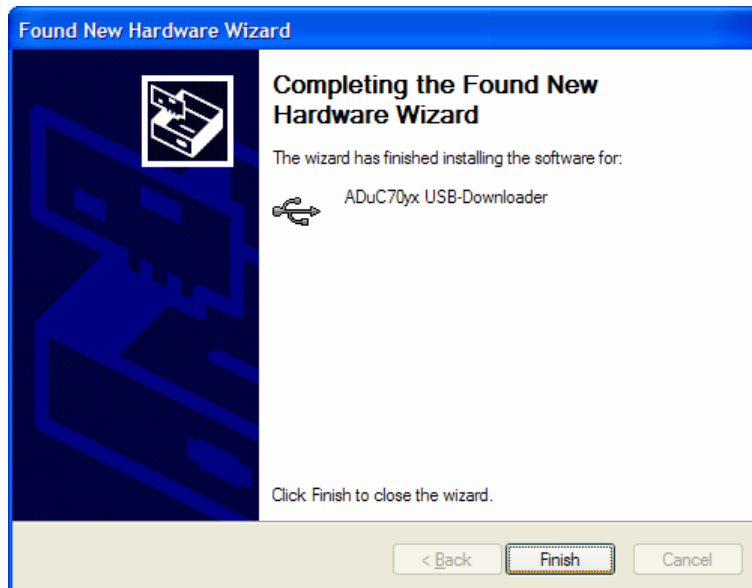


Figure 5 - Installing the LIN dongle driver [Screenshot 4]

In order to complete the hardware setup, simply connect the LIN Dongle to the corresponding header pins (i.e. Vbat, LIN and Ground) on the ADuC7032 device's hardware.

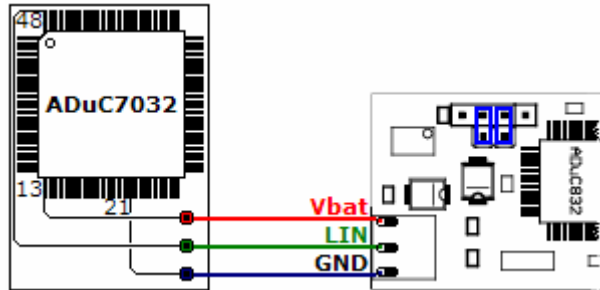


Figure 6 - ADuC7032 and LIN Dongle LIN connection

ADuC7032 Microconverter

The ADuC7032 Series of microconverters contain a kernel which implements the LIN download protocol as described in [1].

Procedure

The step-by-step procedure of programming the Flash/EE on the ADuC7032 device via LIN using the LIN Windows Serial Downloader (LINWSD) is described in this section.

How to...

1. Start the LINWSD application

To start the LINWSD application, double-click the LINWSD shortcut icon on the desktop.



If prompted by the “*Open File – Security Warning*” window shown in Figure 7, click ‘Run’.

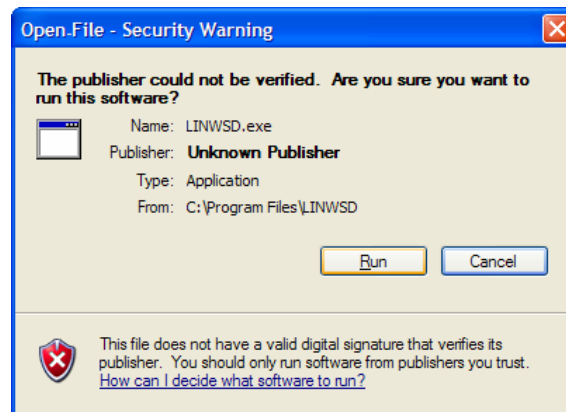


Figure 7 - Open File – Security Warning

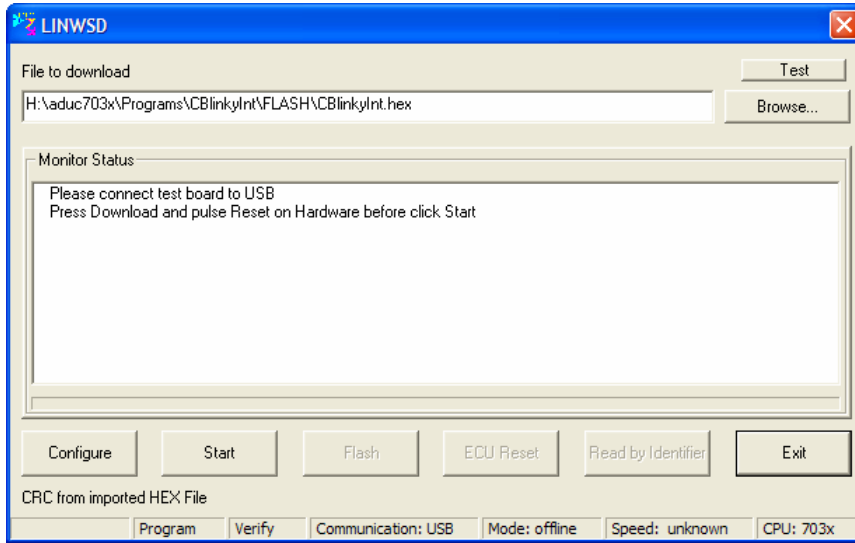


Figure 8 - LINWSD application main window

Figure 8 shows the main window of the LINWSD application.

2. Configure the LINWSD for the ADuC7032

Click on the 'Configure' button. The screen shown in Figure 9 will appear.

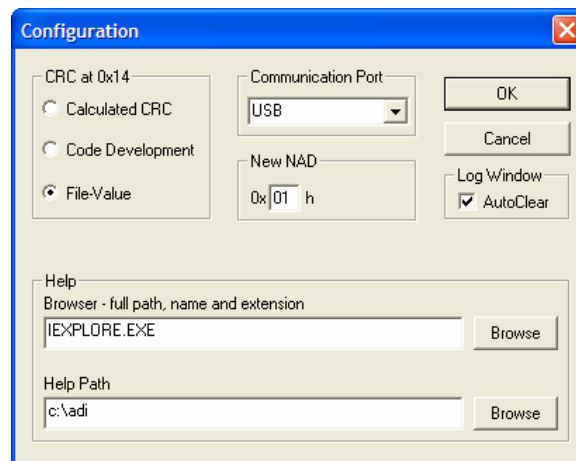


Figure 9 - LINWSD Configuration window

The configuration screen allows the user to configure the *Communications*, *Location 0x14* values, *New NAD* value and *Help* options.

Communications Port

Choose the desired *Communications Port*, i.e. USB.

CRC at 0x14

The user may choose the value that is to be stored at location 0x14 in flash upon completion of flash programming. The value determines how the ADuC7032 device will behave upon a reset, in accordance with [1]. The user can choose from the following options:

- i. *Calculated CRC*: the LINWSD automatically stores the calculated checksum of page 0 in flash at location 0x14 (i.e. normal operation). User code is executed if the sum of all the half words of page 0, excluding a 32 bit word at 0x14, equals the checksum.
- ii. *Code Development*: stores 0x27011970 at location 0x14. This value indicates code development for all ADuC703x Series parts. User code is executed immediately.
- iii. *File-Value*: stores some value which is specified in the download file.

New NAD

The user may specify the value that will be assigned to the ADuC7032 node as its new NAD (Node Address for Diagnostics) upon an *'AssignNAD'* diagnostic request.

Log Window

The user can choose whether the log window is cleared after every download or not by selecting/deselecting the *'AutoClear'* option.

Help

In the *'Browser'* edit box type the full path and application name of the browser that will be used for help.

In the *'Help Path'* edit box type the full path to the help files. If the location is unknown, search for *'AD_P.html'* and use its path.

Exit

Click the 'OK' button to fix these settings or 'Cancel' to discard the changes. If the popup window shown in Figure 10 appears, simply click 'OK' to dismiss it.

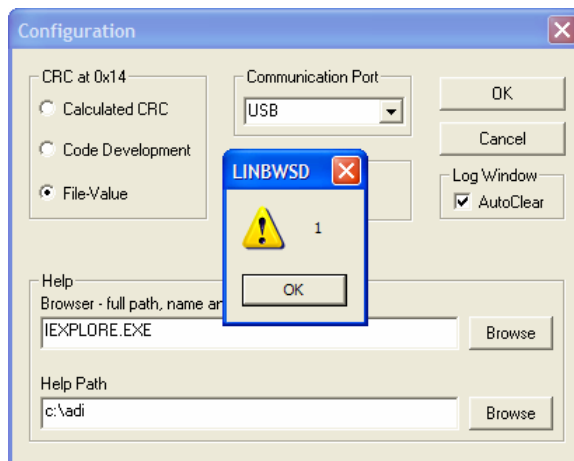


Figure 10 - LINBWSN NAD value warning popup window

All configuration settings are persistent and parameters are stored in the 'armwsd.ini' file, which is located in the same directory as the 'LINWSD.exe' file.

3. Specify the file for download

Either type in the location of the file in the 'File to Download' edit box or click the 'Browse' button and browse to the file location.

The file path is persistent and parameters are stored in the 'armwsd.ini' file, in the same directory as the 'LINWSD.exe' file, and will be reloaded the next time LINWSD is run.

4. Enter download mode of the ADuC7032 device

Entering download mode is described on page 3 of [1]. For convenience, a typical entry procedure is briefly described here:

- i. Ensure location 0x14 in Flash/EE memory is set to the 32 bit value: 0xFFFFFFFF
- ii. Hold the *nTRST* pin low (e.g. connect Pin 11 on the ADuC7032 to ground)
- iii. Perform a reset.

After a reset the kernel checks the *nTRST* pin to see which state it is in. If it is held low the kernel monitors location 0x14. If the 32 bit contents at that location equal 0xFFFFFFFF the kernel download mode is entered.

Note: If in the configuration window either the *Calculated CRC* or *Code Development* option is specified, the user will have to somehow corrupt the contents at location 0x14 in order to be able to perform a subsequent LIN download.

5. Download to the ADuC7032 using the LINWSD

The user must hold *nTRST* low and pulse reset on the ADuC7032 hardware in order to initiate the LIN download sequence.

On the LINWSD main window, click 'Start' to begin the "ADuC7032 Flash/EE Programming via LIN" download protocol sequence.

Click 'Flash' to commence programming of the ADuC7032 devices integrated Flash/EE. The LINWSD application provides the user with a log on the status of the LIN download via the log window as shown in Figure 11.

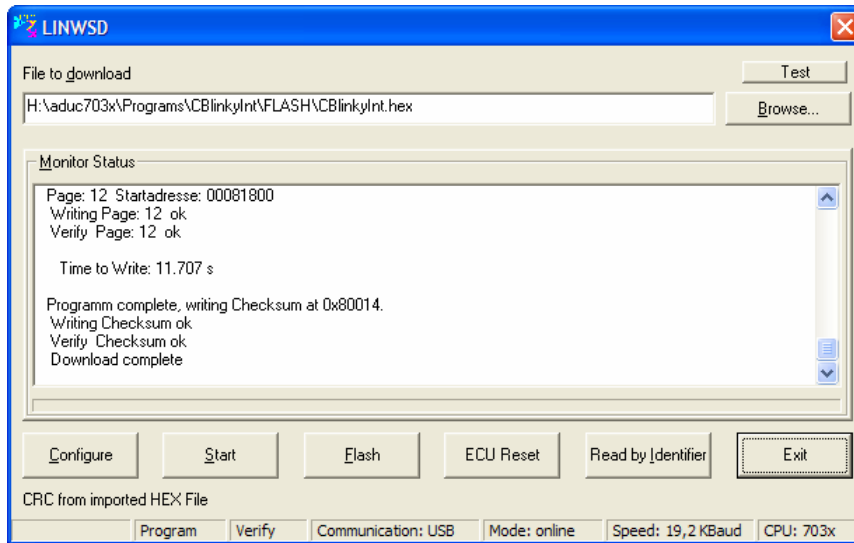


Figure 11 - LIN download log

6. Request the ‘Read by Identifier’ LIN diagnostic service

The ADuC7032 Series LIN Flash programming specification enables the user to access user-predefined values from memory. This is achieved by requesting the ‘*ReadByIdentifier*’ LIN diagnostic service. The identifiers that are defined for the ADuC7032 Series are summarized in Table 1.

Identifier	Description	ADuC7032 Response	Memory Range
0x00	LIN Identification information	NAD 0x06 0xF2 0x3A 0x00 0x32 0x00 0x00	N/A
0x32	User-defined 5 byte value	NAD 0x06 0xF2 0x-- 0x-- 0x-- 0x--0x--	0x977ED -> 0x977F1
0x33	User -defined 5 byte value	NAD 0x06 0xF2 0x-- 0x-- 0x-- 0x--0x--	0x977F2 -> 0x977F6
0x34	User -defined 5 byte value	NAD 0x06 0xF2 0x-- 0x-- 0x-- 0x-- 0x--	0x977F7 -> 0x977FB

Table 1 – Read by Identifier response information

Click ‘*Read by Identifier*’. The LINWSD will return the corresponding information as shown in Figure 12, where the values returned for identifiers 0x32, 0x33 and 0x34 are examples, and will in fact be user-specific.

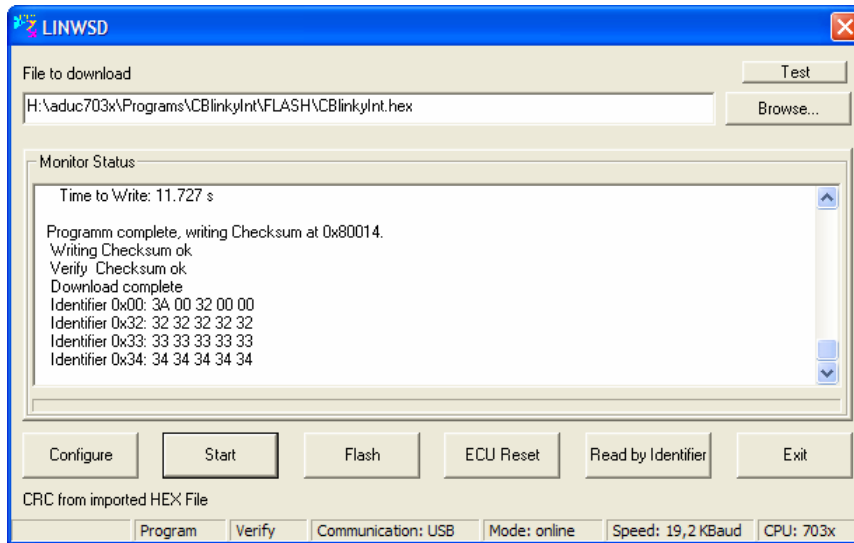


Figure 12 - Sample Read by Identifier responses

7. Reset the ADuC7032

When download is complete click '*ECU Reset*'. This restarts the kernel and Steps 3 - 5 must be repeated as necessary for further downloads, as per the instructions shown in Figure 13.

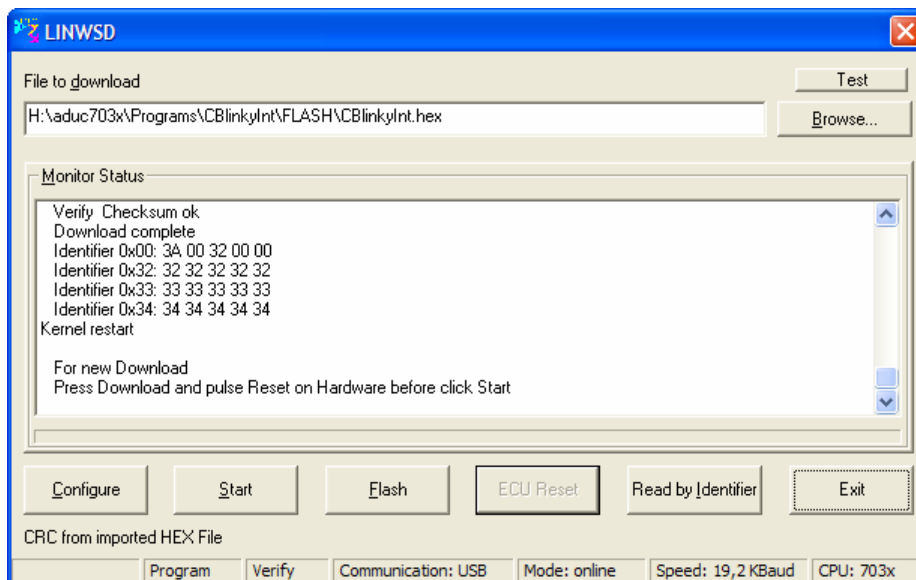


Figure 13 – ECU Reset notification

The programming of the ADuC7032 device's integrated Flash/EE via LIN is now complete.

Click '*Exit*' to close the LINWSD application.

References

- [1] Analog Devices Inc., 'ADuC703x Flash Programming via LIN', Rev. 04, November 2005.