
Cirrus Logic CobraNet® Developer Tips for CS1810xx / CS4961xx Devices

1. INTRODUCTION

This document contains a compendium of information useful in the development of products based on the Cirrus Logic CS1810xx and CS4961xx CobraNet® devices. It is intended as an initial guideline for hardware and software engineers, which are new to the development of designs using CobraNet devices.

The information required for product development is also contained in various application notes, data sheets and manuals available on the Cirrus Logic and CobraMC websites.

The CobraMC website is a password protected site which provides support for CobraNet OEMs. Access to this site is provided to qualified customers upon execution of a standard non-disclosure agreement (NDA) with Cirrus Logic. Please contact your local Cirrus Logic distributor or sales representative in order to execute an NDA and gain access to this site and any other protected materials described in this document.

1.1 Required References

It is compulsory to obtain and study the following references:

1. **CobraNet Programmer's Reference Manual** - Contains information on the control and setup of CobraNet devices. Most of the manual is a reference describing each of the configuration variables used to control and monitor a CobraNet interface.
2. **CobraNet Hardware User's Guide** - This is the data sheet for the CS181xx/CS4961xx chips. It contains a schematic for the CM-2 CobraNet module which can be used as a reference design.
3. **CobraNet Discovery User's Manual** - This manual is installed with CobraNet Discovery. CobraNet Discovery is an application used to monitor and control CobraNet devices and to update the firmware of CobraNet devices.
4. Application Notes:
 - a. **CobraNet Audio Routing Primer** — Basic information about setting bundle numbers and channel assignments
 - b. **Bundle Assignments in CobraNet Systems** — Considerations and guidelines when setting up audio bundles in a CobraNet installation. Ramifications of different settings and how they impact network performance and utilization.
 - c. **Integrating CobraNet into Audio Products** — Basic hardware design guidelines for CobraNet products. Much is focused on integrating CobraNet modules into audio equipment but a wealth of applicable information of a general nature and pertaining to chips is contained here.
 - d. **AN312, CobraNet Clocking Modes** — This application note is required for any manufacturer that intends to use any clocking mode other than the default. Proper use and support of CobraNet audio clocks is essential to correct operation of the individual devices and the audio network.
 - e. **AN279, Controlling and Monitoring DSP Conductor™ Configurations** — This application note describes how to access the R/W variables used to control the DSP parameters created with DSP Conductor.
 - f. **AN334, CS1810xx / CS4961xx Bing-up Instructions** — This application note describes how to get a newly manufactured CobraNet design up and running using either a pre-programmed flash or I²C® debugging tools.

2. CobraNet DISCOVERY

The CobraNet Discovery Software (also referred to as 'Disco') should be downloaded and installed. Disco provides the following indispensable functions:

- Discovers and displays all CobraNet devices on the network.
- Provides a user configurable watch window to monitor device health.
- Provides a firmware update function.
- Assigns IP addresses to CobraNet devices. **CobraNet device IP addresses are dynamic by default. A CobraNet interface will not have an IP address when powered up.** Disco is used to automatically or explicitly assign IP addresses when needed.
- Provides a GUI interface for changing commonly used configuration variables.
- Provides an advanced interface for changing or monitoring any CobraNet variable via SNMP.
- Provides a report generation function useful for documenting configuration and troubleshooting.

Read the CobraNet Discovery manual that is installed with the program.

3. FIRMWARE

It is important to select the correct Firmware when updating the CobraNet Flash memory as the Firmware needs to match the actual hardware.

CobraNet Firmware Matrix				
Platform		Firmware that will run on platform		
CM-2 and chip- based platforms	181002	cm18100_2_11_x.bin		
	181012	cm18100_2_11_x.bin	cm18101_2_11_x.bin	
	181022	cm18100_2_11_x.bin	cm18101_2_11_x.bin	cm18102_2_11_x.bin
	496102	cm49610_2_11_x.bin cm18100_2_11_x.bin		
	496112	cm49610_2_11_x.bin cm18100_2_11_x.bin	cm49611_2_11_x.bin cm18101_2_11_x.bin	
	496122	cm49610_2_11_x.bin cm18100_2_11_x.bin	cm49611_2_11_x.bin cm18101_2_11_x.bin	cm49612_2_11_x.bin cm18102_2_11_x.bin

Table 1: CobraNet Firmware Matrix

Note:

The CO2-boards from Atterotech, Inc. use the I²S digital audio format mode on the serial audio interface or SSI channels. Standard code will not work properly.

Please contact Atterotech, LLC at <http://www.atterotech.com> for support on binary code firmware images for Atterotech boards.

1. The latest version of CobraNet firmware is available on the Cirrus Logic website or on the CobraMC website.
<http://www.cirrus.com> — Public
<http://www.peakaudio.com/cobramc/> — Requires NDA
2. Specific firmware files (.bin files) are required for specific CobraNet devices. These are available for web download. Figure 1 above illustrates which firmware is compatible with which CobraNet devices.
3. CobraNet firmware is stored in external FLASH memory. Firmware must be loaded to FLASH before the device will function.
 - a. FLASH memory can be pre-programmed before soldering to the circuit board.
 - b. FLASH memory can be programmed in a development environment using an adapter card and software provided by Cirrus logic. The software is called CID and, along with CobraNet Discovery, can be used to load firmware to FLASH. The CID adapter connects to the CobraNet chip via the debug header JP1- CON4 as shown in the schematic in the appendix of the CobraNet Hardware User's Guide.
 - c. Refer to Cirrus Logic AN334, *CS1810xx / CS4961xx Bing-up Instructions* provided with the CID for complete instructions.
4. CobraNet Discovery is primarily an end user tool and contains a feature that prevents the user from loading incorrect firmware to a device. It may be necessary to override this feature when updating a device's firmware in a development environment so that unrecognized firmware can be selected and loaded. The update protection mechanism can be overridden by doing the following:
 - a. Make sure CobraNet Discovery is NOT running.
 - b. Open the `cn Disco.ini` file found in the *Program Files\Cirrus Logic\CobraNet Discovery* folder
 - c. Add the line: `Advanced Feature=1` to the [Configuration]

Note: The line is case and space sensitive.

```
[Configuration]  
Advanced Feature=1
```

- d. Save and close `cn Disco.ini`.
- e. Launch CobraNet Discovery.
- f. Now, when the firmware selection screen is displayed, there will be a new checkbox labeled: *Show all Firmware Versions*.
- g. Check this option and all firmware in the firmware directory will be available for selection.

Warning: Use this option carefully as it will be possible to update incompatible firmware with this option enabled.
- h. Once this has been done, CobraNet Discovery will then enter the code version into its database and it will be recognized thereafter without need to check *Show all Firmware Versions*.

4. FIRMWARE CUSTOMIZATION

CNCustom is a program available to qualified manufacturer's which is used to create firmware binary image files with manufacturer specific default configuration settings. Most configuration variables described in the Programmer's Reference can be assigned other than default settings. Although any configuration variable's default value can be changed, the most common and useful changes are to:

- **sysDescription** — Identify the device with an ASCII string
- **firmwareMfgID** — A Cirrus Logic assigned integer defining the manufacturer of the device. Please contact your local Cirrus sales representative for a manufacturer ID number.
- **firmwareMfgProductID** — A manufacturer assignable integer **firmwareMfgVersion** — A manufacturer-assignable integer

Use of CNCustom will result in creation of a device specific firmware image that should be given a unique file name. It is important to observe proper naming conventions when choosing file names.

5. FIRMWARE NAMING CONVENTIONS

CobraNet firmware binary image files adhere to a standard naming convention necessary for recognition by CobraNet Discovery and the Python manufacturing script.

As an example, the file name *cm1800_0_11_6_2.bin* indicates that this is build 2 of pre-release version 0.11.6 targeted at a CS18100 chip with two MAC/PHY chips attached.

- Decode for standard Cirrus supplied firmware:

The first two alpha characters will be *cm* or *cs.*, i.e. *cm1800_2_11_6.bin*

cm indicates a build for a dual MAC/PHY interface

cs indicates a build for a single MAC/PHY interface

- The next characters before the first '_' can be anything but, in the case of Cirrus standard builds, indicates the target device *cm1800_2_11_6.bin*.

This could be:

18100, 18101, 18102, 49610, 49611, or 49612 for 32-bit platforms.

12, 14, or 18 for 8x8, 16x16, or 32x32 channel CM-1 builds respectively.

- The digits following the first '_' and separated by underscores indicate the firmware revision *cm1800_2_11_6.bin*.
- A leading 0, instead of the 2, as in this example, would indicate a pre-release version. In this case there will often also be a fourth digit indicating the build number. i.e. *_0_11_6_3* indicates build 3 of a pre-release version. Build numbers may, but are typically not, included in the released code filename.
- A manufacturer can name firmware created by them as desired provided that the naming convention is followed.
- The first part of the name can be any string. The first underscore '_' indicates the beginning of the revision number is indicated.
- For example, a manufacturer could use a file name similar to the following:

AudioMatic3_2_11_6.bin

Where **AudioMatic3** is defined by the manufacturer, but all characters following the first underscore adhere to the revision indication convention. Note that you cannot put underscores in the leading string. The revision numerals are delimited by underscores and must always be present in the proper locations. Underscores cannot be used in the name for any other purpose.

6. MAC ADDRESSES

- Each CobraNet device must be assigned a unique MAC address. Cirrus Logic provides a Python script that is used to assign unique MAC addresses. This is done via the network after valid firmware has been loaded to FLASH. The process updates the existing firmware as well as updating the MAC address. Instructions for downloading and installing the required Python framework as well as for use of the script are provided by Cirrus to qualified manufacturers.
- It is useful when using pre-programmed FLASH to preprogram the FLASH with the lowest-common-denominator firmware (see [Table 1 on page 2](#)) in order to insure that the stock of FLASH chips on hand can be used with any version CobraNet chip. Subsequent use of the Python manufacturing script is then used to update the firmware with the correct MAC address and with the latest firmware appropriate to the target platform.
- MAC addresses are available from the IEEE or can be provided to qualified manufacturers by Cirrus Logic.

7. DSP CONDUCTOR™

- This is a development tool used by manufacturers to easily create DSP code for the CS4961xx family of devices.
- A downloadable binary image incorporating user selected DSP functions, and based on current CobraNet firmware, can be created using DSP Conductor.
- Distribution to, or use by, end users of DSP Conductor is strictly prohibited.
- Refer to the application note AN279 for instructions on how to control DSP functions.
- DSP Conductor, as a development tool, loads DSP code to a target device's RAM, not to its FLASH memory. Once the design is finished and stable, use *Tools > Generate Deliverables > Patch Image...* to create a firmware file which can be downloaded to the target device's FLASH memory by using CobraNet Discovery.
- Refer to the PDF manual included with DSP Conductor for usage instructions

8. BOARD HARDWARE DESIGN CONSIDERATIONS

- The CM-2 design published in the appendix of the *CobraNet Hardware User's Guide* can be used as a reference design. Note that this is a proven design, so deviations from this design example are strongly discouraged.
- It is also recommended that the design guidelines and tips presented in the *"Integrating CobraNet Into Audio Products"* application note be respected.
- Good supply bypassing, grounding and stable power supplies are essential to good performance, particularly in the areas of the MAC/PHY supply and PLL supply (1.8V analog supply on the chip). These are particularly sensitive to stability and noise issues.
- The following signals are required to be present / connected to the CM-2 boards in order to operate properly with the standard firmware.
 - All GND and 3.3 V supply lines connected and properly bypassed.
 - The CM-2 provides MCLK at 12.288 MHz to an external audio source/sink; which is required to operate in slave mode and left-justified digital audio format.
 - The CM-2 provides a SCLK signal at $64 * LRCK = 3.072$ MHz to an external audio source/sink, which is required to operate in slave mode.

- which is required to operate in slave mode.
- The CM-2 provides a LRCK signal at 48 kHz (Sampling Rate or Fs) to an external audio source/sink, which is required to operate in slave mode.
- The external audio source/sink provides digital audio data to / receives from the CM-2 module.
- An external active-low reset signal in accordance with the hardware specifications is applied.
- There are two deviations from the standard reference design that can be safely made at the designer's option:
 - Refer to U4 on page 2 of 7 of the reference design. This device is used to select between an external audio master clock and the local VCXO generated master audio clock. This MUX can be omitted when use of an external master clock is not required. The master audio clock can be connected from the VCXO to the CobraNet processor. The series termination resistor should be retained. If the clock will be used by more than one load then it should be buffered. Application Note AN312 should be carefully read and understood if other than the standard clocking mode 0x00 will be used.
 - Refer to U11 and U10C on page 4 of 7 of the reference design. The audio word clock (FS1) is taken from pin 22 or pin 14 of the CobraNet chip depending on whether or not a 16x16 channel device is used. This circuit will automatically select the correct pin based on clock activity. If the design does not require this flexibility (most do not), then FS1 can be hardwired from Pin 14 for 16x16 channel devices or from Pin 22 for other devices. R53, the series termination resistor, should be retained.

9. CobraNet SILICON SERIES DEVICE DIFFERENCES

The CS18100, CS18101, CS18102, CS49610, CS49611 and CS49612 are members of the Cirrus Logic CobraNet® Silicon Series of devices. They differ from each other based on the presence of a user-programmable audio DSP core and in the number of audio channels supported. They are otherwise identical devices.

- The package and pinout are the same for all three parts.
- The word clock (FS1) changes from pin 22 to pin 14 for the CS18102 and CS49612. See [Figure 2](#).
- The bit clock (SCLK) is the same for all parts.
- For all parts, regardless of which pin is used for FS1, **DAO1_LRCLK** and **DAI1_LRCLK** should be tied together.
- The SSI channels run at 128FS (4 channels per SSI) for CS18102/CS49612 and 64FS (2 channels per SSI) for all other parts.
- Only **DAO1_DATA0** and **DAI1_DATA0** are active for CS18100/CS49610. All three lines, **DAO1_DATA[3:0]** and **DAI1_DATA[3:0]** are active for all other parts.
- The firmware running on each part is specific to that part.
- The following CobraNet features are only available in CS1810xx-based systems and **are not** available on the CS4961xx platform: Audio meters (audioMeter...), loopback (audioLoop...) and duplication (audioDup...). If required in a CS4961xx-based system, this functionality is easily achieved with DSP Conductor primitives.

9.1 CS18100/CS49610

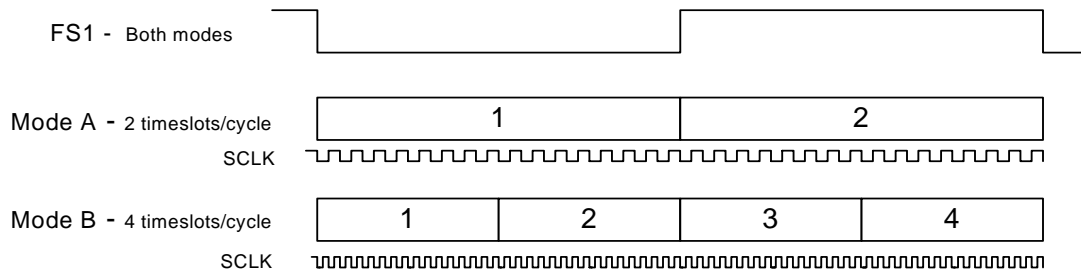
- One SSI channel is supported allowing input of 2 audio channels and output of 2 audio channels simultaneously. This channel runs at 64 FS. See Mode A in [Figure 1](#).
- 48-kHz or 96-kHz sample rates are supported.
- **DAO1_LRCLK** on pin 22 is used for FS1 (word clock). See [Figure 2](#).

9.2 CS18101/CS49611

- Four SSI channels are supported allowing input of 8 audio channels and output of 8 audio channels simultaneously. These channels run at 64 FS. See Mode A in [Figure 1](#).
- 48-kHz or 96-kHz sample rates are supported.
- **DAO1_LRCLK** on pin 22 is used for FS1 (word clock). See [Figure 2](#).

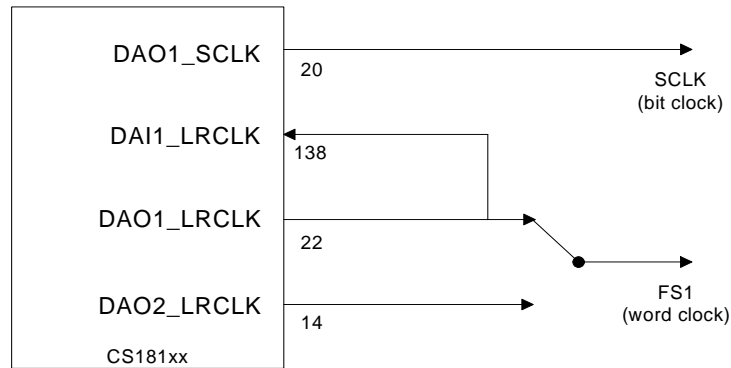
9.3 CS18102/CS49612

- Four SSI channels are supported allowing input of 16 audio channels and output of 16 audio channels simultaneously. These channels run at 128 FS. See Mode B in [Figure 1](#).
- 48k-Hz sample rate is supported.
- **DAO2_LRCLK** on pin 14 is used for FS1 (word clock). See [Figure 2](#).



Mode A: CS18100, CS18101, CS49610, CS49611
 Mode B: CS18102, CS49612

Figure 1. Normal Mode Timing



In all cases: Pin 22 is connected to Pin 138 (DAO1_LRCLK, DAI1_LRCLK)
 For CS18100, CS18101: FS1 is taken from Pin 22 (DAO1_LRCLK)
 For CS18102: FS1 is taken from Pin 14 (DAO2_LRCLK)

Figure 2. Audio Clock Connections

10.DIFFERENCES BETWEEN CM-A AND CM-2 INTERFACES

Detailed information on the points referred to here are available in the *CobraNet Programmer's Reference Manual* and the *CobraNet Hardware User's Guide* available for download at <http://www.cirrus.com>.

- There is an additional address line on the CM-2. See schematic for connector pin out. This line should always be driven or tied low. The CM-2 module contains a pull-down resistor on this pin allowing it to be left unconnected.
- CM-2 uses a single 3.3V supply. It does not use 5V. If a 5V supply exists on the connector it can be left in place in order to gain an additional AC return path.
- Placement of bypass caps on the supply lines close to the connector is recommended, even on the unused 5V line.
- Four of the serial I/O (SSI) lines (see CM-2 schematic) have pull-up / pull-down resistors used by the processor to determine the boot mode. If you have pull-ups / pull-downs on the host side of the connector to terminate unused SSI lines, make sure the values are high (> 50k Ohm) so they do not overpower the on-board resistors.
- The HMI interface differs. There is a code example in the *Hardware User's Guide* which illustrates how to auto-detect presence of a CM-1 or CM-2. This code can be used to determine module type and appropriate interface protocol to use. There are also examples showing how to properly use the CM-2 interface. The most significant command change involves use of the *Translate Address* and *Goto Address* commands recommended in lieu of the *Set Address* command.
- Polarity of HREQ changes on chips and CM-2 modules depending on transfer direction.
- The HMI interface on CM-2 and chips is 32 bits wide, but most data is still contained within a 24-bit window of that 32 bits. There are some exceptions. Please refer to the *Programmer's Reference* and *Hardware Manual* for possible changes to variables that will be used. The MSB must be nulled, if not used.
- The setup and hold timing has changed between the modules. This could be an issue, if the processor connected to the HMI features high speed interfaces. Please review the timing diagrams in the *Hardware's User's Manual* to insure HMI interface timing compliance.
- The same Flash memory type is used for CM-1 and CM-2 modules.

11.CONNECTION STATUS DETECTION

- Detection of the current connection status of CobraNet nodes can be easily accomplished by reading MIB-variables.
- An array variable called **ifmtStatus** provides the current connection status and one variable exists for each Ethernet interface. It can be accessed via SNMP or as an HMI variable.
- During normal operation, **ifmtStatus** will show a value of 0x07. At least, it should show 0x03 if the link is present as a full duplex connection.
- Please refer to page 118 of the *Programmer's Reference Manual* version DS651PM25 for information on this variable.

12.CM-2 MODULE INTERFACE CONNECTORS

- The mating connectors for the CM-2 modules are manufactured by Samtec, type SQW-120-01-L-D-VS-A. Please refer to <http://www.samtec.com> for details and ordering samples.

Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative.
To find one nearest you go to <http://www.cirrus.com>

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