56F83xx

SCI/CAN Bootloader

User Manual

56F8300
16-bit Digital Signal Controllers

MC56F83xxBLUM
Rev. 6.0
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About This Document

This manual describes the 56F83xx SCI/CAN Bootloaders application.

The Bootloaders application was not designed for the 56F81xx devices. The 56F83xx Bootloaders application does, however, fully support 56F81xx software development.

Audience

This manual targets software developers utlizing the 56F83xx Bootloaders applications.

Organization

This User's Manual consists of the following sections:

- **Chapter 1, Bootloader** -- describes the serial and CAN Bootloaders applications provided with the FlexCAN driver
- **Chapter 2, License** -- provides the license required to use this product
- **Appendix A** -- describes the tests and performance of the SCI Bootloader
- **Appendix B** -- describes the tests and performance of the CAN Bootloader

Suggested Reading

We recommend that you have a copy of the following references:

- *DSP56800E Reference Manual,* Freescale, DSP56800ERM
- *56F8300 Peripheral User Manual*, Freescale, MC56F8300UM
- *Inside CodeWarrior: Core Tools*, Metrowerks Corp.
- *NI-CAN User Manual*, National Instruments

Conventions

This document uses the following notational conventions:

Typeface, Symbol or Term	Meaning	Examples
`Courier Monospaced Type`	Code examples	`//Process command for line flash`
Italic	Directory names, project names, calls, functions, statements, procedures, routines, arguments, file names, applications, variables, directives, code snippets in text	...and contains these core directories: *applications* contains applications software... ...CodeWarrior project, *3des.mcp* is... ...the *pConfig* argument.... ...defined in the C header file, *aec.h*....
Bold	Reference sources, paths, emphasis	...refer to the **Targeting DSP56F80x Platform** manual.... ...see: **C:\Program Files\freescale\help\tutorials**
Blue Text	Linkable on-line	...refer to Chapter 7, License....
Number	Any number is considered a positive value, unless preceded by a minus symbol to signify a negative value	3V -10 DES^{-1}
ALL CAPITAL LETTERS	# defines/ defined constants	# define INCLUDE_STACK_CHECK
Brackets [...]	Function keys	...by pressing function key [F7]
Quotation marks, “...”	Returned messages	...the message, “Test Passed” is displayed.... ...if unsuccessful for any reason, it will return “NULL”...

Definitions, Acronyms, and Abbreviations

The following list defines the acronyms and abbreviations used in this document. As this template develops, this list will be generated from the document. As we develop more group resources, these acronyms will be easily defined from a common acronym dictionary. Please note that while the acronyms are in solid caps, terms in the definition should be initial capped ONLY IF they are trademarked names or proper nouns.

CAN	Controller Area Network
CAN ID	CAN Identifier
IDE	Identifier Extension
FlexCAN	Flexible Controller Area Network
RAM	Random Access (read/write) Memory

References

The following sources were used to produce this book:

1. *DSP56800E Reference Manual,* Freescale, DSP56800ERM/D
2. *CAN Specifications*, Version 2.0, 1991, Robert Bosch GmbH
3. *NI-CAN User Manual,* National Instruments

Chapter 1
Bootloader

1.1 Bootloaders

Note: *CAN applications are NOT supported on 56F81xx devices*

The Bootloaders for the 56F83xx devices were developed to load and run a user's application by parsing an S-Record file, then copying the parsed S-Record file into the appropriate Program and Data memory. **Figure 1-1** illustrates the S-Record flow.

The Bootloader supports two communication methods:

- via SCI peripheral
- via CAN bus peripheral

The Bootloader can be used for the following 56F83xx part numbers:

- 56F832x devices
  - MC56F8322
  - MC56F8323
- 56F834x devices:
  - MC56F8345
  - MC56F8346
  - MC56F8347
- 56F835x devices:
  - MC56F8355
  - MC56F8356
  - MC56F8357
- 56F836x devices:
  - MC56F8365
  - MC56F8366
  - MC56F8367

1.1.1 Concept

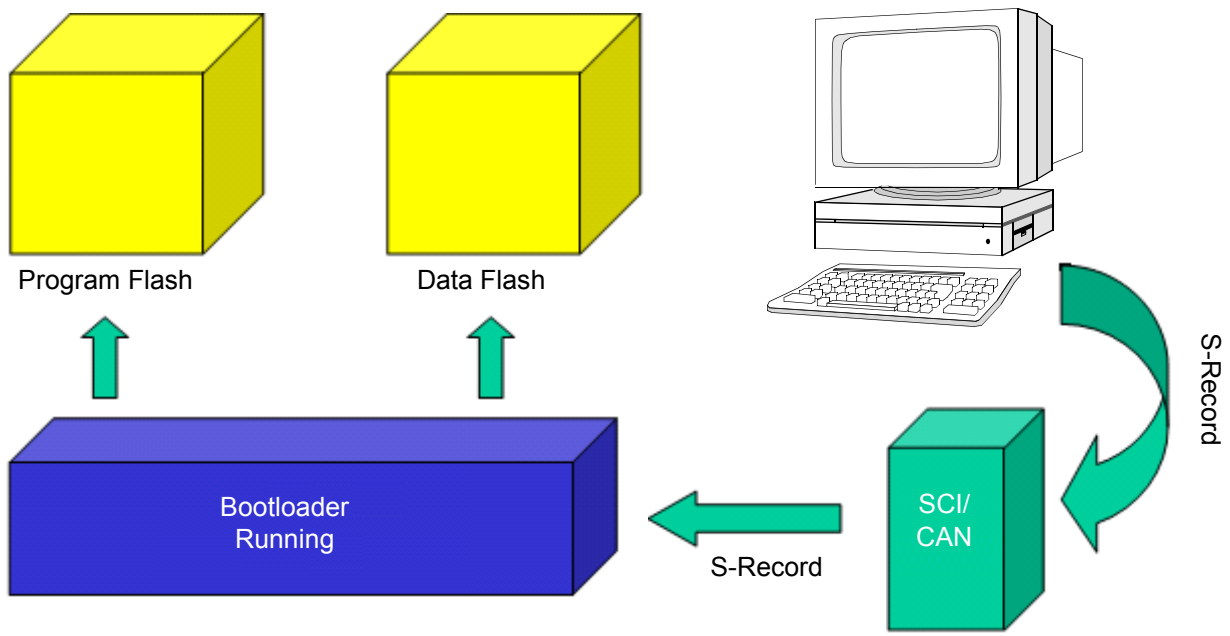


Figure 1-1. Programming Flash on a 56F83xx Device

The Bootloaders are located in a dedicated Program Memory region of the 56F83xx device, called Boot Flash. The Bootloaders application first performs a mass erase of the entire program Flash and then reads the S-Record file of the user's application (generated by CodeWarrior, for example) via an SCI or CAN interface. It then parses the S-Record lines and stores code and data in Program and Data Flash memory.

When the processing of the S-Record file is finished, the Bootloaders launch the loaded application. If an error occurs during the loading of the S-Record file, the Bootloader outputs an error message with an error number via the serial connection and waits for a processor reset.

1.1.2 BootLoader Clock Generation

The 56F834x, 56F835x, and 56F836x Bootloaders use an off-chip crystal to generate the clock for the processor. A 56F832x Bootloader can use either its internal relaxation oscillator or an off-chip crystal for processor clock generation. In all cases, the Bootloader determines how the clock is generated and makes the necessary adjustments.

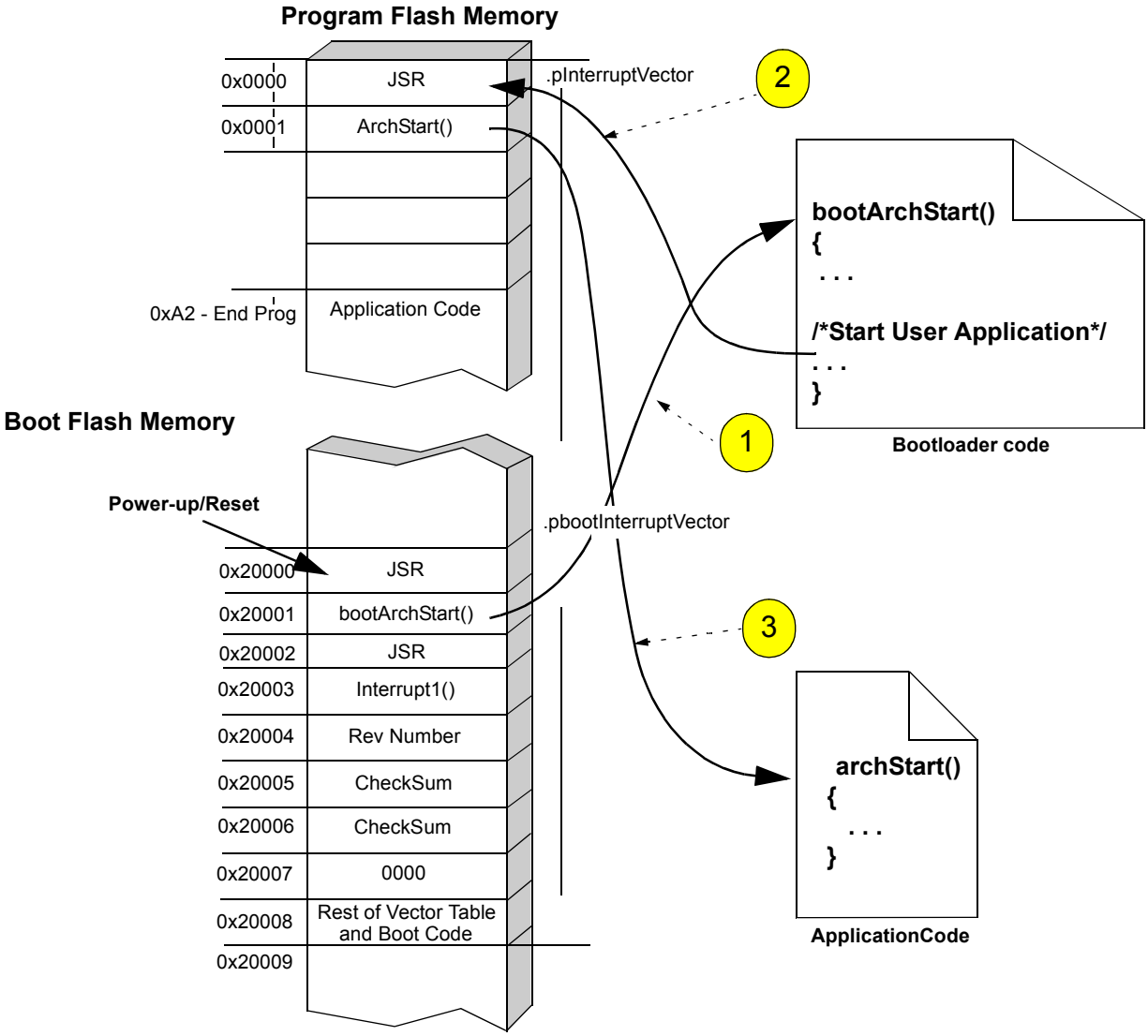
1.1.3 Bootloader Version History

Table 1-1. Software Revision Description

Version Number	Description
1.0.0	• Did not write entire trim register value for 832x on-chip oscillator (See FAQ #21234) • Wrote FMCLKD register independent of Flash programming which prevents user application from writing. This bug only affects customers that need to program Flash at run-time with system clock rates outside of the range of 38.4 to 51.2MHz. • COP reset vector programmed incorrectly preventing application use • See FAQ #25093
1.0.1	• Cleaned up code and documentation • Fixed 832x trim value • Added support for 835x
1.0.2	• First attempt to correct FMCLKD bug, which failed
1.0.3	• Fixed FMCLKD bug • Fixed COP reset vector to jump to Bootloader start • Added support for 836x • See FAQ #21042 for code and documentation

1.1.4 Start-up Sequence

Figure 1-2 illustrates the Start-up Sequence with the Bootloaders.



1. **Power-up/Reset --** The hardware reset vector identifies the address that the processor accesses when it recognizes a power-up or power reset. When the 56F83xx Bootloader is present, the **Bootloader Code** is executed first.
2. **Bootloading Process** -- When the 56F83xx Bootloader completes its execution, it transfers control to the **Application Code** by performing a JMP instruction to an address specified in the corresponding S-record file (default 0x0000).
3. **Jump to the User Application Code** -- The Application Code entry point is called by the JMP instruction from the 0x0000 address.

Figure 1-2. 56F83xx Boot Sequence with Bootloader

1.1.5 Device Peripheral Usage

The Bootloaders are used with the 56F83xx device configured in MODE 0 (MA = 0).

The Bootloaders use only internal Data RAM from 0x0000 to 0x0FFF and internal Program RAM for data buffering.

The Bootloaders initialize only the following 56F83xx device peripherals:

- SCI 0 for 56F836x devices
- SCI 0 for 56F835x devices
- SCI 0 for 56F834x devices
- SCI 1 for 56F832x devices
- CAN
- Timer A
- PLL initialization

Each peripheral is set to its default state when loading is complete.

1.1.6 Files

The Bootloader applications for the 56F836x, 56F835x, 56F834x and 56F832x targets are found in the following directory locations:

- If installed from FAQ zip file:
  - CAN version of Bootloader:
    ..\bootloader\can
  - SCI version of Bootloader:
    ..\bootloader\sci
- If generated from Processor Expert Examples Stationery:
  - All files will be located in the project folder specified by the user.

Each version of the Bootloaders' software includes the following files:

- Project file:
  - *bootloader.mcp*
- Main program:
  - *bootloader.c*
- Header file with common parameters:
  - *bootloader.h*

- Support file, *appconfig.c*:
  - ..*appconfig**appconfig.c*
- Support file, *appconfig.h*:
  - ..*appconfig**appconfig.h*
- Linker Command files:
  - ..*appconfig**56F836x_boot_flash_linker.cmd*
  - ..*appconfig**56F835x_boot_flash_linker.cmd*
  - ..*appconfig**56F834x_boot_flash_linker.cmd*
  - ..*appconfig**56F832x_boot_flash_linker.cmd*
- Flash configuration files:
  - ..*appconfig**56F836x_flash.cfg*
  - ..*appconfig**56F835x_flash.cfg*
  - ..*appconfig**56F834x_flash.cfg*
  - ..*appconfig**56F832x_flash.cfg*

1.1.6.1 Building and Loading the Bootloader

- To build and link a Bootloader application:
  - Open the *bootloader.mcp* project file for either the SCI or CAN Bootloader in the CodeWarrior IDE
  - Select the **56F836x, 56F835x**, **56F834x** or **56F832x** target
  - Execute the *Project/Make* command
- To build and download this application:
  - Open the *bootloader.mcp* project file for either the SCI or CAN Bootloader in the CodeWarrior IDE
  - Select the **56F836x, 56F835x**, **56F834x** or **56F832x** target
  - Execute the *Project/Debug* command

1.1.7 Configuration of the Bootloaders

The Bootloaders can be configured in two ways:

- **User's application** - The user's application can modify certain Data Flash Addresses at **run-time** to modify the configuration of the Bootloaders. These are described in more detail in **Section 1.1.7.1**.
- **Modifying the Bootloader application's *appconfig.h* file** - The *appconfig.h* file for the Bootloaders' project can be modified to change the Bootloader's configuration before burning the Bootloader into the 56F83xx device's Flash. This is described in more detail in **Section 1.1.7.2**.

1.1.7.1 User's Application Bootloader Configuration

The Bootloaders allow a user's application to configure certain parameters within the Bootloader during the **run-time** of the user's application. They are described in **Table 1-2**.

Note: The last 3 cells in the Data Flash memory are **reserved** for Bootloader configuration.

Table 1-2. Bootloader Configuration via User's Application

Parameter	Data Flash Address	Default Setting	Description
BOOT_START_DELAY	0x1FFD (low byte)	#define **BOOT_START_DELAY** 30	This macro defines the Bootloader inactivity interval in seconds, after which time the Bootloader passes control to the user's application. See **Table 1-2.**
BOOT_VERSION_PROMPT	0x1FFD (high byte)	#define **BOOT_VERSION_PROMPT** 0xFF	This macro defines whether the Bootloader displays a version prompt after reset. To turn off the version prompt, #define **BOOT_VERSION_PROMPT** to 0x00.

Note: The setting of Bootloader configuration parameters by an application is optional, except **BOOT_START_DELAY**. This parameter **must** be defined by the user's application.

Note: Data Flash locations 0x1FFE and 0x1FFF are used by the Bootloader to store the starting address of the user application.

The following example illustrates how a user configures his application to modify the delay start time to 20 seconds from the default of 30 seconds. Upon a power-on reset, the Bootloader application reads the **BOOT_START_DELAY** and **BOOT_VERSION_PROMPT** values and behaves according to **Table 1-3**.

The **user's application** *linker.cmd* file must contain the following:

```
...
.xBootCfg           (R)    : ORIGIN = 0x1FFD,  LENGTH = 0x0003
...
FORCE_ACTIVE {FCfg_StartDelay}
...
.ApplicationConfiguration :
{
      * (appconst.data)
} > .xBootCfg
...
```

Note: A user must define *.xFlash* within the *linker.cmd* file so there is no overlap with the previously described *.xBootCfg*.

The **user's application code** must contain the following:

```
#define BOOT_START_DELAY 20
#define BOOT_VERSION_PROMPT 0xFF

#pragma define_section bootcfg_section "appconst.data" R

#pragma section bootcfg_section begin
const unsigned short Cfg_StartDelay = (BOOT_VERSION_PROMPT << 8) |
                                      BOOT_START_DELAY;
#pragma section bootcfg_section end
```

Note: A user's application could easily incorporate a function that could change the current delay time dynamically by writing a value to 0x1FFD.

Table 1-3. Boot Start Delay Value

BOOT_START_DELAY	Result
0	Jumps immediately to the application's Start Address
1-254	Waits a specified number of seconds before the S-Record begins to download. If a message is not received before the delay time has expired, the Bootloader jumps to the application's Start Address.
255	Waits forever before the S-Record begins downloading

1.1.7.2 Bootloader *Appconfig.h* Configuration

The Bootloaders have certain parameters that can be set and configured from their default values by modifying the Bootloader application's *appconfig.h* file. These parameters are described in Table 1-4.

Table 1-4. Bootloader Configuration via Bootloader *appconfig.h*

Parameter	Default Setting	Description	Bootloader
BOOT_SCI_BAUD_RATE	#define **BOOT_SCI_BAUD_RATE** 115200 bps	Sets the SCI baud rate **NOTE: Maximum rate is 115200 bps**	SCI
USE_HYPERTERMINAL	None	#undef USE_HYPERTERMINAL	A user should define this parameter when using a hyperterminal program other than the *srecload* utility provided with the Bootloader software.

Note: The CAN Bootloader uses extended IDs associated with the CAN 2.0B spec. This is explained in detail in the **NI-CAN User Manual**.

1.1.8 Error Processing

Table 1-5 describes possible error messages receieved when utilizing the Bootloaders.

Table 1-5. Error Codes for the Bootloader Applications

Error Code	Error Title	Possible Reasons	What to Do
02	Invalid Character	The character received is not “S” or any hexadecimal digit	• Verify that S-Record file does not contain any inaccurate characters • Check connections and send mode in terminal program
03	Invalid S-Record Format	• Invalid record type; permitted types are 0,3,7 • The S-Record length is less than the address plus checksum length	• Verify S-Record file
04	Wrong S-Record Checksum	The checksum calculated around the S-Record received did not match the one received	• Check the S-Record file • Check connections and send mode in terminal program
06	Flash Programming Error	After programming a word into Flash, the programmed word read back is not equal to the expected value	• The Bootloader tries to program Flash only once and performs a read back / verification of the value
0C	CAN Error	CAN communication error	• Check the CAN connections and try to repeat download
0D	Low Voltage Interrupt	Low Voltage Interrupt occurred	• Check power and try to repeat download

1.1.9 Requirements for a User Application

The following restrictions apply if an application is loaded via the Bootloader:

- An application cannot place code into the **Boot Flash** memory area of the 56F83xx device
- Initialized variables from an application **cannot** be placed into internal Data RAM or into internal Program RAM while loading; therefore, the user’s application is responsible for initializing data after loading is complete
- The user’s application **must** fit within Program and Data Flash of the 56F83xx device

1.1.10 S-Record Generation

Figure 1-3 illustrates how a user's application can set up CodeWarrior to generate an S-Record needed by the Bootloaders to program the user's application into the 56F83xx device's Flash.

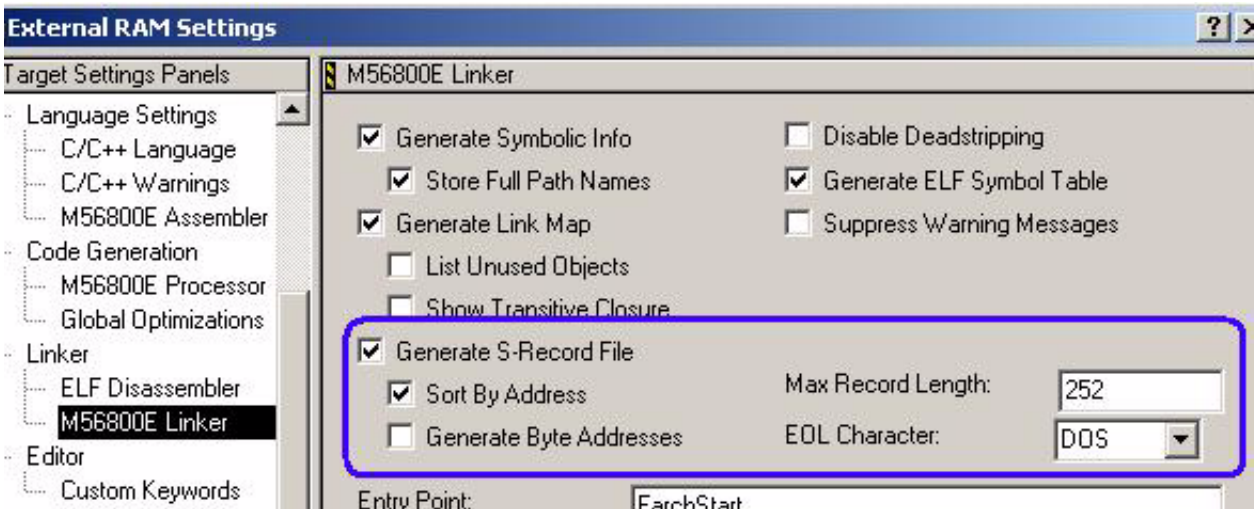


Figure 1-3. S-Record Settings in User Application's Project Settings

Note: "Max Record Length" and "EOL Character" are set to the default values shown in Figure 1-3. "Max Record Length" can be modified to up to 252. "EOL Character" can be changed to "Mac" or "UNIX" with no effect.

1.2 SCI Bootloader

The SCI Bootloader supports loading a user application presented as an S-record file via SCI by using a standard serial terminal program on a host PC; see Figure 1-4.

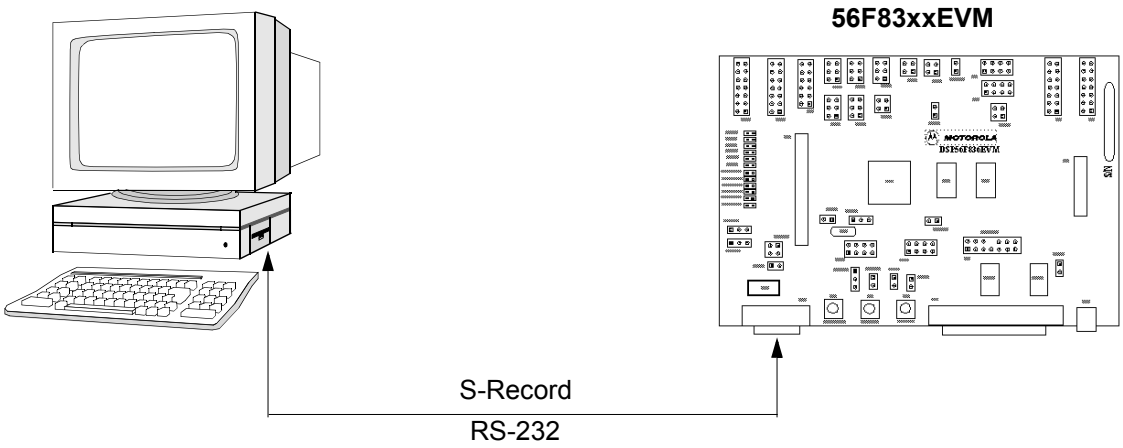


Figure 1-4. Loading a User's Application via SCI

1.2.1 Serial Terminal Programs

Most serial terminal programs can be used to download an S-Record file from a host to an 56F83xx device via the SCI Bootloader.

A PC Serial Host Loader utility has been developed for both the SCI and CAN Bootloaders. This utility is **optimized to speed up** the download time of the user's application S-Record. SCI options and use are described in **Section 1.2.1.2**.

1.2.1.1 Host Serial Terminal Program Configuration

A Host Serial Terminal program must be configured as follows:

Baud rate	115200 bps
8N1	8 data bits, no parity, 1 stop bit character format
Flow Control Protocol	Xon/Xoff

1.2.1.2 PC Host Loader Utility - SCI

The utility can be found at the following location,

- If installed from FAQ:
  x86\win32\applications\srec\srecLoad.exe
- If installed with CodeWarrior:
  <CodeWarrior_Installation_Directory>\ProcessorExpert\Tools\applications\srec\sRecLoad.exe

SCI options for the command-line PC Host Loader utility include:

-i:<Interface>	The COM port used for download - (COM1, COM2)
-s:<S-Record file>	The name of the S-Record file to download
-l:<logfile>	The name of the log file to log utility operations
-b:<baudrate>	The baud rate value for SCI (RS-232) **Default = 115200bps**

The following example shows how to use the utility with the SCI Bootloader:

```
srecLoad -i:COM1 -s:56F8346_flash.elf.S -b:115200 -l:log.txt
```

1.2.1.3 PC Host Loader Utility - CAN

The utility can be found at the following location,

- If installed from FAQ:
  x86\win32\applications\srec\srecLoad.exe
- If installed with CodeWarrior:
  <CodeWarrior_Installation_Directory>\ProcessorExpert\Tools\applications\srec\sRecLoad.exe

SCI options for the command-line PC Host Loader utility include:

-i:<Interface>	The CAN device name used for download (CAN0, CAN1)
-s:<S-Record file>	The name of the S-Record file to download
-l:<logfile>	The name of the log file to log utility operations
-b:<baudrate>	The baud rate value defines SCI or CAN speed to communicate with the Bootloader in bits per second (bps) **Default = 500000bps**
-r:<CAN ID>	The host request CAN ID to transmit S-record **Default = 20000001**
-a:<CAN ID>	Bootloader reply (acknowledgement) CAN ID **Default = 20000002**

The following example shows how to use the utility with the CAN Bootloader:

```
srecLoad -i:CAN1 -s:56F8346_flash.elf.S -b:500000 -r:20000001 -a:20000002
```

1.2.2 56F83xxEVM Jumper Settings

1.2.2.1 56F835xEVM or 56F836xEVM Jumper Settings

To load the Bootloader into the 56F835xEVM or 56F836xEVM device, the following jumper settings are needed:

- **Set Jumper JG4 -** "Int BOOT", (EXTBOOT pin on chip)
- **Do not connect Jumper JG10** - "RS-232 Disable"
- **Do not connect Jumper JG3 -** "CC Disable"

To start a previously loaded Bootloader on the 56F835xEVM or 56F836xEVM board while the parallel cable **is** connected to the EVM board, the following jumper settings are needed:

- **Set Jumper JG4 -** "Int BOOT", (EXTBOOT pin on chip)
- **Do not connect Jumper JG10 -** "RS-232 Disable"
- **Do not connect Jumper JG3 -** "CC Disable"

To start a previously loaded Bootloader on the 56F835xEVM or 56F836xEVM board while the parallel cable **is not** connected to the EVM board, use these jumper settings:

- **Set Jumper JG4 -** "Int BOOT", (EXTBOOT pin on chip)
- **Do not connect JumperJG10 -** "RS-232 Disable"
- **Set Jumper JG3 -** "CC Disable"

Note: All other 56F835xEVM jumper settings should be set to default values.

1.2.2.2 56F834xEVM Jumper Settings

To load the Bootloader into the 56F834xEVM device, the following jumper settings are needed:

- **Set Jumper JG3 -** "Int BOOT", (EXTBOOT pin on chip)
- **Do not connect Jumper JG7** - "RS-232 Disable"
- **Do not connect Jumper JG9 -** "CC Disable"

To start a previously loaded Bootloader on the 56F834xEVM board while the parallel cable **is** connected to the EVM board, the following jumper settings are needed:

- **Set Jumper JG3 -** “Int BOOT”, (EXTBOOT pin on chip)
- **Do not connect Jumper JG7 -** “RS-232 Disable”
- **Do not connect Jumper JG9 -** “CC Disable”

To start a previously loaded Bootloader on the 56F834xEVM board while the parallel cable **is not** connected to the EVM board, use these jumper settings:

- **Set Jumper JG3 -** “Int BOOT”, (EXTBOOT pin on chip)
- **Do not connect JumperJG7 -** “RS-232 Disable”
- **Set Jumper JG9 -** “CC Disable”

Note: All other 56F834xEVM jumper settings should be set to default values.

1.2.2.3 56F832xEVM Jumper Settings

To load the Bootloader into the 56F832xEVM device, the following jumper settings are needed:

- **Do not connect Jumper JG4** - “RS-232 Disable”
- **Do not connect Jumper JG3 -** “CC Disable”

To start a previously loaded Bootloader on the 56F832xEVM board while the parallel cable **is** connected to the EVM board, the following jumper settings are needed:

- **Do not connect Jumper JG4 -** “RS-232 Disable”
- **Do not connect Jumper JG3 -** “CC Disable”

To start a previously loaded Bootloader on the 56F832xEVM board while the parallel cable **is not** connected to the EVM board, use these jumper settings:

- **Do not connect JumperJG4 -** “RS-232 Disable”
- **Set Jumper JG3 -** “CC Disable”

All other 56F832xEVM jumper settings should be set to default values.

1.2.3 Loading an Application with the SCI Bootloader

- Set jumpers as described in **Section 1.2.2**
- Connect a parallel cable from the Host to the 56F83xxEVM (P1)
- Connect a serial cable from the Host to the 56F83xxEVM (P2)
- Apply power to the 56F83xxEVM (P3)

- Build and load the SCI Bootloader into Flash as described in **Section 1.1.6.1**
- Press the RESET button (S1) on the 56F83xxEVM
- Use the PC Host Loader utility as described in **Section 1.2.1.2**

If loading is successful, something similar to the following is displayed in the command window:

```
(c) 2003 MOTOROLA. S-Record loader for the MC56F83xx. ver. 1.0.1

Waiting for application
S-Record.....................................................................
.....................................................................
.....................................................................
........
Loaded 0x021FCC    bytes.
Application started from address 0x015D
```

If any error is detected while loading the S-Record file, the Bootloader displays an error message; see **Table 1-5** for a detailed list of error messages. For example, if an S-record file contains a character that is not permitted for S-Records, the following message is displayed:

```
"Error # 02"
```

After an error message is displayed, the Bootloader waits for a processor reset.

1.3 CAN Bootloader

Note: *The CAN Bootloader is NOT available on 56F81xx devices.*

The CAN Bootloader allows a user to load his application via an S-Record and CAN interface; see **Figure 1-5**.

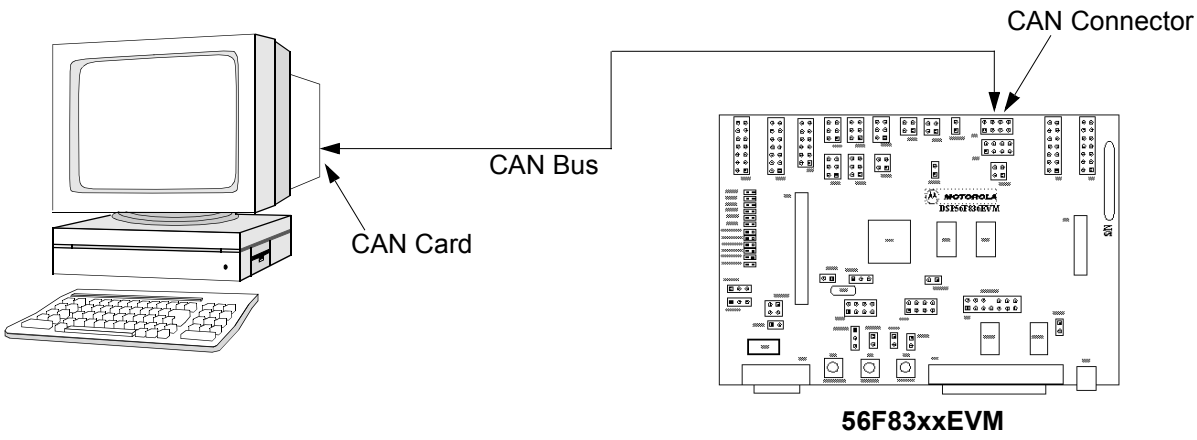


Figure 1-5. Loading User Code/Data via CAN Interface

1.3.1 CAN Bootloader Protocol

The CAN Bootloader supports the loading of a user's application via the CAN bus. A PC Host Loader utility sends an S-Record image file through a CAN bus in accordance with the CAN Bootloader protocol.

The entire S-Record image file may contain several S-Records. Each S-Record is transmitted according to the protocol presented in **Table 1-6** and **Figure 1-6**.

The CAN Bootloader protocol is based on two frames:

- S-Record **Segment frames** contain at least 8 bytes of the loaded S-Record
- **Acknowledgement frames** contain the target S-Record counter and the error field

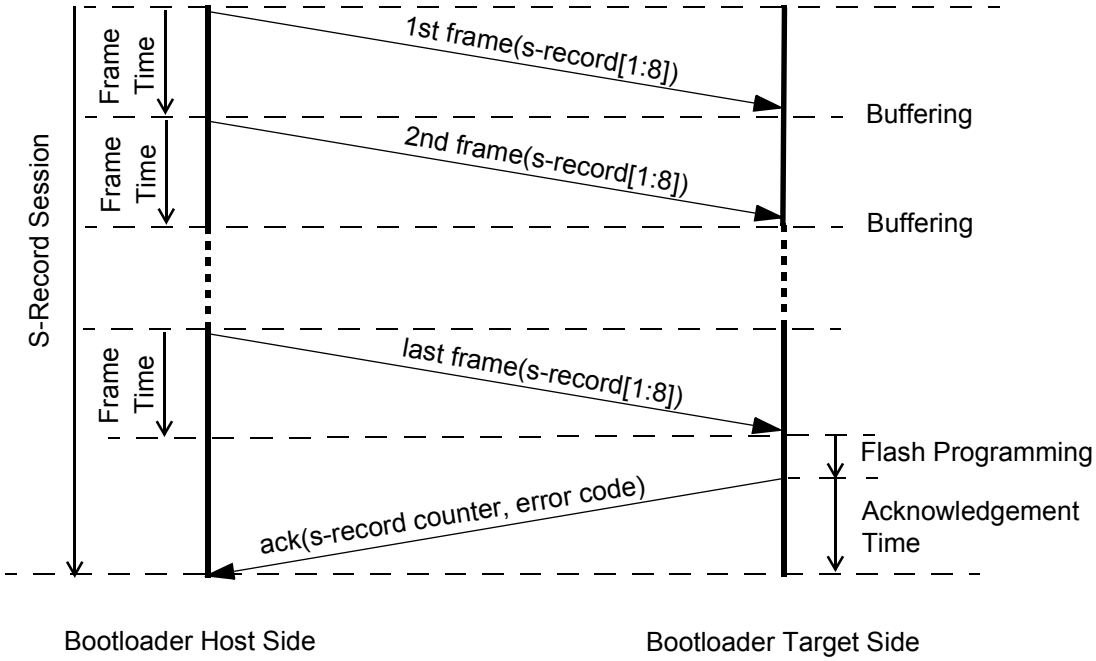


Figure 1-6. CAN Bootloader Message Flow and Protocol

Table 1-6. Bootloader CAN Protocol Frames Format

CAN Frame	S-Record Segment	Last S-Record Segment	Data Reply
CAN ID	*CAN_ID_CODE*	*CAN_ID_CODE*	*CAN_ID_REPLY*
Length	8	1:8	6
Data 0	S-Record	S-Record	S-Record Counter[1]
Data 1			
Data 2			
Data 3			
Data 4			Error Code
Data 5			
Data 6			
Data 7			

1. The Bootloader version is located in the acknowledgement frame in response to the first S-Record line; the application's Start Address is located in the acknowledgement frame in response to the last S-Record line.

1.3.2 CAN Bus Installation

The simplest CAN bus is two wires terminated by 124 ohm resistors, as shown in **Figure 1-7.** The 56F83xxEVM board contains a CAN terminator resistor that can be enabled/disabled via a jumper; see **Figure 1-8**.

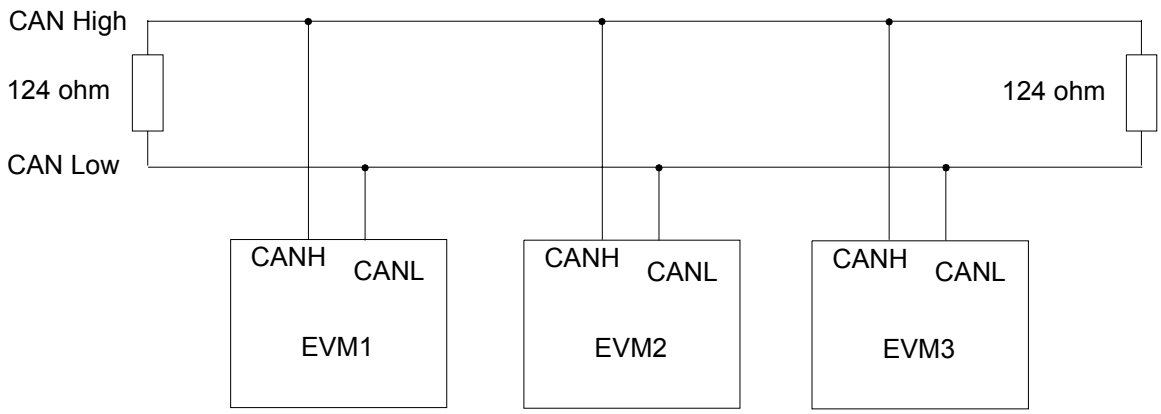


Figure 1-7. Typical CAN Bus

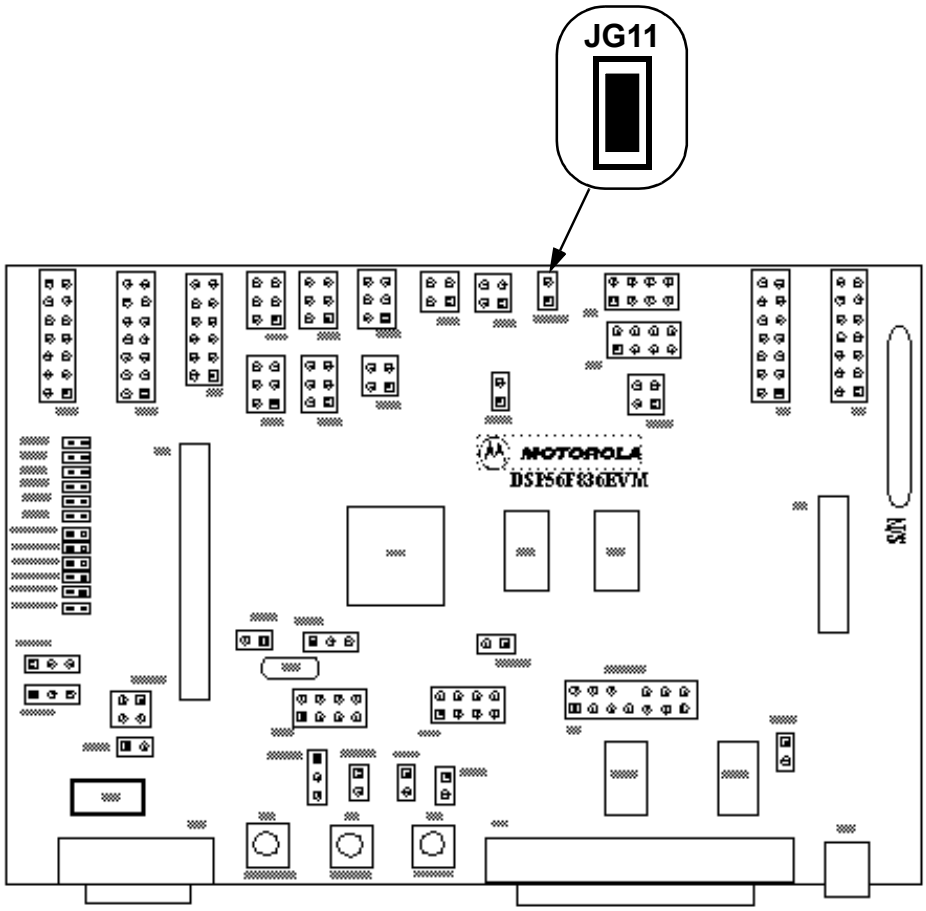


Figure 1-8. CAN Termination Selected Jumper for 56F834xEVM

To enable the CAN termination, place a jumper on:

- **JG13** for the 56F835xEVM and 56F836xEVM
- **JG11** for the 56F834xEVM
- **JG10** for the 56F832xEVM

Removing the jumper (NC) disables the CAN termination.

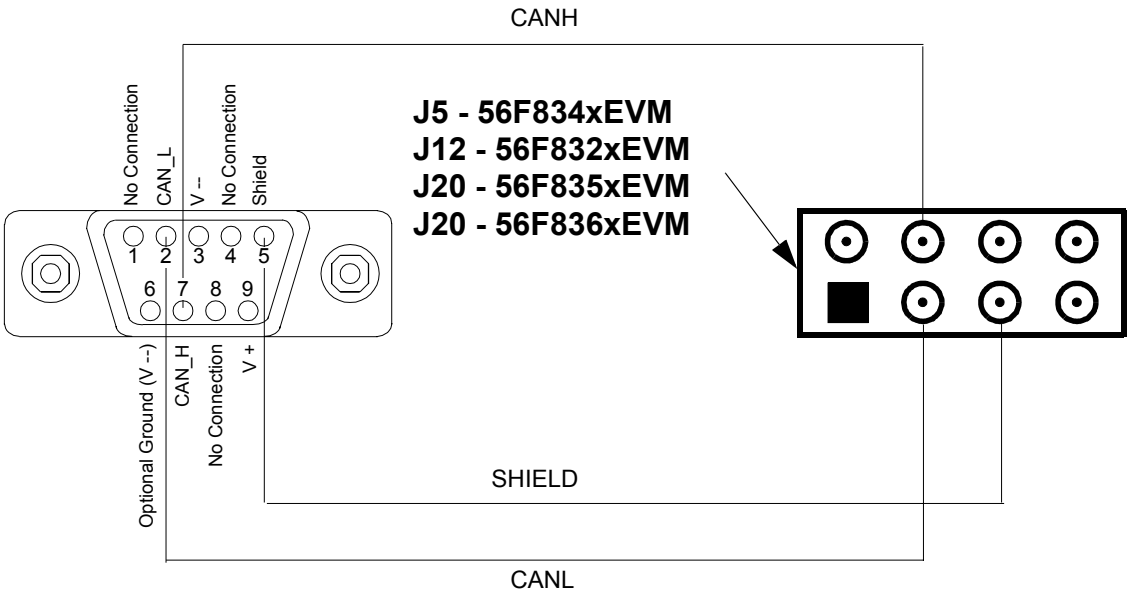


Figure 1-9. Connections Between the 56F83xxEVM (Jumper J5/J12) and PC Host

- Connect Pin 3, CANL, on the 56F83xxEVM to CANL, Pin 2, on the PC CAN card
- Connect Pin 4, CANH, on the 56F83xxEVM to CANH, Pin 7, on the PC CAN card
- Connect Pin 5, GND, on the 56F83xxEVM to Shield, Pin 5, on the PC CAN card

1.3.3 PC CAN Board

The CAN PC Host application uses National Instruments' PCI-CAN/2 board. The software drivers shipped with the board are labeled as: "National Instruments NI-CAN Software for Windows 2000/NT/XP/Me/9x and LabVIEW Real-Time (RT) Version 1.6".

1.3.3.1 Location of NI-CAN Configuration Software

Figure 1-10 illustrates the location of the NI-CAN software.

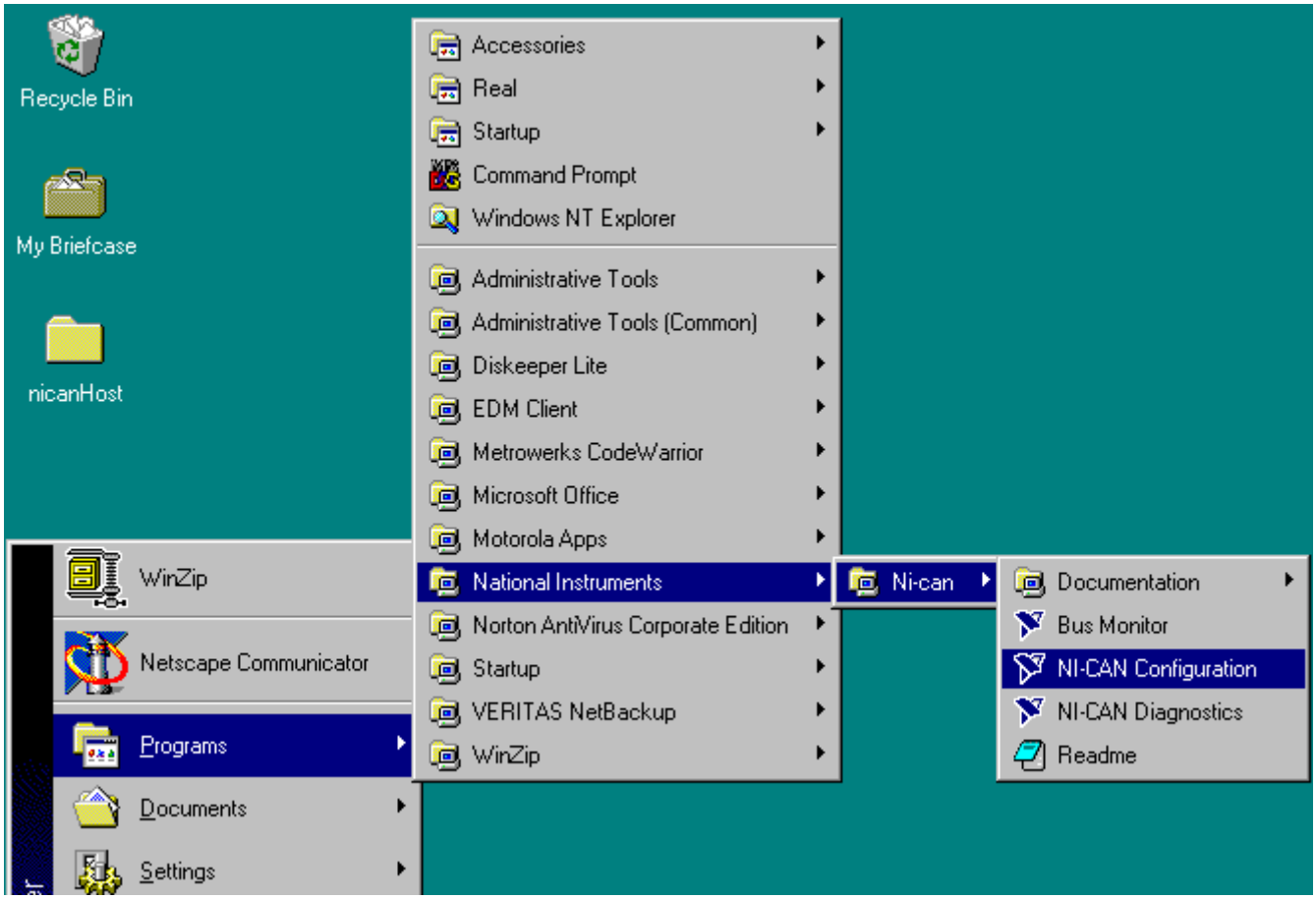


Figure 1-10. Location of NI-CAN Software

1.3.3.2 NI-CAN Software Configuration

Figure 1-11 illustrates what a user would see after the NI-CAN driver software has been successfully installed. Please refer to National Instruments' NI-CAN Software documentation for more details on configuring the driver software.

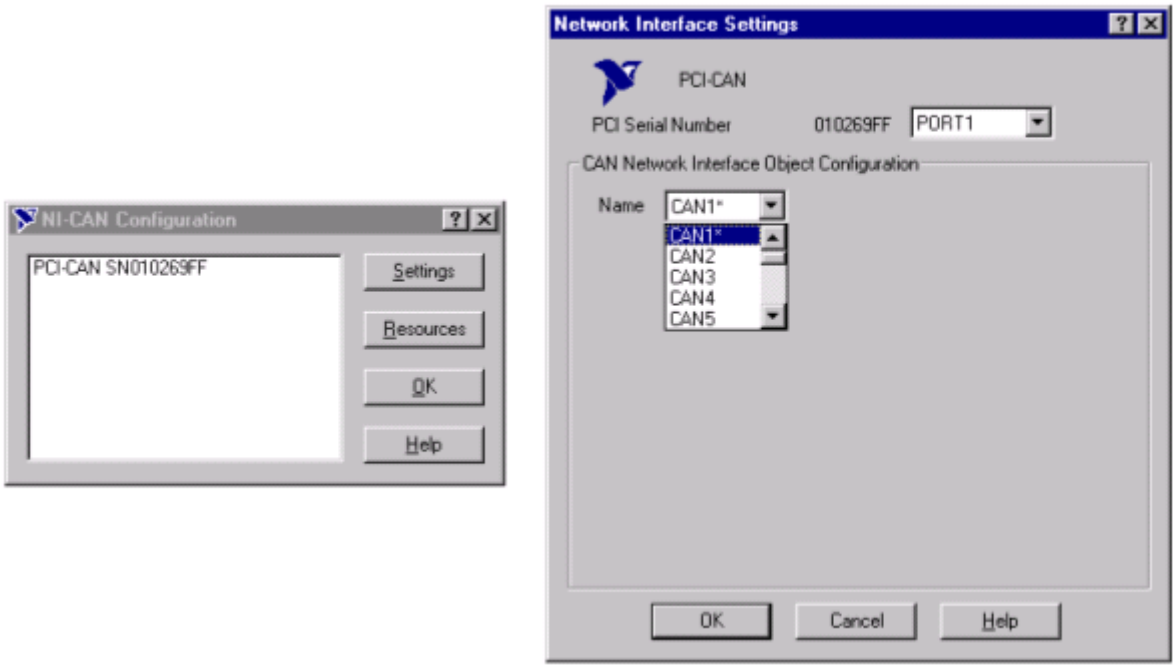


Figure 1-11. NI-CAN Software Configuration

1.3.4 Loading Application with CAN Bootloader

- Configure NI-CAN software as described in Section 1.3.3
- Set jumpers as described in Section 1.2.2
- Connect a parallel cable from the Host to the 56F83xxEVM (P1)
- Connect the CAN bus as shown in Figure 1-9
- Apply power to the 56F83xxEVM (P3)
- Build and load the CAN Bootloader into Flash as described in Section 1.1.6.1
- Push the RESET button (S1) on the 56F83xxEVM board
- Use the PC Host Loader utility as described in Section 1.2.1.3

If loading is successful, something similar to the following is displayed in the command window:

```
(c) 2003 MOTOROLA. S-Record loader for the MC56F83xx. ver. 1.0.1

Waiting for application
S-Record.....................................................................
.....................................................................
.....................................................................
........
Loaded 0x021FCC    bytes.
Application started from address 0x015D
```

If any error is detected while loading the S-Record file, the Bootloader displays an error message; see **Table 1-5** for a list of error codes. For example, if an S-record file contains a character that is not permitted for S-Records, the following message is displayed:

```
"Error # 02"
```

After an error message is displayed, the Bootloader waits for a processor reset.

Chapter 2
License

2.1 Limited Use License Agreement

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Appendix A
SCI Bootloader Test Applications

A.1 LoadPDFlash Test

This test checks the SCI Bootloader's ability to correctly load data into Program and Data Flash. The Bootloader loads a data array and the test routine into Program and Data Flash. After loading, the test routine verifies the data array was loaded correctly into Data and Program Flash. A **green** LED indicates the test was successful and a **red** LED indicates the test failed.

Because this test utilizes almost the entire the Program and Data Flash, it is largest application possible.

A.1.1 Test Procedure

- Set the 56F83xxEVM's jumpers as described in **Section 1.2.2**
- Connect a parallel cable from the Host to the 56F83xxEVM (P1)
- Connect a serial cable from the Host to the 56F83xxEVM (P2)
- Apply power to the 56F83xxEVM (P3)
- Build and load the SCI Bootloader into Flash as described in **Section 1.1.6.1**
- Push the RESET button (S1) on the 56F83xxEVM
- Using CodeWarrior, open:
  bootloader\LoadPDFlash\LoadPDFlash.mcp
- Select which target to build: the **56F836x, 56F835x**, **56F834x**, or **56F832x**
- Build the *LoadDataFlash.mcp* project, which creates an S-Record for the test application
- Load:
  bootloader\LoadPDFlash\Debug\56F8xxx_flash.elf.S
  with the PC Host Loader utility as described in **Section 1.2.1.2**
- A **green** LED indicates the test passed and a **red** LED indicates the test failed

If loading was successful, the command window displays a message similar to this:

```
(c) 2003 MOTOROLA. S-Record loader for the MC56F83xx. ver. 1.0.1

Waiting for application
S-Record.....................................................................
.....................................................................
.....................................................................
........
Loaded 0x021FCC    bytes.
Application started from address 0x015D
```

A.2 SCI Bootloader Performance

Table A-1. SCI Bootloader Performance

Boot Program Flash Size	Speed (using PC Host Utility)
3017 words	2495 words per second

Appendix B
CAN Bootloader Test Applications

Note: *CAN is NOT available on 5681xx devices.*

B.1 LoadPDFlash Test

This test checks the CAN Bootloader's ability to correctly load data into Program and Data Flash. The Bootloader loads a data array and the test routine into Program and Data Flash. After loading, the test routine verifies the data array was loaded correctly into Data and Program Flash. A **green** LED indicates the test was successful and a **red** LED indicates the test failed.

Because this test utilizes almost the entire the Program and Data Flash, it is the largest application possible.

B.1.1 Test Procedure

- Set the 56F83xxEVM's jumpers as described in **Section 1.2.2**
- Connect a parallel cable from the Host to the 56F83xxEVM (P1)
- Connect a serial cable from the Host to the 56F83xxEVM (P2)
- Apply power to the 56F83xxEVM (P3)
- Build and load the CAN Bootloader into Flash as described in **Section 1.1.6.1**
- Push the RESET button (S1) on the 56F83xxEVM
- Using CodeWarrior, open:
  bootloader\LoadPDFlash\LoadPDFlash.mcp
- Select which target to build: the **56F836x, 56F835x, 56F834x**, or **56F832x**
- Build the *LoadDataFlash.mcp* project, which creates an S-Record for the test application
- Load:
  bootloader\LoadPDFlash\Debug\56F8xxx_flash.elf.S
  with the PC Host Loader utility as described in **Section 1.2.1.3**
- A **green** LED indicates the test passed and a **red** LED indicates the test failed

If loading is successful, the command window displays a message similar to this:

```
(c) 2003 MOTOROLA. S-Record loader for the MC56F83xx. ver. 1.0.1

Waiting for application
S-Record.....................................................................
.....................................................................
.....................................................................
........
Loaded 0x021FCC    bytes.
Application started from address 0x015D
```

B.2 CAN Bootloader Performance

Table B-1. CAN Bootloader Performance

Boot Program Flash Size	Speed (using PC Host Utility)
3852 words	3706 words per second

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