

N I N T E N D O  
**NITRO**-System

## Build System

### Source Tree Description

Version 1.2.0a

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## Revision History

Version	Revision Date	Description
1.2.0a	2007/04/27	Corrected typographical errors. Changed dates in Revision History to international format.
1.2.0	2006/05/29	Deleted the description of the NITRO-SDK sound patch.
1.1.0	2004/10/12	Added a description of <code>nnslibdefs</code> and <code>commondefs.cctype.CW</code> to "Files Required to Build" on page 10. Changed the term "variable" to "macro switch" according to the notation in the SDK. Changed the word "TEG" to "TS" in descriptions and figures.
1.0.8	2004/08/10	Corrected Figure 3-4 (Build directory structure).
1.0.7	2004/06/22	Changed "interface" to "include" on page 8.
1.0.6	2004/04/12	Corrected typo.
1.0.5	2004/04/08	Standardized terminology for NITRO-SDK, IS-NITRO-CHARACTER, etc. Revised trademark description.
1.0.4	2004/04/02	Added an item in Chapter 4, related to installing the NITRO-SDK sound driver. Supplemented the description of the build tool in Chapter 6 (about placing <code>commondefs</code> and <code>modulerules</code> in include statements).
1.0.3	2004/02/20	Deleted description related to build on the sub processor (ARM7).
1.0.2	2004/02/20	Added a <code>depend</code> directory to Figure 3-5 and Figure 3-6.
1.0.1	2004/02/13	Major revision of the source tree description because the storage location of the sub processor source files and header files changed.

# 1 Introduction

This document describes the procedure for building the NITRO-System library and demo programs, and describes the NITRO-System source tree. The NITRO-System library is built on the NITRO-SDK. Please read the NITRO-SDK documentation along with this document.

## 2 Quick Start

This section describes the creation of waveform data.

### 2.1 Preparing the Development Tools

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NITRO-System is built on the NITRO-SDK. Therefore, the environment for building the NITRO-System library is matched to the environment for building the NITRO-SDK. When you use the NITRO-System library, you must have an environment that allows the build of the NITRO-SDK.

NITRO-System can be built in the Microsoft Windows 2000 Professional environment.

1. You need the following tools and SDK to build (compile and so forth) NITRO-System.
  - CodeWarrior for NITRO
  - Cygwin or MinGW (MSYS tool)
  - NITRO-SDK
2. You need one of the following tools to debug.
  - NITRO emulator ensata
  - IS-NITRO-EMULATOR

### 2.2 Building the NITRO-System Library

---

This section contains a description of the procedure for building the NITRO-System library and demo programs.

#### 2.2.1 Extracting the NITRO-System Package

---

Extract the NITRO-System package anywhere on the local disk. The NITRO-System package is compressed in ZIP format. Use an appropriate tool to decompress it. When the package is decompressed, a directory called `NitroSystem` will be created.

#### 2.2.2 Setting the Environment Variable

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Set the absolute path to the extracted directory, `NitroSystem`, in the environment variable `NITROSYSTEM_ROOT`. If the environment variable `NITROSYSTEM_ROOT` is not specified, the path will be treated as if `C:\NitroSystem` had been set. Hereafter we will refer to this directory as `$NitroSystem`.

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### 2.2.3 Building the NitroSystem Tree

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After you have set the environment variable, run `make` in the NITRO-System library root directory (`NitroSystem` directory) to build the library and the samples.

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### 2.2.4 Running the Demo Programs

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To confirm that the build was performed properly, try running the sample programs. This section describes the procedure using the NITRO emulator `ensata` as an example.

#### 2.2.4.1 Starting `ensata`

Double-click the `ensata` icon to start `ensata`. There are two `ensata` programs: `ensata_dx.exe`, which uses DirectX to perform the drawing process, and `ensata.exe`, which does not use DirectX to process drawing. Select according to the environment on your PC. Both require `DirectInput8` (`DINPUT8.DLL`) to support controller input. If DirectX is not installed on the PC you are using, get the DLL from the Microsoft Web site.

#### 2.2.4.2 Loading Executable Files

Right-click in the `ensata` window, and select "Open NITRO File". Use the dialog box to specify the `nef` file that you want to run.

#### 2.2.4.3 Executing Files

Click the "Run" button (the second button to the right of the Frame button) in the `ensata` window.

#### 2.2.4.4 Stopping Execution

To stop execution click the "Stop" button (the button that shows a hand) in the `ensata` window.

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## 2.3 Build Tools

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NITRO-System contains files with a description of often-used procedures, making it easy to write a makefile for applications that use the NITRO-System library. The file names and the directory in which they are found are listed below.

- Directory: `$NitroSystem/build/buildtools/`
- Definition file for macro switch, etc.: `commondefs`
- Definition file for compile procedures: `modulerules`

When you make an application that uses the NITRO-System library, use these two files by placing them in include statements in the makefile. For information on using these files, refer to the makefiles that are used for compiling the sample programs, and so forth, in the NITRO-System library.

The NITRO-System build system is built on the NITRO-SDK build system. In the setting files for these build systems, `commondefs` and `modulerules` in NITRO-SDK are placed in include statements, and NITRO-System library-specific settings are added to the NITRO-SDK settings. Therefore, if the NITRO-System versions of the `commondefs` and `modulerules` files are placed in include statements, there is no need to place the NITRO-SDK `commondefs` or `modulerules` files in include statements.

### 2.3.1 Describing the Makefile

You code and build a makefile for NITRO-System in almost the same way as when you develop using only the NITRO-SDK. The only difference to the NITRO-SDK makefile is the section in which the `commondefs` and `modulerules` files are placed in include statements (only the name of the environment variable is different).

- Placing the file in an include statement in the NITRO-SDK makefile

```
include $(NITROSDK_ROOT)/build/buildtools/commondefs
include $(NITROSDK_ROOT)/build/buildtools/modulerules
```

- Placing the file in an include statement in the NITRO-System makefile

```
include $(NITROSYSTEM_ROOT)/build/buildtools/commondefs
include $(NITROSYSTEM_ROOT)/build/buildtools/modulerules
```

### 2.3.2 Build Switches

With NITRO-System you can use the three build switches that are provided in the NITRO-SDK. The TS board release version library is linked by default. However, you can use macro settings during building to build a debug version or a final ROM version. The following table shows the NITRO-System build switches that you can use.

**Table 2-1 Build Switches You Can Use**

Command	Process
% make NITRO_DEBUG=TRUE	Builds the final target of the debug version.
% make NITRO_RELEASE=TRUE	Builds the final target of the release version.
% make NITRO_FINALROM=TRUE	Builds the final target of the final ROM version.

For detailed information on the build switches see the following NITRO-SDK documentation.

`$NitroSDK/docs/SDKRules/Rule-Defines.html`



### 2.3.3 Target

---

With the NITRO-System library, you can use some of the targets provided by the NITRO-SDK. The following table shows the targets that you can use.

**Table 2-2 Targets You Can Use**

Command	Process
% make build	Starts compiling and creates final target.
% make install	Installs (copies) the files created by make build in another directory.
% make run	If IS-NITRO-EMULATOR can be used in this environment, begins to run the target files generated by make build.
% make full	Generates files for all versions of each compile target.
% make clean	Deletes files generated by make build.
% make clobber	Completely deletes files generated by make build.

For detailed information on targets see the following NITRO-SDK documentation:

`$NitroSDK/docs/SDKHowTo/HowToBuildSDKTree.pdf`

## 3 Source Tree

Figure 3-1 First Directory Level of the Source Tree

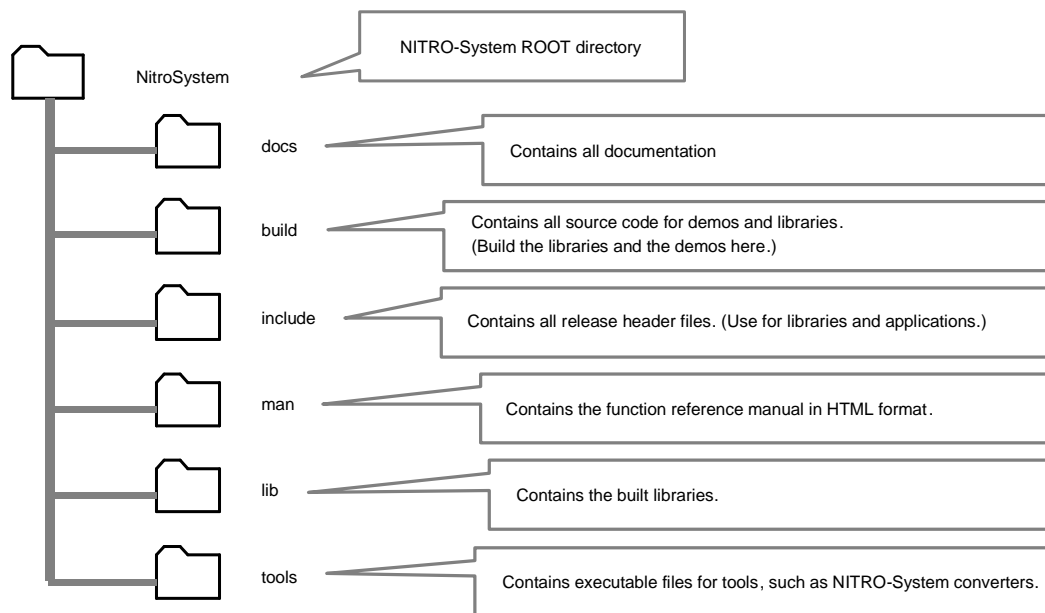


Figure 3-1 shows the directories in the first level of the NITRO-System source tree. The following sections describe the main directory structures in the source tree.

### 3.1 Include

Figure 3-2 Include Directory Structure

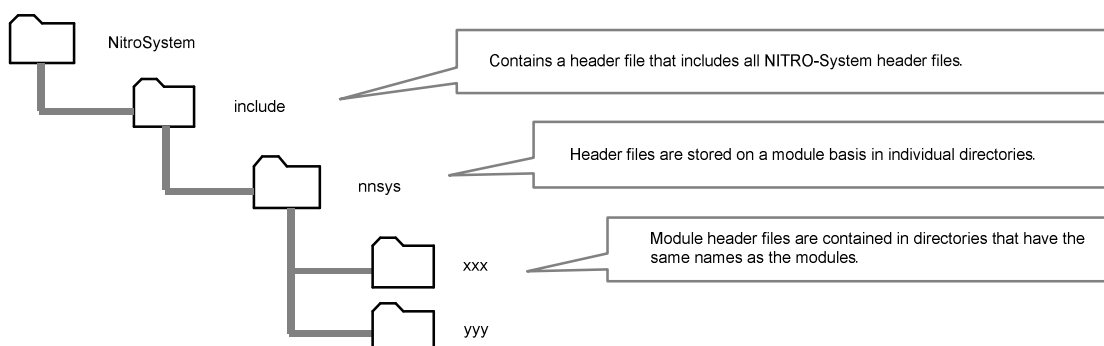


Figure 3-2 shows the structure of the include directory. All system include paths in NITRO-System library are relative paths from `$NitroSystem/include`.

The `$NitroSystem/include` directory contains a header file, `nnsys.h`, to place all header files in the NITRO-System library in an include statement. To place this file in an include statement, specify as shown below.

```
#include <nnsys.h> // Places all header files in an include statement.
```

Headers for each module are stored in the `nnsys` directory that is in `$NitroSystem/include`. They are stored in directories that are unique to each module. To place a header file (Foundation library, NITRO-Composer, and so forth) for a specific module in an include statement in the application, use the following specification.

```
#include <nnsys/fnd.h> // Places all Foundation library header files in an include statement.  
#include <nnsys/snd.h> // Places all NITRO-Composer header files in an include statement.
```

## 3.2 Library

Figure 3-3 Library Directory Structure

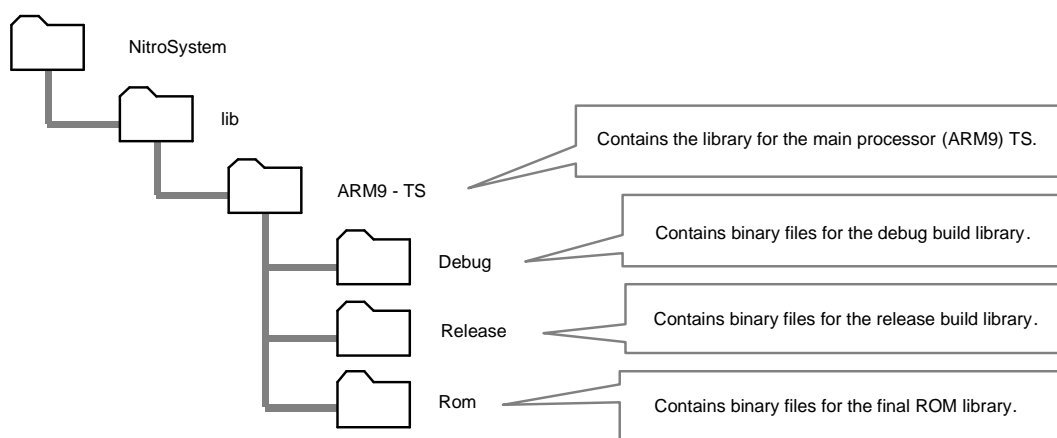


Figure 3-3 shows the structure of the library directory. It contains all of the NITRO-System library binary files. In the build system of NITRO-System library, switch the library used according to the specified build switch. All necessary libraries will be passed to the linker. Therefore, the developer does not need to consider which libraries should be linked.

### 3.2.1 Library File Naming Convention

In principle, NITRO-System library names have the prefix `lib` (which indicates library) followed by `nns` (which indicates that the file belongs to NITRO-System) followed by a 2-3 alphabetic-character module name (library name).

Libraries built in THUMB mode have `.thumb` appended to the module name.

<code>lib+nns+&lt;module name&gt;.a</code>	Library for the main processor (ARM mode)
<code>lib+nns+&lt;module name&gt;.thumb.a</code>	Library for the main processor (THUMB mode)

Here are some examples of actual library names:

```
libnnsfnd.a           // Foundation library (main processor, ARM mode)  
libnnsfnd.thumb.a    // Foundation library (main processor, THUMB mode)
```

### 3.3 Build Tree

Figure 3-4 Build Directory Structure

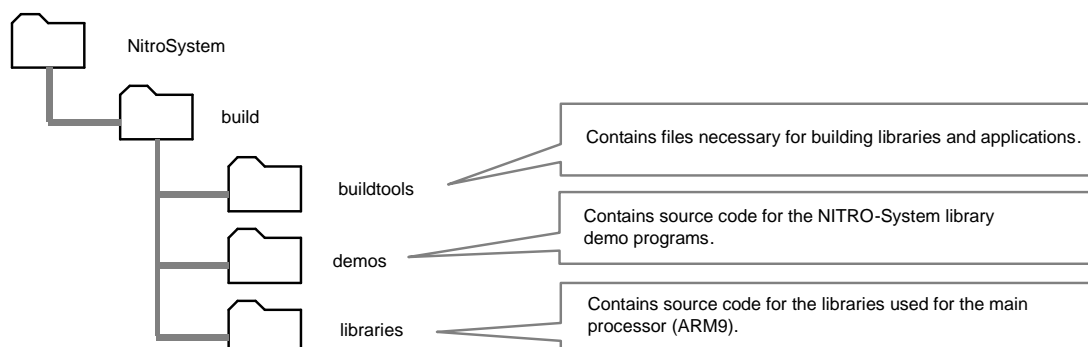


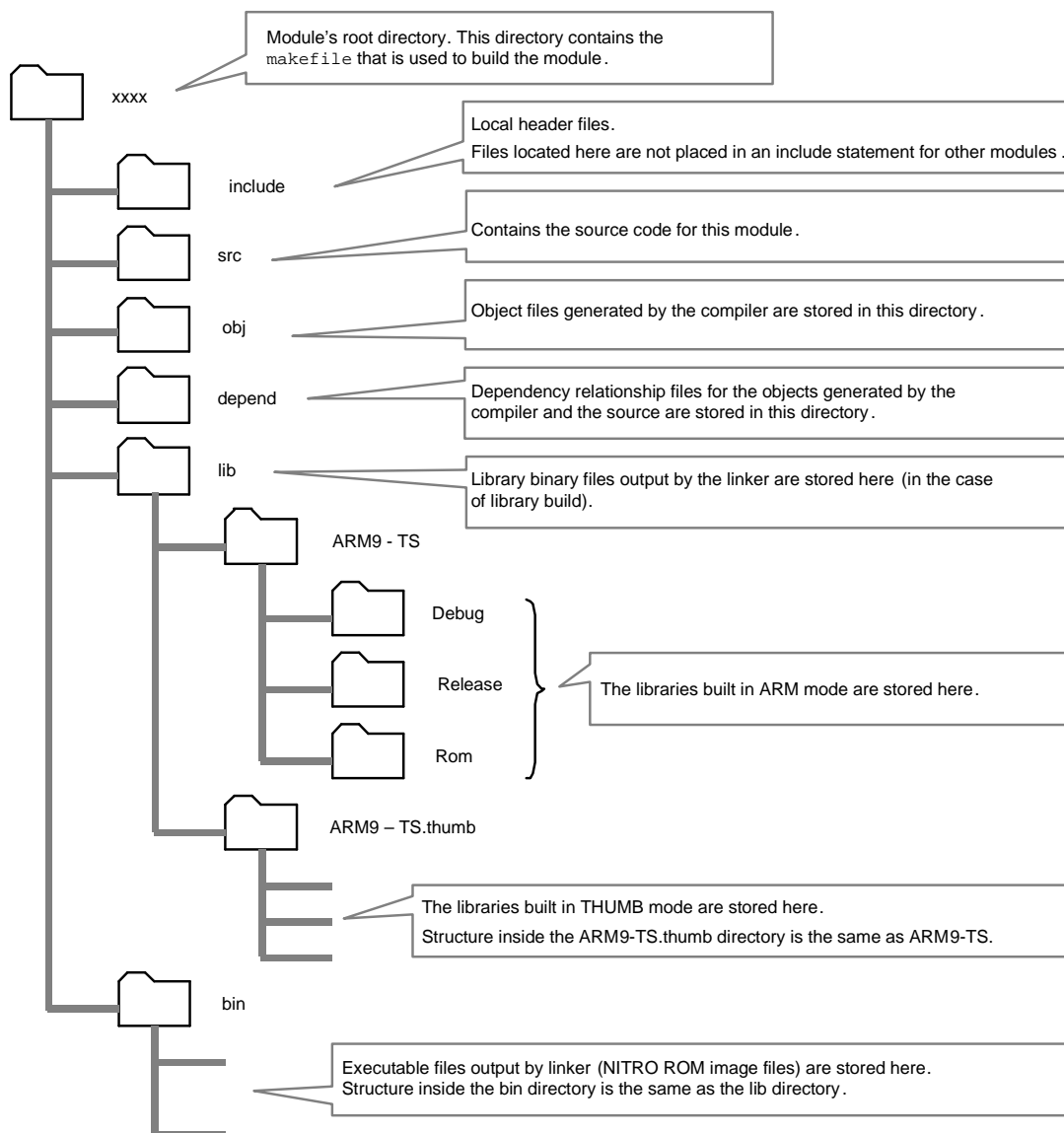
Figure 3-4 shows the structure of the build directory. Library demo program source code is stored under the build directory. The library and demo programs are built here.

Library source code is stored under the libraries directory. There is a different directory for each module. The **buildtools** directory contains the **commondefs** and **modulerules** files that are placed in include statements in the **makefile** that is used to build libraries and application software.

### 3.4 Library and Demo Sub Directory Structure

Libraries, demo programs, and individual modules for test programs have basically the directory structure shown in Figure 3-5.

**Figure 3-5 Library and Demo Basic Directory Structure**



The makefile used to build a module is located in the root directory of that module. The makefile uses the `commondefs` and `modulerrules` files in `$NitroSystem/build/buildtools` to generate a dependencies file and start the compiler and the linker.

Each directory that has a module name contains a local include directory. This directory is for exclusive header files that are not shared between modules.

## 3.5 Files Required for Build

---

The following files that are in the `$NitroSystem/build/buildtools/` directory are used to build the NITRO-System library and applications that use NITRO-System library. These files are placed in an include statement in the `makefile`.

### 3.5.1 `commondefs` File

---

The `commondefs` file defines the macro switches that are needed to build the NITRO-System library. The `commondefs` file of NITRO-SDK is placed in an include statement of the `commondefs` file of NITRO-System library. In addition to the settings that are performed in the NITRO-SDK `commondefs` file, this file sets macro switches that are related to the NITRO-System library.

### 3.5.2 `modulerules` File

---

Currently the NITRO-System library `modulerules` file does nothing more than place the NITRO-SDK `modulerules` file in an include statement. However, in the future, it is possible that some settings will be added. Therefore when you use the NITRO-System library, use the NITRO-System `modulerules` file instead of using the NITRO-SDK `modulerules` file directly.

### 3.5.3 `nnslibdefs` File

---

The `nnslibdefs` file is placed in an include statement from the NITRO-SDK `commondefs` file. This file sets the include path and the library path in the NITRO-System library, as well as the library that is passed to the linker.

In NITRO-System library version 2004/10/12 and later, the NITRO-System library setting is done without using `LINCLUDES`, `LLIBRARY_DIRS`, and `LLIBRARIES`, which are macro switches in the NITRO-SDK. These macro switches are completely released so that the user can set the special library.

### 3.5.4 `commondefs.cctype.CW` File

---

The `commondefs.cctype.CW` file is placed in an include statement in NITRO-System's `commondefs` file. This file sets the macro switch being used in the NITRO-System library.

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