***dtabldtla* Version 0.1 User Guide**

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# General Information

## Introduction and Overview

*dtabldtla* Version 0.1 is a *Win32* console-mode utility designed to assist in the software build process for microcontroller products. By “software build” I mean the process of compiling, linking, and preparing an executable image for a microcontroller product (most traditionally represented as an S-record file). *dtabldtla* has been used successfully in these ways:

* Invoked from an MS-DOS batch file to perform tasks necessary for building software.
* Invoked from the ST Microelectronics *STVD* product as a replacement for Cosmic Software’s *chex* utility.
* Run interactively with statements entered one-at-a-time manually.

*dtabldtla* can perform the following operations, using S-record or ELF files as input and S-record files as output:

* Filling unused portions of a memory image.
* Placing a checksum or cryptographic hash of certain portions of a memory image into specified locations of the memory image.

*dtabldtla* is controlled using a fairly rich scripting language (§3, p. 9), with the script provided:

* On the command line, *or*
* In a separate command file, *or*
* Statement-by-statement manually.

## Supported Platforms

*dtabldtla* can be built both for *Windows* and *Linux* (§6, p. 14). Because the program is single-threaded, there are very few operating system dependencies.

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# Invoking and Controlling *dtabldtla*

## Invocation

*dtabldtla* can be invoked in at least the following ways:

* From within an MS-DOS shell.
* From a MS-DOS batch file.
* By creating a Windows shortcut.
* From the ST Microelectronics *STVD* program.
* From another compiled program.

*dtabldtla* accepts command-line parameters using the standard mechanisms, so any invocation mechanism that works with other programs should also work with *dtabldtla*.

## Modes of Operation

### Interactive Mode

If *dtabldtla* is invoked with no command-line parameters, it enters interactive mode. In interactive mode, the program accepts statements one-by-one from the console. A typical use of interactive mode is to examine and modify S-record file contents manually.

In interactive mode:

* The results of assignments are printed immediately to *stderr*.
* The normal prompt character in interactive mode is “$”. However, if an incomplete statement (no terminating “;”) and/or block (no terminating “}”) is entered via the console, the prompt changes to “>” and the statement and/or block must be completed before any portion of it can be processed. CTRL-C will cause the pending statement and/or block to be discarded.

### Command Line Mode

In command-line mode, an entire [usually very short] script is entered directly on the command line using the -s option (see §2.4 and Table 1).

The script provided via the -s option must be a complete [but usually short] script as defined in §3. Scripts provided via the command line differ from scripts provided via a command file only in typical length.

### Command File Mode

In command file mode, a script is provided in a separate file specified via the -cf option (see §2.4 and Table 1).

The script provided via the -s option must be a complete script as defined in §3.

## Return Code

Because *dtabldtla* is used for software builds (correctness is critical), there is no notion of a warning. All suspicious conditions are errors, and all errors are fatal.

*dtabldtla* will produce a return code of 0 if there are no errors, and a return code of 4 if there are errors.

§8 (p. 15) provides a complete list of all error codes and messages that may be emitted by the program as it terminates. All errors are fatal, and will result in a return code of 4.

## Command-Line Parameters

*dtabldtla* accepts the command-line parameters described in Table 1, below.

Table : *dtabldtla* Command-Line Parameters

|  |  |
| --- | --- |
| **Command-Line Parameter** | **Description** |
| -aversion *vn* | Asserts that the short version number of the dtabldtla program is *vn*. The program will exit with a return code of 4 if the version number of the program is not vn. |
| -aversionlong *vn* | Asserts that the short version number of the dtabldtla program is *vn*. The program will exit with a return code of 4 if the version number of the program is not vn. |
| -cf *filename* | Specifies the path to the command file, if any.This option is incompatible with the *-s* option. Any script to be executed must be entirely in a command file or entirely on the command line. |
| -dbglvl*n* | Specifies the amount of debugging information emitted by the program. *-dgblvl0* (the default) specifies the least amount of debugging information, whereas *-dbglvl9* specifies the maximum amount of debugging information. |
| -gplnoticesuppress | Suppresses the GPL copyright notice which is normally written to *stderr* when *dtabldtla* starts. |
| -v*n* | Verbosity of the program.*-v0* specifies the lowest verbosity, whereas *-v9* specifies the highest verbosity. The default is *-v4*. |
| -s *cfl\_script* | Allows a script to be specified as part of the command line, subject to operating system limitations on command-line parameter length.Scripts are normally quoted, as they may contain space characters or other whitespace.This option is incompatible with the *-cf* option. Any script to be executed must be entirely in a command file or entirely on the command line. |
| -version | Emits the short version number of the *dtabldtla* program.  |
| -versionlong | Emits the long version number of the *dtabldtla* program. |
| -vcinfo | Emits version control information about the software components compiled to create the *dtabldtla* program. |

# CFL (Command File Language) Description

## Overview

The language that may be used on the command line (with the -s option; see §2.4 and Table 1) or in a separate file (with the -cf option; see §2.4 and Table 1) is called the command file language (CFL for short).

CFL is based on Tcl and PHP, in addition to whatever random thoughts Dave Ashley had at the time the *dtabldtla* program was written. There are several excellent extensible scripting languages—especially Tcl—in existence. The reason a separate language was created was so that a minimalist interpreter could be created, designed, tested in accordance with known best practices. Because the program will be used for software builds, because dynamic allocation is used heavily, and because memory images are buffered into memory; the ability to ensure that the program has no defects is extremely important.

## Command-File Language (CFL) Features

### Absolute Maximums

The CFL interpreter will in general use all of available dynamic memory as required to execute scripts. However, to avoid 32-bit integer overflows and pointer errors, it is necessary to have limits that are short of the point where such errors would occur.

Table : CFL Absolute Maximums

|  |  |
| --- | --- |
| **Parameter** | **Absolute Maximum** |
| **Size of CFL Script File** | 230-1 = 1,073,741,823 Characters |
| **Number of Bits in Integer** | 230-1 = 1,073,741,823 Bits |
| **Number of Bits in Numerator or Denominator of Rational Number** | 230-1 = 1,073,741,823 Bits |
| **Minimum Array Subscript** | -(230-1) = -1,073,741,823 |
| **Maximum Array Subscript** | 230-1 = 1,073,741,823 |
| **Depth of Function Calling Tree** | 230-1 = 1,073,741,823 Levels |
| **Length of String** | 230-1 = 1,073,741,823 Characters |
| **Identifier Length** | 215-1 = 32,767 Characters |
| **Number of Open Files** | Limited only by C runtime library and operating system |

### Nature of the Interpreter

The CFL interpreter is designed for simplicity rather than efficiency. When parsing a script, the interpreter completes these phases:

* Buffering
	+ The entire script is buffered to dynamic memory.
	+ Illegal characters are detected and will cause termination of the program.
* Tokenization
	+ The source script is broken into tokens (identifiers, “(“, “{“, “=”, “++”, etc.).
	+ Comments are discarded.
	+ Error conditions that will prevent tokenization are detected and will cause termination of the program.
* Parsing
	+ The stream of tokens is converted to an intermediate data structure.
	+ Certain errors are detected and will cause termination of the program.
* Conversion to Bytecode
	+ The data structure that is the result of the parsing is converted to a bytecode representation.
* Interpretation
	+ The bytecode is interpreted.

### Character Sets

TBD.

### Token-Oriented Nature

TBD.

### Organization of a CFL Script

TBD.

### Identifiers

TBD.

### String Constants

TBD.

### Integer Constants

TBD.

### Rational Number Constants

TBD.

### Variables and Simple Data Types

TBD.

#### Strings

TBD.

#### Rational Numbers

TBD.

#### Integers

TBD.

#### Memory Images

TBD.

### Constant Variables

TBD.

### Variable Scope and Using Global Variables Within a Function

TBD.

### Arrays and Structures

TBD.

### Operators

TBD.

### Expressions

TBD.

### Statements

TBD.

### For Loops

TBD.

### Pre-Test While Loops

TBD.

### Post-Test While Loops

TBD.

### Function Definitions

TBD.

### Function Invocations

TBD.

### Pass-By-Value vs. Pass-By-Reference

TBD.

### Variable-Length Argument Lists

TBD.

### Recursion

TBD.

### Calling a Function Whose Identity Varies at Runtime

TBD.

### Executing a Statement Calculated at Runtime

TBD.

### Suppressing Errors that Occur During Evaluation of a Statement or Function

TBD.

## Debugging

TBD.

## CFL Implementation Version 1

TBD.

## CFL Implementation Version 2

TBD.

# CFL Built-In Functions

TBD.

## Type Conversion

TBD.

## Integer Arithmetic

TBD.

## Rational Number Arithmetic

TBD.

## Checksum and Cryptographic Hash of Non-Memory Images

TBD.

## Array and Structure Manipulation

TBD.

## Arbitrary Expression Evaluation

TBD.

## Memory Image Manipulation

TBD.

## Checksum and Cryptographic Hash of Memory Images

TBD.

## S-Record File Input and Output

TBD.

## ELF File Input and Output

TBD.

## Debugging

TBD.

## Command-Line Argument Retrieval

TBD.

## Program Termination

TBD.

# Software Design of *dtabldtla*

## Processing of Command-Line Parameters

TBD.

## Script Buffering

TBD.

## Script Tokenization

TBD.

## Script Parsing

TBD.

## Bytecode Generation

TBD.

## Bytecode Interpretation

TBD.

# Recompiling *dtabldtla* From Source Code

TBD.

## Windows

TBD.

## Linux

TBD.

# Modifying the *dtabldtla* Source Code

TBD.

## Adding Additional Built-In Functions

TBD.

## Other Types of Modifications

TBD.

# Error Codes and Messages

TBD.

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Figure : Sample Figure

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