PERSISTOR® CF1

Getting Started Guide

Rev 8

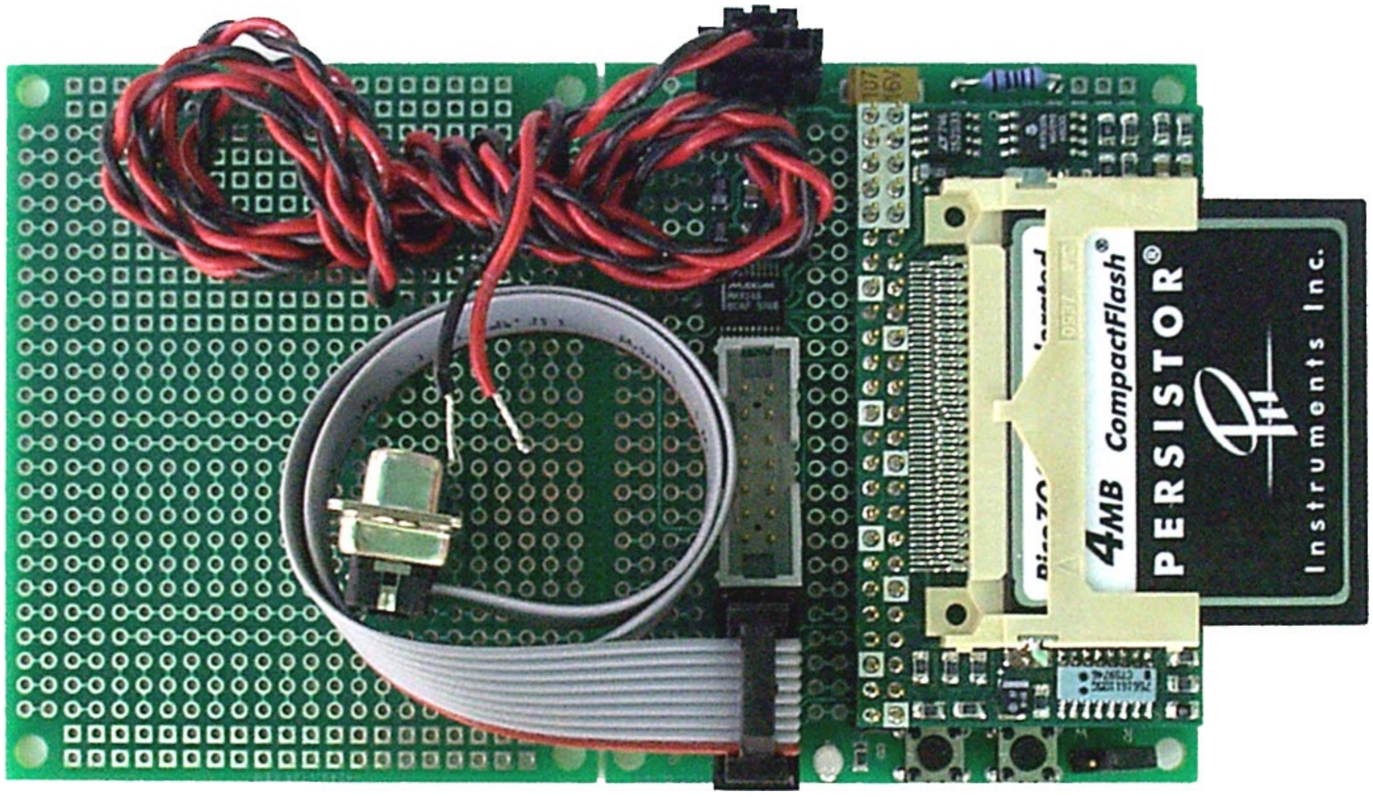

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Table of Contents

General Information

Introduction

This getting started guide describes how to setup and install the various components that make up your Persistor CF1 Starter Kit. This printed manual stops at the point where you’ve installed the online HTML and PDF documentation, though we’ve included some diagrams and tables that you may find handy in working with the Persistor.

The combination of a Persistor and RecipeCard let you quickly start working on your experiment goals without putting a lot of front-end effort into wiring up the hardware. In many cases, this will be all you need for the initial prototype, proof-of-concept, or feasibility studies. The RecipeCards come with complete schematics, parts lists, and design notes for when and if you decide to move portions to your custom board.

What’s in the Kit?

Your CF1 Starter Kit should contain the following items:

1	PERCF1C	Persistor CF1
1	PCF8MBC	8MB CompactFlash Card
1	PCFADAP	PCMCIA Adapter Card
1	PRCPDAQ	PicoDAQ Analog RecipeCard
1	CBL10H10DB9	10” DB-9 Serial Adapter Cable
1	CBL30CG4TL	30” Power Cable to Tinned Leads
3	SHNTJMPS	Shunt Jumpers
3	CGPINS	Space C-Grid Connector Pins
1	MXWCF1	MotoCross for CF1 (CD-ROM)

Equipment Required

4-20VDC, 100mA power supply
PC running Win95/98/NT or Macintosh with System 7 or above with free serial port
Metrowerks CodeWarrior and MotoCross for CF1

Warnings and Precautions

We really don't want to dampen the excitement of exploring your new board, but there's some stuff you really ought to know. Even the old-timers may find something new to worry about with this new 3.3 volt system and its lowest power suspend mode. Just take a minute to skim this short section and save the possible embarrassment and expense of having to admit you leaped before looking.

3.3V I/O: ***The CF1 is a 3.3 volt only system, and cannot tolerate any voltages above 3.6 volts on any of its I/O or BUS lines***, except for the RS-232 signals (RSTXD, RSRXD, RSCTS, RSRTS). Even momentary connection to 5 volt signals will likely result in permanent damage to the board's components. ***Do not attempt to get around this by running the board at 5 volts as the RAM, and especially the flash will suffer stress damage!***

Suspend Mode: When the CF1 goes into suspend mode, all of the I/O and BUS pins (except for the RS232, /WAKE, and /SHDN) look like very low impedance current sinks with about a 1.3-1.8 volt forward drop. CF1 I/O or BUS lines being driven from off-board peripherals will try very hard (and succeed) at pulling these levels low, which is probably not what you want. Any I/O lines being pulled high to an external V+ source will be pulled down to this forward voltage drop. Both of these situations will consume lots of current which defeats the purpose of suspend mode.

Static Sensitive CMOS: Every component on the CF1 is CMOS and susceptible to immediate damage, or worse, premature field failures if you don't take precautions to guard against damage from static electricity.

Develop with a current limited power supply! You can save yourself a lot of grief by running the board from a bench supply current limited to about 100mA. Jumpers, test probes, and programming bugs make it very easy to send the CF1 into some horrible current sucking latchup and current limiting can keep a spurious slip from destroying your board.

Develop at low voltage! The CF1 onboard voltage regulator can handle +/-20 volt inputs, but nothing else on the board can. Just like current limiting, developing at around 4 volts is a good way to keep a simple slip from destroying your board.

Floating Inputs: Most of the I/O lines on the CF1 do not have onboard pull-up resistors, and most of these are left in their default input state at reset. CMOS floating inputs draw current in somewhat unpredictable fashion - nowhere near enough to do any damage, but enough to defeat the gains of some of the power saving modes. You should either pull unused I/O lines to VREG or GND, or force them to be outputs.

Don't Stick Probes in the Header Sockets: The header strips used in the RecipeCards are meant to accept 0.025" square posts. Anything else is likely to permanently deform the connectors and cause your system to fail or behave erratically. We did this here with a scope probe tip (0.037" diameter), and a customer did it with a miniature DMM probe (0.044" diameter). We both spent many frustrating hours searching for the source of bizarre problems. The deformation damage is quite visible, but only with the help of a microscope - and no, this would not be covered under the warranty.

Backup battery is required: The CF1 depends on a separate PIC microcontroller to manage startup, power-off watchdogs, suspend mode, and CF card changes. Even if you're not using the last three features, you probably want the CF1 to start up when you apply power - and that's not guaranteed unless there is voltage at the VBBK pin during power-up. If you really don't want to provide a backup cell, you can connect separate 3 volt regulator between your main supply and VBBK.

Installing CodeWarrior

Your first step toward developing with the CF1 is installing Metrowerks® CodeWarrior®. This section explains how to install CodeWarrior Release 6 for use with MotoCross® libraries and support tools for the CF1. Follow the instructions on these four pages (mostly pictures), then perform the simpler MotoCross installation. If you follow these installation instructions to the letter, you should be running your first MotoCross program in less than an hour.

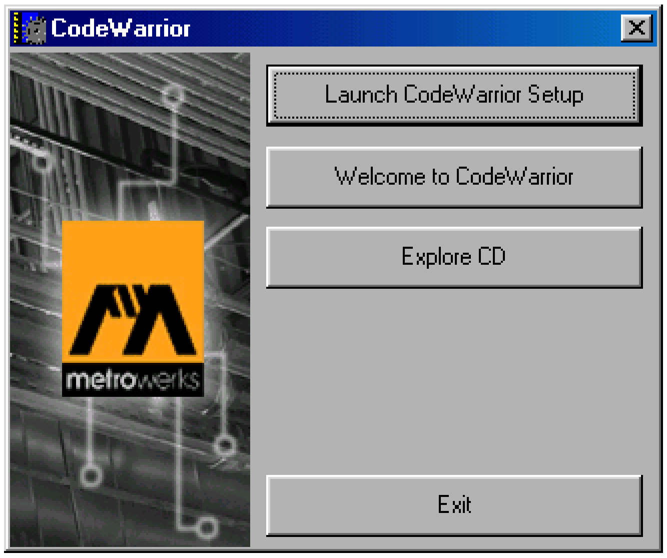
To use the MotoCross package, you will need:
1) Metrowerks CodeWarrior Pro - Release 6 (or later)
2) 32MB RAM, 120MB Free Disk Space, CD-ROM
3) Pentium-class processor (recommended), 80386, or 80486
4) Windows NT 4, Windows 95, or Windows 98

MotoCross requires that you install CodeWarrior using the Metrowerks CD installer with any of their options to build MacOS-68K projects. If you have an existing installed CWPro and can compile MacOS 68K applications, you can skip this section and resume with the CF1 Getting Started Guide. If you're using CodeWarrior solely for CF1 development, you need only select the options checked in the screen captures below, which will require about 160MB of disk space. Keep an eye on the Space Required and if it varies a lot from the screen snapshots, carefully review your selections. If you have trouble, it's perfectly safe to reinstall CodeWarrior in part or whole, and that generally will get you going.

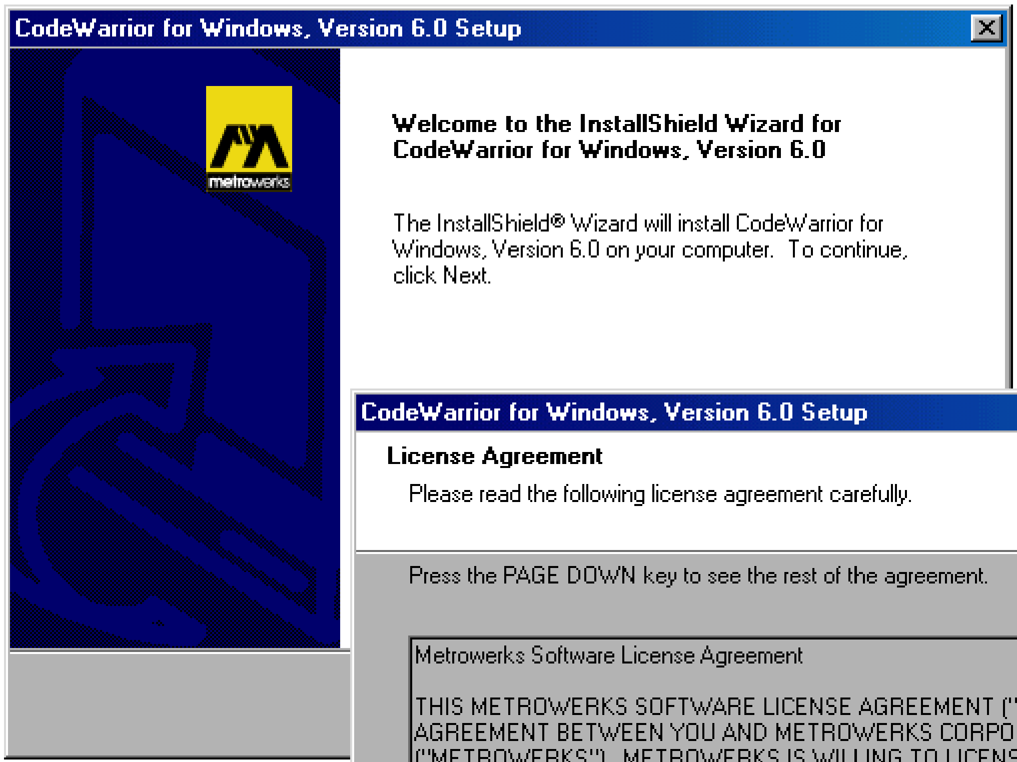
CD Installation

Start by inserting the CodeWarrior CD. On most PCs, you will automatically be presented with the installation dialog. On some others, you will have to double click on the CD icon to get things started. Pay attention to the following note from the Metrowerks documentation:

"The installation software on CodeWarrior Professional can't successfully install a new version of CodeWarrior if an older version of CodeWarrior already exists on your computer. To remove the old version of CodeWarrior, launch the Uninstall CodeWarrior program. This program is available from the Start menu."

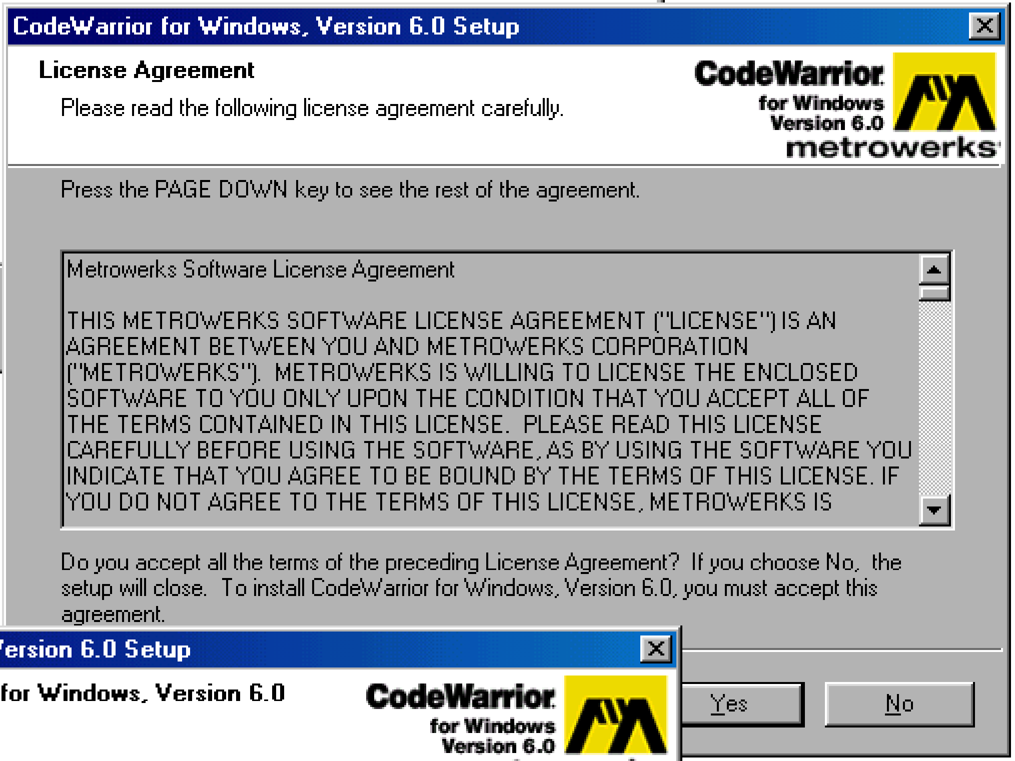


That done, click the Launch CodeWarrior Setup button. Then work your way through the next several information dialogs...



Welcome to the InstallShield Wizard for CodeWarrior for Windows, Version 6.0

The InstallShield® Wizard will install CodeWarrior for Windows, Version 6.0 on your computer. To continue, click Next.


CodeWarrior for Windows, Version 6.0 Setup
CodeWarrior for Windows Version 6.0 metrowerks
Yes
No

License Agreement

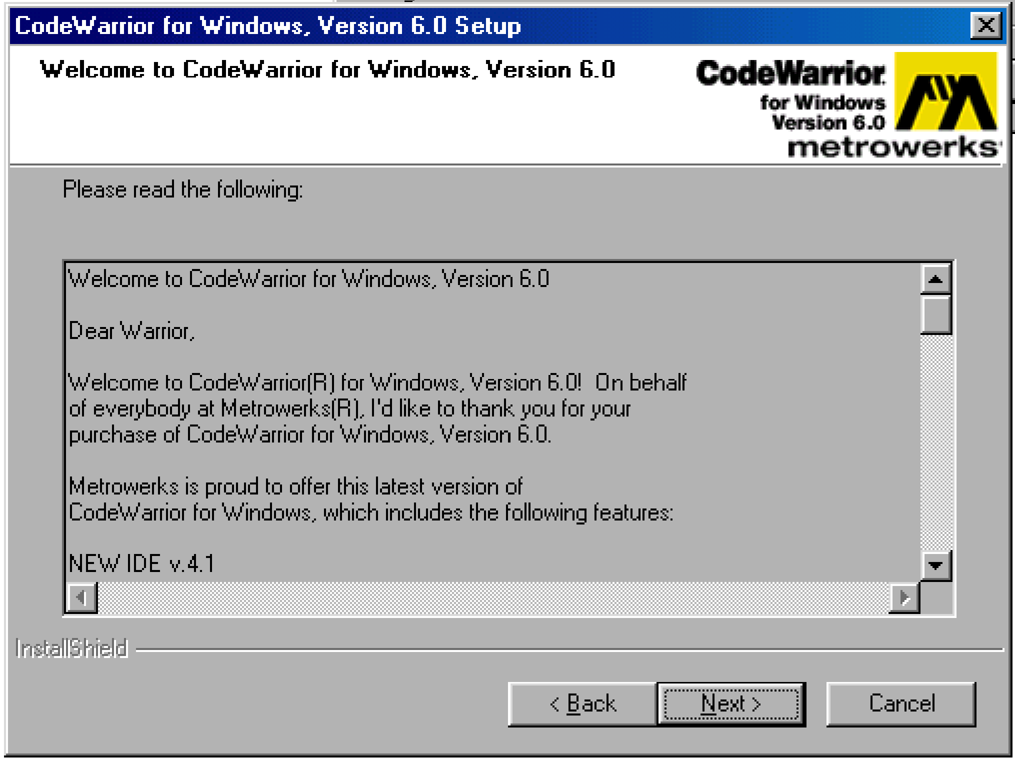
Please read the following license agreement carefully.

Press the PAGE DOWN key to see the rest of the agreement.

Metrowerks Software License Agreement

THIS METROWERKS SOFTWARE LICENSE AGREEMENT ("LICENSE") IS AN AGREEMENT BETWEEN YOU AND METROWERKS CORPORATION ("METROWERKS"). METROWERKS IS WILLING TO LICENSE THE ENCLOSED SOFTWARE TO YOU ONLY UPON THE CONDITION THAT YOU ACCEPT ALL OF THE TERMS CONTAINED IN THIS LICENSE. PLEASE READ THIS LICENSE CAREFULLY BEFORE USING THE SOFTWARE, AS BY USING THE SOFTWARE YOU INDICATE THAT YOU AGREE TO BE BOUND BY THE TERMS OF THIS LICENSE. IF YOU DO NOT AGREE TO THE TERMS OF THIS LICENSE, METROWERKS IS

Do you accept all the terms of the preceding License Agreement? If you choose No, the setup will close. To install CodeWarrior for Windows, Version 6.0, you must accept this agreement.


CodeWarrior for Windows, Version 6.0 Setup
CodeWarrior for Windows Version 6.0 metrowerks
InstallShield
< Back
Next >
Cancel

Welcome to CodeWarrior for Windows, Version 6.0

Please read the following:

Welcome to CodeWarrior for Windows, Version 6.0

Dear Warrior,

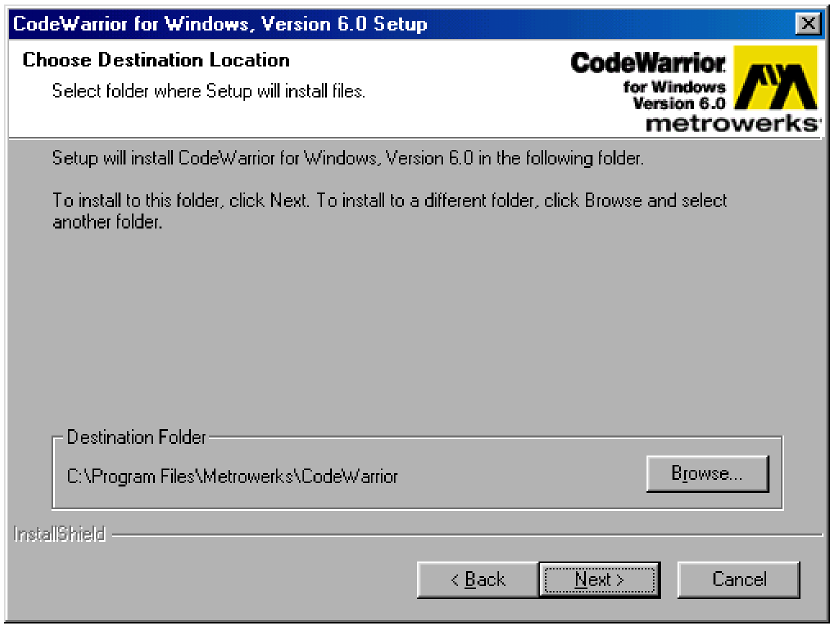
Welcome to CodeWarrior(R) for Windows, Version 6.0! On behalf of everybody at Metrowerks(R), I'd like to thank you for your purchase of CodeWarrior for Windows, Version 6.0.

Metrowerks is proud to offer this latest version of CodeWarrior for Windows, which includes the following features:

NEW IDE v.4.1

Destination

You're best off just accepting the default directory offered by the installer. You can actually put CodeWarrior anywhere, though all of the other CF1 documentation and installers will reference locations to the standard default. The actual location of the CodeWarrior program files does not matter a great deal, as you will not actually be working in this directory. In fact, the Metrowerks directory is a particularly bad place to keep your own projects as they can get inadvertently deleted when you upgrade to the next release of CodeWarrior. This is covered in more detail in the getting started documentation.


CodeWarrior for Windows, Version 6.0 Setup

Choose Destination Location

Select folder where Setup will install files.

Setup will install CodeWarrior for Windows, Version 6.0 in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

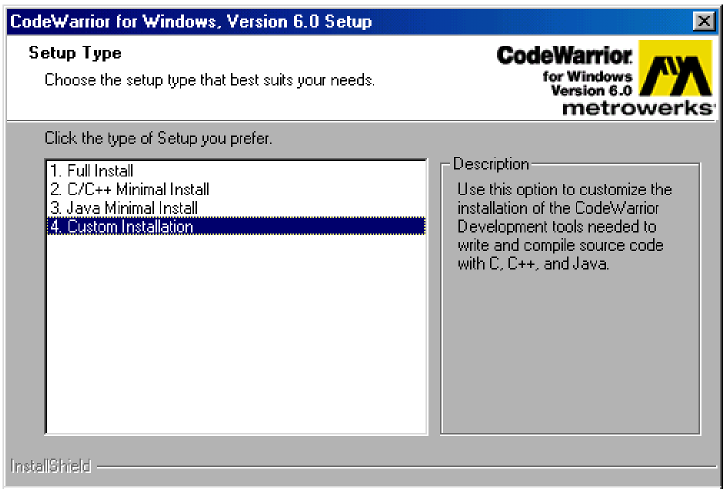
Destination Folder

C:\Program Files\Metrowerks\CodeWarrior

Select Components

Using the screen snapshots as a guide…

1) **Setup Type**
   a) Click-select "**4. Custom Installation**"
   b) Click **Next>**
2) **Select Components**
   a) Check "**CodeWarrior IDE**"
   b) Check "**PPC-68K Development**"
   c) Click **Next>**
3) **Select Program Folder**
   a) Click **Next>**
4) **Select File Associations Option**
   a) Choose "Typical: Selected…"
   b) Click **Next>**
5) **Start Copying Files**
   a) Click **Next>**
   b) Wait for the copy to complete
6) **Register CodeWarrior**
   a) Fill out the registration information
   b) Click **Next >**
7) **InstallShield Wizard Complete**
   a) Click **Finish>**


CodeWarrior for Windows, Version 6.0 Setup

Setup Type

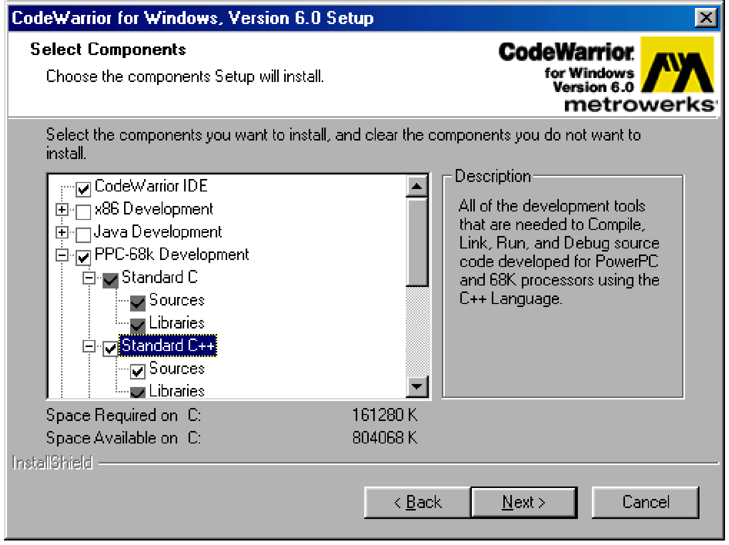
Choose the setup type that best suits your needs.

Click the type of Setup you prefer.

1. Full Install
2. C/C++ Minimal Install
3. Java Minimal Install
4. Custom Installation

Description

Use this option to customize the installation of the CodeWarrior Development tools needed to write and compile source code with C, C++, and Java.


CodeWarrior for Windows, Version 6.0 Setup

Select Components

Choose the components Setup will install.

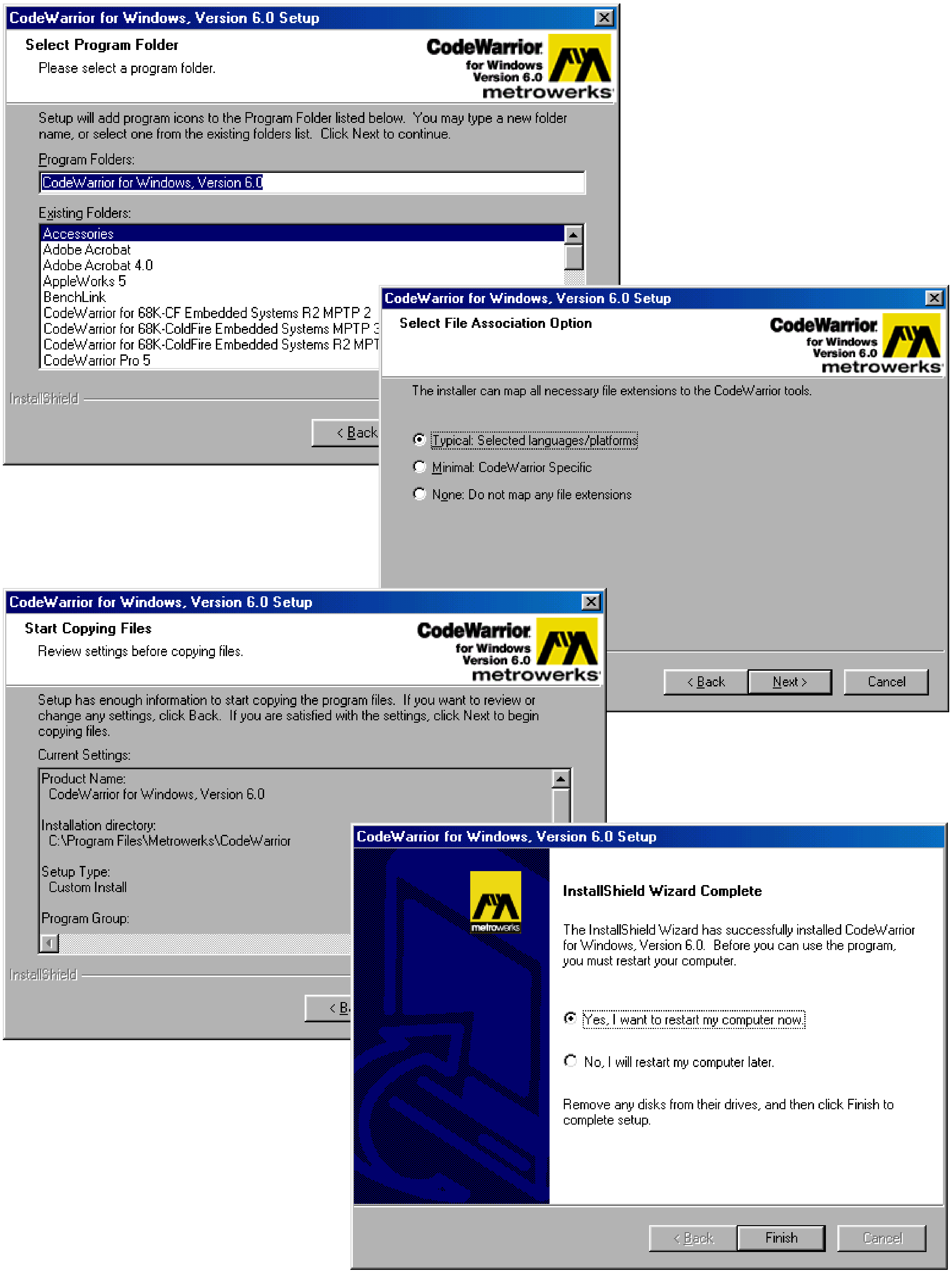
Select the components you want to install, and clear the components you do not want to install.

- [✓] CodeWarrior IDE
- [ ] x86 Development
- [ ] Java Development
- [✓] PPC-68k Development
  - [✓] Standard C
    - [✓] Sources
    - [✓] Libraries
  - [✓] Standard C++
    - [✓] Sources
    - [✓] Libraries

Description

All of the development tools that are needed to Compile, Link, Run, and Debug source code developed for PowerPC and 68K processors using the C++ Language.

Space Required on C:	161280 K
Space Available on C:	804068 K



CodeWarrior for Windows, Version 6.0 Setup

Select Program Folder

Please select a program folder.

Setup will add program icons to the Program Folder listed below. You may type a new folder name, or select one from the existing folders list. Click Next to continue.

Program Folders:

CodeWarrior for Windows, Version 6.0

Existing Folders:

Accessories
Adobe Acrobat
Adobe Acrobat 4.0
AppleWorks 5
BenchLink
CodeWarrior for 68K-CF Embedded Systems R2 MPTP 2
CodeWarrior for 68K-ColdFire Embedded Systems MPTP 3
CodeWarrior for 68K-ColdFire Embedded Systems R2 MPT
CodeWarrior Pro 5

CodeWarrior for Windows, Version 6.0 Setup

Select File Association Option

The installer can map all necessary file extensions to the CodeWarrior tools.

[✓ Typical: Selected languages/platforms]
Minimal: CodeWarrior Specific
None: Do not map any file extensions

CodeWarrior for Windows, Version 6.0 Setup

Start Copying Files

Review settings before copying files.

Setup has enough information to start copying the program files. If you want to review or change any settings, click Back. If you are satisfied with the settings, click Next to begin copying files.

Current Settings:

Product Name:
CodeWarrior for Windows, Version 6.0

Installation directory:
C:\Program Files\Metrowerks\CodeWarrior

Setup Type:
Custom Install

Program Group:

CodeWarrior for Windows, Version 6.0 Setup

InstallShield Wizard Complete

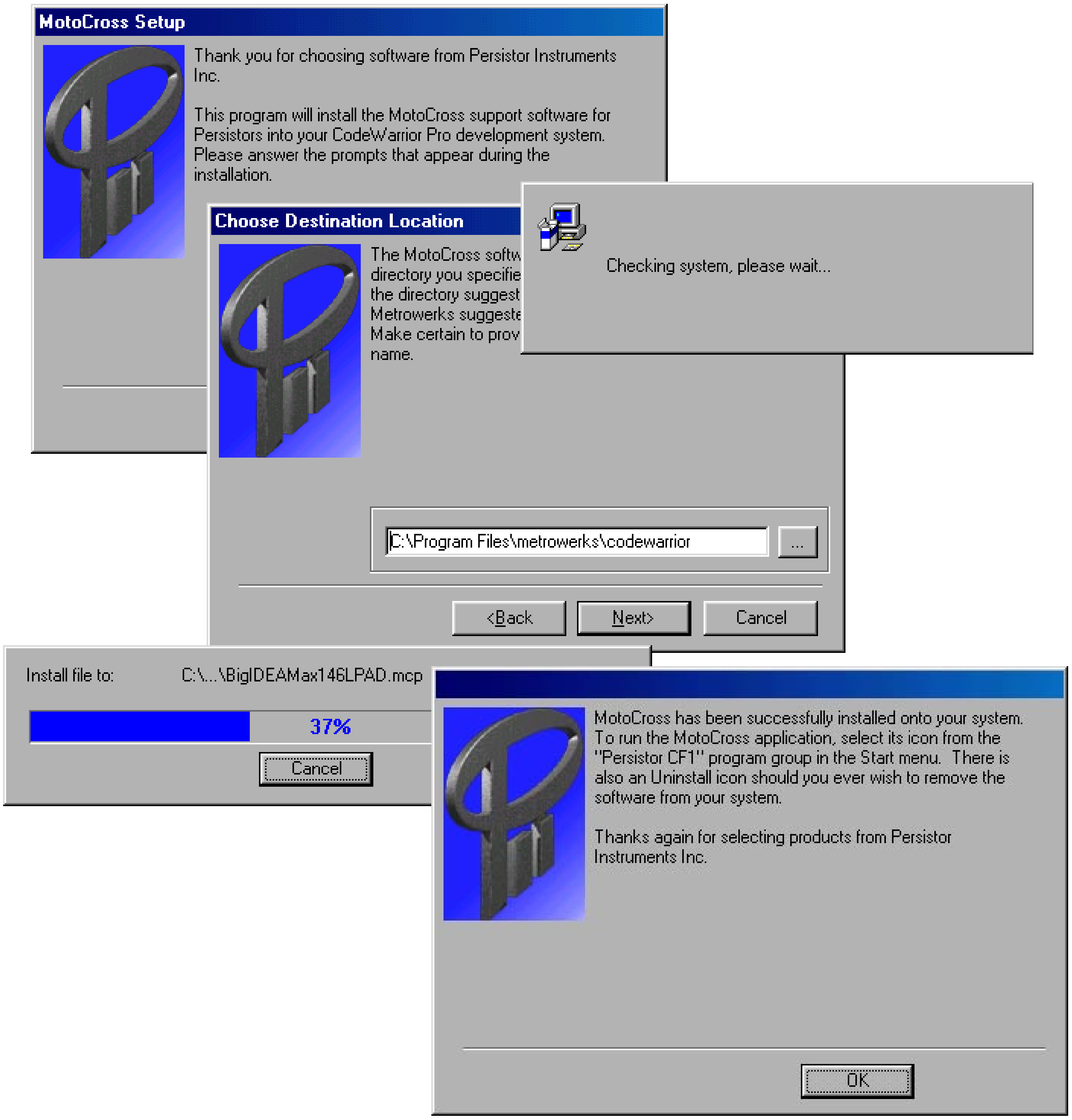
The InstallShield Wizard has successfully installed CodeWarrior for Windows, Version 6.0. Before you can use the program, you must restart your computer.

[✓ Yes, I want to restart my computer now.]
No, I will restart my computer later.

Remove any disks from their drives, and then click Finish to complete setup.

Installing MotoCross

After you've installed CodeWarrior, insert the Persistor CF1 Tools CD and double-click the Setup.exe icon to run the MotoCross Installer. If you followed the destination suggested by CodeWarrior, our installer will just require a few clicks on the "Next" button to complete installation. Here's what it should look like:



MotoCross Setup

Thank you for choosing software from Persistor Instruments Inc.

This program will install the MotoCross support software for Persistors into your CodeWarrior Pro development system. Please answer the prompts that appear during the installation.

Choose Destination Location

The MotoCross softw
directory you specifie
the directory suggest
Metrowerks suggeste
Make certain to prov
name.

C:\Program Files\metrowerks\codewarrior

Checking system, please wait...

Install file to: C:\...\BigIDEAMax146LPAD.mcp

37%

MotoCross has been successfully installed onto your system. To run the MotoCross application, select its icon from the "Persistor CF1" program group in the Start menu. There is also an Uninstall icon should you ever wish to remove the software from your system.

Thanks again for selecting products from Persistor Instruments Inc.

Location, Location, Location

After installing CodeWarrior and MotoCross, you should have something that looks like what's adjacent. CodeWarrior is very fussy about the relative locations of its various components, and the preconfigured MotoCross stationery makes similar location-relative assumptions. If things get moved around, expect your compilations to start failing.

Fortunately, you won't be doing much inside the CodeWarrior directory. All of your work should be done in completely separate directories with whatever convention you find best. For our projects, we typically use:

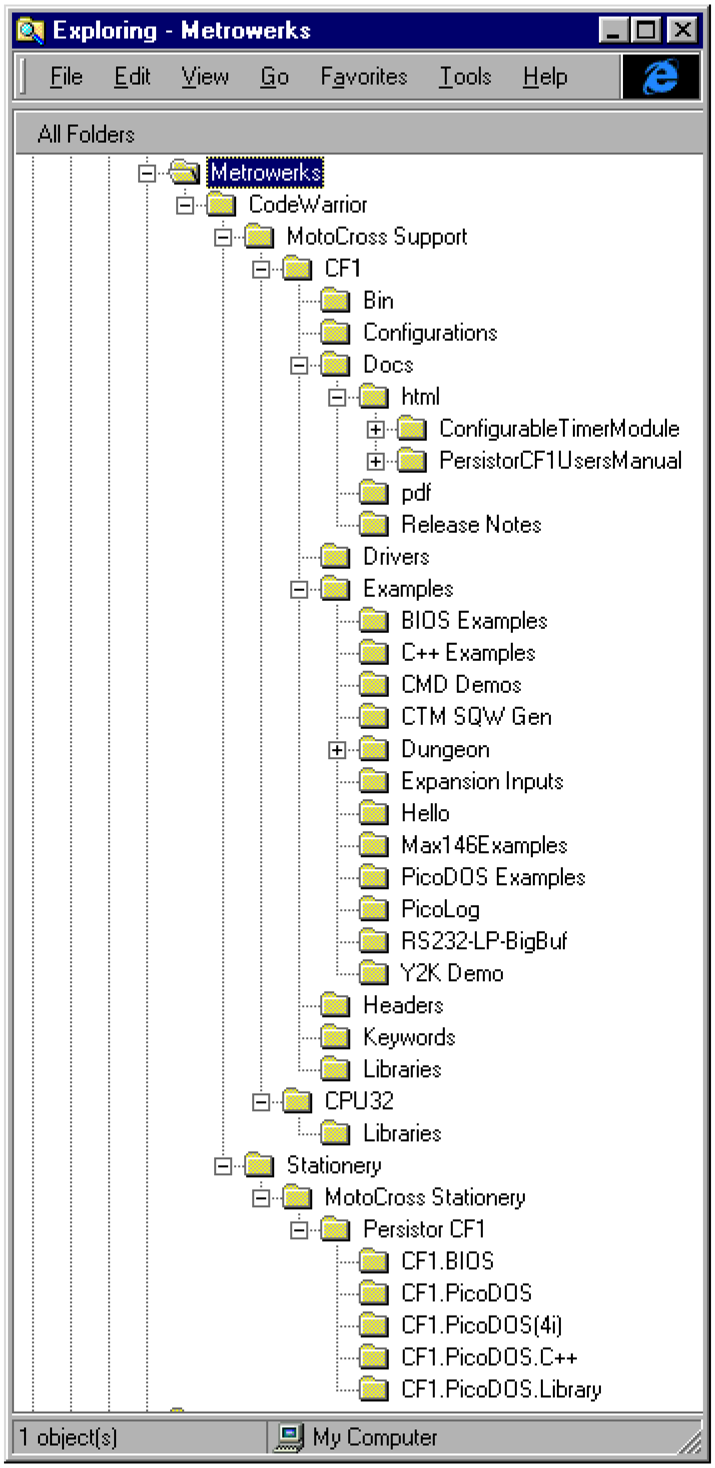
```
    C:\piisoft\CF1\
```

You can even have projects scattered over many directories or drives. The main point is:

Don't put your projects in the Metrowerks directory!

They will be lost when you install updated versions of CodeWarrior, and this is likely to happen a couple of times a year. Even though MotoCross installs and lets you run example programs in the Metrowerks directory, it knows you can recover them by simply reinstalling MotoCross. This is not the case for your projects and the source files you create.

The only things that should go into the Metrowerks directories are installations from Metrowerks and Persistor Instruments. You should also always assume that files in the Metrowerks directory will get deleted during update installations.

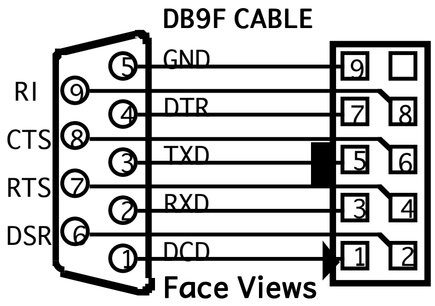


```
Metrowerks
  CodeWarrior
    MotoCross Support
      CF1
        Bin
        Configurations
        Docs
          html
            ConfigurableTimerModule
            PersistorCF1UsersManual
          pdf
          Release Notes
        Drivers
        Examples
          BIOS Examples
          C++ Examples
          CMD Demos
          CTM SQW Gen
          Dungeon
          Expansion Inputs
          Hello
          Max146Examples
          PicoDOS Examples
          PicoLog
          RS232-LP-BigBuf
          Y2K Demo
        Headers
        Keywords
        Libraries
      CPU32
        Libraries
    Stationery
      MotoCross Stationery
        Persistor CF1
          CF1.BIOS
          CF1.PicoDOS
          CF1.PicoDOS(4i)
          CF1.PicoDOS.C++
          CF1.PicoDOS.Library
```

Hookup and First Run

There are several jumper pins on the RecipeCard and these come pre-configured to select default options that let you quickly try out your new system. You'll need to insert the CF1 into the sockets on the RecipeCard. This is very difficult to do incorrectly. If you have any doubts, look at the picture on the front cover.

Insert the power and RS-232 cables into their respective headers. These are shrouded and polarized to prevent incorrect insertion. Connect the red lead of the power cable to your supplies positive terminal and connect the black lead to negative. The power cabling uses Molex C-Grid connectors and these are available from DigiKey and Allied among others.



The RS-232 cable adapts the RecipeCards 2x5 dip header to a standard DB-9F that connects to standard PC comm port or extension cable. The cable wires the 2x5 connector such that pin 1 of the DB9 connects to pin 1 of the 2x5, and all of the other 2x5 connections are setup such that they map correctly to a standard DCE as shown.

If you haven't installed MotoCross yet, but already have a communications program on your PC you can give the Persistor a quick try by setting your communications program for direct connection, 9600 baud, no parity, 8 data bits, and 1 stop bit. Apply power to the Persistor, and you'll probably see something like the following:

```
-------------------------------------------------------------
Persistor CF1 - Persistor Instruments Inc. - www.persistor.com
     SN 10945 - PicoDOS V2.26 - BIOS V2.26 - PBM V2.26
        (C) 2000 Peripheral Issues - www.periph.com
-------------------------------------------------------------

C:\>
```

The PicoDOS prompt is a standard DOS-like drive identifier when a flash card is installed. When there's no card, PicoDOS displays a warning that many functions are disable and reverts to the PicoDOS prompt. From either prompt, you can type the VERsion command with the –Verbose option for system details as shown:

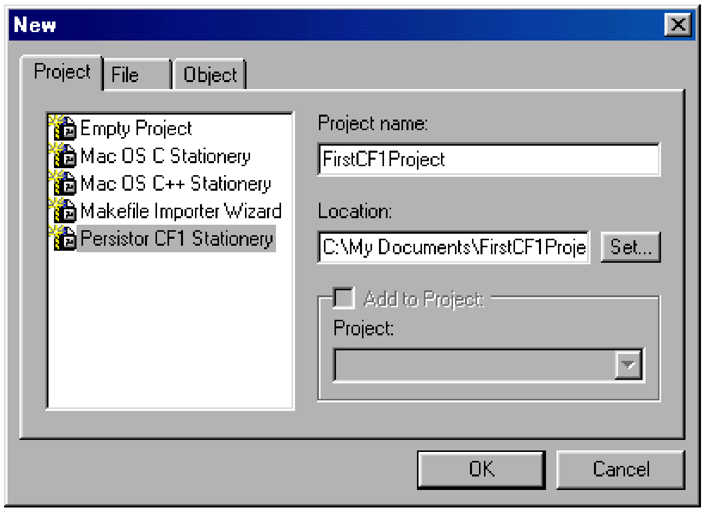
```
C\>VER –V <ret>
CF1 SN  10945
PicoDOS 2.26
BIOS    2.26
PBM     2.26
PIC     1.44
```

Typing HELP will always give you a list of the available PicoDOS commands

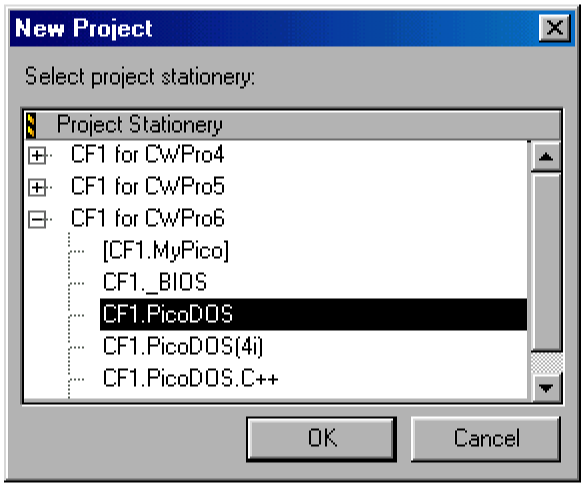
CF1 C Programming Tutorial

So, you've gotten your Persistor out of the box hooked up and ready to go. Now it's time to find out what the CF1 can really do. This tutorial assumes that you have followed the correct installation procedure for both CodeWarrior and MotoCross. If CodeWarrior is not installed or MotoCross is installed improperly, this tutorial will be of little utility.

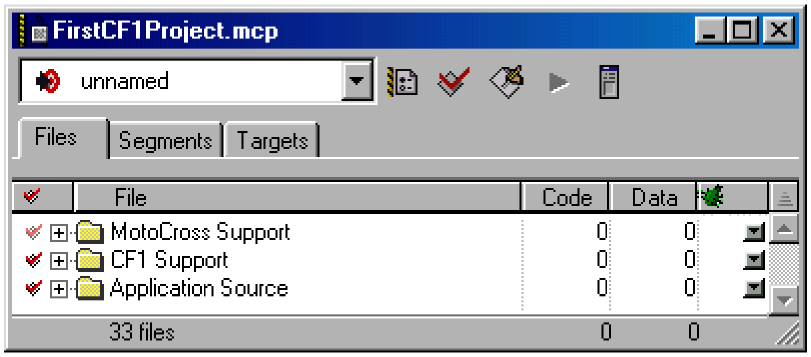
Your First Project



To begin, launch CodeWarrior. Select **File -> New Project**. A "New" window will appear allowing you to select from a list of stationery. You will see options for several types of projects, but for now just choose Persistor CF1 Stationery. Type the desired name (we'll use FirstCF1Project) in the Project Name box and click "OK". The next "New Project" window will ask to specify which type of CF1 project you want, and you should expand the appropriate CodeWarrior version (probably CWPro6) and choose CF1.PicoDOS and click "OK".



Once the above steps are completed, you will be presented with a CodeWarrior Project window. There are several "groups" within the project window. These are merely organizational tools and do not reflect any "on disk" structure for the project. When first opened, these groups are collapsed and you can click on their expander controls (the boxes on the left) to view the files in the groups. The two snapshots at right show the same project with different expansion levels. We'll go through the groups one by one ahead:

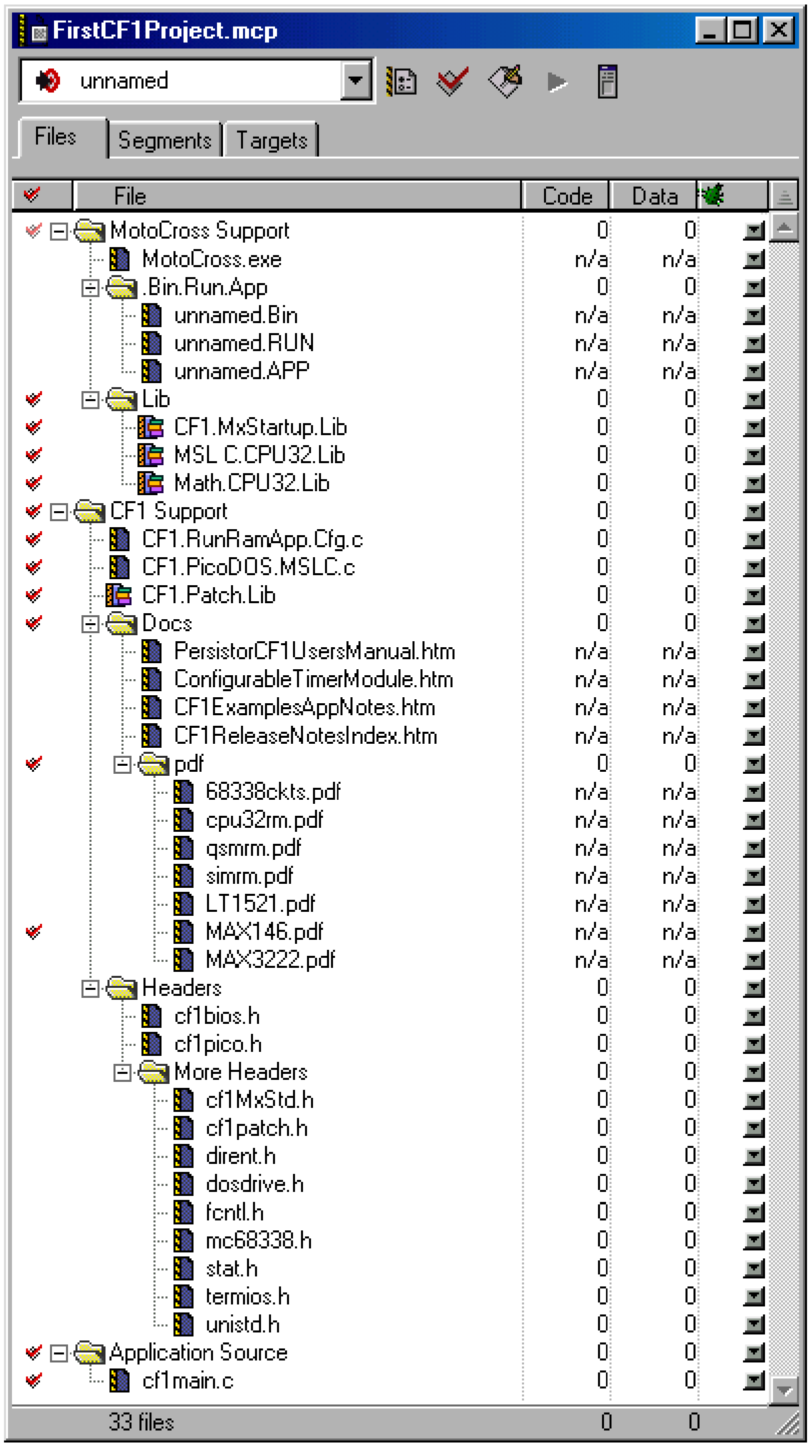


File	Code	Data
MotoCross Support	0	0
CF1 Support	0	0
Application Source	0	0
33 files	0	0

1) **MotoCross Support** - This group contains several libraries crucial to compiling projects for the CF1. These files include a special version of the C standard library and math support library for the CF1 and a special startup library that sets up your C program to run in the CF1 environment. You will generally never make changes to this group or to the files in this group.

2) **CF1 Support -** This group contains a pair of C files that control runtime memory mapping and provide some interface support between the CF1 firmware and the standard C libraries. You will generally never make changes to this group or to the files in this group.

3) **Docs -** This group is the key to easy development on the CF1. In this folder are links to starting points for all of the on-line documentation for the CF1. Bear in mind that you will need to have Adobe Acrobat as well as a modern web browser like Explorer or Netscape installed on your machine for this to work. There are two HTML files accessible to you in the folder. **PersistorCF1UsersManual.htm** is the master link to the user's manual. You may just double click that file directly in the window to launch your web browser and begin viewing the manuals. **ctm.htm** is a link to the Configurable Timer Documentation. In addition, in the **Docs** folder you should see a **pdf** folder. This folder contains links to most of the hardware and part-level documentation that we provide in PDF format that can be read with Adobe Acrobat.



✓	File	Code	Data
✓	MotoCross Support	0	0
	MotoCross.exe	n/a	n/a
	.Bin.Run.App	0	0
	unnamed.Bin	n/a	n/a
	unnamed.RUN	n/a	n/a
	unnamed.APP	n/a	n/a
✓	Lib	0	0
✓	CF1.MxStartup.Lib	0	0
✓	MSL C.CPU32.Lib	0	0
✓	Math.CPU32.Lib	0	0
✓	CF1 Support	0	0
✓	CF1.RunRamApp.Cfg.c	0	0
✓	CF1.PicoDOS.MSLC.c	0	0
✓	CF1.Patch.Lib	0	0
✓	Docs	0	0
	PersistorCF1UsersManual.htm	n/a	n/a
	ConfigurableTimerModule.htm	n/a	n/a
	CF1ExamplesAppNotes.htm	n/a	n/a
	CF1ReleaseNotesIndex.htm	n/a	n/a
✓	pdf	0	0
	68338ckts.pdf	n/a	n/a
	cpu32rm.pdf	n/a	n/a
	qsmrm.pdf	n/a	n/a
	simrm.pdf	n/a	n/a
	LT1521.pdf	n/a	n/a
✓	MAX146.pdf	n/a	n/a
	MAX3222.pdf	n/a	n/a
	Headers	0	0
	cf1bios.h	0	0
	cf1pico.h	0	0
	More Headers	0	0
	cf1MxStd.h	0	0
	cf1patch.h	0	0
	dirent.h	0	0
	dosdrive.h	0	0
	fcntl.h	0	0
	mc68338.h	0	0
	stat.h	0	0
	termios.h	0	0
	unistd.h	0	0
✓	Application Source	0	0
✓	cf1main.c	0	0
	33 files	0	0

4) **Headers** - This folder contains links to the main header files used in development for the CF1. If you need to look up any function prototypes or typedefs used with any of the Persistor API functions or PicoDOS, you can find those files here. Once again, you can open the files by simply double clicking on them.

5) **Application** - This is the folder where you can store all of your application source files. You will notice that it already contains a file called **cf1main.c**. This is a starter file that we have provided to help make it easier for you to begin development. It contains the all of the standard ANSI header file includes as well as all of the device specific includes that you will need to work with the CF1.

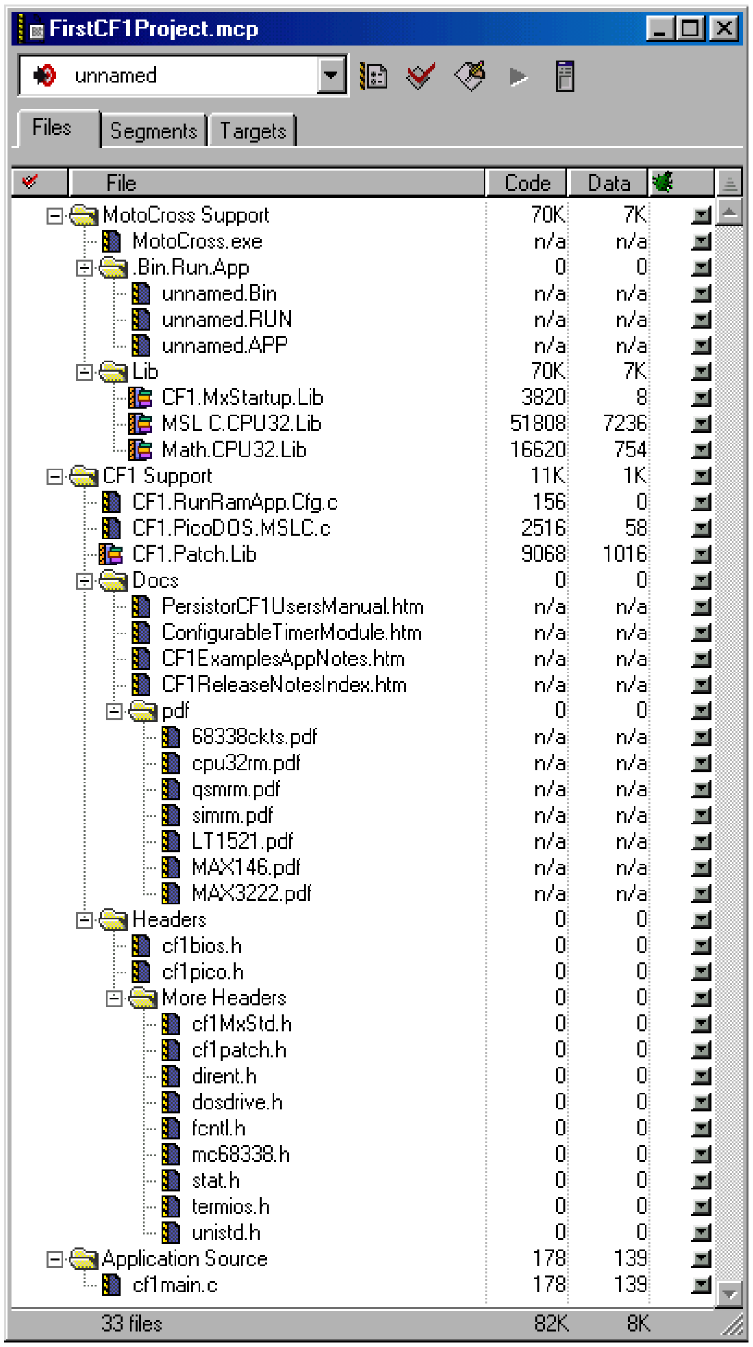
Once you become familiar with CodeWarrior and CF1 development, you can begin to tailor the organization of projects to meet the specific needs of your application. The format described above works well for most projects, but just like the arrangement of files on your PC desktop, it's really just an organizational convenience.

A Note About Targets

Metrowerks CodeWarrior has a special feature that allows "multiple targets" in one project file. This allows us, in our examples to keep related, yet separate projects together in one file for organizational purposes.

To pick a particular target use the target pull-down menu in the project window located beneath the Files tab at the top of the window. The left edge of the menu has a bullseye with an arrow pointing at it.

Some multi-target projects send the compilers object and binary data to either a "bin" directory, or into a directory named "<PROJECTNAME> Data". Point MotoCross to one of these if you do not see the binaries in the main project directory. However, if you use our project stationery this should not be an issue.

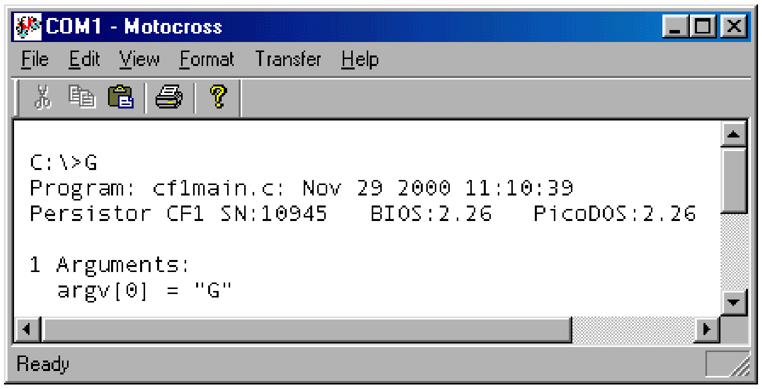


File	Code	Data
MotoCross Support	70K	7K
MotoCross.exe	n/a	n/a
.Bin.Run.App	0	0
unnamed.Bin	n/a	n/a
unnamed.RUN	n/a	n/a
unnamed.APP	n/a	n/a
Lib	70K	7K
CF1.MxStartup.Lib	3820	8
MSL C.CPU32.Lib	51808	7236
Math.CPU32.Lib	16620	754
CF1 Support	11K	1K
CF1.RunRamApp.Cfg.c	156	0
CF1.PicoDOS.MSLC.c	2516	58
CF1.Patch.Lib	9068	1016
Docs	0	0
PersistorCF1UsersManual.htm	n/a	n/a
ConfigurableTimerModule.htm	n/a	n/a
CF1ExamplesAppNotes.htm	n/a	n/a
CF1ReleaseNotesIndex.htm	n/a	n/a
pdf	0	0
68338ckts.pdf	n/a	n/a
cpu32rm.pdf	n/a	n/a
qsmrm.pdf	n/a	n/a
simrm.pdf	n/a	n/a
LT1521.pdf	n/a	n/a
MAX146.pdf	n/a	n/a
MAX3222.pdf	n/a	n/a
Headers	0	0
cf1bios.h	0	0
cf1pico.h	0	0
More Headers	0	0
cf1MxStd.h	0	0
cf1patch.h	0	0
dirent.h	0	0
dosdrive.h	0	0
fcntl.h	0	0
mc68338.h	0	0
stat.h	0	0
termios.h	0	0
unistd.h	0	0
Application Source	178	139
cf1main.c	178	139
33 files	82K	8K

Your first program

The default C project stationery contains a simple bit of code that prints out the serial number of your CF1 as well as information regarding the program build and the versions of the BIOS and PicoDOS that are burned into your Persistor's flash. You may wish to look at the file **cf1main.c** before compiling it. Once you are comfortable with the code you see select **Project -> Make**. If everything is installed correctly this should build a binary executable that the MotoCross program can then load into your CF1. During the build, the files and groups in your project window will update with information about the size of the code and data required for each module as shown. These numbers reflect the worst case usage, and the smart linker will generally reduce that by quite a bit. Map files created by CodeWarrior and MotoCross give complete details on memory usage and mapping.

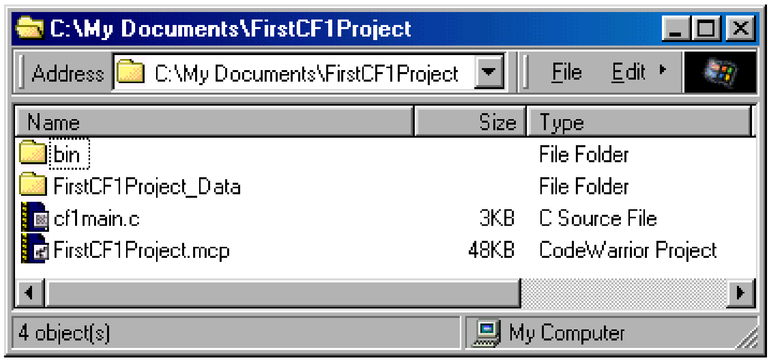
You can run MotoCross by double-clicking the MotoCross.exe file at the top of your project window's list of files. Select **MotoCross -> Post Link and Load…** then navigate to your project's bin directory and select the file with the ".bin" extension. In a few seconds, MotoCross will load the file into the CF1 and leave you in its terminal window where you'll see something like the following.



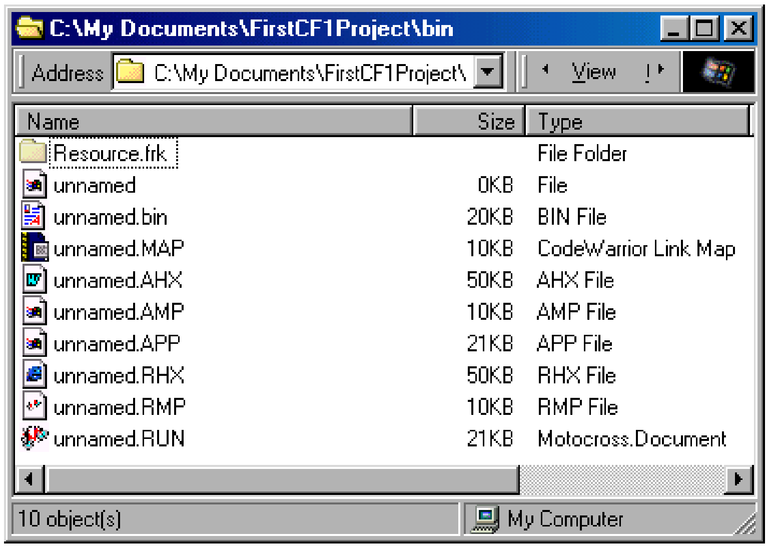
```
C:\>G
Program: cf1main.c: Nov 29 2000 11:10:39
Persistor CF1 SN:10945   BIOS:2.26   PicoDOS:2.26

1 Arguments:
  argv[0] = "G"
```

This prompt indicates that the code was loaded into your CF1 and the G (which was automatically sent by MotoCross) is an abbreviation for the GO command that will launch your program. At this point, if you press Enter, your program will execute.

What Happened?


C:\My Documents\FirstCF1Project
Address C:\My Documents\FirstCF1Project
File Edit
4 object(s)
My Computer

Name	Size	Type
bin		File Folder
FirstCF1Project_Data		File Folder
cf1main.c	3KB	C Source File
FirstCF1Project.mcp	48KB	CodeWarrior Project


C:\My Documents\FirstCF1Project\bin
Address C:\My Documents\FirstCF1Project\
View
10 object(s)
My Computer

Name	Size	Type
Resource.frk		File Folder
unnamed	0KB	File
unnamed.bin	20KB	BIN File
unnamed.MAP	10KB	CodeWarrior Link Map
unnamed.AHX	50KB	AHX File
unnamed.AMP	10KB	AMP File
unnamed.APP	21KB	APP File
unnamed.RHX	50KB	RHX File
unnamed.RMP	10KB	RMP File
unnamed.RUN	21KB	Motocross.Document

Congratulations, you have just compiled and run your first program for your CF1. When you chose the CF1.PicoDOS stationery and gave it the name FirstCF1Project, CodeWarrior created a new folder and populated it with the project file (FirstCF1Project.mcp), a starter C source file (cf1main.c), a project data folder (FirstCF1Project Data) and a bin folder to hold compliled binary code. CodeWarrior also automatically opened the project and added it to the list of recent projects so you can quickly open it again from the File menu.

When you chose **Project -> Make**, CodeWarrior checked all of the file dependencies, compiled all of the C source files, then linked the C code with the libraries. If it had found any errors, it would have displayed an error window with a list of problems for you to fix by double-clicking on the error message.

There were no errors, so it created the binary file (unnamed.bin) that thinks it is a Macintosh 68K executable, along with a map file that specifies the locations of functions and global variables in a not-so-useful relative offset format. Because CodeWarrior thinks in terms of creating Macintosh programs, it also generated a few other items which you can safely ignore, including a zero length file (unnamed), and a possibly invisible directory called Resource.frk.

When you ran MotoCross and post-linked unnamed.bin, MotoCross created six new files that are the real targets for the CF1. The file with the extension RUN is a CPM68K binary file, and it's what loaded into RAM and ran on the CF1. The APP is the same program, but targeted to load into flash memory when you use the **MotoCross ->Load CPM68K…** command.

The RHX and AHX files are also applications, but in Motorola S Record (hex) format. The RMP and AMP files contain text listing the functions and global variables, exactly as they are used on the CF1. You can open and read these maps directly from CodeWarrior.

Beyond Standard C Libraries

As you may have read elsewhere, the CF1 supports the ANSI C Standard Library. This fact should put an experienced C programmer well on their way to writing more meaningful and useful programs for the CF1. However, it is unlikely that you bought the CF1 solely to write programs with the C Standard Library. You probably want to take advantage of the CF1's I/O features, low-power operation and more of its many specialty subsystems. The following is a blow-by-blow description of the major hardware subsystems in the CF1.

CF1 Hardware Subsystems

The CF1 as an embedded controller is very diverse and agile. It can do almost anything. There are many different sections of APIs for accessing each of the internal capabilities. The following is a list of the major subsystems that you will find described in further detail in the online User's Manual.

ATA Device Drivers - The CF1 API has a suite of functions that allow you to manipulate ATA storage devices (usually CompactFlash) from within your programs. Although most developers will never have a need to use these in light of the standard file routine compatibility, they are nonetheless provided for your programming convenience.

CompactFlash Low Level Drivers - The CompactFlash Low Level drivers cover programming needs specific to CompactFlash card management and use. It is unlikely that you would ever use these but they are provided as an additional abstraction layer between the hardware and the ATA device drivers.

Checksums and Cyclic Redundancy Check Functions - Because many CF1 applications involve the transfer of data between the CF1 and a host computer as well as any other mating systems, there is often a need for error checking and data integrity tests. These functions provide a built in mechanism for performing checksum verification and cyclic redundancy checks.

Chip Select Drivers - One of the more interesting and distinguishing features of the CF1 is the ease with which you can add memory-mapped peripherals. The functions in the API subsection provide relatively high level mechanisms for mapping and configuring the two bus chip select lines that are available for your use. Examples are also provided which make use of these functions for mapping in new I/O. See the examples folder in the User's Manual for more information on this specific example.

Configurable Timer Module - The CF1 uses the Motorola MC68CK338 processor as its main brain. The '338 contains several hardware submodules that are specifically tailored to the common tasks in embedded computing. One of these submodules is the Configurable Timer Module. While it is one of the more complex subsystems in the '338, we have attempted to provide high-level accessor function to all of the features of the CTM6. The CTM contains both Single Action and Double Action modules that can perform tasks such as period measurement and Pulse Width Modulation. For a more detailed description of the CTM please see the included HTML documentation from Motorola which you will find in the same directory as your user's manual.

Flash Memory Functions - The CF1 has 1MB of non-volatile flash memory built-in. This is used to hold both the BIOS libraries and PicoDOS as well as other system internals. However, there is about 768K free for non-volatile application storage or data storage if you find the need. Because flash memory has special requirements and does not support random access unlike conventional RAM, we have developed a suite of functions that perform the writing and erasing tasks on the flash as well as other maintenance chores and diagnostic utilities. If you wish to develop programs that will make use of the Flash, you will need to familiarize yourself with this section in the User's Manual.

Interrupt and Exception Vector Wrapper Functions - We recognize that many applications in embedded computing are time sensitive or could be best serviced by a hardware or software interrupt mechanism. These functions provide you with a simple, easy to understand method for creating your own interrupt handlers written in C. We also provide functions that install your new interrupt handlers, written either in C using our prototyping and definition tools or written directly in assembly language, in to the Vector Table of the 68338.

LED Signal Functions - The CF1 has two dual color LEDs mounted near the sides of the Compact Flash header. They can be used as simple indicators of program status, as a visual watchdog or whatever else you can think of. This set of simple, almost self explanatory functions control the state and behavior of these LEDs making it easy for your programs to provide the most minimal of visual feedback.

Pin I/O Drivers, Functions and Macros - These functions and macros allow you to control and manipulate the behavior of the CF1's 33 general-purpose I/O lines. Some of the I/O pins on the CF1 have alternate functions related to other subsystems. This section contains functions that allow you to manipulate these alternate functions and correctly manage the use of the I/O pins on connector C on the CF1. Furthermore, there is a set of macros that provide ultra high-speed access allowing you to perform basic pin operations in under a microsecond with certain restrictions.

Periodic Interrupt Timer - Another hardware feature of the Motorola MC68CK338 is the Periodic Interrupt Timer or PIT. The PIT allows the '338 to trigger an interrupt on a set period. The period can be adjusted in increments of 100 microseconds from 100µs to 25.5ms and in increments of approximately 51ms from 51ms to around 13s. The CF1 API also proved a chore management system for the PIT allowing you to perform more than one chore, written in standard C with no special considerations (other than speed), on each interrupt and to shield the programmer from the necessity of writing low-level interrupt handlers.

PicoDOS Library Functions - Providing that PicoDOS is resident in flash in your particular application, which is normally the case, you can access most of the core functionality of PicoDOS from within your applications. Also provided is a subsystem called CMD processor which provides a deep and valuable framework for setting up a command line interface to your program. The CMD Processor allows your program to accept commands from a user interactively over the serial port, parse their arguments and dispatch the appropriate function. This can be a huge time saver if you want your program to be interactive.

Power Management Drivers - One of the more crucial features of the CF1 is its low power consumption with non-executing power-down modes as low as 5 µA, The CF1 really is a low-power panacea for the embedded system designer. This driver section gives you access to all the different power modes and power conservation functions the CF1 has to offer. There are many ways to reduce power in an embedded system. In this API section we have attempted to provide an intuitive management scheme for these many and diverse options.

Queued PicoBUS - Another Persistor Exclusive. The Motorola QSPI bus is a powerful way to add peripherals such as A/D converters and various other sensors to an embedded system. Until now there hasn't been an intuitive, managed, yet performance oriented software layer to control and manage this bus, but PicoBUS has solved this problem. The QPB API allows you to configure and manage your SPI devices. Furthermore, our internal library of device configurations is growing all the time. We may already have done some of the groundwork for the device you want to use.

Real Time Clock Drivers - The 68338 has an onboard Real Time Clock (RTC) that has its own precision crystal and its own power lines to allow ultra-reliable operation and persistence through low power shutdowns and hardware reset cycles. This suite of API functions gives you access to setting and reading this clock. It also provides its own periodic interrupt much in the same way as the PIT but it is fixed at 1 second intervals. Furthermore, it is worth noting that all of the ANSI C time-related functions are linked in at a low level to the RTC, so it is more than possible that you will never need to use these driver functions.

Serial Controller Interface Driver - The serial controller interface (SCI) is the main line of communication with the outside world during development. It consists of a low-level driver for the onboard UART and line drivers. Once again all of the ANSI C stdio functions are built on top of this driver but if power conservation is your game you may need to use some of these low-level calls to configure the UART in a specific way to help meet your design needs. We have attempted to cover all of the bases in this driver, from normal operation to the lowest power modes.

System Clock and Wait State Management - One of the easiest ways to conserve power in an embedded controller is to turn down the speed. Power consumption in a processor varies almost linearly with speed, and we provide functions for you to adjust the system clock anywhere from 160KHz to 16MHz and beyond. Right there you can reduce your power consumption by an order of magnitude. Furthermore, these functions provide a great level of control regarding the wait states and access speeds of the various bus peripherals. If you are interested in measuring and characterizing the performance of your CF1, you may wish to see our example program called **Hurry Up and Wait.** This program provides a great example of how to change the system clock and the number of wait states used with each peripheral.

Utility Functions - Lastly, there are functions that don't seem to fit anywhere else. These functions include a hexdump function that can be extremely useful during development and other useful, but difficult to classify functions.

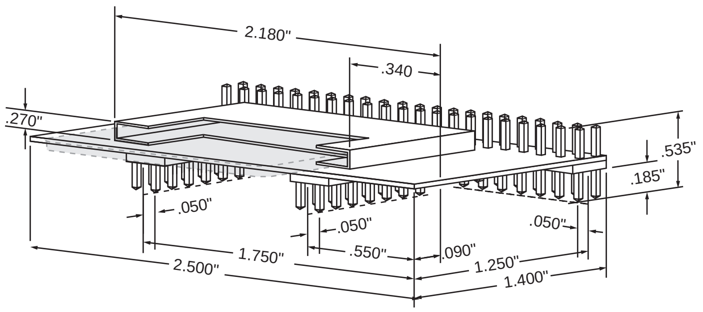
Specifications

Absolute Maximum Ratings

VBAT to GND	±20V
VREG and VBAT to GND	±20V
Digital Signals to GND	-0.3V to VREG+0.3V
Operation Temperature	-25°C to +75°C
Storage Temperature	-40°C to +85°C
Humidity:	0 to 95% (non-cond)

Physical Specifications

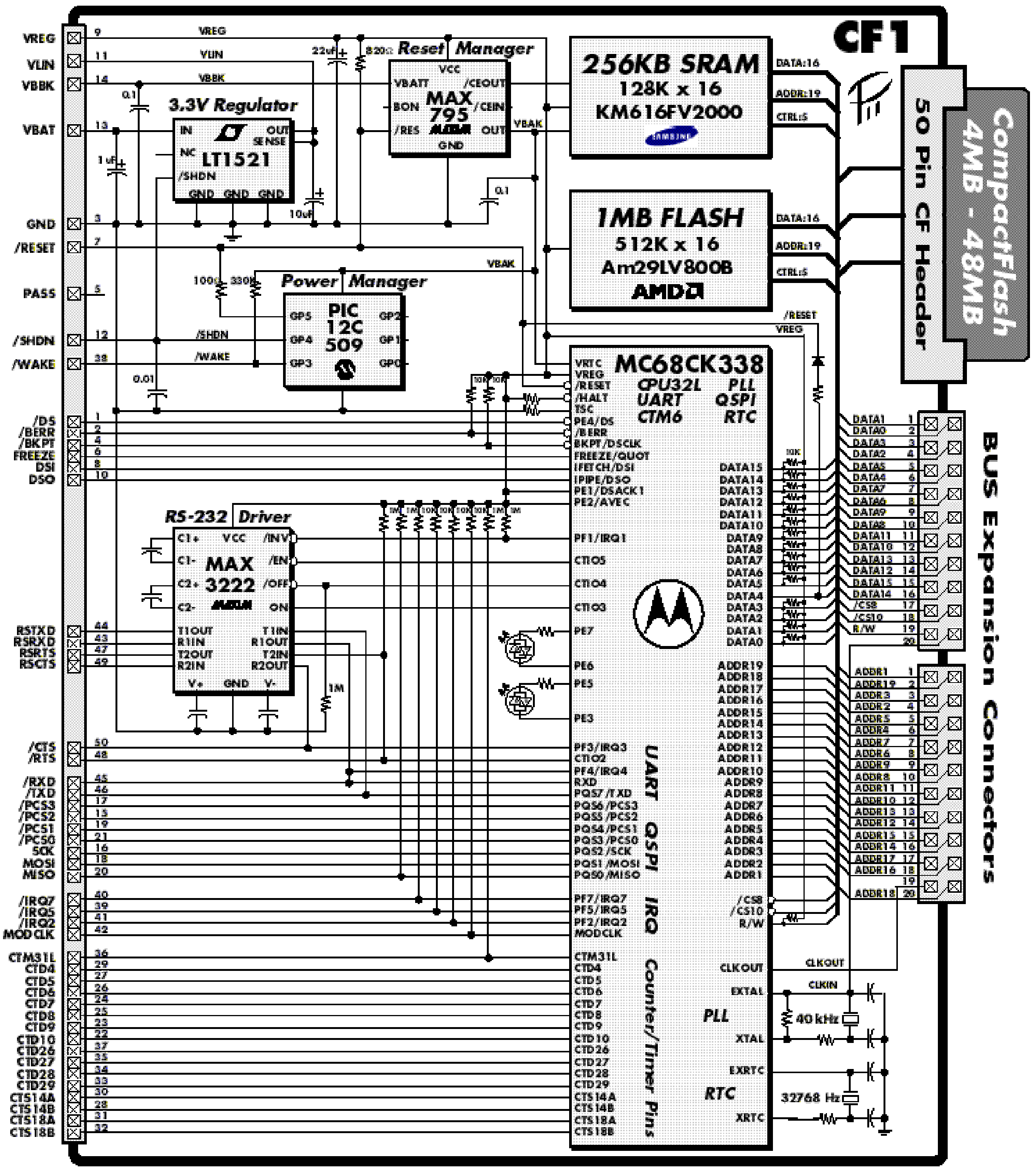
PARAMETER	SI	US
Weight		< 1oz
with CF Card		< 1.2 oz
Length	63.5 mm	2.5 in
Width	35.5 mm	1.4 in
with CF Card	51.0 mm	2.0 in
Thickness	14.5 mm	0.57 in



Electrical Characteristics

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
VBAT Operating Voltage	-25° C to +75° C at 40mA	3.6		20	V
	-25° C to +30° C at 75mA	3.6		20	V
	-25° C to +75° C at 75mA	3.6		12.8	V
	-25° C to +30° C at 250mA	5.0		8.4	V
	-25° C to +75° C at 250mA	5.0		6.0	V
VREG Operating Voltage		3.1	3.3	3.6	V
VREG Operating Current	16MHz Constant CF Write		100	125	mA
	16MHz (CF Idle)		55	70	mA
	8 MHz (CF Idle)		32	40	mA
	4 MHz (CF Idle)		20	25	mA
	320kHz (CF Idle)		4	10	mA
	LPSTOP (CF Idle)		300	500	µA
	LPSTOP (no CF)		240	400	µA
	Suspend		6	20	µA
VBBK Operating Voltage		2.7	3.0	VREG	V
VBBK Operating Current	Backup/Suspend		2.8	20	µA
	VREG > VBBK		0.1	1	µA
System Clock		0.160		16	MHz
PLL Crystal	±100ppm	39.996	40.000	40.004	kHz
RTC Crystal	±50ppm	32.766	32.768	32.770	kHz

Block Diagram and Signal Connections



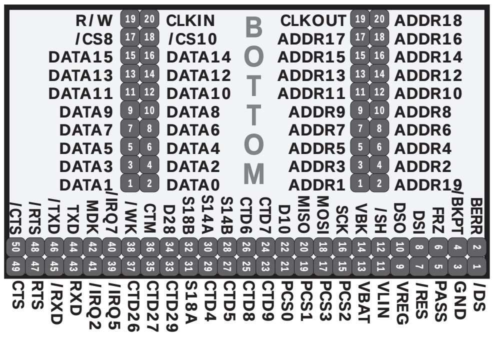
Pin Descriptions

Type	Description
A	Output only signals that are always driven.
Ao	Type A that can operate in open drain mode.
Aw	Type A output with weak pull-up during reset.
B	Three state output that includes circuitry to pull up output before high impedance is established to ensure rapid rise time.
Bo	Type B that can operate in open drain mode.
...Pxx	Has onboard pull-up resistor of value xx.
...PxxG	Has onboard pull-down resistor of value xx.
...RSI	RS-232 (EIA) level input.
...RSO	RS-232 (EIA) level output.

The CF1 interfaces to your circuitry using three standard double-row 0.1" headers. Many CF1 based systems will only need to access the signals on the 2x25 pin "C" connector, which brings out pins on both sides of the board (OEM versions may specify pins on only one side or the other).The 2x10 "A" and "B" connectors bring out the address and data bus along with control signals for system expansion.

The first ten pins of connector "C" form a standard BDM (Background Debugger Mode) connector block at the top of the CF1, and these are identified by a solid white silk-screen. In addition, every fifth pin of connector "C" is marked with white to help quickly identify the proper pin.

Pin type designations are taken from the MC68CK338 Technical Summary, and where appropriate, suffixed with the value of onboard pullup resistors or special notes.



Static Sensitive CMOS! All of the CF1 pins connect to static sensitive CMOS circuitry. You must take precautions to guard against damage to these parts from static electricity.

A	Signal	Desc.	Dir.	Function	Type
1	ADDR1	Address Bus 1	Out	BUS	A
3	ADDR3	Address Bus 3	Out	BUS	A
5	ADDR5	Address Bus 5	Out	BUS	A
7	ADDR7	Address Bus 7	Out	BUS	A
8	ADDR9	Address Bus 9	Out	BUS	A
11	ADDR11	Address Bus 11	Out	BUS	A
13	ADDR13	Address Bus 13	Out	BUS	A
15	ADDR15	Address Bus 15	Out	BUS	A
17	ADDR17	Address Bus 17	Out	BUS	A
19	CLKOUT	System CLock Output	Out	CLK	A

A	Signal	Desc.	Dir.	Function	Type
2	ADDR19	Address Bus 19	Out	BUS	A
4	ADDR2	Address Bus 2	Out	BUS	A
6	ADDR4	Address Bus 4	Out	BUS	A
8	ADDR6	Address Bus 6	Out	BUS	A
10	ADDR8	Address Bus 8	Out	BUS	A
12	ADDR10	Address Bus 10	Out	BUS	A
14	ADDR12	Address Bus 12	Out	BUS	A
16	ADDR14	Address Bus 14	Out	BUS	A
18	ADDR16	Address Bus 16	Out	BUS	A
20	ADDR18	Address Bus 18	Out	BUS	A

B	Signal	Desc.	Dir.	Function	Type
1	DATA1	Data Bus 1	I/O	BUS	AwP1M
3	DATA3	Data Bus 3	I/O	BUS	AwP1M
5	DATA5	Data Bus 5	I/O	BUS	AwP1M
7	DATA7	Data Bus 7	I/O	BUS	AwP1M
8	DATA9	Data Bus 9	I/O	BUS	AwP1M
11	DATA11	Data Bus 11	I/O	BUS	AwP1M
13	DATA13	Data Bus 13	I/O	BUS	AwP1M
15	DATA15	Data Bus 15	I/O	BUS	BP10K
17	/CS8	Chip Select 8	Out	BUS	A
19	R/W	Read/Write	Out	BUS	AP10K

B	Signal	Desc.	Dir.	Function	Type
2	DATA0	Data Bus 0	I/O	BUS	AwP1M
4	DATA2	Data Bus 2	I/O	BUS	AwP1M
6	DATA4	Data Bus 4	I/O	BUS	Aw*1
8	DATA6	Data Bus 6	I/O	BUS	AwP1M
10	DATA8	Data Bus 8	I/O	BUS	AwP1M
12	DATA10	Data Bus 10	I/O	BUS	AwP1M
14	DATA12	Data Bus 12	I/O	BUS	AwP1M
16	DATA14	Data Bus 14	I/O	BUS	AwP1M
18	/CS10	Chip Select 10	Out	BUS	A
20	CLKIN	40kHz Clock Input	In	CLK	*2

C	Signal	Desc.	Dir.	Function	Type
1	/DS	Data Strobe	Out	BDM/BUS	B*8
3	GND	Ground	Pwr	BDM/PWR	-
5	PASS	Pass Through (not used)			*10
7	/RESET	Reset	I/O	BDM/BUS	BoP820
9	VREG	3.3V Power to Circuitry	In	BDM/PWR	
11	VLIN	3.3V Regulator Ouput	Out	PWR	
13	VBAT	Main Battery Input	In	PWR	
15	PCS2	SPI Chip Select 2	I/O	QSPI/GPIO	Bo*9
17	PCS3	SPI Chip Select 3	I/O	QSPI/GPIO	Bo*9
19	PCS1	SPI Chip Select 1	I/O	QSPI/GPIO	Bo*9
21	PCS0	SPI Chip Select 0	I/O	QSPI/GPIO	Bo*9
23	CTD9	Double Action Timer	I/O	TMR/GPIO	Ao
25	CTD8	Double Action Timer	I/O	TMR/GPIO	Ao
27	CTD5	Double Action Timer	I/O	TMR/GPIO	Ao
29	CTD4	Double Action Timer	I/O	TMR/GPIO	Ao
31	CTS18A	Single Action Timer	I/O	TMR/GPIO	A
33	CTD29	Double Action Timer	I/O	TMR/GPIO	Ao
35	CTD27	Double Action Timer	I/O	TMR/GPIO	Ao
37	CTD26	Double Action Timer	I/O	TMR/GPIO	Ao
39	/IRQ5	Interrupt Request 5	I/O	IRQ/GPIO	B10K*5
41	/IRQ2	Interrupt Request 2	I/O	IRQ/GPIO	B10K*5
43	RSRXD	RS232 Receive (EIA)	In	UART	RSIP5KG
45	IRQ4/RXD	IRQ/RS232 Rx (CMOS)	In	UART	*7
47	RSRTS	RS232 RTS (EIA)	Out	UART	RSO
49	RSCTS	RS232 CTS (EIA)	In	UART	RSIP5KG

C	Signal	Desc.	Dir.	Function	Type
2	BERR	Bus Error	Out	BDM/BUS	BP10K
4	/BKPT	Breakpoint	In	BDM	P10K
6	FREEZE	Freeze	Out	BDM	A
8	DSI	BDM Input	IN	BDM	A
10	DSO	BDM Output	Out	BDM	A
12	/SHDN	Shutdown	Out	PWR	*3
14	VBBK	Backup Battery Input	In	PWR	
16	SCK	SPI Clock	I/O	QSPI/GPIO	Bo*9
18	MOSI	SPI Data Out	I/O	QSPI/GPIO	Bo*9
20	MISO	SPI Data In	I/O	QSPI/GPIO	BoP1M
22	CTD10	Double Action Timer	I/O	TMR/GPIO	Ao
24	CTD7	Double Action Timer	I/O	TMR/GPIO	Ao
26	CTD6	Double Action Timer	I/O	TMR/GPIO	Ao
28	CTS14B	Single Action Timer	I/O	TMR/GPIO	A
30	CTS14A	Single Action Timer	I/O	TMR/GPIO	A
32	CTS18B	Single Action Timer	I/O	TMR/GPIO	A
34	CTD28	Double Action Timer	I/O	TMR/GPIO	Ao
36	CTM31L	External Timer Load	In	TMR/GPIO	AP1M
38	/WAKE	External Wakeup	In	PWR	*4
40	/IRQ7	Interrupt Request 7	I/O	IRQ/GPIO	B10K*5
42	MODCLK	Alternate Clock Source	I/O	CLK/GPIO	B10K*6
44	RSTXD	RS232 Transmit (EIA)	Out	UART	RSO
46	/TXD	RS232 Transmit (CMOS)	Out	UART	Bo
48	/RTS	RS232 RTS (CMOS)	Out	UART	AP1M
50	IRQ3/CTS	IRQ/CTS (CMOS)	In	UART	B*7

***1**. DATA4 is pulled low with 10K during reset.

***2**. CLKIN is connected to the 68338 EXTAL input for the 40kHz crystal. It is an extremely high impedance input and care must be taken not to make unintentional connection to this pin, which would likely cause erratic behavior. Contact the factory for information on using CLKIN with an external precision clock source.

***3**. /SHDN is an output signal controlled by the power management circuitry. Your peripheral circuitry can monitor this signal, but only with inputs having less than 100nA leakage and less than 100pF capacitance. When low, all of the CF1 circuitry is powered off. Do not attempt to assert or load this line.

***4**. /WAKE is input to the power management circuitry and is pull high with 1M to the internal VBAK volage. External circuitry (coordinated with CF1 driver software) may use this line to pull the CF1 out of suspend mode.

***5**. These lines must be left floating, or asserted high at reset.

***6**. This line must be floating or asserted high at reset for normal operation. It may be pulled low during reset to disable the onboard PLL clock oscillator and insert an external clock. Contact the factory for application notes.

***7**. /RXD and /CTS are inputs to the 68338, but are normally driven by the RS232 driver chip. You can disable the RS232 driver under software control to allow the CF1 to run the UART at CMOS levels.

***8**. DS comes out of reset as an active driving bus output, but is not used by the CF1 except when connected to a BDM debugger. When your program gets control, you can define this line as a BUS signal (for decoding), an input signal (though you must not drive into it until you redefine it), or an output signal. The convenient location and the fact that it is less useful as a general purpose control line (since it flails at reset) makes this an ideal pin for diagnostics and timing or profiling your functions with a scope using the fast I/O macros.

***9**. All of the QSPI (PicoBUS) signals revert to inputs at reset which means they may assume any state, and that could be trouble for attached SPI devices which could interpret reset flailing as commands, which in turn could have the SPI device do something the CF1 would not like. You should add 10K to 100K pullups to the /CS lines of your SPI devices to prevent trouble.

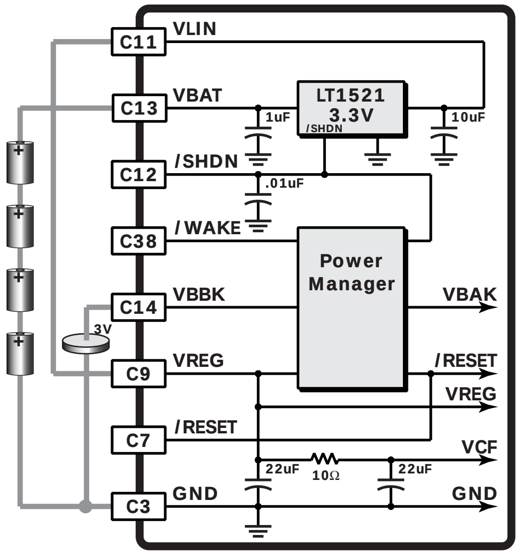
***10**. The PASS pin does not connect to any circuitry on the CF1 and may be used to pass a signal from a top mounted expansion board to another bottom mounted board.

Power Connections

The CF1 has very flexible power management support circuitry to simplify integration with your electronics. The onboard 3.3 volt linear regulator with reverse battery protection and thermal current limiting that "floats" on the CF1 board to allow you to bypass, augment, or reassign it to other circuitry. Normally, you simply wire your positive supply to the VBAT input, then jumper VLIN (the regulator output) to VREG.

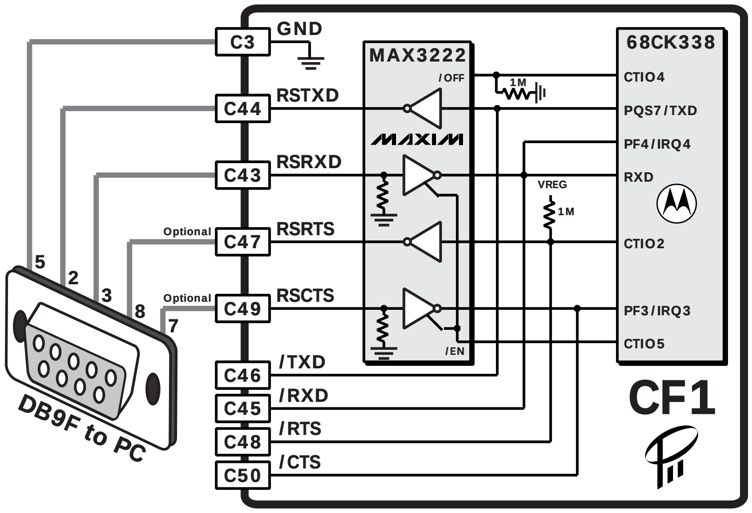
An onboard power supervisor ensures that the CF1 will receive an orderly reset and that the memory and real-time clock will be preserved in the event of a power disruption.

A separate power managing controller lets the CF1 drop into a SUSPEND mode where the system draws less than 10 microamps. It can wake and resume after a programmed delay or on detection of /WAKE signal or CompactFlash card change event.



C	Signal	Dir.	Description
3	**GND**	In	This is the negative return for all of the CF1 power signals and digital ground for all of the CF1 logic.
13	**VBAT**	In	This is the unregulated DC input voltage to the onboard LT1521 linear regulator. The LT1521 will allow the CF1 to work with inputs from 3.6 to 20 volts and provides reverse power protection to -20 volts. This input connects to a 1uF tantalum filter capacitor. Leave this input unconnected if you are not using the onboard regulator.
11	**VLIN**	Out	This is the regulated 3.3 volts from the onboard LT1521 linear regulator. The LT1521 has a rated output of 300mA maximum, but the actual continuous current will vary with temperature and input voltage. Refer to the specifications on page 2 for operating limits. The regulated output does not connect directly to any onboard components and is normally wired to VREG with an offboard connection to power the CF1 electronics. This output connects to a 10uF tantalum filter capacitor.
9	**VREG**	In	This is the regulated 3.3 volts to the CF1 electronics. It is normally wired to VLIN, but may be driven by any 3.3 volt supply. VREG connects to an onboard 22uF tantalum filter capacitor. It also connects to the MAX795 power supervisor which resets the CPU and switches over to VBBK when the input drops below 3 volts (2.85 to 3.00).
-	**VCF**	-	This onboard only power signal feeds the CompactFlash header through a 10 ohm current limiting resistor to VREG. It has its own 22uF tantalum filter capacitor.
14	**VBBK**	In	This is the 3 volt backup battery supply input. It feeds into the MAX795 power supervisor and runs the real-time clock and 256KB SRAM when the main voltage drops below 3 volts.
-	**VBAK**	-	This onboard only power signal comes from the MAX795 power supervisor and feeds the RTC and SRAM from VREG when main power is normal, and from VBBK when the main voltage drops below 3 volts.
7	**/RESET**	I/O	This open-drain bidirectional signal resets the CF1 electronics. This is pulled to VREG with an 820 ohm resistor. Both the MAX795 power supervisor and the PIC power manager can assert this signal.
12	**/SHDN**	Out	This is an output signal controlled by the power management circuitry. Your peripheral circuitry can monitor this signal, but only with inputs having less than 100nA leakage and less than 100pF capacitance. When low, all of the CF1 circuitry is powered off. Do not attempt to assert or load this line.
28	**/WAKE**	In	This is the input to the power management circuitry and is pulled high with 330K to the internal VBAK voltage. External circuitry (coordinated with CF1 driver software) may use this line to pull the CF1 out of suspend mode.

UART Connections

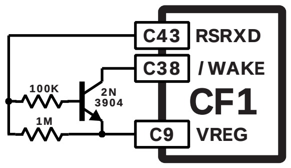


The 68338 has a Serial Controller Interface (SCI) that provides standard UART functions at rates from 64 to 500 kbaud with advanced error detection circuitry. The SCI supports full or half duplex operation, double buffering, optional parity generation and detection, and wakeup on idle line or address detection.

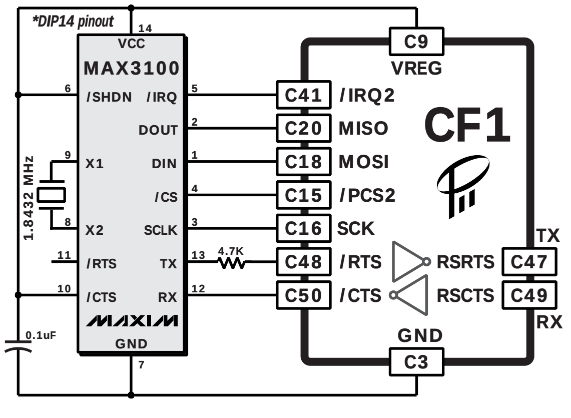
The CF1 has an onboard MAX3222 dual EIA driver to interface directly to any standard RS-232 terminal or device. Either or both the receive and transmit drivers can be disabled under software control to conserve power or allow connection to alternate RS-485 or RS-422 drivers.

BIOS UART Support: The CF1 BIOS software handles port configuration, polled or buffered receive and transmit, and flow control with several dozen high-level C functions. One of the example projects that ships on the CF1 Developer's CD demonstrates how to stream incoming RS-232 data to a file on the CompactFlash card at any standard BAUD rate while automatically dropping to less than 2mA whenever the serial line idles. This particular example is 180 lines of C code, over 100 of which are just comments and formatting.

RS-232 Wakeup Call: Both the RXD and CTS signals connect to interrupt request pins on the 68338 to allow wakeup from deep sleep modes from any UART activity. However, in the 10µA SUSPEND mode, power to the CPU is completely off so we add the simple circuit at right to yank on the /WAKE line when a UART character comes in. It may seem odd to tie the emitter of the NPN transistor to VREG, but VREG actually looks like GROUND when the CF1 is in SUSPEND, and this circuit keeps the WAKE line from flailing during normal operation.



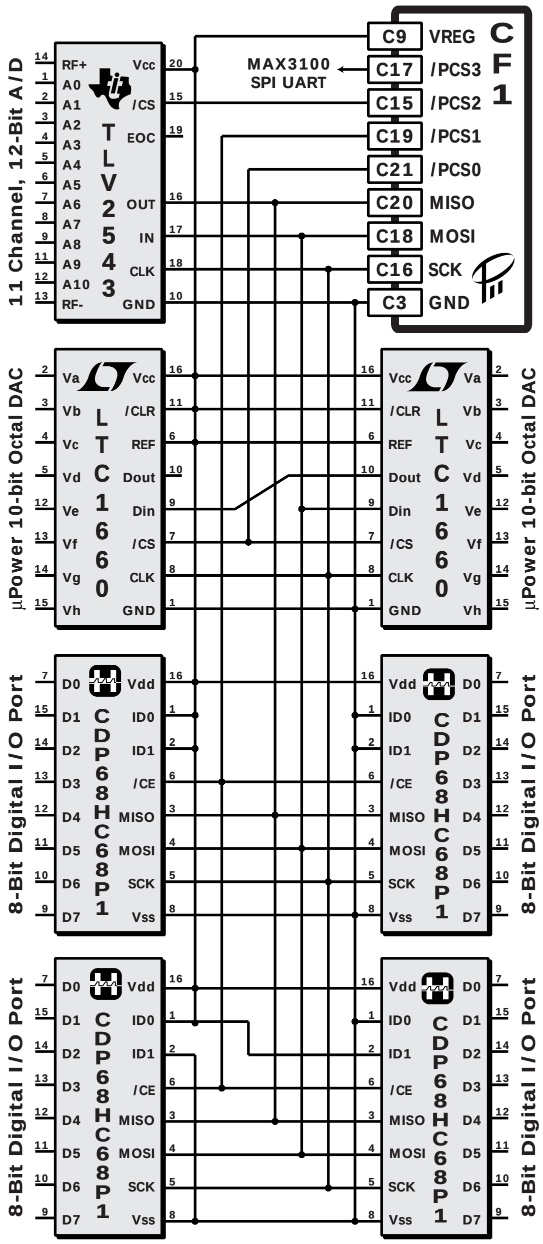
2nd UART borrowing spare drivers: All of the CMOS level UART signals are brought out to allow driver replacement, and the RTS and CTS signals can be used for EIA level flow control or reassigned to work as RXD and TXD signals for a second external UART such as a MAX3100 SPI UART shown. In the next section, you'll see that this same technique can be used to expand to up to 14 additional UARTs.



QSPI Connections

The 68338 has a powerful Queued Serial Peripheral Interface that allows simple hardware expansion to over five hundreds different SPI compatible devices. The circuit at right demonstrates glueless expansion adding a second UART (from the previous section) 11 A-D channels with 12-bit resolution, 16 voltage output 10-bit D-A channels, and 32 individually programmable bidirectional digital I/O pins.

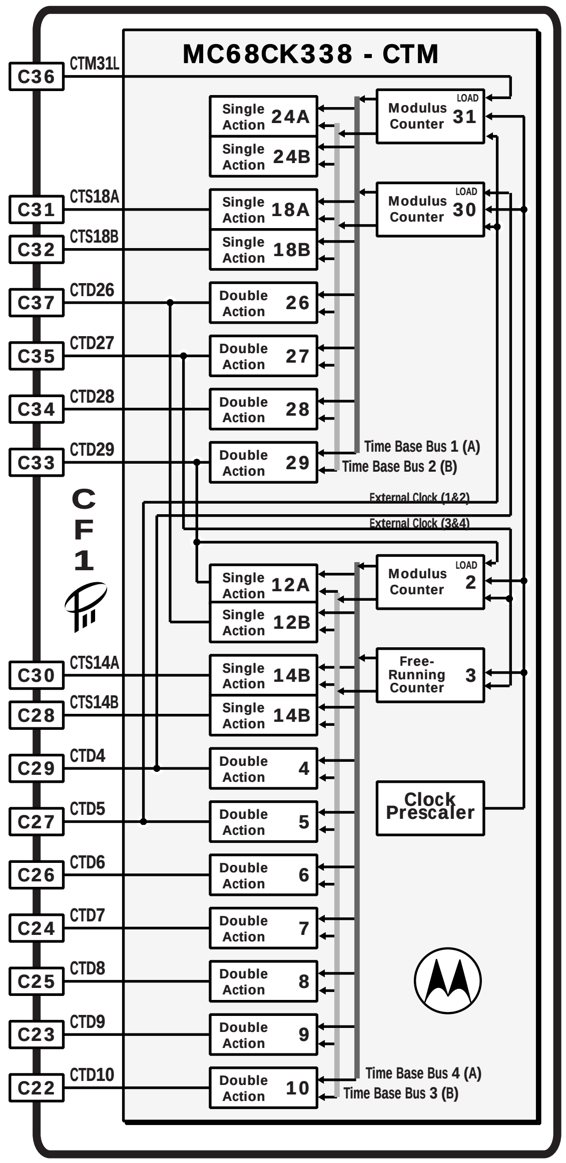
The table below lists some of the manufacturers of SPI compatible devices and their product offerings. This is by no means complete, but it does give you an idea of the expansion possibilities just working the serial bus.



SPI Devices

	A-D 8/10 bit	A-D 12/14 bit	A-D 16+ bit	D-A 8/10 bit	D-A 12/14 bit	D-A 16+ bit	Analog MUX	EEPROM	Driver	RTC	PLL	MISC
Allegro MicroSystems									●			
American Microsystems									●			
Analog Devices	●	●	●	●	●	●	●					
Atmel								●				
Burr-Brown		●	●		●	●						
Catalyst								●				
Dallas Semiconductor										●		
Exar		●		●	●							
Exel Microelectronics										●		
Fujitsu Microelectronics											●	
Harris Semiconductor	●	●	●						●	●		●
Linear Technology	●	●	●		●							
Maxim	●	●	●	●	●	●	●		●			
Micrel Semiconductor									●			
Microchip Technology								●				
Micro Linear	●	●		●								
Motorola	●	●		●					●	●	●	
National Semiconductor	●	●		●					●	●	●	
Ramtron								●				
Signal Processing Tech.	●											
SGS-Thomson								●				
Siemens									●		●	
Sipex				●	●							
Texas Instruments	●	●		●								
Xicor								●				

Counter/Timer



The Counter Timer Module is actually a collection of separate timer modules with specialized capabilities. Most of these are independent single-action or double-action counter/timers that connect to a bidirectional I/O pin on the CF1. The remaining modules cooperate to provide the four timebases used by the CTMs to perform their work.

A Single Clock Prescaler Submodule (CPSM) feeds one Free-Running Counter Submodule (FCSM) and three Modulus Counter Submodules (MCSM) with six individually selectable clocks derived from the CPU system clock. The FCSM and MCSM modules drive the four timebases from one of these clocks or from an external clock. The FCSM has a fixed modulus of 65536, while the MCSMs have loadable modulus registers and load inputs for greater flexibility.

Single Action Submodules: The CTM has eight SASMs, six connect to I/O pins from the CF1, while the other two are used internally by the CF1 for simple I/O. Each SASM can perform one of the following functions:

Input Capture: Capture the timebase on either edge of the I/O pin and optionally generate an interrupt.

Output Port: Set or clear the I/O pin.

Output Compare: Set or clear the I/O pin on a timebase match and optionally generate an interrupt.

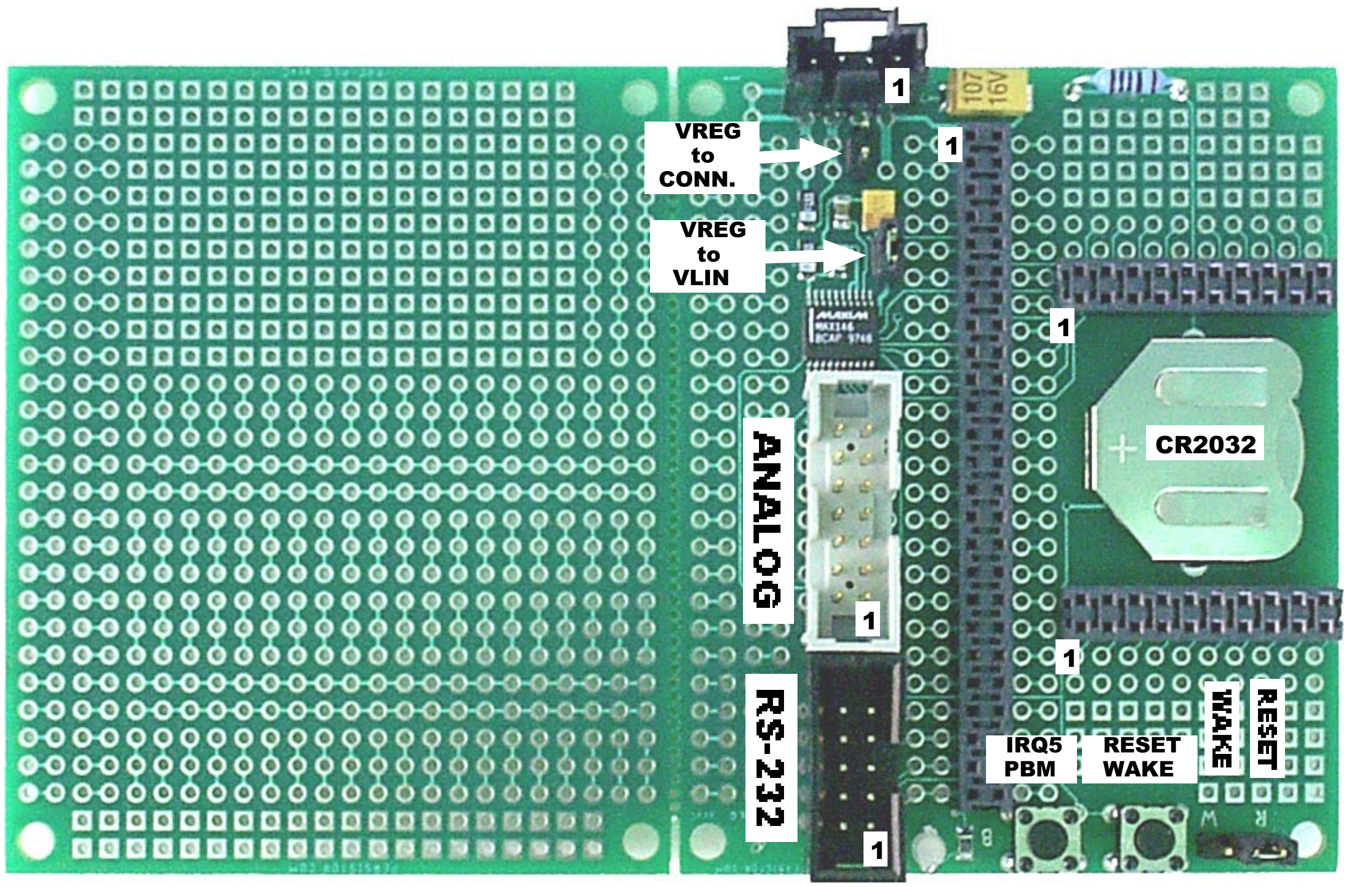
Output Compare and Toggle: Toggle the I/O pin on a timebase match and optionally interrupt.

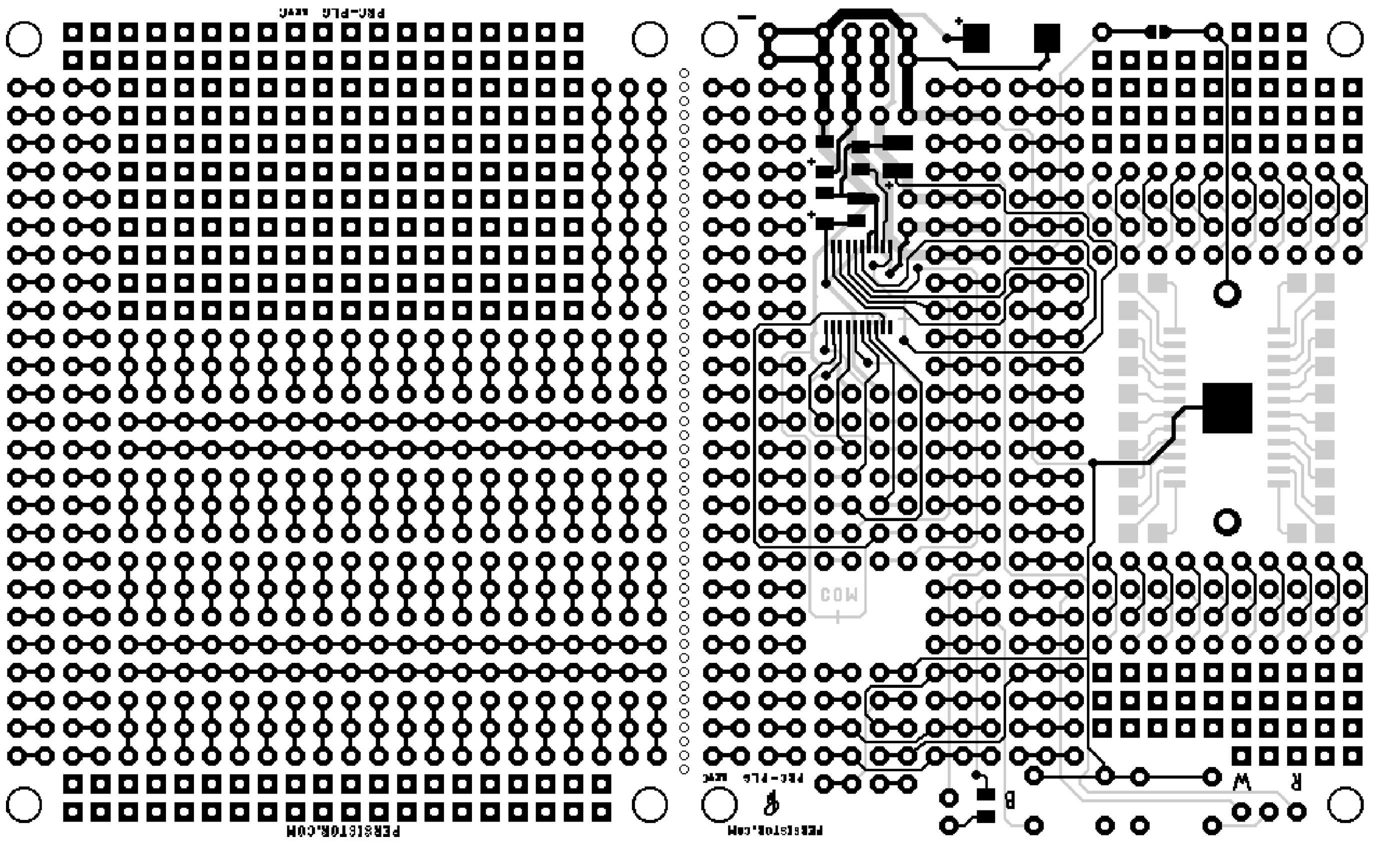
Double Action Submodules: The CTM has eleven DASMs which all connect to I/O pins from the CF1. In addition to the functions listed for the SASMs, each DASM can perform one of the following functions:

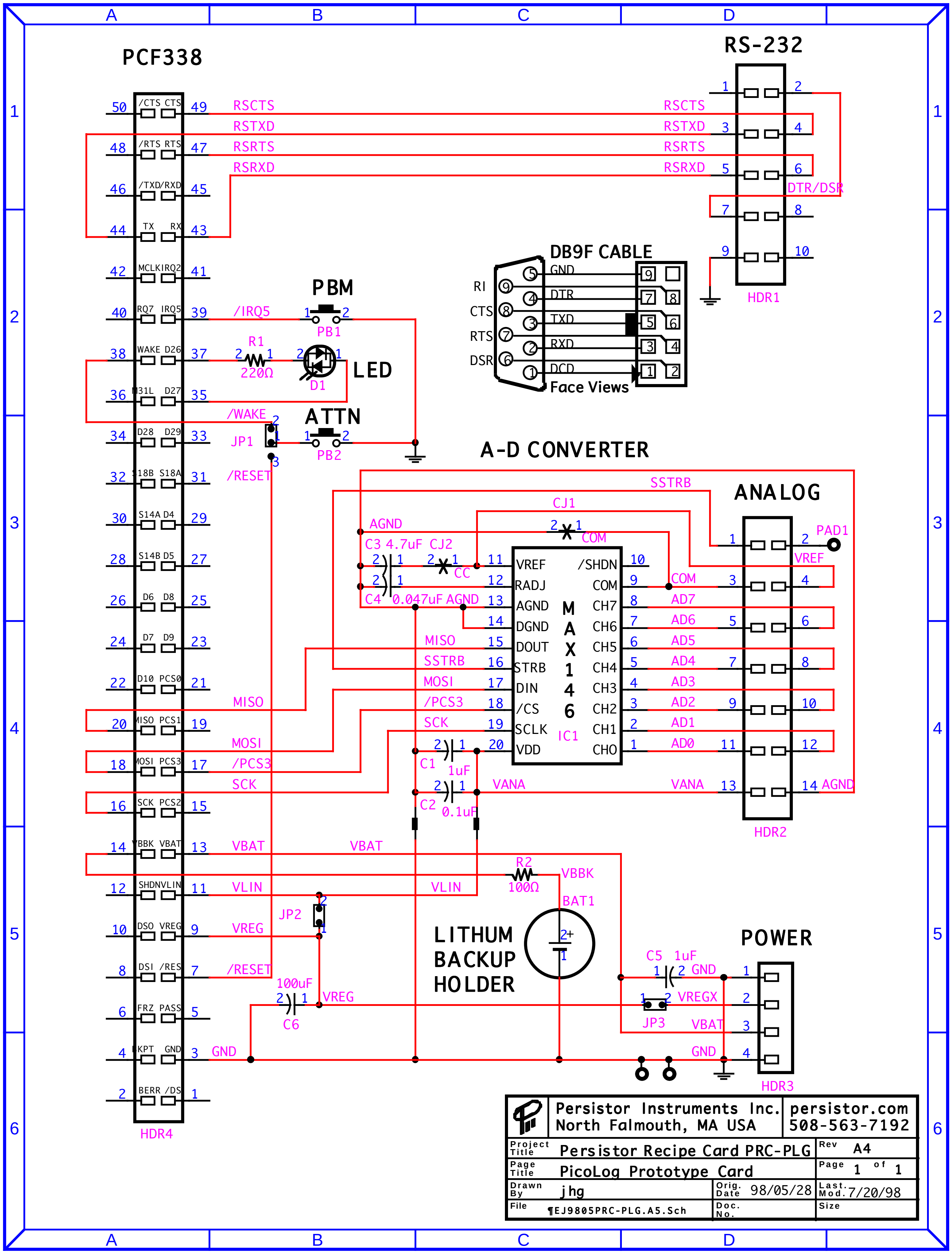
Input Pulse Width Measurement: Measure the time between leading and falling edges of the I/O pin and optionally generate an interrupt on completion.

Input Period Measurement: Measure the time between two successive leading or falling edges of the I/O pin and optionally generate an interrupt on completion.

Output Pulse Width Modulation: Generate a pulse width modulated waveform with selectable resolutions of 7, 9, 11, 12, 13, 14, 15, or 16 bits.

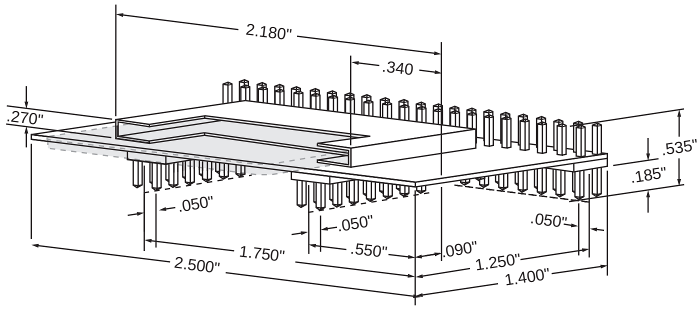

1
VREG to CONN.
1
VREG to VLIN
1
CR2032
ANALOG
1
1
RS-232
IRQ5 PBM
RESET WAKE
WAKE
RESET
1

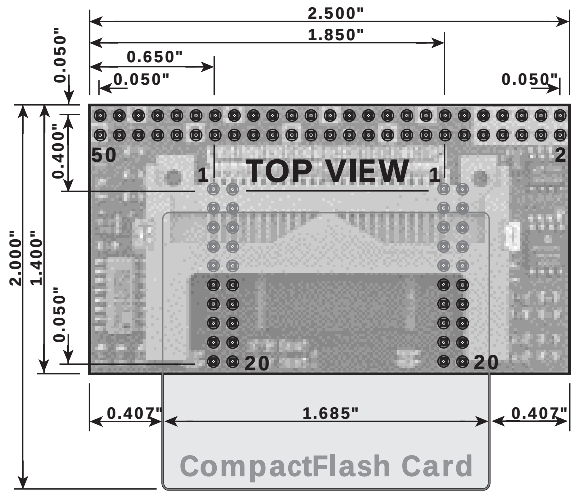

PRC-PLG
PERSISTOR.COM
W
R
B

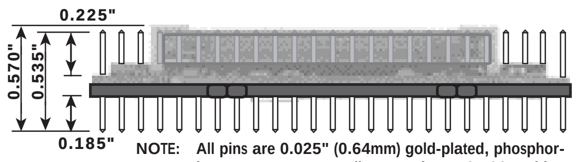


Persistor Instruments Inc. North Falmouth, MA USA	persistor.com 508-563-7192	
Project Title: Persistor Recipe Card PRC-PLG		Rev A4
Page Title: PicoLog Prototype Card		Page 1 of 1
Drawn By: jhg	Orig. Date 98/05/28	Last. Mod. 7/20/98
File: ¶EJ9805PRC-PLG.A5.Sch	Doc. No.	Size

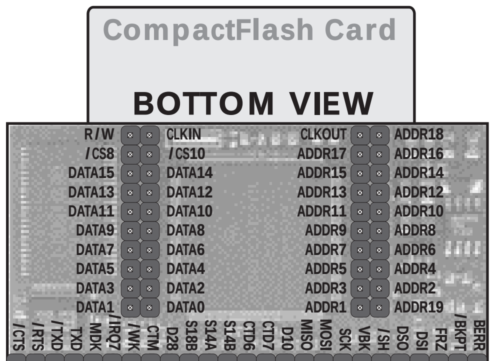
CF1 Dimensions and PCB Pad Placement



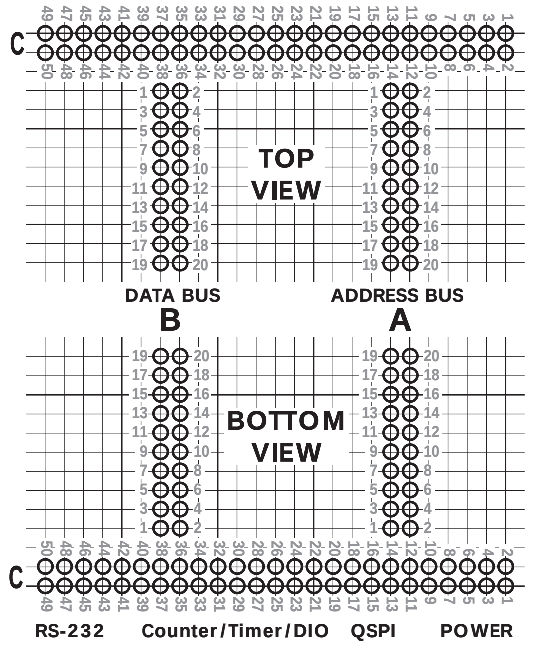




NOTE: All pins are 0.025" (0.64mm) gold-plated, phosphor-bronze square posts, all centered on a 0.100" grid.



CompactFlash Card
BOTTOM VIEW
R/W
/CS8
DATA15
DATA13
DATA11
DATA9
DATA7
DATA5
DATA3
DATA1
CLKIN
/CS10
DATA14
DATA12
DATA10
DATA8
DATA6
DATA4
DATA2
DATA0
CLKOUT
ADDR17
ADDR15
ADDR13
ADDR11
ADDR9
ADDR7
ADDR5
ADDR3
ADDR1
ADDR18
ADDR16
ADDR14
ADDR12
ADDR10
ADDR8
ADDR6
ADDR4
ADDR2
ADDR19
/CTS
/RTS
/TXD
TXD
MDK
/IRQ7
/WK
CTM
D28
S18B
S14A
S14B
CTD6
CTD7
D10
MISO
MOSI
SCK
VBK
/SH
DSO
DSI
FRZ
/BKPT
BERR
CTS
RTS
/RXD
RXD
/IRQ2
/IRQ5
CTD26
CTD27
CTD29
S18A
CTD4
CTD5
CTD8
CTD9
PCS0
PCS1
PCS3
PCS2
VBAT
VLIN
VREG
/RES
PASS
GND
/DS



C
TOP VIEW
DATA BUS
ADDRESS BUS
B
A
BOTTOM VIEW
C
RS-232
Counter/Timer/DIO
QSPI
POWER