Configuring the Microsoft Visual Studio IDE to build Custom Modules

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If you typically use the Microsoft Visual Studio® environment to build applications, you might prefer to build DAPL custom modules in that same environment. The environment is designed to make it easy to build applications that run in the Windows® system, and it does a remarkable job of providing all of the settings you would normally need for this. However, since downloadable binary modules for the DAPL system do not run in the Windows host system environment, you will need to make many adjustments.

Preparing your system

First, install your compiler tools. Verify that the compiler system works, and you can configure and build the examples that come with the compiler.

Second, run the DAPtools Professional software installer and select the "DAPL Command Development" item. This installation process will look in your system, identify the compiler version that you are using, and set up a compatible set of library and configuration options. It will also set up a copy of several custom command examples. Even if you don't plan to use the Windows command line environment, you should run the test that follows.

To test the command line environment, go to the main Windows menu and select

```
Microstar Laboratories | DTD | MSL DTD command window
```

Use the CD command to locate the folder with your copy of the example files. The exact location of these files in the "user documents area" will depend on the version of the Windows system that you are using.

```
CD "\Users\<username>\Documents\Microstar Laboratories\DTD\Examples"
```

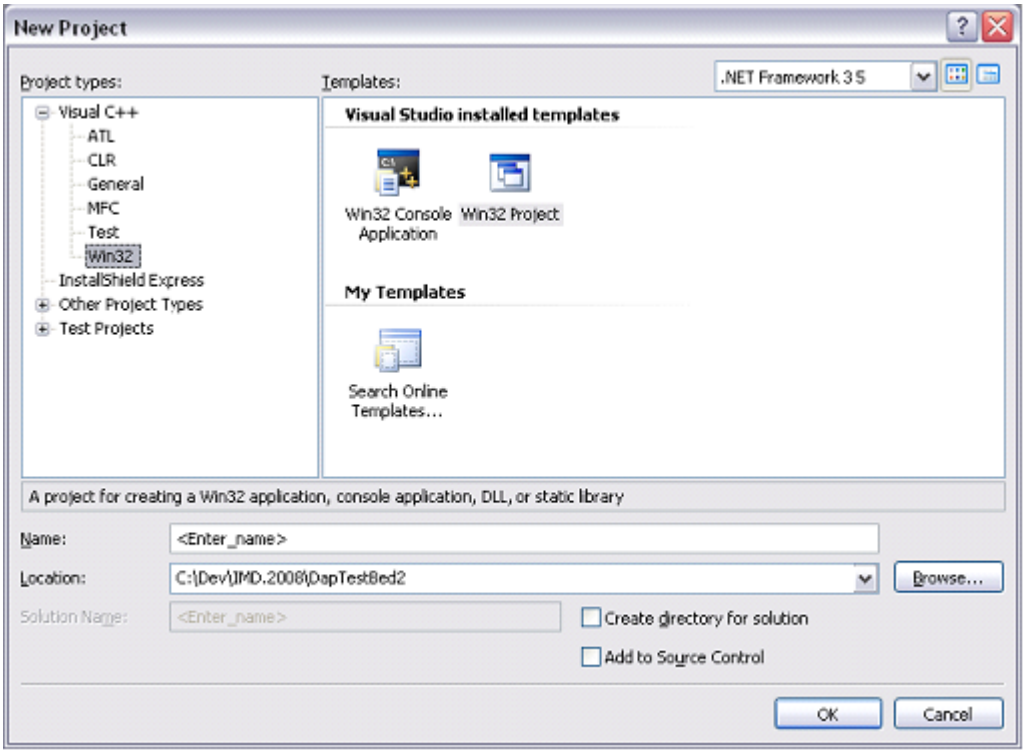
Then type in the following command line.

```
NMAKE -f MODMAKEM.MAK
```

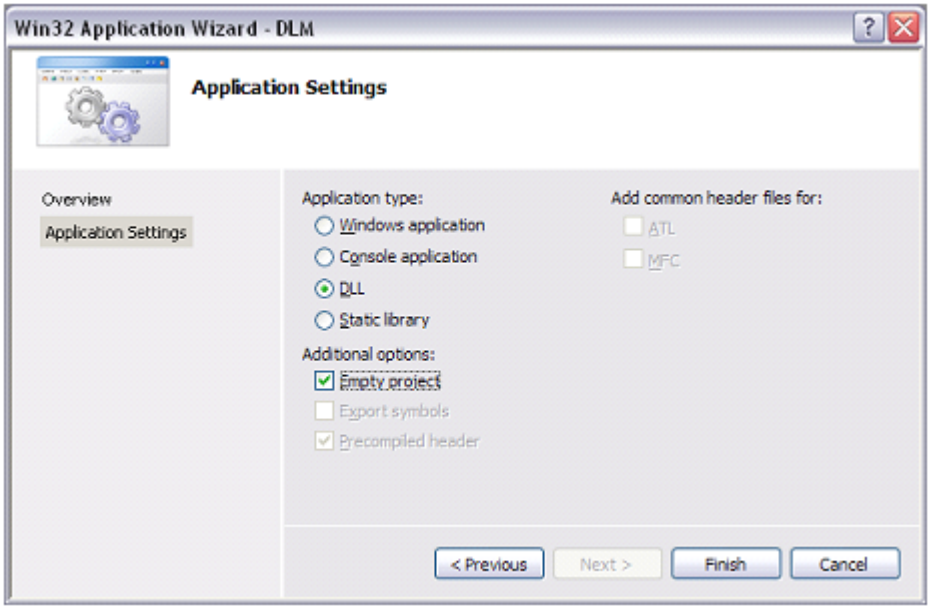
This test verifies that your DTD interface code is correctly installed where your compiler system can find it. A downloadable module file should be successfully built for each of the example C++ files. If this test fails, there is very little chance that you will get useful results from the graphical IDE environment.

Running the "New Project" Setup wizard

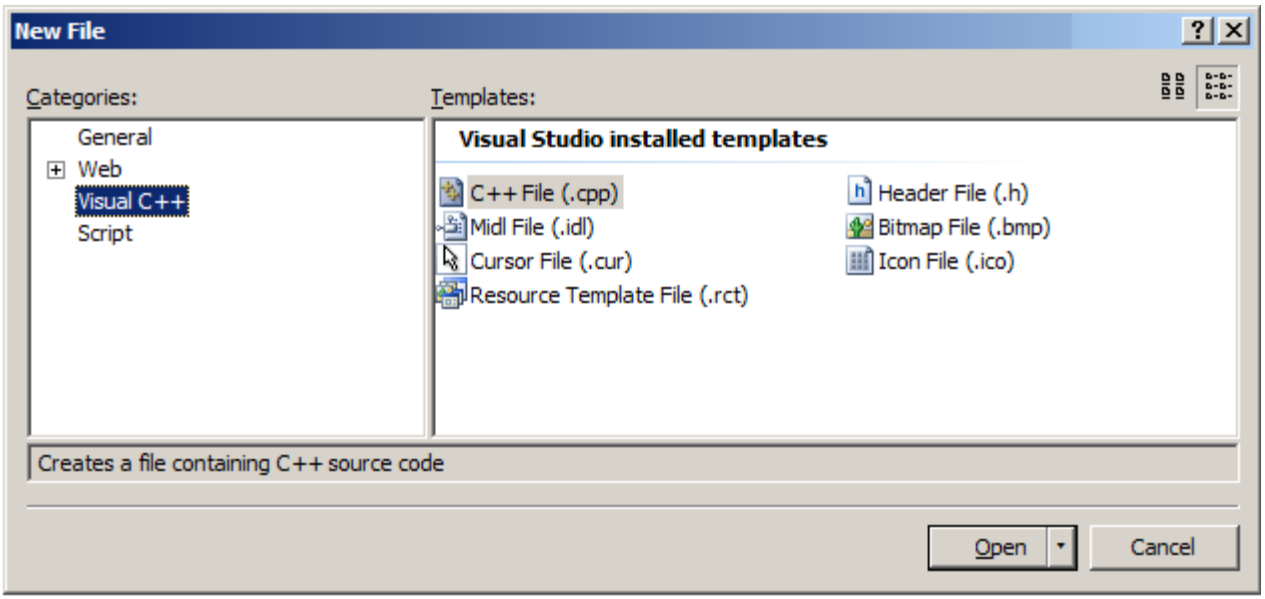
From the Visual Studio main menu select `File | New | Project...` and pick the Project type `Win32`. Click to select the `Win32 Project` installed template. Specify a name and location for your project files.



Click `OK` and continue to the next screen. Specify that you are building a DLL starting from an empty project.



When the wizard is finished, you need to set up an initial C++ code file. Go to the main menu and pick `File | New | File.` Select `Visual C++` language, and the `Visual Studio C++` File template.



You will get an empty code page. Insert the following "generic" code in that page.

```
#include "DTDMOD.H"
#include "DTD.H"

#define  COMMAND  "CC"
#define  ENTRY    CC_entry

int __stdcall ENTRY (PIB **plib)
{
     return 0;
}

extern "C" __declspec(dllexport) int __stdcall ModuleInstall(void *hModule)
{
     return (CommandInstall(hModule, COMMAND, ENTRY, NULL)) ;
}
```

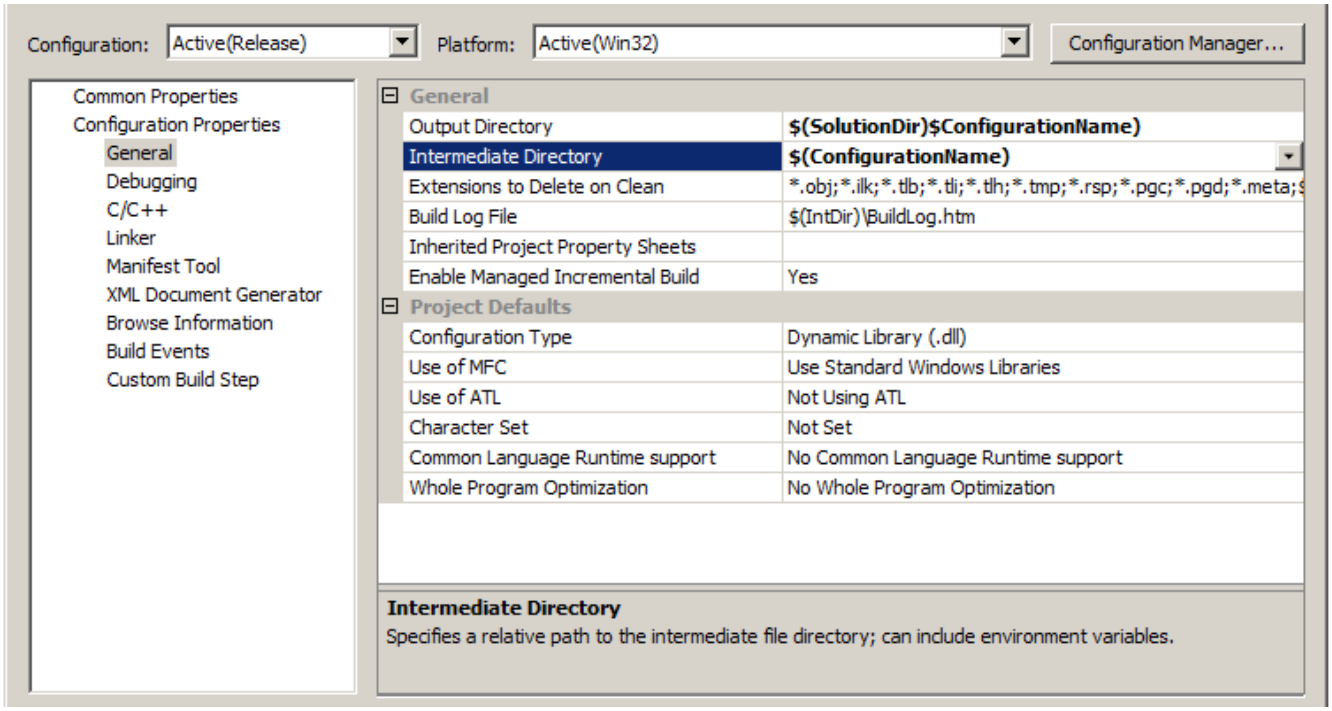
For the "CC" items appearing in the code above, substitute the name of the custom command as you want it to appear in your DAPL configuration scripts later. The command name *must not* be the same as the name of the project, which will determine the name assigned to the final DLM file. If the names were the same, the DAPL system could not distinguish the module file from the command inside of it.

Save this file in your project folder.

Now add this file to the *Solution Explorer* by right-clicking in the *Solution Explorer* window (usually at the left margin of the display) and picking `Add | New item`. The file name will then appear in the *Solution Explorer* pane. Double click on the file name to open it.

General project settings

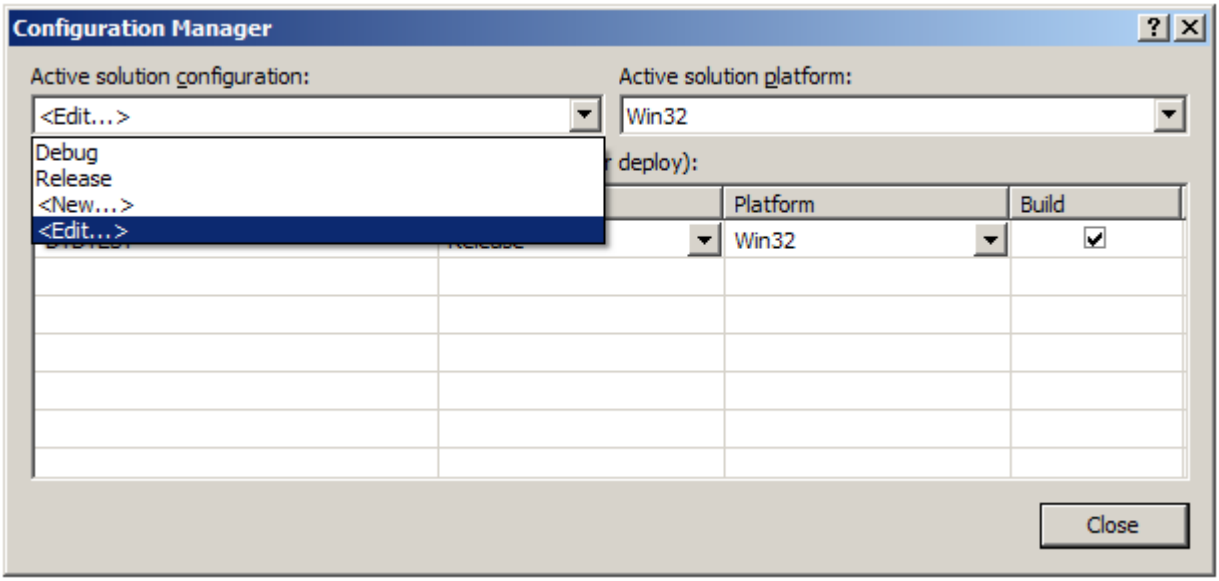
Open the project. Select the `Project | Properties` dialogs from the main menu. Click on `Configuration Properties` and `General`. The first screen will verify the general project properties that you entered in the wizard when first setting up the new project.



Verify the `DLL` output file format. The DAPL system uses 8-bit characters, so you will most likely prefer to avoid multi-character or UTF8 character coding.

There is no Windows debugging for downloadable modules.

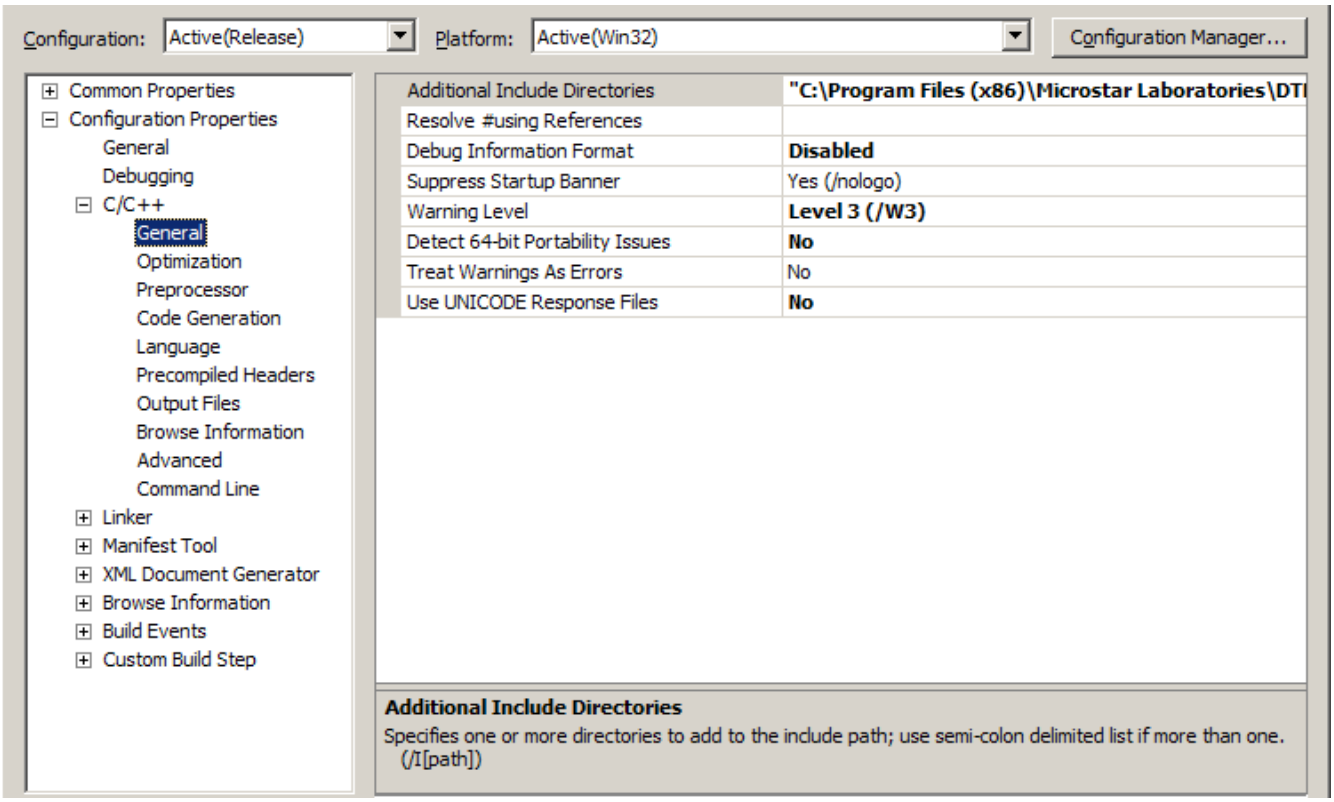
Click the Configuration `Manager` button in the upper right corner. In the drop-down dialog, click the `Edit...` option.



In the dialog that follows, disable the `debug` configuration option – this does not apply to code that runs in the embedded DAPL environment.

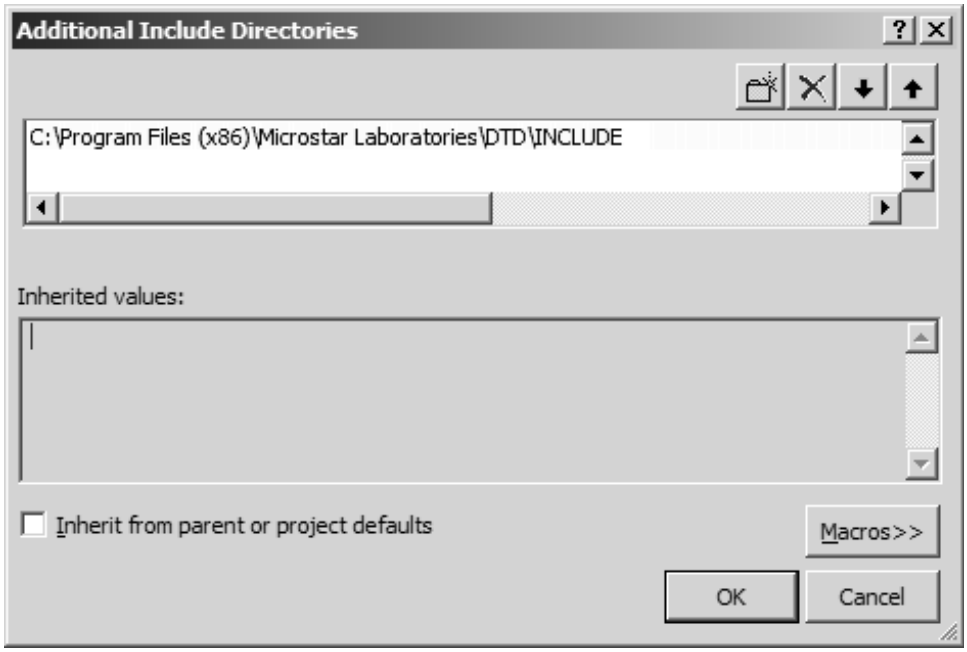
Compiler settings

Select `Project | Properties` from the main application menu. In the pane at the left, select the `Configuration Properties` and then `C/C++ - General`.



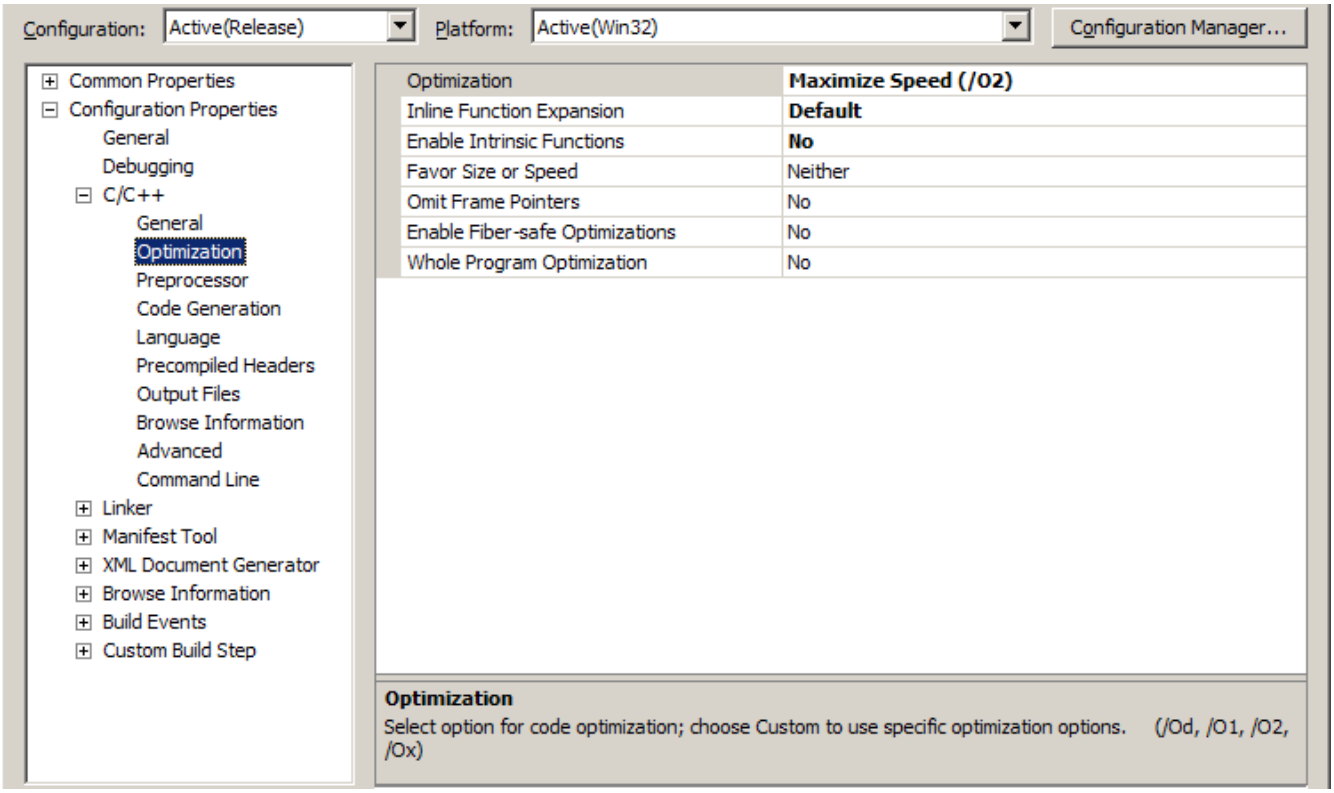
- Warning level 3 is optional, but most downloadable files can compile free of warning messages at this rigorous level. Since debugging can become difficult for software downloaded to an embedded environment, you will probably want as many early warnings as possible.
- Do not use 64-bit Windows detection.

Click the `Additional Include Directories` item and then the button that appears at the right. Click the "open folder" icon to add a new line, then click the button that appears on the right to locate the directory. Uncheck the `Inherit from parent or project defaults` box at the lower left. Unless you have changed the default install location of the DAPL software, your will add a new line that specifies the location
`C:\Program Files\Microstar Laboratories\DTD\INCLUDE`
as in the following illustration.



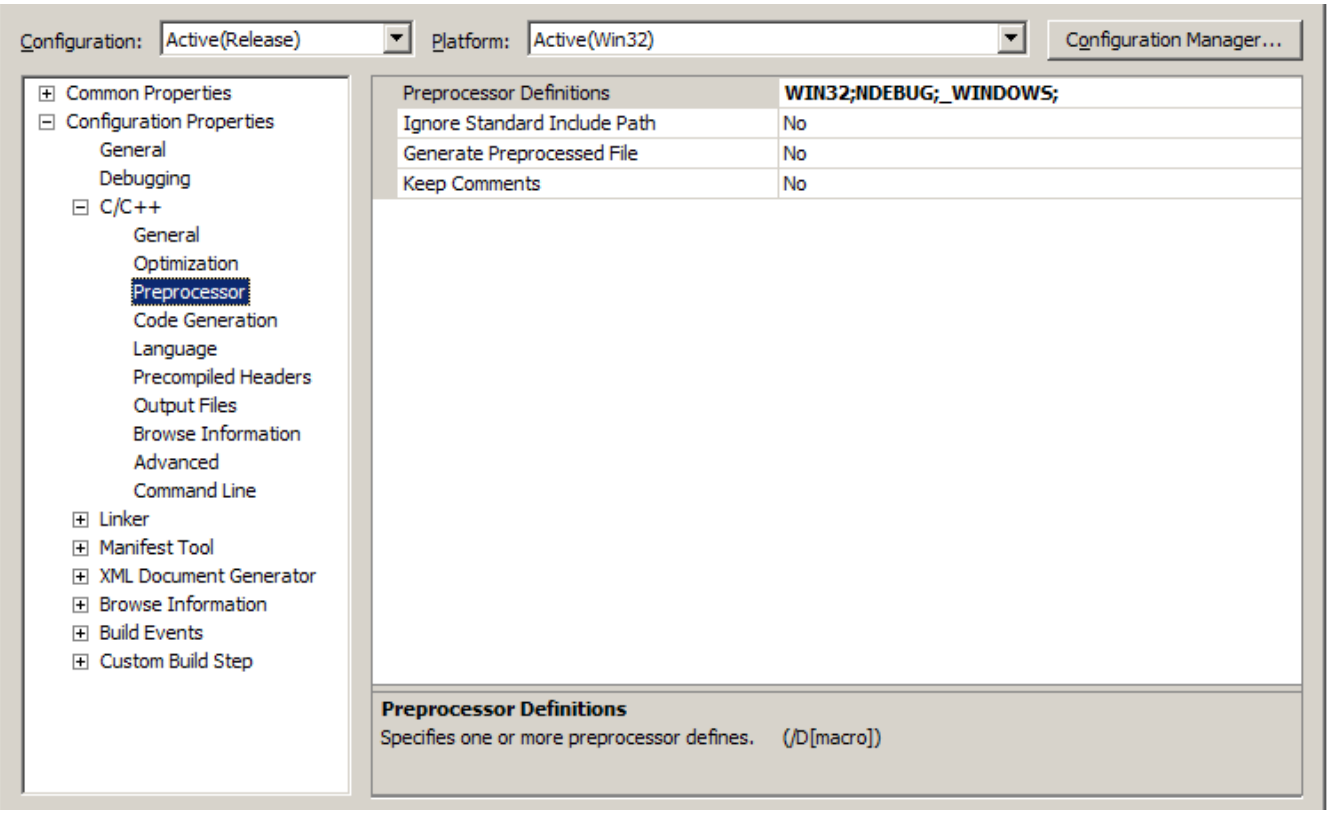
When you click `OK` here, the line you added will be inserted into the C++ general configuration dialog.

Next, click on the `Optimization` item in the `Configuration properties` column.

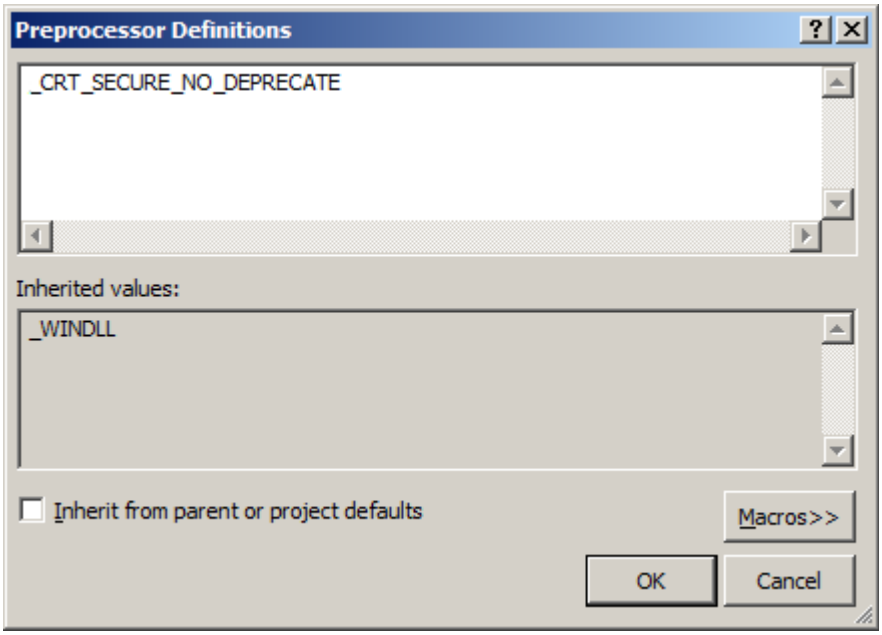


- The Maximize Speed option is suggested, but other optimization choices may also work fine.
- There are generally no problems with inline function expansion.
- Do not allow "intrinsic functions". These will conflict with "standard" math library functions.

Click on the `Preprocessor` item in the Configuration properties column. Click on the `Processor Definitions` item and then on the button that appears on the right.

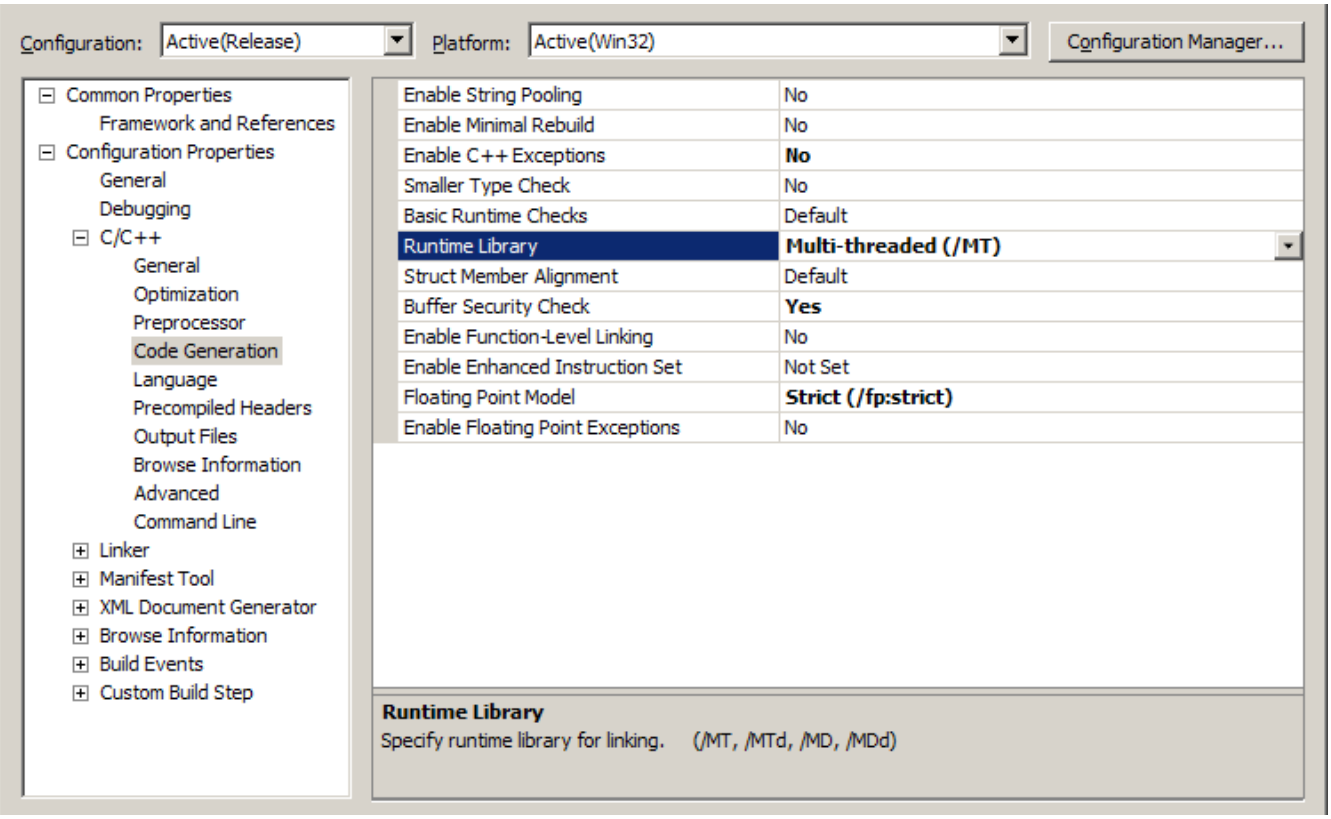


Click the `Preprocessor Definitions` item, and then the button that appears at the right.



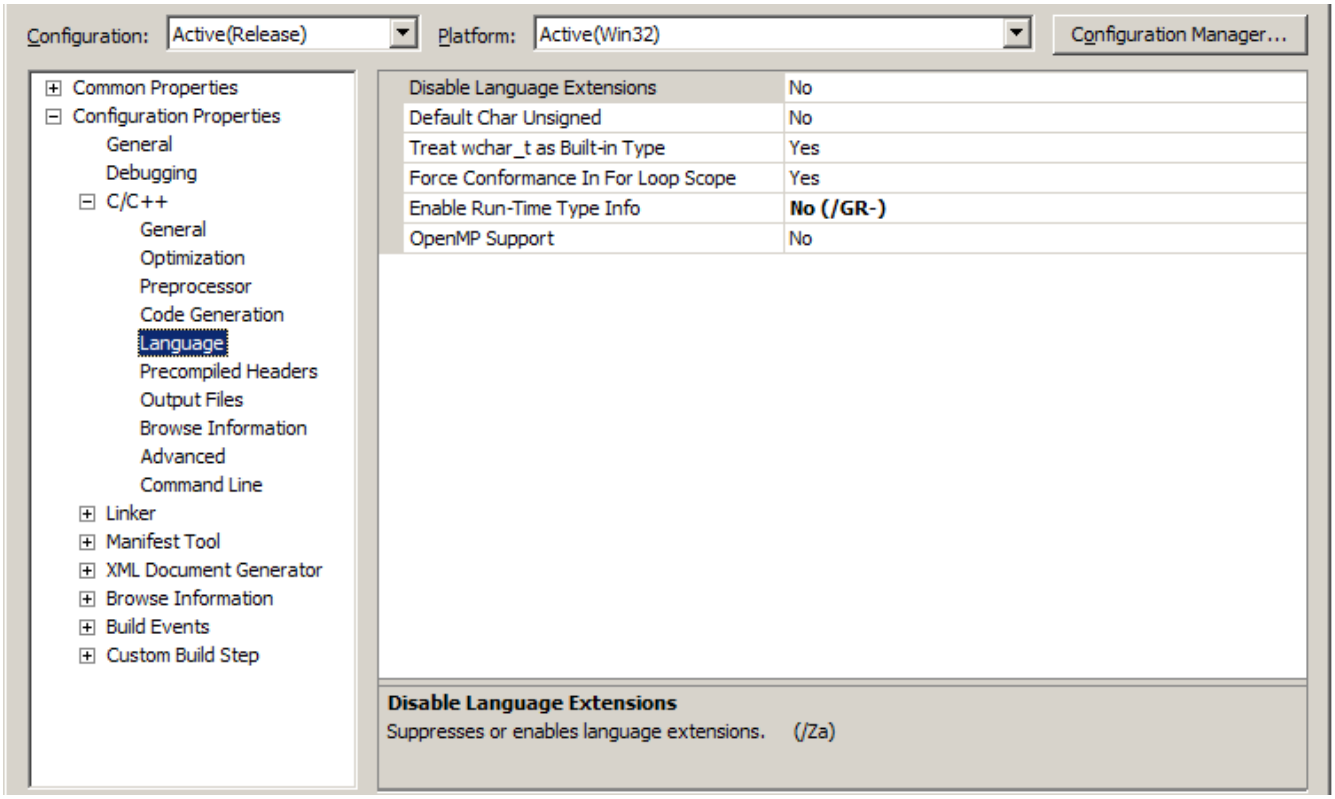
- Clear the check box `Inherit from parent or project defaults` in the lower left corner.
- Click in the text window and type in the preprocessor macro `_CRT_SECURE_NO_DEPRECATE` as shown. Though not absolutely required, this macro is strongly recommended. The purpose is to turn off stack intrusion checks. This hazard does not exist unless an attacker has already overtaken your host system. Under healthy operation, the usual unrestricted stack diagnostics can by themselves produce processor overload hazards.

Click on the Code Generation item in the Configuration properties column.



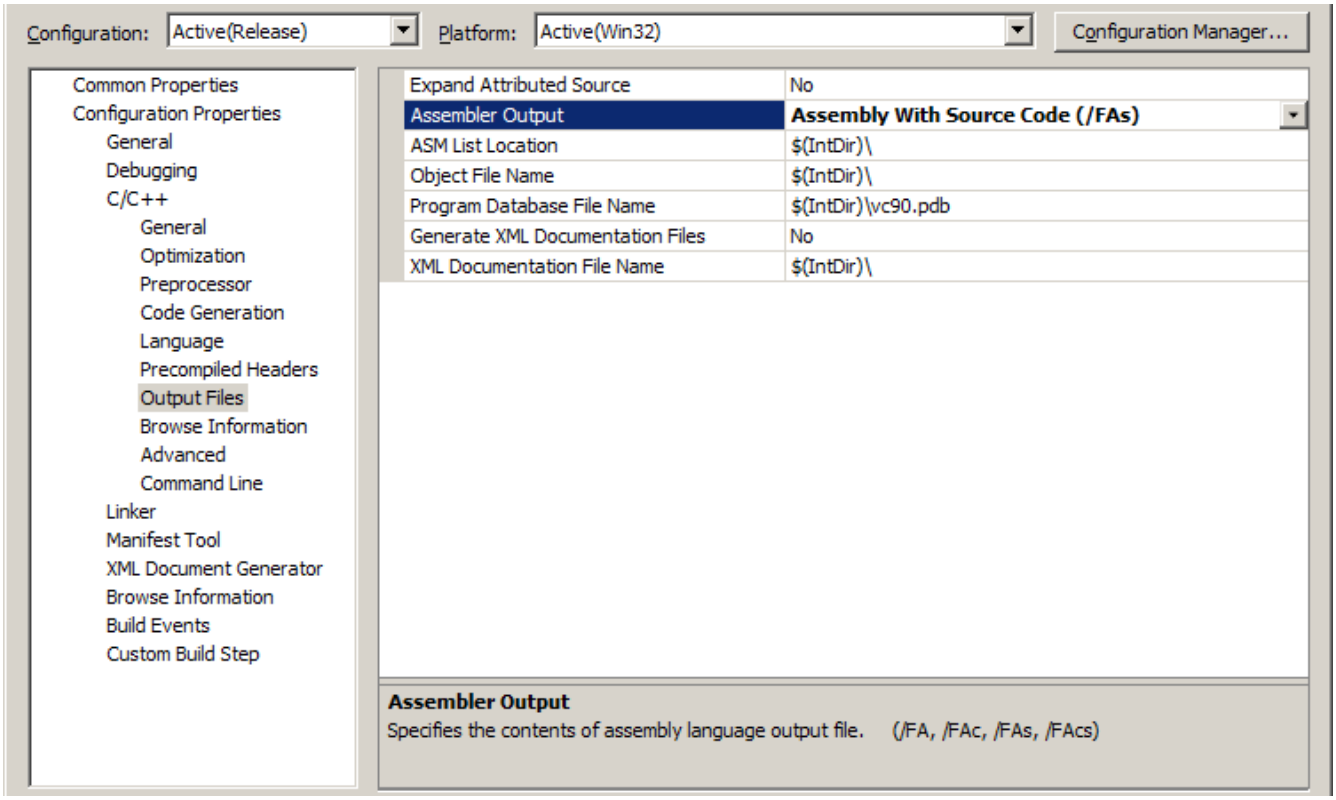
- Disable exceptions. The exception handling library functions are Windows system dependent.
- Use the `/MT - Multi-Threaded Application` library option. This might seem peculiar using an "application library" to produce "DLL code" but DLL features that the Windows system uses are not appropriate for the embedded DAPL system. The DTD installation instructions might tell you to avoid multi-threaded libraries, but that advice applies only to some earlier compiler versions.
- Buffer security check. This is the equivalent of the `/GS` option, and it is allowable.
- Other floating point model options should also work.

Click on the `Language` item in the `Configuration properties` column.



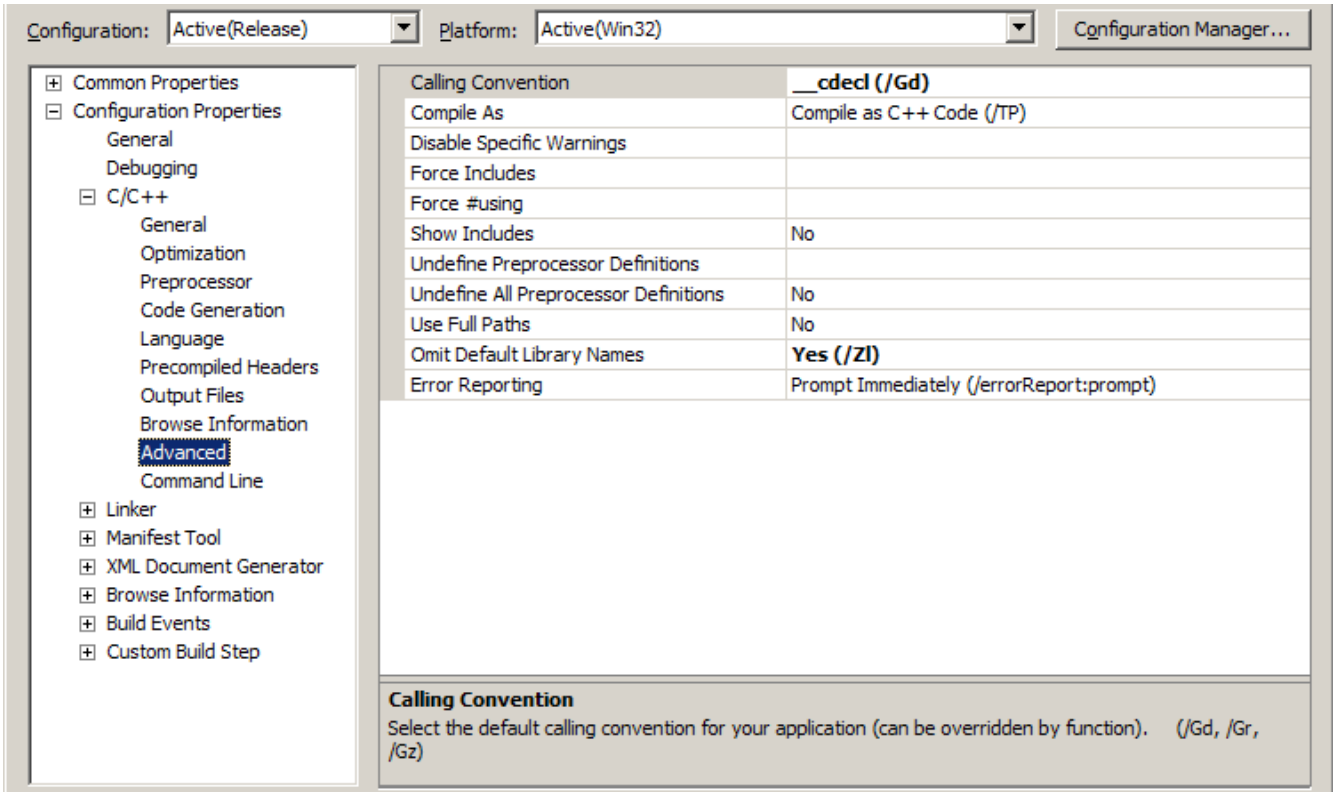
Disable the `Runtime Type Info` feature. This calls library functions that are Windows system dependent.

Next, some optional diagnostic listings are available under the `Output Files` item in the `Configuration Properties` column.



The optional `Assembly with Source Code (/FAs)` option produces a listing that is sometimes useful for finding the cause of unexpected external function calls.

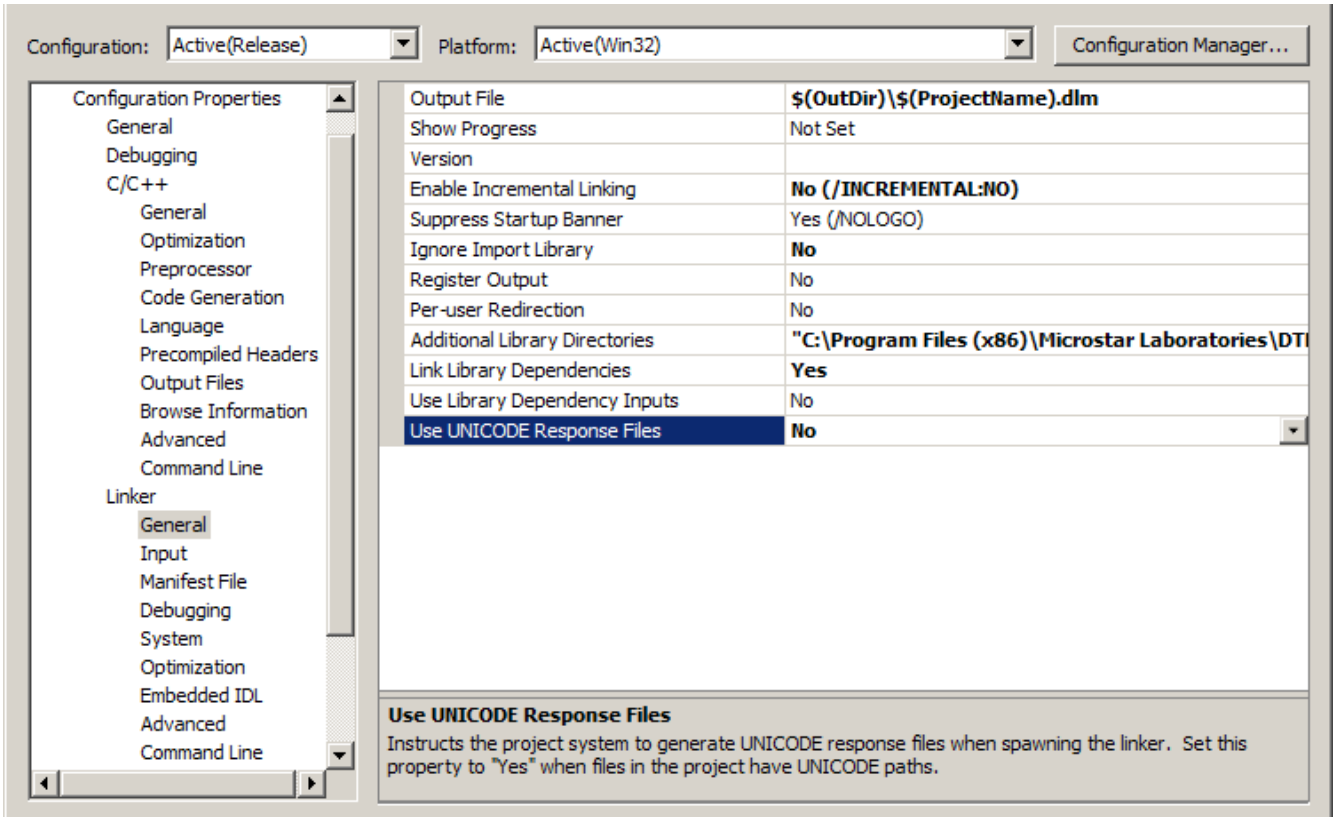
Click on the `Advanced` item in the `Configuration properties` column.



- The Developer's Toolkit for DAPL functions use `cdecl` calling conventions. For other calling conventions, you can use the `__stdcall` declarations in the code files where needed.
- Compile as C++ (`/TP` option). If you prefer C, code as if using the C compiler and you will rarely notice any difference. The Developer's Toolkit functions use no special C++ notations (no classes, no function overloading, etc.)
- Omit embedded library names using the `/Zl` option. Ordinarily, compiled code will contain a long list of library files, most of which can do nothing but cause trouble for your module

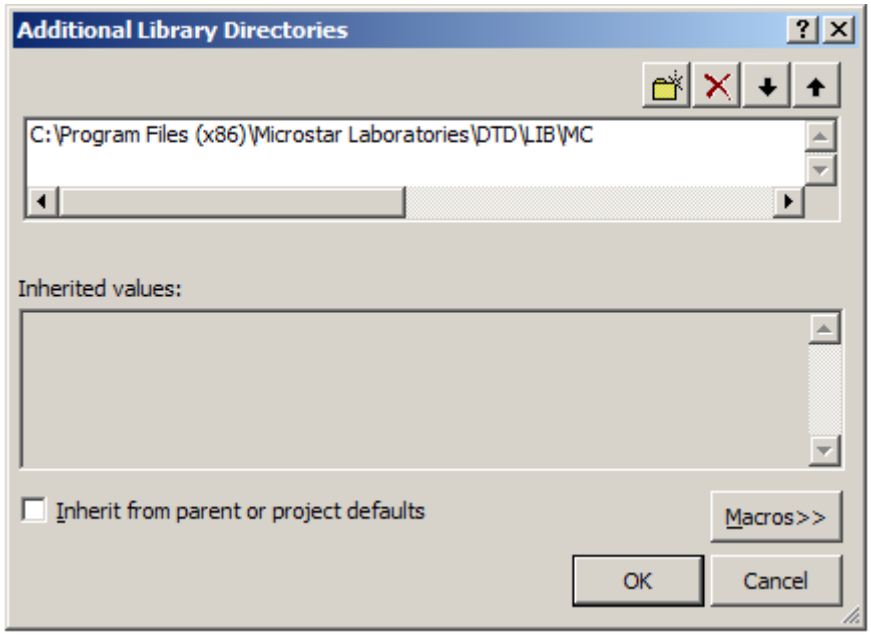
Linker properties

Next, you will need to configure the linker properties. In the `Configuration Properties` column, select `Linker` and then `General`.



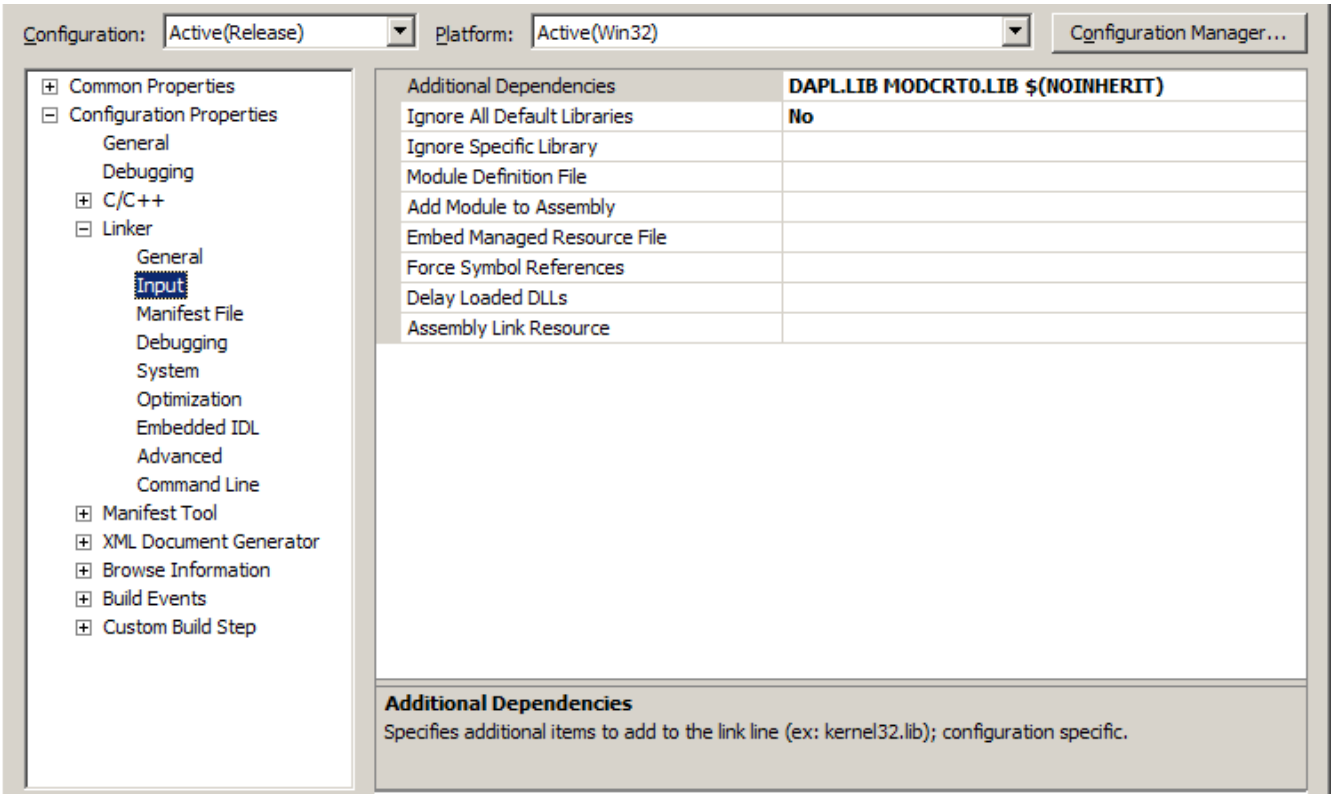
- Modify the name of the output file type to `dlm` ("downloadable module") rather than the usual `dll`.
- Incremental linking will typically be suppressed anyway because of other options – disabling it will avoid warning messages.

While still in the `Linker - General` section, click the `Additional Library Directory` item and then click the button that appears to the right. In the dialog box, click on the "new folder" icon and then on the button that appears to the right. Locate the folder where the special Developer's Toolkit for DAPL library files are located. If you installed in the default location, your added line will look like the following.

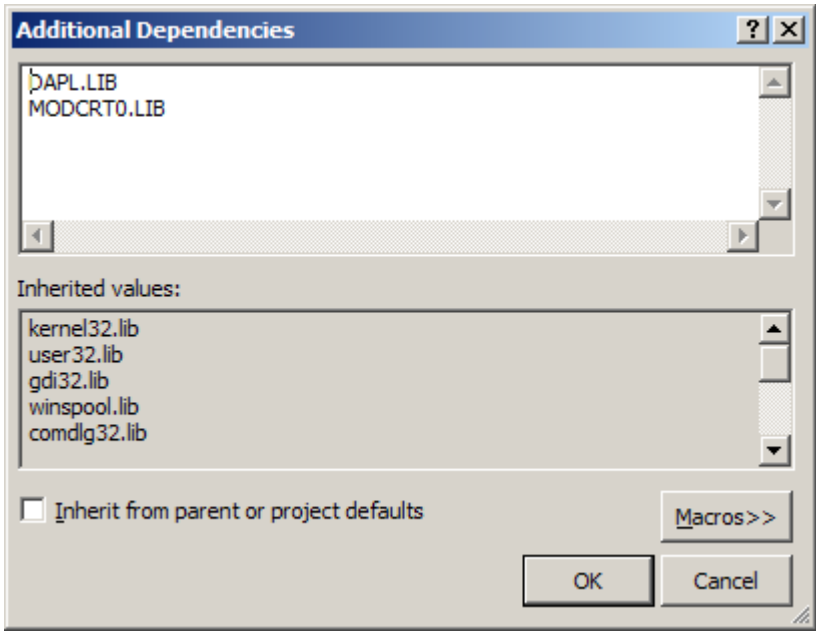


- Click to disable the check box at the lower left to Inherit from parent or project defaults
- Click the "new folder" icon at the top and navigate to the location shown. The location might be different if you did not install in the default location.

Select the `Input` item under `Linker`. Here you will make some very important adjustments. The linker *must* check the special Developer's Toolkit for DAPL libraries first, before trying to resolve function calls with any other libraries. If any library functions carry additional links to features of the Windows environment, your module will not link and you will be faced with some very mysterious messages reporting unresolved references.

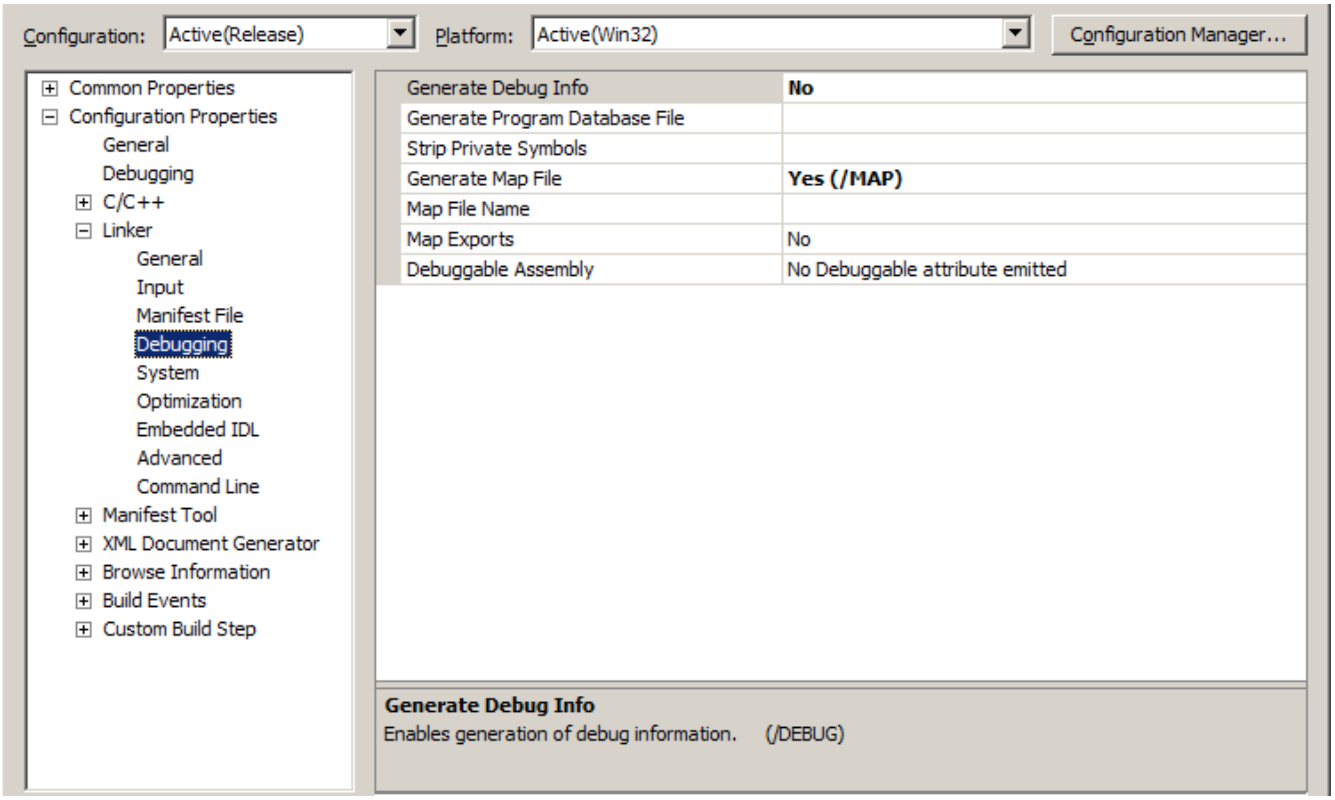


Click on the `Additional Libraries` item. Click on the button that appears at the right. This dialog tells the Linker about the existence of the two special Developer's Toolkit for DAPL libraries, and forces these libraries to be scanned before any other library files.



- Very important, click to uncheck the `Inherit from parent or project defaults` box. Any of the libraries you see listed in the central display pane can cause unresolvable link errors.
- Enter the two special library names as shown. The name `MODCRT0` contains the letter `O` and ends with numerical digit `0`.
- The compiler is allowed to resolve function calls by searching its run-time library, but be aware that depending on what is called, this could result in unresolvable and seemingly unrelated link problems.

The linker debugging is not interactive, and produces log files. These options are safe to use. Select the `Input` item under `Linker`.



- The optional linker MAP file is sometimes useful to identify how library function calls were resolved when the module was built.

In the `Configuration Properties` column, select `Advanced`. You can verify that the code is generated for the MachineX86 architecture. It would be a good idea to disable the `Manifest` inclusion, since this is not used, and wastes memory.

Finishing and Compiling

After completing your project configuration, save your project. Now you can use the *Solution Explorer* to begin your normal code development work, starting from the initial code page that you set up, and adding any additional code files that you need. When your code is ready, use the main `Build` menu to build your project code and produce the downloadable command module.
