IAR Embedded Workbench C-SPY

Abstract

This document describes the usage of the IAR Embedded Workbench C-SPY debugger as target system. Normally, only a C-SPY project file template and the debug general file need to be adjusted to the specific configuration of your hardware.

More adjustments may be needed when using real hardware.

Important note: *If you are using an emulator you will most likely have to disable your watchdog (see chapter 2.6).*

Important note: *The latest adaption uses* ***cspybat*** *for normal test runs (see chapter 2.1.4) and the IAR Embedded Workbench for interactive debugging. The* ***Run to*** *box must contain _exit (see chapter 2.1.2).*

Important note: *For current versions of TESSY you must set the macro file path to* `tessy_cspy.mac` *as described in chapter 2.1.2.*

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1 IAR C-SPY

In order to run tests with the IAR Embedded Workbench respectively cspybat an IAR project file and a C-SPY macro file is needed.

A sample project file and the corresponding settings files are located in subdirectory `sys\targets\iar` of the TESSY installation directory.

The C-SPY macro file which is used to handle the C-SPY debugger will be generated from a template file that is specified within the TESSY Environment Editor (TEE) (see chapter 2.2). You may add your own macro code or call your own macros by changing this template file. Be careful with any changes, since this may cause the communication between TESSY and C-SPY to fail.

Since version 4.2.3 TESSY copies the target binary of your test object into TESSY´s test object directory. Thus simulator unit tests can run in parallel.

The examples in this application note have been tested for version V6.0 of the IAR Embedded Workbench running a MSP430 CPU.

For interactive debugging TESSY starts the IAR Embedded Workbench before each test execution. So please **close all running instances of IAR Embedded Workbench** before starting a TESSY test run with breakpoint set.

2 Project and Setup File Templates

Please specify the IAR project and setup files to be used within the **TESSY Environment Editor**. You may either adapt the given IAR project files (located in `\sys\targets\iar` of your TESSY installation) or create a new IAR Embedded Workbench project file and adjust it as described below.

***Please note**: It is recommended to copy the default IAR project files from `\sys\target\iar` to the subdirectory `\tessy\config` of your TESSY project or create new ones. Update the TEE attributes **Project File** and **Setup File** accordingly (see chapter 2.2).*

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2.1 Generating the Target Binary

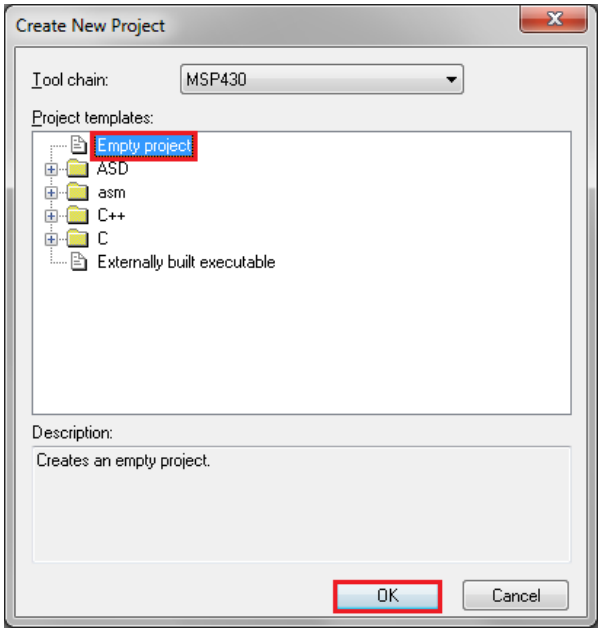
If you want to modify an existing project file template or create a new project file from scratch, you will have to build a binary file from within TESSY at first. The steps below describe how this is done.

- Create a new TESSY project and prepare your test as described in the TESSY User Manual.
- Select the IAR compiler and IAR Embedded Workbench as TESSY environment.
- Generate the test driver and run the test using the default options.
- When the IAR Embedded Workbench appears, ignore any error messages and close the IDE. Stop the test execution from within TESSY.

After performing these steps, you will find the generated test driver binary within the working directory of your TESSY project directory which is found by selecting the **General** tab of the **Properties** view, open the context menu of the **Test Directory** text field, and click **Copy** to copy the path.

2.1.1 Creating a new Project File Template

Open the IAR Embedded Workbench and choose **Create New Project** from the **Project** menu. Select **Empty project** within the dialog and click OK.



Save the project into the TESSY project test object directory (the path you just copied) and name it ‘ts_slave’.

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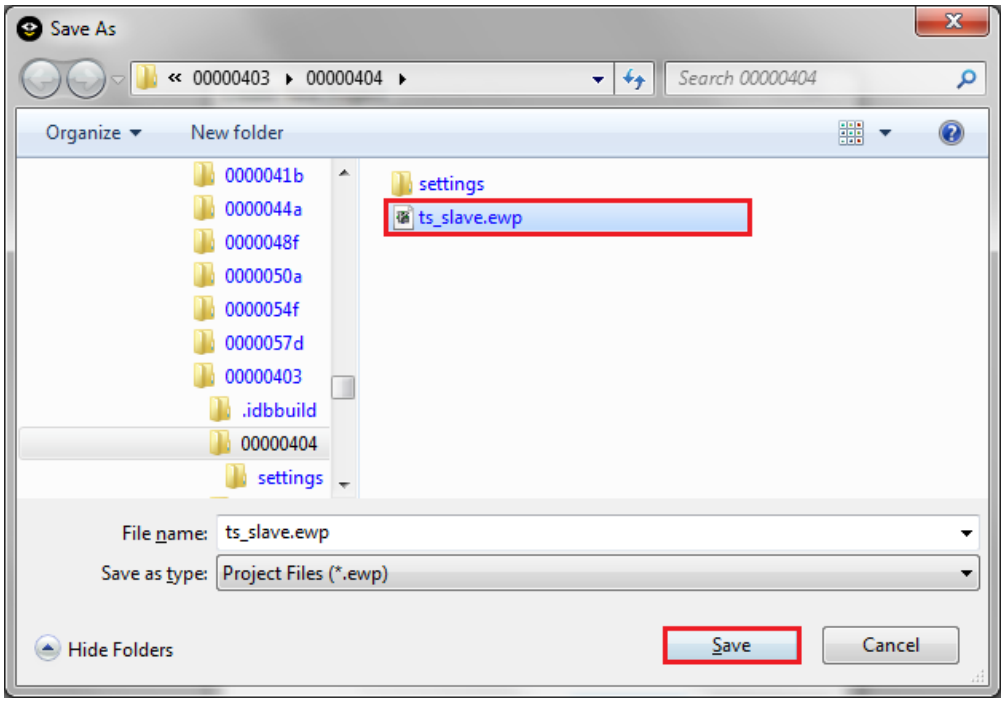
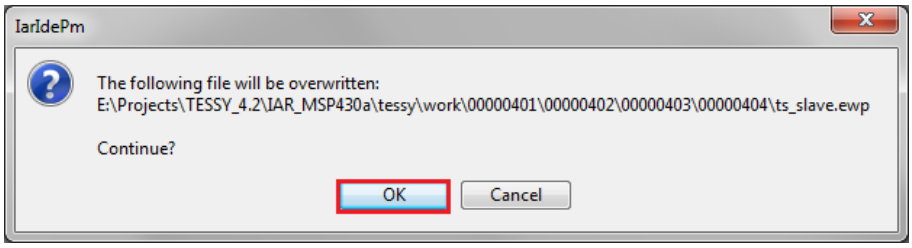
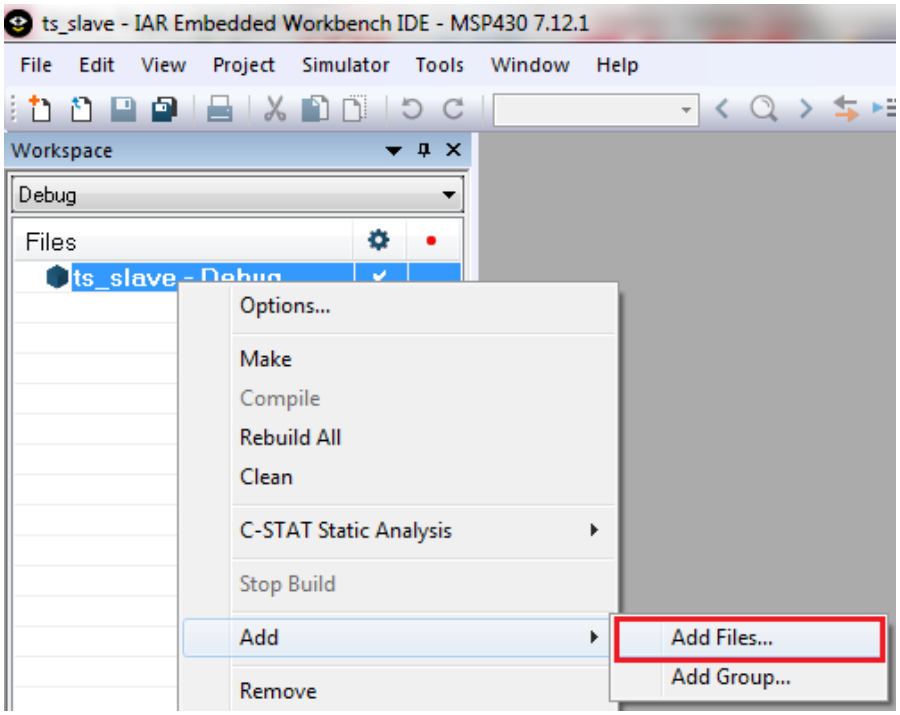




2.1.2 Adjusting Project File Settings

Select the new project and choose **Add->Add Files…** from the context menu.



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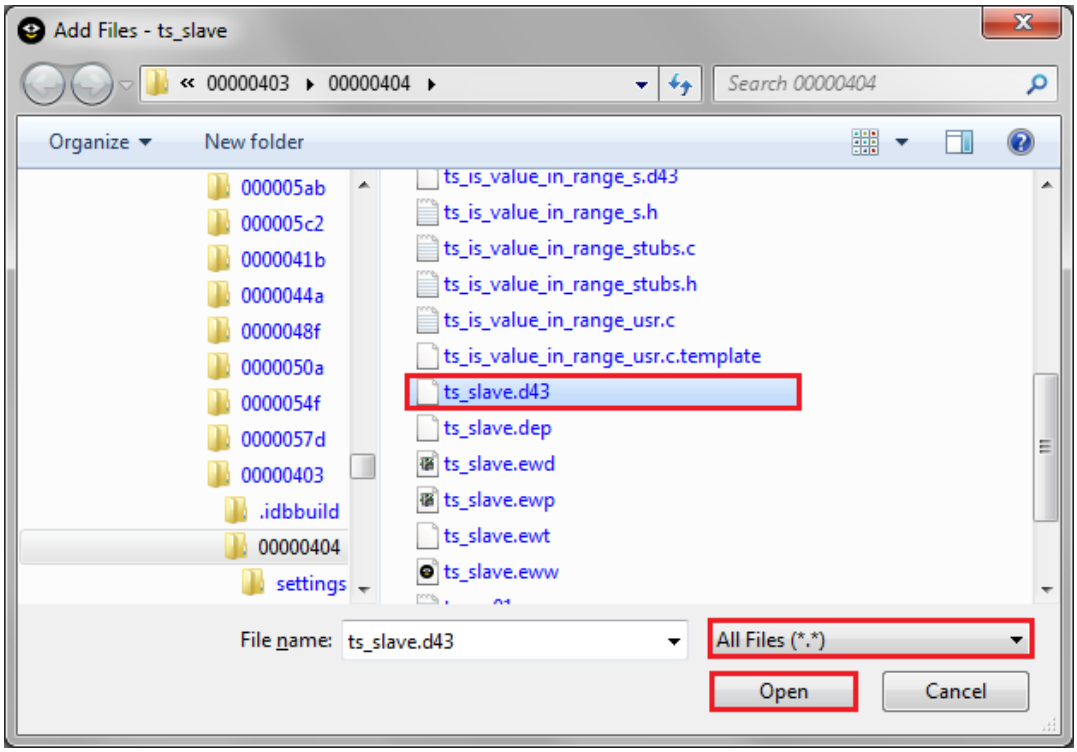
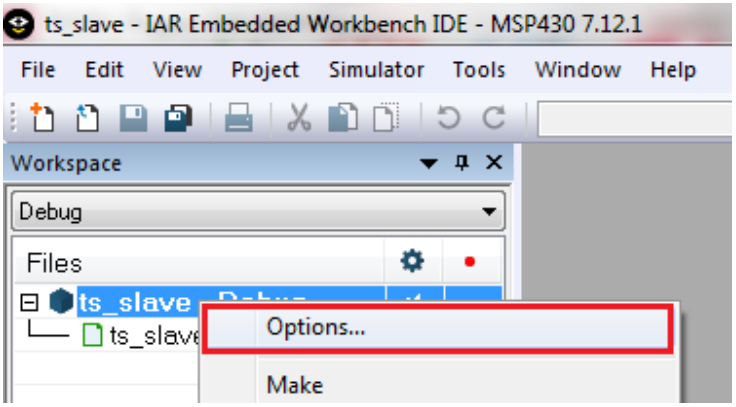
Within the dialog (see below) choose **All Files** from the file type combo box and select the binary file you just created with TESSY of which name begins with `ts_slave.d...` (e.g. `ts_slave.d43`). Other processors may result in different file extensions for the binary file.



Click ‘Open’.

- Open the context menu of the project and choose **Options…**.



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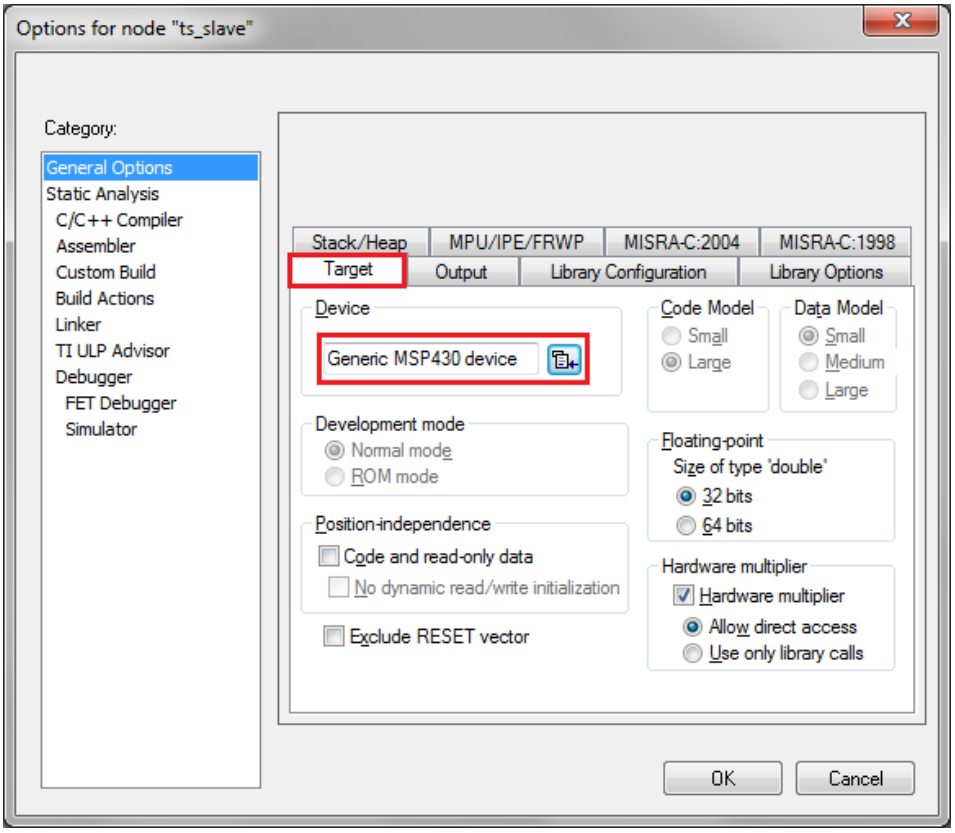
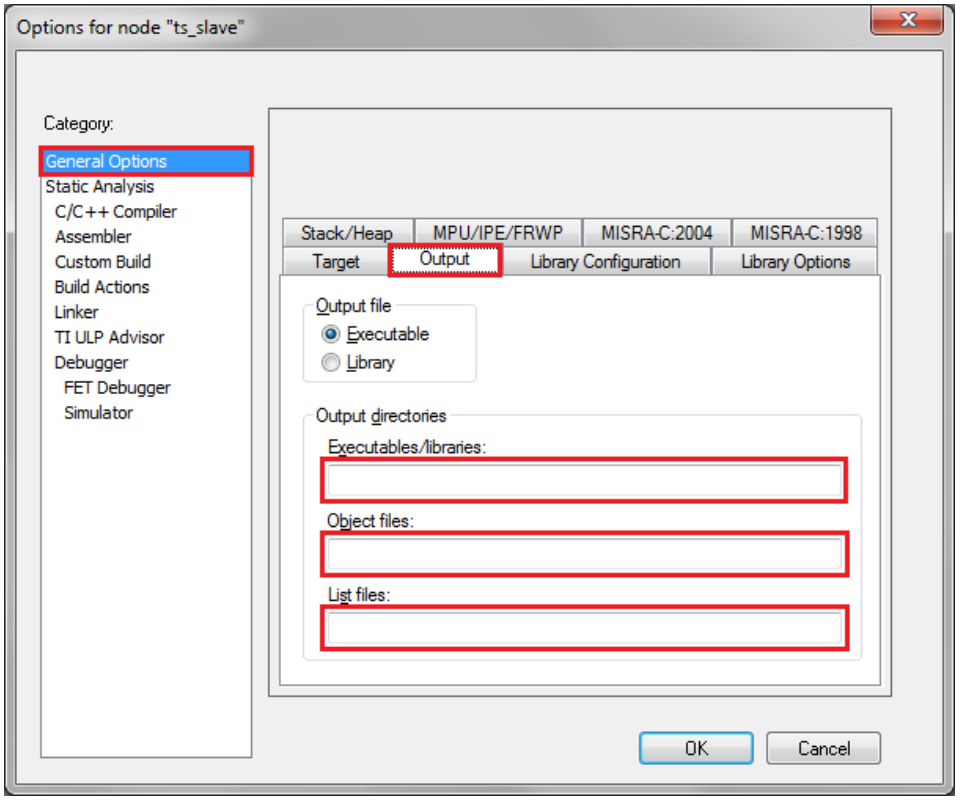
- Select **General Options** and specify your processor variant (**Device**).



- Select the tab **Output**.
- Make sure that there is no subdirectory to the executable.



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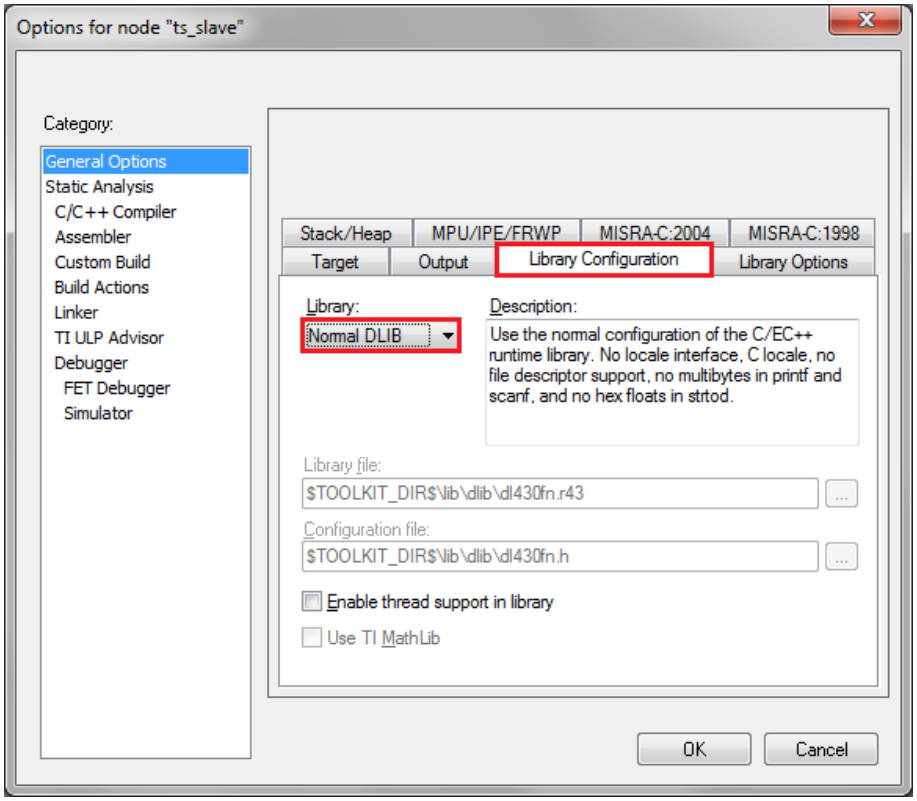
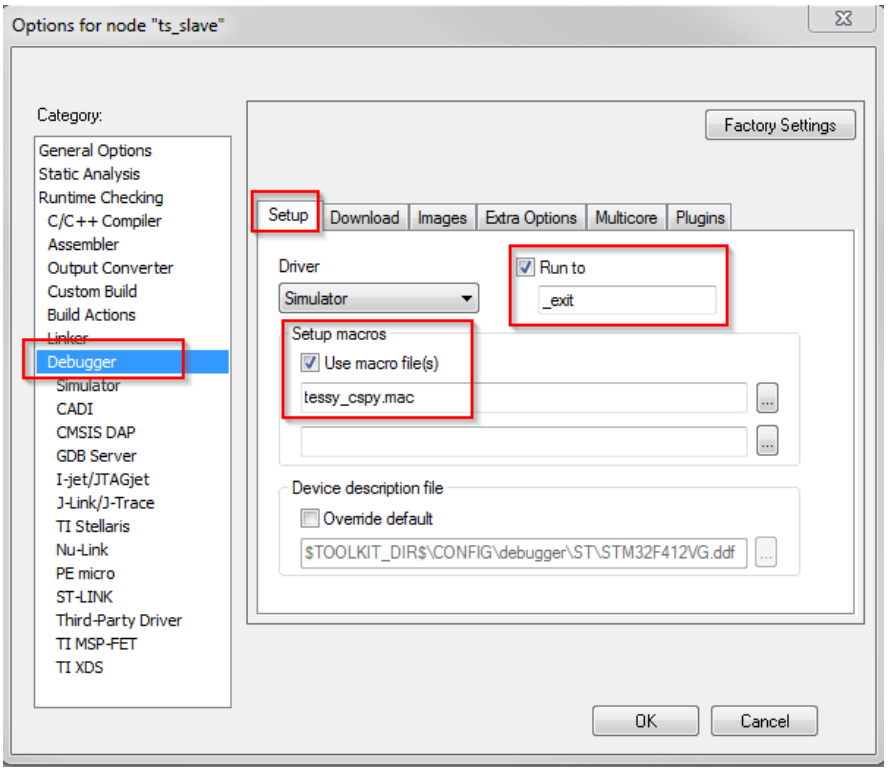
- Select the tab **Library Configuration**.
- In the **Library** combo box select Normal DLIB.



***Note**: If you need to use a different library refer to chapter 2.5.*

- Select the category **Debugger**.



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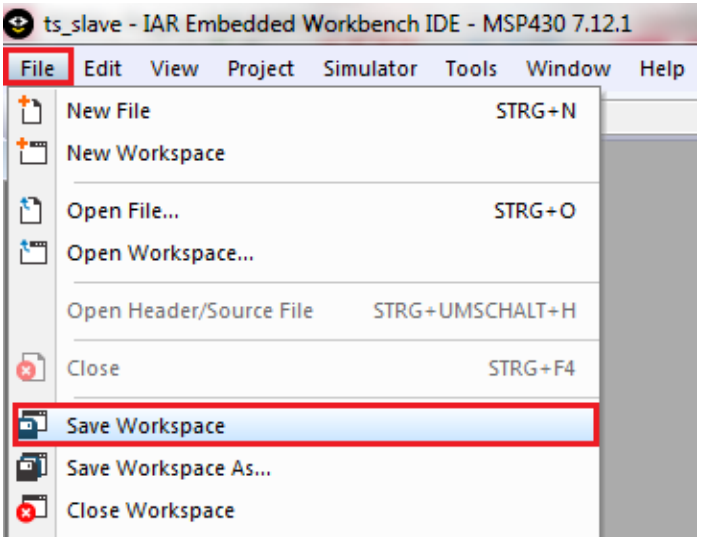
- Checkmark **Use macro file** and copy the following string into the input field: **`tessy_cspy.mac`**.

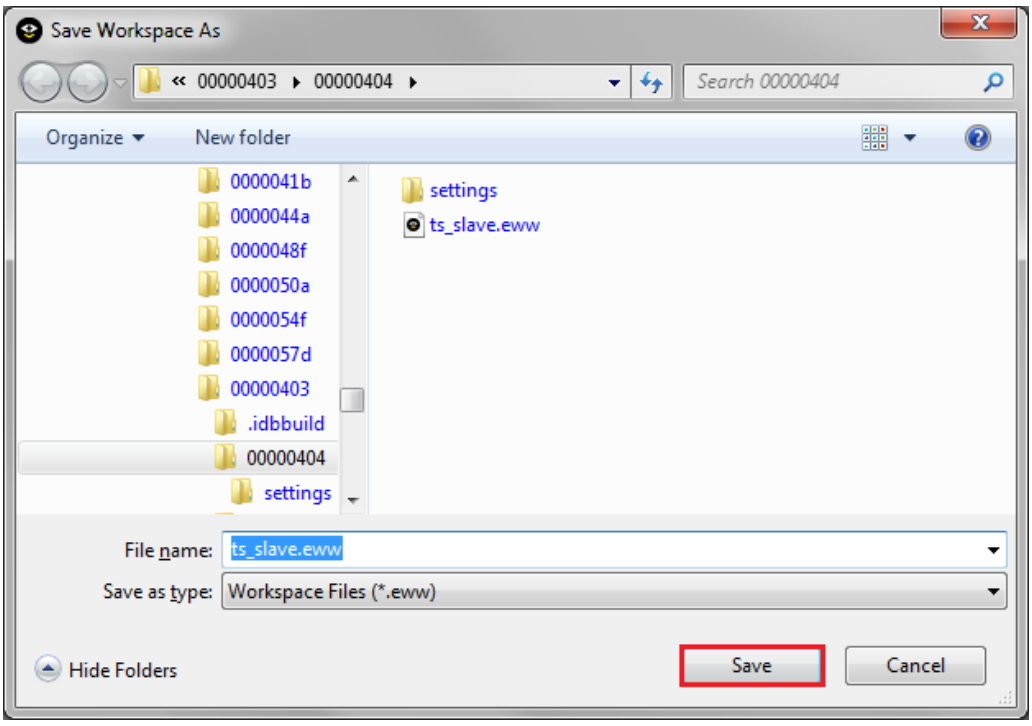
  This file will be created by TESSY before and executed right after startup of the C-SPY debugger by the IAR Embedded Workbench. It handles the test execution and the communication process between C-SPY and TESSY.

- It is crucial to fill into the **Run to** box the symbol *_exit*. This will start the program automatically after the debugger starts. The default value, *main*, does ***not*** suffice!

  After you have successfully initialized your project please save the IAR workspace and the IAR project.

- From the **File** menu choose **Save Workspace** and select *ts_slave.eww* as file name and click **Save**.





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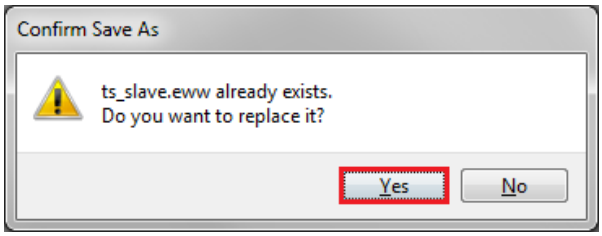
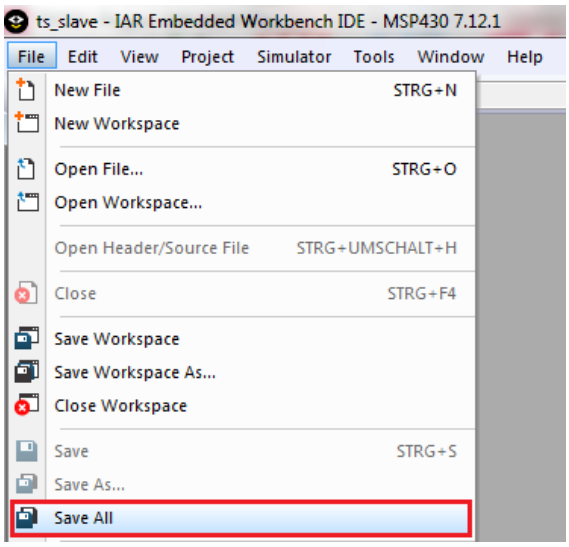
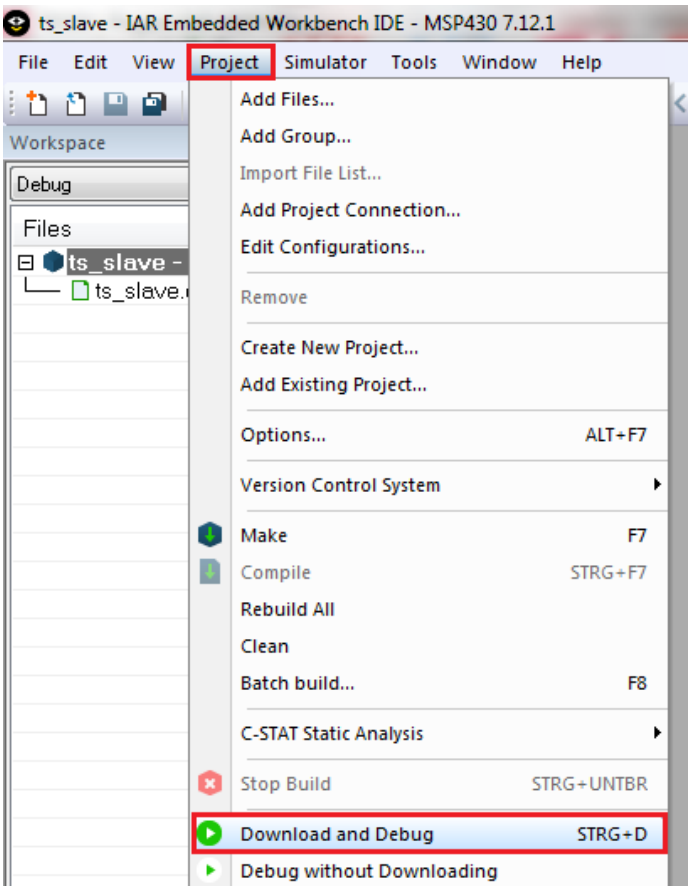
- Click ‘Yes’ to override the existing workspace.



- From the **File** menu select **Save All** to save the project.



- Finally, try to download and debug the binary created by TESSY.



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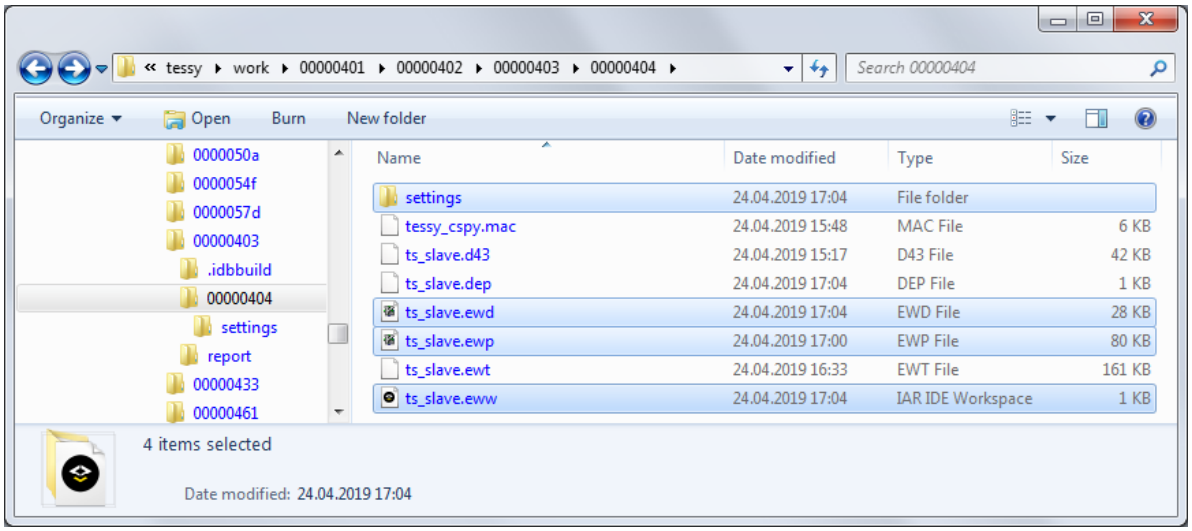
- If you are using hardware instead of a simulator perform all necessary steps.
- Close the IAR Embedded Workbench.

2.1.3 Copying the Project Files

After you have finished the setup of the IAR project you have to copy the created files to another location (e.g. into `\tessy\config` of your TESSY project directory).

The following files and directory have to be copied:



After you have copied the files you can rename them but *make sure that all files including the files of the settings directory have the same base name*.

Now update your TEE attributes **Project File** and **Setup File** appropriately (refer to chapter 2.2).

2.1.4 Prepare cspybat files

For normal test runs (without interactive debugging) TESSY uses cspybat which in current versions of the IAR Embedded Workbench needs two special files—*`ts_slave.Debug.driver.xcl`* and *`ts_slave.Debug.general.xcl`* which are found both in the *`settings`* folder of the IAR Embedded Workbench's project directory.

Please open file *`ts_slave.Debug.general.xcl`* and change the paths to the test binary and to the macro file as shown below. The file extension of the binary depends on your target and may differ from this example.

```
"E:\IAR Systems\Embedded Workbench 8.0\430\bin\430proc.dll"

"E:\IAR Systems\Embedded Workbench 8.0\430\bin\430sim.dll"

"ts_slave.d43"

--plugin "E:\IAR Systems\Embedded Workbench 8.0\430\bin\430bat.dll"

--macro "tessy_cspy.mac"
```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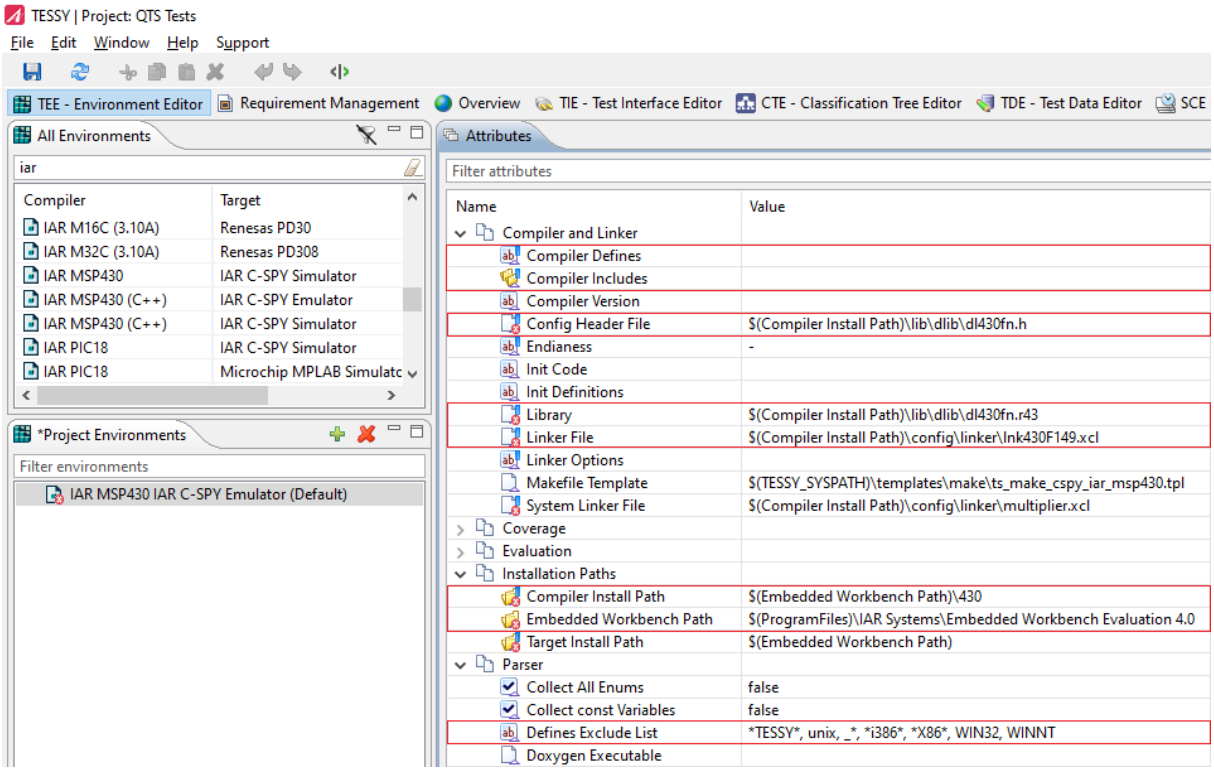
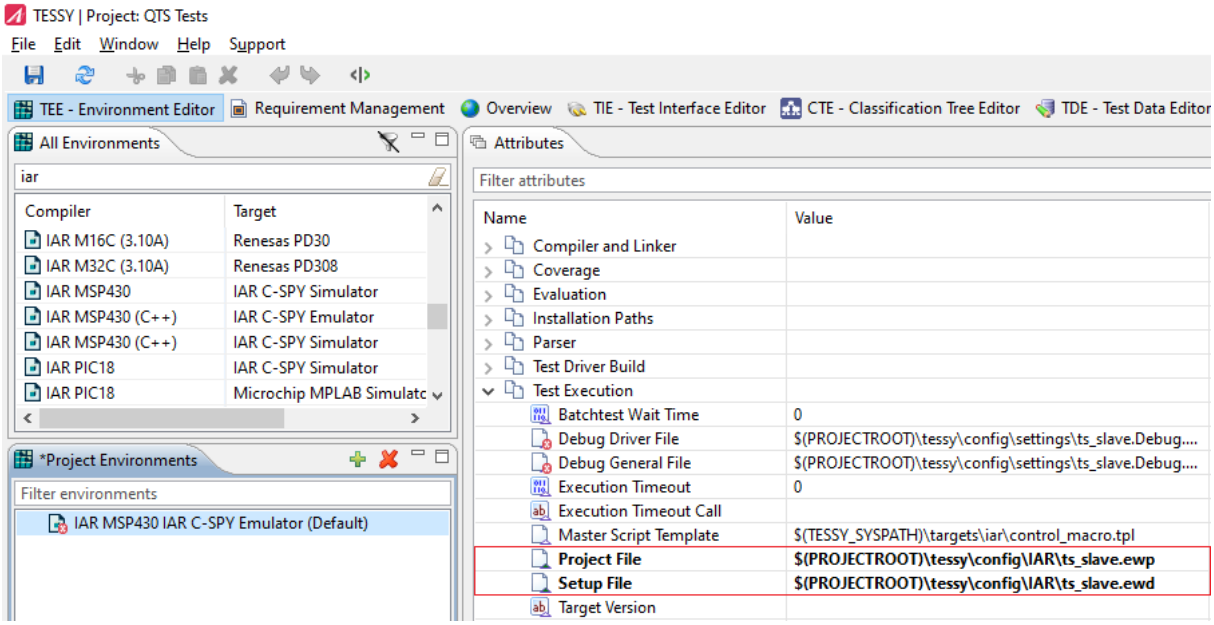
Make sure the TEE attributes **Debug Driver File** and **Debug General File** point to the files used for the test run. For older versions of cspybat the commands normally found in these files are given on command line for cspybat. Please refer to chapter 3.4 for further instructions.

2.2 TESSY Environment Editor (TEE) Settings

Adjust the following attributes properly: **Embedded Workbench Path**, **Config Header File**, **Library**, **Linker Files, Compiler Defines, and Compiler Includes**.



Select the appropriate IAR project and setup files.



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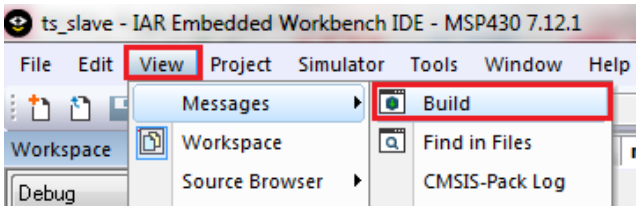
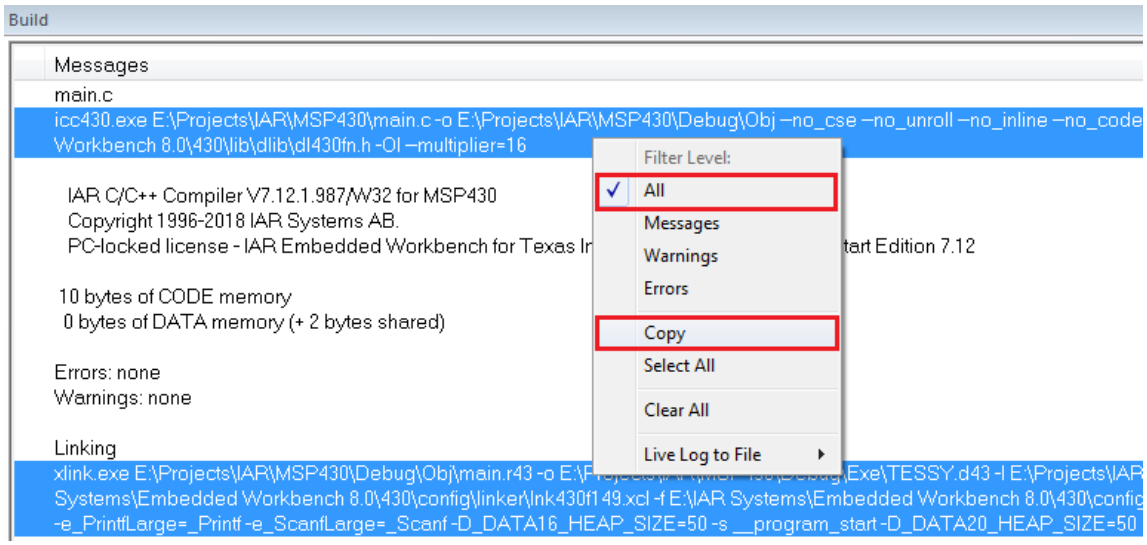
2.3 Determining the Compiler and Linker Options

To determine the compiler and linker options used by your original developer project (not the one created above) you may copy the build messages within the IAR Embedded Workbench from the Build console. In the IAR Embedded Workbench select **Messages->Build** from the **View** menu.



Rebuild your original IAR project. Open the context menu from the Build console and select **All**. Now press and hold **Control** on your keyboard and select the compiler and linker command lines. Open the context menu again, click **Copy,** and paste the command lines into an editor of your choice.



To determine the compiler and linker options used in your TESSY project please enable the logging of the Makefile commands (Help->Logging…->Makefile commands) and start a test run. The compiler and linker command line are displayed in the **Console** view of TESSY.

You can now compare the compiler and linker options TESSY is using with those you are using in the IAR Embedded Workbench. Additional options can be added in the TEE (refer to chapter 2.2). Changes can also be done in the Makefile template (refer to the TEE attribute **Makefile Template** to determine the currently used template).

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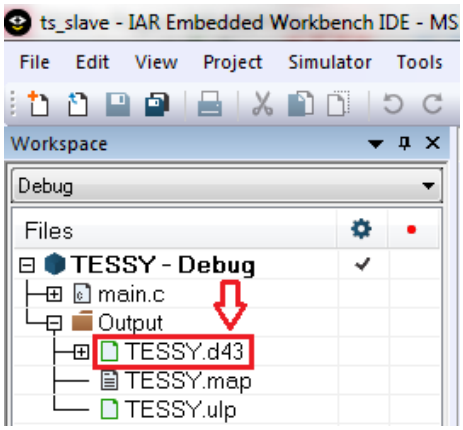
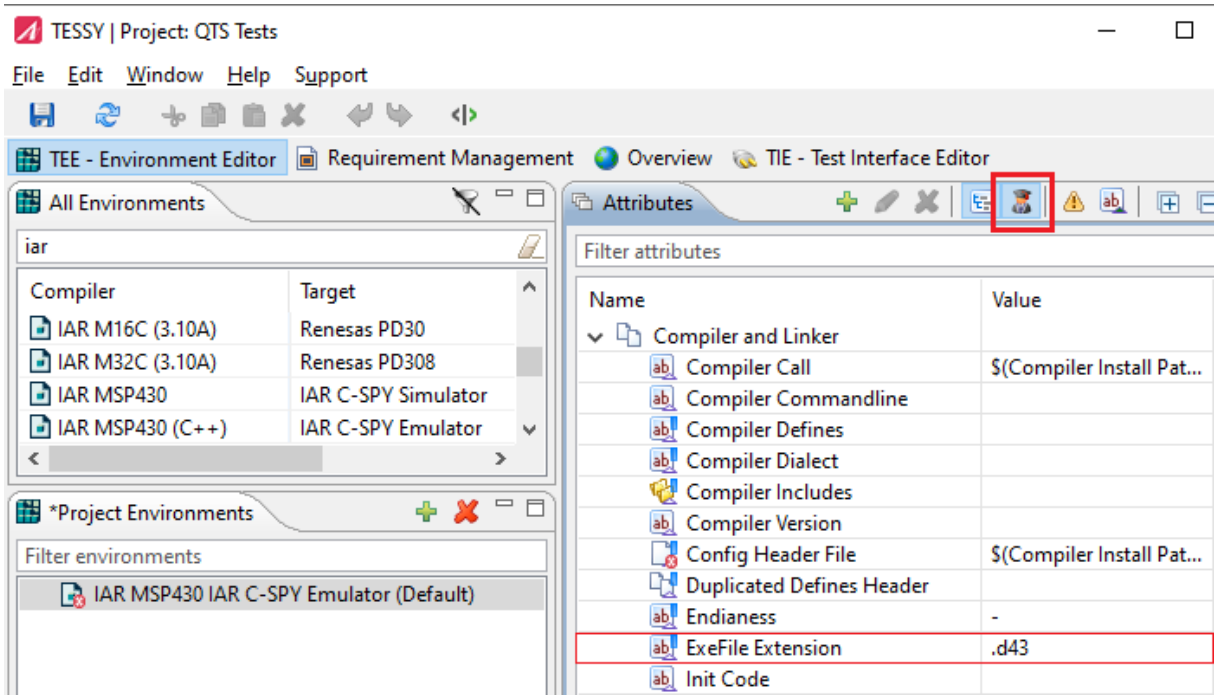
2.4 Adjusting the Executable File Extension

TESSY uses a default file extension depending on the IAR compiler. If this default value does not fit please adjust the TEE attribute **ExeFile Extension**. To determine the file extension for the IAR compiler, take a look at the project tree within the IAR Embedded Workbench.



In the TEE activate the **Expert Mode** and adjust the attribute **ExeFile Extension**.



2.5 Using CLIB instead of DLIB (for deprecated compilers)

If you have to use CLIB instead of DLIB perform the following steps:

- Delete the entry of the TEE attribute **Config Header File**.
- Select the appropriate library (TEE attribute **Library**).

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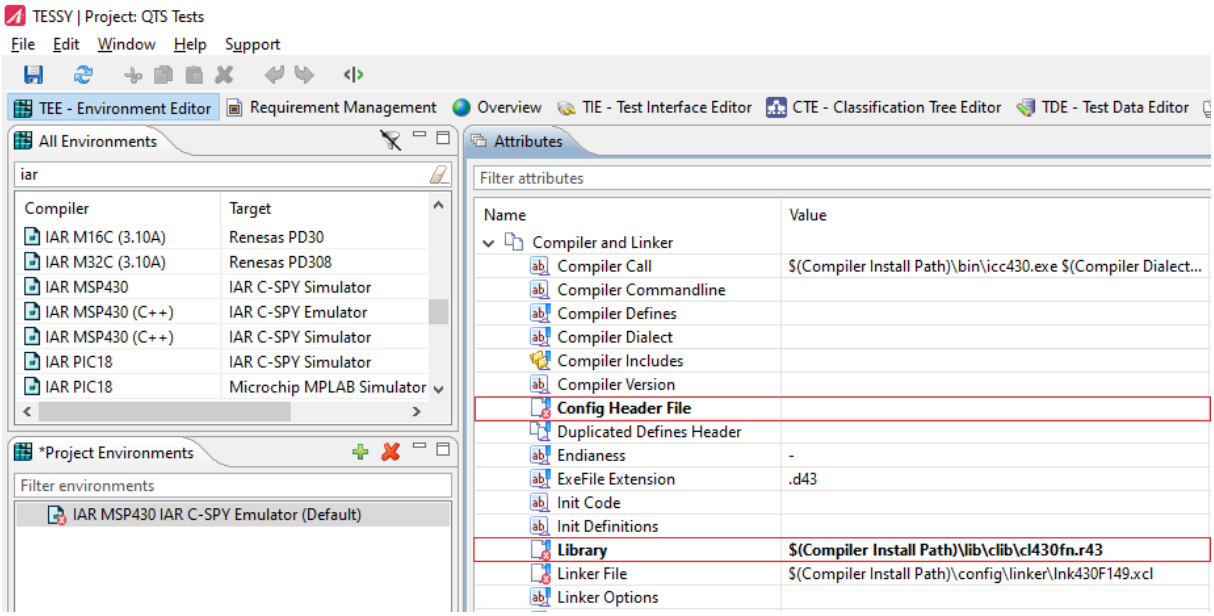


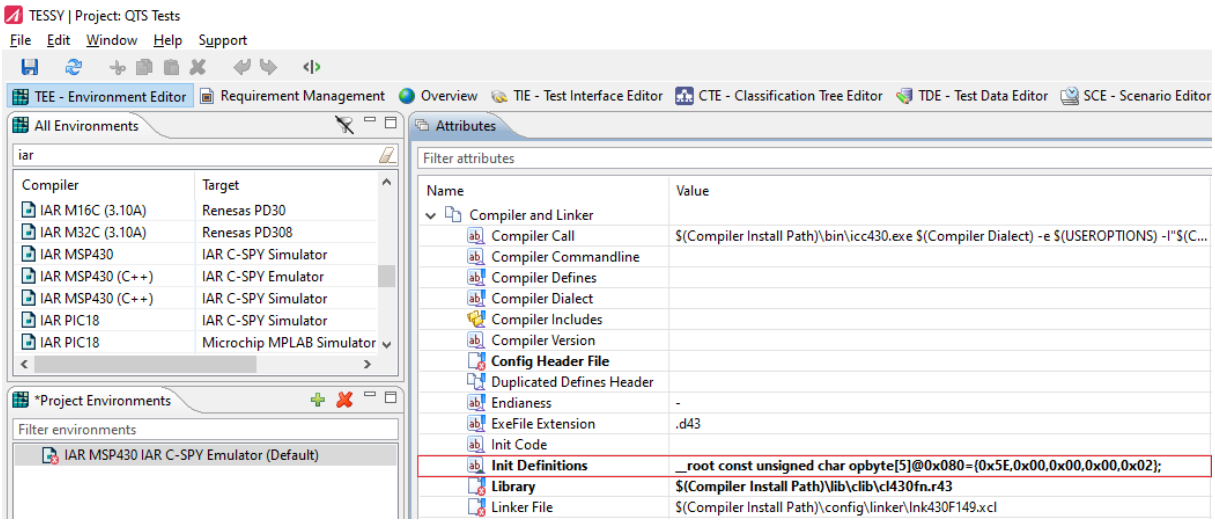
2.6 Disabling the Watchdog

When using an emulator instead of the simulator it is necessary to disable the watchdog timer in order to run tests with TESSY. How to disable the watchdog depends on the microcontroller in use. Please refer to the manuals of the respective hardware manufacturer.

Normally, the watchdog needs to be disabled by writing to a specific microcontroller register. This can be done with the TEE attribute **Init Definitions**. You may have to include the register definition header files or declare the register directly at a specific address. This depends on the microcontroller in use.

Please note, the 78K0 requires an option byte to be defined and initialized as described below. For example the following code has to be placed into the TEE attribute **Init Definitions** (i.e. for NEC µPD78F0881).

```
__root const unsigned char opbyte[5] @ 0x080 ={0x6E,0x00,0x00,0x00,0x02};
```



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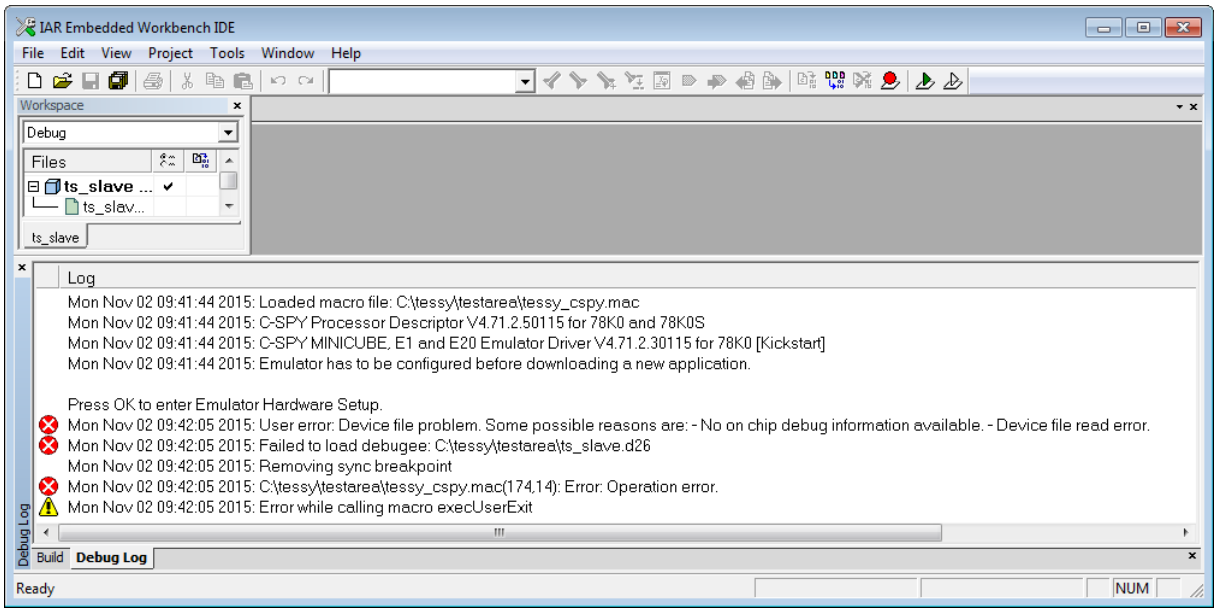
3 Troubleshooting

3.1 Startup of the C-SPY Debugger fails

If the debugger hardware is not connected or if there are other hardware related problems (e.g. wrong device file) you will get error messages as shown below within the **Debug Log** view of C-SPY.



In this case abort the test from within TESSY and follow the instructions above to change the hardware settings. Ensure that the debugger within the IAR Embedded Workbench starts without errors using the project template files that are used by TESSY.

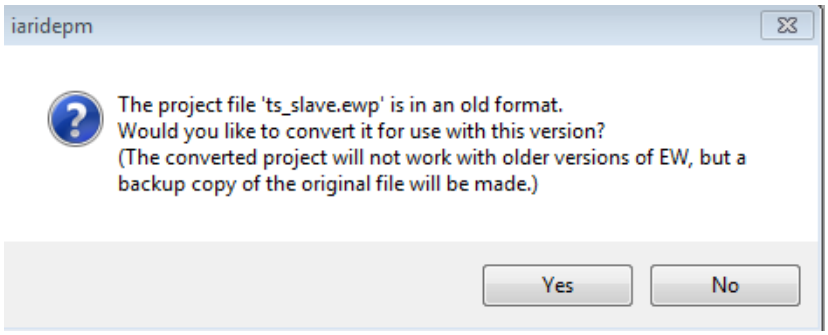
3.2 Test Execution Stops during Debugging

If the test execution process is stopped within C-SPY before the test is actually finished assure that the watchdog is disabled.

3.3 The IAR Project Files have the Wrong Version

The default EWB project files from `\sys\targets\iar` of your TESSY installation have been created with a specific version of the IAR Embedded Workbench. You will probably have to create your own project files with your version of the workbench.

If the following dialog appears



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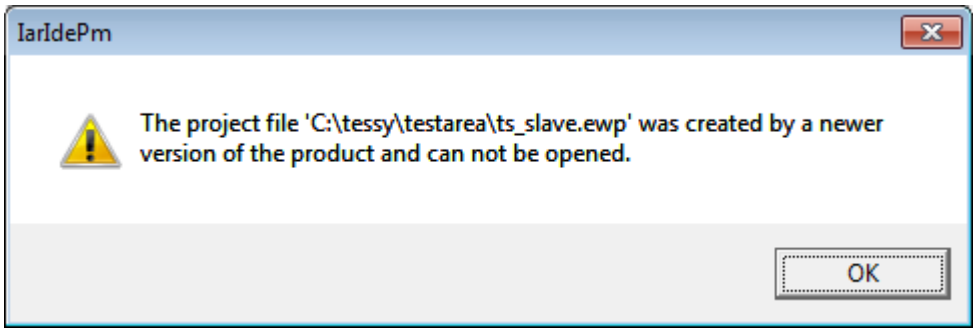
your project file is to old. You can convert it by clicking ‘Yes’ or create a new one as described above (refer to chapter 2).

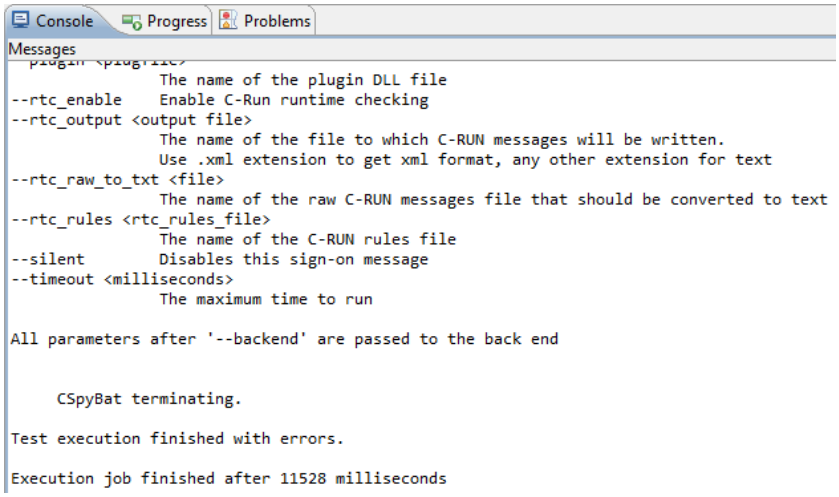
If you click ‘Yes’ you have to copy (and rename it if necessary) the converted project and setup files from the TESSY test area to the directory where your project file resides (see the TEE attributes **Project File** and **Setup File** (refer to chapter 2.2)).

If the following dialog appears your project file is to new.



Thus you have to create a new one with your currently used version of the EWB (see chapter 2).

3.4 Startup of cspybat fails



Unless you have on older versions of IAR Embedded Workbench check the TEE attributes **Debug Driver File** and **Debug General File** (see chapter 2.1.4).

If you are using an IAR Embedded Workbench version which creates no driver respectively general file you may edit file *ts_slave.Debug.cspy.bat* from the *settings* folder of your C-SPY project. In this case you can ignore the TEE attributes **Debug Driver File** and **Debug General File.** Activate **Expert Mode** in TEE. Copy the last *cspybat* command line, e.g.

```
"E:\IARSystems\EWB7.0_MSP430_610\common\bin\cspybat"
"E:\IARSystems\EWB7.0_MSP430_610\430\bin\430proc.dll"
"E:\IARSystems\EWB7.0_MSP430_610\430\bin\430sim.dll" %~1 --plugin
"E:\IARSystems\EWB7.0_MSP430_610\430\bin\430bat.dll" --macro
"C:\tessy\testarea\tessy_cspy.mac" --backend -B "--hardware_multiplier"
"32" "--hwmult_type" "8" "-p"
"E:\IARSystems\EWB7.0_MSP430_610\430\config\debugger\MSP430F5358.ddf" "--
core=430Xv2" "--data_model=small" "--iv_base" "0xFF80" "--odd_word_check"
"-d" "sim" "--derivativeSim" "MSP430F5358"
```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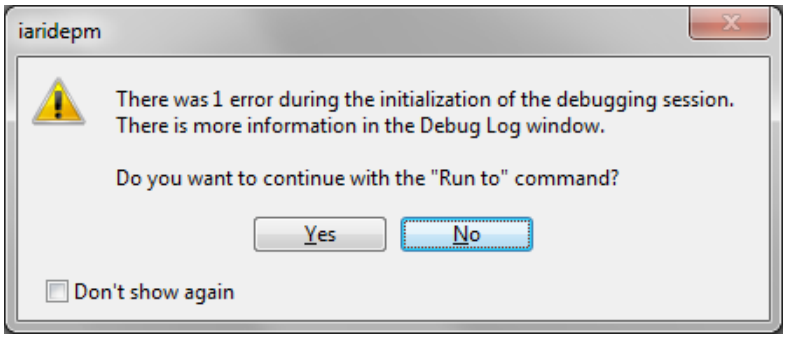
Substitute *%~1* (some IAR Embbedded Workbench versions use *%1* as place holder) for *ts_slave$(ExeFile Extension)* and paste the resulting string into TEE attribute **Slave Call**. So, in our example the resulting **Slave Call** value would look like the following.

```
$(MODULEPATH):@:"E:\IARSystems\EWB7.0_MSP430_610\common\bin\cspybat"
"E:\IARSystems\EWB7.0_MSP430_610\430\bin\430proc.dll"
"E:\IARSystems\EWB7.0_MSP430_610\430\bin\430sim.dll" ts_slave$(ExeFile
Extension) --plugin "E:\IARSystems\EWB7.0_MSP430_610\430\bin\430bat.dll" -
macro tessy_cspy.mac --backend -B "--hardware_multiplier" "32" "--
hwmult_type" "8" "-p"
"E:\IARSystems\EWB7.0_MSP430_610\430\config\debugger\MSP430F5358.ddf" "--
core=430Xv2" "--data_model=small" "--iv_base" "0xFF80" "--odd_word_check"
"-d" "sim" "--derivativeSim" "MSP430F5358"
```

3.5 Interactive debugging fails



Stop the debugger by terminating the unit test from within TESSY. Make sure you set the path to the correct macro file path, i.e. `tessy_cspy.mac`. ***You must not use any other path!***

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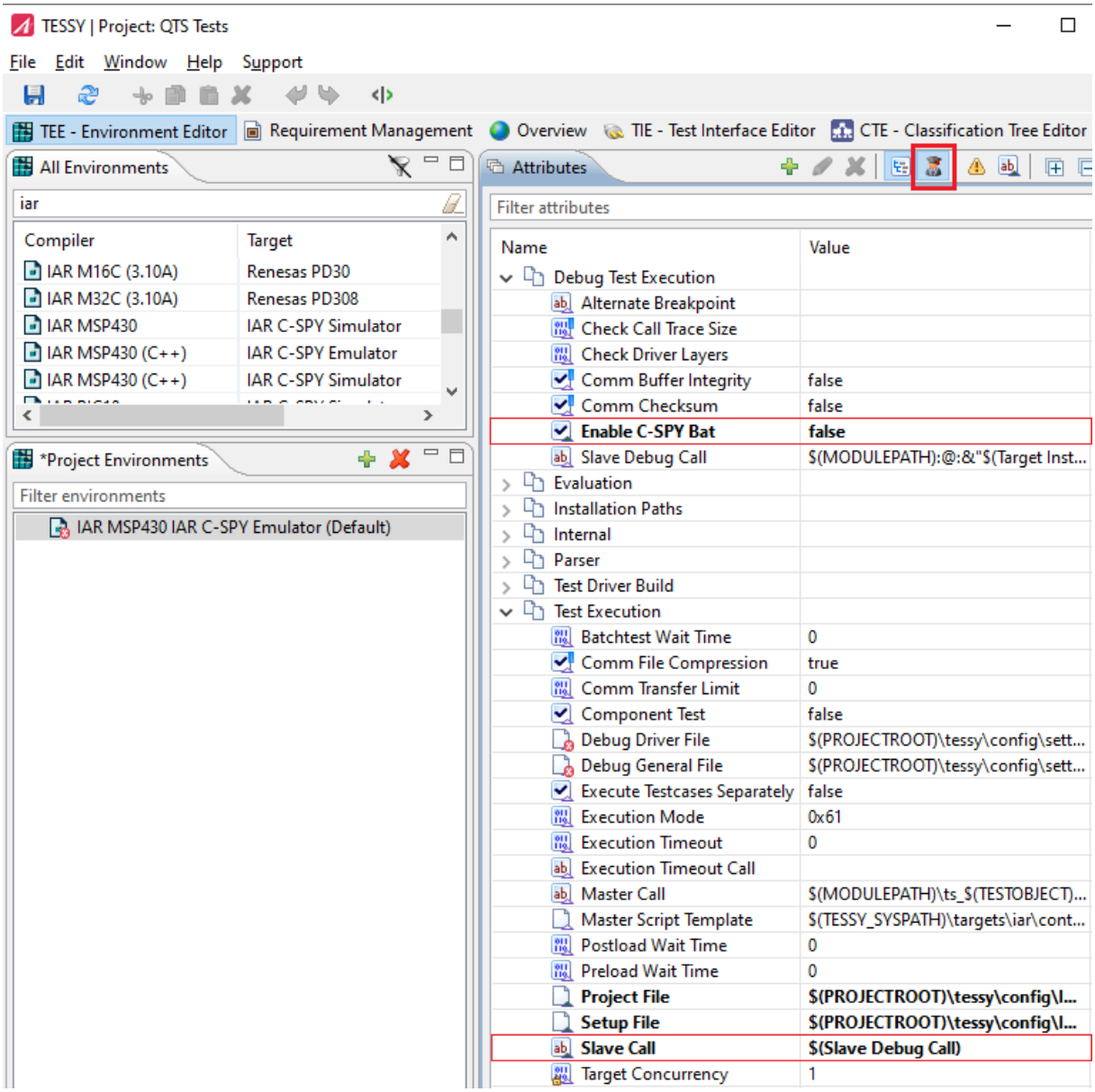
3.6 cspybat is missing

You may either restart your IAR installation file and install cspybat or configure your TESSY project to use the IAR Embedded Workbench for the non-interactive unit tests as well. This is easily done. Set TEE attribute **Slave Call** to the value of `$(Slave Debug Call)`. Set TEE attribute **Enable C-SPY Bat** to false. Both attributes are visible in TEE's **Expert Mode**.



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3.7 Pragma still open error

If you encounter a similar error as shown below, you should use the legacy version of the IAR IDB Makefile, i.e. `iar-idb-legacy.mak`.

```
***** Compiling Communication Modules ******
  #include "tsteval.h"
                      ^
"C:\TESSYS~1.3\168319~1\PROJEC~1\tessy\work\00000401\00000402\
00000403\0000040A\ts_src01.c",1260  Error[Pa074]:
          "#pragma language = save" at line 1256 still open
    #pragma language=restore
                             ^
"C:\TESSYS~1.3\168319~1\PROJEC~1\tessy\work\00000401\00000402\
00000403\0000040A\ts_src01.c",1270  Error[Pa075]:
          no matching save pragma
```


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