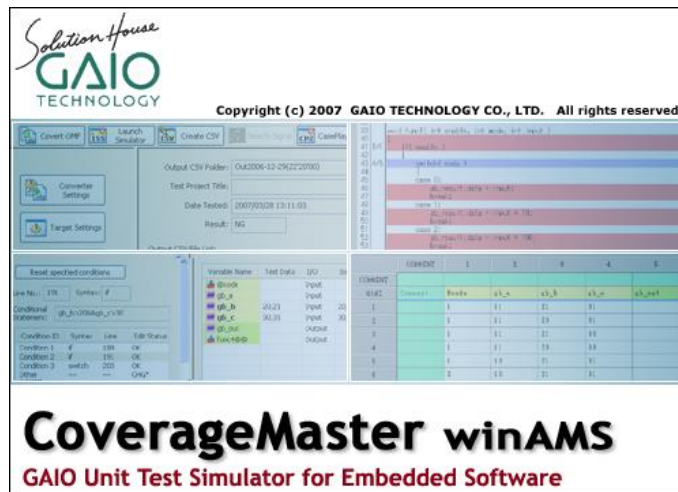


CoverageMaster winAMS - Coverage Measurement Hook Code (MC/DC) Setup Guide



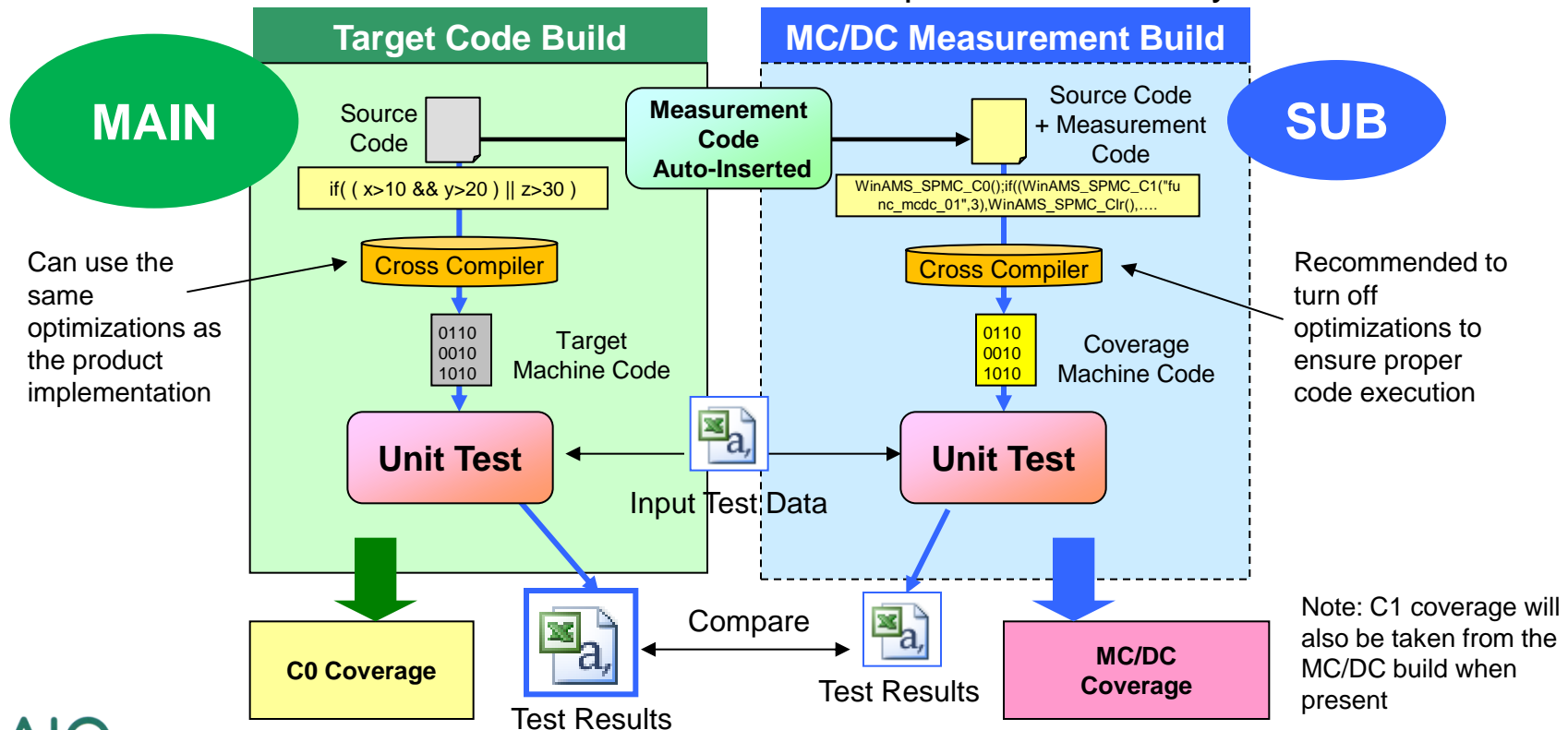
The screenshot displays the CoverageMaster winAMS interface. At the top, it features the Solution House GAIO TECHNOLOGY logo and a copyright notice: "Copyright (c) 2007 GAIO TECHNOLOGY CO., LTD. All rights reserved." The main window is divided into several panes. On the left, there are buttons for "Convert OMP", "Launch Simulator", "Create CSV", "Search Report", and "CaseRun". Below these are "Coverage Settings" and "Target Settings" buttons. The central pane shows "Output CSV Folder: Out2004-12-09222030", "Test Project Title", "Date Tested: 2007/03/28 13:11:03", and "Result: NG". The bottom-left pane lists "Reset specified conditions" and a table of variables: "Variable Name", "Test Data", "I/O", and "SI". The bottom-right pane shows a table with columns "ITEMID", "Coverage", "Breaks", and "OK/NG".

CoverageMaster winAMS
GAIO Unit Test Simulator for Embedded Software

How MC/DC is Measured

■ In order to measure MC/DC, the test is run twice

- Main run: the unit test results are acquired from the unmodified target source code and compared with the expected results
- Sub run: coverage measurement code inserted into the source code is used for measuring coverage
- The results of the two executions are compared for accuracy



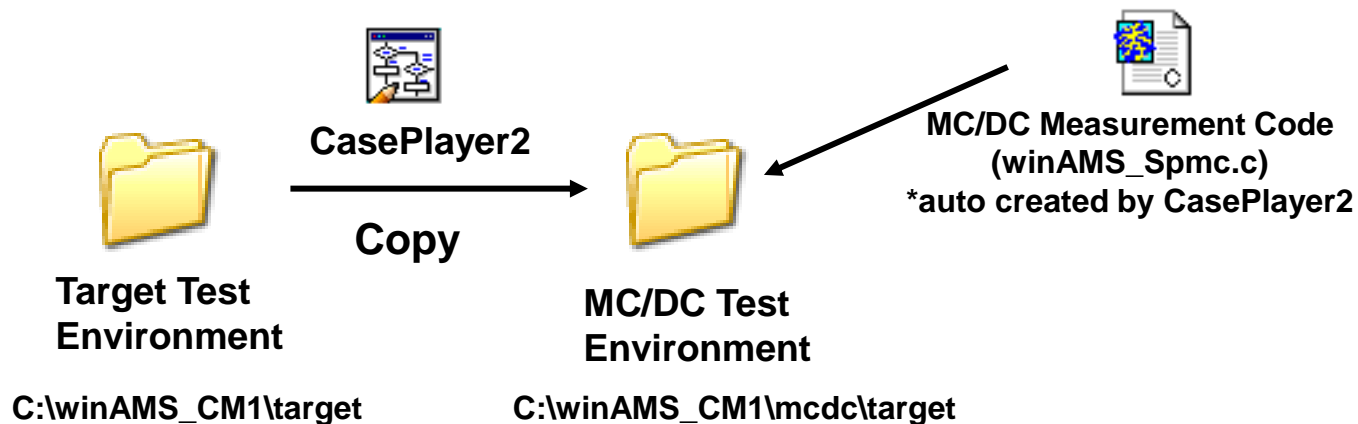
MC/DC Testing Setup Outline

■ MC/DC test environment setup procedure

A full copy of the target test environment including the build project and source files will be made and then configured for MC/DC testing.

1. Create a copy of the test environment using CasePlayer2
 - CasePlayer2 will auto insert the necessary MC/DC measurement code into the copied MC/DC test environment source files.
2. Add the MC/DC measurement code file (winAMS_Spmc.c) to the MC/DC test environment's build project and rebuild
3. Enable CoverageMaster MC/DC test settings

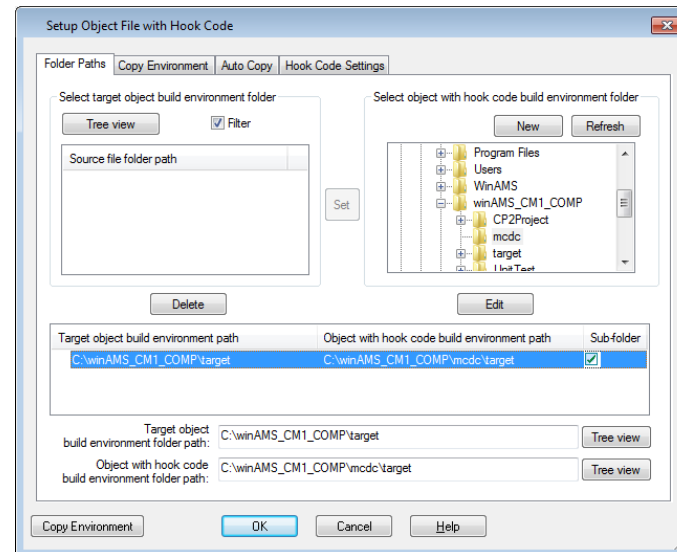
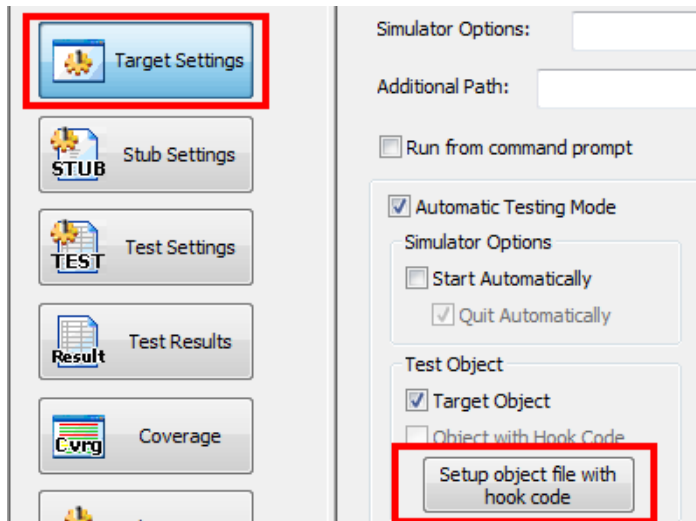
**Note: the CoverageMaster tutorial test environment is used as an example for this document. Replace path locations with your project paths if different.*



MC/DC Test Environment Setup (1)

■ Copy the target test environment

1. From the SSTManager main screen click the **Target Settings** button
 - Click the **Setup object file with hook code** button
(CasePlayer2 opens the **Setup Object File with Hook Code** dialog)
 2. Select target object build environment folder: **C:\winAMS_CM1\target**
 3. Select object with hook code build environment folder: **C:\winAMS_CM1\mcdc**
(To create a new folder: select the project folder (**C:\winAMS_CM1**), click the **New** button, then name the folder as **mcdc**)
 4. Click the **Set** button (with both original and new build environment folders selected)
 5. Click the **Copy Environment** button
- *Note: for large build environments this can take some time*



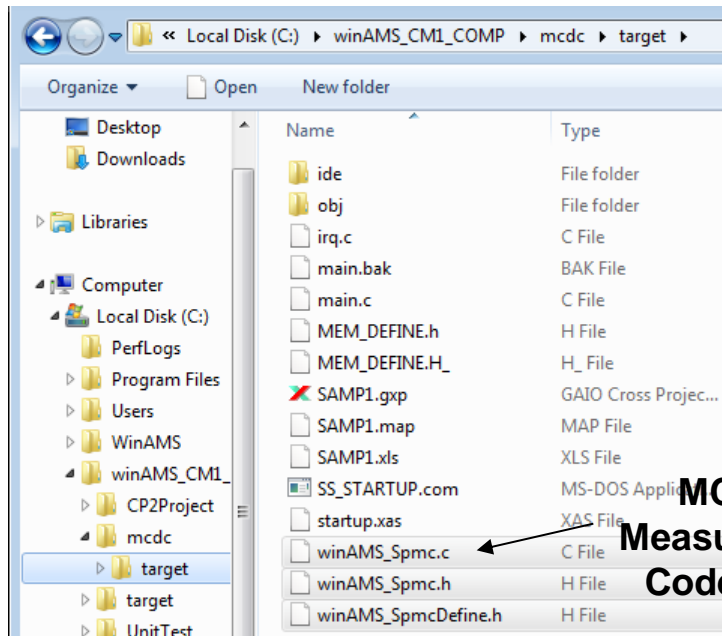
MC/DC Test Environment Setup (2)

■ Insert coverage measurement hook code

1. From the CasePlayer2 menu click:

Project - Re-create all Documents

- Coverage measurement hook code will be inserted into the MC/DC build environment folders source files
- Additional .c & .h files for MC/DC measurement will appear in the MC/DC build environment folder (**C:\winAMS_CM1\mcdc\target**)



```
#include "winAMS_Spmc.h"

#line 9 "C:\winAMS_CM1_COMP\target\main.c"
unsigned int *IRQ_COUNT = 0x04000000;
unsigned int *TIM_ENABLE = 0x04000004;
#line 12
void main()
{
#line 15
}
#line 27
struct ST_PARAM
{
int data;
int ret_code;
} gb_result;
#line 33
void func1( int enable, int mode, int input )
{
if((WinAMS_SPMC_C1("func1",3),WinAMS_SPMC_Clr(1),
WinAMS_SPMC_C1("func1",5),switch( mode )
```

main.c with coverage measurement hook code

MC/DC Measurement Code Files

MC/DC Test Environment Setup (3)

■ Add the MC/DC measurement code file (winAMS_Spmc.c) to the MC/DC test environment build project and rebuild

1. Double-click **SAMP1.gxp** found in **C:\winAMS_CM1\mcdc\target** (for tutorial users using GAIO's cross compiler)

**Note: for users using other compilers, you need to open your MC/DC build environment's build project*

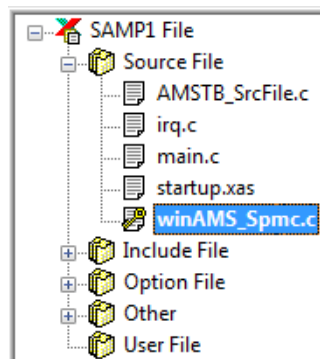
1. From the GAIO Framework menu click:

File - Register File in Project

Select **C:\winAMS_CM1\mcdc\target\winAMS_Spmc.c**, click **OK**.

Note: if a message was displayed stating that AMSTB_SrcFile.c is missing, remove the file from the project (using the right-click menu), then re-add **C:\winAMS_CM1\UnitTest\AMSTB_SrcFile.c*

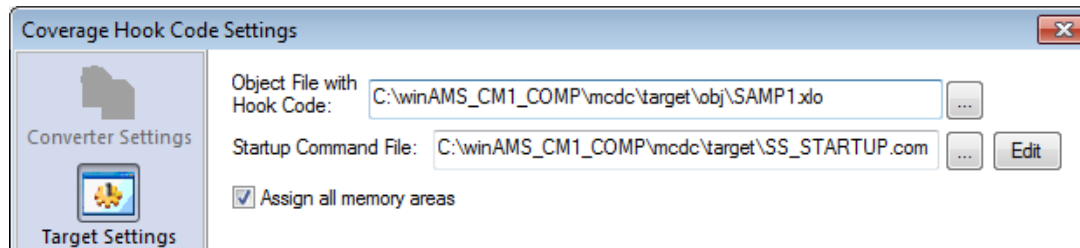
2. From the GAIO Framework menu click: **Build - Rebuild**



MC/DC Test Environment Setup (4)

■ Add the MC/DC test object to CoverageMaster (SSTManager)

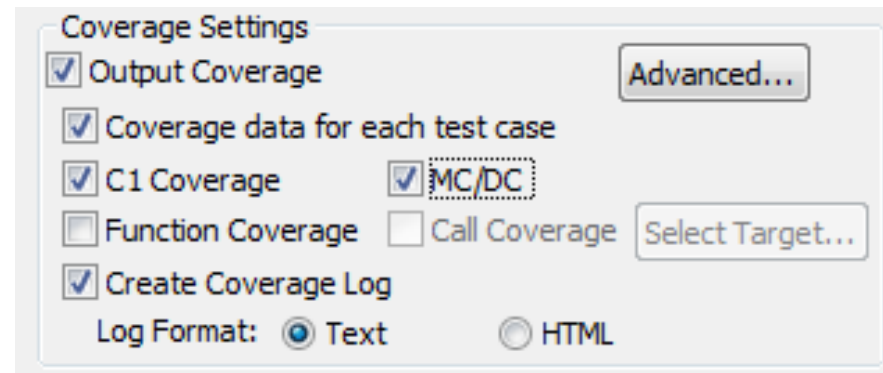
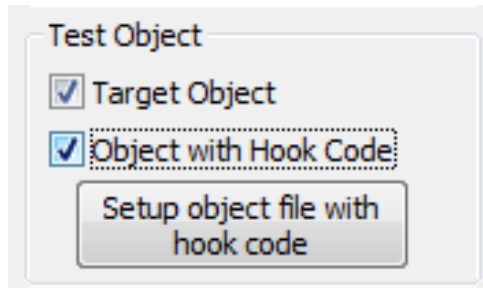
1. From the SSTManager main screen click the **Coverage Hook Code Settings** button (the dialog will appear).
 1. Target Settings - Object File with Hook Code:
C:\winAMS_CM1\mcdc\target\obj\SAMP1.xlo
(for tutorial users using GAIO's cross compiler)
**Note: for users using other compilers, you need to add the object file to Converter Settings – Input Object and then OMF Convert*
 2. Target Settings - Startup Command File:
C:\winAMS_CM1\mcdc\target\SS_STARTUP.com
**Note: in order to increase simulation speed, the set trace line in the startup command file should be commented out or removed. Refer to Exercise 1 in the tutorial for additional information.*
 3. Check the Target Settings - **Assign all memory areas** box
 4. Click **OK**



MC/DC Test Environment Setup (5)

■ Enable MC/DC test settings in CoverageMaster (SSTManager)

1. From the SSTManager main screen click the **Target Settings** button
 - Under the **Test Object** section, check the **Object with hook code** box (leave **Target Object** box checked as well)
2. From the SSTManager main screen click the **Test Settings** button
 - Under the **Coverage Settings** section, check the **MC/DC** box



MC/DC Testing

■ Start the test

1. From the SSTManager main screen click the **Start Simulator** button
 - The simulator will run twice for each test CSV file (one for the target object, and again for the Object with Hook Code)
2. From SSTManager main screen click the **Coverage** button in order to view the coverage results

The screenshot displays the SSTManager interface. At the top, there are status buttons: Run (red), Not-run (yellow), C1-OK (green), C1-NG (blue), MC/DC-OK (green), and MC/DC-NG (blue). Below these are buttons for 'Show Disassembled Code', 'Show in Flowchart', 'Show MC/DC', and 'All Tests'. On the left, a table shows coverage for four functions. On the right, a code editor shows the source code for 'func4' with MC/DC annotations.

Function	C0	C1	MC/DC
func1	100%	100%	100%
func2	100%	100%	100%
func3	100%	100%	100%
func4	100%	100%	100%

```
183 | | | int func4( int code )
184 | | | {
185 | | | 8 int return_value=FALSE;
186 | | | 8 int i;
187 | | |
188 | | |
189 | T/F | 8 | if( gb_a > 10 )
190 | | | | [MC/DC t/f] gb_a>10
191 | T/F | 3 | {
192 | | | | if( gb_b > 20 && gb_c > 30 )
193 | | | | [MC/DC t/f] gb_b>20
194 | | | | [MC/DC t/f] gb_c>30
195 | | | | {
196 | | | | }
197 | | | }
```



END

**For more information visit
<http://www.gaio.com/>**

GAIO TECHNOLOGY CO.,LTD.

**GAIO Technology CO., LTD.
3-12-8 Nihombashi-Ningyo-cho Chuo-ku, Tokyo
〒103-0013**

**TEL: (03) 3662-3041
FAX: (03) 3662-3043
Email: info@gaio.co.jp**

- * Company names and product names that appear in this presentation are trademarks of their respective company.
- * Unauthorized distribution or duplication of this presentation material is prohibited.