g GE Energy	**Functional Testing Specification**
Parts& Repair Services ***Louisville, KY***	**LOU-GEF-MIC1**

Test Procedure for MIC1 Printed Circuit Board for a 1050HL Control

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PREPARED BY	REVIEWED BY	REVIEWED BY	QUALITY APPROVAL
Rick Diercks			Charlie Wade
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Functional test procedure for 1050HL MIC1 Printed Circuit Board

1. SCOPE

1.1 The instructions apply to all MIC1 1050HL Board boards in test.

2. STANDARDS OF QUALITY

2.1 Refer to the current revision of the IPC-A-610 standard for workmanship standards.

3. APPLICABLE DOCUMENTS

3.1 The following document(s) shall form part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue shall apply.

3.1.1 **GEK-25340** Diagnostic Section of the Operators Manual for 1050HL Controls

4. ENGINEERING REQUIREMENTS

4.1 Description

4.1.1 The 1050 Control is a solid-state, integrated circuit controller/processor system using LSI circuits for data processing and control. The static logic circuits are arranged on modular, plug in, printed circuit boards, clearly identified by type. The circuit boards are mounted with functional grouping. In addition, a board identification number marks each rack slot.

4.2 Equipment Cleaning

4.2.1 Equipment should be clean and free of debris prior to applying power unless performing an initial check. Refer to the local documented procedures for cleaning guidelines.

4.3 Equipment Inspection

4.3.1 Equipment should be visually inspected for any defects prior to applying power. This inspection should include the following as a minimum:

4.3.1.1 Wires broken or cracked
4.3.1.2 Terminal strips / connectors broken or cracked
4.3.1.3 Loose wires
4.3.1.4 Components visually damaged
4.3.1.5 Capacitors leaking
4.3.1.6 Solder joints damaged or cold
4.3.1.7 Circuit board burned or de-laminated
4.3.1.8 Printed wire runs burned or damaged

5. EQUIPMENT REQUIRED

5.1 The following equipment is required to perform the process requirements. Equipment may be substituted provided that all accuracy's and test ratios are equivalent or better.

Qty	Reference #	Description
1	GE 1050HL	Control with axis cart

6. TESTING PROCESS

6.1 Setup:

6.1.1 To describe the procedure for testing the circuitry of the MIC1 board using the 1050HL simulator. Digital tests are first performed using the system's resident diagnostic software. A manual check of the axis feedback resolver is also performed.

6.2 Diagnostics Tests

6.2.1 Remove test MIC1 board from slot 19 or 20 and insert board to be tested.

6.2.2 Place Special Mode switch (UP).

6.2.3 Press "ON".

6.2.4 "00" should appear in the message display and "?" in the alphanumeric display.

6.2.5 A "20" in the message display indicates that no machine setup date (MSD) is stored in memory. MSD is not necessary to operate the software diagnostics, but is required to perform the functional testing.

6.2.6 Press "P4", "1", and "Enter". This instructs the control to read from the resident diagnostic boards (DPMA and DPMD).

6.2.7 "T" will appear in the alpha display. Press '4000" and "Enter". This instructs the control to read the block of diagnostics that contains the MIC1 board tests. See exhibit A.

6.2.8 "C" will appear in the alpha display. The 4000 block consists of thirteen subtests (00-12). Press 99, and then ENTER to run all subtests or press the desired test number and ENTER to run a particular subtest.

6.2.9 Press "FWD". "I" will appear in the alpha display. Press "Enter" to run test once or press 00, ENTER to iterate testing.

6.2.10 "S" will appear in the alpha display. Press "Enter" to stop if an error is detected, or N, ENTER to continue testing.

6.2.11 "V" will appear in the alpha display. Press FWD and testing will begin.

6.2.12 Any detected errors will be displayed in the message display. The meaning of these error codes can be found in Exhibit A.

6.2.13 If no errors are detected, proceed.

6.2.14 Press “Delete Block” to exit 4000 block of diagnostics.

6.2.15 Press 6000, ENTER to call up the operator aided diagnostics. See Exhibit B.

6.2.16 The 6000 block consists of twelve subtests, but only subtest 3 or 4 (depending on which slot the board is to be tested is in) pertains to the MIC1 card.

6.2.17 Press 3 if the board to be tested is in slot 19 or press 4 if the board is in slot 20.

6.2.18 Press ENTER, FWD, ENTER, ENTER, FWD, and G.

6.2.19 Turn the axis resolver and observe that the display varies smoothly from 0000 to 0999.

6.2.20 If there is no errors proceed. Depress “DELETE BLOCK”

6.2.21 Press “P3”

6.2.22 At line 00 reads “0050054” the MSD is loaded. If not load the MSD note press up arrow to increment to next line down arrow to decrement to previous line. Key in Data then “enter” then up arrow to next line.

LINE NO.	DATA
00	00500054
01	02000000
02	20202020
03	20202020
04	06060808
05	99991500
06	00000000
07	00000000
08	15001500
09	15001500

6.3 **Part Program Test**

6.3.1 **TURN OFF CONTROL**

6.3.2 Special Mode Switch should be on (down)

6.3.3 **TURN ON CONTROL**

6.3.4 Go to TOOL OFFSETS Press up arrow key in “X” 00.00 “ENTER, “Z” 00.00.

6.3.5 Go to PROGRAM and load in Part Program.

```
0010    G90  X15  Z-5  F100
0020    G04  X5
0030    X-5  Z15
0040    G04  X5
0050    X0  Z0
0060    G04  X5
0070    G25  P1 0010  P2 0060  P3 100
0080    M30
```

6.3.6 TURN Control OFF - ON

6.3.7 TURN ON AXIS CART

6.3.8 Select AUTO, Press “ON” “CYCLE START”

6.3.9 Program will start running X and Z Axis.

6.3.10 After Program in finished Turn OFF AXIS Cart and Control. Remove SUP Board replaced Master Board.

6.4 ***TEST COMPLETE ***

6.5 Exhibit A

AXIS CONTROLLER MACHINE INTERFACE CONTROL AND MACHINE INTERFACE INPUT/OUTPUT DIAGNOSTIC

Identification Number: 4000 (Composed of 13 sub-tests, numbered 4000-4012.)

Boards Tested: MIC1, all but analog and waveshaper of MIIO. Also all interrupts of APA1.

Commands:

The user must command one of the following:

1. Run a particular sub-test. Enter the sub-test's number (from Table 10). Push Enter.

2. Run a particular sub-test on a certain MIC1 board. Enter the sub-test's number. Press decimal point (.). Input the MIC1 board's slot number. Push Enter.

3. Execute all applicable sub-tests on a particular MIC1 board. Enter 9, 9, . , and then the slot number. ('99' means 'all applicable tests'.) Press Enter. See example 4, page 6.

4. Run all sub-tests. Input no digits. Just push Enter.

If the user enters commands which the test does not recognize, a '94' error message is displayed.

Table 10.
AXIS CONTROLLER MACHINE INTERFACE CONTROL TESTS

CODE	FUNCTION
00	Selects and runs false acknowledge test.
01	Selects and runs RAM pattern test (55).
02	Selects and runs RAM pattern test (AA).
03	Selects and runs RAM pattern test (00).
04	Selects and runs RAM addressing test.
05	Selects and runs RAM interference test.
06	Selects and runs constant PROM test.
07	Selects and runs ALU add and subtract test.
08	Selects and runs feedback calculation tests.
09	Selects and runs block transfer check.
10	Selects and runs axis flag tests.
11	Selects and runs axis interrupt tests.
12	Selects and runs miscellaneous tests.

Displays: Standard displays

All other displays are documented with the individual test descriptions which follow.

TEST 00 - FALSE ACKNOWLEDGE

Identification Number: 4000

Description:

This test writes to the board 12 times and reads from the board 12 times. In the event of an error one of the following message codes is displayed:

01: Write error only

02: Read error only

03: Both read and write errors

TEST 01 - RAM P ATTERN (55)

Identification Number: 4001

Description:

This RAM check writes then reads 55 for each stack location. An error in any stack causes the error code for that stack to be displayed:

Stack A1: 04

Stack A2: 05

Stack B1: 06

Letter R: Displays actual data.

Letter W: Displays correct data.

Letter U: Displays RAM address (00-2F).

The error displayed is the last occurring error for that stack. Checking the error count reveals how many other errors occurred in that stack.

TEST 02 - RAM PATTERN TEST (AA)

Identification Number: 4002

Description:

This RAM check writes then reads AA for each stack location. An error in any stack causes the error code for that stack to be displayed:

Stack A1: 07

Stack A2: 08

Stack B1: 09

Letter R: Displays actual data.

Letter W: Displays correct data.

Letter U: Displays RAM address (00-2F).

The error displayed is the last occurring error for that stack. Checking the error count shows how many other errors occurred in that stack.

TEST 03 - RAM PATTERN TEST (00)

Identification Number: 4003

Description:

This RAM check writes then reads 00 for each stack location. An error in any stack causes the error code for that stack to be displayed:

Stack A1: 10

Stack A2: 11

Stack B1: 12

Letter R: Displays actual data.

Letter W: Displays correct data.

Letter U: Displays RAM address (00-2F).

TEST 04 - RAM ADDRESSING TEST

Identification Number: 4004

Description:

This is a stack addressing error test. Each stack position has its address written into it; then all positions are checked for the correct address.

Any addressing error causes an error message to be displayed:

Letter R: Displays actual data.

Letter W: Displays correct data.

Letter U: Displays RAM address.

Error Code:

Stack A1: 13

Stack A2: 14

Stack B1: 15

TEST 05 - RAM INTERFERENCE TEST

Identification Number: 4005

Description:

This is a RAM interference test that zeroes the entire RAM, writes 00 in the test address and FF everywhere else. It then reads back from the test address, and compares to 00.

Error Code:

Stack A1: 16

Stack A2: 17

Stack B1: 18

The following auxiliary information is available:

Letter U: Test address.

Letter R: Actual data.

Letter W: Correct data.

TEST 06 - CONSTANT PROM CHECK

Identification Number: 4006

Description:

This test checks the contents of the constant PROM. In the event of an error, the following auxiliary data is available:

Letter W: Correct data.

Letter R: Actual data.

Letter U: PROM address (00-05)

Error Message - 19

TEST 07 - ALU ADDITION AND SUBTRACTION

Identification Number: 4007

Description:

This test checks double precision addition and subtraction of the ALU. Error codes for this test are:

20 - Addition failure

21 - Subtraction failure

The following auxiliary information is also available:

Letter X: Input data.

Letter Z: Input data.

Letter W: Correct data.

Letter R: Actual data.

TEST 08 - FEEDBACK CALCULATION TESTS

Identification Number: 4008

Description:

This test generates artificial waveshaper positions of '0', '250', '566', '816' * '250' in that order and checks each for the proper result for:

1. Previous position
2. Discriminator
3. Absolute position

TEST 08 - Continued

Error Codes are:

22 - Initial 250 failure

23 - Initial 566 failure

24 - Initial 816 failure

25 - Second 250 failure - Checks through zero.

26 - Second 816 failure - Checks through zero reverse.

Readout is:

Letter X: MS word of absolute position

Letter Z: LS word of absolute position

Letter F: Previous position

Letter U: Discriminator

Letter W: Discriminator standard

Letter R: Previous position standard

TEST 09 - BLOCK TRANSFER CHECK

Identification Number: 4009

Description:

This test generates a block transfer from buffer and checks the results.

Error Codes are:

27 - Incorrect TX

28 - Incorrect results

X - displays

01 = WDCMD
02 = Distance
04 = Delta Di
08 = Scale
} Error 27

01 = Buffer distance not zeroed
02 = Remainder not 500
} Error 28

TEST 10 - AXIS FLAG TESTS

Identification Number: 4010

Description:

This diagnostic tests the following axis flags which are identified as follows when the X pushbutton is depressed for readout of errors.

01 - Error limit

02 - Axis error (005-Loss of feedback/clock)

04 - Out-of-position zone

08 - Distance not zero

Error codes are:

29 - Cannot clear flags

30 - Loss of feedback; does not set axis error

31 - Cannot set flags

Failed flags displayed with X pushbutton.

TEST 11 - AXIS INTERRUPT TESTS

Identification Number: 4011

Description:

This test checks first the APA1 interrupt for a segment with no distance; then a normal 10 ms move is checked. Next, a position move is made, and the interrupt should wait for in-zone. Then a 1 ms move is checked (last block). In addition, the discriminator is checked to insure that it goes the total distance.

Error codes are:

32 - 10ms, no distance

33 - 10ms, normal distance

34 - Positioning

35 - 1ms, last block

36 - Discriminator error

Auxiliary readout:

Letter X: 01 = Too fast

02 = Too slow

*Note that this group will fail on all MIC1 boards if one board has a failure which inhibits the axis complete command bus.

TEST 12 - MISCELLANEOUS TESTS

Identification Number: 4012

Description:

This test checks that error limit and feedhold hold up calculations and that the discriminator disable works.

Error codes are:

37 - Feedhold does not hold up calculations.

38 - Error limit does not hold up calculations.

39 - Discriminator counts when disabled.

Auxiliary readout:

Letter X = Distance for 38

Letter X = Discriminator for 39

Table 11.
AXIS CONTROLLER MACHINE INTERFACE CONTROL AND
MACHINE INTERFACE INPUT/OUTPUT DIAGNOSTIC (4000-4012)

ERROR CODE	DESCRIPTION
01	A false acknowledge was generated for a MIC1 write command.
02	A false acknowledge was generated for a MIC2 read command.
03	A false acknowledge was generated for both a read and a write to the MIC1 board.
04	There was a stack A1 error for pattern '55'.
05	There was a stack A2 error for pattern '55'.
06	There was a stack B1 error for pattern '55'.
07	There was a stack A1 error for pattern 'AA'.
08	There was a stack A2 error for pattern 'AA'.
09	There was a stack B1 error for pattern 'AA'.
10	There was a stack A1 error for pattern '00'.
11	There was a stack A2 error for pattern '00'.
12	There was a stack B1 error for pattern '00'.
13	There was an addressing error for stack A1.
14	There was an addressing error for stack A2.
15	There was an addressing error for stack B1.
16	There is an interference error for stack A1.
17	There is an interference error for stack A2.
18	There is an interference error for stack B1.
19	There is an error in the Constant PROM contents (since the data from the PROM is transferred to stack B1 to be read stack 1 may be what is in error).
20	There was an ALU addition error.
21	There was an ALU subtraction error.
22	There was a feedback calculation error for resolver angle of 250.
23	There was a feedback calculation error for resolver angle of 566.
24	There was a feedback calculation error for resolver angle of 816.
25	There was a feedback calculation error for resolver angle of 250.
26	There was a feedback calculation error for resolver angle of 816.
27	Data was not properly transferred from buffer to active.
28	For data transfer (buffer to active) one or both of the following did not occur. 1. Buffer distance zeroed; 2. Remainder set to 500
29	Board flag(s) cannot be cleared. Distance Zero Out of Zero Axis Error Error Limit
30	Loss of feedback does not generate axis error and/or distance zero is generated for minus.
31	Board flag(s) cannot be set.
32	The axis complete (10ms) interrupt did not occur properly for zero distance.
33	The axis complete (10ms) interrupt did not occur properly for normal distance command.
34	The axis complete (10ms) interrupt did not occur properly for positioning.
35	The axis complete interrupt did not occur properly when the last block was set. Time should be one millisecond.
36	Discriminator counts when disabled.
37	Feedhold command (Output Command not Pushbutton) did not hold up motion.
38	Error limit did not hold up motion.
39	Discriminator does not count when enabled.
94	Illegal commands.
99	False acknowledge.
	(All test numbers and slot numbers must be 2 digits.)

6.6 Exhibit B

AXIS CONTROLLER
OPERATOR-AIDED DIAGNOSTICS

Identification Number: 6000. Composed of 12 sub-tests, numbered 6001-6012.

Boards Tested: First MIC, Second MIC, Third MIC, Fourth MIC, SPPC, MCD, MHO

Commands:

Key in test number of function to be exercised per the table below. (See example 3, page 6.)

Table 14.
AXIS CONTROLLER OPERATOR-AIDED DIAGNOSTICS

COMMAND NUMBER	FUNCTION
1	Selects and runs spindle RPM check.
2	Selects and runs spindle resolver check.
3	Selects and runs first axis feedback resolver check.
4	Selects and runs second axis feedback resolver check.
5	Selects and runs third axis feedback resolver check.
6	Selects and runs fourth axis feedback resolver check.
7	Selects and runs first axis reversal error count check.
8	Selects and runs second axis reversal error count check.
9	Selects and runs third axis reversal error count check.
10	Selects and runs fourth axis reversal error count check.
11	Selects and runs manual feedrate override check.
12	Selects and runs spindle speed override check.

Displays: Standard displays excluding Error Count/ Pass Count

G - display dependent upon test being exercised.

Error Numbers: 94 - Invalid Command

General Comments:

Each sub-test requires that the user verify proper operation of the feedback devices or functions being tested. In these operator-aided diagnostics, the function to be exercised is selected by entering the command number for the desired test. If the entered command number is invalid, error code 94 is displayed as soon as the test begins to execute.