Functional Testing Specification

LOU-GEF-MII01

Test Procedure for MII01 Printed Circuit Board for a 1050HL Control

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C			

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DATE 10/15/2007	**DATE** 9/21/2010	**DATE**	**DATE** 10/15/2007

Functional test procedure for 1050HL MII01 Printed Circuit Board

1. SCOPE

1.1 The instructions apply to all MII01 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-71770

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 Diagnostic Procedure

6.1.1 Remove the test MII01 board from slot 26 and insert the board to be tested.

6.1.2 Special Mode Switch should be on (UP).

6.1.3 Press "ON".

6.1.4 "00" or "20" should appear in the message display and "?" in the alphanumeric display

6.1.5 A "20" in the message display indicates that no machine set up data (MSD) is stored in memory. MSD is not necessary to operate the software diagnostics, but is required to perform the functional tests.

6.1.6 The procedure for entering MSD into control memory is described in Exhibit A.

6.1.7 Press "P4", "1", and "ENTER". This instructs the control to read from the resident diagnostics boards (DPMA and DPMD).

6.1.8 A "T" will appear in the alpha display. Press "4000" and "ENTER". This instructs the control to read the block of diagnostics that contains the MII01 board tests. See Exhibit B

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

6.1.10 Press "FWD".

6.1.11 An "I" will appear in the alpha display. Press "ENTER" to run test once or press "00" and "ENTER" to iterate testing.

6.1.12 An "S" will appear in the alpha display. Press "ENTER" to stop if an error is detected or "N" and "ENTER" to continue testing.

6.1.13 A "V" will appear in alpha display. Press "FWD" to begin testing.

6.1.14 Any detected errors will be displayed in the message display. The meaning of these error codes can be found in Exhibit B, Table 11, Page 26.

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6.1.15   If no errors are detected then proceed.

6.1.16   Press "DELETE BLOCK" to exit 4000 block of diagnostics.

6.1.17   Press "6000" and "ENTER" to call up the operator aided diagnostics. See Exhibit C.

6.1.18   The 6000 block consists of twelve subtests, however only subtests 3 and 4 pertain to the MII01 board.

6.1.19   Press "3", "ENTER", "FWD", "ENTER", "ENTER", "FWD", and "G".

6.1.20   The X-axis resolver position will now appear in the main display. Manually turn X-axis resolver and observe that the display varies smoothly from 0000 to 0999.

6.1.21   Press "DELETE BLOCK" to exit 6003 test.

6.1.22   Press 6000, "ENTER", "4", "ENTER", "FWD", "ENTER", "ENTER", "FWD", and "G".

6.1.23   The Y-axis resolver position will now appear in the main display. Manually turn Y-axis resolver and observe that the display varies smoothly from 0000 to 0999.

6.1.24   This concludes the first part of the MII01 board tests. The following test can only be done on the HLE simulator.

6.2   Motion Test for the MII01 Board

6.2.1   MSD must be stored in memory. See step 8.1.6 on previous page.

6.2.2   Special Mode switch must be off (DOWN).

6.2.3   Press "ON".

6.2.4   Check sine waves at J3 and J6. They must be from 9.4 to 11.4 volts P-P with no DC offset.

6.2.5   A "00" should appear in the message display. If an error code appears, consult Exhibit D for explanation.

6.2.6   Move display select to program. Press "DELETE PRGRM" to clear program memory. NOTE: Detailed programming instructions may be found in GEK-71740.

6.2.7 Key in the following program. Move to the next block by pressing "NEXT BLOCK".

Block Number

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 0100
0080	M30			

6.2.8 Note: Program will remain in memory unless "DELETE PRGRM" is pressed; therefore this step does not need to be repeated for each board.

6.2.9 Move display select to active mode

6.2.10 Press "TEST". Loop relay will drop out.

6.2.11 Connect Meter to MII01 jacks on front panel.

6.2.12 Move switch to X-axis position and adjust P5 to zero volts.

6.2.13 Move switch to Z-axis position and adjust P6 to zero volts.

6.2.14 Press "TEST" again to exit test mode (LED will go out).

6.2.15 Inhibit X and Z-axis on left control panel, (Switches UP).

6.2.16 Set move select to .1 inch.

6.2.17 Jog X and Z-axis to .3 (.2 for MIIO1A).

6.2.18 Note: X and Z-axis positions can be display alternately by pressing "P1".

6.2.19 Adjust Z-axis output to 7.5VDC using P3 and P4.

6.2.20 Move switch to X-axis position. Adjust output to 7.5VDC using P1 and P2.

6.2.21 Jog X and Z-axis to -.3 (-.2 for MII01A).

6.2.22 Output of each should be –7.275VDC to –7.725VDC.

6.2.23 Turn OFF axis inhibits. (Switches DOWN).

6.2.24 Press "CYCLE START". Program will run.

6.2.25 Observe axis for proper position moves, oscillation, vibration, or jerking movement.

6.3 ***TEST COMPLETE ***

7.   REFERENCE:

EXHIBIT A

7.1.1   Special Mode switch on (UP).

7.1.2   Press "CNTRL ON".

7.1.3   Press "P3"

7.1.4   Key in "00500054".

7.1.5   Press, "ENTER".

7.1.6   Press "↑" to increment to next line. ("↓" may be used to decrement to previous line).

7.1.7   Use the above procedure to enter the reminder of the MSD as follows:

Line Number	Data
00	00500054 (Previously entered)
01	02000000
02	20202020
03	20202020
04	06060808
05	99991500
06	00000000
07	00000000
08	15001500
09	15001500

7.1.8   Errors may be corrected by simply writing over the incorrect data line and pressing, "ENTER".

7.1.9   To exit MSD mode press "OFF" then "ON", data will be retained in the battery supported RAM on the PGM2/5 board.

EXHIBIT B

Exhibit B

PI

ROM Board Diagnostics for the 1050H Control
Test Descriptions – Axis Controller
Machine Interface Control Tests

GEK-71770

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 deci-mal 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 num-ber. ('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.

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ROM Board Diagnostics for the 1050H Control
Test Descriptions - Axis Controller
Machine Interface Control Tests

GEK-71770

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 PATTERN (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).

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ROM Board Diagnostics for the 1050H Control
Test Descriptions - Axis Controller
Machine Interface Control Tests

GEK-71770

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

Exhibit B   P4

ROM Board Diagnostics for the 1050H Control   GEK-71770
Test Descriptions - Axis Controller
Machine Interface Control Tests

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   } Error 27

   08 = Scale

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.

Exhibit B

.. P5

ROM Board Diagnostics for the 1050H Control
Test Descriptions - Axis Controller
Machine Interface Control Tests

GEK-71770

TEST 11 - AXIS INTERRUPT TESTS

Identification Number: 4011

Description:

This test checks first the APA1 interrupt for a seg-
ment 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 discrimi-
nator is checked to insure that it goes the total dis-
tance.

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 com-
plete 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

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ROM Board Diagnostics for the 1050H Control   GEK-71770
Test Descriptions – Axis Controller
Machine Interface Control Tests

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.)

EXHIBIT C

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Exhibit C

P1

ROM Board Diagnostics for the 1050H Control
Test Descriptions – Axis Controller
Operator-Aided Diagnostics

GEK 71770

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, MIO.

Commands:

Key in test number of function to be exercised per the table below. (See example 3, page 8.)

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: 04 – 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 04 is displayed as soon as the test begins to execute.

D1

EXHIBIT D

Exhibit D   P1

Operating the 1050HLX Control   GEK-84805

SECTION 4
OPERATOR MESSAGES

The following table contains a list of operator messages generated by the Control, their meanings, and the time at which the check is performed. A complete description including probable cause and recovery procedure is contained in Section 3, page 40.

Table 4.
OPERATOR MESSAGES

MESSAGE	MESSAGE MEANING
00	M00 program stop.
01	M01 option program stop.
02	M02 End of Program.
10**	Data control RAM error.
12****	Data control PROM checksum error.
13**	PCI RAM error.
14**	PCI PROM CHECKSUM ERROR. This check will be made only if the PCI option is installed.
16	Part program memory full.
17	RS-232 Port overrun or parity error.
18	Part program format error loaded from RS-232 port.
19*	Flashing - channel operation or data error.
20****	MSD checksum error. In addition to displaying an error message, the MSD is set to zero when the checksum error is detected. LOAD MSD
21*	Part program checksum error. Part program storage is cleared.
23****	Tool Data/Offset checksum error. Tool data file and offsets are set to zero.
24	Program index table full.
25	No program ID on tape.
26	Over temperature.
30	M30 program stop-rewind.
40*	Supervisor halted by controller hardware.
45	Illegal lead screw MSD
46	Tool parameter error.
47	Invalid tool number.
48	X axis servo board fault; out-of-sync; loss of clock; loss of feedback.
49	Z axis servo board fault; out-of-sync; loss of clock; loss of feedback.

*Checked during power-up. Failure will cause a Stop condition that may be cleared only by turning the Control off and then on again.

**Checked during power-up and clear.

****Checked during power-up, clear, and each time Cycle Start is pushed.

Operating the 1050HLX Control

Exhibit D P2

GEK-84805

Table 4. (Continued)
OPERATOR MESSAGES

MESSAGE	MESSAGE MEANING
50	Canned cycle threading error.
51	Other canned cycle error.
52	Worksurface programming error.
53	Illegal G code in the Execute mode.
54	G63, G64, G65 programming error.
55*	X axis MIC not present.
56*	Z axis MIC not present.
57*	Spindle board not present (except for resolverless IPR).
58*	D/A Input board (MCD1) not present.
59*	Programming productivity PROM not installed.
60	Data format error in part program block.
61	No Constant Surface Speed constraint programmed.
62	No Constant Surface Speed surface speed programmed.
63	Illegal combination of data.
64	Parametric subroutine parameter (#) entry without G24.
65	Too many blocks in G66, G67, G68, or G69 contour description.
66	Change in G66, G67, G68, or G69 contour direction.
67	Parameter error in subroutine or G66-G69. G66-G69 error.
68	Subroutine error.
69	End of stored program in memory.
71*	Invalid MSD for feedback gearing.
72*	Axis MSD for error limit, out-of-sync or zone = 0.
73	Axis error - false acknowledge.
74***	Axis error - lost interrupt.
75	Reference, grid, or set zero required.
76	Offset error.
77**	Axis control 16-bit RAM error.
78**	Axis control 8-bit RAM error.
79**	Axis control PROM checksum error.
80	Spindle overspeed.
81	Reference zero required..
82	Jog-off - reference.
83*	SAC Board missing (Turret Indexer board).
84*	AEI Board missing (Axis Encoder Interface board).
85**	Program Variables lost

*Checked during power-up. Failure will cause a Stop condition that may be cleared only by turning the Control off and then on again.
**Checked during power-up and clear.
***Checked during clear only.

INDUSTRIAL CONTROL DEPARTMENT, GENERAL ELECTRIC COMPANY, CHARLOTTESVILLE, VIRGINIA

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