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GE Energy

**Functional Testing Specification**

*Inspection & Repair Services  
Louisville, KY*

**LOU-GEF  
CMC-0001-2-B**

**Test Procedure for a CMC-0001-2-B Master Amplifier**

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## Test Procedure for a CMC-0001-2-B Amplifier

### 1. SCOPE

1.1 This is a functional testing procedure for a CMC-0001-2-B & CMC-31CX-2-B Amplifier.

### 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 Pub 127

3.1.2 Pub 42

3.1.3 CMC-31CX-2-B & CMC-31PX-2-B Parameter Settings

### 4. ENGINEERING REQUIREMENTS

#### 4.1 Equipment Cleaning

4.1.1 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.

#### 4.2 Equipment Inspection

4.2.1 Equipment should be visually inspected for any defects prior to applying power.

This inspection should include the following as a minimum:

4.2.1.1 Wires broken or cracked

4.2.1.2 Terminal strips / connectors broken or cracked

4.2.1.3 Loose wires

4.2.1.4 Components visually damaged

4.2.1.5 Capacitors leaking

4.2.1.6 Solder joints damaged or cold

4.2.1.7 Circuit board burned or de-laminated

4.2.1.8 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	CMC-31CX-2-B	Slave Drive
1	CMC-0001-2-B	Master Drive
1	15vdc PS	Power Supply
1	Cable Set	Master/Slave cable set
1	Motor	Motor with encoder
1	Variac	110vac variac

## 6. TESTING PROCESS

### 6.1 Connection Setup

6.1.1 Before hooking up controller/amplifier ohm check the dipswitches.

### 6.2. Testing Procedure

#### 6.2.1. CMC-0001 Setup

6.2.2. Set all dipswitches (SW1 & SW2) on controller to left except for (SW2) 5,7, & 8 they go to the right. This sets up the address to "0" and sets up communications.

6.2.3. Hookup the CMC communication cable to P3. Cable is not reversible, be sure to connect proper end to amp and to the PC. If communication has been established you should see an echo from the drive every time you hit enter on the PC.

6.2.4. This unit is 220VAC model, be sure to hook up power cable to the transformer through the autoformer. Hook up power and encoder cable to controller's P2 connector; leave P1 off at this time. Plug encoder into encoder cable. The XMIT LED will blink every time screen updates/transmits.

#### 6.2.5. CMC-3141 Setup for Resolver Feedback

6.2.6. Hook up large motor and cable with resolver feedback to slave unit. Run a three-line cable from master to slave unit for communication. Use a small jumper wire to connect 1 & 3 and 2 & 4 on the CMC-3141 unit.

CMC-0001	CMC-31CX
(1) link.a	(1)
	(8)
(2) link.b	(6)
	(9)
(3) Ground)	(5) Ground)

- 6.2.7. Set all dipswitches (SW1 & SW2) on controller to left except for (SW1) 5 & 10 they go to the right.
- 6.2.8. The CMC-31CX-2-B unit needs 230VAC 3 phase input voltage. I had to use 2 of the phases to supply 220VAC input voltage to supply the logic voltage to this unit and the master controller.
- 6.2.9. Jumper wires needed to be added from 2 to 14 and 3 to 15 to provide logic voltage to controller. Also add a jumper from 11 to 12 if not already on unit.
- 6.2.10. Power up computer and go into CCS for DOS.
- 6.2.11. Access CCS and go to the Terminal Mode. Enter the address of the amplifier. Controller communication LED will blink when the enter key is pressed, if you are communicating.
- 6.2.12. Download the following program CMC-31CX into master CMC controller. Once done go into the On-line communication mode and setup Master unit's address to zero and talk to master controller. Flip switches Forward, Reverse, and enable on slave unit, motor should be engaged but not moving. Enter 0GT1 or 0GT2 or 0GT3 (If profiles are active, flip switch Profile 3 to manually enter 0GT3 program) into computer and slave should begin to turn and continue until a command is given to stop the unit.
- 6.2.13. Motor should start turning in about 4 to 5 seconds and continue to spin reversing directions every 6 or 8 seconds with a slight delay of about 3 seconds between runs.
- 6.2.14. The Green LED will be on when motor spins in a clockwise direction.
- 6.2.15. The Amber LED will be on when motor spins in a counterclockwise direction.
- 6.2.16. To stop the motor, use either the 0HT or 0ST commands.
- 6.2.17. Testing the Inputs
- 6.2.18. Enter command RSX at 200 milliseconds in the query mode. You should see a change in the readings when the Home, Reverse, Forward, and Enable switches are flipped.
- |                               |  |
|-------------------------------|--|
| 6.2.18.A. 0011 0011 0000 0101 | All switches flipped up on wooden blocks |
| 6.2.18.B. 0000 0000 0000 0101 | Switch 12 down (Enable)                  |
| 6.2.18.C. 0000 0001 0000 0101 | Switch 11 down (Reverse)                 |
| 6.2.18.D. 0000 0000 0000 0101 | Switch 10 down (Forward)                 |
| 6.2.18.E. 0000 0000 0010 0101 | Switch 9 down (Home)                     |
- 6.2.19. Disable drive. The next test checks the Profiles and Trigger inputs. Enter Diagnostics 0DG1 and the screen should display the results of any switch 1 through 8 which is toggled. If not, you may have to enter 0PE=1 to enable profiles. Check all switches.
- 6.2.20. If unit passes this test run controller for a day.
- 6.2.21. End of test for the CMC-31CX-2-B.

## Auto tune for the CMC31CX

To run the auto tune – do MS (Motor Setup) first. Press P and scroll down to MS, press V for variable and scroll to AT. Once AT is displayed, enable drive. Drive should cause motor to spin one revolution that determines the new values. Once done disable drive.

Go to parameters again and go to CS (Control Setup) press V for variables and enter AT on display, enable drive and wait for motor to stop spinning. When done you should be able to run drive and motor combination (OGT1) program.

Last auto tune on a CMC31CX with our large motor came out with the following numbers.

### Control Setup

GN=80           (50 HEX)  
 IB=34           (22 HEX)  
 ZR=90           (5A HEX)  
 FF=36           (24 HEX)  
 PL=3            (03 HEX)

### Motor Setup

AR=120          (78 HEX)  
 PR=2            (02 HEX)  
 C0=192          (C0 HEX)

#### 6.2.22. CMC-0001 Setup

6.2.23. Be sure cable is wired correctly for each profile, no tachometer needed at this time. Be sure connector is wired correctly. Connector P1-1 should be +12V and inputs are P1-2 through P1-13, ground connections are P1-14 & P1-19.

#### 6.2.24. Testing the Inputs

6.2.25. Enter RDI in query mode so that screen shows switch settings. Once connector is hooked up correctly and voltage applied to inputs; as you flip SW1 through SW12 on the switch box you should see the response on the PC screen.

	<b>SW12</b>		<b>SW1</b>
i.	1000	<b>0000</b>	0000
ii.			<b>0000</b>

6.2.26. With encoder plugged in P2 connector, as you turn encoder clockwise the Green LEDs will light. Counterclockwise the Amber LEDs will light. They should all toggle together.

6.2.27. Testing Analog Inputs

6.2.28. Use HP6826 Power Supply. Drive will need to be enabled and you should go to terminal mode and query the inputs (F7). Enter RA1 thru RA4 to display all four inputs at once.

6.2.29. The following values were taken from the first unit tested. Use as a comparison for further units. The more exact you are to the actual voltage, the closer you should get to the actual numerical value.

<u>Voltage Input</u>	<u>Number Value</u>	<u>Voltage Input</u>	<u>Number Value</u>
0V	0-10	0V	0-10
1V	205	-1V	205
2V	411	-2V	410
3V	615	-3V	615
4V	821	-4V	825
5V	1029	-5V	1030
6V	1239	-6V	1235
7V	1440	-7V	1440

Seven volts should be high enough to verify or register any problems. The unit is supposed to take up to ten volts, but I would rather not go that high at this point. Done with the CMC-0001-2-B

6.3. \*\*\***TEST COMPLETE**\*\*\*

## 7. NOTES

## 8. REFERENCES

CMC-0001 Master Motor Controller

Switch 1

- |    |        |                                |
|----|--------|--------------------------------|
| 1  | L      |                                |
| 2  | L      | Channel One Pulse Multiplier   |
| 3  | L      |                                |
| 4  | L      |                                |
| 5  | L      | Channel Two Pulse Multiplier   |
| 6  | L      |                                |
| 7  | L      |                                |
| 8  | L      | Channel Three Pulse Multiplier |
| 9  | L      |                                |
| 10 | Unused |                                |

Switch 2

- |   |          |                       |   |                         |
|---|----------|-----------------------|---|-------------------------|
|   |          | Y                     | Z | W other Axis' Addresses |
| 1 | <b>L</b> | L                     | L | L                       |
| 2 | <b>L</b> | L                     | R | R                       |
| 3 | <b>L</b> | R                     | R | L                       |
|   |          |                       |   |                         |
| 4 | Unused   |                       |   |                         |
| 5 | R        | Echo                  | L | Non-Echo                |
|   |          |                       |   |                         |
| 6 | <b>L</b> | <b>9600 Baud Rate</b> |   |                         |
| 7 | <b>R</b> |                       |   |                         |
|   |          |                       |   |                         |
| 8 | L        | RS-232 Communications |   |                         |

L=Closed

R=Open

<p><b>LOU-GEF CMC-0001-2-B REV. A</b></p>	<p><b>g</b></p> <p><b>GE Energy</b></p> <p><i>Inspection &amp; Repair Services Louisville, KY</i></p>	<p><b>Page 8 of 9</b></p>
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### **Configuration and test procedures for CMC-0X0X-X-B**

The power bd. is calibrated the same way for all cmc-0 and cam-0 using Wets procedure #WETS5400. There is no separate configuration for 110VAC or 220VAC. This power bd. can withstand either. To test a CMC-0000 or CMC-0001, be sure to burn in the correct e-proms respectively. For CMC-0000, use EPROMs 31450066 and 31450067. For CMC-0001, use EPROMs 31450068 and 31450069. Be sure to put the correct e-prom in u6 and u7. For sinking, JP1 jumper closest to J1 connector to rt. And one behind to the left. For sourcing, move the jumpers over. Run through WETS5418 test and forward to assembly. To test a CMC-0100 or CMC-0101, be sure to burn in the correct EPROMs and put in the corresponding socket. For CMC-0100, use EPROMs 31450056 and 31450055. For CMC-0101, use EPROMs 31450061 and 31450062. Again, set the jumpers the same way. Run through WETS5417 test and forward to assembly.

31450067	61FA
31450066	C05C
31450068	C12F
31450069	5D47

### **Repairs and what to look for on CMC-0 units**

Most of the time there is a no problem found condition. The customer usually has a problem with their programmed IC's at U33 and U34 on the logic board.

If the unit has been in the field a couple of years, it is a good idea to change the battery and upgrade the EPROMs (U6&U7) to the latest revision.

Be sure U15 on logic bd. has a 70004482 bd. with the green lead going to pin 20 of U5. If not, install one. Install a 70004446 bd. at U22 to U28 if not present.

On the power bd. upgrade R2, R3, R4, and R13 with the metal oxide type. Be sure the capacitors at C12-17 are the new style. If not, replace with new. Finally, be sure there are no 1N4935 diodes anywhere. If so, replace with 1N4937 (D1 & D2).

If there is still trouble after all of this and you already pulled out the schematic, it is probably time to replace a board or the unit.

R2	47K 2 Watt
R4, R1	56K 2 Watt
C7-C11	330uf 35vdc
C5, C6	180uf 250vdc



### **Configuration and Test procedures for XMC-3-B**

Use test WETS5405 to calibrate XMC-3 power bd.

Same testing procedure and tests for 6 Amp and 4Amp drives. The only difference is the Power and half bridgeboards.

Use test WETS5404 for 4 AMP half bridgeboard testing. (70003850)

Use test WETS5407 for 6 AMP half bridgeboard testing. (70004879)

To change power bd. for 110VAC operation, add a jumper at JP1.

To convert unit from sink to source, change EPROM (U29), set JP1 to A & B and E & F, then remove R76 and put it in R25 spot.

E-proms are as follows:

For IMC-31X0	31450035
IMC-31X1	31450036
CMC-31X0	31450037
CMC-31X1	31450038

To convert from IMC to CMC, use applicable EPROM, remove U9 and jumper pins 9 & 11, then remove U8 and replace with 31320090.

Now mate the power and logic boards together with a shield board between them.

Connect AC power cable to power board and turn on power. Connect voltmeter positive side to U6 pin 25 and ground to U29 pin 14. Turn R35 pot until meter reads 0volts. Now turn off power and seal pot.

Run WETS5427 test procedure at Jeff's old bench.

IMC: U8 – DAJ – 31290093

U9 – DBI – 31320592

CMC: U8 – DAJ – 31290090

### **Repairs and what to look for on XMC-3 units**

If the unit is returned for repair, be sure the board is not burned. If it looks repairable, more than likely have to replace R25-28 and C32-36. Need to replace C22-25 only if any one of R25-28 is open.

If the clamp circuit is burned up, you may just want to replace the power board. Many times a short on the logic board +5V or +12V line causes this clamp circuit to burn up. So if you replace the power board, be prepared to troubleshoot a bad cap or IC on the logic bd. Be sure the half bridge modules 70003850 are up to date.

Half bridge module upgrades are simple. Install a .001ufd cap across R29, cut foil on solder side at R29 and tack a 1K ohm resistor from R29 lead to other side of cut. See model if necessary.

To trouble shoot a half bridge bd., use the model B half bridge test set and be sure the pulses are at U8 pins 11 and 12. Most of the time U8 is bad. Be sure Q1&2 are not shorted. If one of them are shorted, replace both Q1&2, C28, U14, and quite possibly Q3, 4, 5, and 6.

To upgrade logic boards, replace U15 with 70004444 bd., replace CR13 with zero ohm resistor, upgrade EPROM to latest revision. Cut out CR10&11 and Q3. Run jumper wire from U29 pin 28 to U30 pin 28. Run more jumper wire from U15 pin 7 to U14 pin 14 and U15 pin 14 to U14 pin 7. Finally, replace U30 ram with battery-backed version 31430050 for IMC's only.

If troubleshooting new power boards, power OK but will not run correctly, be sure no transistors are shorted to the T-bar. Always be on the look out for shorts and missing parts.

Commutator board on the other hand, Good Luck! They always gave me trouble. Try socketed IC and look for shorts. Be sure voltages are correct on the bd. See if directional lights work as you turn the motor.

Usually not too many problems with this board.