g GE Industrial Systems	**Functional Testing Specification**
Renewal Services ***Louisville, KY***	**LOU–GED-AFTROL**

Test Procedure for a Card

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Functional test procedure for a Card

1. SCOPE

1.1 This is a functional testing procedure for a Card.

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-85701**
- **3.1.2 GEK-85702**

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		Fluke 85 DMM (or Equivalent)
1		Ammeter

6. TESTING PROCESS

6.1 Setup

6.1.1 Check the back of the card to be tested; cold solder joints are common on the connector pins.

6.1.2 Insert the card to be tested, connect all the cables to the appropriate connections on both the regulator and inverter card.

6.1.3 Make sure the back on of the inverter card is isolated from the hinge that attaches to the regulator card. Secure both cards together.

Note:

6.2 Testing Procedure

6.2.1 Set the operator's speed potentiometer to zero (completely counter-clockwise). If the Follower option is included, set the operator's Manual/Auto selector switch in the Manual position.

6.2.2 Apply 230 volts AC power to the controller, The green RPS and CPS LED's on the Regulator card and the green IPS LED on the Inverter card should come ON, indicating operation of the control power supplies. Three of the six red inverter transistor LED's (T11 thru T61) on the Inverter card should come ON. All other LED's do not come ON, refer to steps C1 thru C18 of the troubleshooting chart.

6.2.3 If the Regulator card **MIN SPD** and **VOLT BOOST** potentiometers have not been previously adjusted for the motor, set them both full CCW. If the optional Load Monitor card is installed, set the **IR COMP** potentiometer full CCW if it has not been preset.

Press the operators START pushbutton (or close the run switch if used) to start the controller. The red RUN LED on the Regulator card should come ON, the red G1, G2 and G3 LED's on the Regulator card should glow dimly (G1 and G2 only on single phase drives) and the TI1, T21, T31, T41, T51 and T61 red LED's should start alternately flashing ON and OFF. For normal conditions, the controller output frequency should be 2 to 3 Hertz.

6.2.4 If the maximum speed and Volts/Hz have not been set using the **VOLTS/HZ** and **MAX SPD** potentiometers and the MF1 thru MF2 jumpers, set them using the instructions given in the Regulator Card Adjustments part of this section.

Note: IF THE CONTROLLER HAS BEEN STORED FOR OVER 6 MONTHS. THE ELECTROLYTIC FILTER CAPACITORS SHOULD BE "FORMED" BEFORE OPERATING THE CONTROLLER ABOVE 150V AC TO THE MOTOR. FORMING IS ACCOMPLISHED BY OPERATING THE CONTROLLER AT 150V ACOUTPUT· FOR 5 MINUTES AND THEN INCREASING THE OUTPUT TO 200 VOLTS AC AND OPERATING FOR 5 MORE MINUTES. AFTER THIS PROCEDURE, THE CONTROLLER MAY BE OPERATED OVER ITS ENTIRE RANGE.

6.2.5 Slowly increase the operator's speed potentiometer. The inverter transistor LEDs (T11 thru T61) on the Inverter card should increase their blinking frequency and the motor should begin to rotate. If the motor rotation is backwards and the Reversing option in not provided, press the operators STOP pushbutton to stop the motor. Disconnect the AC input power and reverse the connections to any two motor leads and restart the controller.

6.2.6 Check the AC motor current with a clamp on ammeter, If the motor shaft is disconnected from the driven machinery, the current reading should be approximately 1/3 of the motor nameplate current rating for standard induction motors,

6.2.7 Slowly increase the speed potentiometer up to the maximum speed setting while observing motor current and motor operation. The motor should run smoothly up to its rated speed and the current of the disconnected motor should remain fairly constant over its entire speed range. If the motor does not operate properly, refer to the Troubleshooting section,

6.2.8 Press the operator's STOP pushbutton and the motor should decelerate with the inverter transistor LED's blinking frequencies decreasing until the motor stops. The RUN LED should then go OFF and three of the six inverter transistor LED's should stay ON.

6.2.9 If different adjustments of minimum speed, minimum frequency, maximum speed, volts per hertz or linear time are desired, they should be made and tested while the motor shaft is still disconnected from its load. Refer to the ADJUSTMENT part of this section for adjustment recommendations and to the section DESCRIPTION, for an explanation under REGULATOR card.

6.2.10 Connect the motor shaft to the driven machinery and repeat the above start-up steps. The motor current will be dependent on the driven load, but should not exceed the motor or controller nameplate rating. If the controller cannot start the motor or if motor current is excessive at low speeds, adjust the VOLT HOOST potentiometer on the Regulator card (and/or the IRCOMP potentiometer on the optional Load Monitor card if present) as explained in the Adjustments part of this section.

- **ADJUSTMENTS -- REGULATOR CARD**

6.2.11 If it is desired to change the Regulator card adjustments, the following procedures are suggested. Refer to the section, DESCRIPTION, for information on adjustment ranges and operation.

- **MIN SPD (Minimum Speed)**

6.2.12 Normally the MIN SPD potentiometer is set full CCW, however turning it CW increases the minimum speed signal from the operators speed potentiometer (into the linear time circuit) if required. When the drive is started, the motor will accelerate, thru the linear time circuit, from the minimum frequency set by the **MIN FREQ** potentiometer to the minimum speed set by the **MIN SPD** potentiometer. The **MIN FREQ** potentiometer should be set before adjusting the **MIN SPD** potentiometer.

- **MIN FREG (Minimum Frequency)**

6.2.13 The **MIN FREQ** potentiometer should normally be set for a controller output frequency of 2 to 3 hertz with the operator's speed potentiometer set at zero (CCW) and the **MIN SPD** potentiometer set full CCW. Turning the **MIN FREQ** potentiometer CW increases the minimum output frequency. The inverter transistor LED's, T11 thru T61, should blink ON and OFF at the controller output frequency. If a synchronous reluctance motor is being used, it is recommended that MIN FREQ be set for a 6-hertz minimum frequency.

- **MAX SPD (Maximum Speed--Base Frequency)**

6.2.14 Jumper the MF1, MF2, MF3, MF4 and MF5 Regulator card posts as indicated in Table A for the base frequency range desired. (The frequencies listed in the table are the controller output frequencies). With the Operator's speed potentiometer set at 100% (full CW), adjust the **MAX SPD** potentiometer to obtain the desired maximum speed within the range selected by the base

frequency jumpers. The voltage at Regulator card post RV1 and COM (2TB-22) should be within the range of 6.5 to 8.5 volts. If the RV1 to COM voltage is greater than 8.5 volts, change the base frequency jumpers (MF1 thru MF5) to the next higher base frequency range and repeat the above adjustment of the **MAX SPD** potentiometer. If the RV1 to COM voltage is less than 6.5 volts, change the base frequency jumpers to the next lower base frequency range and repeat the above adjustment of the **MAX SPD** potentiometer.

TABLE A

Base Frequency Jumpers

Base Frequency	Jumper Selection
36 to 54 Hz	None
41 to 61 Hz	MF2 to MF3
47 to 71 Hz	MF1 to MF2
54 to 82 Hz	MF1 to MF3
60 to 90 Hz	MF3 to MF4
66 to 98 Hz	MF3 to MF5
74 to 110 Hz	MF2 to MF4
82 to 122 Hz	MF2 to MF5
96 to 144 Hz	MF1 to MF2 & MF3 to MF4
110 to 166 Hz	MF1 to MF2 & MF3 to MF5
136 to 204 Hz	MF1 to MF4
170 to 254 Hz	MF1 to MF5

6.2.15 Note that due to circuit tolerances, the next higher or lower base frequency jumper selection may have to be used.

6.2.16 If the base frequency jumpers are changed, readjust the **MIN FREQ** and **MIN SPD** potentiometers.

- **VOLT/HZ (Volts per Hertz Adjustment)**

6.2.17 Set the Speed Adjust potentiometer at the maximum (fully CW) to obtain rated motor nameplate frequency (normally 60 Hz) and speed. If the AC motor is disconnected from the driven machinery so that it is at no load, adjust the **VOLT/HZ** potentiometer to obtain 210V AC across the motor terminals or

approximately 90% of rated motor voltage, if different than 230 volts. After the motor shaft has been connected to its load and the IR COMP potentiometer on the optional Load Monitor card (if installed) has been adjusted for best low speed operation, return the Speed Adjust potentiometer to its maximum setting and recheck the motor terminal voltage. Before readjusting the **VOLT/HZ** potentiometer, mark the original setting point. Slightly adjust Volt/Hz in either direction to try to achieve the following:

6.2.17.1 Minimum motor current at the loaded operating condition.

6.2.17.2 Motor terminal voltage no greater than 230V AC for 3 phase input controllers.

6.2.17.3 For single phase input controllers, it may not be possible to obtain more than 210 to 220 volts at rated load. It may be necessary to slightly reduce Volts/Hz setting or increase the **MAXSPD** potentiometer setting to obtain rated motor speed at full load.

6.2.18 If rated motor voltage is less than 230 volts, adjust Volt/Hz to obtain rated motor voltage.

The above Volt/Hz adjustment should include the effects of the **VOLT BOOST** potentiometer. If the **VOLT BOOST** potentiometer setting is changed, readjust the **VOLT/HZ** potentiometer.

VOLT BOOST (Voltage Boost)

6.2.19 This adjustment is dependent on the amount of motor torque required at speeds below about one-fourth of rated, or the amount of breakaway torque required. If motor torque requirements below one-fourth rated speed are less than 25% of rated torque, no voltage boost is required and Volt Boost should be set counter-clockwise. For higher motor loading at low speeds, a certain amount of voltage boost is required to prevent the motor from "pulling out" and stalling. The amount of adjustment of the **VOLT BOOST** potentiometer from the CCW end depends on the amount of motor load torque at low speeds and type of motor (larger motors require less voltage boost than smaller motors). Adjust Volt Boost only enough so that the motor(s) accelerates smoothly from rest.

ACCEL and DECEL (Linear Time Adjustment)

6.2.20 The **ACCEL** and **DECEL** potentiometers are used to set acceleration and deceleration times respectively, from zero to base speed. Adjust the **ACCEL** and **DECEL** potentiometers to obtain the desired acceleration and deceleration times. Ten seconds is a good average ACCEL and DECEL time for many industrial applications. CW rotation of the **ACCEL** and **DECEL** potentiometers increases the respective times. If the controller trips out during acceleration or deceleration, set the **ACCEL** and **DECEL** potentiometers for a longer time. Note that a fast timing rate may be selected by removing the Regulator card TR1 and TR2 jumper. See the Linear Time description in Section Detailed Description.

CROSSOVER (Link Voltage Crossover Adjust)

6.2.21 This potentiometer should normally be set full CW. If the constant horsepower feature is used, this potentiometer should be set according to the steps given under the Constant HP Range description in section Detailed Description.

ADJUSTMENTS - INVERTER CARD

IOC (Instantaneous Overcorrect)

6.2.22 This potentiometer sets the instantaneous current level where the controller trips out on an overcorrect (OC) fault. It should normally be set at approximately 125% of full load controller current. (Approximately 3/4 turn in CW direction). If another trip level is required, CW rotation of the IOC potentiometer increases the current trip point and CCW· rotation decreases the trip point,

ADJUSTMENTS -- Option Cards

6.2.23 The System Follower card contains the following adjustments: GAIN, OFFSET, SLIP COMP, MAX SPD, MIN SPD, and FV CAL. Refer to the option description in section Standard Specifications for adjustments. The Speed Readout card contains a FV CAL potentiometer which is adjusted the same as the System Follower card. The Load Monitor card contains the following adjustments: TOL, TL, ENERGY SAVER, IR COMP and LOAD CAL. Refer to the option descriptions in section Standard Specifications for adjustments.

6.2.24

6.3 ***TEST COMPLETE ***

7. NOTES

8. <u>Oscilloscope Verification Examples:</u>

Fig. 1

Fig. 2