



GE Energy Services

**Functional Testing Specification***Inspection & Repair Services  
Louisville, KY***LOU-GED-IS200TREG-G****Test Procedure for an IS200TREG Mark VI Terminal Card****DOCUMENT REVISION STATUS: Determined by the last entry in the "REV" and "DATE" column**

REV.	DESCRIPTION	SIGNATURE	REV. DATE
A	Initial release	John Madden	4/5/06
B	Added changes to 6.2.5	Steve Pharris	4/24/06
C	Added changes to 6.2.3 & 6.2.5	John Madden	3/19/07
D	Added another item to test (6.2.6)	John Madden	5/21/07
E	Added data to 6.2.3, corrected 6.2.5, deleted extraneous data on 6.3	John Madden	12/30/08
F	Added line 6.3, running the card on the TMR, functional test.	R. Johnson	8/3/2011
G	Added steps to verify snubber circuits in 6.2.5	F. Howard	1/29/16
H	Added step 4.2.1.8 to inspect J2 connector orientation.	L. Groves	9/7/2017

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## 1. SCOPE

1.1 This is a functional testing procedure for an IS200TREG Terminal Cards.

## 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 **GEH-6421H**

3.1.2 **IS200TREG Schematic Diagram**

3.1.3 **Test Notation Drawings on server as K:\IS2\IS200T\TREG\TREG notated prints.PDF**

## 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 site specific SRA's 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, cracked, or loosely connected

4.2.1.2 Terminal strips / connectors - broken or cracked

4.2.1.3 Components - visually damaged

4.2.1.4 Capacitors - bloated or leaking

4.2.1.5 Solder joints - damaged or cold

4.2.1.6 Circuit board - burned or de-laminated

4.2.1.7 Printed wire runs / Traces - burned or damaged

4.2.1.8 \*\*\*\*\*NOTE - YOU MUST CHECK J2 CONNECTOR FOR PROPER POLARITY.\*\*\*\*\*

## 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 87 DMM (or Equivalent)
1		IS200TREG Loop back Harness
1		Tenma (or equivalent) 28Vdc power supply
1		125Vdc supply (two or more Tenma or equivalent supplies may be used)
1		5Vdc supply (there should be an auxiliary one on the 28Vdc supply) and a 10K ohm resistor to act as a pull-up.

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## 6. TESTING PROCESS

### 6.1 Setup

- 6.1.1** Be sure to read the ID chips first to get that out of the way. Use the Card ID PC to do this. Occasionally you'll find one with blank ID chips, or with the wrong revision model #, or even a wrong serial # or no serial # at all. If you run into the situation where the PC doesn't have your particular Model # revision, or isn't set up to read a 5 or 7 digit serial #, consult either Robert Duval, Monte Starling, or John Madden to modify the Card ID program to accommodate your particular board.
- 6.1.2** Connect Loop back harness to unit under test. Notice that the power leads of the harness are labeled P28, P125, and N125. This is how they are to be connected to the power supplies. In the event that these labels are missing, refer to the Test Notation Drawings for proper connections. Connect a ground lead from the 28V supply to eyelet E1 or E2. Also tie this connection to the 5Vdc supply's negative connection. Connect a 10k Ohm resistor to the positive side of the 5V supply, and connect to the other side of it to make your 5V pull-up connection.



**Note: The Monitor circuits on this card use HCPL-0731 opto-isolators, which act as open collectors. You will not get any output from them unless you use a 5v pull-up circuit that you make with the aforementioned resistor and take your reading between the opto and the resistor.**

### 6.2 Testing Procedure

- 6.2.1** There are fourteen relay circuits on this card that are fired in different combinations to achieve certain outputs. Nine are "Simplex", requiring only one input to be grounded to fire the relay, and the rest are "TMR", or Triple Mode Redundancy, and require at least two out of their three inputs be grounded to fire them. In addition, there are three more circuits that require two "Simplex" circuits be fired in combination with a "TMR" circuit to get the required output in each instance. Simply going by the Salem prints will confuse you and lead you on a wild goose chase at times, so use the Test Notation Drawings to get a good understanding of where to look for problems. Use the prints for in-depth troubleshooting once you've isolated a bad circuit—something very common with these cards. You'll find shorted FETs, shorted/open opto-isolators, shorted/open buffers ("ul trans arrays"), and shorted/open op-amps.
- 6.2.2** Connecting and powering up the Loop back harness should enable the E-STOP circuitry to allow KX4, KY4, & KZ4 to pick up as soon as you apply 28V power to either JX1-1,

JY1-1, or JZ1-1. Since you will need each of these powered up, go ahead and connect 28V to them at this time. Remember, COM is at E1 & E2 eyelets.

- 6.2.3** Tie your meter's COM into the 5V & 28V COM at the power supply. Connect the 5V pull-up circuit to the meter's Positive connection, and then use the meter's POS lead to probe JX1-29. It should read LO (less than 1Vdc)(you should have both the 28Vdc and 125Vdc power supplies on by this time). Now connect a ground lead to JX1-25. You should hear relay KX1 fire, and the output at JX1-29 should go HI (above 4Vdc). Refer to the following table to see what inputs are tied to each output, and through which op-amps and trans arrays, and just repeat this step on the following circuits:

Input Pin	Op-amp	via QN#	Relay	Output Pin (& troubleshooting pt.)
JX1-25	U16	QN3 1 & 16	KX1	JX1-29 (U9 pin7)
JX1-7	U16	QN3 2 & 15	KX2	JX1-11 (U10 pin 7)
JX1-26	U16	QN3 3 & 14	KX3	JX1-30 (U11 pin 7)
JY1-25	U17	QN2 1 & 16	KY1	JY1-29 (U21 pin 7)
JY1-7	U17	QN2 2 & 15	KY2	JY1-11 (U22 pin 7)
JY1-26	U17	QN2 3 & 14	KY3	JY1-30 (U23 pin 7)
JZ1-25	U18	QN1 1 & 16	KZ1	JZ1-29 (U1 pin 7)
JZ1-7	U18	QN1 2 & 15	KZ2	JZ1-11 (U2 pin 7)
JZ1-26	U18	QN1 3 & 14	KZ3	JZ1-30 (U3 pin 7)

- 6.2.4** The "TMR" relay circuits test the same as above, but require multiple inputs to be fired for a particular output. Also note that there will be three outputs for each circuit. Move your meter with it's 5V pull-up arrangement to either JX1-12, JY1-12, or JZ1-12, and fire relay KE1 by grounding at least two of the following: JX1-8, JY1-8 or JZ1-8, you will see the output transition from LO to HI as it did in step 6.2.4. The following table lists what outputs are tied to specific inputs:

Input Pins	Op-amp	Via QN#	Relay	Output Pins
JX1-8, JY1-8, JZ1-8	U12	QN1 6 & 11	KE1	JX1-12, JY1-12, JZ1-12
JX1-27, JY1-27, JZ1-27	U12	QN2 6 & 11	KE2	JX1-31, JY1-31, JZ1-31
JX1-9, JY1-9, JZ1-9	U12	QN3 6 & 11	KE3	JX1-13, JY1-13, JZ1-13
JX1-28, JY1-28, JZ1-28	U19	QN2 7 & 10	K25A	JX1-32, JY1-32, JZ1-32
JX1-10, JY1-10, JZ1-10	U19	QN1 7 & 10	KCL4	JX1-14, JY1-14, JZ1-14

- 6.2.5** Finally, there are three circuits that use a combination of previously tested "Simplex" relays (Step 6.2.3) to generate their outputs. Take note that these circuits will transition

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from HI to LO, and the LO will not be a hard LO, but rather they will drop to around .4V and “bleed off” to .1V or so when fired. You can also test the snubber circuits at this time. Put a volt meter on associated TB point. It will initially read <> -1.5VDC and as the relays are energized and outputs toggle low, the meter will flash to +10VDC and then quickly bleed off to less than +500mV. See the following table:

<b>Simplex Relays &amp; Inputs</b>	<b>Outputs</b>	<b>TB Connector</b>
KX1 @ JX1-25, KY1 @ JX1-25, KZ1 @ JX1-25	JX1-5, JY1-5, JZ1-5	TB-1
KX2 @ JX1-7, KY2 @ JY1-7, KZ2 @ JZ1-7	JX1-24, JY1-24, JZ1-24	TB-5
KX3 @ JX1-26, KY3 @ JY1-26, KZ3 @ JY1-26	JX1-6, JY1-6, JZ1-6	TB-9

**6.2.6** Remove 5V pull-up from meter. Set meter up to read resistance, and if you prefer, set it to tone out for continuity. Connect it across J1-1 & 2 (the little white connector next to JZ1). Now fire K4CL by grounding two out of three of the following: JX1-10, JY1-10, and/or JZ1-10. Your meter should now read continuity across these two pins.

**6.2.7** This concludes the test, assuming all circuits passed.

**6.3** Install unit into TMR Test Rack and check all outputs using Toolbox.

**6.4 \*\*\*TEST COMPLETE \*\*\***

## **7. NOTES**

**7.1** None at this time.

## **8. ATTACHMENTS**

**8.1** K:\IS2\IS200T\TREG\TREG notated prints.pdf.



TREG notated prints.PDF