g GE Industrial Systems	**Functional Testing Specification**
Renewal Services ***Louisville,KY***	**LOU–GED-193X545xx**

Test Procedure for a 193X545AAG0x

DOCUMENT REVISION STATUS: Determined by the last entry in the "REV" and "DATE" column

REV.	DESCRIPTION	SIGNATURE	REV. DATE
A	Initial release	J. Wychulis	08/12/02
B	Changed Tab 37 to 27 in step 3.01	David smith	10-29-02
C			

PREPARED BY	REVIEWED BY	REVIEWED BY	QUALITY APPROVAL
J. Wychulis	D. Smith		Robert Durell
DATE	**DATE**	**DATE**	**DATE**
08/12/02	10/29/02		11/04/02

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 224X427AA, Eng. Spec. & Test Instruction**
- **3.1.2 36C764186AA, Schematic & Component Locator**

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	H033961	545 test box
1		+/-20v supply
1		Rainbow box

6. TESTING PROCESS

6.1 Setup

6.2 Hook power supply to 545 box----attach a 193x connector box to rainbow box

6.3 Jumper all the connections from 545 box to rainbow box including power connections

6.3.1

Note:

6.4 Testing Procedure

6.4.1 Follow factory test in section 3.0 of document # 224X427AA (attached)

GENERAL ELECTRIC 224X427AA

REV NO. 2 | 224X427AA | CONT ON SHEET 2 SH NO. 1

TITLE: TORQUE PROVING CARD
ENGINEERING SPEC & TEST INSTRUCTIONS

FIRST MADE FOR 193X545AAG01

CONT ON SHEET 2 SH NO. 1

REVISIONS

1.0 GENERAL

The following covers the features, performance and test instructions for the subject card. The card is designed to operate with either of the Valutrol Main Control Cards in a Maxspeed Crane Control System.

The basic card function is to prevent releasing the hoist motor brake until proper current response to both a positive and negative reference has been detected. The card performs the following associated functions:

1.01 Clamps the timed reference, TR, to about 2 volts following a start command.

1.02 Provides an auxiliary timed reference signal, ATR.

1.03 Provides a circuit to detect and latch up for ref. and CFB both negative (hoist) and a similar circuit for ref. and CFB both positive (lower).

1.04 Provides LED indicating lights for completed current check in each direction.

1.05 Provides a relay driver circuit for energizing an external brake release relay following bidirectional current detection.

1.06 Provides a FET switch, T1, which resets TR to zero for an adjustable time (0 to .5 sec.) following the energization of the brake release relay.

1.07 Provides a latch reset on preconditioning.

1.08 Provides a latch reset unless bidirectional current is detected within 1 second.

1.09 Has provision for unidirectional current check by adding of two receptacle jumpers.

1.10 Provides a circuit for reducing the current limit during testing.

NOTE: G02 has a higher ATR/TR gain for improved polarity check.

2.0 PERFORMANCE

When subjected to the operating conditions in Sec. 2.08, the card performance will be as follows:

2.01 Inputs/Outputs

Tabs 31, 15, 2	Power supply inputs, +20V, COM, -20V
Tab 17	Unregulated -30V input
Tab 20	Timed reference input from MCC (TR)
Tab 19	Timed reference clamp output to MCC (RJ)
Tab 30	Current feedback input from MCC (CFB)

2 Add Note after 1.10 5/19/82

AW(BW)
5B(8)M
5D(CD)
5E(A&S)
5P(1)BW
5R(2)BW
PRINTS TO

MADE BY H.O.Loberg Re-typed 5/19/82 | APPROVALS NEB | SVPO DIV OR DEPT | 224X427AA

ISSUED H.O.Loberg 7/7/78 | Erie, PA LOCATION | CONT ON SHEET 2 SH NO 1

FF-803-WA (9-81) PRINTED IN U. S. A. CODE IDENT NO

GENERAL ELECTRIC 224X427AA

REV NO. 2 | 224X427AA | CONT ON SHEET 3 SH NO. 2

TITLE: TORQUE PROVING CARD
ENGINEERING SPEC & TEST INSTRUCTIONS

FIRST MADE FOR 193X545AAG01

REVISIONS

Tab 3 — Latch reset input from MCC (PRE)
Tab 5 — Latch reset input from MCC (DP2)
Tab 18 — Relay driver output to BR relay
Tab 9 — ILIM recalibration output to MCC (ILA)

For unidirectional current check connect tab 8 to tab 14 and tab 6 to tab 15.

2.02 Timed Reference Clamp
When preconditioning is released and a reference signal is applied, the TR voltage will time up as a function of the reference signal until the clamp level of 1.6V to 2.0V is reached.

2.03 Auxiliary Timed Reference
The TR voltage is now inverted by OA1 such that ATR + -TR ±.1 volt. The ATR signal is applied to the regulator in addition to the TR signal, but at twice the current level resulting in a net effect of inverting the applied reference. G02: ATR = -7.5TR ± 1.0 volts.

2.04 Current Detection
The initial test involves checking for proper polarity in response to the inverted reference.

For a negative input the TR voltage is negative and the ATR voltage is positive which should result in a positive CFB signal. If CFB > +.8V with ATR > +.8V the voltage at tab 27 is pulled low (< 1V), the voltage at IC1(2) swings high (> +15) and the voltage at IC1(4) swings low (< 1V) to latch in the circuit. When IC1(4) swings low LED1 is illuminated to indicate the detection of a positive CFB signal with ATR positive.

The second test is then initiated by checking for a current response to the TR reference only. As IC1(4) swings low, transistor T8 is turned on to close the FET switches T6 & T7. This changes OA1 to a non-inverting amplifier such that ATR-TR ± .1V. The auxiliary timed reference is now removed from the regulator by the closing of T7. The regulator than only sees the clamped TR voltage which should result in a current reversal.

For a negative reference as described above, both TR and ATR is negative and a negative CFB voltage should result. Thus if CFB < -.7V with ATR < -.7V the voltage at tab 12 is pulled low, IC1(6) swings high and the voltage at IC1(8) swings low to latch in the circuit. Now as IC1(8) swings low LED2 is illuminated to indicate the detection of a negative CFB signal with ATR negative.

If the input reference is positive the test would be performed in the reverse order by LED2 being illuminated before LED1.

With both current polarities detected tab 10 and tab 13 both changed to a high state (> +15V) making IC1(10) swing low. The output of the

2 Add G02: note after 2.03 & 2.04 5/19/82

AW(BW)
5B(8)M
5D(CD)
5E(A&S)
5P(1)BW
5R(2)BW
PRINTS TO

MADE BY		APPROVALS	DIV OR DEPT.	
H.O.Loberg	Re-typed 5/19/82		SVPO	224X427AA
ISSUED H.O.Loberg	7/7/78	NEB	Erie, PA LOCATION	CONT ON SHEET 3 SH NO 2

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GENERAL ELECTRIC 224X427AA

REV NO. 2 | TITLE | CONT ON SHEET 4 SH NO. 3

224X427AA

CONT ON SHEET 4 SH NO. 3

TORQUE PROVING CARD
ENGINEERING SPEC & TEST INSTRUCTIONS
FIRST MADE FOR 193X545AAG01

second half of OA1 at tab 22 then switches from positive saturation to negative saturation. This turns on transistor T17 to energize the external BR relay. At the same time T2 is opened to remove the TR clamp, but now the T1 switch is closed for a period adjustable by P1 from zero to .5 seconds to clamp the TR voltage at zero until the brake opens. The saturation output voltages of OA1 will have a magnitude of 15V to 20V. G02: The non-inverting gain ATR=8.1TR ± 1.0V.

2.05 Latch Reset

If the input signal is removed shortly after application it is possible to detect and latch up in one direction, but not in the other as the reference is removed. If the test is not completed, i.e., if the voltage at tab 22 does not swing negative within 1 second following the detection of one current polarity transistor T16 will turn on to reset the circuit.

When the drive is preconditioned by the PRE voltage changing from -3.5V to zero, transistor T14 turns on to reset the circuit. In the Diagnostic mode a positive signal, DP2, is applied at tab 6 to override the preconditioning reset which allows a diagnostic check of the circuit.

2.06 Current Limit Recalibration

By connecting tab 9 to MCC(1LA) the drive current limit will be reduced during testing. Tab 9 can sink a maximum of 20mA from a positive source.

2.07 Unidirectional Current Check

With tab 6 connected to common, and tab 8 connected to tab 14, the circuit will check for a current response to the actual applied reference signal. Transistor T8 is turned on to make ATR=TR ±.1V and at the same time the ATR signal is shunted away from the regulator through T7.

As soon as a current response to the clamped TR signal is detected, both current circuits will be latched in by the feedback through the tab 8 - tab 14 connection and the OA1 output at tab 22 will switch negative to energize the BR relay.

If the tab 6 to common connection is left out, the circuit will check for a current response opposite that of the applied reference since ATR=-TR ± 1V. However, as soon as a current is detected both current circuits will latch in and energize the BR relay.
G02: ATR = -7.5TR ± 1.0V, ATR = +8.1TR ± 1.0V.

2.08 Operating Conditions

Power Supply:	+20V ± .1V -25V to -40V unregulated
Temperature:	0 to +75°C
Humidity:	24 hrs in 90% relative humidity at 40°C
Voltage to Ground:	600V

REVISIONS

2 | Add G02: After 2.07 | 5/19/82

AW(BW)
5B(8)M
5D(CD)
5E(A&S)
5P(1)BW
5R(2)BW

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0216V GENERAL ELECTRIC 224X427AA

REV NO. 4 224X427AA CONT ON SHEET 5 SH NO. 4

TITLE TORQUE PROVING CARD ENGINEERING SPEC & TEST INSTRUCTIONS 193X545AAG01

FIRST MADE FOR

CONT ON SHEET 5 SH NO. 4

REVISIONS

2.09 The power supply requirement will be 40mA at +20V and 15mA at -20V
The relay will require 55mA at -30V unregulated power.

3.0 TEST INSTRUCTIONS
The card can be functionally tested by using the circuit shown in Fig. 1.
Turn the P1 pot fully CW.

3.01 Apply power to the card with all switches in the OFF position.
Tab voltages should be as follows:

	G01	G02
Tab 29	0 + .35V	0 + 3.0V
Tab 12, 27	+18V to +20V	+18 to +20V
Tab 10, 13	0 to +1V	0 to +1V
Tab 22	+15V to +20V	+15 to +20V
Tab 18	-18V to -20V	-18 to -20V
Tab 9	+1.1V to +1.5V	1.1V to 1.5V

3.02 Connect S2 to -20V to simulate preconditioning release, and S1 to -20V to simulate a negative reference. Voltages should change as follows:

	G01	G02
Tab 20	-1.6V to -2.8V	-1.6V to -2.8V
Tab 29	+1.5V to +2.9V	+11V to +19V
Tab 28	+ .4V to + .8V	+.6V to +1.1V

3.03 Connect S3 to the +1V reference to simulate a correct current response. The "LC" light (LED1) should turn on. Turn S3 off. The "LC" light should turn off within 1 second.

3.04 Turn S3 to connect tab 29 to tab 30. The ATR signal is now used as both reference and current signal.
Both lights should turn on.
The voltage at TR tab 20 should switch to -10V +/-1V after .5 to 1 second
With both lights on, the voltages at tab 22 should be -15V to -19V and at tab 18 should be -5V to -10V. The tab 9 voltage should be +20V.

3.05 Turn S1 off and reset by turning S2 off. Turn the "Ref Delay" pot, P1. CCW and S2 back on. Turn S1 to +20V. Both lights should turn on and the TR tab 20 voltage should switch without delay to +10V +/- 1 V

3.06 Apply +20V to tab 5. Turn S1 and S2 off. The lights should remain on. Remove +20V from tab 5, - the lights should turn off.

3.07 Connect tab 8 to tab 14, and tab 6 to common. Connect S2 to -20V, S1 to +20V and S3 to +1V. Both lights should turn on indicating a completed test with unidirectional current. Reset P1 to mid position.

Chg 3.07 10/7/83

AW(BW)
5B(8)M
5D(CD)
5E(A&S)
5P(1)BW
5R(2)BW
PRINTS TO

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CONT ON SHEET FL SH NO. 5

REV NO. @ 1
224X427AA
CONT ON SHEET FL SH NO. 5

TITLE
TORQUE PROVING CARD
ENGINEERING SPEC & TEST INSTRUCTION
FIRST MADE FOR 193X545AAG01

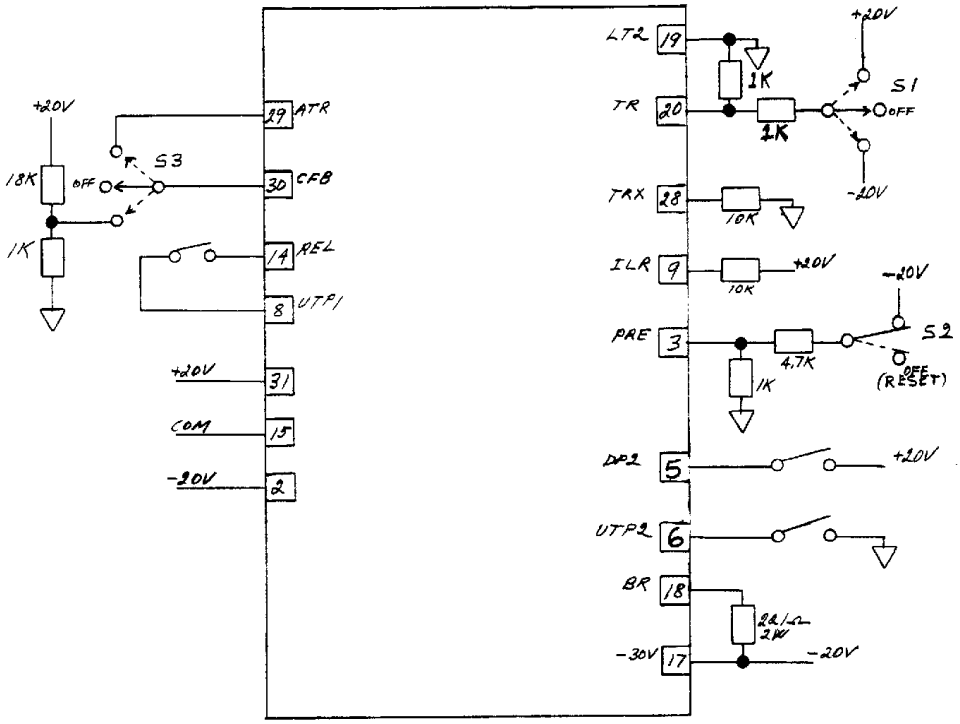
REVISIONS

3.08 Test Conditions:

Same as 2.08 except -20V may be used instead of -30V if the relay coil is simulated by a resistive load.

Figure 1

Torque Proving Card, 193X545AAG01



Chg Figure 1 9/7/78

AW (BW)
5B (8) M
5D (CD)
5E (3) BK
5R (2) BW

PRINTS TO

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6.5 ***TEST COMPLETE ***

7. NOTES

8. Oscilloscope Verification Examples:

Fig. 1

Fig. 2