GE Motors & Industrial Systems

GATE PULSE AMPLIFIER BOARD DS200FGPA__

These instructions do not purport to cover all details or variations in equipment, nor to provide every possible contingency to be met during installation, operation, and maintenance. If further information is desired or if particular problems arise that are not covered su f-ficiently for the purchaser's purpose, the matter should be referred to GE Motors & Industrial Systems.

CONTENTS

SAFETY SYMBOL LEGEND

WARNING Indicates a procedure, practice, condition, or statement that, if not strictly observed, could result in personal injury or death.

CAUTION Indicates a procedure, practice, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.

NOTE Indicates an essential or important procedure, practice, condition, or statement.

FUNCTIONAL DESCRIPTION

INTRODUCTION

The DS200FGPA Gate Pulse Amplifier (FGPA) provides three basic functions for the Load Commutated Inverter (LCI).

- **Gate driver.** Each FGPA supplies the gate power for one phase of an SCR bridge. To accomplish this, each FGPA contains two gate driver circuits. Each gate driver is capable of supplying gate power of sufficient magnitude and duration to gate from one to six series-connected SCR's. Upon receipt of a gating command via fiber optic link from the LCI control, the gate driver sends gate power to the SCR gates through isolation CTs (current transformers) located on DS200FHVA cards mounted near the SCRs. (One FHVA per SCR). The primaries of the isolation CTs are connected in series to ensure simultaneous gating of all SCRs.

- **SCR status monitor.** The FGPA accumulates cell voltage information from up to 12 FHVAs and relays this information via an optical serial data link back to the LCI control.

- **Switching power supply.** The FGPA accepts a power input of 120 Vrms ±20% ac. This input is converted into the dc control voltages required by the gating and status functions.

Three FGPAs are required for each 3-phase SCR bridge.

GATE DRIVER CIRCUITS

There are two identical gate driver circuits on each FGPA. Signal names for each are identical except that the names for circuit A end in *A* and signal names for circuit B end in *B*. The following description of circuit A applies as well to circuit B.

The command to produce SCR gate power is received via plastic optical fiber. Light received is interpreted as a command to gate. A high frequency filter connected to the output of the fiber optic receiver causes an initial delay of approx. 1.5 uSec.

Each gate driver utilizes a push-pull circuit driving a center-tapped transformer primary to produce an AC output current signal. The secondary of the transformer is connected to output stabs AGATE1 and AGATE2. Current from AGATE1 flows through a conductor to the isolation CT on DS200FHVA. The conductor is routed through the window of each isolation CT to create a single-turn primary winding and back to AGATE2. The AGATE2 stab is grounded through stab AGND. (See Table 5 for stab connections.) The frequency of the output is approximately 33 Khz. The CT on the FHVA card has a 5 turn secondary connected to the input of a full wave diode bridge. This combination steps the ac current from FGPA down by a ratio of 5:1, then rectifies and sends the resulting dc current on to the SCR gate.

Two sources supply gate current to the push-pull circuit:

- **Gate Pedestal.** This is the large current pulse required to initially gate the SCR. Pedestal current is generated by charging a capacitor to approximately 90 volts while the gate command is off and then discharging the capacitor through the primary of the output transformer when a gate command is received.

  This action produces an initial 20 to 25 amps of peak current from AGATE1 through the FHVA CT's and back to AGATE2. The peak current decays exponentially over the duration of the first half-cycle (15 uSec).

- **Gate Backporch.** A switching regulator operating in current limit mode is also enabled when a gate command is received. As the pedestal current decreases, this regulator continues to supply a constant current though the push-pull to the primary of the output transformer.

  The result is a current of approx. 5 amps rms from AGATE1 to AGATE2 for the duration of the gate command. This 5 amps ac is also stepped down and rectified at the FHVA card and reaches the SCR as a holding current of approximately 1 amp dc.

The gate command is triggered by a fiber-optic receiver. Light received is interpreted as a command to gate for as long as light is present at the receiver input.

STATUS CIRCUIT

The FGPA's Status circuit collects SCR voltage status information through a fiber-optic link from each of the 2 to 12 FHVA boards connected to the FGPA outputs. Light transmitted on each fiber indicates that the SCR being monitored is blocking voltage. Since polarity is not specified , the SCR may be blocking either forward or reverse voltage.

The FGPA's Status Circuit multiplexes the optical signals, then transmits the information via a serial fiber-optic link back to the control. Included in the data is the status of the switching power supply.

SWITCHING POWER SUPPLY

The FGPA switching power supply converts ac input into the various dc control voltages required by the gating and status functions:

- P90 A/B – Gate pedestal power
- P40 A/B – Gate "backporch" power
- P15 A/B – Gate bias for power MOSFETs
- P5 A/B – Logic power

See Application Data, Power Supply Voltage, for voltage levels.

POWER SUPPLY UNDERVOLTAGE

If gate power supplies (P40 and P90) fall below acceptable levels, an alarm signal is sent to the control via the Status Circuit described above.

If the signal power supply (P5) falls below the acceptable level, the alarm signal is sent, plus gating is inhibited.

APPLICATION DATA

TESTPOINTS

The FGPA provides the testpoints listed in Tables 1 – 3. See Figure 1 for testpoint locations.

POWER SUPPLY VOLTAGE

The FGPA accepts a power input of 120 Vrms ± 20% , 50/60 Hz, approximately 350 VA maximum. Acceptable power supply voltage levels at these points are:

- P5 = 4.7 – 5.1 V dc
- P40 ≥ 25 V dc
- P90 ≥ 81 V dc
- P15 = Not monitored, but typically 13.5 – 14.5 V dc

The dc power supply at node DCOM is grounded through stab connector GND (see Table 5).

FIBER-OPTIC CONNECTIONS

FGPA has one fiber optic transmitter and 14 fiber optic receivers (see Table 4). Two of the receivers, U101 and U201, are intended for use with a duplex fiber optic cable (two fibers per cable). All others are simplex (one fiber per cable).

Although there is nothing to prevent simplex connectors from being inserted into U101/102, the original design uses a single duplex cable to the FCGD receiver pair.

Table 1. Testpoints for Gate A

Name	Nomenclature	Description
TP101	1PUSHA	Logic 1 = command to start push cycle
TP102	1PULLA	Logic 1 = command to start pull cycle
TP103	VSWA	Output of backporch regulator
TP104	IBKPA	Backporch voltage
TP105	VLINKA	Primary voltage
TP107	CPSHA	Push cycle enable
TP108	CPULA	Pull cycle enable
TP109	1RELA	Logic 1 = release gate inhibits
TP110	0RELA	Logic 0 = release gate inhibits

Table 2. Testpoints for Gate B

Name	Nomenclature	Description
TP201	1PUSHB	Logic 1 = command to start push cycle
TP202	1PULLB	Logic 1 = command to start pull cycle
TP203	VSWB	Output of Backporch regulator
TP204	IBKPB	Backporch voltage
TP205	VLINKB	Primary Voltage
TP207	CPSHB	Push Cycle enable
TP208	CPULB	Pull Cycle enable
TP209	1RELB	Logic 1 = release gate inhibits
TP210	0RELB	Logic 0 = release gate inhibits

Table 3. Testpoints for Cell Status Monitors

Name	Nomenclature	Description
TP301	1COND6	Cell status SCR # 6 (Logic 1 = conduction)
TP302	1COND5	Cell status SCR #5 (Logic 1 = conduction)
TP303	1COND4	Cell status SCR #4 (Logic 1 = conduction)
TP304	1COND3	Cell status SCR #3 (Logic 1 = conduction)
TP305	1COND2	Cell status SCR #2 (Logic 1 = conduction)
TP306	1COND1	Cell status SCR #1 (Logic 1 = conduction)
TP307	1COND12	Cell status SCR #12 (Logic 1 = conduction)
TP308	1COND11	Cell status SCR #11 (Logic 1 = conduction)
TP309	1COND10	Cell status SCR #10 (Logic 1 = conduction)
TP310	1COND9	Cell status SCR #9 (Logic 1 = conduction)
TP311	1COND8	Cell status SCR #8 (Logic 1 = conduction)
TP312	1COND7	Cell status SCR #7 (Logic 1 = conduction)

Table 4. Fiber-optic Connectors

Name	Nomenclature	Description
U101	AGATEIN	Receiver for Gate A command input
U201	BGATEIN	Receiver for Gate B command input
U301	CSAT6	Receiver for Cell Status SCR # 6
U302	CSAT5	Receiver for Cell Status SCR #5
U303	CSAT4	Receiver for Cell Status SCR #4
U304	CSAT3	Receiver for Cell Status SCR #3
U305	CSAT2	Receiver for Cell Status SCR #2
U306	CSAT1	Receiver for Cell Status SCR #1
U307	CSAT12	Receiver for Cell Status SCR #12
U308	CSAT11	Receiver for Cell Status SCR #11
U309	CSAT10	Receiver for Cell Status SCR #10
U310	CSAT9	Receiver for Cell Status SCR #9
U311	CSAT8	Receiver for Cell Status SCR #8
U312	CSAT7	Receiver for Cell Status SCR #7
U318	STATUS	Transmitter for 12 SCR and 1 power supply status bits

Table 5. Stab Connectors for Gates A and B

Name	Nomenclature	Description
E101	AGATE1	Gate power to primary of gate pulse transformer on FHVA
E102	AGATE2	Gate power return path from FHVA
E103	AGND	Ground connection for gate power signal AGATE2
E201	BGATE1	Gate power to primary of gate pulse transformer on FHVA
E202	BGATE2	Gate power return path from FHVA
E203	BGND	Ground connection for gate power signal BGATE2

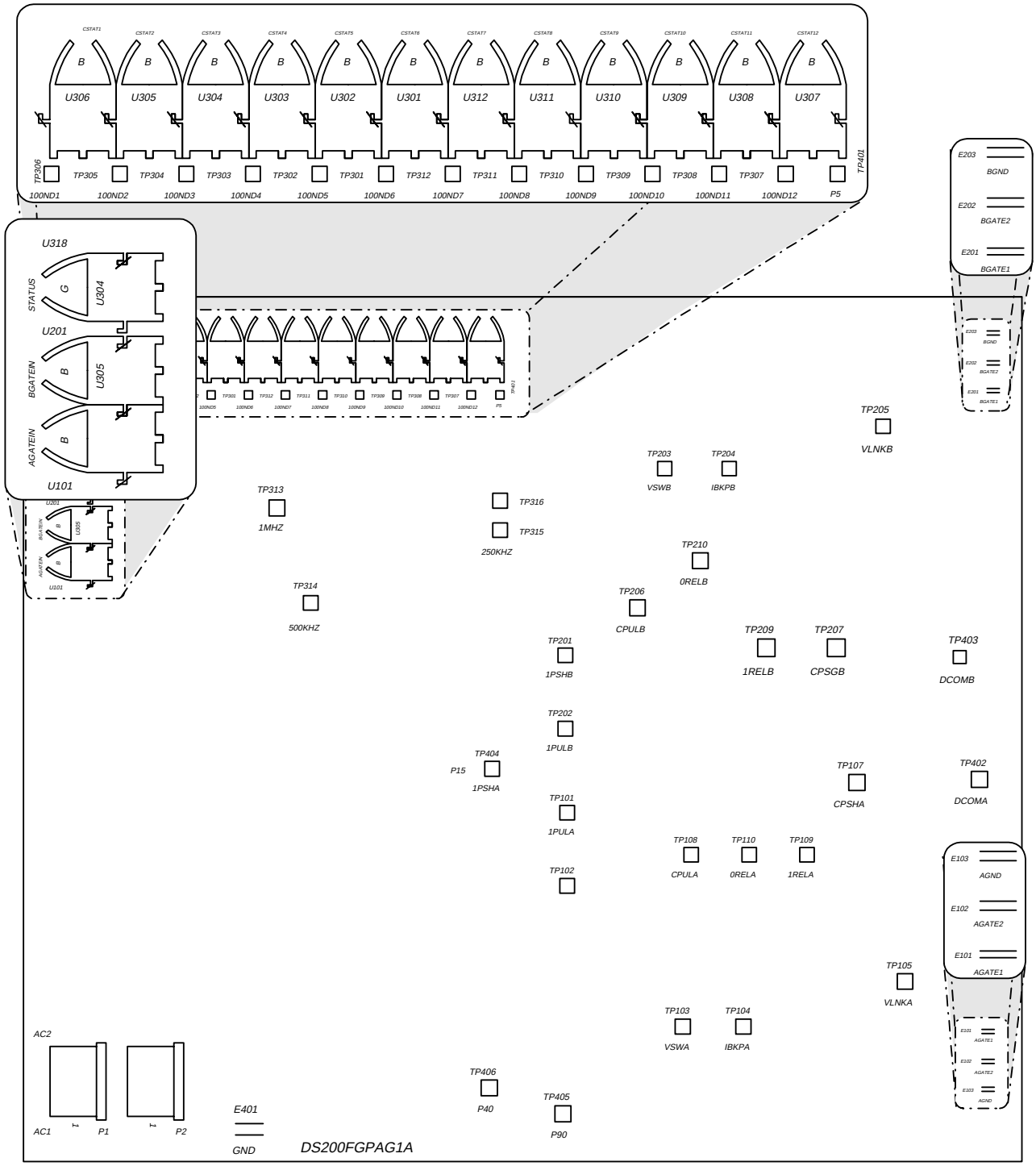

Figure 1. FGPA Board Layout

RENEWAL/WARRANTY REPLACEMENT

BOARD IDENTIFICATION

A printed wiring board is identified by an alphanumeric part (catalog) number stamped on its edge. For example, the FGPA is identified by part number DS200FGPAG#.

Figure 2 describes each digit in the part number.

NOTE

All digits are important when ordering or replacing any board.

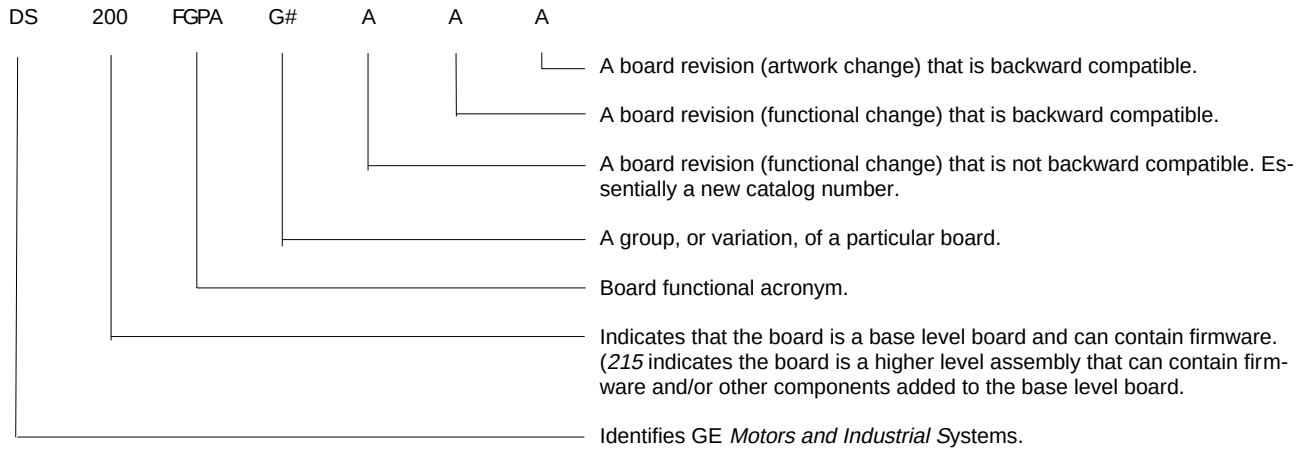

Figure 2. Sample Board Part Number, DS Series

WARRANTY TERMS

The GE Motors & Industrial Systems Terms and Conditions brochure details product warranty information, including the **warranty period** and **parts and service** coverage.

The brochure is included with customer documentation. It may able be obtained separately from the nearest GE Sales Office or authorized GE Sales Representative.

WARRANTY PARTS AND SERVICE

This board has no fuses or other end-user serviceable parts. If it fails, it needs to be replaced as a unit.

To obtain a replacement board, or service assistance, contact the nearest GE Service Office.

Please have the following information ready to exactly identify the **part** and **application**:

- GE requisition or shop order number
- LCI serial number and model number
- Board number and description

PROCEDURE FOR REPLACING BOARDS

WARNING

To prevent electric shock, turn off power to the board, then test to verify that no power exists in the board before touching it or any connected circuits.

CAUTION

To prevent equipment damage, do not remove boards or connections, or re-insert them, while power is applied to the drive.

Treat all boards as static-sensitive. Use a grounding strap when changing boards and always store boards in anti-static bags or boxes they were shipped in.

To replace an FGPA board:

1. **Turn off power**.

2. To remove the FGPA board, carefully disconnect all cables, as follows:

   — For fiber-optic connectors, press the latch on the mating cable connector. Pull the connector only; do not pull the fiber-optic cable.

   — For cables with pull tabs, carefully pull the tab.

3. Remove the standoffs that hold the board in place. Remove the lock washers.

CAUTION

Avoid dropping the lock washers into the board or unit, which could cause damage.

4. Keep the FGPA board level and carefully remove it with both hands by pulling the board straight out.

5. Install the new FGPA board, replace the standoffs and lock washers.

6. Reconnect all cables, ensuring that each connector is properly seated at both ends.

NOTE

Because of upgrades, boards of different revision levels may not contain identical hardware. However, GE Motors & Industrial Systems ensures backward compatibility of replacement boards.

Notes:

GE Motors & Industrial Systems

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