GE Industrial Control Systems

POWER SUPPLY BOARD

DS200DCFBG1A_ _ and DS200DCFBG1B_ _

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 sufficiently for the purchaser's purpose, the matter should be referred to GE Industrial Control 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

WARNING

This equipment contains a potential hazard of electric shock or burn. Only adequately trained persons who are thoroughly familiar with the equipment and the instructions should install or maintain this equipment.

INTRODUCTION

NOTE

The DCFB board is used in DC2000, CB2000, EX2000, FC2000, GF2000, ME2000, and AC2000 IGBT drive applications. The EX2000 uses the board for a different purpose than a drive does. When the information is different for the EX2000 applications, it is shown by italics in parentheses (NA = Not Applicable).

The DS200DCFB Power Supply Board (DCFB) receives 38 and 115 V ac (*24 V dc*) input power from the control power transformer (CPT), and provides control-level power to the drive and 115 V ac power (*NA*) to the enclosure fans. The DCFB board includes the following circuits:

- Control-level power supplies (+5, ±15, and ±24 V dc)

- Motor field power circuits (except the SCR module)
- Driver circuits for the motor field SCR gate pulse generators
- Circuits to monitor numerous ac line and dc motor signals, including:
  - Armature current(s) and voltage(s) (*NA*)
  - Motor field currents (*NA*)
  - Ac line current
  - Ac line voltage magnitude and phase sequence

POWER SUPPLIES

The DCFB board receives 38 V ac (±10%) from the CPT (*24 V dc*). This voltage is full-wave rectified and filtered to produce the unregulated ±24 V dc outputs. The +24 V dc output is rated at 3 A and the –24 V dc output is rated at 1 A.

Regulators on the DCFB board derive ±15 V dc from the ±24 V dc supplies. The ±15 V dc outputs are each rated at 0.8 A, of which 0.25 A is available for external loading.

The DCFB board also generates a +5 V dc, 4 A output from the +24 V dc supply. The /PSEN signal on 2PL goes to a TTL low state when the +5 V dc supply is in regulation and the signal goes high if the +5 V dc supply goes out of regulation. When high, /PSEN generates a microprocessor reset on the Drive Control Card (SDCC/LDCC).

The DCFB board provides isolated +5 and ±15 V dc supplies to power the armature current feedback circuits.

The power supply outputs are protected against short circuits by fuses FU2 and FU3 (7 A, 2AG). Light-emitting diodes (LEDs) CR51 and CR55 provide blown fuse indication for these fuses. The 115 V ac output is protected by fuse FU1 (1/2 A, 2AG). Neon light LT1 provides blown fuse indication for FU1.

VOLTAGE AND CURRENT FEEDBACK VCO CIRCUITS

The DCFB board includes voltage-controlled oscillator (VCO) circuits that convert input voltages to frequency signals. Each VCO has a nominal output frequency of 250 kHz. The output frequency varies from 0 to 500 kHz, depending upon the input voltage. VCO outputs are sent to the SDCC/LDCC board through connector 1PL to provide feedback of the following:

- SCR bridge ac input voltage
- Output bridge voltage
- Motor voltage (*NA*)
- Millivolt signals from field shunts
- Millivolt signals from armature shunts

The output bridge VCO circuit provides feedback to the SDCC/LDCC board through connector 1PL, pin 13 (1PL-13). DIP switch SW4 is used to scale the voltage applied to the circuit. A frequency-to-voltage reconstruction circuit provides a diagnostic signal for testpoint TP37 on the SDCC/LDCC board through 1PL-37. The diagnostic bridge voltage signal can be viewed using an ac-coupled oscilloscope. The second VCO provides feedback of the motor voltage to the SDCC/LDCC board through 1PL-39. DIP switch SW5 is used to scale the voltage applied to the circuit.

Two other VCO circuits provide feedback of the input voltage from a shunt. The VCO output frequency signals are sent to the SDCC/LDCC board through connector 1PL.

The DCFB board also includes two motor armature VCO circuits. The frequency output signals from these VCOs are sent to the SDCC/LDCC board through 1PL-8 and 1PL-10. These VCOs are at the potential of the armature bus and are fed by an isolator.

MOTOR VOLTAGE ATTENUATION CIRCUIT

The DCFB board includes a motor voltage attenuation circuit that provides an analog representation of the motor voltage. This signal is sent to the SDCC/LDCC board through 1PL-6. The attenuation circuit is biased at 2.5 V, and can vary from 0 to 5 V depending on the motor voltage. DIP switch SW6 is used to scale the motor voltage feedback.

AC LINE MAGNITUDE AND ZERO CROSSING

The DCFB board contains amplifier circuits that process the ac line-to-line voltages. The voltage feedback signals are sent to the SDCC/LDCC board through 1PL-11, 1PL-12, and 1PL-29. These signals are used to detect power bridge SCR failures and may also be used to derive the synchronization signal for the firing of the SCRs. DIP switches SW1, SW2, and SW3 are used to scale the ac line voltage feedbacks.

AC LINE CURRENT TRANSFORMER INTERFACE

In some applications, the drive's ac input lines L1 and L3 include ac line current transformers (ACCTs). Switch SW7 on the DCFB board is used to select the burden resistance as a function of rated 1 per unit (pu) dc output current. (The rated 1 pu dc output current is defined as 0.5 V across the DCFB board's ACCT burden resistors.) The DCFB board sends the ACCT signals to the SDCC/LDCC board through 1PL. The SDCC/LDCC board uses the ACCT signals to check for commutation failure and ac instantaneous overcurrent (IOC). Testpoint ACCT on the DCFB board may be used to view the ACCT signals.

CONTACTOR DRIVE CIRCUITS

The DCFB board includes relay K2, that serves as a pilot relay for the MD contactor. The SDCC/LDCC board drives the coil of this relay through 1PL-34, 1PL-35, and 1PL-36. Connector MACPL provides 24 V dc FET output to the MD contactor driver.

FIELD/ARMATURE SCR FIRING CONTROL CIRCUITS

The DCFB board contains a gate array circuit that controls the firing of the SCRs in the bridge based upon control signals received from the SDCC/LDCC board through connector 1PL. The gate array is programmed at powerup by a serial PROM.

The 5 V outputs of the gate array are converted by gate pulse amplifier circuits into the power level required to feed the forward and reverse gate pulse transformers on the DS200PCCA Power Connect Card (PCCA). These signals are sent to the PCCA board through 5PL. To prevent spurious firing signals, the firing power is removed from the gating circuits until the gate array is programmed and the 5 V power is being regulated.

BOARD GROUPS

There is only one group of the DCFB board, G1. However, the G1 board has two revision levels, G1A and G1B.

APPLICATION DATA

BOARD HARDWARE

The DCFB board includes 12 configurable jumpers (13 on revision BKC and later boards), seven DIP switches, two LED indicators, a neon light indicator, five testpoints, three fuses, and wiring connectors (18 plug connectors and nine stab connectors) as part of the board. These items are described in the following paragraphs of this section.

CONFIGURABLE JUMPERS (JP) and DIP SWITCHES (SW)

DCFB boards include 12 configurable jumpers (13 on revision BKC and later boards) and seven DIP switches for selection of customer options. Most jumper and DIP switch selections are factory set. The test data sheets supplied with each controller (in the equipment door pocket) show the factory set positions. When a DCFB board is replaced, the jumpers and switches on the new board must be set in the same position as on the board being replaced (unless the instructions state otherwise). See Figure 1 for the locations of the jumpers and switches and Tables 1 and 2 for descriptions.

LED AND NEON LIGHT INDICATORS

Two red LED indicators (CR51 and CR55) and one neon light indicator (LT1) are present on the DCFB board for fuse status indication. See Figure 1 for the location of the indicators and Table 3 for descriptions.

TESTPOINTS

Five testpoints are present on the DCFB board to allow checking of voltage signals, DCFB board common, and ACCT signal status. See Figure 1 for the locations of the testpoints and Table 5 for descriptions.

FUSES (FU1, FU2, and FU3)

The DCFB board includes three protective fuses (FU1, FU2, and FU3) for power supply protection. An indicator will light when any of the fuses is blown. See Figure 1 for the locations of the fuses and Table 4 for descriptions.

BOARD CONNECTORS

The DCFB board receives input signals/power and sends output signals/power via 18 plug connectors and nine stab connectors. See Figure 1 for a DCFB board layout diagram showing the locations of these connectors and see Tables 6 through 22 for signal descriptions of the individual connector pins.

The tables are organized as follows:

- **Table 6 -** 1PL Connector
- **Table 7 -** 2PL Connector
- **Table 8 -** 4PL Connector
- **Table 9 -** 5PL Connector
- **Table 10 -** 1CPL Connector
- **Table 11 -** CNPL Connector
- **Table 12 -** CPTPL Connector
- **Table 13 -** FAPL Connector
- **Table 14 -** NPL Connector
- **Table 15 -** PPL Connector
- **Table 16 -** SQPL Connector
- **Table 17 -** IA1PL Connector
- **Table 18 -** IA2PL Connector
- **Table 19 -** IF1PL Connector
- **Table 20 -** IF2PL Connector
- **Table 21 -** MACPL Connector
- **Table 22 -** Stab Connector Terminals

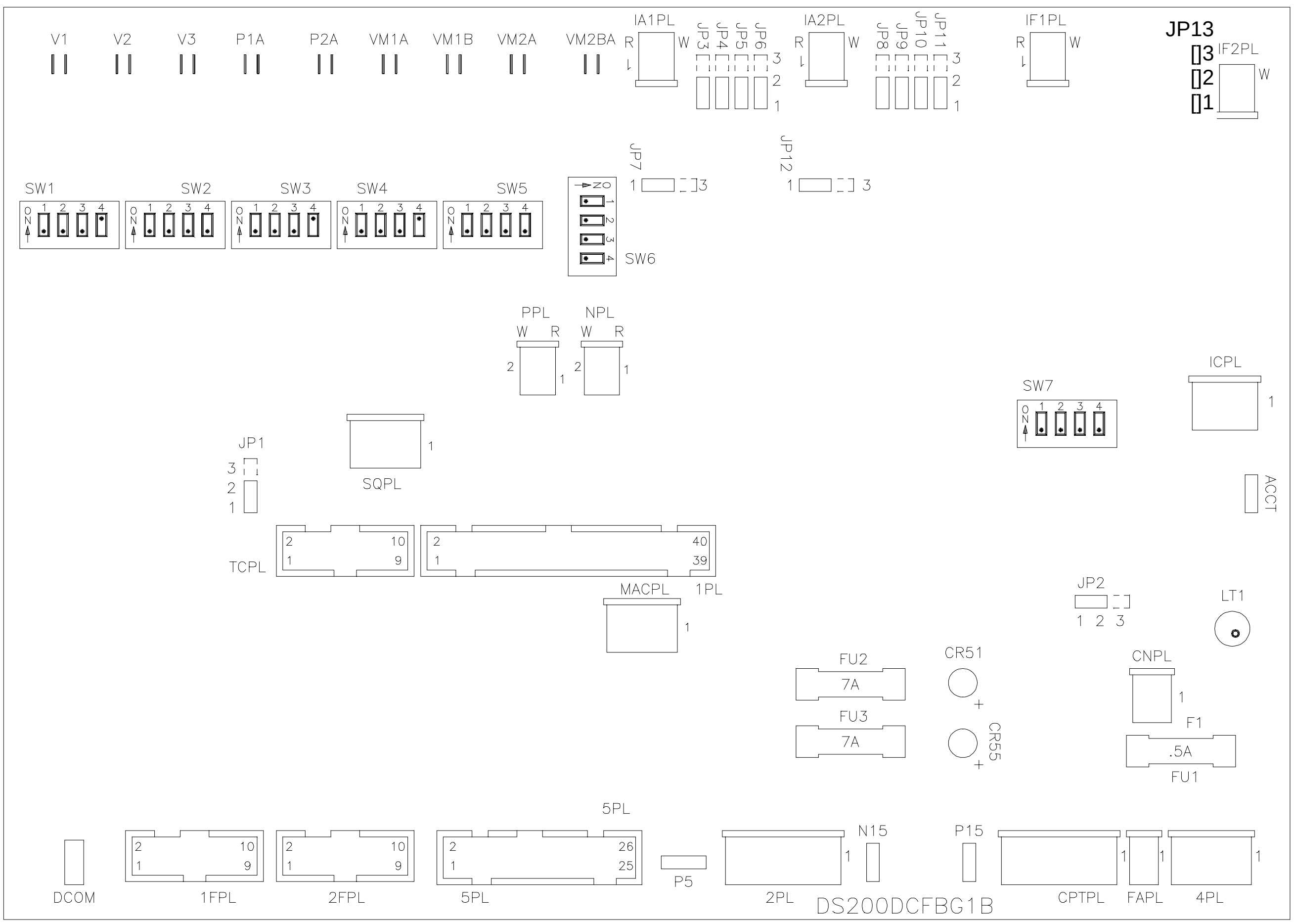

Figure 1. DCFB Board Layout Diagram

Table 1. DCFB Board Jumper Settings

Revision	Name	Description
All	JP1	Selects the source of the ac line synchronization signal passed to the SDCC/LDCC board Proper synchronization to the ac line is critical to the operation of the drive, and 1.2 is the only valid setting of this jumper for DC2000s. 1.2 Generated by DCFB using line voltage 2–3 (DC2000 and ME2000 applications) 2.3 Generated by the TCCB card (EX2000 applications)
All	JP2	Decreases ac contactor drop-out time Normally this circuit delays opening of the ac contactor to ensure all load current has been extinguished. Removal of this jumper (0) can cause the control-on circuit to drop out the MA relay before the current has been brought to zero. 1.2 Normal operation, gives about 100 ms delay 0 Minimum delay (and manufacturing test)
All	JP3	Configuration of armature shunt #1 input circuit Jumpers JP3 through JP7 must be set together for proper operation of the voltage controlled oscillator (VCO) that converts the shunt current to a frequency signal that is then read by the SDCC/LDCC board. *Application* — *JP3, JP4* — *JP5–JP7* G, C or D frame DC2000 — 1.2 — 1.2 L, M, J or K frame DC2000/EX2000 — 1.2 — 2.3 GF2000 or ME2000 with SVIA board — 2.3 — 1.2 ME2000 with SHVM board — 1.2 — 2.3 M frame CB2000 — 1.2 — 1.2 J frame CB2000 with SHVI board — 1.2 — 2.3 When JP3 & 4 are in position 1.2, no attenuation affects the IA1PL input signal which may come from either a 100 mV (1 pu) shunt or an external VCO. The local VCO will produce 0 Hz at –5 pu and 500 kHz at +5 pu from a shunt signal. A frequency input signal from an external VCO must be bypassed around the local VCO (See JP5 and JP6). Putting JP3 and JP4 in position 2.3 rescales the input to receive an analog isolator (SVIA) signal such that the local VCO produces a frequency output of 12 kHz with –5.0 V input and 488 kHz with +5.0 V input (1V = 1 pu). Jumpers JP5–7 select and enable the local (DCFB) VCO when in position 1.2. When in position 2.3 the local VCO is disabled and bypassed to allow use of an upstream VCO circuit. 1.2 Direct input of shunt or external VCO signal 2.3 Input rescaled for analog isolator signal
All	JP4	Configuration of armature shunt #1 input circuit (see JP3) 1.2 Direct input of shunt or external VCO signal 2.3 Input rescaled for analog isolator signal
All	JP5	Configuration of armature shunt #1 VCO circuit (see JP3) 1.2 Local VCO circuit selected 2.3 Local VCO circuit bypassed
All	JP6	Configuration of armature shunt #1 VCO circuit (see JP3) 1.2 Local VCO circuit selected 2.3 Local VCO circuit bypassed
All	JP7	Configuration of armature shunt #1 VCO circuit (see JP3) 1.2 Local VCO circuit enabled 2.3 Local VCO circuit disabled

Table 1. DCFB Board Jumper Settings — Continued

Revision	Name	Description
All	JP8	Configuration of armature shunt #2 input circuit Jumpers JP8 through JP12 must be set together for proper operation of the voltage controlled oscillator (VCO) that converts the shunt current to a frequency signal that is then read by the SDCC/LDCC board. *Application* — *JP8, JP9* — *JP10–JP12* G, C or D frame DC2000 — 1.2 — 1.2 L, M, J or K frame DC2000/EX2000 — 1.2 — 2.3 GF2000 or ME2000 with SVIA board — 2.3 — 1.2 ME2000 with SHVM board — 1.2 — 2.3 M frame CB2000 — 1.2 — 1.2 J frame CB2000 with SHVI board — 1.2 — 2.3 When JP8 & JP9 are in position 1.2, no attenuation affects the IA2PL input signal which may come from either a 100 mV (1 pu) shunt or an external VCO. The local VCO will produce 0 Hz at –5 pu and 500 kHz at +5 pu from a shunt signal. A frequency input signal from an external VCO must be bypassed around the local VCO (See JP10 and JP11). Putting JP8 and JP9 in position 2.3 rescales the input to receive an analog isolator (SVIA) signal such that the local VCO produces a frequency output of 12 kHz with –5.0 V input and 488 kHz with +5.0 V input (1V = 1 pu). Jumpers JP10–12 select and enable the local (DCFB) VCO when in position 1.2. When in position 2.3 the local VCO is disabled and bypassed to allow use of an up stream VCO circuit. 1.2 Direct input of shunt or external VCO signal 2.3 Input rescaled for analog isolator signal
All	JP9	Configuration of armature shunt #2 input circuit (see JP8) 1.2 Direct input of shunt or external VCO signal 2.3 Input rescaled for analog isolator signal
All	JP10	Configuration of armature shunt #2 VCO circuit (see JP8) 1.2 Local VCO circuit selected 2.3 Local VCO circuit bypassed
All	JP11	Configuration of armature shunt #2 VCO circuit (see JP8) 1.2 Local VCO circuit selected 2.3 Local VCO circuit bypassed
All	JP12	Configuration of armature shunt #2 VCO circuit (see JP8) 1.2 Local VCO circuit enabled 2.3 Local VCO circuit disabled
0 – BKB	JP13	Deleted Jumper
BKC – Present	JP13	Scaling set for shunt 1.2 Scaling set for field supply's shunt 2.3 Scaling set for multibridge totalizing shunt
All	JP14	Deleted Jumper

Table 2. DCFB Board Switch Settings

Revision	Name	Description
All	SW1	Selects the ac line voltage applied to the line voltage 1–2 circuit SW1 and SW3 scale the V1–2 and V1–3 line voltage feedbacks into the VCOs used to provide the SDCC/LDCC board with a frequency signal proportional to instantaneous line voltages. These are used for phase loss and sequence detection, and for line sync via the bi-phase PLL. SW2 scales the V2–3 voltage applied to the circuit used to generate the ac line synchronization and frequency measurement signal via the zero-crossing detector. Scaling of SW1–SW3 must be performed in conjunction with the SHVI/SHVM SCR High Voltage Interface board's voltage attenuators, if used. The maximum nominal V ac is the maximum ac input voltage that may be 15% high without saturating the instrumentation circuitry. For DC2000 applications, switches SW1, 2, 3, 4, 5, and 6 must all be set to the same position. Above 617 V ac, SHVI/SHVM attenuators must be used (refer to SHVI/SHVM board's JP9 through JP17). For EX2000 applications, switches SW1, 2, 3, 4, 5, and 6 must all be set to the same position. The EX2000 uses SHVI or SHVM attenuation based on IEEE 421.3 hipot requirements. Above 250 V dc applications, SHVI/SHVM attenuators must be used (refer to SHVI/SHVM board's JP9 through JP17). Switches are then set to scale inputs for a nominal 20000 counts accordingly. For GF2000/ME2000 applications, switches SW1 through SW4 must be set to the same position; switches SW5 and SW6 may be set to different positions than SW1–SW4, depending upon the application. Above 617 V ac, SHVI/SHVM attenuators must be used (refer to SHVI/SHVM board's JP9 through JP17). For the DC2000, the settings of these switches affect the scaling of VAR.108 (ACLINMAG), that affects the phase loss protective fault (see EE.582). For each of the maximum nominal rms line-to-line voltage selections, if the input is at the maximum nominal, VAR.108 will be approximately 25700 counts. For the EX2000, these switches have a similar effect on the phase loss function provided by EE.576, PUATHR. For both drive types, a scale factor, EE.VLL_SF allows these voltages to be scaled to a 1 pu = 20000 basis prior to being applied to the phase loss function. 0 (All off) 308 max nominal V ac (762 V ac using SHVI/SHVM attenuators) 8 (4 on) 364 max nominal V ac (901 V ac using SHVI/SHVM attenuators) 1 (1 on) 488 max nominal V ac (1214 V ac using SHVI/SHVM attenuators) 9 (1 & 4 on) 545 max nominal V ac (1353 V ac using SHVI/SHVM attenuators) 2 (2 on) 617 max nominal V ac (1535 V ac using SHVI/SHVM attenuators)
All	SW2	Select the ac line voltage applied to the line sync circuit (see SW1) 0 (All off) 308 max nominal V ac (762 V ac using SHVI/SHVM attenuators) 8 (4 on) 364 max nominal V ac (901 V ac using SHVI/SHVM attenuators) 1 (1 on) 488 max nominal V ac (1214 V ac using SHVI/SHVM attenuators) 9 (1 & 4 on) 545 max nominal V ac (1353 V ac using SHVI/SHVM attenuators) 2 (2 on) 617 max nominal V ac (1535 V ac using SHVI/SHVM attenuators)
All	SW3	Select the ac line voltage applied to the line voltage 1–3 circuit (see SW1) 0 All off) 308 max nominal V ac (762 V ac using SHVI/SHVM attenuators) 8 4 on) 364 max nominal V ac (901 V ac using SHVI/SHVM attenuators) 1 1 on) 488 max nominal V ac (1214 V ac using SHVI/SHVM attenuators) 9 1 & 4 on) 545 max nominal V ac (1353 V ac using SHVI/SHVM attenuators) 2 2 on) 617 max nominal V ac (1535 V ac using SHVI/SHVM attenuators)

Table 2. DCFB Board Switch Settings — Continued

Revision	Name	Description
All	SW4	Selects the voltage applied to the dc bridge voltage feedback VCO circuit SW4 scales the voltage applied to the circuit used to generate the frequency representation of dc bridge voltage (P1 to P2) feedback passed to the SDCC/LDCC board. SW5 scales the voltage applied to the circuit used to generate the frequency representation of dc motor voltage feedback passed to the SDCC/LDCC board. SW6 scales the voltage applied to the circuit used to generate the analog representation of dc motor voltage feedback passed to the SDCC/LDCC board. Scaling of SW4 through SW6 must be performed in conjunction with the SHVI/SHVM board's voltage attenuators, if used. The voltages listed in the selection table are maximum nominal V ac and nominal V dc. The maximum nominal V ac is the maximum ac input voltage that may be 15% high without saturating the VCO channel instrumentation circuitry. For the dc VCO channels, nominal V dc is the dc voltage that results in 20,000 counts raw voltage feedback (VFBRAW) before scaling by EE.1503 (VFBSFn). For DC2000/EX2000 applications, switches SW1, 2, 3, 4, and 5 should be set to the same position. Above 617 V ac, SHVI/SHVM attenuators must be used (refer to SHVI/SHVM board's JP9 through JP17). For GF2000/ME2000 applications switches SW1 through SW4 should be set to the same position; switches SW5 and SW6 may be set to different positions than SW1–SW4, depending upon the application. Above 617 V ac, SHVI/SHVM attenuators must be used (refer to SHVI/SHVM board's JP9 through JP17). 0 (All off) 308 V ac, 341 V dc (762 V ac, 843 V dc using SHVI/SHVM attenuators) 8 (4 on) 364 V ac, 403 V dc (901 V ac, 996 V dc using SHVI/SHVM attenuators) 1 (1 on) 488 V ac, 541 V dc (1214 V ac, 1342 V dc using SHVI/SHVM attenuators) 9 (1 & 4 on) 545 V ac, 602 V dc (1353 V ac, 1496 V dc using SHVI/SHVM attenuators) 2 (2 on) 617 V ac, 683 V dc (1535 V ac, 1698 V dc using SHVI/SHVM attenuators)
All	SW5	Selects the voltage applied to the dc motor voltage feedback VCO circuit 0 (All off) 308 V ac, 341 V dc (762 V ac, 843 V dc using SHVI/SHVM attenuators) 8 (4 on) 364 V ac, 403 V dc (901 V ac, 996 V dc using SHVI/SHVM attenuators) 1 (1 on) 488 V ac, 541 V dc (1214 V ac, 1342 V dc using SHVI/SHVM attenuators) 9 (1 & 4 on) 545 V ac, 602 V dc (1353 V ac, 1496 V dc using SHVI/SHVM attenuators) 2 (2 on) 617 V ac, 683 V dc (1535 V ac, 1698 V dc using SHVI/SHVM attenuators)
All	SW6	Selects the voltage applied to the analog dc motor voltage feedback circuit SW6 is an analog instrumentation channel. The channel feeds an A/D converter on the SDCC/LDCC board. A 2.5 V bias added on the DCFB board allows the unipolar A/D converter to "read" bipolar instrumentation signals. A change of ±1 pu for a dc voltage results in a ±1.7 V swing about the +2.5 V bias. A ±1 pu change for an ac voltage results in a ±1.535 V swing about the +2.5 V bias. 0 (All off) 154 V ac, 171 V dc (380 V ac, 422 V dc using SHVI/SHVM attenuators) 1 (1 on) 244 V ac, 270 V dc (605 V ac, 671 V dc using SHVI/SHVM attenuators) 2 (2 on) 308 V ac, 341 V dc (766 V ac, 849 V dc using SHVI/SHVM attenuators) 4 (3 on) 385 V ac, 427 V dc (959 V ac, 1062 V dc using SHVI/SHVM attenuators) 11 (1,2,4 on) 426 V ac, 472 V dc (1061 V ac, 1175 V dc using SHVI/SHVM attenuators) 5 (1,3 on) 475 V ac, 526 V dc (1184 V ac, 1312 V dc using SHVI/SHVM attenuators) 6 (2,3 on) 540 V ac, 598 V dc (1345 V ac, 1489 V dc using SHVI/SHVM attenuators) 7 (1,2,3 on) 630 V ac, 697 V dc (1570 V ac, 1739 V dc using SHVI/SHVM attenuators)

Table 2. DCFB Board Switch Settings — Continued

Revision	Name	Description
All	SW7	Selects ac line current transformer (CT) burdens as a function of rated drive hp and voltage (*Not used on EX2000*) These switch settings scale the ac line CTs as a function of dc amps. Correct scaling is essential for proper operation of the ac IOC protective feature. These CTs are mounted on lines 1 and 3 of the power converter, and are wired through plug 1CPL to a common burden resistor. Select the proper setting as a function of drive current and CT turns ratio. The CT ratio can be determined from its part number and the following table. *Part Number* *Turns Ratio* 104X157AB 023 1000:1 104X157AB 025 2000:1 104X157AB 020 4000:1 104X157AB 013 5000:1 104X157AB 024 5000:1 104X157AB 026 8000:1 When set properly, the current magnitude read in VAR.1019 (CTCFB) should be scaled within 15% of the current magnitude in VAR.104 (CFB). Above 144 mA ACCT secondary current, the CTs are routed through a set of 10:1 step down CTs on the SHVI/SHVM board, using JP1 through JP8 on the SHVI/SHVM board. The enumerations listed are in terms of the mA input to the DCFB board (ACCT secondary milliamps attenuated by 10:1 SHVI/SHVM attenuation if selected). At present, the SHVI/SHVM boards are used on M, J, K, and L frames only, and the 10:1 CTs are used only if the ACCT secondary current is > 144 mA. The CT secondary current (in milliamps) is approximated by: $Ict,\ mA = \dfrac{1\ pu\ rated\ current \times 1000}{Combined\ CT\ turns\ ratio}$ 0 (All off) 0.0 ≤ Ict, mA < 6.0 1 (1 on) 6.0 ≤ Ict, mA < 13.4 2 (2 on) 13.4 ≤ Ict, mA < 21.1 3 (1,2 on) 21.1 ≤ Ict, mA < 28.4 4 (3 on) 28.4 ≤ Ict, mA < 39.3 5 (1,3 on) 39.3 ≤ Ict, mA < 46.7 6 (2,3 on) 46.7 ≤ Ict, mA < 54.4 7 (1,2,3 on) 54.4 ≤ Ict, mA < 61.8 8 (4 on) 61.8 ≤ Ict, mA < 88.7 9 (1,4 on) 88.7 ≤ Ict, mA < 96.0 10 (2,4 on) 96.0 ≤ Ict, mA < 103.0 11 (1,2,4 on) 103.0 ≤ Ict, mA < 111.0 12 (3,4 on) 111.0 ≤ Ict, mA < 122.0 13 (1,3,4 on) 122.0 ≤ Ict, mA < 129.0 14 (2,3,4 on) 129.0 ≤ Ict, mA < 137.0 15 (All on) 137.0 ≤ Ict, mA < 144.0

Table 3. LEDs and Neon Lamp on DCFB Board

Name	Indication
CR51	(Red LED) When lit, it indicates that fuse FU2 in the +24 V dc line to the +15 V dc regulator is blown.
CR55	(Red LED) When lit, it indicates that fuse FU3 in the –24 V dc line to the –15 V dc regulator is blown.
LT1	(Neon lamp) When lit, it indicates that fuse FU1 in the 115 V ac line to CNPL-1, CPTPL-2, and FAPL-2 is blown.

Table 4. DCFB Board Fuses

Fuse	Function
FU1	*Fuse for the 115 V ac power supply brought to 3TB; 1/2 A, 2AG fast acting.* FU1 protects the 115 V ac power supplied for customer use. Check for wiring errors or overload if this fuse blows. When the fuse is blown and a load is connected, neon light LT1 on the DCFB board will be lit.
FU2	*Fuse for signal-level power supplies +24, +15, and +5 V dc; 7 A, 2AG fast acting.* When FU2 is blown, the drive is unable to generate fault messages, but LED CR51 will be lit when control power is applied to the drive. The usual cause of this fuse blowing is an accidental short of +24 V dc, either while probing or due to a wiring error at the terminal board. If FU2 continues to blow when 1PL, 2PL, and 5PL are disconnected from the DCFB board, the DCFB board should be replaced.
FU3	*Fuse for signal-level power supplies –24 and –15 V dc; 7 A, 2AG fast acting.* When FU3 is blown, the Programmer is unable to display fault messages, but LED CR55 on the DCFB board will be lit when control power is applied to the drive. The usual cause of this fuse blowing is an accidental short of –24 V dc, either while probing or due to a wiring error at the terminal board. If FU3 continues to blow when 1PL, 2PL, and 5PL are disconnected from the DCFB board, the DCFB board should be replaced.

Table 5. DCFB Board Testpoints

Name	Description
P5	Testpoint for regulated +5 V dc (±5%) power supply.
DCOM	0 V common reference point for test signals.
P15	Testpoint for regulated +15 V dc (±5%) power supply.
N15	Testpoint for regulated –15 V dc (±5%) power supply.
ACCT	Testpoint for ACCT signal from DCFB to SDCC.

Table 6. Connector 1PL,
I/O Between DCFB Board and SDCC/LDCC Board

Pin	Nomenclature	Description
1PL-1	FAN0	ACCT current.
1PL-2	--------	Not connected.
1PL-3	--------	Not connected.
1PL-4	--------	Not connected.
1PL-5	--------	Not connected.
1PL-6	FAN5	Motor voltage #2 analog output.
1PL-7	FIG5	FIN5 counter control.
1PL-8	FIN0	Dc armature shunt #1 VCO output.
1PL-9	FIN1	Motor field current shunt #1 VCO output.
1PL-10	FIN2	Dc armature shunt #2 VCO output.
1PL-11	FIN4	V1–V2 ac line voltage feedback.
1PL-12	FIN5	V1–V3 ac line voltage feedback.
1PL-13	FIN6	Dc bridge voltage feedback.

Table 6. Connector 1PL,
I/O Between DCFB Board and SDCC/LDCC Board — Continued

Pin	Nomenclature	Description
1PL-14	--------	Not connected.
1PL-15	FIG4	FIN4 counter control.
1PL-16	/ENREV	Enable reverse armature SCRs.
1PL-17	/ENFWD	Enable forward armature SCRs.
1PL-18	/FF2	Field #2 SCR firing.
1PL-19	/FF1	Field #1 SCR firing.
1PL-20	A14R	A14R cell decode signal.
1PL-21	A25R	A25R cell decode signal.
1PL-22	A36R	A36R cell decode signal.
1PL-23	--------	Not connected.
1PL-24	A14F	A14F cell decode signal.
1PL-25	A25F	A25F cell decode signal.
1PL-26	A36F	A36F cell decode signal.
1PL-27	SCRTST	Short circuit SCR test mode select line.
1PL-28	XIL	XILINX programmed (0 = Yes; 1 = No).
1PL-29	SYNC	Ac line synchronization signal.
1PL-30	--------	Not connected.
1PL-31	/RST1	System reset.
1PL-32	FLD1CTRL	Field #1 control enable.
1PL-33	FLD2CTRL	Field #2 control enable.
1PL-34	MAC1	MA contactor drive.
1PL-35	MAC2	MD contactor #1 drive.
1PL-36	MAC3	MD contactor #2 drive.
1PL-37	VFBB	Dc voltage feedback testpoint.
1PL-38	DTYPE	Drive type (1.8 – 2.2 V dc for DC2000 drive).
1PL-39	FIN7	Motor voltage feedback VCO output.
1PL-40	FIN8	Shunt #2 VCO output.

Table 7. Connector 2PL,
I/O Between DCFB Board and NTB/3TB or STBA and SLCC and SDCC/LDCC Boards

Pin	Nomenclature	Description
2PL-1	/PSEN	Power supply enable (active low).
2PL-2	–15V	–15 V dc, ±5%, to the NTB/3TB or STBA, SDCC/LDCC, and SLCC boards.
2PL-3	+15V	+15 V dc, ±5%, to the NTB/3TB or STBA, SDCC/LDCC, and SLCC boards.
2PL-4	DCOM	Drive common to the NTB/3TB or STBA, SDCC/LDCC, and SLCC boards.
2PL-5	+5V	+5 V dc, ±5%, to the NTB/3TB or STBA, SDCC/LDCC, and SLCC boards.
2PL-6	+5V	+5 V dc, ±5%, to the NTB/3TB or STBA, SDCC/LDCC, and SLCC boards.
2PL-7	DCOM	Drive common to the NTB/3TB or STBA, SDCC/LDCC, and SLCC boards.
2PL-8	–24V	–24 V dc, ±20%, to the NTB/3TB or STBA, SDCC/LDCC, and SLCC boards.
2PL-9	+24V	+24 V dc, ±20%, to the NTB/3TB or STBA, SDCC/LDCC, and SLCC boards.

Table 8. Connector 4PL,
I/O Between DCFB Board and NTB/3TB or STBA Board

Pin	NTB/3TB Terminal	STBA Terminal	Nomenclature	Description
4PL-1	85	55	X2	115 V ac output (unfused side).
4PL-2	83	54	FX1	115 V ac output (fused side).
4PL-3	81	53	MANC	Form C normally-closed contact from the MA pilot relay (K2).
4PL-4	79	52	MANO	Form C normally-open contact from the MA pilot relay (K2).
4PL-5	77	51	MACM	Form C common contact from the MA pilot relay (K2).

Table 9. Connector 5PL,
I/O Between DCFB Board and PCCA Power Connect Card

Pin	Nomenclature	Description
5PL-1	A6F	Drives cell 6F gate pulse transformer.
5PL-2	P24	+24 volt output.
5PL-3	A5F	Drives cell 5F gate pulse transformer.
5PL-4	P24	+24 volt output.
5PL-5	A4F	Drives cell 4F gate pulse transformer.
5PL-6	P24	+24 volt output.
5PL-7	A3F	Drives cell 3F gate pulse transformer.
5PL-8	P24	+24 volt output.
5PL-9	A2F	Drives cell 2F gate pulse transformer.
5PL-10	P24	+24 volt output.
5PL-11	A1F	Drives cell 1F gate pulse transformer.
5PL-12	P24	+24 volt output.
5PL-13	A1R*	Drives cell 1R gate pulse transformer.
5PL-14	P24	+24 volt output.
5PL-15	A2R*	Drives cell 2R gate pulse transformer.
5PL-16	P24	+24 volt output.
5PL-17	A3R*	Drives cell 3R gate pulse transformer.
5PL-18	P24	+24 volt output.
5PL-19	A4R*	Drives cell 4R gate pulse transformer.
5PL-20	P24	+24 volt output.
5PL-21	A5R*	Drives cell 5R gate pulse transformer.
5PL-22	P24	+24 volt output.
5PL-23	A6R*	Drives cell 6R gate pulse transformer.
5PL-24	P24	+24 volt output.
5PL-25	DCN (SDCI) -------- (DCFB)	On SDCI, dc bridge voltage (negative), On DCFB, test attenuation.
5PL-26	DCP (SDCI) -------- (DCFB)	On SDCI, dc bridge voltage (positive), On DCFB, test attenuation.

* Reversing bridges only.

Table 10. Connector 1CPL, I/O Between DCFB Board and SHVI/SHVM Board

Pin	Nomenclature	Description
1CPL-1	ACCT1	L1 ACCT current input, white.
1CPL-2	ACCTCOM	L1 ACCT current input, red.
1CPL-3	ACCTCOM	L3 ACCT current input, red.
1CPL-4	ACCT3	L3 ACCT current input, white.

Table 11. Connector CNPL, I/O Between DCFB Board and Components

Pin	Nomenclature	Description
CNPL-1	X1	MA contactor control output.
CNPL-2	MA115V	MA contactor control output.

Table 12. Connector CPTPL, I/O Between DCFB Board and Components

Pin	Nomenclature	Description
CPTPL-1	X2	115 V ac output (unfused side).
CPTPL-2	X1	115 V ac output (fused side).
CPTPL-3	--------	Not connected.
CPTPL-4	DCOM	Common connection.
CPTPL-5	--------	38 V ac output.
CPTPL-6	--------	38 V ac output.

Table 13. Connector FAPL, I/O Between DCFB Board and Components

Pin	Nomenclature	Description
FAPL-1	X2	115 V ac output for controller cooling fan.
FAPL-2	X1	115 V ac output for controller cooling fan.

Table 14. Connector NPL, I/O Between DCFB Board and Components

Pin	Nomenclature	Description
NPL-1	N1C	NRX N2 SCR cathode, red.
NPL-2	N1G	NRX N2 SCR gate, white.

Table 15. Connector PPL, I/O Between DCFB Board and Components

Pin	Nomenclature	Description
PPL-1	P1C	NRX P1 SCR cathode, red.
PPL-2	P1G	NRX P1 SCR gate, white.

Table 16. Connector SQPL, I/O Between DCFB Board and SHVI/SHVM Board

Pin	Nomenclature	Description
SQPL-1	ACNP	25 kHz positive power (+) to SHVI/SHVM board.
SQPL-2	ACNN	25 kHz negative power (–) to SHVI/SHVM board.
SQPL-3	ACNACOM	25 kHz power common.
SQPL-4	ACNACOM	25 kHz power common.

Table 17. Connector IA1PL, I/O Between DCFB Board and SHVI/SHVM Board

Pin	Nomenclature	Description
IA1PL-1	--------	Motor armature current shunt positive input (+), red (*Main generator field shunt*).
IA1PL-2	--------	Motor armature current shunt negative input (–), white (*Main generator field shunt*).

Table 18. Connector IA2PL, I/O Between DCFB Board and SHVI/SHVM Board

Pin	Nomenclature	Description
IA2PL-1	--------	Motor #2 armature current shunt positive input (+), red (*Attenuator field shunt*).
IA2PL-2	--------	Motor #2 armature current shunt negative input (–), white (*Attenuator field shunt*).

Table 19. Connector IF1PL, I/O Between DCFB Board and Shunts

Pin	Nomenclature	Description
IF1PL-1	IF1+	Motor field current shunt positive input (+), red.
IF1PL-2	F1ACOM	Motor field current shunt negative input (–), white.

Table 20. Connector IF2PL, I/O Between DCFB Board and Shunts

Pin	Nomenclature	Description
IF2PL-1	IF2+	Motor #2 field current shunt positive input (+), red (*Flashing shunt*).
IF2PL-2	F2ACOM	Motor #2 field current shunt negative input (–), white (*Flashing shunt*).

Table 21. Connector MACPL, I/O Between DCFB Board and Contactor Driver Circuits

Pin	Nomenclature	Description
MACPL-1	MD1CTRL	MD #1 contactor control common output.
MACPL-2	MDCTRLPW	MD #1 contactor control 24 V dc output.
MACPL-3	MD2CTRL	MD #2 contactor control common output. (Not connected on SDCI.)
MACPL-4	MDCTRLPW	MD #2 contactor control 24 V dc output. (Not connected on SDCI.)

Table 22. DCFB Board Stab Terminal Connections

Stab	Description
V1	Phase A ac line voltage.
V2	Phase B ac line voltage.
V3	Phase C ac line voltage.
P1A	Dc bridge positive voltage (+).
P2A	Dc bridge negative voltage (–).
VM1A	Motor armature positive voltage (+) (*Generator field feedback*).
VM1B	Motor armature negative voltage (–) (*Generator field feedback*).
VM2A	Motor #2 armature positive voltage (+) (*Battery voltage feedback*).
VM2B	Motor #2 armature negative voltage (–) (*Battery voltage feedback*).

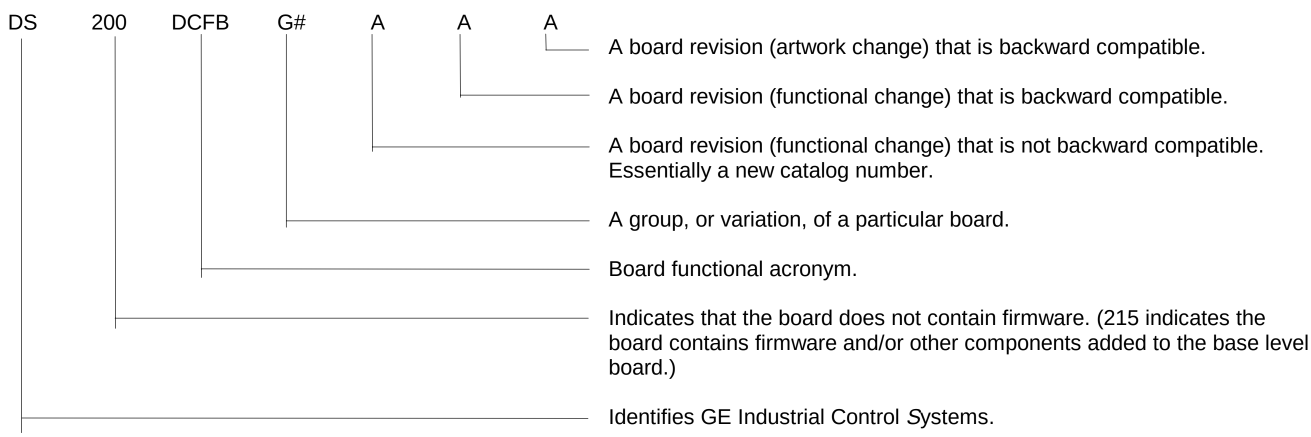

Figure 2. Sample Board Part Number, DS Series

RENEWAL/WARRANTY REPLACEMENT

BOARD IDENTIFICATION

A printed wiring board is identified by an alphanumeric part (catalog) number stamped on its edge. For example, the Power Supply Board is identified by part number DS200DCFBG#ruu. (See Figure 2 for part number breakdown.)

NOTE

All digits are important when ordering or replacing any board.

WARRANTY TERMS

The GE Industrial Control 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 be obtained separately from the nearest GE Sales Office or authorized GE Sales Representative.

WARRANTY PARTS AND SERVICE

Fuses FU1, FU2, and FU3 are the only end-user replaceable components on the DCFB board. If any other components on the board fail, the board 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
- Equipment serial number and model number
- Board number and description

PROCEDURE FOR REPLACING BOARDS

WARNING

Potentially lethal voltages are present on the DCFB board when powered. To prevent electric shock, turn off power to the drive, then test to verify that no power exists on 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 or software chips, and always store boards in anti-static bags or boxes they were shipped in.

To replace a DCFB board:

1. **Turn off all power to the drive**, then wait several minutes for all the power supply's capacitors to discharge. Test any electrical circuits before touching them to ensure the power is off.
2. Open the equipment's cabinet door to access the printed wiring boards.
   - This exposes the drive control card, which faces the front (in the front board carrier).
   - The DCFB board is normally mounted in the board carrier behind the drive control card, also facing the front (*for some EX2000 applications, it may be in a different location*).
3. Pull the lock tabs located on either side of the board rack, then lift the front board carrier (with the drive control card) and tilt it forward and down to access the DCFB board.
4. Carefully disconnect all cables from the DCFB board as follows:
   – For ribbon cables, grasp on each side of the cable connector that mates with the board connector and gently pull the cable connector free.
   – For a cable with a pull-tab, carefully pull the tab.
5. Push back on the plastic snaps (holders) to release the DCFB board from the board carrier.
6. Verify that all jumpers and switches on the new (replacement) DCFB board are set in the same position as they were on the old board.
   - If a board revision has added or eliminated a configurable component, or re-adjustment is needed, refer to Table 1 and/or Table 2.

   NOTE

   Because of upgrades, boards of different revision levels may not contain identical hardware. However, GE Industrial Control Systems ensures compatibility of its replacement boards.
7. Orient the new DCFB board in the same position as the one removed and install it onto the board carrier.
   - Make sure all plastic snaps (holders) snap back into position to secure the board.
8. Reconnect all cables to the DCFB board as labeled and ensure that the cables are properly seated at both ends.
9. Adjust the EE parameters per the procedure in the EE Parameter Adjustments paragraph (located after step 10 of this procedure).
10. Swing the front board carrier back up into position, slide the lock tab(s) on the side of the board rack back into the locking position, then close the drive cabinet door.

EE PARAMETER ADJUSTMENT

After installing a new DCFB board, the EE parameter for voltage feedback offset, EE.574 (VFBOFS), must be adjusted. The procedure for performing this adjustment varies with the application of the board and the tools that are available (programmer board, ST2000, GE Control System Toolbox, or LynxOS™ Configurator).

™ LynxOS is a trademark of Lynx Real-Time Systems, Inc.

The DCFB board is used in DC2000, CB2000, EX2000, FC2000, GF2000, ME2000, and AC2000 IGBT drive applications. Refer to applicable drive instruction book for performing the EE parameter adjustment procedure, if applicable.

Notes:

GE Industrial Control Systems

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General Electric Company
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA