5-4.12. Dc Power Supply and Instrumentation Board (DS200SDCI)

The DS200SDCI Dc Power Supply and Instrumentation Board (SDCI) provides logic power and interface circuitry for the DC2000 drive. The board includes the following circuits:

- +5 V dc, 4 A; ±15 V dc, 0.4 A; ±24 V dc, and 115 V ac, 0.4 A power supplies
- Motor field power circuits (except the SCR module)
- Driver circuits for the armature SCR gating
- Circuits to monitor numerous ac line and dc motor signals, including:
  - Armature current and voltage
  - Field current
  - Ac line currents, voltage magnitude, and phase sequence

There are two group numbers of the SDCI. The G1 version of the board includes circuits for an internal ≤10 A field exciter; the G2 version is used with external field exciters.

Section 6-7 defines I/O points for the SDCI board. Section 7-5 defines SDCI onboard fuses, and section 7-6.7 defines SDCI testpoints.

5-4.12.1. POWER SUPPLIES. The SDCI board receives 38 V ac (±10%) from the control power transformer (CPT). This voltage is rectified and filtered to produce the unregulated ±24 V dc outputs. The +24 V dc output is rated at 3 A; the -24 V dc output is rated at 1 A. Of these, 0.5 A is available for external loading.

Regulators on the SDCI derive ±15 V dc from the ±24 V dc supplies. The ±15 V dc outputs are rated at 0.4 A, of which 0.25 A is available for external loading.

The SDCI also generates a +5 V dc, 4 A output from the +24 V dc supply. The /PSEN signal on connector 2PL goes to a TTL low state when the +5 V dc supply is in regulation: the signal goes high if the supply goes out of regulation. When high, /PSEN is used to generated a microprocessor reset on the SDCC card.

The DCFB also provides isolated +5 and ±15 V dc supplies used to power the armature current feedback circuit. This circuit is at the potential of the motor armature since it connects to the armature current sensing shunt.

The outputs of the SDCI power supplies are protected by fuses FU2 and FU3 (7A, 2AG). Light-emitting diodes (LEDs) CR51 and CR55 provide blown fuse indications for FU2 and FU3, respectively.

5-4.12.2. FIELD POWER CIRCUITRY AND CURRENT VCO. The G1 version of the SDCI board includes a field supply circuit for fields up to 10 A. The SDCIG1 board contains all field power circuitry, except the SCR module.

The field power circuit contained on the SDCIG1 board includes snubbers and a reactor. Field power is input at stab terminals AC1 through AC3. The field current is filtered by the reactor. The field is connected to stab terminals FAC2 and FAC3. Depending on drive frame size, a 3-phase MOV may be attached to stab terminals MOV1 through MOV3. The field outputs and MOV outputs are protected by fuses FU5 and FU6. Neon lights LT5 and LT6 indicate if FU5 or FU6, respectively is blown. For more information on the fuses, refer to Chapter 9.

The SDCIG2 board is used in applications greater than 10 A. These applications require a field power circuit that is external to the SDCI board. The SDCIG2 board omits the field power circuit described above.

Both group numbers of the SDCI board include a voltage-controlled oscillator (VCO) circuit for feedback signals from the field shunt. The VCO converts the input voltage from the field shunt to a frequency signal. The nominal output frequency of the VCO is 250 kHz; the output frequency varies from 0 to 500 kHz, depending upon the input voltage. The frequency signal is sent to the SDCC card through 1PL-9. The field shunt VCO circuit is isolated (up to 600 V) from drive common (DCOM) and from the armature VCO described in the following section.

5-4.12.3. DC ARMATURE VOLTAGE VCO. The motor armature voltage is attenuated, and then brought into the SDCI board as a differential input on connector 5PL. The armature voltage VCO circuit converts the voltage to a ±5 V frequency signal, which is sent to the SDCC card through 1PL-13. The armature voltage VCO circuit also provides an analog representation of the armature voltage (VFBB), which is sent to the SDCC through 1PL-37, and can be measured at SDCC testpoint TP37.

5-4.12.4. ARMATURE CURRENT VCO. A third VCO circuit, which floats at the armature bus potential (up to 600 V above DCOM), instruments motor current detected from a shunt. The shunt voltage is converted to a frequency and is sent to a counter circuit on the SDCC through 1PL-8.

5-4.12.5. AC LINE ZERO CROSSING, MAGNITUDE, AND PHASE SEQUENCE. A 3-phase filter and amplifier circuit processes the ac line-to-line voltages. These voltages are logically ORed to derive the VMAG and VSEQ signals, which are sent to the SDCC through 1PL-5 and 1PL-6, respectively. One of the amplifier circuit outputs is also filtered, processed by a zero-crossing detector, and made TTL-compatible to produce the SYNC signal sent to the SDCC through 1PL-29.

The SDCC uses these signals to determine the magnitude and phasing of the ac line-to-line voltages. VMAG represents the average voltage on the incoming ac lines. VSEQ is used with the SYNC signal to determine if the ac line phasing is correct. SYNC is the V2–V3 zero-crossing synchronization signal.

5.4.12.6. AC LINE INSTRUMENTATION. The drive's 1 and 3 ac lines include current transformers CT1 and CT2. DIP switch SW1 is used to select burden resistance as a function of the nominal dc output current of the CTs (see Table 5-7). The SDCI board sends the ACCT output current signals IL3 and IL1 to the SDCC through 1PL-1 and 1PL-2, respectively. The SDCC uses these two signals to check for commutation failure and ac instantaneous overcurrent (IOC).

5-4.12.7. CONTACTOR DRIVE CIRCUITS. The SDCI board includes relay K2, which serves as a pilot relay to the MA or MD contactor. The SDCC drives the coil of K2 through 1PL-34 and 1PL-35.

Connector CNPL provides 115 V ac to the MA contactor; connector MACPL provides a 24 V dc FET output to the MD contactor driver. Jumper JP1 is used to select whether the MD contactor is controlled independently of the MA contactor by the SDCC MCP. Jumper JP2 selects the dropout time for the MA contactor (see Table 5-7).

5-4.12.8. ARMATURE AND FIELD FIRING CIRCUITS. The SDCI board contains two programmable array logic (PAL) circuits that decode armature and field firing signals from the SDCC card. Based upon these firing signals, the PALs direct firing pulses to the appropriate SCR bridge or field gate pulse transformer drivers. The SDCI includes transformers that isolate the field gate firing outputs.

The SDCC provides a 25 kHz, 10% duty cycle pulse train (SYOSC) through connector 1PL-14. This pulse train, along with the enable and initial pulse (IPU) signals from the SDCC, are used to form the firing bursts. The SDCC also generates signals to select which SCR pair is enabled, and to indicate when the Cell Test Mode is active.

5-4.12.9. DELAYED FIRING POWER. A delayed firing power circuit on the SDCI board provides power to the SCR bridge gate-pulse transformer outputs. As a protection, the power remains off until gating is required. As an additional protection, this circuit removes gate firing power in the event of a failure.

5-4.12.10. CONFIGURABLE HARDWARE. The SDCI board includes Berg-type jumpers and a DIP switch used for customer options. Figure 5-16 shows the layout of the SDCI board, including the locations of the jumpers and switch. Table 5-11 lists and defines these items.

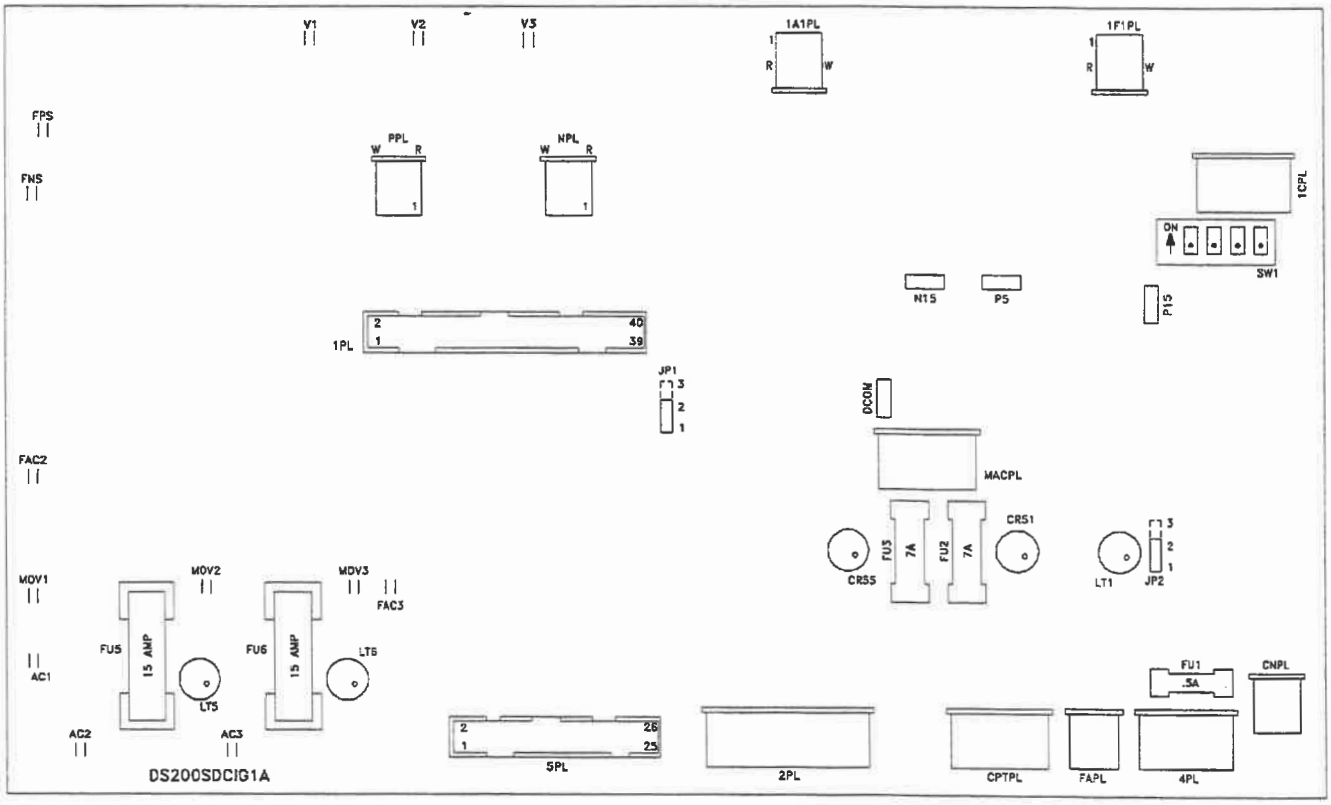

Figure 5-16. SDCI Board Layout

Table 5-11. SDCI Board Adjustable Hardware

Revision	Name	Description
All	JP1	MD control source This jumper allows the MD contactor drive hardware output to be slaved to the MA contactor drive hardware output. Normally the MD contactor drive output is controlled independently by MCP software (JP1 = 1-2). 1.2 MD controlled by MCP (Normal Operation) 2.3 MD hardware slaved to MA operation
All	JP2	MA 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 during normal running 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 2.3 Minimum delay, (and manufacturing test)
All	SW1	Select ac line CT burdens as a function of nominal dc output current These switch settings scale the ac line current transformers as a function of dc amps. Correct scaling is essential for proper operation of the ac IOC protective feature. These CTs are mounted on ac lines 1 and 3 of the power bridge and are wired through connector 1CPL to a burden resistor network. 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

Table 5-11. SDCI Board Adjustable Hardware — Continued

Revision	Name	Description
		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 card, using JP1–JP8 on the SHVI/SHVM card. The enumerations listed are in terms of the mA input to the DCFB card (ACCT secondary mA attenuated by 10:1 SHVI/SHVM attenuation if selected). At present the SHVI/SHVM cards are used on M, J, K, and L frames only, and then 10:1 CTs are used only if the ACCT secondary current is > 144 mA.

The CT secondary current (in mA) is approximated by:

$$Ict, mA = \frac{1\ pu\ rated\ current \times 1000}{Combined\ CT\ turns\ ratio}$$

0	(All off)	0.0 ≤ Ict, mA < 6.1
1	(1 on)	6.1 ≤ 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

5-4.13. SCR High Voltage Interface Board (DS200SHVI)

The DS200SHVI SCR High Voltage Interface Board (SHVI) provides an interface for signals from the DC2000 drive's SCR bridge to the DCFB or SDCI board and PCCA card. The SHVI performs the following functions:

- Converts shunt signals (–500 mV to +500 mV) into differential-frequency outputs (0 to 500 kHz) that are sent to the DCFB or SDCI board
- Incorporates hardware jumper-selectable 10:1 current transformers to provide additional current attenuation capability
- Provides attenuation of line and bridge voltages
- Incorporates three neon indicator lights to provide visual indication of a blown line filter fuse
- Includes driver circuits for both standard and fast contactors

Section 6-15 defines I/O points for the SHVI board.

5-4.13.1. CONFIGURABLE HARDWARE. The SHVI board includes Berg-type jumpers. Revision AAA of the board also included hard-wired jumpers that were connected to stab terminals to connect or bypass the board's attenuation circuits. Figure 5-17 shows the SHVI board layout, including the locations of the Berg-type jumpers. Table 5-12 lists and defines the Berg-type and hard-wired jumpers.