GE Industrial Systems

SCR-Diode Converter Interface Board
IS200SCNVG_A_ _

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 Systems.

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.

Contents

™ Innovation Series is a trademark of General Electric Company, USA.

Functional Description

The IS200SCNV SCR-Diode Converter Interface Board (SCNV) is the control to bridge interface board for Innovation Series SCR-Diode Converters (1800 amp and 1000 amp stand-alone units). It is used for 6-pulse sources driving three SCRs (66 mm or smaller) per board. It is not used for driving paralleled SCRs from the same board. The SCNV board includes three input current sense circuits, three SCR gate drive circuits, two line-to-line voltage feedback circuits, one dc link voltage feedback circuit, one DB IGBT VCE feedback circuit, and one Dynamic Braking (DB) IGBT gate drive circuit.

The DRVP5 and NDRPC signals from the IS200BIC_ Bridge Interface Board (BIC_) are used to disable/enable gating. DRVP5 should be high (+5 V) and NDRPC should be low (DCOM) in order to enable gating. The gate drive is disabled when either DRVP5 goes low or NDPRC goes high. Driver and feedback circuits are galvanically and optically isolated.

A serial add-only memory device is provided on the SCNV board. This memory is programmed with board identification and revision information. Access to the information is through a single data line (BRDID) on the P1 connector.

The SCNV board mounts in slot 6 of the Innovation Series™ board rack and connects to J15 of the IS200CABP Control Assembly Backplane Board (CABP). See Figure 1 for a block diagram of the SCNV board.

DB IGBT Gate Drivers

There is one isolated IGBT gate driver circuit for dynamic braking (DB, optional). The circuit is composed of an optically isolated hybrid gate driver module and a few discrete components. The module switches the IGBT gate-to-emitter voltage between VCC (+15 V) and VEE (−7.5 V).

Two types of faults are generated by this circuit.

- A **Desaturation Fault** is generated when the IGBT is commanded to turn on and VCE exceeds 10 V for 4 microseconds or longer. When a desaturation fault occurs, the module will slowly decrease VGE until the IGBT is OFF (soft shutdown).
- A **Driver Supply Undervoltage Fault** is generated when the voltage between VCC and VEE drops below 16 V.

These faults are ORed together and optically coupled back to the control logic. These faults are transient in nature and must be latched by the fault handling circuit monitoring the faults through P1 (this is done on the BIC_ board).

SCR Gate Drivers

There are three individually isolated SCR gate driver circuits. Each circuit uses the same hybrid module used in the DB gate drive circuit, but in a different configuration. The SCR gate driver circuit switches between VCC (22 V) and VEE (0 V) to deliver the gate current. No SCR gate driver faults are reported on this board.

Feedback Signals

Shunt Current Feedback: Output phase current is monitored by deriving a voltage controlled oscillator (VCO) output signal from the voltage dropped across the phase shunt. This voltage is amplified and then passed on to the VCO circuitry. The VCO has a range of 0 – 2 MHz and the circuit is biased so that at zero current the nominal output is 1 MHz. A ±400 millivolt shunt voltage is converted into a ±800 kHz change in the VCO output frequency. The output of the VCO is optically coupled to a differential driver interface to the control logic.

Line-to-Line Voltage Feedback: There are two isolated line-to-line voltage feedback circuits for VAB and VBC. Input line-to-line voltage is monitored by deriving two VCO signals, VAB and VBC, from the input phase shunt connections. The circuits share power supplies and clock oscillators with phase B and C shunt feedback circuits, VAB corresponds to phase B and VBC corresponds to phase C. The VCOs have a range of 0 – 2 MHz and the circuit is biased so that a zero line-to-line voltage produces a nominal output of 976.8 kHz. A ±1 V change in line-to-line voltage translates into a ±959.58 Hz change in output frequency. The outputs of the VCOs are optically coupled to the control logic. The line-to-line voltage feedback circuits have an input filter with break frequency of 17.46 kHz.

Dc Link Voltage Feedback: There is one isolated dc link voltage feedback circuit. The dc link voltage feedback circuit shares its power supply with the DB IGBT VCE feedback circuit. It is referenced to the negative dc link that is the same as the DB IGBT emitter. The positive dc link input is fed to the VCO circuit through a resistive attenuator. The VCO has an output range from 0 – 2 MHz. The input is scaled so that 0 – 1197.5 link volts corresponds to 0 – 2 MHz. The output of the VCO is optically coupled to the control logic. The dc link voltage feedback circuit has an input filter with a break frequency of 10.03 kHz.

DB IGBT VCE Feedback: There is one isolated DB IGBT VCE feedback circuit (if equipped with DB option). It shares its power supply with the dc link voltage feedback circuit. It is referenced to the DB IGBT emitter that is the same as the negative dc link. The DB IGBT collector input is fed to the VCO circuit through a resistive attenuator. The VCO has an output range of 0 – 2 MHz. The input is scaled so that 0 – 1197.5 Volts corresponds to 0 – 2 MHz. The output of the VCO is optically coupled to the control logic. The DB IGBT VCE voltage feedback circuit has an input filter with a break frequency of 10.03 kHz.

DB Temperature Fault

An isolated 15 V supply (P15T) is used as a power supply for the DB temperature fault circuit (if equipped with DB option). The signal DBTF is used to enunciate DB temperature faults to the BIC_ board. Under normal conditions (no faults), the externally supplied thermostat contact is closed and 12 milliamps flow into the optocoupler causing DBTF to be low.

When a fault occurs (DB heatsink temp > thermostat threshold), the thermostat contact opens and no input current flows into the optocoupler causing DBTF to be high.

Power Supplies

Regulated +5 V dc (P5) and DCOM are supplied to the SCNV board via the P1 connector. A 25 kHz, 18.4 V ac square wave input (VAC1 and VAC2) is also supplied to the SCNV board transformer primaries through the P1 connector (unregulated). There are nine power supplies derived from the secondaries of the four transformers as follows:

- **T1, Phase A SCR Gate Drive Supply:** Isolated +22.5 V halfwave supply referenced to the positive dc bus. (unregulated, ±10%, maximum 1 amp average)
- **T1, Phase A Shunt Feedback Supply:** Isolated +12, –12, +5 V fullwave supply referenced to the bridge side of shunt A. (unregulated except 5 V supply, ±10%, maximum 100 milliamp average for each voltage)
- **T2, Phase B SCR Gate Drive Supply:** Isolated +22.5 V halfwave supply referenced to the positive dc bus. (unregulated, ±10%, maximum 1 amp average)
- **T2, Phase B Shunt Feedback/VAB Feedback Supply:** Isolated +12, –12, +5V fullwave supply referenced to the bridge side of shunt B. (unregulated except 5 V supply, ±10%, maximum 100 milliamp average for each voltage)
- **T3, Phase C SCR Gate Drive Supply:** Isolated +22.5 V halfwave supply referenced to the positive dc bus. (unregulated, ±10%, maximum 1 amp average)
- **T3, Phase C Shunt Feedback / VBC Feedback Supply:** Isolated +12, –12, +5V fullwave supply referenced to the bridge side of shunt C. (unregulated except 5 V supply, ±10%, maximum 100 milliamp average for each voltage)
- **T4, DB IGBT Gate Drive Supply:** Isolated +15/-7.5 V halfwave supply referenced to the DB IGBT emitter = negative dc bus. (unregulated, ±5%, maximum 1 amp average)
- **T4, DC Link Voltage/DBVCE Feedback Supply:** Isolated +12, –12, +5V fullwave supply referenced to negative DC bus = DB IGBT emitter. (unregulated except 5 V supply, ±10%, maximum 100 milliamp average for each voltage)
- **T4, DB Temperature Fault Supply:** Isolated +15 V halfwave supply (unregulated, ±10%)

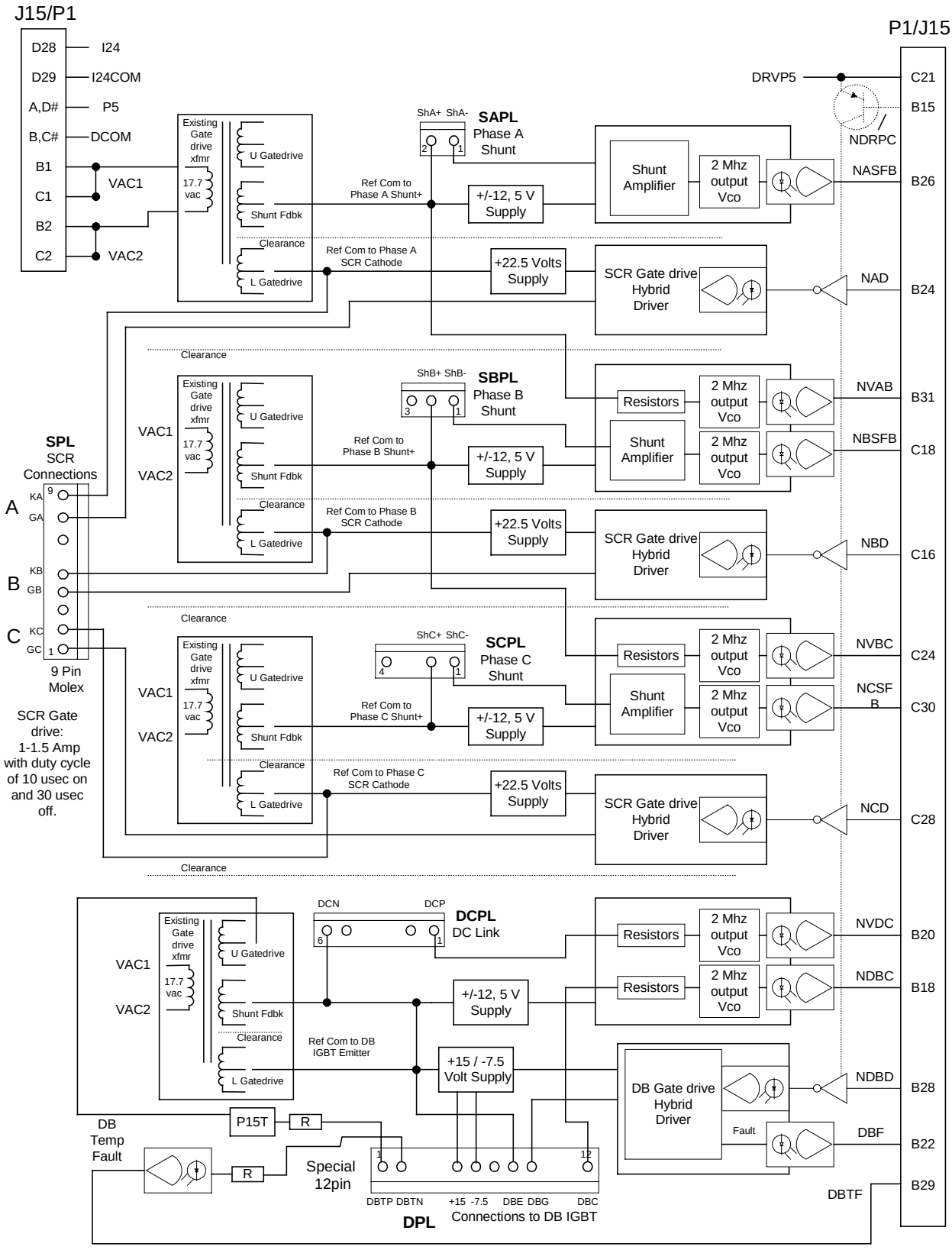

Figure 1. SCNV Board Block Diagram

Application Data

The SCNV board has no LED indicators, fuses, user testpoints or adjustable hardware included on it. The SCNV board does have six plug connectors and one backplane connector (P1). See Figure 2 for a front panel diagram and Figure 3 for a board component layout diagram showing the locations of these devices.

WARNING

The four testpoints (TP1 – TP4) located on the SCNV board are for engineering test use only and are not to be accessed by the user (high voltage is present, 575 V ac or 900 V dc).

Connectors

The SCNV board contains one 128-pin backplane connector (P1). This connector provides standard Innovation Series board rack signals and interfacing with other boards. See **Table 7** for **P1** pin signal descriptions

Additionally, six plug connectors are provided on the board. These connectors provide for interfacing with the gate drivers, dc link, and current shunts. Refer to the Tables as follows for pin signal descriptions of these connectors:

- See **Table 1** for **SAPL**, Phase A Shunt Connector pin signal descriptions
- See **Table 2** for **SBPL**, Phase B Shunt Connector pin signal descriptions
- See **Table 3** for **SCPL**, Phase C Shunt Connector pin signal descriptions
- See **Table 4** for **SPL**, SCR Gate Driver pin signal descriptions
- See **Table 5** for **DPL**, DB Gate Driver pin signal descriptions (only connected if equipped with the DB option)
- See **Table 6** for **DCPL**, Dc Link Voltage pin signal descriptions

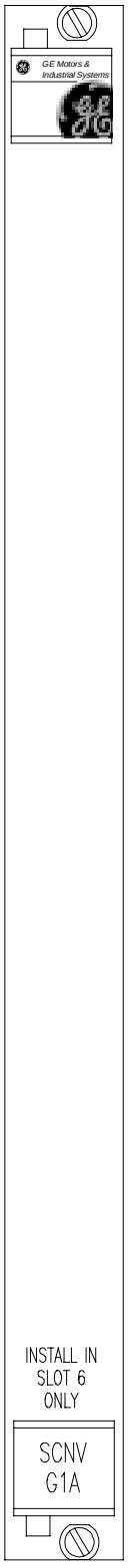

Figure 2. SCNV Board Front Panel

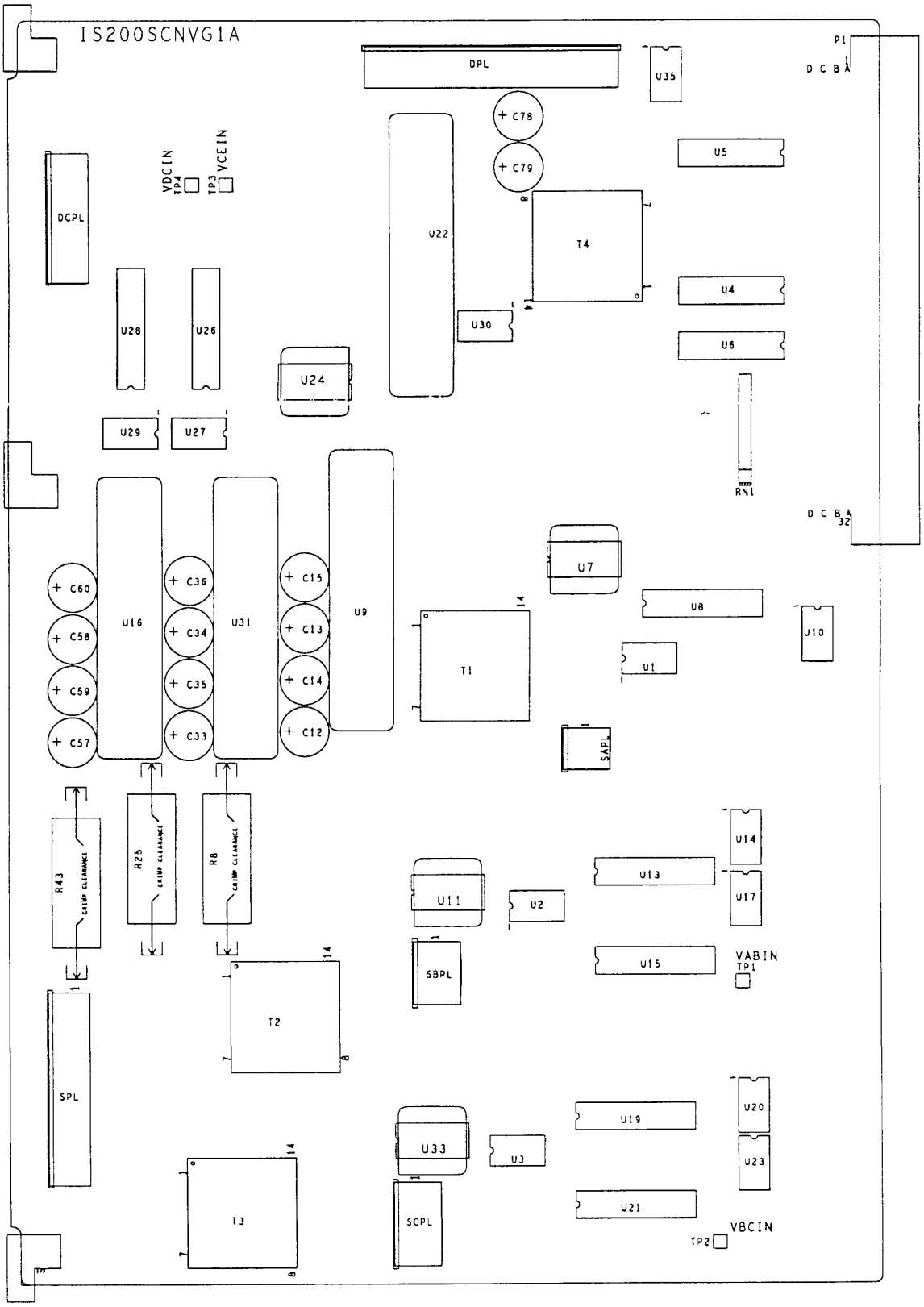

Figure 3. SCNV Board Layout Diagram

Table 1. SAPL, Phase A Shunt Connector

Pin #	Nomenclature	Description
SAPL-1	ASHL	Ac Line Side of Shunt (A–)
SAPL-2	AFCOM	Bridge Side of Shunt (A+)

Table 2. SBPL, Phase B Shunt Connector

Pin #	Nomenclature	Description
SBPL-1	BSHL	AC Line Side of Shunt (B–)
SBPL-2	BFCOM	Bridge Side of Shunt (B+)
SBPL-3	NC	Not Connected

Table 3. SCPL, Phase C Shunt Connector

Pin #	Nomenclature	Description
SCPL-1	CSHL	AC Line Side of Shunt (C–)
SCPL-2	CFCOM	Bridge Side of Shunt (C+)
SCPL-3	NC	Not Connected
SCPL-4	NC	Not Connected

Table 4. SPL, SCR Gate Drive Connector

Pin #	Nomenclature	Description
SPL-1	GC	SCR Phase C Gate
SPL-2	CDCOM	SCR Phase C Cathode
SPL-3	NC	Not Connected
SPL-4	GB	SCR Phase B Gate
SPL-5	BDCOM	SCR Phase B Cathode
SPL-6	NC	Not Connected
SPL-7	NC	Not Connected
SPL-8	GA	SCR Phase A Gate
SPL-9	ADCOM	SCR Phase A Cathode

Table 5. DPL, DB Gate Drive Connector

Pin #	Nomenclature	Description
DPL-1	DBTP	DB Temperature Positive
DPL-2	DBTN	DB Temperature Negative
DPL-3	NC	Not Connected
DPL-4	NC	Not Connected
DPL-5	DBP15	+15 V PS for DB Gate Drive
DPL-6	DBN7	–7.5 V PS for DB Gate Drive
DPL-7	NC	Not Connected
DPL-8	DBE	DB IGBT Emitter
DPL-9	DBG	DB IGBT Gate
DPL-10	NC	Not Connected
DPL-11	NC	Not Connected
DPL-12	DBC	DB IGBT Collector

Table 6. DCPL, Dc Link Voltage Connector
(Not used if not equipped with DB option)

Pin #	Nomenclature	Description
DCPL-1	DCP	Dc Link Positive
DCPL-2	NC	Not Connected
DCPL-3	NC	Not Connected
DCPL-4	NC	Not Connected
DCPL-5	NC	Not Connected
DCPL-6	DBCOM	Dc Link Negative

Table 7. P1 Backplane Connector, Row A

Pin #	Nomenclature	Description
P1-A1	N/C	Not Connected
P1-A2	N/C	Not Connected
P1-A3	N/C	Not Connected
P1-A4	N/C	Not Connected
P1-A5	N/C	Not Connected
P1-A6	N/C	Not Connected
P1-A7	N/C	Not Connected
P1-A8	N/C	Not Connected
P1-A9	N/C	Not Connected
P1-A10	N/C	Not Connected
P1-A11	N/C	Not Connected
P1-A12	N/C	Not Connected
P1-A13	N/C	Not Connected
P1-A14	N/C	Not Connected
P1-A15	P5	+5 V dc digital power source
P1-A16	P5	+5 V dc digital power source
P1-A17	N/C	Not Connected
P1-A18	N/C	Not Connected
P1-A19	N/C	Not Connected
P1-A20	N/C	Not Connected
P1-A21	N/C	Not Connected
P1-A22	N/C	Not Connected
P1-A23	P5	+5 V dc digital power source
P1-A24	P5	+5 V dc digital power source
P1-A25	N/C	Not Connected
P1-A 6	N/C	Not Connected
P1-A27	N/C	Not Connected
P1-A28	N/C	Not Connected
P1-A29	N/C	Not Connected
P1-A30	N/C	Not Connected
P1-A31	P5	+5 V dc digital power source
P1-A32	P5	+5 V dc digital power source

Table 7. P1 Backplane Connector, Row B – Continued

Pin #	Nomenclature	Description
P1-B1	VAC1	18.4 V ac, 25 kHz squarewave power supply input
P1-B2	VAC2	18.4 V ac, 25 kHz squarewave power supply input
P1-B3	N/C	Not Connected
P1-B4	N/C	Not Connected
P1-B5	N/C	Not Connected
P1-B6	N/C	Not Connected
P1-B7	N/C	Not Connected
P1-B8	N/C	Not Connected
P1-B9	N/C	Not Connected
P1-B10	N/C	Not Connected
P1-B11	N/C	Not Connected
P1-B12	N/C	Not Connected
P1-B13	N/C	Not Connected
P1-B14	N/C	Not Connected
P1-B15	NDRPC	Drive enable (active low)
P1-B16	DCOM	+5 V dc digital power return (common)
P1-B17	N/C	Not Connected
P1-B18	NVDBCE	Dynamic Braking VCE feedback
P1-B19	DCOM	+5 V dc digital power return (common)
P1-B20	NVDC	Dc link voltage feedback
P1-B21	DCOM	+5 V dc digital power return (common)
P1-B22	DBF	Dynamic Braking fault
P1-B23	N/C	Not Connected
P1-B24	NAD	SCR phase A gate drive
P1-B25	DCOM	+5 V dc digital power return (common)
P1-B26	NASFB	Phase A shunt feedback (current)
P1-B27	DCOM	+5 V dc digital power return (common)
P1-B28	NDBD	Dynamic Braking gate drive
P1-B29	DBTF	Dynamic Braking temperature fault
P1-B30	DCOM	+5 V dc digital power return (common)
P1-B31	NVAB	VAB feedback
P1-B32	DCOM	+5 V dc digital power return (common)

Table 7. P1 Backplane Connector, Row C – Continued

Pin #	Nomenclature	Description
P1-C1	VAC1	18.4 V ac, 25 kHz squarewave power supply input
P1-C2	VAC2	18.4 V ac, 25 kHz squarewave power supply input
P1-C3	N/C	Not Connected
P1-C4	N/C	Not Connected
P1-C5	N/C	Not Connected
P1-C6	N/C	Not Connected
P1-C7	N/C	Not Connected
P1-C8	N/C	Not Connected
P1-C9	N/C	Not Connected
P1-C10	N/C	Not Connected
P1-C11	N/C	Not Connected
P1-C12	N/C	Not Connected
P1-C13	N/C	Not Connected
P1-C14	N/C	Not Connected
P1-C15	N/C	Not Connected
P1-C16	NBD	SCR phase B gate drive
P1-C17	DCOM	+5 V dc digital power return (common)
P1-C18	NBSFB	Phase B shunt feedback (current)
P1-C19	BRD_ID	Serial board identification line
P1-C20	N/C	Not Connected
P1-C21	DRVP5	Drive enable (active high)
P1-C22	N/C	Not Connected
P1-C23	DCOM	+5 V dc digital power return (common)
P1-C24	NVBC	VBC feedback
P1-C25	DCOM	+5 V dc digital power return (common)
P1-C26	N/C	Not Connected
P1-C27	N/C	Not Connected
P1-C28	NCD	SCR phase C gate drive
P1-C29	DCOM	+5 V dc digital power return (common)
P1-C30	NCSFB	Phase C shunt feedback (current)
P1-C31	DCOM	+5 V dc digital power return (common)
P1-C32	N/C	Not Connected

Table 7. P1 Backplane Connector, Row D – Continued

Pin #	Nomenclature	Description
P1-D1	N/C	Not Connected
P1-D2	N/C	Not Connected
P1-D3	N/C	Not Connected
P1-D4	N/C	Not Connected
P1-D5	N/C	Not Connected
P1-D6	N/C	Not Connected
P1-D7	N/C	Not Connected
P1-D8	N/C	Not Connected
P1-D9	N/C	Not Connected
P1-D10	N/C	Not Connected
P1-D11	N/C	Not Connected
P1-D12	N/C	Not Connected
P1-D13	N/C	Not Connected
P1-D14	N/C	Not Connected
P1-D15	N/C	Not Connected
P1-D16	N/C	Not Connected
P1-D17	N/C	Not Connected
P1-D18	N/C	Not Connected
P1-D19	N/C	Not Connected
P1-D20	N/C	Not Connected
P1-D21	N/C	Not Connected
P1-D22	N/C	Not Connected
P1-D23	N/C	Not Connected
P1-D24	N/C	Not Connected
P1-D25	N/C	Not Connected
P1-D26	N/C	Not Connected
P1-D27	N/C	Not Connected
P1-D28	I24	Isolated 24 V dc power source (for customer relays)
P1-D29	I24_COM	I24 isolated power return (common)
P1-D30	N/C	Not Connected
P1-D31	P5	+5 V dc digital power source
P1-D32	P5	+5 V dc digital power source

Renewal/Warranty Replacement

How to Order a Board

When ordering a replacement board for a GE drive, you need to know:

- How to accurately identify the part
- If the part is under warranty
- How to place the order

This information helps ensure that GE can process the order accurately and as soon as possible.

Board Identification

A printed wiring board is identified by an alphanumeric **part (catalog) number** located near its edge. Figure 4 explains the structure of the part number.

The board's functional acronym, shown in Figure 4, normally is based on the **board description**, or name. For example, the SCNV board is described as the SCR-Diode Converter Interface Board.

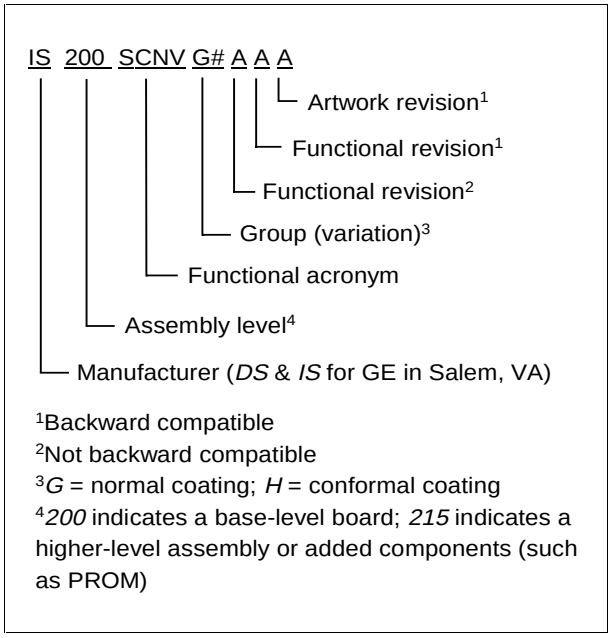

Figure 4. Board Part Number Conventions

Warranty Terms

The GE *Terms and Conditions* brochure details product warranty information, including **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.

Placing the Order

Parts still under **warranty** may be obtained directly from the factory:

GE Industrial Systems
Product Service Engineering
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA
Phone: +1-540-387-7595
Fax: +1-540-387-8606
("+" indicates the international access code required when calling from outside of the USA.)

Renewals (spares or those not under warranty) should be ordered by contacting the nearest GE Sales or Service Office. Be sure to include:

- Complete part number and description
- Drive serial number
- Drive Material List (ML) number

Note

All digits are important when ordering or replacing any board.

The factory may substitute later versions of boards based on availability and design enhancements. However, GE Industrial Systems ensures backward compatibility of replacement boards.

How to Replace the Board

Handling Precautions

CAUTION

To prevent component damage caused by static electricity, treat all boards with static sensitive handling techniques.

Printed wiring boards may contain static-sensitive components. Therefore, GE ships all replacement boards in antistatic bags. Use the following guidelines when handling boards:

- Store boards in antistatic bags or boxes.
- Use a grounding strap when handling boards or board components.

Replacement Procedures

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. High Voltage is present on this board (575 V ac or 900 V dc).

CAUTION

To prevent equipment damage, do not remove, insert, or adjust board connections while power is applied to the equipment.

Remove the board from the Innovation Series board rack as follows:

1. Make sure that the drive in which the board resides has been deenergized.
2. Open the drive's cabinet door, and using equipment designed for high voltages, test any electrical circuits **before touching them** to ensure that power is off.
3. Carefully remove the board from the rack, as follows:
   a. Loosen the screws at the top and bottom of the board, near the board ejector tabs. (The screws are captive in the board front and should not be removed.)
   b. Unseat the board by raising the ejector tabs.
   c. Using both hands, gently pull the board from the rack.

Install the new (replacement) board in the rack as follows:

1. Slide the board into the **correct slot** in the rack.

CAUTION

Because Innovation Series boards are designed for specific rack slots, inserting the SCNV board into the wrong slot can damage the electronics.

2. Begin seating the board by firmly pressing the top and bottom of the board at the same time with your thumbs.
3. Finish seating the board in the slot by starting and then tightening the screws at the top and bottom of the board. **Tighten the screws evenly** to ensure that the board is seated squarely.

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