GE Industrial
Control Systems

IGBT Drive Bridge Personality Interface Board
IS200BPIBG_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 Control 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

Functional Description

The IS200BPIB Bridge Personality Interface Board provides the signal conditioning required to interface P1 connector logic level digital control signals to three or six Gate Driver/Shunt Feedback boards and isolated VCO feedback circuits to monitor the dc link, VAB and VBC phase output voltages. The BPIB board also captures faults detected by the Gate Driver boards and reports the fault information. Some faults are processed locally by the board. The main control interface is through the P1 connector. All logic signals to and from the Gate Driver boards are double optocoupled with an isolated 5 V interim supply derived from the 17.7 V ac feed.

Control logic for each phase is implemented in an Electronically Programmable Logic Device (EPLD) for that phase. With the exception of common configuration, clock, and reset functions, these three devices process the following functions independently.

- UP/DOWN driver control.
- Driver soft shutdown on fault
- Fault latching
- Parallel bridge latched fault reporting
- Parallel bridge current feedback VCO output summing

The BPIB board has the capability to control six driver boards in a parallel bridge configuration or three driver boards for a single bridge configuration.

Connections to the phase A, B, and C IGBT driver boards are made through six plug connectors. Phase A, B, and C sensing signals and dc link positive and negative sensing signals are provided via five stab-on terminal connectors. The BPIB board is mounted in a VME type rack. See Table 1 for board specifications and Figure 1 for a block diagram of the board.

Power Supplies

There are six isolated supplies that are derived from the secondaries of three transformers, one per phase. A 17.7 V ac square wave input is supplied to the transformer primaries from the P1 connector. One secondary on each transformer is fullwave rectified and filtered to provide an isolated +7.5 V dc that is linear regulated down to 5 V for the isolated control interfaces. A second secondary is fullwave rectified and filtered to provide the isolated ±12 V required by the voltage feedback VCO circuitry. A light 5 V logic supply is also generated by a 5 V linear regulator on the +12 V supply. Control logic referenced +5 V is supplied to the BPIB board through P1.

Phase IGBT Gate Drive Control

Each phase gate control circuit receives UP/DOWN command signals through P1 and the fault status from the associated gate driver feedback board or boards. The circuit processes these signals and provides the following functions:

- Upper and lower IGBT driver control for one or two driver boards.
- Soft shutdown 2 MHz modulation of the driver ON control signal when a desaturation of that IGBT is detected or when a current imbalance is detected for that phase.
  - Once the soft shutdown sequence has been initiated, the sequence will be completed even if the ON command is removed.
  - All ON commands received after the soft shutdown will be ignored until the fault latch has been cleared.
- Decode and latch the upper/lower desaturation or driver undervoltage fault and to report the fault through the P1 connector.

The DRVPC line should be logic low and 5 V should be applied to the DRVP5 line during normal operation. When a fault is detected, taking the DRVPC line high initiates a high-speed driver disable. Removing 5 V power from the DRVP5 removes the driver interface power.

Table 1. BPIB Board Specifications

Phase to Phase Voltage Feedback VCO	
Range	0–2 MHz
Bias	976.8 kHz
Transfer Function	±1.0 V = ±959.58 hz
Output Offset	±0.15% typical
Gain Error	±0.5% typical, 1.5% maximum
All Drift Errors	±0.0085% per degree C maximum
DC Link Voltage Feedback VCO	
Range	0–2 MHz
Bias	0 kHz
Transfer Function	+1198 V = 2 MHz
Gain Error	±0.5% typical, 1.5% maximum
All Drift Errors	±0.0085% per degree C maximum
IGBT Driver Card Interface	
Driver Output	Isolated Differential 5 V
Fault Inputs	Isolated Differential 5 V
VCO Feedback Inputs	Isolated Differential 5 V, 2 MHz
Interface Supply Output	Isolated 5 V dc, 500 Ma Maximum
Driver Supply Output	Distributed 17.7 V ac, 25 kHz
Power Requirements	
+5 V dc	2.5 Watts Max.
17.7 V ac	**3 Driver boards** 20 W typical, 5 kHz Switching 35 W typical, 10 kHz Switching **6 Driver boards** 35 W typical, 5 kHz Switching 65 W typical, 10 kHz Switching

Note: 17.7 V ac loading will vary dependent on drive switching frequency and the power IGBT gate resistor.

Phase Shunt Current/Fault Feedback

In a single bridge configuration, the phase current VCO feedback is conditioned and passed through the BPIB board directly to the P1 connector. Parallel bridge configurations have two VCO signals per phase that are conditioned, averaged, and then passed through the P1 connector. A digital imbalance detector monitors both current VCO signals per phase. When an imbalance is detected, a desaturation fault is forced and the imbalance fault latches are set.

Typically a 10% imbalance will cause a trip within 88 microseconds and a bridge-to-bridge shoot through will cause a trip in about 8 microseconds.

An ORed overcurrent (OC) or DI/DT shunt fault from the driver board is reported through the P1 connector. A soft shutdown will not be initiated if a shunt fault is detected, and the fault will not be latched in the BPIB board. Shunt fault logic has to be implemented in the board receiving the shunt fault through the P1 connector.

There are two bridge enable lines on the P1 connector. These lines control which bridge shunt VCO signals are passed through to the control. These control lines are used to select one or two bridge configurations or to diagnose individual bridge signals for fault diagnostic information.

Fault Control

The upper and lower gate driver faults are individually latched per phase. When an IGBT is commanded to turn ON, latched faults associated with that driver circuit are annunciated on the appropriate phase P1 fault line. Shunt faults are not latched; they are passed straight through to the P1 connector. In a multiple bridge configuration, the faults for both bridges are ORed together. Bridge #1 faults can be distinguished from bridge #2 faults by observing the fault latches on the P1 fault lines. The fault latches that are set will remain set until the P1 fault reset line is asserted.

V A-B and V B-C Phase-to-Phase Voltage Feedback

Output phase-to-phase voltage is monitored by deriving two VCO signals (VA-B) and (VB-C) from the drive output phase stab-on connections. The two VCO circuits have independent and isolated power supplies. The VCOs have a range of 0–2 MHz and the circuit is biased so that at zero phase-to-phase voltage the nominal output is 976.8 kHz. A ±1.0 V phase-to-phase voltage is converted to a ±959.58 Hz change in the VCO output frequency. The outputs of the VCOs are optically coupled to the control logic.

Vdc Dc Link Voltage Feedback

A third isolated VCO voltage feedback circuit to monitor the DC Link voltage is also provided on the BPIB card. The VCO has a range of 0 - 2 Mhz. The input is scaled so that 0 to 1198 link volts equal 0 to 2 MHz. The output of the VCO is optically coupled to the control logic.

Serial Board Identification

A serial 1024-bit memory device is present on the BPIB board. This memory is programmed with board identification and revision information.

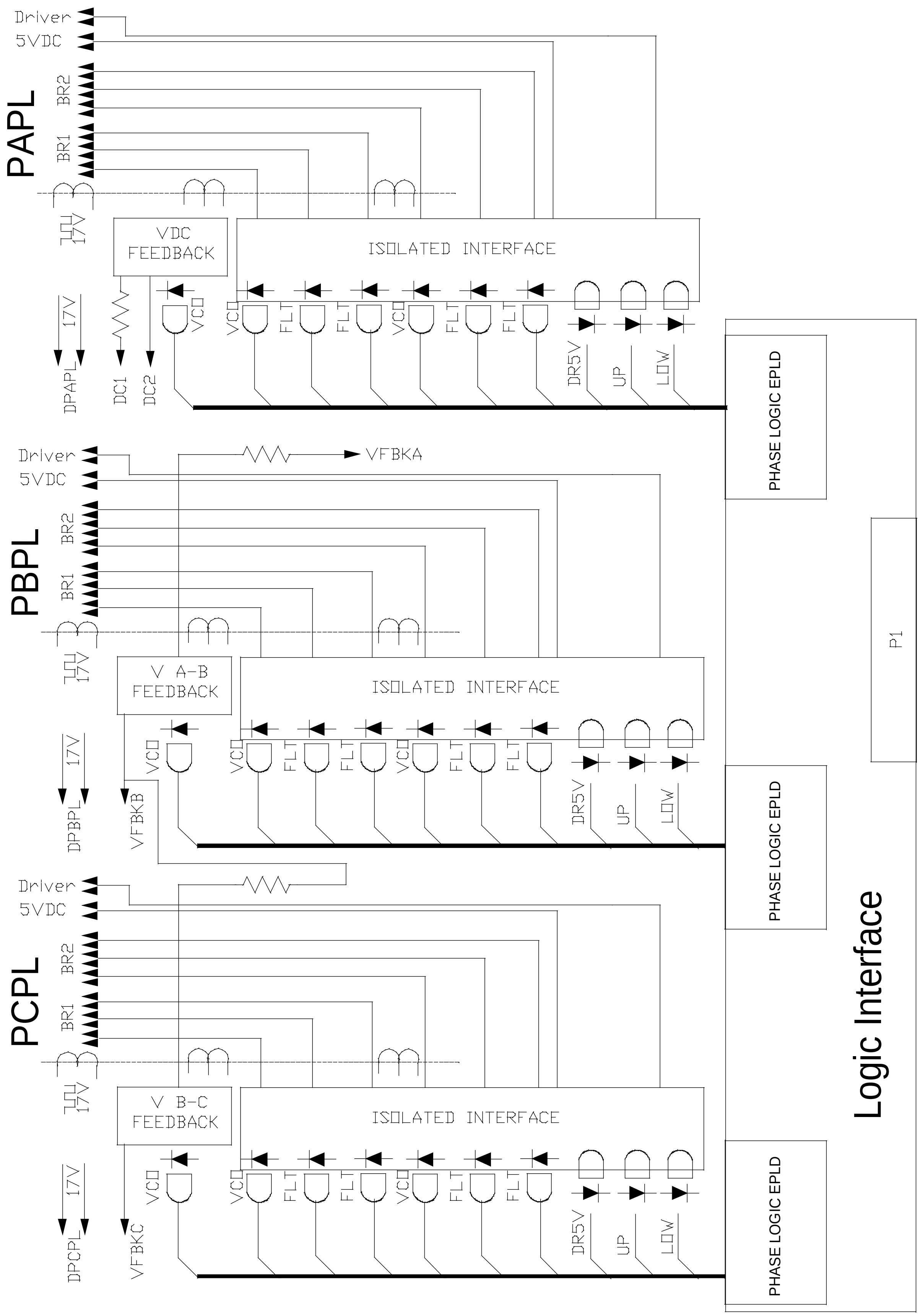

Figure 1. BPIB Board Block Diagram

Application Data

The BPIB board plugs into in a VME type rack via the P1 connector (see Table 2). Connections to the phase A, phase B, and phase C IGBTs are made through six plug connectors included on the board as follows:

- Table 3. PAPL, Phase A Driver Board Interface Connector
- Table 4. PBPL, Phase A Driver Board Interface Connector
- Table 5. PCPL, Phase A Driver Board Interface Connector
- Table 6. DPAPL, DPBPL, and DPCPL, 17.7 V Ac Power Connectors

Phase A, B, and C sensing signals and dc link positive and negative sensing signals are provided via five stab-on terminal connectors. See Table 7.

The BPIB board does not include any adjustable hardware, testpoints, LED indicators, or fuses. See Figure 2 for a board faceplate illustration and Figure 3 for a board layout diagram.

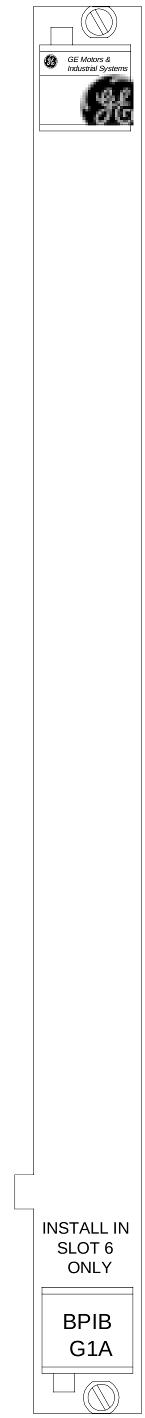

Figure 2. BPIB Board Faceplate

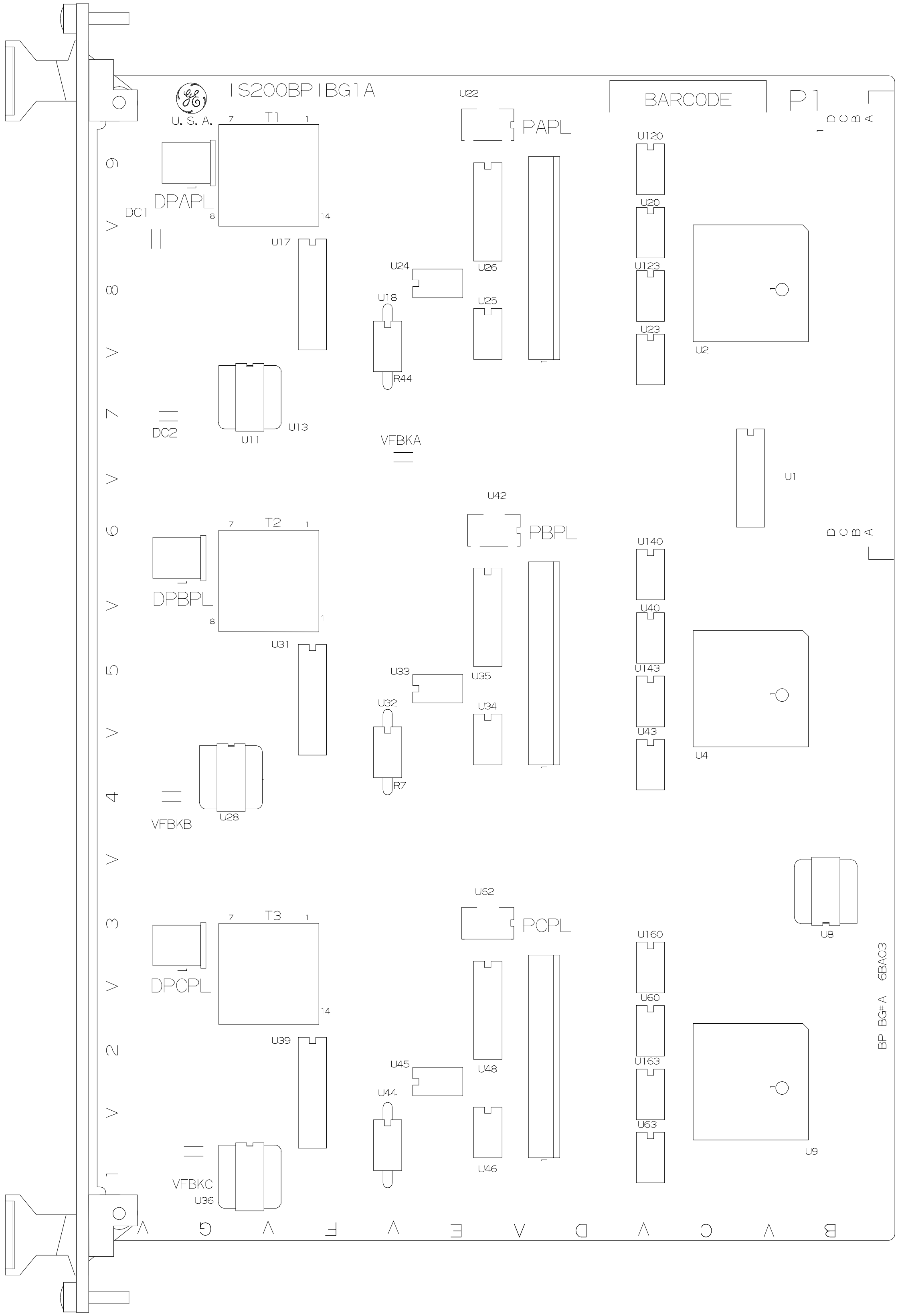

Figure 3. BPIB Board Layout Diagram

Table 2A. P1 Bridge Control Connector

P1 Pin	Nomenclature	Description
A1	NC	No Connect, Voltage Clearance
A2	NC	No Connect, Voltage Clearance
A3	NC	No Connect, Voltage Clearance
A4	NC	No Connect, Voltage Clearance
A5	NC	No Connect
A6	NC	No Connect
A7	NC	No Connect
A8	NC	No Connect
A9	NC	No Connect
A10	NC	No Connect
A11	NC	No Connect
A12	NC	No Connect
A13	NC	No Connect
A14	NC	No Connect
A15	P5	+5 V Supply
A16	P5	+5 V Supply
A17	NC	No Connect
A18	NC	No Connect
A19	NC	No Connect
A20	NC	No Connect
A21	NC	No Connect
A22	NC	No Connect
A23	P5	+5 V Supply
A24	P5	+5 V Supply
A25	NC	No Connect
A26	NC	No Connect
A27	NC	No Connect
A28	NC	No Connect
A29	NC	No Connect
A30	NC	No Connect
A31	P5	+5 V Supply
A32	P5	+5 V Supply

Table 2B. P1 Bridge Control Connector

P1 Pin	Nomenclature	Description
B1	VAC1	17.7 V ac Connection 1
B2	VAC2	17.7 V ac Connection 2
B3	NC	No Connect, Voltage Clearance
B4	NC	No Connect, Voltage Clearance
B5	NC	No Connect, Voltage Clearance
B6	NC	No Connect
B7	NC	No Connect
B8	NC	No Connect
B9	NC	No Connect
B10	NC	No Connect
B11	NC	No Connect
B12	NC	No Connect
B13	BR2EN	Bridge 2 Enable
B14	BR1EN	Bridge 1 Enable
B15	NDRPC	Driver power control; Low = Power ON
B16	DCOM	Digital Common
B17	NFLTRST	Bridge fault reset; Low = Reset (BPIB)
B18	AUF	Phase A Upper Desaturation/UV fault; High = Fault
B19	DCOM	Digital Common
B20	NVDC	Link V dc VCO; 0 – 1198 V dc = 0 – 2 MHz
B21	DCOM	Digital Common
B22	ALF	Phase A Lower Desaturation/UV fault; High = Fault
B23	ASF	Phase A Shunt fault; High = Fault
B24	NAUD	Phase A Upper driver; Low = ON
B25	DCOM	Digital Common
B26	NASFB	IA VCO; 1 MHz ±200 mV = ±800 kHz
B27	DCOM	Digital Common
B28	NALD	Phase A Lower driver; Low = ON
B29	BUF	Phase B Upper Desaturation/UV fault; High = Fault
B30	DCOM	Digital Common
B31	NVAB	VA – VB VCO; 976.8 kHz ±959.58 Hz/1 V
B32	DCOM	Digital Common

Table 2C. P1 Bridge Control Connector

P1 Pin	Nomenclature	Description
C1	VAC1	17.7 V ac Connection 1
C2	VAC2	17.7 V ac Connection 2
C3	NC	No Connect, Voltage Clearance
C4	NC	No Connect, Voltage Clearance
C5	NC	No Connect, Voltage Clearance
C6	NC	No Connect
C7	NC	No Connect
C8	NC	No Connect
C9	NC	No Connect
C10	NC	No Connect
C11	NC	No Connect
C12	NC	No Connect
C13	NC	No Connect
C14	BLF	Phase B Lower Desaturation/UV fault; High = Fault
C15	BSF	Phase B Shunt fault; High = Fault
C16	NBUD	Phase B Upper driver; Low = ON
C17	DCOM	Digital Common
C18	NBSFB	IB VCO; 1 MHz ±200 mV = ±800 kHz
C19	BRDID	Serial Board ID Line
C20	NBLD	Phase B Lower driver; Low = ON
C21	DRVP5	Driver Switched 5 V power output
C22	CUF	Phase C Upper Desaturation/UV fault; High = Fault
C23	DCOM	Digital Common
C24	NVBC	VB – VC VCO; 976.8 kHz ±959.58 Hz/1 V
C25	DCOM	Digital Common
C26	CLF	Phase C Lower Desaturation/UV fault; High = Fault
C27	CSF	Phase C Shunt fault; High = Fault
C28	NCUD	Phase C Upper driver; Low = ON
C29	DCOM	Digital Common
C30	NCSFB	IC VCO; 1 MHz ±200 mV = ±800 Khz
C31	DCOM	Digital Common
C32	NCLD	Phase C Lower driver; Low = ON

Table 2D. P1 Bridge Control Connector

P1 Pin	Nomenclature	Description
D1	NC	No Connect, Voltage Clearance
D2	NC	No Connect, Voltage Clearance
D3	NC	No Connect, Voltage Clearance
D4	NC	No Connect
D5	NC	No Connect
D6	NC	No Connect
D7	NC	No Connect
D8	NC	No Connect
D9	NC	No Connect
D10	NC	No Connect
D11	NC	No Connect
D12	NC	No Connect
D13	NC	No Connect
D14	NC	No Connect
D15	NC	No Connect
D16	NC	No Connect
D17	NC	No Connect
D18	NC	No Connect
D19	NC	No Connect
D20	NC	No Connect
D21	NC	No Connect
D22	NC	No Connect
D23	NC	No Connect
D24	NC	No Connect
D25	NC	No Connect
D26	NC	No Connect
D27	NC	No Connect
D28	NC	No Connect
D29	NC	No Connect
D30	NC	No Connect
D31	NC	No Connect
D32	NC	No Connect

Table 3. PAPL, Phase A Driver Board Interface Connector

Pin	Nomenclature	Description
1	SVA1P	Phase A Shunt VCO BR1 Positive
2	SVA1N	Phase A Shunt VCO BR1 Negative
3	SFA1P	Phase A Shunt Fault BR1 Positive
4	SFA1N	Phase A Shunt Fault BR1 Negative
5	ULA1N	Phase A Upper/Lower Fault BR1 Negative
6	ULA1P	Phase A Upper/Lower Fault BR1 Positive
7	SVA2P	Phase A Shunt VCO BR2 Positive
8	SVA2N	Phase A Shunt VCO BR2 Negative
9	SFA2P	Phase A Shunt Fault BR2 Positive
10	SFA2N	Phase A Shunt Fault BR2 Negative
11	ULA2N	Phase A Upper/Lower Fault BR2 Negative
12	ULA2P	Phase A Upper/Lower Fault BR2 Positive
13	IA5	Phase A Interface +5 V
14	IACOM	Phase A Interface Common (COM)
15	UAD	+5 V for Phase A Upper Drive
16	LAD	+5 V for Phase A Lower Drive

Table 4. PBPL, Phase B Driver Board Interface Connector

Pin	Nomenclature	Description
1	SVB1P	Phase B Shunt VCO BR1 Positive
2	SVB1N	Phase B Shunt VCO BR1 Negative
3	SFB1P	Phase B Shunt Fault BR1 Positive
4	SFB1N	Phase B Shunt Fault BR1 Negative
5	ULB1N	Phase B Upper/Lower Fault BR1 Negative
6	ULB1P	Phase B Upper/Lower Fault BR1 Positive
7	SVB2P	Phase B Shunt VCO BR2 Positive
8	SVB2N	Phase B Shunt VCO BR2 Negative
9	SFB2P	Phase B Shunt Fault BR2 Positive
10	SFB2N	Phase B Shunt Fault BR2 Negative
11	ULB2N	Phase B Upper/Lower Fault BR2 Negative
12	ULB2P	Phase B Upper/Lower Fault BR2 Positive
13	IB5	Phase B Interface +5 V
14	IBCOM	Phase B Interface Common (COM)
15	UBD	+5 V for Phase B Upper Drive
16	LBD	+5 V for Phase B Lower Drive

Table 5. PCPL, Phase C Driver Board Interface Connector

Pin	Nomenclature	Description
1	SVC1P	Phase C Shunt VCO BR1 Positive
2	SVC1N	Phase C Shunt VCO BR1 Negative
3	SFC1P	Phase C Shunt Fault BR1 Positive
4	SFC1N	Phase C Shunt Fault BR1 Negative
5	ULC1N	Phase C Upper/Lower Fault BR1 Negative
6	ULC1P	Phase C Upper/Lower Fault BR1 Positive
7	SVC2P	Phase C Shunt VCO BR2 Positive
8	SVC2N	Phase C Shunt VCO BR2 Negative
9	SFC2P	Phase C Shunt Fault BR2 Positive
10	SFC2N	Phase C Shunt Fault BR2 Negative
11	ULC2N	Phase C Upper/Lower Fault BR2 Negative
12	ULC2P	Phase C Upper/Lower Fault BR2 Positive
13	IC5	Phase C Interface +5 V
14	ICCOM	Phase C Interface Common (COM)
15	UCD	+5 V for Phase C Upper Drive
16	LCD	+5 V for Phase C Lower Drive

Table 6. AAPL, Phase A Upper Amplifier Supply

Pin	Nomenclature	Description
1	ALP15	Phase A Lower +15 V Supply
2	ALN7	Phase A Lower –7.5 V Supply
3	NC	Not Connected
4	NC	Not Connected
5	AUP15	Phase A Upper +15 V Supply
6	AUN7	Phase A Upper –7.5 V Supply

Table 7. DPAPL, DPBPL, and DPCPL 17.7 V Ac Power Connections

Pin	Nomenclature	Description
1	VAC1	Phase Driver Board 17.7 V ac Supply
2	VAC2	Phase Driver Board 17.7 V ac Supply

Table 8. Sensing Line Stab-On Connectors

Nomenclature	Description
VFBKA	Phase A Voltage Sensing Line Output
VFBKB	Phase B Voltage Sensing Line Output
VFBKC	Phase C Voltage Sensing Line Output
DC1	Dc Link Positive Sensing Line Output
DC2	Dc Link Negative Sensing Line Output

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 *BPIB* board is described as the *IGBT Drive Bridge Personality Interface* board.

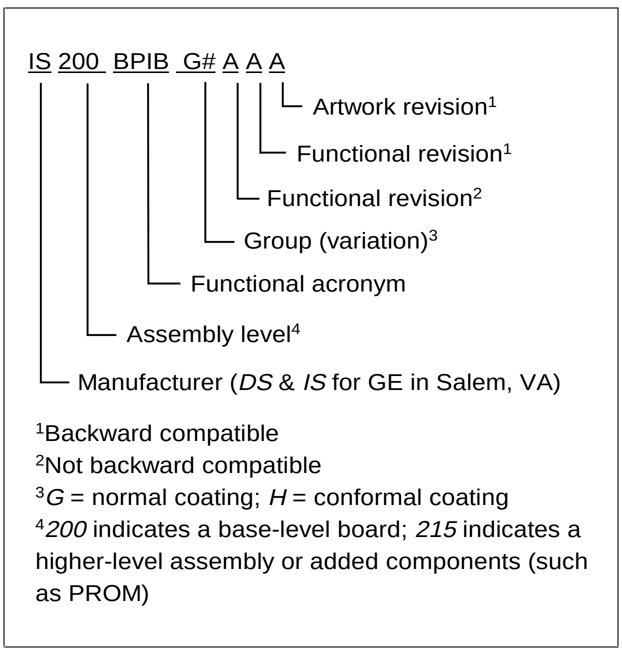

Figure 4. Board Part Number Conventions

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 Control 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 Control 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:

1. Store boards in antistatic bags or boxes.

2. 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.

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 VME rack as follows:

1. Make sure that the drive in which the board resides has been deenergized.

2. Open the drive's cabinet door. Using equipment designed for high voltages, test any electrical circuits **before touching them** to ensure that power is off.

3. Remove the protective cover from the right side of the board rack as follows:

   a. Loosen the four screws in the side of the cover. (It is not necessary to remove these screws because the cover is slotted for removal.)

   b. Loosen the screws at the top and bottom of the cover. (The screws are captive in the cover front and should not be removed.)

   c. Slide the protective cover forward and then to the right to remove it from the side screws.

4. Carefully disconnect all cables from the BPIB board as follows:

- Verify cables are labeled with the correct connector name (as marked on the board) to simplify reconnection.
- For ribbon cables, grasp each side of the cable connector that mates with the board connector and gently pull the cable connector loose.
- For cables with pull tabs, carefully pull the tab.

5. 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 VME bus rack.

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

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

CAUTION

Because VME boards are keyed for specific rack slots, inserting the BPIB 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.

4. Reconnect all cables to BPIA board as labeled and ensure that cables are properly seated at both ends.

5. Reinstall the protective cover on the right side of the board rack as follows:

   a. Place the protective cover over the four side screws, then slide it towards the rear of the rack (in the four slots).

   b. Tighten the screws at the top and bottom of the cover front. (The screws are captive in the cover front.)

   c. Tighten the four screws in the side of the cover.

6. Close the drive cabinet door.

Notes:

GE Industrial
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