GE Industrial Systems

H-Bridge Interface and Control Board
IS200BICHH_A_ _

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 IS200BICH 3-Level H-Bridge Interface and Control Board (BICH), along with an IS200BPIH Bridge Personality Interface Board (BPIH) subassembly, mount in an Innovation Series™ board rack. The IS200DSPX Digital Signal Processor Control Board (DSPX) interfaces to the BICH control logic via a 32-bit data path over the IS200CABP Control Assembly Backplane (CABP). The BPIH board connects into the CABP, communicating to the BICH board through existing signal interfaces.

Most of the BICH board's bridge inputs/outputs (I/O) are routed through the BPIH subassembly to the IS200FOSB Fiber-Optic Interface Board (FOSB) on a per phase basis via three identical cables, assigned to phase A, B, and C signals. There is one connector cable (JM) which goes directly to the FOSB board. The FOSB board multiplexes all phase faults (except instantaneous overcurrent, IOC) into one serial fault stream that the BICH board receives and demultiplexes. The front panels of the BICH board and BPIH subassembly provide high-density shielded connectors for these cables and maintain shield continuity to the board rack chassis (see Figure 1).

The BICH, BPIH, and FOSB boards provide all required gating, protective, feedback interface, and signal processing functions needed to interface the DSPX board to the 3-level H-bridge.

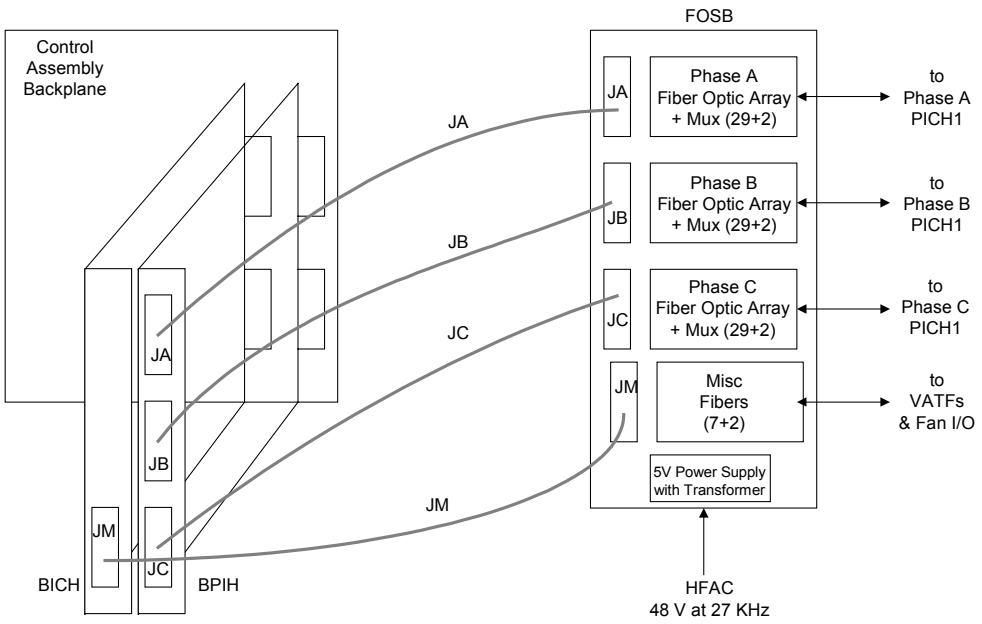


Figure 1. BICH Board, BPIH Subassembly, and FOSB Board Interconnections

The IS200RAPA Rack Power Supply Board (RAPA) generates the required +5 V, ±15 V, and isolated +24 V power for the BICH board and BPIH subassembly. (The BPIH subassembly requires only +5 V power.)

Individual gate driver signals are provided for each switching element with fiber-optic interfaced command and status signals. The required gate driver logic modules for each phase are subassemblies mounted on an IS200PICH Phase Interface and Control Board (PICH). The ac grid voltages are monitored via the IS200VATF Voltage Attenuator Feedback Board (VATF) that generates voltage controlled oscillator (VCO) pulse-trains over a duplex fiber-optic cable to the BICH board.

The BICH board interfaces with 24 gate drivers for the neutral-point clamped (NPC) H-bridge. PWM timing is established by six timers (14 bits), two per phase. Nominal gating rate is 1.5 kHz. The timers are capable of establishing two switching events for each of the three H-bridges during every gating period. The PWM timings are activated by a synchronous pulse issued from the DSPX board. Minimum zero state timing is enforced by the DSPX board gating logic.

The BICH board gating logic supplies a lockout function that will delay switch turn-on by the specified time (switch turn-offs are not delayed). The BICH board gating logic also supplies a minimum state function that forces, on a per phase basis, a bridge state for a minimum amount of time. The purpose of the minimum state function is to guarantee that each IGDH subassembly is commanded ON long enough for the following sequence of events to occur:

For a desaturation fault to build up, be transmitted by the IGDH subassembly mask timer, propagate through the fiber optic transmitter/receiver, pass through the 0.250 microsecond BICH board digital filter, and latch a fault bit on the BICH board.

Temperature Feedback

IGBT cooling plate temperature is monitored by an IS200TFBH IGBT Temperature Feedback Board subassembly (TFBH, mounted on the PICH board) supplied on a per phase basis. The BICH board is configured to accept three fiber-optic signals (via the FOSB and BPIH boards), one per phase. Each TFBH subassembly monitors cooling plate temperature at two locations with thermistors.

Dc Bus Charge Control

A control power transformer (CPT, not part of the BICH board) charger is provided to charge the three dc buses. The CPT charger interfaces to the BICH board via dedicated discrete I/O (one of the eight universal discrete outputs is used for charge contactor control and one of the eight universal discrete inputs is used for charge contactor status).

Current Feedbacks

The four IS205VCXH Feedback Transmitter Board subassemblies (VCHX, mounted on the PICH board) transmit the current feedback signals (shunt interface) from the PICH board via the FOSB and BPIH boards. Signals are transmitted via six duplex fiber-optic cables (two per phase). The signals include a VCO feedback signal and an overcurrent signal (amplitude and rate trips) for each phase. The feedbacks are accumulated on the DSPX board.

Voltage Feedbacks

Bridge ac and dc voltages are monitored via the VATF boards that are mounted within the bridge compartment. Synchronous VCO devices provide voltage feedback pulsetrains that are transmitted to the BICH board by fiber-optic cable via the FOSB and BPIH boards. The voltage feedbacks come from either the VCXH subassemblies or from dedicated VATF boards and are provided for the following signals:

- Two grid l-l voltages (Vab, Vbc)
- Three motor l-n voltages or 2 Motor l-l voltages (optional) (Vab, Vbc)
- Six dc link voltages
- One neutral resistor voltage

Grid Monitoring

Ac grid voltage monitoring for two line-to-line voltages at one transformer secondary is provided via two VCO channels from a VATF board to the BICH board via the FOSB and BPIH boards. No input currents are monitored.

Diagnostic I/O

Three frequency-to-voltage converters (FVCs) are provided for scope viewing of analog power signals without requiring access to the medium voltage enclosure. The bandwidth of these diagnostic signals is 10–15 kHz.

Digital-to-analog (D/A) converters are supplied for dedicated diagnostic output channels and can be written to from the control software. A software generated trigger signal is also available in addition to load pulses generated. Diagnostic I/O testpoints are available on the BICH board faceplate (see Table 1 for descriptions).

Protective Functions

Bridge protective functions are incorporated on the BICH board. The DSPX board is capable of accessing all status bits. A VATF board monitors the voltage across the dc neutral grounding resistor. The DSPX board software monitors this input and takes the appropriate action for ground fault protection. One of the discrete inputs to the BICH board is dedicated to monitoring a series contact string for blown fuse interlocks. An interposing relay is supplied off-board to directly interface to the fuse interlocks. This prevents high voltage from inadvertently reaching the BICH board in the event of a flashover or fuse rupture. The interposing relay is powered from 115 V ac. The DSPX board software monitors this input and takes appropriate action

The RAPA board supplies 5 V power for monitoring and power-up reset functions. The DSPX board provides a gate disable signal if it detects an invalid supply. The BICH board monitors for valid voltages on the remaining analog supplies. Invalid voltages directly disable the gating signals.

Secure Gate Shutdown

The BICH board EPLD carries out all shutdown activity. Shutdown inputs are reported to the DSPX board.

Note

The FOSB board has a redundant shutdown circuit as a safeguard in case communication from the BICH board is lost.

Fault Classification, Reset, & Enables

The BICH board classifies faults into two classes, bridge faults and BICH board faults. Bridge faults (such as overcurrent) initiate a 10 microsecond soft-shutdown sequence, slowly turning off any conducting IGBTs thereby reducing device voltage stresses. BICH board faults initiate an immediate turnoff of all IGBTs via a two-stage shutdown process.

- **Bridge faults that will cause a soft-shutdown include:** phase IOC, phase di/dt, phase A,B,C gate faults, local & sysfault e-stop inputs (maskable), isolated 24 V UV, dc overvoltage and software generated DCOV.
- **BICH board faults that will cause an immediate shutdown include:** BICH power supply UV and clock faults.

Overvoltage Trips

Hardware overvoltage comparators are provided (one for each dc bus half) on the four VCXH board subassemblies. The hardware overvoltage signal (DCOV) is transmitted back to the BICH board by fiber-optic signal from the PICH board via the FOSB and BPIH boards. A PICH board power supply undervoltage signal (PSUV) is also be transmitted via the same fiber-optic path. Absence of transmitted light is interpreted as a DCOV fault.

Hardware Current Limit

The hardware current limit is the only signal not in the serial fault stream from the FOSB board. It is transmitted separately via the FOSB and BPIH boards. This hardware current limit function is supplied to enable the converter to drive into a relatively low impedance load without tripping. A BICH board logic bit enables the current limit mode. The VCXH subassembly hardware overcurrent comparators activate the current limit events on the BICH board. Activation of the hardware current limit is latched by the BICH board and reported back to the DSPX board. The hardware current limit does not fault the drive. The control software maintains a current limit activation count and takes appropriate control action to either reduce current or disable gating.

Application Data

The BICH board has no adjustable hardware. The board has 29 testpoints and 18 LED indicators for signal observation. The BICH board also has one plug connector (JM) and two backplane connectors (P1 and P2). Two fuses, FU1 and FU2 are included on the inputs to the local (FU1) and system (FU2) fault strings. These are 250 V, 200 mA replaceable fuses, part #44A725207-004. See Figure 2 for the locations of these components and the following tables for descriptions:

Table	Description
1	Testpoints
2	LED indicators
3	Plug connector JM
4	Backplane connector P1
5	Backplane connector P2

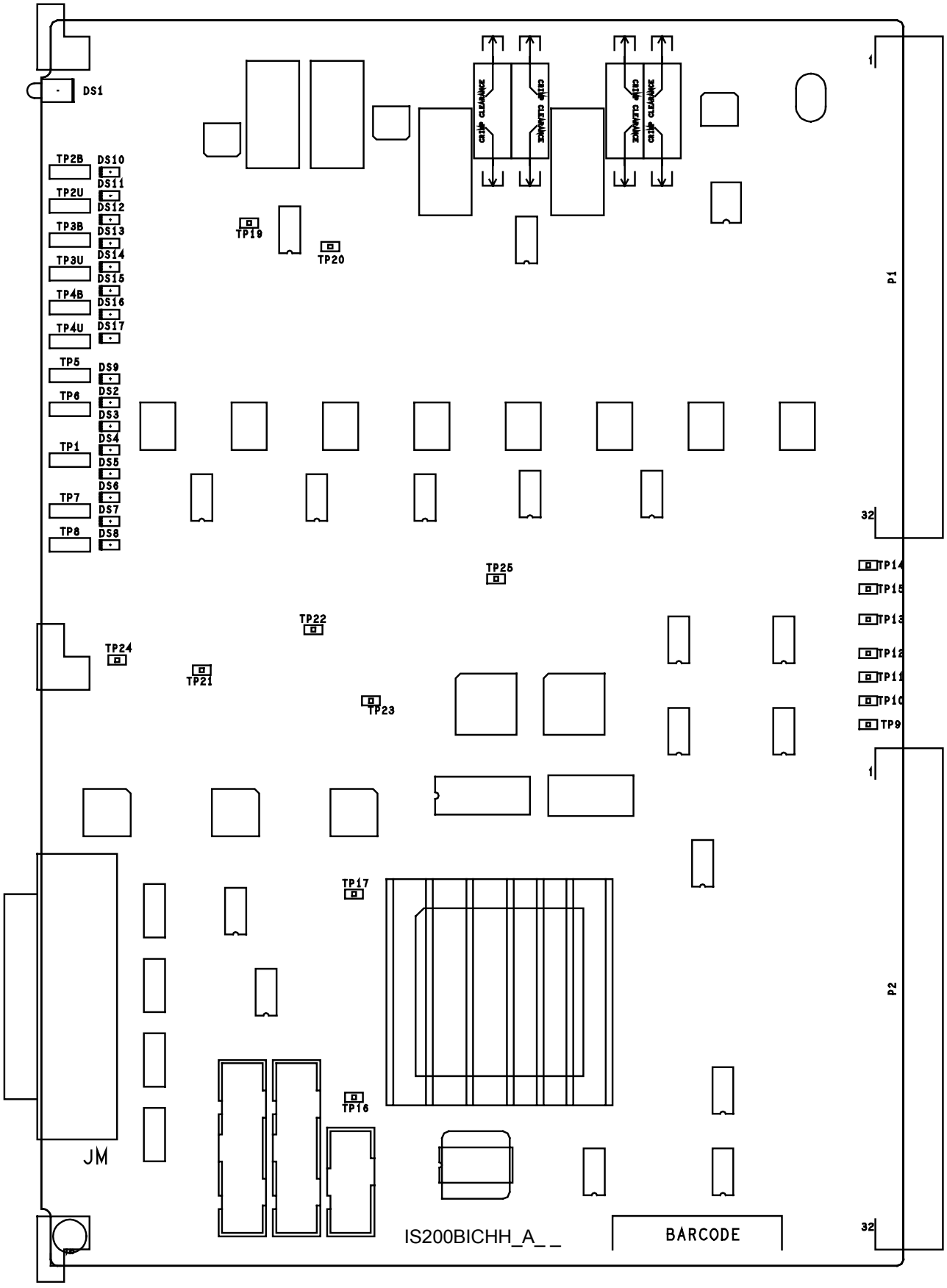


Figure 2. BICH Board Layout Diagram

Table 1. BICH Board Testpoints, Faceplate and Board Mounted

Testpoint	Nomenclature	Location	Description
TP1	ACOM	Faceplate	Analog common
TP2U*	FVT1U	Faceplate	Frequency to voltage converter output #1 (unipolar, + only)
TP2B*	FVT1B	Faceplate	Frequency to voltage converter output #1 (bipolar, ±)
TP3U*	FVT2U	Faceplate	Frequency to voltage converter output #2 (unipolar, + only)
TP3B*	FVT2B	Faceplate	Frequency to voltage converter output #2 (bipolar, ±)
TP4U*	FVT3U	Faceplate	Frequency to voltage converter output #3 (unipolar, + only)
TP4B*	FVT3B	Faceplate	Frequency to voltage converter output #3 (bipolar, ±)
TP5*	DA1	Faceplate	Digital to analog converter #1 output
TP6*	DA2	Faceplate	Digital to analog converter #2 output
TP7*	TRG	Faceplate	Trigger signal
TP8	DCOM	Faceplate	Digital common
TP9	P5	Board	Positive 5 V dc
TP10	DCOM	Board	Digital common
TP11	P15	Board	Positive 15 V dc
TP12	N15	Board	Negative 15 V dc
TP13	ACOM	Board	Analog common
TP14	I24	Board	Isolated 24 V dc
TP15	I24_RTN	Board	Isolated 24 V dc return
TP16	OSTATUS	Board	For engineering use only
TP17	CONF_DONE	Board	For engineering use only
TP18	IMOK	Board	For engineering use only
TP19	0MAC	Board	For engineering use only
TP20	0MBC	Board	For engineering use only
TP21	N5REF	Board	For engineering use only
TP22	P2REF	Board	For engineering use only
TP23	TPWB	Board	For engineering use only
TP24	P5REF	Board	For engineering use only
TP25	BIC_PSOK	Board	For engineering use only
TP26	TAMB	Board	For engineering use only

*These testpoints are controlled within the software.

Table 2. BICH Board LED Indicators

LED	Nomenclature	Color	Description (LED is On when circuit is active)
DS1	IMOK	Green	BICH board operating status is OK
DS2	DO2	Yellow	Solid state relay output 2; 28 V dc, 0.7 A
DS3	DO3	Yellow	Solid state relay output 3; 28 V dc, 0.7 A
DS4	DO4	Yellow	Solid state relay output 4; 28 V dc, 0.7 A
DS5	DO5	Yellow	Solid state relay output 5; 28 V dc, 0.7 A
DS6	DO6	Yellow	Solid state relay output 6; 28 V dc, 0.7 A
DS7	DO7	Yellow	Solid state relay output 7; 28 V dc, 0.7 A
DS8	DO8	Yellow	Solid state relay output 8; 28 V dc, 0.7 A
DS9	DO1	Yellow	Solid state relay output 1; 28 V dc, 0.7 A
DS10	DI1	Yellow	Discrete input 1, 0 – 30 V dc
DS11	DI2	Yellow	Discrete input 2, 0 – 30 V dc
SD12	DI3	Yellow	Discrete input 3, 0 – 30 V dc
DS13	DI4	Yellow	Discrete input 4, 0 – 30 V dc
DS14	DI5	Yellow	Discrete input 5, 0 – 30 V dc
DS15	DI6	Yellow	Discrete input 6, 0 – 30 V dc
DS16	DI7	Yellow	Discrete input 7, 0 – 30 V dc
DS17	DI8	Yellow	Discrete input 8, 0 – 30 V dc
DS18	CONF_DONE	Yellow	EPLD configuration done

Table 3. BICH Board Connector JM Pin Signal Descriptions*

Pin No.	Nomenclature	Description
1	FLT1N	Extra fault line 1 (RS422 negative)
2	FLT1P	Extra fault line 1 (RS422 positive)
3	M_UCAN	Motor VBA line-to-line voltage VCO feedback (RS422 negative)
4	M_UCAP	Motor VBA line-to-line voltage VCO feedback (RS422 positive)
5	M_UBAN	Motor VCA line-to-line voltage VCO feedback (RS422 negative)
6	M_UBAP	Motor VCA line-to-line voltage VCO feedback (RS422 positive)
7	S_UCAN	Source VBA line-to-line voltage VCO feedback (RS422 negative)
8	S_UCAP	Source VBA line-to-line voltage VCO feedback (RS422 positive)
9	S_UBAN	Source VCA line-to-line voltage VCO feedback (RS422 negative)
10	S_UBAP	Source VCA line-to-line voltage VCO feedback (RS422 positive)
11	UMIDN	Midpoint voltage VCO feedback (RS422 negative)
12	UMIDP	Midpoint voltage VCO feedback (RS422 positive)

*If this cable is swapped with JA, JB, or JC of BPIH board, then gating will be disabled via pin arrangements.

Table 3. BICH Board Connector JM Pin Signal Descriptions (continued)*

Pin No.	Nomenclature	Description
13	FANSN	Fan status line (RS422 negative)
14	FANSP	Fan status line (RS422 positive)
15	DCOM	Digital Common
16	GDISABLEN	Gate drive disable (RS422 negative)
17	GDISABLEP	Gate drive disable (RS422 positive)
18	OBR_FLTN	Bridge fault signal for FOSB board EPLDs to allow soft shutdown (active low, RS422 negative)
19	OBR_FLTP	Bridge fault signal for FOSB board EPLDs to allow soft shutdown (active low, RS422 positive)
20	BRD_ID	Board identification line
21	OJM_CHK1	JM cable fault line 1
22	OJM_CHK2	JM cable fault line 2
23	DCOM	Digital Common
24	OFLT_RSTN	Fault reset signal (reset = low, RS422 negative)
25	OFLT_RSTP	Fault reset signal (reset = low, RS422 positive)
26, 27	N/C	Not Connected
28	FANTXN	Fan speed control (RS422 negative)
29	FANTXP	Fan speed control (RS422 positive)
30	0RLYS	Gate drive power supply relay status (low = ON)
31 – 34	N/C	Not Connected
35, 36	DCOM	Digital Common
37	DRV_P5	Gate drive positive 5 V dc
38	DCOM	Digital Common
39	PWROKN	Voltage isolation OK from CPFP board (RS422 negative)
40	PWROKP	Voltage isolation OK from CPFP board (RS422 positive)
41	TESTN	Spare transmitter (RS422 negative)
42	TESTP	Spare transmitter (RS422 positive)
43, 44	N/C	Not Connected
45, 46	CHASSIS	Screw terminal connection to chassis ground

*If this cable is swapped with JA, JB, or JC of BPIH board, then gating will be disabled via pin arrangements.

Table 4. BICH Board Backplane Connector P1 Pin Signal Descriptions (128 pins - 4x32)

Pin No.	Nomenclature	Description
A1	CONA_NO	A contactor pilot NO contact to J1, J6 (ATBA board)
A2	N/C	Not Connected (voltage clearance)
A3	CONA_NC	A contactor pilot NC contact to J1, J6 (ATBA board)
A4	N/C	Not Connected (voltage clearance)
A5	CONA_C	A contactor pilot COM contact to J1, J6 (ATBA board)
A6	N/C	Not Connected (voltage clearance)
A7	CONB_C	B contactor pilot COM contact to J1, J6 (ATBA board)
A8	N/C	Not Connected (voltage clearance)
A9	CONB_NO	B contactor pilot NO contact to J1
A10	N/C	Not Connected (voltage clearance)
A11	DI1N	Digital input #1 negative to J4A (CTBC board)
A12	DI3P	Digital input #3 positive to J4A (CTBC board)
A13	DI4N	Digital input #4 negative to J4A (CTBC board)
A14	DI5N	Digital input #5 negative to J4A (CTBC board)
A15	P5	Positive 5 V power supply to J14 (RAP_ board)
A16	P5	Positive 5 V power supply to J14 (RAP_ board)
A17	DI6P	Digital input #6 positive to J4A (CTBC board)
A18	OAG_1N	Phase A, neutral IGBT #1 gate drive output to J16 (BPIH board P1, low = ON)
A19	OAG_2N	Phase A, neutral IGBT #2 gate drive output to J16 (BPIH board P1, low = ON)
A20	OAG_3N	Phase A, neutral IGBT #3 gate drive output to J16 (BPIH board P1, low = ON)
A21	OAG_4N	Phase A, neutral IGBT #4 gate drive output to J16 (BPIH board P1, low = ON)
A22	DO1P	Digital output #1 positive to J4A (CTBC board)
A23, A24	P5	Positive 5 V power supply to J14 (RAP_ board)
A25	DO3P	Digital output #3 positive to J4A (CTBC board)
A26	DO4P	Digital output #4 positive to J4A (CTBC board)
A27	DO5P	Digital output #5 positive to J4A (CTBC board)
A28	DO6P	Digital output #6 positive to J4A (CTBC board)
A29	DO6N	Digital output #6 negative to J4A (CTBC board)
A30	DO7P	Digital output #7 positive to J4A (CTBC board)
A31, A32	P5	Positive 5 V power supply to J14 (RAP_ board)

Table 4. BICH Board Backplane Connector P1 Pin Signal Descriptions (128 pins - 4x32) (continued)

Pin No.	Nomenclature	Description
B1	N/C	Not Connected (voltage clearance)
B2	MASENP	A contactor sense positive 24-115 V ac/dc input to J1, J6 (ATBA board)
B3	N/C	Not Connected (voltage clearance)
B4	MASENN	A contactor sense negative 24-115 V ac/dc input to J1, J6 (ATBA board)
B5	N/C	Not Connected (voltage clearance)
B6	LCL115	Local panel fault string 115 V ac/dc input to J6 (ATBA board)
B7	N/C	Not Connected (voltage clearance)
B8	LCL24	Local panel fault string 24 V ac/dc input to J6 (ATBA board)
B9	N/C	Not Connected (voltage clearance)
B10	OAG_1M	Phase A, motor IGBT #1 gate drive output to J16 (BPIH board P1, low = ON)
B11	DI2P	Digital input #2 positive to J4A (CTBC board)
B12	DI3N	Digital input #3 negative to J4A (CTBC board)
B13	OAG_2M	Phase A, motor IGBT #2 gate drive output to J16 (BPIH board P1, low = ON)
B14	OAG_3M	Phase A, motor IGBT #3 gate drive output to J16 (BPIH board P1, low = ON)
B15	OAG_4M	Phase A, motor IGBT #4 gate drive output to J16 (BPIH board P1, low = ON)
B16	DCOM	Digital common to J14 (RAP_ board)
B17	OAG_DB1	Phase A, DB IGBT #1 gate drive output to J16 (BPIH board P1, low = ON)
B18	OAG_DB2	Phase A, DB IGBT #2 gate drive output to J16 (BPIH board P1, low = ON)
B19	DCOM	Digital common to J14 (RAP_ board)
B20	AFLT	Phase A faults, serial data, 11 faults multiplexed to J16 (BPIH board P1)
B21	DCOM	Digital common to J14 (RAP_ board)
B22	OBG_1M	Phase B, motor IGBT #1 gate drive output to J16 (BPIH board P1, low = ON)
B23	OBG_2M	Phase B, motor IGBT #2 gate drive output to J16 (BPIH board P1, low = ON)
B24	OBG_3M	Phase B, motor IGBT #3 gate drive output to J16 (BPIH board P1, low = ON)
B25	DCOM	Digital common to J14 (RAP_ board)
B26	OBG_4M	Phase B, motor IGBT #4 gate drive output to J16 (BPIH board P1, low = ON)
B27	DCOM	Digital common to J14 (RAP_ board)
B28	OBG_DB1	Phase B, DB IGBT #1 gate drive output to J16 (BPIH board P1, low = ON)
B29	OBG_DB2	Phase B, DB IGBT #2 gate drive output to J16 (BPIH board P1, low = ON)
B30	DCOM	Digital common to J14 (RAP_ board)
B31	BFLT	Phase B faults, serial data, 11 faults multiplexed to J16 (BPIH board P1)
B32	DCOM	Digital common to J14 (RAP_ board)

Table 4. BICH Board Backplane Connector P1 Pin Signal Descriptions (128 pins - 4x32) (continued)

Pin No.	Nomenclature	Description
C1	SYS115	System fault string 115 V ac/dc input to J6 (ATBA board)
C2	N/C	Not Connected (voltage clearance)
C3	SYS24	System fault string 24 V ac/dc input to J6 (ATBA board)
C4	N/C	Not Connected (voltage clearance)
C5	SYS_COM	System fault string common 24–115 V ac/dc input to J6 (ATBA board)
C6	N/C	Not Connected (voltage clearance)
C7	ADCN	Phase A negative dc bus voltage VCO feedback to J16 (BPIH board P1)
C8	N/C	Not Connected (voltage clearance)
C9	DI1P	Digital input #1 positive to J4A (CTBC board)
C10	ADCP	Phase A positive dc bus voltage VCO feedback to J16 (BPIH board P1)
C11	DI2N	Digital input #2 negative to J4A (CTBC board)
C12	DI4P	Digital input #4 positive to J4A (CTBC board)
C13	DI5P	Digital input #5 positive to J4A (CTBC board)
C14	AVFB	Phase A motor voltage VCO feedback to J16 (BPIH board P1)
C15	AIFB	Phase A motor current VCO feedback to J16 (BPIH board P1)
C16	ADBRV	Phase A DB resistor voltage VCO feedback to J16 (BPIH board P1)
C17	DCOM	Digital common to J14 (RAP_ board)
C18	ATFB	Phase A temperature VCO feedback to J16 (BPIH board P1)
C19	DI6N	Digital input #6 negative to J4A (CTBC board)
C20	ADBTRIP	Phase A DB trip to J16 (BPIH board P1, high = DB ON)
C21	AIFBS	Phase A current fault to J16 (BPIH board P1, high = fault)
C22	BDCN	Phase B negative dc bus voltage VCO feedback to J16 (BPIH board P1)
C23	DO1N	Digital output #1 negative to J4A (CTBC board)
C24	BDCP	Phase B positive dc bus voltage VCO feedback to J16 (BPIH board P1)
C25	DCOM	Digital common to J14 (RAP_ board)
C26	BVFB	Phase B motor voltage VCO feedback to J16 (BPIH board P1)
C27	BIFB	Phase B motor current VCO feedback to J16 (BPIH board P1)
C28	BDBRV	Phase B DB resistor voltage VCO feedback to J16 (BPIH board P1)
C29	DCOM	Digital common to J14 (RAP_ board)
C30	BTFB	Phase B temperature VCO feedback to J16 (BPIH board P1)
C31	DCOM	Digital common to J14 (RAP_ board)
C32	BDBTRIP	Phase B DB trip to J16 (BPIH board P1, high = DB ON)

Table 4. BICH Board Backplane Connector P1 Pin Signal Descriptions (128 pins - 4x32) (continued)

Pin No.	Nomenclature	Description
D1	N/C	Not Connected (voltage clearance)
D2	LKPL	Local panel fault string common to J2 (connected to LCL COM on J6 of ATBA board when interlock closed)
D3 – D7	N/C	Not Connected
D8	ACOM	Analog common to J4
D9	N/C	Not Connected
D10	ACOM	Analog common to J4
D11, D12	N/C	Not Connected
D13	TAMB_1	Ambient RTD temperature sensor input 1 to J4
D14	TAMB_2	Ambient RTD temperature sensor input 2 to J4
D15	ARX1	Phase A spare receiver to J16 (BPIH board P1)
D16	ATX1	Phase A spare transmitter to J16 (BPIH board P1)
D17	OJA_OK	Phase A FOSB board to BPIH board cable detector to J16 (BPIH board P1, low = OK)
D18	N/C	Not Connected
D19	DI7P	Digital input #7 positive to J4A (CTBC board)
D20	DI7N	Digital input #7 negative to J4A (CTBC board)
D21	DI8P	Digital input #8 positive to J4A (CTBC board)
D22	DI8N	Digital input #8 negative to J4A (CTBC board)
D23	DO2P	Digital output #2 positive to J4A (CTBC board)
D24	DO2N	Digital output #2 negative to J4A (CTBC board)
D25	DO3N	Digital output #3 negative to J4A (CTBC board)
D26	DO4N	Digital output #4 negative to J4A (CTBC board)
D27	DO5N	Digital output #5 negative to J4A (CTBC board)
D28	I24	Isolated 24 V dc to J4A (CTBC board), J6, J7 (ATBA board)
D29	I24_RTN	Isolated 24 V dc common to J4A (CTBC board), J6, J7 (ATBA board)
D30	DO7N	Digital output #7 negative to J4A (CTBC board)
D31	DO8P	Digital output #8 positive to J4A (CTBC board)
D32	DO8N	Digital output #8 negative to J4A (CTBC board)

Table 5. BICH Board Backplane Connector P2 Pin Signal Descriptions (128 pins - 4x32)

Pin No.	Nomenclature	Description
A1	P5	Positive 5 V power supply to J14 (RAP_ board)
A2	D0	Data line 0 to J18 (DSPX board)
A3	D4	Data line 4 to J18 (DSPX board)
A4	DCOM	Digital common to J14 (RAP_ board)
A5	D8	Data line 8 to J18 (DSPX board)
A6	D12	Data line 12 to J18 (DSPX board)
A7	D16	Data line 16 to J18 (DSPX board)
A8	D20	Data line 20 to J18 (DSPX board)
A9	D24	Data line 24 to J18 (DSPX board)
A10	D28	Data line 28 to J18 (DSPX board)
A11	A0	Address line 0 to J18 (DSPX board)
A12	DCOM	Digital common to J14 (RAP_ board)
A13	A4	Address line 4 to J18 (DSPX board)
A14, A15	N/C	Not Connected
A16	OCS_BIC	BIC_ chip/board select to J18 (DSPX board)
A17	OBG_1N	Phase B, neutral IGBT #1 gate drive output to J21 (BPIH board P2, low = ON)
A18	OBG_2N	Phase B, neutral IGBT #2 gate drive output to J21 (BPIH board P2, low = ON)
A19	OBG_3N	Phase B, neutral IGBT #3 gate drive output to J21 (BPIH board P2, low = ON)
A20	DCOM	Digital common to J14 (RAP_ board)
A21	OBUS_RST	Hard reset – system reset trigger to J18 (DSPX board)
A22	P15	Positive 15 V power supply to J14 (RAP_ board)
A23	OCG_1N	Phase C, neutral IGBT #1 gate drive output to J21 (BPIH board P2, low = ON)
A24	OCG_2N	Phase C, neutral IGBT #2 gate drive output to J21 (BPIH board P2, low = ON)
A25	OCG_3N	Phase C, neutral IGBT #3 gate drive output to J21 (BPIH board P2, low = ON)
A26	IA_VCO1	Phase A motor current feedback to J18 (DSPX board)
A27	VDB2_VCO5	Phase B DB resistor voltage feedback to J18 (DSPX board)
A28	DCOM	Digital common to J14 (RAP_ board)
A29	OCG_4N	Phase C, neutral IGBT #4 gate drive output to J21 (BPIH board P2, low = ON)
A30	CFLT	Phase C faults, serial data, 11 faults multiplexed to J21 (BPIH board P2)
A31	CHASSIS	Chassis connection passed from BPIH board J21 (BPIH board P2)
A32	P5	Positive 5 V power supply to J14 (RAP_ board)

Table 5. BICH Board Backplane Connector P2 Pin Signal Descriptions (128 pins - 4x32) (continued)

Pin No.	Nomenclature	Description
B1	P5	Positive 5 V power supply to J14 (RAP_ board)
B2	D1	Data line 1 to J18 (DSPX board)
B3	D5	Data line 5 to J18 (DSPX board)
B4	D9	Data line 9 to J18 (DSPX board)
B5	D13	Data line 13 to J18 (DSPX board)
B6	D17	Data line 17 to J18 (DSPX board)
B7	D21	Data line 21 to J18 (DSPX board)
B8	DCOM	Digital common to J14 (RAP_ board)
B9	D25	Data line 25 to J18 (DSPX board)
B10	D29	Data line 29 to J18 (DSPX board)
B11	A1	Address line 1 to J18 (DSPX board)
B12	A5	Address line 5 to J18 (DSPX board)
B13	N/C	Not Connected
B14	DCOM	Digital common to J14 (RAP_ board)
B15	N/C	Not Connected
B16	OBG_4N	Phase B, neutral IGBT #4 gate drive output to J21 (BPIH board P2, low = ON)
B17	CLK_CPU	CPU clock from DSPX board = ½ CLKIN to CPU (J18, DSPX board)
B18	DCOM	Digital common to J14 (RAP_ board)
B19	CLKT0	Clock defining PWM scheduling interval to J18 (DSPX board)
B20	CLKT1	Clock defining task 1 sample interval to J18 (DSPX board)
B21	ACOM	Analog common to J14 (RAP_ board)
B22	OCG_1M	Phase C, motor IGBT #1 gate drive output to J21 (BPIH board P2, low = ON)
B23	OCG_2M	Phase C, motor IGBT #2 gate drive output to J21 (BPIH board P2, low = ON)
B24	DCOM	Digital common to J14 (RAP_ board)
B25	CLK0	Clock representing the maximum resolution adjustable clock to J18 (DSPX board)
B26	IB_VCO2	Phase B motor current feedback to J18 (DSPX board)
B27	VDB3_VCO6	Phase C DB resistor voltage feedback to J18 (DSPX board)
B28	OCG_3M	Phase C, motor IGBT #3 gate drive output to J21 (BPIH board P2, low = ON)
B29	OCG_4M	Phase C, motor IGBT #4 gate drive output to J21 (BPIH board P2, low = ON)
B30	OCG_DB1	Phase C, DB IGBT #1 gate drive output to J21 (BPIH board P2, low = ON)
B31	OCG_DB2	Phase C, DB IGBT #2 gate drive output to J21 (BPIH board P2, low = ON)
B32	P5	Positive 5 V power supply to J14 (RAP_ board)

Table 5. BICH Board Backplane Connector P2 Pin Signal Descriptions (128 pins - 4x32) (continued)

Pin No.	Nomenclature	Description
C1	P5	Positive 5 V power supply to J14 (RAP_ board)
C2	D2	Data line 2 to J18 (DSPX board)
C3	D6	Data line 6 to J18 (DSPX board)
C4	D10	Data line 10 to J18 (DSPX board)
C5	D14	Data line 14 to J18 (DSPX board)
C6	D18	Data line 18 to J18 (DSPX board)
C7	D22	Data line 22 to J18 (DSPX board)
C8	DCOM	Digital common to J14 (RAP_ board)
C9	D26	Data line 26 to J18 (DSPX board)
C10	D30	Data line 30 to J18 (DSPX board)
C11	A2	Address line 2 to J18 (DSPX board)
C12	A6	Address line 6 to J18 (DSPX board)
C13	N/C	Not Connected
C14	DCOM	Digital common to J14 (RAP_ board)
C15	OBUS_RD	Bus read strobe to J18 (DSPX board)
C16	INT_BIC	BIC_ interrupt to DSPX J18 (DSPX board)
C17	BIFBS	Phase B current fault to J21 (BPIH board P2, high = fault)
C18	DCOM	Digital common to J14 (RAP_ board)
C19	CLKT2	Clock defining task 2 sample interval to J18 (DSPX board)
C20	OJB_OK	Phase B FOSB board to BPIH board cable detector to J21 (BPIH board P2, 0 = OK)
C21	ACOM	Analog common to J14 (RAP_ board)
C22	N/C	Not Connected
C23	CDCN	Phase C negative dc bus voltage VCO feedback to J21 (BPIH board P2)
C24	DCOM	Digital common to J14 (RAP_ board)
C25	CDCP	Phase C positive dc bus voltage VCO feedback to J21 (BPIH board P2)
C26	IC_VCO3	Phase C motor current feedback to J18 (DSPX board)
C27	CVFB	Phase C motor voltage VCO feedback to J21 (BPIH board P2)
C28	CIFB	Phase C motor current VCO feedback to J21 (BPIH board P2)
C29	CDBRV	Phase C DB resistor voltage VCO feedback to J21 (BPIH board P2)
C30	CTFB	Phase C temperature VCO feedback to J21 (BPIH board P2)
C31	CDBTRIP	Phase C DB trip to J21 (BPIH board P2, high = DB ON)
C32	P5	Positive 5 V power supply to J14 (RAP_ board)

Table 5. BICH Board Backplane Connector P2 Pin Signal Descriptions (128 pins - 4x32) (continued)

Pin No.	Nomenclature	Description
D1	P5	Positive 5 V power supply to J14 (RAP_ board)
D2	D3	Data line 3 to J18 (DSPX board)
D3	D7	Data line 7 to J18 (DSPX board)
D4	DCOM	Digital common to J14 (RAP_ board)
D5	D11	Data line 11 to J18 (DSPX board)
D6	D15	Data line 15 to J18 (DSPX board)
D7	D19	Data line 19 to J18 (DSPX board)
D8	D23	Data line 23 to J18 (DSPX board)
D9	D27	Data line 27 to J18 (DSPX board)
D10	D31	Data line 31 to J18 (DSPX board)
D11	A3	Address line 3 to J18 (DSPX board)
D12	DCOM	Digital common to J14 (RAP_ board)
D13, D14	N/C	Not Connected
D15	OBUS_WRI	Bus write strobe to J18 (DSPX board)
D16	OBUSY	Ready/busy handshake output to J18 (DSPX board)
D17	BRXI	Phase B spare receiver to J21 (BPIH board P2)
D18	BTXI	Phase B spare transmitter to J21 (BPIH board P2)
D19	BRD_ID	Board identification serial I/O line to J18 (DSPX board)
D20	DCOM	Digital common to J14 (RAP_ board)
D21	BIC_DABL	BIC_ disable that tells BIC_ board to turn off during powerup to J18 (DSPX board)
D22	N15	Negative 15 V power supply to J14 (RAP_ board)
D23	CRX1	Phase C spare receiver to J21 (BPIH board P2)
D24	CTX1	Phase C spare transmitter to J21 (BPIH board P2)
D25	OJC_OK	Phase C FOSB board to BPIH board cable detector to J21 (BPIH board P2, 0 = OK)
D26	VDB1_VCO4	Phase A DB resistor voltage feedback to J18 (DSPX board)
D27	N/C	Not Connected
D28	DCOM	Digital common to J14 (RAP_ board)
D29, D30	N/C	Not Connected
D31	CIFBS	Phase C current fault to J21 (BPIH board P2, high = fault)
D32	P5	Positive 5 V power supply to J14 (RAP_ board)

Renewal/Warranty Replacement

How to Order a Board

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

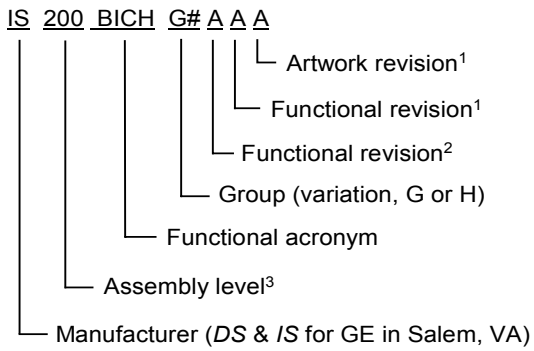
- How to accurately identify the part
- If the part is under warranty
- How to place the order

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 3 explains the structure of the part number.

The board's functional acronym, shown in Figure 3, normally is based on the **board description**, or name. For example, the BICH board is described as the H-Bridge Interface and Control Board.



[1]Backward compatible
[2]Not backward compatible
[3]*200* indicates a base-level board; *215* indicates a higher-level assembly or added components (such as PROM)

Figure 3. 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
(Replace + with the international access code.)

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. Wear a wrist grounding strap when handling boards or components, but only after boards or components have been removed from potentially energized equipment and are at a normally grounded workstation.

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 (per previous *Caution* criteria).

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 BICH board from the Innovation Series board rack as follows:

1. Make sure that the drive in which the board resides has been de-energized and follow all local safety practices of Lock-Out/Tag-Out.

2. Open the control cabinet door and, using equipment designed for high voltages, test any electrical circuits **before touching them** to ensure that power is off.

3. Carefully disconnect all cables from the BICH board to be replaced as follows:
   - Verify cables are labeled with the correct connector name (as marked on the board) to simplify reconnection.
   - For cables with pull-tabs, carefully pull the tab.

Caution

Avoid dropping mounting hardware into the unit, which could cause damage.

4. Carefully remove the board from the rack, as follows:
   a. Loosen the screws at the top and bottom of the faceplate, near the ejector tabs. (The screws are captive in the faceplate and should not be removed.)
   b. Unseat the module by raising the ejector tabs.
   c. Using both hands, gently pull the board from the rack.

Install the new (replacement) BICH board as follows:

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

Caution

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

2. Begin seating the board by firmly pressing the top and bottom of the faceplate 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 faceplate. **Tighten the screws evenly** to ensure that the board is seated squarely.

4. Reconnect all electrical connections that were disconnected in step 3 of *remove the board*.

5. Close the control cabinet door.

GE Industrial Systems

Issue date: 1999-03-29

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