GE Industrial Systems

High Frequency Power Supply Board
DS200GDPAG_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 DS200GDPA High Frequency Power Supply Board (GDPA) is a 600 or 700 watt (W) high frequency power supply board with the ability to draw input power from both AC and DC sources. See Figure 1, GDPA Board Block Diagram.

The GDPA board provides the following:

- An input rectifier and filter
- A regulator (buck chopper) that drives a regulated dc bus
- A 27 kHz inverter that operates from the regulated bus
- An output transformer providing 50 V ac outputs
- A 120 V dc power supply
- Control power supply
- Control signal level circuits
- Protective circuits

The PWM control on the GDPA board provides frequency reference for all operation, output voltage regulation, and the control signals to the regulator. The frequency reference is adjusted at the factory and need not be readjusted.

Voltage regulation of all GDPA board outputs is accomplished by sensing the voltage on windings 10, 11, 12 of output transformer T1. The output voltage is adjusted at the factory for 50 V ac at half load on the supply.

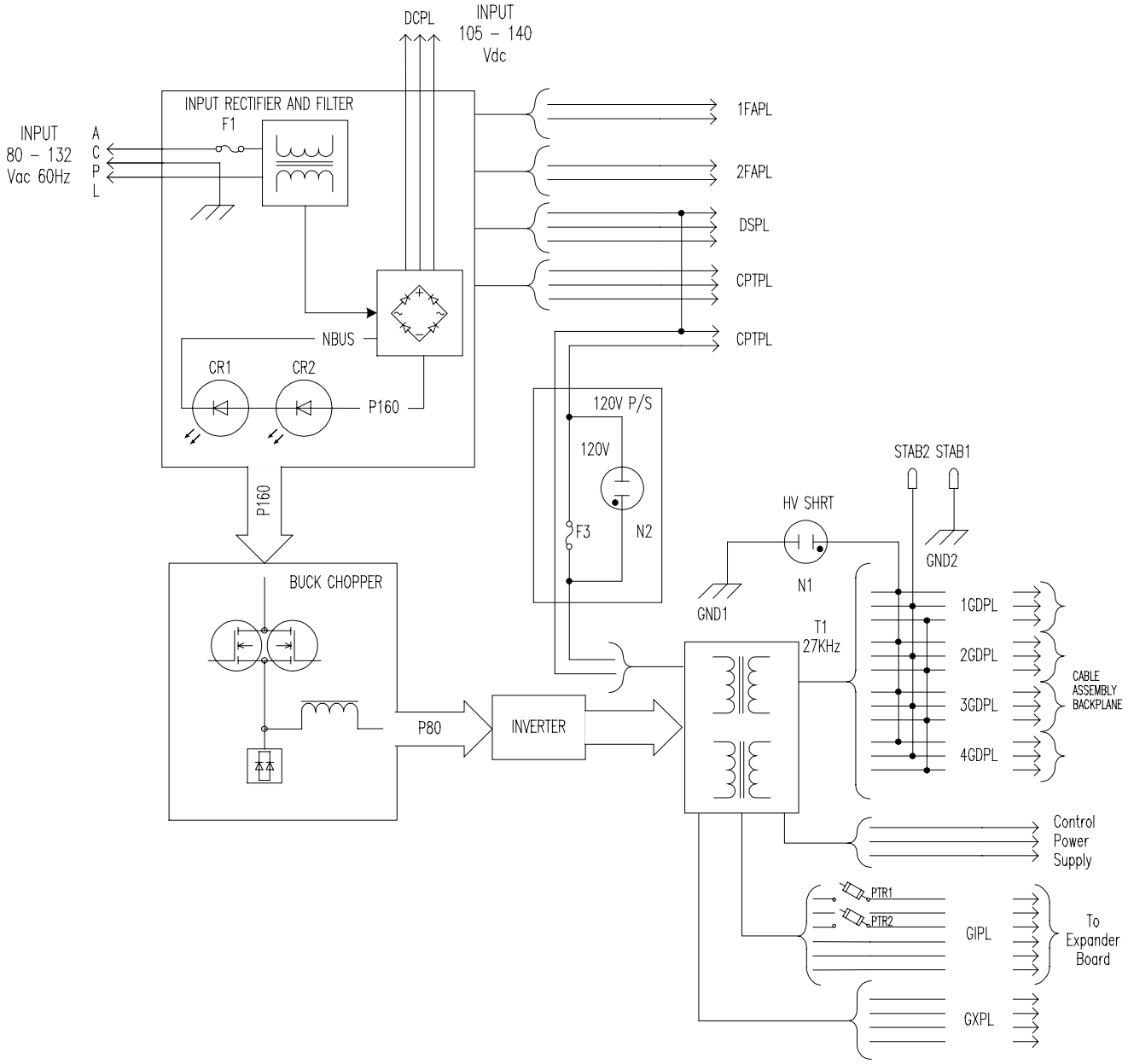

Figure 1. GDPA Board Block Diagram

Power Supply Inputs and Outputs

The GDPA board is designed to accept inputs from both ac and dc sources. Table 1 lists the ac and dc input sources.

Table 1. GDPA Board Input Sources.

Input	Range	Notes
AC Input	80–132 V ac at 28–66 Hz	Source should be impedance limited
DC Input	105–140 V dc	In-rush limiting and fusing must be supplied in the dc supply

The board is capable of operating with input voltages below 102 V ac, but thermal damage may occur when fully loaded. With reduced loading, the board can operate with input voltages below 95 V dc.

All outputs are isolated from the inputs so that an input transformer is not necessary for isolation purposes. The board provides 50 V ac and 120 V dc voltage outputs.

The board contains three fuses, two current limiters, and other protective functions that provide protection from overloads and faults. See Application Data section for fuse listing and other paragraphs for protective circuits.

AC Input. Ac input is routed from connector ACPL, through an EMI filter, and then to a full-wave bridge. The ac input is then rectified, and routed through the unregulated dc bus to the buck chopper for regulation, to the control power supply, and to the high voltage driver. The ac input is also tapped for external use. Ac power to operate the fans is provided through connectors 1FAPL and 2FAPL, and made available for other external use at connector CPTPL.

DC Input. Dc input is routed from connector DCPL directly to the unregulated dc bus. If a dc source is not used, optional ride-through capacitance may be connected. Under normal operation, the voltage range on the unregulated bus is 94–178 V dc. The bus output is filtered and then supplied to the regulator.

The regulator (buck chopper) reduces the voltage on the bus to a fixed level of approximately 83 V on the P80 bus. The regulated 83 V output is routed through a 27 kHz inverter that drives output transformer T1, and to the protection circuits.

Control Power Supply. Control power for the GDPA board is provided by the 15 V bus (P15). The negative side of the P15 bus is labeled ACOM and connected to the NBUS.

If the GDPA board power supply is provided from an isolated and ungrounded 115 V ac source, NBUS can be grounded at connector DCPL, pin 1. When power is supplied from a dc source, ACOM can be brought near ground by grounding the negative side of the dc input.

Current limiting for the control power is provided by fuse F2. Once the GDPA board is operational, control power is supplied by output transformer T1.

Output Transformer

The P80 bus input to the T1 output transformer provides a 50 V ac, 27 kHz output that is delivered to connectors 1GDPL, 2GDPL, 3GDPL, and 4GDPL. The 50 V ac output is also routed to the cable assembly backplane as a power input.

Note

The HI VOLT SHRT neon indicator (N1) comes ON when a failure that causes voltages greater than 300 V ac or 300 V dc to ground to be applied at plugs 1GDPL through 4GDPL.

Pin 2 of connectors 1GDPL through 4GPDL can be used to terminate a grounded shield by connecting a jumper between STAB1 (ground) and STAB2. This grounding may not be used if the 1300 V isolation capability of the transformer is to be utilized, because the connectors will not withstand high voltages between pins.

Output transformer T1 provides a center-tapped 50 V RMS output that is rectified to produce a voltage of approximately 24 V dc. This output is used as an input to the Expander/Load Source board through connector GIPL.

Current limiters PTR1 and PTR2 (on T1 windings 7 and 9) serve as self-resetting fuses on this output. These devices are rated for 3.75 A, 50 V. The limiters will automatically reset when the connected load on the output drops to zero or when the input to GDPA board is removed.

Output transformer T1 provides an input to the 120 V dc power supply, where it is then supplied to connector CPTPL for external use. Faults on this output are limited by fuse F3. Neon indicator N2 lights when fuse F3 has blown.

Protective Circuits

The GDPA board has no RESET function. In case of a failure, the board does not latch in the OFF state, but continues to operate in a failure state. Because of this, protective circuits have been designed to safely protect the GDPA board and output devices from voltage and current fluctuations. See Figure 2.

The protective functions are:

- Inverter overcurrent.
- Regulator overcurrent.
- P80 overvoltage.
- Control voltage undervoltage
- CVOK running signal.

Inverter Overcurrent. An overcurrent signal in the inverter indicates that the output of the board is shorted or overloaded. If this occurs, the GDPA board limits output current by reducing the P80 output rather than tripping the inverter. The overcurrent reference level is reduced as the voltage on P80 is reduced.

This causes the inverter current limit set point to fold back so that the short circuit current is only a little over half the overcurrent level that is effective at full output voltage.

Regulator Overcurrent. The regulator current is measured and compared to a preset reference signal. When the regulator current exceeds the reference level, the regulator overcurrent shutdown signal terminates the regulator output.

A fold-back feature is implemented in the regulator overcurrent as in the inverter overcurrent. The output duty cycle of the regulator is reduced proportionally to provide continuous current limiting.

P80 Bus Overvoltage. The P80 bus overvoltage shuts down the inverter in case of an output short. In the case of such a failure, P80 potential will become the same as P160, and all the outputs of the supply would be at approximately double voltage. If the P80 regulator voltage is high, but controllable, the P80 bus overvoltage cycles the output voltage to zero, lets the voltage build back to the trip point, and cycles the voltage off again.

Control Voltage Undervoltage. At startup, the control voltage may be too low for proper operation. The control voltage undervoltage circuits shut down the inverter and the regulator output until the control voltage has reached operational levels.

CVOK Running Signal. If the GDPA board has sufficient voltage on P160 to maintain output, and if the regulator control is still responding to commands, then the GDPA board is functioning correctly (although it may be overloaded or shorted).

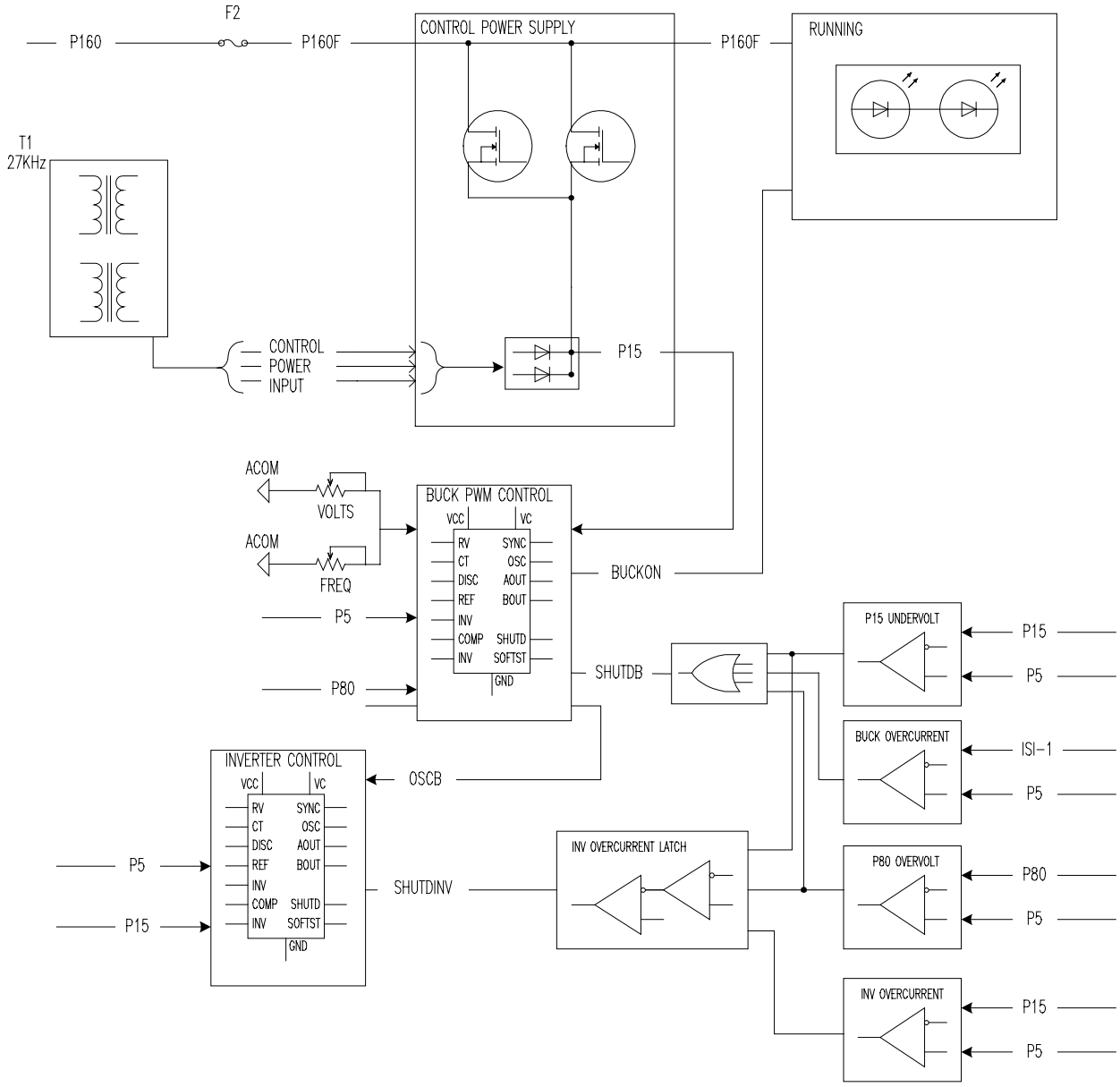

Figure 2. GDPA Board Control and Protection Block Diagram

Application Data

The GDPA board includes twelve plug connectors and two stab-on connectors. The board is grounded via three mounting screws (GND1, GND2, GND3). There are also fuses, testpoints, and indicators (LED and neon) on the GDPA board. See Figure 3 for a layout diagram that shows the location of major board components.

Indicators

The board contains four LED indicators (designated CR_) and two neon indicators (designated N_) that give a visual display of board status. The LED indicators are labeled PWR IN (CR1 and CR2), and READY (CR37 and CR39). The neon indicators are labeled 120 V DC FUSE (N2) and HI VOLT SHORT (N1). See Table 3 for a description of these status indicators.

Fuses and Testpoints

The GDPA board includes three fuses that provide protection from overloads and faults. See Table 2 for a GDPA board fuse list and Figure 3 for locations.

The GDPA board also includes several testpoints that vary per board version. See Table 13 for a description of test points found on 600 VA versions, and Table 14 for testpoints found on 700 VA versions. See Figure 3 for testpoint locations.

I/O Connectors

The GDPA board includes twelve plug connectors and two stab-on connectors. See Figure 3 for connector locations. See Tables 4 through 12 for connector descriptions as follows:

- Table 4 1FAPL and 2FAPL Connectors
- Table 5 1GDPL - 4GDPL Connectors
- Table 6 ACPL Connector
- Table 7 CPTPL Connector
- Table 8 DCPL Connector
- Table 9 DSPL Connector
- Table 10 GIPL Connector
- Table 11 GXPL Connector (see Note)
- Table 12 Stab-On Connectors

Note

On Innovation Series™ drives, connector GXPL is normally disconnected. On AC2000 Series™ drives, the connector provides a non-center-tapped input to the GTO High Voltage board.

Table 2. GDPA Board Fuses

Designation	Rating	Description	GE P/N
F1	15 Amp, 600V, current limiting	Limits damage if there is a major failure on the board. Under normal operation, fuse can also blow during continuous full load operation at ac input of less than 102 V ac.	104X109AD
F2	.25A, 250V	Provides control power current limiting; if blown, indicates a failure of the control power regulator.	573A392P6
F3	1.5A, 250V	Protects against faults of the T1 output to the 120 V dc power supply.	573A392P12

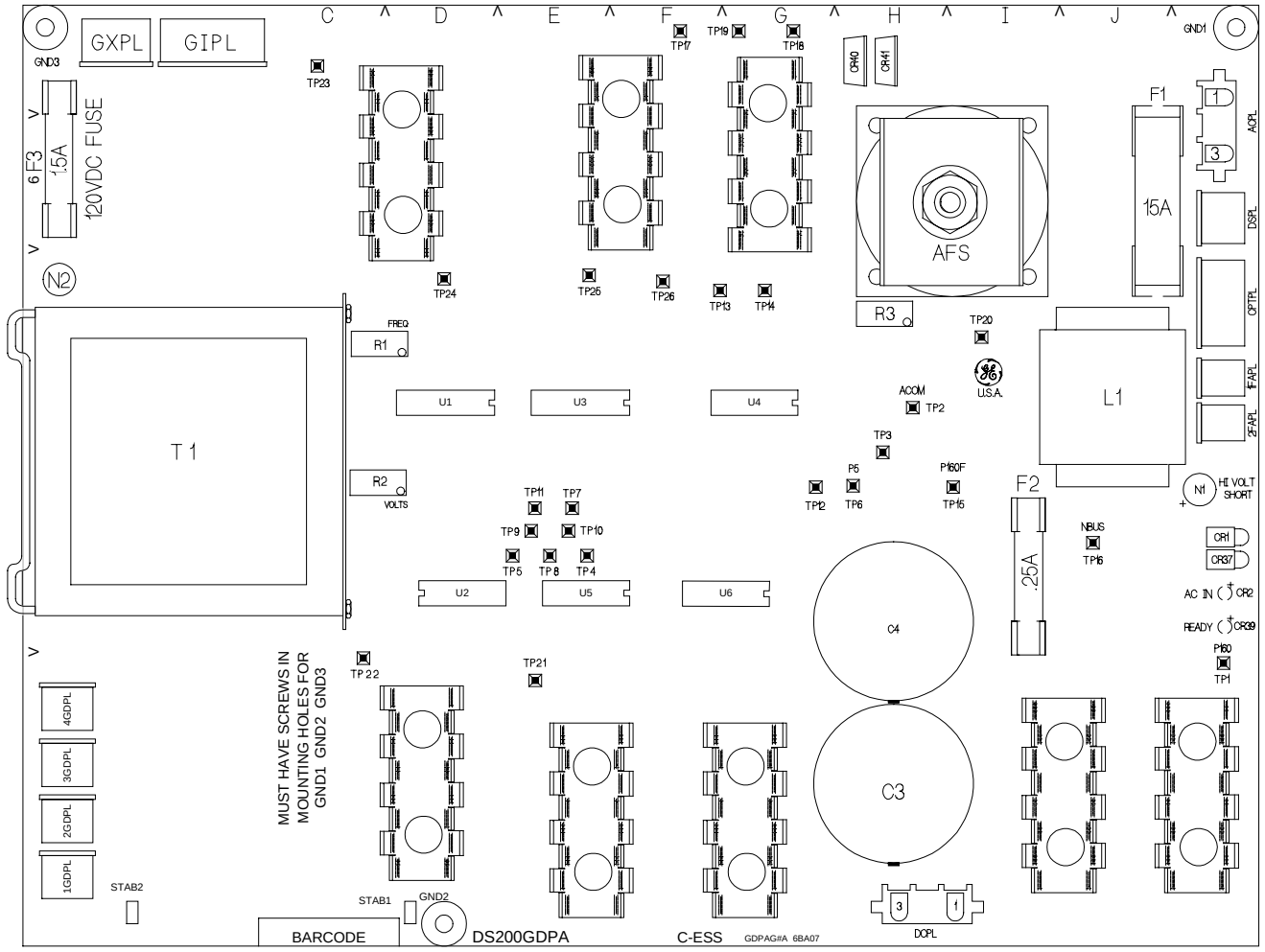

Figure 3. GDPA Board Layout Diagram

Table 3. GDPA Board Indicator Descriptions

Indicator	Nomenclature	Color	Description
CR1	PWR IN	Yellow	**Ac Input:** ON when ac voltage is present and fuse F1 is not open. **Dc Input:** On when high voltage levels are present; remains ON until voltage levels are less than 50 V dc.
CR2	PWR IN	Yellow	**Ac Input:** ON when ac voltage is present and fuse F1 is not open. **Dc Input:** On when high voltage levels are present; remains ON until voltage levels are less than 50 V dc.
CR37	READY	Green	ON when voltage level is high enough to operate and board is good; also remains ON if GDPA outputs remain at zero due to current limit.
CR39	READY	Green	ON when voltage level is high enough to operate and board is good; also remains ON if GDPA outputs remain at zero due to current limit.
N1	HI VOLT SHORT	Orange	ON when one of the GDPL connector pins is tied to an external voltage greater than 300 V ac/dc. This has no effect on the operation of the supply, but indicates an insulation breakdown in the wiring or loads connected to the supply.
N2	120 VDC FUSE	Orange	ON when fuse F3 in the 120 V dc output is blown

Table 4. 1FAPL and 2FAPL Connectors

Pin	Nomenclature	Description
_FAPL-1	AC1F	115 V ac input to fan assembly
_FAPL-2	AC2	115 V ac input to fan assembly

Table 5. 1GDPL – 4GDPL Connectors

Pin	Nomenclature	Description
_GDPL-1	HF1	Input to control assembly backplane (50 V RMS ac bulk)
_GDPL-2	HFSH	Input to control assembly backplane *Grounded for use as shield when jumpered at STAB1/STAB2
_GDPL-3	HF2	Input to control assembly backplane (50 V RMS ac bulk)

* Connecting these jumpers voids the double insulated design of the output.

Table 6. ACPL Connector

Pin	Nomenclature	Description
ACPL-1	AC1F	80–132 V ac, 60 Hz input. Circuit protection provided by fuse F1
ACPL-2	GND	Ground for use as shield or ground
ACPL-3	AC2	80–132 V ac input

Table 7. CPTPL Connector

Pin	Nomenclature	Description
CPTPL-1	CP120	Positive 120 V for external use
CPTPL-2	120SW	120 V door switch power
CPTPL-3	CN120	Negative 120 V for external use
CPTPL-4	AC1F	ACIF input for external use (See Table 6)
CPTPL-5	AC2	AC2 input for external use (See Table 6)

Table 8. DCPL Connector

Pin	Nomenclature	Description
DCPL-1	NBUS	*Negative 105–140 V dc input
DCPL-2	XCAP	*Not Connected
DCPL-3	PEXT	*Positive 105–140 V dc input

* DCPL pins 1, 2, and 3 may be shorted together if external ride through capacitor option is chosen.

Table 9. DSPL Connector

Pin	Nomenclature	Description
DSPL-1	CP120	120 V power to door switch
DSPL-2	NC	Not Connected
DSPL-3	120SW	120 V power to door switch

Table 10. GIPL Connector

Pin	Nomenclature	Description
GIPL-1	CVOKP	CVOK diagnostic output positive to expander board
GIPL-2	CVOKN	CVOK diagnostic output negative to expander board
GIPL-3	HFCS	Shield ground to GND3
GIPL-4	HFC1	50 VRMS center-tapped AC output to expander board
GIPL-5	HFC2	50 VRMS center-tapped AC output to expander board
GIPL-6	HFC3	50 VRMS center-tapped AC output to expander board

Table 11. GXPL Connector

Pin	Nomenclature	Description
GXPL-1	HFC1	50 VRMS center-tapped ac output to high voltage source board (not connected on Innovation Series™ drives)
GXPL-2	NC	Not Connected
GXPL-3	HFCS	Shield ground to GND3 (not connected on Innovation Series™ drives)
GXPL-4	HFC3	50 VRMS center-tapped ac output to high voltage source board (not connected on Innovation Series™ drives)

Table 12. Stab-On Connectors

Stab-On	Nomenclature	Description
STAB1	GND2	Shield ground to GND2
STAB2	HFSH	Input to control assembly backplane *Grounded for use as shield when jumpered at STAB1/STAB2

Table 13. Testpoints, 600 VA GDPA Board

Name	Nomenclature	Description
TP1	P160	Positive 160 V bus voltage
TP2	ACOM	Analog common
TP3	P15	Positive 15 V bus voltage for control power supply
TP4	OSCB	Oscillator B signal for buck pulse width modulation control
TP5	BUCK	Buck pulse width modulation control
TP6	P5	Positive 5 V for buck pulse width modulation control
TP7	SDBUCK	Shutdown buck pulse width modulation control
TP8	OSC1	Oscillator signal for inverter control
TP9	FG3	Inverter MOSFET gate signal
TP10	FG4	Inverter MOSFET gate signal
TP11	SDINV	Shutdown signal for inverter control
TP12	0FLT	P80 OV or P15 UV
TP13	INVOC	Inverter overcurrent signal
TP14	BUCKOC	Buck overcurrent signal
TP15	P160F	Positive 160 V bus voltage for control power supply
TP16	NBUS	Negative Bus

Table 14. Testpoints, 700 VA GDPA Board

Name	Nomenclature	Description
TP1	P160	Positive 160 V bus voltage
TP2	ACOM	Analog common
TP3	P15	Positive 15 V bus voltage for control power supply
TP4	OSCB	Oscillator B signal for buck pulse width modulation control
TP5	BUCK	Buck pulse width modulation control
TP6	P5	Positive 5 V for buck pulse width modulation control
TP7	SDBUCK	Shutdown buck pulse width modulation control
TP8	OSC1	Oscillator signal for inverter control
TP9	FG3	Inverter MOSFET gate signal
TP10	FG4	Inverter MOSFET gate signal
TP11	SDINV	Shutdown signal for inverter control
TP12	0FLT	P80 OV or P15 UV
TP13	Unlabeled	Inverter overcurrent signal
TP14	Unlabeled	Buck overcurrent signal
TP15	P160F	Positive 160 V bus voltage for control power supply
TP16	NBUS	Negative bus
TP17	Unlabeled	P80 bus voltage
TP18	Unlabeled	Control power supply Q7
TP19	Unlabeled	Control power supply Q7B
TP20	FS12	Buck MOSFET source signal
TP21	FG1	Buck MOSFET gate signal
TP22	FG2	Buck MOSFET gate signal
TP23	FG3	Inverter MOSFET gate signal
TP24	FG4	Inverter MOSFET gate signal
TP25	FG5	Inverter MOSFET gate signal
TP26	FG6	Inverter MOSFET gate signal

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 *GDPA* board is described as the *High Frequency Power Supply* board.

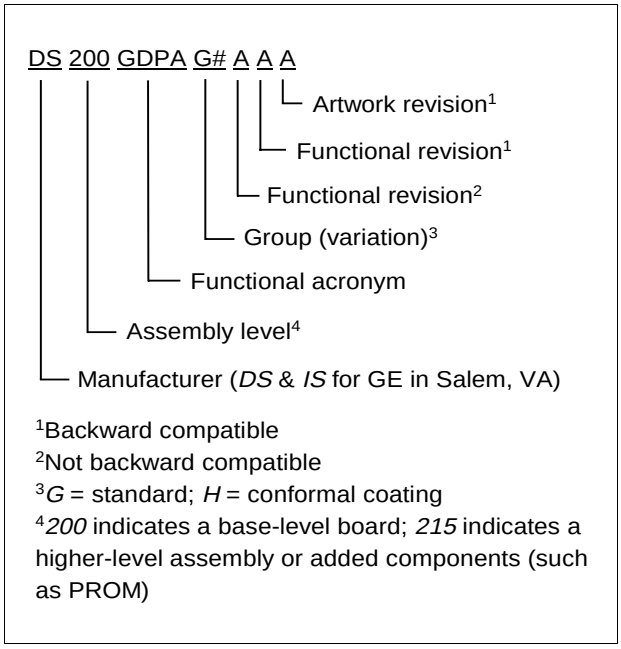

Figure 4. Board Part Number Conventions

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 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.

CAUTION

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

Replace a GDPA board (**installed on a plate**) 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.

NOTE

The GDPA may be mounted onto a drive mounting plate, or directly onto the drive cabinet, depending on drive configuration.

3. Identify and disconnect all cables from the board.
4. Locate and loosen two bolts and washers securing bottom portion of the GDPA board mounting plate.
5. Locate and remove two bolts and washers securing top portion of the GDPA board mounting plate.
6. Remove the mounting plate and GDPA board by sliding mounting plate upwards until the slotted grooves in mounting plate are clear of the bottom bolts.
7. Remove nuts and washers securing the GDPA board to the mounting plate.
8. Remove the nylon standoffs from GDPA board.
9. Place the nylon standoffs that were removed from the old GDPA board onto the new board.
10. Place the new GDPA board onto the mounting plate, ensuring metal standoffs are correctly located, and secure with nuts and washers.
11. Install the mounting plate and new GDPA board by sliding mounting plate downwards until the it rests fully on the bottom bolts.
12. Install and tighten the two bolts and washers that secure the top portion of the mounting plate to the rack.
13. Tighten the two bolts and washers that secure the bottom portion of the mounting plate to the rack.
14. Identify and reconnect all cables to the new GDPA board.

Replace a GDPA (**mounted directly onto the drive**) 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. Identify and disconnect all cables from the board.
4. Remove nuts and washers securing the GDPA board to the drive standoffs.
5. Remove the GDPA board.
6. Remove the nylon standoffs from the GDPA board.
7. Place the nylon standoffs that were removed from the old GDPA board onto the new board.
8. Place the new GDPA board in the drive, ensuring metal standoffs are correctly located, and secure with nuts and washers.
9. Identify and reconnect all cables to the new GDPA board.

Notes

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