GE Motors & Industrial Systems

DIGITAL SIGNAL PROCESSOR CONTROL BOARD

DS200DSPCG_A_ _

CONTENTS

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.

FUNCTIONAL DESCRIPTION

INTRODUCTION

The DS200DSPC board (DSPC) is a high performance processor board based on a digital signal processor that provides computational capacity and communications bandwidth for direct control of high performance power converter applications such as uninterruptable power sources (UPS), active filters, dynamometers, wind turbines, high performance drives, and large multi-bridge power converters. The board plugs into one slot of a VME rack, but occupies two slots of space (for quantity of one to four daughterboards). The DSPC board can serve as a master or slave device, yet it provides its own program memory and expandable local high speed I/O for direct interface to control signals without using the VME datapath.

GENERAL FEATURES

Processor

The DSPC board processor is a floating point digital signal processor (DSP) that operates at 50 MHz. The DSP can be reset by one of the following methods:

- VME sysreset
- VME master bus writes to the VME control register
- Power-up reset
- Reset pushbutton

A watchdog timer with timeout fixed at 1ms monitors the DSP.

VME Bus

The DSPC board provides optional VME bus interface connectors (P1 and P2) that are compatable with the GE Fanuc 90/70™ Programmable Logic Controllers (PLCs). The DSPC board can function as an A24/D16 VME bus *slave* with a 8K dual-ported SRAM interface. The board can also function as a VME bus *master* to initiate a bus transfer cycle, including bus arbitration. VME bus access is controlled in a configurable static random access memory (SRAM) based field programmable gate array (FPGA) device. Bus interface configuration information resides in a programmable logic device that can be reconfigured as required for a specific application (this method minimizes manual jumpers). VME bus I/O is asynchronous and a timeout is provided for non-responding addresses.

Programmable Logic/Hardware Features

Program and FPGA logic configuration data is stored in flash memory on a removable SIMM, while configurable items for applications are stored in a socket mounted EEPROM. Program code is executed from high speed static RAM after startup. Flash EPROM facilitates the downloading and updating of the application real-time code and erasable programmable logic device (EPLD) logic. Logic is concentrated in a combination of SRAM based FPGAs and EPLD programable logic devices. Surface mounted in-circuit programmable devices are used for ready generation, chip select, and boot control logic (these devices are programmed by an in-system programmable [ISP] serial interface). On board I/O and synchronization logic include a quadrature encoder input with marker pulse and synchronization logic. The synchronization logic accepts VME backplane signals, DSP timer outputs, and expansion port inputs as synchronization inputs. Output signals are individual synchronization commands to the input device/port. This enables the FPGA to be configured for a variety of different bridge syschronization arrangements. Two 12-bit a/d converters and six 12-bit d/a converters are supplied (two d/a converters have front panel access).

Serial Communications

Serial asynchronous communication is provided by a dual channel universal asynchronous receiver/transmitter (UART). The UART is timed from an oscillator and provides up to 1.152mb data rates. The UART provides 16 byte first-in first-out (FIFO) communications on both transmit and receive data streams. These FIFOs enable a polled interface between the DSP and the UART.

One channel of the UART is routed to a board front panel DB15 connector (P5) through an RS485 transceiver for connection to a standard PC serial port. (An external RS-485 to RS-232C conversion box is needed.) This physical arrangement keeps the PC ground separate from the DSPC board common. This connection is identical to those present on the GE Fanuc Series 90 PLCs. (A serial interface cable may be ordered from GE Fanuc as part number IC690AC6901B.) The second channel of the UART is routed to a front panel infrared data access (IrDA) compliant infrared link that is reserved for future product enhancements.

High speed synchronous serial communications are available on the DSP and are accessed through connector P6. This can be used for DSPC board to DSPC board comunications independent of the VME bus.

Daughterboard Options

The DSPC board has provisions for mounting up to four optional daughterboards for communication and I/O expansion. A pair of high density connectors, one 60-pin (XA1, 2, 3, 4) and one 40-pin (XB1, 2, 3, 4), provide mounting and signal connection to each of the four daughterboard positions. Additional mounting rigidity is provided by three standoffs (with screws) per daughterboard position on the DSPC board. The daughterboards do not engage the VME rack guides. The four daughterboard positions are interchangable (any daughterboard can be assigned per project to any of the four positions). The positions are not interchangable after being project-assigned.

The DSPC board provides input and output signal lines for synchronization and interrupt requirements. Configuration lines for each daughterboard position are supplied to allow parallel downloading of FPGA logic. A status line from each position allows the DSP to monitor the daughterboard for successful configuration completion.

Board Faceplate (See Figure 1)

The DSPC board is equipped with a metal faceplate that provides mechanical mounting restraints within the VME rack. The faceplate and mounting hardware also provide a low impedance electrical path to earth ground for control of high frequency interference. The green IMOK, red FAIL, and four software driven LEDs are visible on the faceplate of the board.

™ Series 90/70 is a trademark of GE Fanuc Automation North America, Inc.

The Reset (SW1) and Serial Boot Request (SW2) pushbuttons are located on the board faceplate. Testpoints TP1, TP2, TP3, and TP4 are located on the board front edge. Connectors P5 and P6 are also located on the board faceplate and provide shield grounding through a metal shell connection to the faceplate. All of these pushbuttons, testpoints, and connectors are accessible when the DSPC board is mounted in a VME rack.

Each daughterboard has a front faceplate that mates with a cutout in the DSPC board front faceplate (positions 1, 2, 3, and 4; see Figure 1). If no daughterboard is present in any of the four positions, the empty position must be filled with a blockoff assembly that mounts on the front two standoffs furnished for mounting a daughterboard. (All standoffs and screws for mounting up to four daughterboards are furnished with the DSPC board.)

Backplanes

Primary power input to the DSPC board is from the P2 backplane. Analog power input (±12 V dc) is from the P1 backplane and is diode isolated from the analog input at P2 so that P2 can provide ±15 V dc without back-feeding the VME bus. Many diagnostic signals are also assigned to the P2 connector pins left available by the VME standard. A set of 12 application definable signals have been provided in the P2 connector for backplane access by the DSPC daughter boards. Four of these signals are 5 V TTL that the DSPC board can read as well.

Electronic Board Identification

Each board in the LCI system has an add-only electronic ID memory that contains board identification and hardware revision information. This memory is accessed through a 1-wire LAN and allows the DSPC board to electronically identify the daughterboards and other boards that are present. This information is read and reported during power-up. The DSPC board hosts the ID interface for reading, but it cannot alter the ID information.

APPLICATION DATA

LEDS

There are six LEDs located on the DSPC board faceplate (see Figure 1 for location). Two of these LEDs indicate DSPC board status while the other four are software driven. See Table 1 for a full description of all LEDs.

TESTPOINTS

There are four (TP1–4) located on the DSPC board (see Figures 1 and 2 for location). These test points can be used for signal measurement purposes as described in Table 2.

CONNECTORS

The connectors that are located on the DSPC board are shown in Table 3 (with a brief description of signals). See Figures 1 and 2 for location. The individual pin signals for the P5 and P6 connectors are shown in Tables 4 and 5. Connector pairs XA_ and XB_ are for connecting the optional daughterboards.

SWITCHES

Two pushbutton switches are furnished on the DSPC board (see Figure 1). SW1 is a hard reset switch for the DSP. Pressing this pushbutton switch to reset the DSP also forces a hard reset of all daughterboards. SW2 is a serial boot switch for the DSP. Holding this pushbutton in while pressing and releasing SW1 forces the DSP to boot from its synchronous serial port (P6). These pushbottons are recessed on the DSPC board faceplate and require a ballpoint pen or pencil to press (this eliminates accidental pressing).

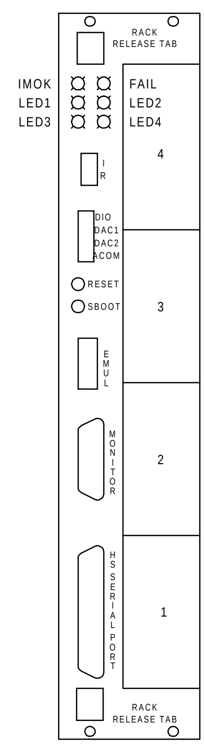

Figure 1. DSPC Board Faceplate

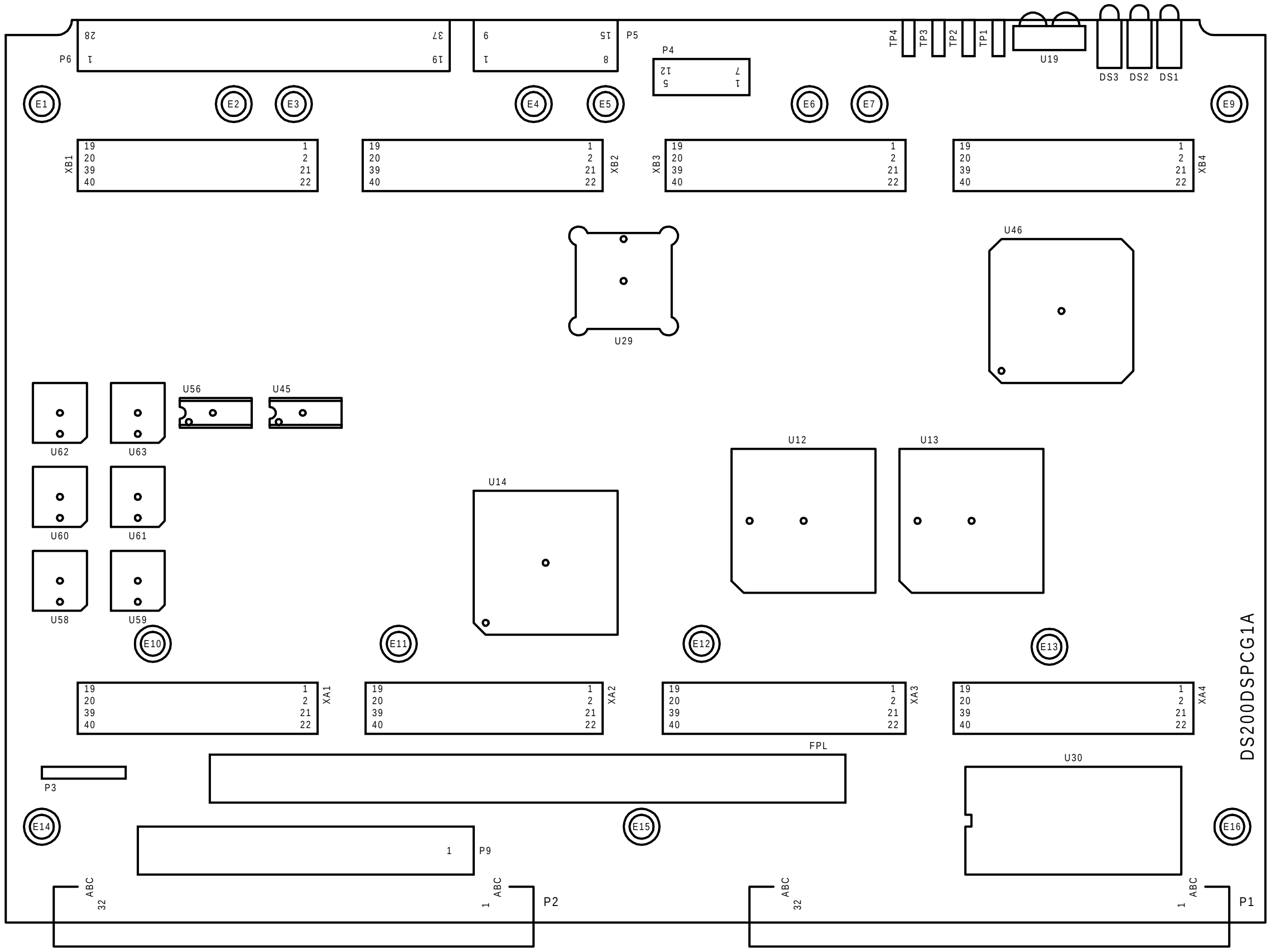

Figure 2. DSPC Board Layout

Table 1. DSPC Board LEDs

Color	Designation	Description
Green	IMOK	Indicates that the board is functioning properly
Red	FAIL	Indicates that the VME bus has reported that the board has failed
Amber	LED1	Software defined per individual project
Amber	LED2	Software defined per individual project
Amber	LED3	Software defined per individual project
Amber	LED4	Software defined per individual project

Table 2. DSPC Board Testpoints

Testpoint	Description	Range
TP1 - DIO	Processor digital I/O testpoint	0-5 V dc TTL logic signal
TP2 - DAC1	DAC #1 analog output	±10 V dc output
TP3 - DAC2	DAC #2 analog output	±10 V dc output
TP4 - ACOM	Analog common	Not applicable

Table 3. DSPC Board Connectors

Connector	Description	Type
P1	VME Standard	DIN C96
P2	VME Standard plus user definable pins as follows: 6 tach inputs, 3 diagnostic digital inputs, 3 diagnostic digital outputs, 6 diagnostic DAC outputs (DAC 1 = TP2, DAC 2 = TP3), 2 differential analog inputs, 1 direct DSP I/O output (TP1), 1 DSP clock, 1 ID tag data line, and 12 application definable lines to all daughterboards (4 must be digital and may be read by the DSP)	DIN C96
P3	ISP programming port for logic devices	8-pin header
P4	DSP emulator port – See Texas Instrument's TMS320C31 emulator pod for pin signal descriptions	12-pin header
P5	RS-485 asychronous serial communications port that includes the following pin signals: 3 receive data - terminator R, 3 send data - terminator R, and 4 power supply	DB15
P6	RS-485 synchronous high speed serial communications port that includes the following pin signals: 3 receive data - terminator R, 3 receive frame sync - terminator R, 3 receive clock - terminator R, 3 xmit data - terminator R, 3 xmit frame sync - terminator R, 3 xmit clock - terminator R, 3 sync pulse, and 3 power supply	DB37
P9	Buffered expansion port (vertical connect to interface board) that includes the following pin signals: 32 data lines, 24 address lines, 12 power supplies, 1 reset, 2 read/write, 1 clock, 1 daughterboard select, 3 xid and xrst lines, 4 expansion board select, 4 expansion board configuration lines, 4 expansion board configuration status, 4 expansion board sync inputs, and 4 expansion board sync outputs	DIN C96
FPL	Flash SIMM memory port	80-pin
XA1	Connector A for daughterboard position 1 that includes the following pin data and power signals: 16 xdata, 4 +5 V, 2 +12/15 V, 2 -12/15 V, 7 DCOM & 1 ACOM, 8 general purpose user definable lines to daughterboards, 4 logic user definable lines to daughterboards, and 16 reserved for future data lines	60-pin high density
XB1	Connector B for daughterboard position 1 that includes the following pin address and control signals: 20 xaddress, 1 0x_cs - daughterboard select, 2 0xread/0xwrite, 1 ID - data, 1 0xconfig - EPLD configure (nCS), 1 0xconfig_status - EPLD configuration status (nSTATUS), 1 clock, 1 signal in - sync signal input, 1 0busy, 1 signal out - interrupt, and 7 DCOM	40-pin high density
XA2	Connector A for daughterboard position 2 (see pin signals for XA1)	60-pin high density
XB2	Connector B for daughterboard position 2 (see pin signals for XB1)	40-pin high density
XA3	Connector A for daughterboard position 3 (see pin signals for XA1)	60-pin high density
XB3	Connector B for daughterboard position 3 (see pin signals for XB1)	40-pin high density
XA4	Connector A for daughterboard position 4 (see pin signals for XA1)	60-pin high density
XB4	Connector B for daughterboard position 4 (see pin signals for XB1)	40-pin high density

Table 4. P5 RS-485 Asynchronous Serial Monitor Port Pin Descriptions*

Pin #	Signal	Description
P5-1	DCOM	Digital common
P5-2	N/C	Not connected
P5-3	TXRT	Transmit termination resistor
P5-4	N/C	Not connected
P5-5	+5 V	Positive 5 V dc
P5-6	CTSP	Clear to send positive (+)
P5-7	DCOM	Digital common
P5-8	CTSN	Clear to send negative (–)
P5-9	RXRT	Receive termination resistor
P5-10	RXN	Receive negative (–)
P5-11	RXP	Receive positive (+)
P5-12	TXN	Transmit negative (–)
P5-13	TXP	Transmit positive (+)
P5-14	CTSN	Clear to send negative (–)
P5-15	CTSP	Clear to send positive (+)
P5-16	GND**	Ground (jacket screws)
P5-17	GND**	Ground (jacket screws)

**The connector pinouts are assigned to operate with the miniconverter kit used with Series 90 Programmable Logic Controllers (PLC).*

***Pins P5-16 and P5-17 are not pins of the connector.*

Table 5. P6 High Speed Serial Interface Port Pin Descriptions

Pin #	Signal	Description
P6-1	DCOM	Digital common
P6-2	CLKROP	Positive (+) receive clock input
P6-3	CLKRON	Negative (–) receive clock input
P6-4	FSROP	Positive (+) receive frame sync signal
P6-5	FSRON	Negative (–) receive frame sync signal
P6-6	DROP	Positive (+) receive data input
P6-7	DRON	Negative (–) receive data input
P6-8	N/C	Not connected
P6-9	DSYNCP	Positive (+) bidirectional digital sync signal
P6-10	DSYNCN	Negative (–) bidirectional digital sync signal
P6-11	DSYNCP	Positive (+) bidirectional digital sync signal
P6-12	OINT3	Serial boot request signal input
P6-13	DXON	Transmit data negative (–)
P6-14	DXOP	Transmit data positive (+)
P6-15	FSXON	Negative (–) transmit frame sync output
P6-16	FSXOP	Positive (+) transmit frame sync output
P6-17	CLKXON	Negative (–) transmit clock output
P6-18	CLKXOP	Positive (+) transmit clock output
P6-19	DCOM	Digital common
P6-20	CLKRORT	Receive clock termination resistor
P6-21	N/C	Not connected
P6-22	FSRORT	Receive frame sync termination resistor
P6-23	N/C	Not connected
P6-24	DRORT	Receive data termination resistor
P6-25	N/C	Not connected
P6-26	PWR RST	Reset power input
P6-27	N/C	Not connected
P6-28	+5 V	Positive (+) 5 V dc
P6-29	+5 V	Positive (+) 5 V dc
P6-30	DSYNCRT	Digital sync termination resistor
P6-31	N/C	Not connected
P6-32	DXORT	Transmit data termination resistor
P6-33	N/C	Not connected
P6-34	FSXORT	Transmit frame sync termination resistor
P6-35	N/C	Not connected
P6-36	CLKXORT	Transmit clock termination resistor
P6-37	N/C	Not connected
P6-38	GND*	Ground (jacket screws)
P6-39	GND*	Ground (jacket screws)

**Pins P6-38 and P6-39 are not pins of the connector.*

RENEWAL/WARRANTY REPLACEMENT

BOARD PART NUMBER IDENTIFICATION

A printed wiring board is identified by an alphanumeric part (catalog) number stamped on its edge. For example, the DSPC board is identified by part number DS200DSPCG#. Figure 3 describes each digit in the part number.

NOTE

All digits are important when ordering or replacing any board.

WARRANTY TERMS

The GE Motors & Industrial Systems Terms and Conditions brochure details product warranty information, including the **warranty period** and **parts and service** coverage.

The brochure is included with customer documentation. It may also be obtained separately from the nearest GE Sales Office or authorized GE Sales Representative.

WARRANTY PARTS AND SERVICE

This board has no fuses or other end-user serviceable parts. If it fails, it needs to be replaced as a unit. To obtain a replacement board, or service assistance, contact the nearest GE Service Office.

Please have the following information ready to exactly identify the **part** and **application**:

- GE requisition or shop order number
- LCI serial number and model number
- Board number and description

PROCEDURE FOR REPLACING BOARDS

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 boards or connections, or re-insert them, while power is applied to the drive.

Treat all boards as static-sensitive. Use a grounding strap when changing boards and always store boards in anti-static bags or boxes they were shipped in.

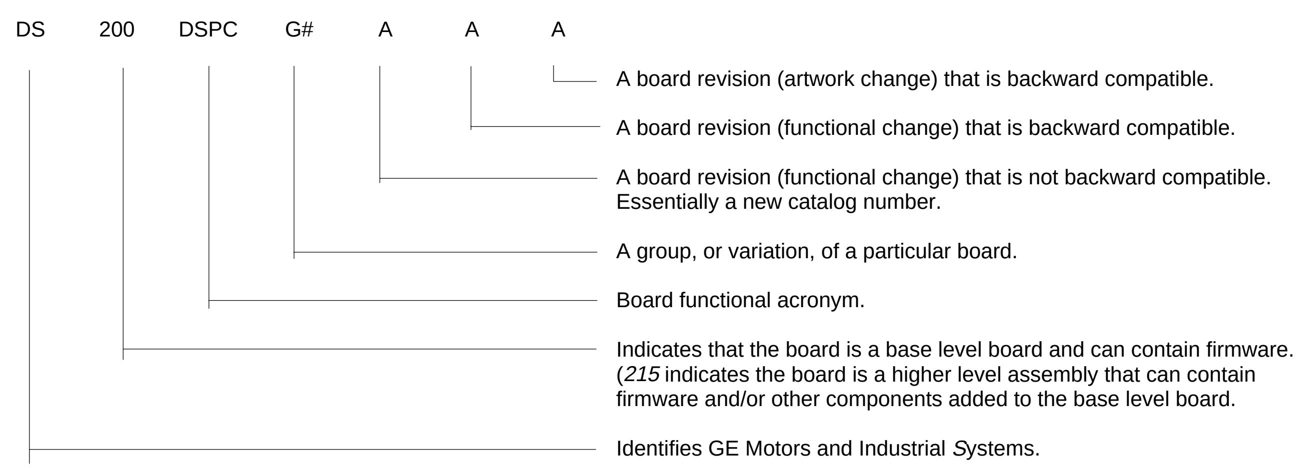

Figure 3. Sample Board Part Number, DS Series

To replace a DSPC board: (see Figures 2 and 4).

1. **Turn off power**.

2. Carefully disconnect all cables connected to the DSPC board faceplate and any daughterboards as follows:

   – For ribbon cables, grasp each side of the cable connector that mates with the board connector, press the metal retaining clips inward, and gently pull the cable connector loose.

   – For cables with pull tabs, carefully pull the tab.

3. Remove the four screws with washers that secure the DSPC board faceplate to the VME rack assembly and set them aside.

CAUTION

Avoid dropping any hardware into the VME rack, which could cause damage.

4. Push the two rack release tabs away from the center of the board to disengage the DSPC board P1 and P2 connectors from the VME backplane connector and remove the board from the rack (complete with any daughterboards or blockoffs).

5. Remove the two (for blockoff assemblies) or three (for daughterboards) screws that secure these items to the standoffs on the DSPC board.

6. Grasp any daughterboards by the top and bottom edge and carefully, with a slight rocking motion, pull the daughterboard loose from its XA_ and XB_ connectors on the DSPC board.

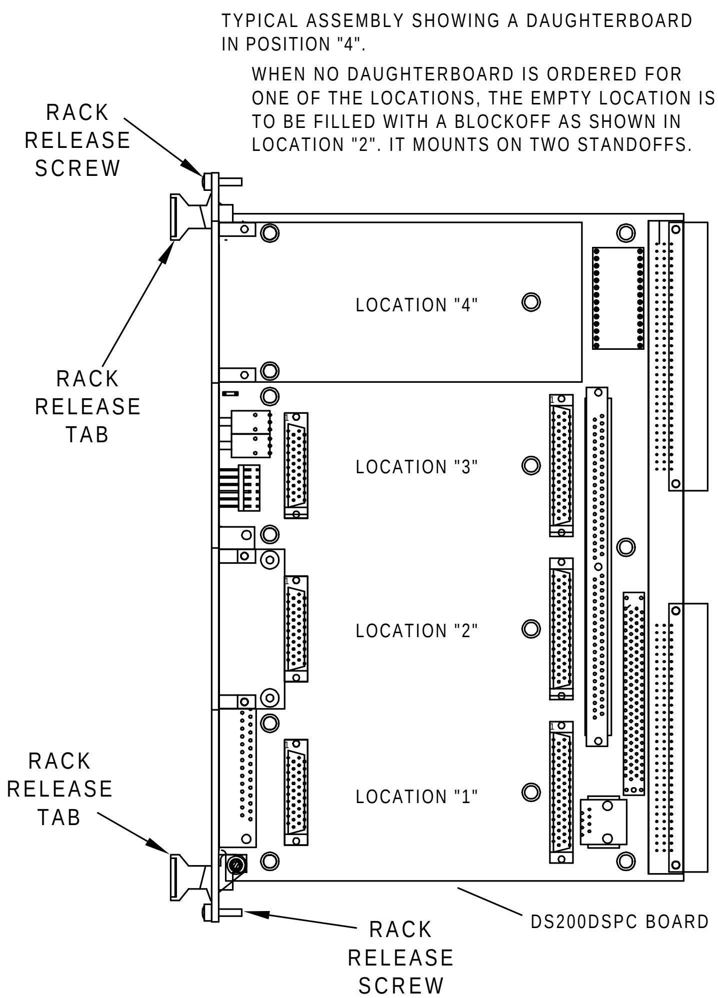

Figure 4. DSPC Board Daughterboard and Blockoff Assemblies

NOTE

Screw the mounting screws and washers back into the standoffs of the old DSPC board. New mountings screws are provided with the new DSPC board.

NOTE

If the EEPROM chip or the SIMM flash memory from the old DSPC board are going to be reused on the new DSPC board, change these devices at this point. See Replacing EEPROM Chip/SIMM Flash Memory paragraph following this procedure.

7. Install the removed daughterboards or blockoff assemblies onto the new DSPC board in the same position as they were removed from with the screws provided with the new board.

8. Install the new DSPC board into the VME rack by carefully aligning the P1 and P2 connectors with the VME backplane connector and pushing the board into its mounted position.

9. Secure the new DSPC board to the VME rack assembly with the four screws removed in step 3 and reconnect all cables that were disconnected in step 2. Ensure that each connector is properly seated.

NOTE

Because of upgrades, boards of different revision levels may not contain identical hardware. However, GE Motors & Industrial Systems ensures backward compatibility of replacement boards.

Replacing EEPROM Chip/SIMM Flash Memory

Configurable items for applications are stored in a socket mounted EEPROM (see Figure 2, device U30) that is mounted on the DSPC board. When replacing the DSPC board, it may be necessary to either enter the application information into the new EEPROM chip (on the new DSPC board) or to place the EEPROM chip from the original board into the new board.

Program and FPGA logic configuration data is stored in a flash memory on a removable SIMM. When replacing the DSPC board, it may be necessary to to either enter this information into the new SIMM or to place the SIMM from the original board into the new board.

NOTE

If application information must be loaded into a new EEPROM chip or SIMM, follow the procedures in the main LCI instruction book.

When replacing or exchanging the EEPROM chip or SIMM, the following practices must be observed:

WARNING

To prevent electric shock, make sure that all power supplies to this equipment are turned off. Then ground and discharge the equipment before performing any adjustments, servicing, or other act requiring physical contact with the electrical components or wiring.

CAUTION

To prevent component damage caused by static electricity, treat all boards with static sensitive handling techniques. Use a grounding strap when handling boards or components. Store boards in anti-static bags or boxes.

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

CAUTION

To prevent damage, use the proper EEPROM extraction/insertion tool when removing and inserting EEPROMS. GE Motors & Industrial Systems recommends use of a clamp type puller that exerts a pushing force against the receptacle or board.

Do not use a screwdriver to pry one end of the chip from the receptacle.

To prevent damage to the EEPROM chip, ensure that it is properly oriented when inserting into the socket. Improper orientation of the EEPROM chip may result in the destruction of the EEPROM chip or the board.

Replace EEPROM chip as follows:

1. Remove EEPROM chip from replaced DSPC board using the proper removal tool.

2. Remove EEPROM chip from new DSPC board using the proper removal tool. (Retain new unprogrammed EEPROM chip from new board for possible future use.)

3. Orient old EEPROM chip in socket on new DSPC board and press into mounted position.

Replace SIMM flash memory as follows:

1. Remove SIMM from the replaced DSPC as follows:
   a. Push retaining clips on each end of the SIMM away from the SIMM to release it from the socket.
   b. Tilt the SIMM down and carefully slide it out from the socket.

2. Remove SIMM from the new DSPC by performing substeps a and b of step 1. (Retain new unprogrammed SIMM from new board for possible future use.)

3. Orient old SIMM in socket on new DSPC board and tilt the SIMM upward into mounted position allowing the retaining clips on each side of the socket to snap into position and secure the SIMM.

Notes:

GE Motors &
Industrial Systems

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