



# Application Control Layer Module (ACL) IS215ACL\_H\_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 or condition that, if not strictly observed, could result in damage to or destruction of equipment.

**Note** Indicates an essential or important procedure or statement.

*These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met during installation, operation, and maintenance. If further information is desired or if particular problems arise that are not covered sufficiently for the purchaser's purpose, the matter should be referred to GE Industrial Systems.*

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Windows is a trademark of Microsoft Corporation.  
Modbus is a trademark of Modicon.  
QNX is a registered trademark of QNX Software Systems, Ltd.

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## Functional Description

The IS215ACL\_ Application Control Layer Module (ACL) is a microprocessor-based master controller used to perform multiple duties over communication networks such as Ethernet™ and ISBus. The ACL mounts in a standard Innovation Series™ drive or EX2100 exciter board rack and occupies two half-slots. The ACL and board rack are located in the control cabinet. In drive applications, the ACL's P1 connector (4-row 128-pin) plugs into the Control Assembly Backplane Board (CABP). In the EX2100 exciter, the ACL mounts in the Exciter Backplane (EBKP).

The ACL can be ordered in two different I/O configurations as follows:

- IS215ACLAH1A Module with one 10BaseT Ethernet port and two serial communication ports (COM1 and COM2), as used in the EX2100
- IS215ACLIH1A Module with one 10BaseT Ethernet port, two serial communication ports (COM1 and COM2), and two ISBus ports

Refer to Figure 1 for the module faceplates.

Optional hardware accessories are available. These items must be ordered separately from the ACL and include the following:

- Serial adapter cable (336A4929G1)
- Serial cable (336A3582P1)

Primary features of the ACL core software include:

- Control blockware language and library
- Online application configuration loading
- I/O points and internal Booleans forcing
- Diagnostics for broken run/start permissives
- Application level alarm messages
- Non-volatile flash memory
- Toolbox interface and support through Ethernet
- Application control for Innovation Series drives

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**Note** Do not reset or power down the ACL when the FLSH LED is lit (see Figure 1 for location). Doing so may corrupt the flash file system and a flash reload may be required.

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ACL Part Number	486DX4-100	8MB DRAM	4M Flash Memory	8 Status LEDs	4 Function LEDs	4 ISBus LEDs	Reset Switch	10BaseT Ethernet	COM1 and COM2	PC/104™ Transition Board	IS200ISBA ISBus™ Board
IS215ACLAH1A	•	•	•	•	•		•	•	•	•	
IS215ACLIH1A	•	•	•	•	•	•	•	•	•	•	•

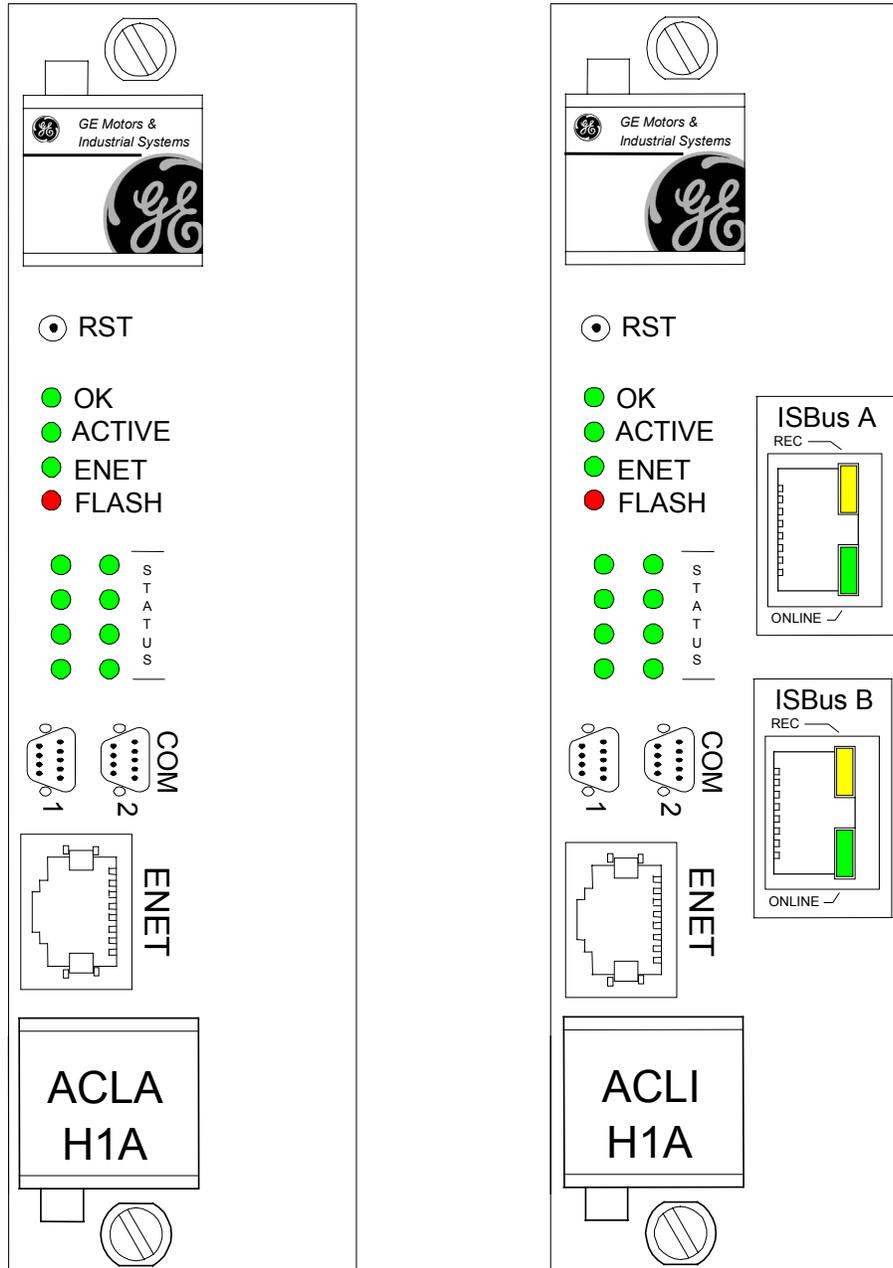


Figure 1. IS215ACLA and IS215ACLI Module Faceplates

## Hardware Features

Integrated circuits on the ACL provide the following features:

- Central processing unit (CPU)
- Peripheral component interconnect (PCI) controller
- 128 K byte level 2 cache
- 8 MB dynamic random access memory (DRAM)
- 4 MB flash memory basic input/output system (BIOS)
- Ethernet
- Bus target interface
- Serial ports COM1 and COM2
- Ethernet
- ISBus communication ports (IS215ACLI only)

Refer to Figure 3 for an ACL functional flow diagram.

**CPU** incorporates 16 K byte of internal L1 cache. It is a 486 type processor operating at 100 MHz.

**PCI controller** manages all memory, I/O, and configuration transfers to and from the PCI bus. Memory and I/O transfers are normal reads/writes from the CPU. Configuration reads/writes must be accessed as 32-bit transfers by writing the configuration address to an I/O port, and then accessing another I/O port to read/write the configuration register.

**128 KB Level 2 (L2) Cache** is controlled by the PCI controller. The L2 cache is preset to produce 152 Ns cache line fills between the L2 cache and the L1 cache.

**BIOS** is a 1 MB (128 KB x 8) 5 V flash memory device and mounts in a socket on the ACL. See Table 4, *Basic BIOS Settings*, for settings accessible through the toolbox, as well as through the setup utility. The BIOS will redirect the video display to COM1 if a video BIOS is not found (if there is no PC/104 VGA board installed).

The flash memory BIOS is divided into three sections:

- main BIOS
- BIOS setup utility
- GE Industrial Systems Extended BIOS

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**Note** To corrupt the CMOS for reset, remove power and then short all three pins of J1 together for ten seconds, then reset the drive. (Refer to Figure 4 for J1 location.)

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**DRAM** consist of 8 MB of 60 Ns EDO nonparity. The PCI controller controls access to the DRAM.

**Bus Target interface** provides a bridge between the PCI bus and the ACL local bus ISA controller. The interface can select up to four local bus devices, although only three are used in the drives. Figure 2 shows the Bus Target interface connection.

**Dual-Ported RAM (DPRAM)** (8k x 8 size) is located on the local bus and identified as Device0. The ACL communicates with the Digital Signal Processor board (DSPX) through the 32-bit P1 bus and the DPRAM. The DSPX board generates the P1 bus cycles. If simultaneous accesses occur on the same address, the ACL may hold the DSPX board in an OFF condition for a maximum of 100 Ns.

*DPRAM can only be used on modules that do not use the ISBus.*

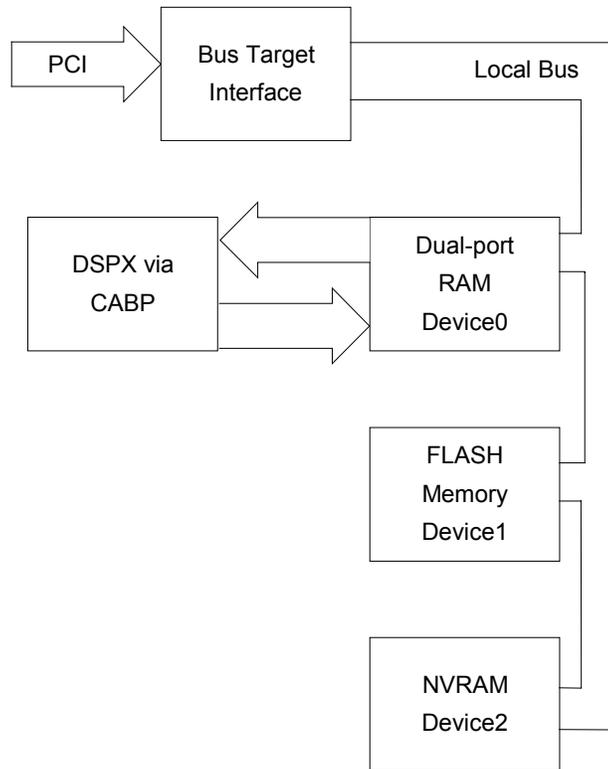


Figure 2. Bus Target Interface Connection

**Flash Memory Device** is located on the local bus side of the bus target interface, and is identified as Device1. The device is accessed in byte mode.

**PCI/ISA Bridge** is connected to the PCI controller through the CPU Address bus and the LINK bus and controls the following functions:

- ISA bus control logic
- IRQ to PCI interrupt routing
- System clock generator

**Reset Switch Logic** is connected through the RESET switch located directly below the top ejector on the ACL faceplate.

**PC Compatible interface** is also handled by the ISA controller and provides the following functions:

- Numeric coprocessor and CPU interface logic
- Keyboard and speaker control logic
- Two programmable interrupt controllers
- Real Time Clock (RTC)
- Two DMA controllers
- One programmable interval controller
- System management interrupt control logic
- Advanced power management control logic
- Power management unit control logic

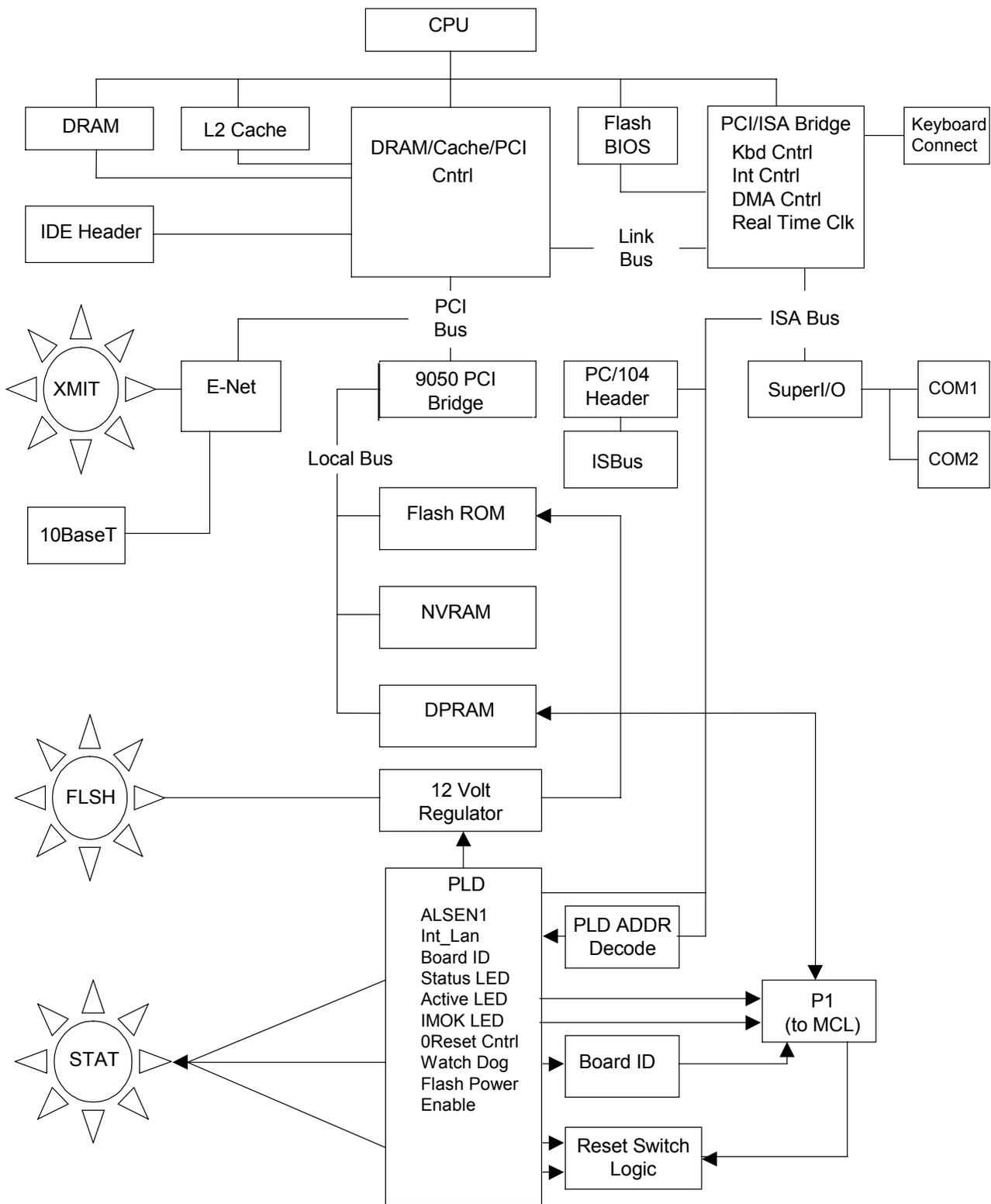


Figure 3. ACL Flow Diagram

See Table 5 for COM1/COM2 pin definitions and Figure 6 for connector diagram.

Refer to Figure 4 for J4 and J5 locations.

The time signal is disabled during power up.

The ACL is compatible with the QNX operating system (OS).

**Keyboard Interface** is handled through the keyboard controller. This interface requires that an adapter cable be constructed on-site.

**Serial Ports COM1 and COM2** are stacked, micro-miniature 9-pin D connectors located on the ACL faceplate. Because of the size of the 9-pin D connectors, an adapter cable is needed to convert the 9-pin micro-miniature connector to the standard 9-pin miniature D connector (336A4929G1).

**Transition Board with PC/104 Header** is included in the ACL with the PC/104 specification. The transition board is not used by exciter systems.

**IS200ISBA ISBus Daughterboard** is provided in the IS215ACLI versions of the ACL. This daughterboard has two ISBus communication channels (A and B) with two status LEDs per channel. The ACLI versions are not used by the exciter systems.

**Ethernet** connection uses IRQ 5 that is initialized by the BIOS. The Ethernet connection is a 10BaseT (RJ45) jack located on the ACL front panel. The shield can be directly tied to chassis common, or through a 0.1 µfarad capacitor as selected by jumpers J4 and J5. Table 1 lists the ACL interfaces.

Table 1. ACL Ethernet Interfaces

Component	Function	Protocol
GE Control System Toolbox	ACL configuration	TCP/IP
GE Control System Toolbox	DSPX configuration	TCP/IP
CIMPLICITY™	Human-machine interface	Ethernet global data (EGD)
ACL Master Controller	Real time control	Ethernet global data (EGD)
Modbus™	Interface to other systems	Ethernet Modbus SRTP

**ISBus Interface** is in the IS215ACLI only. It provides two ISBus channels and can operate as an ISBus master, or as an ISBus slave, depending on software configuration. The purpose of the ISBus is to allocate a pool of synchronous channels to swap data back and forth between master controllers and slave modules. An asynchronous channel is also provided for configuration purposes. For more information refer to the *ISBus User's Manual, GEH-6416*.

**Board Identification** is through a read-only memory chip tied to the BRD\_ID line and DCOM. It is accessed by the DSPX board to obtain the following information:

- unique serial number assigned by the semiconductor manufacturer
- board catalog number
- major and minor revision record

**INT\_LAN Time Synchronization** provides a programmable on-board timer that produces a periodic time signal to the DSPX board through the INT\_LAN signal on P1 and the selectable IRQ line. The period of the DSPX time tic is fixed at 1 ms. Driving of the P1 and the ISA IRQ lines can be enabled and disabled through I/O port writes.

## Software Features

**Basic Input/Output System (BIOS)** identifies and initializes the hardware. During initialization, the BIOS directs all output display information to the COM1 serial port. The BIOS also supports serial loading of the operating system (compatible with present GE loader) during the initial boot sequence through the COM1 port.

The GE extended BIOS performs the following functions:

- Overwrites the boot interrupt to point to GE's extended BIOS
- Displays the CMOS settings via the COM1 serial port (accessible through the toolbox and setup utility)
- Accommodates an RS-232C download
- Initializes any GE-specific hardware
- Resets the ACL\_ through RESDRV when needed through an I/O write
- Enables flash disk support and booting
- Overwrites INT 10 with calls to the serial interrupt

## **GE Control Systems Toolbox**

*To order the toolbox software and specific product support files, refer to the Product Catalog, GEP-9145.*

The ACL is configured, and its firmware upgraded, using the GE Control System Toolbox (toolbox). Complete application data is downloaded to the ACL through Ethernet. Refer to *GEH-6402, GE Control System Toolbox for Innovation Series Controller* for toolbox installation and operation instructions.

To configure an ACL, install the following (available on GE Control Systems Solutions CD):

- toolbox
- Innovation Series controller, or EX2100 exciter

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**Note** Additional application dependent block library (ADLIB) files are available for specific applications on separate CDs.

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### **Warning**

**To prevent personal injury or equipment damage caused by equipment malfunction, only trained persons should modify any programmable machine.**

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*A firmware download is required any time an ACL is replaced.*

The toolbox is used to configure the runtime actions of the ACL. It specifies all application code configuration information and records it using a binary format called *Pcode*. The toolbox downloads Pcode to the ACL into volatile or permanent (Flash) storage. It is also used to monitor and alter parameters, and to make minor code changes online. The toolbox upgrades the latest product code firmware, such as block libraries, scheduler, and others over the Ethernet.

The ACL operating system (QNX) is upgraded using the Serial Loader. Instead of changing the EPROM, this firmware is loaded into the flash memory of the ACL over a serial cable. The TCP/IP address of the ACL is also set with the Serial Loader, providing additional communication with the toolbox over Ethernet.

## **Related Documents**

*If needed for supplementary information, refer to the following documents as applicable*

This document references other manuals that contain information pertaining to the ACL manual. It should be used in conjunction with them when additional information is required. Related manuals include the following:

- GEP-9145 Product Catalog
- GEH-6402 Control System Toolbox for Innovation Series Controllers
- GEH-6410 Innovation Series Controllers System Manual
- GEH-6382 EX2100 User's Guide
- GEH-6631 EX2100 Installation and Startup Guide

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# Application Data

## Power Requirements

Table 2. ACL Power Requirements

Module	15 V dc (Amps)	5 V dc (Amps)
IS215ACLAH1A	100 mA (peak)*	1.9
IS215ACLIH1A	100 mA (peak)*	2.2

\*This peak occurs when writing to the flash memory.

## Adjustable Hardware

*Jumper J1 is for special purposes, refer to BIOS in the section Hardware Features.*

The ACL includes three jumpers on the ACLA board and one additional jumper on the ISBA board (IS215ACLI modules only). ACLA board jumpers J4 and J5 select the Ethernet shielding and are defined in Table 3. ISBA board jumper JP1 should always be set in the BD1 position. Refer to Figure 4 and Figure 5 for jumper locations.

## Connector Pin Signals

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**Note** ACLA board backplane connector P1 requires a custom extender board to access individual pin signals. Checking of these signals is not a part of standard in-service testing/troubleshooting procedures and these signals are not described in this publication. PC/104 header signals are also not defined.

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User connectors are located on the ACL faceplate. Pin signals for these connectors are defined in the following tables:

Table	Connector
5	COM1/2 Interface Connectors
6	P3 Ethernet Interface Connector
7	ISBus Connectors (IS215ACLI modules only)

## Status and Fault Indicators

Status and fault indicators are located on the ACL front panel (see Figure 1).

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**Note** For complete LED fault code information, refer to the *System Manual for Innovation Series Controller, GEH-6410*.

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The LED indicators are as follows:

**OK** is lit solid when the watchdog timer is enabled, and goes out when the watchdog times out.

**ACTIVE** is lit solid when the CPU is accessing memory.

**ENET** blinks when the Ethernet is transmitting data.

**FLASH** is lit solid when a flash write operation is enabled, and goes out when the operation has completed.

**STATUS** display diagnostic information. The LEDs indicate BIOS steps during the ACL boot sequence.

- Once the ACL is properly initialized, each LED lights for 0.5 seconds and then goes out, and another LED lights. If an LED remains lit, the ACL has stalled.
- If a fault occurs while loading the application code, the LEDs blink a Status Code indicating an application fault.
- If a fault occurs during operating system startup, the LEDs present a non-blinking BIOS Status Code indicating a startup fault.

**ISBus Receive/Online LEDs** (IS215ACLI Modules Only, see Figure 1)

On the IS215ACLI modules (includes ACLA board), four more LEDs are provided on the ISBus connectors (two per channel).

- The yellow ISBus REC LEDs light when the ISBus is receiving modulation from the network through that channel.
- The green ISBus ONLINE LEDs light steady when the ISBus network for that channel is operational and online.

Table 3. Ethernet Shielding Option Jumper Combinations

J4	J5	Description
Out	Out	Shield not tied to chassis
Out	In	Shield tied directly to chassis
In	Out	Shield tied to chassis through capacitor
In	In	Shield tied directly to chassis

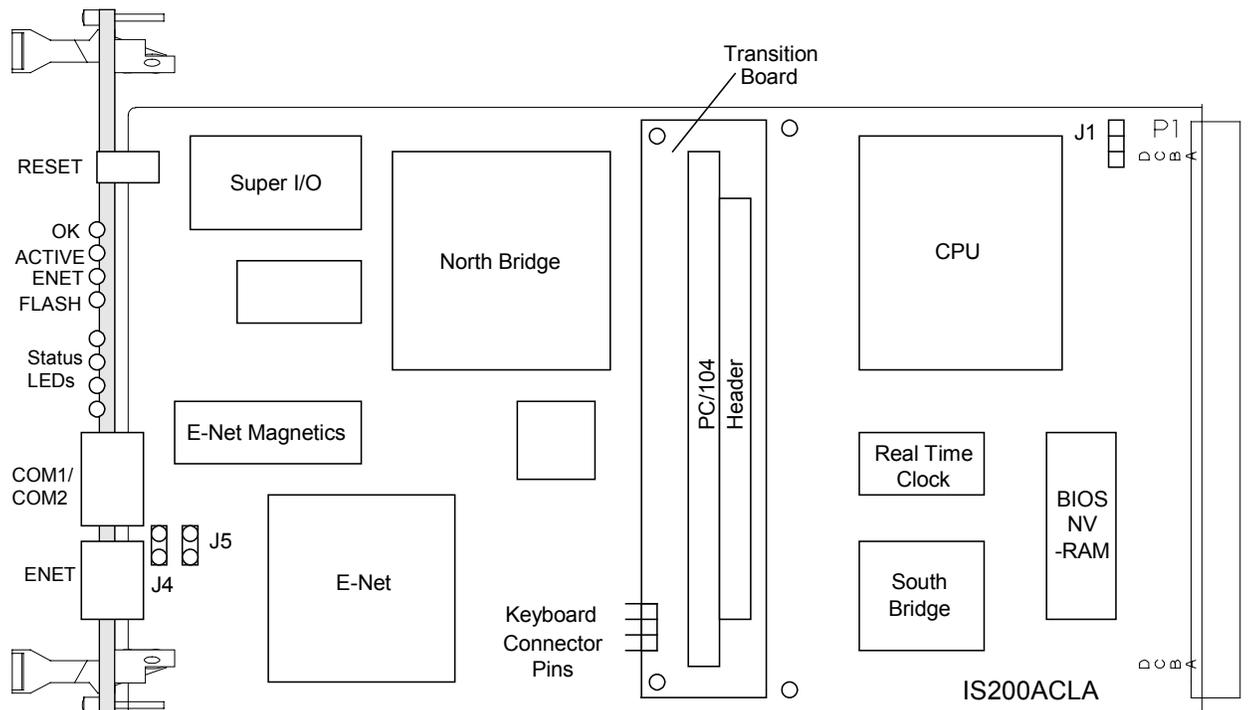


Figure 4. IS200ACLA Board Layout Diagram

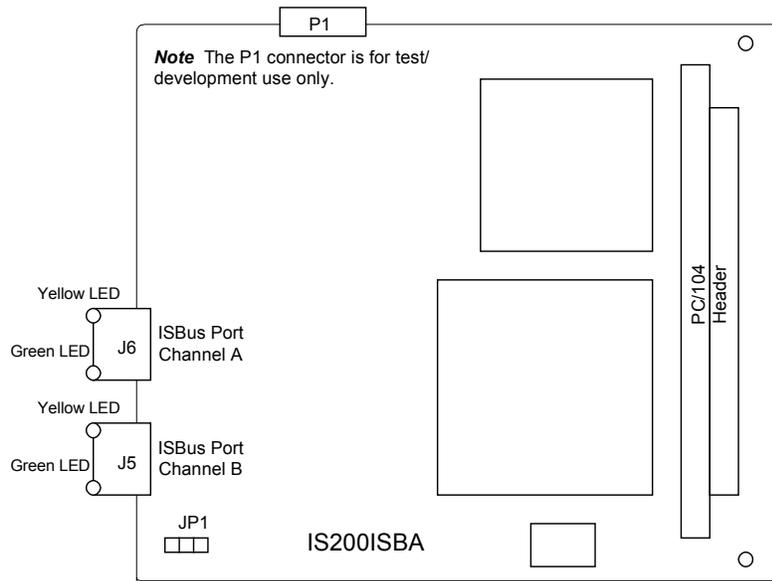


Figure 5. IS200ISBA Board Layout Diagram

Table 4. Basic BIOS Settings

Section	Setting	Main BIOS	
Basic Settings	Time: Hours	00	
	Minutes	00	
	Seconds	00	
	Date: Month	01	
	Day	00	
	Year	1970	
Boot/UMB Options	Memory Check*	On	
	Flash Boot Enable	Yes	
	Ethernet Boot Enable	No	
	Boot Sequence	C:..A:	
	L1 Cache Enable	On	
	L2 Cache Enable	On	
	Shadow C0000-CBFFF	No	
	Shadow CC000-CFFFF	No	
	Shadow D0000-D3FFF	No	
	Shadow D4000-D7FFF	No	
	Shadow D8000-DBFFF	No	
	Shadow DC000-DFFFF	No	
	Shadow E0000-E7FFF	Yes	
	Shadow E8000-EFFFF	No	
Shadow System BIOS	Yes		
Shadow Video BIOS	Yes		
Drive Settings	Drive 0 Cylinders	989	
	Drive 0 Heads	12	
	Drive 0 Sectors/Track	35	
	Drive 1 Cylinders	0000	
	Drive 1 Heads	00	
	Drive 1 Sectors/Track	00	
	IDE Enable	No	
	Floppy Enable	No	
	RAM Chipset Control	AT Bus Clock	CPU/4
		DRAM Read Timing	Fastest
DRAM Write Timing		Fastest	
SRAM Read Timing		2-1-1-1	
SRAM Write Timing		0 wait	
Parity Check Enable		No	
Hidden Refresh Enable		Yes	
PCI to ISA Control	ISA I/O Recovery Time	Off	
	CPU to PCI Write Buffer	On	
	Byte Merge Enable	Yes	
	Fast Back to Back	On	
	VGA Locate Bus	ISA	
	PCI to DRAM Buffer	On	
	PCI VGA Palette Snoop	Off	
M1-SC Linear Wrapped Mode	Off		
	PCI INT0 to ISA Routing	IRQ 5	

\*The Memory Check setting defaults to OFF when GE BIOS.

**Note** All GE BIOS settings default to N/C (not connected).

Table 5. COM1/COM2 Interface Connector

Pin No.	Nomenclature	Description
1	DCD	Data Carrier Detect, from modem
2	RXD	Received Data, from modem
3	TXD	Transmitted Data, to modem
4	DTR	Data Terminal Ready, to modem
5	SIG GND	Serial Interface Ground reference
6	DSR	Data Set Ready, to modem
7	RTS	Request To Send, to modem
8	CTS	Clear To Send, from modem
9	RI	Ring Indicator, from modem

**Note** GE Industrial Systems supplies a cable to convert the 9 pin receptacle microminiature D connector to a standard 9 pin subminiature D connector (Part No. 336A4929G1)

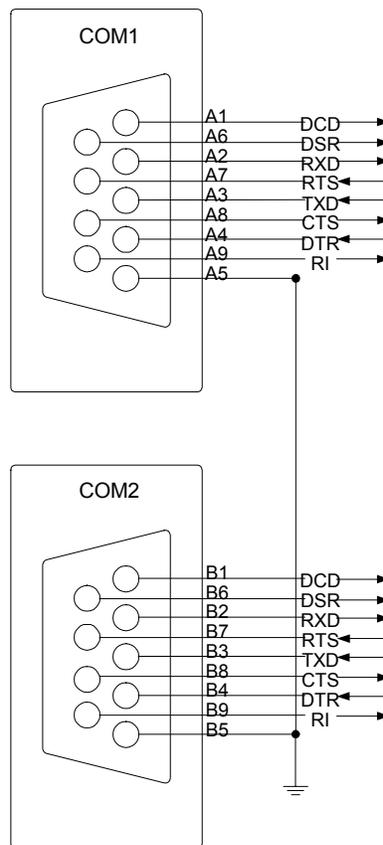


Figure 6. COM1/COM2 Interface Connector

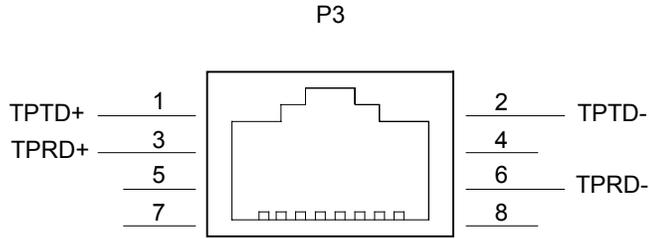


Figure 7. P3 Ethernet (RJ45) Interface Connector

Table 6. P3 Ethernet (RJ45) Interface Connector Pin Signal Descriptions

Pin No.	Nomenclature	Description
1	TPTD+	Transmit (differential positive)
2	TPTD-	Transmit (differential negative)
3	TPRD+	Receive (differential positive)
4-5	N/C	Not connected
6	TPRD-	Receive (differential negative)
7-8	N/C	Not connected

**Note** A direct Ethernet connection from the ACLA to a PC requires an Ethernet null modem cable.

Table 7. ISBus Interface Connector Pin Signal Descriptions (Channels A and B)

Pin No.	Nomenclature	Description
1	TXP	Transmit data positive
2	TXN	Transmit data negative
3	RXN	Receive data negative
4, 5	-----	Looped back
6	RXP	Transmit data positive
7, 8	N/C	Not connected

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# Board/Module Replacement

The IS215ACLI module consists of an Application Control Layer Board and a PC/104 ISBus Expansion Board. To order a replacement module that includes the expansion board, specify an **IS215ACLIH\_A** module.

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**Note** The IS215ACLI module should be replaced as a unit. It is not recommended to replace the boards individually due to software compatibility issues.

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## Handling Precautions

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### 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.**

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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 above Caution criteria).

## For Drives

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### Warning

**To prevent electric shock, turn off power to the board/module, then test to verify that no power exists in the board before touching it or any connected circuits.**

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### Caution

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

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#### ➤ To remove the module from the drive board rack

1. Make sure that the drive in which the module resides has been de-energized.
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. Disconnect all communication cables from the COM1/2, ENET, or ISBus connectors on the ACL faceplate.
4. Carefully remove the module 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 it from the rack.

➤ **To install the new (replacement) module in the drive board rack**

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**Caution**

Because ACL modules are designed for specific rack slots, inserting the ACL board into the wrong slot can damage the electronics.

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1. Set all adjustable hardware on the new module in the same positions as on the module removed.
  2. Slide the module into the **correct slot** in the rack.
  3. Begin seating the board by firmly pressing the top and bottom of the faceplate at the same time with your thumbs.
  4. Finish seating the module 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 module is seated squarely.
  5. Reconnect all communication cables that were disconnected when the old module was removed.
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**Note** After the ACL is replaced, it must be reconfigured. Refer to the *System Manual for Innovation Series Controller, GEH-6410* for the required procedures. Also refer to the *GE Control Systems Toolbox, GEH-6402* for additional procedures that may be required.

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**For Exciters (Offline)**

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**Warning**

To prevent electric shock, turn off power to the exciter, then test to verify that no power exists in the board before touching it or any connected circuits. There are special procedures for online repair, see *Online Replacement Procedures*.

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**Caution**

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

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➤ **To replace the board offline**

1. Make sure that the exciter has been de-energized.
2. Open the control cabinet door and check that the power indicators on the EPDM and EPSM power supplies are off, and the LEDs on the ACL are off.
3. Disconnect the Ethernet and any other communication cables from the ACL front panel.

*Refer to the EX2100 Installation and Startup Guide, GEH-6631 for complete de-energizing procedures and follow all local practices for lock-out/tag-out.*

4. Carefully remove the ACL board and the attached blank plate underneath from the control rack, as follows:
  - a. Loosen the screws at the top of the ACL faceplate and the bottom of the blank plate, near the ejector tabs. (The screws are captive in the faceplate and should not be removed.)
  - b. Unseat the ACL and attached plate by raising the ejector tabs.
  - c. Using both hands, gently pull both from the rack.
5. Remove the blank plate from the bottom of the ACL, and attach it to the replacement ACL.
6. Slide the replacement ACL board and plate into the correct slot in the rack.
7. Begin seating the board by firmly pressing the top and bottom of the faceplate at the same time with your thumbs.
8. Finish seating the module in the slot by starting and then alternately tightening the screws at the top and bottom of the faceplate assembly. **Tighten the screws evenly** to ensure that the module is seated squarely.
9. Reconnect all communication cables that were disconnected when the old module was removed.

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**Note** After the ACL is replaced, it must be reconfigured. Refer to the toolbox for configuring the exciter and the Innovation Series Controller System Guide, GEH-6410, for the required procedures.

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## ***For Redundant Exciters (Online)***

For a **redundant** control system, it is possible to replace the failed ACL while the exciter is running. You have the option to leave the failed ACL in place and let the exciter run on the remaining controller. However, in the unlikely event of a second control failure the exciter will shut down. If you decide to change the ACL board, follow the procedure below.

### **➤ To replace a board in a redundant control rack online**

1. Open the control cabinet door and confirm the failed ACL from the indicators on the front of the board. Check that the rotating green LEDs are stopped, if both ACL LEDs are rotating, check the keypad to determine the failed ACL.



### **Warning**

**Care should be taken in replacing the board since the other controllers, power supplies, and terminal boards are still energized and active.**

2. De-energize the section of the control rack containing the ACL to be replaced, either section M1 or M2. This section is de-energized by switching off the appropriate section of the exciter power distribution module (EPDM). Check that the LED indicator on the appropriate section of the EPDM and the EPSM are both off.
3. Check the ACL and ESEL board's LEDs to confirm that control is transferred to the other master. Check that all the power indicators on the boards in the section of the control rack containing the ACL to be replaced are off before touching the ACL or any connected circuits.

4. Disconnect the Ethernet and any other communication cables from the ACL front panel.
5. Carefully remove the ACL board and the attached blank plate underneath from the control rack as follows:
  - a. Loosen the screws at the top of the ACL faceplate and the bottom of the blank plate, near the ejector tabs. (The screws are captive in the faceplate and should not be removed.)
  - b. Unseat the ACL and attached plate by raising the ejector tabs.
  - c. Using both hands, gently pull both from the rack.
6. Remove the blank plate from the bottom of the ACL, and attach it to the replacement ACL.
7. Slide the replacement ACL board and plate into the correct slot in the rack.
8. Begin seating the board by firmly pressing the top and bottom of the faceplate at the same time with your thumbs.
9. Finish seating the module in the slot by starting and then alternately tightening the screws at the top and bottom of the faceplate assembly. **Tighten the screws evenly** to ensure that the module is seated squarely.
10. Apply power to the appropriate section of the control rack from the EPDM, and check that the LED power indicators on the EPDM and EPSM come on. Check that the green OK LED lights on the ACL, and green power LEDs on the adjacent controller boards come on.
11. Reconnect all communication cables that were disconnected when the old module was removed.
12. From the toolbox, reconfigure and download the ACL.
13. The replaced ACL can be tested by transferring control from the active master to the inactive master and observing correct operation.



**Caution**

After the ACL is replaced, it must be reconfigured. Refer to the toolbox for configuring the exciter and the Innovation Series Controller System Guide, GEH-6410, for the required procedures.

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# Renewal/Warranty Replacement

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

When ordering a replacement board/module 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

## Board Identification

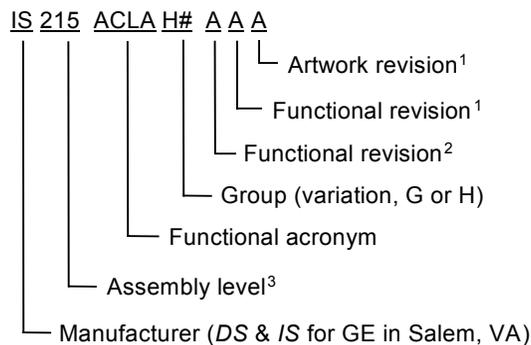
*All digits are important when ordering or replacing any board.*

A printed wiring board/module is identified by an alphanumeric **part (catalog) number** located near its edge. *Board/Module Part Number Conventions* explains the structure of the part number.

The board/module's functional acronym, shown in *Board/Module Part Number Conventions* is normally based on the **board/module description**, or name. For example, the ACL module is described as the *Application Control Layer Module*.

## 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.



<sup>1</sup>Backward compatible

<sup>2</sup>Not backward compatible

<sup>3</sup>200 indicates a base-level board; 215 indicates a higher-level assembly or added components (such as PROM)

*Board/Module Part Number Conventions*

## **Placing the Order**

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

*“+” indicates the international access code required when calling from outside of the USA.*

GE Industrial Systems  
Product Service Engineering  
1501 Roanoke Blvd.  
Salem, VA 24153-6492 USA

Phone: + 1 800 533 5885 (United States)

+ 1 540 378 3280 (International)

Fax: + 1 540 387 8606 (All)

**Renewals** (spares or those not under warranty) should be ordered by contacting the nearest GE Sales or Service Office.

When ordering any warranty or renewal parts, be sure to include:

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

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**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.

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## ***GE Industrial Systems***

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