GE UCSB Controllers

Table of Contents

1.2 GE UCSB Controllers

The UCSB controllers are stand-alone computers that run the application code. The controller mounts in a panel, and communicates with the I/O packs through on-board I/O network (IONet) interfaces. IONet is a private special-purpose Ethernet that only supports Mark* controls I/O modules and controllers. The controller operating system (OS) is QNX Neutrino, a real time, multitasking OS designed for high-speed, high-reliability industrial applications. Unlike traditional controllers where I/O is on a backplane, the UCSB controller does not host any application I/O. Also, all I/O networks are attached to each controller providing them with all input data. The hardware and software architecture guarantees that no single point of application input is lost if a controller is powered down for maintenance or repair.

The Mark VIeS UCSBS1A Safety controller and Safety I/O modules are used for functional safety loops to achieve SIL 2 and 3 capabilities. Mark VIeS Safety equipment is used by operators knowledgeable in safety-instrumented system (SIS) applications to reduce risk in critical safety functions. Safety controllers and distributed I/O modules are programmed specifically for safety control use, and this specific control hardware and software has IEC 61508 certification.

The UCSB controllers offer the following advantages:

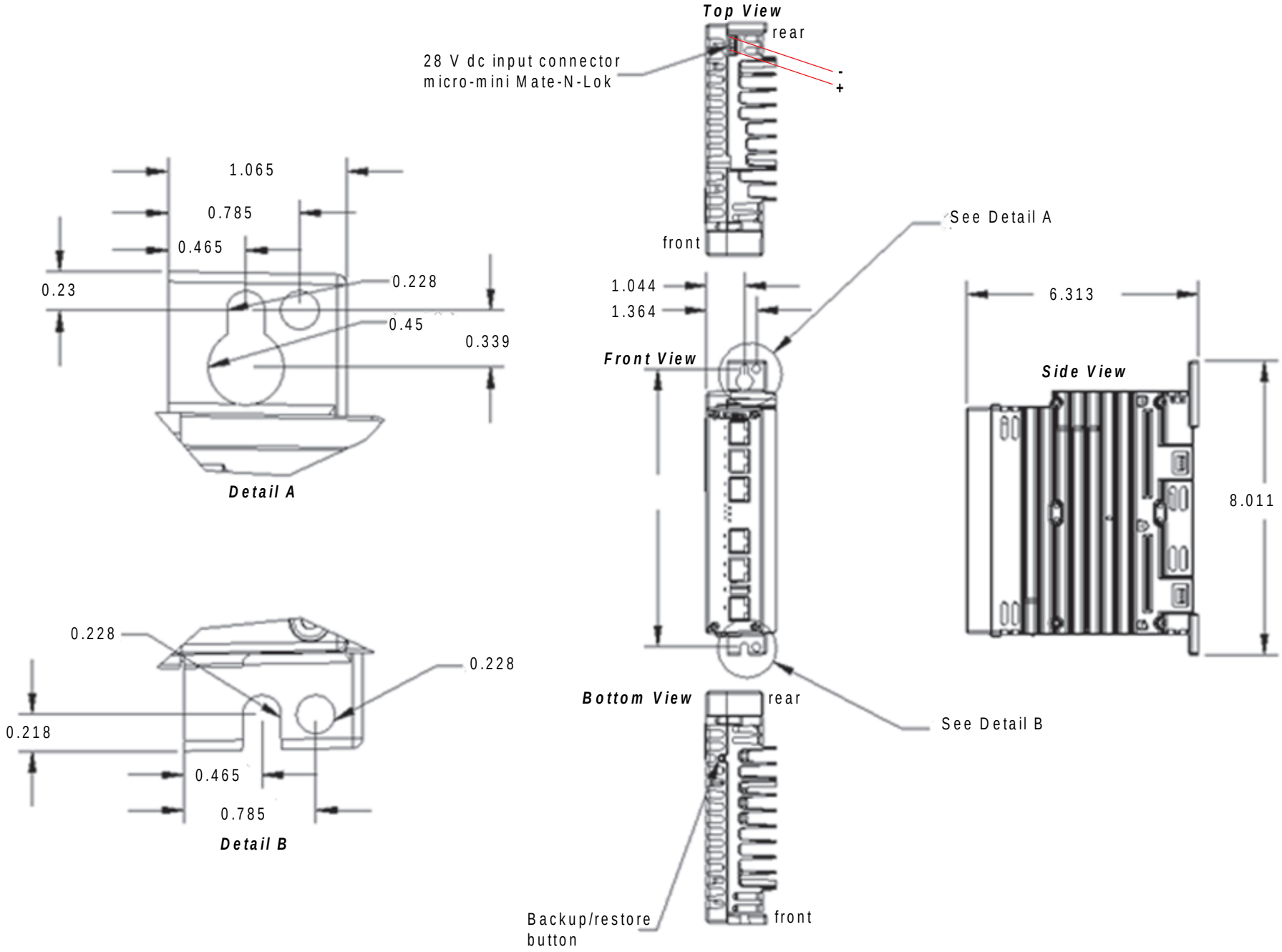
- Single module
- Built-in power supply
- No jumper settings required
- No battery
- No fan (UCSBS1A, UCSBH1A, UCSBH4A)
- Dual-redundant fans with IS420UCSBH3A
- Smaller panel footprint
- Flash memory can be conveniently updated

1.2.1 UCSB Specifications

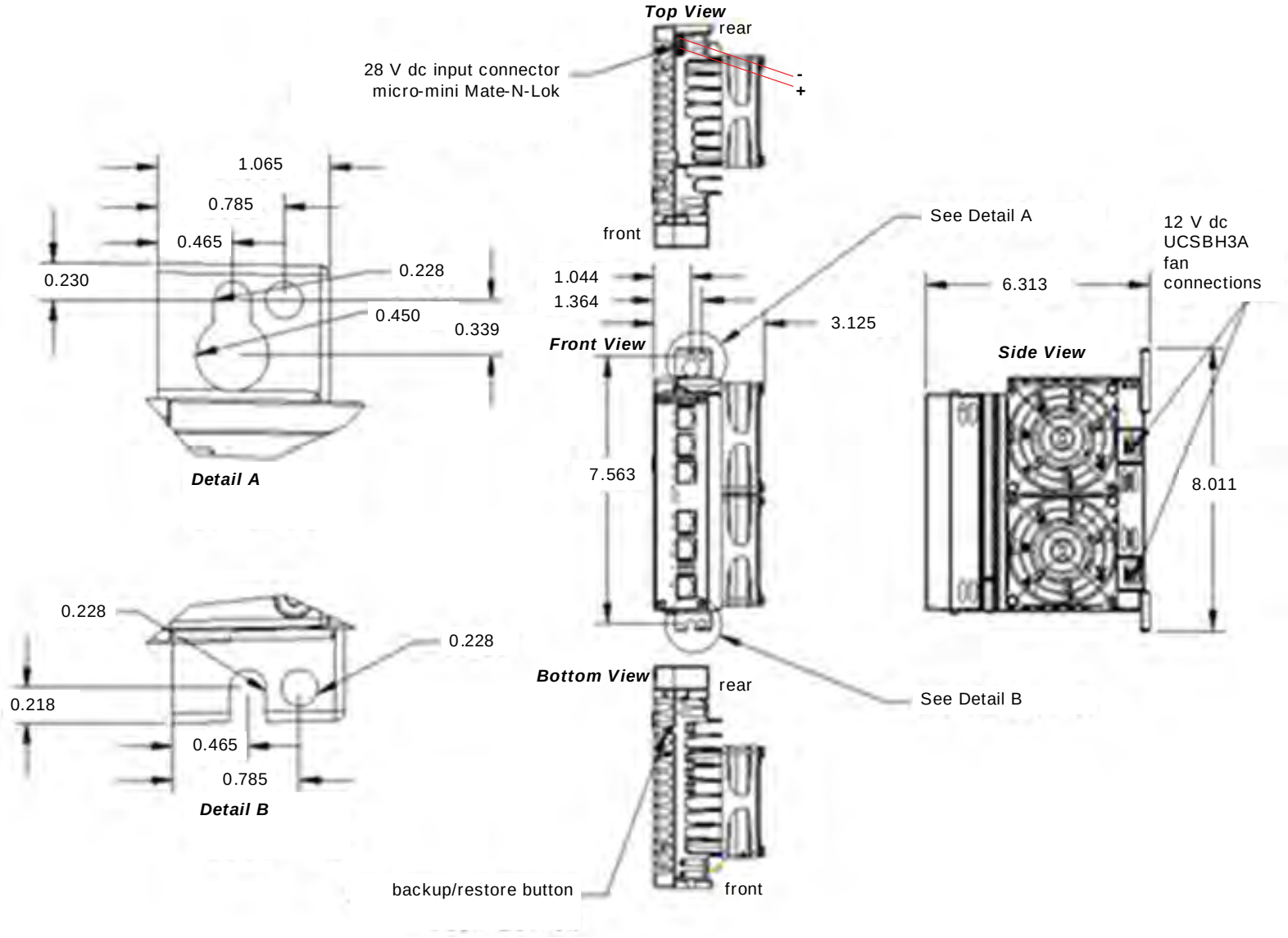
Item	UCSB Specification
Microprocessor	UCSBH1A and UCSBS1A: 600 MHz Intel EP80579
	UCSBH3A: 1200 MHz Intel EP80579
	UCSBH4A: 1066 MHz Intel EP80579
Memory	256 MB DDR2 SDRAM with error-correcting code (ECC) Flash-backed SRAM NAND flash size is 2 gigabytes
NVRAM	ControlST V07.05 and higher supports 3067 non-volatile program variables, 338 forces, and 128 totalizers ControlST V07.04 and lower supports 3067 non-volatile program variables, 338 forces, and 64 totalizers *Not supported by Mark VIeS Safety control*
Operating System	QNX Neutrino
Programming	Control block language with analog and discrete blocks; Boolean logic represented in relay ladder diagram format. Supported data types include: • Boolean • 16-bit signed integer • 16-bit unsigned integer • 32-bit signed integer • 32-bit unsigned integer • 32-bit floating point • 64-bit long floating point
Primary Ethernet Interface, ENET1	Twisted pair 10Base-TX/100Base-TX, RJ-45 connector TCP/IP protocol used for communication between controller and the ToolboxST application TCP/IP protocol used for alarm communication to HMIs EGD protocol for application variable communication with CIMPLICITY HMI and Series 90-70 PLCs
Secondary Ethernet Interface, ENET2 (***Not supported for Mark VIeS control***)	Twisted pair 10Base-TX/100Base-TX, RJ-45 connector Ethernet Modbus, OPC UA, or CDH
IONet Ethernet Interface (3 ports)	Twisted pair 10Base-TX/100Base-TX, RJ-45 connectors: • TCP/IP protocols used to communicate between controllers and I/O modules • IONet redundancy is equal to controller redundancy • Red, black, and blue Ethernet cables connect from controllers to IONet switches
COM1	This is an optional setup for the controller IP address, instead of using the flash drive. For cabling use GE-provided Ethernet cables, which are specifically designed for use in the Mark controller product family (GE part #342A4944P1).
Power Requirements	UCSBH1A and UCSBS1A: 26.7 W peak, 15.6 W nominal
	UCSBH3A: 28.7 W peak, 17.3 W nominal
	UCSBH4A: 28.7 W peak, 17.3 W nominal
Weight	UCSBH1A and UCSBS1A: 2.4 lbs (1 Kg)
	UCSBH3A: 2.9 lbs (1.3 Kg)
	UCSBH4A: 2.4 lb (1 Kg)
† Ambient rating for enclosure design	UCSBHIA and UCSBS1A: -30 to 65°C (-22 to 149 °F)
	UCSBH3A: 0 to 65°C (32 to 149 °F)
	UCSBH4A: -30 to 65°C (-22 to 149 °F)
† Refer to GEH-6721_Vol_I, the chapter Technical Regulations, Standards, and Environments for additional equipment rating information depending on application requirements.	

1.2.2 UCSB Installation

The controller is contained in a single module that mounts directly to the panel sheet metal. The following diagrams display the module envelope and mounting dimensions. All dimensions are in inches. The UCSB is to be mounted to the panel as shown with vertical air flow through the fins to be unobstructed.

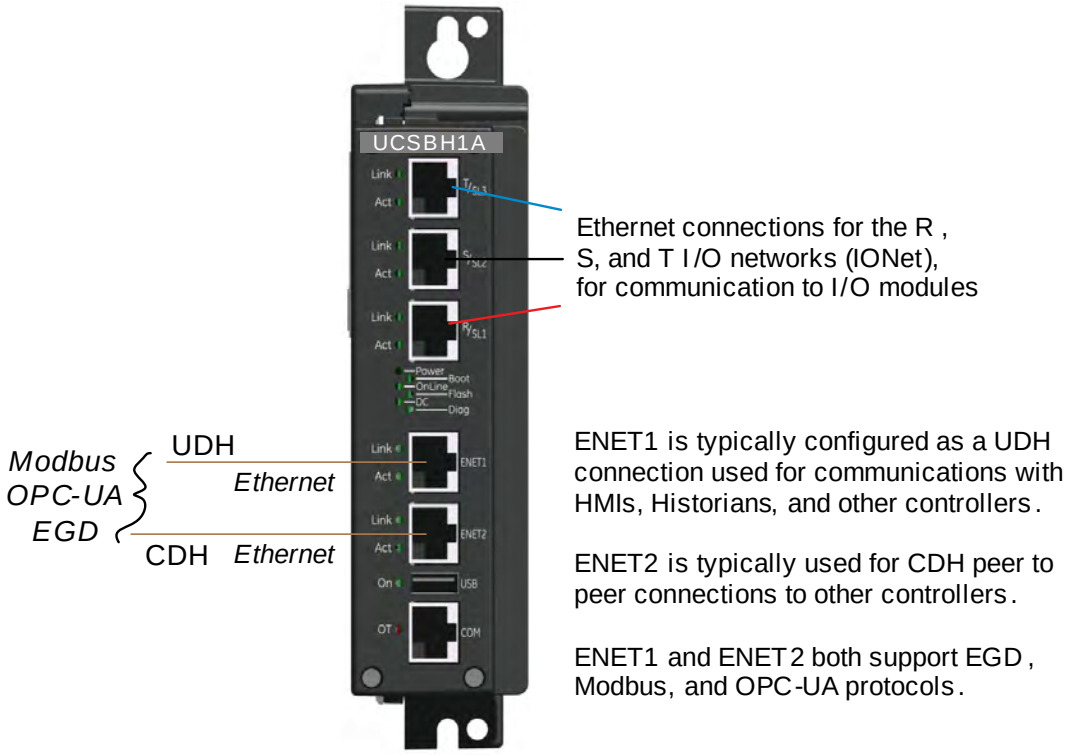


Mark VIeS UCSBS1A, Mark VIe UCSBH1A, H4A Envelope & Mounting Dimensions



Mark VIe UCSBH3A Envelope and Mounting Dimensions

The following communication ports provide links to I/O, operator, and engineering interfaces from the Mark VIe controller:



Typical Ethernet Connections

Note The Mark VIeS Safety controller does not use any CDH network, nor does it allow for OPC-UA.

OPC-UA from the Mark VIe controller requires firmware version 5.01 or later.

1.2.3 UCSB Software and Communications

The controller is loaded with software specific to its application. It can run rungs or blocks. Minor modifications to the control software may be made online without requiring a restart. The IEEE 1588 protocol is used through the R, S, and T IONets to synchronize the clock of the I/O packs and controllers to within ±100 microseconds. External data is transferred to and from the control system database in the controller over the R, S, and T IONets. This includes process inputs/outputs to the I/O modules.

In a dual system, this also includes:

- Internal state values and initialization information from the designated controller
- Status and synchronization information from both controllers

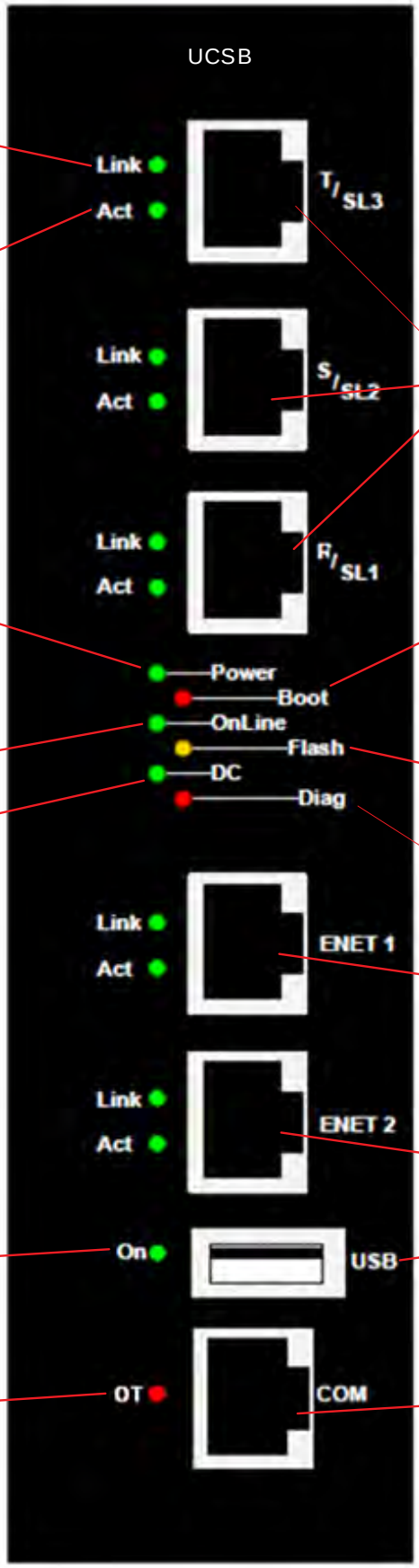
In a triple modular redundant (TMR) system, this also includes:

- Internal state values for voting and status, and synchronization information from all three controllers
- Initialization information from the designated controller

1.2.3.1 Mark VIeS Safety Controller Software Branding

If the Mark VIeS Safety controller application code is changed and downloaded, then a Branding of the new code is required. Changes that are not downloaded may cause a Brand change. Refer to *GEH-6723, Mark VIeS Safety Control Safety Instruction Guide*, the section, *Application Code Branding*. This feature is a requirement for functional safety.

1.2.4 UCSB LEDs and Connections



Link
solid green = Ethernet link has been established with the IONet switch

Act
solid green = IONet packet traffic
Flashing green = traffic is low

Power
solid green = internal 5 V supply is on and regulating The UCSB converts the incoming 28 V dc to 5 V dc. All other internal power planes are derived from 5 V.

OnLine
solid green = controller is online and running application code

DC
solid green = this is the designated controller

On
solid green = USB is active

OT over-temperature
Yellow = alarm is present
Red = trip has occurred

Ethernet connections for R, S, and T I/O networks (IONet)

Boot
solid red = startup in process
off = startup has completed
flashing red = an error is detected
flashes red once every 3 seconds = Baseload signature verification has failed

Flash
flashing **amber** = a flash device is being accessed

Diag flashing red = Active diagnostic alarm

Ethernet connection to (UDH for communication with HMI)

Provides optional CDH, OPC UA, or Modbus TCP/IP (***not supported for Mark VIeS control***)

USB connection used during initial setup of controller UDH IP address and for the backup/restore function

Used by GE during development process or for alternate IP address setup

1.2.5 UCSB Boot LED

The boot LED is lit continuously during the boot process unless an error is detected. If an error is detected, the LED flashes at a 1 Hz frequency. The LED, when flashing, is on for 500 ms and off for 500 ms. After the flashing state, the LED turns off for three seconds. The number of flashes indicates the failed state.

If the flash image is valid but the runtime firmware has not been loaded, the boot LED flashes continuously at a 1 Hz rate. Once the firmware is loaded, the boot LED turns off. If the controller does not go *online*, use the ToolboxST application to determine why the controller is blocked. Once an IP address has been assigned, ToolboxST application uses the Ethernet for configuration.

UCSB Boot LED Flashing Codes

State	Description	# of Flashes
Executing BIOS	Normally booting BIOS	On
Failed SPD	SPD has bad data	1
Failed DRAM	DRAM memory test has failed in the BIOS	2
Failed BIOS SPI	BIOS was unable to validate the BIOS SPI checksum	3
Failed CPLD	BIOS was unable to communicate with the complex programmable logic device (CPLD)	4
Failed APP SPI	BIOS was unable to communicate with the APP SPI	5
Failed QNX IFS	BIOS was unable to read or verify the QNX IFS image	6
Fully Booted	Fully Booted	Off

1.2.6 Transfer IP Address to UCSB Controller

For the software configuration procedure, refer to the *ToolboxST User Guide for Mark Controls Platform* (GEH-6700 or GEH-6703), the chapter *Controller Setup*, the section *Configure and Transfer IP Address to UCSB / UCSC Controller.*

1.2.7 UCSB Controller Replacement

Warning

To prevent personal injury or equipment damage caused by equipment malfunction, only adequately trained personnel should modify the following equipment.

Caution

Verify the controller being replaced has a RED LED. A RED LED indicates the controller is in a fault condition and is the one that needs to be replaced. Ensure the remaining two control loops are free of faults or alarms before proceeding. A failure on one of the remaining loops could cause a turbine trip.

Attention

If the Mark* VIe controller interfaces with a SecurityST* platform and Secure Mode is implemented on the controller, then the controller cores should be taken out of Secure Mode prior to executing this maintenance procedure. Once maintenance has been completed, the Mark VIe controller cores should be placed back into Secure Mode.

Note Maintenance of this component may cause loss of communication, loss of power, and a small change in valve position. When the portion of the null bias for the PSVO or PSVP I/O pack is lost, the valve might move slightly in the direction of the spring bias.

Note Refer to the Mark VIe site-specific wiring documentation for the UCSB power and communication connections. Main unit applications use three JPDCs, and feed pump turbine applications only use one JPDC in their power distributions.

Note Before performing this procedure, obtain the controller connector (serial port to Ethernet adapter, GE Part Number 342A4944P1) and an Ethernet cable long enough to connect from the controllers to a Mark VIe engineering workstation with access to the turbine controller software.

➢ To replace the Mark VIe UCSBHxx or Mark VIeS UCSBS1A

1. If possible, back up the old UCSB's NAND flash.
2. Disconnect the power plug JCR on the associated JPDC for the controller being replaced:
   a. For <R> controller, plug JCR.
   b. For <S> controller, plug JCS.
   c. For <T> controller, plug JCT.
3. Disconnect the IONet cables.
4. Disconnect the VLAN cable.
5. Loosen the screws holding the controller in place. The mounting is a keyhole design.
6. Remove the controller by lifting to align the large portion of the keyhole with the mounting screws and pull forward.
7. Install the replacement controller by lining up the large open portion of the keyhole with the mounting screws and pushing it flush with the mounting backplane. Slide the replacement controller down so that the smaller portion of the

keyhole holds the controller in place. Tighten the mounting screws to firmly hold the controller in place. Do not apply power yet.

8. Connect the VLAN cable per its wire label or in accordance with the Mark VIe site wiring documentation.
9. Connect the IONet cables per their wire labels or in accordance with the Mark VIe site wiring documentation. Connect the power to the replacement controller per the controller power wire label or the Mark VIe site wiring documentation.
10. Connect the controller connector to one end of the Ethernet cable. Connect the controller connector to the engineering workstation.
11. Connect the opposite end of the Ethernet cable to the COM port on the replacement controller.
12. Update the replacement UCSB's NAND flash with the backup from step 1.
13. If backup/restore was not successful, configure the new controller's TCP/IP address. Refer to the *ToolboxST User Guide for Mark Controls Platform* (GEH-6700 or GEH-6703), the section *Controller Setup*.

1.2.8 UCSB Backup and Restore

If the UCSB controller fails, back up the UCSB configuration (including the UDH IP address), install a replacement controller, and restore the configuration to the replacement UCSB to allow for communication to the ToolboxST application. A software recovery push-button located on the bottom of the controller is used to update the NAND flash. A 2.0-compliant, non-encrypted USB with a minimum capacity of 4 GB must be used.

➢ **To perform a UCSB backup**

Note If a serial terminal is connected to the UCSB, open the Microsoft Hyperterminal program to display backup and restore status.

1. Insert a FAT32 DOS-formatted USB drive into the front USB port on the UCSB. The USB device must be USB 2.0-compliant, non-encrypted, with a minimum capacity of 4 GB.
2. From the bottom of the UCSB, press and hold in the backup/restore button until the USB *On* LED is lit.
3. Release the button and wait while the LED remains lit and the backup is in progress. The LED turns off when the backup completes successfully.
4. Remove the USB drive.
5. If the LED flashes at a 1 Hz rate, a failure has occurred. Remove the USB drive or retry.

➢ **To perform a UCSB restore**

1. Remove power from the UCSB.
2. Insert the backed-up USB drive into the USB port.
3. Press and continue to hold in the backup/restore button, apply power to the UCSB, and continue to hold in the backup/restore button until the USB *On* LED is lit.
4. Release the button and wait while the LED remains lit and the restore is in progress. The LED turns off when the restore completes successfully.
5. Remove the USB drive.

Note If the LED flashes at a 1 Hz rate, a failure has occurred. Remove the USB drive or retry.

6. After a restore, a download from ToolboxST may be required to bring the controller back online and in the controlling state.