

Mark* V1e UCPA Controller with Integral I/O

Instruction Guide

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Document Updates

Safety Symbol Legend



Warning

Indicates a procedure or condition 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.



Attention

Indicates a procedure or condition that should be strictly followed to improve these applications.

Acronyms and Abbreviations

Acronym	Definition
AWG	American Wire Gauge
BOOL	Boolean data type
DINT	Double integer (4 byte) data type
DHCP	Dynamic Host Configuration Protocol
EGD	Ethernet Global Data
EMC	Electromagnetic Capability
EMI	Electromagnetic Interference
FE	Functional Earth
HMI	Human-machine Interface
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
INT	Signed integer (2 byte) data type
LAN	Local Area Network
NEMA®	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NTP	Network Time Protocol
PE	Protective Earth
RTU	Remote Terminal Unit
SOE	Sequence of Events
STWC	The base I/O board that is contained within the UCPA controller module
UCPA	Mark* VIe controller platform with integral I/O capability
UDH	Unit Data Highway
UDINT	Unsigned double integer (4 byte) data type
UTP	Unshielded Twisted Pair (cabling)
WEXP	The expansion I/O board that is contained within the UCPAH2A

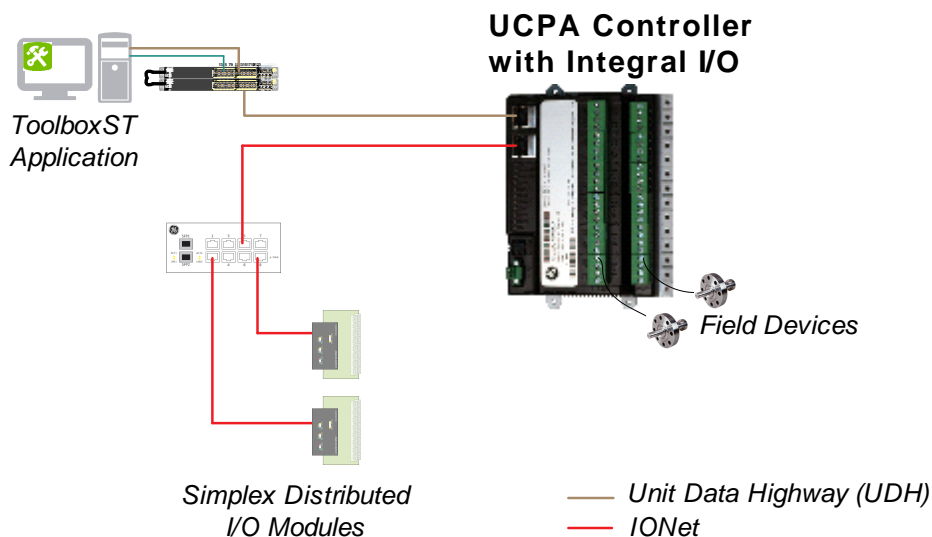
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1 Mark VIe UCPA Controller with Integral I/O

The UCPA is a Mark* VIe controller platform that runs application code (control logic). The controller has both integral I/O capabilities and can communicate with external I/O packs through a simplex IONet. The UCPA Mark VIe controller is commercial in design and not intended for use at any time in a residential environment. The UCPA controller is panel-mounted and includes the following features:

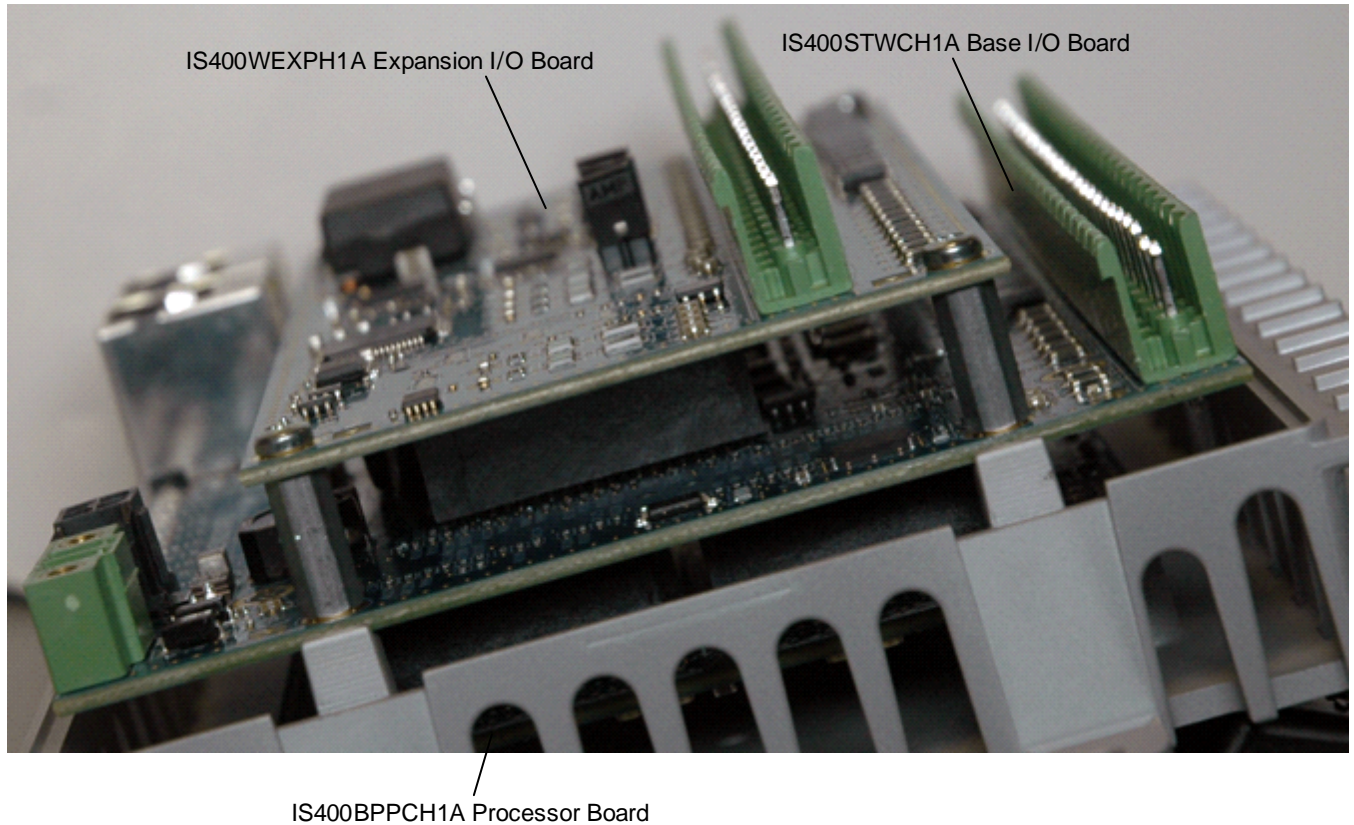
- Controller and I/O in a single module
 - Smaller panel footprint with integral I/O
 - IONet port for simplex I/O module expansion
- Single 12 V dc power supply, runs at 4 W (low power)
- Can operate in -40 to 70°C ambient temperature range
- No battery or fan
- Cost-effective platform for simplex control and I/O
- Uses ControlST* V05.04 or later with the same ToolboxST* configuration tools across the Mark Controls platform



1.1 UCPA Controller Versions

The Mark VIe UCPA controller contains the following components:

- IS400BPPCH2A processor board
- IS400STWCH1A base I/O board
- IS400WEXPH1A expansion I/O board (included with UCPAH2A)



The IS420UCPAH1A includes the IS400STWCH1A (base I/O board) and the BPPCH2A processor board. It provides the following inputs and outputs:

- Two Hall Effect [Pulse Inputs](#)
- Two [Analog Inputs \(AI\)](#)
- Four [Digital Inputs or Outputs with feedback \(DIO\)](#)

The IS420UCPAH2A also includes the IS400WEXPH1A expansion I/O board. The WEXP provides the following additional I/O:

- Six AIs (for a total of 8)
- Two Analog Outputs
- Four DIOs (for a total of 8)

Note Some I/O points are configurable on a per point basis. Refer to the section, [Configuration](#) for more information.

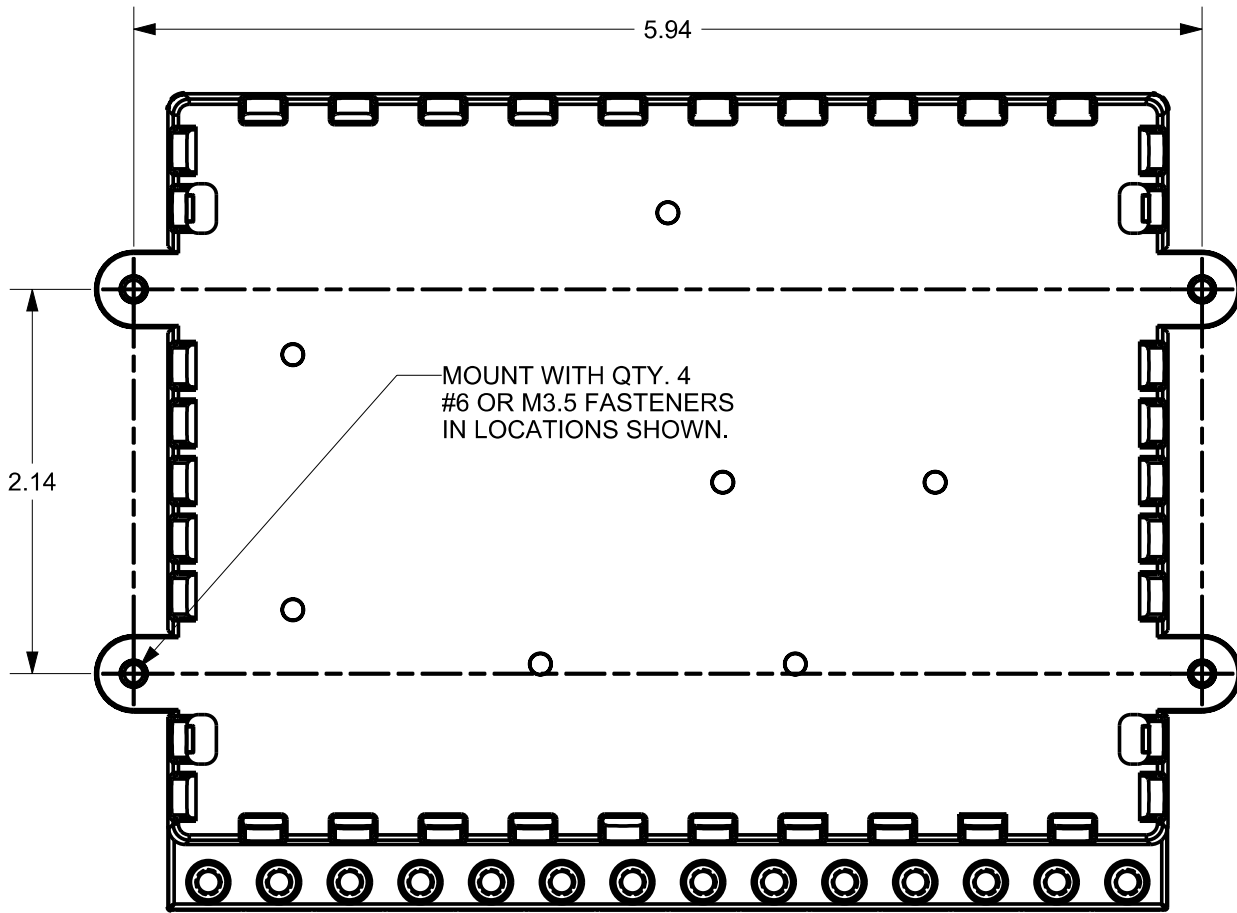
1.2 UCPA Specifications

Item	UCPA Specification
Processor	Freescale 3308 processor, 332 MHz, (BPPC-based)
Memory	64 MB RAM
	256 MB onboard flash
	32 KB NOVRAM
Temperature/Humidity rating	-40°C to +70°C, 5 TO 95% relative humidity non-condensing
Ethernet ports	2 Ethernet ports, 10/100 Mbps, ENET1 for UDH, ENET2 for IONet to (maximum 6) distributed I/O modules
Ethernet protocols supported	Modbus TCP slave, NTP, and other GE proprietary protocols
Shared IONet	Not supported
10 ms frame period	Is only supported if not using any distributed I/O packs over IONet
COM serial port	Used to set the network IP address or for maintenance by qualified GE engineer
Controller and I/O module Redundancy	Simplex
Configuration software	ToolboxST application
Internal operating system	QNX (Mark VIe controller)
Operating voltage	9 V to 16 V dc, nominal 12 V dc
Power consumption	4 W
Dimensions	162 mm X 115 mm X 72 mm
Mounting	Base-mounted
Terminal blocks	Wire sizes: 22 to 12 AWG Screw torque: 4.5 in-lb Temperature rating for copper wire: 80°C
2-pin Euro style power plug <i>Included with the UCPA part kit</i>	Wire sizes: 22 to 14 AWG Screw torque: 2.2 in-lb Temperature rating for copper wire: 80°C Wiring to power input terminals shall be limited to 30 meters in length
Expansion I/O pack capability	A maximum 6 simplex Mark VIe I/O packs over IONet with a minimum frame period of 20 milliseconds can connect to one UCPA. For a list of available simplex I/O modules, refer to <i>GEH-6721_Vol_I, Mark VIe and Mark VIeS Control System Guide</i> , the section <i>I/O Types</i> .
<i>Internal I/O Types</i>	
Discrete inputs or outputs (DIO) <i>Each point can be either a discrete input or a discrete output with feedback</i>	12 V dc, 4 DIOs on STWC and 4 additional DIOs with WEXP 2.2 V min for input high, 0.6 V max for input low, 16 V dc max input Accumulates counts, frequency up to 500 Hz Up to 500 mA sink on digital outputs for resistive and lamp loads. Up to 100 mA sink for inductive loads. Refer to the section, Discrete Output Derating

Item	UCPA Specification
Analog Inputs	Two analog inputs on STWC Gains used in scaling: 1, 64, 128 Voltage In: Refer to the section, Analog Input Modes . Current (option channel 2): 4 to 20 mA Accuracy: 0.1% of full range
	Six analog inputs on WEXP Voltage In: 0 V to 5 V, fixed gain 1 (option channels 6, 7, and 8) Current: 4 to 20 mA (all channels 3–8) Accuracy : 0.1% of full range
Analog outputs	Two analog outputs on WEXP
	Voltage : 0 to 10 V
	Current : 0 to 20 mA
	Accuracy: 0.3% of full range
Pulse Inputs	Two Hall Effect Pulse Inputs on STWC
	20 mA sink current required, 5 V dc source provided (for Hall Effect sensor)
	Accumulates counts and measures time between pulses, frequency up to 5 kHz
Sequence of Events (SOEs)	Not available with internal I/O Are supported with distributed I/O packs

1.3 UCPA Installation

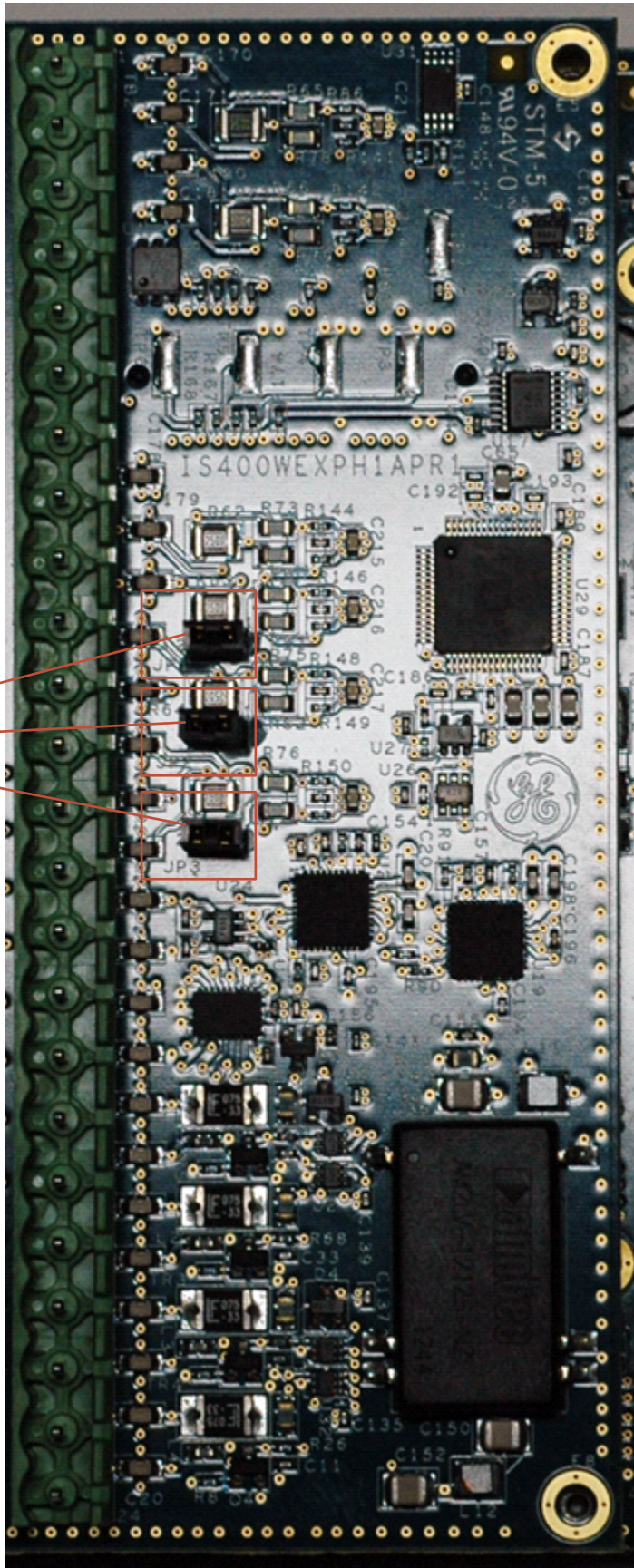
The controller is contained in a single module that mounts directly to the panel sheet metal. It is base-mounted and has integrated shield ties. Use #6_32 screws for mounting. The bottom part of the module is cast aluminum and the top portion is plastic. Provide approximately one inch of space around the UCPA within the panel for airflow and connection to shield ties.



UCPA Mounting, Dimensions are Inches

The WEXP has three jumpers (JP1, JP2, and JP3) that correspond to I/O points [ExpAI6](#) to ExpAI8 (analog inputs 6, 7, and 8) respectively. By default, these jumpers are installed to support the 4–20 mA input mode. Remove the jumpers to set these analog inputs to the 0–5 V input mode. For the removal of these jumpers, the removal of the UCPA cover is required (to expose the WEXP). The following figure displays the location of these jumpers.

ExpA16-8
Jumper
Locations



1.3.1 Remove UCPA Cover

The UCPAH2A requires partial disassembly to remove the WEXP jumpers. This sets the expansion analog inputs 6–8 to 0–5 V mode (default with jumpers is 4–20 mA mode).

➤ **To remove the UCPA cover**

1. Use a small flat-head screwdriver to unscrew the retaining screws on the power connector and remove it.
2. Remove the field wiring portion of both terminal blocks.
3. Locate the two indented sections of the cover (as shown in the following photo) and press firmly inward while pulling the cover away from the base.



1.3.2 Wiring and Cabling

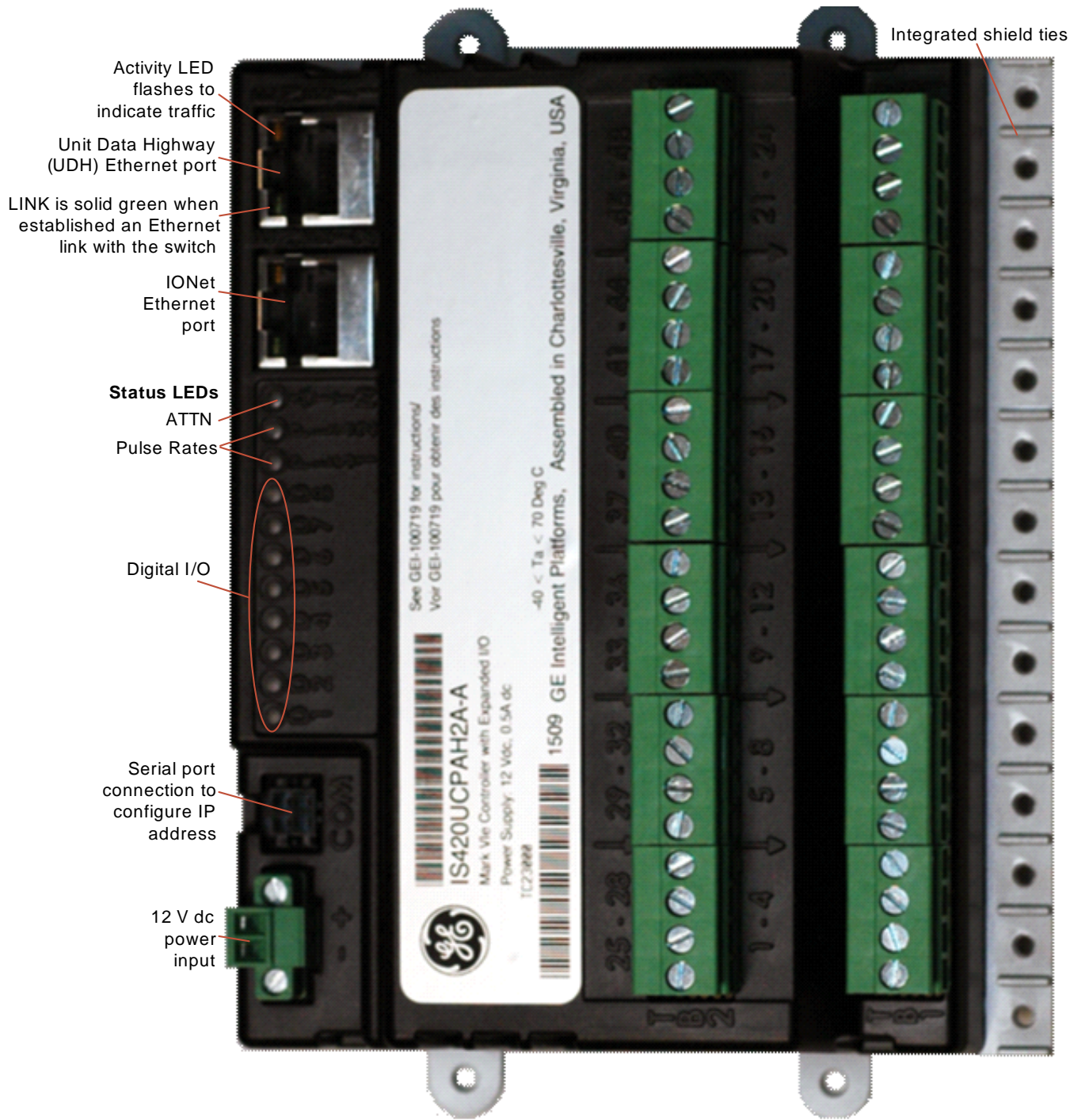
Analog inputs, analog outputs, pulse rate inputs, and any associated field power should use shielded signal cables with shield wires terminated on the provided chassis terminals. Discrete I/O may use non-shielded wiring. Ethernet cables should also be the shielded type. Shielded cables provide additional surge suppression for signals exposed to transients. For field wiring, refer to the terminal block pin definition tables for the [STWC](#) and [WEXP](#).

The UCPA runs on a nominal 12 V dc power supply (9 to 16 V dc). The correct power connector is included with the UCPA controller part kit (it is not the one used with the UCSB). The 12 V dc power input is intended to be powered from a supply with Class II protection level. Wiring to the controller power input terminals shall be no more than 30 meters in length.



Caution

More than 16 V dc to the UCPA can cause damage to the components.



UCPA Ports and LEDs

1.3.3 IP Address Configuration

The UCPA requires a special serial port cable (GE part # 115T8986P0001) and a DB9 COM port to USB port adapter for the setup of network IP address. The factory default IP address is 192.168.101.111. The correct UDH IP address must be properly set up so that the UCPA can communicate to the site HMIs.



➤ To change the UDH network IP address for the UCPA

1. Verify that the computer running the ToolboxST application has been configured with the correct UDH IP address. Also, verify that from the ToolboxST Component Editor, the controller **Platform** is set as UCPAHxA. This is valid for both versions of the UCPA (H1A or H2A).
2. From the Component Editor, General Tab, Property Editor, **Network Adapter 0**, confirm that the correct UDH IP address has been configured or change it to the appropriate address as a relative subnet to the UDH IP address from Step 1.
3. Connect the serial cable to the UCPA serial port. Connect a (DB9 COM port to USB) port adapter to the other end of the serial cable, and then connect to the computer that is running the ToolboxST application. Refer to GEH-6700, ToolboxST User Guide for Mark VIe Control for more information.
4. From the ToolboxST Component Editor General tab, select **Devices, Download, Controller Setup** to launch the **Controller Setup Wizard**.
5. Complete the Controller Setup Wizard using the default choices.

1.4 UCPA Performance and Limitations

The UCPA is designed for simplex unit controls with integral I/O capability, a smaller footprint, and can operate in -40 to 70°C ambient temperature range. BPPC processor speed and amount of RAM are the limiting factors. UCPA has approximately 25% the memory of UCSB. Be aware, however, that the internal UCPA processor and memory do have the following limitations as compared to the UCSB controller:

- UCPA performance as relative to the UCSBH4A (1066MHz Intel® processor) is approximately 15% capability.
- UCPA performance as relative to the UCSBH1A (600 MHz Intel processor) is approximately 25% capability.
- UCPA cannot be part of a Shared IONet system.
- UCPA does not support OPC UA direct from the controller.
- UCPA can only support a maximum of six simplex distributed I/O packs over IONet with a minimum frame period of 20 ms.
- UCPA does not have a real-time clock, which is needed to fully support the SecurityST server.
- Foundation Fieldbus is not supported with UCPA.

1.5 BPPC Processor in the UCPA

The UCPA uses the IS400BPPCH2A processor version, which passes all connections through the internal STWC I/O board. It runs at nominal 12 V dc (9 to 16), and accepts a serial interface.

The BPPC processor board provides the following features:

- High-speed processor with RAM and flash memory
- Two fully independent 10/100 Ethernet ports with connectors
- Hardware watchdog timer and reset circuit
- Internal temperature sensor
- Status-indication LEDs
- Electronic ID and the ability to read IDs on other boards
- Local CPU power supplies

At startup, the processor reads board ID information to ensure the correct matching of UCPA internal circuit boards. With a good match, the processor attempts to establish Ethernet communications, starting with request of a network address. The address request uses the industry standard dynamic host configuration protocol (DHCP).

After Ethernet initialization, the processor programs the on-board logic, runs the application, and enables the acquisition board to begin operation. The processor application code contains all the logic necessary to allow the UCPA controller and I/O module to operate with or without IONet to external I/O packs. The Ethernet ports on the processor auto-negotiate between 10 and 100 Mbps speed, and between half-duplex and full-duplex operation.

1.5.1 Controller Application Logic

The controller runs software specific to its application. The application code (control logic) is made up of function blocks configured with the ToolboxST application. From the ToolboxST Block Diagram Editor, right-click the block diagram and select Block Help for more information. Minor modifications to the control software may be made online. Variables are connected to block diagrams. The logic is then downloaded to the controller from the ToolboxST application.

1.5.2 IONet Communications

The UCPA controller can communicate over IONet to simplex distributed I/O packs (maximum of six) through an unmanaged ESWA or ESWB switch. Refer to the figure, [UCPA Control and Communications](#). IEEE 1588 protocol is used through the IONet to synchronize the clock of the distributed I/O packs and the UCPA to within ± 100 microseconds. External data is also transferred to the controller over the IONet, including process inputs from and outputs to the I/O modules. Sequence of Events (SOEs) are supported with distributed I/O packs, but not with the UCPA integral I/O.

1.6 UCPA Diagnostics

The I/O functions integral to the UCPA do not provide any diagnostics that are available to the user as variables or from the ToolboxST application as alarms. There are diagnostics common to Mark VIe controllers, which are supported, with possible causes and solutions that are viewable from the ToolboxST application. In addition, diagnostic messages from distributed I/O packs are also supported by the UCPA controller. Refer to the ToolboxST User Guide for Mark VIe Control (GEH-6700) for more information on how to view diagnostics.

1.6.1 UCPA Status LEDs

The internal UCPA processor (BPPC) provides the following diagnostics as status LEDs. Refer to the figure, [UCPA Ports and LEDs](#). There are two LEDs (Yellow/Green) for each Ethernet connector (ENET1 and ENET2), which are embedded in the RJ-45 connectors. The green LED indicates an Ethernet connection has been established. The yellow LED indicates packet traffic.

UCPA LEDs

Label	Color	Description
DIO1 to DIO8	Yellow	ON indicates discrete input/output is active low
PULSE1 PULSE2		ON indicates pulse input is active low
ATTN	Red and Green	Bi-color LED, red for Attention, green for Sync — displays processor status

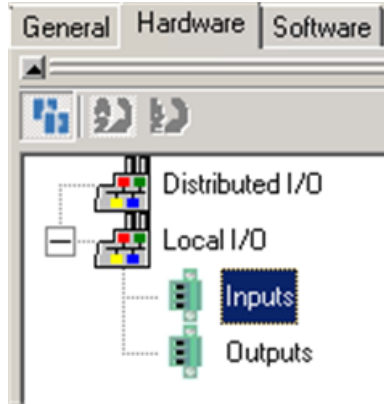
ATTN LED Flash Codes

LED	Flashing Pattern	Description
Red ATTN	Solid	Booting - prior to reading board ID
	4 Hz 50%	Diagnostic alarm active
	2 Hz 50%	Awaiting an IP address
	1 Hz 50%	No firmware to load (Program mode)
	0.5 Hz 50%	Application code not loaded
	LED out	Initializing, no problems detected
Green ATTN	Solid	BIOS (at power on), but if it remains in this state, the component is not functioning properly and should be replaced
	1 or 2 Hz at 50%	Component has completed power up, and is progressing through the state machine, no problems detected
	Two 4 Hz flashes every 4 sec	Online and controlling

1.7 UCPA Configuration

Note Refer to GEH-6700, ToolboxST User Guide for Mark VIe Control for configuring Modbus.

Configure the integral UCPA I/O points from the ToolboxST Component Editor **Hardware** tab.



The inputs and outputs are global variables that can be modified by double-clicking **Live Values**. These variables can be used directly in the controller application logic without connection to a different local variable.

Live Values	Name
125903359	BaseAI1
-30081	BaseAI2
1	BaseDigitalAcc1
3	BaseDigitalAcc2
1	BaseDigitalAcc3
1	BaseDigitalAcc4
False	BaseDInput1
False	BaseDInput2
False	LocalIOVariables.BaseDInput1

1.7.1 Inputs

Name	Description	Type	Mode or Notes
BaseAI1	Base Analog Input 1 (screws 1–4)	DINT	± 39 mV, ± 78 mV, ± 5 V differential, 0-5 V single-ended
BaseAI2	Base Analog Input 2 (screws 5–10)	DINT	± 39 mV, ± 78 mV, ± 5 V differential, 0-5 V single-ended, 4-20 mA (with a jumper placed between screws 9 and 10)
BaseDigitalAcc1	Base Digital Accumulator 1	UDINT	Increments on the falling edge of the digital input or output (counts up by 1)
BaseDigitalAcc2	Base Digital Accumulator 2	UDINT	
BaseDigitalAcc3	Base Digital Accumulator 3	UDINT	
BaseDigitalAcc4	Base Digital Accumulator 4	UDINT	
BaseDInput1	Base Discrete Input 1 (screws 11–12)	BOOL	‡ Low level equals True
BaseDInput2	Base Discrete Input 2 (screws 13–14)	BOOL	
BaseDInput3	Base Discrete Input 3 (screws 15–16)	BOOL	
BaseDInput4	Base Discrete Input 4 (screws 17–18)	BOOL	
BaseDOReadBack1	Base Discrete Output Read Back 1 (screws 11–12)	BOOL	‡ Low level equals True Active Low
BaseDOReadBack2	Base Discrete Output Read Back 2 (screws 13–14)	BOOL	
BaseDOReadBack3	Base Discrete Output Read Back 3 (screws 15–16)	BOOL	
BaseDOReadBack4	Base Discrete Output Read Back 4 (screws 17–18)	BOOL	
‡ Refer to the section, Discrete Input and Output, Non-isolated for more information on the hardware functions and options for field wiring.			
BasePulse1	Base Pulse 1 (screws 19–21)	BOOL	Low level equals True
BasePulse2	Base Pulse 2 (screws 22–24)	BOOL	Low level equals True
BasePulseAcc1	Base Pulse Accumulator 1	UDINT	Increments on the falling edge of the pulse inputs (counts up by 1)
BasePulseAcc2	Base Pulse Accumulator 2	UDINT	
DeltaTimePulse1	Base Delta Time for Pulse Input 1	UDINT	Time between falling edges in microseconds
DeltaTimePulse2	Base Delta Time for Pulse Input 2	UDINT	
ExpAI3	Expansion Analog Input 3 (screws 25–26)	DINT	4-20 mA
ExpAI4	Expansion Analog Input 4 (screws 27–28)	DINT	4-20 mA
ExpAI5	Expansion Analog Input 5 (screws 29–30)	DINT	4-20 mA
ExpAI6	Expansion Analog Input 6 (screws 31–32)	DINT	0-5 V without jumper 4-20 mA with jumper
ExpAI7	Expansion Analog Input 7 (screws 33–34)	DINT	
ExpAI8	Expansion Analog Input 8 (screws 35–36)	DINT	
ExpDigitalAcc5	Expansion Digital Accumulator 5	UDINT	Increments on the falling edge of the digital input or output (counts up by 1)
ExpDigitalAcc6	Expansion Digital Accumulator 6	UDINT	
ExpDigitalAcc7	Expansion Digital Accumulator 7	UDINT	
ExpDigitalAcc8	Expansion Digital Accumulator 8	UDINT	

Name	Description	Type	Mode or Notes
ExpDInput5	Expansion Discrete Input 5 (screws 41–42)	BOOL	‡ Low level equals True
ExpDInput6	Expansion Discrete Input 6 (screws 43–44)	BOOL	
ExpDInput7	Expansion Discrete Input 7 (screws 45–46)	BOOL	
ExpDInput8	Expansion Discrete Input 8 (screws 47–48)	BOOL	
ExpDOReadBack5	Expansion Discrete Output Read Back 5 (screws 41–42)	BOOL	‡ Low level equals True Active Low
ExpDOReadBack6	Expansion Discrete Output Read Back 6 (screws 43–44)	BOOL	
ExpDOReadBack7	Expansion Discrete Output Read Back 7 (screws 45–46)	BOOL	
ExpDOReadBack8	Expansion Discrete Output Read Back 8 (screws 47–48)	BOOL	
ExpIoEnabled	Expansion I/O Enabled	BOOL	WEXP installed if True
LatchedPulseAcc1AtPulse2	Latches Pulse Accumulator 1 (rpm pulse count) as captured on the falling edge of Pulse Input 2 (crank), not synced to any interrupt	UDINT	Does not function on LatchMode event
LatchedBaseAI1	Latched Load Value	DINT	† A cohesive sample set based on LatchMode Event
LatchedBaseAI2	Latched Position Value	DINT	
LatchedDeltaTimePulse1	Latched Delta Time for Pulse 1, in microseconds	UDINT	
LatchedBasePulseAcc1	Latched Pulse Accumulator 1	UDINT	
LatchedSampleCount	Latched Sample Count	UDINT	
‡ Refer to the section, Discrete Input and Output, Non-isolated for more information on the hardware functions and options for field wiring.			

1.7.2 LatchedMode Event

Five [local input variables](#) are sampled at regular intervals and latched to a cohesive set of inputs. These values are sampled together as close as possible for application-specific use. The fastest sample rate for these signals is 2048 microseconds.

The two modes used to configure the data latching are as follows:

- By writing the value **0** (default value) to the [LatchMode](#) output variable, the UCPA latches the variable set on every falling edge of BasePulse1.
- By writing the value **1** to the **LatchMode** variable and setting a value into the [LatchTime](#) variable, the UCPA latches the variable set when the latch timer expires. Set the LatchTime variable to a value greater than or equal to the minimum of 2048 microseconds, and then set LatchMode to a value of 1 to engage the timer to trigger the data latching.

Note With either LatchMode, this function generates an interrupt and subsequent move of the values into signal space.

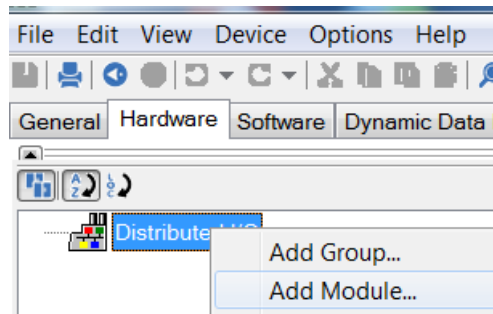
1.7.3 Outputs

Name	Description	Type	Mode
‡ BaseDOutput1	Discrete Output 1, True drives output Active Low (screws 11–12)	BOOL	
‡ BaseDOutput2	Discrete Output 2, True drives output Active Low (screws 13–14)	BOOL	
‡ BaseDOutput3	Discrete Output 3, True drives output Active Low (screws 15–16)	BOOL	
‡ BaseDOutput4	Discrete Output 4, True drives output Active Low (screws 17–18)	BOOL	
ExpAO1	Expansion Analog Output 1 (screws 37–38)	UDINT	0–10 V 0–20 mA
ExpAO2	Expansion Analog Output 2 (screws 39–40)	UDINT	0–10 V 0–20 mA
‡ ExpDOutput5	Expansion Discrete Output 5, True drives output Active Low (screws 41–42)	BOOL	
‡ ExpDOutput6	Expansion Discrete Output 6, True drives output Active Low (screws 43–44)	BOOL	
‡ ExpDOutput7	Expansion Discrete Output 7, True drives output Active Low (screws 45–46)	BOOL	
‡ ExpDOutput8	Expansion Discrete Output 8, True drives output Active Low (screws 47–48)	BOOL	
† LatchMode	Latch Mode Select, 0 = edge-triggered, 1 = timer-triggered	UDINT	
† LatchTime	32-Bit countdown timer in microseconds, used for latching Analog Input 1 and 2 as well as Pulse Accumulator 1 Used when LatchMode = 1	UDINT	
† Refer to the section LatchedMode Event for more information.			

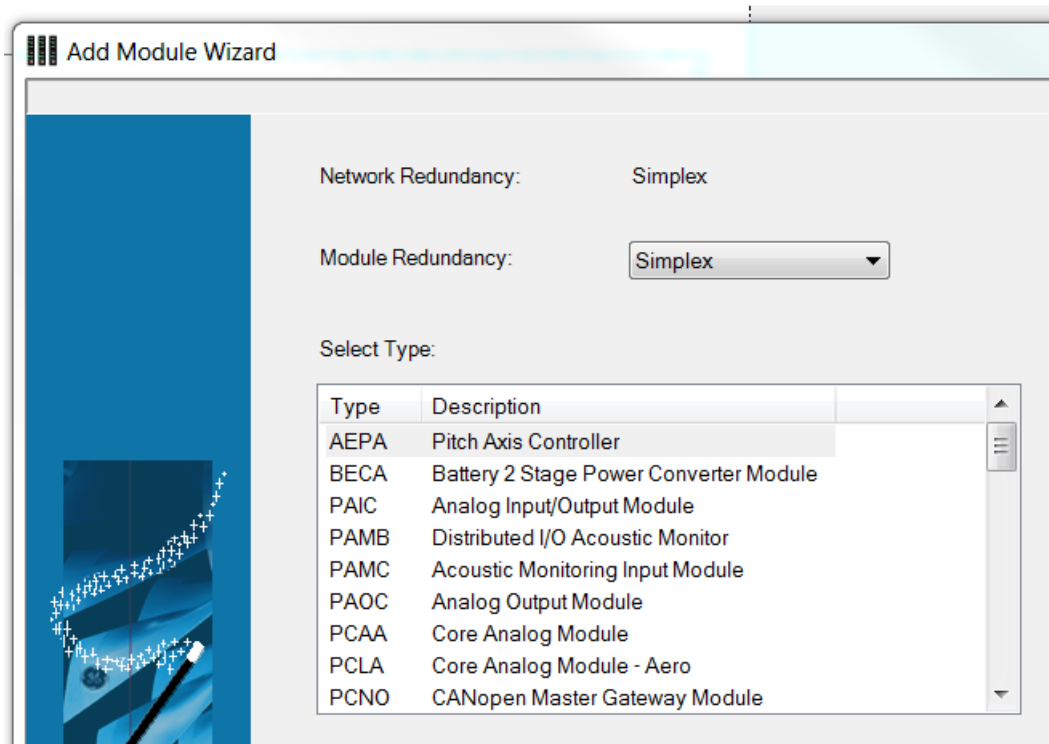
Note ‡ Refer to the section, [Discrete Input and Output, Non-isolated](#) for more information on the hardware functions and field wiring.

1.7.4 Distributed I/O Types

Connecting to distributed I/O modules is accomplished from the Component Editor Hardware tab, using the typical procedure for adding a new simplex module. The figure, [UCPA Control and Communications](#), displays an example of the UCPA connected to distributed I/O packs.



Module Redundancy must be **Simplex**.



1.8 STWC I/O Board

The STWC is the base internal I/O board for the UCPAH1A and UCPAH2A controllers. It provides the following inputs and outputs:

- Two Hall Effect [Pulse Inputs](#)
- Two Analog Inputs (AI)
- Four Digital Inputs or Outputs with feedback (DIO)

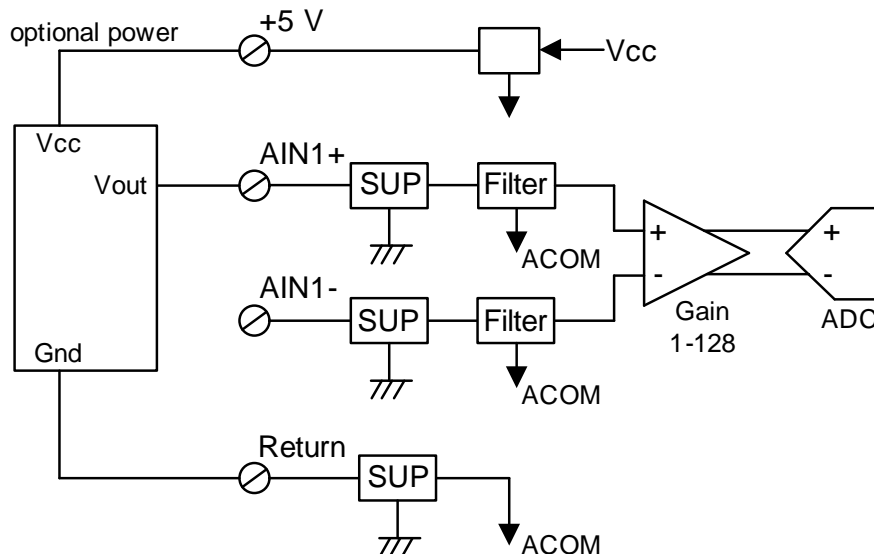
TB1 Terminal Block Pin Definitions

Screw #	Screw Name	Global Variable	Description
1	AIN1_5V	BaseAI1	Analog Input 1, 5 V field power, 15 mA max
2	AIN1_P		Analog Input 1 Positive
3	AIN1_N		Analog Input 1 Negative
4	AIN1_RET		Analog Input 1 Return
5	AIN2_5V	BaseAI2	Analog Input 2, 5 V field power, 15 mA max
6	AIN2_P		Analog Input 2 Positive
7	AIN2_N		Analog Input 2 Negative
8	AIN2_RET		Analog Input 2 Return
9	AIN2_JPR		Analog input 2 has a 4-20 mA option. Apply a terminal jumper between pins 9 and 10. This applies the 250 ohm burden across the AIN2 differential input.
10	AIN2_JPR		
11	DIO1	BaseDInput1 or BaseDORedBack1 BaseDOutput1	Digital Input or Output 1
12	DIO1_RET		DIO Return 1
13	DIO2	BaseDInput2 or BaseDORedBack2 BaseDOutput2	Digital Input or Output 2
14	DIO2_RET		DIO Return 2
15	DIO3	BaseDInput3 or BaseDORedBack3 BaseDOutput3	Digital Input or Output 3
16	DIO3_RET		DIO Return 3
17	DIO4	BaseDInput4 or BaseDORedBack4 BaseDOutput4	Digital Input or Output 4
18	DIO4_RET		DIO Return 4
19	PULSE_P5		Pulse Rate 1, 5 V Power Output for Hall Effect Sensor, 10 mA
20	PULSE1	BasePulse1	Pulse Rate 1 Input Signal
21	PULSE_COM		Pulse Rate 1 Ground
22	PULSE_P5		Pulse Rate 2, 5 V Power Output for Hall Effect Sensor, 10 mA
23	PULSE2	BasePulse2	Pulse Rate 2 Input Signal
24	PULSE_COM		Pulse Rate 2 Ground

1.9 STWC Analog Differential Voltage Inputs, Group-Isolated

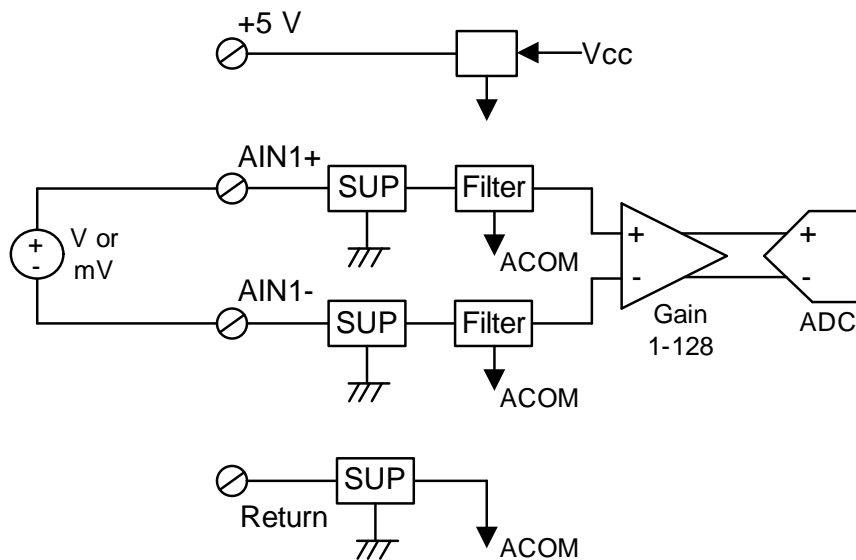
These analog inputs are group isolated. Power is supplied by 12 V dc-dc isolated power supply. The digital signal interface is isolated with a capacitive coupled isolator. The primary application is differential voltage inputs for a LOAD bridge ($\pm 10\text{mV}$) and POSITION Inclinometer (0-5V).

The analog inputs are single-ended inputs when using terminals 2 and 4 for analog input 1 or terminals 6 and 8 for analog input 2, and setting the appropriate ToolboxST configuration for [BaseA11](#) or BaseA12. This is the case for most 5 V field devices.



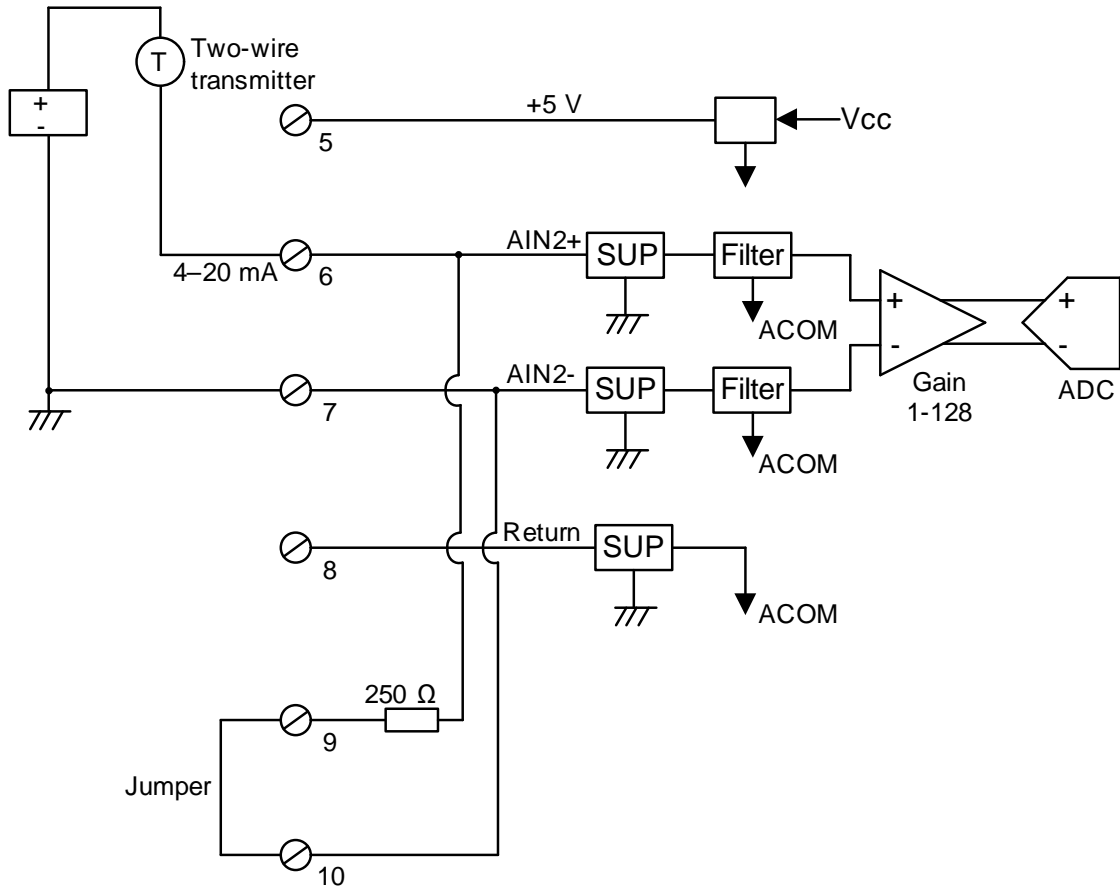
0–5 V Single-ended with Analog Input 1 or 2

From the ToolboxST configuration, $\pm 5\text{ V differential}$ is also the selection for 0 to 5 V differential. The analog inputs are differential inputs when using terminals 2 and 3 for analog input 1 or terminals 6 and 7 for analog input 2, and setting the appropriate ToolboxST configuration for [BaseA11](#) or BaseA12.



0–5 V Differential with Analog Input 1 or 2

Analog input 2 can also be a 4-20 mA input. When configured for 4-20 mA, a differential connection should be made to terminals 6 and 7, install a wire or jumper between TB1 pins 9 and 10 (which inserts the 250 Ohm 0.1% load resistor), and select the *AI Mode* from the ToolboxST application.



Analog Input 2 4-20 mA Connection Example

1.9.1 Analog Input Modes

The ADS1220 A/D converter supports differential and single-ended inputs, with a gain from 1 to 128. The programmable gain amplifier (PGA) may be bypassed for rail-to-rail 5 Volt signals.

AI	Signal Level	Input Connections	Common Mode Voltage	Signal Type Mux Mode	ADC Gain	PGA Mode
1, 2	0 to +5 V	+in, ACOM	0 V	Single-ended	1	Bypassed
1, 2	0 to +5 V	+in, -in	0 V	Differential	1	Bypassed
1, 2	±5 V	+in, -in	2.5 V	Differential	1	Bypassed
1, 2	±39mV	+in, -in	2.5 V	Differential	128	Enabled
1, 2	±78mV	+in, -in	2.5 V	Differential	64	Enabled
2	4 to 20 mA	+in, -in	0 to 5 V	Differential	1	Bypassed

1.9.2 Scaling of Analog Inputs 1–2

Analog Input	Gains	Voltage	Current
1	1, 64, or 128 depending on the Input Mode (5V, 78mV, or 39 mV)	$V_{in} = \frac{5 \text{ (BaseAI1)}}{2^{31} \text{ (GAIN)}}$	n/a
2	1, 64, or 128 depending on the Input Mode (5V, 78mV, or 39 mV)	$V_{in} = \frac{5 \text{ (BaseAI2)}}{2^{31} \text{ (GAIN)}}$	$A_{in} = \frac{5 \text{ (BaseAI2)}}{2^{31} \text{ (250)}} \times 1000 \text{ (mA)}$

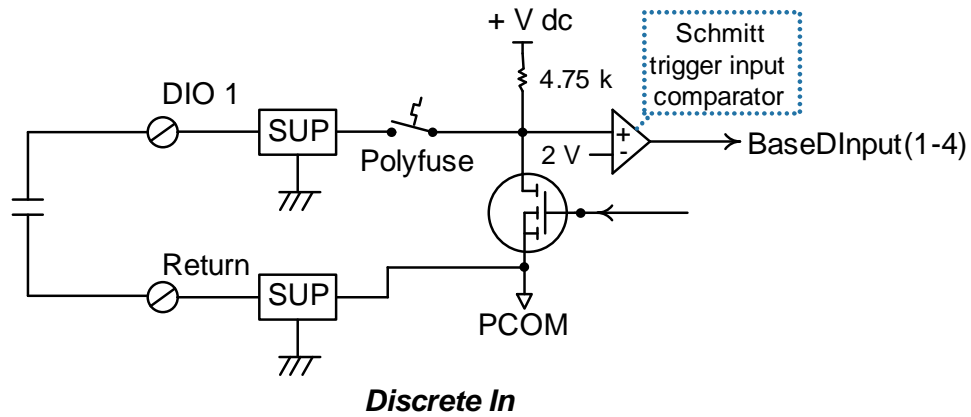
Analog Input	Volts to Counts (+/-39mv)	Volts to Counts (+/-78mv)	Volts to Counts (+/-5v)	Milliamps to Counts (4-20ma)
1	0v = 0	0v = 0	5v = 2,147,483,647	n/a
	25mv = 1374389535	25mv = 687194767	2.5v = 1,073,741,824	
		50mv = 1374389535	0v = 0	
			-2.5v = -1,073,741,824	
			-5v = -2,147,483,648	
2	0v = 0	0v = 0	5v = 2,147,483,647	20ma = 2,147,483,647
	25mv = 1374389535	25mv = 687194767	2.5v = 1,073,741,824	16ma = 1,717,986,918
		50mv = 1374389535	0v = 0	12ma = 1,288,490,189
			-2.5v = -1,073,741,824	8ma = 858,993,459
			-5v = -2,147,483,648	4ma = 429,496,730
				0ma = 0

1.10 STWC Discrete Input or Output with feedback, Non-isolated

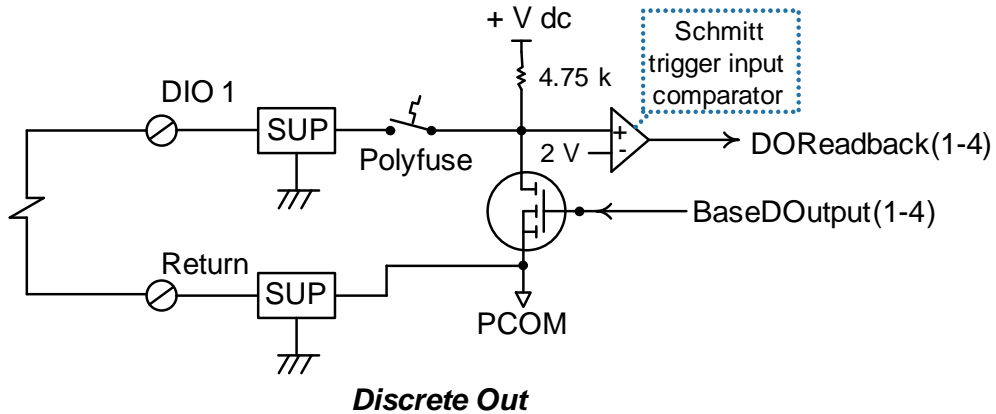
Four non-isolated digital I/O points are individually configurable in the ToolboxST application for either 12 V input or open drain output with feedback. When an I/O point is configured as an output, the input circuitry functions as a feedback signal. The signal is pulled-up with 4.75k Ohms to the 12 V supply.

The discrete input or output (DIO) terminals are compatible with 12 V I/O (9 V to 16 V). The terminals are bidirectional. When configured by ToolboxST as an output, a Boolean state of True drives the open-drain terminal low. When the Boolean state is False, the terminal is pulled high by the resistance. Output loads such as relay coils may be driven by switching the low side and connecting the high side to the 12 V dc external power supply. Inductive loads should have fly-back suppression installed on the relay. Input signals must be less than 0.6 V to indicate that the Boolean state is True, and should be greater than 2.2 V to indicate a Boolean state of False.

The input is RC filtered by 20k Ohm and 10nF for bandwidth of 800 Hz (allowable bandwidth is specified lower than this as 500 Hz). The input is sensed by a Schmitt trigger IC powered from 3.3 V supply with threshold of about 2 Volts.



This is an open drain style output. It uses an Si2308BDS MOSFET with 500 mA current sink capability for resistive or lamps load types and 100 mA for inductive load types. Wetting power is provided from external 12 V supply, which can be the same supply that powers the board 12 V input.

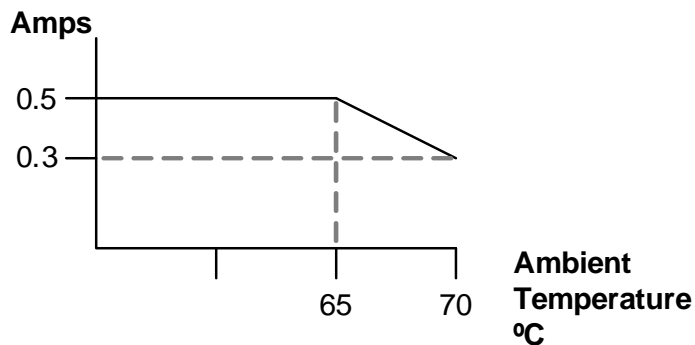


1.10.1 Discrete Output Derating



Attention

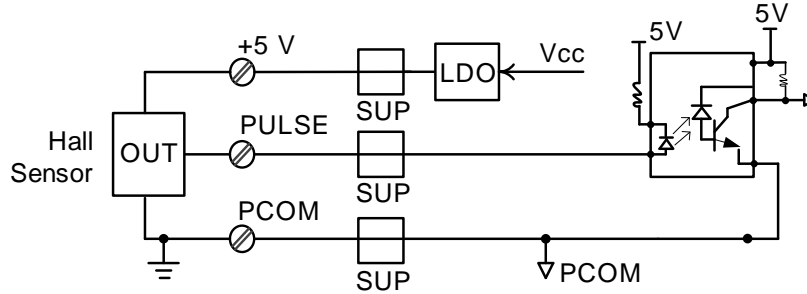
The discrete output sink current should be derated for elevated ambient temperatures using the following graph.



1.11 STWC Pulse Accumulator Inputs

The pulse inputs are 5 V open-collector inputs that source 20 mA when driven low by the sensor. The bandwidth is 5 kHz. The inputs are not galvanically isolated. The sensor ground is AC-coupled to chassis and ferrite-coupled to board ground. For low frequency signals (including up to the pulse rate input bandwidth), sensor ground is the same as board ground.

2 Pulse Rate (Hall Effect) Inputs



Designed for open-collector output devices

Nominal 20 mA input current

1.12 WEXP Expansion I/O Board

The WEXP expansion I/O board is part of the IS420UCPAH2A. There are three [jumpers](#) on the WEXP that are removed to allow for 0–5 V Analog Inputs on channels 6–8. These inputs are 4–20 mA with the JP1, JP2, or JP3 jumpers installed. The WEXP provides the following I/O types:

- 6 Analog Inputs
- 2 Analog Outputs
- 4 Discrete Inputs and Outputs

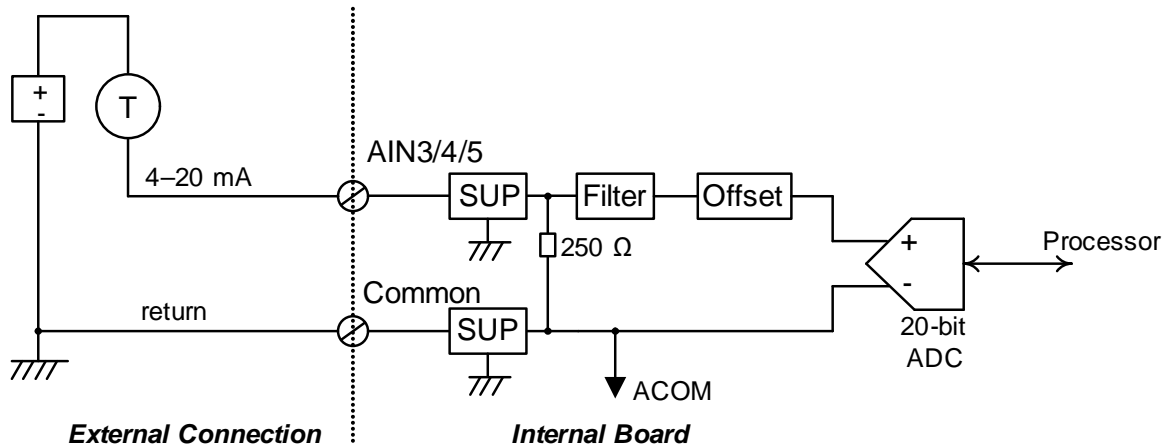
TB2 Terminal Block Pin Definitions

Screw #	Screw Name	Global Variable	Description
25	AIN3	ExpAI3	Expansion Analog Input 3, 4-20 mA
26	AIN3_RET		Expansion Analog Input 3 Return
27	AIN4	ExpAI4	Expansion Analog Input 4, 4-20 mA
28	AIN4_RET		Expansion Analog Input 4 Return
29	AIN5	ExpAI5	Expansion Analog Input 5, 4-20 mA
30	AIN5_RET		Expansion Analog Input 5 Return
31	AIN6	ExpAI6	Expansion Analog Input 6, 0-5 V without jumper 4-20 mA with jumper
32	AIN6_RET		Expansion Analog Input 6 Return
33	AIN7	ExpAI7	Expansion Analog Input 7, 0-5 V without jumper 4-20 mA with jumper
34	AIN7_RET		Expansion Analog Input 7 Return
35	AIN8	ExpAI8	Expansion Analog Input 8, 0-5 V without jumper 4-20 mA with jumper
36	AIN8_RET		Expansion Analog Input 8 Return
37	AOUT1	ExpAO1	Expansion Analog Output 1
38	AOUT1_RET		Expansion Analog Output 1 Return
39	AOUT2	ExpAO2	Expansion Analog Output 2
40	AOUT2_RET		Expansion Analog Output 2 Return
41	DIO5	ExpDInput5 or ExpDOReadBack5 ExpDOutput5	Expansion Discrete Input or Output 5
42	DIO5_RET		Expansion DIO Return 5
43	DIO6	ExpDInput6 or ExpDOReadBack6 ExpDOutput6	Expansion Discrete Input or Output 6
44	DIO6_RET		Expansion DIO Return 6
45	DIO7	ExpDInput7 or ExpDOReadBack7 ExpDOutput7	Expansion Discrete Input or Output 7
46	DIO7_RET		Expansion DIO Return 7
47	DIO8	ExpDInput8 or ExpDOReadBack8 ExpDOutput8	Expansion Discrete Input or Output 8
48	DIO8_RET		Expansion DIO Return 8

1.13 WEXP Analog Inputs, Single-Ended, Group-Isolated

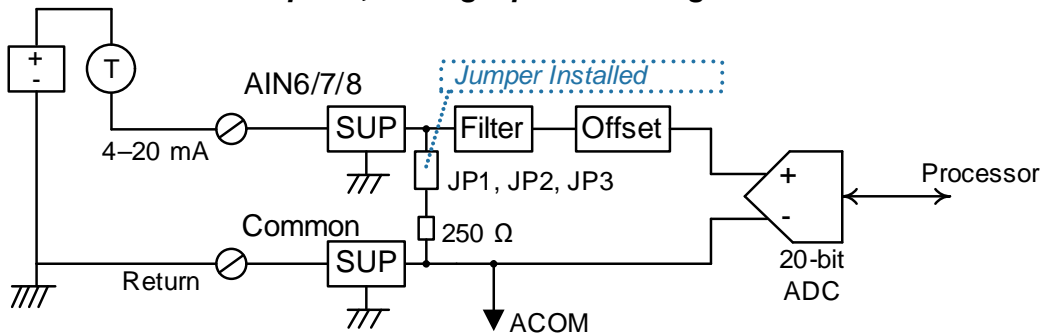
AIN 3 – 8 connections are made on TB2 pins in +/- pairs. Provide a signal and return path for single-ended analog inputs. These inputs are group isolated. Power is supplied by 12 V DC-DC ISO supply. AIN 3, 4, and 5 are 4–20 mA only.

Analog Inputs 3 through 5

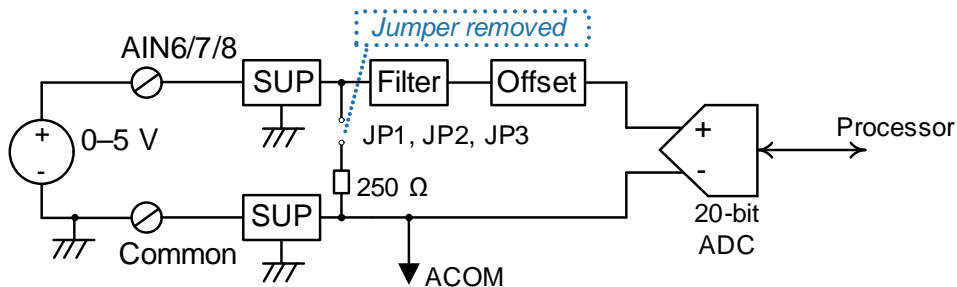


AIN 6, 7, and 8 are configurable by removing the [jumper](#) for 0–5 V input. The jumper may be left installed (factory default) for 4–20 mA input mode. No software configuration changes are necessary in either mode.

4–20 mA Option, Analog Inputs 6 through 8



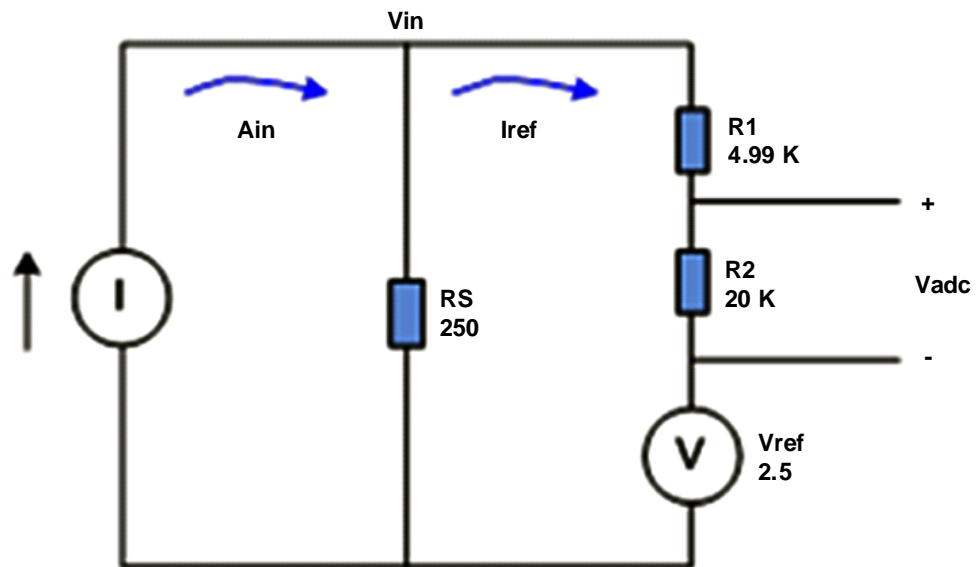
5 V Input Option for Analog Inputs 6 through 8



1.13.1 Scaling of Analog Inputs 3–8

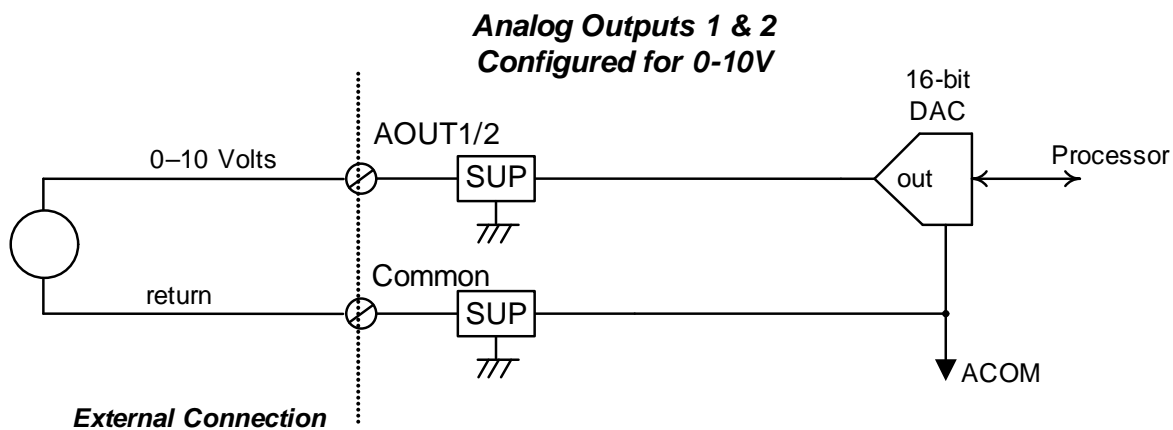
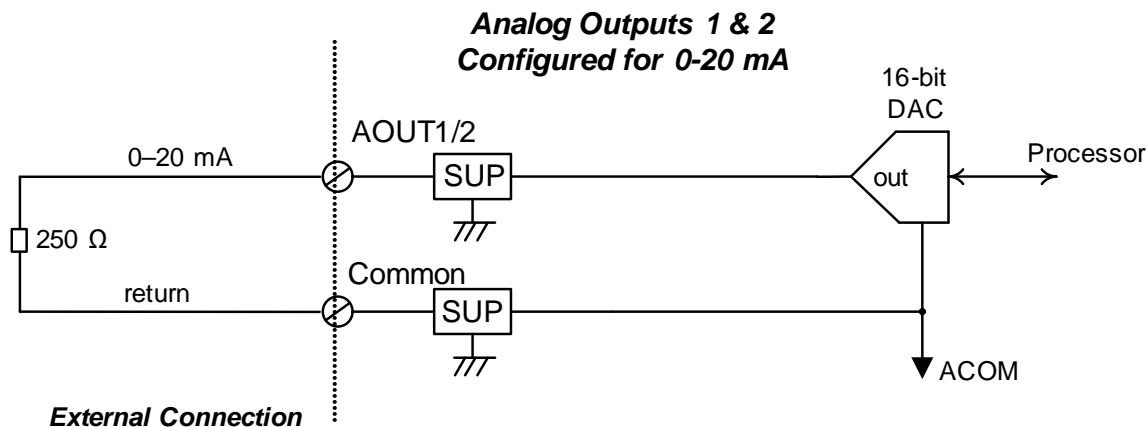
Analog Input	Gains	Voltage	Current
3–5	1	n/a	$A_{in} = \frac{3.155 \left[\frac{(\text{ExpAI6})}{2^{31}} \right] + 2.5}{250} \times 1000$ (mA)
6–8	1	$V_{in} = \frac{3.12375 (\text{ExpAI6})}{2^{31}} + 2.5$	

Analog Input	Volts to Counts (0-5v)	Milliamps to Counts (4-20ma)
3–5	n/a	20ma = 1,701,651,068
		16ma = 1,020,990,641
		12ma = 340,330,214
		8ma = -340,330,214
		4ma = -1,020,990,641
		0ma = -1,701,651,068
6–8	5v = 1,718,674,388	20ma = 1,701,651,068
	4v = 1,031,204,633	16ma = 1,020,990,641
	3v = 343,734,878	12ma = 340,330,214
	2v = -343,734,878	8ma = -340,330,214
	1v = -1,031,204,633	4ma = -1,020,990,641
	0v = -1,718,674,388	0ma = -1,701,651,068



1.14 WEXP Analog Outputs

These outputs are referenced to module ACOM. Each analog output is configured for 0–10 V or 0–20 mA output in the ToolboxST application.



$$\text{ExpAO1} = \frac{\text{Iref (Amps)}}{0.020} \times 2^{32}$$

Current

$$\text{ExpAO1} = \frac{\text{Vref (Volts)}}{10} \times 2^{32}$$

Voltage

Counts

Analog Output	Counts to Volts (0-10v)	Counts to Milliamps (0-20ma)
1-2	4,294,967,295 = 10v	4,294,967,295 = 20ma
	3,435,973,837 = 8v	3,435,973,837 = 16ma
	2,576,980,378 = 6v	2,576,980,378 = 12ma
	1,717,986,918 = 4v	1,717,986,918 = 8ma
	858,993,459 = 2v	858,993,459 = 4ma
	0 = 0v	0 = 0ma

1.15 WEXP Discrete I/O, Non-isolated

These DIOs are identical to those described in the Discrete Input and Output, Non-isolated [STWC](#) board.

UCPA for Hazardous Locations (HazLoc)

This equipment is suitable for use in Class I Division 2 Groups ABCD, Class I Zone 2, and ATEX Zone 2 locations.



Warning

Refer to *Mark VIe UCPA Controller Instructions for Safe Use (GFK-2951)* for requirements.

UCPA and Federal Communications Commission (FCC) Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

and

2. This device must accept any interference received, including interference that may cause undesired operation.



Caution

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

2 Release History

Date	Firmware Revision	Hardware Revision	Notes
May, 2015	Mark VIe V05.04.00C	A	Initial release of UCPA controller platform
Sept, 2015	Mark VIe V05.04.03C	A	Update to raise the limit on Modbus commands per second New parameter, LatchedPulseAcc1AtPulse2

3 Replacement and Ordering

Replacement parts may contain static-sensitive components. Therefore, GE ships replacement parts in anti-static bags. When handling electronics, make sure to store them in anti-static bags or boxes and use a grounding strap (per the following Caution criteria).



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.



Warning

To prevent personal injury or damage to equipment, follow all GE safety procedures, Lockout Tagout (LOTO), and site safety procedures as indicated by Employee Health and Safety (EHS) guidelines.



Warning

This equipment contains a potential hazard of electric shock, burn, or death. Only personnel who are adequately trained and thoroughly familiar with the equipment and the instructions should install, operate, or maintain this equipment.

3.1 Replacement Procedures

Troubleshooting should be done at the system component level. The failed system component (least replaceable part) should be removed, returned to GE, and replaced with a known good spare. Do not attempt to repair system components.



Warning

To prevent electric shock, turn off power to the equipment, 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.



Attention

Replacement of the terminal board requires full reconfiguration of the changed component using the ToolboxST application. For this reason, it is generally preferable to replace only the I/O pack unless the terminal board is known to be the point of failure.

3.1.1 UCPA Replacement

➤ **To replace the UCPA**

1. Lock out and tag out the equipment.
2. Disconnect the incoming 12 V dc power plug.
3. Disconnect the Ethernet cables.
4. Remove the terminal wiring.
5. Remove the screws holding the controller in place.
6. Remove the old controller from the panel.
7. If installing a new UCPAH2A that has the WEXP, remove the plastic cover to set the jumpers if needed. Refer to the controller [Installation](#) section for more information.
8. Reinstall the new controller by reversing steps 6 through 1.
9. [Configure the IP address](#) of the new controller.
10. Download the firmware and application to the new controller.
11. From the ToolboxST application, verify the status of the controller. It should be in the controlling state with no warnings or errors.

3.2 Ordering Parts

Renewals and spares (or those not under warranty) should be ordered by contacting the nearest GE Sales or Service Office, or an authorized GE Sales Representative.

Prior to ordering a replacement part:

- Determine if the part is under warranty
- Identify the part
- Refer to the *Mark VIe and Mark VIeS Control System Volume I: System Guide* (GEH-6721_Vol_I), the section *Component Part Numbers*.

Control system electronics are identified by a 12-character alphanumeric part number and a single revision letter. When ordering, be sure to include the complete part number and revision letter. All digits are important when ordering or replacing any device. The factory may substitute newer versions based on availability and design enhancements, however, GE ensures backward compatibility of replacements.

UCPA part number

