

ACORN CNC controller _rev4 Specifications Manual

For Revision 190201

Updated 2/22/19

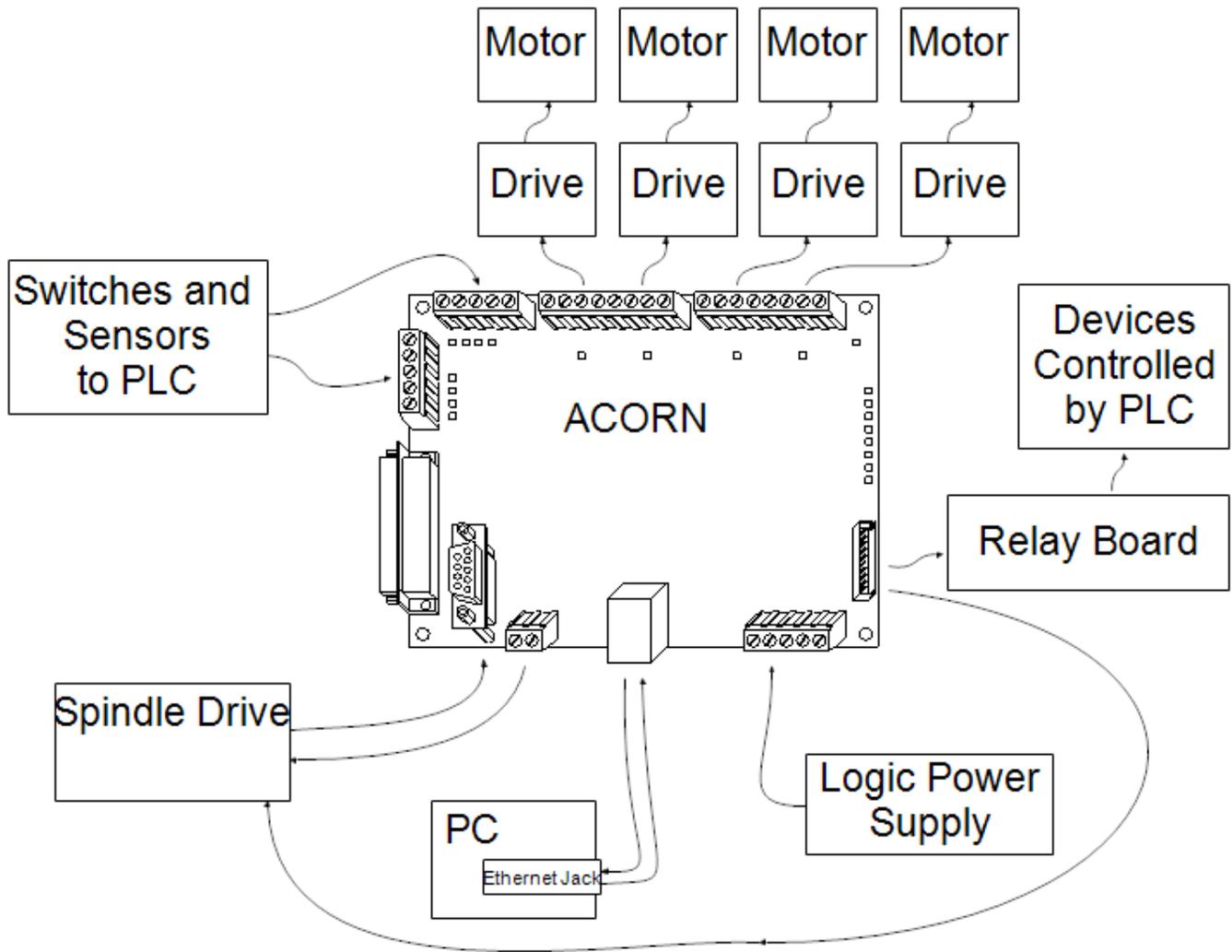
Overview

ACORN is technically a breakout board for the BeagleBone Green or BeagleBone Black embedded computer. The remainder of this document will refer to the breakout board with BeagleBone installed as ACORN. It is a low cost motion control processor, PLC, and drive interface board. It is intended to operate entry level machining equipment with up to four axes.

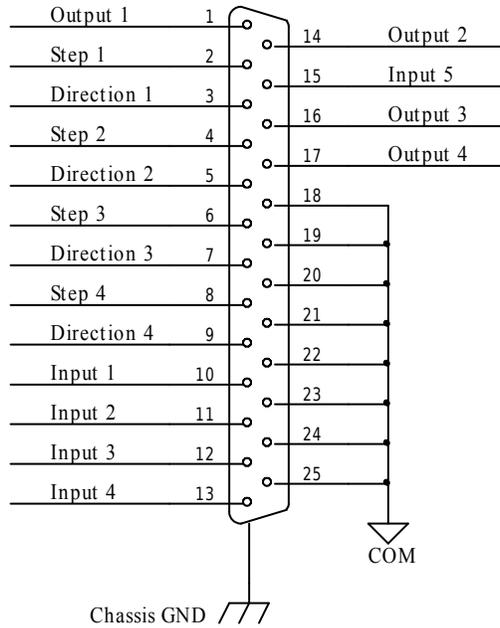
Features

Function:	Motion Control Processor, PLC, and Drive Interface
Maximum number of Axes:	4
Maximum pulse rate:	400kHz
Control Interface:	100 Mb/s Ethernet to PC
Drive Application:	Drives with step and direction inputs
Digital PLC Inputs:	8
Digital PLC Outputs:	8
Analog Output resolution:	12 bits
Dimensions (W*D*H):	5.4 * 4.2 * 0.7 inches

Typical Connections

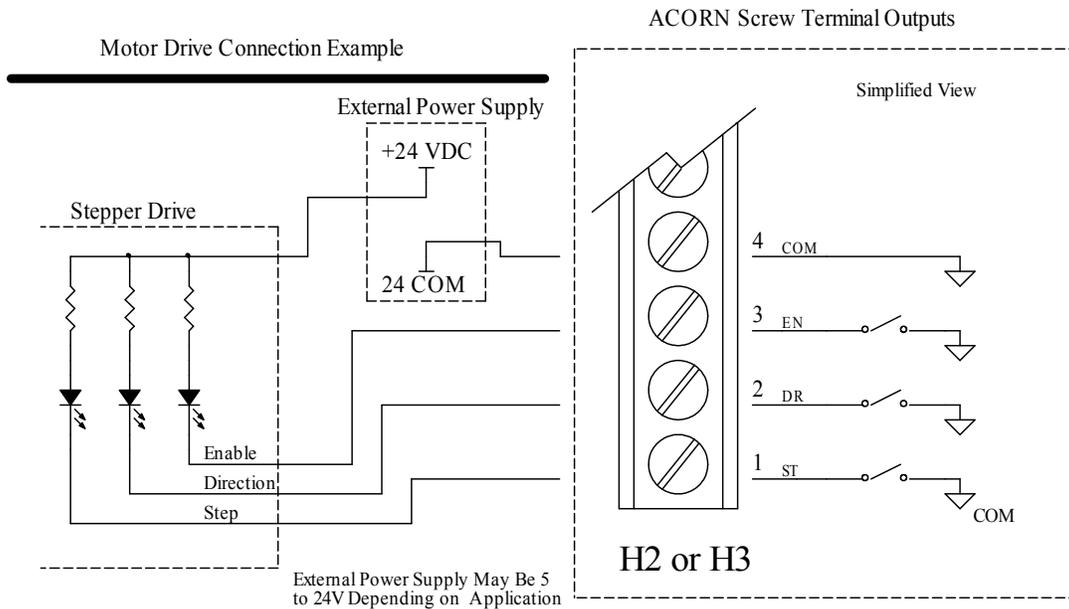


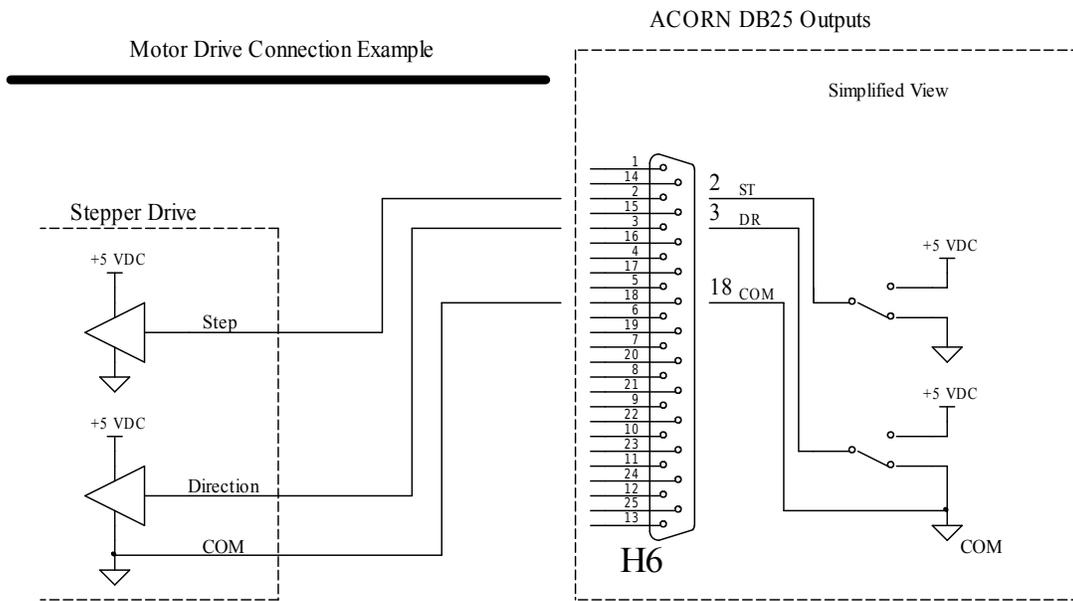
DB25 (H6) Signals



Drive Interface Section

Four sets of step and direction outputs are provided to control motor drives. The outputs can provide up to 400kHz step frequency. Screw terminal (open collector) or DB25 (5V push / pull logic) connection must be selected based on the voltage level and input circuit of the motor drive. Most industrial class drives will use 24V optically isolated inputs similar to the first example below. Hobby class drives will often use low current 5V isolated inputs or logic inputs similar to the second example.



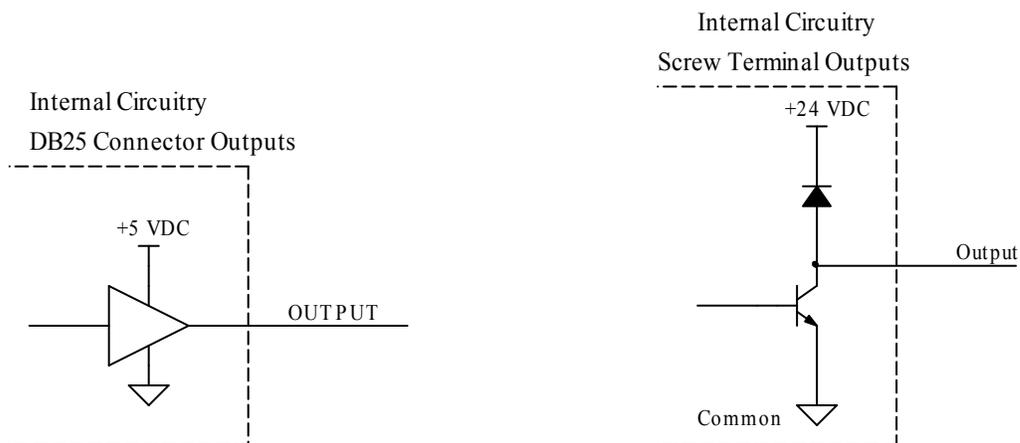


PLC Section

The ACORN has 8 digital inputs, 8 digital outputs, and one analog output. Check the “ACORN I/O Map” and “ACORN Specifications” sections to determine I/O type and capability.

Outputs

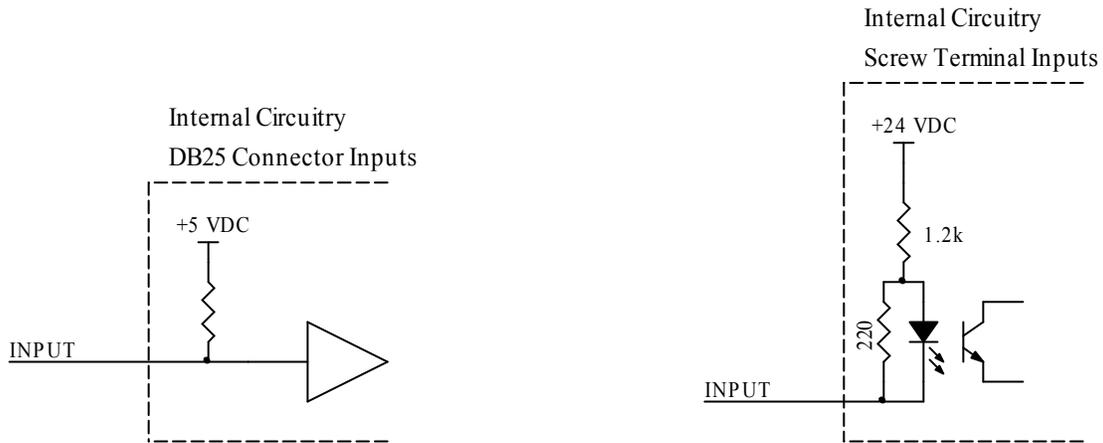
5V logic level relay outputs are available on the DB25 connector. 8 open collector outputs are normally wired with a ribbon cable to an external 8 relay board.



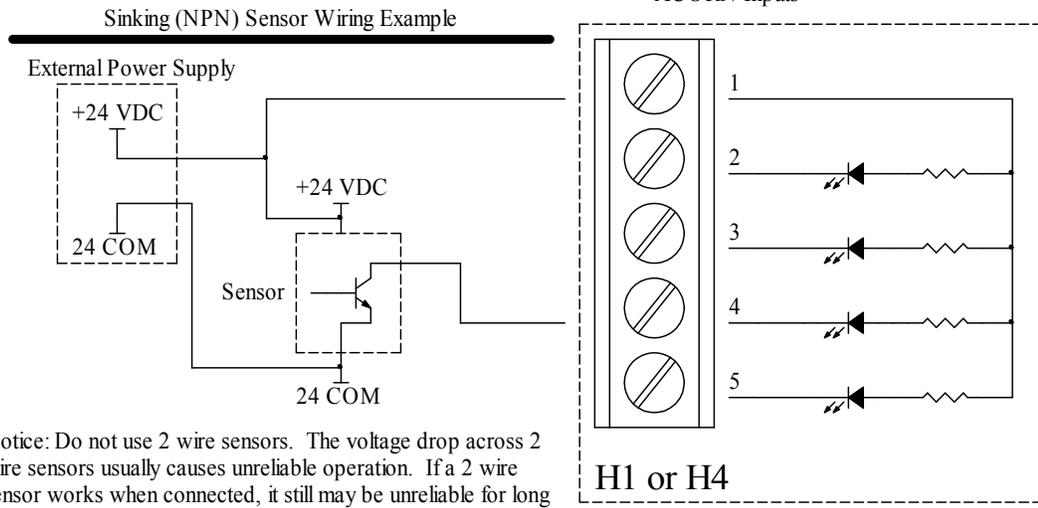
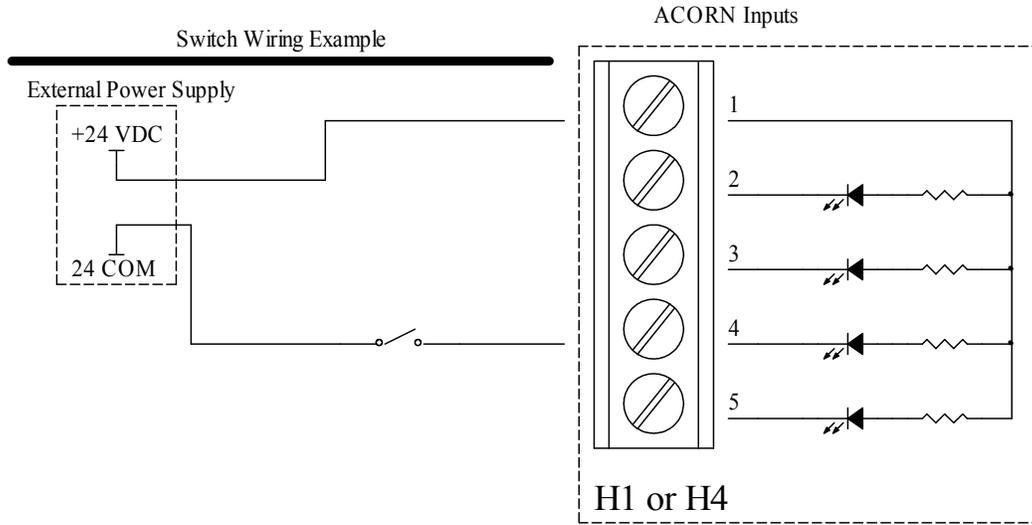
Inputs

ACORN uses optically isolated inputs for screw terminal inputs. These inputs can be used with 24 VDC sensors or switches. The 24 VDC for inputs may be supplied from the ACORN logic supply. For improved isolation and noise immunity, a separate 24 VDC may be used to power the inputs. Compare the specifications of sensors to the “ACORN Specifications” chart to ensure reliable operation.

DB25 inputs are only compatible with 5V logic levels. These inputs are not isolated.



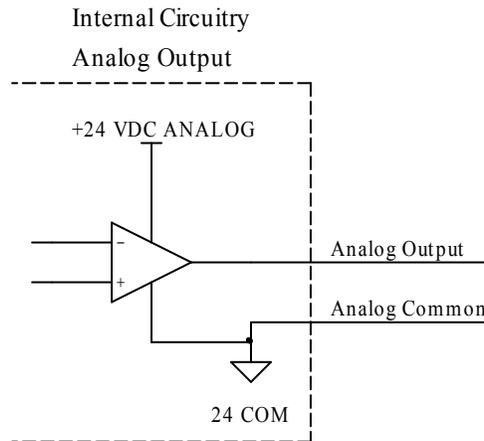
Input Connection Examples



Notice: Do not use 2 wire sensors. The voltage drop across 2 wire sensors usually causes unreliable operation. If a 2 wire sensor works when connected, it still may be unreliable for long term use.

Analog Output

An analog output is provided for controlling spindle speed. The output voltage range is 0 to 10 VDC.



Analog Output Calculations

The analog output uses a 12 bit digital to analog converter (DAC) to generate analog from the DAC request sent from the PLC program. The 12 bit value allows a DAC request of 0 to 4095, which corresponds to 0 to 9.998 volts in the 0 to 10V range.

$$\text{output voltage} = \frac{\text{DAC Request}}{4096} * 10$$

Analog Output Wiring

The analog output should be wired using a shielded twisted pair for best results. The analog output terminal is paired with a common terminal for direct wiring of the signal, common, and shield. In most cases, it is best to connect the shield to the common only at the ACORN. Routing analog cables away from power wires and other noise sources is also critical for good performance. See “ACORN Connections” section for terminal locations.

ACORN I/O Map

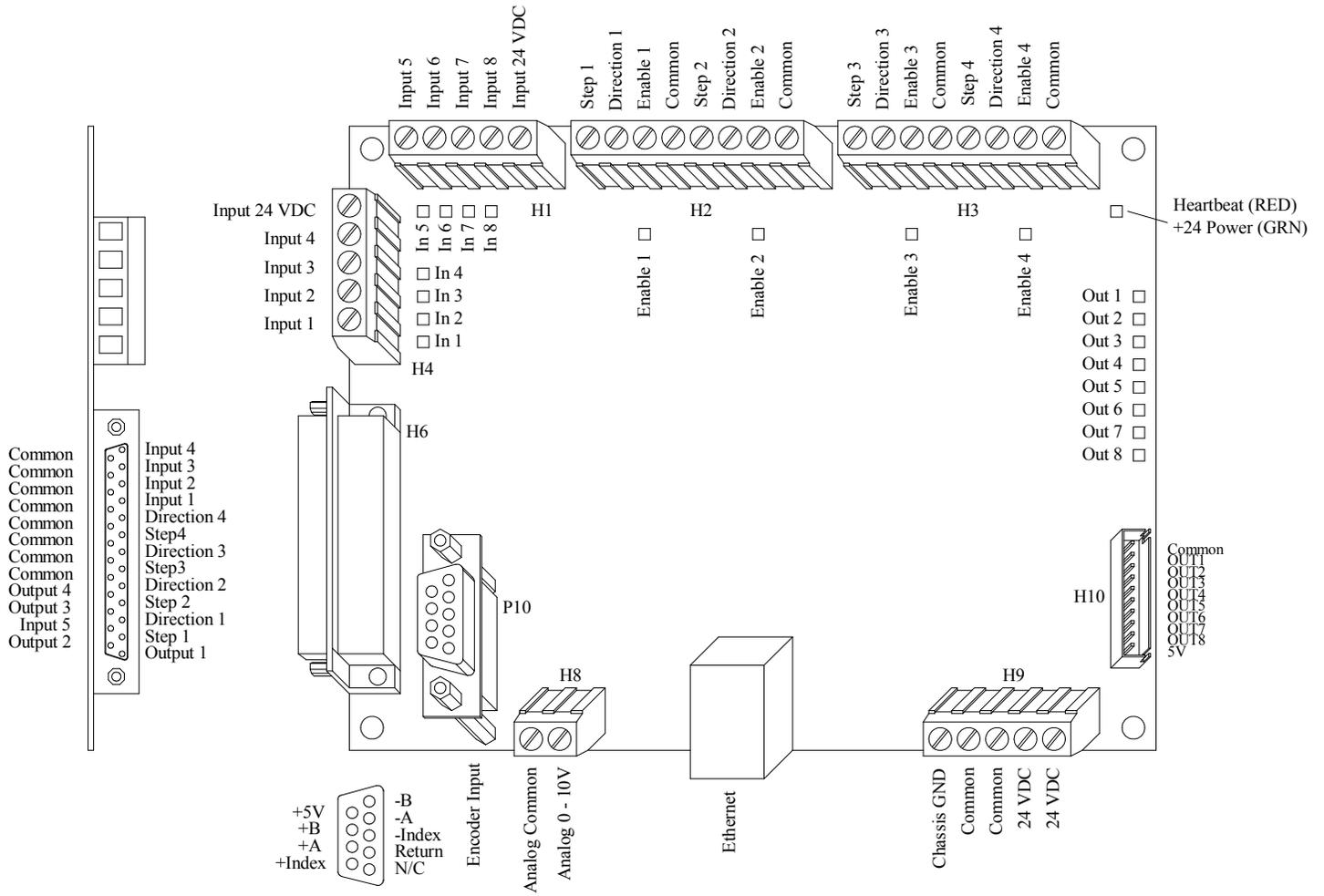
Input Specification		Input Location 1			Input Location 2		
Number	Function	Type	Connector	Pin	Type	Connector	Pin
1	General Purpose	Sourcing	H4	5	Logic w/ 5V Pullup	H6	10
2	General Purpose	Sourcing	H4	4	Logic w/ 5V Pullup	H6	11
3	General Purpose	Sourcing	H4	3	Logic w/ 5V Pullup	H6	12
4	General Purpose	Sourcing	H4	2	Logic w/ 5V Pullup	H6	13
5	General Purpose	Sourcing	H1	5	Logic w/ 5V Pullup	H6	15
6	General Purpose	Sourcing	H1	4	-	-	-
7	General Purpose	Sourcing	H1	3	-	-	-
8	General Purpose	Sourcing	H1	2	-	-	-

Output Specification		Output Location 1			Output Location 2		
Number	Function	Type	Connector	Pin	Type	Connector	Pin
1	General Purpose	Open Collector	H10	2	5V Logic	H6	1
2	General Purpose	Open Collector	H10	3	5V Logic	H6	14
3	General Purpose	Open Collector	H10	4	5V Logic	H6	16
4	General Purpose	Open Collector	H10	5	5V Logic	H6	17
5	General Purpose	Open Collector	H10	6	-	-	-
6	General Purpose	Open Collector	H10	7	-	-	-
7	General Purpose	Open Collector	H10	8	-	-	-
8	General Purpose	Open Collector	H10	9	-	-	-
17-28	Analog out	12 bit DAC	H8	1	-	-	-

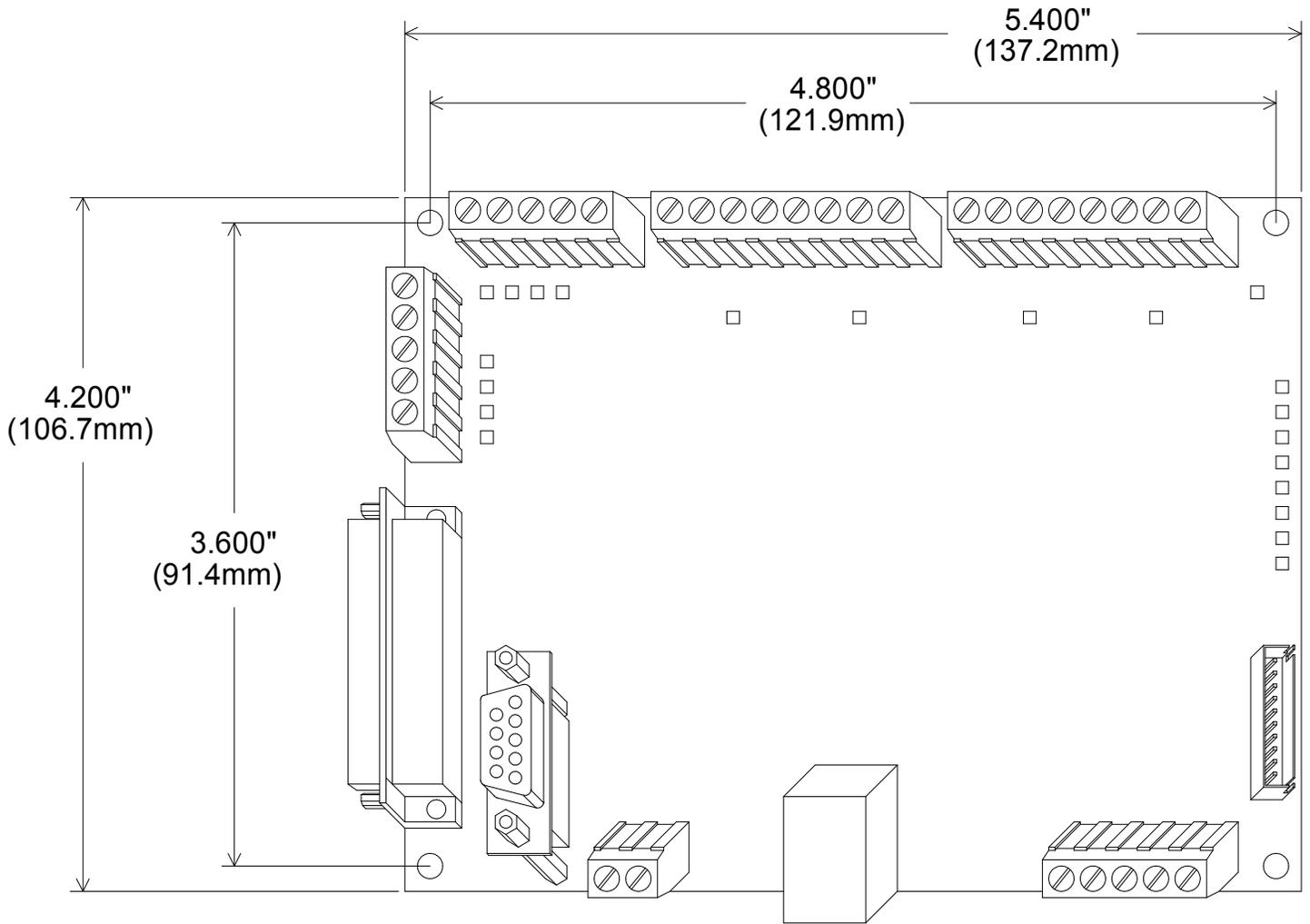
ACORN Specifications

Characteristic	Min.	Typ.	Max.	Unit
24 Volt Supply Current (Vsupply)	0.5	-	-	A
24V Input Pullup Voltage (Vinp)	22	-	26	VDC
24V Input Off Voltage	19.1	-	26	VDC
24V Input On Voltage	0	-	5.9	VDC
24V Input Operating current	9	11	15	mA
Open Collector Output Current	0	10	50	mA
Open Collector Output Voltage	0	24	26	VDC
DB25 Input Pullup Voltage (internal) (VCC)	4.35	4.75	5.15	VDC
DB25 Input On Voltage	VCC x 0.7	-	-	VDC
DB25 Input Off Voltage	-	-	VCC x 0.3	VDC
DB25 Output High Voltage	3.61	4.7	VCC	VDC
DB25 Output Low Voltage	0	0.1	0.44	VDC
DB25 Low Level Output Current	0	3	20	mA
DB25 High Level Output Current	0	3	20	mA
Analog Output Current	0	1	10	mA
Analog Output Voltage	0	-	10	V
Analog Output Resolution	-	12	-	bits
Relay Output Current (relay board)	0.01	-	10	A @ 125VAC
Relay Output Current (relay board)	0.01	-	10	A @ 28VDC
5 Volt Supply Current (relay board)	0.3	-	-	A
Size: 5.4 * 4.2 * 0.7 (W*D*H)				Inches

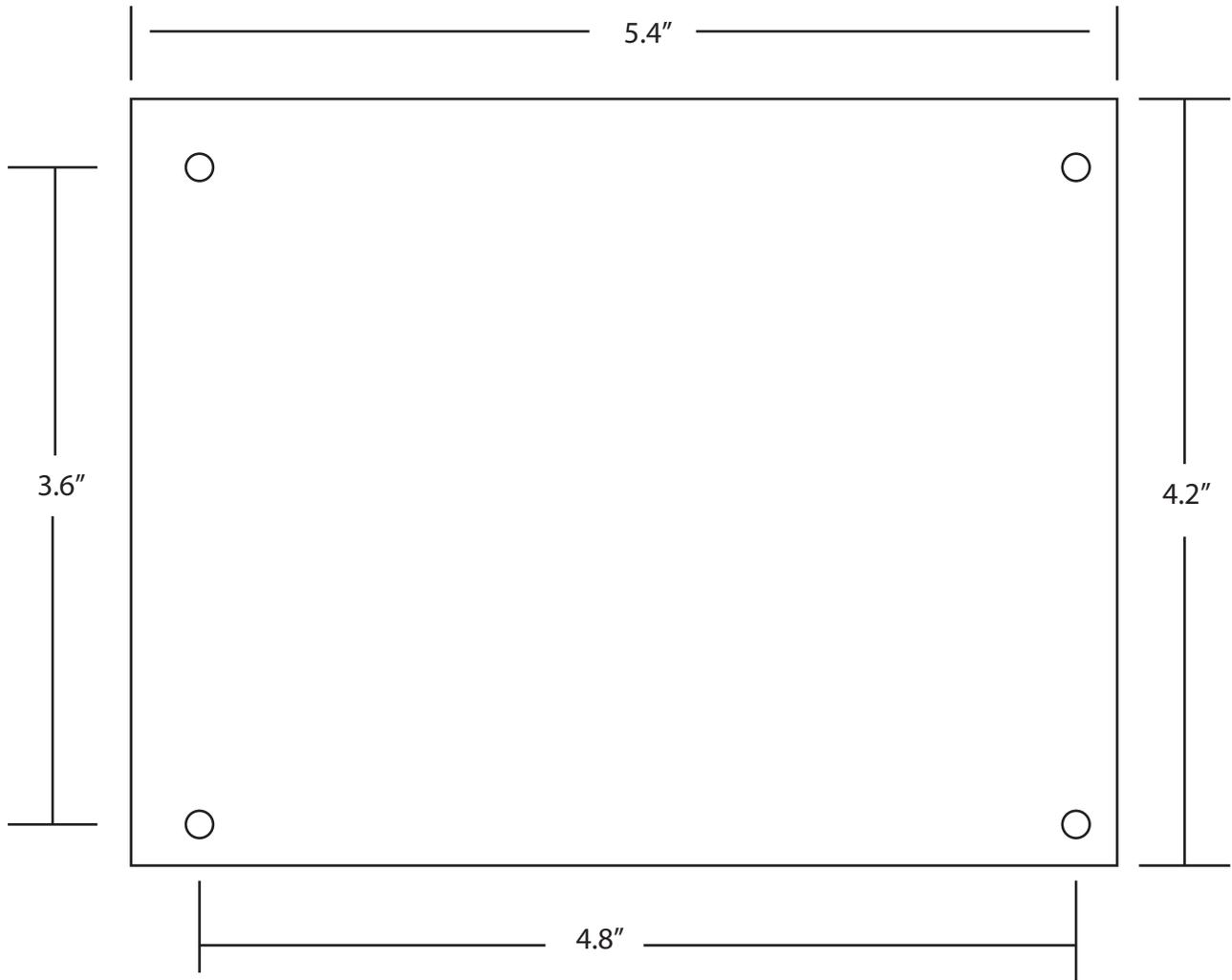
ACORN Connections



ACORN Mounting Footprint



Acorn CNC control board Mounting Footprint.



- Holes are clearance for 6-32 (.1495" diameter)
- 6-32 standoffs are recommended