

ACORN CNC controller _rev4 Specifications Manual

For Revision 190201

Updated 9/16/19

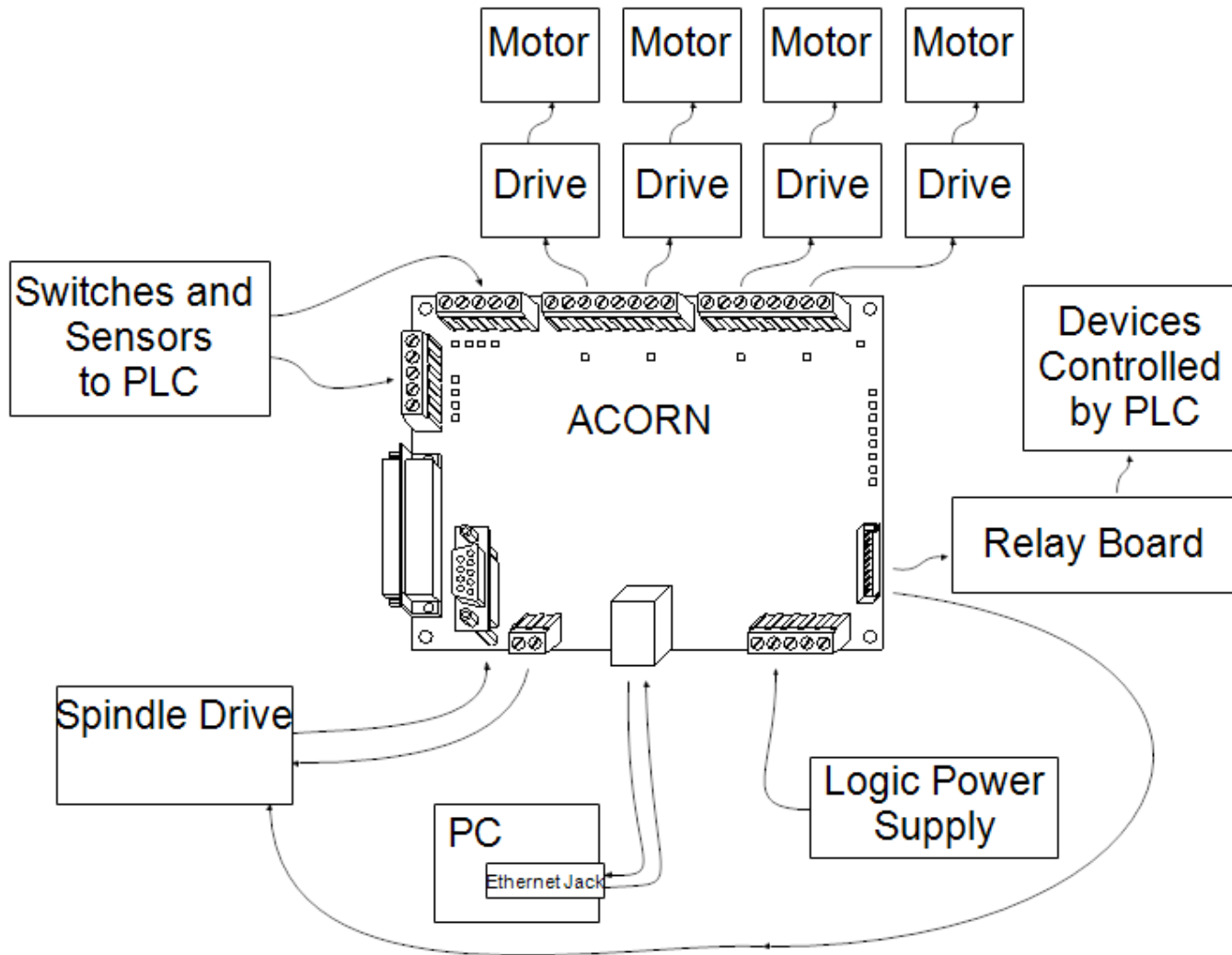
Overview

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



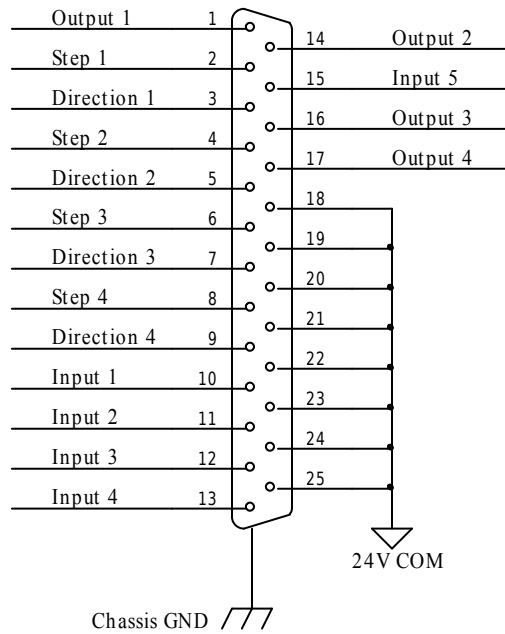
Connections

Two connection methods are available. A female DB25 connector is available that can mate with many stepper control units with a straight through cable. The inputs and outputs are 5V compatible. Check the DB25 pinout and circuit descriptions to determine if it is compatible with a particular control unit. The DB25 provides the simplest and quickest connection method if it is compatible.

Screw terminals are available for custom configurations. This allows for additional I/O and the most connection versatility. All input and output signals on the DB25 connector are available on the screw terminals except with 24V levels.

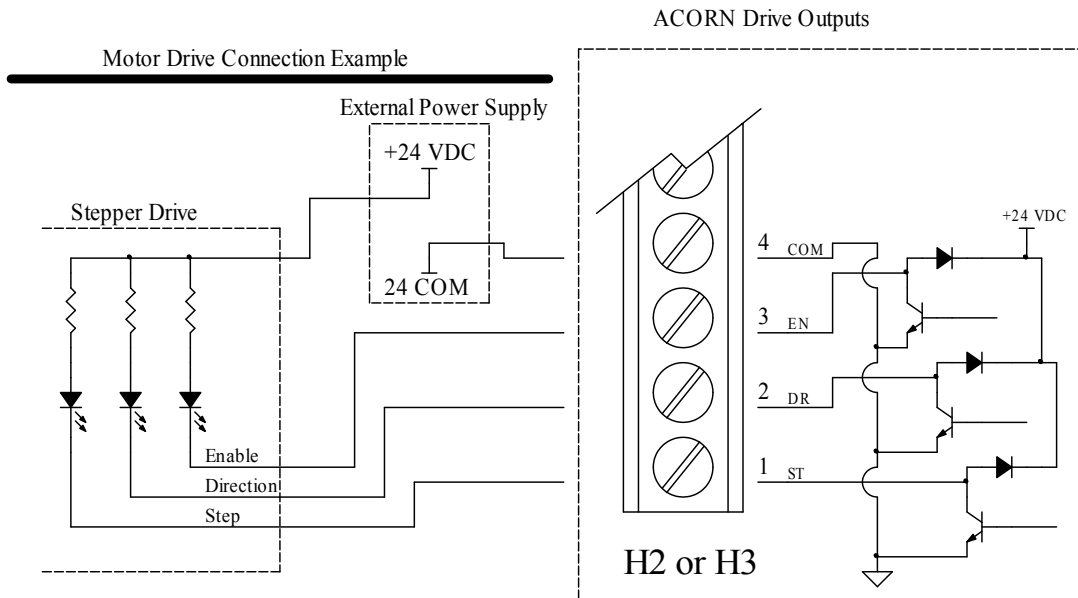
Inputs may only be used on the DB25 or screw terminal, not both. For example, only screw terminal input 1 or DB25 input 1 may be connected at the same time. However, screw terminal input 1 may be used at the same time as DB25 input 2.

DB25 (H6) Signals



Drive Interface Section

Four sets of step, direction, and enable outputs are provided to control motor drives. The outputs are open collector type and can provide up to 400kHz step frequency.

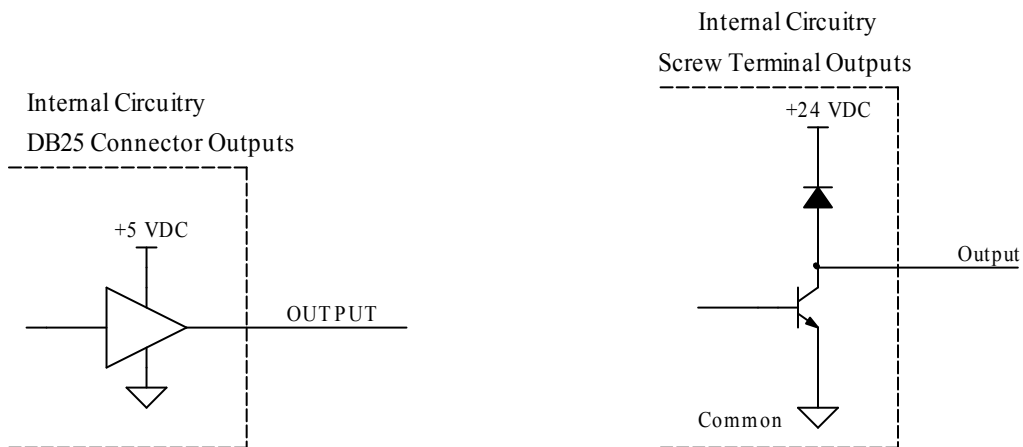


PLC Section

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

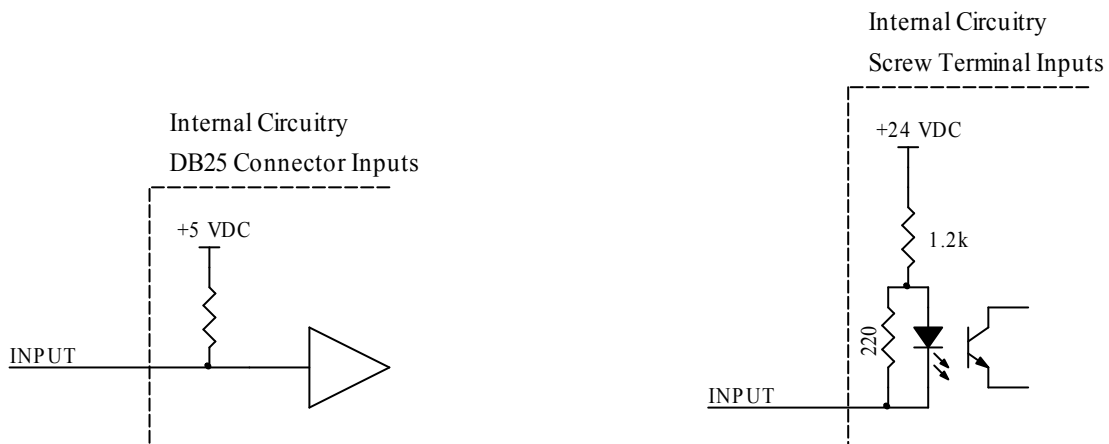
5V logic level relay outputs are available on the DB25 connector. 8 open collector outputs are normally wired with a ribbon cable to an external 8 relay board.



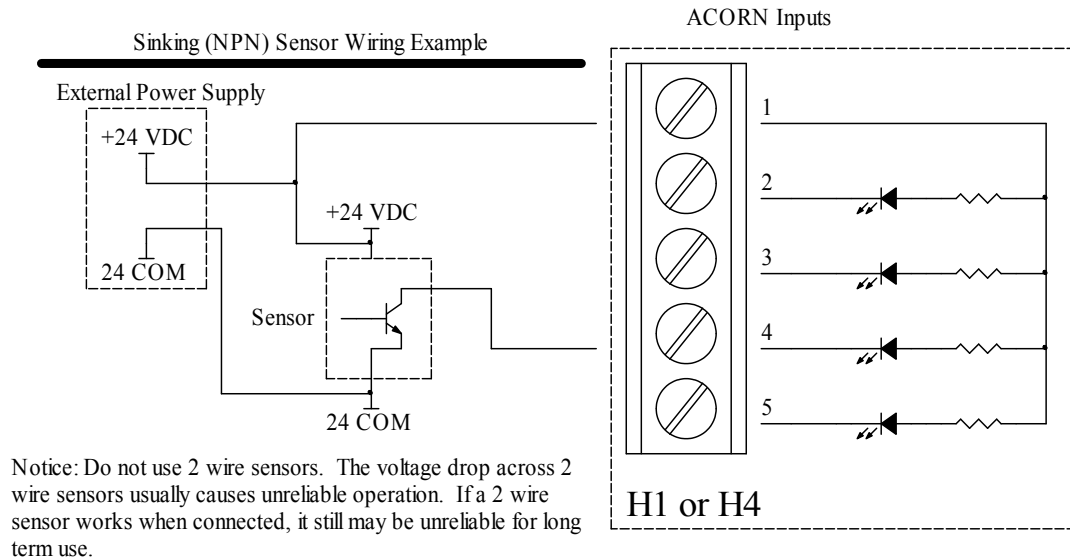
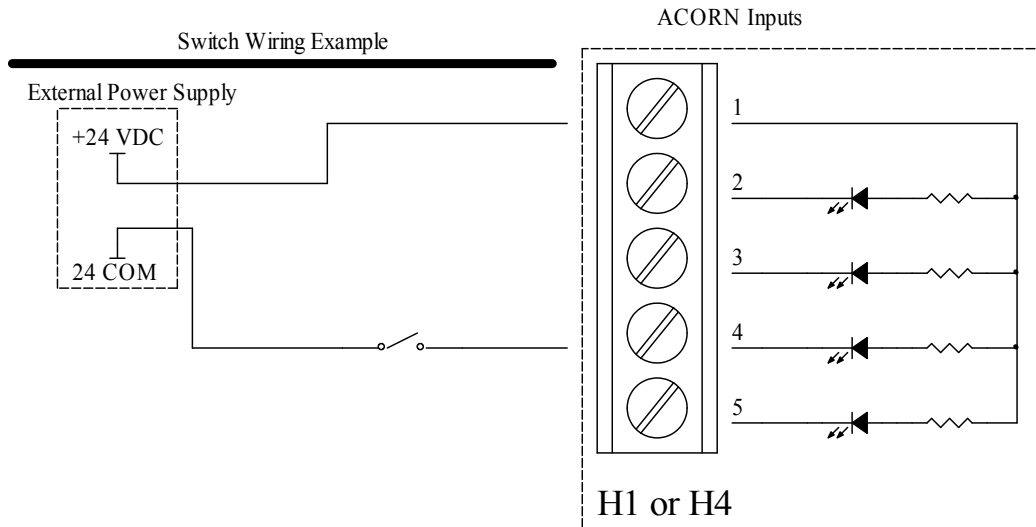
Inputs

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.

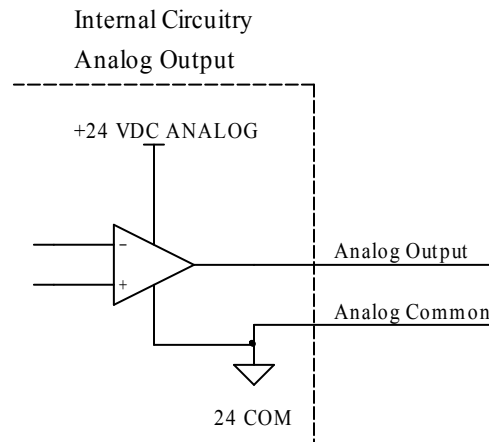


Input Connection Examples



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

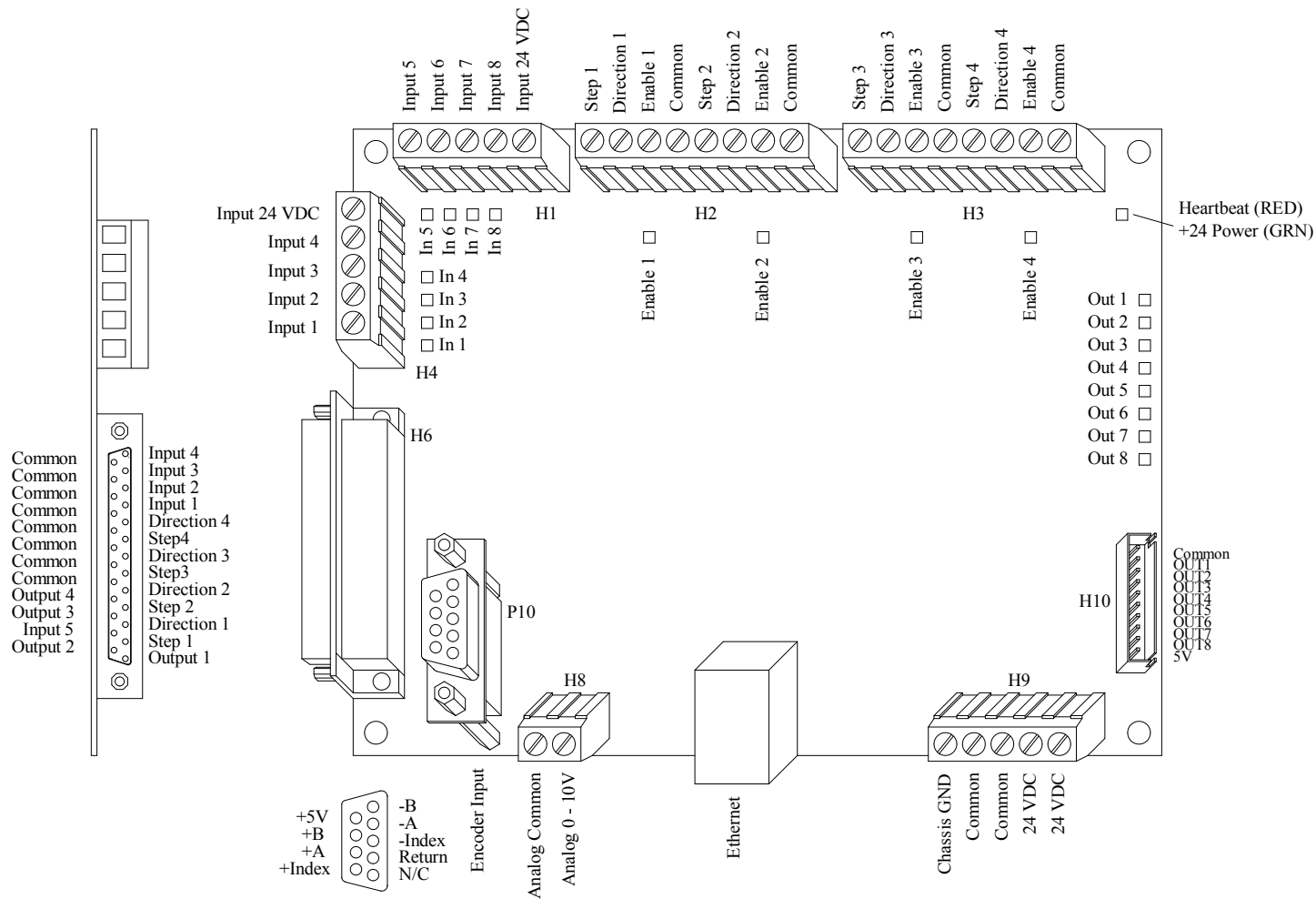
Input Specification		Input Location 1			Input Location 2		
Number	Function	Type	Connector	Pin	Type	Connector	Pin
1	General Purpose	Sourcing	H4	5	Logic w/ 5V Pullup	H6	10
2	General Purpose	Sourcing	H4	4	Logic w/ 5V Pullup	H6	11
3	General Purpose	Sourcing	H4	3	Logic w/ 5V Pullup	H6	12
4	General Purpose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

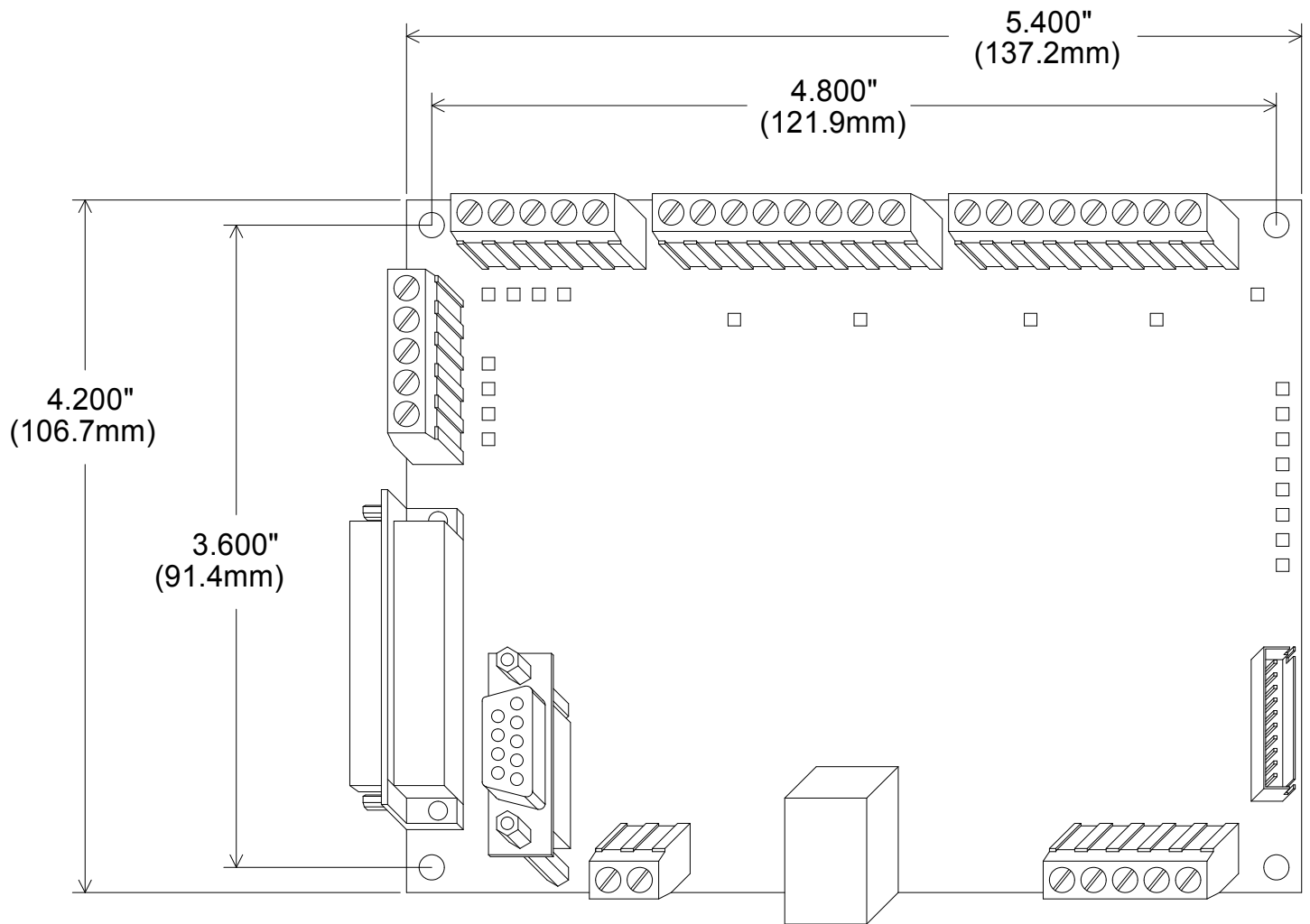
ACORN Specifications

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	Vsupply	VDC
DB25 Input Pullup Voltage (internal) (VCC)	3.8	4.4	5.5	VDC
DB25 Input On Voltage	VCC x 0.7	-	-	VDC
DB25 Input Off Voltage	-	-	VCC x 0.3	VDC
DB25 Output High Voltage	3.66	4.4	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

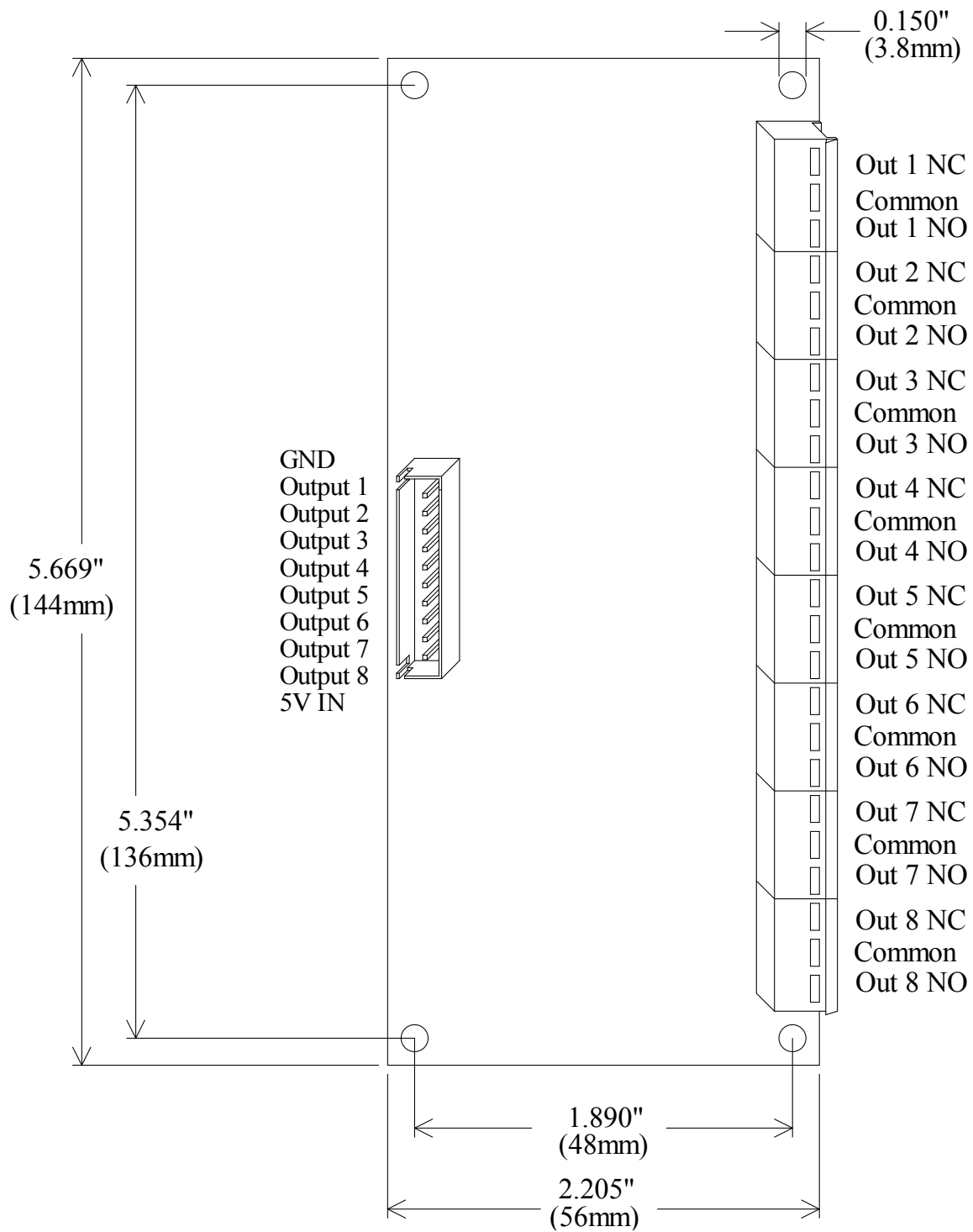
ACORN Connections



ACORN Mounting Footprint



8 Relay Board Mounting Footprint



SONGLE RELAY

	RELAY ISO9002	SRD
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1. MAIN FEATURES

- Switching capacity available by 10A in spite of small size design for highdensity P.C. board mounting technique.
- UL,CUL,TUV recognized.
- Selection of plastic material for high temperature and better chemical solution performance.
- Sealed types available.
- Simple relay magnetic circuit to meet low cost of mass production.

2. APPLICATIONS

- Domestic appliance, office machine, audio, equipment, automobile, etc.
(Remote control TV receiver, monitor display, audio equipment high rushing current use application.)

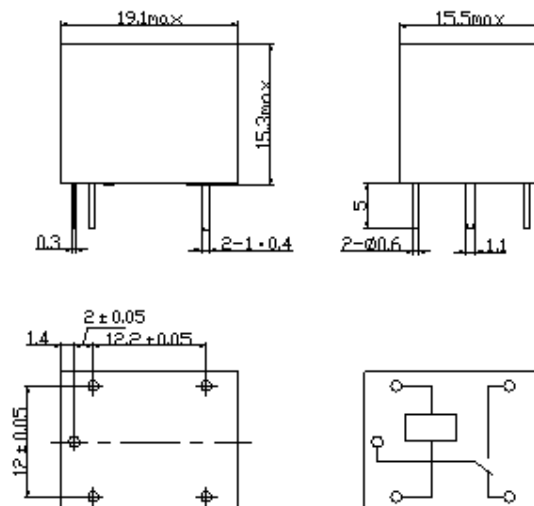
3. ORDERING INFORMATION

SRD	XX VDC	S	L	C
Model of relay	Nominal coil voltage	Structure	Coil sensitivity	Contact form
SRD	03、05、06、09、12、24、48VDC	S:Sealed type	L:0.36W	A:1 form A
		F:Flux free type	D:0.45W	B:1 form B
				C:1 form C

4. RATING

CCC	FILE NUMBER:CH0052885-2000	7A/240VDC
CCC	FILE NUMBER:CH0036746-99	10A/250VDC
UL /CUL	FILE NUMBER: E167996	10A/125VAC 28VDC
TUV	FILE NUMBER: R9933789	10A/240VAC 28VDC

5. DIMENSION(unit:mm) DRILLING(unit:mm) WIRING DIAGRAM



6. COIL DATA CHART (AT20°C)

Coil Sensitivity	Coil Voltage Code	Nominal Voltage (VDC)	Nominal Current (mA)	Coil Resistance (Ω) $\pm 10\%$	Power Consumption (W)	Pull-In Voltage (VDC)	Drop-Out Voltage (VDC)	Max-Allowable Voltage (VDC)
SRD (High Sensitivity)	03	03	120	25	abt. 0.36W	75%Max.	10% Min.	120%
	05	05	71.4	70				
	06	06	60	100				
	09	09	40	225				
	12	12	30	400				
	24	24	15	1600				
	48	48	7.5	6400				
SRD (Standard)	03	03	150	20	abt. 0.45W	75% Max.	10% Min.	110%
	05	05	89.3	55				
	06	06	75	80				
	09	09	50	180				
	12	12	37.5	320				
	24	24	18.7	1280				
	48	48	10	4500	abt. 0.51W			

7. CONTACT RATING

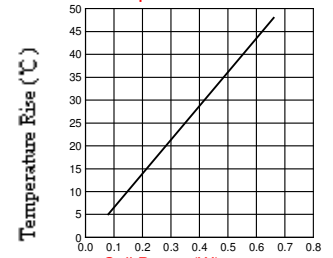
Item	Type	SRD	
		FORM C	FORM A
Contact Capacity Resistive Load ($\cos\Phi=1$)		7A 28VDC 10A 125VAC 7A 240VAC	10A 28VDC 10A 240VAC
Inductive Load ($\cos\Phi=0.4$ L/R=7msec)		3A 120VAC 3A 28VDC	5A 120VAC 5A 28VDC
Max. Allowable Voltage		250VAC/110VDC	250VAC/110VDC
Max. Allowable Power Force		800VAC/240W	1200VA/300W
Contact Material		AgCdO	AgCdO

8. PERFORMANCE (at initial value)

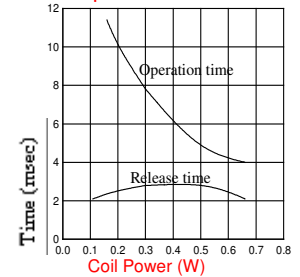
Item	Type	SRD
Contact Resistance		100m Ω Max.
Operation Time		10msec Max.
Release Time		5msec Max.
Dielectric Strength		
Between coil & contact		1500VAC 50/60HZ (1 minute)
Between contacts		1000VAC 50/60HZ (1 minute)
Insulation Resistance		100 M Ω Min. (500VDC)
Max. ON/OFF Switching		
Mechanically		300 operation/min
Electrically		30 operation/min
Ambient Temperature		-25°C to +70°C
Operating Humidity		45 to 85% RH
Vibration		
Endurance		10 to 55Hz Double Amplitude 1.5mm
Error Operation		10 to 55Hz Double Amplitude 1.5mm
Shock		
Endurance		100G Min.
Error Operation		10G Min.
Life Expectancy		
Mechanically		10 ⁷ operations. Min. (no load)
Electrically		10 ⁵ operations. Min. (at rated coil voltage)
Weight		abt. 10grs.

9. REFERENCE DATA

Coil Temperature Rise

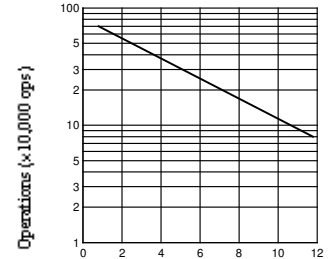


Operation Time

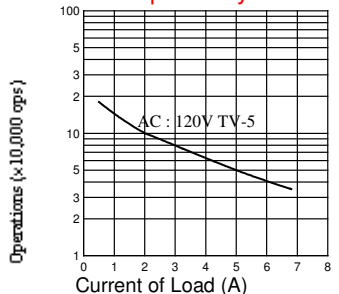


Life Expectancy

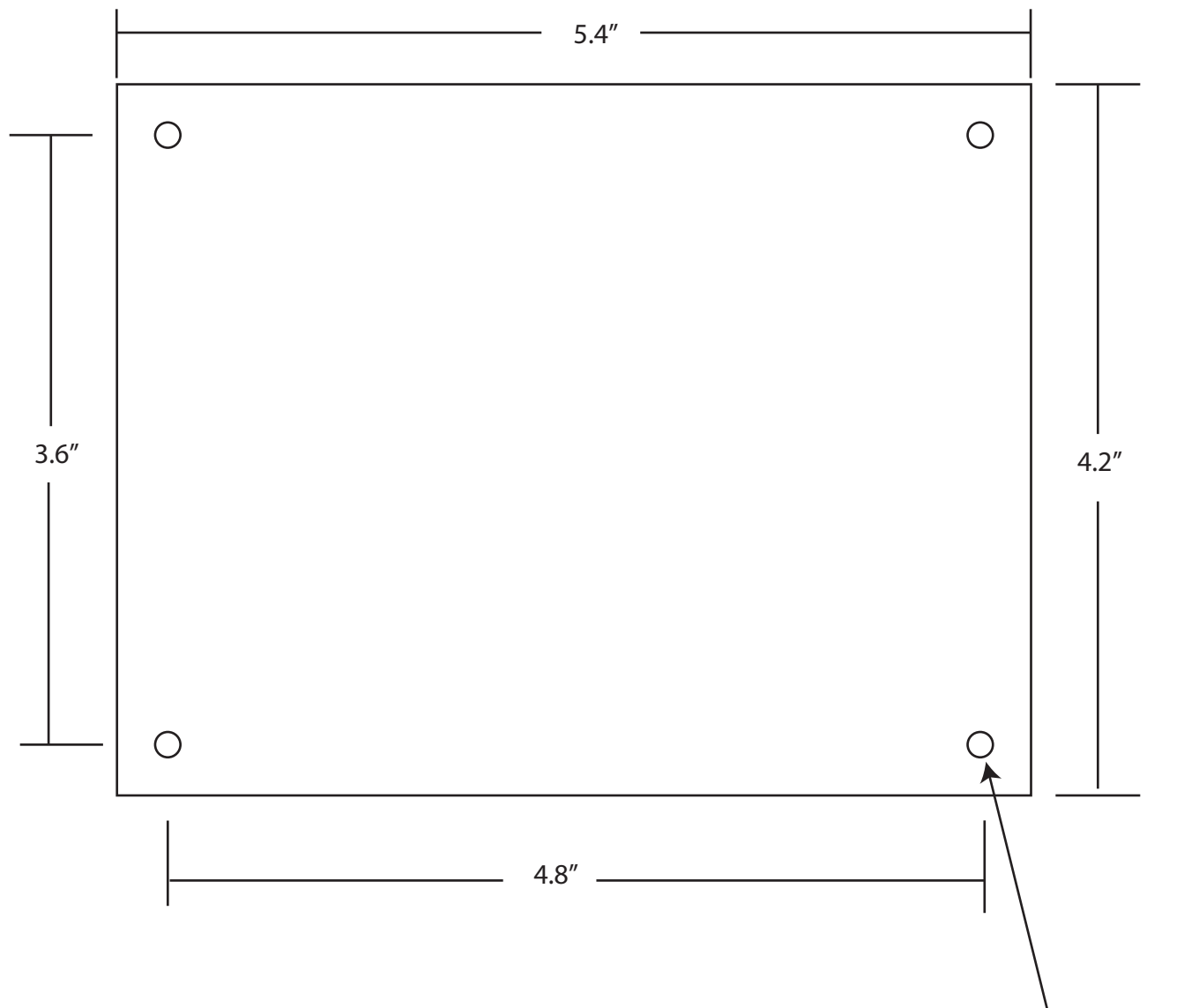
AC120V/DC24V $\cos\Phi=1$



Life Expectancy

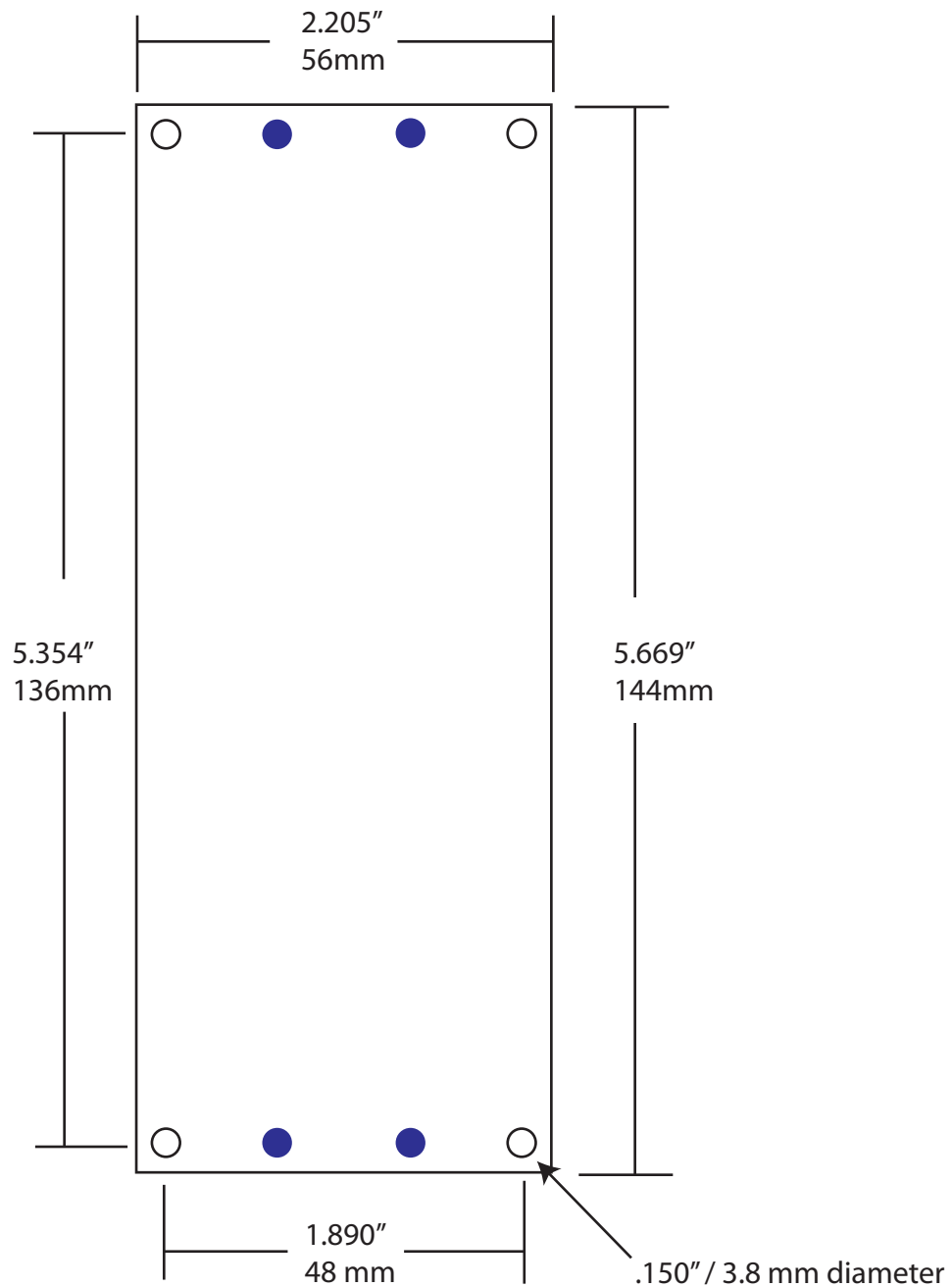


Acorn CNC control board Mounting Footprint.



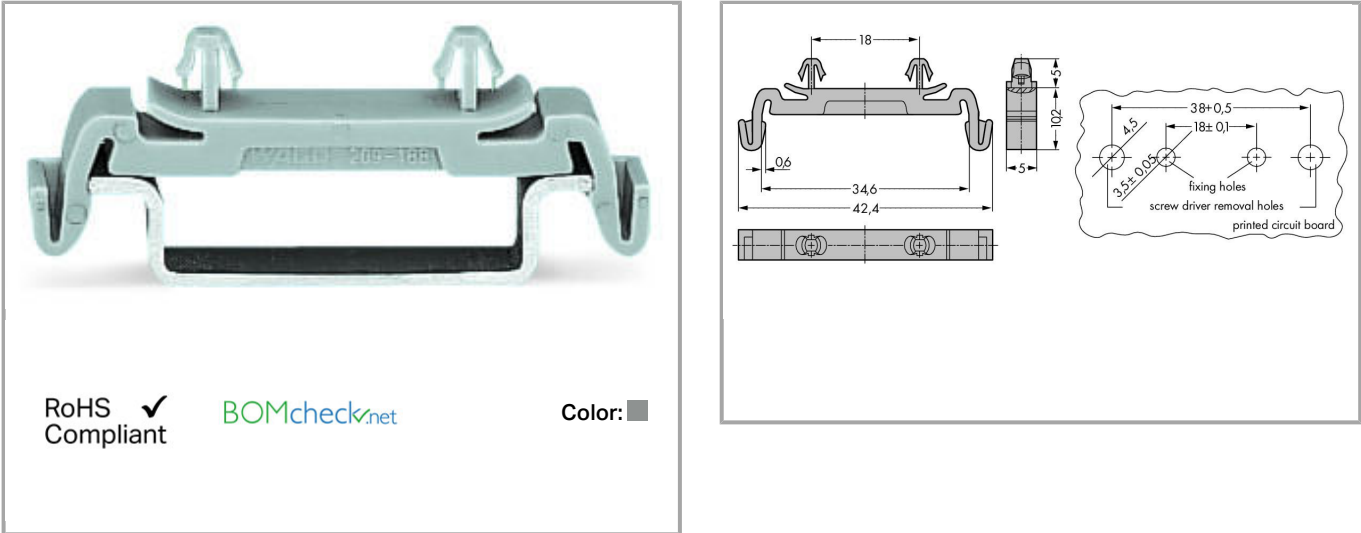
- Holes are clearance for 6-32 (.150\" / 3.8 mm diameter diameter)
- 6-32 metal standoffs are recommended

Acorn CNC 8 Relay Module Mounting Footprint.



- Holes are clearance for 6-32 (.150" / 3.8 mm diameter)
- 6-32 metal standoffs are recommended

● The 8 Relay Module Din Rail Mounting holes accept Din Rail standard clips such as the Wago 209188 clip and alternatives. <https://www.wago.com/us/rail-chassis-terminal-blocks/mounting-foot/p/209-188>



Data

Geometrical Data

Width	5 mm / 0.197 inch
Height from upper-edge of DIN-35 rail	5.1 mm / 0.201 inch
Depth	42.4 mm / 1.669 inch

Material Data

Weight	0.96 g
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Commercial data

Product Group	2 (Terminal Block Accessories)
Country of origin	DE
GTIN	4017332200998

Downloads

CAD/CAE-Data

CAD data

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