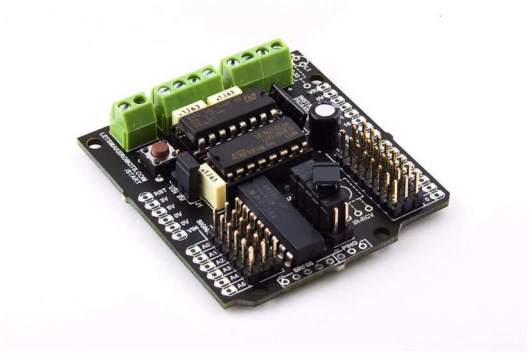
Instant Robot Shield (AXE408)

1.0 Introduction

Thank you for purchasing this Instant Robot shield. This datasheet is designed to give a brief introduction to how the shield is assembled, used and configured.



Kindly note that in the kit we only supply the title page of this datasheet - the full datasheet, and links to videos and tutorials and more advice is available at the PICAXE website at **www.picaxe.com/products/axe408**

1.1 Overview

The 'Instant Robot Shield' is designed to enable you to rapidly create a robot based upon a PICAXE-28X2 shield base or Arduino controller. Simply push the shield onto your controller, connect your motors, sensors and servos and you can have a working robot within just a few minutes!

Key Features:

- Two 500mA motor channels with optional PWM control
- Two 500mA buffered outputs (for optional buzzers etc).
- 6 analogue or digital inputs, with optional on-board 10k pull down resistor
- 8 servo or digital outputs
- Power either from shield base or via separate battery pack

1.2 Preparation:

For the pre-assembled PCB, part AXE408, please see appendix A.
For the self-assembly kit, part AXE408KIT, please see appendix B.

If you have purchased the self assembly kit please see appendix C for the soldering instructions.

1.3 Further Information

For further information on how to use the instant robot shield please see the following web links:

www.picaxe.com/instant

www.letsmakerobots.com/start

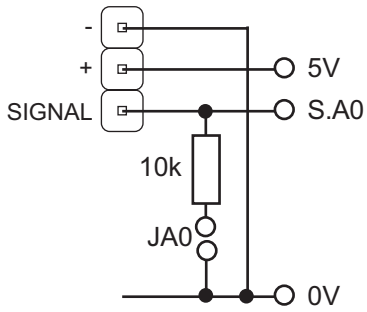
For each Instant Robot shield sold the manufacturer will donate $5 to letsmakerobots to help develop and support this active robot building community

2.0 Input/Output Pin Summary

S.A0 to S.A5

These 6 pins are connected to the 'SIGNAL' pad next to the label. A V+ (+) and 0V (-) pad are also provided, to enable use of 3 way 'servo' style cables on each position.

Each pin also has an optional 10k pull-down resistor. This resistor is enabled by connecting the appropriate jumper JA0 to JA6.



When the jumper is in place a 10k resistor is connected between that pin and 0V. Therefore when the 10k jumper is in place an analogue sensor (e.g. LDR) or digital sensor (e.g. push switch or micro switch) is simply connected between the + pin and the signal pin (0V (-) pin is not used in this situation).

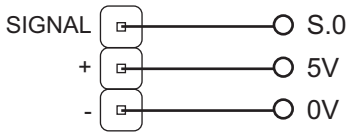
These pins are normally used as inputs – digital, analogue or touch. However they may also be used as outputs.

Example PICAXE program (switch on input S.A0):

```
#picaxe  28x2
do
      if pinS.A0 = 1 then
            high S.13     ; output on
      else
            low S.13      ; output off
      end if
loop
```

S.0 to S.7

These 8 pins are connected to the 'SIGNAL' pad next to the label. A V+ (+) and 0V (-) pad are also provided, to enable use of 3 way 'servo' style cables. Radio control servos may be connected directly to the headers, or other input/output devices may be connected via servo extension leads.



These pins are normally used as digital outputs. However they may also be used as inputs – digital, analogue or touch.

Note that these pins connect directly to the microcontroller. They can therefore be used to directly drive low current devices (such as servos, LEDs and piezo sounders), but must not be used to directly drive high current devices (motors, buzzers etc).

Example PICAXE program (servo on output S.2):

```
#picaxe  28x2
servo S.2, 150            ; initialise servo
do
      servopos S.2, 100   ; move servo
      pause 1000          ; wait i second
      servopos S.2, 200   ; move servo
      pause 1000          ; wait i second
loop
```

Pins S.5 to S.7 also have optional secondary PCB features as follows (explained in more detail in the optional add-ons section of this datasheet).

S.5 Ultrasonic Range Finder Sensor for distance sensing
S.6 Infra-red Sensor for infra-red control
S.7 Infra-red LED for infra-red control

S.8 to S.11

These 4 pins control the two motors A and B. Each motor has a direction pin and an on/off/pwm control pin. The motor control function is provided by an SGS L293D motor controller IC.

S.8	Motor A Direction
S.9	Motor A Control (On/Off/PWM)
S.10	Motor B Control (On/Off/PWM)
S.11	Motor B Direction

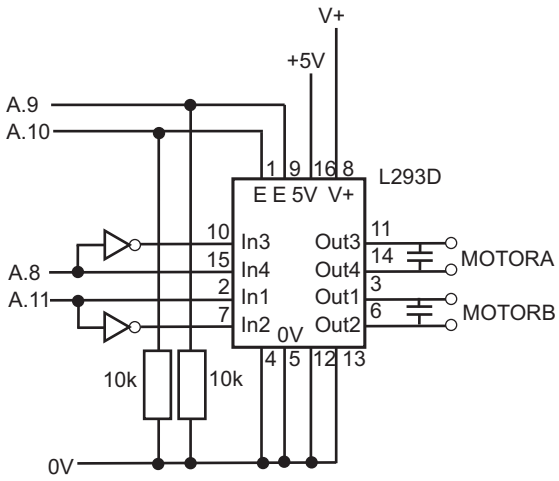
A motor is switched on or off by simply switching the appropriate control pin high or low. The direction of the motor can be reversed by switching the direction pin high or low.

Example PICAXE program:

```
#picaxe  28x2

      high  S.9          ; motor A on
do
      high S.8           ; motor A forwards
      pause  1000        ; wait 1 second
      low  S.8           ; motor A backwards
      pause  1000        ; wait 1 second
loop
```

If speed control is required a PWM stream (e.g. from the PICAXE 'pwmout' command) may be applied to the control pin instead of just switching it high (high always gives full speed). By varying the mark-space ratio of the PWM stream the speed of the motor may be controlled.

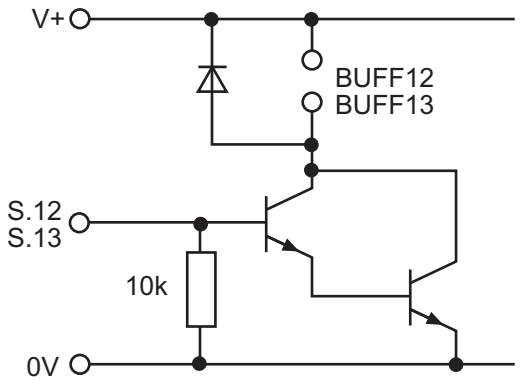


S.12 to S.13

These 2 pins control the two buffered (open collector, 500mA) outputs. The output device is connected between the two screw terminals and may be switched on and off by switching the appropriate pin high or low.

S.12 Buffer 12
S.13 Buffer 13

Kindly note these are open collector buffered outputs, so the two terminal blocks connect to the buffer output and V+ (not 0V). To check operation with a multimeter connect the multimeter to V+ (not to 0V).



Example PICAXE program:

```
#picaxe  28x2
do
      high  S.13
      pause  1000
      low  S.13
      pause  1000
loop
```

3.0 Optional Add-Ons (not included)

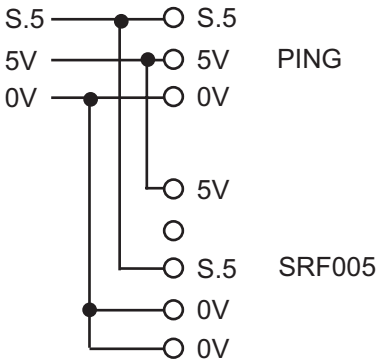
Ultrasonic Range Finder (e.g. part SRF005)
These pads allow connection of either a SRF005 or PING))) ultrasonic range finder.
When connected the ultrasonic sensor is connected to pin S.5

The SRF005 is connected to the 5 pin header.
The PING))) is connected to the 3 pin header.

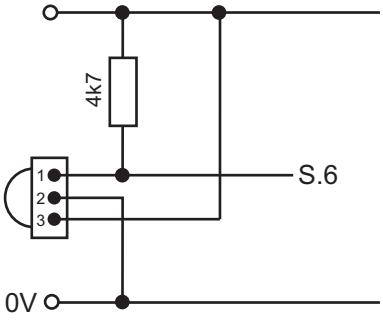
The SRF005 ultrasonic sensor may be controlled via the PICAXE 'ultra' command.

Example PICAXE program:

```
#picaxe  28x2
do
      ultra S.5,b1        ; read distance
      if b1 > 10 then     ; test for 10cm
            high S.13     ; output on
      else
            low S.13      ; output off
      end if
loop
```



IC3 – Infra-red Receiver (e.g. part LED020)
These pads allow connection of an 38kHz or 40kHz infra red sensor. When soldered in position this sensor connection is pin S.6. Note that R1, 4k7 ohms, should also be soldered in place at the same time as the sensor.



The infra-red receiver may be controlled by the PICAXE 'irin' command.

Example PICAXE program:

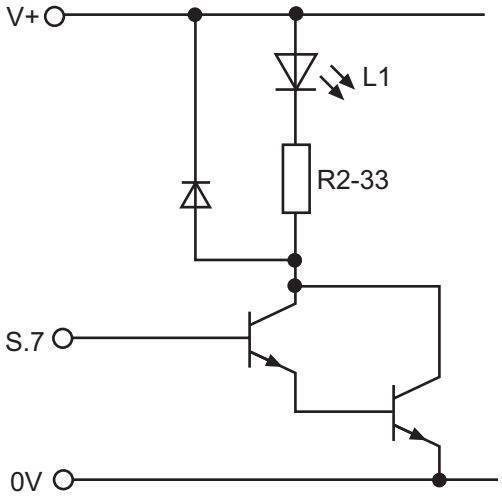
```
#picaxe  28x2
do
      irin S.6,b1          ; read infra red signal
      if b1 = 1 then       ; test for button
            high S.13      ; output on
      else
            low S.13       ; output off
      end if
loop
```

LI – Infra-red LED (e.g. part LED021)
These pads allow connection of an infra red LED. When soldered in position the LED is controlled by pin S.7. Note that R2, 33 ohms, should also be soldered in place at the same time as the sensor. The LED is buffered via the ULN2003A darlington driver chip IC2 to allow a larger current for increased range.

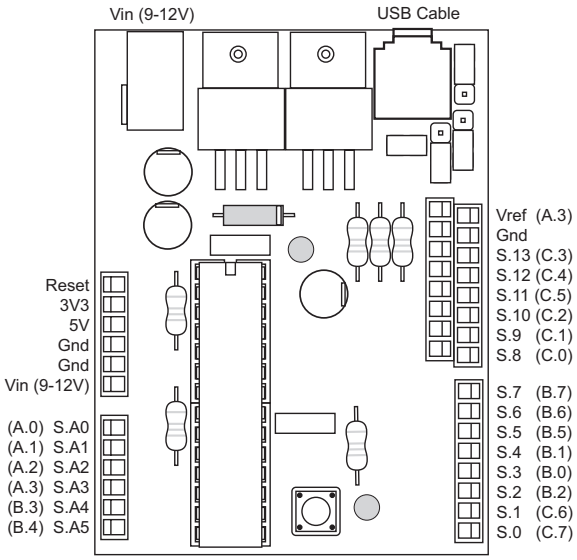
The infra-red LED may be controlled by the PICAXE 'irout' command, which automatically modulates the signal for use with the infra-red receiver (e.g. for two or more shields to communicate with each other).

Example PICAXE program:

```
#picaxe  28x2
do
      irout S.5,1,1        ; send infra red signal
      pause 1000           ; wait 1 second
loop
```



4.0 PICAXE Shield Base



AXE401 PICAXE-28X2 Shield Base

Shield Header	Shield Nickname	Primary Pin Function	Advanced Pin Function	PICAXE Pin Name	PICAXE ADC
RESET		Reset		Reset	
3V3		3.3V Supply Out		V+	
5V		5V Supply Out	5V Supply In	V+	
GND		0V	0V Supply In	0V	
GND		0V		0V	
VIN		Supply In (9-12V DC)			
A0	S.A0	In / Out / ADC / Touch	Comp1-	A.0	0
A1	S.A1	In / Out / ADC / Touch	Comp2-	A.1	1
A2	S.A2	In / Out / ADC / Touch	Comp2+ / DAC	A.2	2
A3	S.A3	In / Out / ADC / Touch	Comp1+ / Vref	A.3	3
A4	S.A4	In / Out / ADC / Touch		B.3	9
A5	S.A5	In / Out / ADC / Touch	hpwm D	B.4	11
0	S.0	In / Out / ADC / Touch	hserin / kb data	C.7	19
1	S.1	In / Out / ADC / Touch	hserout / kb clk	C.6	18
2	S.2	In / Out / ADC / Touch	hpwm B / hint 2	B.2	8
3	S.3	In / Out / ADC / Touch	pwm / hint0	B.0	12
4	S.4	In / Out / ADC / Touch	hpwm C / hint 1	B.1	10
5	S.5	In / Out / ADC / Touch	pwm	B.5	13
6	S.6	In / Out		B.6	-
7	S.7	In / Out		B.7	-
8	S.8	In / Out	timer clk	C.0	-
9	S.9	In / Out	pwm	C.1	-
10	S.10	In / Out / ADC / Touch	hpwm A / pwm	C.2	14
11	S.11	In / Out / ADC / Touch	hspi sdo	C.5	17
12	S.12	In / Out / ADC / Touch	hspi sdi / hi2c sda	C.4	16
13	S.13	In / Out / ADC / Touch (or LED via H4)	hspi sck / hi2c scl	C.3	4
GND		0V		0V	
VREF	S.A3	In / Out / ADC / Touch	Comp1+ / Vref	A.3	3

5.0 Shield Power Supply Options.

The shield has three main options for connecting power. Option 1 is the most commonly used.

1) All power is supplied by the shield base 5V supply
2) Logic power taken from shield base 5V, motor/outputs from separate supply
3) All power supplied by the screw terminal block on the AXE408 shield.

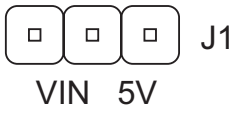
Option 1

When the jumper on J1 links the centre pin to right hand '5V' pin the entire shield power supply is taken from the shield base 5V regulator. The 9-12V DC supply is connected to the shield base 2.1mm connector and the shield regulator then regulates this supply to 5V.

The motors and buffered outputs operate at 5V.
In this mode **do not** make a connection to the two way terminal block.

Option 2

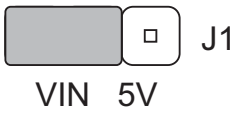
When no jumper link is used the motor/buffered outputs power supply is taken from the power screw terminal block. The 'logic level' supply (e.g. for the sensors on S.A0 to S.A5 and S.0 to S.7) is still 5V from the shield base 5V regulator. Therefore two power supplies are required, one on the shield base and one on the AXE408 shield.



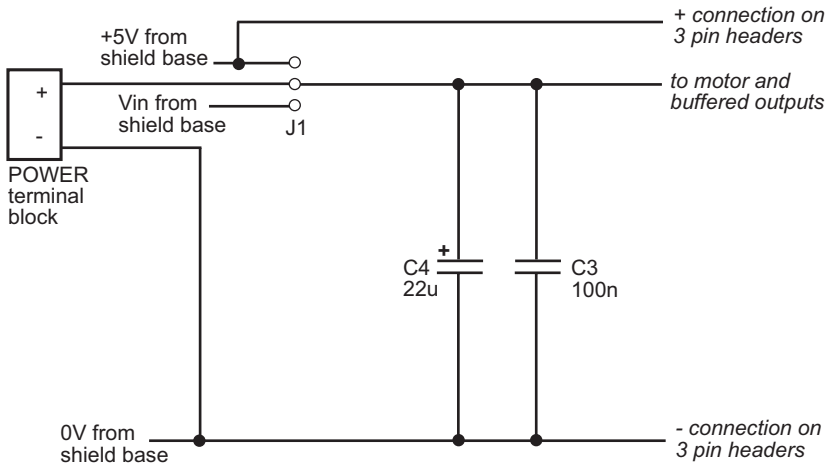
The motors and buffered outputs operate at the terminal block power supply.

Option 3

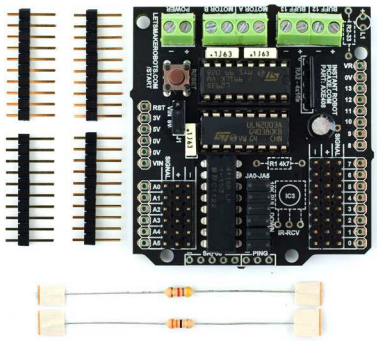
When the jumper on J1 links the centre pin to the left hand 'Vin' pin the shield motor/buffered outputs power supply is taken from the power screw terminal block. This supply is **also connected to the Vin on the shield base**, so both the shield and shield base are powered via this one power supply (connected via the terminal block). The 'logic level' supply (e.g. for the sensors on S.A0 to S.A5 and S.0 to S.7) is still 5V, as it is still regulated via the shield base 5V regulator.



The motors and buffered outputs operate at the terminal block power supply.
In this mode **do not** make a connection to the shield base 2.1mm power connector, as the shield base is already powered via the terminal block supply.



Appendix A - Pre-assembled PCB



Contents

1	AXE408 Instant Robot Shield (pre-assembled)
7	jumper links
4	10 way 2.54mm headers

Pre-assembled kit preparation

Peel the 'green' protective covering from the rear of the PCB over the side pads etc. (if present). This can be easily lifted with a finger nail or edge of a small screwdriver.

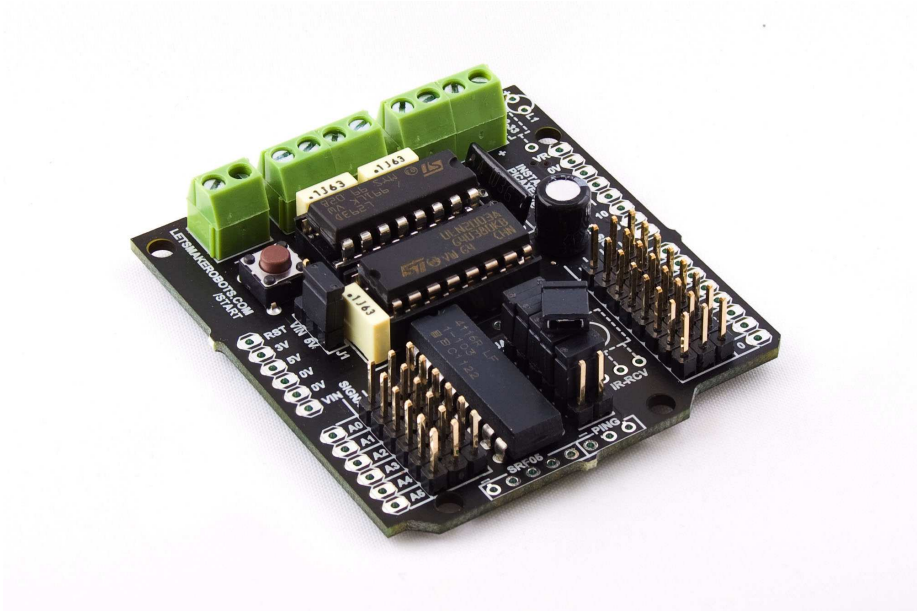
Place 6 of the jumper links on the pins labelled JA0-JA5
Place the final jumper link on 3 pin header J1, to link the right hand pin (labelled 5V) to the centre pin.

Carefully snap the 10 way headers into the following combinations:

6 way x 2
8 way x 2

Solder the headers in position (underneath the board, solder joints on top) so that the shield will fit on top of your shield base. Tip - place the headers into the shield base whilst soldering to keep them aligned.

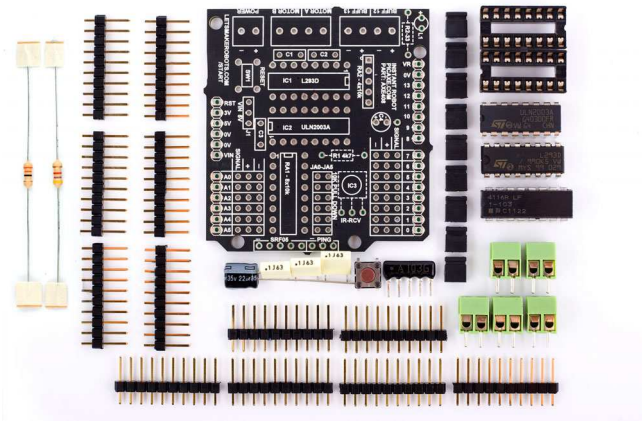
These headers are not provided pre-soldered as some people prefer to use 'stacking' headers instead on their shields. These stacking headers are available separately as parts CON060 (6 pin) and CON061 (8 pin), 2 of each would be required.



Please download the latest full assembly instructions and datasheet from this web link:

www.picaxe.com/products/axe408

Appendix B - Self assembly PCB



Contents:

	1	AXE408 Instant Robot Shield PCB	
C1,C2,C3	3	100nF polyester capacitor	104 or .1
C4	1	22uF 35V electrolytic capacitor	22u
SW1	1	6mm miniature push switch	
IC1,2	2	16 pin pressed pin IC socket	
IC1	1	L293D	
IC2	1	ULN2803A	
RA1	1	16 pin resistor array (10k)	4116R LF 1-103
RA2	1	5 pin 10k commoned resistor array	A 103 G
H1-8	12	10 way 2.54mm headers *(snap to length, see below)*	
JA0-6, J1	8	2.54mm jumper links	
TB1-2	5	2 way terminal blocks	
Optional - do	not add unless required via infra-red add-on:		
R1	1	4k7 0.25W resistor	yellow violet red gold
R2	1	33 0.25W resistor	orange orange black gold

Tools required for assembly (not supplied)

Soldering iron and 22swg solder
Minature side cutters / pliers
Small cross-head screwdriver

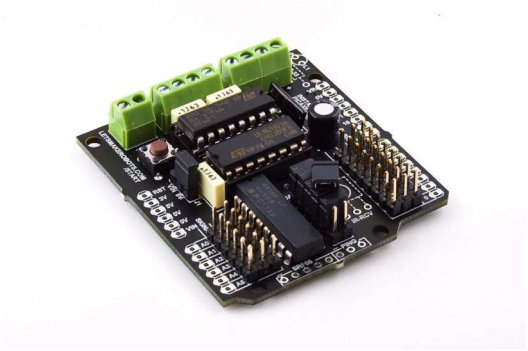
Basic soldering skills have been assumed.

Please download the latest full assembly instructions and datasheet from this web link:

www.picaxe.com/products/axe408

Appendix C

Self assembly kit preparation



Peel the 'green' protective covering from the rear of the PCB over the side pads etc. (if present). This can be easily lifted with a finger nail or edge of a small screwdriver.

Assembly:

1) Solder the resistor array RA2 in position, ensuring the writing on one side aligns with the RA2 marking on the PCB.
2) Solder the two IC sockets in position.
3) Solder the resistor array, marked 1-103) in position.
4) Solder the reset switch SW1 in position.
5) Solder the 3 100nF capacitors C1-3 in position.
6) Solder the 22uF capacitor C4 in position, ensuring correct polarity of the + and – legs.

Note: the headers are a very tight fit. This is to ensure they do not fall out when you turn the board over to solder. You may find it easier to use the side of a small coin to help push them into position.

7) Snap 3 headers into 8 way lengths and solder beside outputs 0-7.
8) Snap 3 headers into 6 way lengths and solder beside outputs A0-A5.
9) Snap 2 headers into 6 way lengths and solder beside outputs JA0-JA5.
10) Snap a header into a 3 way length and solder in position J1.

11) Slide 2 green terminal blocks together and solder beside buff '12/13'.
12) Slide 2 green terminal blocks together and solder beside motor 'A/B'.
13) Solder 1 green terminal block beside 'power'

Note the base connector pins are placed underneath the board, so the solder joints are on the top of the board. You may find it easier to do this soldering by placing the headers in the base whilst soldering – this helps keep the headers level and in position.

14) Snap 2 headers into 6 way lengths and 2 headers into 8 way lengths. Place underneath the board, and solder in position (the solder joints in this case are on the top of the board).

15) Insert the L293D chip into its socket, ensuring pin1 is next to the resistor array RA1.
16) Insert the ULN2003A chip into its socket, ensuring pin1 is next to the capacitor and Jumper J1.