Parts List:

5	Q1-Q5	TIP-120
5	Q6-Q10	TIP-125
1	5V REG	LM2940CT +5V regulator
1	U1	PIC 16F877A
1	U2	4049
2	C1 & C2	.22pf
2	C3 & C4	300 uf capacitors
10	R1-R10	100 K resistor
1	R11	2.2 K resistor
1	R12	6.8 K resistor
1	R23	4.7 K resistor
10	R13-R22	10 K ohm 1/8 watt resistor
1	XTAL	4 MHz crystal
1	40-DIP	40-pin IC socket
1	SW11	DPDT pc-mount switch
1	MOLEX	8 wire cable connector
1	HEADER	10-pin right-angle female header
1	16 PIN	IC Socket
1	D1	LED
1		330 ohm Resistor

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SRI-01
Speech Interface Kit
for
OWI Robotic Arm 535

*** REQUIRES: SR-07 Speech Recognition Circuit & 535 Robotic Arm**

Table of Contents

Introduction

The speech interface kit is a complete easy to build interface that allows one to use verbal commands to control the OWI 535 Robotic Arm Trainer. **The interface kit requires Images SI Inc. SR-07 Speech Recognition Circuit and OWI's 535 Robotic arm Trainer.**

This kit allows you to experiment with speech recognition and control technology.

Speech recognition and control will become the method of choice for controlling appliances, toys, tools and computers. At its most basic level, speech controlled appliances and tools allow the user to perform parallel tasks (i.e. hands and eyes are busy elsewhere) while working with the tool or appliance.

These factors should be kept in mind to achieve the high accuracy possible from the circuit. This becomes increasingly important when the speech recognition circuit is taken out of the lab and put to work in the outside world.

Testing & Retraining:

After training the circuit, test the circuit by repeating all the trained words into the microphone. The corresponding word number for each word spoken should be displayed on the digital display. You should achieve word recognition accuracy greater than 95%.

If the circuit continually confuses two spoken words, you can retrain one of the words. To retrain a word, press the word number using the keypad, the word number should be displayed on the digital display. Press the "T" key and say the word into the microphone. If the circuit still confuses the two words after retraining you may have to change one of the words.

Connection To OWI Robotic Arm:

Once the speech recognition kit has been trained and tested its time to connect it to the robotic arm. With the speech recognition kit turned off, remove the keypad and digital display. Connect the Robotic Arm Speech interface to the SR-07 speech recognition circuit using the 10 pin connector, see figure 2 and figure 3. NOTE: The digital display must be removed as it uses the same connection. Connect the robotic arm to the interface using the 8 wire cable.

First turn on the speech recognition kit. Say the command to "Stop" the robotic arm, then turn on the speech interface using the power switch.

Each word command given now will initiate the corresponding arm function. One thing to be aware of is it can take up to ½ second for a verbal command to propagate through the speech recognition circuit and interface. This creates a small delay between the issuing of a command and its execution.

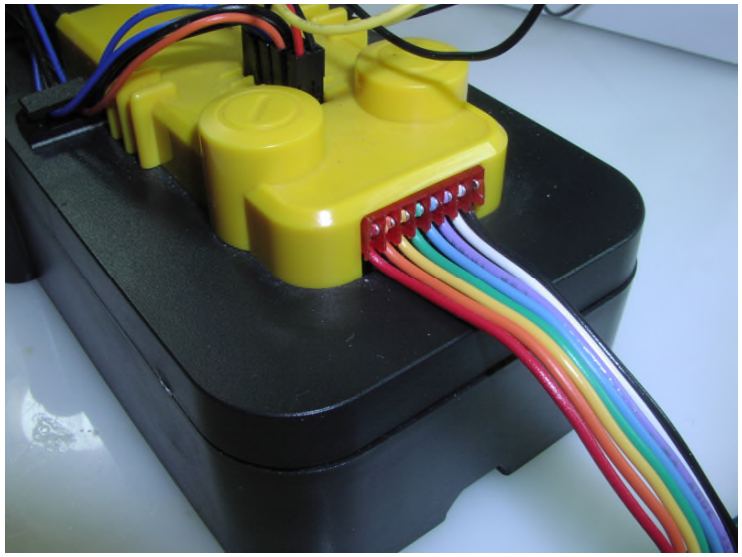


Figure 2 Side view of interface board and base of OWI robotic arm

SR-07 48 PDIP Version shown in picture.
SR-07 PLCC version is not shown.

Figure 3 Top view of SR-07 and speech interface board

The Voice With Stress & Excitement:

Stress and excitement alters ones voice. This affects the accuracy of the circuit's recognition. For instance assume you are sitting at your workbench and you program the target words into the circuit. Then you use the circuit to control the robotic arm in a stressful situations. In the heat of the situation you're voice may change from when you were sitting down relaxed and training the circuit.

General Circuit Construction:

Electronic components are mounted on the top side of the pc board. The top side of the pc board has white silk screen component drawings. The components are mounted on the top side and are soldered on the opposite side of the pc board. After soldering the component to the board any excess wire is clipped off.

Chip Installation:

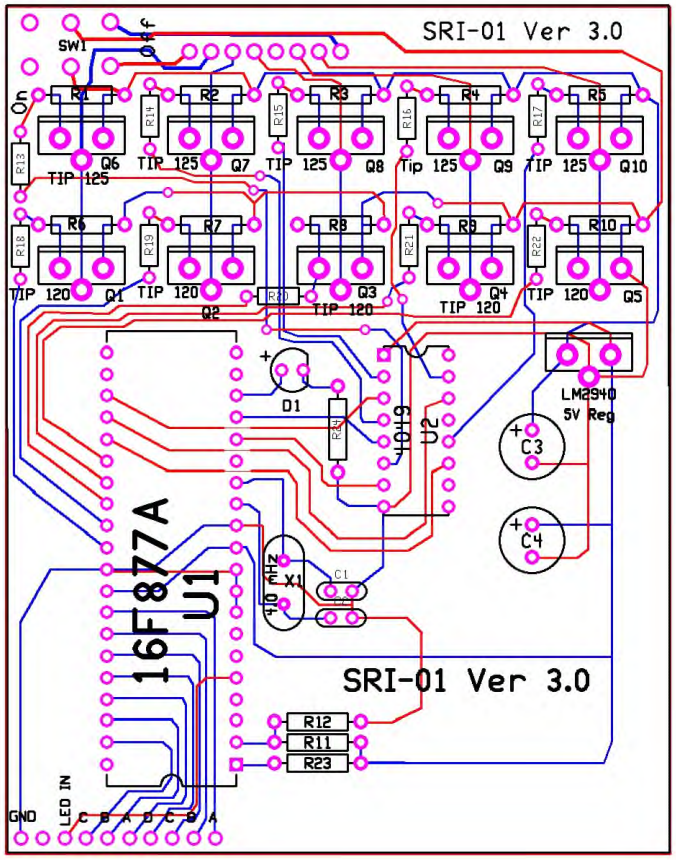
When installing integrated circuit (IC) chips, begin by first identifying the top of the chip. The top of the chip has a marker, many times it is a half circle cutout. Sometimes it is a small mark identifying pin 1 on the IC. In both cases the marks show us the top of the IC chip. Orientated the top of IC chips with the white silk screen drawings of the components on the top of the pc board (usually a half circle cutout) or on the parts placement drawings and install the IC into their socket.

Circuit Construction:

The schematic for the SRI-01 Speech Interface Circuit is shown in figure 1. Begin construction by mounting and soldering the IC sockets into place. Next mount and solder the following resistors: the 100K ohm resistors R1 to R10. The 100 K resistors have the following band colors: brown, black yellow and gold, R11 resistor, 2.2K ohm (color bands red, red, red and gold), R12 resistor 6.8K ohms (color bands blue, gray, red and gold), R23 resistor 4.7K ohms (color bands yellow, purple, red and gold). The 10K ohm, 1/8 watt resistors are marked R13– R22 (color bands brown, black, orange and gold). Next mount and solder the 330 ohm resistor marked 330 (color bands orange, orange, brown). Mount Red subminiature LED to D1. The longer lead on the LED is the positive lead.

Install capacitors C3 and C4. These are 330 uf capacitors. When installing, note polarity: the negative side of the capacitor is marked with a negative sign. Match this side up to the negative sign (-) as marked on the PCB silkscreen. Next, install the 4 MHz crystal and C1 and C2, which are the small 22 pf capacitors.

Mount and solder the TIP125 transistors, Q6 through Q10. Next, install the TIP120 transistors, Q1 through Q5. Then install the LM2940 5 volt regulator. Mount and solder.



Cable wiring for the OWI-535 Robotic Arm, see text.

Install the power switch SW11. Next, mount and solder the female 10-pin header, making sure it's pointing outwards in order to mate with the speech recognition board.

Finally, mount and solder the 8-wire cable. Be sure to start with red wire next to power switch. Then follow this color sequence. Starting with red, then orange, yellow, green, white, brown, blue and black, see photo on opposite page. This end connector of the cable will plug into the robotic arm. That's it; you're done.

Training the Speech Recognition Circuit:

The SR-07 is trained as per instructions in the SR-07 manual. You may train the speech recognition circuit with any words you want to use to control the robotic arm. The following list is a suggestion of words. You may change any word you wish.

Word Number	Function	Word Suggestion
1	Grip	Close
2	Wrist Up	W-up
3	Elbow Up	E-up
4	Base CCW	Left
5	Shoulder-up	S-up
6	Shoulder-down	S-down
7	Base CW	Right
8	Elbow Down	E-down
9	Wrist Down	W-Down
10	Grip Open	Release
11	Stop	Stop
12	Stop	Stop
13	Stop	Stop

Training Tips Homophones:

Homophones are words that sound alike. For instance the words cat, bat, sat and fat sound alike. Because of their like sounding nature they can confuse the speech recognition circuit. When choosing target words for your system do not use homophones.