

R-535J ASSEMBLY MANUAL

Version 1.01

October 1996

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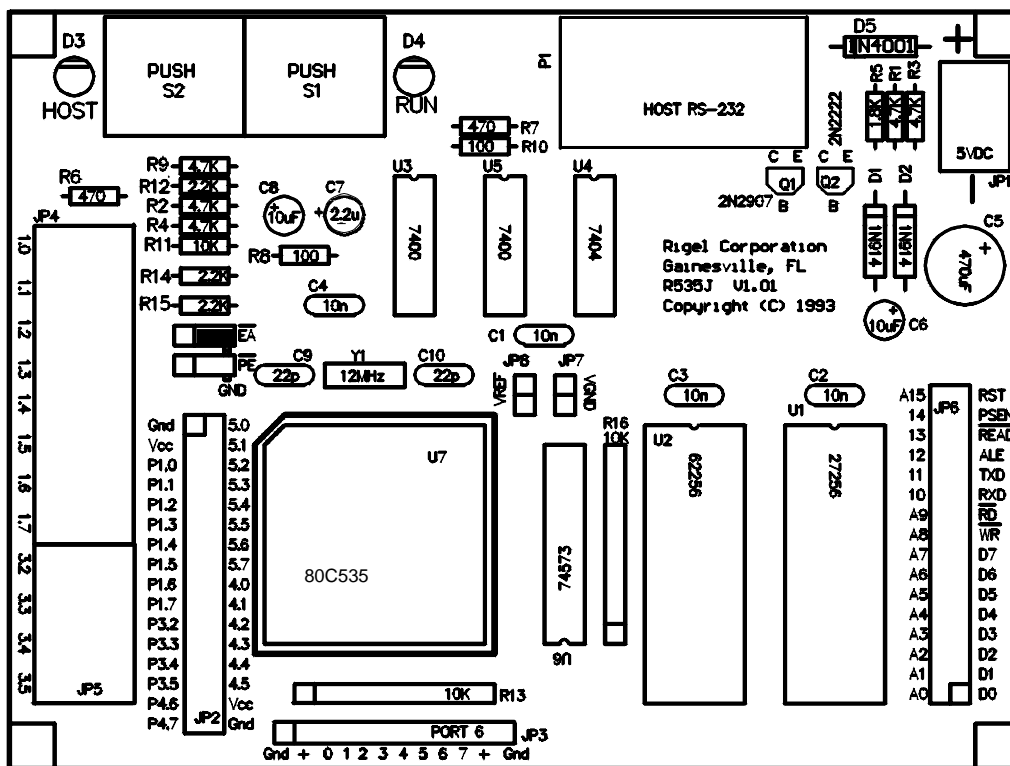
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1. Introduction

The R-535J is designed for easy assembly by the hobbyist or prototyping engineer. All component locations, along with the component designations and component values, are marked on the board. The components are assembled on the top side as marked, i.e., the side with the silk screen overlay of component outlines and designations. All of the integrated circuits are inserted into sockets. The recommended sequence for manual assembly is as follows:

1. Power header (1 quantity)
2. Terminal Blocks (2 quantity)
3. Jumpers (4 quantity)
4. Push buttons (2 quantity)
5. Sockets (7 quantity)
6. 32-pin headers (2 quantity)
7. 12-pin header (1 quantity)
8. DB-9 Connector (1 quantity)
9. Light Emitting Diodes - LEDs (2 quantity)
10. Resistor network (2 quantity)
11. Discrete components (resistors, capacitors, diodes, transistors, crystals, voltage regulator)



The board may then be tested.

The assembly and test steps are explained in detail in the following pages. Please refer to the board layout for part placement locations. Depending on your experience, the assembly process may take between 1 to 3 hours. It is a good idea to read all instructions before starting the assembly process.

2. Soldering

Use a low power (about 30 Watts) soldering iron. Heat the component lead and the pad with the iron, and then apply solder to the lead and pad. Solder should be shiny in appearance. Be careful not to deposit too much solder on the joints. The most common problem with board assembly is shorted pins or tracks due to excessive solder.

Solder may be removed by solder-removal braid, also known as solder wick. Place the wick over the solder and heat the solder through the wick. The wick will absorb the excess solder. Use a good quality solder, such as Radio Shack's silver bearing solder. Soldering is the most important aspect of assembly. Please be patient and strive for excellence!

Please note that solder contains lead. Take the necessary precautions when working with solder. Work in a well ventilated area. Do not inhale the solder vapors. Wash your hands after soldering.

3. Assembly Steps

Familiarize yourself with the board, the components, and the layout. Also refer to the bill of materials at the end of this assembly manual.

3.1. Power header JP1:

This header brings the 5Volt operating current to the board. A screw-type terminal block is used. The positive terminal of JP1 is marked by a '+' on the R-535J board. Solder the terminal blocks so that the wire insertion posts are accessible.

3.2 Terminal Blocks JP4 and JP5:

These terminal blocks have solder tails with 200 mil separation. JP4 is an 8 position connector connected to PORT 1 of the microcontroller. JP5 is a 4 position connector connected to 4 bits of PORT 3 of the microcontroller. You will receive 6 two position terminal blocks for JP4 and JP5. Assemble them by dovetailing all 6 of them together. Solder the terminal blocks so that the wire insertion posts are accessible.

3.3 Jumper S3, S4, JP7, and JP8:

Jumper S3, S4, JP7, and JP8 accept shorting (jumper) connectors to configure the R-535J. S3 and S4 have two positions, connecting the center post to either the left or the right post. The right posts are marked GND. In this position, signals EA\ and PE\ are grounded. Connecting EA\ (External Enable) to ground forces the microcontroller to fetch all instructions from external program memory. Connecting PE\ to ground enables the microcontroller to enter the power down mode.

JP7 and JP8 connect the VAGND and VAREF inputs to ground and 5 Volt Vcc, respectively. VAGND and VAREF are the reference voltages for the analog-to-digital converter. If other reference voltages are to be used, connect the lower posts (away from the LEDs) to the desired reference voltages.

3.4 Push buttons S1 and S2:

Press the push button firmly so that it securely lays against the board. S1 is marked as RUN on the board, and S2 as HOST. Both push buttons are reset buttons. Pressing HOST (S2) resets the microcontroller with the EPROM in socket U1 occupying the lower half of memory. Thus, reset invokes the monitor program. Pressing RUN (S1) resets the microcontroller with the static RAM in socket U2 occupying the lower half of external memory. This is convenient for running application programs which use the interrupts, after an application program is downloaded into memory.

3.5 Sockets:

Sockets use the same designation as the components they hold. Several different size sockets are used. U3, U4, and U5 use 14-pin sockets, U6 uses a 20-pin socket, U1 and U2 use 28-pin sockets, and U7 uses a 68-pin PLCC socket. The 14- and 20-pin sockets are dual In-line Package (DIP) sockets with 300 mils between rows. The 28-pin sockets are also DIP sockets, but with 600 mils between rows.

The orientation of the sockets is critical. The DIP sockets have a notch or mark on one end. This should be matched with the notch on the board. When the notch is to the left, and viewed from the top, the lower leftmost pin is pin 1. Similarly, the PLCC socket has one corner marked, which should be matched with the outline on the board. On the R-535J board, the pads of pin 1 of the Integrated Circuits (ICs) are square. All other IC pads are circular.

3.6 32-Pin Headers JP2 and JP6:

JP2 and JP6 are 32-post headers which are connected to the microcontroller ports and to the system data, address and control signals. Access to all system signals are gained through these headers. If the board is to be operated in a stand-alone fashion, these headers need not be installed. Pin 1 of the header is marked on the board. Also, the pad for pin 1 is square. Orient the headers so that pin 1 matches the marked pad and the shorter side is through the board.

3.7 12-Pin Header JP3:

Input to Port 6 is through JP3. Port 6 bits may be used for either analog or digital inputs. Note that besides the port bits, JP3 provides the Vcc and Ground signals which may be used with external analog ratiometric devices such as thermistors.

3.8 DB-9 Connector P1:

P1 accepts the serial modem cable that connects the R535J to the host PC.

3.9 Light Emitting Diodes (LEDs) D3 and D4:

Either D3 or D4 is lit when the R-535J is powered. More specifically, D3 is lit when the board is first powered up, or after the HOST button is pressed. D4 is lit after the RUN button is pressed. It is recommended that a red LED is used for D3 and a green LED for D4.

The LEDs are diodes, and thus, their polarity must be observed. The LED has two leads. The anode lead is the longer lead. In addition, the LED has a flat section on the rim of its base. This flat cut designates the cathode. The R-535J board designates the cathode by a line going through the cathode pad. Match the flat side of the LED with the line on the board.

3.10 Resistor networks R13 and R16:

R13 and R16 are resistor networks which contain 9 resistors with a common terminal. The common terminal is marked on the resistor networks with a line or with a dot. The R-535J board is also marked by a line where the common terminal is to be inserted. In addition, the pad for the common terminal is square.

3.11 Discrete components.

3.11.1 Resistors:

These resistors have no polarity. The resistor values are color coded. Hold the resistor so that the color bands are to the left. A gold rightmost band indicates a 5% tolerance resistor, and a silver band, a 10% tolerance resistor. The first 3 bands give the value. The first and the second band are the two digits, and the third indicates the number of zeros to add after the first two digits. The color code corresponding to each digit is shown below:

0	Black	5	Green
1	Brown	6	Blue
2	Red	7	Violet
3	Orange	8	Grey
4	Yellow	9	White

For example, a 1K (1 Kilo Ohm) resistor is 1000 ohms. The first digit is 1 (Brown) and the second digit is 0 (Black). After the first two digits (10) two more zeros follow. The two zeros are thus indicated by Red. The 1K resistor has a color code Brown-Black-Red.

3.11.2 Electrolytic capacitors:

Capacitors C5, C6, C7, and C8 are electrolytic capacitors. Electrolytic capacitors are polarized components. The R-535J board shows the positive terminal of a capacitor by the (+) sign. The capacitors have labels to indicate their polarity. Often, the negative terminal is indicated by a minus (-) sign. The value is also written on the capacitor.

3.11.3 Non-polarized capacitors:

Capacitors C1, C2, C3, C4, C9, and C10 are disc capacitors without polarity. The value is usually written on the capacitor. The 22 picofarad (pF) capacitors may only have 22 written on. The 10 nanofarad (nF) capacitors may have 0.01 or .01 written on, indicating 0.01 microfarads. Note that $1000\text{pF}=1\text{nF}$, and that $1000\text{nF}=1\mu\text{F}$.

3.11.4 Crystal:

Y1 is the microcontroller clock crystal. A 12MHz crystal yields exactly 1 microsecond instruction cycles. An 11.059 MHz crystal is convenient to generate almost all of the common Baud rates. The crystals is not polarized. Crystals usually have metal enclosures and thus should not be pushed to touch the board. A sixteenth of an inch distance between the crystal and the board will assure that the crystal case does not short any of the underlying tracks. A 12 MHz crystal is supplied with the board.

3.11.5 Diodes D1, D2, and D5:

R-535J uses the diodes D1 and D2 with the serial port driver. Diodes are polarized. The cathode is marked on the diode with a band. The R-535J board also shows a line next to the cathode pad of each diode. Match the band on the diode with the line on the board. Diode D5 is placed across the supply voltage in reverse polarity. It shorts the supply if the power is applied backwards, thus protecting the R-535J board.

3.11.6 Transistors:

Transistors Q1 and Q2 are used in conjunction with the serial port. The transistors are assumed to have a TO-92 package. When viewed from the flat face, leads pointing toward the floor, the leads, from left to right are emitter, the base, and the collector. The R-535J is designed to work with any general purpose PNP and NPN transistors such as the 2N2907 and the 2N2222.

4. Visual Inspection

Most of the problems in assembling the R-535J are due to faulty solder joints. Inspect each solder joint. Look for missing solder, too much solder, shorts between pins or tracks due to excessive solder. Remove excessive solder with solder wick. Care taken for a thorough visual inspection often saves time in the long run.

5. Power Supply Testing

Before any of the ICs are inserted, connect a 5 Volt power supply to the power header JP5 labeled "5 Volts" on the board. Verify the voltage on the Vcc and Ground pins of the sockets for U1, U2, U3, U4, U5, U6, and U7.

The ICs and the DIP sockets have a notch or mark on one end. This must be matched with the notch on the board. When the notch is to the left, and viewed from the top, the lower leftmost pin is pin 1. Pins in the lower row are enumerated, from left to right. For example, the last pin in the bottom row of U1 is pin 14. The pins on the upper row are enumerated from right to left (thus, continuing in the counterclockwise direction). The rightmost pin in the top row of U1 is pin 15, and the leftmost, pin 28.

IC socket	IC	Vcc pin	Ground pin
U1	27C256	28	14
U2	62C256	28	14
U6	74HC573	20	10
U4	74HC04	14	7
U3, U5	74HC00	14	7

If supply voltages are not observed, inspect all tracks, connections, and solder joints.

6. Functional Testing

You are now ready to insert the ICs and test the functionality of the board. In order to prevent permanent damage to the ICs, do not attempt this step if discrepancies were observed during the prior tests. Please note that almost all of the ICs are CMOS (Complementary Metal Oxide Semiconductors), which are affected by static. **Do not insert or remove the ICs while the power is connected to the R-535J.** Also avoid exposure to static electricity. For example, the ICs may be zapped by static electricity collected on a sweater. Ground yourself, or touch a good conductor to ground before handling the ICs.

Disconnect the power. Insert the ICs, observing their orientation. The ICs have a notch or mark on one end. This must be matched with the notch on the board and should match the notch on the socket. When the notch is to the left, and viewed from the top, the lower leftmost pin is pin 1. The 80C535 has one of its corners cut which should match with the cut corner of the socket. In addition, Pin 1 which is in the middle of one of its sides is marked by a small dot. The socket has a mark, usually an arrow, indicating where pin 1 should go.

Connect the power supply. The HOST indicator D3 should light up.

6.1 Communicating with the PC Host

Connect the R535J to either the COM1 or the COM2 port of the host PC. Run READS. Once in Reads select the demo program Deom00.ASM. Once in the editor, press F10 for the menu. Select Options to specify which port you are using. Set the communication parameters to 9600 Baud rate, 8 data bits, and 1 stop bit. Save the options so that next time you run READS you need not configure the host. Note that from the editor, you may press Alt-O hot key combination to activate the options menu.

Activate the menu again (F10) and select TTY to talk to the board. Alternatively, you may press the Alt-T hot key combination to activate the communications environment. Press the HOST button on the R535J. The greeting message "80515 monitor" followed by the asterisk should appear. Press H (or h, since the monitor program is case insensitive) to activate the monitor help screen.

From the host keyboard, type

```
x8000-ffff=0
```

which will fill the RAM chip with 0s. Verify by typing

```
x8000-ffff
```

Repeat this test with different values.

Next, assemble the various demonstration programs given on the distribution disk. Download the object codes and run on the R-535J. Refer to the R-535J/READS User's Guide and the program listings for specific information on the demonstration programs.

7. Bill of Materials

The bill of materials given below lists all components in alphabetical order by their reference as they appear on the board top overlay. Note that this list does not include the sockets.

Revised: December 5, 1993
Alphabetical List Of Materials

Item	Quantity	Reference	Part	Description
1	4	C1, C2, C3, C4	10nF	Disk Capacitor
2	1	C5	470uF	Electrolytic Capacitor
3	2	C6, C8	10uF	Electrolytic Capacitor
4	1	C7	2.2uF	Electrolytic Capacitor
5	2	C9, C10	22pF	Disk Capacitor
6	2	D1, D2	1N914	Diode
7	1	D3	LED	Red LED (HOST mode)
8	1	D4	LED	Green LED (RUN mode)
9	1	D5	1N4001	Diode
10	1	JP1	Power Port	Power In 5VDC
11	1	JP2	I/O	32-pin Header
12	1	JP3	SIP Header	Port 6
13	1	JP4	TB8	8-post Terminal Block
14	1	JP5	TB4	4-post Terminal Block
15	1	JP6	I/O	32-pin Header
16	1	JP7	2-post Jumper	Connects VAGND to Vcc
17	1	JP8	2-post Jumper	Connects VAREF to Ground
18	1	P1	DB-9 Port	RS-232 Port
19	1	Q1	2N2907	PNP Transistor TO-92
20	1	Q2	2N2222	NPN Transistor TO-92
21	5	R1, R2, R3, R4, R9	4.7K	Resistor
22	1	R5	1.8K	Resistor
23	2	R6, R7	470	Resistor
24	1	R8, R10	100	Resistor
25	1	R11	10K	Resistor
26	2	R13, R16	10K	Gang Resistor
27	3	R12, R14, R15	2.2K	Resistor
28	1	S1	Push Button	Reset RUN Mode
29	1	S2	Push Button	Reset HOST Mode
30	1	S3	3-post Jumper	EA\ Select
31	1	S4	3-post Jumper	PE\ Select
32	1	U1	27C256	32 Kilobyte EPROM
33	2	U2	62C256	32 Kilobyte Static RAM
34	2	U3, U5	74HCT00	NAND Gate

35	1	U4	74HCT04	Invert Gate
36	1	U6	74HC573	Octal D-Type Latch
37	1	U7	80C535	CPU
38	1	Y1	Crystal	12 MHz

R-535J Component Cross Reference

The following is a list of components as they appear in the circuit diagrams. Note that the circuit diagrams are presented as a hierarchy. The sheet name and number indicate which sheet in the hierarchy the component belongs to. The part field gives component names as they appear in the diagrams.

Cross Reference: Revised: December, 1993

	<u>Referen</u>	<u>Part</u>	<u>Sheet</u>	<u>Sheetnumb</u>
	<u>ce</u>			<u>er</u>
1	C1	10uF	SERIAL	3
2	R5	1.8K	SERIAL	3
3	R8	100	RESET	5
4	R10	100	RESET	5
5	R11	10K	RESET	5
6	R16	10K	CPU	7
7	C1	10nF	POWER	2
8	C2	10nF	POWER	2
9	C3	10nF	POWER	2
10	C4	10nF	POWER	2
11	C6	10uF	SERIAL	3
12	C8	10uF	RESET	5
13	Y1	12MHz	CPU	7
14	R13	10K	PIO	6
15	D1	1N914	SERIAL	3
16	D2	1N914	SERIAL	3
17	D5	1N4001	POWER	2
18	R12	2.2K	RESET	5
19	R14	2.2K	CPU	7
20	R15	2.2K	CPU	7
21	C7	2.2uF	RESET	5
22	C9	22pF	CPU	7
23	C10	22pF	CPU	7
24	U1	27256	MEMOR Y	4
25	Q2	2N2222	SERIAL	3
26	Q1	2N2907	SERIAL	3
27	R1	4.7K	SERIAL	3
28	R2	4.7K	SERIAL	3
29	R3	4.7K	SERIAL	3
30	R4	4.7K	SERIAL	3
31	R9	4.7K	RESET	5
32	R6	470	RESET	5
33	R7	470	RESET	5
34	C5	470uF	POWER	2
35	U6	74HC573	CPU	7
36	U3	74HCT00	RESET	5
37	U5	74HCT00	RESET	5

38	U4	74HCT04	RESET	5
39	U7	80C535	CPU	7
40	U2	62C256	MEMOR Y	4
41	S3	EA	CPU	7
42	D3	HOST	RESET	5
43	P1	HOST	SERIAL	3
44	S2	HOST	RESET	5
45	JP2	I/O	PIO	6
46	JP6	I/O	PIO	6
47	S4	PE\	CPU	7
48	JP3	Port 6	PIO	6
49	D4	RUN	RESET	5
50	S1	RUN	RESET	5
51	JP5	TB4	PIO	6
52	JP4	TB8	PIO	6
53	JP1	VCC	POWER	2
54	JP7	VGND	CPU	7
55	JP8	VREF	CPU	7