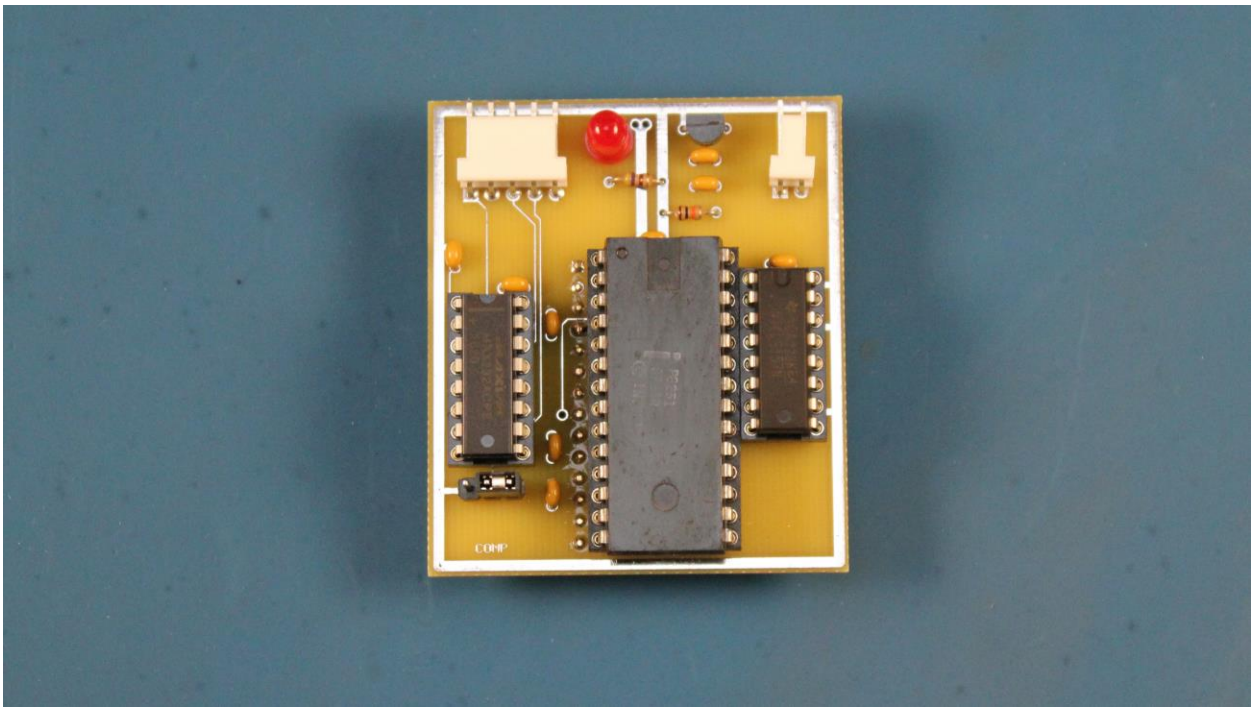


H8-5-1 Daughter Board

Introduction

My first attempt to in creating an RS232 serial interface used to transfer files between my H8 and a standard PC, used an existing board from one of my other projects. While this board did successfully create an interface, it required the removal of several integrated circuits. It also required the solder of extra wires on to the H8-5 Cassette Tape and Serial Interface board. This rendered the native cassette tape interface non-operational.

For me, this was unsatisfactory. Some form of interface system was need that allowed the H8-5 to be fully functional in both modes of operation. Tape interface and RS232 serial.

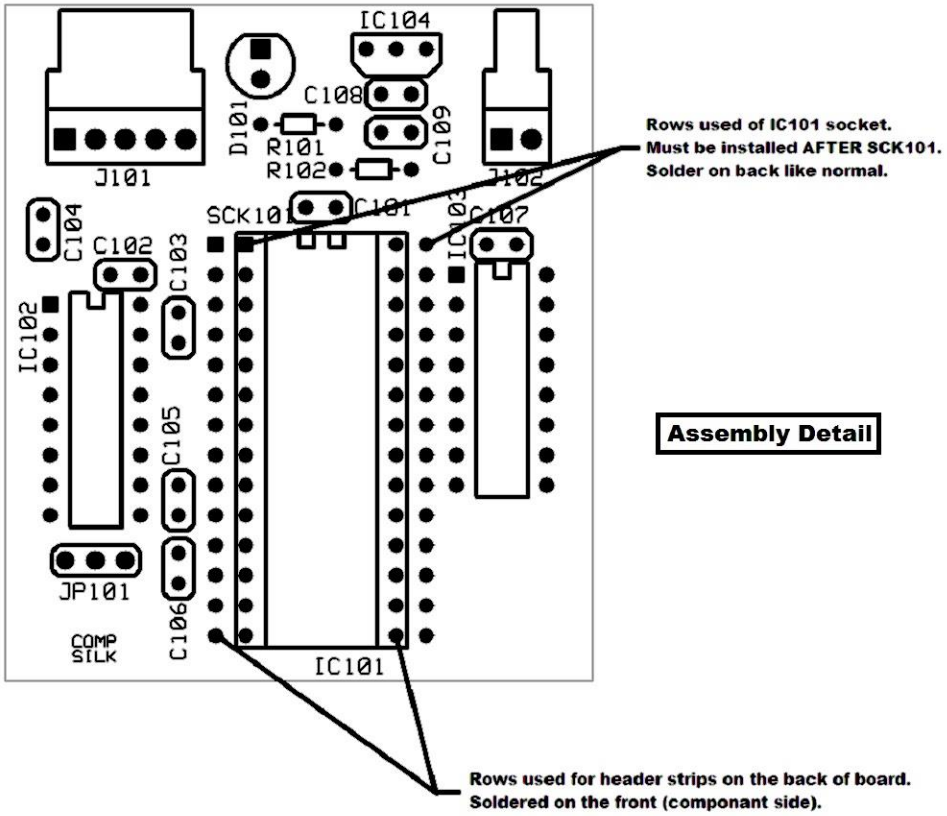
After reviewing the H8-5's schematic, the idea of creating a pluggable daughter board seemed logical. This daughter board would replace the P8251 UASRT at location IC123.

The following manual is the resulting design that was created to fulfill this goal.

PC board Parts list

Label	Description	Digikey PN	MFG	Mfg PN
C101	Capacitor, ceramic, 0.1uF, 50V, 20%	399-4151-ND	Kemet	C315C104M5U5TA
C102	Capacitor, ceramic, 0.1uF, 50V, 20%	399-4151-ND	Kemet	C315C104M5U5TA
C103	Capacitor, ceramic, 0.1uF, 50V, 20%	399-4151-ND	Kemet	C315C104M5U5TA
C104	Capacitor, ceramic, 0.1uF, 50V, 20%	399-4151-ND	Kemet	C315C104M5U5TA
C105	Capacitor, ceramic, 0.1uF, 50V, 20%	399-4151-ND	Kemet	C315C104M5U5TA
C106	Capacitor, ceramic, 0.1uF, 50V, 20%	399-4151-ND	Kemet	C315C104M5U5TA
C107	Capacitor, ceramic, 0.1uF, 50V, 20%	399-4151-ND	Kemet	C315C104M5U5TA
C108	Capacitor, ceramic, 0.1uF, 50V, 20%	399-4151-ND	Kemet	C315C104M5U5TA
C109	Capacitor, ceramic, 0.001uF, 50V, 20%	399-9770-ND	Kemet	C320C102M5R5TA
D101	LED, red, diffuse, 5mm round	754-1266-ND	Kingbright	WP7113LID
IC101	Socket, IC, 28-pin, DIP	AE10017-ND	Assmann	AR 28 HZL-TT
IC102	IC, MAX232A	MAX232ACPE+-ND	Maxim	MAX232ACPE
IC102	Socket, IC, 16-pin, DIP	AE10013-ND	Assmann	AR 16 HZL-TT
IC103	IC, 74LS157	296-1645-5-ND	TI	SN74LS157N
IC103	Socket, IC, 16-pin, DIP	AE10013-ND	Assmann	AR 16 HZL-TT
IC104	IC, DS1233	DS1233-10+-ND	Maxim	DS1233-10+
J101	Header, 5-pin, 0.1 pitch, right angle	A19481-ND	Amp	640457-5
J102	Header, 2-pin, 0.1 pitch, right angle	A1926-ND	Amp	640457-2
JP101	Header, 3-pin, 0.1 pitch, straight	3M9448-ND	3M	961103-6404-AR
JP101	Shorting block, 2-pin, black	952-2165-ND	Harwin	M7567-46
P101	Connector housing 5-pin	WM2003-ND	Molex	0022013057
P102	Connector housing 2-pin	WM2000-ND	Molex	0022013027
R101	Resistor, 470 ohm, 1/8 watt, CF, axial	CF18JT470RCT-ND	Stackpole	CF18JT470R
R102	Resistor, 10K ohm, 1/8 watt, CF, axial	CF18JT10K0CT-ND	Stackpole	CF18JT10K0
SCK101	32-position header	SAM1112-32-ND	Samtec	TS-132-T-A
PWB	H8-5-1 Daughter Board	N/A	DTR Eng	H8-5-1A
6-QTY	Terminals female 22-30 AWG	WM2312-ND	Molex	0008550102

Assembly



NOTE: Two 14-pin sip header strips need to be installed on the solder side (bottom) at location SCK101. It is through these 28-pins that the daughter board will plugged into the H8-5 board at location IC123.

( ) Locate the 32-position header strip. Count out 14-pins and carefully snap the strip into two pieces between the 14th and 15th pins.

( ) Count out another 14-pins on the remain larger strip. Again snap the stip in to two pieces between the 14th and 15th pins.

NOTE: You should now have two 14-pin header strips. The remaining 4-pin header strip pins are not used and may be discarded.

( ) R101: 470 ohm, 1/8-watt, 5% (yellow-violet-brown)

( ) R102: 10K ohm, 1/8-watt, 5% (brown-black-orange)

( ) Solder the leads to the foil and cut off the excess lead lengths.

( ) C101: .1uF ceramic.

( ) C102: .1uF ceramic.

( ) C103: .1uF ceramic.

( ) C104: .1uF ceramic.

( ) C105: .1uF ceramic.

( ) C106: .1uF ceramic.

( ) C107: .1uF ceramic.

( ) C108: .1uF ceramic.

( ) C109: .001uF ceramic.

( ) Solder the leads to the foil and cut off the excess lead lengths.

Note: 16-pin and 28-pin IC sockets are used in this kit. Make sure all pins are straight and insert the socket pins in to the circuit board holes. Make sure that the index notch on the integrated circuit socket is on the same end as pin one (a square pad indicates pin 1) of that IC location.

16-pin IC sockets at the following locations.

( ) IC102

( ) IC103

( ) Locate the 28-pin IC socket for IC101. We will be using the 28-pin IC socket as a alignment tool while we solder the two 14-pin header strips on to the bottom side of the circuit board. Loosely place each 14-pin header strips in to each side to the 28-pin IC socket. Do not seat the 14-pin header strips fully in to the 28-pin socket but just enough to hold them in place.

( ) From the bottom (solder side) of the circuit board, insert the two rows of 14-pin header strips in to the location SCK101. Be very careful to use the correct set of 28-pin holes. As viewed from left-to-right, the correct set of 14-pin holes are rows two and four.

( ) On the top (component side) of the circuit board, again viewed from left-to-right, make sure that the two rows of 14-pin headers protrude through the first and third rows of the four 14-pin rows. Rows two and four will be used by the 28-pin IC socket at IC101.

( ) Check the alignment and locations of the two 14-pin header strips. On the top (component side) of the circuit board, solder the leads to the foil and cut off the excess lead lengths as close to the board as possible.

( ) Remove the 28-pin IC socket from the header pins and save it for the upcoming installation step.

28-pin IC sockets at the following location.

( ) IC101

Carefully check each socket for solder bridges between pins. If a solder bridge has occurred, hold the circuit board solder side down and hold the soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip.

NOTE: When you install the following integrated circuit, position the flat side of the IC as shown in the outline on the assembly drawing. Then insert the three leads into their correct holes. Solder the leads to the foil and cut off the excess lead lengths.

( ) IC104: IC, DS1233.

NOTE: Installing the red LED, position the flat side as shown in the assembly drawing and that the short LED lead is in the square hole. Solder the leads to the foil and cut off the excess lead lengths.

( ) D101: Red LED.

( ) JP101: 3-pin straight jumper header.

( ) JP101: Initially place the black 2-pin shorting block over the right two pins on JP101.

( ) J101: 5-pin, right angle header.

( ) J102: 2-pin, right angle header.

NOTE: In the following steps, install integrated circuits in the designated sockets. Be careful to match the pin 1 end of each integrated circuits to the index mark on the socket.

Before you apply downward pressure to an integrated circuit, make sure each integrated circuits pin is centered in its proper socket hole. Handle integrated circuits with care, as their pins bend very easily.

CAUTION: The integrated circuits that you will install are CMOS or MOS devices that can be damaged by static electricity. Use the following sequence when you install the integrated circuits.

1. Pick up the conductive foam block with the desired integrated circuits mounted on it.
2. Hold the IC in one hand and pull the conductive foam pad from the pins.
3. Pick up the circuit board while you hold the integrated circuits.
4. Carefully insert the IC in its socket before you set the circuit board down in to your work surface.

The IC is now protected by circuit board's sockets and foil.

( ) IC102: MAX232A.

( ) IC103: 74LS157.

This completes the assembly of the H8-5-1 Daughter Board used on Heathkit's H8-5 Cassette Tape/Serial Board. Proceed to "Installation."

Installation

( ) Be sure your computer is turned off.

( ) Remove the two 6-32 x ¼ inch rear panel screws holding the top cover and set the top cover aside if not already done.

( ) Remove the 6-32 x 3/8 inch rear panel screw securing the board tie support bracket to the H8. Loosen any 6-32 x ¼ inch screws that connect installed boards to the tie bracket. Remove the bracket and set it aside.

( ) Locate the H8-5 SERIAL Board and remove the 6-32 x ¼ inch mounting screw located under the H8 computer system.

( ) Carefully remove the H8-5 SERIAL Board from the computer system and place it component side up on your work surface.

NOTE: In the next steps you will be transferring the P8251 integrated circuit located on the H8-5 SERIAL board at location IC123 to the H8-5-1 Daughter Board into location IC101.

( ) Place the H8-5-1 Daughter Board within easy working distance for the H8-5 SERIAL board. You should be able to remove the P8251 from the H8-5 and transfer it in to the H8-5-1 board.

CAUTION: The integrated circuits that you will transferring is a CMOS type device that can be damaged by static electricity. Use the following sequence when you remove and re-install the integrated circuit.

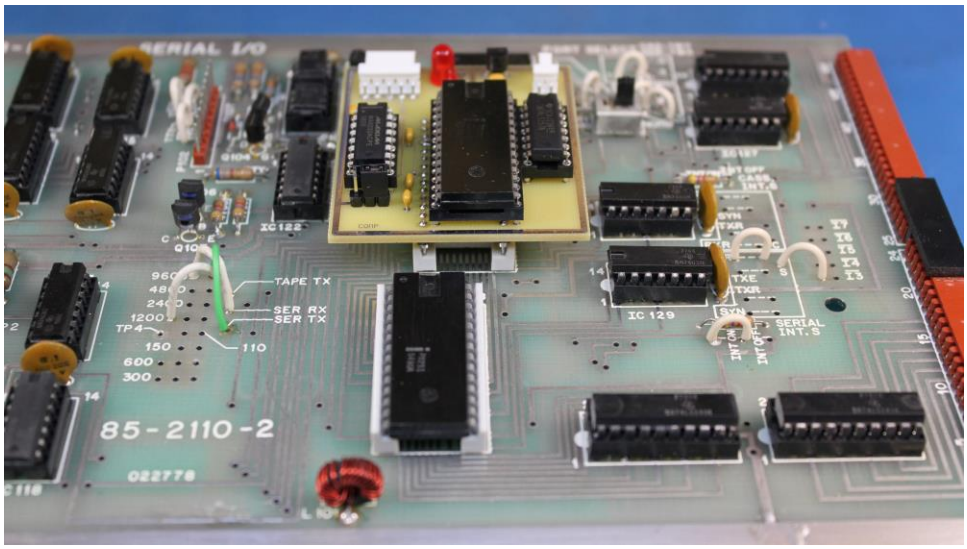
( ) Located IC123 on the H8-5 SERIAL Board.

( ) While holding the aluminum heat sink/mounting bracket located on the left side of the H8-5 SERIAL Board, use a small flat bladed screwdriver or similar removal tool. Work the integrated circuit a little from each end and be careful to not bend the pins excessively. Carefully pry the integrated circuit at location IC123 from the socket.

( ) Still holding the heat sink, pick and hold the P8152. Release the heat sink on the H8-5.

NOTE: Check the alignment of the pins on the P8251. Before you apply downward pressure to an integrated circuit, make sure each pin is centered in its proper socket hole. Handle integrated circuit with care, as the pins bend very easily.

( ) Pick up the H8-5-1 Daughter Board while you continue to hold the integrated circuit. Install the P8251 in the integrated circuit socket at location IC101 on the H8-5-1 Daughter board.



Installation Detail

( ) Referring to Installation Detail picture above, align the H8-5-1 Daughter Board so that the two 14-pin header strips that make up SCK101 on the H8-5-1 Daughter Board are in alignment with the socket IC123 on the H8-5 SERIAL Board. Verify that all 28-pins on the bottom of the H8-5-1 Daughter Board fit in to each of the corresponding pin holes on socket IC123 on the H8-5 Board. Carefully press the Daughter Board's pins in to the socket on the H8-5 Board.

NOTE: The H8-5 SERIAL Board can be installed in to any of the H8 system bus locations. Do to the extreme closeness to metal case parts, it is not recommended to use bus location P10. Given it's placement towards the back of the H8 system, bus location P9 is the best location for the H8-5.

( ) Reinstall the finished H8-5 SERIAL Board with the added H8-5-1 Daughter Board back in the H8 computer system at the desired bus location.

( ) Install the 6-32 x ¼ inch board support screw in to location on the bottom of the H8 computer system.

( ) Replace the board tie support bracket by aligning all the loosened 6-32 x ¼ inch screws on each of the installed boards in the H8 system.

( ) Replace and tighten the 6-32 x 3/8 inch rear panel screw securing the board tie support bracket to the H8. Tighten the remaining 6-32 x ¼ inch board support screws.

( ) Verify that the newly installed H8-5-1 Daughter Board is not interfering with any adjacent boards installed in the H8.

( ) Using the tables below and the schematic in the Appendix A, assemble both the RS232 serial (J101)and switch (J102) cable assemblies and install to match your particular needs for your H8 system.

Description	Pin
RS232 Serial input	1
Not used	2
RS232 Serial output	3
RS232 Serial level output	4
RS232 Serial ground	5

J101 pinout

Description	Pin
Serial / Tape select input (ground for Tape)	**1**
Ground	**2**

J102 pinout

( ) Replace the top cover and secure it with the two 6-32 x ¼ inch rear panel screws.

Operation

Operation of the H8-5-1 Daughter Board is very simple. A sign SPST switch is used to select between normal Cassette Tape operation or using an external RS232 serial connection to a PC other serial data device. When the two pins on J102 are shorted the Tape mode is selected. Leaving the input on J102 open places the system in to serial transfer mode.

The red LED indicates the board is receiving +5 volt DC power.

The three pin jumper at JP101 may be used to generate a high or low RS232 signal output level at pin 4 of J101. This signal can then be used to place any handshake lines on an external serial data storage device into a required state.

Circuit description

IC102, C102 through C106, JP101 and J101 make up the RS232 serial interface circuit. The core of the interface is the MAX232A (IC102) integrated circuit. RS232 level signals are routed through the 5-pin connector J101 to the MAX232A. Here the RS232 signal levels are converted to standard TLL or CMOS digital levels. The four 0.1uF capacitors C103 through C106 are used by the MAX232A to create both a 5 volt to 10 volt voltage pump as well as a –10 volt inverter. While the pump/inverted combination can only source/sink a few milliamps, this is more than enough to handle most standard RS232 interfaces found on terminals or PCs.

Selectable jumper JP101 may be used to set up a RS232 high or low logic level on pin 4 of J101. This optional signal may be used to define a needed handshake inputs that might be needed while interfacing external serial device.

The final 0.1uF capacitor C102 is a simple power rail decoupling capacitor for IC102.

IC103 and C103 make up the serial signal switching circuit. Serial signal switching is handled by a 74LS157 (IC103) quad 2 to 1 data selector integrated circuit. Serial data to and from the P8251 (IC101) along with the serial input clock are switched between ether the normal cassette interface electronics or the RS232 serial interface section handled by the MAX232 (IC102) described above.

Integrated circuit DS1233 (IC104), 10K ohm resistor R102 and a 0.001uF capacitors (C109) are used to create a switch debounce used by the incoming switching single received via 2-pin connector J102. This 3-pin, TO-92 cased integrated circuit is also used as a power on reset controller for the board. When power is applied, the DS1233 monitors the VCC supply until it reaches about 10% of 5 volts. When VCC returns to an in-tolerance condition, the reset signal continues the active low state for approximately 350ms to allow the power supply to stabilize.

The 10K resistor R102 is used to pull high the switch input while 0.001uF capacitor C109 is used to help stabilize the switch debounce function on the DS1233. While the input to J102 is in the open state, the resulting control signal into the 74LS157 (IC103) pin 1 will be high selecting the external RS232 signaling. Shorting pins 1 and 2 on J102 will pull the DS1233 low placing 74LS157 (IC103) pin 1 low and selecting the normal internal cassette tape interface. Removing the short on J102 again allow the DS1233 to return the select signal to high after a pre-programmed debounce of 350mS.

The final 0.1uF capacitor C108 is a simple power rail decoupling capacitor for IC104.

The remaining IC101 socket is the P8251 integrated circuit removed from the original H8-5 circuit board and place on to the daughter board. For the circuit description of this component, refer to the Heathkit documentation supplied with the H8-5 board.

Frequently Ask Questions

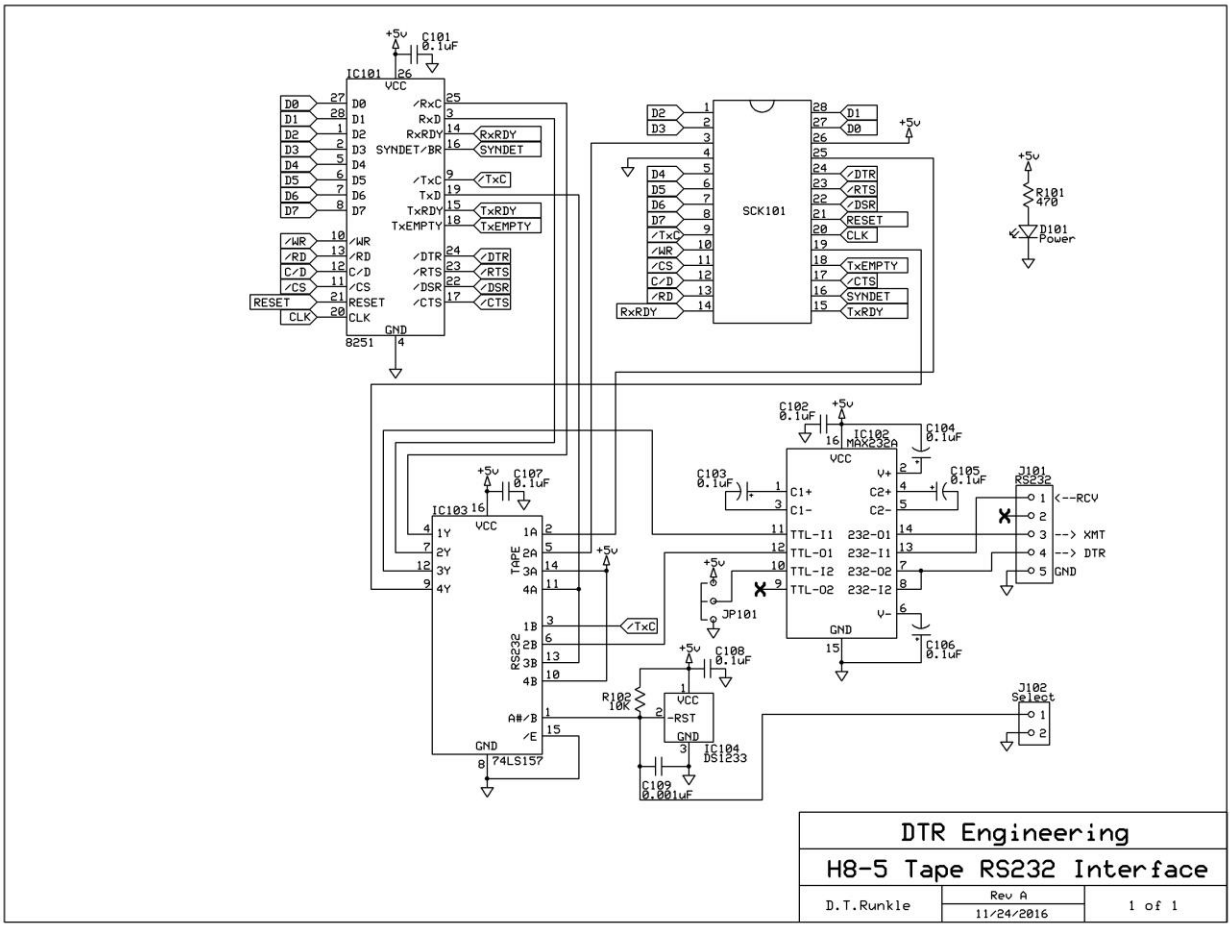
Q: It is very infrequent that I use my Cassette Tape Interface. Can the H8-5-1 Daughter Board be used to create a second RS232 serial port on the H8-5 board?

A: Yes. since this is exactly what the H8-5-1 Daughter Board does while in serial mode. While in serial mode, you can send and receive data via the simple 3 wire (Tx, Rx and Ground) serial interface at the tape baud rate setup via the H8-5's on board jumpers.

Q: Can I change the H8-5's jumpers to a higher baud rate to allow faster data transfer rates via serial?

A: Yes with a caveat, the normal cassette tape baud rates are either 300 or 1200 baud. While at one of these rates the serial data transfer rate will also be 300 or 1200. Changing the baud rate to a higher speed will allow you a faster data transfer rate, but will also make cassette tape usage impossible until you return the rates back to the 300/1200 allowed.

Appendix A


DTR Engineering
H8-5 Tape RS232 Interface
D.T.Runkle
Rev A
11/24/2016
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