

Coleco ADAM Floppy Drive Controller/Power Supply PCB Repair Guide

Rev. A

Does not include troubleshooting the actual MPI-501C floppy drive portion

By John Lundy

***Note:** This guide is based on experiences and lessons learned while repairing a small number of drives. It is not considered a complete resource and may contain errors. This guide assumes you have the basic skills on how to use a multimeter and oscilloscope and the ability to read schematics to some degree.*

Important things to know

The Coleco ADAM 5-1/4" 160kB floppy drive is based around the MPI 501C floppy drive component and the Coleco Controller/Power Supply PCB P/N# 29039-001. The Controller/Power Supply PCB utilizes a 2793 Floppy Drive Formatter/Controller IC interfaced with a Motorola MC6801 microcontroller and associated circuitry. Several versions of the 2793 Floppy Drive Formatter/Controller IC have been used by Coleco, and a Western Digital WD2793, TMS2793, and Siemens SAB2793 can all be used interchangeably. There may be more options.

The disk drive is unique from other ADAMnet devices using the Motorola MC6801 because its code is not contained within the MC6801 itself and is located externally in an EPROM. The ability to have code contained in the MC6801 is there but not used and is configurable by the E1-E2-E3 jumpers on the PCB. An interesting fact as to why the code was not contained in the MC6801 itself was explained by Howard Eglowstein, a former Coleco engineer. Apparently, Coleco had a large quantity of MC6801 data drive processors with faulty code that didn't allow Data Drive Two to function correctly. Since the MC6801 was expensive and only a one-time write device, rather than throwing them out, they were repurposed for use in the floppy drive. The internal code is bypassed by using the E2-E3 jumper setting to allow using an external EPROM for code. This decision was an interesting one and unintentionally opened-up the ability to modify code and reprogram the EPROM by third-party companies later to support larger drive sizes.

The 2793 Floppy Drive Formatter/Controller IC requires a specific set of adjustments to configure the system read and write timing structure correctly. If any of these calibration tolerances are off enough, read, write, and formatting issues will occur. More on that later in this guide in Step 6.

Troubleshooting

Note: This guide assumes the MPI-501C floppy drive itself inside the unit is good and offers a known good starting point for working on the Controller/Power Supply PCB. This guide can be followed in any order depending on the fault condition known for reference. If the Controller/Power Supply PCB is not working at all, this guide is designed to be followed in order to diagnose the issue.

Step 1: Verifying voltages

Verify the external power transformer is working when plugged it into a wall outlet and NOT connected (unloaded) to the floppy drive. It should have a reading of approximately 11VAC.

Everything past this point requires the drive to be opened up and the MPI-501C floppy drive portion removed and set aside exposing just the Controller/Power Supply PCB. CAUTION: This guide assumes the knowledge of proper ESD precautions and how to properly handle a powered device for troubleshooting.

With the Controller PCB portion by itself on a work surface, individual voltages can be checked easily. Attach the external transformer power connector to the power inlet jack of the Controller/Power Supply PCB while the power switch is in the OFF position.

Power ON unit and verify all the following DC voltages are present.

- Controller/Power Supply PCB power
 - Across C24 (located just under connector P6) - +5V Controller PCB power (from VR3)
- Dedicated MPI-501C floppy drive power
 - Connector P6 (Pin 1 is closest to heatsink)
 - Pin 1 – +12V (from VR4)
 - Pin 2 – GND
 - Pin 3 - +12V (from VR2)
 - Pin 4 - +5V (from VR1)
- Connector P7 (Pin 1 noted with a dot) – Unregulated voltage approximately +12V (from bridge rectifier created by CR13,14,15,16)

Note: It is normal for the regulator heat sinks to feel hot, especially VR3 which runs very hot.

Everything past this point will require an oscilloscope.

Step 2: Verify clock signal at U6 (6801)

Verify the clock signal of Y1 is 4MHz to both pins 11 and 12 of U6. If no clock is present, the crystal might be bad or possibly the U6 6801 itself.

Everything past this point requires the MPI-501C floppy drive portion to be connected to the Controller/Power Supply PCB.

Power OFF and unplug the power inlet cable. Place the drive and Controller PCB on their side facing the operator without using any drive mounting screws. Pull the drive portion away from the main controller as much as possible to expose as much of the Controller PCB as much as possible while being careful to not pull out or loosen any cables in the process. See *Figure 1*.

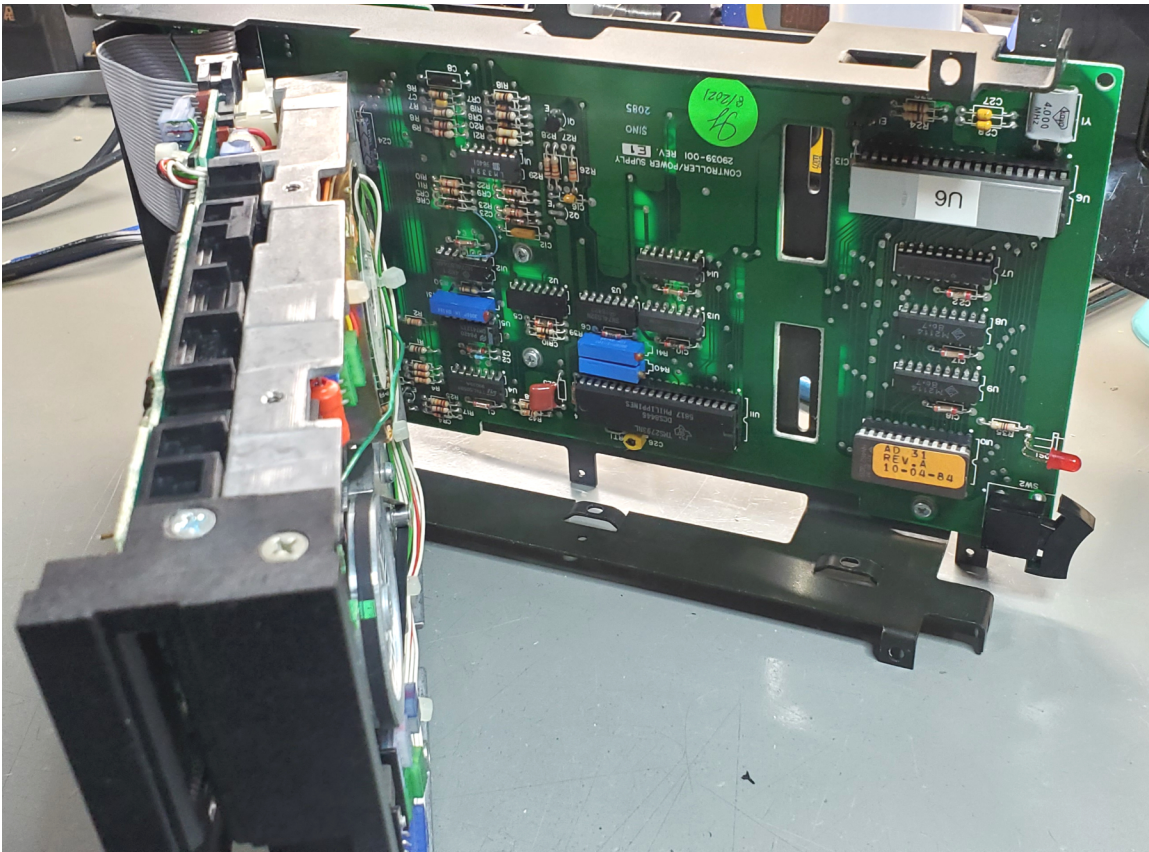


Figure 1

Attach the power inlet cable and power ON the unit at this time.

Step 3: Verify disk inserted signal is getting to U6 (6801)

With a floppy disk NOT inserted, verify pin 13 is +5V. Insert a floppy disk and verify pin 13 goes low (0V) to confirm disk insert signal is working. It is fine if the drive motor is spinning during this test.

Step 4: Verify ADAMnet data is getting to and from U6 (6801)

Remove any floppy disk present and power OFF the drive. Connect the unit under test to a functioning ADAM console utilizing a known good ADAMnet cable from the console ADAMnet connector to the disk drive “IN” connector. Power ON the drive and verify the drive motor spins continuously. Now, power ON the ADAM console and verify the drive stops spinning. This will confirm ADAMnet data is getting to and from U6 6801.

If the drive doesn't spin at all or only briefly spins when powered ON while the console is still turned OFF, it is not likely the failure is associated with ADAMnet communication.

If the drive spins continuously after the console is turned ON, there may be an ADAMnet issue. Verify ADAMnet data input is seen at U6 pin 11. If data is not seen at U6 pin 11, verify the ADAMnet cable is good and inspect the drive “IN” ADAMnet connector for damage or broken or shorted pins. If the connector is fine, further troubleshooting is required using the schematic. U1 is a possible failure point or the U6 6801 itself. See *Figure 2*.

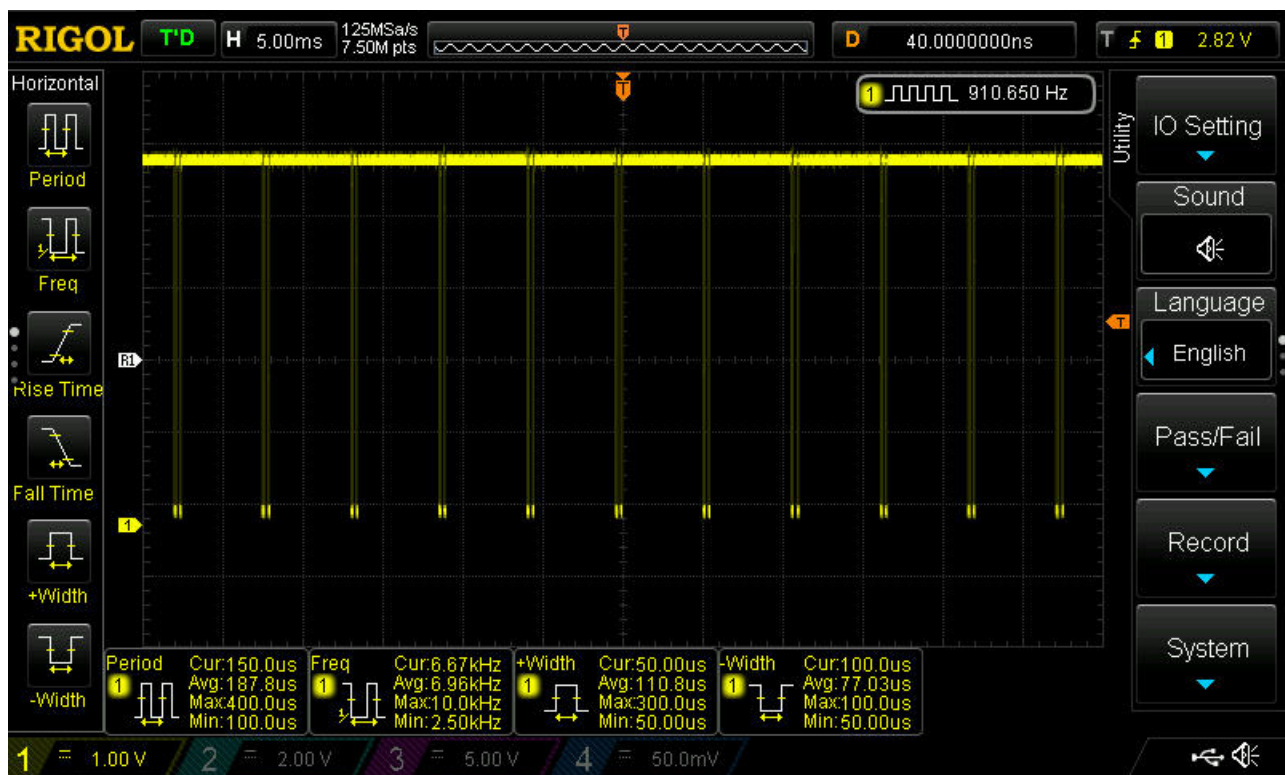


Figure 2

If ADAMnet data input shows data, verify ADAMnet data output on U6 pin 12 while performing an action that will initiate a disk drive read from the console. If data is seen, ADAMnet is working. If data isn't seen, further troubleshooting is required using the schematic. U1 and Q1 are possible failure points or U6 6801 itself. See *Figure 3*.

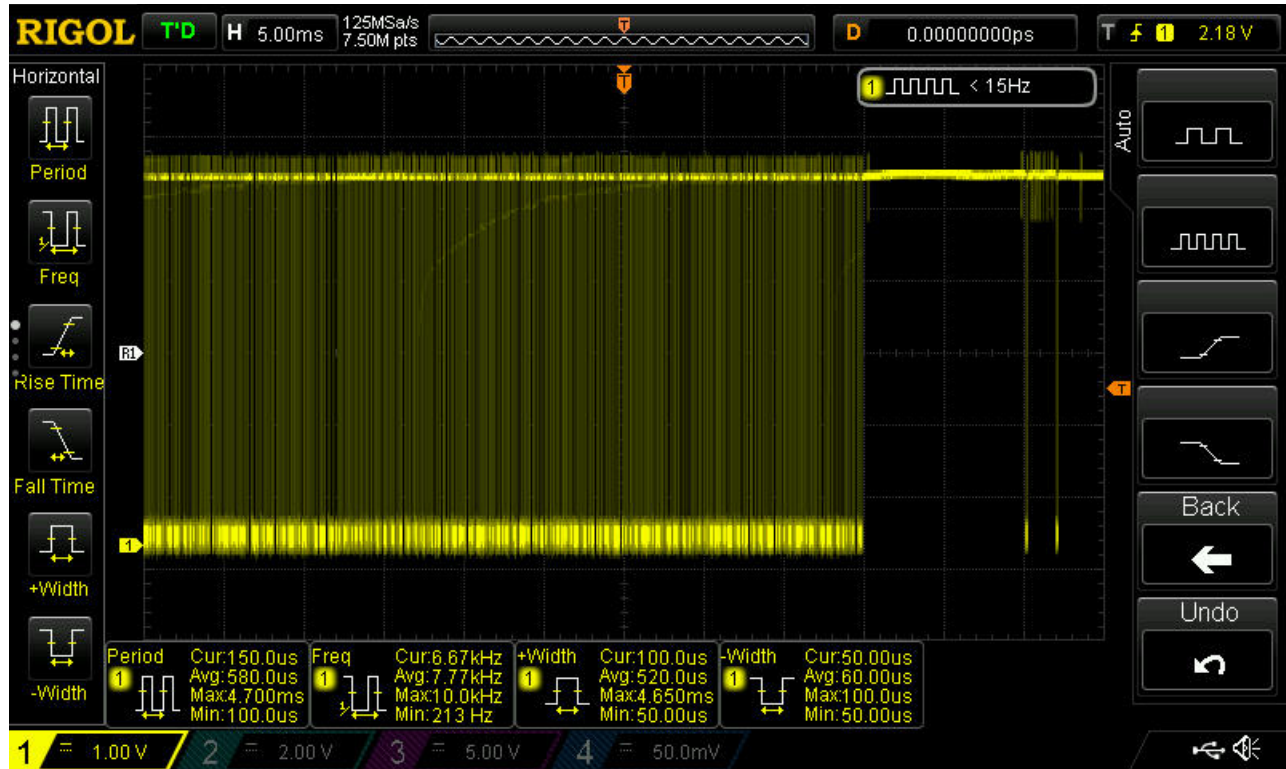


Figure 3

Step 5: ADAMnet seems to be functioning and drive still doesn't work at all

This is the worst case scenario and could be a broad range of failure points. Advanced troubleshooting skills are needed at this point with the ability to read schematics. It's best to work from U6 6801 out to the various logic. Start with verifying if data is seen and bits are not held low or high at U6 pins 30-37. If data isn't seen and bits are held high or low, possible failure points are U6, U7, U8, U9, U10, or U11. If data issues are only associated with D0-D3, it might be U8 and D4-D7 might be U9. Address issues will be contained to U6, U7, U8, U9, and U10. Other discrete logic like U2, U3, U13, and U14 are also a possibility. If data and addressing seem to be fine, it could still be a failure of anything already mentioned or a failure of U4, U5, U11 or failure affecting the calibration of U11. See next step for proper calibration of U11.

Step 6: Drive seems to partially work and experiences read, write, or formatting issues

The 2793 Floppy Drive Formatter/Controller IC U11 requires calibration to configure read and write timing signals properly to interface with the MPI-501C floppy drive. If any of these calibration tolerances are off enough, read, write, and formatting issues will occur.

Turn off the drive and disconnect the power and ADAMnet cables. Disconnect and remove the MPI-501C disk drive portion from the Controller/Power Supply PCB. With the Controller PCB by itself on a flat work surface and NOT powered ON, attach one side of a jumper wire clip to the leg of R38 closest to C25 and C14. Attach the power cable and power on the controller PCB. With power ON, attach the other end of the jumper wire clip to ground. The ground side leg of C1 closest to R25 is a good ground choice.

Grounding to the leg of R38 closest to C25 and C24 after power up holds U11 pin 2 low and puts it in calibration mode. Continue to hold U11 pin 2 low for all calibration adjustments below.

Perform a VCO (Voltage Controlled Oscillator) adjustment by attaching the scope probe to U11 pin 16. The VCO frequency should read 250kHz +/- 650Hz. If the frequency is not in this range, adjust C26 variable capacitor as close to 250kHz as possible. If the frequency can't be adjust in range, it's possible C26 or U11 is faulty. See *Figure 4*.

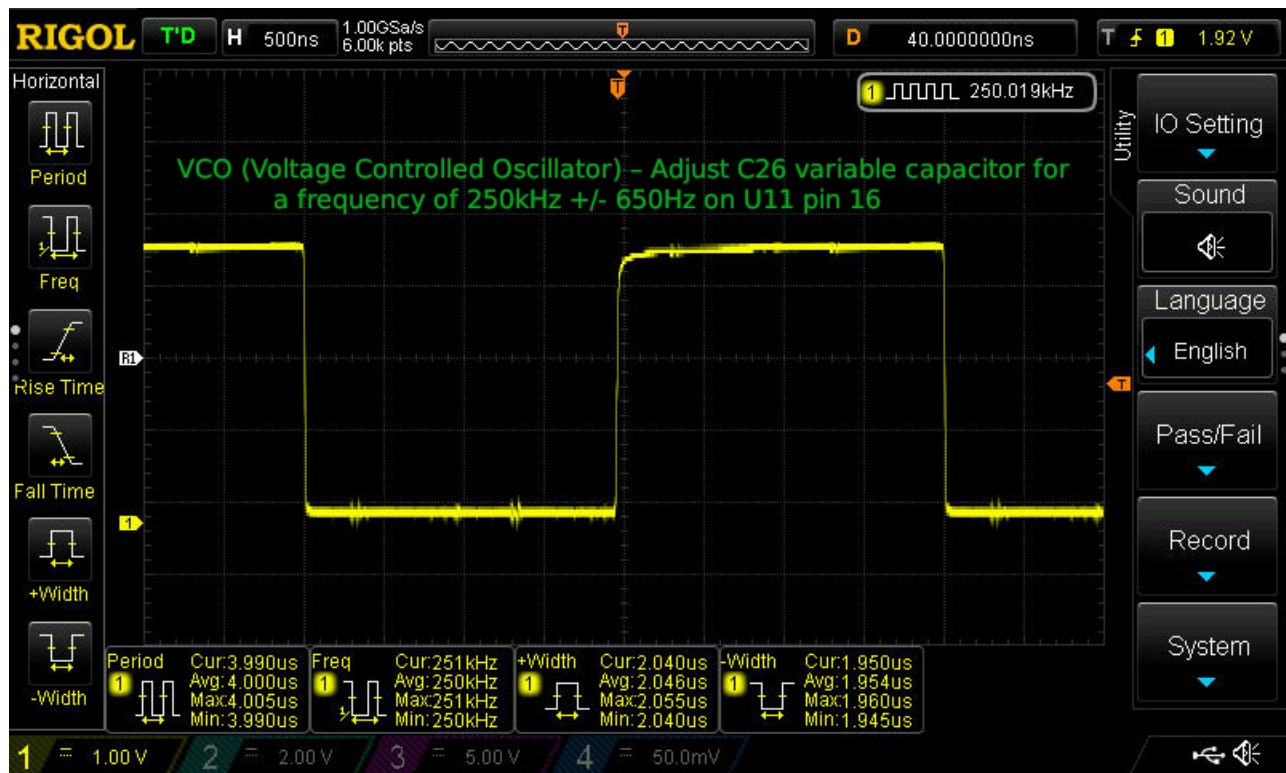


Figure 4

Perform a Write Precompensation/WPW adjustment by attaching the scope probe to U11 pin 31. It should have a positive pulse width of 188ns +/- 20ns. If it is not in this range, adjust the R41 potentiometer as close to 188ns as possible. If it can't be adjusted in range, it's possible R41 or U11 is faulty. See *Figure 5*.

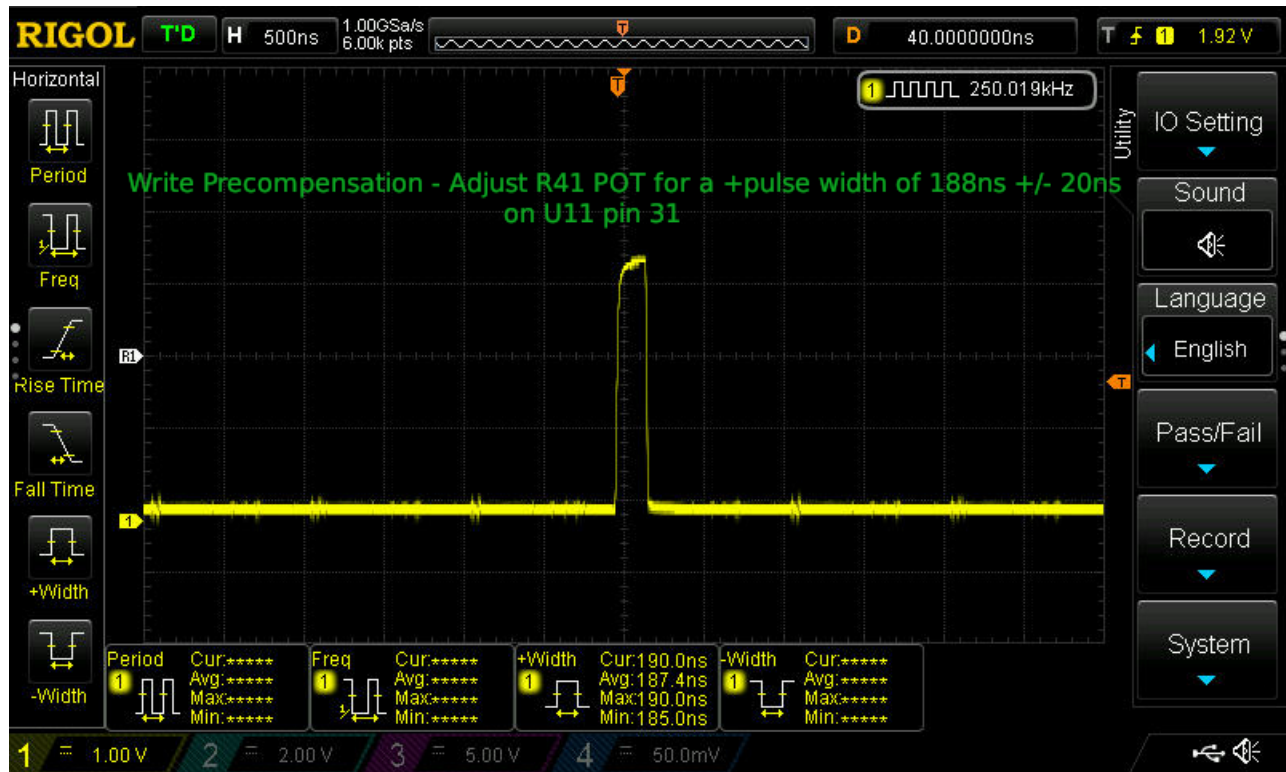


Figure 5

Perform a Data Separation/RPW adjustment by attaching the scope probe to U11 pin 29. It should have a positive pulse width of 475ns +/- 15ns. If it is not in this range, adjust the R40 potentiometer as close to 475ns as possible. If it can't be adjusted in range, it's possible R40 or U11 is faulty. See *Figure 6*.

Perform a Write Enable/WE adjustment by attaching the scope to U11 pin 2. It should have a negative pulse width of 350ns +/- 5ns. If it is not in this range, adjust the R31 potentiometer as close to 350ns as possible. If it can't be adjusted in range, it's possible U5, U13, U14, R30, C2, or U11 might be faulty. See *Figure 7*.

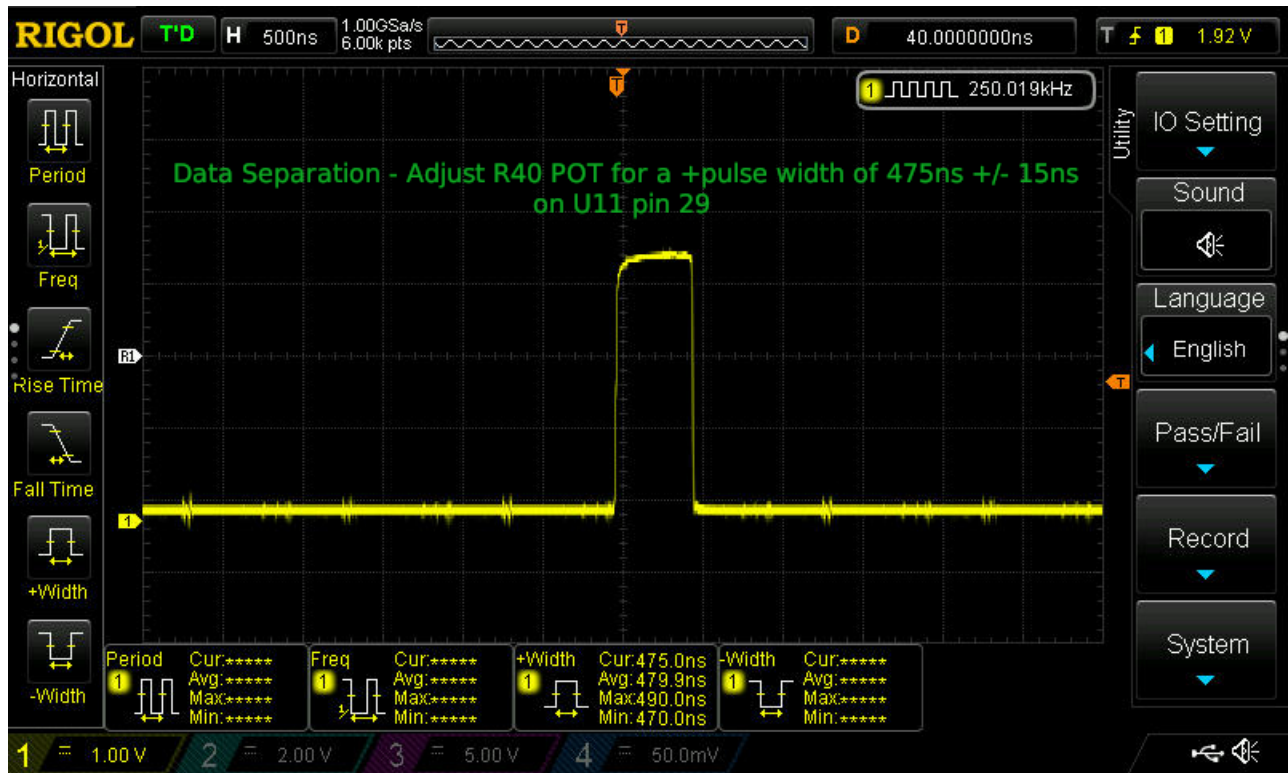


Figure 6

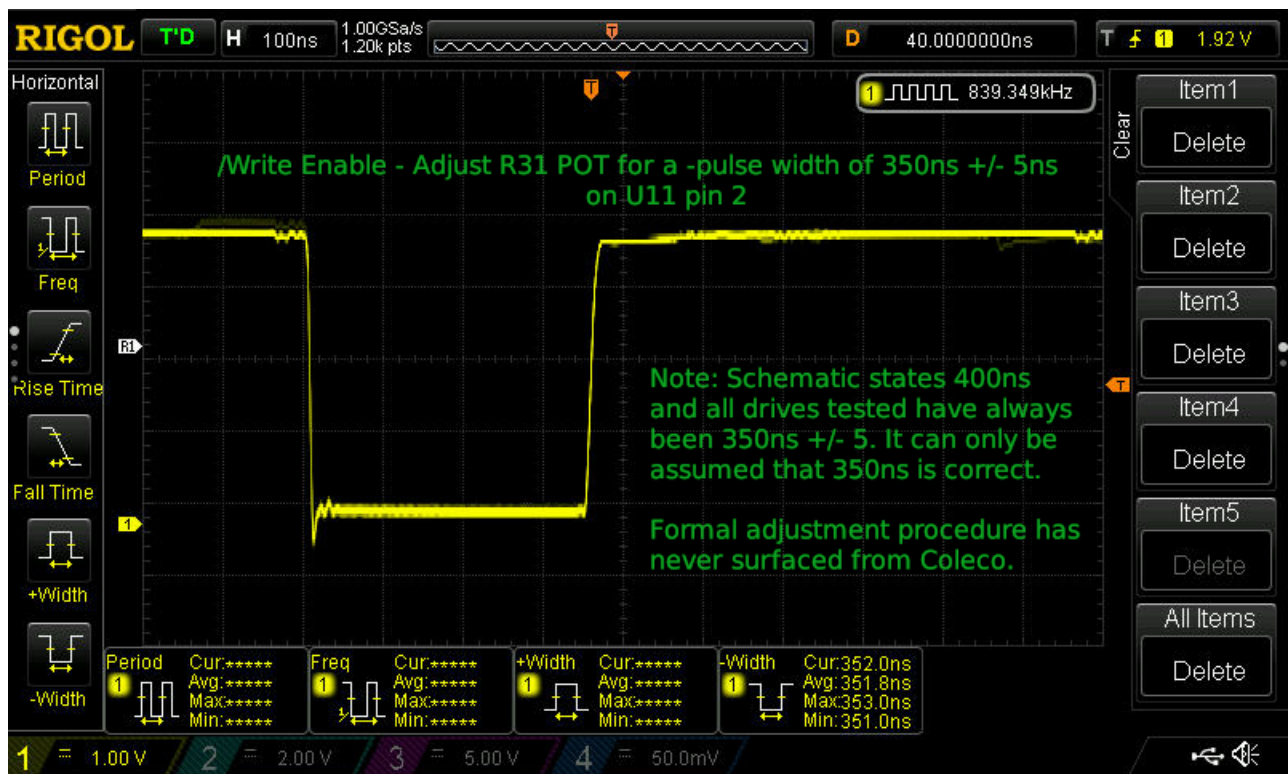


Figure 7

This concludes all calibrations for U11 2793 Floppy Drive Formatter/Controller IC.

Power off the Controller/Power Supply PCB and remove the jumper from R38 to ground. Attach the MPI-501C floppy drive portion and test that the drive is fully functional by reading, writing, and formatting a floppy disk within the Coleco Disk Manager software.

Other known problems and fixes

If the drive is always configured as Drive 2 and can't be changed to Drive 1, the Drive Select (SW1) switch is faulty/open or one of the legs of the switch is broken. Replace the switch with a C&K P/N# L101011ML04Q (Digikey P/N# CKN11874-ND).