

RS-485 TERMINATION RESISTOR SWITCH SOLUTION

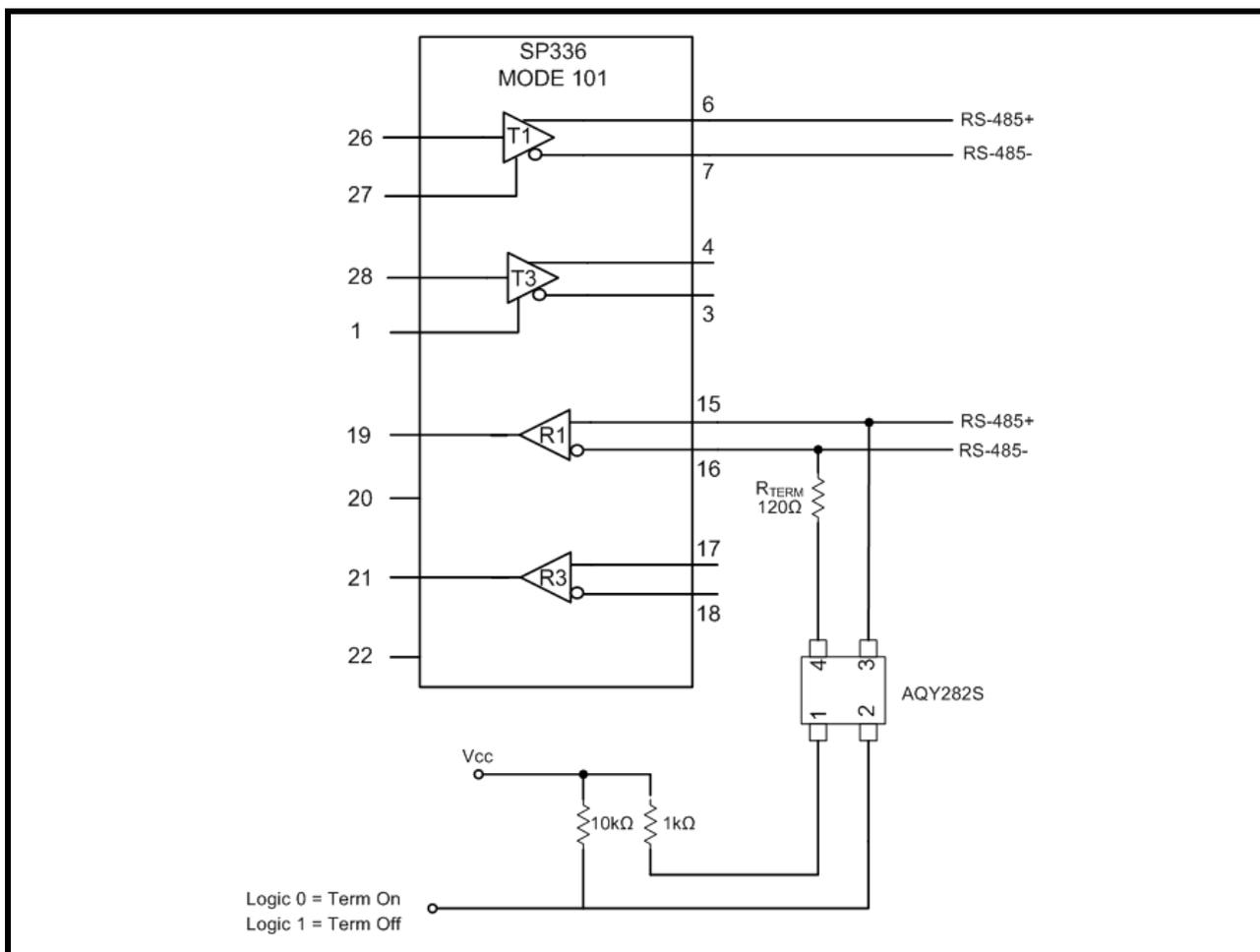
1.0 INTRODUCTION

This document provides a solution for connecting and disconnecting the RS-485 termination resistor in multi-protocol applications using a PhotoMos Relay. This solution eliminates the need of using manual type jumpers like header pins with a shunt. The SP336 and SP337 offer both RS-232 and RS-485 configurations. When termination is used for high speed RS-485 applications it must be disconnected from the receiver input when the SP336 or SP337 is configured for RS-232 mode. Otherwise, data error will occur during RS-232 mode. The following figure shows how the RS-485 termination resistor connection can be controlled from a logic signal using the Panasonic AQY282S PhotoMos Relay. The drawings and waveforms are from using SP336, but they would also be similar for SP337.

2.0 RS-485 RECEIVER TERMINATION SWITCH CIRCUIT

Figure 1 below shows the PhotoMos Relay connected to the receiver of the SP336 to switch the termination resistor in or out of circuit.

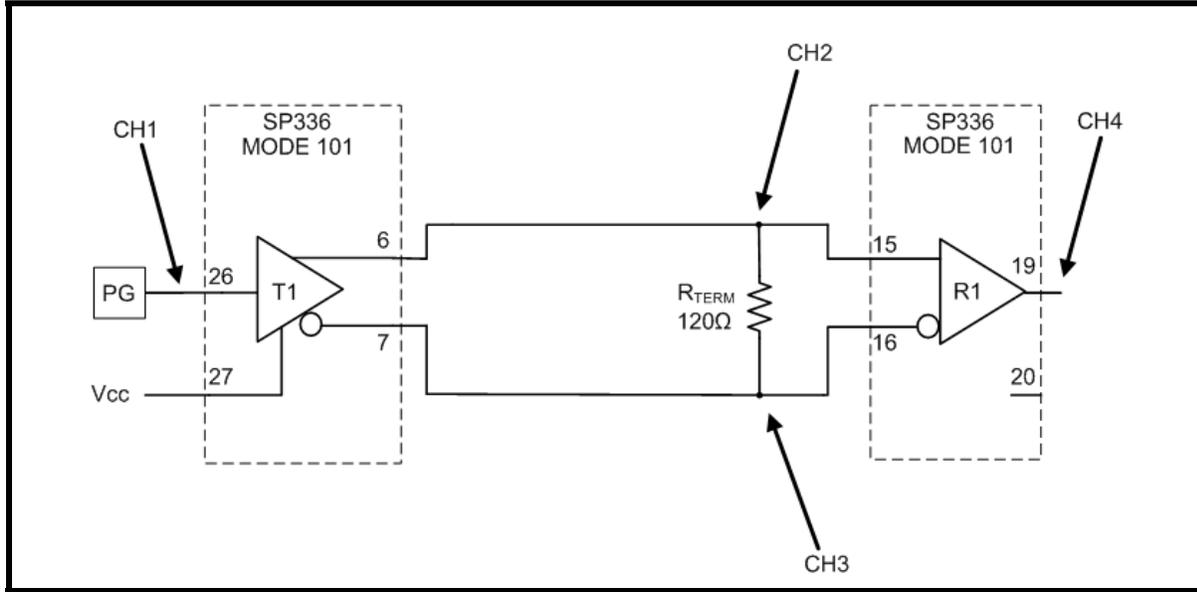
FIGURE 1. SP336 WITH RS-485 TERMINATION RESISTOR SWITCH.



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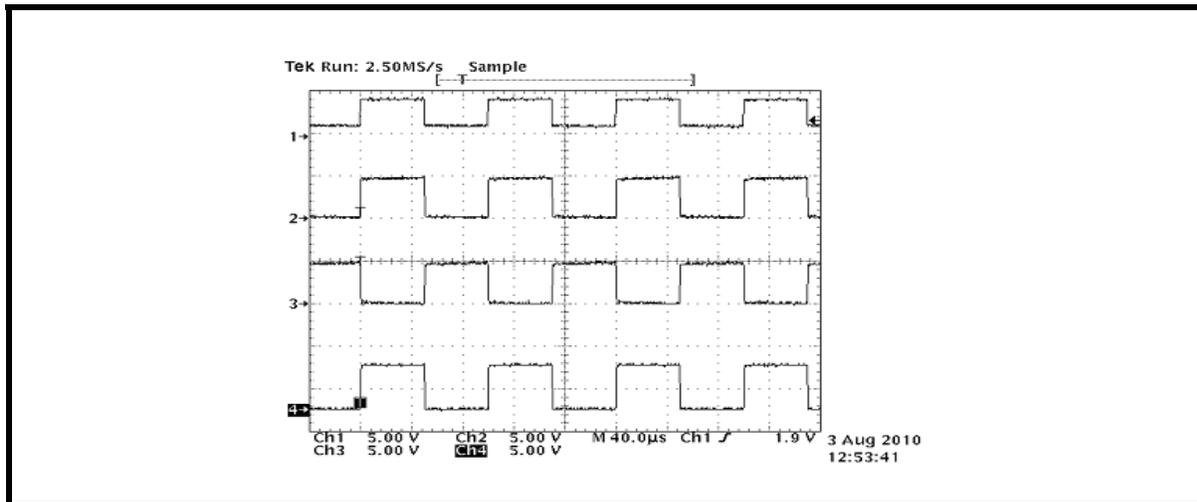
3.0 PHOTOMOS BENCH TEST CIRCUIT RESULTS

FIGURE 2. TEST CIRCUIT USED TO TEST RS-485 SIGNALS USING SP336.



The above test circuit is used to capture a typical RS-485 differential signal from driver to receiver when the line is terminated. The bold arrows indicate the oscilloscope channel used for measuring the signals. The following waveforms have each channel identified by number.

FIGURE 3. RS-485 TYPICAL WAVEFORM WHEN TERMINATED.



Above are the typical I/O signals as measured from Figure 2 test circuit. CH1 is the driver input from a pulse generator, CH2 and CH3 are the driver outputs / receiver inputs and CH4 is the receiver output. CH2 and CH3 show a typical RS-485 signal when terminated. The driver non-inverting output (CH2) follows the driver input levels while the inverting output (CH3) is 180 degrees out of phase to non-inverting output. The receiver output (CH4) follows the original logic signal at driver input.

FIGURE 4. RS-485 TEST CIRCUIT WHEN AQY282S IS CONNECTED.

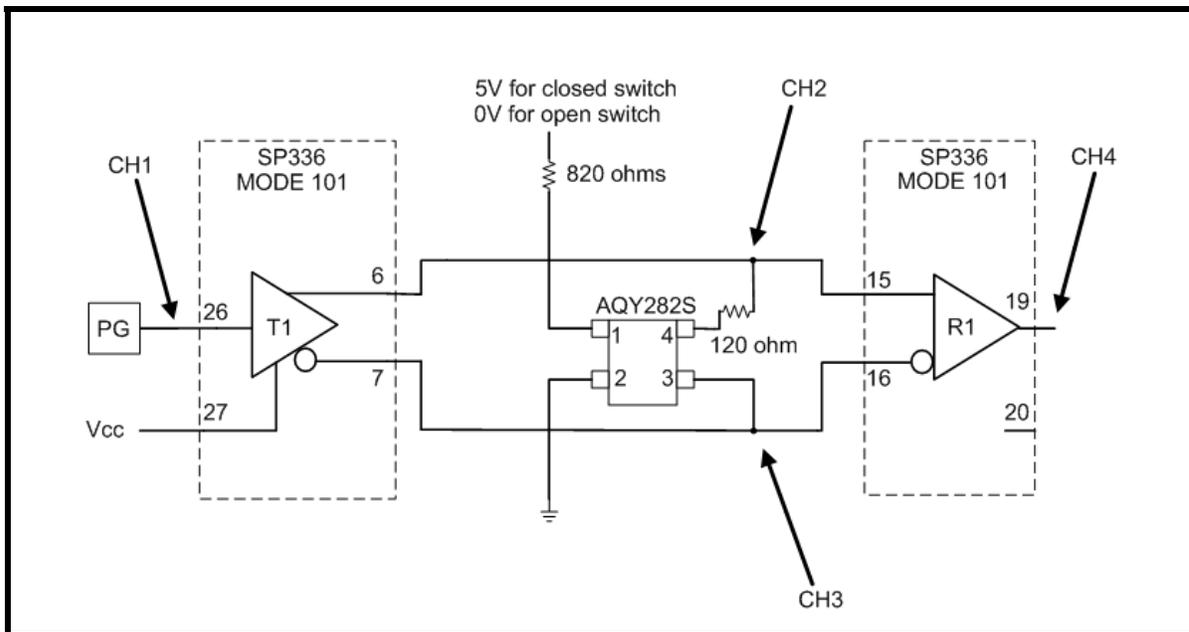
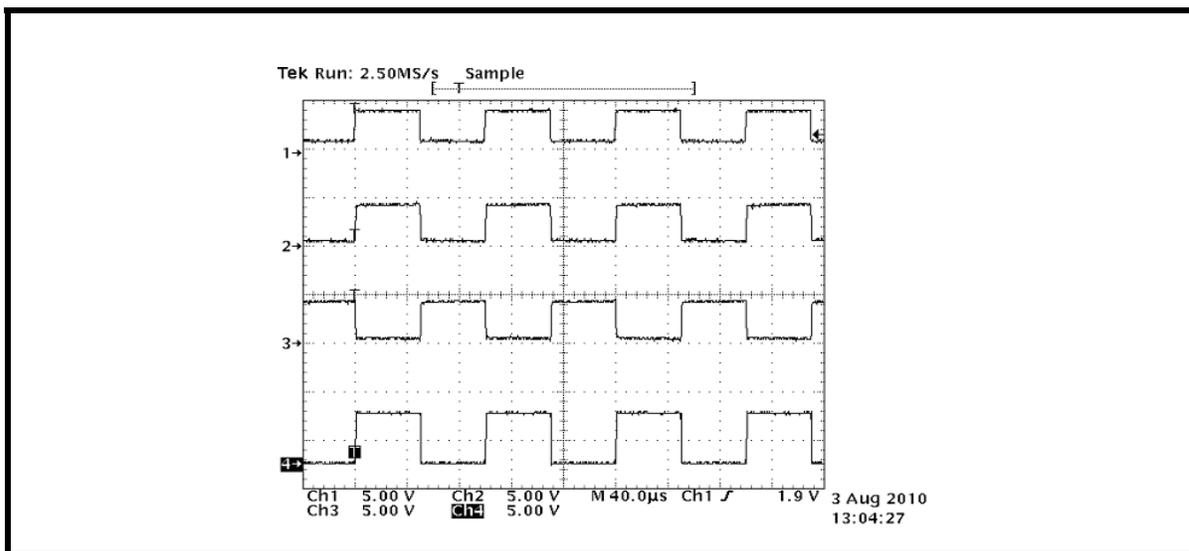


FIGURE 5. RS-485 TYPICAL WAVEFORM WHEN TERMINATION RESISTOR IS CONNECTED USING AQY282S.



The resultant waveform while using the AQY282S looks the same as when the PhotoMos is not used as shown in Figure 3.

FIGURE 6. TEST CIRCUIT USED TO TEST RS-232 SIGNALS USING SP336.

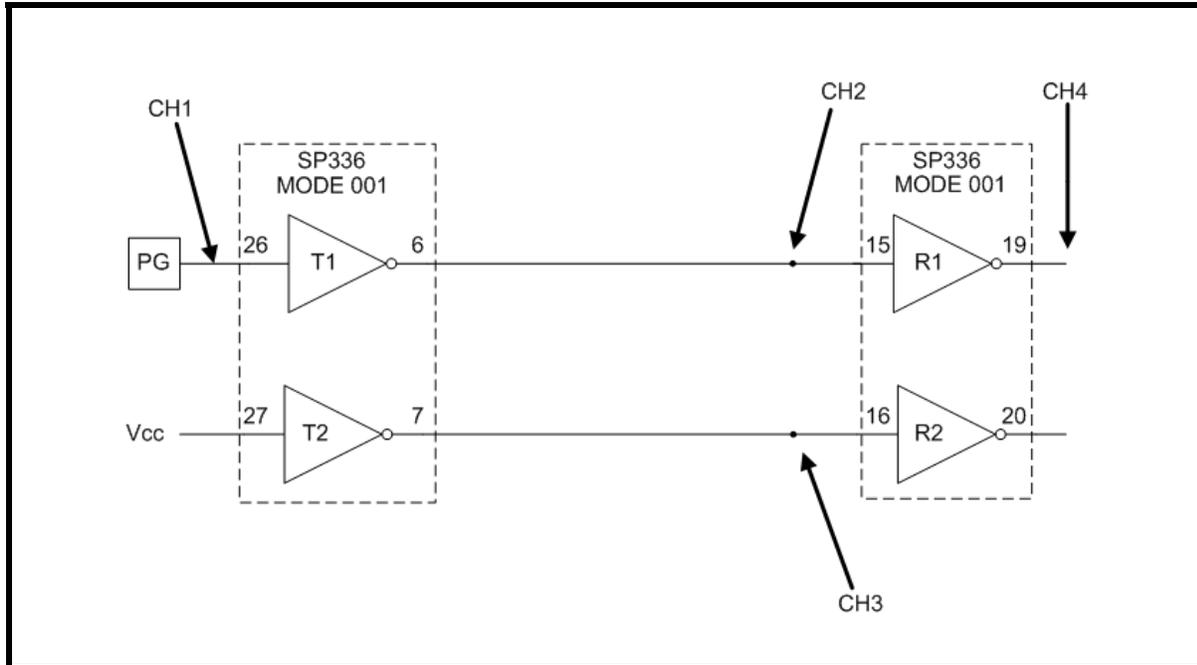
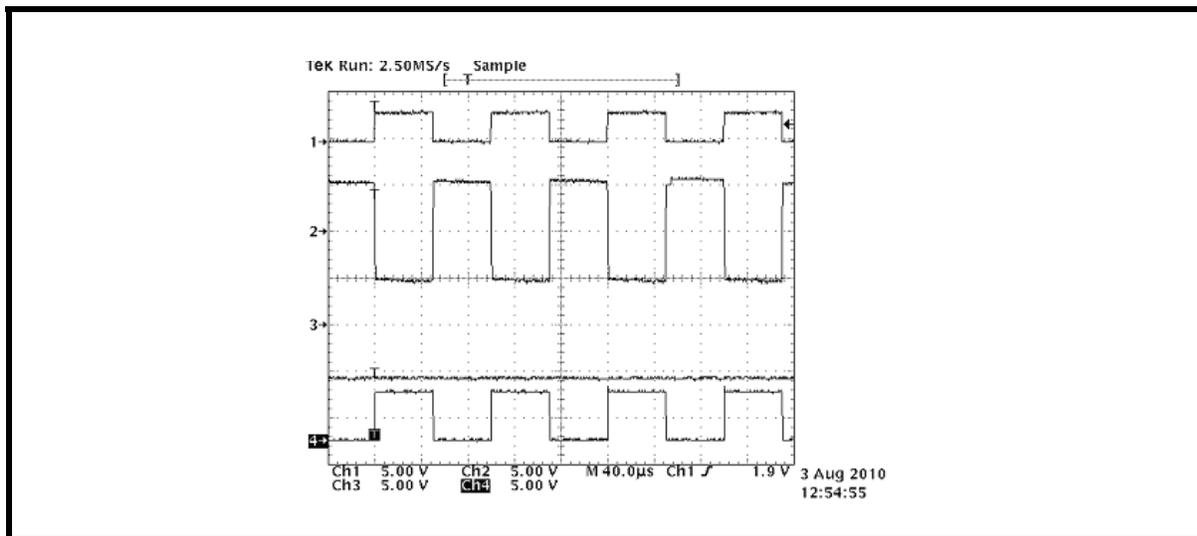


FIGURE 7. RS-232 TYPICAL WAVEFORM.



The resultant waveform from using Figure 6 test circuit is showing typical RS-232 driver output voltage levels on active channel 2 and idle channel 3. Receiver output follows logic signal at driver input.

FIGURE 8. TEST CIRCUIT FOR TESTING RS-232 SIGNALS WHEN AQY282S IS USED TO DISCONNECT TERMINATION FROM SP336.

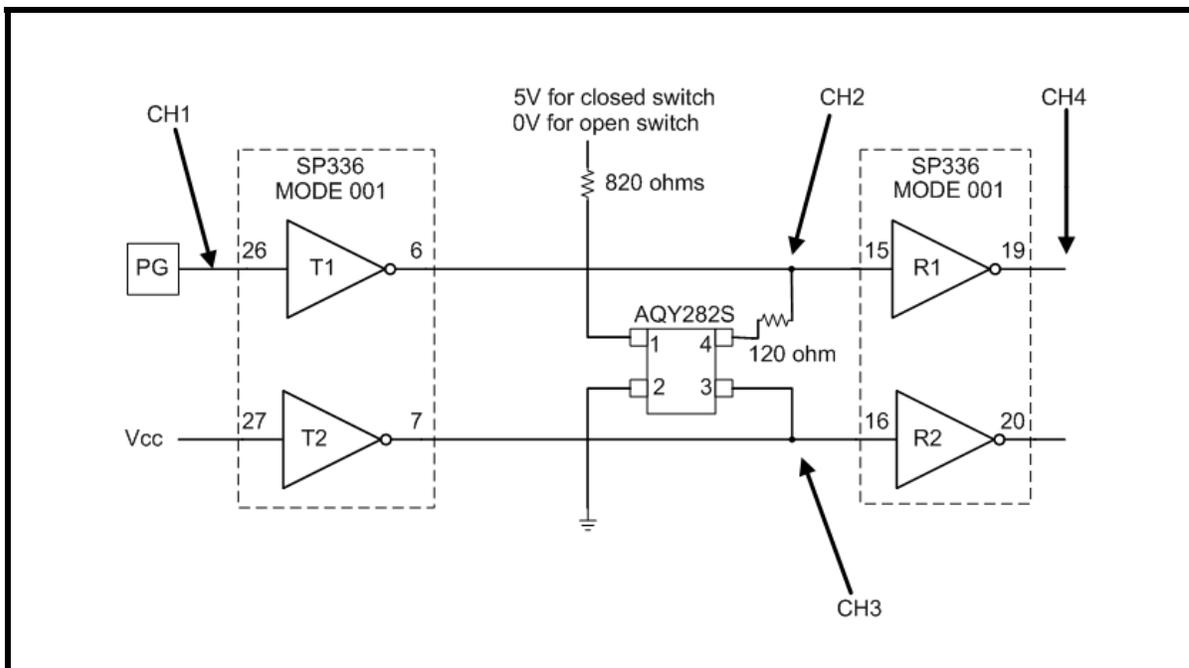
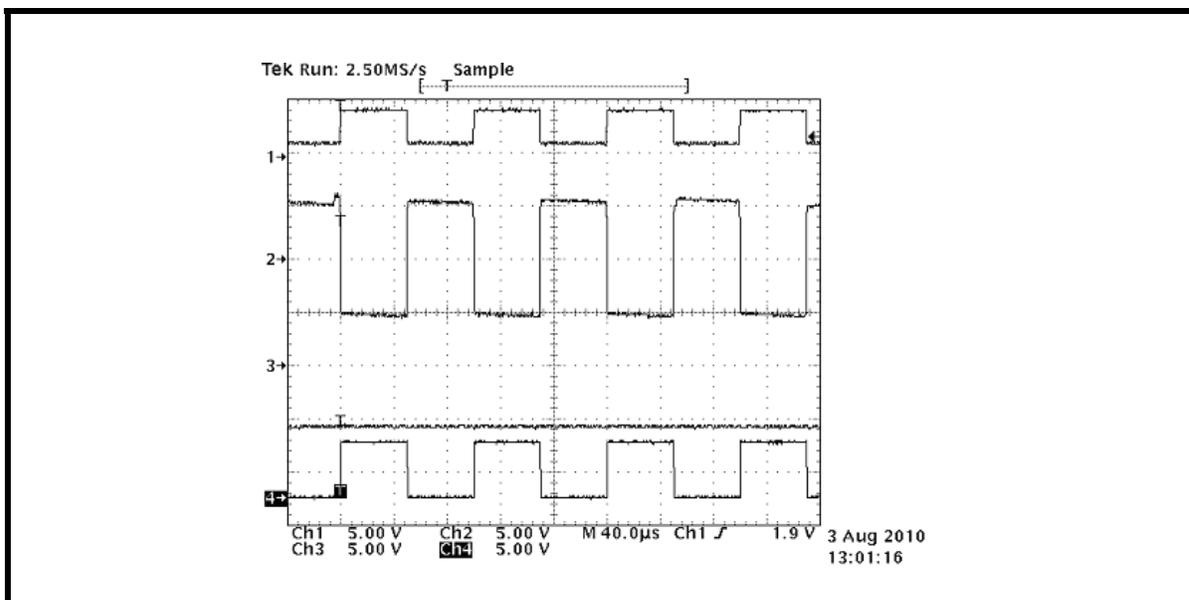
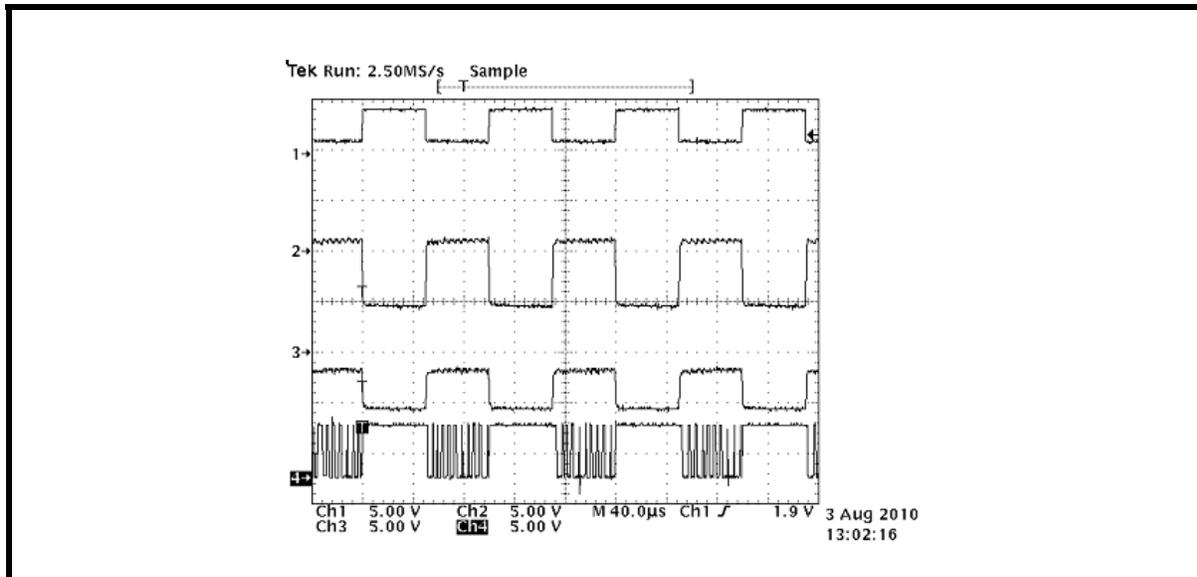


FIGURE 9. RS-232 MODE WAVEFORM IF TERMINATION RESISTOR IS DISCONNECTED USING AQY282S.



This waveform is the same as Figure 7's typical RS-232 signals while the AQY282S is used to disconnect the termination resistor from circuit.

FIGURE 10. RS-232 MODE WAVEFORM IF TERMINATION RESISTOR IS NOT REMOVED TO SHOW ERROR.



If the termination resistor is not removed during RS-232 mode then data error is likely. The above waveform shows driver 1 output not switching to typical RS-232 levels and the idle driver's output (CH3) is now switching. This is due to the resistive path provided by the connected 120 ohm termination resistor between receiver 1 and 2 input pins. The receiver output signal is corrupt due to its input signal V_{IH} being close to its input threshold range. The ripple or noise present on the input signal's high level is causing the driver to have unwanted signal transitions during the signal's OFF state.

4.0 SUMMARY

The SP336 and SP337 offer RS-232 and RS-485 configurations for both high and low speed applications. The Panasonic Electric Works AQY282S PhotoMos Relay is an ideal device for reliably connecting and disconnecting the RS-485 termination resistor using logic signals. This solution provides the user with an alternative method for controlling the termination resistor over the usual cumbersome method of using header pins with shunts. Bench testing was performed to ensure the RS-232 and RS-485 signal integrity of the multi-protocol SP336 was maintained while using the Panasonic AQY282S. The results of this bench test demonstrates the relay's ability to successfully provide reliable control of the SP336 or SP337 termination resistor's connection while maintaining signal integrity.

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