Application Note

DP83822 Cable Break Test for Profinet Compliance

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ABSTRACT

Cable breaks can occur while a system is running, and as such, it is imperative that the DP83822 is able to detect the break and indicate that the link has been lost in an accurate and timely manner. As a Profinet compliant device, the DP83822 is expected to indicate a dropped link as soon as it occurs. This applicaton note covers the cable break test scenarios the DP83822 were tested for and the register configuration required for Profinet qualification.

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Trademarks

1 Introduction

It is imperative that information about status changes with the ethernet PHY be delivered to the MAC device in a timely and accurate manner. This becomes an important factor in systems designed for industrial applications that are time sensitive and require accuracy. For the purpose of this app note, the link drop status will be the focus. Regardless of cable length, the PHY must accurately and quickly indicate that a link has been dropped whenever there is a disturbance on the cable to prevent issues from propagating to the rest of the system.

2 Test Setup and Procedure

The cable break test is designed to check if a link down is recognized after a disruption purposefully casued by the break machine, and if a link up is recognized after the disruption is cleared. DP83822 is connected to a break machine using a cable of varied length. The break machine is connected to a link partner with a cable that is always 1 meter. Figure 2-1 shows the cable break test setup. The test described in this app note is conducted with cable length up to 140 m. However, any length of cable can be used depending on the requirements of the application.

Figure 2-1. Cable Break Test Setup

The break machine is capable of either breaking or shorting any combination of 4 wires and the shield for a total of 32 different breaks and shorts. When a break or short executes, both the DP83822 and link partner should recognize a link down. This disruption is active for 2 seconds. After the two seconds, the break or short is withdrawn, and both PHYs should recognize a link up and packets will be transmitted. This process was repeated 500 times for each of the 32 disruption combinations.

Figure 2-2 shows an example of a break scenario that was covered during the test. In the figure, wire 1 and wire 6 were broken.

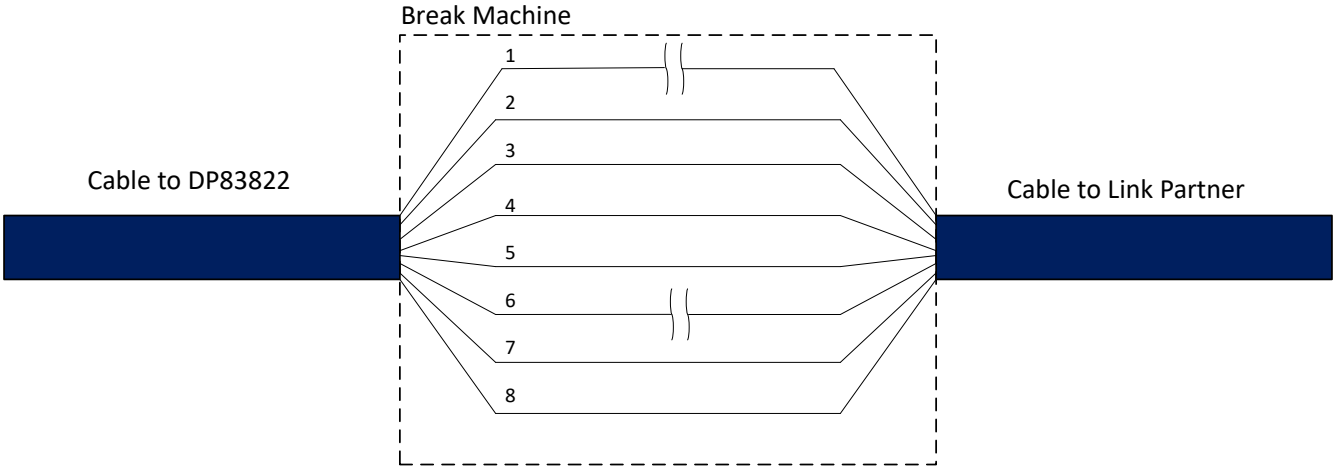

Figure 2-2. Wire 1 and 6 Break Scenario

Figure 2-3 shows an example of a short scenario that was covered during the test. In the figure, wire 1, 2, and 3 were shorted together.

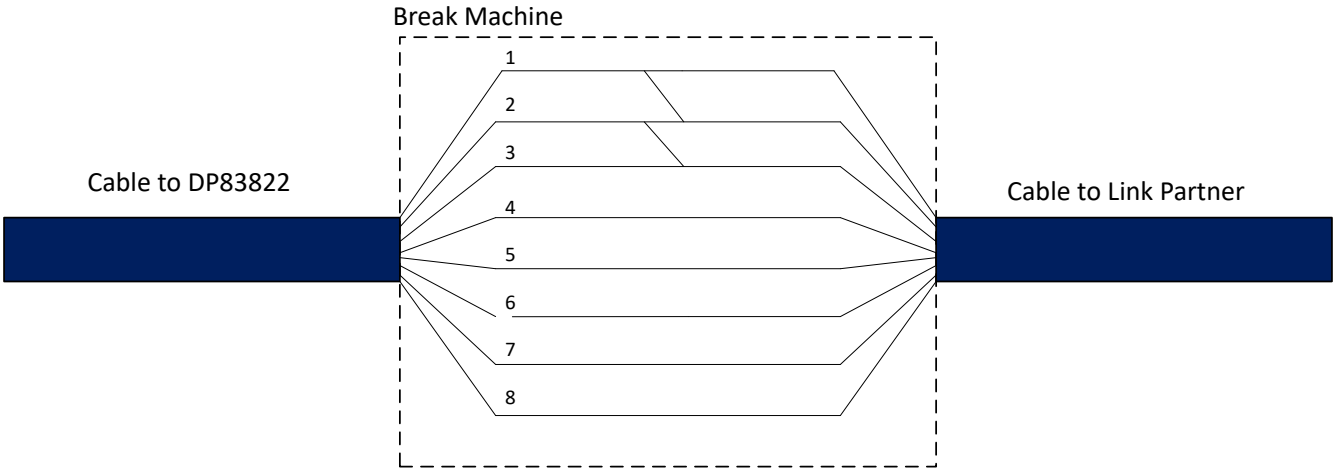

Figure 2-3. Wire 1, 2, and 3 Short Scenario

3 Cable Break Test

The cable break test was executed using both the auto-negotiation settings and forced mode settings for both the DP83822 and the link partner. Each disruption occured at least 500 times during a test with a certain cable length.

For a scenario to pass, the following requirements must be met:

1. The time to detect link down when a disruption is activated must be less than 15 µsec for both auto-negotiation and forced mode.
2. While the disruption is active, a link down status must always be recognized.
3. When the disruption is removed, a stable link up must be acheived within 30 ms for forced mode, or 5 sec for auto-negotiation mode.
4. After the disruption is removed, there must be no further indication of a link drop or unstable connection.

For the cable break test to pass as a whole, all scenarios must pass.

The following section contains the script to configure the DP83822 for the cable break test. The script in the following section is formatted for use with the USB-2-MDIO tool. When using the USB-2-MDIO tool, the extended registers setting must be set to "yes".

3.1 Cable Break Test Script Configuration

begin

001F 8000 // Hard reset (clears registers)

000B 120F // Ensures a fast link down in all scenarios

0101 2082 // Disables internal filter during a phase of link-up training

0106 D4FD // Configures filter to solve issues with shorting channels

0107 0605 // Set default value of register

0126 462B // Adjust timer for DSP state shift to ensure a fast link up

04D4 3322 // Optimization of bandwidth settings for time loop

0121 0A00 // Tighten threshold to see if device should link up

0122 0400 // Tighten threshold to see if device should link up

0123 0200 // Tighten threshold to see if device should link up

010F 0100 // Selects DC corrected output as input for the gain correction loop

0111 6009 // Provide initial value of gain index

0129 009F // Provide limits of max gain index and min gain index

0130 470A // Disable gain retrain

0410 6000 // Enable fixed value for DC correction

0416 1070 // Bandwidth adjusted to work across cable lengths

0418 3F00 // Gain adjusted to work across cable lengths

0450 2141 // Bypass equalizer calibration

003F B40F // Timer adjusted for descrambler unlock

040D 000E // Adjust auto-negotiation pulse threshold

04D1 0182 // Disables EEE (optional)

001F 4000 // Soft reset

end

3.2 Post-Script Results

Table 3-1 shows the results of the cable break test with the script applied. For all combinations of disruptions and cable lengths from 20 m to 140 m, the test passes, which means all the requirments outlined in Section 3 were met.

Table 3-1. Cable Break Test Results

	Cable Length												
	20m	**30m**	**40m**	**50m**	**60m**	**70m**	**80m**	**90m**	**100m**	**110m**	**120m**	**130m**	**140m**
Break of wire 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 1 and 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 3 and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 3 and 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 3, 2, and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 6	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 6 and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 6 and 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 6, 2, and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 6 and 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 6, 3, and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Table 3-1. Cable Break Test Results (continued)

	Cable Length												
	20m	**30m**	**40m**	**50m**	**60m**	**70m**	**80m**	**90m**	**100m**	**110m**	**120m**	**130m**	**140m**
Break of wire 6, 3, and 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 6, 3, 2, and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Break of wire 6, 3, 2, 1, and shield	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of shield and wire 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of shield and wire 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 1 and 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of shield and wire 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 3 and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 3 and 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 3, 2, and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Table 3-1. Cable Break Test Results (continued)

	Cable Length												
	20m	**30m**	**40m**	**50m**	**60m**	**70m**	**80m**	**90m**	**100m**	**110m**	**120m**	**130m**	**140m**
Short circuit of shield and wire 6	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 6 and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 6 and 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 6, 2, and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 6 and 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 6, 3, and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 6, 3, and 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of wire 6, 3, 2, 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Short circuit of shield and wire 6, 3, 2, and 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

4 Conclusion

This app note explains the setup for the cable break test, and the requirements that need to be met for the DP83822 to pass. The results are provided for each disruption combination, and the script configuration for the qualification is provided as well.

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