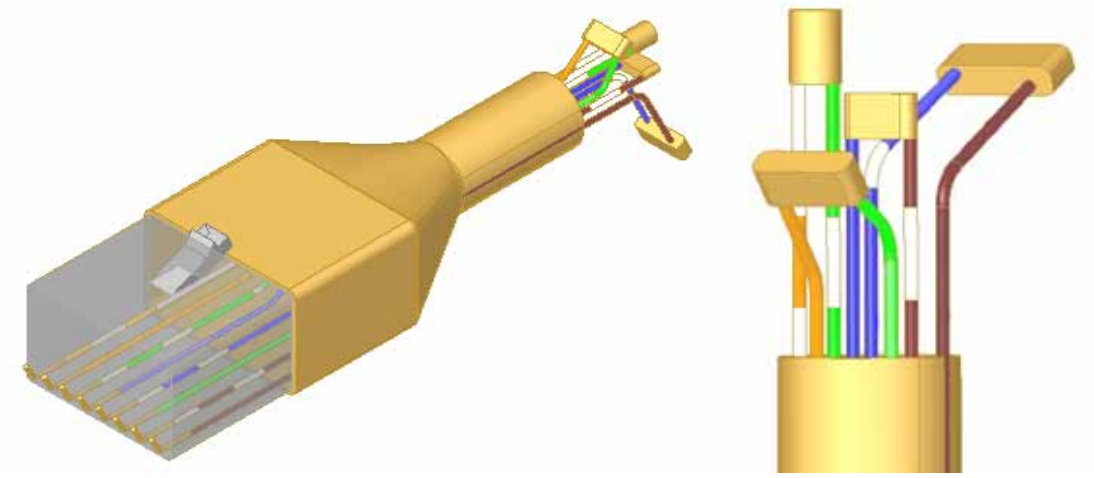
Wiring a Gigabit Ethernet (GigE) Loopback Connector

Despite some common myths about not being able to perform loopback tests on Gigabit Ethernet (GigE) copper connections, it is quite possible. The major factors are having a GigE compatible loopback connector, and a Transceiver (PHY) that allows you to turn off the Near End Cross Talk (NEXT) cancellation.

The loopback cable is a relatively simple modification. Any 10/100 loopback cable already has the orange & green wires as well as the orange-white & green-white wires connected. To turn this into a gigabit capable loopback, you need to also connect the blue & brown-white together and the brown & blue-white together. The connections are as follows.

Connect	Pin 1 (orange-white)	to	Pin 3 (green-white)
	Pin 2 (orange)	to	Pin 6 (green)
	Pin 4 (blue)	to	Pin 7 (brown-white)
	Pin 5 (blue-white)	to	Pin 8 (brown)



After completing this cross-over connection, you have a cable that is capable of loopback at Ethernet speeds of 10, 100, or 1000 Mbps.

The more difficult task of GigE loopback is making sure the NEXT (Near End Cross Talk) cancellation is turned off in the transceiver. GigE must use all four (4) pairs of wires at a base baud rate of 125Mhz in order to function. This configuration creates a lot of crosstalk[1], so all GigE PHYs must incorporate some sort of crosstalk cancellation. However, when you are performing loopback and have the wires directly connected to each other, the crosstalk will appear to be at 100% even though this configuration is intentional. Therefore, the NEXT canceller needs to be disabled for loopback testing.

[1] Crosstalk is the effect of two signals being superimposed on each other due to electromagnetic or electrostatic coupling between the conductors which are carrying the signals

Some GigE PHYs do not have an option to disable the NEXT canceller, but most do. You will need to consult the datasheet for your transceiver to determine the specific sequence. Some can be as simple as enabling a single bit in a control register -- others require a more complicated sequence such as:

1. Force the PHY to “Master” mode
2. Perform PHY reset
3. Force the PHY into GigE mode
4. Enable the Gigabit stub (i.e. - the loopback connector)
5. Disable NEXT cancellation

Once the NEXT canceller is disabled, you should be able to perform loopback testing using the GigE loopback cable.

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