

Technical FAQ

Revision 1.1
AM/IC 3rd October 2006

1) What type of signal does HIGHWIRE use ?

HIGHWIRE uses a unique digital communications format and protocol to carry Ethernet information over coaxial cable. It can carry data at up to 200 Megabits/second, in order to allow 100 Megabit Ethernet communication in both directions simultaneously over a single coaxial cable.

It will not interface to anything else so the coaxial cable should not be connected to ordinary video or Ethernet equipment etc.

2) How does the HIGHWIRE connection appear to other devices on the network ?

The HIGHWIRE-coax-HIGHWIRE connection will be completely transparent to network devices. This means that individual packets of data will simply pass through the HIGHWIRE connection without any loss, error or modification. The network devices (IP camera, switch etc.) will be unaware that there is anything other than an ordinary Ethernet cable between them.

3) Does the HIGHWIRE connection cause network traffic to be delayed (latency) ?

Each HIGHWIRE unit stores incoming Ethernet packets in a memory buffer before transmission, resulting in a delay of around 100 microseconds - comparable to a normal Ethernet switch for example, which stores packets in the same way.

The theoretical maximum delay with high activity in both directions is around 500 microseconds; undetectable by a human operator and insignificant compared to processing delays introduced by equipment such as IP cameras, codec systems, DVRs and viewing applications.

4) What is the maximum length of coaxial cable for a full-rate connection ?

The maximum cable length for *full-rate* transmission depends on the type of cable used and its condition, but is typically in the range 200-300m (600-900ft). The HIGHWIRE devices auto-adapt their signal rate for greater lengths, decreasing in steps down to a minimum of one quarter of full rate (50 Megabits/second total bandwidth).

Also note that although, historically, standard Ethernet cable runs have been limited to less than 100m (<300ft) to allow for collision detection, HIGHWIRE cable lengths have no such constraint.

5) What happens when HIGHWIRE reduces its signal rate ?

Both HIGHWIRE units continually test the cable and will use the highest rate that is achievable on the cable and that they both support. The green indicator LED will flash if a full-rate connection is not possible.

Note that when bandwidth is limited, it is the *total* capacity of the HIGHWIRE link in both directions that it is reduced. This will still be fast enough for all but the most demanding applications as HIGHWIRE data communication is asymmetric - i.e. it can use the available bandwidth to transmit data faster in one direction than the other, which is ideal for IP cameras sending high data-volume video streams down the cable and only requiring light data-volume control signals up the cable. For example, if the bandwidth is limited to 100 Megabits/second, an IP camera (or group of IP cameras) can still send an average of 90 Megabits/second of information to the network over HIGHWIRE, while simultaneously receiving information at up to 10 Megabits/second.

6) What happens if I exceed the available bandwidth ?

Some Ethernet packets will simply be dropped if there is not the capacity available to transmit them. The HIGHWIRE unit is designed to be as simple and as transparent as possible in operation. It does not appear as a network device (and thus requires no IP address or set-up), so it cannot report errors or request packet transmission to be repeated or paused. In any case, the normal Ethernet devices on the network will cope with packet loss at a higher level as they do through collision detection.

Note that operation in conditions where cable length and quality dictate a reduced bandwidth cannot be guaranteed. The user should always check their particular HIGHWIRE installation before completing an installation. However, almost all continuous-cable installations will allow a full bandwidth HIGHWIRE signal, and will only require a total bandwidth that is much lower than that available through the HIGHWIRES.

7) My cable won't support a full rate connection. How can I improve this ?

If the cable is less than 250m (750ft) long, this could be due to damage to the cable: refit the BNC connectors and check the cable for any kinks, cuts or abrasion. If the image quality from the analogue camera which was originally on the cable was very poor, this is an indication that the cable might be damaged or badly terminated. In such cases, HIGHWIRE may still be able to establish a reliable connection, but the data rate may be reduced. Obviously if a reliable connection *is* attained, the cable quality will no longer affect the image quality (from the digital IP cameras).

In extreme cases, replacing the cable may be the only option. Whilst this may appear to defeat the purpose of HIGHWIRE (i.e. to re-use the existing cable), remember that HIGHWIRE can provide Ethernet communications over three-time the length of normal Ethernet cable. Remember also that because the comms link is now an Ethernet link, multiple IP cameras can be piped down the single cable. Thus, in summary, if the existing cable is in extremely poor condition, it may still make sense use HIGHWIRE over a replacement cable.

8) My coaxial cable is very long and includes analogue video signal repeaters. Will HIGHWIRE work in this case ?

No. HIGHWIRE requires a continuous length of co-axial cable with no breaks, junctions, T-pieces or video signal boosters in the line. However, it would be possible to replace the analogue signal repeaters with another pair of HIGHWIRES back-to-back (refer to next FAQ below).

9) Can I use multiple HIGHWIRES in series to create very long signal runs ?

Yes. Whilst this is not the standard way of using HIGHWIRES, there is no reason why the maximum co-axial cable run may not be doubled or even tripled by using an extra one or two pairs of HIGHWIRES back-to-back at suitable points along the cable. Not that power must be available at the "repeater" points to power the HIGHWIRES.

10) Can I connect a HIGHWIRE link between 10BaseT and 100BaseT devices?

Each HIGHWIRE unit supports 10BASE-T and 100BASE-TX, full or half duplex, and will auto-negotiate with any Ethernet device it is connected to so that the fastest common rate is used. In almost every situation, both units will be connected to devices which support the fastest combination (100BASE-TX, full-duplex), so for simplicity HIGHWIRE does not have the capability to disconnect, reconnect and re-negotiate to make the rates at either end match.

So, while it is possible to mix Ethernet rates at either end of the link, care should be taken to ensure that the required bandwidth is safely within the minimum supported, otherwise the link is at risk of 'clogging up' as too many packets are dropped and re-sent without proper flow control.

11) Can I use my camera's power supply for its HIGHWIRE converter as well ?

Yes, as long as its rated current is greater than the camera's supply current plus the HIGHWIRE unit's supply current at that voltage, as shown in the datasheet. Using the HIGHWIRE's screw terminal power plug to connect more than one pair of wires is not recommended: however if it is used to connect both the camera and the power supply then they should be well twisted together and preferably soldered. Also ensure that both are securely clamped, and not able to move (e.g. if fitted to a PTZ camera). The HIGHWIRE unit will still operate if its DC supply voltage is reversed, but care must be taken to ensure the camera's power input polarity is correct.

The HIGHWIRE unit's supply voltage must be within the range specified in the datasheet. Power supply voltages can vary considerably depending on the load, so this should be measured first with no load, and then with the HIGHWIRE, and camera etc. connected. HIGHWIRE units can normally be used with 9 Volt DC camera supplies but the voltage must be measured at the power input terminals to ensure it does not fall below a strict minimum of 8 Volts DC under full load.

12) Is HIGHWIRE 'hot-swappable'?

The power, Ethernet and coaxial cables can be connected in any order, however it is strongly recommended that the ground connection is the first to be made when installing the unit, and the last to be broken when un-installing.

13) When should an inline isolator be fitted?

The inline isolator is used to prevent hazards and signal degradation caused by differences in the ground (earth) voltage potential at either end of the cable. This can happen in installations where there are long runs of coaxial cables or where the grounds on the devices at either end are not common.

Thus the isolator should be fitted where the HIGHWIRE units at either end are not connected to a common ground; where this is not known but likely (remote location, separate buildings etc.); where a voltage difference has been measured, or observed to cause a spark or shock; where an analogue video isolation transformer has previously been fitted; or where fitting one on test has improved performance.

The inline isolator can be fitted to either end of the cable and in either orientation, as long as care is taken to prevent accidental human contact with the remote side connector. Leaving a HIGHWIRE unit disconnected from ground in any of the above situations is strongly discouraged and may result in damage to the unit or a shock or spark from the casing.

14) I have a old 50-ohm “thin Ethernet” cable. Can I re-use this cable for 100BaseT connections with HIGHWIRE ?

A standard HIGHWIRE unit will not work on 50-ohm cable except over quite short distances. However, a minor modification to HIGHWIRE would allow full performance and over full 50-ohm cable lengths. If we receive sufficient customer interest for the production of a 50-ohm adapted HIGHWIRE, we shall consider making such a version available.

15) Will HIGHWIRE work over co-ax cables which have been extended by connecting extra cable lengths in series ?

Yes, so long as each section is properly terminated with a BNC connector and if straight-through (“barrel”) connectors are use to connect BNC to BNC. Unbroken cable lengths are preferable, but HIGHWIRE was developed and tested using many lengths of coaxial cable joined to together in this way. The total length of the cable will still be limited to normal HIGHWIRE lengths.

16) If my IP camera comms fail, how do I tell if this is because the camera has failed, or if a HIGHWIRE has failed ?

If the HIGHWIRE at the control room end has a steady green light (or a slow pulsing green light) then the HIGHWIRE pair have a good data link across the co-axial cable and this indicates that they are not the problem.

If the orange light on the other side of the network connector is flashing, then this indicates that there is network traffic to and from the camera. In this case, it is likely that the camera is also OK and that the problem lies with a network connection in the control room or elsewhere, or some other network configuration problem (e.g. conflicting IP address or incorrect IP settings).

If the orange light is steady and unblinking then this means that the network either side of the HIGHWIREs is connected, but there is no network traffic. This could mean that the IP camera has failed or lost power.

If there is only a regular brief flash of green light on the HIGHWIRE data link indicator, then it may mean that the coax is not properly connected, or is broken, or is disconnected at the other end. Another reason may be that the HIGHWIRE at the camera end has lost power or has failed.

If there is no green light at all on the HIGHWIRE at the control room end, this means it has lost power or has failed.

In the last two cases the only way to test further is to replace the HIGHWIRE unit and re-test. Note : HIGHWIREs are very easily bench tested. Simply connect the HIGHWIRE to be tested to a known good unit across a short length of coax and power up both. If a green light appears (it will appear on both or not at all) then the unit is good.