A new type of CCTV camera has been developed to provide HD “High Definition” cameras that operate on existing 75 Ohm coaxial cable. Unlike a two way IP “Internet Protocol” HD camera that requires a network set-up and two sets of 100 Ohm twisted pair wires, this type of HD camera uses the SDI signal protocol used by the broadcasting industry. This kind of camera operates in one direction only on coaxial cable and no address or network set-up is required. When replacing old analog cameras with new HD cameras it reduces your installation time and cost because you have the advantage of being able to use the existing coaxial cable.

However just like the IP protocol there is a limitation to the maximum distance you can go with the SDI camera. In fact the distance recommendations for IP cameras and the SDI cameras are just about the same approximately 100 meters or 330 feet. But actual equipment testing has shown that you can go almost double that distance to nearly 200 meters or 660 feet, but don’t count on it without making actual measurements of the loss in the cable.

All cable is not created equally and the loss due to distance varies by manufacture and other factors detailed below. Manufacturers of cable publish tables that show the loss in dB relative to the frequency being used. One of the major problems facing users of SDI cameras is that the coaxial cable being used frequently has greater loss than the Coaxial Cable Manufacturer claims for their product. This excess loss is installation related and has nothing to do with the published theoretical loss of the cable.

As the loss in your cable increases the HD camera signal will abruptly fail with total loss of picture, or the picture will come and go irregularly and in some cases right at the edge of the fail point you will see the picture but the colors will be completely wrong in the picture.

This is a particular problem because of the digital nature of the SDI camera signal. It is the nature of digital signals to work perfectly for various lengths of coaxial cable, until a certain length of cable is reached, and then fail to receive the camera signal at any greater length or (loss) in the cable. Either the picture is "perfect" or it breaks up or wipes out completely, with no prior warning that "the end is near".

The major advantage of digitizing a video signal (such as in the SDI system), is also the greatest disadvantage to the user because they cannot detect excess loss in the transmission system until a slight additional transmission loss results in total failure to receive the picture. This effect is referred to as the “digital cliff effect” like falling off the cliff. It can be a particularly difficult problem when setting up remote or temporary cable runs at sporting events, etc. What is needed is a simple way to measure coaxial cable loss at the highest frequency that is used to transmit the camera signal when that cable is first installed to insure that it is capable of carrying the SDI signal reliably. This measurement should include a suitable safety margin of cable loss to insure that small changes in the cable loss do not cause picture loss. Installation and operational issues can cause small cumulative losses that can combine to create highly variable excessive loss in your cable.

These excess losses can be caused by many different field conditions:

1. Excess loss caused by improperly locked BNC connectors. When BNC connectors are only partially twisted on and not rotated to the cam lock position, excess losses can average between a fraction of a dB to more than one dB, and will vary when the connector is wiggled.
2. Excess loss caused by incorrect installation of the BNC connector. Be sure to follow the connector manufactures installation directions very carefully particularly with regard to trimming the insulation length, proper shield wire trimming and installation of the compression ring to insure good grounding of the shield to the connector. Good installation technique is very important and will help to maintain the coaxial cable dielectric constant through the connector and reduce the overall loss.

3. Excess loss caused by corrosion of the BNC connector. Corrosion can set in to a connector, particularly if the connector is left out in the open, gets wet, or is slightly loose allowing moisture to enter the connector. Gold plating of the connector pin and mating components will reduce this problem but moisture carries with it other contaminants that will work to pit the connector and deposit salts that will create extra resistance at the mating point of the connector.

4. Excess loss caused by too many BNC connectors in tandem. Each connector will create additional loss on the cable even if properly installed. Avoid extra connectors in any given cable run as much as possible. Each connector will increase the total cable loss by a significant fraction of a dB and it all adds up.

5. Excess loss caused by moisture, or even worse, actual rain or sea water entering the cable through a pinhole or cut in the cables protective jacket. Rain or standing puddles of water will find any pinhole there is in a cable jacket. Try to protect any outside cable from the effects of rain and if you see physical damage to the outer jacket of the cable tape it up to seal the opening to prevent the incursion of moisture.

6. Excess loss caused by stretching of the cable, even slightly. Pulling a cable should be avoided whenever possible. It is better to un-reel a cable as you go rather than to set up a cable reel at one end and then pull the cable to get to the other end. The loss of a cable at 750 MHz can actually be increased by the action of stretching the cable. When a cable is stretched the physical dimensions of the are distorted and that changes the characteristic impedance of the cable creating higher than normal losses in the cable. Once stretched the cable is permanently damaged.

7. Excess loss caused by short radius bends or "kinks" in the cable. Short radius bends in the cable should be avoided as they will increase the loss of the cable. Actual "kinks" in the cable are capable of producing severe excess loss in the cable that cannot be cured by straightening the cable out. A deformed spot in the cable causes an interruption in the continuous dielectric constant of the cable which results in a high loss area in the cable.

8. Excess loss caused by cable that has been "run over" by mashing the cable. Steel wheels are the worst for causing this type of damage, but even inflated tires rolling over the cable can cause additional loss in a cable and that loss is permanent caused by the deformation of the dielectric.

9. Excess loss caused by cable that has been overheated at some prior time. High temperatures can cause temporary increases in cable loss, but severe overheating can make the additional loss permanent. It is important to note that cable losses will increase with the temperature of the cable dielectric as it expands and changes dimension also the center conductor will “suck out” or change is length relative to the length of the coaxial cable with temperature change. This is normally not a problem except when the connector center pin is not correctly attached to the center pin.

10. Excess loss incurred because the cable is still on a spool. The curved cable has greater loss than when it is laid out straight. Tight curves in the cable can cause additional loss. Even the slight loss of a full turn can be multiplied when there are many turns on the reel.
11. Incorrect BNC type installed on the cable. The majority of BNC connectors sold on the market today are 50 Ohm type BNC connectors used in the radio industry. The mechanical difference between a 50 Ohm BNC and a 75 Ohm type BNC connector is small but the electrical difference in the dielectric constant of the connector is of concern. Besides the dielectric constant mismatch in the impedance the real serious problem is that when a combination of 75 Ohm and 50 Ohm connectors are mated together the mechanical differences will cause immediate destruction of the 75 Ohm connector. The male pin on the 50 Ohm connector is larger than the male pin on the 75 Ohm connector and when the two are mated together the female receptacle will be bent out of shape causing a point contact that goes intermittent when the connector is wiggled. Unfortunately the BNC connector will be permanently damaged, one time is all it takes to destroy the connector. If a 75 Ohm male connector is mated with a 50 Ohm female connector the center pin of the 75 Ohm connector will float inside the oversized 50 Ohm female receptacle and have intermittent contact when the connector is wiggled. Be certain that your connectors are all 75 Ohm.

Very few of these conditions will incur failure by themselves on short runs of cable, but when the cable is near maximum length, any of these conditions may be sufficient to cause system failure. Often a cable may be plagued by more than one such condition at the same time, increasing the possibility of system failure.

It is recommended that reels of cable be tested at regular intervals on any cable that is used for temporary camera installations to reveal any damage that may have been done at some prior time, before the same cable is used for another application. A cable loss record can be attached to the reel so that changes in the cable loss may be recorded and dealt with before the next installation.

There are two ways that this cable loss measurement can be made. A true power meter and a high frequency band-pass filter (such as the SDI-2 true power meter, and the BPF-600) can be connected to the cable length and a camera source to accurately indicate excess losses from any of the above conditions. If no camera source is available to make the test you can connect a CTG-500 Cable Test Generator at one end of the cable and the SDI-2 true power meter on the other end of the cable to make the test. The CTG-500 Kit is available that has the required SDI-2 true power meter, power supply, and CTG-500 cable test generator in a sturdy protective carrying case.