SensorNet Network Design Guidelines

Understanding the SensorNet network is very important for a successful installation. This understanding will help you to plan an efficient, reliable, and flexible network that can meet the facility's long-term needs. This section provides basic guidelines for selecting a suitable topology and installing the network devices.

> Distances and device counts contained in this section assume **AWG 22 un-shielded twisted-pair cable**. Shielding adds capacitance, causing the SensorNet signal level to decline more rapidly as devices are attached or cable length increases. When pre-existing wire makes it necessary to use shielded twisted pair cable, the maximum distance will be reduced. For example, Belden 8760 cable will typically support complete network links (including backbone and branches) of approximately 750m (2500').
>
> The receivers on SensorNet devices will operate satisfactorily at signal levels between 5v and 0.3v (differential peak-to-peak, measured with a scope). For installation planning purposes, an operating range of 5v to 1v is recommended. A SensorNet J-Box can be attached as the signal reaches 1-2v, to amplify the signal back to 5v. This will extend the network's distance and allow additional devices to be attached.

Network Design Considerations

A SensorNet network consists of one or more **network "links"**. Each link includes a twisted-pair **cable**, a SensorNet **host** and 1-32 SensorNet **devices**. A SensorNet link's maximum cable length is 1km (3300'). Devices can attach anywhere along the cable.

For proper operation, both ends of each SensorNet link must be terminated. This prevents signals reaching the end of the line from being reflected back along the line. All SensorNet devices and hosts have a termination switch or jumper for this purpose. When in the "terminate" position, a resistor is placed across the SensorNet cable connections to suppress reflected signals.

Think of each SensorNet link as a single twisted pair cable with a terminating resistor at each end. A host and up to 32 devices are then placed along the cable. If the host is placed at one end of the cable, it must be terminated, and can only support one cable branch.

If the host is placed in any other position, it is not terminated and can support 2-4 cable branches. In this configuration, the last device attached to each cable branch must be terminated.

A J-Box can serve as a host repeater, to add a SensorNet link and up to 32 more devices, or to allow SensorNet cable runs beyond 1km (3300'). For maximum distance, attach the repeater J-Box at a point where the signal level has reached 1-2v (differential peak-to-peak, measured with a scope). This takes advantage of the prior host's driver capabilities, while providing a strong signal for amplification. No more than 3 repeaters should be used in series between any two network devices, as this can create signal distortion, and cause operational errors.

SensorNet supports **three network link topologies**: daisy chain, backbone, and star. Each network link can be wired to apply the topology that best suits the link's unique requirements.

- A **daisy chain** topology originates at the host and sequentially connects multiple devices along a single path until the last device is attached. A separate twisted-pair cable connects each device to the next.

- A **backbone** topology uses a single continuous cable, with multiple devices attached directly or through short stub cables. The host can attach anywhere along the backbone.

- A **star** topology has up to four network branches that connect to a host which serves as the hub.

> The distinction between daisy chain and backbone wiring is mostly physical. Daisy chains use separate cable segments to connect devices, while backbones connect all devices to one cable.
>
> After the compression connectors are attached, the two topologies become electrically identical. However, backbone wiring may have a lower resistance because the cable is not cut.

Daisy Chain Link Guidelines

With a daisy chain network link, **a separate cable connects each device to the next device** in the chain. This facilitates quick and easy installation. The daisy chain is a good solution for a temporary network or where the host and a few devices are located in the same room or area. Consider using a backbone or star topology when installing large and permanent networks.

Figure 3- 5. Daisy Chain Link

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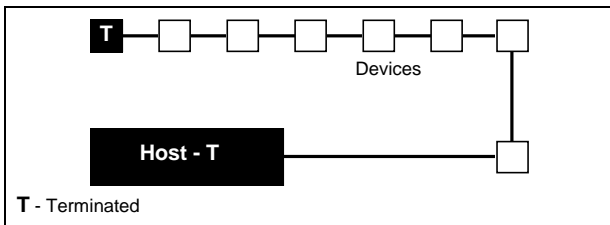
1. Terminate devices at both ends of the daisy chain. Leave all others unterminated.

2. Attach up to 32 devices on each link.

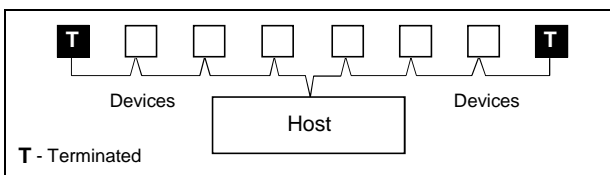3. Limit combined cable length (from host to farthest device) to 1km (3300') or less.

> Daisy chain hosts are usually terminated and placed at one end; however, this location is not critical. If the host attaches elsewhere, the network becomes a 2-branch star. In this configuration, both end devices are terminated and the host is not terminated.

Backbone Link Guidelines

In a backbone network, a **single continuous cable connects all devices** served by the link. The unbroken cable allows you to install a permanent network that maintains a high level of reliability, even when you must attach, disconnect or move a device.

Use the backbone topology for large and permanent networks; it is also a good solution when connecting a few devices located in the same general area.

Figure 3- 6. Backbone Link


Figure 3- 6. Backbone Link

1. Locate the host anywhere along the backbone.

2. Terminate devices at both ends of each backbone link. Leave all others unterminated.

3. Attach up to 32 devices on each link.

4. Limit combined cable length (from host to farthest device) to 1km (3300') or less.

5. To attach unterminated devices, strip 1.2cm (.5") of insulation from each conductor at the connection point, fold in the middle of the stripped area, and secure in the device's compression connector.

Star Link Guidelines

With a star network link, **up to four branches connect to a central "hub" location**. Devices can attach with a single continuous cable (backbone style) or separate cables (daisy chain style).

A star topology is a good solution when using existing cable. It also allows easy reconfiguration as devices are added or relocated.

Figure 3-7. Star Links

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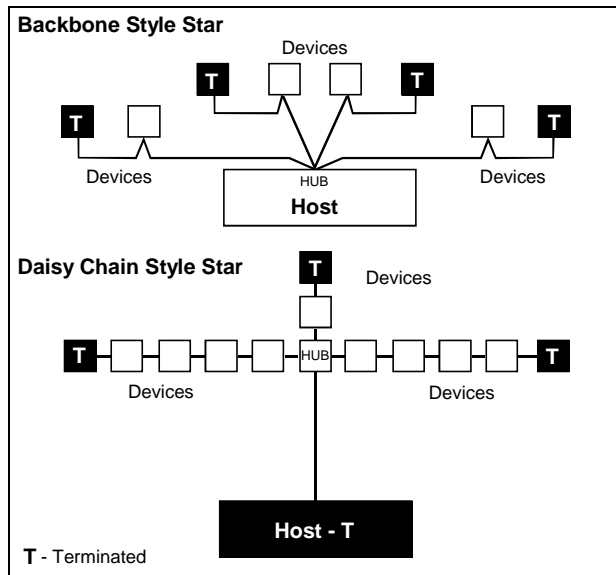
1. Terminate devices at the end of each branch (4 maximum). Leave all others unterminated.

2. Attach up to 32 devices on each link.

3. Limit combined cable length (from host to farthest device) to 1km (3281') or less.

4. Whenever possible, attach devices backbone style, following the instructions under Backbone Link Guidelines.

Network Checkout

To simplify network checkout, attach devices in stages, one J-Box at a time. Attach all devices associated with the first link before starting the second link. After connecting a set of devices, select each one individually from the surveillance system and confirm that the device response is correct. If not, correct the problem before continuing with the installation activities.