

## Fieldbus 302

# Network wiring options

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## Overview

### How do I connect the pieces?

With FOUNDATION fieldbus you have a broad range of options for building a network that meets your needs.

The choices you make depend on the location of each device, the amount of existing wiring you want to use in the new network, and the wiring practices best suited for your plant or project. This course outlines some of those choices.

*Hint: As you go through the topics in this course, watch for answers to these questions:*

- *When is a branch layout a better choice than a tree layout?*
- *What are the advantages of pre-assembled cables and connectors?*

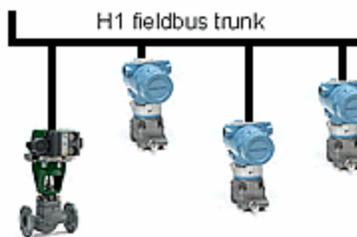
- *How can you convert wiring in an existing junction box from analog to fieldbus?*

## Tree and branch topologies

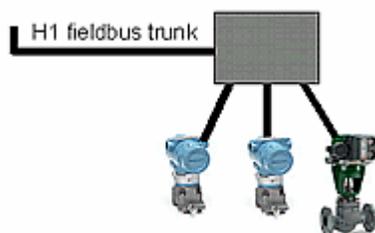
A fieldbus network should be designed with the location of the field devices in mind. That's especially true in an existing plant with wiring, conduit, junction boxes, field devices, and related equipment already installed.

Some devices will be located by themselves, others in groups. FOUNDATION fieldbus accommodates both situations through **branch** and **tree** network layouts (also called "topologies").

**Branch.** Like its namesake, a branch is a single "limb" or spur off the main trunk of a fieldbus segment. A branch layout makes sense when the devices on a segment are geographically separated from each other.



**Tree.** A tree layout (also called a "chicken foot") has a number of branches, or spurs, that connect to the main trunk in one location. This layout works well when several devices are located near each other.



Either of these network layouts can be used with wire in conduit or not, with a combination of conduit and armored cable, and with existing wiring and junction boxes. The topics that follow will examine each of these configurations in more detail.

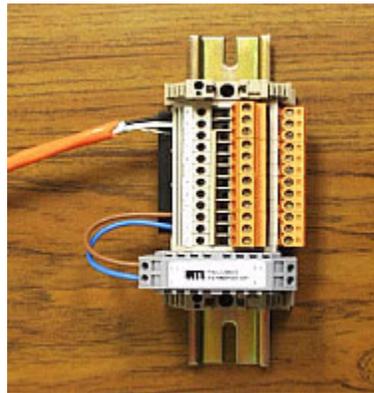
## Conduit options: tree

Many plants have existing wire in conduit. This setup can easily be used in a FOUNDATION fieldbus network with either tree or branch layouts.

A tree layout connects several spurs to the main fieldbus trunk (also called a **home-run** cable) at a single point. You can use standard shielded, twisted-pair wire for the home-run cable and for the spurs that connect to the devices. Or you can use conduit for the home run cable and the trunk, and armored exposed cable for the spurs.

The connection to the main cable is often made with a junction box or spur block. A spur block takes in a segment and passes it out to other spur blocks or remote devices.

Another connection option is to use standard field terminal blocks. The style of terminal block shown below — called a disconnect block — reduces the risk of a short circuit by eliminating the need to physically unscrew a device in order to remove it from a segment.



## Practical pointer

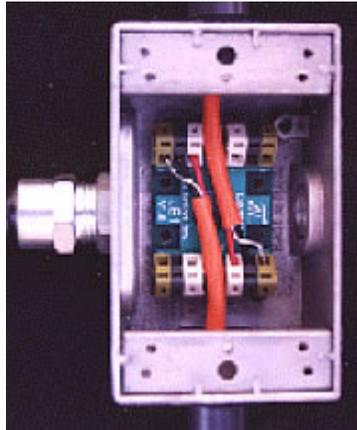
Establish standard practices such as "segment in at upper left" and "segment out at upper right" for making connections at junction boxes, spur blocks, or terminal blocks.

Such conventions can help reduce wiring errors and simplify maintenance. For example, a maintenance technician will know which terminals affect only a single device, and which affect the rest of the segment.

## Conduit options: branch

There are also several options for using conduit with a **branch** layout.

One option is called a **condulet**.



As the photo shows, a condulet is designed so that a segment comes into the box on one side (the top side in this photo) and extends through the opposite side, if necessary. The branch line to the device is attached on the third side.

In the example shown in this photo, conduit is used all the way to the field device.

## Combining conduit and armored cable

You may want to use a combination of conduit and armored cable for your project -- either because it's too expensive to run conduit to remote areas, or because you already have both conduit and armored cable installed in the plant.

Whatever the reason, there are options for this combined approach, too.

The first photo shows one of these options. The unit -- which accepts either two devices, or a single device and a terminator -- mounts on a standard conduit run like that shown in the second photo. Then pre-assembled armored cable connects the unit to the field device.



## Practical pointer

Pre-assembled cables and connectors may increase the cost of materials, but they usually reduce overall project cost because they reduce the time and labor required for installation.

They also reduce costs by protecting against many types of maintenance errors. For example, they provide short-circuit protection by eliminating exposed wires at the termination points that could be accidentally shorted together or grounded.

However, pre-assembled cables must be ordered to length or assembled to length in the field. It's sometimes difficult to order the correct lengths in advance, and assembly in the field

## Non-conduit options: tree

Conduit is expensive — especially if you need a lot of it. So rather than installing miles of conduit, many plants use cable trays or other ways of routing signal wires.

You can still use traditional junction boxes if you take this approach, but other options are also available.

One option for use in a tree layout is a pre-assembled fieldbus junction box like the one in the photo. The junction box — sometimes called a "brick" — combines a set of cable connectors and interconnect wiring in a potted assembly suitable for mounting in a plant environment.



These junction boxes come with connectors for four to eight devices, plus connectors for segment-in and segment-out. Each connector is labeled to help prevent incorrect assembly. Caps protect unused connectors from the environment.

This type of junction box is typically mounted to a plant structural member close to the devices it serves.

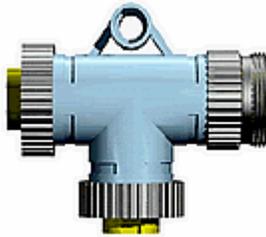
## Practical pointer

Some junction boxes are available with short circuit protection. If there is a short circuit on a spur, the short is isolated to just that spur, and therefore just one device. This reduces the risk of a wiring problem affecting several devices.

When you're installing a fieldbus segment, avoid filling a junction box completely. Allow room for growth by leaving at least one location open for either a fieldbus terminator or an extension of the segment trunk.

## Non-conduit options: branch

For non-conduit installations with a branch layout — where each device is attached to an individual drop off the main trunk — a **"T" connector** offers low cost and easy installation.

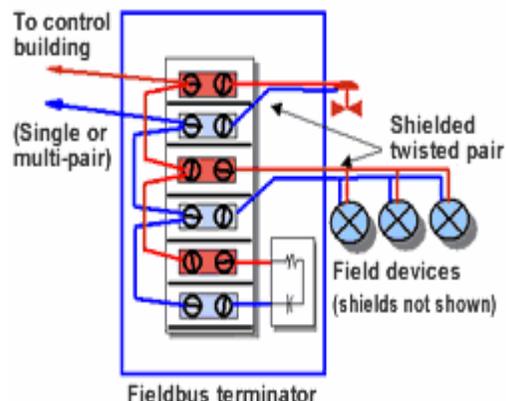


The "T" connector has a segment-in and a segment-out connection, plus a connection for the single spur or branch to the individual field device.

Like a fieldbus "brick," the "T" connector can be mounted on a plant structural member close to the segment trunk. And, like the brick, it's made to withstand typical plant environments.

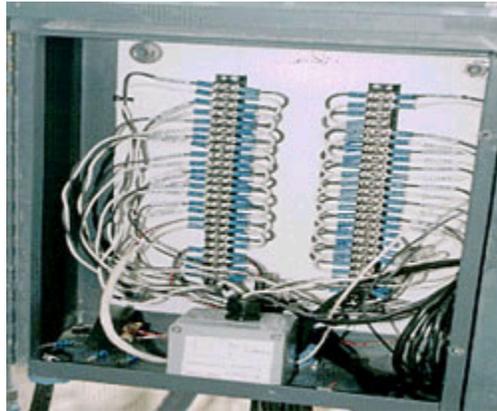
## Using existing wiring and junction boxes

FOUNDATION fieldbus is designed to work with existing instrument-grade wires. With just a few wiring changes to a junction box, you can convert point-to-point analog wiring to a FOUNDATION fieldbus trunk with spurs.



As the diagram shows, the positive wires are jumpered together, as are the negative wires, on the home run (or host) side of the junction box. The individual plus and minus terminals on the field side connect to the spurs that run to groups of 1 to 3 devices per spur.

The photo shows a conventional junction box that has been converted to a FOUNDATION fieldbus H1 junction box.



### Practical pointer

Converting one or two of the twisted pairs in a multi-core cable from analog to FOUNDATION fieldbus can substantially extend the capacity of installed wiring.

It's also significantly less expensive than pulling new cable, especially if conduit is used and the conduit is at recommended capacity.

If you convert only part of a cable bundle from analog to fieldbus, clearly label the fieldbus segments so anyone working with the cable in the future will know which is which.