

Testing Fieldbus Cable with an FBT-6 and FBT-5

Fieldbus cable can be tested using the FBT-6 Fieldbus Monitor and the FBT-5 Wiring Validator. The FBT-5 puts a DC voltage and fieldbus signals on the wire pair. A FBT-6 is used to test the voltage, signal level, noise and detect shield shorts in the wiring. These tests can be performed on existing instrumentation wiring, newly installed fieldbus cable or a fieldbus wiring system with wiring blocks and terminators already installed.

1. Testing a Single Cable

1.1. Connection

Connect the FBT-5 using the clip leads at one end of the cable. Connect the Terminator using the clip leads to the other end of the cable. Connect the FBT-6 to the Terminator. The red clips should connect to the positive Fieldbus wire and the black clips to the negative Fieldbus wire. If the wires are reversed, the Monitor will not turn on. Clip the FBT-6 green shield wire to the cable shield.

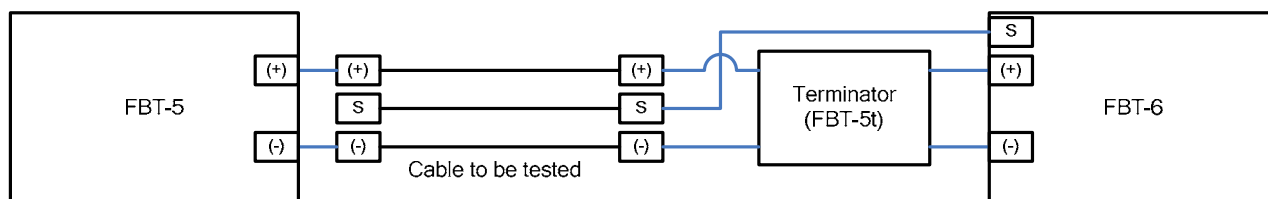


Figure 1

1.2. Operation

The Wiring Validator has a push-button Power switch that turns it on or off. If the Wiring Validator is turned on with a single click of the Power button, it stays on for about 5 minutes and then turns itself off to save battery power. If the Wiring Validator needs to be on indefinitely, push and hold down the Power button for about 3 seconds.

The green light shows that the Wiring Validator is on.

- If the green light blinks rapidly (about 3 times per second) the Wiring Validator or the Monitor is not attached to the wire pair being tested or the connection is backwards.
- If the green light blinks slowly (about once a second) there is a good connection to the wire pair, the Wiring Validator is in the battery save mode and will automatically power down in five minutes.
- If the green indicator light is on continuously there is a good connection and the Wiring Validator will stay on until it is turned off.

When the Wiring Validator is turned on, the Monitor powers up. The Monitor displays its firmware version, NETWORK CHECK IN PROGRESS, then ALL MEASUREMENTS OK. If the Monitor detects a parameter that is not OK, it displays the screen for the first BAD parameter it finds instead of ALL MEASUREMENTS OK.

Scroll through the Monitor screens by pressing the FUNC button and check the following readings.

- At the VOLTAGE screen the voltage should be between 9 and 11 Volts and say "OK".
- At the DEVICE screen the LAS signal level reading should say "OK" and show the signal level.

Signal Level	Cable Condition
350 or more	Excellent
200 - 350	Good
150 - 200	Marginal
150 or less	Not Good

- At the FF PK NOISE (peak fieldbus frequency noise) screen. The reading should say "OK" and show a noise reading.

FF Noise Level (mV)	Cable Condition
<30	Good
30-75	Marginal
>75	Bad

- Push the SEL button to view the LF PK NOISE and HF PK NOISE screens. The readings should say OK and show a noise reading.

LF or HF Noise Level (mV)	Cable Condition
<50	Good
50-150	Marginal
>150	Bad

- At the WIRING screen, the Monitor should indicate WIRING OK. Wiring readings that are bad are shown below.

BAD Wiring Readings
(+) TO SHIELD SHORT BAD
(+) TO SHIELD SHORT INTERMITTENT
(-) TO SHIELD SHORT BAD
(-) TO SHIELD SHORT INTERMITTENT

2. Testing a Cable System

A fieldbus cable system with two terminators and other wiring blocks installed can be tested before devices are connected. This is done the same way as the single cable testing described above. The only difference is that the Test Terminator is not used.

If the cable system has the two terminators required for fieldbus operation, the cable system test will have results comparable to the results from testing the cable by itself. If, however, not enough terminators or too many terminators have been installed, the measured signal levels will be different. The chart below shows the **relative** changes:

Number of Terminators	LAS Signal Level
0	1250
1	930
2 (correct number)	730
3	670

2.1. Limitations

The FBT-5 was designed for testing a single cable only. Testing a cabling system with the FBT-5 has limitations.

2.1.1. Do not attach fieldbus devices

The cable system must not have fieldbus devices attached to it during the test. The FBT-5 can not power fieldbus devices and its signal generator will interfere with any data transmission from the fieldbus devices.

2.1.2. Do not attach a fieldbus power supply/conditioner

The cable system must not have a fieldbus power supply attached to it during the test. Attaching a fieldbus power supply will prevent the FBT-5 from functioning.

2.1.3. Be aware of the fieldbus voltage

The FBT-5 only supplies a small amount of current at a low voltage. Any equipment connected to the fieldbus causes increased current consumption and/or voltage drops that will impact the ability to test the cabling system. Examples include:

- ◆ Megablocks. Megablock wiring blocks (or any powered wiring blocks) on the segment draw current and cause segment voltage to drop up to 0.4VDC. Megablocks have a power indicator LED that turns on between 9 and 10VDC. If the voltage supplied to the Megablock is between 9 and 10VDC, the LED may turn on and off, causing DC voltage fluctuation and large amounts of noise on the fieldbus. If this occurs, break the segment into smaller pieces by lifting cable connections to Megablocks until the voltage level is high enough to be stable. Test the smaller pieces of the segment separately. Replacing the batteries in the FBT-5 may also help.
- ◆ Cable Resistance. Cable has resistance and by Ohm's Law ($V=IR$) the more current passing through the cable, the more voltage is dropped by the cable. Be aware that voltage is different at different points on the segment. Just because you have 10VDC near the FBT-5 doesn't mean you have 10V everywhere on the segment.
- ◆ Spur ports. Short circuit protection circuitry (SpurGuards) on the spur ports of Megablock wiring blocks and other wiring blocks cause a voltage drop from the trunk ports to the spur of up to 0.4VDC.

2.2. Other options

If extensive cabling system testing is required on many fieldbus segments, call Relcom for additional solutions at (503) 357-5607.

3. Additional Information

3.1. Error Conditions

If the outputs of the Wiring Validator are shorted, the red Low Battery light blinks on and off. (As the Wiring Validator is attached to a cable, the Low Battery indicator may blink on momentarily). If the battery is low, the red light is on continuously.

3.2. Self Test

To check if the Wiring Validator and the Monitor are working correctly, connect them to each other through the Test Terminator.

Function	Indication
VOLTAGE	9.5 or more
DEVICE (LAS signal level)	650 or more
FF PK NOISE (peak fieldbus frequency noise)	20 or less

3.3. Special Notes

- The Wiring Validator must not be used in hazardous areas or to power wiring that runs into hazardous areas.
- The measurement values given in this document are general guidelines. Measurement values used to evaluate segment cable may require adjustment due to differences in segment design and construction.
- The limits that determine if a measured parameter (e.g. signal level) is OK or BAD can be changed by the user with the FBT-6 Assistant software. The default limits programmed into the FBT-6 are assumed in this document.

3.4. Additional Cable Test

To get a complete characterization of the fieldbus cable, test the resistance between wires in the cable with an ordinary ohmmeter.

Parameter Measured	Acceptable Value
The resistance between the two twisted-pair wires	100K ohms or higher
The resistance between each of the wires and the drain/shield (if any)	100K ohms or higher
The resistance between the drain/shield and instrument ground bar.	Less than 100 ohms