Fieldbus

FBUS-HSE/H1 Linking Device (LD) User Manual

May 2003 Edition
Part Number 370728A-01

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Consult the FCC Web site at `www.fcc.gov` for more information.

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Federal Communications Commission

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Canadian Department of Communications

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To obtain the DoC for this product, click **Declarations of Conformity Information** at `ni.com/hardref.nsf/`. This Web site lists the DoCs by product family. Select the appropriate product family, followed by your product, and a link to the DoC appears in Adobe Acrobat format. Click the Acrobat icon to download or read the DoC.

* The CE marking Declaration of Conformity contains important supplementary information and instructions for the user or installer.

Contents

About This Manual

This manual describes the mechanical and electrical aspects of the FBUS-HSE/H1 Linking Device (LD) and contains information concerning its installation and operation. The FBUS-HSE/H1 LD product is a High Speed Ethernet to Foundation H1 Linking Device.

How To Use the Manual Set

Begin by reading the *Getting Started with Your FBUS-HSE/H1 Linking Device* manual, a brief quick-start manual that describes how to set up and get started with your kit using the default settings.

This manual contains more details about changing the installation or configuration from the defaults, and about using the hardware.

Conventions

This manual uses the following conventions:

»	The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
	This icon denotes a note, which alerts you to important information.
	This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.
bold	Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.
italic	Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories,

programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.

Related Documentation

The following documents contain information you might find helpful as you read this manual:

- *Foundation Fieldbus Specification: System Architecture*
- *NI-FBUS Configurator User Manual*
- *Getting Started with Your HSE Linking Device and the NI-FBUS Software*

1

Overview of FBUS-HSE/H1 Linking Device (LD) Hardware

This chapter provides an overview of the FBUS-HSE/H1 Linking Device (LD) hardware.

Product Overview

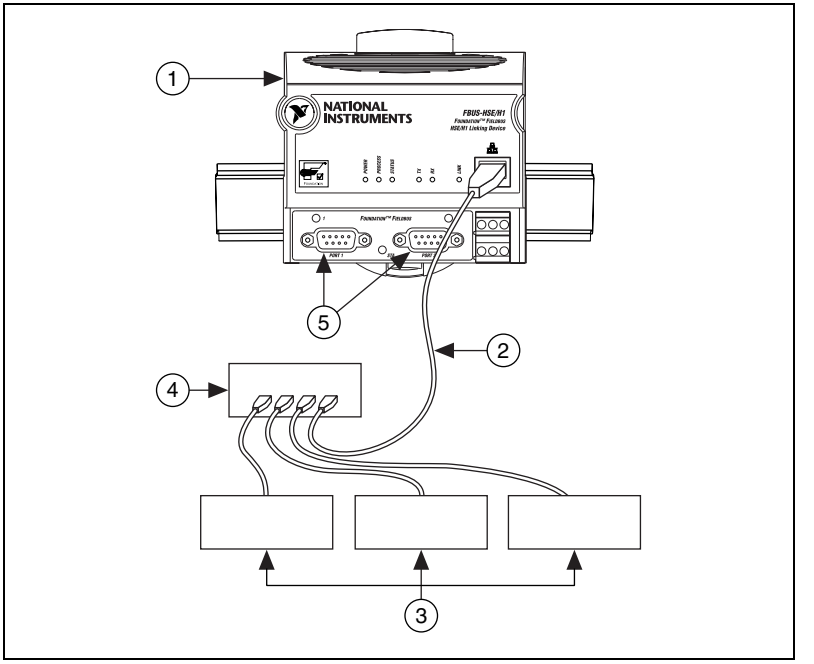
High Speed Ethernet (HSE) is an extension to the Foundation Fieldbus specification and is governed by the Foundation Fieldbus organization. HSE compliments the Foundation Fieldbus H1 network (31.25 kb/s) specification by offering a high speed (10 Mb/s) link to H1 segments. Built on standard Ethernet, HSE extrapolates the Fieldbus protocol and offers controllers the ability to schedule and control H1 devices directly over Ethernet.

An FBUS-HSE/H1 system consists of at least one linking device connected to an Ethernet network and at least one H1 device.

The FBUS-HSE/H1 LD connects a 10 Mbps Ethernet network to Fieldbus H1 devices. Each H1 network can be connected to multiple Fieldbus devices. Each FBUS-HSE/H1 can support two H1 segments, and each segment can support up to 16 H1 field devices (without repeaters). Because the FBUS-HSE/H1 LD is an HSE linking device, your network topology determines the maximum number of FBUS-HSE/H1 LDs that can be installed on your Ethernet network.

The FBUS-HSE/H1 LD connects directly to a 10 Mbps Ethernet network. The FBUS-HSE/H1 autodetects the speed of the Ethernet connection and configures itself accordingly.

Figure 1-1 shows an FBUS-HSE/H1 LD connected to an Ethernet network.



1	FBUS-HSE/H1 LD	3	Ethernet Devices	5	H1 Network Ports
2	Ethernet Cable	4	Ethernet Hub		

Figure 1-1. Typical Ethernet Network Setup

In a distributed application, many Fieldbus H1 segments are networked together using HSE LDs. With Ethernet, you can use an unlimited number of Fieldbus H1 segments. Depending on the Ethernet topology, an unlimited number of host computers can access each bank from any distance.

Configuration and Monitoring

The LD permits the NI-FBUS Configurator, installed on any Ethernet networked computer, to configure H1 Fieldbus devices through an FBUS-HSE/H1 LD as if the configurator were directly connected to the H1 Fieldbus network.

The NI-FBUS Configurator, by way of the FBUS-HSE/H1 LD, transparently generates configuration and device-parameter information about all H1 Fieldbus devices connected to the linking device.

Once configured, the linking device permits HMI software on any PC connected to an FBUS-HSE/H1 LD to access and monitor Fieldbus devices as if the HMI were directly connected to the Fieldbus network.

System Requirements

This section describes the hardware and software components you need before you can use the linking device. You also should review the `README.TXT` file on the linking device setup disk for the latest information.

Hardware

- FBUS-HSE/H1 LD
- Ethernet 10/100 Mbps network interface
- Ethernet network cabling
- Fieldbus cabling

Software

- Windows NT 4.0 with service pack 3 or later, or Windows 2000/XP
- NI-FBUS Configurator version 3.0 or later
- DHCP Server

Compatibility Information

The linking device is compatible with IEEE 802.3, the Fieldbus Foundation specification, and the Fieldbus Foundation HSE specification.

FBUS-HSE/H1 LD Hardware Description

The linking device is designed to be mounted on a 35 mm DIN rail and has one Ethernet port. The Ethernet status LEDs on the front of the linking device display the current status of Ethernet link.

The linking device has two separate H1 Fieldbus ports. Next to each port is an LED to display the current port status.

The **STATUS** LED indicates whether the linking device is powered on and operating properly.

For more information on connecting and configuring the linking device, refer to Chapter 2, *Hardware Installation and Configuration*.

2

Hardware Installation and Configuration

Installing the FBUS-HSE/H1 LD

The FBUS-HSE/H1 LD has a simple rail clip for reliable mounting onto a standard 35 mm DIN rail. Complete the following steps to mount the FBUS-HSE/H1 LD on a DIN rail.

1. Use a flathead screwdriver to open the DIN rail clip to the unlocked position, as shown in Figure 2-1.

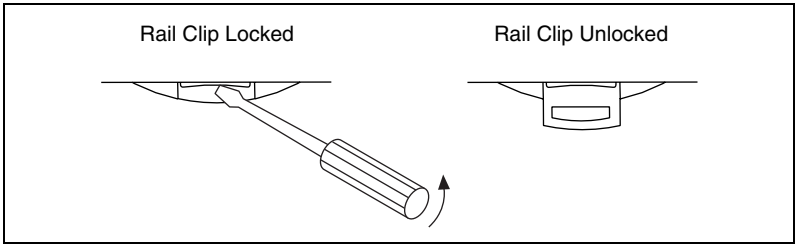
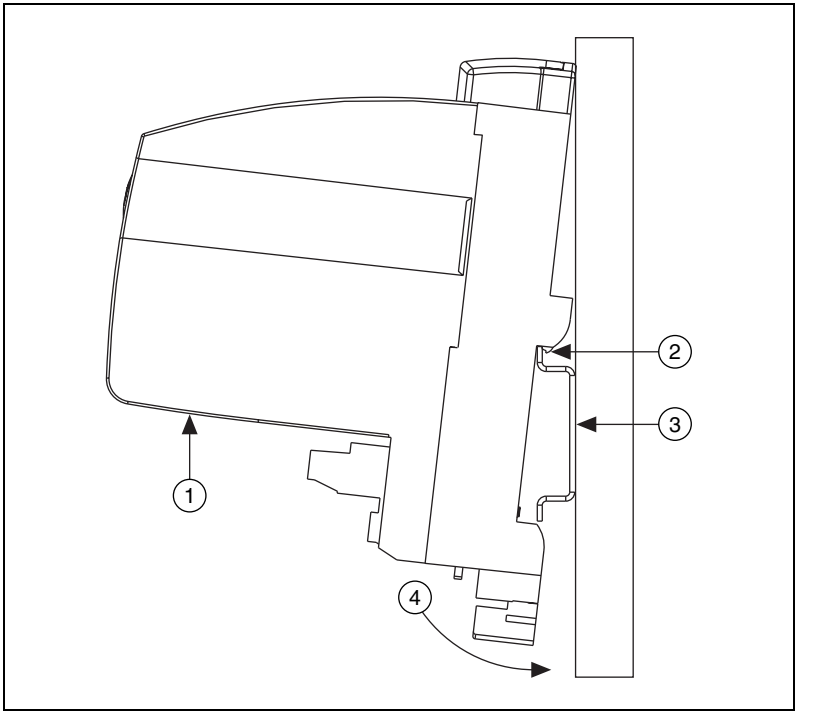


Figure 2-1. DIN Rail Clip

2. Hook the lip on the rear of the FBUS-HSE/H1 LD onto the top of a 35 mm DIN rail and press the FBUS-HSE/H1 LD down onto the DIN rail, as shown in Figure 2-2.



1	Cover	3	35 mm DIN Rail
2	Lip	4	Press on to Rail

Figure 2-2. Mounting the FBUS-HSE/H1 LD on a DIN Rail

3. Slide the FBUS-HSE/H1 LD to the desired position along the DIN rail. After the FBUS-HSE/H1 LD is in position, lock it to the DIN rail by pushing the rail clip to the locked position, as shown in Figure 2-1.

Removing the FBUS-HSE/H1 LD

To remove a linking device, unlock it from the DIN rail by placing a screwdriver in the slot on the rail snap and open the rail snap to the unlocked position, as shown in Figure 2-1. Then lift the device off of the rail.

Mounting the FBUS-HSE/H1 LD to a Panel

Complete the following steps to install the optional Fieldbus network panel mount accessory and mount the FBUS-HSE/H1 LD network module to a panel. You can order the panel mount accessory from National Instruments.

1. Use a flathead screwdriver to open the rail clip to the unlocked position, as shown in Figure 2-1.
2. Snap the panel mount accessory onto the module, as shown in Figure 2-3.

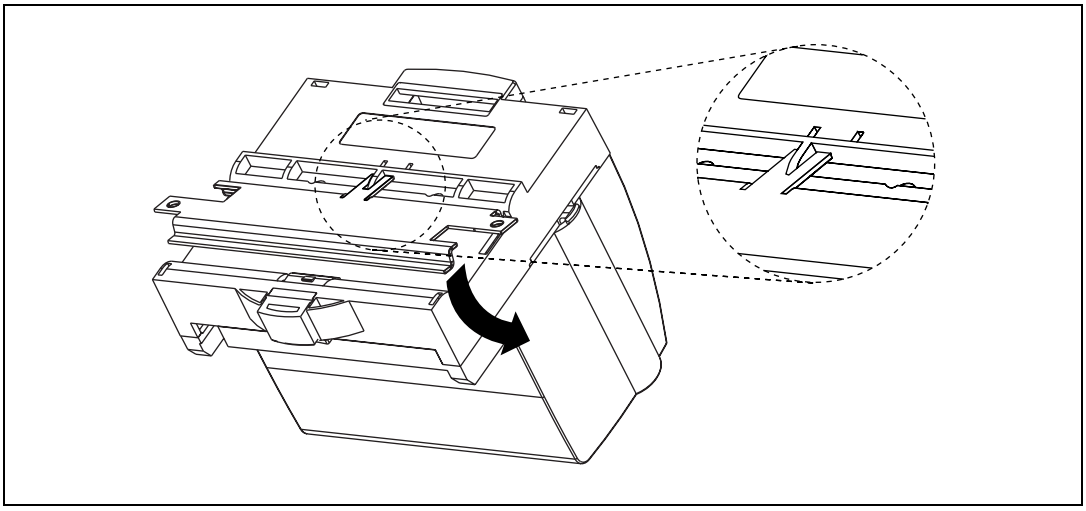


Figure 2-3. Installing the Network Panel Mount Accessory

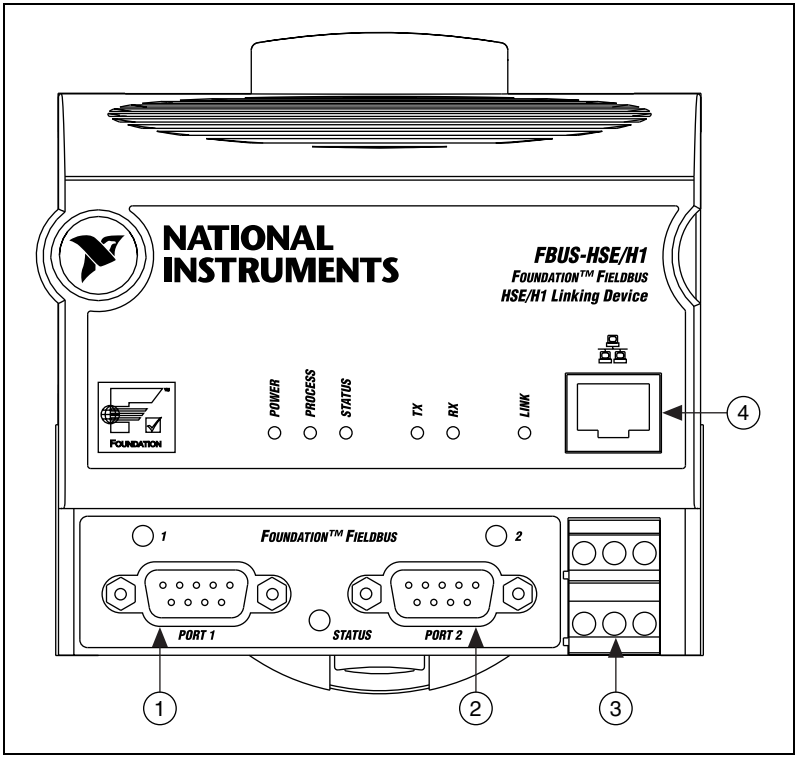
3. Lock the panel mount accessory into place by pushing the rail clip to the locked position.
4. Mount the FBUS-HSE/H1 LD to your panel with the panel mount accessory.

Connect Your FBUS-HSE/H1 LD to the Network

Connect the RJ-45 Ethernet port of the FBUS-HSE/H1 LD to an Ethernet hub using a standard Category 5 Ethernet cable. You also can connect an FBUS-HSE/H1 LD directly to a computer using an Ethernet crossover cable.

Note Do *not* use a cable longer than 100 m. If you are using a 10 Mbps Ethernet, National Instruments recommends using a Category 5 shielded twisted-pair Ethernet cable.

Figure 2-4 shows the power, H1, and Ethernet connectors on the FBUS-HSE/H1 LD.



1 H1 Port 1	2 H1 Port 2	3 Power	4 Ethernet

Figure 2-4. Connectors on the FBUS-HSE/H1 LD

Cabling

If you build your own cables, the following table shows the standard Ethernet cable wiring connections for both normal and crossover cables.

Table 2-1. Ethernet Cable Wiring Connections

Pin	Connector 1	Connector 2 (Normal)	Connector 2 (Crossover)
1	White/Orange	White/Orange	White/Green
2	Orange	Orange	Green
3	White/Green	White/Green	White/Orange
4	Blue	Blue	Blue
5	White/Blue	White/Blue	White/Blue
6	Green	Green	Orange
7	White/brown	White/Brown	White/Brown
8	Brown	Brown	Brown

Figure 2-5 shows the connector pinouts for Fieldbus Ethernet cables.

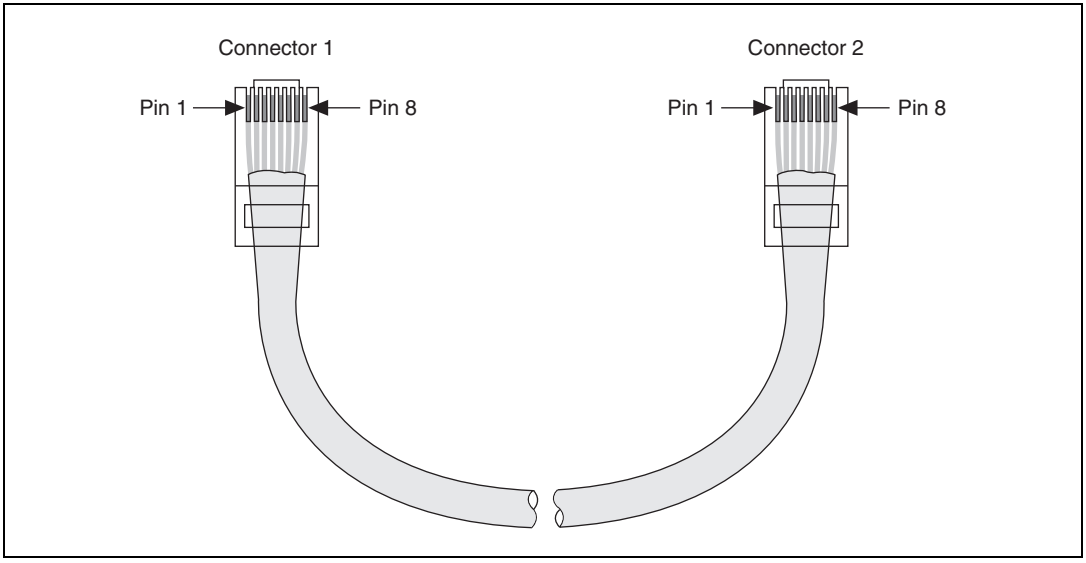


Figure 2-5. Ethernet Cable Pinouts

Connect the FBUS-HSE/H1 LD to the Fieldbus Network

The FBUS-HSE/H1 LD can be one of up to 32 devices connected to a Fieldbus H1 network. The connection is made through one of the two 9-pin male D-sub Fieldbus H1 connectors on the FBUS-HSE/H1 LD, shown in Figure 2-4.

Use a Fieldbus cable with a 9-pin female D-sub connector to connect the FBUS-HSE/H1 LD to a properly terminated Fieldbus network. When you are using only an FBUS-HSE/H1 LD, the power hub is not being used for power. For other Foundation Fieldbus devices that use bus powering, you would apply power to the hub, from which devices would get their power. Refer to the Fieldbus Foundation *Wiring and Installation 31.25 kbit/s, Voltage Mode, Wire Medium Application Guide* for specific information about wiring and installing a Fieldbus network. If you want to make your own Fieldbus cable, refer to the *Fieldbus Standard for Use in Industrial Control Systems, Part 2*, ISA-S50.02.1992. The FBUS-HSE/H1 LD Fieldbus connector pinout is shown in Figure 2-6.

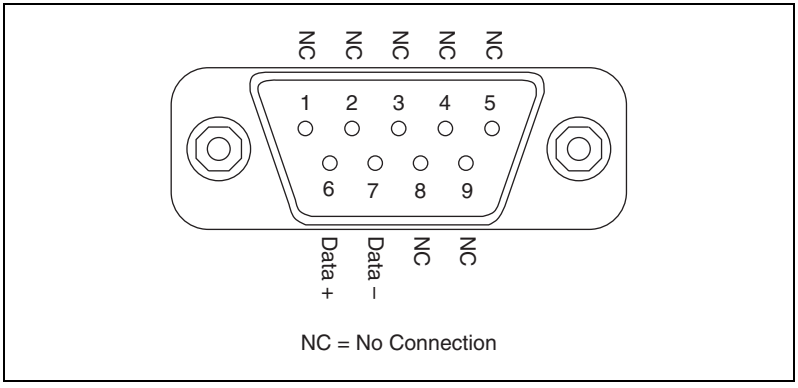


Figure 2-6. FBUS-HSE/H1 LD Connector Pinout

Connect Power to the FBUS-HSE/H1 LD

Each FBUS-HSE/H1 LD on your network requires an 11-30 VDC power supply.

The power connector is a 6-pin screw terminal power connector whose pinout is shown in Figure 2-7.

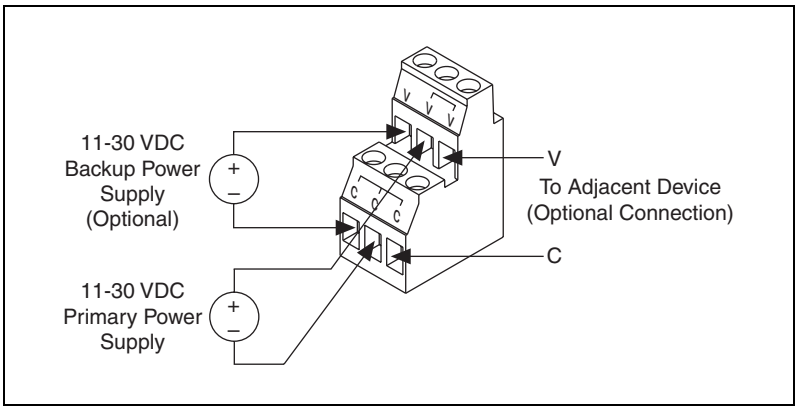


Figure 2-7. FBUS-HSE/H1 Power Connector Pinout

Connect the primary power supply to the center V and C pair with the positive and negative wires on your power cable in the V and C terminals, respectively. You can connect an optional backup power supply to the left V and C pair. The right V and C pair provides the same power supply as the primary power supply.

Power on the FBUS-HSE/H1 LD

At power-up, the FBUS-HSE/H1 LD runs a set of power-on self tests (POST) that take several seconds and the green **POWER** LED is lit. For more information about reading the POST status, refer to the *LED Indicators* section of Appendix B, *Troubleshooting*.

A

Resetting the FBUS-HSE/H1 LD

If the FBUS-HSE/H1 LD cannot communicate with the network, you can configure the Ethernet settings through NI-FBUS software. When you configure the device, it attempts to confirm that the new settings are valid. However, if the configuration process is interrupted or the FBUS-HSE/H1 LD is moved to a new network with different settings, the device might not be able to communicate with the network. If this occurs, you can manually reset the unit to its factory settings.

Complete the follow steps to reset the unit.

1. Power down the FBUS-HSE/H1 LD and remove it from the bank.
2. Locate the slot on the bottom of the FBUS-HSE/H1 LD just above the label. Inside the slot, find the red reset switch, shown in Figure A-1.

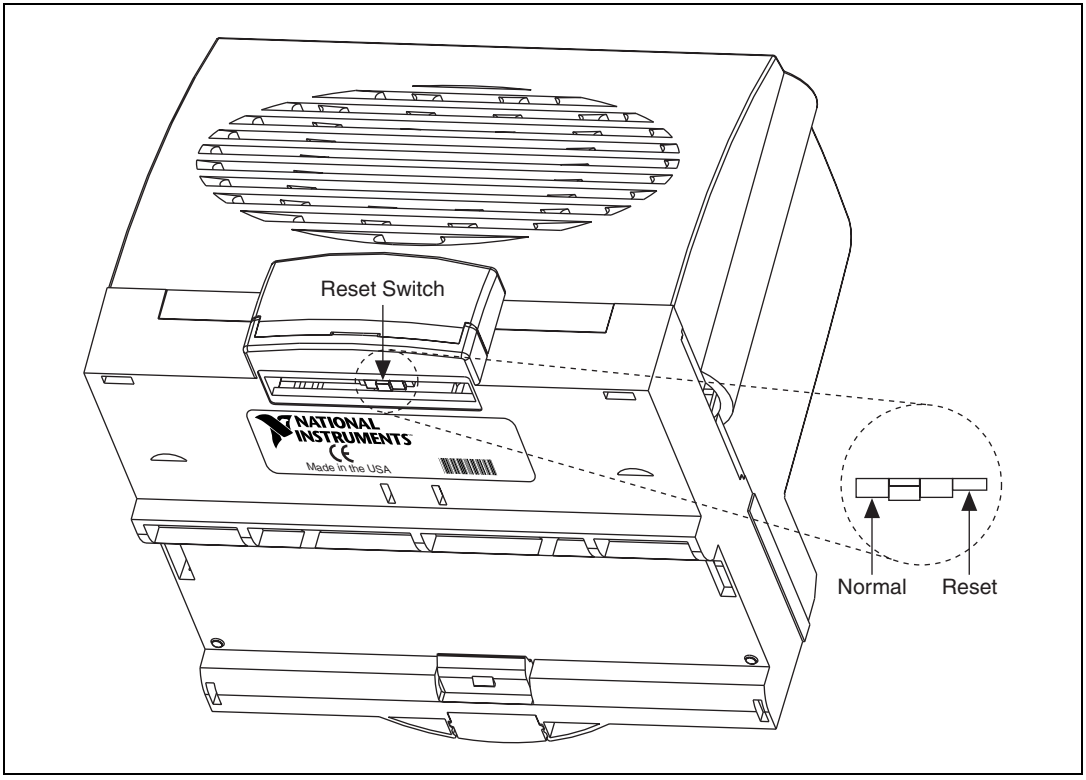


Figure A-1. FBUS-HSE/H1 LD Reset Switch

3. Looking at the FBUS-HSE/H1 LD so that the label is upright, as shown in Figure A-1, use a pen or a small screwdriver to move the Reset switch to the right.
4. Power up the FBUS-HSE/H1 LD and wait for the red **STATUS** LED to flash. When the LED flashes, the FBUS-HSE/H1 LD is in Reset mode.
5. Power down the FBUS-HSE/H1 LD and move the Reset switch back to the left.
6. Reattach the FBUS-HSE/H1 LD to the rail or panel.
7. Power up the FBUS-HSE/H1 LD.

Note There are three switches on the FBUS-HSE/H1 LD. The Reset switch is at the right in Figure A-1. The other two switches are reserved for future use. You should *not* change the Reset Switch unless you want to reset the device.

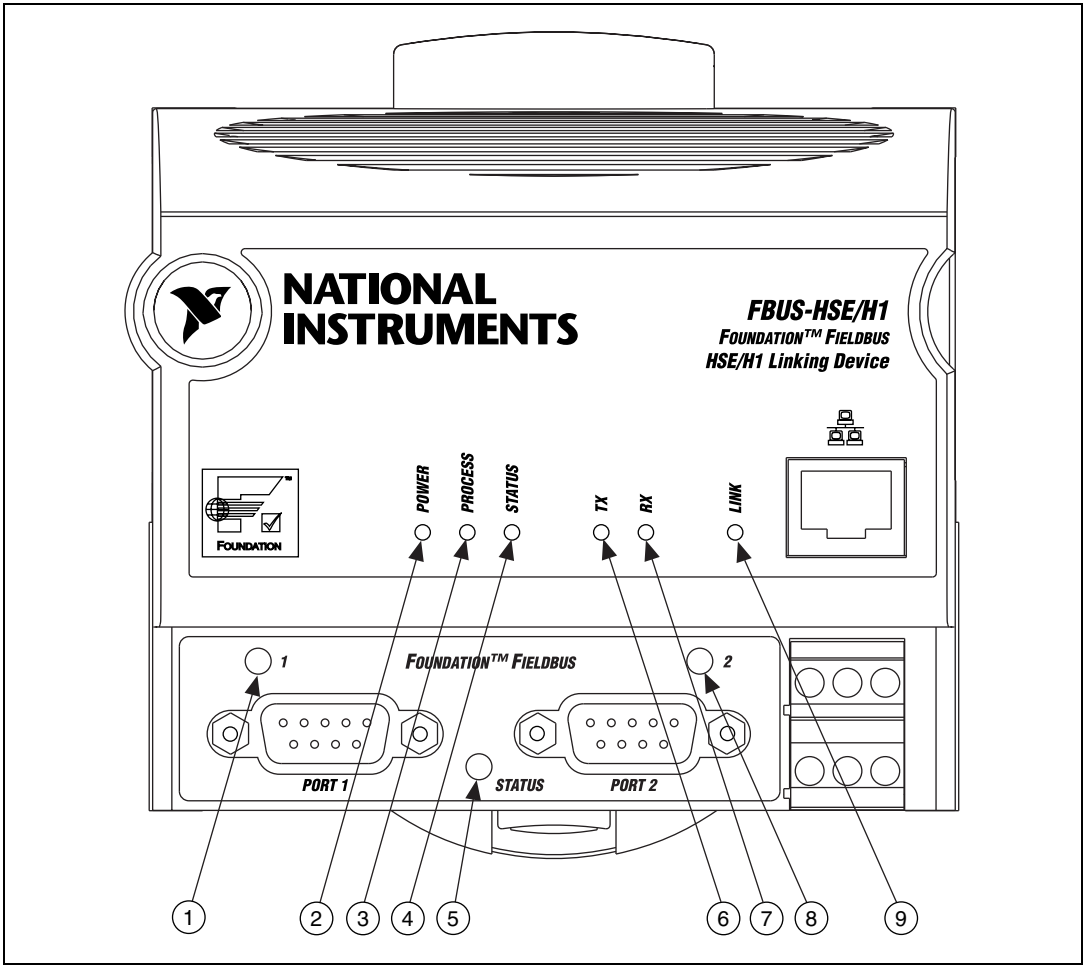
B

Troubleshooting

LED Indicators

Hardware

The FBUS-HSE/H1 LD has seven LED indicators on the top panel and three LEDs on the front panel, as shown in Figure B-1.



1	H1 Port1 Network Status	4	Ethernet Status	7	RX
2	Power	5	Module Status	8	H1 Port 2 Network Status
3	Process	6	TX	9	Link

Figure B-1. LEDs on the FBUS-HSE/H1 LD

Ethernet LEDs

The six Ethernet LEDs are located on the top panel.

The green **POWER** LED is lit while the FBUS-HSE/H1 LD is powered up. This LED indicates that the power supply connected to the FBUS-HSE/H1 LD is acceptable.

Caution Do *not* power down the FBUS-HSE/H1 LD while the **PROCESS** LED is lit.

The green **PROCESS** LED is lit when you update the nonvolatile flash memory of the FBUS-HSE/H1 LD. If you want to change network settings, save channel settings or power-up values, or upgrade its firmware, you need to update the nonvolatile flash memory.

The red Ethernet **STATUS** LED is lit when the FBUS-HSE/H1 LD detects an error. The FBUS-HSE/H1 LD indicates specific error conditions by flashing **STATUS** LED a specific number of times. Table B-1 describes the **STATUS** LED flashing sequences and the corresponding error conditions.

The green **TX** LED is lit when the FBUS-HSE/H1 LD transmits data over the Ethernet.

The green **RX** LED is lit when the FBUS-HSE/H1 LD receives data from the Ethernet. Because of unrelated network traffic, this LED blinks occasionally even when the FBUS-HSE/H1 LD is inactive.

The green **LINK** LED is lit when the FBUS-HSE/H1 LD is connected to an active Ethernet segment.

Table B-1. Ethernet STATUS LED Flashes and Corresponding Error Conditions

Number of Flashes	Error Condition
0 (stays lit)	The FBUS-HSE/H1 LD has not been configured with a proper IP address.
1	The FBUS-HSE/H1 LD is in Reset mode. Switch the FBUS-HSE/H1 LD back to Normal mode by powering down the device and sliding the switch underneath the module.
2	The FBUS-HSE/H1 LD has detected an error in its firmware. This usually occurs when an attempt to upgrade the firmware is interrupted. Repeat the firmware upgrade process.
3	The FBUS-HSE/H1 LD cannot communicate with the NIFBUS. Be sure that the NIFBUS is running on the computer that you specified when you configured the FBUS-HSE/H1 LD.
4 (or more)	The FBUS-HSE/H1 LD has detected an unrecoverable error. Contact National Instruments for more information of finding the cause of this error.

Module STATUS LED

The module **STATUS** LED is located on the front of the linking device, between the two Fieldbus (H1 Network) connectors, as shown in Figure B-1. It indicates whether the linking device is powered, configured, and operating properly. Table B-2 shows how to interpret the **STATUS** LED states.

Table B-2. Interpretation of FBUS-HSE/H1 LD Module STATUS LED

LED State	Meaning
Off	No power to linking device
Flashing red and green	The FBUS-HSE/H1 LD self-testing
Flashing green	Standby state
Solid green	Operational state

Table B-2. Interpretation of FBUS-HSE/H1 LD Module STATUS LED (Continued)

LED State	Meaning
Flashing red	Major recoverable fault
Solid red	Major unrecoverable fault

Standby state indicates the linking device has passed all self tests and is ready to operate. However, it is not functioning because no active Ethernet segment is configured.

Operational state indicates the linking device has left standby state because the necessary network configuration (if any) has occurred.

H1 Network Status LEDs

Each Fieldbus (H1 Network) port on the linking device has an LED to indicate the functional states of the port. Table B-3 describes each state.

Table B-3. Description of Fieldbus Network Status LED States

LED State	Meaning
Off	Fieldbus port is not receiving packets.
Steady green	Fieldbus port is alive as Link Active Scheduler.
Flashing green	Fieldbus port is not alive as Link Active Scheduler.
Flashing red and green	Fieldbus port is seeing traffic, but is at a default or visitor address.
Flashing red	Fieldbus port encountered a transient, nonfatal network error.
Steady red	Fieldbus port encountered fatal network error.

C

Specifications

This appendix describes the specifications of the FBUS-HSE/H1 LD.

Network

Network interface ..... 10BaseT and 100BaseTX Ethernet

Device interface ..... Foundation Fieldbus H1

Compatibility ..... High Speed Ethernet

Communication rates ..... 10 Mbps, autonegotiated for HSE, 31.25 Kbps for H1

Cabling distance ..... 100 m for HSE

Power supply range ..... 11 to 30 VDC

Power consumption ..... 8 W

Maximum number of devices per H1 Fieldbus link (without repeaters) 32

Operating Environment

Ambient temperature ..... 0 to +55 °C

Relative humidity ..... 10 to 90% noncondensing

Storage Environment

Ambient temperature ..... –55 to +85 °C

Relative humidity ..... 5 to 95% noncondensing

Mechanical Dimensions

Dimensions ..... 10.6 × 10.9 × 9.1 cm (4.2 × 4.3 × 3.6 in.)

Safety

This product is designed to meet the requirements of the following standards for safety and electrical equipment for measurement, control, and laboratory use:

- IEC 60950, EN 60950
- UL 1950, UL 60950
- CAN/CSA C22.2 No. 60950

Note For UL and other safety certifications, refer to the product label or to `ni.com`.

Electromagnetic Compatibility

Emissions.....EN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

Immunity .....EN 61326-1:1997/ +A2:2001, Table 1

CE, C-Tick and FCC Part 15 (Class A) Compliant

Note For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety).....73/23/EEC

Electromagnetic Compatibility
Directive (EMC).....89/336/EEC

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, click **Declarations of Conformity Information** at `ni.com/hardref.nsf/`.

D

Technical Support and Professional Services

Visit the following sections of the National Instruments Web site at ni.com for technical support and professional services:

- **Support**—Online technical support resources include the following:
  - **Self-Help Resources**—For immediate answers and solutions, visit our extensive library of technical support resources available in English, Japanese, and Spanish at ni.com/support. These resources are available for most products at no cost to registered users and include software drivers and updates, a KnowledgeBase, product manuals, step-by-step troubleshooting wizards, conformity documentation, example code, tutorials and application notes, instrument drivers, discussion forums, a measurement glossary, and so on.
  - **Assisted Support Options**—Contact NI engineers and other measurement and automation professionals by visiting ni.com/support. Our online system helps you define your question and connects you to the experts by phone, discussion forum, or email.
- **Training**—Visit ni.com/training for self-paced tutorials, videos, and interactive CDs. You also can register for instructor-led, hands-on courses at locations around the world.
- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, NI Alliance Program members can help. To learn more, call your local NI office or visit ni.com/alliance.
- **Declaration of Conformity (DoC)**—A DoC is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electronic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/hardref.nsf.

- **Calibration Certificate**—If your product supports calibration, you can obtain the calibration certificate for your product at `ni.com/calibration`.

If you searched `ni.com` and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Glossary

Symbol	Prefix	Value
m	milli	10^{-3}
k	kilo	10^{3}
M	mega	10^{6}

A

A — Amperes.

A/D — Analog-to-digital converter Alarm. A notification the NI-FBUS Communications Manager software sends when it detects that a block leaves or returns to a particular state.

address character — Code that identifies a specific location (or series of locations) in memory.

administrative function — NI-FBUS function that deals with administrative tasks, such as returning descriptors and closing descriptors.

analog — A description of a continuously variable signal or a circuit or device designed to handle such signals.

AO — Analog output.

B

bandwidth — The range of frequencies present in a signal, or the range of frequencies to which a measuring device can respond.

bank — The combination of one FieldPoint network module and one or more terminal bases and I/O modules.

basic device — A device that can communicate on the Fieldbus, but cannot become the LAS.

bit string — A data type in the object description.

Boolean	Logical relational system having two values, each the opposite of the other, such as true and false or zero and one.
bps	Bits per second.
buffer	Temporary storage for acquired or generated data.
bus	The group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected. Examples of PC busses are the ISA and PCI buses.

C

C	Celsius.
cable	A number of wires and shield in a single sheath.
channel	A pin or wire lead to which you apply or from which you read the analog or digital signal.
circuit	Interconnection of components to provide an electrical path between two or more components.
CISPR	International Special Committee On Radio Interference.
control loop	A set of connections between blocks used to perform a control algorithm.
controller	An intelligent device, usually involving a CPU, that is capable of controlling other devices.
current	The flow of electrons through a conductor.

D

DC	Direct current.
descriptor	A number returned to the application by the NI-FBUS Communications Manager, used to specify a target for future NI-FBUS calls.
device	A sensor, actuator, or control equipment attached to the Fieldbus.
device ID	An identifier for a device that the manufacturer assigns. No two devices can have the same device ID.

device tag	A name you assign to a Fieldbus device.
DI	Discrete input.
digital	Pertaining to data (signals) in the form of discrete (separate/pulse form) integral values.
directory	A structure for organizing files into convenient groups. A directory is like an address showing where files are located. A directory can contain files or subdirectories of files.
distributed control	Process control distributed among several devices connected by a network.
DO	Discrete output.

E

EMI	Electromagnetic interference.
event	Occurrence on a device that causes a Fieldbus entity to send the Fieldbus event message.

F

FBUS	Fieldbus.
FBUS-HSE/H1 LD	Fieldbus High Speed Ethernet to Foundation H1 Linking Device.
FF	Foundation Fieldbus.
field device	A Fieldbus device connected directly to a Fieldbus.
Fieldbus	An all-digital, two-way communication system that connects control systems to instrumentation. A process-control local area network defined by ISA standard S50.02.
Fieldbus cable	Shielded, twisted pair cable made specifically for Fieldbus that has characteristics for good signal transmission within the requirements of the Fieldbus standard.
Foundation Fieldbus	Organization that developed a Fieldbus network specifically based upon the work and principles of the ISA/IEC standards committees.

Fieldbus network address	Location of a board or device on the Fieldbus; theFieldbus node address.
Foundation Fieldbus specification	Communications network specification created by the Fieldbus Foundation.

G

ground	An intentional or accidental conducting path between an electrical system or circuit and the earth or some conducting body acting in place of the earth. A ground is often used as the common wiring point or reference in a circuit.

H

H1	31.25 kbit/second type of Fieldbus.
HotPnP	Hot Plug and Play.
HSE	High Speed Ethernet.
HSE-LD	High Speed Ethernet linking device.
Hz	Hertz.

I

I/O	Input/output.
IEC	International Electrotechnical Commission. A technical standards committee at the same level of ISO.
ISA	Industry Standard Architecture.
isolation	Type of signal conditioning in which the transducer signals are isolated from the computer for safety purposes. This protects you and your computer from large voltage spikes and makes sure the measurements from the devices are not affected by differences in ground potential.

L

LAS	*See* Link Active Scheduler.
LD	Linking device.
LED	Light-emitting diode.
link	A Foundation Fieldbus network is made up of devices connected by a serial bus. This serial bus is called a link. Also known as a segment.
Link Active Scheduler	Fieldbus device currently controlling access to the Fieldbus. A device that is responsible for keeping a link operational. The LAS executes the link schedule, circulates tokens, distributes time, and probes for new devices.
link master device	A device capable of becoming the LAS.
linkage	A connection between function blocks.
loop	*See* control loop.

M

menu	An area accessible from the command bar that displays a subset of the possible command choices. In the NI-FBUS Configuration, refers to menus defined by the manufacturer for a given block.
method	A method describes operating procedures to guide a user through a sequence of actions.
m	Meter.
mm	Millimeter.
mode	Type of communication.

N

network address	Fieldbus network address of a device.
`nifb.exe`	NIFB process that must be running in the background for you to use your Linking Device to communicate between the board and Fieldbus.

node	Junction or branch point in a circuit.
non-volatile memory	Memory that does not require electricity to hold data.

O

object	An element of an object dictionary.

P

parameter	One of a set of network-visible values that makes up a function block.
PC	Personal computer.
polarity	Term used to describe positive and negative charges.
poll	To repeatedly inspect a variable or function block to acquire data.
port	A communications connection on a computer or remote controller.
POST	Power-on self test.
program	A set of instructions the computer can follow, usually in a binary file format, such as an `.exe` file.

R

RA	Ratio.
repeater	Boost the signals to and from the further link.
resistor	Component made of material that opposes the flow of current and therefore has some value of resistance.

S

s	Seconds.
scheduled communications	Communications that occur at the same time during each control cycle.

sensor	A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.
server	Device that receives a message request.
service	A service allows user applications to send messages to each other across Fieldbus using a standard set of message formats.

T

tag	A name you can define for a block, virtual field device, or device.
terminator	A device used to absorb the signal at the end of a wire.
timeout	A period of time after which an error condition is raised if some event has not occurred.

U

unscheduled	Messages sent on the Fieldbus between transmissions of scheduled messages.
upstream	Fewer network hops away from a backbone or hub. For example, a small ISP connects to the Internet through a larger ISP that has its own connection to the backbone and is downstream from the larger ISP. The larger ISP is considered to be upstream from the smaller ISP.

V

V	Volts.
VDC	Volts direct current.
VFD	*See* virtual field device.
virtual field device	A model for remotely viewing data described in the object dictionary. The services provided by the Fieldbus Messaging Specification allow you to read and write information about the object dictionary, read and write the data variables described in the object dictionary, and perform other activities such as uploading/downloading data and invoking programs inside a device. A model for remotely viewing data is described in the object dictionary.

W

Waveform	Multiple voltage readings taken at a specific sampling rate.

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