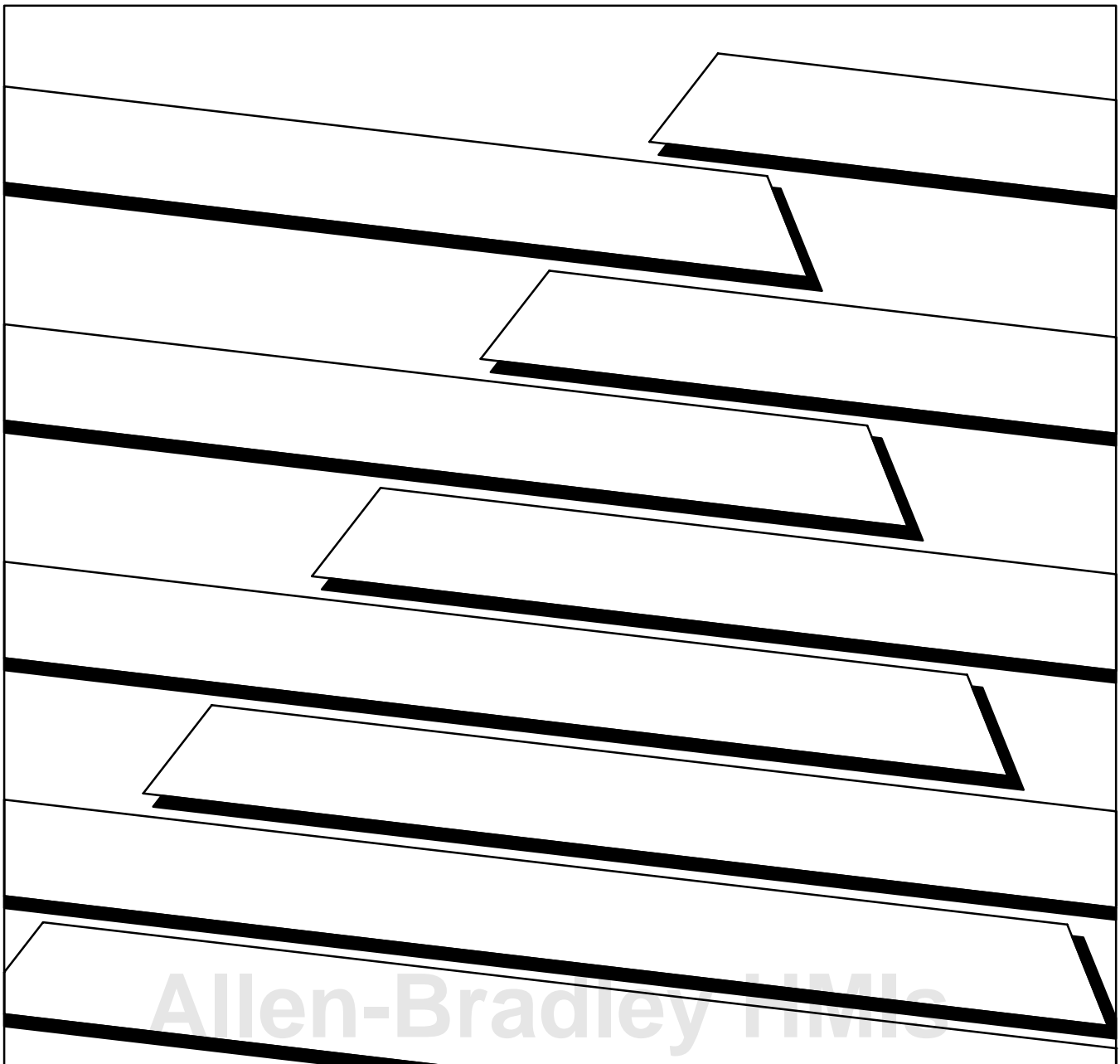




ALLEN-BRADLEY

DH-485
Communication Interface
(Cat. No. 1770-KF3)

User's Manual



Important User Information

Because of the variety of uses for this product and because of the differences between solid state products and electromechanical products, those responsible for applying and using this product must satisfy themselves as to the acceptability of each application and use of this product. For more information, refer to publication SGI-1.1 (Safety Guidelines For The Application, Installation And Maintenance of Solid State Control).

The illustrations, charts, and layout examples shown in this manual are intended solely to illustrate the text of this manual. Because of the many variables and requirements associated with any particular installation, Allen-Bradley Company cannot assume responsibility or liability for actual use based upon the illustrative uses and applications.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits, equipment, or software described in this text.

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Statement of Compliance with Federal Communications Commission

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Statement of Compliance with Canadian Department of Communications

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications. Operation in a residential area may cause unacceptable interference to radio and TV reception requiring the owner or operator to take whatever steps are necessary to correct the interference.

Avis de Conformité aux normes du ministère des Communications du Canada

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada. L'exploitation faite en milieu résidentiel peut entraîner le brouillage des réceptions radio et télé, ce qui obligerait le propriétaire ou l'opérateur à prendre les dispositions nécessaires pour en éliminer les causes.

Warning and Caution Symbols

Throughout this manual, we make notes to alert you to possible injury to people or damage to equipment under specific circumstances.



WARNING: Tells readers where people may be harmed if procedures are not followed properly.



CAUTION: Tells readers where machinery may be damaged or economic loss can occur if procedures are not followed properly.

Warnings and Cautions:

- identify a possible trouble spot
- tell what causes the trouble
- give the result of improper action
- tell the reader how to avoid trouble



WARNING: No user serviceable parts or adjustments inside module. Refer servicing to qualified personnel.

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Manual Overview

This manual:

- describes the features and capabilities of the 1770-KF3
- tells you how to install, configure, and operate your 1770-KF3
- gives troubleshooting tips on diagnosing problems
- defines the specifications of the 1770-KF3

Audience

Read this manual if you are installing and configuring a 1770-KF3 Interface Module for use with a DH-485 network.

You should be familiar with:

- Allen-Bradley SLC 500 series of programmable controllers
- Allen-Bradley DH-485 networks

Related Publications

Publication	Publication Number
Data Highway/Data Highway Plus/DH-485 Protocol and Command Set Manual	1770-6.5.16
SLC 500 Advanced Programming Software Manual	1747-801
PC/DH-485 Interface Module Installation Data	1784-2.23
Allen-Bradley Standard Driver Software User's Manual (6001-F2E)	6001-6.5.5
Bulletin 2755 Bar Code Decoder User's Manual	2755-816

Related Products

Product	Catalog Number
Advanced Programming Software	1747-PA2E
PC/DH-485 Interface Module	1784-KR
Allen-Bradley Standard Driver Software	6001-F2E
Bar Code Decoder	2755-DM6
SLC 500 RS-485 Link Coupler	1747-AIC

Product Overview

The DH-485 Communication Interface

The DH-485 Communication Interface module links host computers with the Allen-Bradley RS-485 Data Highway (DH-485). The module supports the protocol required to act as a node on the DH-485 network, freeing the host computer from this task.

Figure 1.1
The DH-485 Communication Interface (1770-KF3)



Important: The DH-485 Communication Interface module (cat. no. 1770-KF3) will be referred to as “the KF3” or “the module” throughout the remainder of this manual.

The host computer communicates with the KF3 over an RS-232C link using full-duplex or half-duplex DF1 protocol. Through the KF3, the host computer can communicate with nodes on the DH-485 network.

The DH-485 Network

The DH-485 communication network allows devices on the plant floor to share information. Via the network, application programs can:

- monitor process and device parameters and status, including fault and alarm detection
- perform data acquisition
- perform supervisory control functions
- upload/download PLC programs over the network

The DH-485 network offers:

- interconnection of up to 32 nodes
- multi-master capability
- slave devices
- token-passing access control
- the ability to add or remove nodes without disruption of the network
- maximum cable length of 4,000 feet
- data rates up to 19,200 baud

The RS-232C/DF1 Data Link

The RS-232C/DF1 data link features:

- full- or half-duplex DF1 protocol
- data rate up to 19,200 baud
- cable length up to 50 feet
- point-to-point modem connection
- Block Check Character (BCC) or Cyclic Redundancy Check (CRC16) error detection

The DF1 Protocol

DF1 is a full- or half-duplex link protocol designed to carry messages intact over a link. The link protocol delimits messages, detects and signals errors, retries after errors and controls message flow.

Full-duplex protocol is intended for high performance applications where maximum throughput is required. Full-duplex protocol only works on a point-to-point link that allows for two-way simultaneous transmission.

Half-duplex protocol provides a less effective utilization of resources than full-duplex, but is easier to implement. It can operate on point-to-point or multi-point applications.

Table 1.A
Protocol Applications

Protocol	Point-to-Point	Multi-Point
Full-duplex	Yes	No
Half-duplex	Yes	No

A description of these protocols is given in the *Data Highway/Data Highway Plus/DH-485 Protocol and Command Set Manual* (publication 1770-6.5.16).

Installing the KF3

Installation Procedures

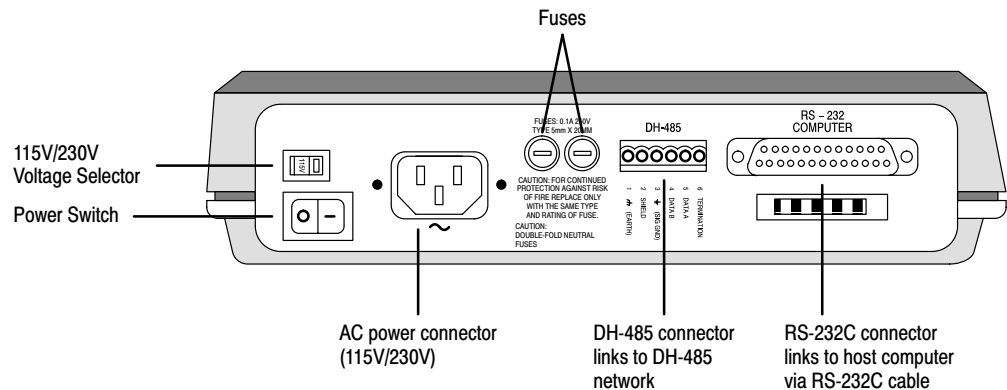
To install the KF3, follow these steps:

1. Define your network needs.
2. Construct the necessary cables.
3. Ground and terminate your network correctly.
4. Determine the correct voltage for your application and set the KF3's voltage selector. Change power cord if necessary.
5. Check the KF3's default configuration parameters and change those which are not suitable for your application.

Interface Connections

Figure 2.1 shows the back panel of the KF3, including its two communication connectors. The connector labelled **RS-232 Computer** connects to the host computer via an RS-232C cable. The connector labelled **DH-485** connects to the DH-485 network.

Figure 2.1
KF3 Back Panel



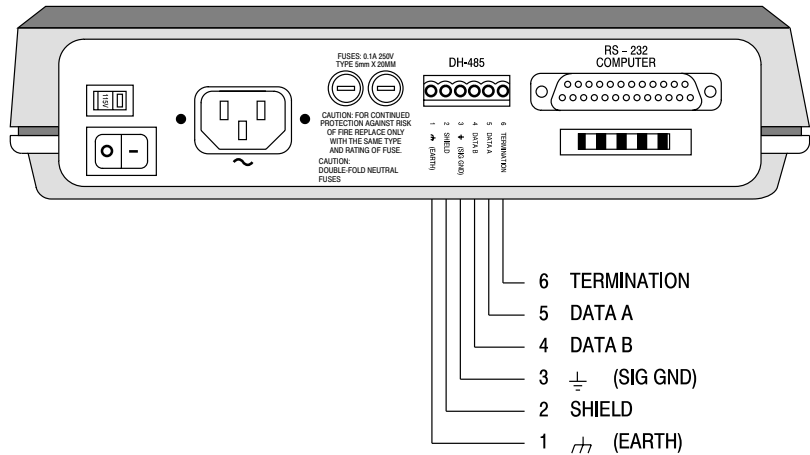
DH-485 Cabling Considerations

Depending on your application, you can use the KF3 module to communicate with a single station via a point-to-point link, or with multiple DH-485 stations (for example, the SLC 500 family of programmable controllers), via the DH-485 network.

You must construct the necessary cable or cables for each application. Use a jacketed and shielded cable with two twisted wire pairs and a drain wire. One pair provides a balanced signal line; one wire of the other pair serves as a common signal reference for all nodes on the link. The shield reduces the effect of electromagnetic noise from the industrial environment. Belden #9842 cable is recommended.

The pinouts for the KF3's DH-485 connector are shown in Figure 2.2.

Figure 2.2
KF3 Pinouts

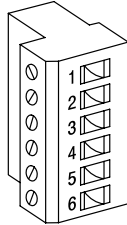


Grounding and Terminating the Network

The precise configuration of the cable connectors is determined by their position on the network.

Connections between intermediate nodes (nodes that are not at either end of the network) require no jumpers. Table 2.A shows the wire and terminal connections for a cable linking any two intermediate nodes.

Table 2.A
Wire/Terminal Connections for Intermediate Nodes



For this Wire/Pair	Connect this Wire	To this Terminal
Shield/Drain	Non-jacketed	Terminal 2 - Shield
Black/White	Black Wire White Wire	Cut back - No connection Terminal 3 (Signal Ground)
Black/Red	Black Wire Red Wire	Terminal 4 (Data A) Terminal 5 (Data B)

The nodes at *each end* of the network must be terminated. Install a jumper wire between terminals 5 and 6 to enable the impedance built into the module.

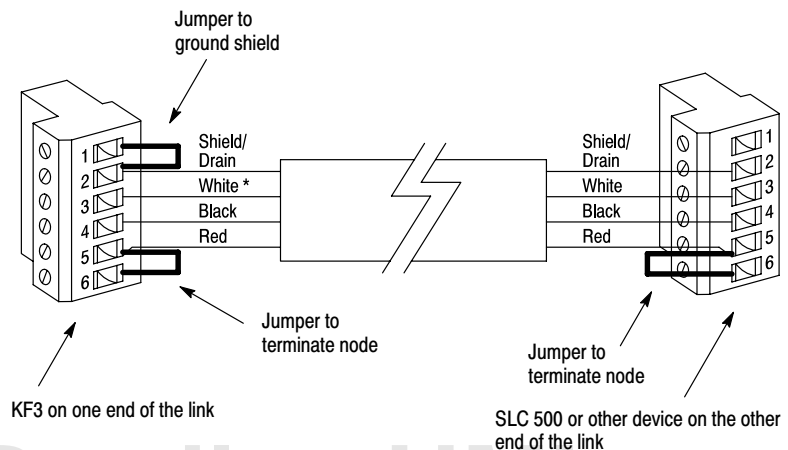
One (*not both*) of the nodes at the end of the network must have an earth ground connection for the communication cable shield. For the node at one end of the network, whether it is the KF3 or some other device, connect the shield to ground by installing a jumper wire between terminals 1 and 2 of the terminal block.



CAUTION: Be sure no other node on the network has its shield connected to ground.

Figure 2.3 illustrates proper jumper connections for end nodes.

Figure 2.3
Jumper Connections for End Nodes

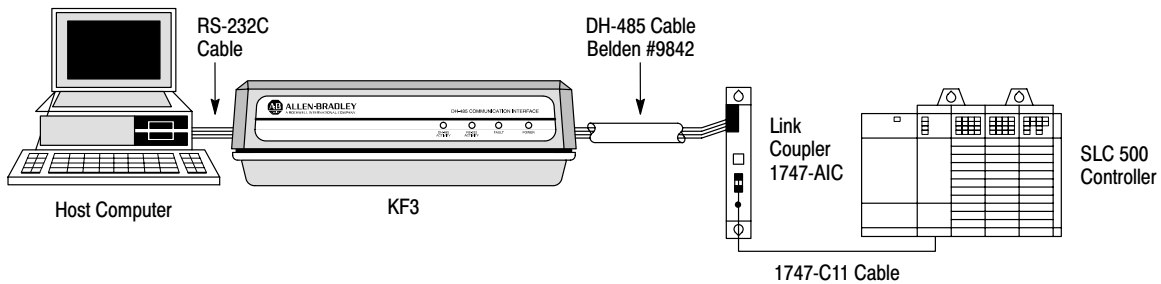


* The black wire of the white/black pair should be cut back (no connection).

Connecting via a DH-485 Link (Point-to-Point Configuration)

Figure 2.4 shows a point-to-point link consisting of a single SLC 500 programmable controller and one host computer station.

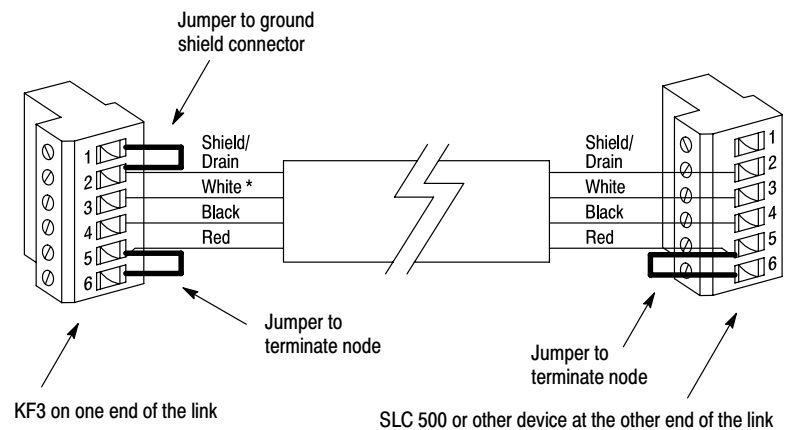
Figure 2.4
A Point-to-Point DH-485 Link



This configuration requires a KF3 and one link coupler. The SLC 500 controller is connected to the link coupler with a 1747-C11 cable. The KF3 is connected directly to the link coupler. In this topology, both the KF3 and the SLC 500 are end nodes.

Construct a cable to attach the DH-485 connector on the back of the KF3 module to the link coupler. Figure 2.5 shows the connection for a point-to-point DH-485 application. The shield ground could be at either end, but must be at one end, and one end only.

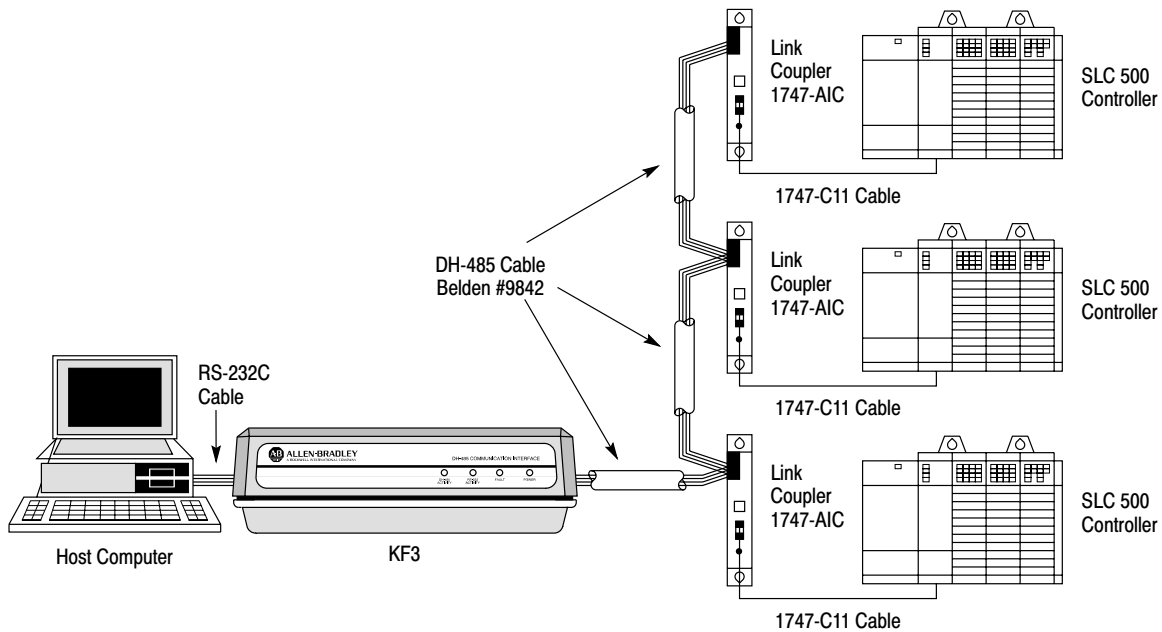
Figure 2.5
Connection for KF3 and Single SLC



Connecting to a DH-485 Network (Multi-Point Configuration)

Figure 2.6 shows a network consisting of three SLC 500 programmable controllers and one host computer station.

Figure 2.6
Connecting to Multiple SLC 500s via the DH-485 Network

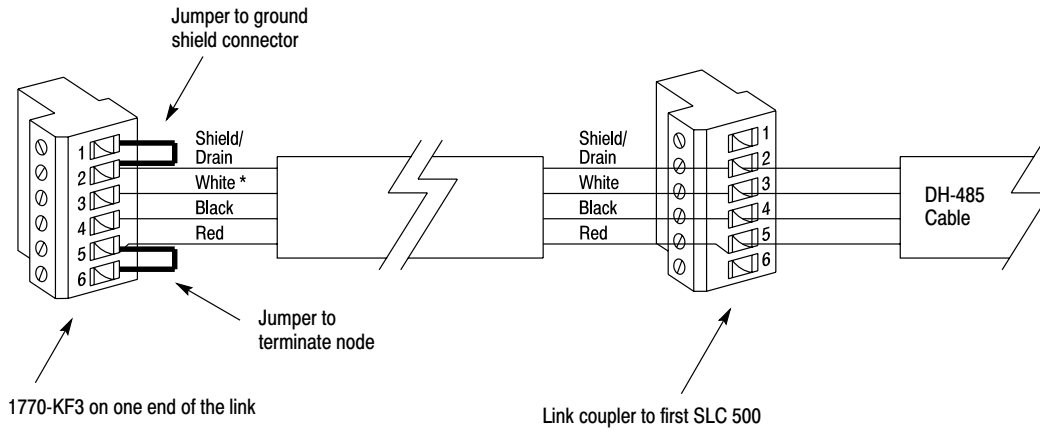


This configuration requires the KF3 and three link couplers:

- one SLC 500 family controller is connected to each of the link couplers with a 1747-C11 cable
- the KF3 is connected to the network at one of the link couplers
- the DH-485 cable consists of three segments of cable daisy-chained to the link couplers and the KF3

The connection between the first node (the KF3) and the link coupler to the second node is shown in Figure 2.7.

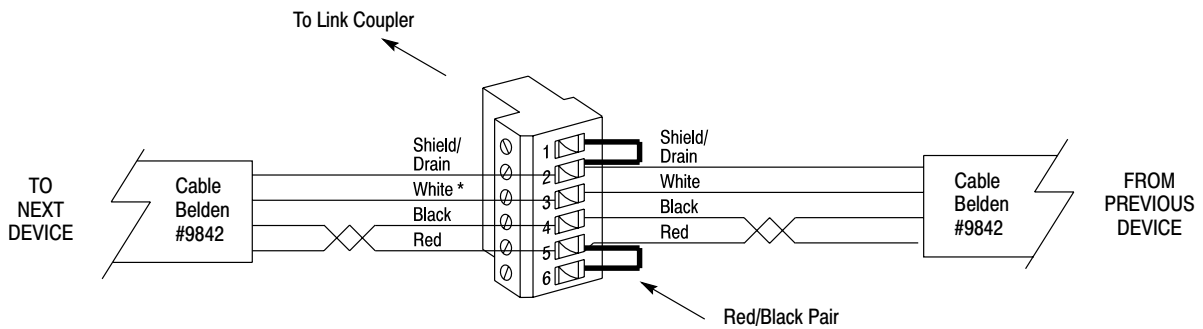
Figure 2.7
Connection for First Segment of a Multidrop Network



* The black wire of the white/black pair should be cut back (no connection).

The cable connecting the second and third nodes of the multidrop network (neither of which is an end station) is shown in Figure 2.8.

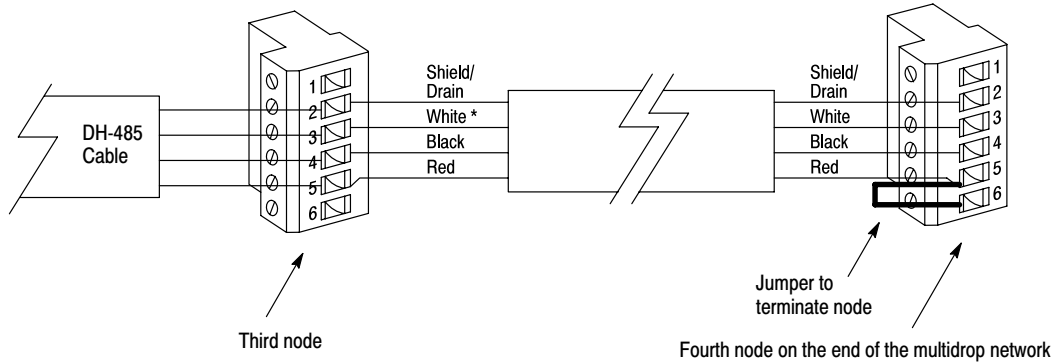
Figure 2.8
Connection Between Two Intermediate Nodes



* The black wire of the white/black pair should be cut back (no connection).

The connection between the third and fourth (end) node is shown in Figure 2.9.

Figure 2.9
Connection for Last Segment of a Multidrop Network

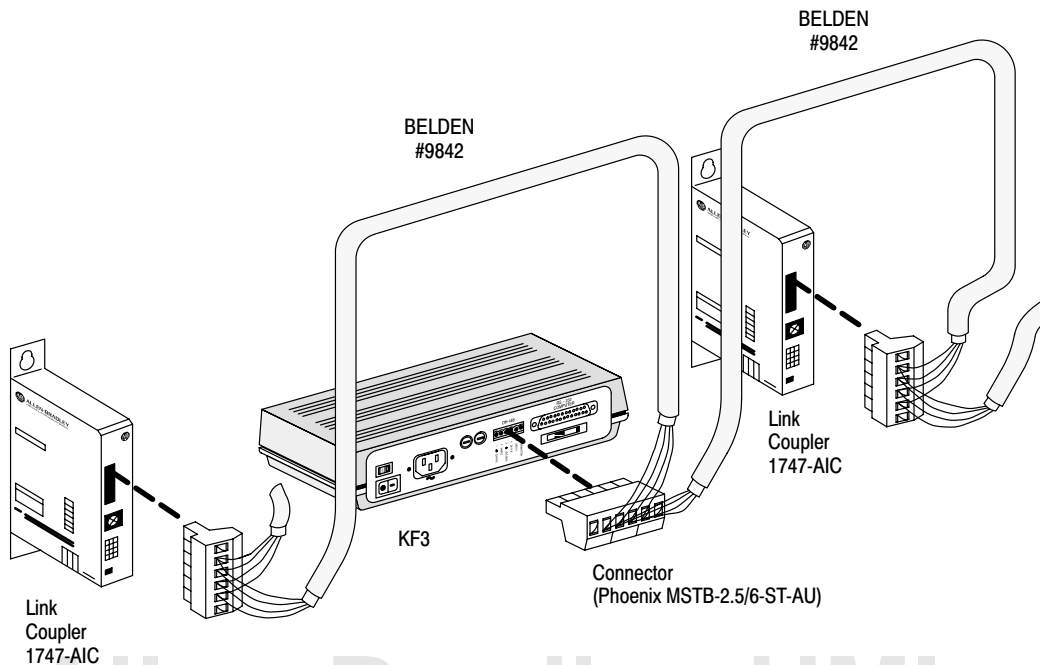


* The black wire of the white/black pair should be cut back (no connection).

Installing the DH-485 Cable

The DH-485 cable consists of a number of daisy-chained segments. The total length of the combined segments must not exceed 4,000 feet. Cut the cable segments long enough to route from one node to the next, allowing sufficient slack to prevent strain on the connectors. Provide strain relief for the cable after it is plugged in to prevent the cable wires from breaking.

Figure 2.10
Cable Connection on a DH-485 Link



RS-232C Cabling Considerations

Cabling for the RS-232C connector of the KF3 will vary depending on your application. The pinouts for this connector are given in Table 2.B.

Table 2.B
RS-232C Connector Pinouts

Signal	Abbreviation	Direction	Pin No.	Meaning
Chassis Ground	-	-	1	The cable shield must be connected to chassis ground at one end only.
Transmit Data	TXD	Output	2	RS-232C serialized data output from the module.
Receive Data	RXD	Input	3	RS-232C serialized data input to the module.
Request to Send	RTS	Output	4	A request from the module to the modem to prepare to transmit. With full-duplex protocol, RTS is always asserted. With half-duplex protocol, it is turned on when the module has permission to transmit, otherwise it is off.
Clear to Send	CTS	Input	5	A signal from the modem to the module that indicates the carrier is stable and the modem is ready to transmit. The module will not transmit until CTS is on. If CTS is turned off during transmission, the module will stop transmitting until CTS is restored.
Data Set Ready	DSR	Input	6	A signal from the modem to the module that indicates the phone is off-hook. It is the modem's answer to DTR. The module will not transmit or receive unless DSR is on. If the modem does not control DSR properly, DSR must be jumpered to a high signal at the module. (It can be jumpered to DTR.)
Signal Ground	GND	-	7	Signal ground - a reference point for the data signals.
Data Carrier Detect	DCD	Input	8	A signal from the modem to the module to indicate that the carrier from another modem is being sensed on the phone line. It will not be asserted unless the phone is off-hook. Data will not be received by the KF3 unless DCD is on. With full-duplex protocol, the module will not transmit unless DCD is on. If the modem does not control DCD properly, DCD must be jumpered to DTR at the module.
Data Terminal Ready	DTR	Output	20	A signal from the module to the modem to connect to the phone line (i.e., "pick up the phone"). The module will assert DTR all the time except during the phone hang-up sequence. Modems built to North American standards will not respond to DTR until the phone rings. The KF3 module will not work correctly with modems which always pick up the phone upon receiving DTR, whether the phone is ringing or not.

Use Belden #8723 (or equivalent) cable to construct a cable to connect the KF3 to a computer.

Important: The length must not exceed 50 feet, and the cable shield must be connected to chassis ground (using Pin 1) at the KF3 end only.

There are various cabling options depending on whether or not your application makes use of handshake signals, whether or not you are connecting to a 9-pin serial port for an IBM AT, and whether or not your computer uses standard IBM pinouts. Figures 2.11 through 2.16 are for IBM computers with either 9- or 25-pin connectors. If your computer has a different pinout, construct a cable using the appropriate signal names for your computer.

If you are not using handshake signals, use the three wire connections shown in Figures 2.11 or 2.12.

Figure 2.11
Three-Wire Connection to IBM Computer (25 pin)

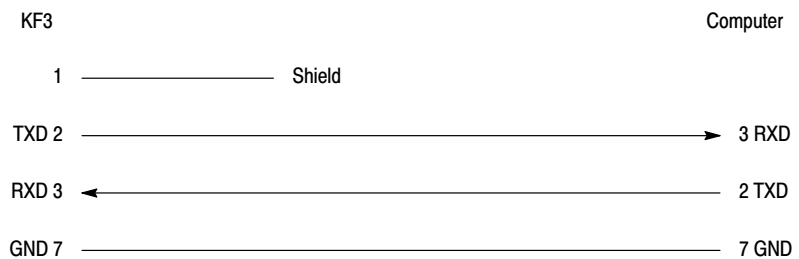
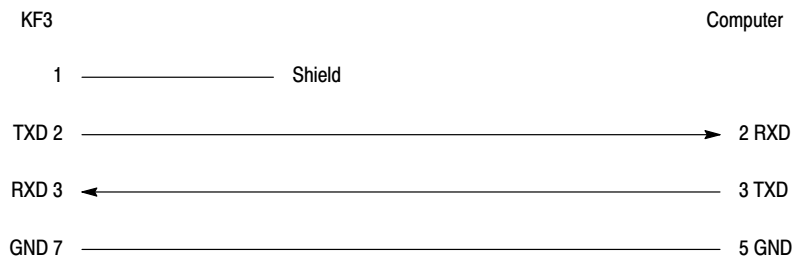


Figure 2.12
Three-Wire Connection to IBM Computer (9 pin)



If your computer requires active DSR and CTS signals, add jumpers to the computer connections as shown in Figures 2.13 and 2.14.

Figure 2.13
Jumper Positions for DSR and CTS Lines (25 pin)

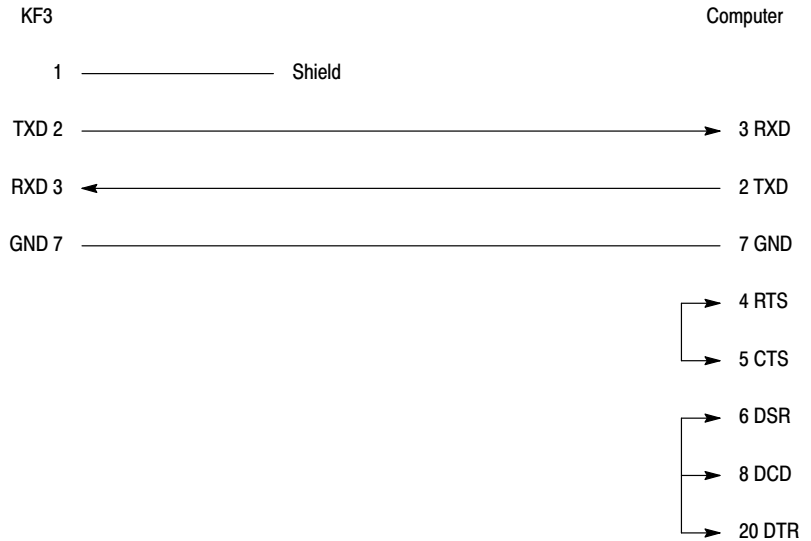
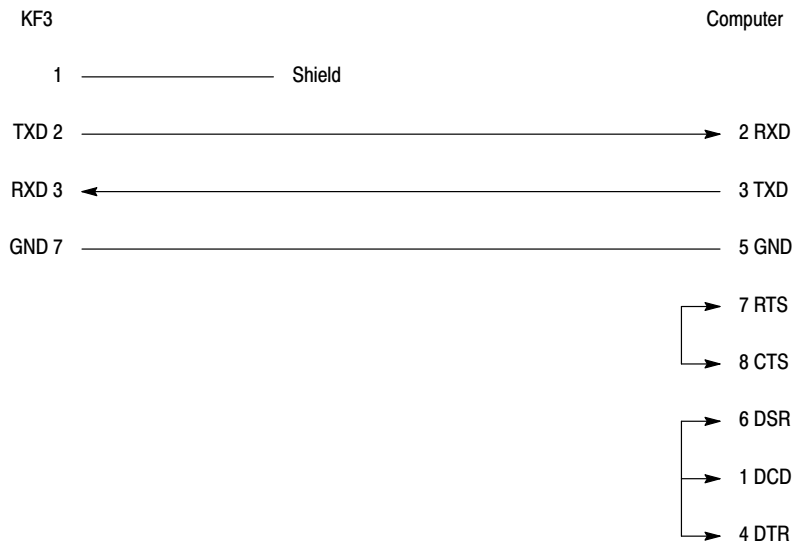


Figure 2.14
Jumper Positions for DSR and CTS Lines (9 pin)



If you are using handshake signals with your computer, use the connection shown in Figure 2.15 or 2.16.

Figure 2.15
Connection to IBM Computer with Handshake Signals (25 pin)

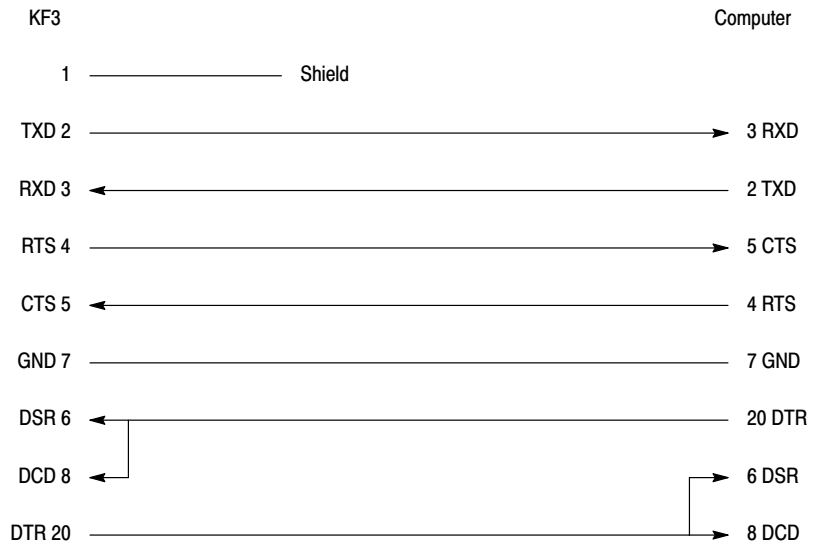
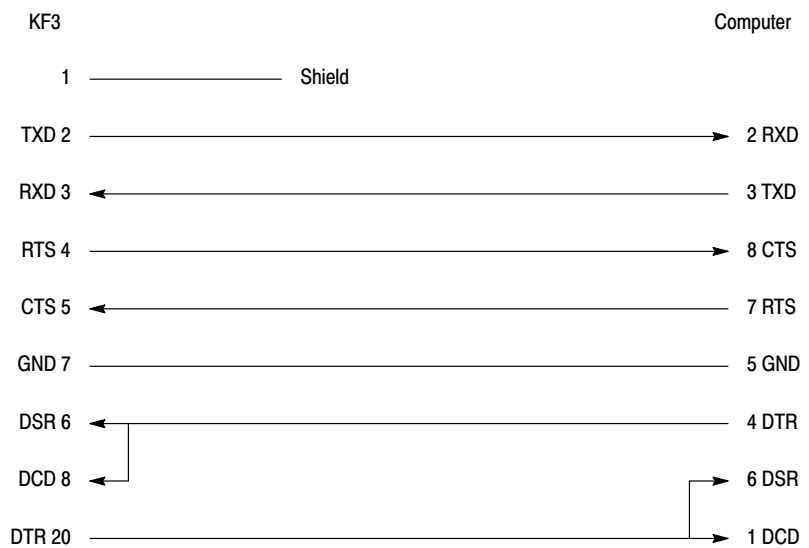


Figure 2.16
Connection to IBM Computer with Handshake Signals (9 pin)

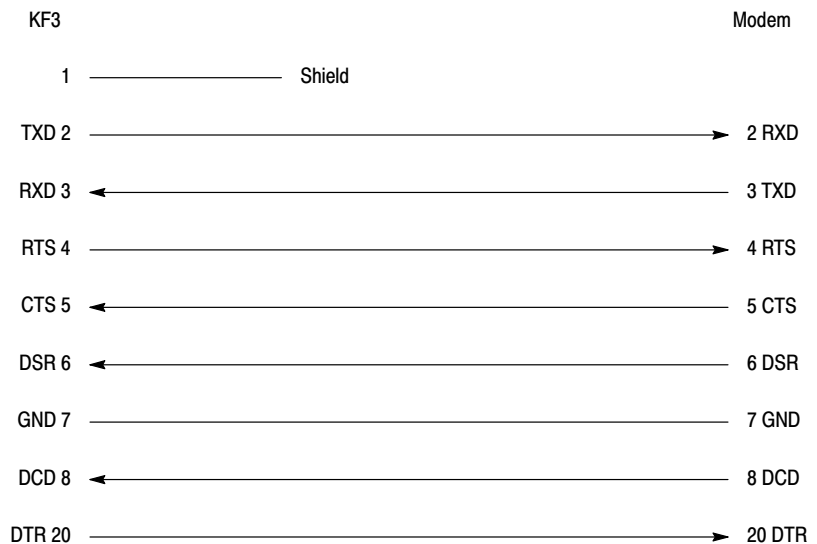


Modem Cabling Considerations

The KF3 is connected to a modem via a direct 25-pin-to-25-pin cable, which you must construct using Belden #8723 (or equivalent) cable.

Important: The length must not exceed 50 feet, and the cable shield must be connected to chassis ground (using Pin 1) at the KF3 end only.

Figure 2.17
Connection between a KF3 and a Modem



The KF3 can be connected to standard asynchronous dial-up modems.

Important: Some modems are designed to respond to the DTR signal by answering the phone whether it is ringing or not. Since the KF3 asserts DTR at all times except during the hang-up sequence, the phone would always appear to be “busy.” Do not use the KF3 with any type of modem that answers the phone as soon as DTR is asserted.

The types of dial-up network modems that you can use are:

- **Manual:** These are typically acoustically coupled modems. The connection is established by human operators at both ends, who insert the handsets into couplers to complete the connection.
- **DTE Controlled Answer:** These unattended modems are directly connected to the phone lines. The KF3 serves as the data terminal equipment to control the modem via the DTR, DSR, and DCD signals. The module incorporates timeouts and tests to properly operate these types of modems.

- **Auto-Answer:** These modems have self-contained timeouts and tests, and can answer and hang up the phone automatically.

The module has no means of controlling an auto-dial modem, but it can be used in conjunction with a separate auto-dialer.

Voltage Selection



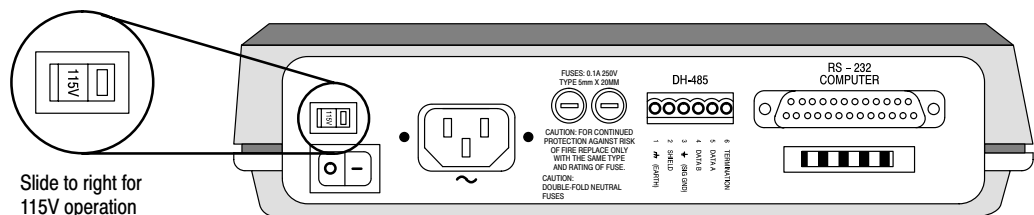
CAUTION: The KF3 must be set to the correct voltage before it is powered up. Connecting to 115V power with the switch set to 230V will result in erratic operation. Connecting to 230V power with the switch set to 115V can damage the module.

The power select switch is located on the back panel. The switch is set at the factory for 115V operation.

115V Operation

Ensure the switch is set to “115V” as shown in Figure 2.18. Plug the power cord supplied with the KF3 into the connector on the back panel, and plug the other end into any standard 115V AC outlet.

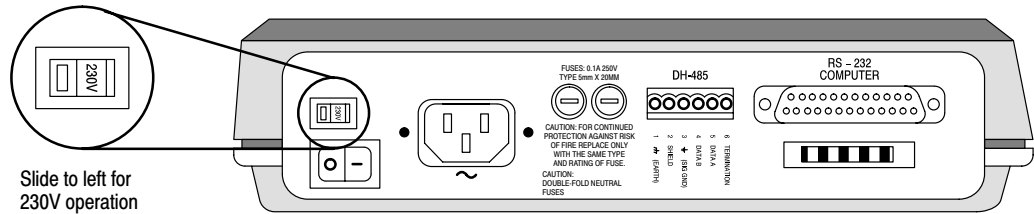
Figure 2.18
Power Select Switch Set for 115V Operation



230V Operation

Set the power select switch to “230V” as shown in Figure 2.19.

Figure 2.19
Power Select Switch Set for 230V Operation



CAUTION: The power cord supplied is approved for 115V operation only. To guard against electrical shock or fire, you must replace the cord with one approved for 230V AC by a recognized agency such as Underwriters Laboratories. To match the KF3 receptacle, the 230V power cord must be terminated with a molded female connector (IEC 320/CEE22).

Replacing Fuses



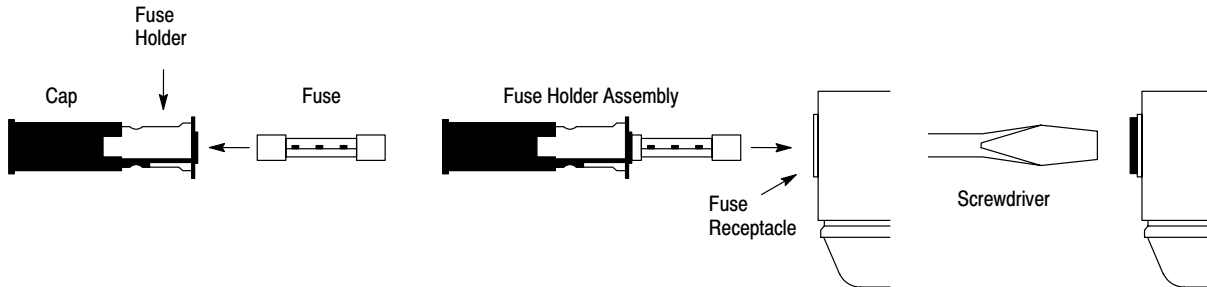
CAUTION: Before replacing fuses, unplug the module’s power cord.

To replace fuses, insert the fuse into the fuse holder in the cap first. Then insert the combined assembly into the fuse receptacle and tighten with a screwdriver.



CAUTION: If you first put the fuse into the receptacle and then attempt to tighten the cap, damage or breakage may result.

Figure 2.20
Replacing Fuses



Positioning the KF3

The KF3 is intended to sit on a flat surface, such as a desk top or shelf. It has been designed for operation in both control room and plant floor environments.

Where you place the KF3 is determined largely by the 50-foot RS-232 cable length restrictions, and by access to an AC power outlet.

Configuring the KF3

Configuration

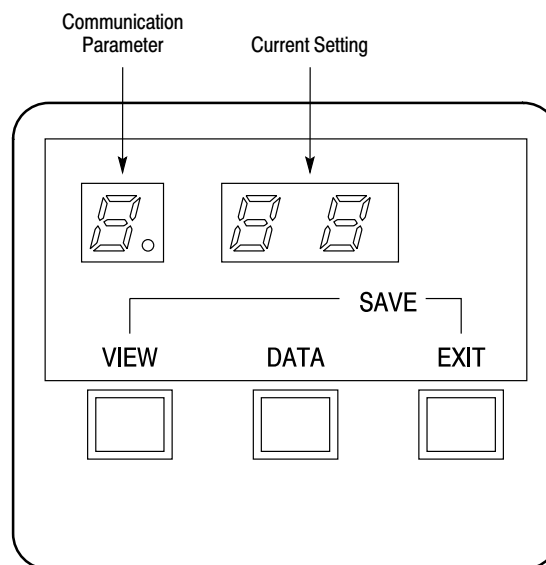
You configure the KF3's communication parameters using the push buttons and displays located on the bottom of the module. The module saves them in nonvolatile memory. Factory default settings (shown in Table 3.B) should be adequate for most industrial usages.

Important: Verify that all parameter settings are correct for your purposes before connecting the KF3 to your network.

The KF3 has two modes of operation, *run mode* and *configuration mode*. During normal operation, the module functions in run mode. Communication parameters are changed in configuration mode. The module continues to communicate while it is in configuration mode. Changes take effect as soon as they are saved and the module returns to run mode. In run mode, the configuration displays are turned off.

Important: If your displays show symbols other than those shown in this chapter, your module is malfunctioning. Contact your A-B representative.

Figure 3.1
Configuration Display and Push Buttons



Displays

Figure 3.1 shows the configuration displays on the bottom of the module. The left display (one digit) shows the number of the communication parameter being configured. The right display (two digits) shows the current setting for that parameter. Communication parameters are configured in two menus, a *main menu*, for basic parameters, and a *submenu*, for more advanced parameters.

Push Buttons

Figure 3.1 shows three push buttons labelled **View**, **Data**, and **Exit**. The operation of these buttons is described in Table 3.A.

Table 3.A
Push Button Operation

Pressing this button or button combination:	Performs this task:
View	In run mode, takes the module into configuration mode. Note: This is the only button that has a function in run mode. In configuration mode, cycles through the possible communication parameters (displayed on the left digit). If you hold the button down for more than 1 second, the parameter numbers will advance automatically.
Data	In configuration mode, cycles through the possible communication parameters for the parameter shown on the left. The data is displayed on the right two digits. If you hold the button down for more than 1 second, the parameter numbers will advance automatically.
Exit	In configuration mode, from the main menu, returns the module to run mode without saving any changes. The change in mode takes effect when the button is released. From the submenu, returns to the main menu without saving any changes.
View + Exit	In configuration mode, saves all configuration changes, and returns the module to run mode from either menu. The module will begin operating with the new configuration as soon as it returns to run mode.
View + Data	In configuration mode, resets all communication parameters to their factory defaults (see Table 3.B). The changes do not take effect until the configuration is saved, and the module returns to run mode—that is, until View and Exit are pushed simultaneously.

Configuration Steps

Entering Configuration Mode

1. Press the **View** button to enter configuration mode. The first parameter number will be displayed on the left, with its current setting on the right.

The KF3 continues to communicate while in configuration mode. Changes in configuration do not affect operation until they are saved and the module returns to run mode.

Configuring

2. Each time you press the **View** button, the parameter number in the left display advances, and the parameter's current setting appears in the right (data) display.

Press the **View** button as often as necessary or hold it down until the desired parameter is reached.

3. Once the desired parameter is displayed, press the **Data** button to cycle through the available settings.
4. When you have reached the desired data setting, you can either save the setting and exit configuration mode, or move on to configure the next parameter.

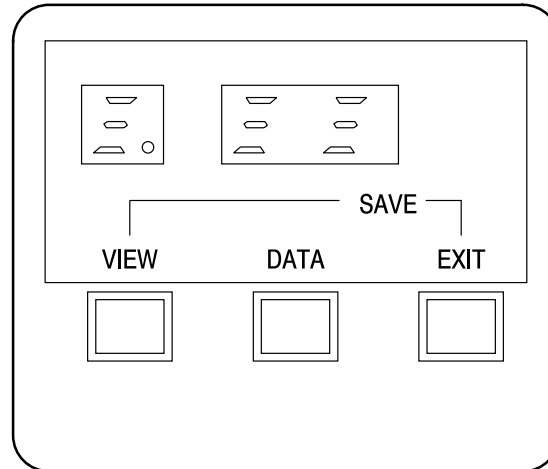
To continue configuration, press the **View** button until the next parameter you wish to change appears in the display. Use the **Data** button to modify its setting.

Save and Exit

5. To save the new data and exit configuration mode, press the **View** and **Exit** buttons simultaneously. The parameters you have changed will be saved in nonvolatile memory. If the save is successful, each display will show three dashes (see Figure 3.2) for a period of two seconds. When the module returns to run mode, the new configuration takes effect immediately, and the displays turn off.

If you press **View** and **Exit** simultaneously while in either menu, all parameters in both menus will be saved and the module will return to run mode.

Figure 3.2
Successful Save Display



If the save is not successful, your KF3 is malfunctioning. The left display will show hardware fault number 6 (see Table 5.B) and the front panel fault indicator will light. If this happens, contact your A-B representative.

Exit Without Saving

6. Pressing only the **Exit** button while in the main menu takes the module out of configuration mode and into run mode *without saving any changes*. The previous settings will remain in effect.

Pressing only the **Exit** button while in the submenu takes the module back to the main menu without saving any changes.

Important: If the module is left inactive (i.e., with no buttons pressed) in configuration mode for 3 minutes, it will return to run mode. Any changes will be lost. If the KF3 is turned off while in configuration mode, any changes will be lost.

Setting Factory Defaults

Pressing the **View** and **Data** buttons simultaneously when in configuration mode will reset all parameters to their factory defaults. When this button combination is pressed, the module displays the first parameter and its factory default. Like any other changes, the factory default parameters are *not* saved until the **View** and **Exit** buttons are pressed simultaneously. If only the **Exit** button is pressed, the module will return to run mode without resetting to factory defaults.

Basic Communication Parameters

For normal operation, the basic communication parameters must be configured. For special communication needs, configure the advanced communication parameters, which permit more flexibility in tuning the operation of the module.

Important: The KF3 is shipped from the factory with the DH-485 Node Address set to 00. If there is to be more than one KF3 on the network, or if a station with this address already exists, you will have to change this parameter setting. The default settings for the other parameters are intended to cover most situations, and need only be changed if they do not meet your requirements.

The basic communication parameters are divided into two groups: those that control the link with the DH-485 network, and those that control the RS-232C link with the computer. The parameter number is shown in the left display, the current setting in the two right displays.

Table 3.B describes each basic communication parameter and its valid settings. The numbers in parentheses are the factory default values as they appear in the display.

Table 3.B
Basic Configuration Parameters












Parameter Number	Parameter	Description	Factory Default
DH-485 Parameters			
	DH-485 Node Address	The address of this node on the DH-485 network. Valid station addresses are 00-31. Every station on the DH-485 network must be given a unique station address. If the KF3 detects another station with the same address, the front panel Fault LED will flash. You should then change this station's address to an unused one. For optimum network performance, set your stations to consecutive addresses, starting at 0. For example, if you have 4 stations, their addresses should be 0, 1, 2, and 3. This minimizes the solicitation of the new stations that is required.	(00).
	DH-485 Baud Rate	Sets the baud rate (the speed in bits/second at which data is transferred) of the DH-485 link. Possible rates are 300 (03), 1200 (12), 2400 (24), 4800 (48), 9600 (96), 19200 (19). Important: All stations on DH-485 must be set to the same baud rate.	9600 baud (96).
	Diagnostic Command Execution	Determines whether diagnostic commands are executed directly by the KF3 (01) or whether they are passed through to the host computer (00).	They are executed by the KF3 (01).

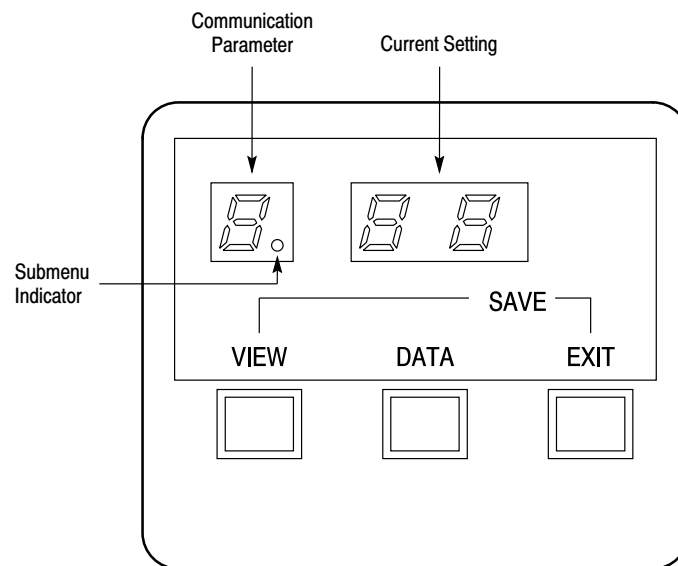
Table 3.B
Basic Configuration Parameters (continued)

Parameter Number	Parameter	Description	Factory Default
RS-232C Parameters			
	RS-232C Baud Rate	Baud rate of the RS-232C link between the host computer and the KF3. The host computer and KF3 must be set to the same baud rate. Possible rates are 300 (03), 600 (06), 1200 (12), 2400 (24), 4800 (48), 9600 (96), 19200 (19).	9600 baud (96).
	RS-232C Parity	Parity of the characters on the RS-232C link. Parity can be None (00) or Even (01). The host computer and KF3 must have the parity set to the same value.	None (00).
	DF1 Device Category	Sets the communication protocol to be used on the RS-232C link. Choices are DF1 full-duplex (00), DF1 half-duplex slave, <i>local</i> mode (01), or DF1 half-duplex slave, <i>remote</i> mode (02). See Chapter 4, <i>Communicating with the KF3</i> , for details.	Full-duplex (00).
	Error Detection	Two forms of error detection are available on the DF1 link: BCC Block Check Code (00) or CRC16 Cyclic Redundancy Check (01). The application program running on the host computer must use the same error detection as the KF3. Refer to your application user's manual for information on the type of error detection it is using, and set the KF3 to the same value.	BCC (00).
	Flow Control	Determines whether modem handshake lines are used for flow control: disabled (00) or enabled (01). Flow control is normally enabled when communicating with a modem.	Disabled (00).
	Duplicate Message Detection	Determines whether duplicate message detection is disabled (00) or enabled (01). When duplicate message detection is enabled, the KF3 will acknowledge (and discard) duplicate messages.	Enabled (01).
Other Parameters			
	Submenu Parameters	Lets you into the submenu to set the advanced communication parameters; the data display will show two dashes. See the section on Advanced Communication Parameters for more information.	N/A
	Series and Revision	Displays the series and revision level of the module. The first digit shows the series (A-J), the second the revision (A-J). For example, Series A, Revision B is displayed as "AB." You cannot set this value.	N/A

Advanced Communication Parameters

The advanced communication parameters are located in the Submenu. When parameter **9**, the Submenu entry parameter, is shown on the left display, the Data display on the right will show dashes. Press the **Data** button to enter the Submenu and display the submenu parameter numbers. The number on the left will change from 9 to 0, and its decimal point will light up, remaining lit as long as you are in the Submenu.

Figure 3.3
Submenu Indicator



Important: Changing the default setting of these parameters can disrupt operation of the network.

Once in the submenu, you change parameters and select parameters in the same manner as in the main menu, using the **View** and **Data** buttons. When the last submenu parameter is reached, press **View** to go back to the first submenu parameter.

Press the **Exit** button alone to return to the main menu without saving submenu changes. Press **Exit** and **View** simultaneously to save all changes in both menus and return the module to run mode.

Table 3.C describes each advanced (submenu) communication parameter and its valid settings. The numbers in parentheses are the factory default values as they appear in the display.

Table 3.C
Submenu Configuration Parameters









Parameter Number	Parameter	Description	Factory Default
	Maximum Token Holder	<p>The node address of the highest-numbered master station on the Address DH-485 link. The valid range for Maximum Token Holder is 01-31.</p> <p>If all stations have consecutive addresses, this parameter should be set to the address of the highest-numbered master station on the link. For example: if there are 5 stations, addressed 0 to 4, this parameter should be set to 04.</p> <p>This improves the token rotation time (the time it takes for the token to go once around the network) by limiting the station solicitation that is required, but only when all stations have consecutive addresses starting at zero. If gaps exist in the station addresses, setting this parameter to the highest station address will have no effect on link performance.</p> <p>Note that setting this parameter to the highest station address will not allow new stations above that address onto the network. Their addresses would be above the maximum token holder address, and therefore they would never be solicited to join. Stations with addresses higher than the maximum token holder address value are not solicited to join the network, but are removed from the network. If you want to add new stations, you must reset this parameter to a higher value.</p> <p>The KF3 will not allow you to set this value to less than its current station address.</p>	(31).
	Token Hold Factor	<p>The number of message that this station is allowed to send on the DH-485 link while it has the token. The valid range is 01-10.</p> <p>Consider carefully before changing this parameter. Setting all stations to a value of 01 gives all stations on the network equal access to the link, and does not allow any one station to affect the performance of other stations. Increasing this value for one station allows that station to hold the token longer if it has more than one message to send. This improves the performance of that station, but at the expense of the other stations on the network.</p>	(01).
	Number of Retries	<p>The number of allowable retries on the RS-232C link. Valid numbers are 00 (no retries per attempt) to 10 (10 retries per attempt).</p>	2 retries per attempt (02).
	DF1 ACK Timeout	<p>The time to wait for an ACK to be received from the host computer. The timeout is from 0.1 to 5 seconds in 0.1 second increments. To calculate the timeout, multiply the number in the display by 0.1 seconds.</p> <p>For example: A setting of 14 means $14 \times 0.1 = 1.4$ seconds.</p>	1 second (10).

Table 3.C
Submenu Configuration Parameters

Parameter Number	Parameter	Description	Factory Default
	CTS to Transmit Delay	<p>The delay between the CTS signal and the start of transmission by the KF3 (half-duplex only). The delay is from 0 seconds to 0.99 seconds, in 10 ms (0.01 second) increments. To calculate the delay, multiply the number in the display by 0.01 seconds.</p> <p>For example: A setting of 48 means $48 \times 0.01 = 0.48$ seconds.</p> <p>This parameter is only required when communicating with the type of radio modem that requires a delay after exerting the Clear To Send (CTS) signal. Refer to your modem manual for information on this point.</p> <p>This parameter only takes effect when the module is in Half-Duplex DF1 (local or remote) mode and handshaking is enabled. See Chapter 4, <i>Communicating with the KF3</i>, for more details of local and remote modes.</p>	No delay (00).
	End of Message to RTS Off	<p>The delay between the end of a message and the KF3 setting RTS inactive (half-duplex only). The delay is from 0 seconds to 0.99 seconds, in 10 ms (0.01 second) increments. To calculate the delay, multiply the number in the display by 0.01 seconds.</p> <p>For example: A setting of 50 means $50 \times 0.01 = 0.50$ seconds.</p> <p>This parameter is only required when communicating with modems that require a delay between sending the last character and raising the Request To Send (RTS) signal. Refer to your modem manual for information.</p> <p>This parameter only takes effect when the module is in Half-Duplex DF1 (local or remote) mode, and handshaking is enabled.</p>	No delay (00).
	Half-Duplex Master Station Address	<p>The station address of the half-duplex master device. This value is in octal and can range from 00-77 inclusive.</p> <p>This parameter only takes effect when the module is in half-duplex remote mode. See Chapter 4, <i>Communicating with the KF3</i>, for more details of remote mode.</p>	(10 octal).
	Group Number	<p>Used in half-duplex remote mode to provide a means of addressing more than 32 DH-485 stations from the half-duplex link. The group number can be 00-07 inclusive.</p> <p>Station addresses for DH-485 nodes on a multidrop link combine the group number and the DH-485 node address. This parameter only takes effect when the module is in half-duplex remote mode. See Chapter 4, <i>Communicating with the KF3</i>, for more details.</p>	(00).

Verifying Your Configuration Parameters

Before connecting the KF3 to your network, cycle through the parameter settings. If you have properly defined your network needs, you know what parameter settings your network requires. Compare the parameters you need for your network to the settings in the module. If you have made no changes to the default settings, the values shown in parentheses in the Factory Default column of the Tables 3.B and 3.C should appear in the displays.

When you connect the module to your network and turn it on, the displays will cycle through the numbers 1-3 and then turn off. If your DH-485 parameters are correctly configured, the DH-485 Activity LED on the front of the module will light up. If the Fault LED lights up instead, check your station address, as stated in Parameter Number 0, Table 3.B. If no lights come on, check your DH-485 Baud Rate setting (Table 3.B, Parameter Number 1).

Once you initiate active communication on the DF1 link, the RS-232 Activity LED will light up. If this fails to happen, check your RS-232C parameters (Table 3.B, Parameters 3-8).

If your displays show symbols other than those shown in this chapter, your module is malfunctioning. Contact your A-B representative.

For more information on troubleshooting, see Chapter 5, *Troubleshooting the KF3*.

Communicating with the KF3

Read this chapter if you are configuring a half-duplex network or if you plan to write a communication driver. A thorough understanding of DF1 protocol, PLC command sets and the use of slave devices on the DH-485 communication network is required.

DF1 Communication

The KF3 supports full-duplex DF1 protocol and half-duplex DF1 slave protocol on its RS-232C connection to a host computer. The details of these protocols can be found in the *Data Highway/Data Highway Plus/DH-485 Protocol and Command Set Manual*.

Full-duplex DF1 protocol is provided for applications where high performance peer-to-peer communication is needed.

The KF3 provides two modes of addressing in half-duplex: *local* and *remote* modes. You select one of these by configuring Submenu option 5 – *DF1 Device Category* (see Table 3.C).

Local mode is provided for compatibility with earlier DF1 products, such as the 1770-KF2. Some users may prefer local mode for use in applications where the RS-232C link is *not* multidrop, since it simplifies the polling algorithm.

Remote mode should be used with a half-duplex master, such as the 1771-KGM, or when SLC 500 communication is added to existing half-duplex networks. Because the KF3 is transparent to the master device, existing drivers can be used without rewriting.

Full-Duplex DF1 Protocol

In full-duplex mode, the KF3 detects embedded responses. The module will not send embedded responses until it receives one from the host. The KF3 makes the assumption that if a host computer sends embedded responses, it can also receive them.

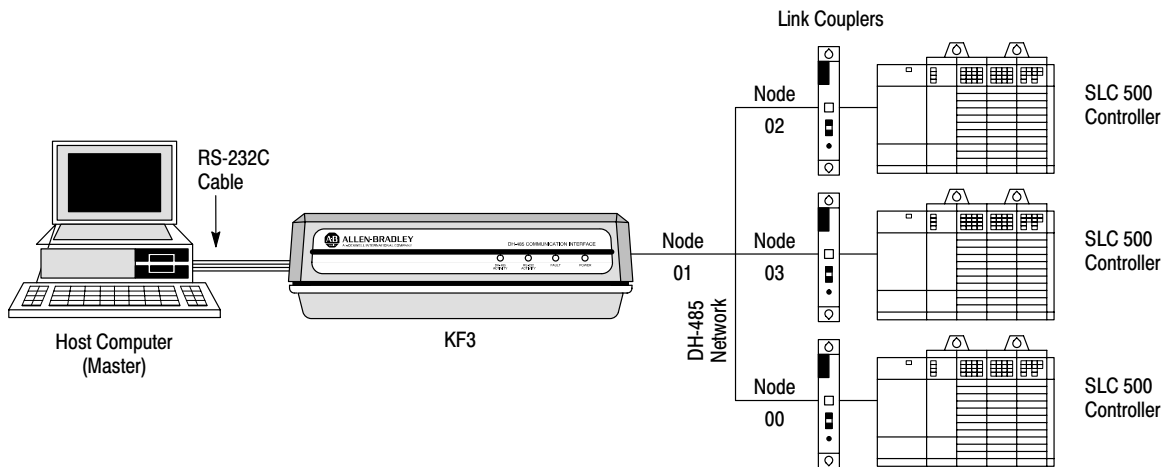
In full-duplex mode, the destination address in a packet sent from the host computer to the KF3 is the address of the DH-485 network node for which the packet is intended. The source address in packets received by the host computer from the KF3 is the node address of the sender.

Half-Duplex DF1 Protocol — Local Mode

Local mode requires an intelligent master device, capable of specifying both a station address and a destination address. Because the KF3 acts as a slave on a DF1 half-duplex network, the half-duplex master's access to the DH-485 nodes is indirect: i.e., the destination address and the station address are generally different.

In local mode, the polling algorithm used by the half-duplex master is simplified so that the master only needs to poll the single KF3. The KF3 will respond to messages from the half-duplex master only if the station address contained in these messages is the node address *of the KF3*. The KF3 then forwards the packet to the appropriate DH-485 node, as defined by the destination address. Responses from remote nodes on the DH-485 network will contain a destination address equal to that of the KF3, and not that of the half-duplex master device. The KF3 will respond to poll packets from the half-duplex master by returning whatever data has been forwarded to it by the remote nodes under its jurisdiction.

Figure 4.1
Local Mode Addressing



In Figure 4.1, the half-duplex master running on the computer only polls the KF3 at station address 01. Messages from the half-duplex master to the SLC 500s are sent using a master message containing both the station address of the KF3 (01) and the destination address of the SLC 500 (03, for example). Responses from the SLC500s to the half-duplex master contain the destination address of the KF3 (01), which then returns all responses to the half-duplex master station upon being polled.

Half-Duplex DF1 Protocol — Remote Mode

The valid range of slave addresses on a half-duplex network is 000-376 *octal* – a total of 255 stations. The valid range of addresses on a DH-485 network is 00-31 *decimal*. In order to make these two systems compatible, two special submenu configuration options have been included in the KF3 (see Table 3.C).

The first, submenu option **6**, must be set to the *address of the half-duplex master*. This value is limited by the KF3 to a range of 00 to 77 *octal* (out of a possible range of 000-376 *octal*). The default address is 10 *octal*.

The second configuration option, submenu option **7**, must be set to the *group number*. Group numbers range from 00 to 07, with each group consisting of up to 32 DH-485 nodes. The KF3 uses group numbers to create unique half-duplex DF1 addresses for each node on the DH-485 network.

In remote mode, the KF3 appears transparent to the half-duplex master, so that remote SLC 500s can be polled directly as individual slaves on the half-duplex network. The KF3 responds to the half-duplex master if the station address specified corresponds to the node address *of any master (token-passing) station on the DH-485 network*.

Messages *from* remote nodes on the DH-485 network (such as the SLC 500s) use the destination address of the KF3. To maintain its transparency to the half-duplex master, the KF3 overwrites this destination address with the value configured in submenu option 6. The message received by the half-duplex master will contain a source address equal to the station address specified in the poll packet and a destination address equal to the address of the half-duplex master device.

Table 4.A provides the address conversion using the group number. Remember that half-duplex DF1 (group) addresses are in *octal* and DH-485 node addresses are in *decimal*.

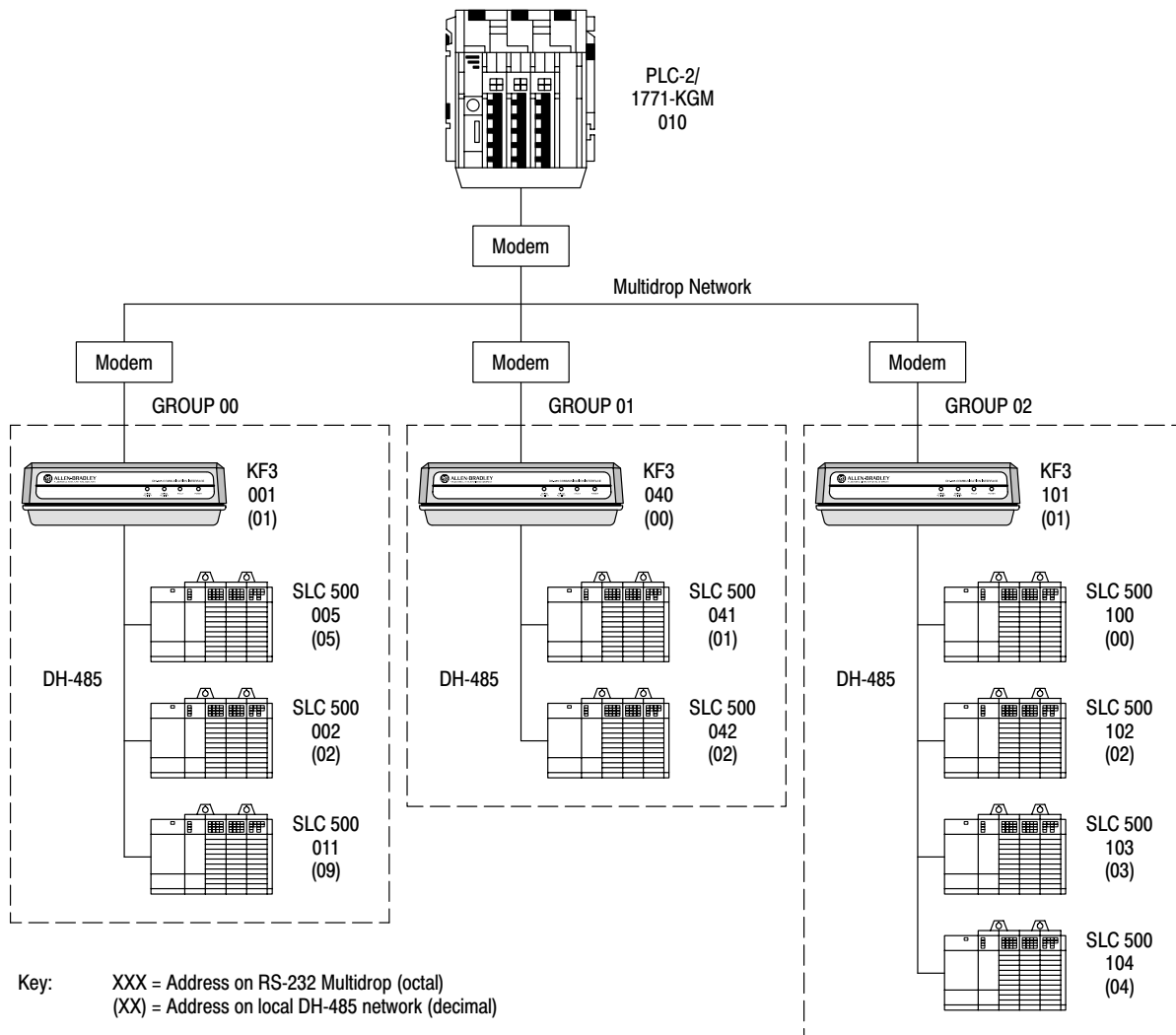
Table 4.A
Half-Duplex Remote Address Conversion Table

DH-485 Node Address (Decimal)	Half-Duplex DF1 Address (Octal)							
	Group 00	Group 01	Group 02	Group 03	Group 04	Group 05	Group 06	Group 07
00	000	040	100	140	200	240	300	340
01	001	041	101	141	201	241	301	341
02	002	042	102	142	202	242	302	342
03	003	043	103	143	203	243	303	343
04	004	044	104	144	204	244	304	344
05	005	045	105	145	205	245	305	345
06	006	046	106	146	206	246	306	346
07	007	047	107	147	207	247	307	347
08	010	050	110	150	210	250	310	350
09	011	051	111	151	211	251	311	351
10	012	052	112	152	212	252	312	352
11	013	053	113	153	213	253	313	353
12	014	054	114	154	214	254	314	354
13	015	055	115	155	215	255	315	355
14	016	056	116	156	216	256	316	356
15	017	057	117	157	217	257	317	357
16	020	060	120	160	220	260	320	360
17	021	061	121	161	221	261	321	361
18	022	062	122	162	222	262	322	362
19	023	063	123	163	223	263	323	363
20	024	064	124	164	224	264	324	364
21	025	065	125	165	225	265	325	365
22	026	066	126	166	226	266	326	366
23	027	067	127	167	227	267	327	367
24	030	070	130	170	230	270	330	370
25	031	071	131	171	231	271	331	371
26	032	072	132	172	232	272	332	372
27	033	073	133	173	233	273	333	373
28	034	074	134	174	234	274	334	374
29	035	075	135	175	235	275	335	375
30	036	076	136	176	236	276	336	376
31	037	077	137	177	237	277	337	Illegal

Example: Remote Mode Addressing on a Multidrop Network

This example uses the 1771-KGM as the half-duplex master in a multidrop configuration. Each of the KF3s is set to half-duplex remote mode, and has the half-duplex Master Address set to the address of the 1771-KGM (010).

Figure 4.2
Remote Mode Addressing



The group number is used by the KF3 to create a unique half-duplex DF1 address for each node on the DH-485 networks. The nodes' addresses would be as follows:

Table 4.B
Multidrop Addresses

Group Number	Device	Address on DH-485	Address on DF1 Half-Duplex
00	1770-KF3	01	001
	SLC 500	02	002
	SLC 500	05	005
	SLC 500	09	011
01	1770-KF3	00	040
	SLC 500	01	041
	SLC 500	02	042
02	SLC 500	00	100
	1770-KF3	01	101
	SLC 500	02	102
	SLC 500	03	103
	SLC 500	04	104

Communicating with DH-485 Master Devices

The KF3 operates as a token-passing master on the DH-485 network. It can communicate with other DH-485 master stations (such as the SLC 500 series of programmable controllers) and with DH-485 slave devices.

The KF3 communicates with other master stations using the Allen-Bradley programmable controller command set. A detailed description of this command set is found in the *Data Highway/Data Highway Plus/DH-485 Protocol and Command Set Manual*.

Communicating with DH-485 Slave Devices

The DH-485 network also supports slave (nontoken-passing) devices. The KF3 communicates with slaves using a special PLC command (CMD) byte.

Application programs communicate with slaves via SRD (Send and Receive Data) messages on DH-485. The SRD message is a link layer service provided on DH-485. The Programmable Controller Command Set has been extended to provide SRD messages by setting the PCCC CMD byte to 09.

The following section on packet formats is advanced information, not required for common applications.

Slave Packet Formats

To invoke DH-485 link layer services, a special PCCC CMD byte is used to support the addition of link-specific information to the packet. Setting the CMD byte = 09 indicates that the packet contains extended link information.

When the CMD byte = 09, the packet contains a “Link Type” field (one byte), a “Link Status” field (one byte), and information specific to the link-type command being sent.

Figure 4.3 shows the SRD request packet format.

Figure 4.3
The SRD Request Packet Format

DLE	STX	DST	SRC	CMD 09	LINK TYPE	LSTS	LINK PACKET INFORMATION	DATA...	DLE	ETX	BCC/CRC
-----	-----	-----	-----	-----------	--------------	------	----------------------------	---------	-----	-----	---------

Link Type (LTYP)

This one-byte field defines the Link Type as follows:

- 1 – SRD Link Request
- 2-255 – Reserved for future expansion

Link STS (LSTS)

This one-byte field indicates the Link Status of the SRD request. It is used on replies to SRD requests only. When sending an SRD command, this field should be set to zero.

- 00 **Success.** The message was successfully sent to the destination device. Note that some slaves will return data with the success code (ACK with Data).
- 01 **NAK, No Memory at Destination (SRD reply).** This link error is returned when the KF3 receives a NAK, No Memory message from the destination station in response to an SRD request.
- 02 **NAK, Undeliverable Message (SRD reply).** This link error is returned if the 1770-KF3 was unable to send the SRD to the destination station (as may occur when the destination does not exist on the network).

- 03 **NAK, Bad LSAP (SRD reply).** This link error is returned when the KF3 receives a NAK, Bad LSAP message from the destination station in response to an SRD request. This indicates that the LSAP you are trying to send the SRD request to is invalid for that destination device.
- 04 **NAK, Unimplemented Function (SRD reply).** This link error is returned when the KF3 receives a NAK, Unimplemented Function message from the destination station in response to an SRD request. The most likely cause is invalid data being sent to the destination device.
- 05 **Invalid or Unsupported Link Type.** This link error is returned if the link type specified does not exist, or the destination of the message is the KF3 and it does not know how to interpret it. The KF3 currently recognizes only 01 as a valid link type. Any other value for the link type will produce this link error.

Link Packet Information

This field contains information specific to the link request. In the case of an SRD request, this field will contain the Destination Link Service Access Point (DLSAP) of the SRD.

Command Format, SRD Request

The format of an SRD request command is shown in Figure 4.4:

- the CMD byte must be set to 09H
- the Link Type byte must be set to 01
- the Link Status byte must be set to 00
- the Link Packet Information must contain the DLSAP for the slave station

The format of the data is completely dependent on how the destination device was implemented. Refer to the destination device’s user manual for this information.

Figure 4.4
Command Packet Format for an SRD Request

DLE	STX	DST	SRC	CMD 09	LINK TYPE 01	LSTS 00	DLSAP	DATA...	DLE	ETX	BCC/CRC
-----	-----	-----	-----	-----------	-----------------	------------	-------	---------	-----	-----	---------

Reply Format, SRD Request

The format of a reply to an SRD request is shown in Figure 4.5:

- the CMD byte will have the reply bit set
- the link type will be set to SRD Request
- the link status will indicate success or failure
- the LSAP of the slave device (SLSAP) will be included
- if the request was successful, the data will be included. Note that some devices may not return data. The format of data is completely dependent on how the destination device was implemented. Refer to the destination device's user manual for this information.

Figure 4.5
SRD Reply Packet Format

DLE	STX	DST	SRC	CMD 49	LINK TYPE 01	LSTS	SLSAP	DATA...	DLE	ETX	BCC/CRC
-----	-----	-----	-----	-----------	-----------------	------	-------	---------	-----	-----	---------

Communicating with a Modem

The handshaking option must be enabled for the KF3 to properly control a modem.

The KF3 module continually asserts DTR when it is waiting for a call.

Under this condition, the modem will answer a call and assert DSR as soon as it detects ringing. The KF3 does not monitor the ring indicator in the RS-232C interface. Once it detects DSR, the module starts a timer (approximately 10 seconds) and waits for the DCD signal. When the module detects DCD, communication can start.

If the KF3 does not detect DCD within the 10-second timeout, the module turns DTR off. This causes the modem to hang up and break the connection. When the hang-up is complete, the modem turns off DSR. This causes the module to reassert the DTR line and wait for another call. This feature protects access to the phone if someone calling a wrong number reaches this node.

After detecting DCD, the KF3 continues to monitor the DCD line. If DCD goes off, the module restarts the 10-second timeout. If DCD is not restored within the timeout, the module initiates the hang-up sequence. This feature allows the remote node to redial in the event that the connection is lost through a fault in the phone network.

This handshaking is necessary to guarantee access to the phone line. If the handshaking protocol is defeated by improper selection of modem options or by jumpers at the connectors, the modem may still answer a call. But if the connection is lost, the modem will not hang up. It will then be impossible for the remote node to reestablish the connection because it will get a busy signal.

Troubleshooting the KF3

Interpreting the Front Panel LEDs

There are four LEDs on the front panel of the KF3. These indicators can help you in diagnosing problems with the module's installation and operation.









Table 5.A
LED Indicators

LED Indicator	Description
Power	This indicator is lit (green) when the module is plugged in and turned on.
Fault	<p>This indicator goes on solid red if a hardware fault is detected on power up, or during operation. If this occurs, the type of fault is displayed on the left numeric display on the bottom of the module. Refer to the section on "Interpreting the Numeric Displays" on page 5-2 for information on fault codes.</p> <p>This indicator will flash red at 1-second intervals when a station with the same address as this node is detected. To correct the fault, go into configuration mode and change the address of one of the stations to an unused one.</p>
RS-232C Activity	This indicator flickers green when data is received by the module from the host computer. The more activity on the RS-232C link, the faster this indicator will flash. At times of high activity, the indicator may flash so rapidly that it appears to be solid green.
DH-485 Activity	Shows activity on the DH-485 network. It turns on (green) while the KF3 has the token, and turns off when another station on the network has the token. It will flash slower as more stations are added to the network, since this node will have the token less frequently. It will also slow down if other nodes on the network are transmitting large data packets.

Interpreting the Numeric Displays

The numeric displays are used to indicate hardware fault conditions. When the front panel fault indicator is lit, the left display will show a number indicating the type of hardware fault. Table 5.B gives a description of the faults.

Table 5.B
Hardware Faults

This number:	Indicates this fault:
	Processor Fault. A hardware fault was detected in the processor. This is a major fault requiring the module to be returned for servicing.
	EPROM fault. The checksum stored in the EPROM does not match the actual checksum for the EPROM. This indicates bad cells in the EPROM. This is a major fault requiring the module to be returned for servicing.
	RAM Fault. The static RAM cannot be reliably written to. This is a major fault requiring the module to be returned for servicing.
	Stuck Button Detected. One or more of the push buttons are stuck on. This could be caused by a mechanical problem with the buttons, or by some object pressing on the push buttons. If the cause is mechanical, the module should be returned for servicing. Otherwise, remove the pressure from the push buttons. This should clear the fault condition. The KF3 will continue to communicate when this fault is detected, but configuration will not be possible.
	EPROM Write Fault. The Flash EPROM could not be burned correctly during download of new firmware. This is a major fault requiring the module to be returned for servicing.
	EEPROM Major Fault. The KF3 was unable to write the new configuration to the EEPROM. This is a major fault requiring the module to be returned for servicing.
	EEPROM Minor Fault. On power up, the KF3 detected invalid configuration data in the EEPROM. The KF3 was able to recover by writing the factory default configuration to the EEPROM. You must power the module off and back on, and then reconfigure it. This is not a major fault, but if the problem persists, the module should be returned for servicing.
	Power Failure. The power supply voltage is below the minimum rating for the KF3.

If your displays show meaningless symbols at startup, or if any values other than the above are displayed, your module is malfunctioning. Contact your A-B representative.

When you connect the module to your network and turn it on, the displays will cycle through the numbers 1-3 and then turn off. If your DH-485 parameters are correctly configured, the DH-485 Activity LED on the front of the module will light up. If the Fault LED lights up instead, check your station address, as stated in Parameter Number 0, Table 3.B. If no lights come on, check your DH-485 Baud Rate setting (Table 3.B, Parameter 1).

Once you initiate active communication on the DF1 link, the RS-232 Activity LED will light up. If this fails to happen, check your RS-232C parameters (Table 3.B, Parameters 3-8).

If you are unable to save new configurations successfully, the left display will display hardware fault 6, and the Fault LED on the front will light up. This indicates a malfunction in the module. Contact your A-B representative.

Specifications

RS-232C Interface

Start bits	1
Data bits	8
Parity	None, Even
Stop bits	1
Baud rates	300, 600, 1200, 2400, 4800, 9600, 19200
Connector	DB-25P (male)
Output	RS-232C

DH-485 Interface

Start bits	1
Data bits	8
Parity	Even
Stop bits	1
Baud rates	300, 1200, 2400, 4800, 9600, 19200
KF3 connector	6-pin, Phoenix MSTBA-1.5/6-G-AU
Cable connector	6-pin, Phoenix MSTB-2.5/6-ST-AU
Output	RS-485

Electrical

AC input voltage	85-132 VAC (RMS) 170-264 VAC (RMS)
AC input frequency	47-63 Hz
Fuse	UL 198G and CSA C22.2, No. 59 rated, 5 mm x 20 mm, 0.1 Amp, 250V, fast-acting
Connector	IEC 320 power inlet
Power consumption	5 watts maximum

Physical

Dimensions	9.5" (24.1 cm) wide x 7.1" (18.0 cm) long x 2.4" (6.1 cm) high
Weight	2 lbs. (.9 kg) approx.

Environmental

Operating temperature	0°C to 60°C (32°F to 165°F)
Storage temperature	-40°C to 85°C (-40°F to 210°F)
Operating humidity	5% to 95% (noncondensing)
Safety requirements	UL 1950
Electromagnetic interference	FCC Part 15, Subpart J, Class A DOC R.I.R. SEP. 1988

Diagnostic Command Support

The KF3 will interpret and respond to the following diagnostic commands:

Table B.A
KF3 Diagnostic Commands

Description	Command Byte	Function Code (hex)
Diagnostic Loop	06	00
Diagnostic Read Counters	06	01
Diagnostic Status	06	03
Reset Diagnostic Counters	06	07
Read Link Parameters	06	09
Set Link Parameters	06	0A

Diagnostic Loop

You can use this command to check the integrity of the transmissions over the communication link. The command message transmits up to 243 bytes of data to a node interface module. The receiving module should reply to this command by transmitting the same data back to the originating node.

Figure B.1
Diagnostic Loop Command Format

1 byte	1 byte	2 bytes	1 byte	243 bytes max
CMD 06	STS	TNS	FNC 00	DATA

Figure B.2
Diagnostic Loop Reply Format

1 byte	1 byte	2 bytes	243 bytes max
CMD 46	STS	TNS	DATA

Diagnostic Read

This command reads the diagnostic counters from the KF3. The format of these counters is given below. Note that the address and size fields can have any value (but they must be included).

Figure B.3
Diagnostic Read Command Format

1 byte	1 byte	2 bytes	1 byte	2 bytes	1 byte
CMD 06	STS	TNS	FNC 01	ADDR 0000	SIZE 00

Figure B.4
Diagnostic Read Reply Format

1 byte	1 byte	2 bytes	52 bytes
CMD 46	STS	TNS	DATA

Table B.B contains the diagnostic read reply values for the KF3:

Table B.B
Diagnostic Read Reply Values

Byte	Description
0	Total DH-485 packets received, low byte
1	Total DH-485 packets received, high byte
2	Total DH-485 packets transmitted, low byte
3	Total DH-485 packets transmitted, high byte
4	Number of DH-485 retries
5	Number of DH-485 packets where the retry limit was exceeded
6	Number of DH-485 NAK, No Memory sent
7	Number of DH-485 NAK, No Memory received
8	Number of DH-485 bad messages received
9	Number of DH-485 line errors
10	Total RS-232C packets received, low byte
11	Total RS-232C packets received, high byte
12	Total RS-232C packets transmitted, low byte
13	Total RS-232C packets transmitted, high byte
14	Number of RS-232C retries
15	Number of RS-232C packets where the retry limit was exceeded
16	Number of RS-232C NAKs sent
17	Number of RS-232C NAKs received
18	Number of RS-232C bad messages received
19	Number of RS-232C line errors
20-51	DH-485 Active Node Table*

* The Active Node Table indicates what stations (nodes) are on the network. The station address is used as an offset into the table. If a node number is not occupied, the node table will show FF. An active node shows the number of its successor, i.e., the number of the station to which it will pass the token. Slave devices do not appear.

Example of an Active Node Table

A network consists of 5 stations, numbered 0, 3, 4, 5, and 7. The Active Node Table would look like this:

0	3
1	FF
2	FF
3	4
4	5
5	7
6	FF
7	0

Diagnostic Status

This command requests a block of status information from a DH-485 device. The reply contains the information in its DATA field. The status information varies from device to device. The KF3's status block is given below.

Figure B.5
Diagnostic Status Command Format

1 byte	1 byte	2 bytes	1 byte
CMD 06	STS	TNS	FNC 03

Figure B.6
Diagnostic Status Reply Format

1 byte	1 byte	2 bytes	24 bytes
CMD 46	STS	TNS	DATA

Table B.C
Diagnostic Status Reply for KF3

Byte	Description	Status Reply (hex)
1	Mode/Status byte	00 (No Modes)
2	Interface/Processor Type Bits 0-3: Interface type (E = Extended) Bits 4-7: Processor type (F = Computer)	FE
3	Extended Interface Type	2C
4	Not Used	
5	Series/Revision Bits 0-4: Bits 5-7:	0 = Revision A 1 = Revision B, etc. 0 = Series A 1 = Series B, etc.
6-16	Bulletin Name = (ASCII)	"1770-KF3"
17-24	Product-specific Information	0

Diagnostic Counter Reset

This command resets the diagnostic counters in the node interface module.

Figure B.7
Diagnostic Counter Reset Command Format

1 byte	1 byte	2 bytes	1 byte
CMD 06	STS	TNS	FNC 07

Figure B.8
Diagnostic Counter Reset Reply Format

1 byte	1 byte	2 bytes
CMD 46	STS	TNS

Read Link Parameters

This command reads the link parameters defined for the KF3. Currently there is only one link parameter: Maximum Token Holder Address. This command returns the value for this parameter in the DATA byte.

Figure B.9
Read Link Parameters Command Format

1 byte	1 byte	2 bytes	1 byte	2 bytes	1 byte
CMD 06	STS	TNS	FNC 09	PARAMETER 0000	SIZE 01

Figure B.10
Read Link Parameters Reply Format

1 byte	1 byte	2 bytes	1 byte
CMD 46	STS	TNS	DATA 1 byte

Set Link Parameters

This command sets the link parameters defined for the KF3 and saves them in EEPROM. Currently there is only one link parameter: Maximum Token Holder Address. This command sets the maximum token holder address in the KF3. Note that this command will override the value set when the module was configured.

Figure B.11
Set Link Parameters Command Format

1 byte	1 byte	2 bytes	1 byte	2 bytes	1 byte	1 byte
CMD 06	STS	TNS	FNC 0A	PARAMETER 0000	SIZE 01	DATA

Figure B.12
Set Link Parameters Reply Format

1 byte	1 byte	2 bytes
CMD 46	STS	TNS

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