A·B QUALITY
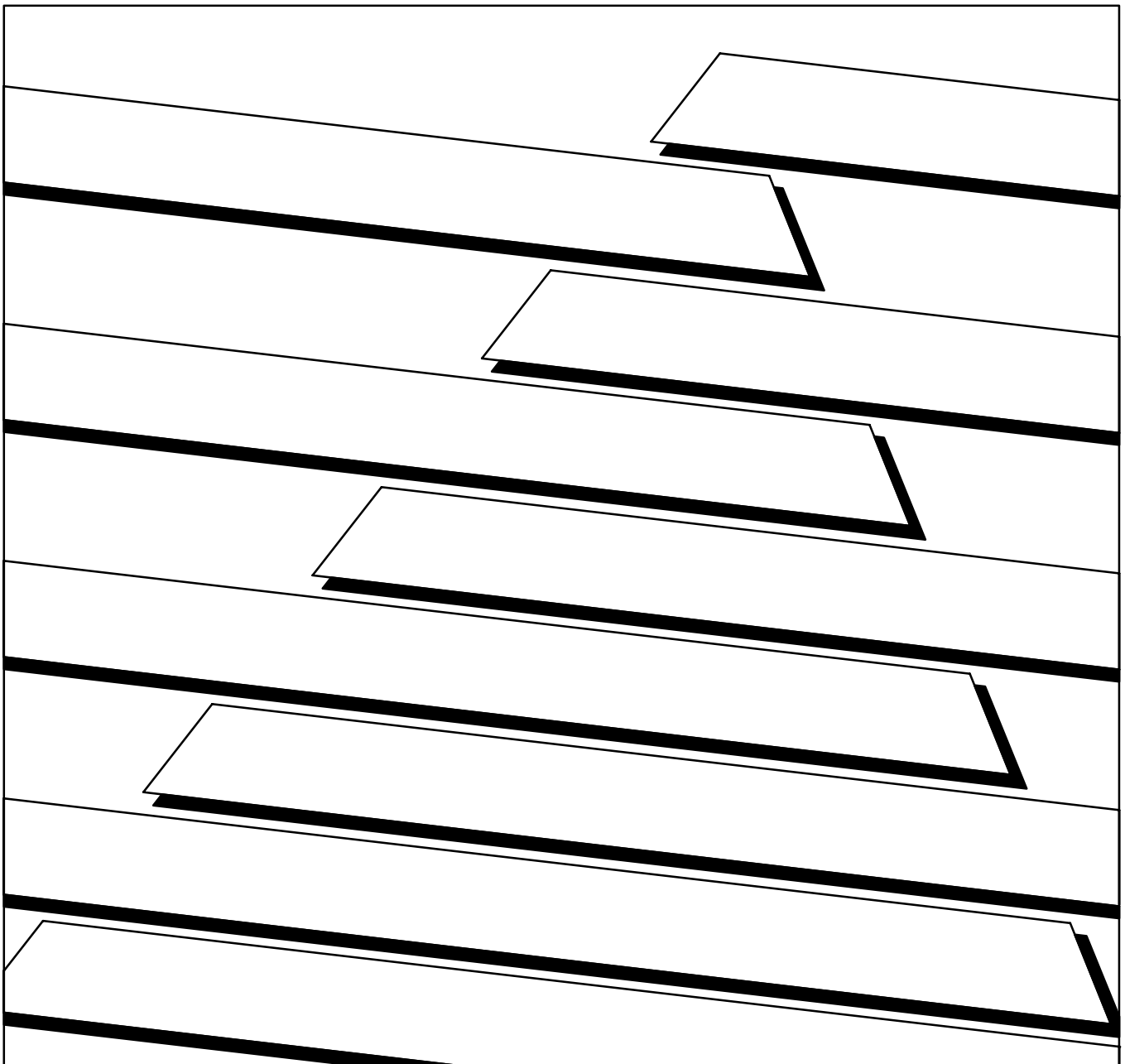
Data Highway Plus/DH485 Communication Adapter Module

(Cat. No. 1785-KA5/B, -KA5P/B)

User Manual

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI–1.1, "Safety Guidelines For The Application, Installation and Maintenance of Solid State Control" (available from your local Allen-Bradley office) describes some important differences between solid-state equipment and electromechanical devices which should be taken into consideration when applying products such as those described in this publication.

Reproduction of the contents of this copyrighted publication, in whole or in part, without written permission of Allen–Bradley Company, Inc. is prohibited.

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

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention helps you:

- Identify a hazard
- Avoid the hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

Important: We recommend you frequently backup your application programs on appropriate storage medium to avoid possible data loss.

Summary of Changes

Summary of Changes

This publication contains new information not included in the last release.

New Information

European Union Directive Compliance
Information on the European Union Directive is located on pages 2-1 and A-1.

Auto Routing Feature
Detailed information on using the Auto Routing Feature is located on pages 2-4 and 2-5.

Power Supply Requirements
Detailed information on power supply requirements for the European Union Directive is located on page 2-13.

Change Bars

The areas in this manual which are different from the previous edition are marked with change bars (as shown to the right of this paragraph) to indicate the addition of new or revised information.

Table of Contents

Using this Manual

Purpose of this Manual

This manual describes the 1785-KA5 Data Highway Plus™/DH485 communication adapter module. It contains information for:

- installing and troubleshooting the module
- using the module

Who Should Read this Manual

We assume that you are already familiar with:

- Allen-Bradley PLC® and SLC™ processors
- Allen-Bradley DH485 and Data Highway Plus

Frequently Used Terms

In this manual, we use the following terms:

This term	Means
1785-KA5 module, or 1785-KA5	1785-KA5 Data Highway Plus/DH485 communication adapter module
DH+	Data Highway Plus
DH485	DH485 Data Highway
link	a physical network
PLC	programmable logic controller
SLC	small logic controller
station (or node)	the interface point at which devices, such as programmable controllers, connect to the network. Usually the station is an interface module, except for the PLC-5® and T50 terminal, which connect directly to the Data Highway Plus

Related Publications

These Allen-Bradley publications contain related information:

Publicaton	Publication Number
SLC 500 Overview brochure	1746-1.1
Bulletin 1746/47 SLC 500 Modular Hardware Style Programmable Controllers I/O manual	1747-804
Hand Held Terminal user's manual	1747-809
Programming Terminals (Cat. Nos. 1784-T45, -T47, -T50) product data	1784-2.1
DH+ LAN product data	1785-2.6
PLC-5 Family Processor product data	1785-2.1
DH/DH+/DH485 Protocol and Command Set reference manual	1770-6.5.16

Also see the Advanced Programming Software (APS) user's manual (Cat. No. 1747-NM002 Series A.)

Updated Information

Since the last release of this manual, some information has changed. We call your attention to the new information with a black revision bar in the margin as shown here.

Chapter 1

Overview of the 1785-KA5 Communication Adapter Module

What this Chapter Contains

Read this chapter for information on:

- what the 1785-KA5 communication adapter module is
- what DH+ and DH485 networks are
- compatible products

What is the 1785-KA5 Communication Adapter Module?

The 1785-KA5 communication adapter module lets devices on the Data Highway Plus (DH+) network communicate with devices on the RS-485 Data Highway (DH485) network for:

- uploading/downloading of SLC 500 programs from a DH+ device

- message communication between DH+ PLC processors and DH485 SLC 500 processors

The 1785-KA5 communication adapter module features:

- concurrent operation as a gateway or router:

    - in gateway mode, DH+ devices must initiate messages; DH485 devices cannot initiate messages

    - in router mode, both DH+ and DH485 devices that implement internet protocol (IP) can initiate messages (SLC 5/01, SLC 5/02, and fixed controllers do not support IP)

- support for existing IP

- compatibility with other Allen-Bradley DH+ hardware and software products

- a baud rate of 57.6 Kbps on the DH+ network and 300bps-19.2 Kbps on the DH485 network

DH+ and DH485 Networks

This section describes the DH+ and DH485 networks. For more information on these networks, see the DH/DH+/DH485 Protocol and Command Set reference manual (publication 1770-6.5.16).

DH+ Networks

DH+ is a baseband local area network (LAN) that allows peer-to-peer communication among a maximum of 64 nodes. Each node has a unique station address between 0–63 decimal and 0–77 octal. Use DH+ when you want to connect a small number of nodes on a common link or with other industrial networks as a part of a plant-wide CIM facility. DH+ features:

- remote programming of PLC-2, PLC-3, and PLC-5 processors on your network (using Allen-Bradley 6200 Series software)

- direct connections to PLC-5 processors and industrial programming terminals

- easy reconfiguration and expansion if you want to add more nodes later

- a communication rate of 57,600 bits per second

The DH+ implements peer-to-peer communication with a token-passing scheme to rotate link mastership among its nodes. Since this method does not require polling, it helps provide time-efficient reliable data transport. The DH+ uses factory set timeouts to restart token-passing communication if the token is lost because of a defective node.

The 1785-KA5 communication adapter module is available in two versions:

Use this version	If your application is
1771 I/O rack mount (Cat. No. 1785−KA5/B)	primarily DH+ with multiple 1771 I/O racks and SLC 500 subnetworks within close proximity
stand-alone panel mount (Cat. No. 1785-KA5P/A)	primarily a SLC (DH485) environment with no 1771 I/O racks in close proximity

Figure 1.1 shows the module's hardware features:

Figure 1.1
1785-KA5 module

Status LEDs

DH+ connection (3-pin Phoenix connector)

DH+ remote programming port (9-pin) D-shell

programming connection (8-pin modular connector)

DH485 connection (6 – pin Phoenix connector)

External power (+5Vdc) connector (4 – pin Phoenix connector)

1785−KA5/B I/O rack mount

1785−KA5P/B panel mount

19190
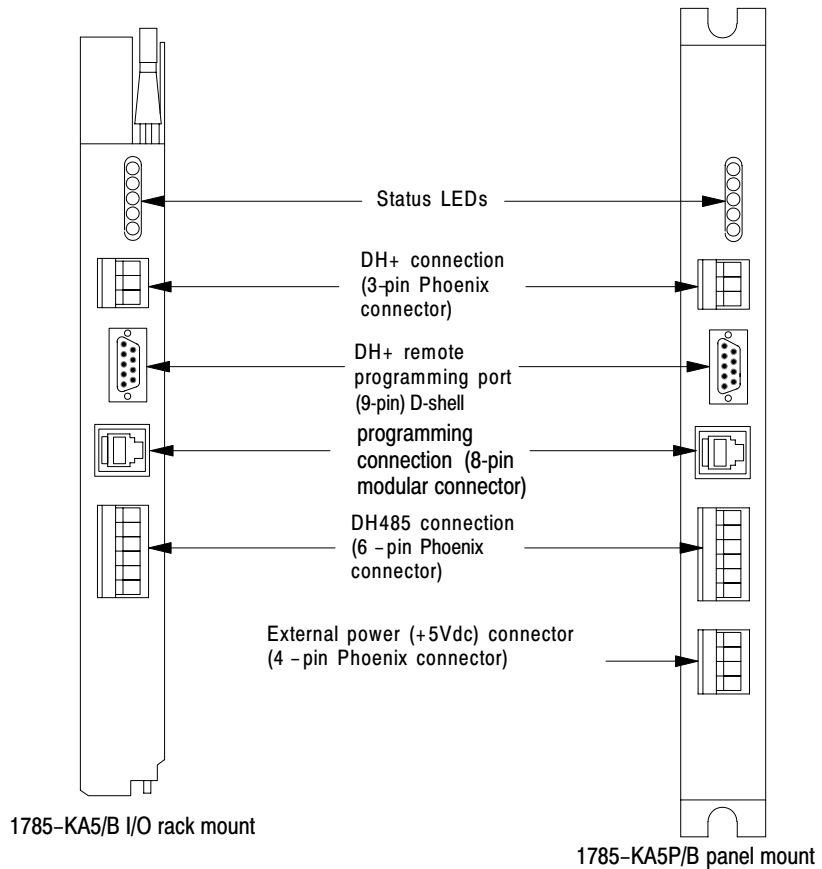
The DH485 Network

This section describes the DH485 network. For more information on this network, see the DH/DH+/DH485 Protocol and Command Set reference manual (publication 1770-6.5.16).

DH485 is a low cost, peer-to-peer programming and data acquisition link for a variety of Allen-Bradley products, such as the SLC 500 family of programmable controllers. A DH485 network provides a networking solution for smaller applications (up to 32 nodes) within a small radius. Each node has a unique station address between 0–31 decimal. The maximum cable length is 4,000 feet. The DH485 link has a maximum communication rate of 19,200 bits per second.

A DH485 network has a topology that is similar to that of a DH or DH+ network. DH485 is based on the EIA Standard RS-485 Electrical Signalling Specification and implements token-passing protocol with rotating mastership. The link protocol delimits messages, detects and signals errors, retries after errors and controls message flow.

A variety of Allen-Bradley products, such as the SLC 500 family of controllers, the SLC 500 APS programming software, the 1784-KTX, -KTXD and -KR modules, and the 1770-KF3 module act as token-passing masters on the DH485 network. The DH485 protocol also supports slave (respond-only) mode for low-level devices on the network.

The 1784-KTX, -KTXD and -KR modules provide an IBM PC backplane link to the DH485. It provides an asynchronous link to connect devices on the network. An asynchronous device can interface with a DH485 module directly or through a modem link.

Compatible Products

You can use the following Allen-Bradley products with the 1785-KA5
module:

This product	Has this Cat. No.
DH+ PLC-2 Communication Module	1785-KA3
Processor Communication Interface Module (for IBM PC/XT/AT)	1784-KT
Processor Communication Interface Module (for IBM PS/2)	1784-KT2
Communication Interface Module for the 1784-T47 Programming Terminal	1784-KL
I/O Scanner-Communication Adapter Module	1775-S5
DH+ PLC-3 Communication Module	1775-S5, -SR5
SLC 500 Hand Held terminal	1747-PT1 (with 1747-PTA1E firmware)
Portable Programming Terminal	1784-T45, -T47
Advanced Programming Software	1747-PA2E (series *x* and up)
Standard Driver Software	6001-F1E, -F1E2
6001-NET (for VAX) Network Communication Software	6001-A1D, -G1D, -A1DB, -G1DB

The following Allen-Bradley PLC and SLC processors are compatible with
the 1785-KA5 module:

- PLC-5/10
- PLC-5/12
- PLC-5/15
- PLC-5/25
- PLC-5/30
- PLC-5/250
- PLC-5/40
- PLC-5/60
- SLC 5/03
- SLC 5/04
- SLC 500 (can only reply to remote messages)
- SLC 5/01 (can only reply to remote messages)
- SLC 5/02 (can only reply to remote messages)

Installing the 1785-KA5 Communication Adapter Module

What this Chapter Contains

This chapter explains how to install the 1785-KA5 module in a 1771 I/O rack or in a stand-alone panel mount setup. It contains the following sections:

- the European Union Directive Compliance
- setting the switches
- installing the 1785-KA5 module in an I/O rack
- installing the 1785-KA5 panel-mount version
- connecting the module
- powering up

European Union Directive Compliance

If this product is installed within the European Union or EEA regions and has the CE mark, the following regulations apply.

EMC Directive

This apparatus is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) using a technical construction file and the following standards, in whole or in part:

- EN 50081-2   EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2   EMC – Generic Immunity Standard, Part 2 – Industrial Environment

The product described in this manual is intended for use in an industrial environment.

Low Voltage Directive

This apparatus is also designed to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131–2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

For specific information that the above norm requires, see the appropriate sections in this manual, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B111

Setting the Switches

The 1785-KA5 module has three banks of DIP switches that let you select various communication options. The switch assemblies and their corresponding options are:

To set the	Use switch assembly
DH485 station address and baud rate	SW-1
DH+ station address and the auto route enable option	SW-2
DH485 and DH+ channel LINK_IDs	SW-3

Figure 2.1 shows the location of the switches on the 1785-KA5 module.

Figure 2.1
1785-KA5 communication adapter module switch assemblies (cat. no. 1785-KA5/B shown)
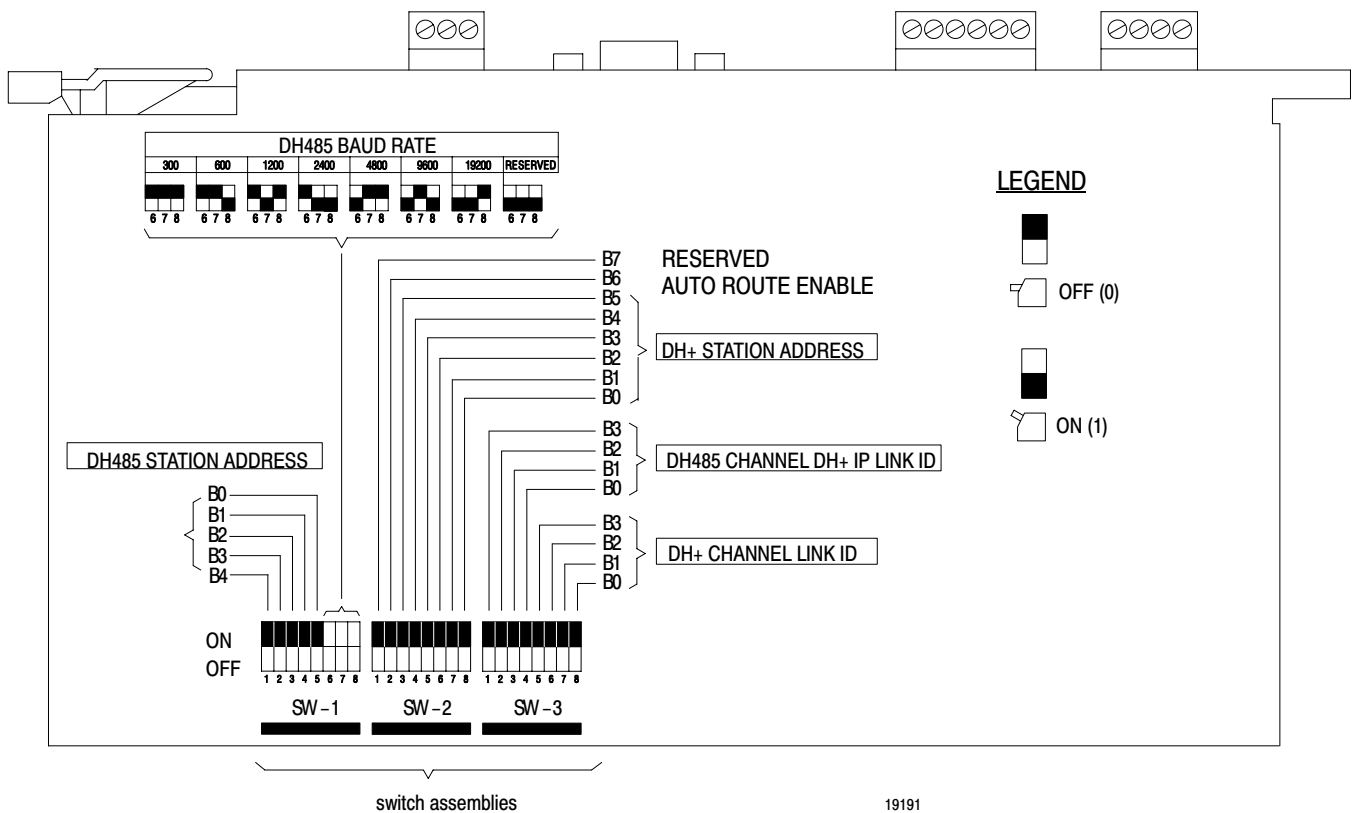
Important: The 1785-KA5 uses the following convention:

- on = binary 1
- off = binary 0

SW-1: DH485 Station Address and DH485 Baud Rate

Use switch assembly SW-1 to select the DH485 station address and baud rate for the 1785-KA5 module. The following sections show you how.

Setting the DH485 Station Address

Set switches 1-5 of SW-1 to the DH485 station address for the 1785-KA5. Valid addresses are 0-31 decimal or 0-37 octal. Set the switches as follows:

Most significant octal digit (switches 1-2)

To set to	Set switch 1 to	Set switch 2 to
0	0	0
1	0	1
2	1	0
3	1	1

Least significant octal digit (switches 3-5)

To set to	Set switch 3 to	Set switch 4 to	Set switch 5 to
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

For example

To set the module's DH485 station address to 15 decimal or 17 octal, set the SW-1 switches as follows:

Set switch	To	
1	0	most significant octal digit = 1
2	1	
3	1	least significant octal digit = 7
4	1	
5	1	

Setting the DH485 Baud Rate

Set switches 6-8 of SW-1 to the DH485 baud rate as follows:

To set this baud rate	Set switch 6 to	Set switch 7 to	Set switch 8 to
300	0	0	0
600	0	0	1
1200	0	1	0
2400	0	1	1
4800	1	0	0
9600	1	0	1
19200	1	1	0
RESERVED	1	1	1

SW-2: Auto Routing and DH+ Station Address

The module has an auto routing feature that broadcasts an information packet over the Data Highway network every 30 seconds.

The following illustration shows **the only two network configurations** that you must use auto routing with:
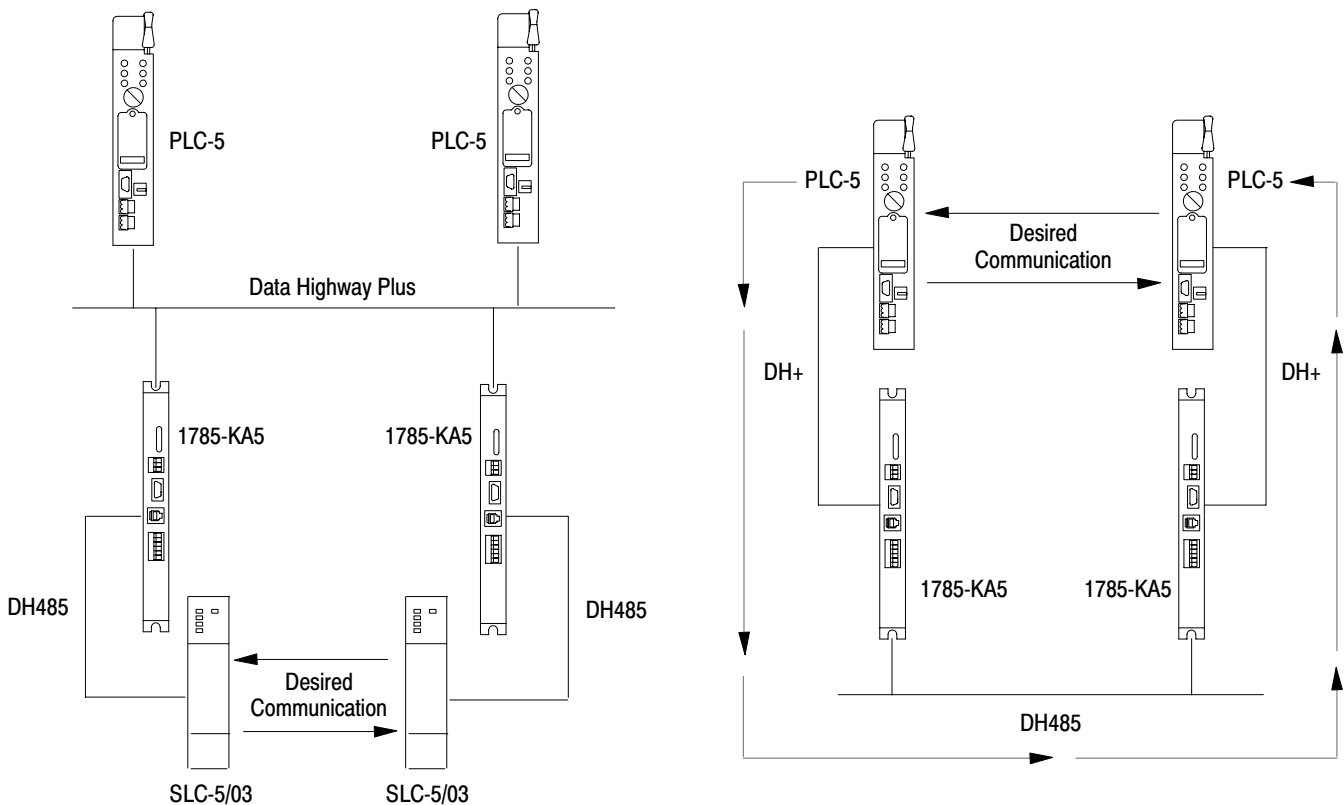
If you are not using one of these two network configurations, **do not use the auto routing feature**.

If you:	Then:
do not plan to use the auto routing feature	skip to the next section, *How to Enable or Disable the Module for Auto Routing* to learn how to **disable** the auto routing feature
plan to use the auto routing feature	continue with this section to determine if you can use the auto routing feature in your network

ATTENTION: Do not use auto routing in a network that includes any of the following components:

- 1785-KE module
- 6008-LTV module
- 1785-KA module
- 1785-KA3 module
- 1775-S5 module
- 1784-KT card
- 1784-KTX card
- 1784-KTXD card

Module and system faults occur when you use auto routing in a system that includes any of these network components. **Be sure to disable the auto routing feature when using these components.**

How to Enable or Disable the Module for Auto Routing
Use switch assembly SW-2 to enable or disable the module for auto routing.

To:	Set switch 2 to
enable auto routing	1
disable auto routing	0

Important: Switch 1 of SW-2 is reserved. Always set this switch to (0).

Setting the DH+ Station Address

Set switches 3-8 of SW-2 to the DH+ station address for the 1785-KA5.
Valid addresses are 0-77 octal Set the switches as follows:

Most significant octal digit (switches 3-5)

To set to	Set switch 3 to	Set switch 4 to	Set switch 5 to
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Least significant octal digit (switches 6-8)

To set to	Set switch 6 to	Set switch 7 to	Set switch 8 to
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

For example

To set the module's DH+ station address to 64 octal, set the switches as
shown below:

Set switch	To
3	1
4	1
5	0
6	1
7	0
8	0

most significant octal digit = 6

least significant octal digit = 4

SW-3: DH485 Channel LINK_ID and DH+ Channel LINK_ID

The 1785-KA5 module has *two* LINK_ID addresses: one for its DH485 side and one for its DH+ side. See the following table to set switches 1-8 of SW-3.

Important: Do not use a LINK_ID of 0 (zero). This address is reserved. If you have more than one 1785-KA5 module on a single physical network, the LINK_IDs for the two modules must be the same.

To set the DH485 LINK_ID to	Set switch 1 to	Set switch 2 to	Set switch 3 to	Set switch 4 to
To set the DH+ LINK_ID to	Set switch 5 to	Set switch 6 to	Set switch 7 to	Set switch 8 to
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

For example
To set the module's DH485 LINK_ID to 4 and DH+ LINK_ID to 8, set the switches as follows:

Set switch	To	
1	0	
2	1	
3	0	DH485 LINK_ID = 4
4	0	
5	1	
6	0	
7	0	DH+ LINK_ID = 8
8	0	

Important: Each physical network link must have a unique LINK_ID address.

The next section shows you how to mount the module in a 1771 I/O rack. See page 2-9 for instructions on mounting the stand-alone version.

Mounting the 1785-KA5 Communication Adapter Module in an I/O Rack

The 1785-KA5 mounts in any slot of an Allen-Bradley 1771 bulletin I/O rack, except slot zero. If you are using a dropline/trunkline configuration, mount the 1785-KA5 module within 10-100 feet of the DH+ trunkline. The maximum cable length for DH485 trunk connections is 4,000 ft., with individual stations "daisy-chained" together.

To install the 1785-KA5 module in a 1771 bulletin I/O rack:

1. Perform an orderly power down of the rack and its controlling PLC processor.

⚠️ **ATTENTION:** Remove system power before removing or installing the module in the 1771 I/O chassis. Failure to observe this warning could result in:
  - damage to the module's circuitry
  - undesired operation and possible injury to personnel

2. Insert the optional keying bands provided with the 1771 I/O rack on the backplane (The 1785-KA5 is keyed to protect against installing it in the wrong I/O rack slot). Insert one band between keying positions 6 and 8. Insert the other between positions 12 and 14. The figure below shows the keying positions:
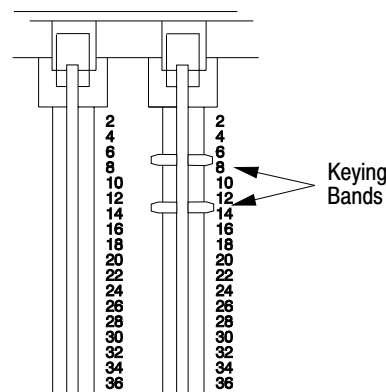

19193

3. Slide the 1785-KA5 module into one of the slots in the 1771 I/O rack. Make sure the module is seated properly. Snap down the latch on the top of the module to secure proper placement in the rack (You can change the position of the keying bands if subsequent system design requires the insertion of a different type of module in this slot).

Now you are ready to connect the module (see page 2-10.)

Panel-mounting the 1785-KA5 Communication Adapter Module

The rear edge of the 1785-KA5 panel-mount version contains a mounting bracket that lets you install the module. If you are using a dropline/trunkline configuration, mount the 1785-KA5 panel-mount module within 10-100 feet of the DH+ trunkline. Figure 2.2 shows the mounting dimensions for the module.

Figure 2.2
1785-KA5 panel-mount module (Cat. No. 1785-KA5P/B) dimensions
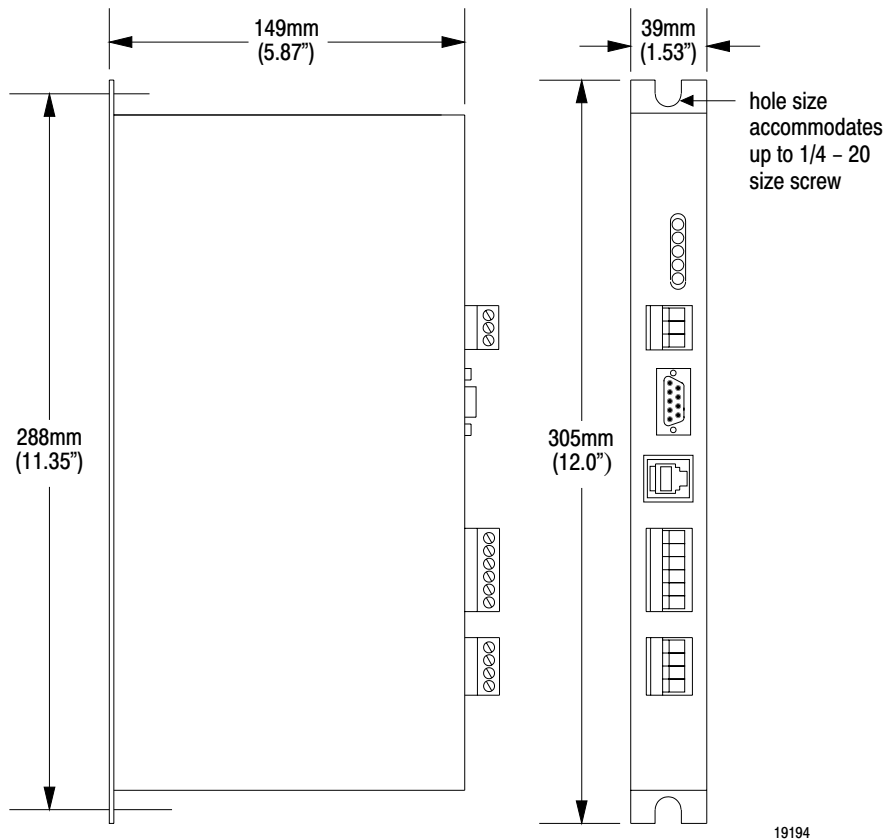
To protect the module from harmful environmental conditions, enclose it in a standard industrial enclosure (NEMA type 12 or equivalent.)
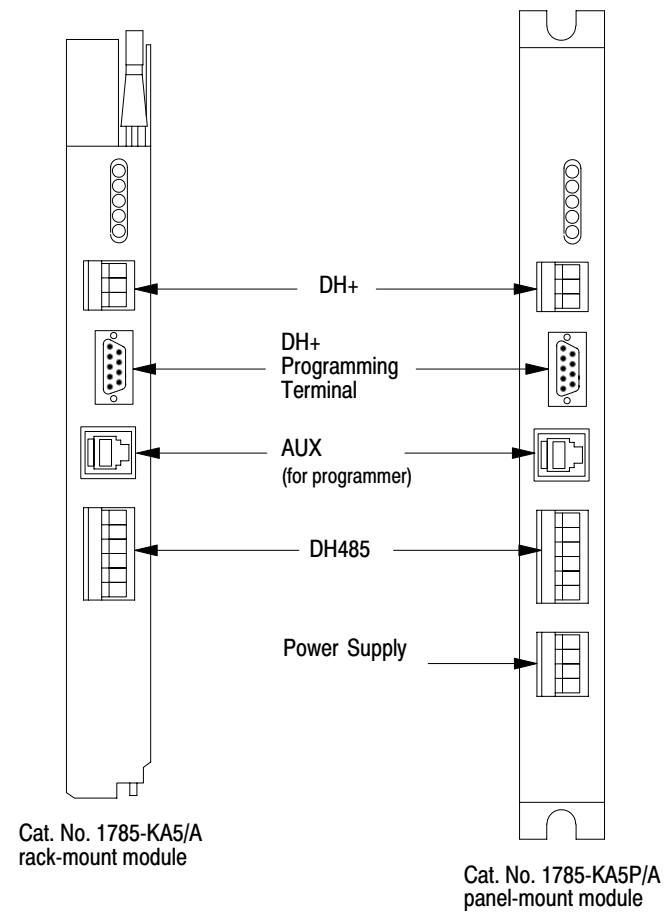
Important: Make sure the enclosure leaves a 6 inch (minimum) clearance at the top and bottom of the module for air flow.

After you mount the module, you are ready to make connections.

Connecting the 1785-KA5 Module

Figure 2.3 shows the ports on the front panel of the 1785-KA5 module:

Figure 2.3
1785-KA5 connectors

DH+

DH+
Programming
Terminal

AUX
(for programmer)

DH485

Power Supply

Cat. No. 1785-KA5/A
rack-mount module

Cat. No. 1785-KA5P/A
panel-mount module

19195

To connect the 1785-KA5 module:

1. Use the 3-pin port labeled **Data Hwy Plus** to connect the DH+ dropline (100 ft. max.) or the daisy-chained cable to the 1785-KA5 module. Connect the Allen-Bradley cable (cat. no. 1770-CD) to the 3-pin plug as shown:

1770-CD
Cable

Blue (2)
Shield (SH)
Clear (1)
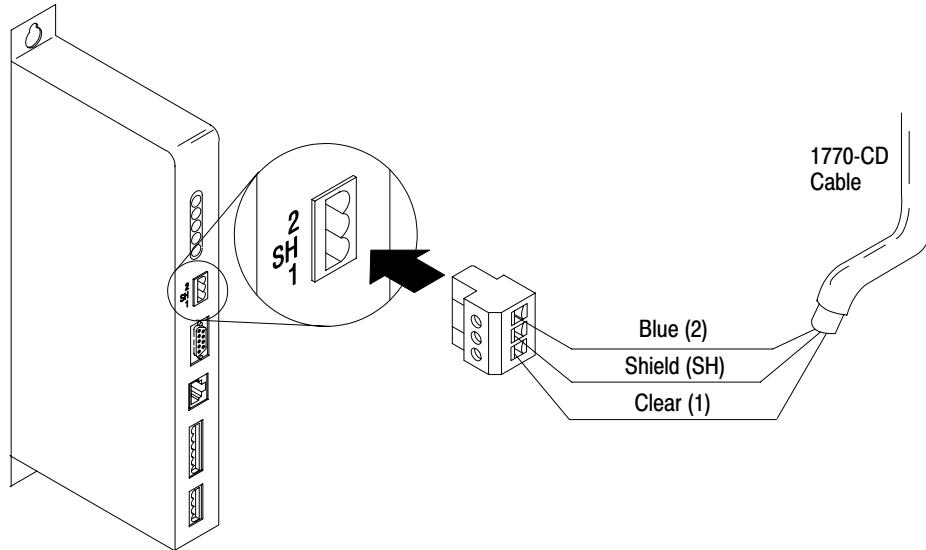
20224

2. Use the 9-pin D-shell port labeled **Data Hwy Plus** to connect your programming terminal (such as the 1784-T50 programming terminal used with a 1784-CP cable) to the DH+ network:

Pin	Signal
1	(clear) signal wire
5	(blue) signal wire
7	(bare) cable shield wire

3. Use the 8-pin modular port labeled **AUX** to connect the SLC 500
programmer. Use an Allen-Bradley cable (cat. no. 1747-C10
series A):

Pin	Signal
1	data (A)
2	–data (B)
3	(not used)
4	24v enable (internally connected to ground pin 7)
5	TXEN (from HHT)
6	earth ground (chassis)
7	signal ground
8	+24V dc @ 105 ma

4. Use the 6-pin terminal block labeled **DH485** to connect to the DH485
dropline. Use Belden #9842 cable:

Pin	Signal
1	earth ground (chassis)
2	cable shield
3	signal ground/common
4	data (B)
5	–data (A)
6	termination

Colors for the Belden #9842 cable are shown below:

|	
earth ground	1
drain cable shield	2
blue/white-stripe	3
white/orange-strip data(B)	4
orange/white-stripe –data(A)	5
termination	6

a. Cut the white wire with the blue stripes from the twisted
wire pair. Do not use this wire.

b. Connect only one end of the trunk cable to earth ground
(chassis) by jumpering pins 1 and 2 together on the connector.

Important: If the 1785-KA5 module is attached at either end of the DH485 network trunk cable, install a wire jumper between pins 4 and 6 of the 6-pin mating connector supplied with the module. This is the termination resistor for the network.

5. If you are connecting a 1785-KA5P/B panel-mount module, you need to connect the external power supply:

Important: To meet the Low Voltage Directive regulations within the European Union or EEA Regions, you must use a Class 2 Safety Extra-low Voltage power supply.

a. Wire a power supply cable as shown below:

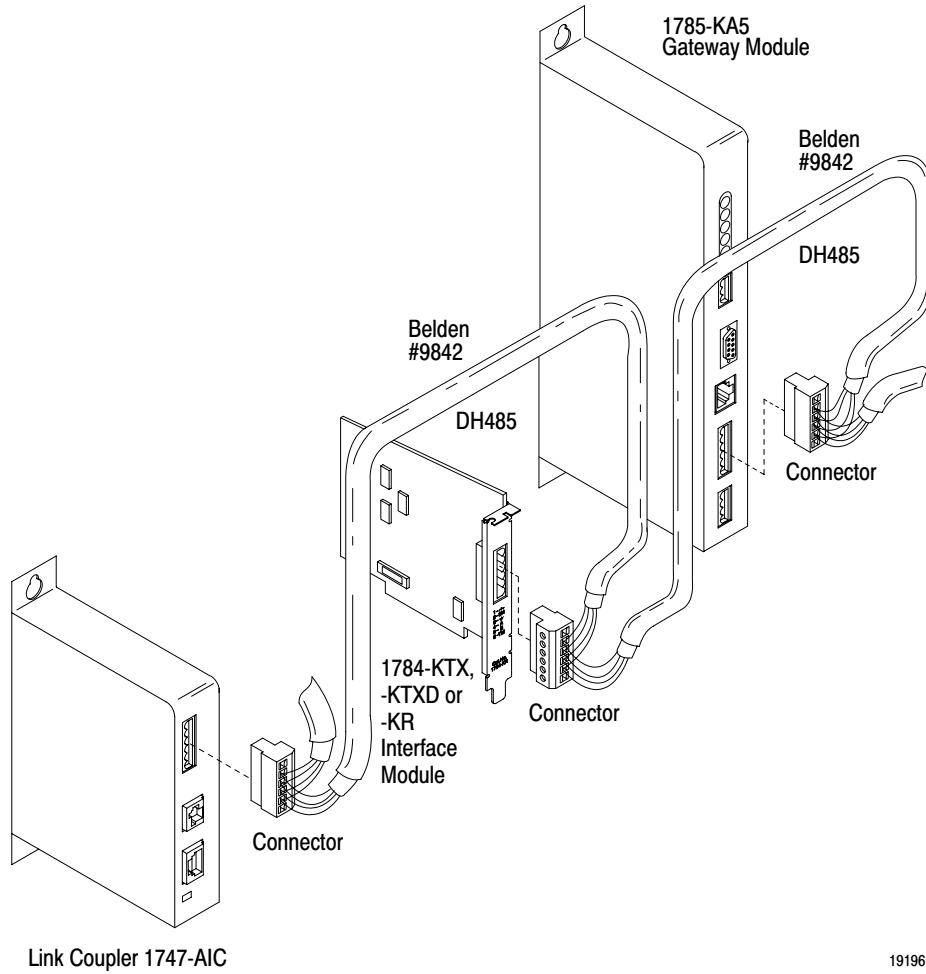4-pin Phoenix-style connector
supplied with 1785-KA5P/B module
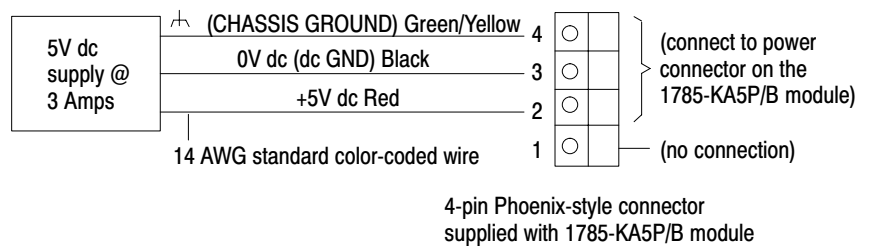
The earth ground or chassis ground wire should be color-coded green with a yellow stripe.

b. Wire the cable using the 4-pin connector you received with your module and connect the cable to the **EXT PWR** connector on the module.
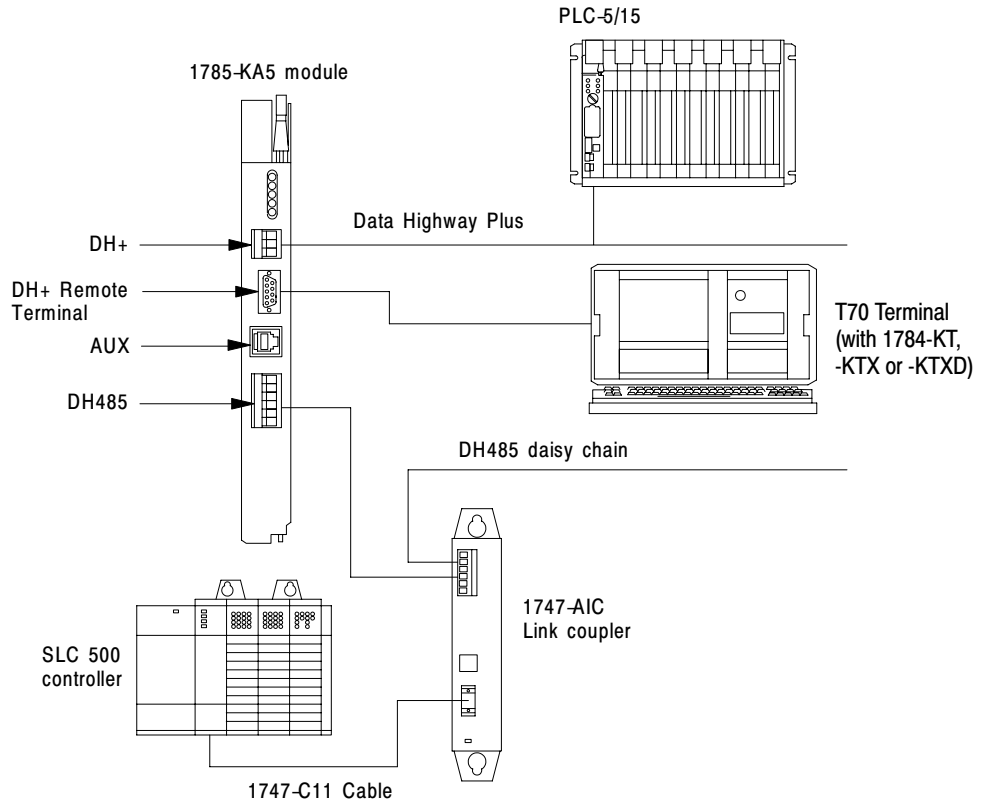
Pin	Signal
1	no connection
2	+5V dc @ 2.0 amps (red)
3	0Vdc (dc GND) black
4	(Chassis Ground) green/yellow

The following figure shows how typical connections are made on the DH485 link.

1785-KA5
Gateway Module

Belden
#9842

DH485

Belden
#9842

DH485

Connector

1784-KTX,
-KTXD or
-KR
Interface
Module

Connector

Connector

Link Coupler 1747-AIC

19196

The figure below shows a typical system connection using the 1785-KA5 module:

PLC–5/15

1785–KA5 module

DH+   Data Highway Plus

DH+ Remote Terminal

AUX

DH485

T70 Terminal
(with 1784-KT,
-KTX or -KTXD)

DH485 daisy chain

1747–AIC Link coupler

SLC 500 controller

1747–C11 Cable

19197

Connect DH485 stations at any point along the length of the cable using a link coupler (cat. no. 1747-AIC) and daisy-chain connections.

Powering Up the 1785-KA5 Module
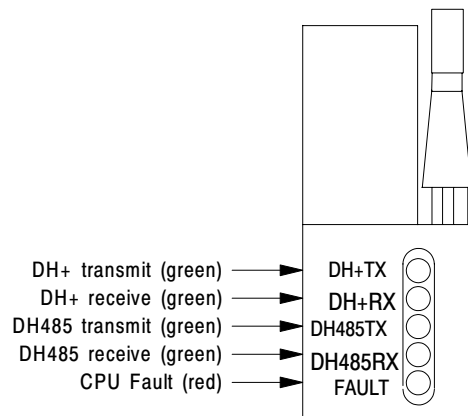
After you have:

- set the switch assemblies on the 1785-KA5 module
- mounted your 1785-KA5 module
- connected the 1785-KA5 module to the DH+ and DH485 (and, optionally, the 1784-T50 programming terminal, the SLC 500 programmer and the external power supply)

you are ready to power up the 1785-KA5 module. To power up the module:

1. Perform a power up of the I/O rack and PLC processor (refer to your PLC user's manual for more information.)

At power-up, the 1785-KA5 performs internal memory and device diagnostic checks. Both the DH+ and DH485 have duplicate address protection. During these tests, the red FAULT LED lights up and the top three green LEDs (DH+TX, DH+RX, DH485TX) sequence through test values.

2. Use the LEDs to verify that the module was installed properly. The diagnostic check is complete when the red FAULT LED turns off (tests normally complete within 10 seconds.) The figure below shows the LEDs.

DH+ transmit (green) → DH+TX
DH+ receive (green) → DH+RX
DH485 transmit (green) → DH485TX
DH485 receive (green) → DH485RX
CPU Fault (red) → FAULT

19198

Use the following table to determine if the installation was successful:

If the installation was	Then
successful	–only the green LEDs flash on and off. –the DIP switches are read. **All DIP switches are read at this time only. Changes you make after this time are ignored.** **Important:** Always power down the module before you change DIP switch settings.
unsuccessful	–the red LED remains on and the green LEDs freeze at the failed value –the 1785-KA5 is removed from both the DH+ and DH485 networks. Originating devices can not send packets through the module and do not receive responses.

Use the module's LEDs and the following table to interpret an installation failure:

DH+TX	DH+RX	DH485TX	Problem
off	off	on	bad ROM checksum
off	on	off	RAM address test failed
off	on	on	RAM pattern test failed
on	off	off	CTC timer tests failed

Important: If only the red FAULT LED lights up, there are two possible causes:

- a duplicate station address was detected on the DH+ or DH485
- the KA5P is indicating that there is a problem with the external power supply or cable

Communicating through the 1785-KA5 Communication Adapter Module

What this Chapter Contains

This chapter includes information on:

- network addressing
- how the 1785-KA5 module operates as a router
- how the 1785-KA5 module operates as a gateway
- PLC-5 to SLC communication
- controlling the flow of data

Internet Protocol Addressing

Each station on the internet must have a unique Internet Protocol (IP) address to help a packet reach its intended receiver. The IP address is the high level address used to send message packets back and forth across the internet. The IP address must be unique over all physical networks that are connected, not just one local network channel. It is needed because a device on the DH+ network may have the same address as a device on the DH485 network. The IP address has two parts:

- LINK_ID address
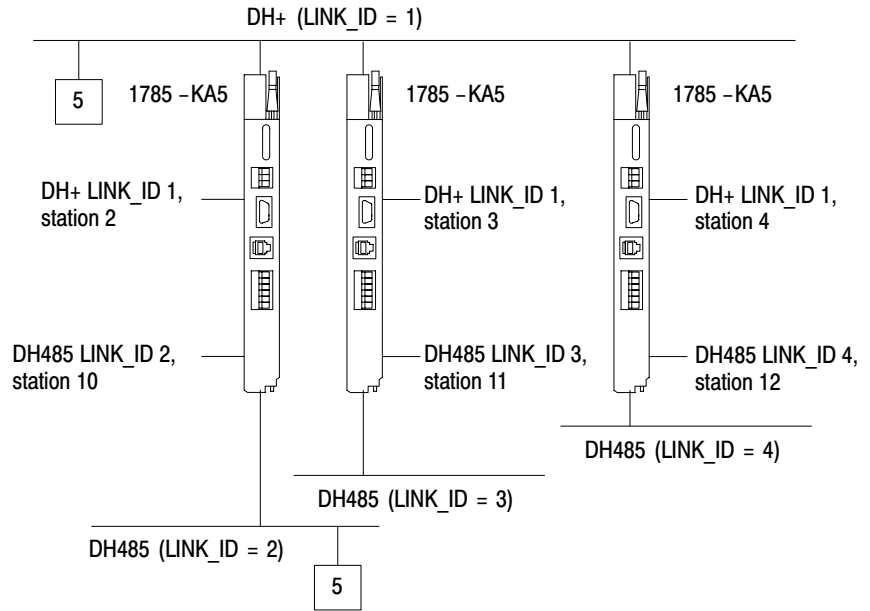- DH+/DH485 STATION address

LINK_ID Address

The LINK_ID is the address of the link (individual cable or channel). Each network link in the internet should have a unique LINK_ID address. You set the LINK_ID address using the switches on the interface module for each station.

Important: If more than one 1785-KA5 module is attached on one physical link, each must have the same LINK_ID address.

For example:

In Figure 3.1, the DH+ LINK_IDs for all three 1785-KA5 modules must be set to 1 (the DH+ LINK_ID.)

Figure 3.1
IP addressing

DH+ (LINK_ID = 1)

5   1785 – KA5   1785 – KA5   1785 – KA5

DH+ LINK_ID 1,   DH+ LINK_ID 1,   DH+ LINK_ID 1,
station 2   station 3   station 4

DH485 LINK_ID 2,   DH485 LINK_ID 3,   DH485 LINK_ID 4,
station 10   station 11   station 12

DH485 (LINK_ID = 4)

DH485 (LINK_ID = 3)

DH485 (LINK_ID = 2)

5

19199

Important: The following LINK_ID addresses are reserved:

This LINK_ID address	Is reserved for the
LINK_ID = 0	local network. When a station does not know its own LINK_ID, it can specify 0 until it determines the value (from a router, for example)
LINK_ID = FFFFh	internet broadcast address. When using this address, the STATION fields must also be all ones. The broadcast address is only permitted in the destination field. The broadcast packet is routed to all internet addresses

DH+/DH485 STATION Address

The DH+ and DH485 address is the low level physical address that identifies a device on a single physical network. Each physical device must have a unique STATION address on that link. You set the STATION address using the switches on the interface module. Valid physical addresses are 0-77 octal for the DH+ network and 0-31 decimal for the DH485 network.

Important: Each physical device on a link must have a unique address on that link. Two devices can not have the same address.

For example:

Figure 3.1 on page 3-2 shows a DH+ network with a LINK_ID of 1 connected to a DH485 network with a LINK_ID of 2 by a 1785-KA5 module. Both networks have stations with addresses of 5, yet each device has a unique IP address.

This device	Has this IP address
device 3 on the DH+ network	LINK_ID = 1, station = 3
device 3 on the DH485 network	LINK_ID = 2, station = 3

**1785-KA5 Router
Communication**

This section explains:

- router mode addressing
- how the 1785-KA5 operates as a router

Router Mode Addressing

A DH+ device wishing to send an internet packet to a DH485 device must set the internet destination address (LINK_ID, STATION) to the:

- LINK_ID of the DH485 network
- STATION address to the DH485 device

How the 1785-KA5 Module Operates as a Router

The 1785-KA5 module operates as a router when attached DH485 stations fully implement IP protocol (if they do not, it acts as a gateway) DH485 stations that **implement IP** can initiate commands, as well as send reply messages.

Important: SLC 5/01, SLC 5/02 and fixed controllers do not support IP. To communicate with one of these processors, use the 1785-KA5 module as a gateway.

When the 1785-KA5 module receives an internet packet, it acts as an intermediate station and passes the packet along in the correct direction. Unlike the gateway process, no packet conversion is necessary because stations on both sides of the 1785-KA5 "speak the same language."

The figure below demonstrates internet router mode communication from a PLC-5 processor (on DH+) to another PLC-5 (on a remote DH+ network) across the DH485. The auto route enable switch, switch 2 of SW-2 (see page 2-2) is set to on (1) for both 1785-KA5 modules.
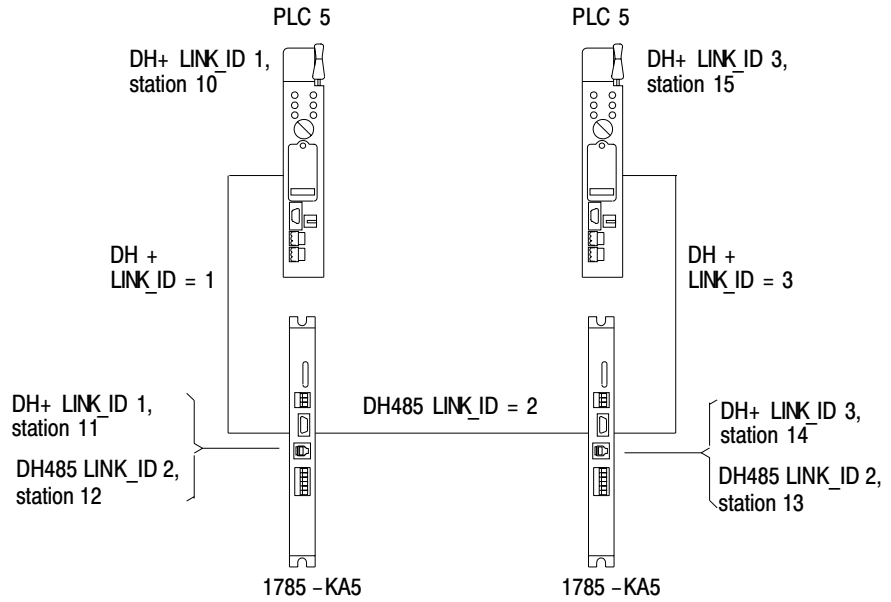
The message instruction below (as shown in Allen-Bradley 6200 Series software) shows the PLC-5 on the left writing 64 words from its data file N20:0 to data file N21:0 of the remote PLC-5 on the right. The 1785-KA5 modules (in router mode) determine which device in the internet to route the message, so if the internet contains multiple 1785-KA5 modules, the message still reaches its intended destination.

Figure 3.2
Message instruction

In this message transfer process:
- the message is first sent to the local node, which is the 1785-KA5 module (DH+ LINK_ID = 1, STATION 11)

- the 1785-KA5 determines the location of the remote station in the internet and reroutes it to the proper destination, which is the PLC-5 (DH+LINK_ID = 3, STATION 15)

MESSAGE INSTRUCTION DATA ENTRY FOR CONTROL BLOCK N10:0	
Communication command:	PLC-5 typed write
PLC-5 data table address:	N20:0
size in elements:	64
Local/Remote:	Remote
Remote station:	15
LINK_ID:	3
Remote link type:	DATA HIGHWAY
Local node address:	11
Destination data table address:	N21:0
Block size = 11 words	

1785-KA5 Gateway Communication

This section explains:

- gateway mode addressing
- how the 1785-KA5 operates as a gateway
- "single-hop" mode packets

Gateway Mode Addressing

All DH+ and DH485 destination and source addresses are contained in the lower address byte, leaving the upper byte free for "sub-addressing." An internet device sends a packet to a non-internet device on the DH485 link by:

- addressing the lower byte of the STATION address (D_STATION[0]) to the 1785-KA5 adapter module for packet processing

- addressing the upper byte of the STATION address (D_STATION[1]) to the actual destination device. The upper byte of the STATION field is defined as follows:

How the 1785-KA5 Module Operates as a Gateway

The 1785-KA5 module operates as a gateway when attached DH485 stations do not fully implement IP. It converts IP packets to DH485 local packets and sends them to their DH485 destination stations.

Important: SLC 5/01, SLC 5/02 and fixed controllers do not support IP. DH+ devices that wish to send packets to DH485 devices that do not implement IP protocol must address the 1785-KA5 DH+ or DH485 gateway service internet address (You set these addresses before you install the 1785-KA5 module. See page 2-7.)

The 1785-KA5 communicates with DH+ devices using IP and DH485 devices using DH485 packets only. The 1785-KA5 module automatically converts between the DH+ and the DH485 as necessary. Neither side is aware of the packet conversion process.

Only devices that fully implement IP protocol may initiate PCCC command packets. DH485 devices that do not implement IP may only send reply packets.

Internet Protocol Single-hop Packets

The IP "single-hop" packet is a special type of IP-to-DH485 remote packet where the DH+ device sending the packet believes it is connected to a gateway that only has two networks – the network it is connected to, and its opposite network.

A single-hop packet is formatted like an IP remote data packet, except that the destination (DST) and source link (S_LINK_ID) fields are zero, so the packet is not routed using the normal IP routing algorithm. When the 1785-KA5 module receives the packet, it automatically retransmits the packet on the network opposite the one on which the packet was received.
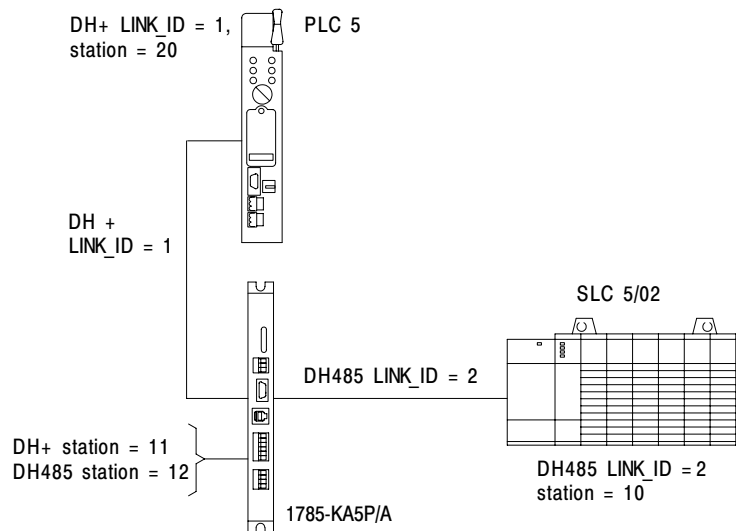
Important: The 1785-KA5 module will accept single-hop packets from its DH+ side only (no DH485 software can generate these packets.) New software running on DH485 devices wanting to send packets off of the DH485 network should only implement full IP-formatted packets – not single-hop packets.

PLC-5 to SLC Communication

A PLC-5 can communicate with a SLC 500, SLC 5/01, SLC 5/02, or SLC 5/03 using a PLC-5 ladder rung message instruction. These SLC devices do not provide a message instruction, but will respond to UNSOLICITED READ and UNSOLICITED WRITE commands.

Read and write commands are addressed to the SLC's data file 9 (also referred to as its common interface file, or CIF.) Data file 9 must be created before the read or write command can be executed. File 9 can be created in the SLC 500 using Advanced Programming Software (APS), which must be locally configured. Contact your sales office for third party software support.

The following example demonstrates communication in an internet using gateway mode. The message instruction shows that the PLC-5 sends 10 words from its data file N40:0 to file 9 (CIF) of the remote SLC 5/02. Note the following:

DH+ LINK_ID = 1,
station = 20   PLC 5

DH +
LINK_ID = 1

SLC 5/02

DH485 LINK_ID = 2

DH+ station = 11
DH485 station = 12

DH485 LINK_ID = 2
station = 10

1785-KA5P/A

19236

MESSAGE INSTRUCTION DATA ENTRY FOR CONTROL
BLOCK N20:0

Communication command:	PLC-2 Unprotected Write
PLC-5 data table address:	N40:0
size in elements:	10
local/remote:	remote
remote station:	012
LINK_ID:	0
remote link type:	Data Highway
local node address:	011
destination table address:	010

size in blocks = 10 words

The following information applies to this transaction:

- The command must be a PLC-2-type command.

- The message is a remote message because the destination is not on the local link.

- The remote station is the octal equivalent of the decimal address of the destination (for example, SLC 5/02 address = 10 decimal = 12 octal.)

- In the message instruction, set the LINK_ID to zero (0) even though the actual LINK_ID does not equal zero.

- The local node is the DH+ station address of the 1785-KA5.

- File 9 must exist in the SLC 5/02.

Important: File 9 must contain a minimum of 17 elements. The PLC-5 begins writing into element 16 because the destination table address contains a minimum of 10 elements.

- The destination data table address specifies the data word number to be accessed within file 9. The PLC-5 automatically converts this address to a byte address by doubling the decimal equivalent of the word address.

For example: $010_8 = 16_{10}$ and $177_8 = 254_{10}$.

SLC 500 processors use two types of addressing:

- word addressing
- byte addressing

| To	Use this type
access only even words	word addressing. SLC 500, 5/01, and 5/02 processors use word addressing. Therefore, you can address only even addresses in file 9 between word 16_{10} and word 254_{10}.
access both even and odd words	byte addressing. The SLC 5/02, series C, FRN 3 or later can use byte addressing when bit S:2/8 is set. Therefore, you can address both even and odd addresses between word 8_{10} and word 255_{10} in file 9.
	If the SLC 5/02 is in word addressing mode, the destination data table address, when doubled and converted to decimal, represents the word number to be accessed.
	If the SLC 5/02 is in byte addressing mode, the destination data table address, when converted to decimal, represents the word number to be accessed (see Table 3.A.)

Table 3.A
SLC 5/02 byte addressing mode

PLC-5 destination table address	Type of addressing	SLC address
010	word	N9:16
011	word	N9:18
176	word	N9:252
177	word	N9:254
010	byte	N9:8
011	byte	N9:9
176	byte	N9:254
177	byte	N9:255

The next sections describe two types of remote messaging. Refer to
Figure 3.3 with the following examples:

- remote read from a 500CPU
- remote read from a 485CIF

Figure 3.3
Connections for a remote message.
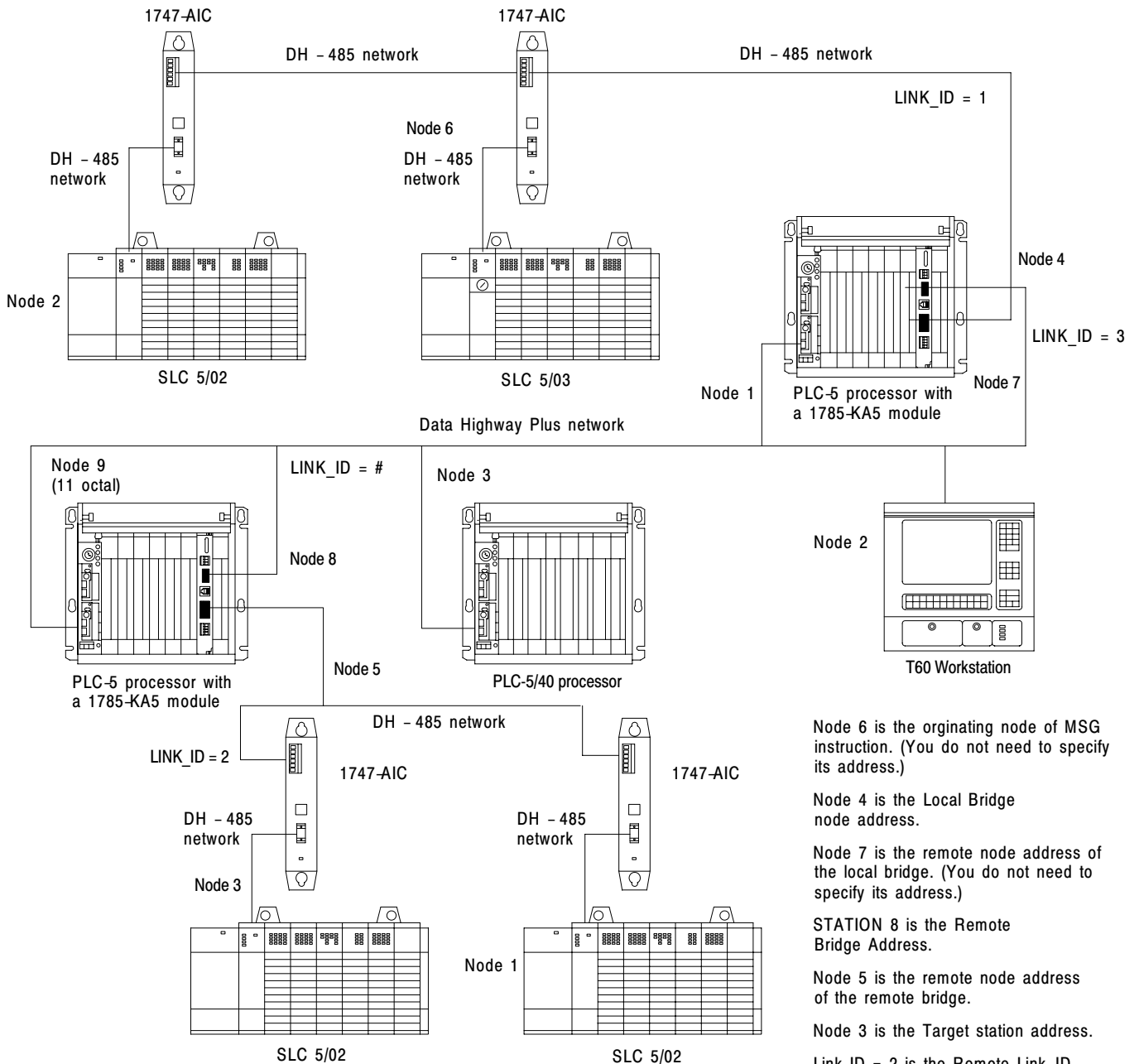
Node 6 is the orginating node of MSG instruction. (You do not need to specify its address.)

Node 4 is the Local Bridge node address.

Node 7 is the remote node address of the local bridge. (You do not need to specify its address.)

STATION 8 is the Remote Bridge Address.

Node 5 is the remote node address of the remote bridge.

Node 3 is the Target station address.

Link ID = 2 is the Remote Link_ID

20096

3-11

Remote Read from a 500CPU

DH485 supports remote messaging. Below is the **data entry screen** for a remote read.

Display Area:	Type:	Peer-to-Peer		
	Read/Write:	READ		
	Target Device:	500CPU	ignore if timed out:	0 TO
	Local/Remote:	Remote	to be retried:	0 NR
	Control Block:	N10 : 0	awaiting execution:	0 EW
F10	Channel:	1	continuous run:	0 CO
F1	Target Node:	3	error:	0 ER
F2	Remote Bridge Link ID:	2	message done:	0 DN
F3	Remote Bridge Node Address:	0	message transmitting	0 ST
F4	Local Bridge Node Address:	4	message enabled	0 EN
F5	Destination/Source File Address:	N7 : 0	waiting for queue space:	0 WQ
F6	Target SRC/Dst File Address:	N7 : 50		
F7	Message Length in Elements:	5		
F8	Message Timeout (seconds):	20		
	ERROR CODE: 0		control bit address: N10 : 0/8	
	Error Code Desc:			

Message:

Prompt: Press a function key: <ENTER> to save and exit, or <ESC> to abort

Data/Cmd Entry:

Status: offline   no forces   INSTR INSERT   File 009

Main Functions: TARGET NODE	REMOTE LINK ID	REMOTE ADDRESS	LOCAL ADDRESS	FILE ADDRESS	TARGET ADDRESS	MESSAGE LIMIT	MESSAGE TIMEOUT	TOGGLE BIT	CHANNEL
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10

Function Key	Description
[F1] Target Node	Specifies the node number of processor that is receiving the message.
[F2] Remote LINK_ID[1]	Specifies the LINK_ID of the remote network where the remote target processor resides.
[F3] Remote Bridge Node Address[2]	Use when the remote target device is a SLC fixed, 5/01, 5/02, or any other non-internet device. The value must be 0 anytime your remote target device is a SLC 5/03, PLC-5, or other internet device. Valid range is 0 – 15 decimal.
[F4] Local Address	Specifies the node address of the bridge residing on the local network that provides the link to the remote target processor. Specifies DH-485 address.
[F5] File Address	For a Read (Destination) this is the address in the initiating processor which is to receive data.
	For a Write (Source) this is the address in the initiating processor that is to send data.
	Valid file types are S, B, T, C, R, N, I, O, M0, M1.
[F6] Target Address	For a Read (Destination) this is the address in the remote target processor that is to send data.
	For a Write (Source) this is the address in the remote target processor that is to receive data.
	Valid file types are S, B, T, C, R, N, I, O, M0, M1.
[F7] Message Length	Defines the length of the message in elements. One word elements are limited to a maximum length of 1 –112. Three word elements are limited to a maximum length of 1 – 37.
[F8] Message Timeout	Defines the length of the message timer in seconds. A timeout of 0 seconds means that there is no timer and the message will wait forever for a reply. Valid range is 0 – 255 seconds.
[F10] Channel	Identifies the physical channel used for the message communication. Available channels are (0, RS232) or (1, DH485).

[1] The Remote Bridge Node Address refers to the side of the remote bridge that is connected to the local bridge's remote side. This address must be within the range of 1 - 15 decimal. When this value is between 1 and 15, the MSG instruction sends "gateway" packets. Gateway packets need to contain the Remote Bridge Node Address to function. The 1785-KA5 module only accepts gateway packets between 1 – 15. The 5/03 MSG instruction contains a gateway packet anytime the Remote Bridge Node Address field is non-zero.

[2] In the cases of MSG instructions to non-internet devices and end devices residing directly on the DH+ link, the Remote LINK_ID is the DH+ LINK_ID. In all other cases, the Remote LINK_ID is the DH485 LINK_ID.

The **monitor display screen** allows you to monitor the status of the message instruction while the processor is running.

Display Area:	Type:	Peer-to-Peer			
	Read/Write:	READ			
	Target Device:	500CPU	ignore if timed out:	0	TO
	Local/Remote:	Remote	to be retried:	0	NR
	Control Block:	N10 : 0	awaiting execution:	0	EW
F10	Channel:	1	continuous run:	0	CO
F1	Target Node:	3	error:	0	ER
	Remote Bridge Link ID:	2	message done:	0	DN
	Remote Bridge Node Address:	0	message transmitting	0	ST
	Local Bridge Node Address:	4	message enabled	0	EN
	Destination/Source File Address:	N7 : 0	waiting for queue space:	0	WQ
F6	Target SRC/Dst File Address:	N7 : 50			
	Message Length in Elements:	5			
F8	Message Timeout (seconds):	20			
	ERROR CODE: 0		control bit address: N10 : 0/8		
	Error Code Desc:				

In this screen, the 5/03 processor reads 5 elements (words) from Target node 3 of Remote Bridge LINK_ID 2, starting at word N7:50. If 20 seconds elapse without a reply, error bit N10:012 will be set, indicating that the instruction has timed out. The device at node 3 of Remote Bridge LINK_ID 2 understands the SLC family protocol.

Message:

Prompt: Press a function key or press <ESC> to exit monitor

Data/Cmd Entry:

Status: offline   no forces   INSTR INSERT   File 009

Main Functions:

TARGET NODE		TARGET ADDRESS	MESSAGE TIMEOUT	TOGGLE BIT
F1		F6	F8	F9

Remote Read from a 485CIF

If you select a remote read from a 485CIF, the following screen appears:

```
Display Area:          Type:                        Peer-to-Peer
                       Read/Write:                  READ
                       Target Device:               485CIF          ignore if timed out:  0   TO
                       Local/Remote:                Remote              to be retried:  0   NR
                       Control Block:               N10 : 0          awaiting execution:  0   EW
                   F10 Channel:                      0                   continuous run:  0   CO
                    F1 Target Node:                  3                            error:  0   ER
                    F2 Remote Bridge Link ID:        3                    message done:  0   DN
                    F3 Remote Bridge Node Address:   0             message transmitting  0   ST
                    F4 Local Bridge Node Address:    4                 message enabled  0   EN
                    F5 Destination/Source File Address: N7 : 0     waiting for queue space:  0   WQ
                    F6 Target Offset                 20
                    F7 Message Length in Elements:   5
                    F8 Message Timeout (seconds):    10

                       ERROR CODE:   0                             control bit address:  N10 : 0/8
                       Error Code Desc:
Message:
Prompt:       Press a function key: <ENTER> to save and exit,  or  <ESC> to abort
Data/Cmd Entry:
Status:       offline    no forces                               INSTR INSERT     File 009
Main Functions: [TARGET NODE F1] [REMOTE LINK ID F2] [REMOTE ADDRESS F3] [LOCAL ADDRESS F4] [FILE ADDRESS F5] [TARGET OFFSET F6] [MESSAGE LIMIT F7] [MESSAGE TIMEOUT F8] [TOGGLE BIT F9] [CHANNEL F10]
```

Function Key	Description
[F1] Target Node	Specifies the node number of processor that is receiving the message. Valid range is 0 – 254 decimal.
[F2] Remote LINK_ID	Specifies the LINK_ID of the remote network where the remote target processor resides.
[F3] Remote Bridge Node Address	Use when the remote target device is a SLC fixed, 5/01, 5/02, or any other non-internet device. Valid range is 0 – 15 decimal.
[F4] Local Address	Specifies the node address of the bridge residing on the local network that provides the link to the remote target processor. Valid range is 0 – 254 decimal.
[F5] File Address	For a Read (Destination) this is the address in the initiating processor that is to receive data.
	For a Write (Source) this is the address in the initiating processor that is to send data.
	Valid file types are S, B, T, C, R, N, I, O, M0, M1.
[F6] Target Offset	For a Read or Write this is the word offset value in the common interface file (byte offset for non-SLC device).
[F7] Message Length	Defines the length of the message in elements. One word elements are limited to a maximum length of 1 –112. Three word elements are limited to a maximum length of 1 – 37.
[F8] Message Timeout	Defines the length of the message timer in seconds. A timeout of 0 seconds means that there is no timer and the message will wait forever for a reply. Valid range is 0 – 255 seconds.
[F10] Channel	Identifies the physical channel used for the message communication. Available channels are (RS232, 0) or (DH485, 1).

The **monitor display screen** allows you to monitor the status of the message instruction while the processor is running:

Display Area:

Type:	Peer-to-Peer	
Read/Write:	READ	
Target Device:	485CIF	ignore if timed out: 0 TO
Local/Remote:	Remote	to be retried: 0 NR
Control Block:	N10 : 0	awaiting execution: 0 EW
F10 Channel:	1	continuous run: 0 CO
F1 Target Node:	3	error: 0 ER
Remote Bridge Link ID:	3	message done: 0 DN
Remote Bridge Node Address:	0	message transmitting 0 ST
Local Bridge Node Address:	4	message enabled 0 EN
Destination/Source File Address:	N7 : 0	waiting for queue space: 0 WQ
F6 Target Offset	20	
Message Length in Elements:	5	
F8 Message Timeout (seconds):	10	

In this screen, the 5/03 processor reads 5 elements (words) from Target node 3 or Remote Bridge LINK_ID 3, starting at byte offset 20 of its PLC 3 compatibility file. This is a byte offset because the device at node 3 is a PLC–5/40.

The 5 elements are placed in the integer file starting at word N7:0. If 10 seconds elapse without a reply, error bit N10:0/12 will be set, indicating that the instruction timed out. The device at node 3 of the Remote Bridge LINK_ID 2 understands the 485CIF (PLC 2 emulation) protocol.

ERROR CODE: 0   control bit address: N10 : 0/8
Error Code Desc:

Message:
Prompt: Press a function key: <ENTER> to save and exit, or <ESC> to abort
Data/Cmd Entry:
Status: offline   no forces   INSTR INSERT   File 009

Main Functions:

TARGET NODE			TARGET OFFSET	MESSAGE TIMEOUT	TOGGLE BIT
F1			F6	F8	F9

Controlling the Flow of Data

The data transfer rate is much higher for DH+ links (57.6 KB) than for DH485 links (19.2 KB), so DH+ devices must control the flow of data to DH485 devices. For example, a DH+ device can send packets to the 1785-KA5 adapter three times faster than the gateway can send the packets out to their DH485 destinations.

The 1785-KA5 adapter module provides only a limited amount of buffer space to account for short term bursts of data transfer. The DH+ device must meter out or otherwise provide other means for flow control to prevent buffer overflow in the gateway.

Specifications

Communication Rates

- Data Highway Plus (DH+): 57, 600 bits per second
- RS-485 Data Highway (DH485): switch-selectable from 300 to 19,200 bits per second

Function

- interface a programmable RS-485 compatible device with an Allen-Bradley DH+ network

Mounting Location

- 1785-KA5/B: single slot in bulletin 1771 I/O rack
- 1785-KA5P/B: stand-alone panel-mount

Communication Ports

- DH+
- DH485

Cabling

- DH+: DH/DH+ station connector (cat. no. 1770-SC)
  Use with Allen-Bradley 1770-CD or cables listed on the Allen-Bradley approved vendor list
- DH485: customer-supplied Belden 9842

Power Requirements

- 2.0A @ 5V dc

Power Source

- 1785-KA5/B: bulletin 1771 I/O rack power supply
- 1785-KA5P/B: user-supplied 5V dc @ 2A

Ambient Temperature Rating

- 0ºC to 60ºC (32ºF to 140ºF) operational
- -40ºC to 85ºC (-40ºF to 185ºF) storage

Ambient Humidity Rating

- 5% to 95% without condensation

Agency Certification (when product or packaging is marked)

- (UL)
- (CSA)
- CE marked for all applicable directives

Rockwell *Automation*

Allen-Bradley

Allen-Bradley, a Rockwell Automation Business, has been helping its customers improve productivity and quality for more than 90 years. We design, manufacture and support a broad range of automation products worldwide. They include logic processors, power and motion control devices, operator interfaces, sensors and a variety of software. Rockwell is one of the worlds leading technology companies.

Worldwide representation.