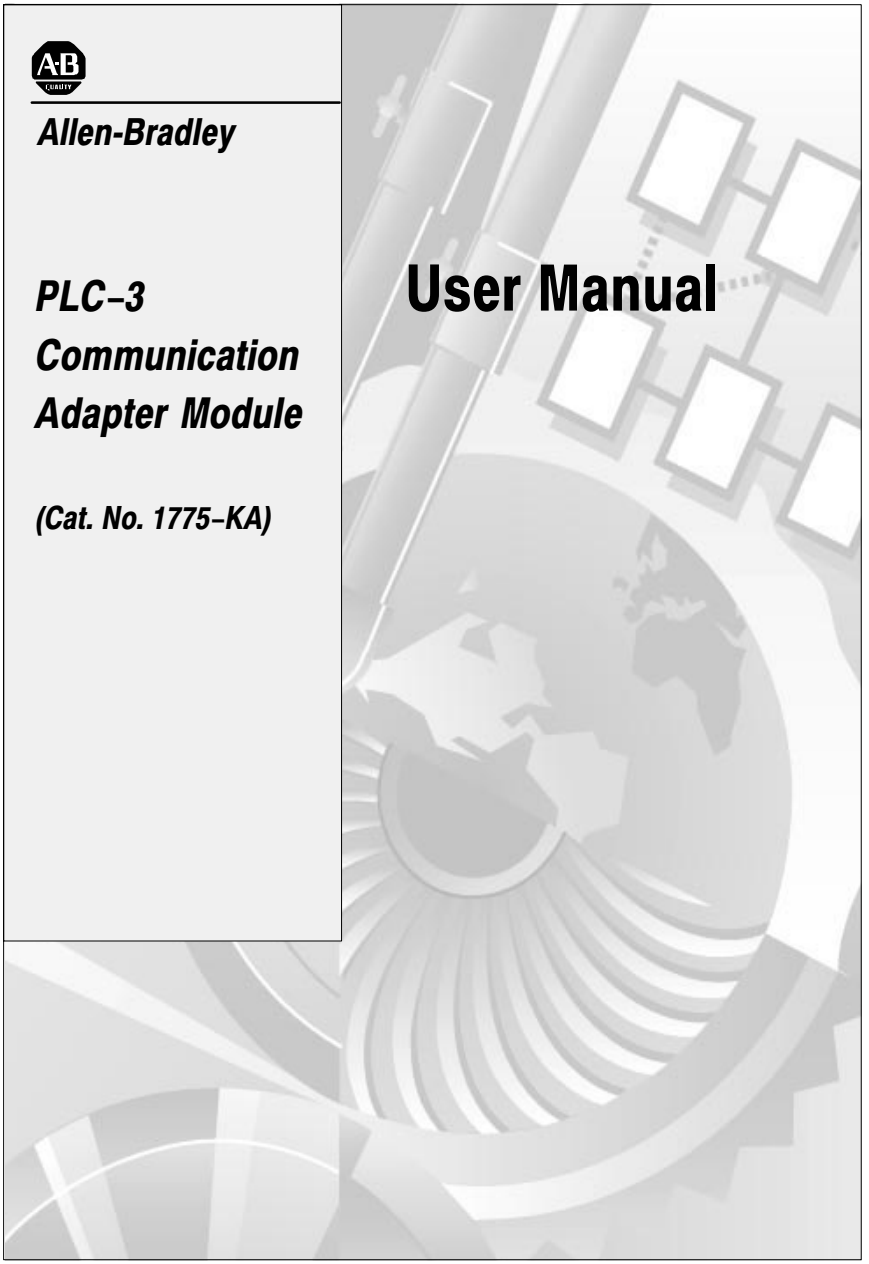


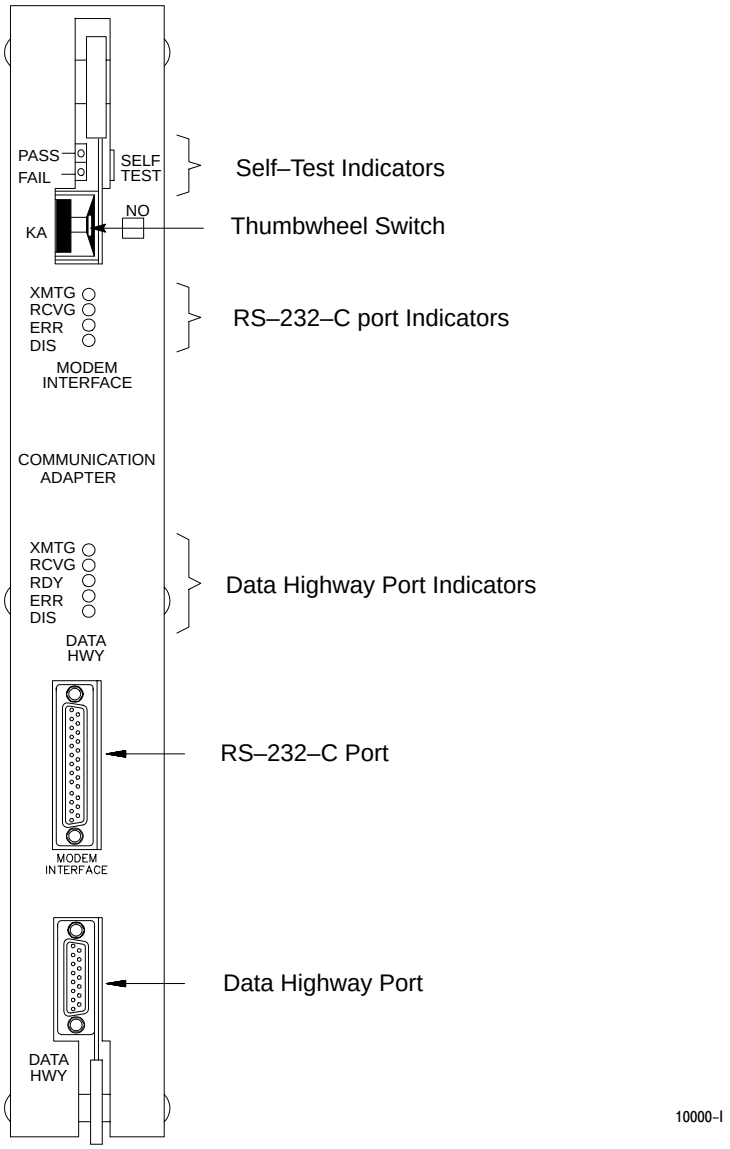
Allen-Bradley

PLC–3 Communication Adapter Module

(Cat. No. 1775–KA)

User Manual

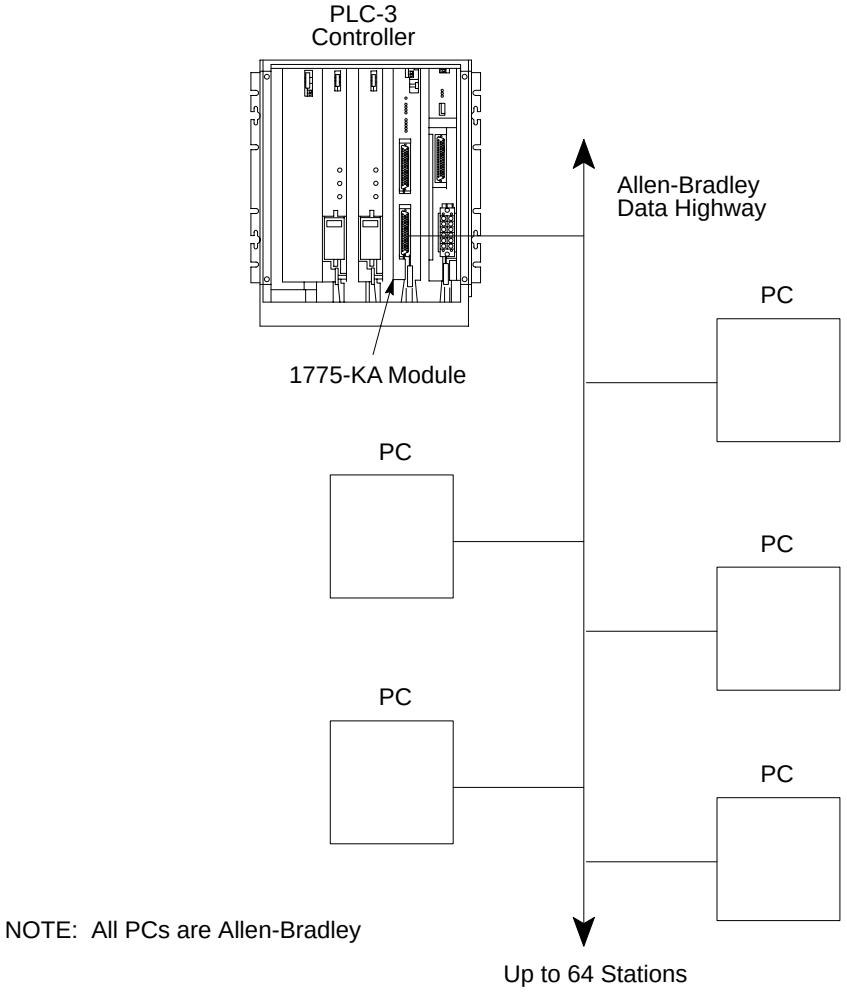
Figure 1.1
Communication Adapter Module (Cat. No. 1775–KA)



In addition, the module provides the following software features:

- Programmable configuration parameters
- Command language that allows for complex logic decisions, looping, and nesting
- Symbolic representation of data and addresses
- Embedded arithmetic expressions and logic operations
- Decimal, octal, or BCD (binary coded decimal) data entry

Figure 1.2
Example Data Highway Configuration



10001–I

The PLC–3 can support multiple 1775–KA modules in the same PLC–3 chassis. This provides the PLC–3 with concurrent access to several independent Data Highways.

The 1775–KA module can also serve as an interface between the PLC–3 programmable controller and an intelligent RS–232–C compatible device or any Allen–Bradley PC and its Data Highway module. Some examples of this application of the module are the following:

- Interfacing two PLC–3 controllers through a modem link
- Interfacing a PLC–3 controller with a computer (either directly or through modems)
- Interfacing a PLC–3 controller with a remote Data Highway through a modem link
- Interfacing a PLC–3 controller as a slave station on a multipoint modem link
- Interfacing a PLC–3 controller on a point–to–point link with PLC–2 Family processor through a 1771–KG module (The 1772–LR processor is not supported in this configuration.)

Figure 1.3 shows the 1775–KA module in a typical modem application.

Figure 1.3
Typical Modem Application

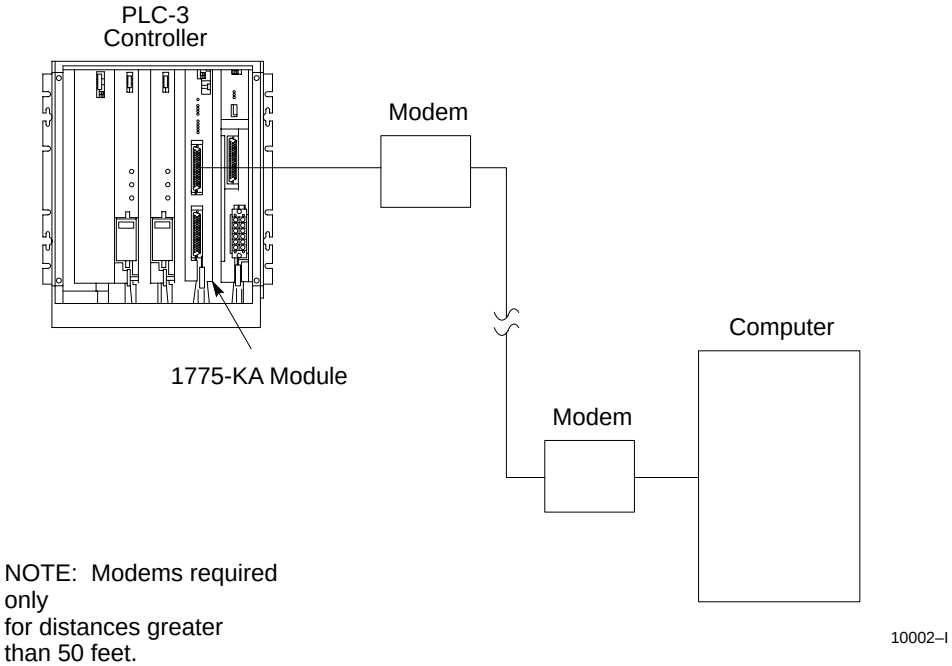
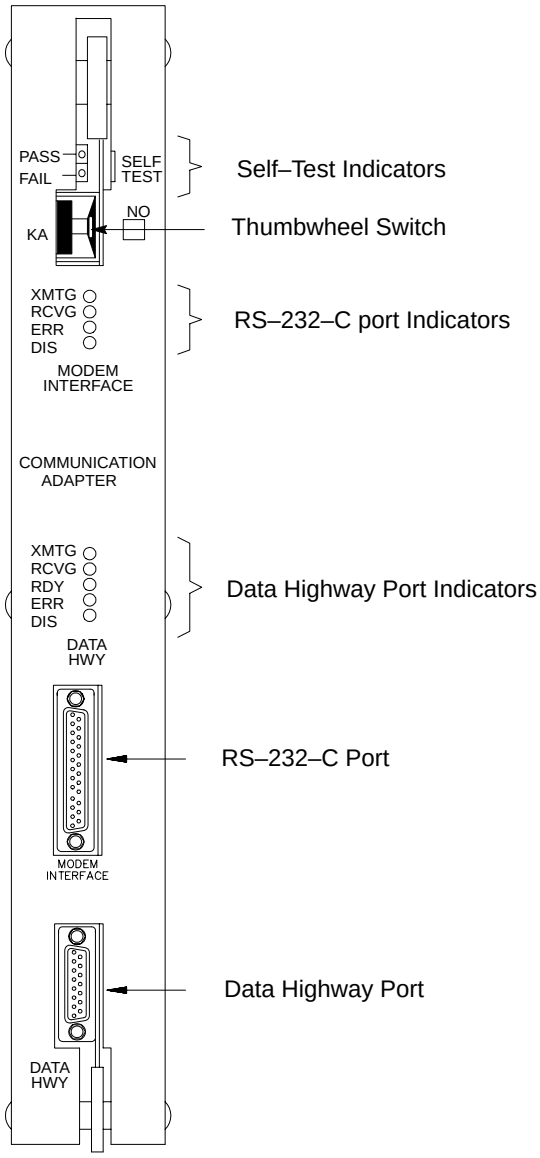


Figure 2.1
Front View of 1775–KA Module



If there is only one 1775–KA module in the PLC–3 chassis, set its thumbwheel switch to the number 1. If there are multiple 1775–KA modules in the same PLC–3 chassis, set their thumbwheel switches to consecutive numbers, starting with the number 1. You may write the selected number in the space provided beside the thumbwheel switch.

CAUTION: To guard against unpredictable operation of the PLC–3 processor, do not change the setting on any thumbwheel switch while the 1775–KA module is powered–up.

Option Switches

Figure 2.2 shows a set of four option switches on the bottom edge of the 1775– KA module. Switches 1 and 2 are used when the PLC–3 controller is programmed to operate in a backup configuration. Switch number 1 determines whether or not a fault in the 1775–KA module will cause the primary PLC–3 controller to switch over to the backup PLC–3. Switch number 2 determines whether or not the 1775–KA module will disable its Data Highway port when the PLC–3 becomes deactive. Switch 3 is for RS–232–C communication. Switch 4 is reserved for future use and should always be left open (up, or off). Use Table 2.A below to determine the appropriate switch setting:

Figure 2.2
Option Switches

Table 2.A
1775–KA Switch Settings

If this switch:	Is:	Then
1	OPEN	the PLC will switch over to backup whenever one of the following fault conditions occurs: 1. The 1775–KA module tries to hold control of the PLC–3 backplane for more than 138 microseconds. 2. The 1775–KA module experiences a execution timeout of more than 32 milliseconds 3. The 1775–KA module experiences an internal stack overflow 4. The 1775–KA module experiences severe Data Highway communication problems.
1	CLOSED	the primary PLC–3 will not switch to backup when a fault occurs with the 1775–KA module.
2	OPEN	the 1775–KA module will disable is Data Highway port whenever the primary PLC–3 controller becomes deactive. The module will no longer be able to transmit or receivemessages through its Data Highway port. Also, setting switch 2 to open enables the backup operation feature.
2	CLOSED	the Data Highway port on the module will remain active if the primary PLC–3 becomes deactive.
3	OPEN	the module may be connected up to 7,000 cable feet away from a 1771–KF, a 1771–KG, 1773–KA or another 1775–KA module. In addition to setting switch 3 to the open position, you must also set switch 2 to closed position. This makes pin 25 on the RS–232–C port of the 1775–KA module active (refer to figures 2.8 to 2.10). Note that switch 3 must always be closed for communication with an RS–232–C device other than a 1771–KF, 1771–KG, 1773–KA, or 1775–KA module.
3	CLOSED	the MODEM INTERFACE port of the 1775–KA module may be connected to a standard RS–232–C device that is located within 50 cable feet of the module.
4	OPEN	Switch 4 is reserved for future use and should always be left open.

Module Placement

After setting the thumbwheel switch, insert the module into any one of the module slots in the PLC–3 processor chassis. Whenever you power–up the processor, the module will receive power also.

Data Highway Cable Connections

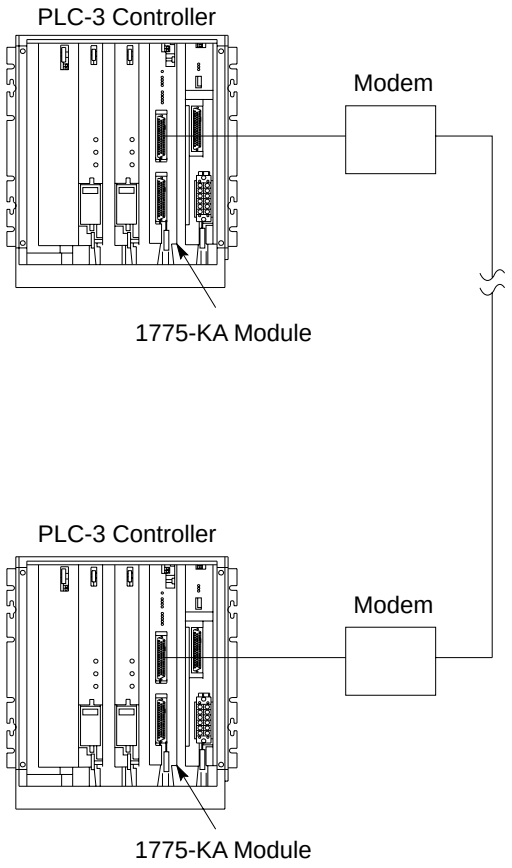
There are two cable connectors, or ports, on the front of the 1775–KA module (Figure 2.1). The bottom port, labeled DATA HWY., is for connection to the Allen–Bradley Data Highway. If you are using the 1775–KA module in a Data Highway application, plug the Data Highway dropline cable into this port. For details on the installation of the Data Highway cable, refer to the Data Highway Cable Assembly and Installation Manual (publication 1770–810).

RS–232–C Cable Connections

The RS–232–C port, labeled MODEM INTERFACE on the 1775–KA module, can interface with any RS–232–C device that is capable of understanding and generating the communication protocol described in this chapter. Some typical RS–232–C applications are:

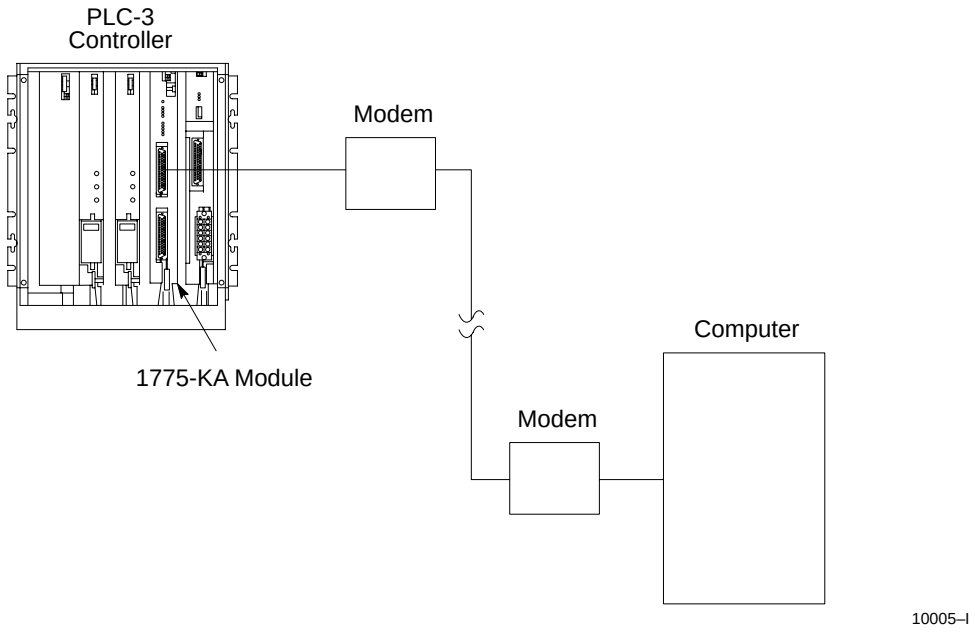
- Interfacing two PLC–3 controllers through a modem link (Figure 2.3)

Figure 2.3
Linking Two PLC–3 Controllers



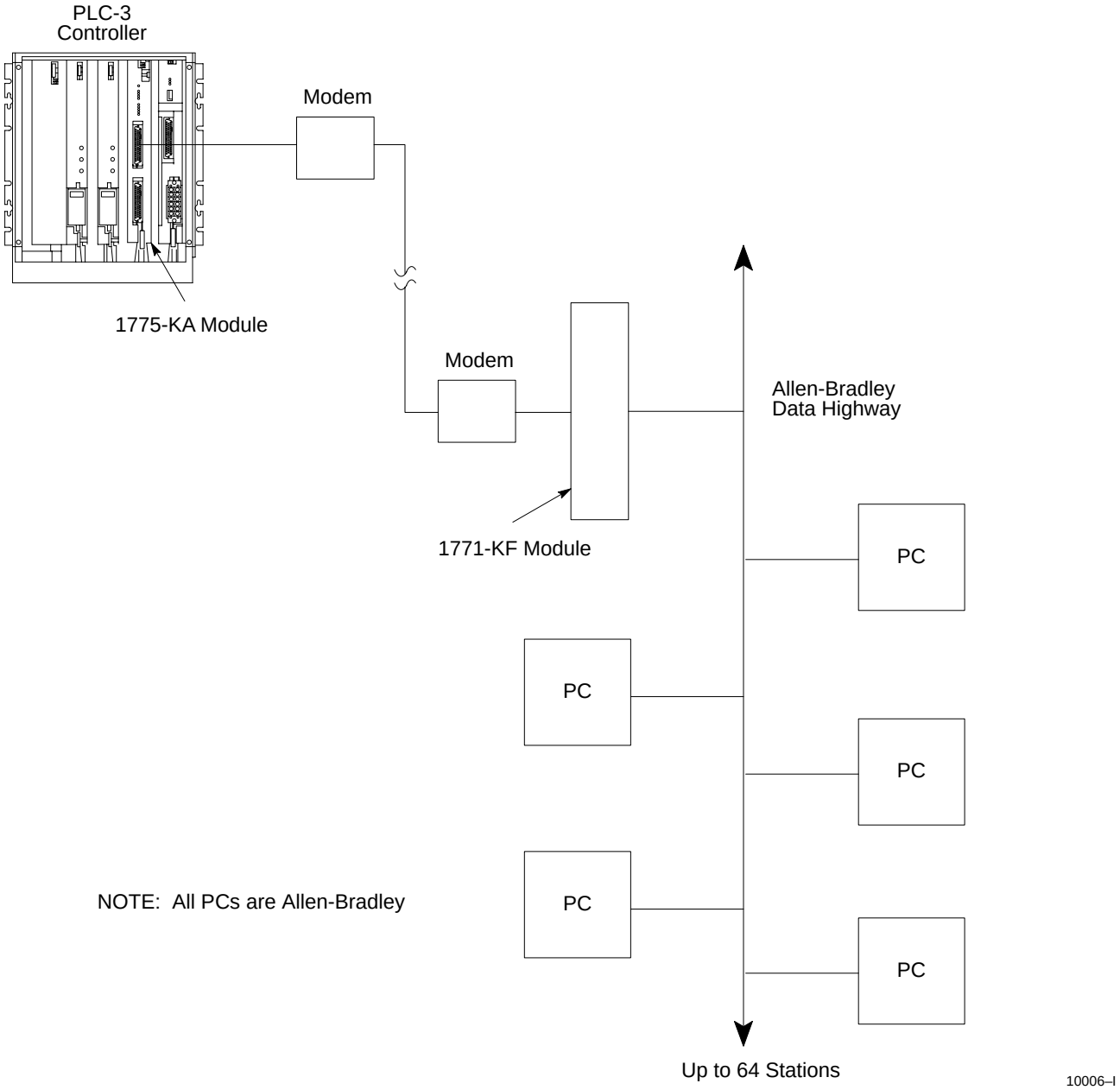
- Interfacing a PLC–3 controller with a computer, either directly or through modems (Figure 2.4)

Figure 2.4
Linking a PLC–3 Station to a Computer



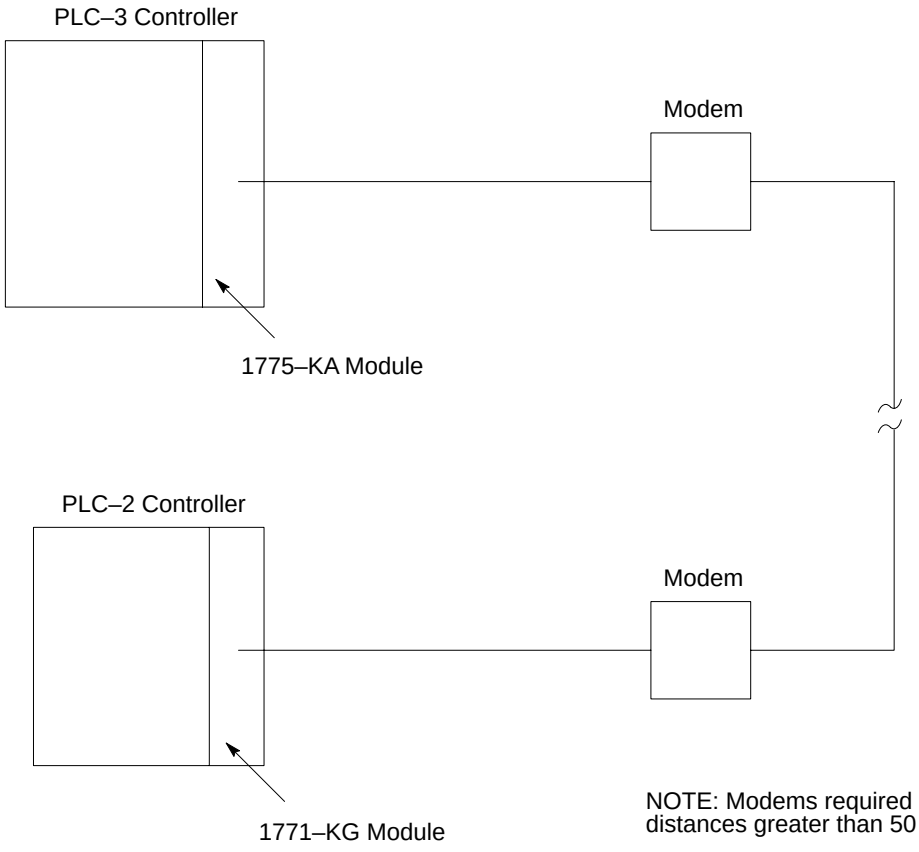
- Interfacing a PLC–3 controller with a remote Data Highway through a modem link (Figure 2.5)

Figure 2.5
Linking a PLC–3 Station to a Remote Data Highway



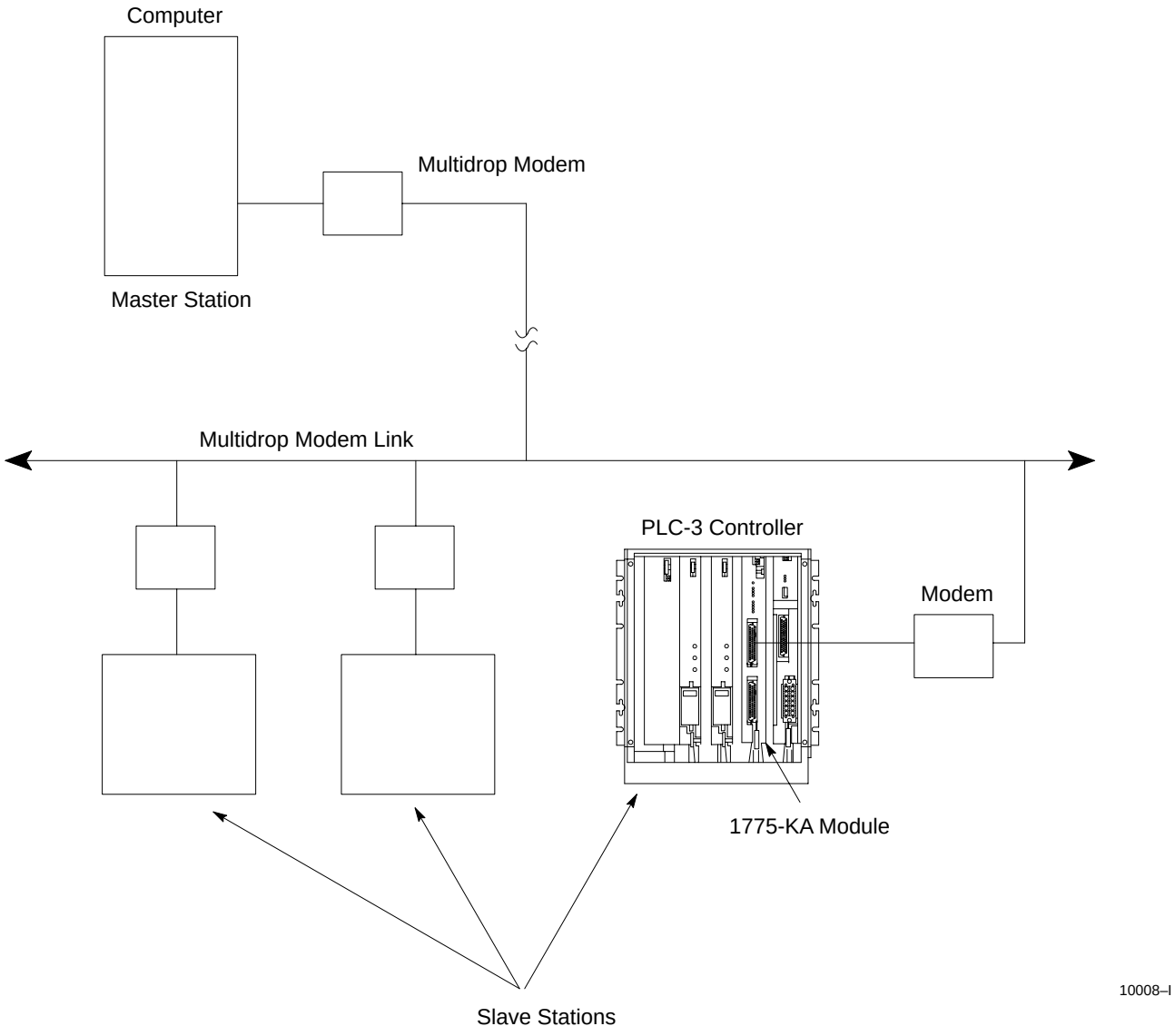
- Interfacing a PLC–3 controller to a PLC–2 Family processor through a 1771–KG module in a point–to–point link (Figure 2.6)

Figure 2.6
Linking a PLC–3 to PLC–2 Family Controller



- Interfacing a PLC–3 controller as a slave station on a multipoint modem link (Figure 2.7)

Figure 2.7
Linking a PLC–3 to a Multi–drop Modem Link



The first four applications above use the module's RS–232–C port in the unpolled mode, while the last application uses the polled mode. You can select the mode of operation and other characteristics of the RS–232–C port through the LIST function.

Pinout

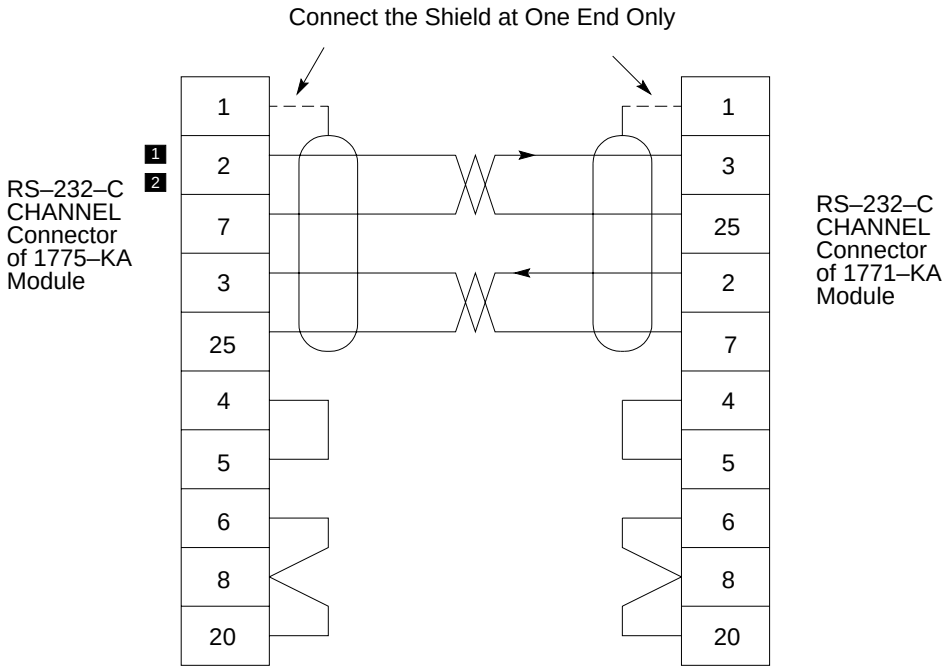
The necessary RS–232–C port connections are described in Table 2.D below:

Table 2.D
RS–232–C Port Connections

Signal at the 1775–KA	Abbreviation	Pin	Input/Output
chassis/shield drain		1	
transmitted data	TXD	2	Output
received data	RXD	3	Input
request to send	RTS	4	Output
clear to send	CTS	5	Input
data set ready	DSR	6	Input
transmitted data return	TXDRET	7/14	
data carrier detect	DCD	8	Input
data terminal ready	DTR	20/11	Output
received data return	RXDRET	25/13	

- TXD (transmitted data) caries serialized data. It is output from the RS–232 connector.
- RXD (received data) is serialized data input to the RS–232 connector. RXD and RXDRET are isolated from the rest of the circuitry on the module.
- RTS (request to send) is a request from the RS–232 connector to the modem to prepare to transmit. It typically turns the data carrier on. When you select the full duplex mode RTS is always asserted. When you select the half duplex mode RTS is turned on when the module has permission to transmit; otherwise it is off.
- CTS (clear to send) is a signal from the modem to the RS–232 connector that the carrier is stable and the modem is ready to transmit. The module will not transmit until CTS is true. If CTS is turned off during transmission, the module will stop sending until CTS is restored.
- DTR (data terminal ready) is a signal from the RS–232 connector to the modem to connect to the phone line (that is, “pick up the phone”). The module will assert DTR all the time except during the phone hangup

Figure 2.9
Connection to Allen–Bradley 1775–KA Module



1 Conductors 2 and 7, 3 and 25 must be twisted pairs for distances longer than 50 feet.

2 Set switch 3 (on the 1775–KA) OFF when the module is communicating with another Allen-Bradley device.

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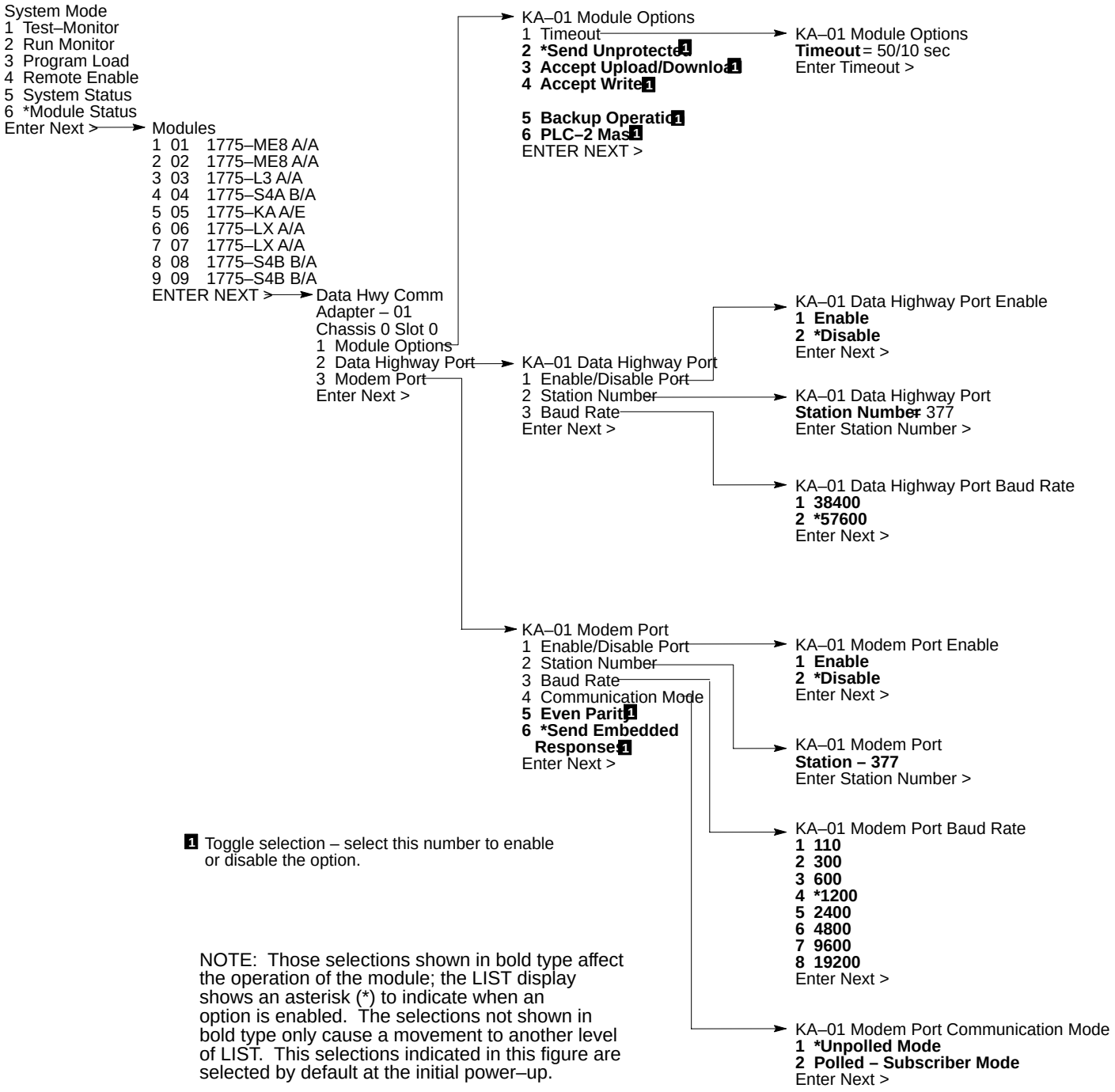
If you want to connect the 1775–KA module to a modem or computer, use the cabling pinout diagram (Figure 2.10) to construct your own cable.

Figure 2.11
LIST Menu for 1775–KA Module



If an automatic switchover occurs:	
And:	**Then:**
the PLC–3 processor is waiting for a response	the response is ignored
another station on the Data Highway is initiating a message	possibly neither of the PLC–3 processors will respond to the message. You must program other stations on the Data Highway to recover from this condition
another station is communicating with the primary PCL–3 processor	the other station will receive no indication that a switchover has occurred. You can, however, program a MSG instruction to execute a message upon switchover (fig. 2.13) or send commands to the backup PLC–3 processor. If you are able to communicate with the backup, you know that no switchover has occurred

Run/Backup Bit

It is important to alert the proper personnel when a switchover occurs. One way you can provide such indication is by having your program monitor the run/backup bit (data table status section, file 0, word 3, bit 17) and turn on alarms or lights when the status changes from backup to run. This bit is set in the primary processor and reset in the backup processor.

Multiple 1775–KA Modules in One PLC–3

It is also possible to link a single PLC–3 controller to more than one Data Highway by installing multiple 1775–KA modules in the same PLC–3. In this configuration, each 1775–KA module connects to a different Data Highway, and each has a unique station number on its associated highway. However, all the 1775–KA modules in the same PLC–3 controller can have either the same or different station numbers.

CAUTION: If such a PLC–3 station is communicating through a PLC/PLC–2 buffer file and all of the stations' 1775–KA modules have the same station number, then all of these modules will transfer data through the same buffer file. This can cause unpredictable results if several 1775–KA modules try to read or write to the buffer file at the same time.

When such a PLC–3 station transmits a command message to a remote Data Highway station, the thumbwheel number specified in the PLC–3 message instruction (section titled PLC–3 Stations) determines which 1775–KA module actually transmits the command.

Chapter 3

Data Highway Communication

General

This chapter introduces some of the concepts and terminology involved with operating the 1775–KA module of the Data Highway.

Some Terminology

The Allen Bradley Data Highway is a communication network for industrial control applications. The Data Highway consists of a central trunkline cable that may be up to 10,000 feet long. This cable can link together as many as 64 distinct communication points (or nodes) called stations.

Each station consists of some type of processor and a **station interface module**. The station interface module enables the processor to communicate with other stations on the Data Highway. The 1775–KA module is the station interface module for the PLC–3 processor. Table 3.A lists all possible combinations of station interface modules and processors.

Table 3.A
Station Components

Processor	Station Interface Module
PLC–4 Microtrol	1773–KA Communication Interface Module
PLC–3	1775–KA Communication Adapter Module
PLC–2 Family	1771–KA Communication Adapter Module
PLC	1774–KA Communication Adapter Module
Computer or other programmable RS–232–C compatible device	1771–KC/KD/KE/KF Communication Controller Module

Communication Terminology

Stations communicate with each other by sending **messages** over the Data Highway. There are two types of messages:

- Command messages
- Reply messages

When the rung becomes true, the message instruction begins sending command(s) across the Data Highway. At the same time, bits in a control file word change their state (Table 3.B) to reflect the status of the command. Even if the rung becomes false, the message command will continue to send commands across the highway.

Table 3.B
The Status of Bits in a Control File Word

WHEN:
the message instruction is true the enable bit (16) is set the latched enable bit (12) is set
the remote Data Highway module has received the message instruction the request bit (17) is set
the 1775–KA module begins operation the busy bit (14) is set
the operation is complete the busy bit (14) is set either the done bit (15) or the error bit (13) is set
the rung becomes false the request bit (17) is reset the busy bit (14) is reset the enable bit (16) is reset the latched enable bit (12) is reset
the rung becomes true a second time either the done bit (15) or the error bit (13) is reset

5. Enter an extended address for the channel. In our Figure 3.1, we address the module status area of memory, specify the 1775–KA module, and a thumbwheel setting of 1.

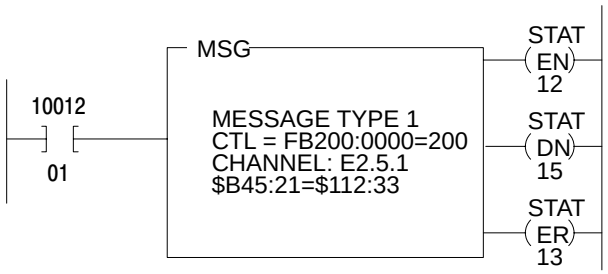
6. Enter either a command or a command procedure. In Figure 3.1, we entered the command procedure, PROC_A.

Data Highway Message Procedure

As already stated, the 1775–KA module has its own programming language that consists of commands (Chapter 8). A group of related commands make up a Data Highway message procedure. These commands and message procedures determine what messages are transmitted over the Data Highway.

Figure 3.3
Two Ways to Use 1775–KA Commands

1) as a single command in a PLC–3 message instruction



2) as part of a message procedure

Message Procedure PROC_A

(other commands)

$B45:21 = $112:33

(other commands)

PLC–3 Message Instruction to Control Execution of Procedure PROC_A

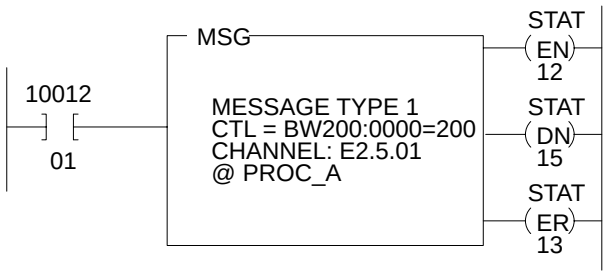


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Table 5.A
Example of Message instruction Editing

System Prompt	Action	Key Strokes
	Start edits.	SED [ENT]
	Insert rung.	IR [ENT]
	Enter the energize bit for the message rung. In this case, binary file 0, word 0, bit 0.	–] [– B0:0/0 [ENT]
	Enter the message instruction.	MSG [ENT]
ENTER FILE ADDRESS	Enter the address of the file where the message instruction will reside in memory. In this case, binary file 1.	FB1 [ENT]
ENTER SYSTEM ADDRESS OR SYMBOL	Enter the channel designation for the 1775–KA module. In this case, 2 is the module status, 5 is the 1775–KA module type, and 1 is the thumbwheel number of the module.	E2.5.1 [ENT]
ENTER MESSAGE TYPE	Enter the message type. This is always 1 for the 1775–KA module.	1 [ENT]
	Enter a single 1775–KA assignment command or the name of a message procedure. In this case, the name of the message procedure is PROC_1.	@PROC–1 [ENT]
	End edits.	EE [ENT]

Allocating Memory

Before the 1775–KA module can transfer data to or from any file in PLC–3 memory, that file must exist and it must have enough memory allocated to it to accommodate the data transfer. You can create and allocate a file using the PLC–3 memory management commands. Refer to the PLC–3 Programming Manual (publication 1775–801) for a description of memory management.

Editing Message Procedures

Table 5.B shows an example of editing a message procedure through an Industrial Terminal connected to a 1775–S4A module. Table 5.C shows how to edit the same message procedure through a data terminal connected to a 1775–S4B module.

Table 5.B
Example of Editing a Message Procedure Through an Industrial Terminal

System Prompt	Action	Key Strokes
	Create the message procedure. In this case, MH1 mean Data Highway message procedure number 1.	ME, MH1, [ENT]
	Deleting existing null characters.	[DEL] [DEL] [DEL] [DEL]
	Enter message procedure commands. Note that you must use either an EXIT or a STOP command to end each procedure.	(other commands) #H022$B0:5CC:1 [ENT] $B0:6=CC:1*2 [ENT] EXIT [ENT] [CANCEL CMD]
	Insert the symbol definition for the name of the message procedure.	IS [ENT]
ENTER SYMBOL STRING	Enter the name of the message procedure. In this case, the name is PROC_1.	PROC_1 [ENT]
ENTER SYSTEM ADDRESS OR SYMBOL	Enter the address where the message procedure is stored. In this case, the symbolic address MH1 can be used.	MH1 [ENT]
ENTER SYMBOL TYPE	Enter the symbol type for the message procedure name. This is always 2 for the 1775–KA module.	2 [ENT]

Table 5.C
Example of Editing a Message Procedure Through a Data Terminal

S4B>	Enter the edit mode and create the message procedure name. Note that the 1775–S4B module automatically creates the symbol definition for the message procedure name.	EDIT /H@PROC_1 [RET]
<EOB>* *	Enter the insert mode of editing	I [RET]
	Enter the message procedure command. Note that you must use either EXIT or STOP command to end each procedure.	(other commands) #H022$B0:5=CC:1 [RET] $B0:6=CC:1*2 [RET] EXIT [RET]
	Exit from the insert mode of editing.	[RET]
	Exit from the editing mode of the 1775–S4B module.	E [RET]
S4B>		