Connecting PLC-5 Processors and SLC Processors through Communication Bridges
## Using SLC 5/03™ Processors

Introduction

This document combines available PLC® and SLC™ documentation to show you how you can communicate between these two types of systems through communication bridges over a serial and DH+™ links.

Note: You can also configure the communication modules described in this chapter to work with SLC 5/04™ processor s

communication bridges

DH-485™ using a 1785-KA5
serial using a 1747-KE
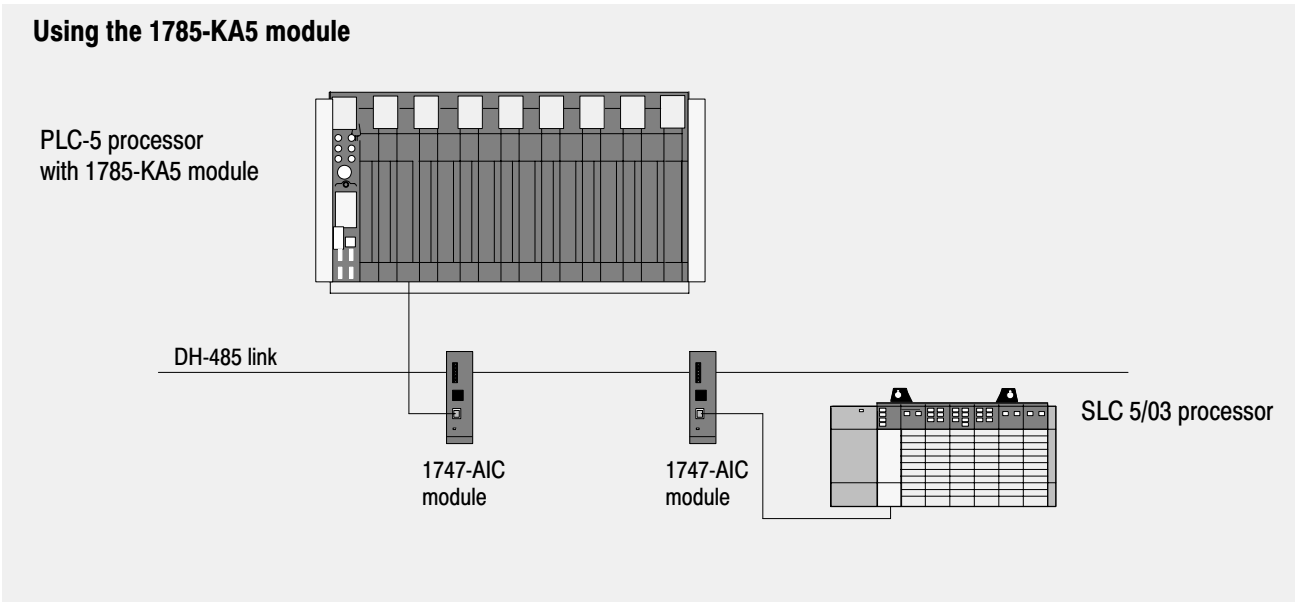serial using a 1746-BAS
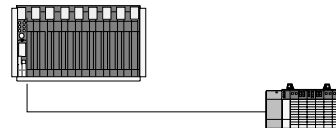
This information is in addition to the user documentation for the processors and communication bridges discussed here. You should already have a solid understanding of how to use this hardware. Each section in this document lists additional documentation you can refer to for detailed information.

This document is one of a larger set of reference materials to help you better use your PLC-5® processor. The 1785-6.8.*x* series of documents provides individual documents for different applications. This reference set is continually expanding, so see your Allen-Bradley sales representative or distributor for an up-to-date list of available reference documents.

Connecting the processors

Using the 1785-KA5 module

PLC-5 processor
with 1785-KA5 module

DH-485 link

1747-AIC
module

1747-AIC
module

SLC 5/03 processor

1785-KA5 module

DH+ connection

Line 1 – Clear
Shield – Shield
Line 2 – Blue

DH-485 connection

Line 6 – termination
Line 5 – orange/white stripe
Line 4 – white/orange stripe
Line 3 – blue/white stripe
Line 2 – shield
Line 1 – ground

1785-KA5 module configurations

DH485 BAUD RATE							
300	600	1200	2400	4800	9600	19200	RESERVED

B7   reserved
B6   auto route enable
B5
B4
B3
B2   } DH+ station address
B1
B0

B3
B2
B1   } DH-485 channel DH+ IP link ID
B0

DH-485 station address

B3
B2
B1   } DH+ channel link ID
B0

B4
B3
B2
B1
B0

ON
OFF

1 2 3 4 5 6 7 8   1 2 3 4 5 6 7 8   1 2 3 4 5 6 7 8

SW-1   SW-2   SW-3

OFF (0)   ON (1)

Application requirements

You connect both DH-485 and DH+ links to a 1785-KA5 module.

Connecting DH-485 cable

You install a DH-485 link as a number of cable segments daisy-chained together. The total length of the cable segments cannot exceed 1219 m (4000 ft). This is the total cable distance from the first node to the last node on the network. The DH-485 communication cable must be Belden 9842 cable.

Install a link coupler (1747-AIC) for each node on the network. The link coupler electrically isolates the DH-485 communication interface from the processor and peripheral connections. Electrical-optical isolation is provided to 1500V. You make connections between an SLC processor and a link coupler with cable 1747-C11, 304.8 mm (12 in), which is supplied with the link coupler.

Connecting DH+ cable

You can connect a DH+ link two ways:

- trunk line/drop line—from the drop line to the connector screw terminals on the DH+ connectors of the processor

- daisy chain—to the connector screw terminals on the DH+ connectors of the processor

> ⚠ **ATTENTION:** Do not mix trunkline/dropline connections with daisy chain connections in one DH+ link.

When installing DH+ communication links, **do not**:

- exceed these cable lengths:
    - trunk line-cable length—3,048 m (10,000 cable-ft)
    - drop-cable length—30.4 m (100 cable-ft)

- connect more than 64 stations on a single DH+ link

Use the 3-pin connector on the processor to connect a DH+ link. The connector's port must be configured to support a DH+ communication link.

Communicating over the gateway

The 1785-KA5 DH+/DH485 Gateway module enables communication and data transfer from PLC-5 and SLC processors on a DH-485 link. The 1785-KA5 also enables APS programming or data acquisition across a DH+ link to a DH-485 link. The SLC processors respond to unsolicited read and unsolicited write commands.

1785-KA5 gateway mode

In gateway mode, DH+ devices must initiate messages; DH-485 devices cannot initiate messages. The 1785-KA5 module acts as a gateway when the attached DH-485 stations do not fully implement internet protocol. The 1785-KA5 module converts packets to DH-485 local packets and sends them to their DH-485 destination stations.

In gateway mode, all SLC processors can respond to DH+ data read and write requests; they cannot initiate data requests.

**1785-KA5
router mode**

In router mode, both DH+ and DH-485 devices that implement internet protocol (IP) can initiate messages. When the 1785-KA5 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."

You can use an SLC 5/03 processor to send a message to the 1785-KA5 module. The SLC 5/03 processor has the ability to respond to data read and write requests when the 1785-KA5 is in router mode.

Using MSG instructions with a 1785-KA5 module

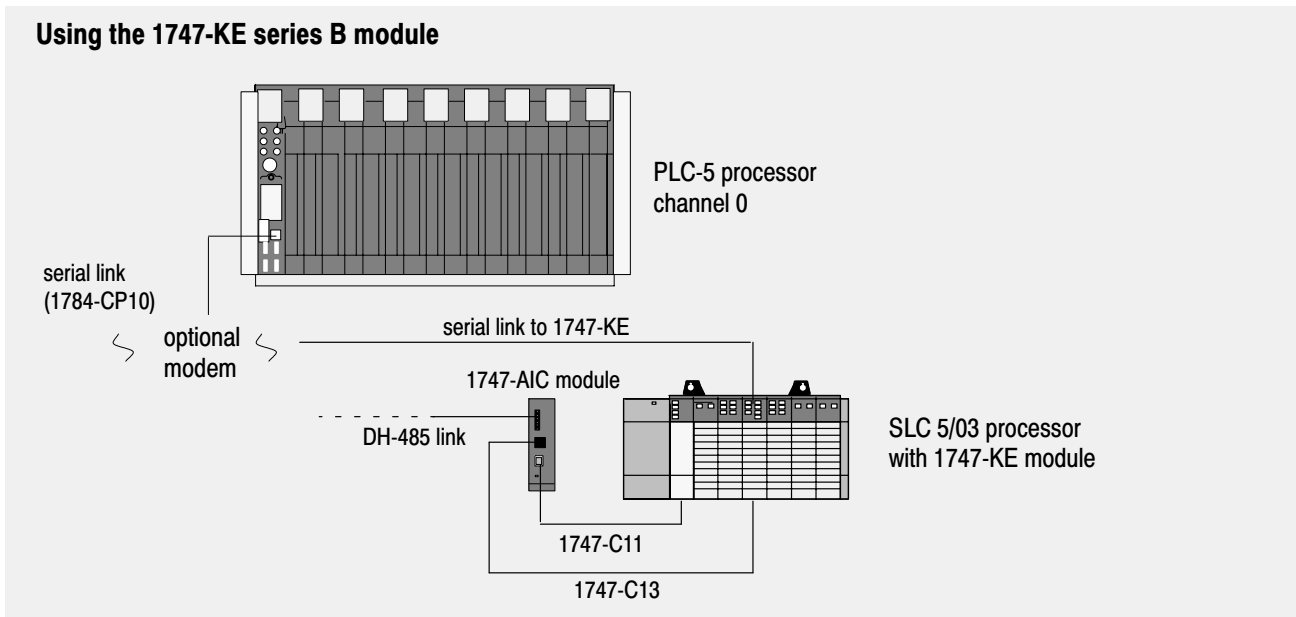Keep the following in mind when using message instructions:

- 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 SLC processor.
- In the message instruction, set the LINK_ID to zero (0) even though the actual LINK_ID is not zero.
- The local node is the DH+ station address of the 1785-KA5.
- The destination data table address specifies the data word number to be accessed within the SLC processor.
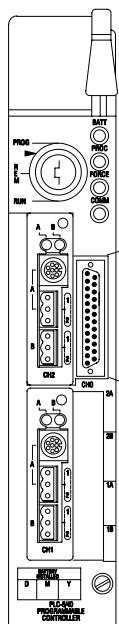
Additional documentation

- 1770-6.5.16 Data Highway/Data Highway Plus/DH-485 Protocol and Command Set Reference Manual
- 1785-6.5.5 DH+/DH-485 Communication Adapter Module (1785-KA5) User Manual
- 1747-6.2 SLC 500 Modular Hardware Style Installation and Operation Manual

Connecting the processors

## Using the 1747-KE series B module

PLC-5 processor
channel 0

serial link
(1784-CP10)

optional
modem

serial link to 1747-KE

1747-AIC module

DH-485 link

SLC 5/03 processor
with 1747-KE module

1747-C11

1747-C13

PLC-5 processor

25-pin male		25-pin female
1	——————	C.GND 1
2	——————	TXD.OUT 2
3	——————	RXD.IN 3
4	——————	RTS.OUT 4
5	——————	CTS.IN 5
6	——————	DSR.IN 6
7	——————	SIG.GND 7
8	——————	DCD.IN 8
20	——————	DTR.OUT 20

25-pin male connector

1747-KE module

DH-485/RS-232C

ACT   Fault
485   BA LOW
CFG   H/D
DF1   F/D

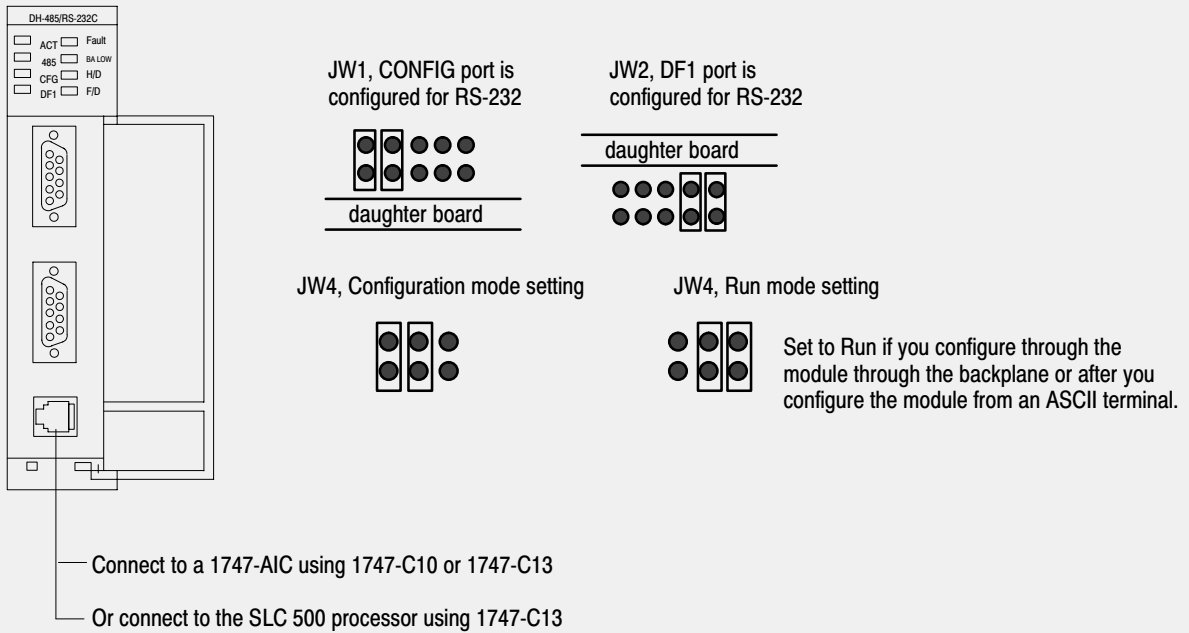| 25-pin male		9-pin female
8	——————	DCD.IN 1
3	——————	RXD.IN 2
2	——————	TXD.OUT 3
20	——————	DTR.OUT 4
7	——————	SIG.GND 5
6	——————	DSR.IN 6
4	——————	RTS.OUT 7
5	——————	CTS.IN 8
22	——————	NC 9
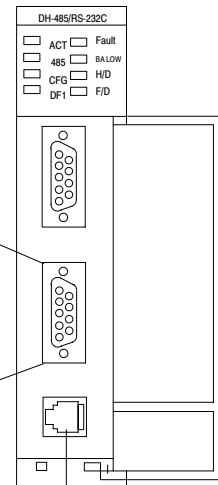
connect to
DF1 port

9-pin female connector

Connect to a 1747-AIC using 1747-C11 or 1747-C13
Or connect to the SLC processor using 1747-C13

1747-KE series B configurations

DH-485/RS-232C

ACT   Fault
485   BA LOW
CFG   H/D
DF1   F/D

JW1, CONFIG port is
configured for RS-232

daughter board

JW2, DF1 port is
configured for RS-232

daughter board

JW4, Configuration mode setting

JW4, Run mode setting

Set to Run if you configure through the
module through the backplane or after you
configure the module from an ASCII terminal.

Connect to a 1747-AIC using 1747-C10 or 1747-C13

Or connect to the SLC 500 processor using 1747-C13

Application requirements

You must configure the SLC chassis and the module. You can use an ASCII terminal to configure the module, or you can send configuration information over the backplane.

Configure the SLC chassis

Use your programming software or a hand-held terminal to assign the 1747-KE module to an open slot in the chassis. Enter the module ID code 3509 for series B functionality.

Configure the module using an ASCII terminal

If you use an ASCII terminal, make sure the jumpers on JW4 are set for Configuration mode. After you finish configuring the module, set the jumpers for Run mode.

1. Configure the DF1 port to match the default CONFIG port parameters, which are:

Parameter:	Selection:
baud rate	1200
bits per character	8
parity	none
stop bits	one
handshaking	software

2. Specify whether the DF1 protocol is half-duplex or full-duplex. Specify the appropriate parameters for the DF1 protocol.

3. Configure the DH-485 port as follows:

Parameter:	Selection:
node address	0–31 each station on the DH-485 must have a unique address
maximum node address	1–31 for maximum performance, set this value no larger than the value of the highest numbered node on the link
message timeout	5000
pass through	disabled
baud rate	19200 all stations on the DH-485 must be set to the same baud rate

Configure the module over the backplane

There are six different configuration packets you can send over the backplane from the SLC processor to the 1747-KE module. Use the DF1 configuration packet to configure communications.

1. Set module mode bit (O:e.0/15). This places the module in software configuration mode.

2. Load 02 as the data ID value (O:e.0/0–3) to specify a DF1 configuration packet.

3. Place the configuration data in the output image file (O:e.1–7).

Use the following table to build the configuration packet.

SLC Output File to the Interface Module

Bit Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0[1]	Module Mode Bit	Data Handshake Bit	Read or Write Bit	Reset Interface Module Bit	Reserved								Data ID=2			
1				Embedded Response Detect (Full) or Local/Remote Mode (Half)	Half or Full Duplex	Constant Carrier Detect[2]	Hardware Hand–shaking[2]	Checksum	Duplicate Packet Detection	Stop Bits	Parity		Bits per character		DF1 Baud Rate	
2	Modem Init String Delay (0–25 sec.)								Enq/Msg Retries (0–254)							
3	Slave Address (Local) (0–254) Group Number (Remote) (0–7)								Master Station Address (Half Duplex) (0–254) NAK Rec Retries (Full Duplex) (0–254)							
4	ACK/POLL Timeout (0–65,535x5 ms)															
5	Message Timeout (100–12,750 ms)															
6	RTS ON Delay (0–65,535x5 ms)[3]															
7	RTS OFF Delay (0–65,499x5 ms)[3]															

[1] To configure the DF1 parameters the Read or Write Bit must be 0 and the Module Mode Bit must be 1. To read the DF1 parameters, the Read or Write Bit must be 1 and the Module Mode Bit can be either 0 or 1.

[2] If Constant Carrier Detect is enabled, Hardware Handshaking is forced on.

[3] The value is ignored if full-duplex is chosen.

4. Write the configuration data by resetting the read or write bit (O:e.0/13).

5. Set the data handshake bit (O:e.0/14) to indicate that the data in the output image file is valid.

The 1747-KE module retrieves the data and places status of the configuration in the SLC input file (I:e.0/4–10). Then the 1747-KE module sets the data handshake bit (I:e.0/140 to indicate that the data in the input image file is valid.

6. Reset the data handshake bit (O:e.0/14).

7. Save your configuration changes by placing the 1747-KE module in software Run mode (reset the module mode bit).

Communicating over a serial link

The 1747-KE DH-485/DF1 Interface module provides a non-isolated DH-485 interface for PLC-5 and SLC processors over RS-232 using full-duplex or half-duplex DF1 protocol. The 1747-KE acts as a bridge between the SLC processor's DH-485 link and serial link. The 1747-KE is ideal for low cost RTU/SCADA applications.

If you use the 1747-KE module in a half-duplex configuration, select polled report-by-exception as the communication method. Polled report-by-exception lets the slave initiate a data transfer. Each slave can contain one MSG instruction to report to the master, rather than requiring the master to have one MSG instruction for each slave – which could use too much of the master's memory and time. You program the slave (the SLC processor with the 1747-KE module) to monitor its own inputs for a change of state or data, which triggers the slave to write data to the master the next time the master polls the slave.

Polled report-by exception messaging is useful if any two or more of the following apply to your application:

- communication channel is slow (2400 bps or less)
- average number of words of data to monitor in each slave is greater than five
- number of slaves is greater than ten

Using MSG instructions with a 1747-KE module

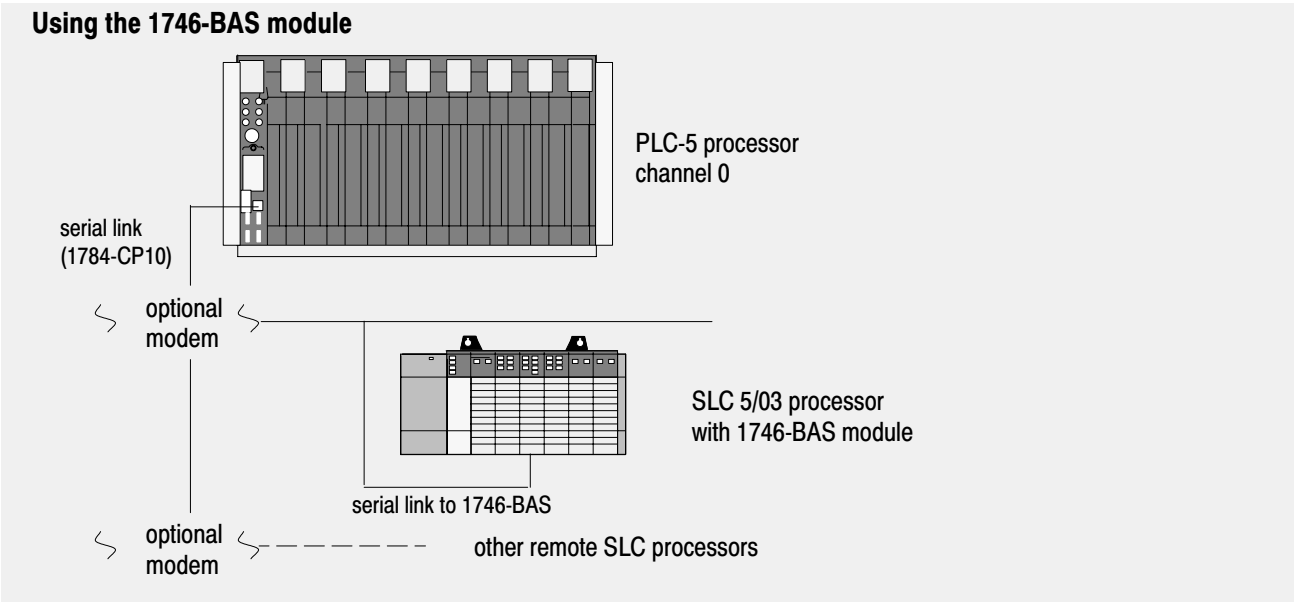Keep the following in mind when using message instructions:

- 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 SLC processor.
- The local node is the station address of the 1747-KE.
- The destination data table address specifies the data word number to be accessed within the SLC processor.
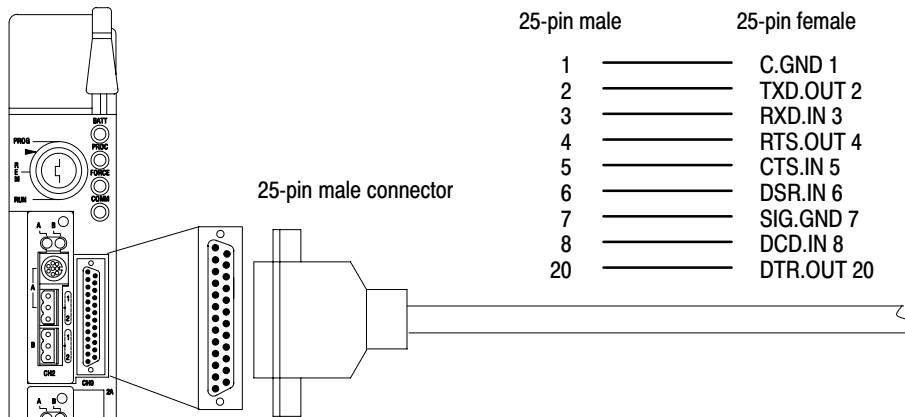
Additional documentation

- 1747-6.12 DH-485/RS-232-C KE Module User Manual
- AG-6.5.8 SCADA System Application Guide
- 1747-6.2 SLC 500 Modular Hardware Style Installation and Operation Manual
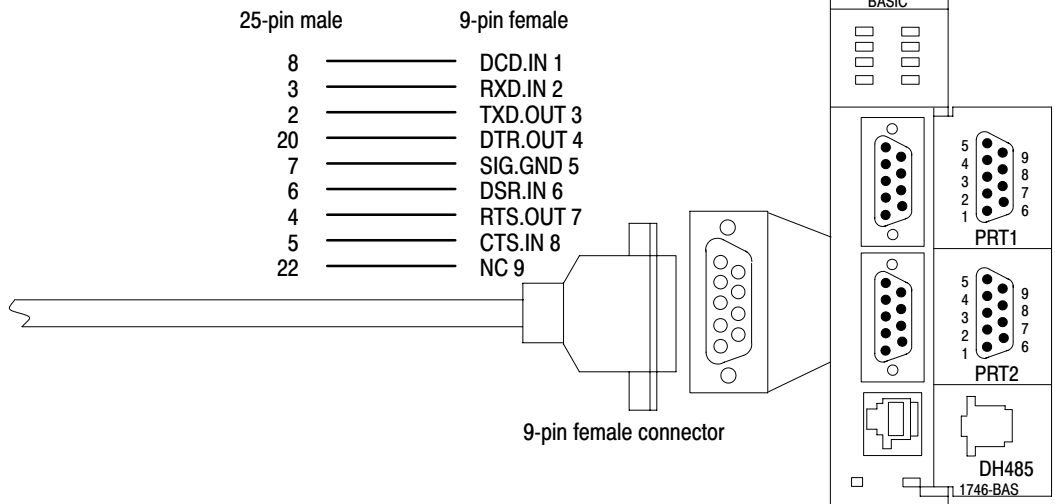
Connecting the processors
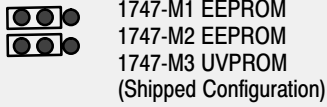
Using the 1746-BAS module

PLC-5 processor
channel 0

serial link
(1784-CP10)

optional
modem

SLC 5/03 processor
with 1746-BAS module

serial link to 1746-BAS

optional
modem

other remote SLC processors

PLC-5 processor

25-pin male		25-pin female
1	————	C.GND 1
2	————	TXD.OUT 2
3	————	RXD.IN 3
4	————	RTS.OUT 4
5	————	CTS.IN 5
6	————	DSR.IN 6
7	————	SIG.GND 7
8	————	DCD.IN 8
20	————	DTR.OUT 20

25-pin male connector

1746-BAS module

BASIC

25-pin male		9-pin female
8	————	DCD.IN 1
3	————	RXD.IN 2
2	————	TXD.OUT 3
20	————	DTR.OUT 4
7	————	SIG.GND 5
6	————	DSR.IN 6
4	————	RTS.OUT 7
5	————	CTS.IN 8
22	————	NC 9

PRT1

PRT2

DH485
1746-BAS

9-pin female connector

1746-BAS module configurations

JW1, PRT1 is
configured for RS-232/423

daughter board

JW3 identifies memory module

1747-M1 EEPROM
1747-M2 EEPROM
1747-M3 UVPROM
(Shipped Configuration)

mother board

JW1

1747-M4 UVPROM

daughter
board

JW3 →

JW4 →

JW4 identifies operation of each port;
configure PRT2 for DF1 protocol

JW2

JW2, PRT2 is
configured for RS-232/423

PRT1 Port = Program port with programmed communication settings
PRT2 Port = DF1 protocol
DH485 Port = Disabled

daughter board
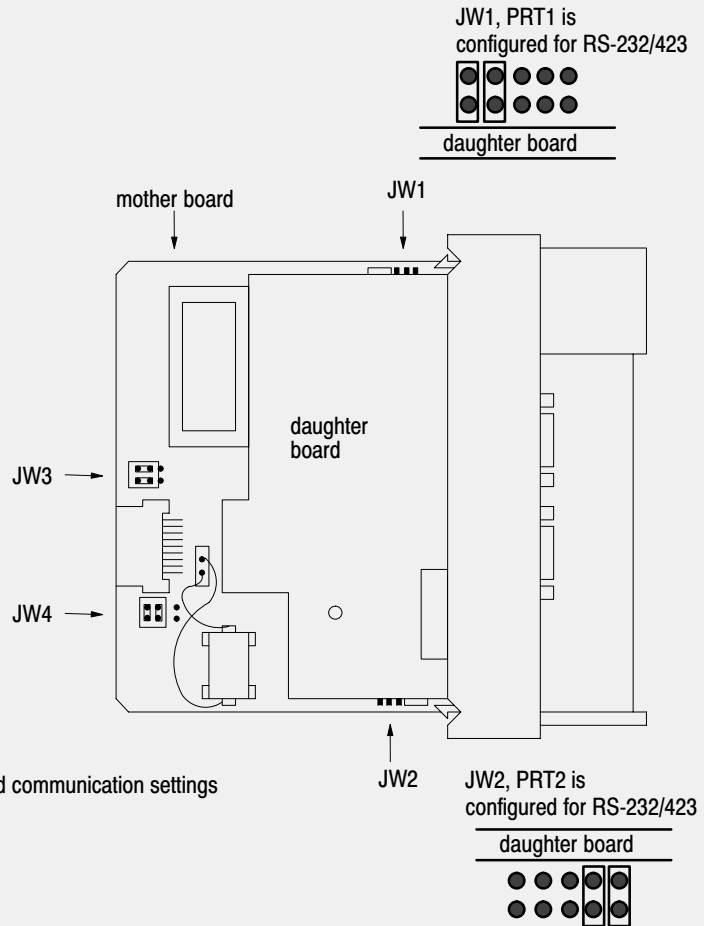
Application requirements

Use PRT2 to transfer DF1 packets to a PLC-5 processor. PRT2 is capable of operating full-duplex at 300, 600, 1200, 2400, 4800, 9600, and 19200 baud. It is electrically isolated to 500V dc.

The maximum serial cable distance for RS-232 is 50 ft (15 m).

Use the RS-423 jumper settings when communicating in RS-232 mode.

Communicating over a serial link

The 1746-BAS BASIC module is an interface between an SLC processor, the 1746 backplane, and an RS-232 device – in this case, a PLC-5 processor communicating over an RS-232 link. Program in BASIC to interface port PRT2 to a PLC-5 processor for data collection.

Transferring Data Between the SLC Processor and Port PRT2

Use port PRT2 to interface the BASIC module with external devices sending ASCII code (to bar code decoders and printers) or DF1 packets (to PLC processors). Use the following commands to transfer data either to or from port PRT2:

Table A
Data transfer commands

Command:	Purpose:
PRINT#	prints a string or variable to PRT2
INPUT#	inputs a string or variable from PRT2
INPL#	inputs a string or variable from PRT2
INPS#	inputs a string or variable from PRT2
GET#	reads a console input device connected to PRT2
CALL 22	reads data from PRT1 or PRT2 to the SLC I/O or M files
CALL 23	writes data from the SLC I/O or M files to PRT1 or PRT2
CALL 118	allows unsolicited writes from a remote SLC or PLC node
CALL 122	reads a PLC data file and transfers it to the SLC I/O or M files
CALL 123	writes data from the SLC I/O or M files to a remote PLC processor

Table B
Status and control commands

Command:	Purpose:
MODE	sets the port parameters for PRT1, PRT2, and DH485
CALL 16	enables interrupt capability when a DF1 packet is received
CALL 17	disables the DF1 packet interrupt capability
CALL 30	sets the port parameters for PRT2
CALL 31	displays the current PRTS port configuration on the program port terminal screen
CALL 35	retrieves the current character in the 256-character input buffer of PRT2
CALL 36	retrieves the number of characters in the input or output buffer of PRT2
CALL 37	clears the peripheral port input and/or output buffers
CALL 97	enables the DTR signal for PRT2
CALL 98	disables the DTR signal for PRT2
CALL 108	enables DF1 driver communications; you must use this CALL with CALLs 16, 17, 118, 122, and 123
CALL 110	prints the complete output buffer with addresses, front pointer, and number of characters in the buffer to the console device
CALL 111	prints the complete input buffer with addresses, front pointer, and number of characters in the buffer to the console device
CALL 113	disables DF1 driver communications
CALL 114	initiates DF1 packet transmission
CALL 115	checks DF1 packet transmission status
CALL 117	gets DF1 packet length
CALL 119	resets port parameters to their default settings

Figure 1
Data flow between the SLC processor and PRT2
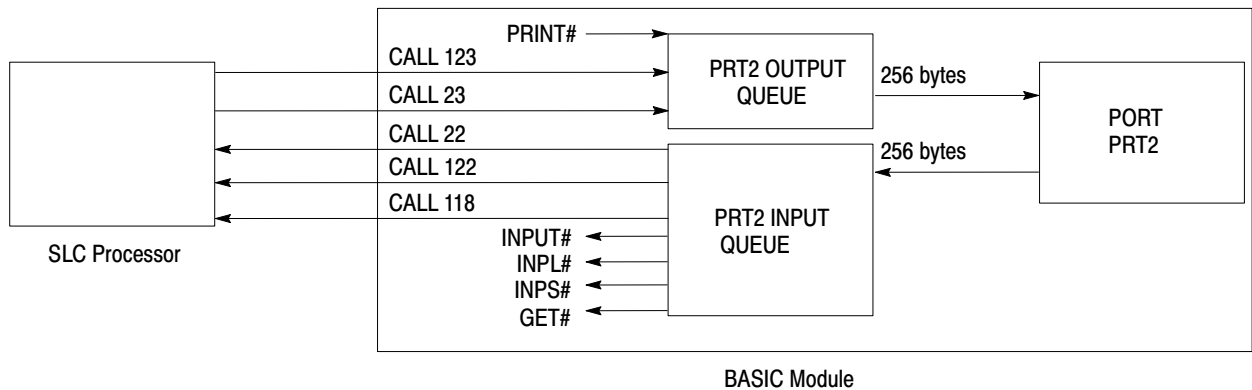
BASIC Module

Additional documentation

- 1746-6.1 SLC 500 BASIC Module Design Manual
- 1746-6.3 BASIC Language Reference Manual

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