



MicroLogix™ 1500 Programmable Controllers

Introduction

Read this document before using your MicroLogix 1500 Controller. This document update contains information about new product features. This document update also includes information that updates or clarifies previously published information.

Purpose of This Document

This Document Update revises the *MicroLogix 1500 Programmable Controllers User Manual*, publication 1764-6.1. Keep this Document Update for reference.

New with this Release

New product features are covered in the following sections:

- List of Products on page 2
- Expansion Power Supply and Cables on page 2
- Adding an I/O Bank on page 3
- Using the Expansion I/O on page 5

Updates to User Manual

Updates to the *MicroLogix 1500 Programmable Controllers User Manual*, publication 1764-6.1, are covered in the following sections:

- Miswiring - 1764-28BXB only (user manual p. 3-8) on page 7
- Wiring Diagrams (user manual p. 3-8) on page 8
- I/O Addressing (user manual p. 5-2) on page 10
- RTC Accuracy (user manual p. 8-2) on page 11
- Specifications (user manual Appendix A) on page 11
- System Loading Worksheets (user manual p. E-2) on page 12
- Calculating Heat Dissipation (user manual p. E-6) on page 20

List of Products

The new features apply to the following products.

Product	Catalog Number
MicroLogix 1500 Processor	1764-LSP, Series A, Revision C and higher
Operating System Version	Firmware Revision Number (FRN) 3 and higher
Programming Software	RSLogix 500, Version 3.01.09 and higher RSLinx, Version 2.10.118 and higher
Power Supplies	1769-PA2 1769-PB2
Cables	1769-CRL1, 1769-CRL3 1769-CRR1, 1769-CRR3
End Caps	1769-ECL 1769-ECR

Expansion Power Supply and Cables

With Operating System Revision Number (FRN) 3, you can now connect an additional bank of I/O to your controller. See Checking the MicroLogix 1500 FRN on page 5 for instructions on how to check and upgrade the FRN.

Using an expansion power supply increases the system's capacity for adding expansion I/O modules (such as the 1769-IF4 and 1769-OF2 analog modules). The additional I/O bank is connected to the controller via a specially designed cable. The additional I/O bank must include a power supply and an end cap.

NOTE

The maximum number of expansion I/O modules per controller is 8. See System Guidelines on page 3 for system limitations and illustrations of expansion I/O banks.

Adding an I/O Bank

System Guidelines

A maximum of one 1769 Bus Communication Expansion Cable can be used in a MicroLogix 1500 system, allowing for two banks of I/O modules (one connected directly to the controller, and the other connected via the cable). Each I/O bank requires its own power supply (Bank 0 uses the controller's embedded power supply).

ATTENTION**ATTENTION: LIMIT OF ONE EXPANSION POWER SUPPLY**

The expansion power supply cannot be connected directly to the controller. It must be connected using one of the expansion cables. Only one power supply (embedded or expansion) may be used on an I/O bank. Exceeding these limitations may damage the power supply and result in unexpected operation.

ATTENTION**ATTENTION: REMOVE POWER**

Remove system power before making or breaking cable connections. When you remove or insert a cable connector with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

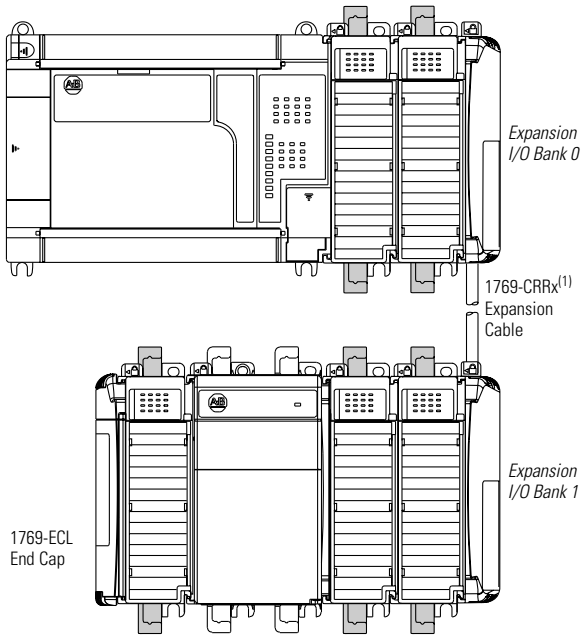
- sending an erroneous signal to your system's field devices, causing unintended machine operation
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector.

Refer to your power supply and I/O module's documentation for instructions on how to set up your system.

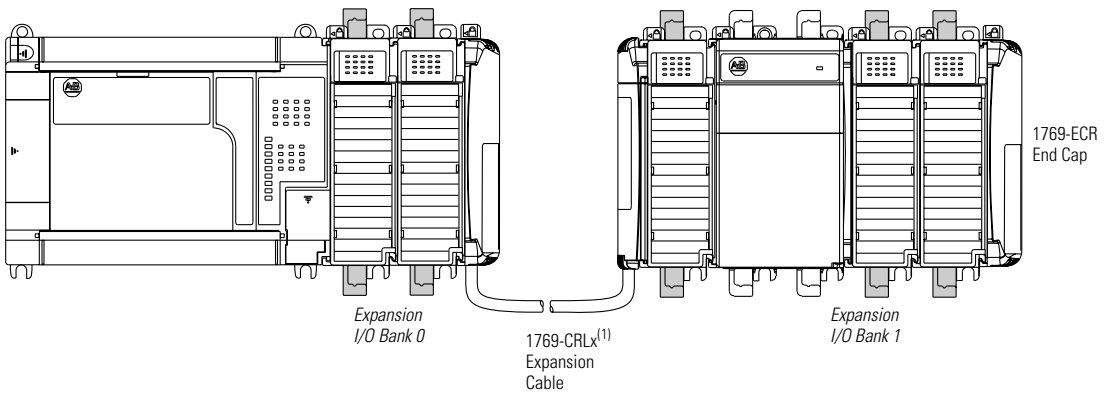
The illustrations on page 4 show a MicroLogix 1500 with an expansion I/O bank.

Vertical Orientation



(1) The x in this catalog number can be either a 1 or a 3 representing the length of the cable:
 1 = 1 foot (305 mm) and 3 = 3.28 feet (1 meter).

Horizontal Orientation



(1) The x in this catalog number can be either a 1 or a 3 representing the length of the cable:
 1 = 1 foot (305 mm) and 3 = 3.28 feet (1 meter).

Checking the MicroLogix 1500 FRN

To use a MicroLogix 1500 controller with a 1769 Expansion I/O Power Supply, verify that you have the following:

- MicroLogix 1500 Processor:
Catalog Number 1764-LSP, Series A, Revision C and higher
- Operating System Version: Firmware Revision Number (FRN) 3 and higher

You can check the FRN by looking at word S:59 (Operating System FRN) in the Status File.

IMPORTANT

If your processor is at an older revision, you *must* upgrade the operating system to FRN 3 or higher to use an expansion cable and power supply. On the Internet, go to <http://www.ab.com/micrologix> to download the operating system upgrade. Enter MicroLogix 1500; go to Tools and Tips.

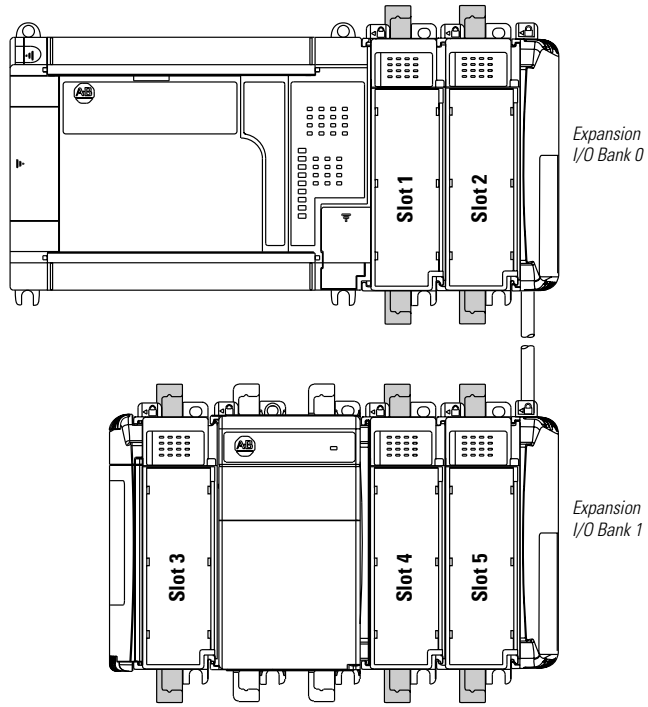
Using the Expansion I/O

Addressing

The expansion I/O is addressed as slots 1 through 8 (the controller's embedded I/O is addressed as slot 0). Power supplies and cables are not counted as slots. Modules are counted from left to right on each bank as shown in the illustrations on page 6.

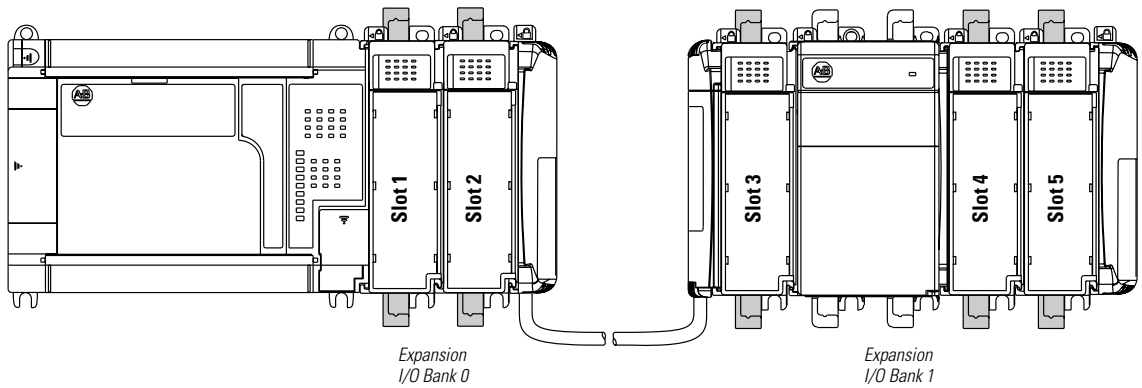
Vertical Orientation

Embedded I/O = Slot 0



Horizontal Orientation

Embedded I/O = Slot 0



Expansion I/O Power Failure

Expansion I/O errors represent failures of the I/O bus or the modules themselves. The error codes are listed in Appendix C of the *MicroLogix 1500 Programmable Controllers User Manual*, publication 1764-6.1. There is one new fault code with this release:

Error Code (Hex)	Advisory Message	Description	Recommended Action
0021	EXPANSION POWER FAIL (EPF)	A power failure is present on the expansion I/O bank. This error code is present only when the controller is powered, and power is not applied to the expansion I/O bank. This is a self-clearing error code. When power is re-applied to the expansion I/O bank, the fault is cleared. See Important note below.	Re-apply power to the expansion I/O bank. See Important note below.

IMPORTANT

If this fault occurs while the system is in the RUN mode, the controller will fault. When expansion I/O power is restored, the controller will clear the fault and re-enter the RUN mode.

If you change the mode switch while this fault is present, the controller may not re-enter the RUN mode when expansion I/O power is restored.

If an EPF condition is present and expansion I/O power is OK, toggle the mode switch to PROGRAM and then to RUN. The fault should clear and the controller will enter the RUN mode.

Miswiring - 1764-28BXB only (user manual p. 3-8)

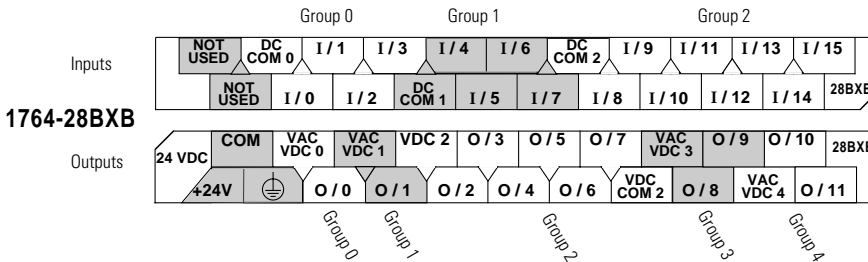
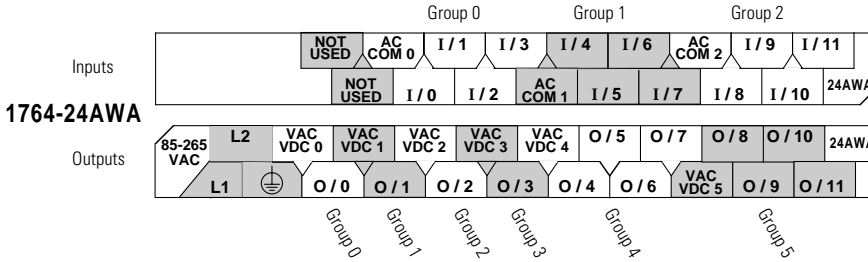
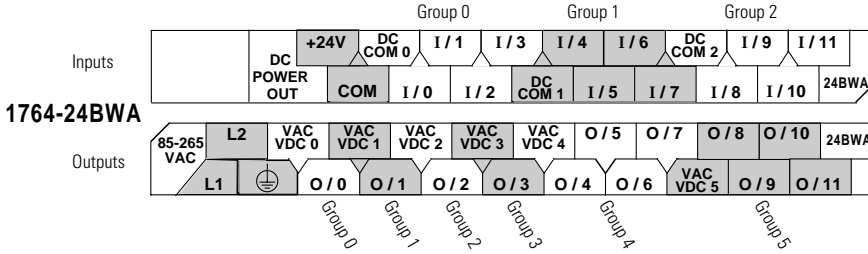
The following table shows miswiring conditions and the consequences of improper wiring:

Condition	Result
Operating with Voltage Less than 20.4V dc	This will not damage the base unit. The base unit may not power up.
	IMPORTANT This is not recommended. You must verify that the line voltage remains within specified limits.
Reverse Wiring of the Line Terminals (0 to 30V dc)	Reverse wiring will not damage the base unit. The base unit will not power up.
Applied Voltage Level Exceeds the Published Recommended Value	Exceeding the published recommended voltage may result in permanent damage to the base unit.

Wiring Diagrams (user manual p. 3-8)

The base unit terminal block layouts are shown below. The shading on the labels indicates how the terminals are grouped. A detail of the groupings is shown in the table following the terminal block layouts.

Terminal Block Layouts



Terminal Groupings

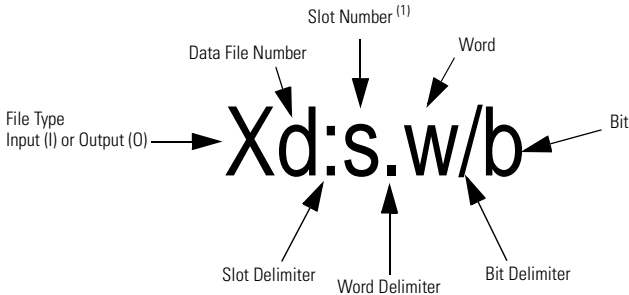
Controller	Inputs		
	Input Group	Common Terminal	Output Terminal
1764-24BWA	Group 0	DC COM 0	I/0 through I/3
	Group 1	DC COM 1	I/4 through I/7
	Group 2	DC COM 2	I/8 through I/11
1764-24AWA	Group 0	AC COM 0	I/0 through I/3
	Group 1	AC COM 1	I/4 through I/7
	Group 2	AC COM 2	I/8 through I/11
1764-28BXB	Group 0	DC COM 0	I/0 through I/3
	Group 1	DC COM 1	I/4 through I/7
	Group 2	DC COM 2	I/8 through I/15

Controller	Outputs		
	Output Group	Voltage Terminal	Input Terminal
1764-24BWA	Group 0	VAC/VDC 0	O/0
	Group 1	VAC/VDC 1	O/1
	Group 2	VAC/VDC 2	O/2
	Group 3	VAC/VDC 3	O/3
	Group 4	VAC/VDC 4	O/4 through O/7
	Group 5	VAC/VDC 5	O/8 through O/11
1764-24AWA	Group 0	VAC/VDC 0	O/0
	Group 1	VAC/VDC 1	O/1
	Group 2	VAC/VDC 2	O/2
	Group 3	VAC/VDC 3	O/3
	Group 4	VAC/VDC 4	O/4 through O/7
	Group 5	VAC/VDC 5	O/8 through O/11
1764-28BXB	Group 0	VAC/VDC 0	O/0
	Group 1	VAC/VDC 1	O/1
	Group 2	VDC 2, VDC COM 2	O/2 through O/7
	Group 3	VAC/VDC 3	O/8 and O/9
	Group 4	VAC/VDC 4	O/10 and O/11

I/O Addressing (user manual p. 5-2)

Putting Together an Address

The addressing scheme for 1769 Expansion I/O is shown below. Examples are shown on page 11.



- (1) I/O located on the controller (embedded I/O) is slot 0.
I/O added to the controller (expansion I/O) begins with slot 1.

Format	Explanation		
Od:s.w/b Id:s.w/b	X	Input (I) or Output (O)	
	d	Data File Number <i>(optional)</i>	0 = output, 1 = input
	:	Slot delimiter	
	s	Slot number (decimal)	Embedded I/O: slot 0 Expansion I/O: left slot of expansion I/O is slot 1 (See Addressing on page 5 for an illustration.)
	.	Word delimiter. Required only if a word number is necessary as noted below.	
	w	Word number	Required to read/write words, or if the discrete bit number is above 15. Range: 0 to 255
	/	Bit delimiter	
	b	Bit number (terminal number for discrete modules)	Inputs: 0 to 15 Outputs: 0 to 15

Addressing Examples

Addressing Level	Example Address ⁽¹⁾	Slot	Word	Bit
Bit Addressing	0:0/4 ⁽²⁾	Output Slot 0 (Embedded I/O)	word 0	output bit 4
	0:2/7 ⁽²⁾	Output Slot 2 (Expansion I/O)	word 0	output bit 7
	I:1/4 ⁽²⁾	Input Slot 1 (Expansion I/O)	word 0	input bit 4
	I:0/15 ⁽²⁾	Input Slot 0 (Embedded I/O)	word 0	input bit 15
Word Addressing	0:1.0	Output Slot 1 (Expansion I/O)	word 0	
	I:7.3	Input Slot 7 (Expansion I/O)	word 3	
	I:3.1	Input Slot 3 (Expansion I/O)	word 1	

(1) The optional Data File Number is not shown in these examples.

(2) A word delimiter and number are not shown. Therefore, the address refers to word 0.

RTC Accuracy (user manual p. 8-2)

The following table indicates the accuracy of the real time clock for various temperatures.

Ambient Temperature	Accuracy ⁽¹⁾
0°C (+32°F)	+34 to -70 seconds/month
+25°C (+77°F)	+36 to -68 seconds/month
+40°C (+104°F)	+29 to -75 seconds/month
+55°C (+131°F)	-133 to -237 seconds/month

(1) These numbers are worst case values over a 31-day month.

Specifications (user manual Appendix A)

Add the specifications as shown in the table below:

Page Number	Catalog Number	Specification	Change
A-1	1764-24BWA	Power Supply Usage	Add this specification. Value is 88 VA.
	1764-24AWA		Add this specification. Value is 70 VA.
	1764-28BXB		Add this specification. Value is 30 VA.
A-1	9324-RL0300ENE	Programming Software	Add this specification. RSLogix 500, Version 3.01.09 and higher RSLinx, Version 2.10.118 and higher
A-2	1764-24BWA and 1764-28BXB	Operating Frequency	Change to: 0 Hz to 1 kHz for Inputs 8 and Higher

System Loading Worksheets (user manual p. E-2)

MicroLogix 1500 System Expansion Worksheet - Example

The following *example* is provided to illustrate system expansion validation. The table below accounts for the amount of 5V dc and 24V dc current consumed by controller, expansion I/O, and user supplied equipment. The worksheet on the next page shows how to validate your specific configuration. Current consumed by the Base Units, Memory Modules, and Real Time Clock Modules has already been factored into the calculations below.

NOTE

For an electronic version of the worksheet, visit the MicroLogix web site. On the Internet, go to <http://www.ab.com/micrologix>. Enter MicroLogix 1500; go to Tools and Tips, Expansion I/O System Qualifier.

Catalog Number		Device Current Requirements		Current Consumed	
		at 5V dc (mA)	at 24V dc (mA)	at 5V dc (mA)	at 24V dc (mA)
1764-LSP		300	0	300	0
1764-DAT ⁽¹⁾		350	0	350	0
1761-NET-AIC ⁽¹⁾		0	120 ⁽²⁾	0	120 ⁽²⁾
2707-MVH232 or 2707-MVP232 ⁽¹⁾		0	80 ⁽²⁾		0 ⁽²⁾
Subtotal:				650	120
Catalog Number	<i>n</i>	<i>A</i>	<i>B</i>	<i>n x A</i>	<i>n x B</i>
	Number of Modules (8 maximum)	Module Current Requirements		Calculated Current	
		at 5V dc (mA)	at 24V dc (mA)	at 5V dc (mA)	at 24V dc (mA)
1769-IA16		115	0		
1769-IA8I		90	0		
1769-IM12		100	0		
1769-IQ16	1	115	0	115	0
1769-IQ6XOW4	1	105	50	105	50
1769-OA8		145	0		
1769-OB16	1	200	0	200	0
1769-OV16		200	0		
1769-OW8	2	125	100	250	200
1769-OW8I		125	100		
1769-IF4		120	150		
1769-OF2		120	200		
Total Modules:	5	Subtotal:		670	250

⁽¹⁾ These are optional accessories. Current is consumed only if the accessory is installed.

⁽²⁾ Current for the 1761-NET-AIC may be supplied from the controller communications port, as seen in this example, or from an external 24V dc source. No current is consumed from the controller when an external source is used. The current for a 2707-MVH232 or 2707-MVP232 MicroView™ Operator Interface is supplied from the controller communication port, if directly connected.

Validating System Loading - Examples

1764-24AWA and 1764-28BxB Base Units

Loading Value	Total 5V dc Current Consumed		Total 24V dc Current Consumed		Total Watts
Maximum Current	2250 mA		400 mA		
Calculated Current	650 mA + 670 mA = 1320 mA		120 mA + 250 mA = 370 mA		
Maximum Power					16W
Calculated Power	1320 mA x 5V = 6.60W	+	370 mA x 24V = 8.88W	=	15.48 W

1764-24BWA Base Units

Add any User 24V sensor current for applications with dc input sensors (1764-24BWA base units only).

User 24V Sensor Current Subtotal (sum of all sensors must be 400 mA or less)
150 mA (example sensor value)

Loading Value	Total 5V dc Current Consumed		Total 24V dc Current Consumed		User 24V dc Sensor Current Consumed		Total Watts
Maximum Current	2250 mA		400 mA		400 mA		
Calculated Current	650 mA + 670 mA = 1320 mA		120 mA + 250 mA = 370 mA		150 mA		
Maximum Power							22W
Calculated Power	1320 mA x 5V = 6.60W	+	370 mA x 24V = 8.88W	+	150 mA x 24V = 3.6W	=	19.08 W

MicroLogix 1500 System Expansion Worksheet

(Refer to the example on page 12.)

Use the worksheet below to account for the amount of 5V dc and 24V dc current consumed by your controller, expansion I/O, and user supplied equipment. Current consumed by the Base Units, Memory Modules, and Real Time Clock Modules has already been factored into the calculations below. A system is valid if the current and power requirements are satisfied.

NOTE

For an electronic version of the worksheet, visit the MicroLogix web site. On the Internet, go to <http://www.ab.com/micrologix>. Enter MicroLogix 1500; go to Tools and Tips, Expansion I/O System Qualifier.

Catalog Number		Device Current Requirements		Current Consumed	
		at 5V dc (mA)	at 24V dc (mA)	at 5V dc (mA)	at 24V dc (mA)
1764-LSP		300	0		
1764-DAT ⁽¹⁾		350	0		
1761-NET-AIC ⁽¹⁾		0	120 ⁽²⁾		
2707-MVH232 or 2707-MVP232 ⁽¹⁾		0	80 ⁽²⁾		
Subtotal:					
Catalog Number	<i>n</i>	<i>A</i>	<i>B</i>	<i>n x A</i>	<i>n x B</i>
	Number of Modules (8 maximum)	Module Current Requirements		Calculated Current	
		at 5V dc (mA)	at 24V dc (mA)	at 5V dc (mA)	at 24V dc (mA)
1769-IA16		115	0		
1769-IA8I		90	0		
1769-IM12		100	0		
1769-IQ16		115	0		
1769-IQ6XOW4		105	50		
1769-OA8		145	0		
1769-OB16		200	0		
1769-OV16		200	0		
1769-OW8		125	100		
1769-OW8I		125	100		
1769-IF4		120	150		
1769-OF2		120	200		
Total Modules:		Subtotal:			

⁽¹⁾ These are optional accessories. Current is consumed only if the accessory is installed.

⁽²⁾ Current for the 1761-NET-AIC may be supplied from the controller communications port, as seen in this example, or from an external 24V dc source. No current is consumed from the controller when an external source is used. The current for a 2707-MVH232 or 2707-MVP232 MicroView™ Operator Interface is supplied from the controller communication port, if directly connected.

Validating System Loading

1764-24AWA and 1764-28BxB Base Units

Loading Value	Total 5V dc Current Consumed		Total 24V dc Current Consumed		Total Watts
Maximum Current	2250 mA		400 mA		
Calculated Current					
Maximum Power					16W
Calculated Power		+		=	

1764-24BWA Base Units

Add any User 24V sensor current for applications with dc input sensors (1764-24BWA base units only).

User 24V Sensor Current Subtotal (sum of all sensors must be 400 mA or less)

Loading Value	Total 5V dc Current Consumed		Total 24V dc Current Consumed		User 24V dc Sensor Current Consumed		Total Watts
Maximum Current	2250 mA		400 mA		400 mA		
Calculated Current							
Maximum Power							22W
Calculated Power		+		+		=	

Considerations for System Expansion using Power Supplies and Cables

The following worksheet is provided to assist in system expansion validation using 1769-PA2 and -PB2 Power Supplies with 1769-CRR1, -CRR3, -CRL1, and -CRL3 Bus Communication Expansion Cables. Expansion power supplies must be used with the expansion cables. Only one power supply may be used on an I/O bank. Using an expansion power supply on the same I/O bank as your MicroLogix 1500 controller or two expansion power supplies on the same bank may damage a power supply and may result in unexpected operation. Use the worksheet below to account for the amount of 5V dc and 24V dc current consumed by your expansion I/O and user supplied equipment.

NOTE

For an electronic version of the worksheet, visit the MicroLogix web site. On the Internet, go to <http://www.ab.com/micrologix>. Enter MicroLogix 1500; go to Tools and Tips, Expansion I/O System Qualifier.

Catalog Number	Number of Modules	Module Current Requirements		Calculated Current = (Number of Modules) x (Module Current Requirements)	
		at 5V dc (in mA)	at 24V dc (in mA)	at 5V dc (in mA)	at 24V dc (in mA)
1769-IA16		115	0		
1769-IA8I		90	0		
1769-IM12		100	0		
1769-IQ16		115	0		
1769-IQ6XOW4		105	50		
1769-OA8		145	0		
1769-OB16		200	0		
1769-OV16		200	0		
1769-OW8		125	100		
1769-OW8I		125	100		
1769-IF4		120	150		
1769-OF2		120	200		
Total Modules⁽¹⁾:		Subtotal:			

⁽¹⁾ The total number of I/O modules cannot exceed 8, including those connected directly to the controller (Bank 0), and those connected via the cable (Bank 1).

Validating System Loading for 1769-PA2 and 1769-PB2 Power Supplies

Power Supply Current Capacity

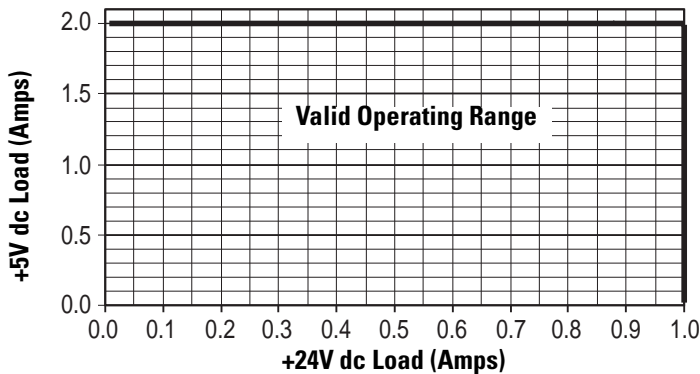
Specification	1769-PA2	1769-PB2
Expansion Bus Output Current Capacity at 0° to +55°C (+32°F to +131°F)	2A at 5V dc and 0.8A at 24Vdc ⁽¹⁾	2A at 5V dc and 0.8A at 24V dc ⁽¹⁾
24V dc User Output Capacity (0° to +55°C)	250 mA (maximum)	not applicable

⁽¹⁾ Refer to the Current Graphs below.

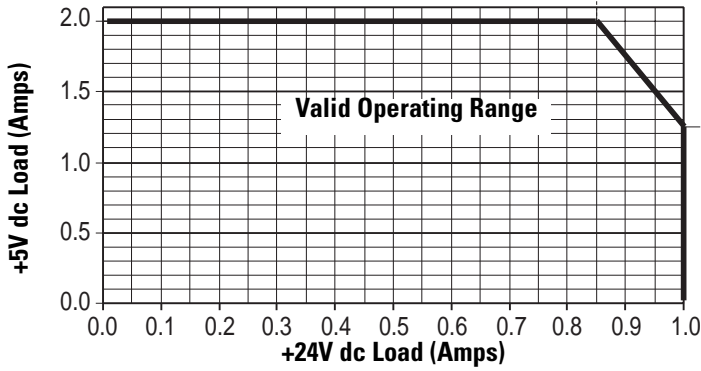
System Using a 1769-PA2

To validate your system, the total 5V dc current and 24V dc current consumed must be considered. The I/O modules must be distributed, such that the current consumed from the left *or* right side of the power supply never exceeds 2A at 5V dc and 1.0A at 24V dc. Use the current graphs below to determine if the power supply loading in your system is within the allowable range.

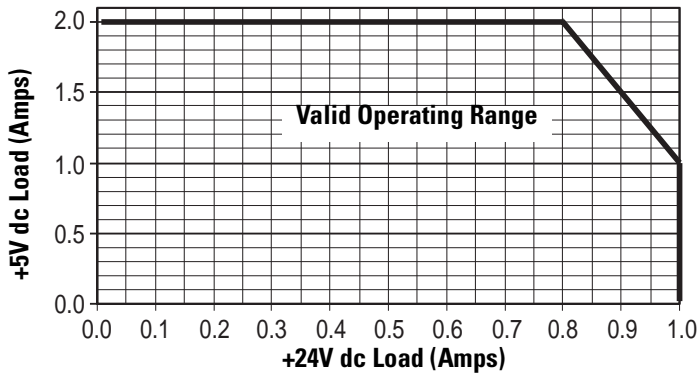
1769-PA2 Current with +24V dc User Load = 0A



1769-PA2 Current with +24V dc User Load = 0.2A



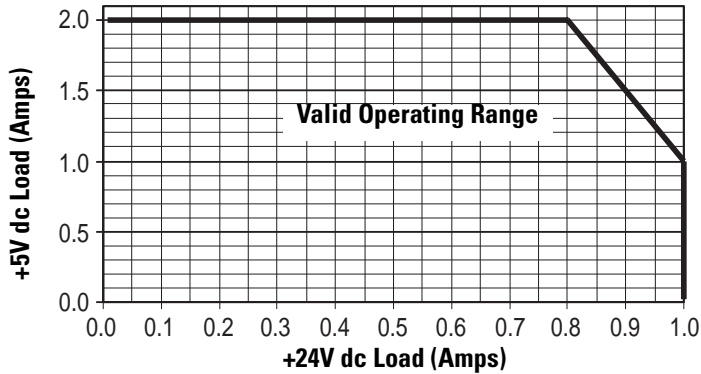
1769-PA2 Current with +24V dc User Load = 0.25A



System Using a 1769-PB2

To validate your system, the total 5V dc current and 24V dc current consumed must be considered. The I/O modules must be distributed, such that the current consumed from the left *or* right side of the power supply never exceeds 2A at 5V dc and 1.0A at 24V dc. Use the current graph below to determine if the power supply loading in your system is within the allowable range.

1769-PB2 Current



Calculating Heat Dissipation (user manual p. E-6)

Use this procedure when you need to determine the heat dissipation for installation in an enclosure. Use the following table.

Catalog Number	Heat Dissipation		
	Equation or Constant	Calculation	Subtotal
1764-24AWA	18W + (0.3 x System Loading)	18W + (0.3 x _____ W)	
1764-24BWA	20W + (0.3 x System Loading)	20W + (0.3 x _____ W)	
1764-28BXB	20W + (0.3 x System Loading)	20W + (0.3 x _____ W)	
1764-LSP	1.5W		
1764-DAT	1.75W		
1764-MM1, -RTC, -MM1/RTC	0		
1769-IA16	3.30W x number of modules	3.30W x _____	
1769-IA8I	1.81W x number of modules	1.81W x _____	
1769-IM12	3.65W x number of modules	3.65W x _____	
1769-IQ16	3.55W x number of modules	3.55W x _____	
1769-IQ6XOW4	2.75W x number of modules	2.75W x _____	
1769-OA8	2.12W x number of modules	2.12W x _____	
1769-OB16	2.11W x number of modules	2.11W x _____	
1769-OV16	2.06W x number of modules	2.06W x _____	
1769-OW8	2.83W x number of modules	2.83W x _____	
1769-OW8I	2.83W x number of modules	2.83W x _____	
1769-IF4	3.99W x number of modules	3.99W x _____	
1769-OF2	4.77W x number of modules	4.77W x _____	
Add Subtotals to determine Heat Dissipation			

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Americas Headquarters, 1201 South Second Street, Milwaukee, WI 53204, USA, Tel: (1) 414 382-2000, Fax: (1) 414 382-4444
European Headquarters SA/NV, avenue Hermann Debroux, 46, 1160 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40
Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

