Kinetix 6000 Multi-axis Servo Drives

Catalog Numbers 2094-ACxx-Mxx-S, 2094-BCxx-Mxx-S, 2094-AMxx-S, 2094-BMxx-S, 2094-ACxx-Mxx, 2094-BCxx-Mxx, 2094-AMxx, 2094-BMxx, 2094-BSP2, 2094-PRF, 2094-SEPM-B24-S

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User Manual

Original Instructions

Chapter 1

Start

Use this chapter to become familiar with the design and installation requirements for Kinetix® 6000 drive systems.

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IAM/AM Module Series Changes

Kinetix 6000 series B and later (460V) drives include the peak current enhancement. The peak current ratings of the Kinetix 6000 (460V) drives are configured at the factory as 150% of continuous current. However, you can program 460V AM modules and the equivalent IAM (inverter) modules, for up to 250% of continuous inverter current.

Table 1 - Kinetix 6000 Enhanced Peak Performance Series Change

IAM Module Cat. No.	AM Module Cat. No.	Peak Current Rating	
		Series A (inverter)	Series B and later (inverter)
2094-BC01-MP5-S	2094-BMP5-S	150%	250%
2094-BC01-M01-S	2094-BM01-S	150%	250%
2094-BC02-M02-S	2094-BM02-S	150%	250%
2094-BC04-M03-S	2094-BM03-S	150%	250%
2094-BC07-M05-S	2094-BM05-S	150%	200%

IMPORTANT Before your drive can deliver enhanced peak performance, you must enable the peak enhancement feature by configuring your drive with DriveExplorer™ software or the Logix Designer application.

Refer to Appendix F on page 217 to recalculate torque and acceleration or deceleration limit values, and paste them into the appropriate Axis Properties dialog box in the Logix Designer application.

For more information on setting axis properties, refer to Configure Axis Properties on page 121.

In series C and later, a mechanical relay for the brake circuit and another for the safe torque-off inputs are replaced by solid-state relays to add robustness. All wiring is consistent with previous series releases.

Catalog Number Explanation

Kinetix 6000 (Bulletin 2094) drive catalog numbers and descriptions are listed in the following tables.

IMPORTANT	Throughout this publication, when the IAM or AM module catalog number is followed by *-x*, for example 2094-BMP5-*x*, the variable (*x*) indicates that the drive module may or may not include the safe torque-off feature.

Table 3 - Kinetix 6000 Drive Catalog Numbers

Integrated Axis Modules (230V)	Cat. No. (with safe torque-off feature)	Cat. No. (without safe torque-off feature)
Kinetix 6000, IAM, 200V-class, 3 kW converter, 5 A inverter	2094-AC05-MP5-S	2094-AC05-MP5
Kinetix 6000, IAM, 200V-class, 3 kW converter, 9 A inverter	2094-AC05-M01-S	2094-AC05-M01
Kinetix 6000, IAM, 200V-class, 6 kW converter, 15 A inverter	2094-AC09-M02-S	2094-AC09-M02
Kinetix 6000, IAM, 200V-class, 11 kW converter, 24 A inverter	2094-AC16-M03-S	2094-AC16-M03
Kinetix 6000, IAM, 200V-class, 23 kW converter, 49 A inverter	2094-AC32-M05-S	2094-AC32-M05
Integrated Axis Modules (460V)		
Kinetix 6000, IAM, 400V-class, 6 kW converter, 4 A inverter	2094-BC01-MP5-S (1)	2094-BC01-MP5
Kinetix 6000, IAM, 400V-class, 6 kW converter, 9 A inverter	2094-BC01-M01-S (1)	2094-BC01-M01
Kinetix 6000, IAM, 400V-class, 15 kW converter, 15 A inverter	2094-BC02-M02-S (1)	2094-BC02-M02
Kinetix 6000, IAM, 400V-class, 28 kW converter, 30 A inverter	2094-BC04-M03-S (1)	2094-BC04-M03
Kinetix 6000, IAM, 400V-class, 45 kW converter, 49 A inverter	2094-BC07-M05-S (2)	2094-BC07-M05
Axis Modules (230V)		
Kinetix 6000, AM, 200V-class, 5 A	2094-AMP5-S	2094-AMP5
Kinetix 6000, AM, 200V-class, 9 A	2094-AM01-S	2094-AM01
Kinetix 6000, AM, 200V-class, 15 A	2094-AM02-S	2094-AM02
Kinetix 6000, AM, 200V-class, 24 A	2094-AM03-S	2094-AM03
Kinetix 6000, AM, 200V-class, 49 A	2094-AM05-S	2094-AM05
Axis Modules (460V)		
Kinetix 6000, AM, 400V-class, 4 A	2094-BMP5-S (1)	2094-BMP5
Kinetix 6000, AM, 400V-class, 9 A	2094-BM01-S (1)	2094-BM01
Kinetix 6000, AM, 400V-class, 15 A	2094-BM02-S (1)	2094-BM02
Kinetix 6000, AM, 400V-class, 30 A	2094-BM03-S (1)	2094-BM03
Kinetix 6000, AM, 400V-class, 49 A	2094-BM05-S (2)	2094-BM05

(1) You can configure the peak inverter current rating of this 460V (series B and later) IAM or AM module for 250% of continuous inverter current.
(2) You can configure the peak inverter current rating of this 460V (series B and later) IAM or AM module for 200% of continuous inverter current. Refer to Peak Enhancement Specifications on page 59, for more information on drive performance in the peak-enhanced mode.

Table 4 - Kinetix 6000 Drive Component Catalog Numbers

Drive Components	Cat. No.
Integrated power interface (IPIM) module, 400V-class, 15 kW, 24 A (rms)	2094-SEPM-B24-S
Kinetix 6000 shunt module, 200/400V-class, 200 W	2094-BSP2
Kinetix 6000 slot-filler module, 200/400V-class	2094-PRF

In this example, the enclosure must have an exterior surface of 6.66 m^2. If any portion of the enclosure is not able to transfer heat, do not include that portion in the calculation.

Because the minimum cabinet depth to house the 460V drive (selected for this example) is 302 mm (11.9 in.), then the cabinet needs to be approximately 2500 mm (high) x 950 mm (wide) x 302 mm (deep).

$$2 \times (0.3 \times 0.95) + 2 \times (0.3 \times 2.5) + 2 \times (0.95 \times 2.5) = 6.82 \text{ m}^2$$

Because this cabinet size is considerably larger than what is necessary to house the system components, consider some means of cooling in a smaller cabinet to be more efficient. Contact your cabinet manufacturer for options available to cool your cabinet.

Table 12 - Power Dissipation Specifications

Bulletin 2094 Drive Modules (1)	Usage as % of Rated Power Output (watts)				
	20%	**40%**	**60%**	**80%**	**100%**
IAM (converter) module (2)					
2094-AC05-MP5-S	8	11	15	19	24
2094-AC05-M01-S	9	12	16	20	25
2094-AC09-M02-S	14	20	28	36	46
2094-AC16-M03-S	19	30	43	58	74
2094-AC32-M05-S	41	68	100	136	176
2094-BC01-MP5-S	18	21	25	29	34
2094-BC01-M01-S					33
2094-BC02-M02-S	36	44	54	64	75
2094-BC04-M03-S	50	67	87	110	135
2094-BC07-M05-S	71	101	137	179	226
IAM (inverter) module or AM module (2)					
2094-AC05-MP5-S or 2094-AMP5-S	28	32	37	41	46
2094-AC05-M01-S or 2094-AM01-S	31	38	46	54	62
2094-AC09-M02-S or 2094-AM02-S	34	45	57	70	84
2094-AC16-M03-S or 2094-AM03-S	48	68	91	116	144
2094-AC32-M05-S or 2094-AM05-S	104	156	212	274	342
2094-BC01-MP5-S or 2094-BMP5-S	46	54	61	69	77
2094-BC01-M01-S or 2094-BM01-S	57	73	90	108	126
2094-BC02-M02-S or 2094-BM02-S	53	72	93	116	142
2094-BC04-M03-S or 2094-BM03-S	94	130	169	211	255
2094-BC07-M05-S or 2094-BM05-S	121	183	252	326	407
Shunt module - 2094-BSP2	68	121	174	227	280
IPIM module - 2094-SEPM-B24-S	To calculate power dissipation for IPIM modules on your 2094 power rail, refer to the Kinetix 6000M Integrated Drive-Motor User Manual, publication 2094-UM003.				

(1) Power dissipation for the Bulletin 2094 control modules, catalog numbers 2094-SE02F-M00-Sx and 2094-EN02D-M01-Sx, is included in the IAM and AM power module specifications.
(2) Internal shunt power is not included in the calculations and must be added based on utilization.

Minimum Clearance Requirements

This section provides information to assist you in sizing your cabinet and positioning your Bulletin 2094 system components.

IMPORTANT	Mount the module in an upright position. Do not mount the module on its side.

ATTENTION: To avoid damage to the power rail during installation, do not remove the protective covers until the module for each slot is ready for mounting.

The Kinetix 6000M integrated drive-motor (IDM) system is supported by Bulletin 2094 (400V-class) power rail configurations. You can mount up to four IDM power interface (IPIM) modules on the Bulletin 2094 power rail. Refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003, for more information.

Determine Mounting Order

Mount IAM, AM/IPIM, shunt, and slot-filler modules in the order (left to right) as shown in Figure 22. Mount axis modules and the IPIM module according to power utilization (highest to lowest) from left to right starting with the highest power utilization.

Power utilization is the average power (kW) consumed by a servo axis. If Motion Analyzer software was used to size the axis, the calculated axis power required can be used for the power utilization value. If Motion Analyzer software was not used, you can use the continuous power value (kW) for each module to determine mounting order.

Table 20 - Kinetix 6000 (200V-class) Axis Modules

Attribute	2094-AMP5-S	2094-AM01-S	2094-AM02-S	2094-AM03-S	2094-AM05-S
Continuous Power Output, nom	1.2 kW	1.9 kW	3.4 kW	5.5 kW	11.0 kW

Table 21 - Kinetix 6000 (400V-class) Axis Modules

Attribute	2094-BMP5-S	2094-BM01-S	2094-BM02-S	2094-BM03-S	2094-BM05-S
Continuous Power Output, nom	1.8 kW	3.9 kW	6.6 kW	13.5 kW	22.0 kW

Table 22 - Kinetix 6000M (400V-class) IPIM Module

Attribute	2094-SEPM-B24-S
Continuous Power Output, nom	15.0 kW

Figure 22 - Module Mounting Order Example

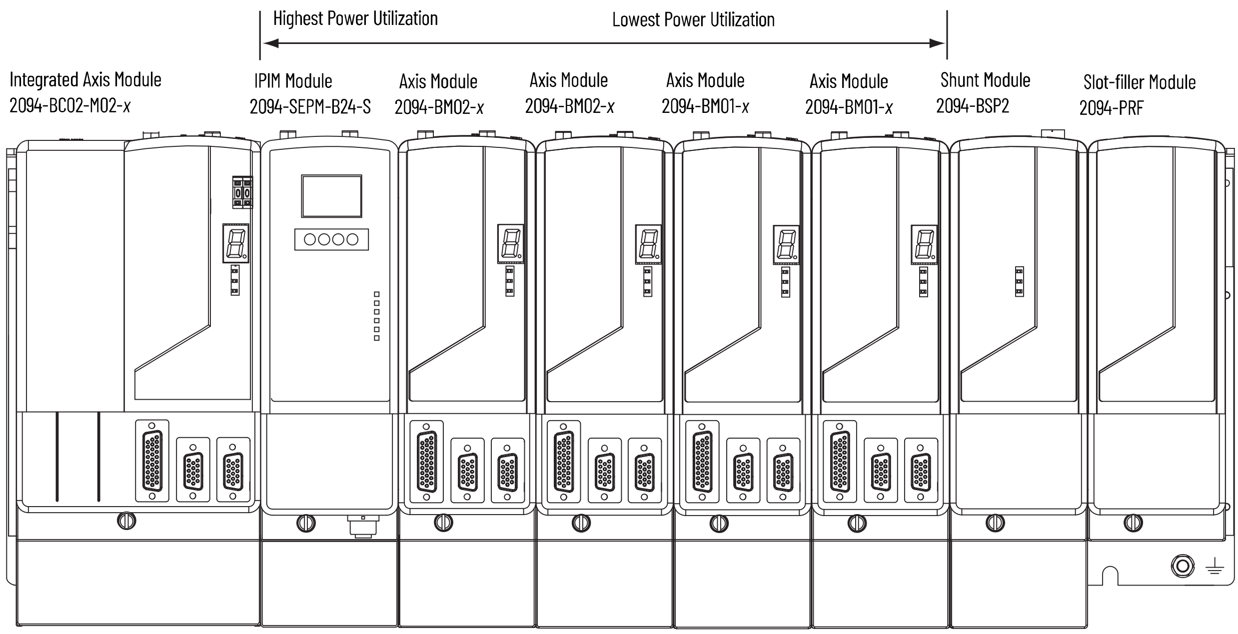

Table 44 - Maximum Input Power Cycling Specifications (460V)

Attribute	2094-BC01-MP5-S	2094-BC01-M01-S	2094-BC02-M02-S	2094-BC04-M03-S	2094-BC07-M05-S
Main AC input power cycling (cycles per minute for 10,000 μf)	0.12		0.52	2.15	4.30

For example, in a 4 axis system with a 2094-BC02-M02-S IAM module and 2,000 μF total capacitance, the calculated capability is 0.52 x 10,000/2000 = 2.6 cycles per minute. However, this value is reduced to 2.0 by the 4 axes per system limitation.

Peak Enhancement Specifications

Drives that support the Peak-enhanced mode have the capability of increasing the maximum inverter peak current to achieve greater overload performance.

IMPORTANT The peak enhancement feature requires the use of RSLogix 5000® software or the Logix Designer application, and drive firmware as specified in Table 45.

Table 45 - Peak Enhancement Software and Firmware Requirements

IAM Module Cat. No.	AM Module Cat. No.	RSLogix 5000 Software Version	Kinetix 6000 Drive Firmware Revision
2094-BC01-MP5-S	2094-BMP5-S	16 or later	1.111 or later
2094-BC01-M01-S	2094-BM01-S	16 or later	1.111 or later
2094-BC02-M02-S	2094-BM02-S	16 or later	1.111 or later
2094-BC04-M03-S	2094-BM03-S	17 or later	1.117 or later
2094-BC07-M05-S	2094-BM05-S	17 or later	1.117 or later

Table 46 - Kinetix 6000 Inverter Peak Overload Support

Kinetix 6000 Drives Cat. No.	Module	Safe Torque-off Drive	Series A	Series B and later
2094-BC*xx*-M*xx*	IAM	Non Safe Torque-off	Standard	N/A
2094-BM*xx*	AM			
2094-BC*xx*-M*xx*-S	IAM	Safe Torque-off	Standard	Standard or Peak Enhanced (1)
2094-BM*xx*-S	AM			

(1) Standard mode is enabled by default to preserve backward compatibility, but you can enable the Peak-enhanced mode to achieve increased peak current performance.

Table 47 - Kinetix 6000 Peak Current Ratings

IAM/AM Module Cat. No.	Peak Inverter Current Rating		Peak Converter Current Rating	
	Standard	Peak Enhanced	Series A	Series B and later
2094-BC01-MP5-S	150%	250%	200%	250%
2094-BC01-M01-S	150%	250%	200%	250%
2094-BC02-M02-S	150%	250%	200%	250%
2094-BC04-M03-S	150%	250%	200%	250%
2094-BC07-M05-S	150%	200%	200%	300%
2094-BMP5-S	150%	250%	N/A	N/A
2094-BM01-S	150%	250%	N/A	N/A
2094-BM02-S	150%	250%	N/A	N/A
2094-BM03-S	150%	250%	N/A	N/A
2094-BM05-S	150%	200%	N/A	N/A

Enhanced Peak Performance

This appendix provides procedures and information, specific to Kinetix® 6000 drive systems, for enabling the peak enhancement feature in each drive.

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Before You Begin

The peak current ratings of the Kinetix 6000 460V drives are configured at the factory as 150% of continuous current. However, you can program 460V (series B and later) AM modules and the equivalent IAM (inverter) modules, for up to 250% of continuous inverter current.

To achieve the enhanced peak performance, you must determine the values of maximum acceleration, deceleration, and torque. This feature is present only in the Kinetix 6000 (series B and later) drives listed in Table 18.

Table 18 - Kinetix 6000 Series Change

IAM Module Cat. No.	AM Module Cat. No.	Peak Current Rating	
		Series A (inverter)	Series B and later (inverter)
2094-BC01-MP5-S	2094-BMP5-S	150%	250%
2094-BC01-M01-S	2094-BM01-S	150%	250%
2094-BC02-M02-S	2094-BM02-S	150%	250%
2094-BC04-M03-S	2094-BM03-S	150%	250%
2094-BC07-M05-S	2094-BM05-S	150%	200%

The default values that populate the AXIS_SERVO_DRIVE properties in the Logix Designer application are calculated for each motor and drive, but assume 150% peak torque in those calculations. For the drive to command more current, you must enter new values for some of those parameters, including the following:

- TorqueLimitBipolar
- TorqueLimitPositive
- TorqueLimitNegative
- MaximumAcceleration
- MaximumDeceleration
- AccelerationLimitBipolar
- AccelerationLimitPositive
- AccelerationLimitNegative

You can access these parameters offline in the Logix Designer application Axis Properties tabs or online as sent to the drive in an SSV instruction.