

Reliance Electric FlexPak 3000 Digital DC Variable Speed Drives Product Summary

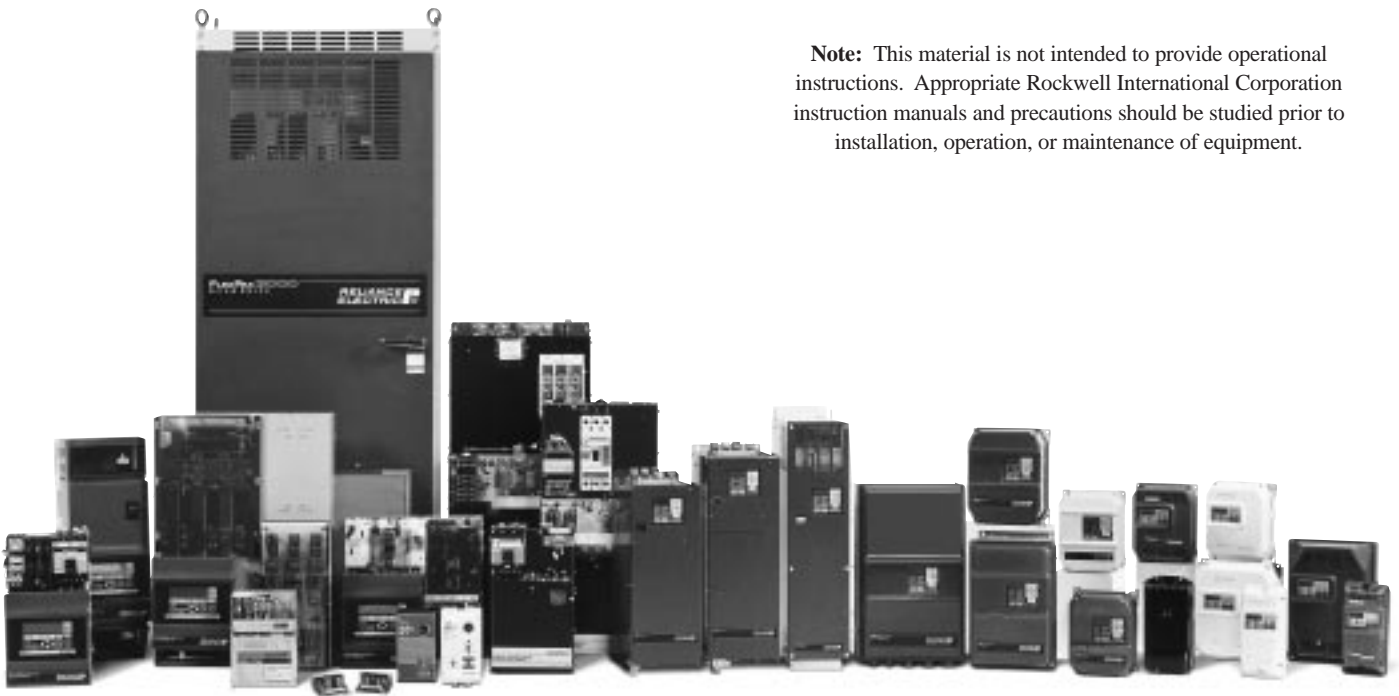
*A three-phase digital DC drive for regenerative
and non-regenerative applications*



PERFORMANCE  **PROVEN**

The Reliance® Family Of Variable Speed AC and DC Drives

Note: This material is not intended to provide operational instructions. Appropriate Rockwell International Corporation instruction manuals and precautions should be studied prior to installation, operation, or maintenance of equipment.



The Reliance® FlexPak 3000 is part of the Reliance Electric family of variable speed AC and DC drives. The FlexPak 3000 digital DC drive features a unique, ergonomic user interface for easy installation, start-up, application, and maintenance. Its unique design uses the latest digital, micro-semiconductor and circuit technology for an exceptional combination of simplicity, flexibility, and reliability in a compact package.

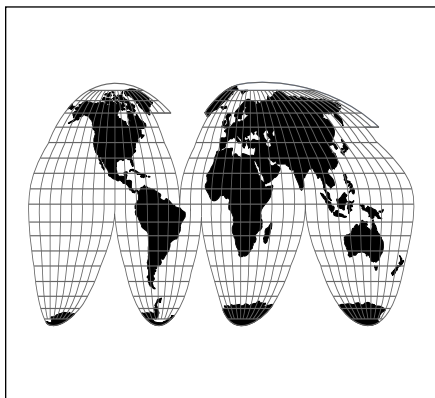
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FlexPak 3000: Simple. Compact. Flexible. Reliable.



FlexPak 3000 DC drives provide high break-away torque, precise control, and the rugged reliability required by rubber and plastic extrusion equipment.



With a single keystroke, the display language of FlexPak 3000 DC drives can be changed to English, German, French, Spanish, or Italian.



Simple.

- Readily accessible control, signal, and field wiring for streamlined installation
- User-friendly, graphical displays and a remote keypad using plain text instructions provide fast and easy set-up
- Five languages, accessible with a single keystroke, for displaying diagnostics, status information, and “help” text

Compact.

- Extensive use of molded parts enable feature-rich power density with a small footprint
- Space-saving package facilitates field wiring, mounting, modification, and maintenance
- Standard chassis design converts easily to NEMA 1 enclosure using NEMA 1 conversion kits or, for high HP controllers, floor-mount NEMA 1 enclosures

Flexible.

- Standard drive software accommodates a wide range of application requirements
- Expanded capabilities available through drive modification kits and options
- Easily modified to a full range of international input-line voltages and frequencies

Reliable.

- Advanced high-density power semiconductor devices, surface mount, and sub-micron ASIC technology for exceptional dependability
- Sophisticated design uses fewer parts for extended performance and reduced maintenance requirements

ISO Certified.

Reliance FlexPak 3000 digital DC drives are manufactured in the U.S.A. in compliance with ISO 9001 certification procedures for consistent, predictable performance. Our program of continuous quality improvement ensures that every FlexPak 3000 drive meets world-class standards of excellence with the ultimate goal of customer satisfaction.

Standard Features and Benefits

Dependable AC Supply For Optimum Reliability

- 50/60 Hz AC line frequency input
- Phase insensitive AC line input
- Semiconductor fuse protection
- AC “N” contactor (DC “M” above 300 HP)

Versatile Power Capabilities For Diverse Application Requirements

- Full-wave, full control 6-Pulse power conversion for smooth efficient operation and high performance
- Burst firing of SCRs
- Non-regenerative or regenerative (required for reversing) controller
- Capable of 150% full-load current for one minute
- DC inverting fault protection on regenerative controllers

User-Friendly Quick Start Menu For Easy Set-Up and Application

Adjustable parameters include:

- Maximum speed
- Minimum speed
- Linear acceleration
- Linear deceleration
- Current limit (positive and negative on regenerative modules)
- I/R compensation (voltage regulated drives)
- Jog speed
- Jog acceleration/deceleration rate
- Reverse disable on regenerative drives

12-Bit Resolution Analog Signals For Exceptional Accuracy

- 10 VDC manual speed reference
- User selectable +/- 10 Volt or 4-20 mA auto speed reference
- 0-10 VDC analog output proportional to speed
- 0-10 VDC analog output proportional to armature current
- Speed feedback from analog tachometer (250 VDC maximum input)

Expanded Offering of Digital Signals For Optimum Flexibility

- Coast, stop, auto/manual, forward/reverse, jog, run, and stop inputs
- Motor thermostat diagnostic input
- Brush wear diagnostic input
- Customer interlock diagnostic input
- Drive running contact output
- Drive alarm contact output
- Drive fault contact output

Feature-Rich “Standard” Package For Exceptional Functionality

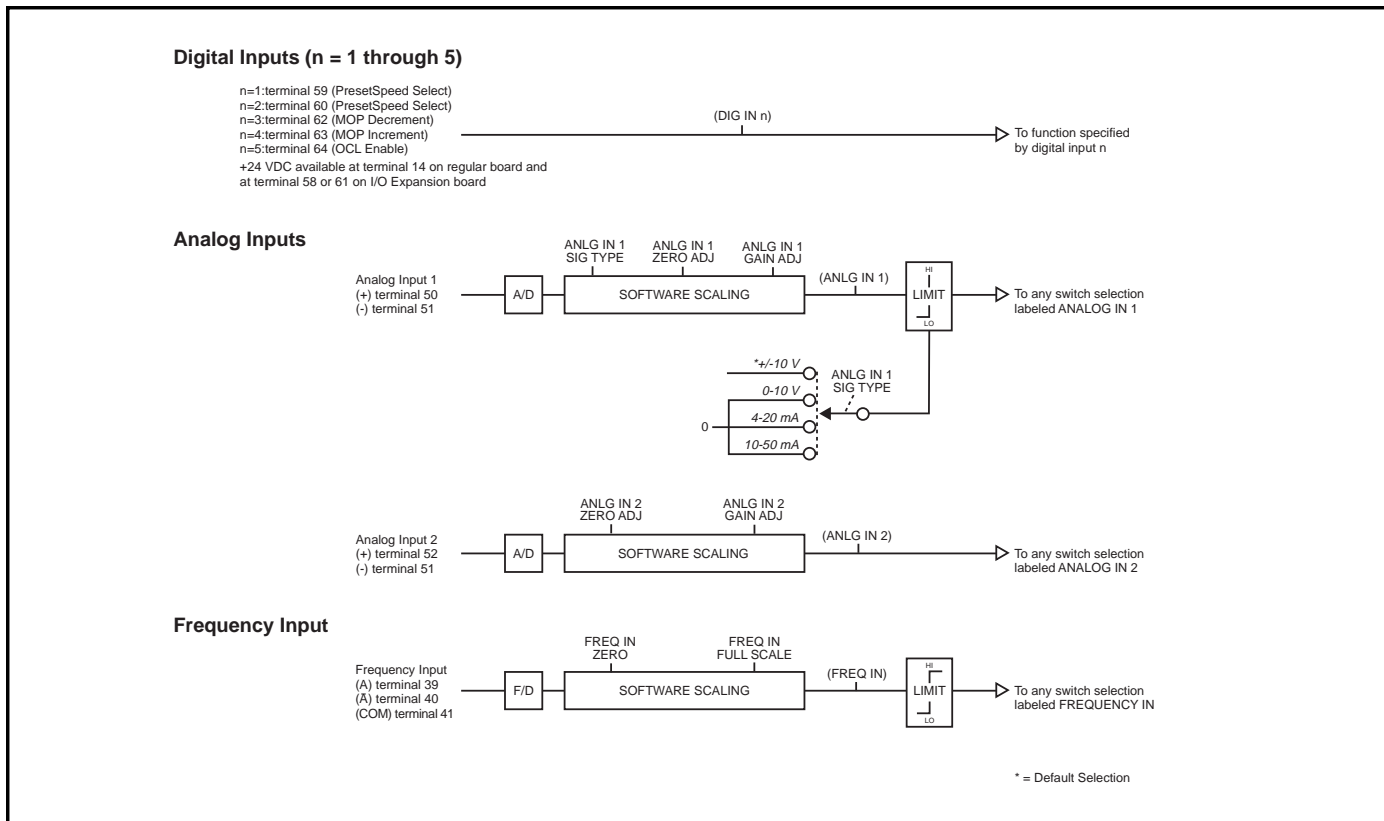
- Self-tuning of speed and current loops without disconnecting the fields
- Field (current) loss protection
- User selectable stop modes
 - Coast
 - Current limit
 - Ramp
- Local controls with interactive keypad and display for:
 - Drive set-up
 - Drive operation
 - Metering and diagnostics (including fault and alarm logs)

Drive Modification Kits With Block Diagrams

Name	Description	Model Number	I/M Number
115 VAC Control Interface	Converts customer-supplied 115 VAC signals to 24 VDC. Mounts separate from the drive.	917FK0100	D2-3338
460 VAC to 230 VAC Fuse Conversion Kit	Allows conversion of the 460 VAC to 230 VAC at 1/2 the 460 VAC horsepower rating.	916FK series	D2-3329
AC Line Disconnect Kit	Mounts on the FlexPak 3000 and allows the three-phase line to be disconnected at the drive.	901FK series	D2-3292 or D2-3315
AC Tachometer Feedback Kit	Allows the drive to accept feedback signals from AC tachometers to a maximum RMS of 275 VAC.	907FK0301	D2-3297
AutoMax Network Communication Board	Allows the drive to communicate on the Reliance AutoMax Distributed Control System (DCS).	915FK0101	D2-3318
Blower Motor Starter Kit	Provides a fused AC starter with adjustable overload and interlocking for control of the three-phase blower motor used to cool the DC motor.	902FK series	D2-3295
DeviceNet Communication Board	Allows the drive to communicate over the open protocol DeviceNet network. (<i>see page 14</i>)	915FK1100	HE-FP3
Drive Control Configuration Software	Windows™ based software that connects any personal computer using Microsoft Windows V 3.1 or higher to a FlexPak 3000 drive.	2CS3000	D2-3348
Dynamic Braking Kit	Provides the hardware, including braking grids, to provide dynamic braking on stop.	908/9/12/13FK series	D2-3313
Enhanced Field Supply Kit	Provides electronic field trim, field economy, and the ability to supply 240 Volts field voltage from a 230 VAC line.	903FK series	D2-3298
Inverting Fault Circuit Breaker	This kit is recommended when applying regenerative drives to high inertia loads or when drive is frequently in low power regenerative mode.	906FK series	D2-3300 OR D2-3330
NEMA 1 Conversion Kit	Converts standard chassis to NEMA 1 enclosure.	904FK series	D2-3299 OR D2-3331
OIM Remote Mounting Kit	Enables mounting of OIM up to five meters from the drive.	905FK0101	D2-3294
Pulse Tachometer Feedback Kit	Allows digital pulse tachometer or digital encoder speed feedback.	907FK0101	D2-3302

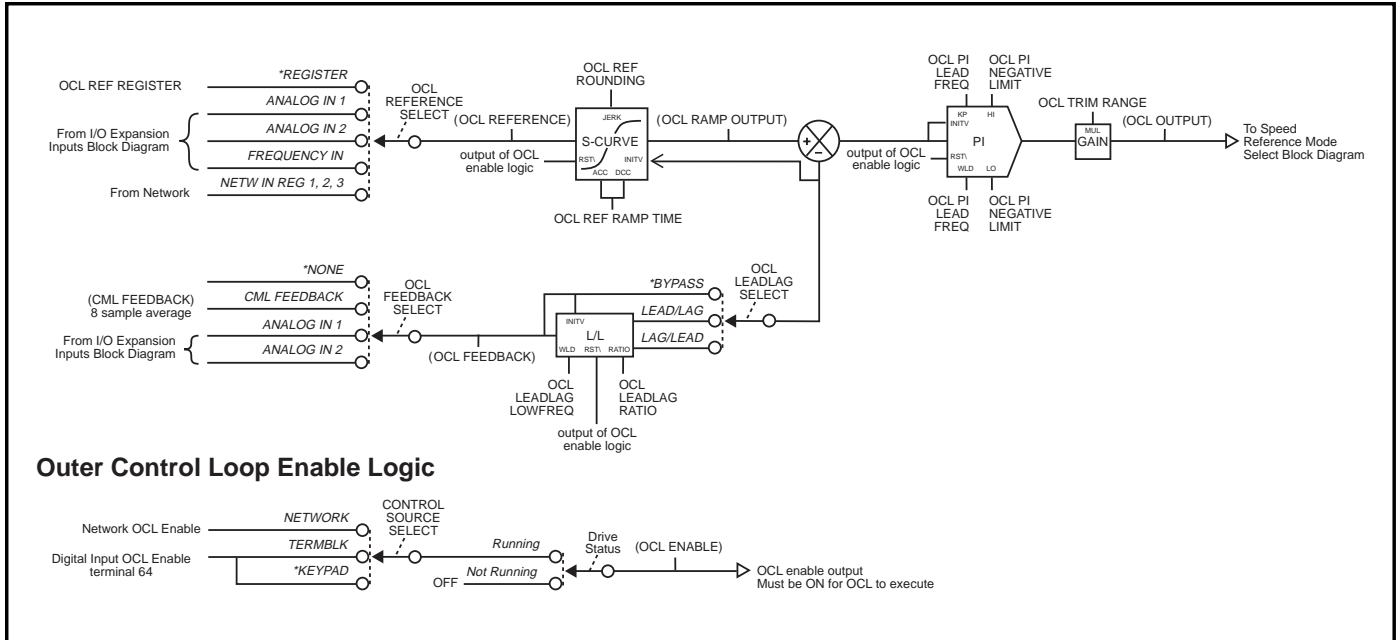
Drive Modification Kits With Block Diagrams

Name	Description	Model Number	I/M Number
Field Current Regulator Kit	Provides field economy, as well as pre-weakening of the field using a fixed reference or field weakening for above base speed operation.	911FK series	D2-3336
I/O Expansion Board	Mounts on the FlexPak 3000 chassis to provide additional analog, frequency, and digital I/O capabilities.	914FK0101	D2-3301



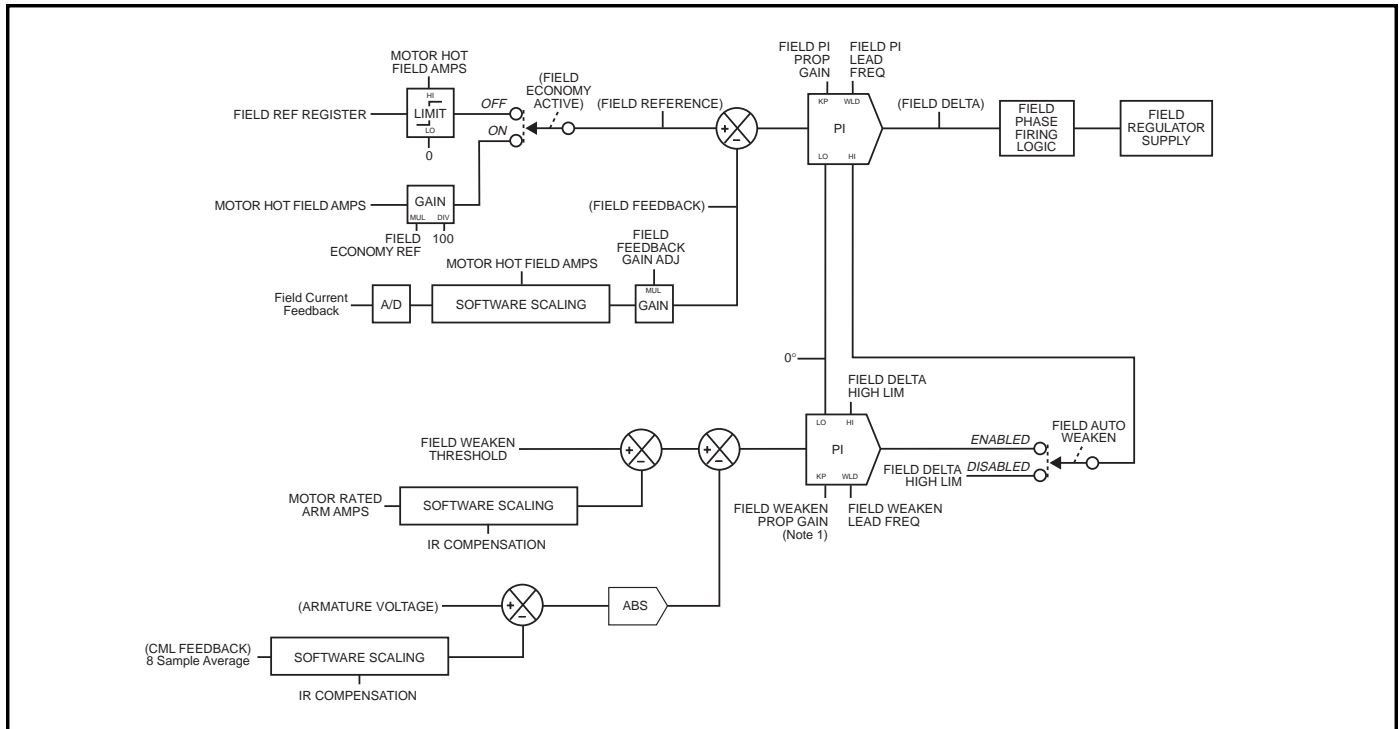
I/O Expansion Board Interconnections

Drive Modification Kits With Block Diagrams



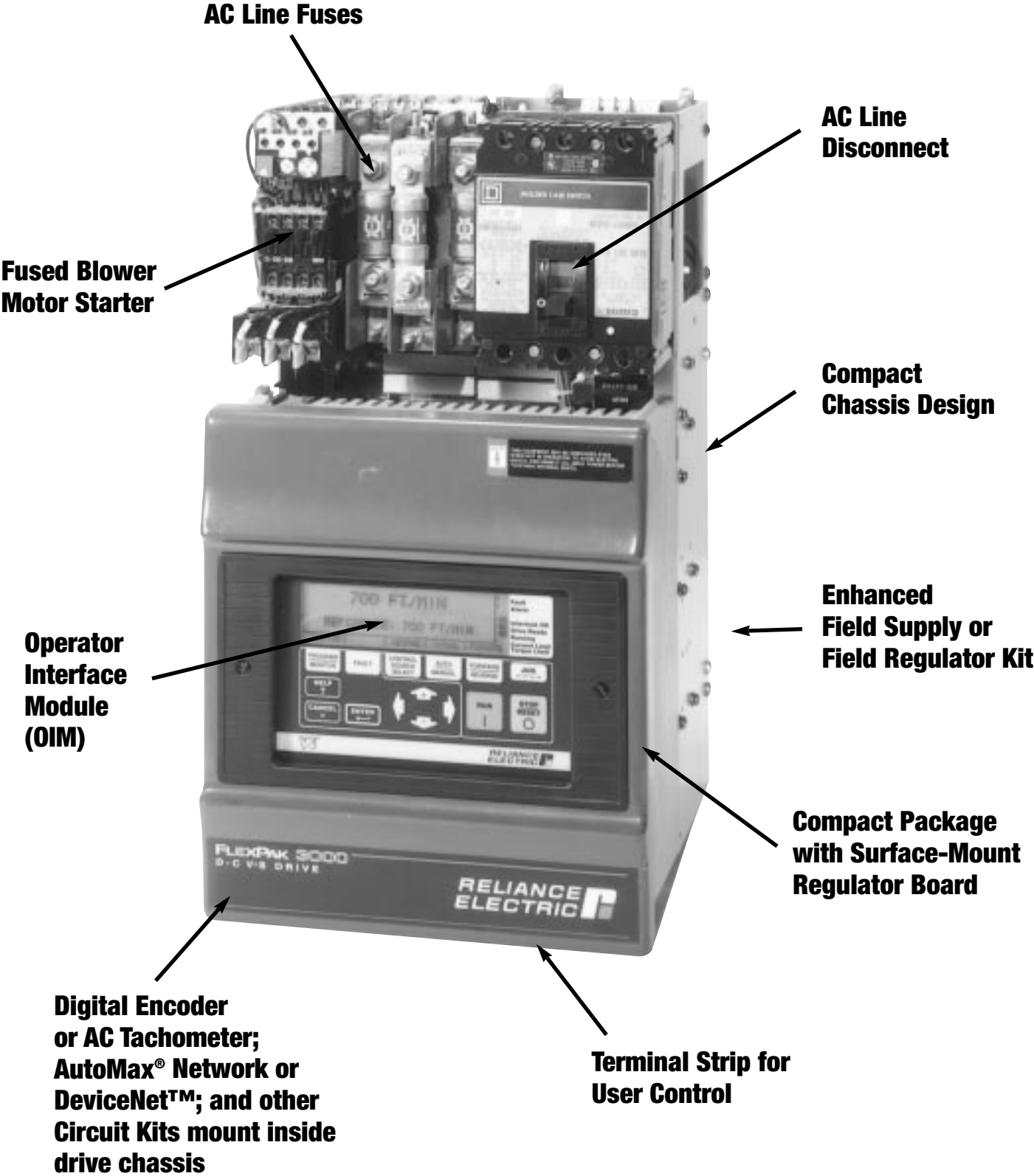
I/O Expansion Board Block Diagram

Drive Modification Kits With Block Diagrams



Field Current Regulator Block Diagram

Features and Benefits



Operator Interface Module (OIM)

Unique Reliance OIM technology makes the FlexPak 3000 digital DC drive exceptionally easy to set-up, start-up, operate, and trouble-shoot. The OIM allows you to start-up, adjust, monitor, and operate the drive through one simple interface. An ergonomic keypad layout and extensive full-text information presented on a large liquid crystal display make the OIM easy to understand and use.

Similar functions are grouped together on the keypad:

- Control keys (start, stop, run, jog, and forward/reverse) on the lower right
- Set-up keys (help, enter, and cancel) grouped together on the left

To promote ready identification of specific functions, the OIM uses symbols as well as text descriptions and keys that vary in size and shape.

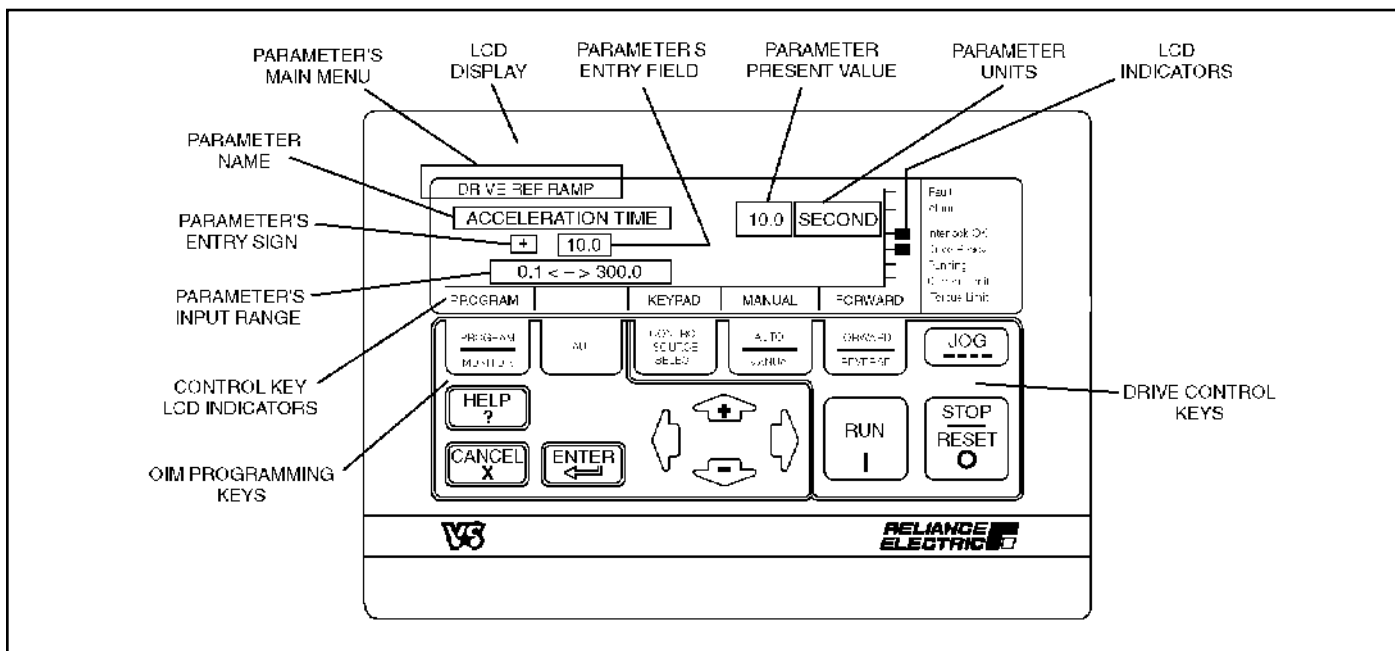
The Quick Start routine makes set-up fast and easy through self-prompting of the drive. The drive can be started in minutes, using the drive and motor nameplate information. To promote international use, all information is displayed in

easy to understand units such as RPM, amps, volts, etc., and in your choice of five languages: English, French, German, Italian, or Spanish. “Help” in the language of your choice, is always only a keystroke away.

More complex set-up and adjustment information is also easily accessible through logically organized, full-text menus that significantly reduce operator training since there’s no need to memorize cryptic names or parameter numbers.

If a fault should occur, the OIM allows quick access to the fault and alarm logs. In addition to logging the time and description of each fault, possible causes are identified. For example, a motor thermostat trip fault might suggest checking for an overloaded motor, incorrect blower rotation, clogged filters, etc. The end result of this sophisticated diagnostic process is reduced downtime.

OIM Integer Value Entry Screen



Operator Interface Module (OIM)

Extensive Operator Control For Quick and Easy Use

- Control keys include:
 - Run
 - Forward/Reverse
 - Control Source Select
 - Stop
 - Auto/Manual
- Quick Start sequence for fast and easy drive set-up
- Large, easy-to-read LCD provides:
 - Built-in digital metering, selectable in units proportional to speed or current such as feet/minute (FPM) or percent load
 - Single keystroke selects display text language:
 - English
 - German
 - French
 - Spanish
 - Italian
 - code
- Multiple parameter values, such as speed and load, can be monitored in a single display
- On-screen menus with non-abbreviated text for adjustments and monitoring
- Drive status display indicators include:
 - Drive fault
 - Drive alarm
 - Interlocks (OK)
 - Drive running
 - Current/torque limit
 - Drive ready

Helpful Diagnostics For Reduced Downtime

Diagnostic displays recommending corrective action include:

- AC line voltage high/low alarm
- Motor brush wear alarm
- Loss of AC line synchronization fault
- Failed SCR fault
- Motor thermostat fault
- Drive thermostat fault
- Drive (inverse time) overload fault
- Drive IET (instantaneous electronic trip) fault
- Tachometer loss fault
- Overspeed fault
- Field current loss fault
- Network communication fault

Quick Start Summary

The Quick Start function from the Main Menu will be used to start-up and tune the drive. CONTROL SOURCE SELECT must be set to KEYPAD for complete OIM control during the Quick Start procedure.

Quick Start Parameter Modification Sequence

This modification sequence is not intended to provide set-up instructions. Refer to the FlexPak Instruction Manual for critical set-up information.

Step Number	Parameter Name	Description
1	TOP SPEED	This is the highest normal running speed of the motor.
2	MOTOR RATED ARM AMPS	This parameter MUST match the rated armature current from the motor nameplate.
3	MOTOR RATED ARM VOLTS	This is the rated armature voltage from the motor nameplate.
4	REVERSE DISABLE	When on, REVERSE DISABLE prevents the drive from operating in reverse.
5	FEEDBACK SELECT	This selects the type of feedback signal used for the speed/voltage loop.
6	ANLG TACH VOLTS/1000	This is the analog tachometer scaling from the tachometer nameplate in volts per 1000 RPM.
7	PULSE TACH PPR	This parameter sets the pulse tachometer pulses per revolution (PPR) from the pulse tachometer nameplate.
8	PULSE TACH	This parameter enables or disables a QUADRATURE tachometer.
9	ACCELERATION TIME	This is the time it takes to accelerate to TOP SPEED.
10	DECELERATION TIME	This is the time it takes to decelerate from TOP SPEED to zero.
11	MINIMUM SPEED	This parameter selects the drive's minimum operational speed.
12	MAXIMUM SPEED	This parameter is the maximum speed of the drive that can be supported by the application or process.

Quick Start Summary

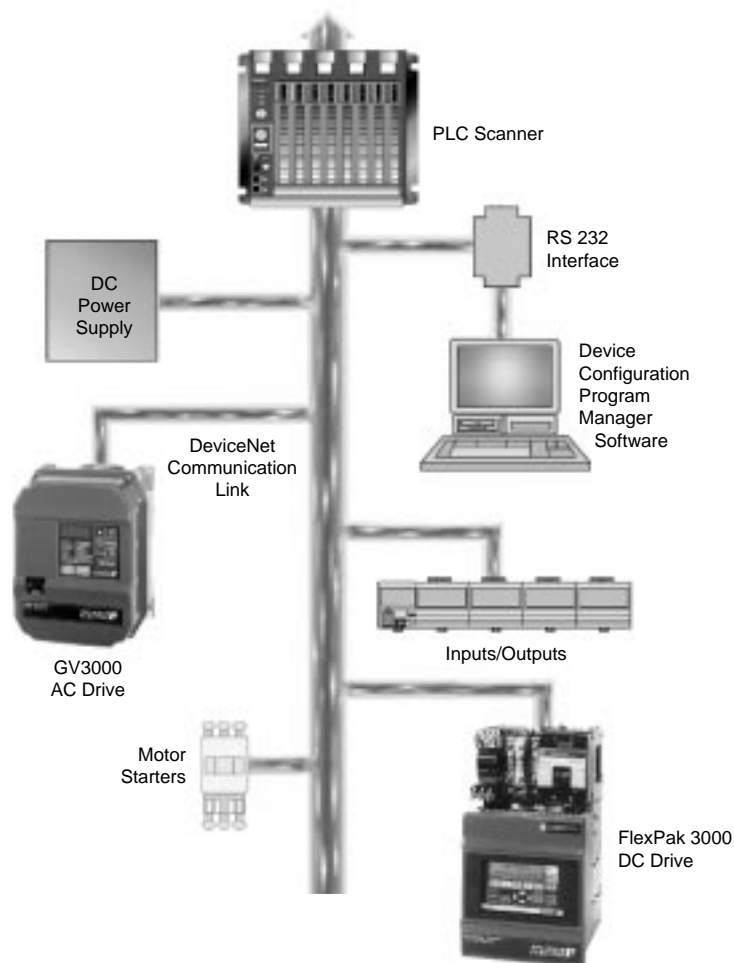
Step Number	Parameter Name	Description
13	JOG ACCEL/DECEL TIME	This is the time it takes the jog reference to reach TOP SPEED from zero.
14	JOG SPEED	This is the operating speed when the drive is jogging.
15	POSITIVE CURRENT LIM	This selects the maximum percent of motor rated armature current for the forward bridge.
16	NEGATIVE CURRENT LIM	This parameter selects the maximum percent of motor rated armature current for the reverse bridge.
17	IR COMPENSATION	This parameter selects the armature voltage loss compensation value used when the drive is configured as a voltage regulator.
18	MOTOR HOT FLD AMPS	This parameter sets the motor rated hot field amps from the motor nameplate.
19	JUMPER INFORMATION DISPLAY	Displays correct regulator jumper positions.
20	SELF TUNE? NO YES	Allows user to self-tune the speed and/or current loops.

Communications and Control Capabilities

DeviceNet

When used in conjunction with the DeviceNet Communication Board, the capabilities of the FlexPak 3000 are extended to include high speed communications over the network that has become the industry standard for open communication. The DeviceNet Communication Board enables drive configuration, control, monitoring, and diagnostics to be accessed from a remote location for optimum versatility.

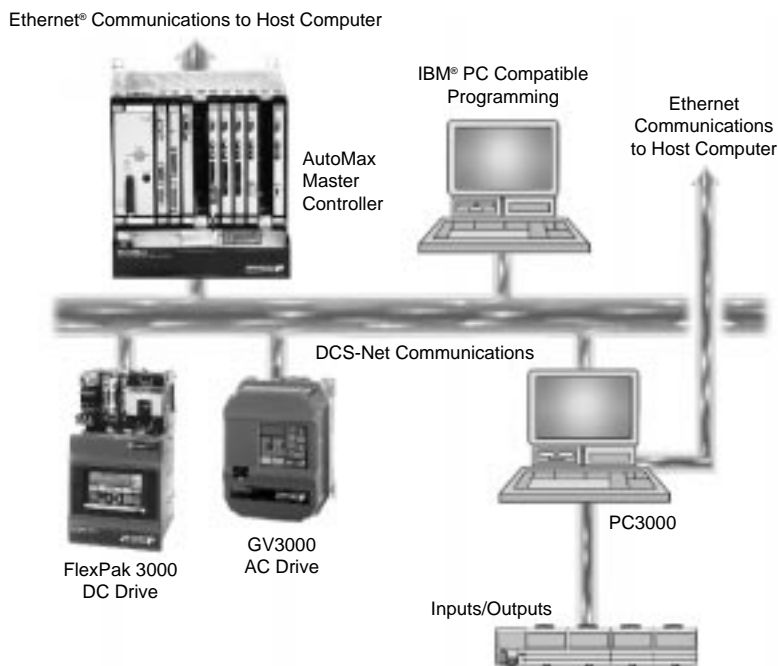
The DeviceNet protocol is supported by a wide array of industrial equipment manufacturers. Typically, a host logic controller is used as the central manufacturing or process control center, with nodes or drops used for all devices on the network. Each device is individually addressed and connected to the network by a single cable to reduce the amount of wiring required. Since all devices communicate through this single network, complex operations such as interlocking and sequencing can be easily configured with software from a single location.



AutoMax DCS-Net

FlexPak 3000 drives are also available with an interface card that allows an AutoMax real-time distributed controller to control their operations. When connected to this network, the drive can receive reference, control, and tuning information and send monitoring and diagnostic information such as speed feedback and drive status through a high-speed network link. All data is pre-defined on the DCS-Net through fixed memory mapping to minimize programming.

FlexPak 3000 DC drives are ideal for use in connected production or processing applications where high-speed communications are required for exacting motor torque and/or speed control.

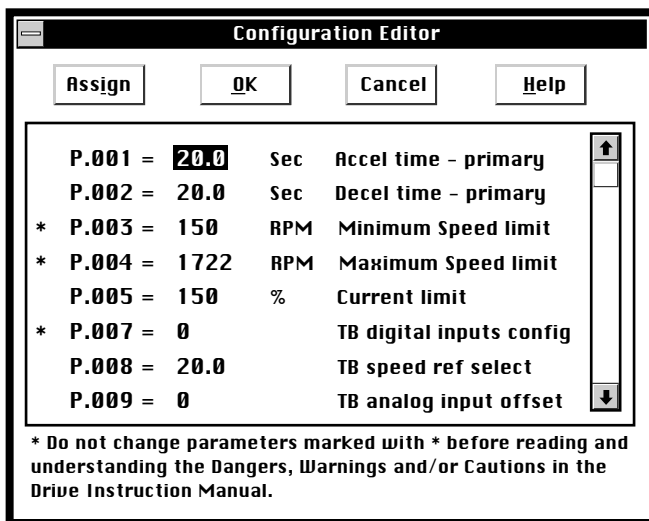


Communications and Control Capabilities

CS3000 Control and Configuration Software

CS3000 is a Windows based software program that can be used to configure and operate FlexPak 3000 drives from a personal computer (PC). It can:

- Create, store, upload, download, and print drive configurations
- Control drive (start, stop, forward, reverse, etc.)
- Monitor drive status (faults, alarms, ready, etc.)
- Drive metering (output speed, output current, etc.)
- Monitor and change drive parameters in English rather than codes
- Compare drive and PC configurations
- Read and reset the drive fault/alarm log

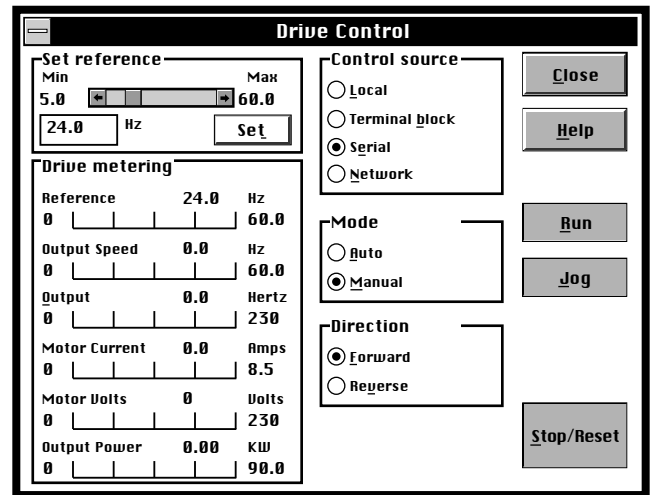


File Management

Opened files can be downloaded to the drive, and all configurations can be saved as files, so it's easy to duplicate configurations for drives on repeat applications.

Drive Configuration

Configurations can be easily downloaded from a PC office environment to a drive on the factory floor.

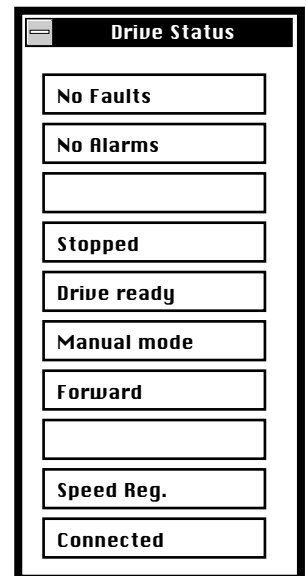


Drive Control

PC drive control facilitates start-ups, minimizes troubleshooting time, and makes it easy to monitor drive status with a wide selection of controls and an extensive display of drive output conditions.

Drive Status

A pop-up drive status window can be viewed whenever a drive connect is performed for convenient monitoring that includes fault/alarm status.



Hardware Requirements

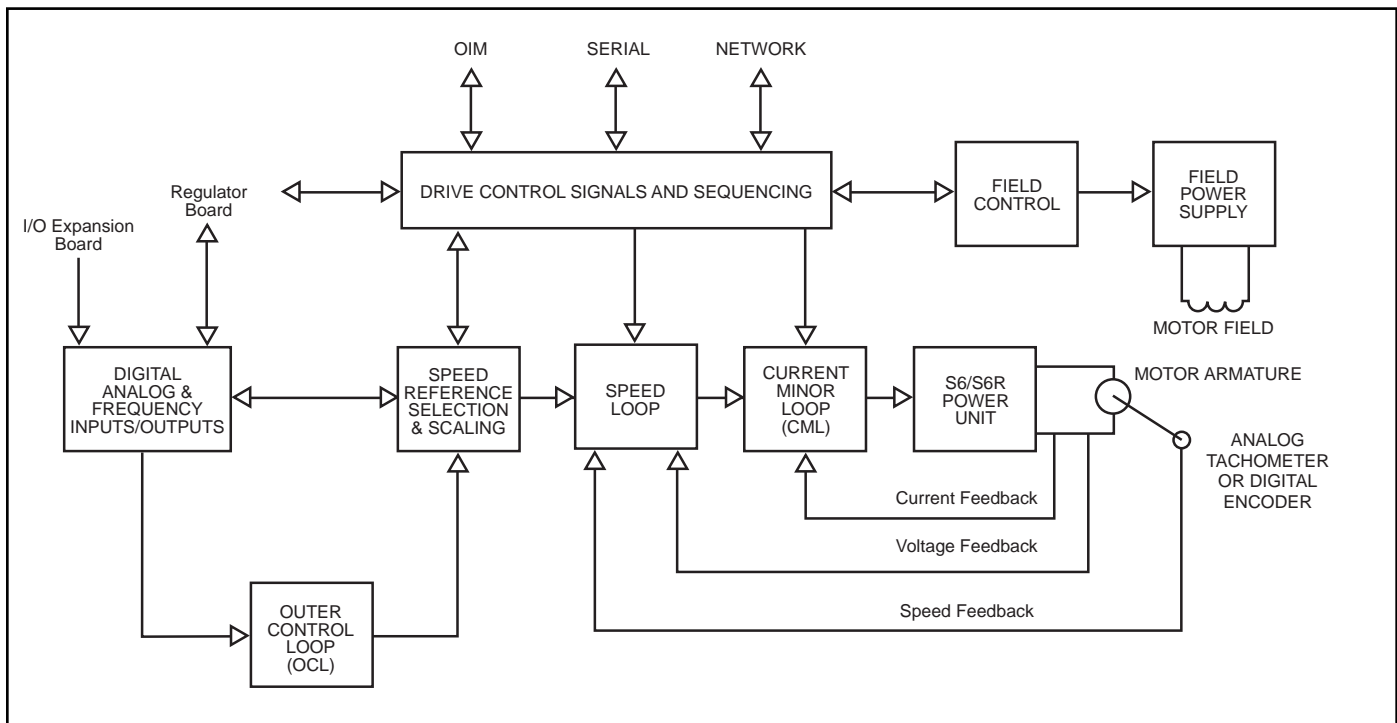
- IBM 286/386/486 Pentium or IBM-compatible PC
- Windows 3.1 or higher
- Hard drive with at least 8 Mbytes of available space
- Minimum of 640 Kbytes of conventional RAM plus 256 Kbytes of extended RAM
- 1 3.5" floppy disk drive
- Monochrome or color EGA, CGA, or VGA monitor
- RS-232 serial COM port

FlexPak 3000 Drive Control Block Diagram

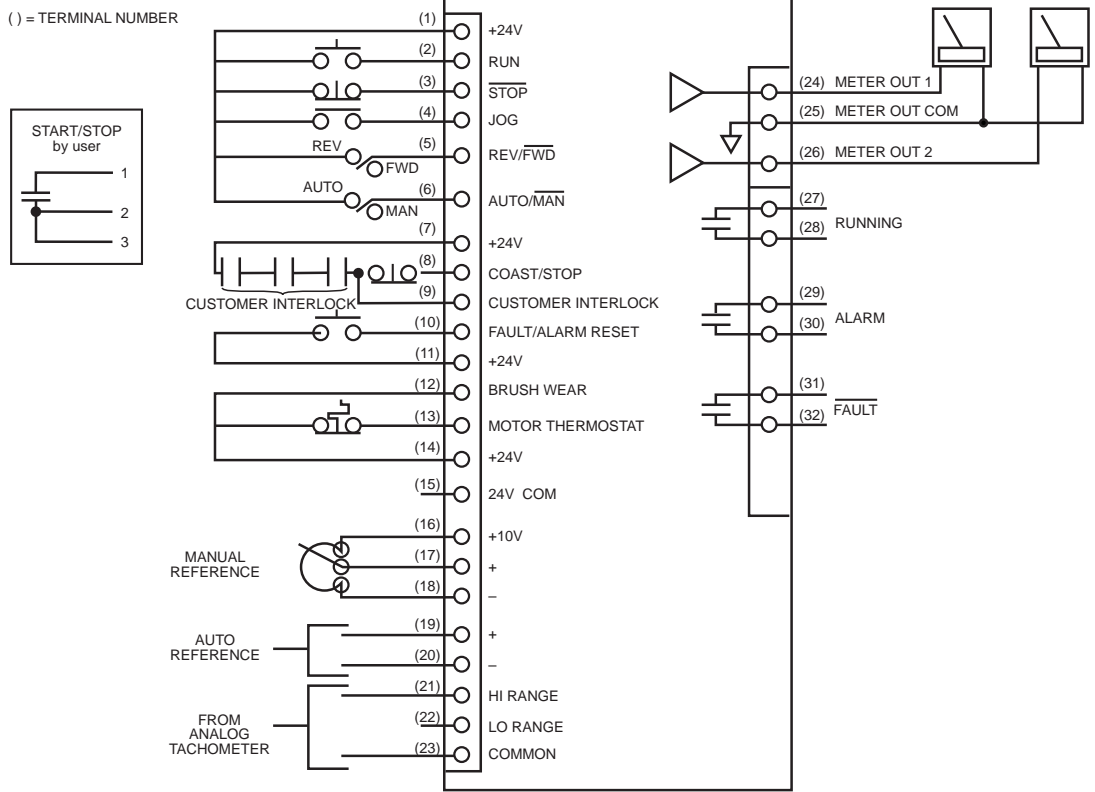
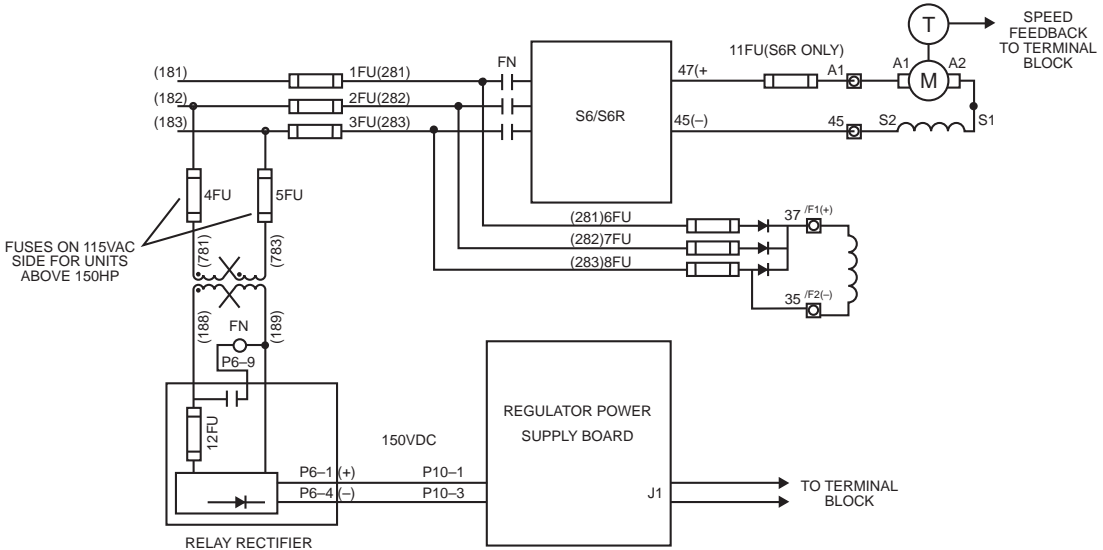
Proven DC Technology For Reliable, Predictable Performance

The FlexPak 3000 is a full-wave, 6-pulse power converter that includes a digital current minor loop and a digital major loop for armature voltage or speed regulation by tachometer. There is also a third control loop for applications requiring an Outer Control Loop (OCL), e.g., a position regulator.

FlexPak 3000 Drive Control Block Diagram

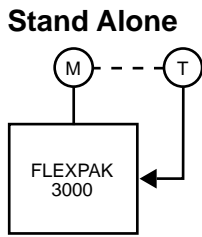


FlexPak 3000 Digital Drive Wiring Diagram



Application Solutions

Stand-Alone FlexPak 3000 Configuration



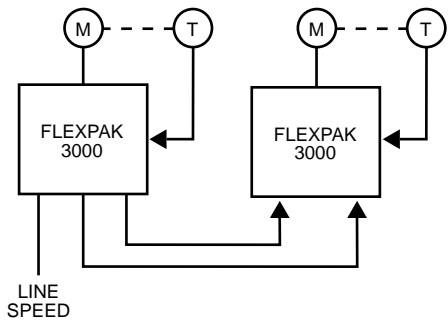
Recommended Applications

- Plastic or food extruders
- Mixers or agitators
- Line shafts
- Lead section for multiple drive MG set replacement

Benefits

- High break-away torque
- Wide speed range
- Excellent speed regulation when used with digital tachometer

Master/Follower FlexPak 3000 Configuration



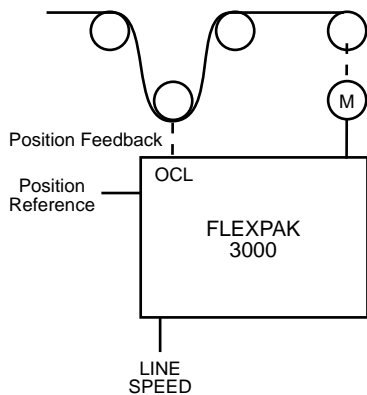
Recommended Applications

- Web handling
- Conveyors
- Wire drawing
- Multi-section process
- Fiber Drawing

Benefits

- Exceptional resolution accuracy with I/O frequency
- Reduced hardware
- Wide speed range
- High starting torque

Dancer Position Regulator FlexPak 3000 Configuration



Recommended Applications

- Textile
- Web processing/handling

Benefits

- Less external hardware
- Simple set-up
- Precise control
- Full PI regulation

Technical Specifications

Service Conditions

Standard Altitude	to 3300 feet (1000 meters)
Above 3300 feet	Derate 3% for every 1000 ft above 3300 ft up to 10,000 ft
Standard Ambient Temperature:	
Cabinet Units	0-40° C (32-104° F)
Chassis Units	0-55° C (32-131° F)
AC Line Voltage Variation	+/-10%
AC Line Frequency	48/62 Hz
AC Line Distribution System KVA Capacity ⁽¹⁾	(1)
Maximum Three Drives/Transformer ⁽¹⁾	(1)
Atmosphere (non-condensing relative humidity)	5-95%
Environment	The drive should be located in an area that is free of dust, dirt, acidic or caustic vapors, vibration and shock, temperature extremes, and electrical or electromagnetic noise interference

Efficiency and Power Factor

Displacement Power Factor	
At Maximum Speed	88.0%
Power Module Efficiency:	
100% Speed, 100% load	99.3%
100% Speed, 25% load.	98.5%
25% Speed, 100% load.	96.8%
25% Speed, 25% Load	94.0%
Drive Efficiency With Motor (typically)	87.0%

Capacities

Service Factor	1.0
Maximum Load	150% for one minute

Conformity to Standards

UL Listed	E59092
C-UL Listed	
IEC Classified	E123851
CE Approved ⁽³⁾	EN 50081-1 EN 50082-2 EN 60204 EN 1050 EN 292 EN 1037

Speed Range

Operating	1% to rated speed ⁽²⁾
Typical Quoted Regulation	200:1 ⁽²⁾
Continuous (for force-ventilated motors)	100% rated torque down to 5% base speed

Speed Regulation

With Digital Encoder	0.01%
With Analog Tachometer	1.0%
With Armature Voltage Feedback	2.0%

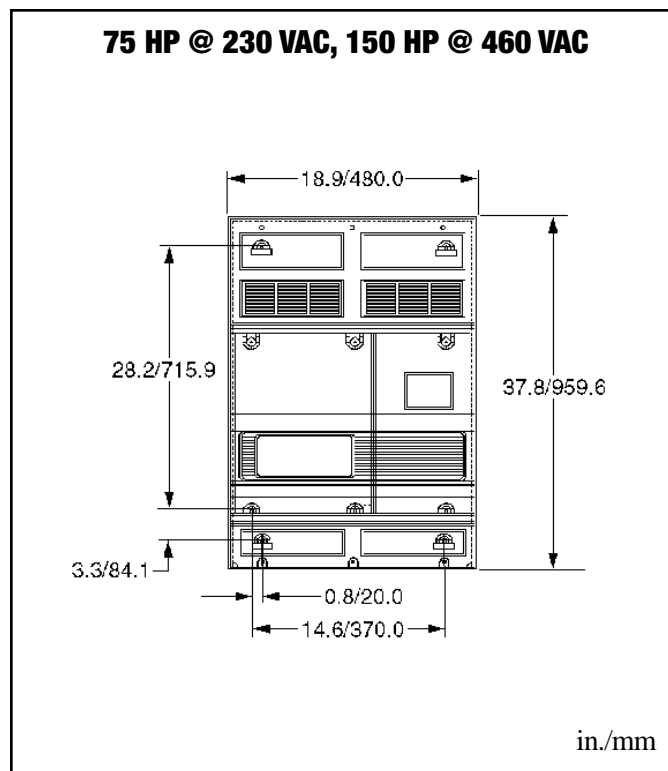
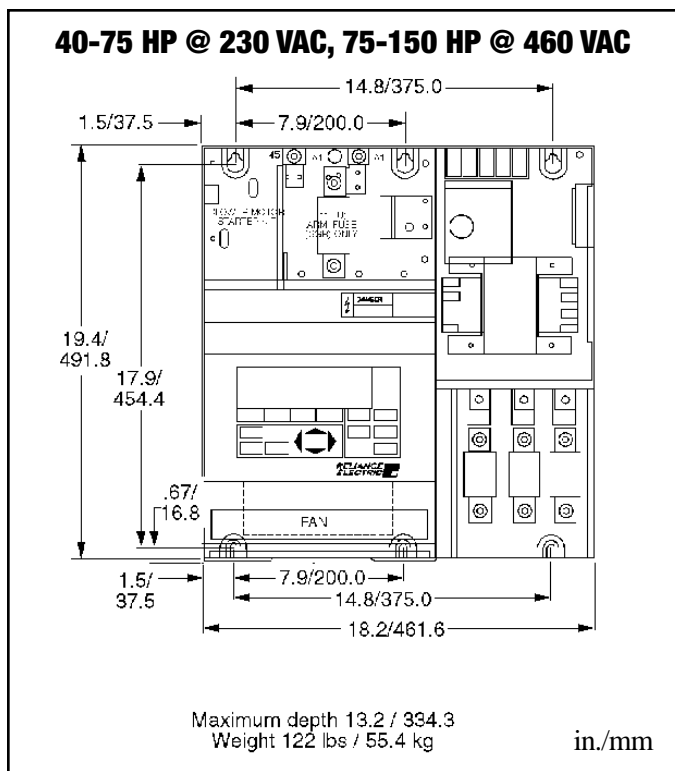
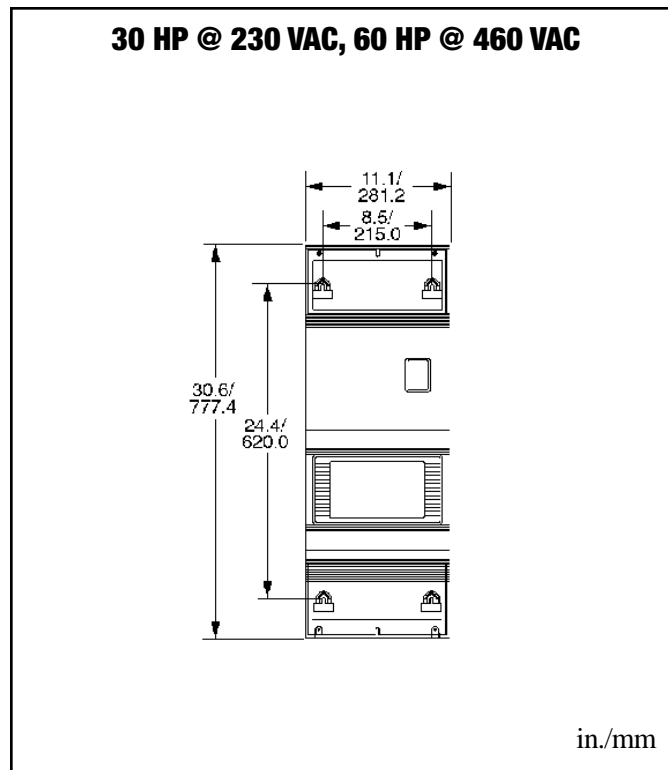
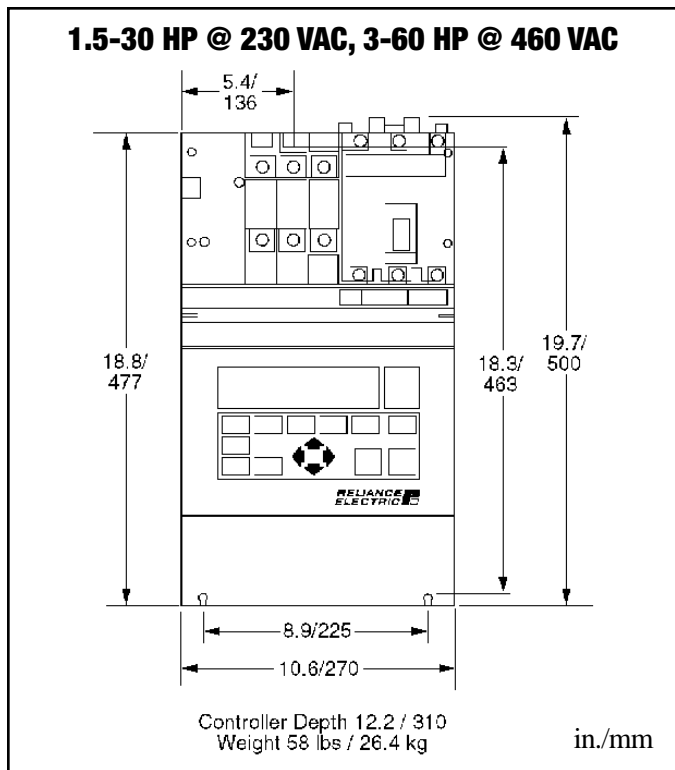
⁽¹⁾ Applying FlexPak 3000 digital DC drives to power distribution systems with KVA capacity in excess of five times the smallest drive rating requires the use of an isolation transformer or line reactors of similar impedance.

⁽²⁾ Dependent on top speed and digital encoder used:

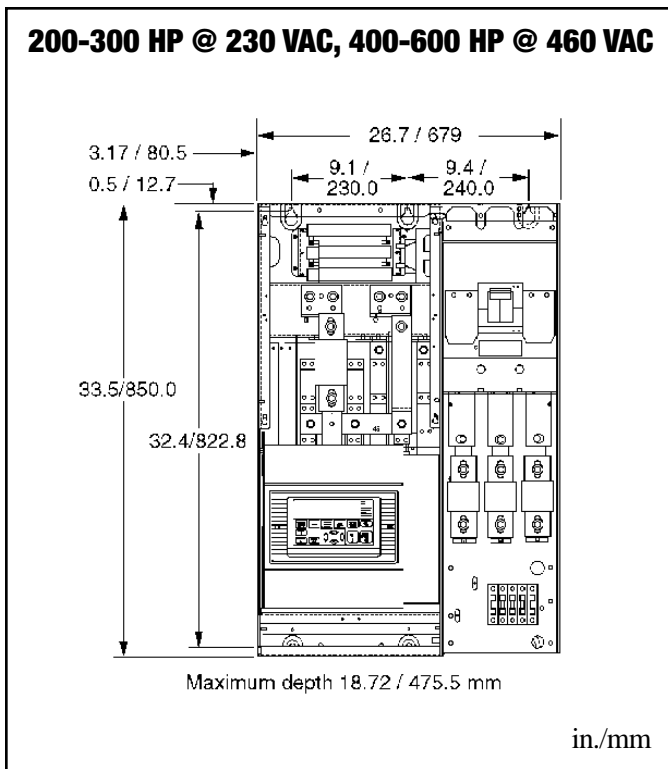
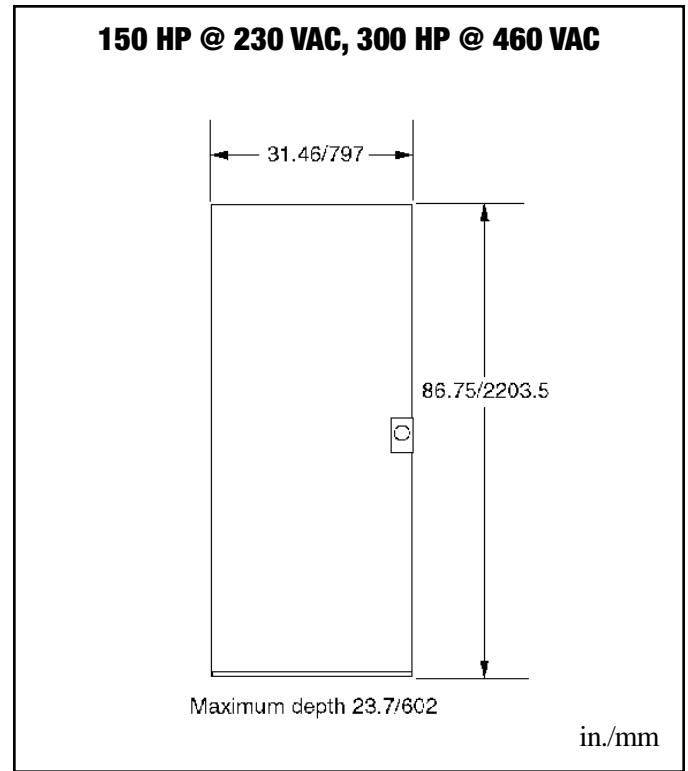
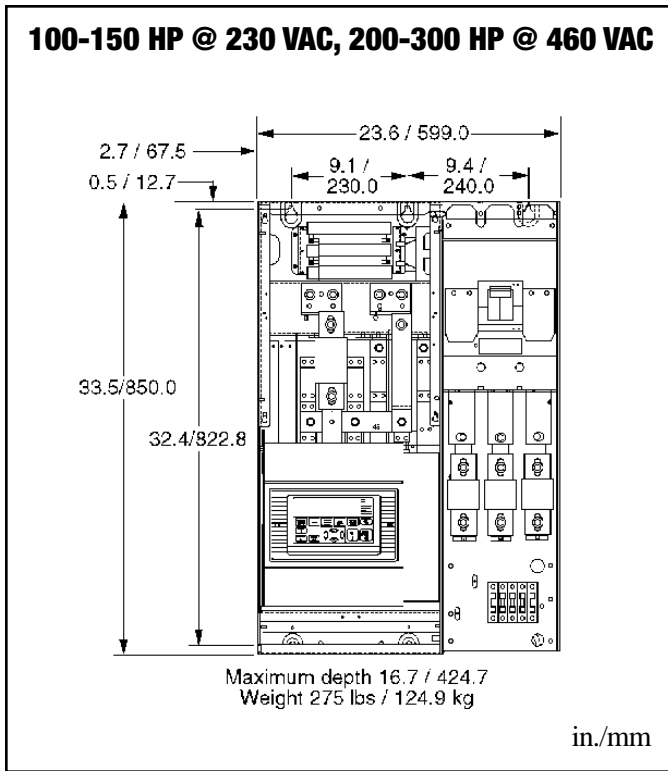
- 5PY = 30:1
- RD120 = 70:1
- RL1024 = 200:1

⁽³⁾ Contact Reliance for installation requirements.

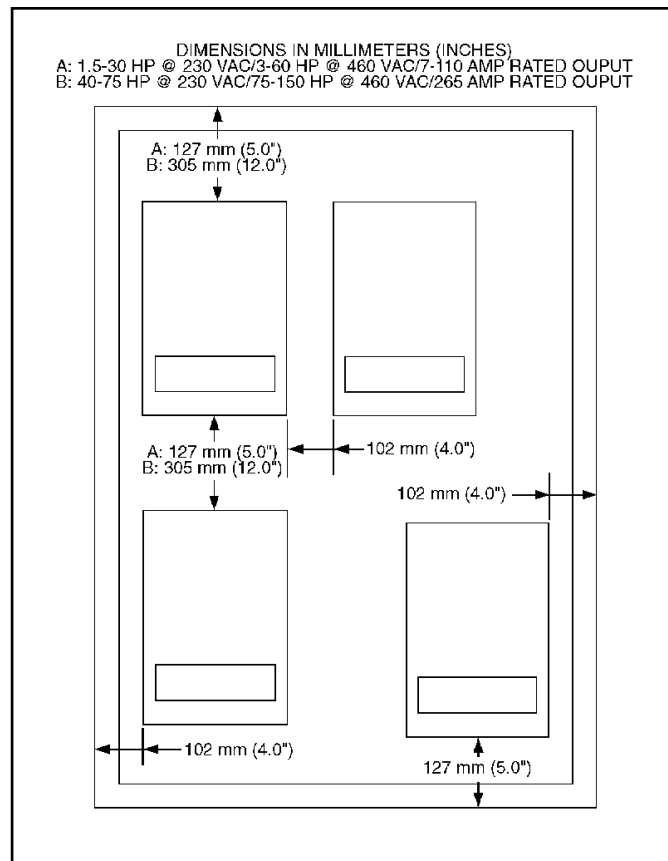
FlexPak 3000 Chassis And Conversion Kit Dimensions



FlexPak 3000 Chassis and Conversion Kit Dimensions



FlexPak 3000 Minimum Mounting Clearance Distances



FlexPak 3000 Controller Ratings

HP Ratings	Full Load Rated RMS AC Line Current (Amperes)		Full Load Rated RMS DC Armature Current (Amperes)		Rated Field Current (Amperes)		HP Ratings	Full Load Rated RMS AC Line Current (Amperes)		Full Load Rated RMS DC Armature Current (Amperes)		Rated Field Current (Amperes)	
	230 VAC	460 VAC	240 VAC	500 VAC	150 VDC	300 VDC		230 VAC	460 VAC	240 VAC	500 VAC	150 VDC	300 VDC
1.5	10	—	7	—	10	—	40	125	63	146	73	15	15
2	11	—	9	—	10	—	50	154	74	180	86	15	15
3	13	10	12	6	10	10	60	186	86	218	100	15	15
5	19	12	20	10	10	10	75	226	110	265	129	20	15
7.5	26	15	29	14	10	10	100	307	143	360	167	20	15
10	33	18	38	19	10	10	125	370	177	434	207	20	15
15	48	24	55	27	10	10	150	443	213	521	250	20	20
20	63	31	73	35	15	10	200	592	281	685	330	20	20
25	80	39	93	45	15	10	250	733	351	850	412	20	20
30	94	45	110	52	15	10	300	859	421	1000	495	20	20
							400	—	550	—	640	—	20
							500	—	689	—	800	—	20
							600	—	833	—	960	—	20

FlexPak 3000 Controller

FlexPak 3000 Controller Selection

Horsepower	Non-Regenerative		Regenerative	
	230 VAC	460 VAC	230 VAC	460 VAC
1.5	1FN2032	–	1FR2032	–
2	2FN2032	–	2FR2032	–
3	3FN2032	3FN4032	3FR2032	3FR4032
5	5FN2032	5FN4032	5FR2032	5FR4032
7.5	7FN2032	7FN4032	7FR2032	7FR4032
10	10FN2032	10FN4032	10FR2032	10FR4032
15	15FN2032	15FN4032	15FR2032	15FR4032
20	20FN2032	20FN4032	20FR2032	20FR4032
25	25FN2032	25FN4032	25FR2032	25FR4032
30	30FN2032	30FN4032	30FR2032	30FR4032
40	40FN2032 ⁽¹⁾	40FN4032	40FR2032 ⁽¹⁾	40FR4032
50	50FN2032 ⁽¹⁾	50FN4032	50FR2032 ⁽¹⁾	50FR4032
60	60FN2032 ⁽¹⁾	60FN4032	60FR2032 ⁽¹⁾	60FR4032
75	75FN2032 ⁽¹⁾	75FN4032 ⁽¹⁾	75FR2032 ⁽¹⁾	75FR4032 ⁽¹⁾
100	100FN2031	100FN4032 ⁽¹⁾	100FR2031	100FR4032 ⁽¹⁾
125	125FN2031	125FN4032 ⁽¹⁾	125FR2031	125FR4032 ⁽¹⁾
150	150FN2031	150FN4032 ⁽¹⁾	150FR2031	150FR4032 ⁽¹⁾
200	200FN2031 ⁽¹⁾	200FN4031	200FR2031 ⁽¹⁾	200FB4031
250	250FN2031 ⁽¹⁾	250FN4031	250FR2031 ⁽¹⁾	250FB4031
300	300FN2031 ⁽¹⁾	300FN4031	300FR2031 ⁽¹⁾	300FB4031
400	–	400FN4031 ⁽¹⁾	–	400FR4031
500	–	500FN4031 ⁽¹⁾	–	500FR4031
600	–	600FN4031 ⁽¹⁾	–	600FR4031

⁽¹⁾ Contact Reliance for Availability.

Special AC Line Voltage Controllers (380/415 VAC)

Unit Type	Input Voltage VAC	Full Load Rated RMS AC Line Current (Amperes)	Full Load Rated DC Armature Current (Amperes)	Rated Field Current (Amperes)	Power Supply Capacity ⁽²⁾	Min. Source KVA	Reference HP @ 460 VAC Input	Model Number (Non-Regen)	Model Number (Regen)
7A	380/415	10	7	10	5000	4/5	3	7FN3031	7FR3031
29A	380/415	26	29	10	5000	16/18	15	29FN3031	29FR3031
55A	380/415	48	55	10	5000	33/36	30	55FN3031	55FR3031
110A	380/415	94	110	15	10000	62/68	60	110FN3031	110FR3031
265A	380/415	226	265	20	25000	145/157	150	265FN3031	265FR3031

⁽¹⁾ When applying FlexPak 3000 drives to a power distribution system with KVA capacity in excess of five times the smallest drive rating the use of an isolation transformer or line reactors of similar impedance is required. Also, the drives are designed for a maximum of three units per transformer.

⁽²⁾ Maximum permissible available symmetrical RMS fault current.

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IMPORTANT NOTICE

This brochure is not intended to provide operating instructions. Appropriate Rockwell International Corporation instruction manuals and precautions attached to apparatus should be read carefully prior to installation, operation, and/or maintenance of equipment.

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