Reliance Electric FlexPak 3000
Digital DC Variable Speed Drives
Product Summary

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

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

### 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.

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<td>Field Current Regulator Kit</td>
<td>Provides field economy, as well as pre-weakening of the field using a fixed reference or field weakening for above base speed operation.</td>
<td>911FK series</td>
<td>D2-3336</td>
</tr>
<tr>
<td>I/O Expansion Board</td>
<td>Mounts on the FlexPak 3000 chassis to provide additional analog, frequency, and digital I/O capabilities.</td>
<td>914FK0101</td>
<td>D2-3301</td>
</tr>
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### Digital Inputs (n = 1 through 5)
- n=1 terminal 59 (PresetSpeed Select)
- n=2 terminal 60 (PresetSpeed Select)
- n=3 terminal 62 (MOP Decrement)
- n=4 terminal 63 (MOP Increment)
- n=5 terminal 64 (OCL Enable)

- +24 VDC available at terminal 14 on regular board and at terminal 58 or 61 on I/O Expansion board

### Analog Inputs
- Analog Input 1 (+) terminal 50 (-) terminal 51
- Analog Input 2 (+) terminal 52 (-) terminal 51
- Analog Input 3 (+) terminal 53 (-) terminal 53
- Analog Input 4 (+) terminal 54 (-) terminal 54
- Analog Input 5 (+) terminal 55 (-) terminal 55

### Frequency Input
- Frequency Input (A) terminal 49 (A) terminal 50 (COM) terminal 51

### I/O Expansion Board Interconnections

* = Default Selection

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Rockwell Automation
Reliance Electric
Drive Modification Kits With Block Diagrams

Outer Control Loop Enable Logic

I/O Expansion Board Block Diagram
Features and Benefits

- **AC Line Fuses**
- **AC Line Disconnect**
- **Fused Blower Motor Starter**
- **Compact Chassis Design**
- **Enhanced Field Supply or Field Regulator Kit**
- **Compact Package with Surface-Mount Regulator Board**
- **Operator Interface Module (OIM)**
- **Digital Encoder or AC Tachometer; AutoMax® Network or DeviceNet™; and other Circuit Kits mount inside drive chassis**
- **Terminal Strip for User Control**
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

![OIM Integer Value Entry Screen Diagram]
Operator Interface Module (OIM)

Extensive Operator Control
For Quick and Easy Use

- Control keys include:
  - Run - Stop
  - Forward/Reverse - Auto/Manual
  - Control Source Select
- 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 - Spanish
    - German - Italian
    - French - 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 running
  - Drive alarm - Current/torque limit
  - Interlocks (OK) - 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
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
- 1.35" floppy disk drive
- Monochrome or color EGA, CGA, or VGA monitor
- RS-232 serial COM port
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.