

# 1130

## Line-Regenerative AC Drive



### Overview

The 1130 line-regenerative AC drive provides flexible, efficient, and cost-effective solutions to a range of control needs. The drive can operate a wide variety of AC motors, with or without encoder feedback. It combines the latest IGBT-based PWM and digital signal processor technologies with a revolutionary, patented digital current regulator to deliver optimum motor performance, full programmability, and simplicity of operation. Compact and rugged, the drive is available in a NEMA 1 (IP23) enclosure or as a chassis unit for mounting in any enclosure.

### Performance Flexibility

The 1130 offers performance capabilities to suit a broad range of applications where variable-frequency AC or conventional DC drives are normally used. It can be configured for either servo-torque, constant-torque, or variable-torque applications. With an optional motor-mounted incremental encoder and interface module, it provides precise velocity or torque control for demanding applications. The 1130 operates in a flux vector mode for precise control of speed and torque. An optional variable-frequency mode allows parallel operation of multiple motors from a single inverter.

### Motor-Independent Design

The 1130 can operate any standard, off-the-shelf or inverter-duty AC induction motor, making it a natural for retrofits as well as new applications. A unique, proprietary current regulator tunes the drive continuously in real-time, eliminating the usual current-loop tuning process required by conventional vector drives.

### Auto Tuning

Once routine electrical connections have been made, the simple-to-use auto-tuning features adjust virtually all motor and inertial parameters to the motor and connected load. No motor maps are required. Simply enter the motor current, voltage, base frequency, and speed from the motor nameplate, and the advanced setup routines do the rest. The drive is completely tuned within minutes.

### Full Line Regeneration

The 1130 is fully line regenerative. Its inverter and regeneration sections, each of which is comprised of six IGBTs, deliver true four-quadrant control of standard AC induction motors without requiring a dynamic braking resistor. Energy that is generated by stopping the motor and load combination is put back onto the power grid rather than wasted as heat in a braking resistor.

### Control Features

The 1130 provides the features needed for a variety of control applications. These include controlled acceleration and deceleration, adjustable and preset speeds, skip frequencies with adjustable windows, automatic restarting after fault trips with adjustable retries and delays, start into a spinning motor, selectable stopping methods, DC injection braking, and more. Three different control modules are available to accommodate differing application requirements.

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**Overview***(continued)***Multiaxis Operation**

The 1130 includes a built-in synchronous communication port for motion control coordination of up to nine slave drives. Setup parameters allow control of the velocity ratio and position phasing between drives.

**Protection and Advanced Diagnostics**

The 1130 monitors its operating conditions and provides a comprehensive set of overload, short circuit, and other protective features. Faults are displayed in plain language along with the operating conditions at the time of occurrence. A log stores the last three faults as well as the bus voltage, motor current, output frequency, operating mode, and time of the most recent fault.

**Serial Connectivity**

The 1130 features a fully-isolated EIA RS-422/485 serial interface that permits a host computer to set up, monitor, and control the drive using an ANSI standard protocol. An EIA RS-232 port is also available for direct connection to most types of personal computers. Optional DF1 and RTU protocols allow direct connection to Allen-Bradley and Modicon programmable controllers. Fiber-optic and modem interfaces are also available.

**Digital Setup, Easy Operation**

The keypad and liquid crystal display provide a simple interface for setting and viewing operating parameters and diagnostics. All controller settings are made digitally through the keypad. Readouts and fault messages are displayed in plain language. A help feature provides on-line assistance at the touch of a button.

**Features & Benefits****General**

- All-digital control for repeatable motor operation
- 24-bit digital signal processor (DSP) for fast, dynamic response
- 8 kilobyte battery backup memory for application setup data
- 48 kilobyte scratch pad memory and 1.5 megabyte firmware memory
- Clock/calendar maintains accurate time during power outage
- Sine-coded PWM waveform output for improved torque performance
- High-switching-frequency IGBT devices for smooth, quiet operation
- Digital current regulator for reduced motor noise and fast response
- Internal control loop for maintaining speed with sudden load changes
- Flux vector control for full starting torque and full torque to base speed
- Six-IGBT bridge regeneration section for fully line-regenerative braking
- Automatic field weakening for speeds up to twice base speed
- Seven preset speeds with separate acceleration and deceleration times
- Auto restart and start into a spinning motor for smooth, efficient operation
- Three skip frequencies with adjustable windows for avoiding resonance
- Master-slave operation using either analog inputs or high-speed serial link
- User-programmable analog and digital inputs and outputs
- Through-hole heat sink mounting of chassis units for dissipating heat externally
- Ideal for applications requiring NEMA 1 (IP23) and NEMA 4 (IP66) enclosures

**Ease of Installation, Setup, and Maintenance**

- Automated setup features require no chart recorders or meters
- Software calibration and adjustment eliminates tuning components
- Digital parameter adjustment for precise and repeatable settings
- Software input and output scaling eliminates potentiometers
- Complete, self-contained package requires minimal option boards
- Identical control boards across full power range reduces spare parts

**Ease of Use**

- Touch keypad for easy parameter adjustment and access to displays
- Two line by 16-character/line descriptive, plain-language display
- Numerical readouts and speed bar graph display
- Comprehensive fault diagnostics displayed in plain language
- Real-time motion information and time-stamped fault log
- Optional DriveLink™ software for managing the drive from a personal computer

**Safe, Reliable Operation**

- Extensive electronic protection circuits
- Tolerant of AC line voltage and frequency fluctuations
- S-curve acceleration reduces shock and extends equipment life
- Multilevel security code prevents unauthorized parameter changes
- Lockout of local operator controls for safe remote operation

## Specifications **Electrical**

### Input Supply

Voltage:	200 to 240, 380 to 480, or 500 to 600 V AC, three-phase Phase sequence insensitive
Voltage tolerance:	-10% of minimum, +10% of maximum
Frequency:	47 to 63 Hz
Power factor:	Displacement: 0.99 at all loads and speeds Overall: 0.94 at rated load

### Output Rating

Voltage:	Zero to input supply voltage, three-phase
Frequency:	Zero to twice base frequency
Switching frequency:	Programmable from 1 to 16 kHz

### Service Conditions

Efficiency:	97% nominal at rated switching frequency
Overload current:	Servo torque: 180% of rated for 1 min; maximum of 250% of rated Constant torque: 150% of rated for 1 min; maximum of 200% of rated Variable torque: 120% of rated for 1 min; maximum of 150% of rated

## Environmental

Operating temperature:	Control section: 32° to 131° F (0° to 55° C) Heat sink: 32° to 104° F (0° to 40° C)
Storage temperature:	5° to 158° F (-15° to 70° C)
Operating humidity:	95% maximum, noncondensing
Altitude:	To 3,300 ft (1,000 m) without derating

## Performance

### Velocity Control

Range:	Zero to base speed at full torque Zero to twice base speed with automatic field weakening
Regulation:	±0.001% of base speed, down to zero, with encoder ±0.5% of base speed, 2 Hz and above, without encoder

### Torque Control

Starting torque:	Servo torque: zero to 200% of rated Constant torque: zero to 150% of rated Variable torque: zero to 120% of rated
Regulation:	±3.0%, with encoder

### Frequency Resolution

Analog input (12-bit):	0.025%
Digital input:	0.010%

## Inputs and Outputs

### Analog Inputs

*20 MHz control:* Three (3) 12-bit analog inputs (0 to +10 V DC, ±10 V DC, and 4 to 20 mA)

*40 MHz control:* Three (3) 12-bit analog inputs (±10 V DC or 4 to 20 mA)

Programmable for speed command, torque command, or parameter adjustment with scaling, offset, and inversion

### Analog Outputs

*20 MHz control:* Two (2) 12-bit analog outputs (±10 V DC)

*40 MHz control:* Two (2) 12-bit analog outputs (±10 V DC and 4 to 20 mA)

Programmable for speed feedback, torque feedback, or parameter value with scaling, offset, and inversion

### Digital Inputs

*20 MHz control:* Eleven (11) digital inputs (sink of 1 mA to common)

*40 MHz control:* Twelve (12) digital inputs (source of 8 mA from 24 V DC)

Preprogrammed with standard feature set (start drive, run enable, jog motor, reverse direction, fault reset, remote operation, external fault, seven preset speeds, and user input) or customized to application-specific requirements

### Digital Outputs

*20 MHz control:* Three (3) standard digital outputs (Form C contact rated 250 V AC @ 5 A, Form A contact rated 250 V AC @ 5 A, and open-collector driver rated 24 V DC @ 500 mA)

*40 MHz logic I/O control:* Three (3) digital outputs (Form A contacts rated 250 V AC @ 5 A)

*40 MHz contact I/O control:* Six (6) alternative digital outputs (open-collector drivers rated 24 V DC @ 500 mA)

Preprogrammed with standard feature set (drive ready and two or five user outputs) or customized to application-specific requirements

**Specifications Serial Communications**

*(continued)*

Asynchronous port: EIA RS-232 and RS-422/485, isolated, 0.3 to 19.2 kbaud  
ANSI-x3.28-2.5-A4 protocol standard;  
optional Allen-Bradley DF1, Modicon RTU, and  
Johnson Controls N2 protocols

Synchronous port: EIA RS-485 for high-speed master/slave networking

**Basic Parameters and Displays**

**Programmable Parameters**

- Setpoint
- Setpoint minimum
- Setpoint maximum
- Setpoint units label, scaling, precision
- Setpoint source
- Torque source
- Request torque
- Acceleration time
- Deceleration time
- Jog speed
- Jog acceleration time
- Jog deceleration time
- (7) preset speeds
- (7) preset speed acceleration times
- (7) preset speed deceleration times
- (3) skip frequencies
- (3) skip bandwidths
- Start mode
- Run mode
- Stop mode
- Direction mode
- Minimum/maximum motoring/braking torques
- Current limit
- Spinning restart select
- Restart retries/delay
- Analog I/O scaling/polarity
- User analog input mode
- User I/O parameter selections
- S-ramp profile smoothing
- Injection brake time/current
- Switching frequency
- Master/slave select/source
- Slave ratio/position phasing
- Keypad enable
- Security code

**Status Displays**

- Set/actual speed
- Set/actual motor torque
- Speed error
- Bus voltage
- Power factor
- Motor current
- Motor frequency
- Motor voltage
- Power consumption
- Energy consumption
- Accumulated thermal load
- Accumulated time run
- Fault log and conditions
- Input status

**Protection**

- Ground fault
- Motor phase-to-phase short circuit
- DC bus overvoltage
- DC bus undervoltage
- Instantaneous overcurrent
- Motor overload
- Heat sink overtemperature
- Ambient overtemperature
- Power transistor fault
- Logic power undervoltage
- Remote speed command signal loss
- Motor runaway
- Dynamic brake duty cycle
- Memory malfunction
- Processor not running fault
- Synchronous serial error

**Option**

**Encoder**

A motor-mounted incremental encoder may be used for highest performance. An interface module is required with this option.

**Power Range**

Input Voltage	Servo-Torque Applications	Constant-Torque Applications	Variable-Torque Applications
230 V AC	5-50 hp (3.7-37 kW)	7 1/2-60 hp (5.5-45 kW)	10-75 hp (7.5-55 kW)
380 V AC	5-100 hp (3.7-75 kW)	7 1/2-125 hp (5.5-90 kW)	10-150 hp (7.5-110 kW)
460 V AC	5-100 hp (3.7-75 kW)	7 1/2-125 hp (5.5-90 kW)	10-150 hp (7.5-110 kW)
575 V AC	5-100 hp (3.7-75 kW)	7 1/2-125 hp (5.5-90 kW)	10-150 hp (7.5-110 kW)

Consult factory for other powers. Other voltages require appropriate derating or adjustment of the switching frequency.

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