3100

Bidirectional DC SCR Drive

UNICO

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Overview

The 3100 is a versatile, four-quadrant DC motor controller that provides dependable velocity and torque control for a wide variety of applications. The drive is available in both an analog-control version, for general-purpose needs, and a digital-control version, for applications requiring greater performance and flexibility. A full range of powers is available in both constant-torque and servo-torque ratings.

Proven Technology

The 3100 uses proven silicon-controlled rectifier (SCR) technology to achieve superior four-quadrant variable-speed control of wound-field DC motors. A twelve-SCR, six-pulse diode bridge converts incoming three-phase power to a full-wave, bidirectional output. This output smoothly controls the speed and torque of a motor by varying the voltage applied to its armature.

Analog Control

The standard 3100 is configured for analog control and uses armature voltage feedback to provide simple, open-loop velocity regulation. For more demanding jobs, an analog tachometer can be added to the motor to close a velocity loop. Hardware tuning components tailor the operating characteristics of the drive to the application. Key settings such as speed command, acceleration and deceleration rates, and current limit can also be easily adjusted with external potentiometers.

Digital Control

Additional control modules can be added to the 3100 to expand its capabilities and make it a fully featured digital-control drive. Processing, feedback interface, analog and digital I/O, and serial communication capabilities provide optimal performance and integration flexibility for challenging applications while adding programmability and enhanced protective and diagnostic features. Remote I/O and Modbus Plus options allow the drive to communicate with programmable controllers. A separate terminal or an optional keypad/display unit can be used for setup and monitoring.

Application-Specific Software

Digital versions of the 3100 can be customized for particular applications using custom or pre-engineered application software. Consult the factory for further information.

Overview *(continued)*

Protection, Easy Troubleshooting

The 3100 incorporates a number of features to protect both the drive and the motor, including adjustable current limits to prevent overloading the drive and thermal overload protection to guard against motor overheating. Sixteen LED indicators on the front panel of the unit display faults and status conditions for easy troubleshooting. Digital versions of the drive offer a number of additional, application-dependent software protective and diagnostic features.

Transducer/Transducerless Operation

Depending upon the needs of an application, the 3100 can be configured to accommodate a variety of feedback devices. No transducer is required with the analog version. The drive operates using compensated motor armature voltage feedback, although an analog tachometer can optionally be added for improved regulation. For exacting speed or position control, digital versions can interface with a variety of transducers, including encoders, resolvers, and absolute encoders. Appropriate interface modules are required.

Features & Benefits

General

- Superior performance
- Speed or torque reference input
- Servo loop operation for speed regulation with sudden load changes
- Zero deadband current regulation for precise servo control
- Armature voltage feedback or optional tachometer for excellent velocity regulation (analog versions)
- Transducer feedback for precise velocity or position regulation (digital versions)
- Active filtration of resonance
- Isolated current feedback and SCR gating circuit
- Integral shunt field supply

Ease of Installation, Setup, and Maintenance

- Compact design requires minimal panel space
- Adjustable acceleration and deceleration rates, current limiting, overload detection threshold, field loss threshold, tachometer loss threshold, instantaneous overcurrent point, velocity- and current-loop tuning
- Fixed, selectable tuning components for easy tuning and adjustment (analog version)
- Numeric parameter setup for precise repeatability (digital version)
- Automatic tuning routines configure drive to connected load (digital version)
- Bolted ring terminals for easy power connections
- Easily replaceable plug-in modules
- Snap-in signal connections for ease of wiring
- Identical control boards across full power range reduces spare parts
- Fault and safety indicators display drive status
- On-screen fault, status, and diagnostic information (digital version)

Safe, Reliable Operation

- Extensive electronic protection circuits reduce failures
- Line voltage compensation maintains control with varying line voltages
- Tolerant of AC line voltage and frequency fluctuations
- Transient protection circuits protect the power SCRs
- Current limits adjustable to 250% of rated load
- Overload detector protects against instantaneous and sustained current overloads
- Heat sink overtemperature protection

Specifications

Electrical

Input Supply

Voltage:	200 to 240 or 380 to 480 V AC, balanced three-phase
Voltage tolerance:	–10% of minimum, +10% of maximum
Frequency:	47 to 63 Hz

Armature Supply

Voltage:	Full-wave, six-pulse, bidirectional SCR 250 V DC (230 V AC input) 500 V DC (460 V AC input)
Current:	Constant torque: 18 to 960 A continuous Servo torque: 14 to 800 A continuous

Control Supply

Input voltage:	115 V_{rms} (±10%) fused at 2 A_{rms}
Frequency:	47 to 63 Hz

Field Supply

Voltage:	90 to 320 V DC, depending upon configuration and input voltage
Current:	Up to 20.0 A

Service Conditions

Overload current:	Servo torque: 200% of rated for 1 min; maximum of 333% of rated Constant torque: 150% of rated for 1 min; maximum of 250% of rated

Environmental

Operating temperature:	Up to 320 A (CT): 32° to 131° F (0° to 55° C) 400 A (CT) or larger: 32° to 122° F (0° to 50° C)
Storage temperature:	5° to 158° F (–15° to 70° C)
Operating humidity:	95%, noncondensing
Altitude:	To 3,300 ft (1,000 m) without derating

Performance

Velocity regulation:	±3% of rated speed with armature voltage feedback ±0.1% of rated speed with analog tachometer ±0.001% of rated speed with incremental encoder

Control Modules

The 3100 has a configurable control rack that accommodates up to ten control modules. Four slots are reserved for the two SCR Control modules, the System Conditioning Module, and the Analog Control Module. Six slots are available in digital-control versions for additional, system-specific control modules from UNICO's 4000 series. Six basic configurations are available:

Basic Analog Control:

- SCR control and current-loop regulation
- Open-loop velocity control using motor EMF with IR compensation
- Closed-loop velocity control using a motor-mounted analog tachometer
- Adjustable current and acceleration limits
- Fault detection and status indication
- Real-time clock/calendar
- 33 MHz 68360 central processor
- 2 megabyte program flash EPROM
- 256 kilobyte battery-backed static RAM
- 512 kilobyte high-speed RAM

(continued)

Specifications *(continued)*

Control Modules *(continued)*

Basic Digital Control *(continued)*:
- Three fiber-optic synchronous communication ports
- One RS-422/485 serial interface for drive setup
- Dual RS-232/422/485 serial interfaces for control communication
- 24 V DC 32-bit discrete input interface
- 24 V DC 32-bit discrete output interface

Remote I/O Digital Control:
- Same as Basic Digital Control, with a dual Remote I/O serial interface instead of a dual RS-232/422/485 serial interface

Modbus Plus Digital Control:
- Same as Basic Digital Control, with a Modbus Plus serial interface instead of a dual RS-232/422/485 serial interface

ControlNet Digital Control:
- Same as Basic Digital Control, with a ControlNet serial interface instead of a dual RS-232/422/485 serial interface

Profibus Digital Control:
- Same as Basic Digital Control, with a Profibus serial interface instead of a dual RS-232/422/485 serial interface

Protection

- AC line input fuses
- Phase loss
- Phase imbalance
- Transient protection
- Line undervoltage
- DC armature fuse
- Motor RMS current overload
- Instantaneous overcurrent
- Field fuses
- Field loss
- Armature overvoltage
- Heat sink overtemperature
- Tachometer loss
- Control power undervoltage
- Digital control drives offer a number of additional, application-dependent software protective features

Power Range

Input Voltage	Servo-Torque Applications	Constant-Torque Applications
230 V AC	3-100 hp (2.2-75 kW)	5-125 hp (3.7-90 kW)
460 V AC	7 1/2-500 hp (5.5-375 kW)	10-600 hp (7.5-450 kW)

Consult factory for other powers. Other voltages require appropriate derating.

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UNICO–Worldwide

Corporate Headquarters
UNICO, Inc.
3725 Nicholson Road
P. O. Box 0505
Franksville, Wisconsin
53126-0505
USA
voice: 262.886.5678
fax: 262.504.7396
www.unicous.com

United States
Novi, Michigan
248.380.7610
New Lenox, Illinois
815.485.5775
Sandy, Utah
801.501.7586

Canada
Mississauga, Ontario
905.602.4677

South America
El Tigre, Venezuela
58.283.241.4024

Europe
Milton Keynes, England
44.1908.260000
Wilnsdorf, Germany
49.2739.303.0

Asia
Osaka, Japan
81.66.945.0077
Beijing, China
86.10.6218.6365