



A REGAL-BELOIT COMPANY



More Than Just a Motor Company



SPEEDMASTER®

AC ADJUSTABLE SPEED DRIVES

Bulletin 1400

SPEEDMASTER® INVERTER DRIVES



Micro Series
1/2 - 60 HP

SM
1/2 - 5 HP

SM Vector
1/2 - 10 HP

SM Plus
1/4 - 25 HP

For complete ordering information, please refer to LEESON Stock Catalog 1050.

As the demand for tighter process control and greater operating efficiency grows, customers increasingly look to LEESON for easy-to-use, cost-effective inverters and complete motor and drives solutions. Our two distinct families of inverters offer specific benefits in many adjustable speed applications.

Micro Series: 1/2 through 60 HP

Full metal NEMA 1 or NEMA 4/12 enclosures. Intuitive alphanumeric display for programming and set-up. Built-in thermal overload protection and heavy-duty wiring terminals. With these industrial-duty features, and many others, SPEEDMASTER® Micro Series inverters set the standard for out-of-the-box functionality. Plus, their modular design reduces manufacturing cost and enhances reliability, making our Micros among the most cost-effective full-featured drives. Best of all, LEESON's customer-friendly inventory approach allows the flexibility to purchase quantities large or small to meet immediate needs.

SM Plus Series: 1/4 through 25 HP

Ideal for OEM or multi-drive applications, the ultra-compact SM Plus inverter offers a removable Electronic Programming Module for off-line set-up and program replication. Over 50 programmable functions, 18 isolated I/O terminals and other software-intensive features mean unlimited versatility. No other Sub-Micro class drive offers a greater range of performance enhancements. Its advanced design makes the SM Plus cost-competitive with DC drives, two-speed motors, adjustable pulleys, soft starters—even, in many cases, with fixed speed AC systems.

SM Series: 1/2 through 5 HP

The right drive for simple speed control applications not requiring the advanced functionality of the SM Plus Series. The SM drive, applied with a LEESON motor now offers a cost advantage over most PMDC

motor/drive combinations; and is a superior alternative to reversing devices, soft-starters, or instead of multi-speed motors. Like all LEESON Sub-Micro Drives, the SM utilizes the innovative Electronic Programming Module for fast, error free drive configuration. Also with over 50 programmable functions, the SM has 11 isolated I/O terminals and a programmable Form A relay for status indication.

SM Vector Series: 1/2 through 10 HP

This is an ideal control if you are needing full torque down to 1Hz. This control also offers 200% starting torque. The SM Series Vector control is designed for easy installation into your control panel. The compact size of this control, along with its contactor style design, takes up little room in your control panel and makes it easy to wire to. This control is easy to program and has auto tuning to make sure you get all the performance you need. It is designed for either Vector or V/Hz mode.

NEMA 4/12 Micro Series WASHGUARD Inverters

- 1/2 - 60 HP
- Food-safe epoxy finish or 300 grade stainless steel
- All steel construction provides complete protection, fully gasketed, water and dust-tight enclosure
- Fully enclosed with no cooling fans
- Ideal for use with LEESON's IRIS™ protected WASHGUARD washdown-duty motors
- Higher HP require cooling fans and are NEMA 12 only



MICRO SERIES

Full Features, Ultra-Friendly Set-Up and Operation



NEMA 1, IP31 Enclosures

Micro Series compact inverters offer “big drive” features for adapting standard or premium efficiency three-phase motors to adjustable speed operation. Utilizing the latest microprocessor and advanced IGBT power conversion devices, these high performance controls program and read-out in plain English terms, eliminating the frustration and time involved in looking up confusing coded symbols. Complete, rugged steel enclosures for NEMA 1 (IP31) or NEMA 4/12 (IP65) service do not require additional enclosure protection as with many plastic-housed compact drives. Built-in thermal overload protection reduces additional costs. Heavy-duty wiring terminals, accessible via three conduit openings on the bottom of the housing, speed installation and cut costs. Available in single-phase and three-phase input models.

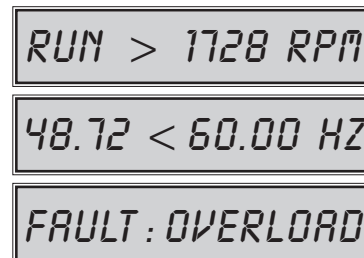
No Drive Is Easier To Use

- “No language barrier,” plain-English programming and operational read-outs
- Back-lit LCD displays for easy readability. 1 line x 16 characters
- Eight-button keypad with choice of scrolling or “speed dial” access to programming, monitoring or operational functions
- “Quick Start” factory presets

Standard Micro Series Features

- Intelligent Power Module—IGBT’s with a 16-bit Intel® motor control microprocessor
- Back-lit 16 character plain-English display
- User choice programming with “speed dial”:
 - ✓ Choice of “Quick Start” factory presets
 - ✓ Built-in English programmable options, 52 parameters, accessible via build-in touch-pad
 - ✓ Serial communication port for RS485 interface with MODBUS® protocol
- Speed reference signal. Choice of potentiometer, 0-10VDC or 4-20mA inputs
- Analog output signal 0-10VDC, speed or load
- Three preset speeds
- Two auxiliary contacts: One from C relay and one open collector output
- Slip compensation
- Adjustable carrier frequency
- Adjustable acceleration and deceleration times
- Forward/reverse
- DC braking – time and voltage adjustable
- Password protected
- Constant torque – with adjustable current limit
- 150% overload capacity for one minute based on nominal output rating of the control
- Rugged, heavy-gauge steel enclosures with barrier type terminal strips
- UL listed
- Optional features available as kits or as modifications:
 - ✓ Remote keypad
 - ✓ Dynamic braking

Plain-English Display Examples



SM PLUS SERIES

Big Performance in a Sub-Micro Package

Key SM Plus Features

- Input line voltage calibration—optimizes over and under voltage trip levels
- Current limit to 180% with frequency foldback
- Adjustable carrier frequency
- Adjustable V/Hz
- Output frequency to 120 Hz
- Seven preset speeds
- Three programmable terminals for speed reference and control activation
- Two open collector auxiliary outputs
- Automatic restart after fault
- Control via terminal strip or optional remote keypad
- Coast or ramp to stop
- Independent accel and decel adjustment
- Forward only or forward and reverse direction
- Adjustable DC injection braking
- Speed reference: Keypad, 0-10 VDC, or 4-20 mA
- Speed reference calibration
- Speed & load indicating output signal selection: 0-10 VDC or 4-20mA



IP20 Enclosures

- Output signal calibration
- I2t motor thermal overload protection
- Torque and accel boost
- Slip compensation
- Activation or disabling of serial communications
- Assignment of serial addresses
- Modbus® Serial Communication Protocol
- Password protection
- Fault history: Stores eight previous trips
- Terminal status indication
- Default parameter reset

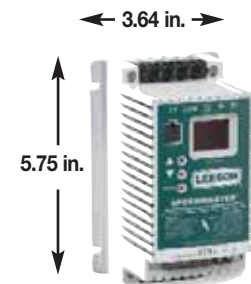
SM SERIES

Big Value in a Sub-Micro Package

Key SM Features

- Removable electronic programming module allows off-line setup and program replication.
- Input line voltage calibration – optimizes over and under voltage trip levels.
- Current limit to 180% with frequency foldback
- Adjustable carrier frequency (4 to 10 kHz)
- Adjustable V/Hz
- Output frequency to 240 Hz
- Seven preset speeds
- Automatic restart after fault
- Control via drive face, terminal strip or optional remote keypad
- Coast or ramp to stop
- Independent Accel and Decel adjustment
- Forward only or forward and reverse direction
- Adjustable DC injection braking

- Speed reference: Keypad, 1-10 VDC, or 4-20 mA
- Speed reference calibration
- I2t motor thermal overload protection; meets UL requirements for motor protection in single motor applications.
- Fixed boost for high starting torque
- Accel boost for high torque accelerating at any speed
- Three-digit LED display
- Password protection
- Fault history: Stores eight previous trips
- Terminal status indication
- Default parameter reset
- IP20 enclosure with finger safe terminals



SM VECTOR SUB-MICRO INVERTER DRIVES

Delivering More Low End Torque in a Sub-Micro Package

Key SM Vector Features

- The SM Vector drive is designed for operation with vector duty rated induction motors rated for 200, 230, 400, 460, or 590VAC from 0 to 240Hz.
- IP20 enclosure with finger safe terminals
- Easy setup and operation – program the SM Vector drive one of four different ways:
 - From the front of the drive
 - The optional remote keypad
 - A PC using the TechLink Software
 - The EPM Programmer
- Modes of operation:
 - Constant Torque V/Hz
 - Variable Torque V/Hz
 - Sensorless Vector – speed mode
 - Sensorless Vector – torque mode
- Auto Tuning determines key performance values based on the motor and installation variables. Required for operation in vector modes,

but can be used to enhance performance in V/Hz mode.

- The SM Vector drive is an approved thermal overload protection device for single motor applications
- 18 isolated terminals provide 5 logic inputs and two logic outputs
- Two reference inputs allow for 4-20mA and either 0-10V or bipolar –10 to +10V
- Two analog outputs indicate speed and load
- Two wire RS485 serial communication
- Output frequency 0-240Hz
- Adjustable carrier frequency 2kHz to 8kHz
- Seven preset speeds
- Jog function – forward and reverse



Accessories for SM, SM Plus and Vector Series Drives

Electronic Programming Unit

Optional SM Plus Electronic Programming Unit allows off-line set-up and replication of the drive's plug-in electronic programming module. Excellent for multi-drive applications. RS-232 serial port allows downloading of configuration files from personal computer.



Remote Keypad

Optional remote keypad kit for SM Plus, SM Series and SM Vector drives includes eight-foot connecting cable and gasket. Mounted in proper enclosure, the keypad kit will provide up to NEMA 4 protection. Micro Series Cables available in 2.5 foot, 5 foot, or 10 foot lengths.



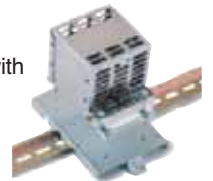
Programming Modules

Plug-in electronic programming modules (EPM) for SM Plus drives. Allow off-line set-up and replication of program using Electronic Programming Unit.



Dynamic Braking Modules & Resistors

Expand the capabilities of any sub-micro drive with panel or DIN rail mountable modules. Braking resistors are built-in for units up through 10HP.



Condensed Inverter Specifications

Input Line Voltages:

Micro Series: 120/240, 200-240 400-480, 480-590 VAC, +10%, -15%

SM Plus: 115/230, 200-230, 460-480, 550-575 VAC, +10%, -15%

SM: 110-120, 200-240, 400-480 VAC, +10%, -15%

Input Frequency: 50/60 Hz, tolerance of 48 to 62 Hz

Output Wave Form: Sine coded, pulse width modulated

Output Frequency: 0-120 Hz

Carrier Frequency:

Micro Series: 2.5 kHz to 14 kHz

SM & SM Plus: 4 kHz to 10 kHz

SM Vector: 2 kHz to 8 kHz

Service Factor: 1.0

Overload Current Capacity:

Micro Series, SM & SM Plus: 150% for 60 sec., 180% for 20 sec.

SM Vector: 150% for 60 sec., 200% for 25 sec.

Speed Reference Follower: 0-10 VDC, 4-20 mA

Control Voltage: 15 VDC

Analog Outputs: 0-10 VDC or 2-10 VDC: Proportional to frequency or load

Digital Outputs: Open-collector: 40 mA at 30 VDC

Power Supply for Aux. Relays: 40 mA at 12 VDC

Ambient Operating Temperature:

Micro Series: NEMA 1, 0° to 50°C

NEMA 4/12, 0° to 40°C

SM Plus: 0° to 50°C

SM: 0° to 40°C

SM Vector: 0° to 50°C

Ambient Humidity: <95% (non-condensing)

Maximum Altitude: 3300 ft (1000m) above sea level

Storage Temperature: -20° to 70° C



INVERTER-CAPABLE MOTORS

Available From Stock

With LEESON, you don't have to wonder whether your motor is suitable for use with an inverter. That's because all LEESON SPEEDMASTER® Inverter-Duty motors, WATTSaver® premium efficiency motors, and WASHGUARD washdown-duty motors, as well as general-purpose three-phase motors 1HP and larger include our exclusive IRIS™ Inverter-Rated Insulation System at no extra cost.

IRIS™ is a multi-level system that results in a motor truly hardened for inverter service. Careful placement of wire within the stator, well thought-out winding and lamination design, and precise insulation practices (including phase insulation, sleeving, connection insulation and varnish) all play critical roles. Second-generation spike-resistant magnet wire, specially coated to resist corona inception, completes the system – offering service life well beyond conventional double, triple or even quad-build wire in inverter-fed applications.

For true inverter-duty performance, meeting NEMA MG1 parts 30 & 31, LEESON's SPEEDMASTER® motor is readily available from stock in either TENV or TEBC designs. LEESON's WATTSaver® line offers NEMA Premium™ efficiency levels and an inverter-rated design. With the addition of a constant speed blower kit, WATTSaver® motors are capable of full torque to zero speed. Encoder kits for closed loop



See chart (opposite page) of inverter motor capabilities.

control are available for both SPEEDMASTER® and WATTSaver® motors, making them excellent for use with vector drives. Both SPEEDMASTER® and WATTSaver® carry a three-year warranty...even in inverter service!

WATTSaver®
Inverter-Duty Premium Efficiency Motor

Premium efficiency WATTSaver® motors are built with greater copper and steel mass, which results in additional tolerance to heat rise in inverter-fed applications. As with all LEESON motors, WATTSaver® efficiencies are verified to IEEE 112B test standards.



Standard at no extra cost on all LEESON stock NEMA three-phase motors, 1 HP and larger, is the exclusive Inverter Rated Insulation System (IRIS™). This provides superior protection against voltage spikes induced by variable frequency drives.



Encoder kits are available for LEESON cast iron TEFC motors from NEMA 182-4T through 284-6T frame size. The encoder slips over the motor's fan-end shaft to provide speed-reference signals for closed-loop control systems. Industrial-duty encoders are isolated from shaft currents, and electrical noise immunity exceeds international standards.



Constant-speed blower kits convert LEESON cast iron TEFC motors to NEMA MG1.6 (IC46) standard for inverter and vector drive applications where continuous cooling is required. Installation requires no shaft modification. Available for NEMA frame sizes 182-4T through 324-6T.

IRIS™ PROTECTED MOTOR INVERTER CAPABILITIES

STEEL FRAME MOTORS

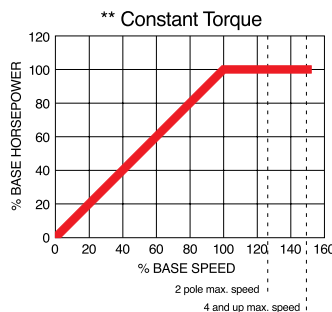
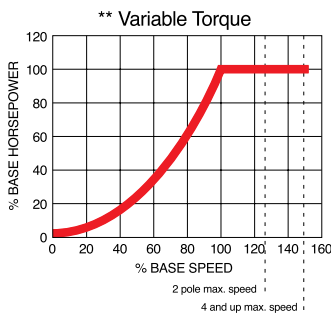
	NEMA Frame	Variable Torque**	Constant Torque**	Constant HP**	Notes
Standard General Purpose					
TEFC	56-210 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
ODP	56-210 frame	6-60 Hz	20-60 Hz	to 90 Hz*	
WATTSAVER® Premium Efficiency					
TEFC	56-210 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
ODP	56-210 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
Special Purpose Motors					
WASHGUARD MOTORS					
TENV	56-140 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
TEFC	56-210 frame	6-60 Hz	6-60 Hz	to 90 Hz*	

CAST IRON MOTORS

	NEMA Frame	Variable Torque**	Constant Torque**	Constant HP**	Notes
Standard General Purpose					
TEFC	180-440 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
ODP	180-440 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
TEFC with blower kit	180-320 frame	5-60 Hz	5-60 Hz	to 90 Hz*	full torque at low speed with vector drive
WATTSAVER® Inverter Duty, Premium Efficiency					
TEFC	180-280 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
	320-440 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
ODP	180-280 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
	320-440 frame	6-60 Hz	6-60 Hz	to 90 Hz*	
TEFC with blower kit	180-320 frame	0-60 Hz	0-60 Hz	to 90 Hz*	full torque at zero speed with vector drive
SPEEDMASTER® Extreme-Duty Inverter Motors					
TENV	143TC-256TC	0-120 Hz	0-120 Hz		
TEBC	284T-449T	0-90 Hz	0-90 Hz		

* The maximum recommended frequency (speed) for 2 pole (3600 rpm) motors, without application analysis, is Hz=75, rather than 90 Hz. Contact factory for details.

** Operation for variable or constant torque is up to a base frequency of 60 Hz only. Operation above 60 Hz to the maximum frequency listed is constant horsepower (horsepower equal to motor rated horsepower).



NOTES:

- All motors are class F insulated, 40°C ambient, 3300 ft. and 1.0 service factor when used with an inverter.
- Optimized voltage boost is required for continuous operation throughout the frequency range specified. (See operating curves.)
- Motors with blower kits have continuous cooling and are capable of full rated torque at 0 speed with properly tuned vector drive.
- Maximum recommended cable length for IGBT inverters is 250 ft. (longer cable lengths may require noise or voltage suppression).
- All motors have LEESON's IRIS™ insulation system, which is designed to meet the NEMA requirements for peak voltages up to 1600 volts, and pulse rise time greater than or equal to 0.1 microseconds.
- Operating curves are available for WATTSAVER® motors. Refer to curves for more details about frequency ranges.



DC Adjustable Speed Drives

SPEEDMASTER® DC drives range from sub-fractional-horsepower through 3 HP. SCR and PWM versions are offered, in reversing or non-reversing options. Four-quadrant regenerative drives are also available. NEMA 1, NEMA 4X or open chassis styles. For more information, request Catalog 1050.



PACKAGED SOLUTIONS

LEESON Electric offers a variety of Inverter Rated Motors and Gear+Motor packages to compliment our family of SPEEDMASTER® AC Adjustable Speed Drive products.

 <p>Vector Duty Motors 2000:1 Constant Torque</p>	 <p>High Efficiency WATTSaver® Motors</p>	 <p>F2 Mount 3-Phase Motors</p>
 <p>NEMA Efficient 3-Phase Motors</p>	 <p>Stainless Steel JM Pump Shaft Motors</p>	 <p>Stainless Steel General Purpose Motors</p>
 <p>JP Pump Motors</p>	 <p>IP55 WASHGUARD Duty White Epoxy Motors</p>	 <p>Blower Kits Available for 56T thru 326T Frame Motors</p>
 <p>WATTSaver® C-Face Motors</p>	 <p>IEC Metric Motors</p>	 <p>Available Gearbox/Motor Combinations</p>

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