

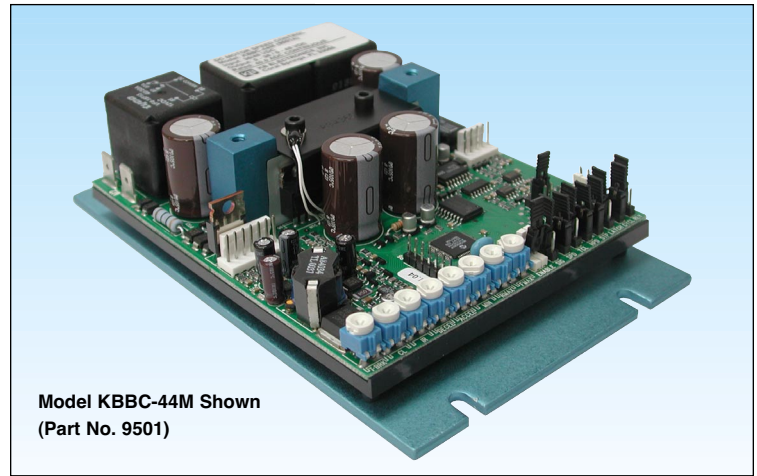
# KBBC SERIES

## MICROPROCESSOR CONTROLLED BATTERY POWERED DC/DC Variable Speed Motor Control

for 12, 24, 36 and 48 Volt  
PM and Series Wound DC Motors  
thru 2HP Continuous Duty and 4HP Peak Duty

### TYPICAL APPLICATIONS

- Scooters • Personnel Carriers • Carts • Electric Boats
- Portable Pumps • Lifts • Floor Polishers



Model KBBC-44M Shown  
(Part No. 9501)

### STANDARD FEATURES

- **High Frequency PWM Operation:** Reduces motor noise and increases efficiency.
- **Controlled Acceleration and Deceleration:** Provides timed acceleration to set speed and deceleration to zero speed.
- **Diagnostic LEDs:** Provide indication of power on (PWR ON) and control status (STATUS).
- **Built-In Reversing Contactor:** Provides forward/reverse operation with a low power reversing switch or with a center-off throttle potentiometer (wigwag).
- **Run Relay:** Used to turn on or off equipment or signal a warning if a fault has occurred.
- **Brake Driver Circuit:** Powers an optional electromechanical brake (current regulated and short circuit protected).
- **Key Switch Operation with Built-In Battery Power Contactor:** Allows the use of a low power switch to turn control on and off.
- **Inhibit Circuit:** Allows control to be turned off electronically with a separate low power switch.
- **Latching Circuit:** Allows momentary switches to start, stop, and reverse the control.
- **Limit Switch Circuit (Stop Forward and Stop Reverse):** Allows limit switches to be used to immediately stop the control in forward or reverse directions.
- **Single-Ended or Wigwag Potentiometer Control:** Allows the Main Speed Potentiometer to be used as single-ended (zero speed is at 0% rotation) or wigwag (zero speed is at 50% rotation).

### PROTECTIVE FEATURES

- **Electronic Current Limit:** Protects the motor and control against overload.
- **Polarity Protected:** Prevents control damage if the battery is wired incorrectly.
- **Short Circuit Protected:** Protects main power transistor from failure due to a short at the motor.
- **Overtemperature Protection:** Reduces control output as the transistors reach maximum operating temperature.
- **Overvoltage Protection:** Will turn off the control if the battery voltage exceeds 125% of nominal.
- **Undervoltage Protection:** Will turn off the control if battery voltage reduces below 65% of nominal.

### SAFETY FEATURES

- **Potentiometer Fault Circuit:** Turns the control off if a short, open, or ground occurs at the potentiometer.
- **High Pedal Disable Function:** Prevents control startup until the potentiometer returns to zero.

### DESCRIPTION

The KBBC series of battery powered variable speed controls are designed for 12, 24, 36, and 48 Volt PM and Series Wound DC motors. Microcontroller design provides superior performance and ease of tailoring to specific applications. Operating in a regenerative mode, precise and efficient control is obtained using state-of-the-art MOSFET technology. The KBBC operates at a switching frequency of 16 kHz, which provides high motor efficiency and quiet operation.

The KBBC contains many standard features such as current limit, short circuit protection, speed potentiometer fault detector, overtemperature sensing, and undervoltage/overvoltage protection. A variety of trimpots are provided, which can be used to tailor the control to exact specifications. The control also contains LEDs that indicate "power on" and "status." A DC power contactor allows a low power switch to turn the control on and off. Reversing contactors provide arcless forward, stop, and reverse operation. In addition, a brake driver circuit is used to power an optional electromagnetic brake.

The KBBC can be controlled in several ways, such as single-ended or wigwag speed potentiometer and 0 - 5 Volts DC signal following. The controls contain a built-in heat sink that also serves as a mounting base.

### TRIMPOT ADJUSTMENTS

- **Timed Brake Delay (T-BRK):** Sets the delay time before the brake is engaged.
- **Current Limit (CL):** Sets the current limit (overload), which limits the maximum current to the motor.
- **IR Compensation (IR):** Sets the amount of compensating voltage required to keep the motor speed constant under changing loads.
- **Deceleration (DECEL):** Sets the amount of time for the motor to decelerate from the set speed to zero speed.
- **Acceleration (ACCEL):** Sets the amount of time for the motor to accelerate from zero speed to the set speed.
- **Minimum Speed (MIN):** Sets the minimum motor speed.
- **Reverse Maximum Speed (RMAX):** Sets the maximum motor speed in the reverse direction (a % of FMAX setting).
- **Forward Maximum Speed (FMAX):** Sets the maximum motor speed in the forward direction.

## GENERAL PERFORMANCE SPECIFICATIONS

Parameter	Specification	Factory Setting
Input Voltage Range (% Nominal)	75 – 125	100
Intermittent Duty Operation (Minutes)	2	—
Peak Duty Operation (Seconds)	7	—
Overvoltage Shutdown (% Nominal Input Voltage)	125	—
Undervoltage Warning (% Nominal Input Voltage, ± 10%)	85	—
Undervoltage Shutdown (% Nominal Input Voltage)	65	—
Nominal Carrier Frequency (kHz)	16	—
Electromagnetic Brake Delay Trimptot (T-BRK) Range (Seconds)	0.2 – 2.5	1
CL Trimptot (CL) Range (% Range Setting)	0 – 200	150
IR Compensation Trimptot (IR) Range (% Nominal Battery Voltage)	0 – 25	4
Acceleration Trimptot (ACCEL) Range (% Base Speed)	0.1 – 15	2
Deceleration Trimptot (DECEL) Range (% Base Speed)	0.1 – 15	2
Minimum Trimptot (MIN) Range (% Base Speed)	0 – 30	0
Forward Maximum Speed Trimptot (FMAX) Range (% Base Speed)*	60 – 100	100
Reverse Maximum Speed Trimptot (RMAX) Range (% Forward Maximum Speed)	50 – 100	100
Electromagnetic Brake Current Rating (Amps DC)	1	—
Heat Sink Overtemperature Protection Point (°C)	100	—
Deadband in Wigwag Throttle Mode (Volts DC)	± 0.3	—
Wigwag Throttle Signal Input Voltage for Maximum Forward (Volts DC)	2.5 – 5.0	5
Wigwag Throttle Signal Input Voltage for Neutral (Volts DC)	1.2 – 2.5	2.5
Wigwag Throttle Signal Input Voltage for Maximum Reverse (Volts DC)	0	0
Single Ended Throttle Signal Range for Full Speed Forward or Reverse (Volts DC)	0 – 2.5 to 5.0	0 – 5
Timed Current Limit (TCL) Trip Time (Seconds)	7	—
Run Relay Output Contact Rating (Amps at 30 Volts DC, Amps at 125 Volts AC)	1, 0.5	—
Auxiliary Power Connector (P2) Rating (Maximum Amps DC)	10	—
Operating Temperature Range (°C)	0 – 45	—

\*FMAX trimptot is also used as an input/output gain potentiometer.

## ELECTRICAL RATINGS

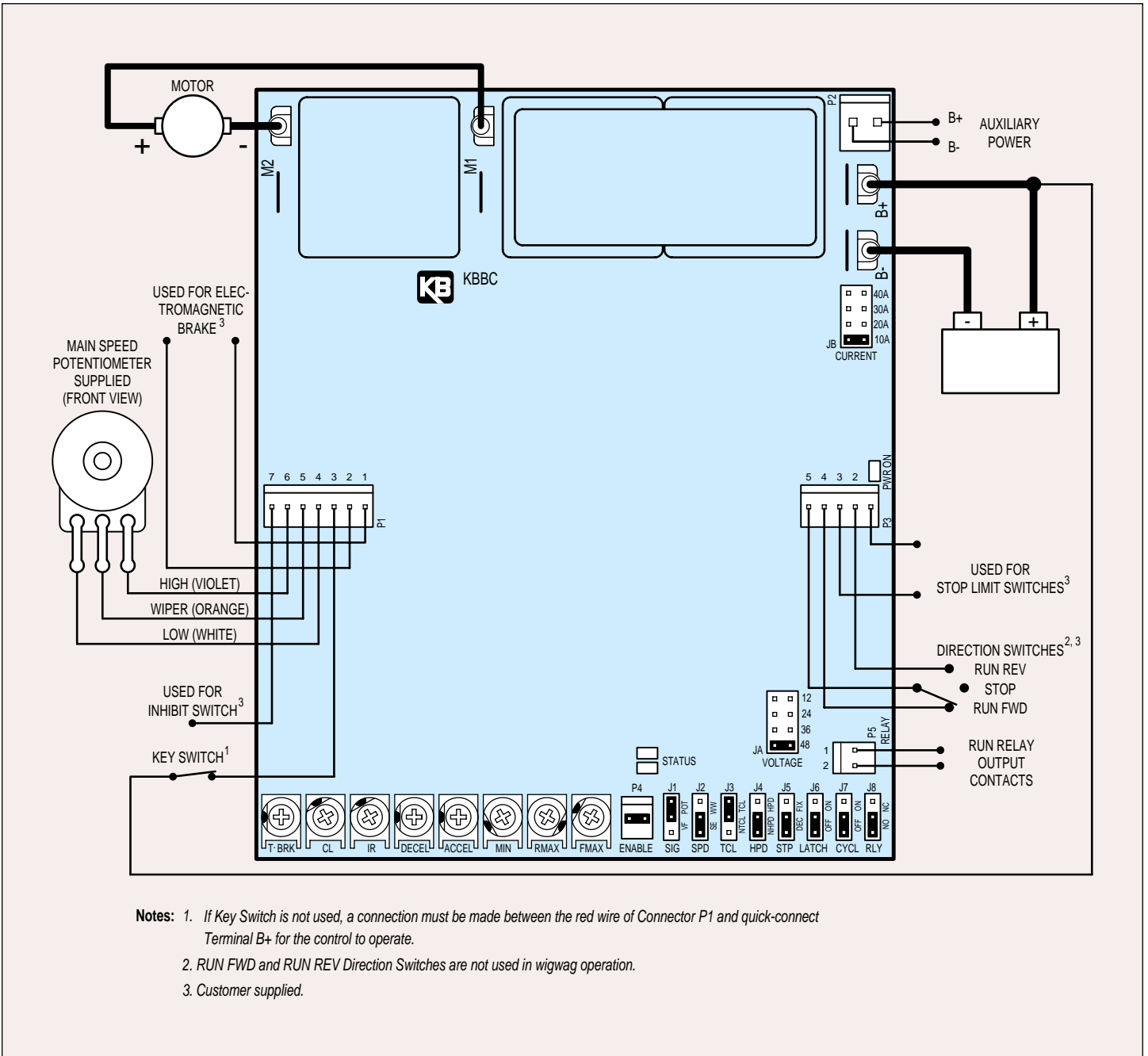
Model No.	Part No.	Nominal Battery Voltage (Volts DC)	Nominal Motor Voltage (Volts DC)	Continuous Duty		Intermittent Duty (2 Minutes)		Peak Duty (7 Seconds)	
				Maximum HP	Amps DC	Maximum HP	Amps DC	Maximum HP	Amps DC
KBBC-24M	9500	12	0 – 12	1/2	40	3/4	60	1	80
		24	0 – 24	1	40	1½	60	2	80
KBBC-44M	9501	12	0 – 12	1/2	40	3/4	60	1	80
		24	0 – 24	1	40	1½	60	2	80
		36	0 – 36	1½	40	2	60	3	80
		48	0 – 48	2	40	3	60	4	80

Note: Custom units are available with various voltages and currents with or without DC Power Contactor or Reversing Contactor.

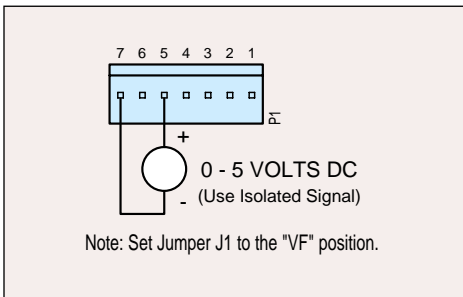
## JUMPER SELECTABLE FEATURES

- **JA - Battery Voltage (VOLTAGE - 12/24/36/48):** Selects nominal battery voltage.
- **JB - Motor Current (CURRENT - 10A/20A/30A/40A):** Selects nominal motor current.
- **J1 - Signal Type (SIG - VF/POT):** Selects voltage following or potentiometer operation.
- **J2 - Speed Potentiometer Mode (SPD - SE/WW):** Selects single-ended or wigwag speed control.
- **J3 - Current Limit Mode (TCL - NTCL/TCL):** Selects non-timed current limit or timed current limit.
- **J4 - High Pedal Mode (HPD - NHPD/HPD):** Selects non-high pedal disable or high pedal disable.
- **J5 - Deceleration Mode (STP - DEC/FIX):** Selects adjustable or fixed (0.1 second) deceleration when a stop command is given.
- **J6 - Direction Switch Type (LATCH - OFF/ON):** Selects maintained or momentary direction commands.
- **J7 - Cycling Mode (CYCL - OFF/ON):** Selects cycling of relay which is used to brake the motor.
- **J8 - Relay Output Contacts (RLY - NO/NC):** Selects normally open or normally closed Run Relay contacts.

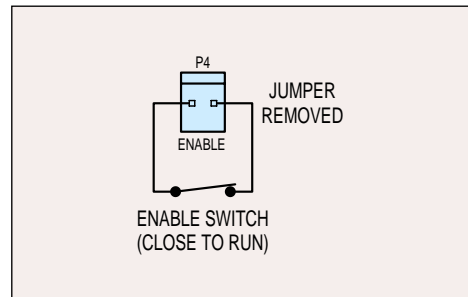
## CONTROL LAYOUT & CONNECTION DIAGRAM



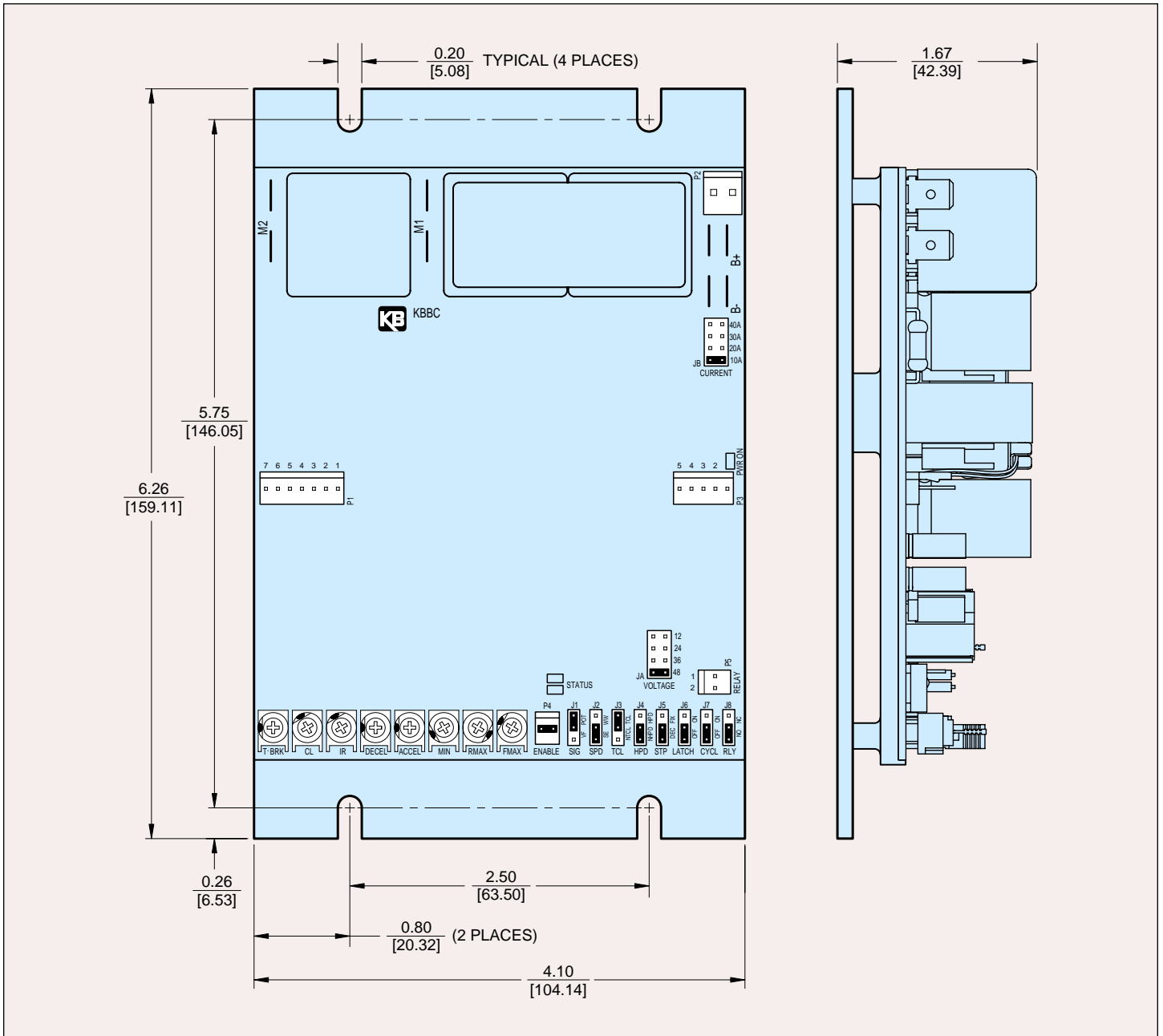
### VOLTAGE FOLLOWING CONNECTION



### ENABLE SWITCH CONNECTION



## MECHANICAL SPECIFICATIONS (Inches / [mm])



### GREEN AND RED STATUS LEDs

Control Status	Green LED	Red LED	Flash Rate*
Run	On	Off	Slow
Stop	On	Off	Quick
Current Limit (Warning)	Off	On	Steady
Undervoltage (Warning)	On	On	Slow
Overtemperature/Undervoltage Fault (Shutdown)	On	On	Quick
Overtemperature Fault (Shutdown)	On	On	Slow Alternating
Main Speed Potentiometer Fault (Shutdown)	On	On	Quick Alternating
Motor or Brake Fault (Shutdown)	On	On	Double Quick Alternating
Timed Current Limit (Shutdown)	Off	On	Quick

\*Flash Rate: Slow = 1 second on / 1 second off. Quick = 0.15 second on / 0.15 second off.



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