MODEL KBET-240D INSTALLATION AND OPERATING INSTRUCTIONS

Frequency to Analog Tachometer and Follower

See Safety Warning on Page 3

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The information contained in this manual is intended to be accurate. However, the manufacturer retains the right to make changes in design which may not be included herein.

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A COMPLETE LINE OF MOTOR DRIVES

* See page 2

TABLE OF CONTENTS

"CE Logo" - This product complies with all CE (not logo) directives pertinent at the time of manufacture. Contact factory for detailed installation instructions and Declaration of Conformity.

SAFETY WARNING - PLEASE READ CAREFULLY

This product should be installed and serviced by a qualified technician, electrician or electrical maintenance person familiar with its operation and the hazards involved. Proper installation which includes wiring, mounting in proper enclosure, fusing or other overcurrent protection and grounding, can reduce the chance of electric shocks, fires or explosion in this product or products used with this product, such as electric motors, switches, coils, solenoids and/or relays. Eye protection must be worn and insulated adjustment tools must be used when working with control under power. This product is constructed of materials (plastics, metals, carbon, silicon, etc.) which may be a potential hazard. Proper shielding, grounding and filtering of this product can reduce the emission of radio frequency interference (RFI) which may adversely affect sensitive electronic equipment. If information is required on this product, contact our factory. It is the responsibility of the equipment manufacturer and individual installer to supply this safety warning to the ultimate user of this product. (SW effective 11/92)

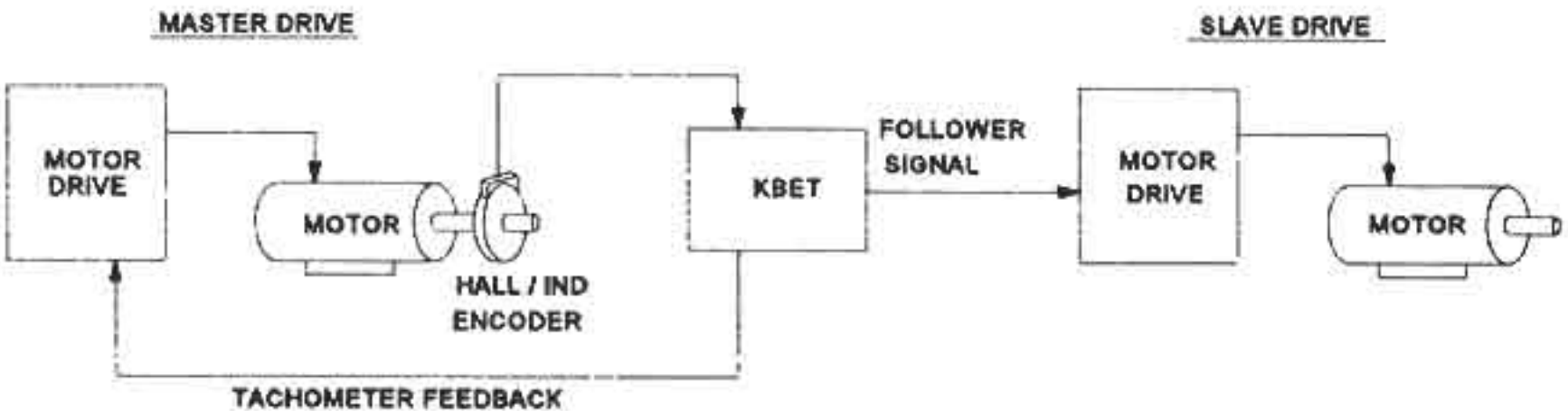
I. General Information

The KBET-240D is designed to accept a pulse input, which is produced by most "open collector" (Hall, magnetic, inductive and opto) or 2-wire inductive pickup, and create two independent isolated output signals. The Tachometer Output is normally used for tachometer feedback. The Follower Output is used to drive a second control in a master/slave system. If tachometer feedback is not required on the master motor, the Tachometer Output can be used to drive an additional slave.

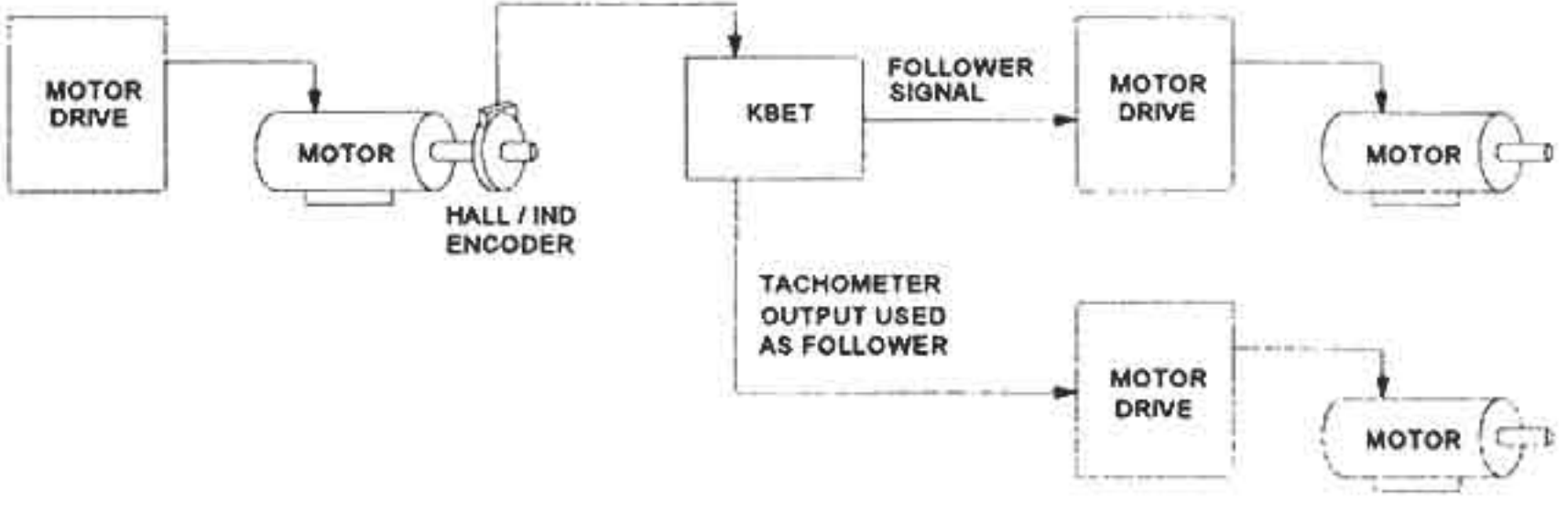
Two LED Indicators are incorporated into the KBET circuitry. The "Power On" LED is used to indicate that the unit has AC power, and the "Pulse" LED is used as a diagnostic to verify the presence of an encoder input.

Jumper selections allow for setting the AC line input voltage (120/240VAC) and the sensor type. The KBET is factory calibrated to 7V/1000 RPM (sensor type--60 pulses/rev) for the Tachometer Output and 10VDC per 1800 RPM for the Follower Output. Multiturn trimpots are provided to tailor the Tachometer and Follower Outputs for specific applications.

(FIG.1) MASTER / SLAVE WITH TACHOMETER FEEDBACK



(FIG. 2) MASTER WITH DUAL SLAVE



II. TABLE 1 - SPECIFICATIONS

AC Line Input Voltage (VAC-50/60Hz)	120/240
Tachometer Output Voltage Range (VDC)	0 - 17
Tachometer Output Trimpot Range (millivolts per pulses/sec)	3 - 8
Tachometer Output Trimpot Range (volts @ 1,000 RPM & 60 pulses/rev)	3.5 -10.0
Load Regulation (Set Speed) (20:1 speed range) (%)	1
Load Regulation (Set Speed) (30:1 speed range) (%)	2
Follower MIN Trimpot Output Range (VDC)*	-4 to +4
Follower MAX Trimpot Output Range (VDC)**	0 - 10
Follower MAX Trimpot Output Range (millivolts per pulses/sec)	0 - 8
Follower Linearity (30:1 speed range) (%)	2
Pulse Generator Resolution (pulses/revolution)	60
Input Frequency Range "open collector" (pulses/sec)	60 - 10,000
Input Frequency Range 2-wire Inductive Pickup (pulses/sec)	100 - 3,000
Ambient Temperature Range (°C)	0 - 50

*See MIN trimpot calibration **Based on speed control potentiometer supply voltage

III. SETTING SELECTABLE JUMPERS.

A. J1A, J1B - Input AC Line Voltage - Set proper input line voltage 120VAC or 240VAC by placing both J1A and J1B in the correct position, "120" or "240". WARNING! Failure to set the KBET to the proper AC line voltage can cause catastrophic failure.

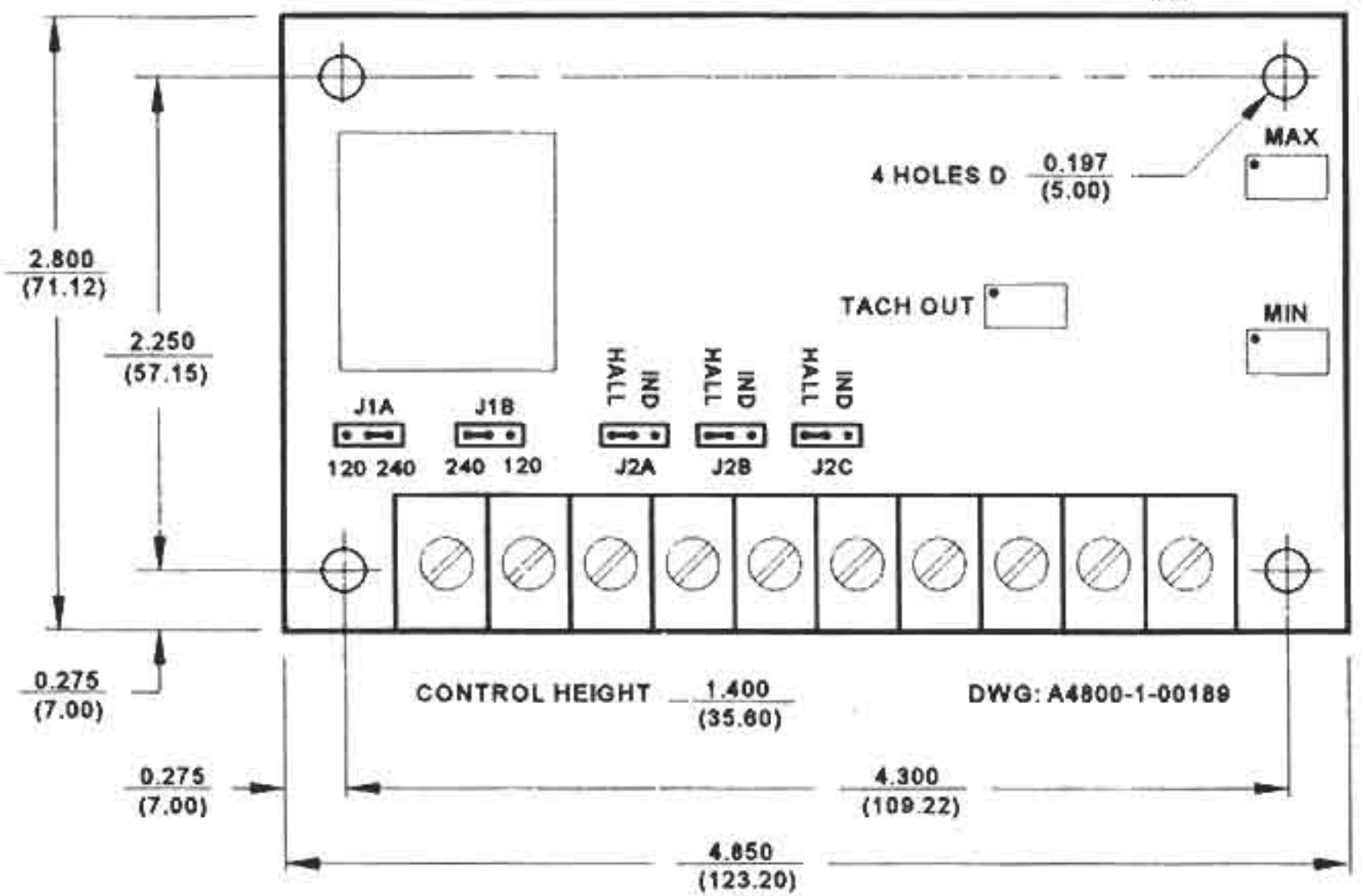
B. J2A, J2B, J2C - Pickup Sensor Type - The type of sensor used consists of two main categories: (1) Open Collector which includes Hall, Inductive, Magnetic and Opto, and (2) Two Wire Inductive. For Open Collector type sensors set jumpers J2A, J2B and J2C to the "Hall" position. For Two Wire sensors set jumpers J2A, J2B and J2C to the "IND" position.

IV. MOUNTING

Mount the KBET-240D on a level surface using four #6 screws and provide enough clearance to wire the unit properly. Be sure the unit is not subjected to excessive moisture, water, metal particles or chemical contamination. If necessary, mount the KBET in an enclosure that will protect it against harsh conditions. See Fig 3 for the mechanical specifications. Note the KBET-240D is designed to mount into the KBPC-240D Nema IV DC motor speed control on the inside front cover.

(FIG. 3) MECHANICAL SPECIFICATIONS

Inches / MM



V. WIRING.

WARNING!

Read Safety Warning on page 3 before attempting to use this control. Wire control in accordance with the National Electric Code and other codes that may apply. A basic connection diagram (Fig. 4) is provided which demonstrates the capabilities of the KBET-240D. Alternate connection diagrams are provided in the Application Section (Sec. VII).

Note:

Shielded cables should be used on all signal wires over 18" (45cm) long. Do not bundle signal wires with any power wires.

A. AC Line

Connect the AC line to terminals "1" and "2." Be sure jumpers J1A and J1B are both set to the correct position ("120" or "240") to match the AC line input voltage.

Application Note:

It is recommended that a 1 amp fuse be installed in series with the AC line to protect the KBET against catastrophic failure.

B. Pulse Generator

The KBET-240D is designed to accept a variety of pulse generators most of which utilize an open collector transistor or operational amplifier output that requires a +12VDC power supply. They are usually categorized as Magnetic, Hall, Inductive or Opto. The second type of common sensor is a 2-wire Inductive pickup.

The KBET is designed to provide optimum performance with a 60 slot pulse generator that produces 60 pulses per revolution. The KBET can also be converted to operate with higher resolution encoders (500 pulses/rev). Consult factory for information.

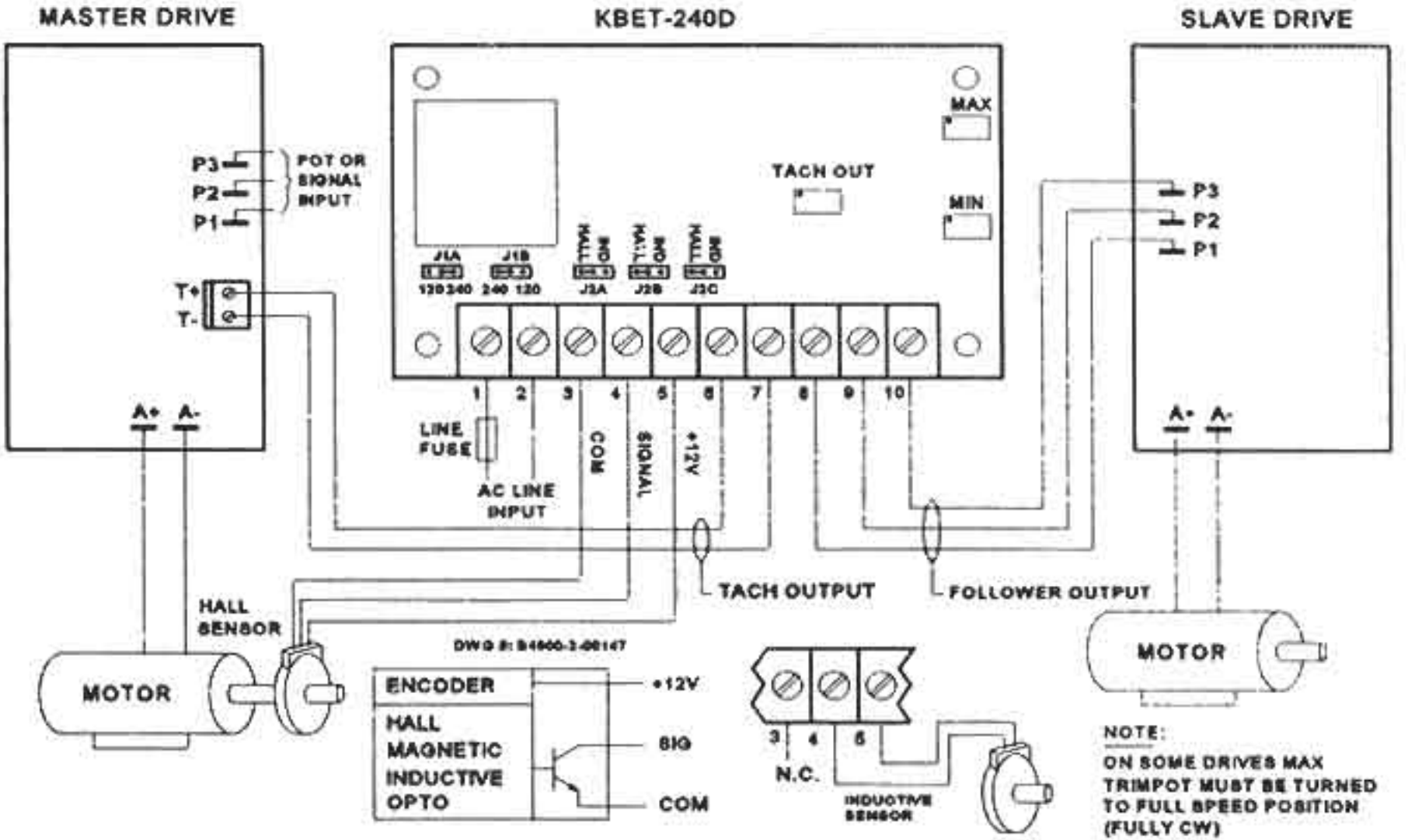
(1) Open Collector

For the open collector type, wire to terminals "3" (com), "4" (signal) and "5" (+12VDC) in accordance with connection diagram **Note:** *Be sure J2A, J2B and J2C are in the "Hall" position. (Fig. 1.)*

(2) 2-Wire Inductive Sensor

Connect the 2-wire Inductive sensor to terminals "4" and "5". These sensors are not polarized so that either lead can be connected to terminals "4" or "5" . **Note:** *Be sure J2A, J2B and J2C are all in the "IND" position. (See Fig. 4 for wiring.)*

(FIG.4) KBET-240D MASTER/SLAVE WITH TACHOMETER FEEDBACK CONNECTION DIAGRAM



C. Tachometer Output - The KBET-240D provides a factory calibrated isolated analog tachometer voltage based on 7 volts per 1,000 RPM with a pulse generator producing 60 pulses per revolution. Wire the tachometer output terminals "6" (+) and "7" (-) to the tachometer input of the motor speed control. Note: Most motor speed controls must be jumper selected for tachometer feedback operation and, in addition, selection must be made for the proper tachometer voltage (7V/1,000 RPM). Follow the speed control instructions for tachometer operation. See connection diagram (Fig. 4).

D. Follower Output - The KBET-240D provides a secondary isolated analog voltage that can be used to control a second drive (voltage following) for master/slave operations. Wire the Follower Output to the motor speed control as follows:

KBET TERMINAL	SPEED CONTROL
"8" (Com)	P1 (Com)
"9" (Sig.)	P2 (Sig
"10"(+12v)	P3 (+12V)

(Also see Fig. 4.)

Note: *On speed controls where the MAX trimpot is in series with the P3 terminal, the trimpot must be turned to its MAXIMUM (cw) position (KBMM, KBIC, KBCC). On speed controls where MIN trimpot is in series with the P1 terminal, the trimpot must be turned to its minimum (ccw) position (KBIC).*

If more than one control is to be "slaved" from the Follower Output, a signal isolator (such as KBSI-240D) must be interfaced between the KBET and the speed control. Standard ratio potentiometers can then be installed for each added slave speed control.

VI. TRIMPOT ADJUSTMENTS

The KBET-240D contains three (3) multiturn (25 turn) trimpots which can be used to tailor the control for specific applications.

A. TACHOMETER OUTPUT TRIMPOT

The KBET-240D is factory calibrated to provide a Tachometer Output of 7V/1,000 RPM, which is based on an 1,800 RPM motor and a 60 pulse-per-revolution sensor. If other than an 1,800 RPM motor and 60 pulse sensor is used, the Tachometer Output must be recalibrated using the TACH OUT trimpot. Since a 7V/1,000 RPM tach running at the full speed of 1,800 RPM produces 12.6 volts, the Tachometer Output must be readjusted to 12.6 volts at the motor's rated speed.

Note: *On some applications, it may be necessary to load the motor lightly to avoid cogging at low speed (under 180 RPM).*

Example:

2,800 RPM motor, 60 pulse/rev sensor. Run motor at full speed (2,800 RPM). Connect a DC voltmeter across KBET terminals "6" (+) and "7" (-). Adjust Tach trimpot (counterclockwise rotation) so that voltage reads 12.6 VDC.

3. Follower Output Trimpots

The Follower Output is factory calibrated to provide a 0-10 VDC output based on a motor speed of 0-1,800 RPM with a 60 pulse/rev sensor. For other output voltages, the MIN and MAX trimpots must be adjusted.

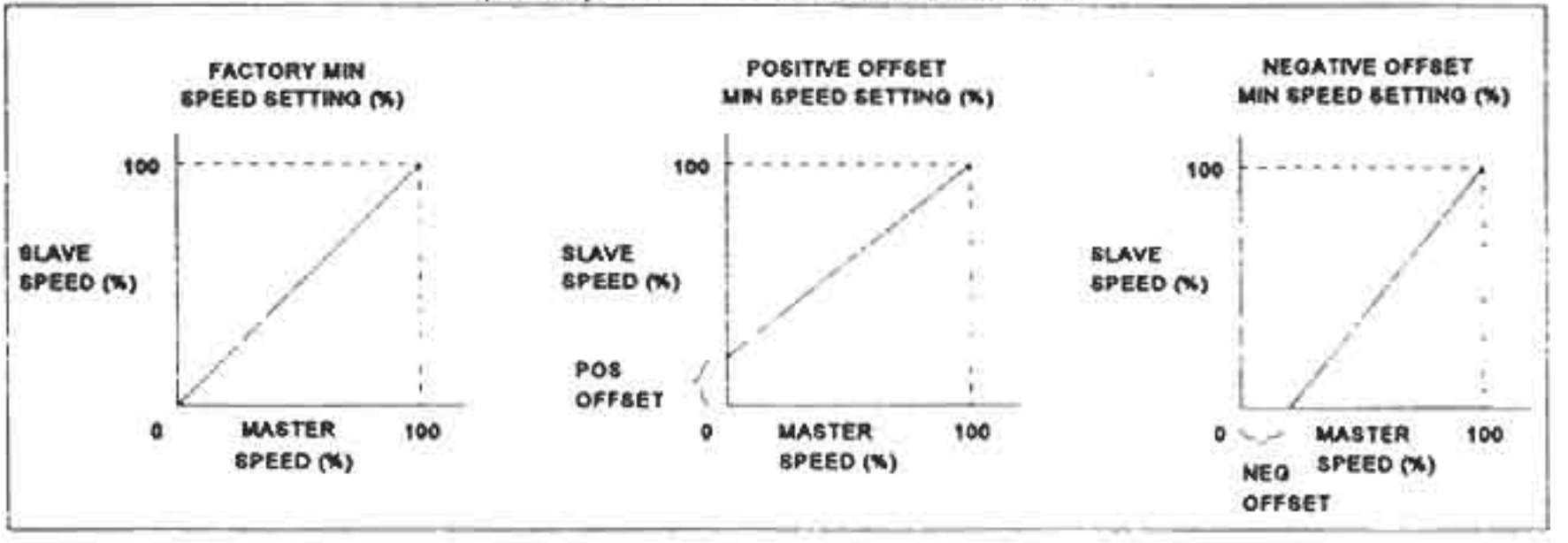
Application Note:

The Follower Output utilizes the speed control potentiometer power supply as a source. Therefore, its output voltage range is based on the potentiometer supply voltage. The follower will also operate on speed controls with a 5 VDC potentiometer supply voltage.

(1) MIN TRIMPOT:

The MIN trimpot is factory adjusted to provide zero output at zero shaft speed. However, it can be readjusted for two modes of operation. (See Fig. 5.)

(FIG. 5) MIN TRIMPOT ADJUSTMENT



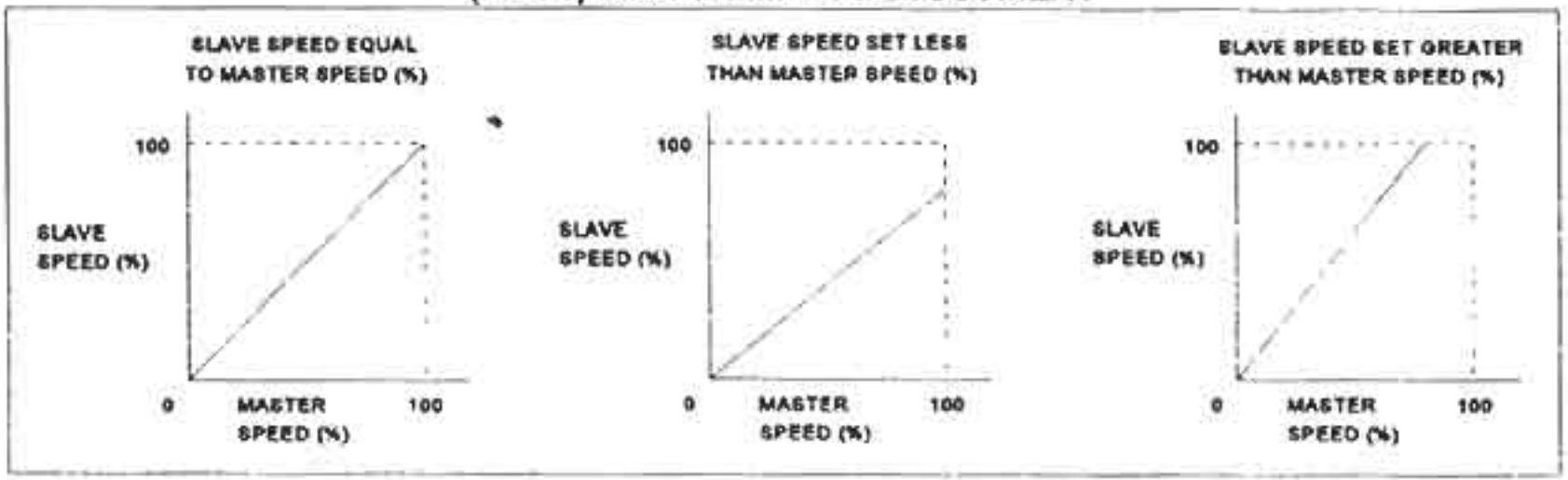
(a) Positive Offset: By rotating the MIN trimpot clockwise, the minimum output will increase. This will cause the slave control to run at a positive minimum speed with master drive set to zero.

(b) Negative Offset: By rotating the MIN trimpot counterclockwise, a deadband is created between the master RPM and slave RPM. The slave motor will not rotate until the master reaches the preset offset speed.

Note: *In the negative offset mode, the KBET does not produce a negative output voltage. Its output will remain at zero until the master negative offset speed is reached.*

(2) MAX TRIMPOT: After MIN trimpot is adjusted, the MAX trimpot can be used to scale the slave drive as a fixed ratio of the master drive speed. (See Fig. 6.)

(FIG. 6) MAX TRIMPOT ADJUSTMENT



Adjust the MAX trimpot by first running the master drive at the desired full speed Adjust the KBET MAX trimpot so that the slave is running at the desired full speed.

Note: *It may be necessary to readjust the MIN trimpot after the MAX trimpot is adjusted. If the MIN is readjusted, the MAX trimpot must also be readjusted.*

VII. DIAGNOSTIC LED'S

The KBET contains two LED indicator lamps that aid in determining its operational status.

1. "Power On": This indicator will light when the AC power is applied to the KBET and will extinguish when AC power is removed.

2. "Pulse": This indicator will blink when the encoder shaft is rotated slowly which verifies that the sensor is properly connected and operational. At higher speeds the indicator will be solidly lighted.

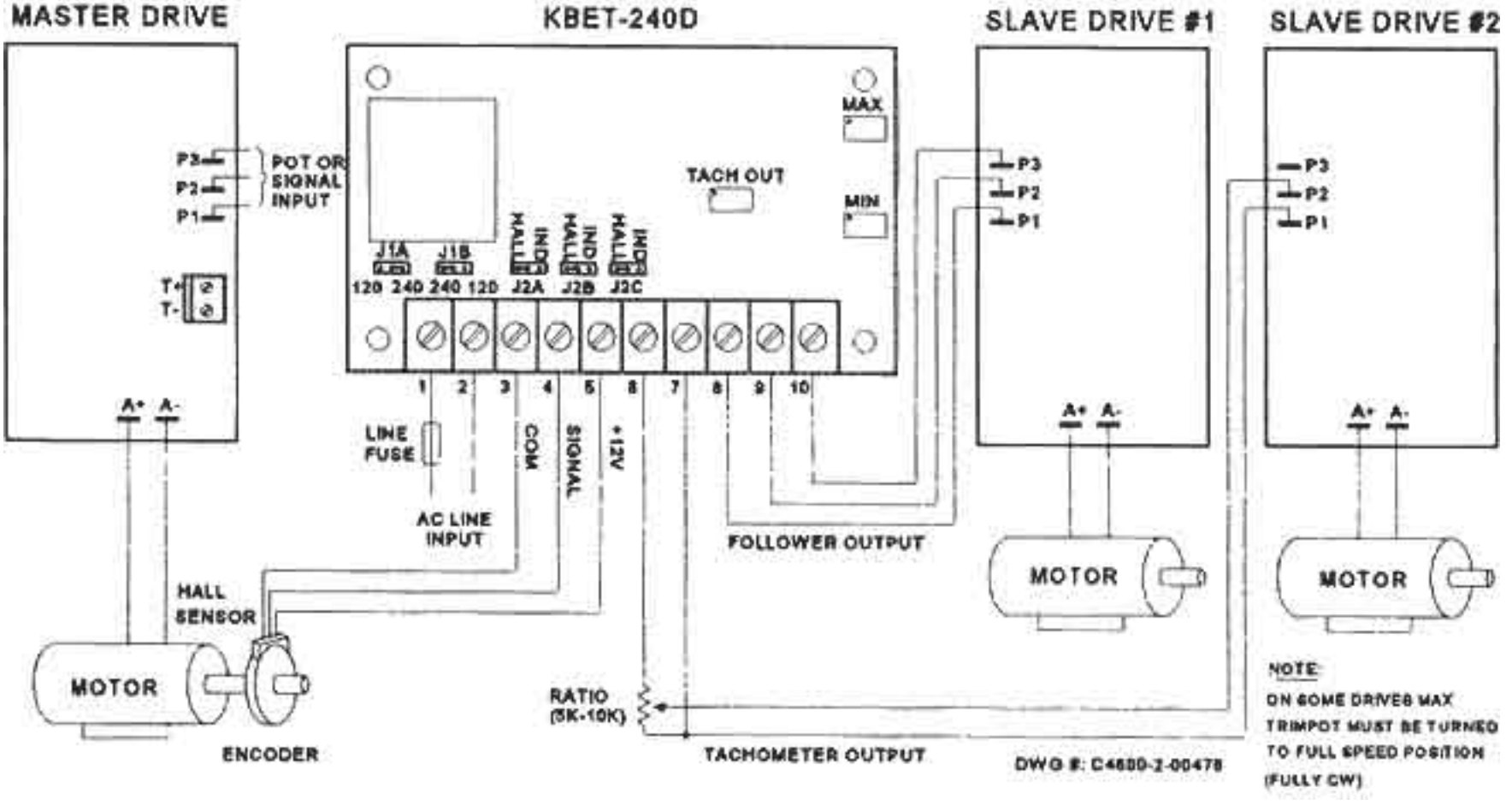
VIII. APPLICATION CONNECTION DIAGRAMS

The following connection diagrams illustrate the capabilities of the KBET-240D:

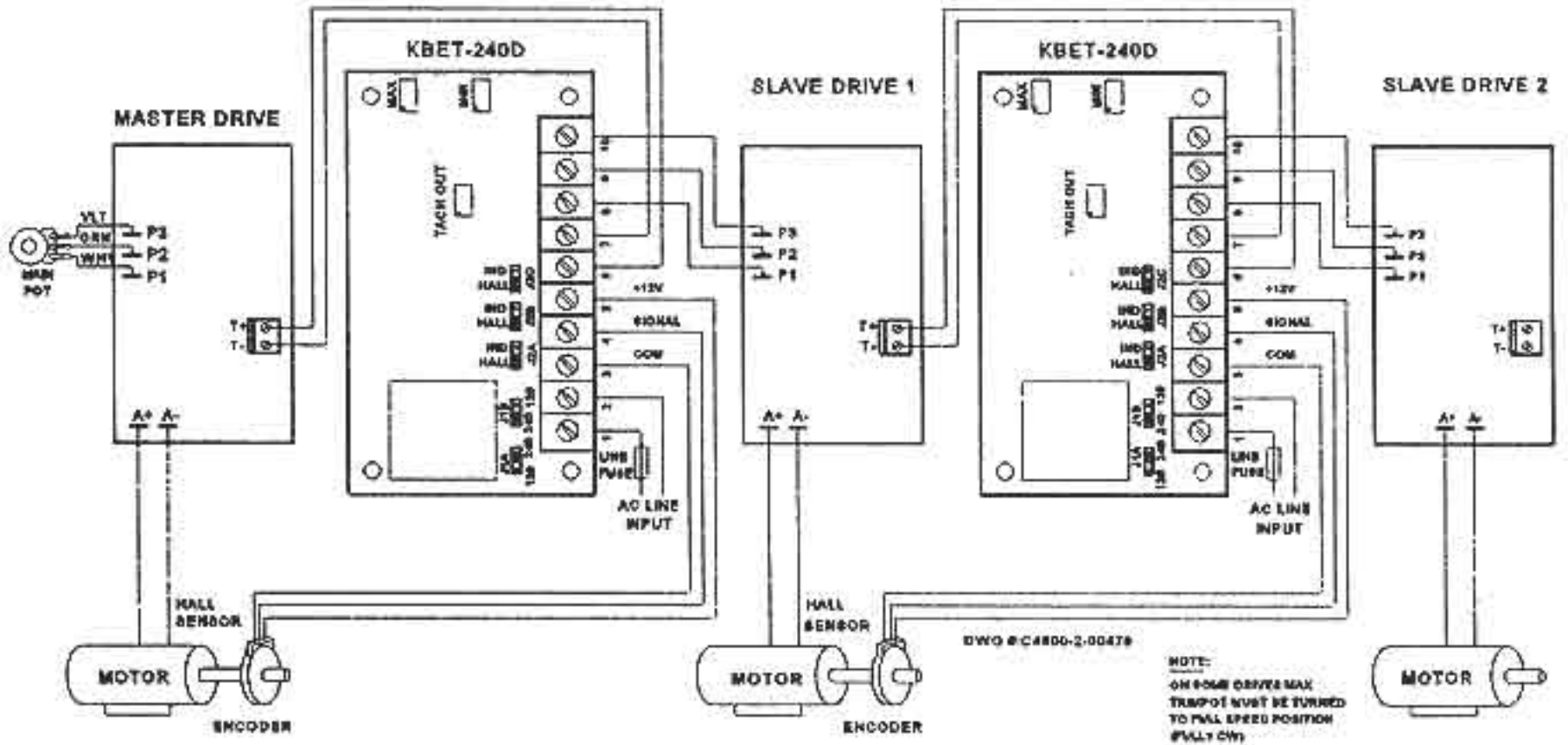
A. Master with two independent slaves (Fig. 7).

B. Multiple master/slave with Tach Feedback (Fig. 8).

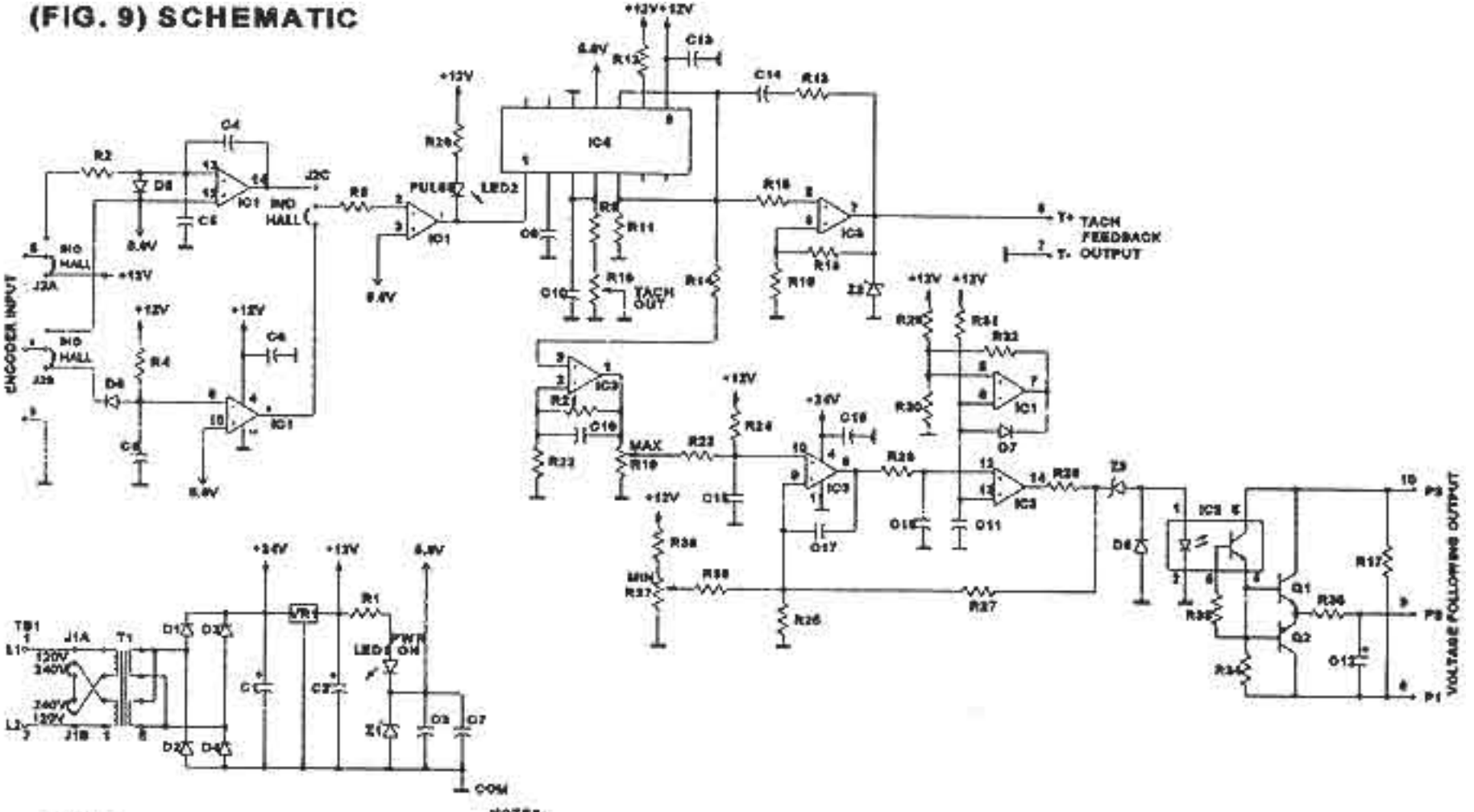
(FIG. 7) KBET-240D MASTER WITH TWO INDEPENDENT SLAVES CONNECTION DIAGRAM



(FIG. 8) MULTIPLE MASTER / SLAVE WITH TACH FEEDBACK



(FIG. 9) SCHEMATIC



WARNING
DO NOT EARTH-GROUND COM TERMINAL

NOTES:
1. ALL JUMPERS SHOWN IN FACTORY SET POSITIONS
2. J1A,J1B - LINE VOLTAGE SELECTION

TABLE 2 - KBET-240D (P/N 9469) PARTS LIST

Ckt Ref	Specification	Manufacturer-Type	Function
C1	220µF-35V-20%	Electrolytic	Capacitor
C2	10µF-35V-20%	Electrolytic	Capacitor
C3	1µF-50V-20%	SM50TQ1NP	Capacitor
C4	4700pF-50V-10%	Multilayer Ceramic	Capacitor
C5,11	0.047µF-50V-20%	Metal Film	Capacitor
C6	1000pF-50V-10%	Multilayer Ceramic	Capacitor
C7,8,13	0.01µF-50V-30%	Ceramic Tubular	Capacitor
C9	4700pF-50V-2%	SA305A472GAA	Capacitor
C10	0.022µF-50V-20%	Metal Film	Capacitor
C12	4.7µF-35V-20%	Electrolytic	Capacitor
C14	2.2µF-50V-20%	SM50TQ2R2NP	Capacitor
C15,17,18	0.1µF-50V-20%	Metal Film	Capacitor
C16,19	0.01µF-50V-30%	Ceramic Tubular	Capacitor
D1-4,6	1A-600PIV	1N4005	Diode
D5,7,8	0.15A-100PIV	1N4148	Diode
IC1	———	TL084N	Quad JFET Input Op
IC2	———	4N37	Optoisolator
IC3	———	LM324N	Quad Op Amp
IC4	———	LM2917N	F/V Converter
LED1	30mA-3mcd-GRN	MV5453	Power On Indicator
LED2	35mA-3mcd-RED	MV5753	Pulse Indicator
Q1	600mA-40V	2N4401	Bipolar Transistor
Q2	600mA-40V	2N4403	Bipolar Transistor
R1,20	4.7K-0.25W-5%	Carbon Film	Resistor

CKT Ref	Specification	Manufacturer - Type	Function
R2,4	3.3K-0.25W-5%	Carbon Film	Resistor
R6,9,11	10K-0.25W-5%	Carbon Film	Resistor
R10	20K-0.5W-10%	EVMCEGA01B24	TACH OUT Trimpot
R12	470Ω-0.25W-5%	Carbon Film	Resistor
R13	390K-0.25W-5%	Carbon Film	Resistor
R14,15,34	22K-0.25W-5%	Carbon Film	Resistor
R16,32	33K-0.25W-5%	Carbon Film	Resistor
R17,35,36	10K-0.25W-5%	Carbon Film	Resistor
R18	270K-0.25W-5%	Carbon Film	Resistor
R19	20K-0.5W-10%	EVMCEGA01B24	MAX Trimpot
R21	68K-0.25W-5%	Carbon Film	Resistor
R22,30	22K-0.25W-5%	Carbon Film	Resistor
R23,26,29	47K-0.25W-5%	Carbon Film	Resistor
R24,27	180K-0.25W-5%	Carbon Film	Resistor
R25,31,33	240K-0.25W-5%	Carbon Film	Resistor
R28	1.5K-0.25W-5%	Carbon Film	Resistor
R37	20K-0.5W-10%	EVMCEGA01B24	MIN Trimpot
R38	100K-0.25W-5%	Carbon Film	Resistor
T1	130mA-18V	DST336	Power Transformer
VR1	0.5A-12V-POS	78L12ACP	Voltage Regulator
Z1	5.6V-0.5W-5%	1N5232B	Zener Diode
Z2	27V-1W-5%	1N4750A	Zener Diode
Z3	12V-1W-5%	1N4742A	Zener Diode
Z3	12V-1W-5%	1N4742A	Zener Diode

LIMITED WARRANTY - KBET-240D

For a period of 18 months from date of original purchase KB will repair or replace without charge devices which our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. The foregoing is in lieu of any other warranty or guarantee expressed or implied, and we are not responsible for any expense; including installation and removal, inconvenience, or consequential damage, including injury to any person, caused by items of our manufacture or sale. Some states do not allow certain exclusions or limitations found in this warranty so that they may not apply to you. In any event, KB's total liability under all circumstances, shall not exceed the full purchase price of this unit. (rev 4/88)

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