Heathkit® Manual

for the

HIGH TORQUE DIGITAL PROPORTIONAL SERVO

Model GDA-1205-8

595-1895-01

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

PARTS LIST

Check each part against the following list. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after you identify it until it is called for in a step. Do not discard any packing materials until all parts are accounted for.

Each circuit part in this kit has its own "Circuit Component Number" (R2, C4, IC1, etc.). This is a specific number for only that one part. The purpose of these numbers is to help you easily identify the same part in each section of the Manual.

These numbers will appear:

- In the Parts List;
- At the beginning of each step where a component is installed;
- In some illustrations;
- In the sections at the rear of the Manual.

To order a replacement part: Always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" inside the rear cover of the Manual. Your Warranty is located inside the front cover. For pricing information, refer to the separate "Heath Parts Price List."

RESISTORS, 1/4-Watt

NOTE: The following resistors have a tolerance of 10% unless they are listed otherwise. 10% is indicated by a fourth color band of silver; 5% is indicated by a gold band.

KEY No.	PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	1-65-12	1	470 Ω, 5% (yellow-violet-brown)	R7*
A1	1-13-12	1	560 Ω (green-blue-brown)	R2
A1	1-2-12	1	1000 Ω (brown-black-red)	R5

*Resistors used for 180° Servo Travel

Resistors, (cont'd.)

KEY No.	PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	1-73-12	1	2700 Ω, 5% (red-violet-red)	R2*
A1	1-112-12	1	16 kΩ, 5% (brown-blue-orange)	R4
A1	1-12-12	1	82 kΩ (gray-red-orange)	R6
A1	1-33-12	1	120 kΩ (brown-red-yellow)	R1
A1	1-47-12	1	150 kΩ (brown-green-yellow)	R6*

CAPACITORS

KEY No.	PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
B1	21-175	1	.001 μF ceramic (brown-black-red-yellow)	C1
B2	21-94	1	.05 μF disc	C3
B3	25-255	1	.22 μF (.22k) tantalum	C5
B3	25-256	1	.47 μF (.47k) tantalum	C2
B4	25-195	1	2.2 μF tantalum	C4

TRANSISTORS-INTEGRATED CIRCUIT

NOTE: Transistors and integrated circuits are marked for identification in one of the following four ways:

1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers; the letters may be different or missing).
3. Part number with a type number.
4. Part number with a type number other than the one listed.

C1	417-268	2	MPS6562 transistor	Q1, Q2
C2	238-62	1	Integrated circuit	IC1

CABLE ASSEMBLY-WIRE-SLEEVING

D1	238-32	1	Cable assembly
	340-3	12″	Bare wire
	344-125	3″	Black wire
	344-126	3″	Brown wire
	344-127	3″	Red wire
	344-130	3″	Green wire
	344-134	6″	White wire
	346-21	1-1/2″	Sleeving

HARDWARE

E1	250-536	2	1-72 × 1/8″ screw (one extra)
E2	250-1209	2	1-72 × 3/16″ screw
E3	250-1208	4	2-56 × 1-1/4″ flat head screw
E4	250-82	4	#4 × 1/2″ wood screw
E5	238-74	1	1/2″ gear pin
E6	238-103	2	#1 fiber washer

KEY No.	PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
NYLON PARTS				
F1	238-75	1	Idler gear marked #2	
F2	238-82	1	Rotary drive gear	
F3	238-83	1	Idler gear marked #3	
F4	238-84	1	Motor coupling gear marked #1	
F5	238-76	1	Rotary output wheel	
F6	238-77	1	Rotary output arm	
F7	238-78	1	Case bottom section	
F8	238-79	1	Case center section	
F9	238-80	1	Case top section	
MISCELLANEOUS				
G1	238-81	1	Control drive shaft	
G2	9-40	1	1500 Ω control	R3
G3	73-59	4	Large rubber grommet	
G3	73-53	1	Small rubber grommet	
	238-95	1	Circuit board	
G4	238-92	1	Control wiper	
G5	420-73	1	Motor	
G6	73-92	1	Foam tape (3/4" wide)	
	391-34	1	Blue and white label	
G7	214-179	1	Wiper installing tool	
	597-260	1	Parts Order Form	
		1	Manual (See front cover for part number.)	
			Solder	

ASSEMBLY NOTES

The circuit board and its components are quite small. Many of these components break easily; handle them with care. It is very important that you take your time while you assemble this kit. Do not attempt "shortcut" procedures. Cut and bend all leads as outlined at the beginning of the "Step-by-Step Assembly" on the following pages.

When you solder, use a small-wattage soldering iron, allow it to reach operating temperature, and then apply it long enough to make a good solder connection.

It is recommended that you use a soldering iron rated at 15 to 25 watts. The tip should be no wider than 1/8"; a pyramid or chisel-shaped tip is best. This type of soldering iron will make the kit easier to assemble, with less chance of solder bridges occurring between foils on the circuit board.

A separate "Illustration Booklet" contains numbered illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. The Step-by-Step Assembly instructions will direct you to the proper illustration in the Booklet. After you have completed the assembly of your kit, place the Illustration Booklet with the Assembly Manual and save them for future reference.

TEST AND ADJUSTMENT

If the Servo does not operate as described in the following steps, refer to the "In Case of Difficulty" section on Page 32. DO NOT proceed until the difficulty has been corrected.

Refer to Figure 5 for the following steps.

( ) Temporarily remove the motor from the gear train.

( ) Connect the Servo to channel #1 of the receiver.

( ) Turn the transmitter and the receiver on. The Servo motor may start to run.

( ) Slowly turn the rotary output arm of the Servo in the direction required to stop the motor.

( ) Turn the rotary output arm of the Servo clockwise. The motor should turn in a counterclockwise direction. Then slowly turn the output arm in the opposite direction until the motor stops.

( ) Turn the rotary output arm of the Servo counterclockwise. The motor should turn in a clockwise direction. Then slowly turn the output arm in the opposite direction until the motor stops.

( ) Reinstall the motor in the case center section.

( ) Move the channel # stick on your Transmitter first one way; then the other. The Servo should rotate in one direction; then the other.

( ) Turn the transmitter and the receiver off and disconnect the Servo from the receiver.

( ) If you wired your Servo for 90° travel, remove the rotary output arm from the rotary drive gear. Leave the rotary output arm on if you wired the Servo for 180° travel.

This completes the Test. Proceed to "Centering," on Page 26, if you wired your Servo for 90° travel. Otherwise, proceed to "180° Servo Travel" on Page 28.

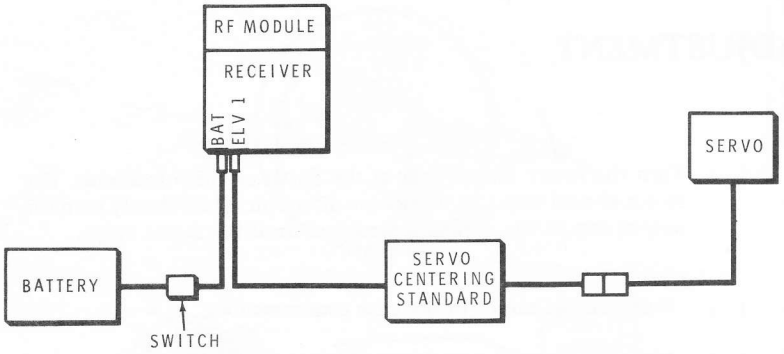


Figure 6

CENTERING

Use the procedure titled "Centering With Servo Centering Standard" if you have one of the transmitters that supplied a servo centering standard.

Use the procedure titled "Centering Without Servo Centering Standard" if you have some other transmitter.

Centering With Servo Centering Standard

( ) Connect the Servo to your receiver through the Servo Centering Standard (supplied with the Transmitter) as shown in Figure 6.

( ) Turn the transmitter and the receiver on. The Servo rotary output post may rotate to some off-center position.

NOTE: When you use the Servo Centering Standard, the transmitter stick controls will have no effect on the Servo. Also the Servo may chatter when you use the Servo Centering Standard.

( ) Refer to Figure 7, Part A, and loosen the two screws that hold the 1500 Ω control one full turn.

NOTE: Use a small pair of long-nose pliers when you adjust the control in the next step. Insert the tips of the pliers into the notches in the top of the control; then carefully rotate the control as required. If your pliers are not small enough, use your soldering iron and heat lug 1 of the control for about 15 seconds. This will temporarily expand the plastic and allow you to rotate the control. Reconnect the green wire to lug 1 before you adjust the control.

( ) Rotate the control in the case center section slightly in either direction until the marked side of the rotary output post is parallel with the end of the case. See Figure 7, Part B.

( ) Tighten the two screws that hold the 1500 Ω control.

( ) Disconnect the Servo from the Servo Centering Standard.

NOTE: The Servo should never need readjustment unless it has been repaired. If at a later date you question the Servo's centering, check it with the Servo Centering Standard.

This completes the "Centering," proceed to "Final Assembly."

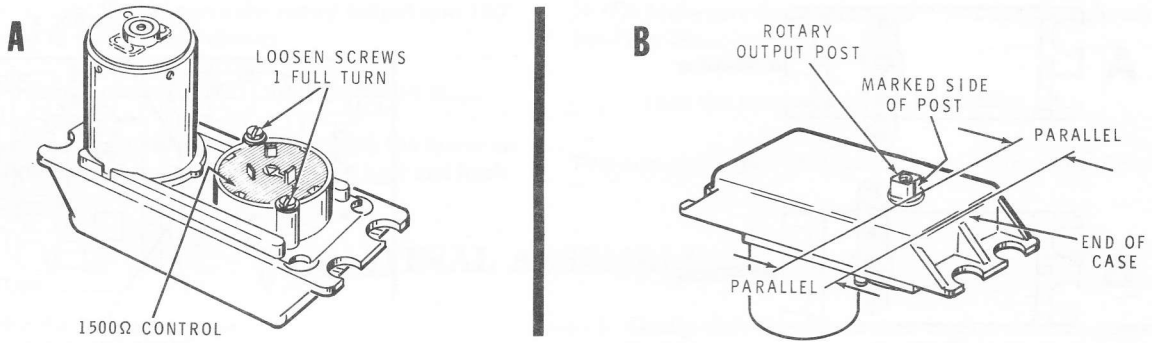


Figure 7

Centering Without Servo Centering Standard

NOTE: Before you perform the following steps, your transmitter must be operating properly.

( ) Connect the Servo to channel #1 on your receiver.

( ) Turn the transmitter and receiver on. The Servo rotary output post may rotate to some off-center position.

( ) Refer to Figure 7, Part A, and loosen the two screws that hold the 1500 Ω control one full turn.

NOTE: Use a small pair of long-nose pliers when you adjust the control in the next step. Insert the tips of the pliers into the notches in the top of the control; then carefully rotate the control as required. If your pliers are not small enough, use your soldering iron and heat lug 1 of the control for about 15 seconds. This will temporarily expand the plastic and allow you to rotate the control. Reconnect the green wire to lug 1 before you adjust the control.

( ) Rotate the control in the case center section slightly in either direction until the marked side of the rotary output post is parallel with the end of the case. See Figure 7, Part B.

( ) Tighten the two screws holding the 1500 Ω control.

This completes the "Centering," proceed to "Final Assembly."

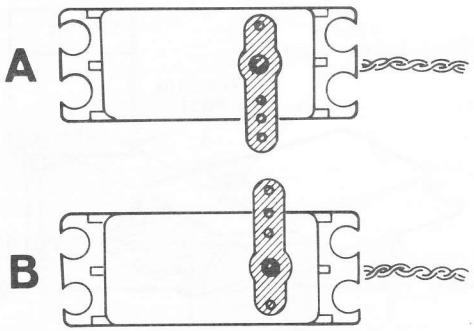


Figure 8

180° SERVO TRAVEL

In the following steps, you will adjust the switched channel (channel 5) in your GDA-1205 Transmitter. Note that there are two range controls on the encoder circuit board for Channel 5.

If your transmitter does not have a switched channel, make the adjustments for 180° servo travel in the same manner you would adjust for 90° travel by completing these instructions in your transmitter manual.

NOTE: The landing gear switch is in the "gear down" position when its lever is toward the rear of the transmitter.

( ) Temporarily remove the motor from the gear train.

( ) Plug your High Torque Servo into the Channel 5 (AUX 5) receiver socket.

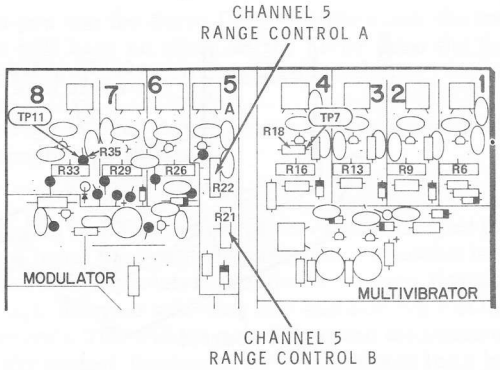


Figure 9

( ) Refer to Figure 8, Part A, and move the rotary output arm to position shown.

( ) Set the Channel 5 landing gear switch so the lever is toward the front of the transmitter.

( ) Turn the transmitter and the receiver on.

Refer to Figure 9 for the following steps.

( ) Turn Channel 5 Range control A, R22, until the motor stops.

( ) Set the Channel 5 landing gear switch so the lever is toward th rear of the transmitter.

( ) Refer to Figure 8, Part B, and move the rotary output arm 180° counterclockwise to the position shown.

( ) Turn Channel 5 Range control B, R21, until the motor stops.

( ) Reinstall the motor in the case center section. Push the motor as far as possible into the case by carefully twisting it back and forth.

NOTE: Make sure the red terminal is positioned as shown in Pictorial 15 (on Page 24).

( ) Turn the receiver and the transmitter off.

This completes the "180° Servo Travel." Proceed to "Final Assembly."

FINAL ASSEMBLY

Refer to Pictorial 16 for the following steps.

( ) Cut a 1/2" square piece of foam tape. Remove the brown paper backing from one side and press the tape onto the top of the control.

( ) Position the circuit board as shown, with the two transistors nearest the motor, and fold the wires under the sides of the circuit board.

( ) Slide the small grommet up the twisted wires to the edge of the circuit board.

( ) Cut a 1/2" square piece of foam tape. Remove the brown paper backing from one side and press the tape onto the foil side of the circuit board.

( ) Gently slide the case bottom section onto the case center section. Position the case so the dimple inside the case bottom section will be on top of the motor and the grommet will be in the slot. Be sure that no wires are pinched between the two case sections.

( ) Secure the case bottom section with four 2-56 × 1-1/4" flat head screws.

( ) Install the four large grommets as shown.

NOTE: The blue and white label that you will install in the following step shows the Model number and Production Series number of your kit. Refer to these numbers in any communications you have with the Heath Company about this kit.

( ) Carefully peel away the paper backing from the blue and white label. Then press the label onto the cover of this Manual.

Troubleshooting Chart

Condition	Possible Cause
Servo completely dead.	1. Dead battery. 2. Faulty solder connections. 3. Transistors Q1 and Q2 installed incorrectly. 4. Solder or wire bridges around the leads of the IC. 5. Check for proper component installation. 6. Motor inoperative.
Servo travels to one end and stays there.	1. Transistor Q1 or Q2. 2. Control R3 wired wrong or defective. 3. Motor wired wrong. 4. Resistors R2, R3, R4, or capacitor C5. 5. Solder bridge.
Servo operates in only one direction.	1. Transistor Q1 or Q2. 2. Capacitor C2 or C5. 3. Resistor R2 or R4.
Servo unstable (hunts or chatters).	1. Capacitors C1, C2, or C4. 2. Resistors R1, R5, or R6. 3. Dirty control element or improperly formed wiper.
Servo slow (sluggish) low power.	1. The gear train. 2. Weak battery. 3. Capacitor C4. 4. Motor.
NOTE: The IC has been pretested and should not be an initial source of a problem. However a defective IC can cause any of the above conditions.	

SPECIFICATIONS

Input Signal	Pulse: 1-2 msec. wide; 4 volts p-p.
Torque	38 in.-oz. at rotor.
Travel Time	0.4 second.
Rotary Output Travel	90° or 180° rotation.
Temperature Range	0° to + 160° F.
Power Requirements	Battery: 4.8V. Idle Current: 20 mA maximum. Stall Current: 1000 mA. No Load Current: 150 mA.
Mechanical Output	1-rotary arm. 1-rotary wheel.
Position Accuracy	1%.
Dimensions	1-5/8″ high × 15/16″ wide × 2-9/32″ long (4.1 × 2.4 × 5.8 cm). (Length includes the mounting ears. Height includes the outputs.)
Net Weight	1.75 oz (50 g).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

The width of the 4-volt pulses from the receiver controls the position of the servo outputs. Widening the pulses drives the servo gear-train in one direction, and narrowing the pulses drives the servo gear-train in the other direction. The pulse widths are variable from one to two milliseconds, and are controlled by a transmitter stick control. Therefore, moving a transmitter stick changes the pulse width, which in turn causes the servo gear-train to move.

Refer to the Schematic Diagram while you read this "Circuit Description."

INPUT AND TIMING CIRCUITS

IC1 generates a negative (reference) pulse and compares it to the positive pulse from the receiver. The width of the reference pulse is controlled by feedback control R3.

If the incoming positive pulse is narrower than the reference pulse, the result is a small negative pulse that is inverted, shaped, and then used to turn on transistor Q2. At this time, the collector of Q1 is grounded through pin 6 of IC1. If the incoming positive pulse is wider than the reference pulse, the result is a small positive pulse that is inverted, shaped, and then used to turn on transistor Q1. At this time, the collector of Q2 is grounded through pin 8 of IC1.

Transistor Q1 drives the motor in one direction and transistor Q2 drives the motor in the other direction. The motor then turns feedback control R3 until the negative reference pulse is the same width as the positive incoming pulse. The pulses then cancel out and the motor stops.

Capacitor C1 determines the dead band of the system. Capacitor C2 and resistor R1 set the minimum duty cycle. Capacitor C5 and resistor R4 determine the pulse timing for the internal circuit in the IC. Resistor R6 controls the damping of the servo.

DRIVE CIRCUIT

The servo motor is connected in the circuit in such a way that when transistor Q1 conducts, current passes through the motor windings in one direction and when transistor Q2 conducts, current passes through the motor windings in the opposite direction. This causes the motor to run in either direction depending upon which transistor is conducting.

Capacitor C3 filters out motor brush noise. Capacitor C4 filters the power supply voltages.

CIRCUIT BOARD X-RAY VIEWS

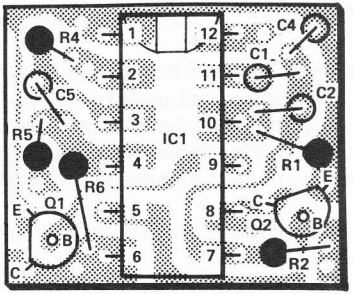
NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

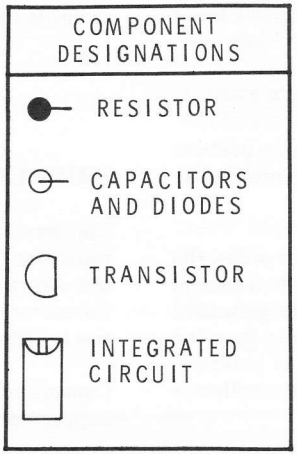
A. Find the circuit component number (R5, C3, etc.) on the X-Ray View.

B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.

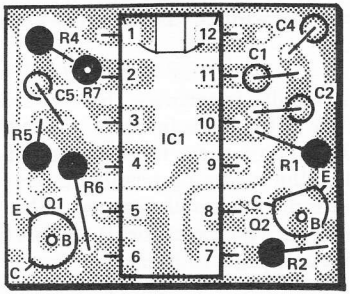
C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.

X-RAY VIEW, 90° TRAVEL
(COMPONENT SIDE)



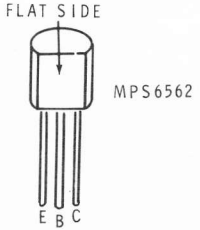


X-RAY VIEW, 180° TRAVEL
(COMPONENT SIDE)



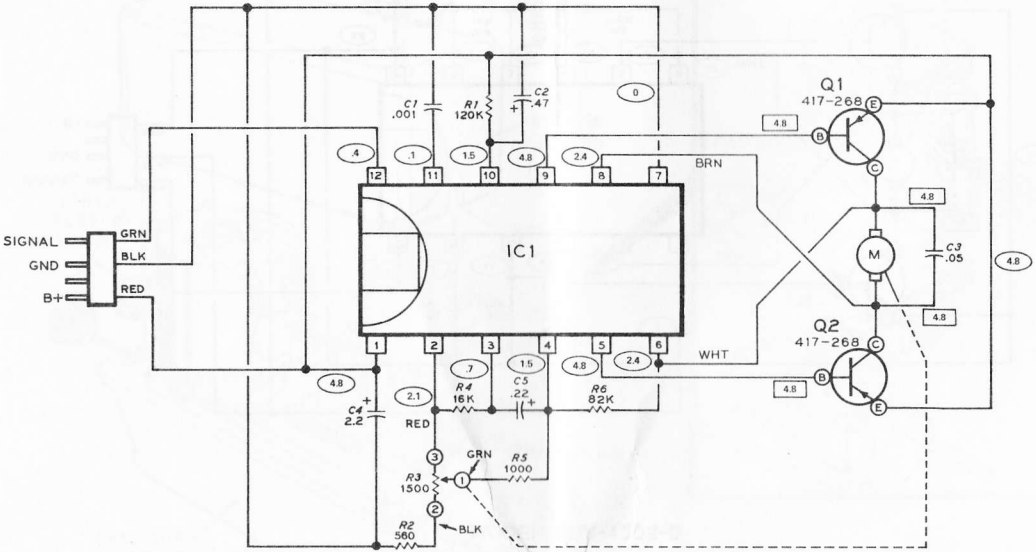
NOTES:

1. ALL RESISTORS ARE 1/4 WATT RESISTOR VALUES ARE IN OHMS (K=1000).
2. ALL CAPACITOR VALUES ARE IN µF UNLESS OTHERWISE MARKED.
3. ◯ THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASUREMENT.
4. ▭ THIS SYMBOL INDICATES THE NORMAL OPERATING VOLTAGE RANGE.
5. VOLTAGE ON PIN 2 OF THE IC IS VARIABLE FROM 0.2 TO 0.4, DEPENDING ON THE INPUT PULSE. VOLTAGE SHOWN IS WITH THE SERVO IN THE CENTER OF TRAVEL.
6. VOLTAGE ON PIN 6 OF THE IC IS VARIABLE FROM 1.5 TO 2.7, DEPENDING ON THE INPUT PULSE. VOLTAGE SHOWN IS WITH THE SERVO IN THE CENTER OF TRAVEL.
7. ALL VOLTAGES ARE MEASURED WITH A HIGH INPUT IMPEDANCE VOLTMETER FROM THE POINT INDICATED TO COMMON GROUND. VOLTAGES MAY VARY ±20%.
8. REFER TO THE CIRCUIT BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS ON THE CIRCUIT BOARD.



SCHEMATIC OF THE HEATHKIT®

HIGH TORQUE DIGITAL PROPORTIONAL SERVO
MODEL GDA-1205-8

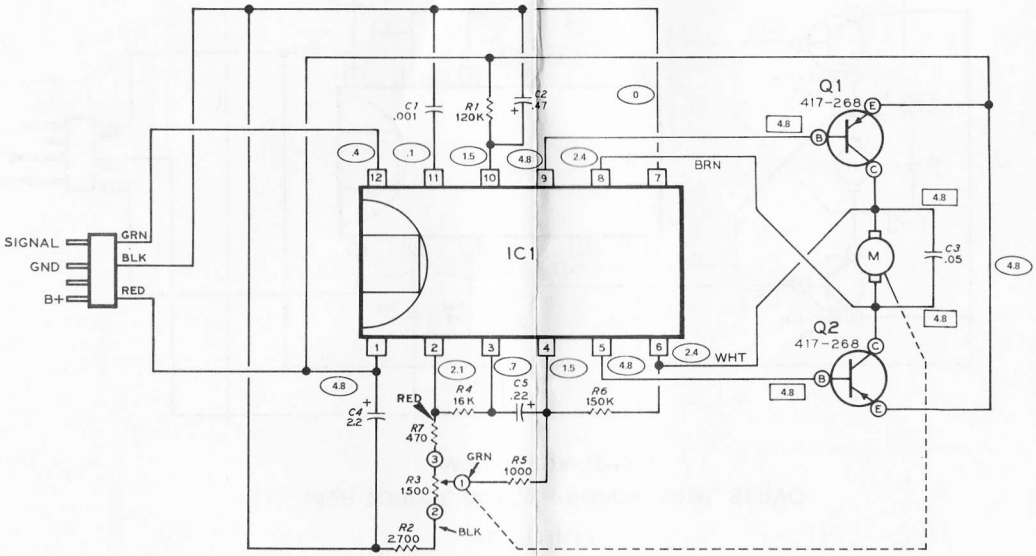


WIRING FOR 90° SERVO TRAVEL

SCHEMATIC OF THE HEATHKIT®

HIGH TORQUE DIGITAL PROPORTIONAL SERVO

MODEL GDA-1205-8



WIRING FOR 180° SERVO TRAVEL