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INTERFACE DRIVER BOARD

ITEM	VALUE	QUANTITY
Resistors		
R1	1KO	1
R2	1OK	
R3-8	2K2 resitor network	1
R9	1K8	
R1O	1K8	
R11	1K8	3
R12	15K	1
R13	1OK	2
R14	18ohm 5w	1
R15-R2O	1KO	6
Capacitors		
C1	1OOp polystyrene	1
C2	1.Ovf Tant	1
C3-C15	1Onf ceramic	13
Semiconductors		
IC1	74LS 125	
IC2	74LS 125	2
IC3	74LS 04	1
IC4	74LS 123	1
IC5	74LS 366	1
IC6	74LS 138	1
IC7-IC12	74LS 175	6
IC13-IC16	ULN2oo3A	4
IC17	UA 7805	1
ZD1	BZX 13v ZENER	1

Miscellaneous

MXJ 1O way edge connector
5 way PCB plug and socket connector
Through Pins
16 pin IC sockets
14 pin IC sockets
4 way modified PCB plug and socket

GENERAL ASSEMBLY SEQUENCE FOR THE PC BOARD

A Fit all of the through pins to the board.

B Fit and screw the 5v regulator to the board.

C Identify and fit the resistors and the 13v zener to the board. The black band v points to the motor connectors (on the zener DlODE).

D Identify and fit all capacitors to the board.

E Solder the 2k2 resistor network, IC sockets, and the 4 and 5 way PCB plugs to the board.

G Solder the lO way socket to the board.

NOTE:

Refer to the overlay diagram and parts list to ensure that the resistors, capacitors, IC,s and other parts are inserted into the correct locations on the PC Board.

BASIC BOARD CHECKS

A Check the board for dry joints and re-solder any found.

B Hold the board under a strong light source and check the underside to ensure there are no solder bridges between the tracks.

FITTING THE PC BOARD TO THE BASE OF THE ROBOT

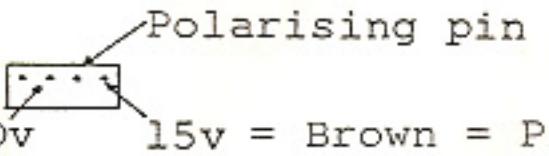
The PCB should be fitted to the base plate using the nylon pillars provided.

MOTOR CONNECTION

Connect the motors to the 5way sockets, ensuring correct 15v polarity, via the ribbon cable, refering to the diagram provided to ensure correct connection.

POWER CONNECTION

Connect the power to the modified 4way socket ensuring correct polarity as shown below.



Blue = Pin 1 on I/P connector=Ov 15v = Brown = Pin 2 on I/P connector

NOTE

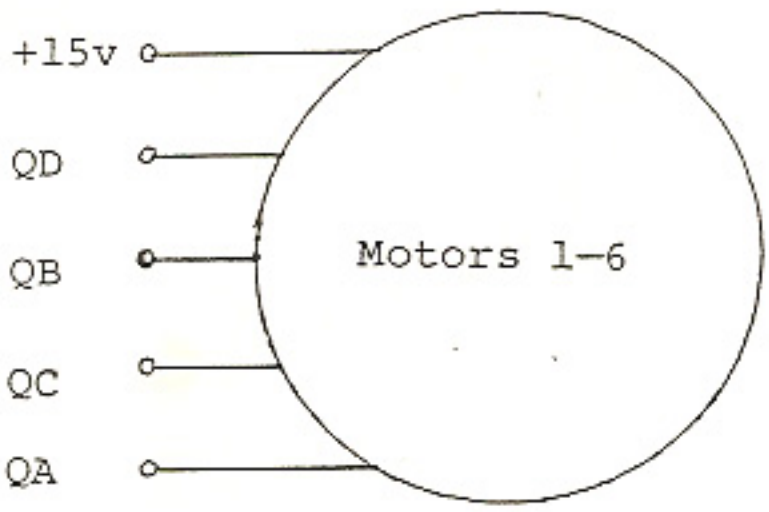
A number of diagrams are given, explaining in detail the inter-connections between the motors and the PCB, if the motors are connected in the manner shown then the software provided will map the keys 1-6 and q,w,e,r,t,y to the motors in the following way

1, q, = GRIPPER. 2, w, = left wrist. 3, e, = right wrist.

4, r, = forearm. 5, t, = shoulder. 6, y, = base.

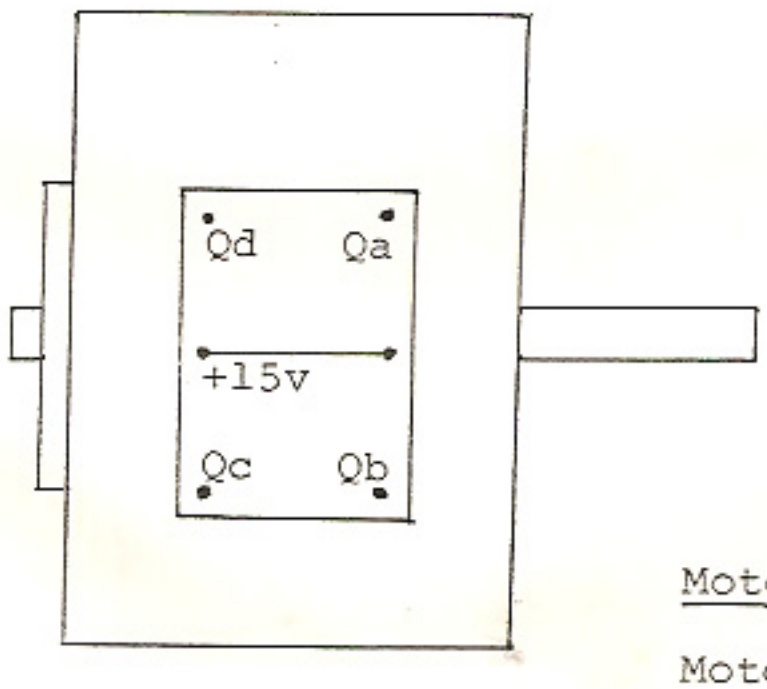
as shown in the diagram, the two middle pins of the stepper motors should be connected together and to 15v.

Motor Connection And Designation Layouts



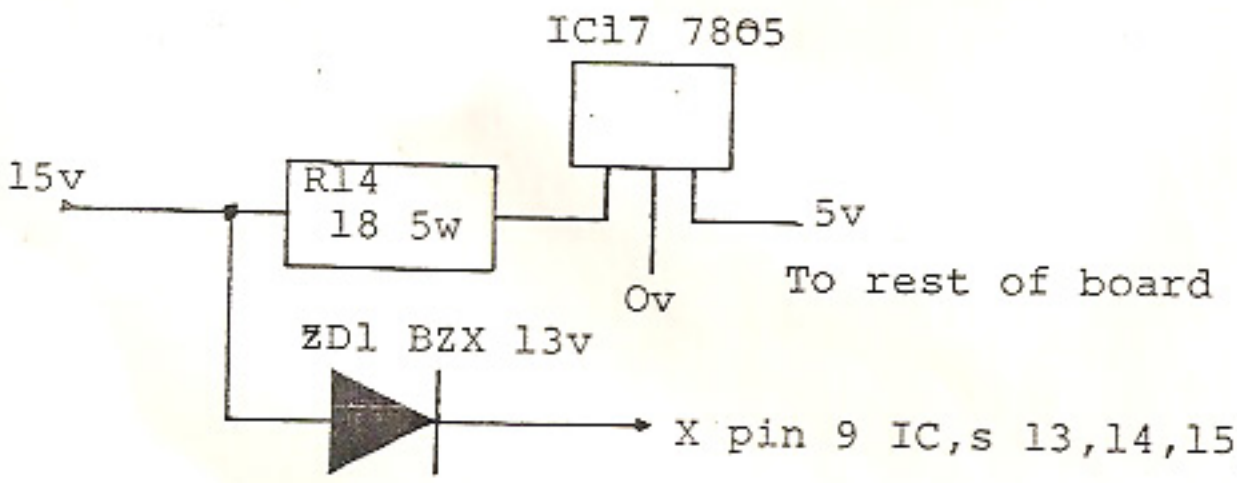
Ribbon Cable To Stepper Motor Connections

Qa Black or Green
Qb Red or Purple
Qc Brown or Blue
Qd Orange or Grey
+15v Yellow or white



Motor Assignments To Functions

Motor 1 = Grip
Motor 2 = Left Wrist
Motor 3 = Right Wrist
Motor 4 = Elbow
Motor 5 = Shoulder
Motor 6 = Base



ELECTRONICS

3.1 Description

The Interface

To enable the Armdroid to function with as wide a range of microprocessor equipment as possible, the interface is designed round a standard 8-bit bidirectional port. This may be latched or non-latched. If non-latched, the interface will normally be used to input data to the micro.

In the output mode the port is configured as follows. The eight lines are defined as four data bits (D8-D5), three address bits (D4-D2) and one bit (D1) to identify the direction of data travel on the port. Four data lines are provided so that the user can control the stepper motor coils direct from computer.

The address bits are used to channel the step pattern to the selected motor. The three address bits can define eight states, of which 1-6 are used to select one of the motors, while states 0 and 7 are unallocated.

D1 indicates the direction of data travel, to the motors when D1 is low, from the microswitches, if installed, when D1 is high. The transition of D1 from high to low generates a pulse which causes the step pattern to be latched into the addressed output latch.

In the input mode D8 - D3 are used to read the six microswitches on the arm. These reed switches and magnets provide a "zero" point for each of the movements of the arm, which can be used as reference points for resetting the arm in any position before a learning sequence begins.

D2 is spare. It is an input bit which can be buffered and used for an extra input sensor, allowing the user to connect a 'home brew' transducer to the system..

The interface circuitry consists of twelve TTL components which decode the data and route it out to the selected motor driven logic. IC1 and IC2 buffer the data out to the decoder and latches. IC6 decodes the three input address bits to provide eight select lines, six of which are for the latches IC7 - IC12.

INTERFACE ONLY

D1 is buffered and fed into a monostable (IC4) to generate a clock pulse. This causes the decoder to provide a latch pulse for approximately 500ns to the addresses motor control latch. D1 is tied to pull-up resister (R1) so that the line is high except when are output from the microprocessor. The buffers IC1 and IC2 are enabled by the buffered output of bit 1 so that data are fed to the latch inputs only when bit 1 is low. The bit 1 buffer is always enabled because its enable is tied low.

The microswitch inputs are buffered by IC5 which is enabled by the complemented output of bit1, so that when bit1 is high IC5 is enabled, and the contents of the microswitches will be input to the microporcessor. This allows the user to operate the arm under bit interupt control, giving instant response to a microswitch change and avoiding having to poll the micro-switches. The six microswitch inputs are pulled up; thus the switches can be connected via only one lead per switch, with the arm chassis acting as ground.

THE MOTOR DRIVERS

the motor drivers are designed so that the arm can be driven from the output of the computer interface circuitry.

The six motor driver stages need two power supplies: 15v at about 3A and 5v at 150 MA.

The four waveforms QA-QD are then fed into IC's 13-16 which are 7 x Darlington Transistor IC's. These provide the high current needed to drive the stepper motor coils, the driving current being about 300 MA at 15v.

CONNECTION OF THE ARMDROID TO THE TRS80 PRINTER PORT

The TRS80 printer port can be used to drive the robot arm, but when using the printer port it will not be possible to read the reed-switches connected to the arm as this port is not a bi-directional port. The TRS80 to ARMDROID connections are shown below.

TRS80 PRINTER PORT PIN CONNECTIONS	ARMDROID CONNECTION ON INTERFACE BOARD
18	+5 blanco
17	0 volts Neg
15	D8 Marron
13	D7 Rojo
11	D6 Naranja
9	D5 Amarillo
7	D4 Verde
5	D3 Azul
3	D2 Morado
	D1 gris

The software driving the motors should output data to the robot arm in the following manner.

The following Z80 code sequence assumes the correct driving pattern and motor address is in the Z80 accumulator.

```
OR      Ø  1H    ;  Set bit D1
LD      PORTAD,A;  Send data to port
AND     ØFEH     ;  Clear bit D1
LD      PORTAD,A;  Now latch data pulse to
                ;  selected motor
```

In the case of the TRS80 level 11 the printer port address is:

PORTAD equals 37E8H