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CONSTRUCTION OF A SUITABLE PORT FOR THE ARMDROID

A circuit diagram is given which describes in particular the construction of an 8 bit bi-directional, non latched port. The circuit as given is for the TRS8Ø bus, but it should be possible with reasonably simple modifications to alter it for most Z8O type systems.

The circuit described is a non latched port so the output data will appear for only a short period on the 8 data lines.

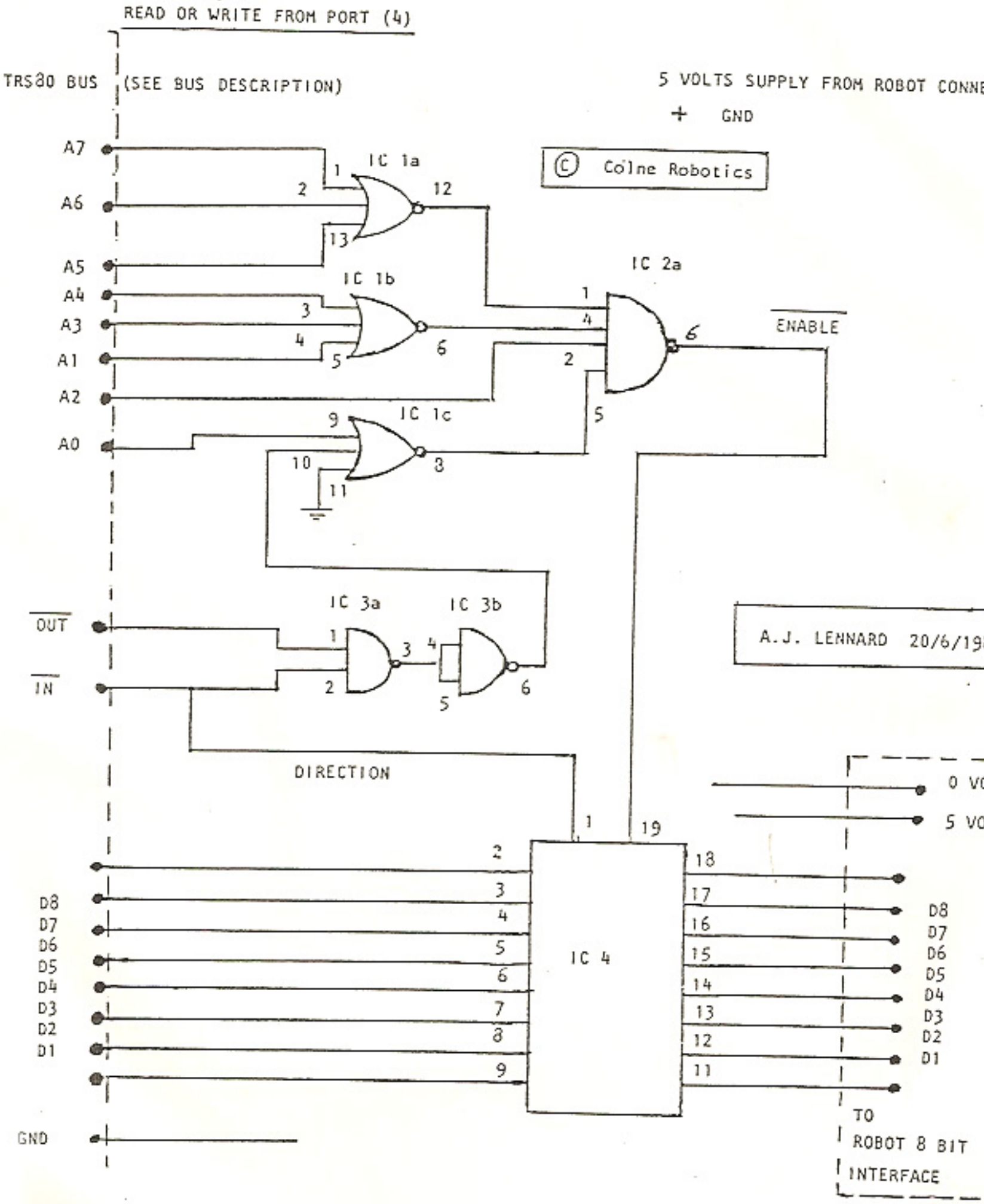
As can be seen from the diagram, the circuit draws its 5 volt power supply from the arm's interface port, and not from the processor it is connected to. The port was constructed this way due to the fact that some commercial microprocessor systems do not have a 5v output supply.

When the above circuit is connected to the arm's interface card the bottom bit is usually pulled high, thus if the user inputs from the port at any time the data presented will mirror the state of the reed switches.

To output data to the arm using this port the user should send the data to the port with the bottom bit cleared. The data will then be latched through to the addressed arm motor latch.

The components for the described port should be easily available from most sources.

TRS80 8 BIT INTERFACE (NON LATCHED BI-DIRECTIONAL)



IC 1:	74LS27	Pin 14: 5 Volts, Pin 7: GND	3*3 INPUT NOR
IC 2:	74LS20	Pin 14: 5 Volts, Pin 7: GND	2*4 INPUT NAND
IC 3:	74LS00	Pin 14: 5 Volts, Pin 7: GND	4*2 INPUT NAND
IC 4:	74LS245	Pin 20: 5 Volts, Pin 10: GND	OCTAL BUS TRANSCEIVER (Tri-state)

CONNECTION OF ARMDROID TO PET/VIC COMPUTERS

PET/VIC USER PORT CONNECTOR

PIN NO	PET/VIC NOTATION	ARMDROID NOTATION
C	PA0	D1
D	PA1	D2
E	PA2	D3
F	PA3	D4
H	PA4	D5
J	PA5	D6
K	PA6	D7
L	PA7	D8
N	GROUND	GROUND

I/O Register Addresses (User Ports)

VIA Data Direction Control: 37138

PET Data Directional Control Register: 59459

VIC I/O Register Address: 37136

PET Data Register Address: 59471

The data direction registers in the VIA define which bits on the respective user ports are input and which are to be used as output bits. A binary one in any bit position defines an output bit position and a zero defines that bit as an input bit.

SIMPLE BASIC ARM DRIVER FOR VIA (PET/VIC)

```
  5 L  =  37136:  Q = 37138
 10 PRINT "VIC ARMDROID TEST"
 20 PRINT
 30 PRINT "HALF STEP VALUES"
 40 T = 8: C = 2: S = 10: M = 1: I = 1: A$ = "F"
 50 FOR I = 1 TO T:  READ W(I):  PRINT W(I):  NEXT I
 60 POKE Q, 255
 70 INPUT "MOTOR NUMBER (1-6)"; M
 80 IF M<1 OR M>8 THEN 70
 90 INPUT "FORWARD BACKWARD"; A$
100 IF A$ = "F" THEN D = 0:  GOTO 130
110 IF A$ = "B" THEN D = 1:  GOTO 130
120 GOTO 90
130 INPUT "STEPS"; S
140 IF S<1 THEN 130
150 O = M + M +1
160 FOR Y = 1 TO S*C
170 F = W(I) + O
180 POKE L,F
190 POKE L,F-1
200 IF D = 0 THEN 230
210 I = I + 1:  IF I>T THEN I = 1
220 GOTO 240
230 I = I - 1:  IF I<1 THEN I = T
240 NEXT Y
250 GOTO 70
260 DATA 192, 128, 144, 16, 48, 32, 96, 64
```

THE VALVES FOR L AND Q FOR THE PET ARE

Q = 59459 = DATA DIRECTION
L = 59471 = I/O

MOTOR STEP RELATIONSHIP PER DEGREE INCREMENT

Below are shown the calculations for each joint to enable the user to calculate the per motor step relationship to actual degree of movement.

These constants will necessary for users wishing to formulate a cartesian frame reference system or a joint related angle reference system.

Base

Motor step angle x ratio 1 x ratio 2

$$7.5^{\circ} \times \frac{20 \text{ teeth}}{72 \text{ teeth}} \times \frac{12 \text{ teeth}}{108 \text{ teeth}}$$

= Ø.2314 degree step or 4.32152 steps per degree.

Shoulder

$$7.5 \times \frac{14 \text{ teeth}}{72 \text{ teeth}} \times \frac{12 \text{ teeth}}{108 \text{ teeth}}$$

= Ø.162 degree per step or 6.17284 steps per degree

Elbow

Same as shoulder joint

Wrists

Same as base joint calculations

Hand

$$7.5 \times \frac{20 \text{ teeth}}{72 \text{ teeth}} \times \frac{12 \text{ teeth}}{108 \text{ teeth}} = Ø.231 \text{ degree per step}$$

$$\frac{\pi \times d \times .231}{360} = (Ø.Ø524/2)\text{mm}$$

=Ø.Ø262mm = hand pulley motion per step

Total hand open to close pulley movement = 2Ø.Ømm

Angle traversed by single finger = 5Ø°

$$\frac{5Ø^{\circ}}{2Ø.Ø \text{ mm}} \times Ø.Ø262\text{mm}$$

= Ø.Ø655° per step or 15.2672 step per degree

π = 3.1415926

d = 26mm = pulley diameter

SOME OVERALL DIMENSIONS

Shoulder	pivot to pivot	= 190mm
Forearm	pivot to pivot	= 190mm
Finger	wrist pivot to fingers closed wrist pivot to finger open (90)	= 90mm = 99mm

Bottom of base to shoulder pivot = 238mm

ANGULAR JOINT SPANS

Shoulder	up = 153	,down 45
Forearm	up = 45	,down 150
Wrist	up = 100	,down 100
Base	no limit ,but suggest caution not to overwind cables in base	
Hand	fingers move over 50	

(All above measurements are in degrees)

NOTE

The above measurements were taken with the arm joints held in a horizontal plane.

SOME EXTRA POINTS TO BEAR IN MIND

a) Long Lead of LED goes to NEGATIVE
Short lead of LED goes via 4.7 kohm Resistor
to POSITIVE

b) Due to LED hole being slightly too large a grommot will first have to be fitted to the LED and its holder can then be super glued if necessary into the grommot.

c) The Torque available is largely a function of speed and hence the user can expect performance to deteriorate as speed is incresed. Tables are supplied earlier in the manual.

FINAL NOTE

BEST WISHES AND GOOD LUCK