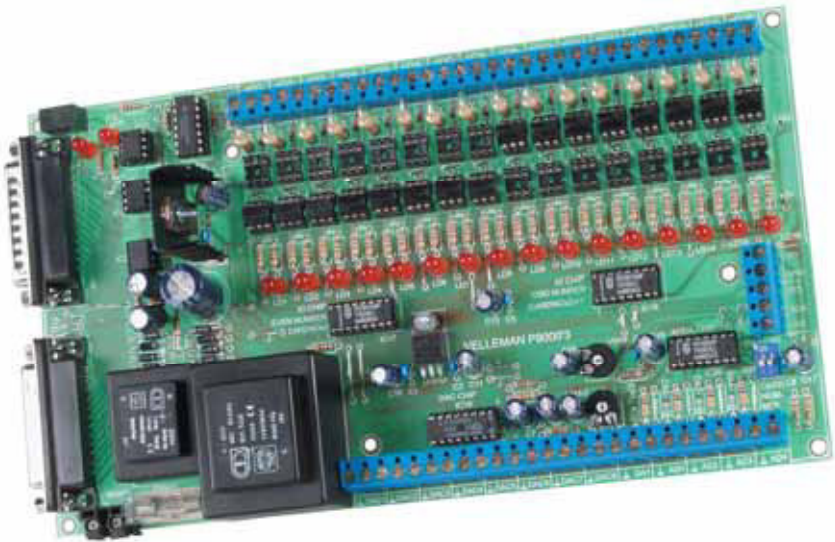


Computer interface board

The K8000 kit is the ideal introduction if you want learn how to drive devices with a program written on a PC in Turbo Pascal, C++, ...
Optically isolated from the PC.

Total solder points: 839

Difficulty level: *beginner* 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☒ *advanced*



K8000

Features :

- ☑ Optically isolated from computer.
- ☑ 16 optically isolated digital connections.
- ☑ 9 analogue outputs, of which one is high precision and 4 analogue inputs.
- ☑ A simple way of controlling using Turbo Pascal, Turbo C, Qbasic, Visual Basic.
- ☑ Printer bypass connector on board.
- ☑ Simple connection with printer port

SpecificationsDigital outputs:

- Optocoupler, open collector output: 50mA - max. 30VDC.

Digital inputs:

- Optocoupler input: 5V/5mA, max. 20V/40mA.

Analogue outputs :

- 8 outputs DAC1 to DAC8, resolution: 64 steps.
- Minimum output voltage: 0.1V at 2mA.
- Maximum output voltage: 11.5V adjustable at 2mA.
- Resolution per step from 0.1 to 11.5V: 160mV +/- 90mV.
- 1 precision output DA1, resolution: 256 steps.
- Minimum output voltage: 0V.
- Maximum output voltage: 4.5V adjustable at 0.5mA.
- Resolution per step from 0 to 4.5V: 17.5mV.

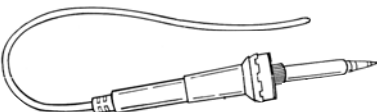
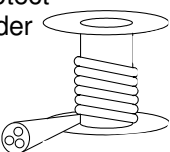
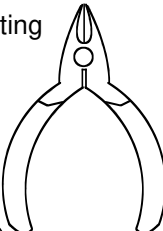
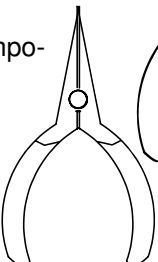
Analogue inputs :

- 4 analogue inputs AD1 to AD4, resolution: 256 steps.
- minimum input voltage: 0V.
- maximum input voltage: 5V.
- input impedance: 50Mohm.
- resolution: 19,5mV.
- Communication protocol: I²Cbus.
- LED indication for each I/O.
- 25 pin D series connector for computer.
- 25 pin D series connector for printer.
- Supply voltage: 230Vac.
- PCB dimensions: 237 x 133mm (9.3" x 5.2").

1. Assembly (Skipping this can lead to troubles !)

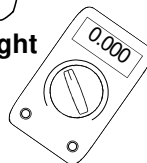
Ok, so we have your attention. These hints will help you to make this project successful. Read them carefully.

1.1 Make sure you have the right tools:

- A good quality soldering iron (25-40W) with a small tip. 
- Wipe it often on a wet sponge or cloth, to keep it clean; then apply solder to the tip, to give it a wet look. This is called 'thinning' and will protect the tip, and enables you to make good connections. When solder rolls off the tip, it needs cleaning. 
- Thin raisin-core solder. Do not use any flux or grease.
- A diagonal cutter to trim excess wires. To avoid injury when cutting excess leads, hold the lead so they cannot fly towards the eyes. 
- Needle nose pliers, for bending leads, or to hold components in place. 
- Small blade and Phillips screwdrivers. A basic range is fine.



For some projects, a basic multi-meter is required, or might be handy



1.2 Assembly Hints :

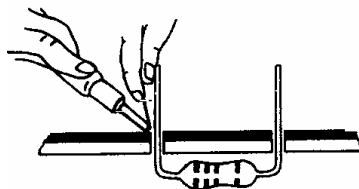
- ⇒ Make sure the skill level matches your experience, to avoid disappointments.
- ⇒ Follow the instructions carefully. Read and understand the entire step before you perform each operation.
- ⇒ Perform the assembly in the correct order as stated in this manual
- ⇒ Position all parts on the PCB (Printed Circuit Board) as shown on the drawings.
- ⇒ Values on the circuit diagram are subject to changes.
- ⇒ Values in this assembly guide are correct*

- ⇒ Use the check-boxes to mark your progress.
- ⇒ Please read the included information on safety and customer service

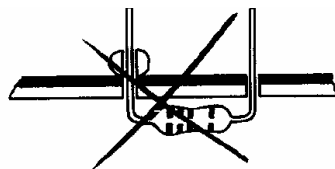
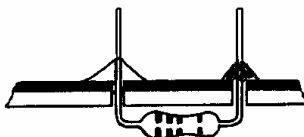
* Typographical inaccuracies excluded. Always look for possible last minute manual updates, indicated as 'NOTE' on a separate leaflet.

1.3 Soldering Hints :

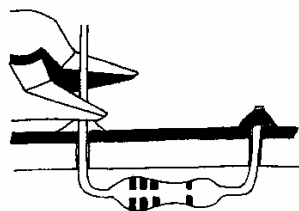
1- Mount the component against the PCB surface and carefully solder the leads



2- Make sure the solder joints are cone-shaped and shiny

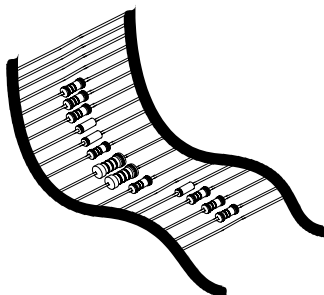


3- Trim excess leads as close as possible to the solder joint



AXIAL COMPONENTS ARE TAPED IN THE CORRECT MOUNTING SEQUENCE !

REMOVE THEM FROM THE TAPE ONE AT A TIME !



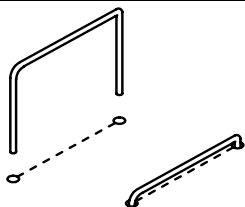
Mount the components in the order indicated in the separate part list. The parts marked with (!) require special attention in the assembly instructions.

IMPORTANT : Read the disk file READ.ME before commencing assembly. This file will report any updated changes.

ATTENTION : If the card is to be built as an expansion card (Slave) to one already connected to the computer (Master), the components marked with **S** should not be mounted.

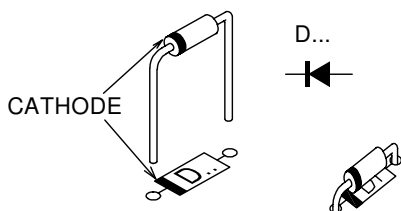
1. Jump wires.

☐ J



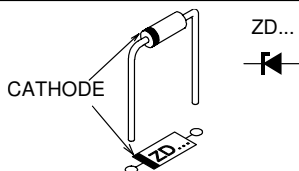
- ☐ D17 : 1N4007 (**S**)
- ☐ D18 : 1N4007 (**S**)
- ☐ D19 : 1N4007 (**S**)
- ☐ D20 : 1N4007 (**S**)
- ☐ D21 : 1N4007
- ☐ D22 : 1N4007
- ☐ D23 : 1N4007
- ☐ D24 : 1N4007

2. Diodes (check the polarity)



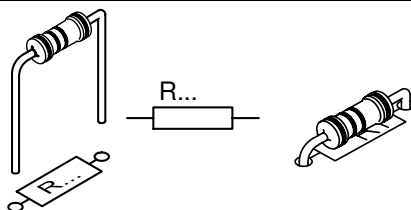
- ☐ D1 : 1N4148
- ☐ D2 : 1N4148
- ☐ D3 : 1N4148
- ☐ D4 : 1N4148
- ☐ D5 : 1N4148
- ☐ D6 : 1N4148
- ☐ D7 : 1N4148
- ☐ D8 : 1N4148
- ☐ D9 : 1N4148
- ☐ D10 : 1N4148
- ☐ D11 : 1N4148
- ☐ D12 : 1N4148
- ☐ D13 : 1N4148
- ☐ D14 : 1N4148
- ☐ D15 : 1N4148
- ☐ D16 : 1N4148

3. Zener diode (check the polarity)



- ☐ ZD1 : 4,7V (4V7) (**S**)

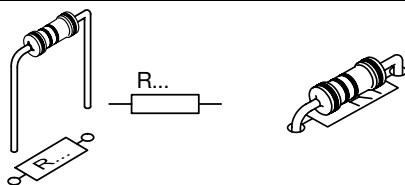
4. 1/4W Resistors.



- ☐ R1 : 100 (1-0-1-B)
- ☐ R2 : 100 (1-0-1-B)
- ☐ R3 : 100 (1-0-1-B)
- ☐ R4 : 100 (1-0-1-B)
- ☐ R5 : 100 (1-0-1-B)
- ☐ R6 : 100 (1-0-1-B)

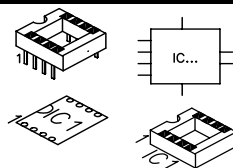
<input type="checkbox"/> R7 : 100 (1-0-1-B)
<input type="checkbox"/> R8 : 100 (1-0-1-B)
<input type="checkbox"/> R9 : 100 (1-0-1-B)
<input type="checkbox"/> R10 : 100 (1-0-1-B)
<input type="checkbox"/> R11 : 100 (1-0-1-B)
<input type="checkbox"/> R12 : 100 (1-0-1-B)
<input type="checkbox"/> R13 : 100 (1-0-1-B)
<input type="checkbox"/> R14 : 100 (1-0-1-B)
<input type="checkbox"/> R15 : 100 (1-0-1-B)
<input type="checkbox"/> R16 : 100 (1-0-1-B)
<input type="checkbox"/> R17 : 100 (1-0-1-B) (S)
<input type="checkbox"/> R18 : 100 (1-0-1-B) (S)
<input type="checkbox"/> R19 : 47 (4-7-0-B) (S)
<input type="checkbox"/> R20 : 150 (1-5-1-B)
<input type="checkbox"/> R21 : 220 (2-2-1-B)
<input type="checkbox"/> R22 : 220 (2-2-1-B)
<input type="checkbox"/> R23 : 220 (2-2-1-B)
<input type="checkbox"/> R24 : 220 (2-2-1-B)
<input type="checkbox"/> R25 : 220 (2-2-1-B)
<input type="checkbox"/> R26 : 220 (2-2-1-B)
<input type="checkbox"/> R27 : 220 (2-2-1-B)
<input type="checkbox"/> R28 : 220 (2-2-1-B)
<input type="checkbox"/> R29 : 220 (2-2-1-B)
<input type="checkbox"/> R30 : 220 (2-2-1-B)
<input type="checkbox"/> R31 : 220 (2-2-1-B)
<input type="checkbox"/> R32 : 220 (2-2-1-B)
<input type="checkbox"/> R33 : 220 (2-2-1-B)
<input type="checkbox"/> R34 : 220 (2-2-1-B)
<input type="checkbox"/> R35 : 220 (2-2-1-B)
<input type="checkbox"/> R36 : 220 (2-2-1-B)
<input type="checkbox"/> R37 : 1K (1-0-2-B)
<input type="checkbox"/> R38 : 1K (1-0-2-B)
<input type="checkbox"/> R39 : 4K7 (4-7-2-B) (S)
<input type="checkbox"/> R40 : 4K7 (4-7-2-B) (S)
<input type="checkbox"/> R41 : 4K7 (4-7-2-B) (S)
<input type="checkbox"/> R42 : 4K7 (4-7-2-B) (S)
<input type="checkbox"/> R43 : 4K7 (4-7-2-B) (S)
<input type="checkbox"/> R44 : 4K7 (4-7-2-B) (S)
<input type="checkbox"/> R45 : 4K7 (4-7-2-B) (S)
<input type="checkbox"/> R46 : 4K7 (4-7-2-B)
<input type="checkbox"/> R47 : 4K7 (4-7-2-B)
<input type="checkbox"/> R48 : 1k8 (1-8-2-B)
<input type="checkbox"/> R66 : 220 (2-2-1-B)

5. 1/2W Resistors.

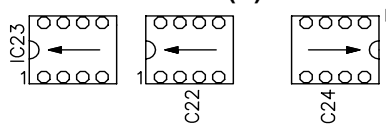


☐ R49 : 10 (1-0-0-B-9) (S)

6. IC sockets

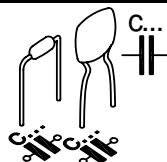


- ☐ IC1 ... IC16 : 6P
- ☐ IC17 ... IC20 : 16P
- ☐ IC21 : 14P (S)
- ☐ IC22 ... IC24 : 8P (S)



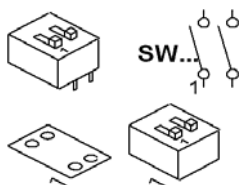
Attention : Look carefully on the direction of the notch of IC24

7. Capacitors



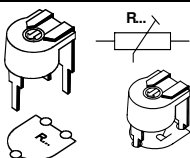
- ☐ C1 : 100n (104, 0.1, u1)
- ☐ C2 : 100n (104, 0.1, u1)
- ☐ C3 : 100n (104, 0.1, u1)
- ☐ C4 : 100n (104, 0.1, u1)
- ☐ C5 : 100n (104, 0.1, u1)
- ☐ C6 : 100n (104, 0.1, u1)
- ☐ C7 : 100n (104, 0.1, u1)
- ☐ C8 : 100n (104, 0.1, u1)
- ☐ C9 : 100n (104, 0.1, u1)

8. Dip Switch



□ SW1 : 2P DIP

9. Resistor Trimmer



□ RV1, RV2 : 10K

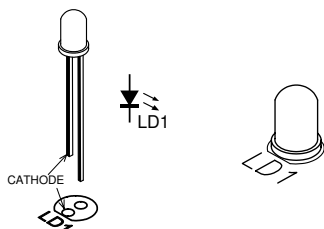
Rv1 = Vmax.

Max DAC output voltage : 0 ...10V

RV2 = Vref.

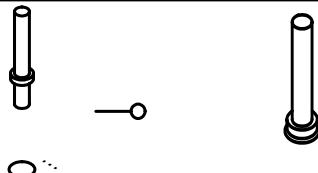
Max IN/OUT voltage : 0 ...5V

10. LEDs. Check the polarity!



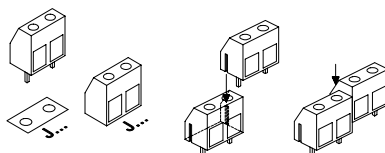
- | | |
|--------------|------------------|
| □ LD1 : 5mm | □ LD11 : 5mm |
| □ LD2 : 5mm | □ LD12 : 5mm |
| □ LD3 : 5mm | □ LD13 : 5mm |
| □ LD4 : 5mm | □ LD14 : 5mm |
| □ LD5 : 5mm | □ LD15 : 5mm |
| □ LD6 : 5mm | □ LD16 : 5mm |
| □ LD7 : 5mm | □ LD17 : 5mm (S) |
| □ LD8 : 5mm | □ LD18 : 5mm (S) |
| □ LD9 : 5mm | □ LD19 : 5mm (S) |
| □ LD10 : 5mm | |

11. PCB tab



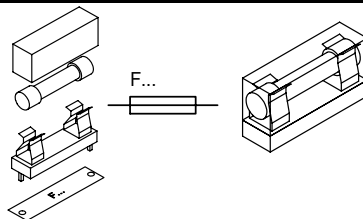
□ I/O1 ... 16; GND; +5V

12. Terminal blocks



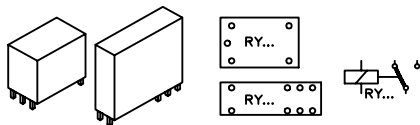
- | | |
|------------|--------------|
| □ J1 : 2P | □ J17 : 2P |
| □ J2 : 2P | □ J18 : 2P |
| □ J3 : 2P | □ J19 : 2P |
| □ J4 : 2P | □ J20 : 2P |
| □ J5 : 2P | □ J21 : 2P |
| □ J6 : 2P | □ J22 : 2P |
| □ J7 : 2P | □ J23 : 2P |
| □ J8 : 2P | □ J24 : 2P |
| □ J9 : 2P | □ J25 : 2P |
| □ J10 : 2P | □ J26 : 2P |
| □ J11 : 2P | □ J27 : 2P |
| □ J12 : 2P | □ J28 : 2P |
| □ J13 : 2P | □ J29 : 2P |
| □ J14 : 2P | □ J30 : 2P |
| □ J15 : 2P | □ J31 : 3P ! |
| □ J16 : 2P | □ J31' : 2P |

13. Fuse



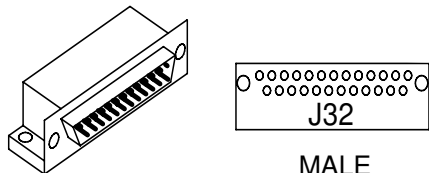
□ F1 : 250mA

14. Relay

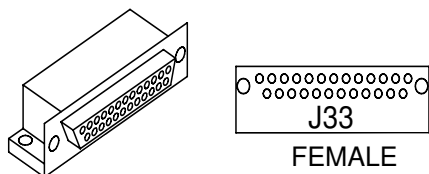


□ RY1 : OUC-5 (S)

15. 25P sub D connectors



MALE



FEMALE

□ J32 : 25P SUB D (!)

□ J32 : 25P SUB D (!)

16. 1W Resistors

□ R50 : 470 (4-7-1-B)

□ R51 : 470 (4-7-1-B)

□ R52 : 470 (4-7-1-B)

□ R53 : 470 (4-7-1-B)

□ R54 : 470 (4-7-1-B)

□ R55 : 470 (4-7-1-B)

□ R56 : 470 (4-7-1-B)

□ R57 : 470 (4-7-1-B)

□ R58 : 470 (4-7-1-B)

□ R59 : 470 (4-7-1-B)

□ R60 : 470 (4-7-1-B)

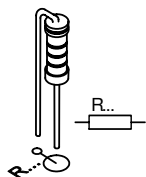
□ R61 : 470 (4-7-1-B)

□ R62 : 470 (4-7-1-B)

□ R63 : 470 (4-7-1-B)

□ R64 : 470 (4-7-1-B)

□ R65 : 470 (4-7-1-B)



17. Electrolytic capacitors. Check the polarity !

□ C10 : 100 μ F

□ C11 : 100 μ F

□ C12 : 100 μ F

□ C13 : 100 μ F

□ C14 : 100 μ F

□ C15 : 100 μ F

□ C16 : 100 μ F

□ C17 : 100 μ F

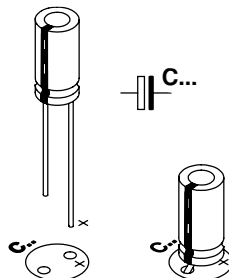
□ C18 : 100 μ F

□ C19 : 100 μ F

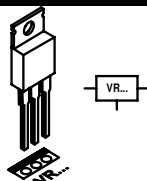
□ C20 : 470 μ F (S)

□ C21 : 470 μ F (S)

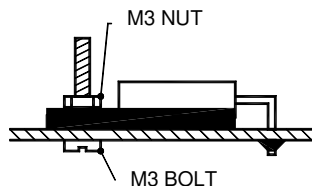
□ C22 : 2200 μ F



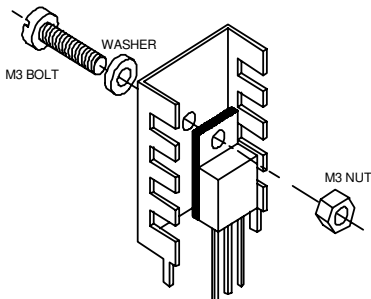
18. Voltage regulator. The back side corresponds to the thick line.



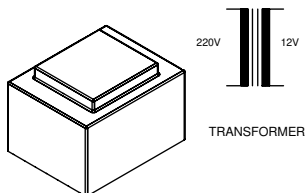
□ VR1 : UA7812!



□ VR2 : UA7805!

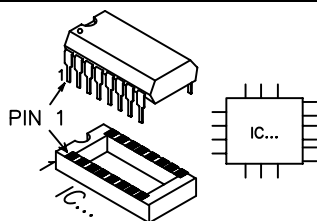


19. Transformers



- ☐ TRANSFO 1 : 1 X 15V (2X7,5V)
- ☐ TRANSFO 2 : 1 X 6V (S)

20. IC's. check the position !



- | | |
|---------------------------------------|--|
| <input type="checkbox"/> IC1 : 4N33 ! | <input type="checkbox"/> IC9 : 4N33 ! |
| <input type="checkbox"/> IC2 : 4N33 ! | <input type="checkbox"/> IC10 : 4N33 ! |
| <input type="checkbox"/> IC3 : 4N33 ! | <input type="checkbox"/> IC11 : 4N33 ! |
| <input type="checkbox"/> IC4 : 4N33 ! | <input type="checkbox"/> IC12 : 4N33 ! |
| <input type="checkbox"/> IC5 : 4N33 ! | <input type="checkbox"/> IC13 : 4N33 ! |
| <input type="checkbox"/> IC6 : 4N33 ! | <input type="checkbox"/> IC14 : 4N33 ! |
| <input type="checkbox"/> IC7 : 4N33 ! | <input type="checkbox"/> IC15 : 4N33 ! |
| <input type="checkbox"/> IC8 : 4N33 ! | <input type="checkbox"/> IC16 : 4N33 ! |

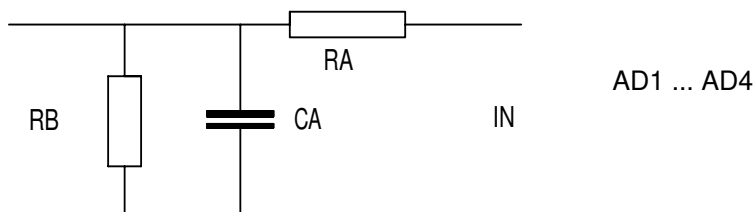
- ☐ IC17: PCF8574A !
- ☐ IC18: PCF8574A !

- ☐ IC19: TDA8444 !
- ☐ IC20 : PCF8591 !
- ☐ IC21 : 74LS125 (S)

- ☐ IC22 : 6N136 (S)
- ☐ IC23 : 6N136 (S)
- ☐ IC24 : 6N136 (S)

21. Information

If desired, a voltage divider or filter can be fitted on each analogue input. The voltage divider can be useful if a higher input voltage than normal is to be monitored. Normally only a maximum of 5V can be accepted by the input. The filter can be useful for eliminating (mains) hum from the signal for example. Points A to D give examples.



- A** No attenuation and no filtering (input impedance= 100K). In place of RA a jump wire needs to be fitted. RA is a resistor. Nothing should be fitted in place of CA.

$R_i = 100K$
 RA : J
 RB : 100K (1-04-B)
 CA : /

- B** 50Hz mains filter (low-pass filter). By use of the formula, different values for RA and CA can be calculated as a function of the desired frequency. If a high value for CA is arrived at, then an electrolytic capacitor can be used, but check the polarity.

Freq. = 50Hz / -3dB

RA : 10K
 RB : /
 CA : 330nF

$$CA = \frac{1}{6,28 \times f \times RA}$$

- C** An input attenuator of 10. This means that up to 50V may be connected to the input, which is then reduced by a factor of 10. With the first values the input impedance is 20k. With the values in brackets the input impedance is 200k. With higher input voltages it is advisable to choose high values for the resistors, otherwise resistors of a high power rating must be used for RA.

Att = 10

RA : 18K (180K)
 RB : 2K (20K)
 CA : /

$$att = \frac{RB}{RA + RB}$$

D Conversion of current to voltage. In order to avoid interruptions, it is possible for a variable current to be measured as the reference input value which is used for current to voltage conversion. Here a variable current from 4 to 20 mA is converted to a voltage of 0.8 to 4V.

$$4\text{—}20\text{mA} > 0,8\text{—}4\text{V}$$

RA : J

RB = 200 ohm

CA = /

22. Connection numbering

Output numbering is important, especially if a number of cards are to be used together as these numbers will be used by the control programmes. Cut out the desired numbers from the sticky labels provided.

Input/Outputs (I/O):

I/O1 to I/O16, or if used as slave

I/O17 to I/O32

I/O33 to I/O48 or I/O49 to I/O64.

Analogue outputs (DAC):

DAC1 to DAC8, or if used as slave

DAC9 to DAC16

DAC17 to DAC24 or DAC25 to DAC32.

Precision analogue output (DA):

DA1, or if used as slave

DA2, DA3 or DA4.

Analogue inputs (AD):

AD1 to AD4, or if used as slave

AD5 to AD8; AD9 to AD12 or AD13 to AD16.

23. Test and Connection

TEST

Prior to testing the card by computer a number of "passive" tests can be done. Connect the connectors, MAINS N and L to the supply voltage.

Normally no LEDs should light up.

Measure the voltage on testpin +5V to see if the 5V supply voltage is present.

Connect the test points 1 to 16, one by one, with the earth (GND) testpin.

Normally the LED from the respective channel should light up.

CONNECTION

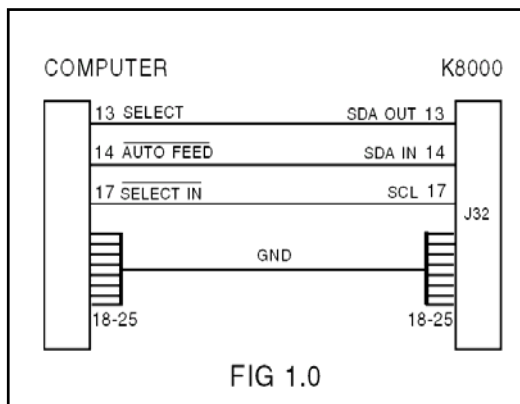
The computer can be connected to the card via a standard cable.

If no printer is to be connected in, a cable can be made up, such as shown in figure 1.0 (the length of the cable has been tested to 10m).

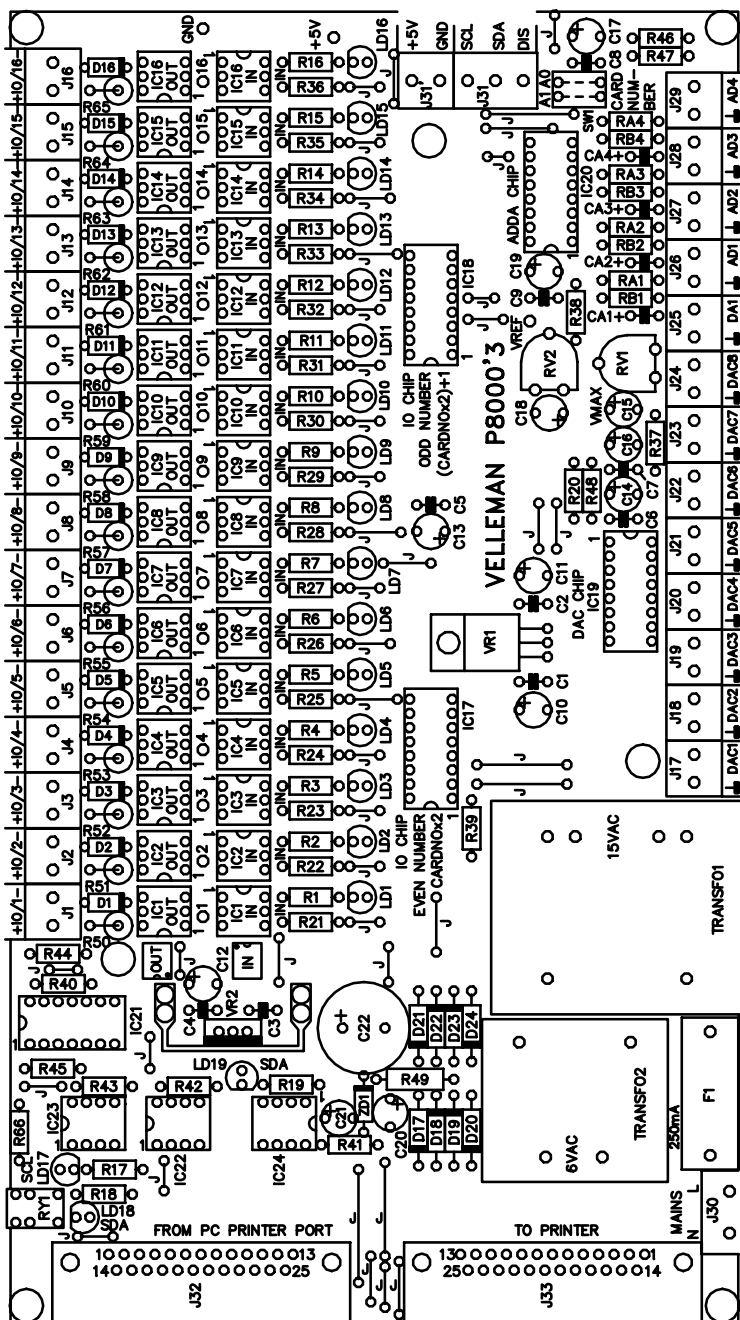
NB: if the printer feed through connector is used and problems subsequently occur with printing, then shorter cables must be used.

If the card has been built as a slave unit, then it must be connected via the three pole connector J31 and through to the GNR, SCL and SDA connections.

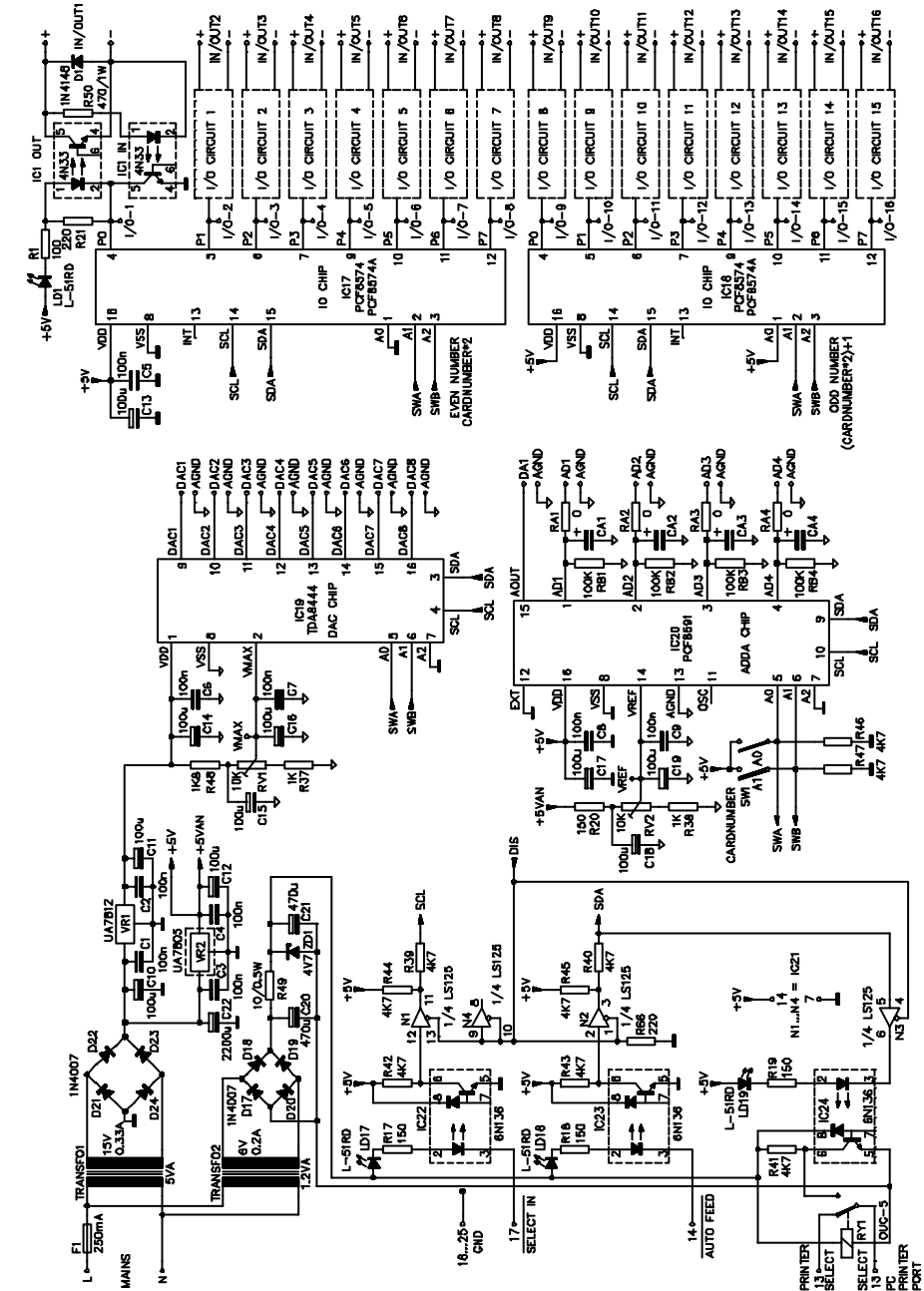
See the users manual for further connection configurations and tests.



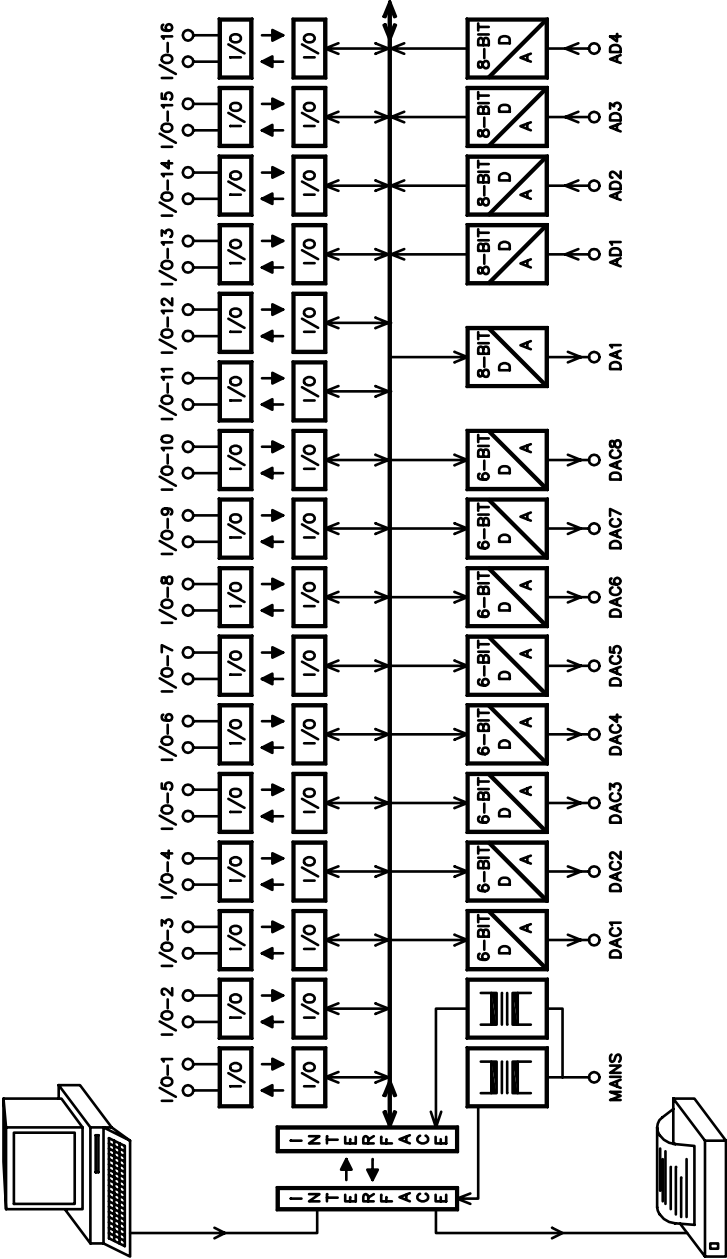
24. PCB



25. Digital selection



26. Opto Coupler selection





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