PCAD12/16H

16-Channel 12-bit ADC Board

Technical Manual

Product Information

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Arcom CONTROL SYSTEMS

Microsoft WindowsNT

FREE Windows NT4.0 Drivers

Visit the 'PC(ISA)bus Boards' page on the Arcom Website, www.arcom.co.uk/ntdrv10_AR.exe to download.

Preface

Packing List

This product is shipped as follows:

- Board
- User Manual
- Utility Disk
- PCbus Library Datasheet

If any of the above appear to be missing, please telephone Arcom 01223 411200.

Utility Disk

This product is shipped with a utility disk which contains:

- Demonstration Programs supplied as DOS ‘C’ libraries, which are compatible with Borland ‘C’ 4.0 and Microsoft Visual Basic 1.5
- PCbus Library Manual
- Source code for all PCbus I/O boards
- Test programs for calibration

Handling

This board contains CMOS devices which could be damaged in the event of static electricity being discharged through them. At all times please observe anti-static precautions when handling the board and always unpack and install the board in an anti-static working area.

Please ensure that should a board need to be returned to Arcom, it is adequately packed and if a battery is fitted, that it is isolated.

Revision History

Manual	PCB	Comments
Issue B	V1 Iss 4	960724
Issue C	V1 Iss 4	980115 ECO2684.

Arcom CONTROL SYSTEMS

Contents

Introduction

The PCAD12/16H is an 8-bit ISA bus add-on board with a 12-bit high-speed analogue to digital converter (ADC) and 16 differential, multiplexed inputs. Four alternative input voltage ranges may be selected through software, while uni-polar or bi-polar operation may be selected by jumpers. The board includes a programmable timer, which may be used to trigger the ADC periodically, or the ADC may be triggered directly through software or external signal.

The D-50 I/O connector conforms to Arcom's standard Signal Conditioning System (SCS) and may be used to drive a range of Signal Conditioning Boards (SCB); see Arcom's PCbus catalogue for more details.

Features

- CE compliant design
- 12-bit high-speed ADC : 20µs conversion time
- Four input ranges: 0.5V, 1V, 5V, 10V
- Uni-polar or bi-polar inputs
- 16 differential input channels : 50µs channel switching time
- Counter-Timer programmable for ADC conversion rate
- External trigger pulse, TTL low
- On-board analogue power supply
- Compact I/O addressing scheme (link-selectable base address)
- Board access LED
- User-controlled indicator LED
- 8-bit ISA bus interface
- I/O connector conforms to Arcom Signal Conditioning System (SCS)
- Operating temperature range, +5°C to +55°C
- Power required: +5V @ 200mA typical, +12V @ 200mA max
- MTBF: 275,000 hours (using generic figures from MIL-HDBK-217F at ground benign)

Getting Started

- Switch off PC
- Install board in supplied configuration
- Switch on PC
- Run EXAMP-01 (supplied on utility disk)
- An access/user LED should flash. If not check default link configuration

Operation

Reading or Writing to the Board

Control of the PCAD12/16H is achieved by writing to a **pointer register** and then accessing a **data register** to read or write the required function. The pointer register need only be written with a new value if a different data register is next to be accessed. ADC data is read from a pair of dedicated registers, so the pointer register does not need to be written first. The board occupies only four bytes of PCbus I/O space. Each time the board is accessed, the Red LED will flash momentarily.

ADC Sequence

The ADC may be triggered from three alternative sources, selected by a jumper:

- Software trigger, from reading a data register
- Hardware trigger, from an external TTL input, approx. 1-2µsec low pulse
- Periodic timer, programmed from the on-board CTC

In the second two cases an interrupt should be used to signal that a new value is ready.

With a software trigger all timing can be done from the program using this sequence:

- Select channel register and write channel value
- Select gain register and write gain value (only needed when gain changes)
- Delay for input settling (about 50µsec)
- Select software trigger register and read (value not defined)
- Delay for ADC conversion (about 20µsec)
- Select status register and read to check that new value is ready
- Read ADC data registers

Programmable Timer

The CTC device has three 16-bit down counters which are connected in a ‘daisy chain’ (i.e. OUT0 connected to IN1 and OUT1 connected to IN2). OUT1 or OUT2 can trigger the ADC, selected by a jumper. CT0 is clocked by a fixed 1MHz square wave. Referring to the Modes defined in the 8254 data sheet, the recommended programming is:

- CT0 set to Mode 3, count 3 (generate a 4µsec period square wave)
- CT1 set to Mode 2, count for selected timing period (rate generator multiple of 4µsec)
- CT2 set to Mode 2 (if required for longer periods)

I/O Map

A value written to the Pointer register is used to select the Function register next to be accessed. The dedicated registers for ADC data can be read without first setting the Pointer.

This board occupies four consecutive addresses and must be set to an address which is a multiple of 4. (e.g. 180h, 184h, 200h)

Address	Read/Write	Register Name	Register Function
Base	Write Only	Pointer Register	Select Data Register
Base + 1	Read/Write	Function Registers	On-board Data/Control
Base + 2	Read Only	ADC Low Byte	LS Data from ADC
Base + 3	Read Only	ADC High Byte	MS Data from ADC

I/O Function Registers

Pointer Value (hex)	Read/Write	Function Register Name	Data Bit	Function
00	Write	Channel Select	Bit 0-3 Bit 4-7	Channel MPX Address Expansion Address
01	Write	Gain Select (Full scale range)	Bit 0-1	0 = 10V Range 1 = 5V Range 2 = 1V Range 3 = 0.5V Range
02	Read	Software Trigger	None	
03	Read	Status	Bit 0	0 = Data available
08	Read/Write	CT0	Bit 0-7	See data sheet for
09	Read/Write	CT1	Bit 0-7	8254*
0A	Read/Write	CT2	Bit 0-7	See data sheet for
0B	Write	CTC Control	Bit 0-7	8254*
80	Write	User LED	Bit 0 only	See data sheet for 8254*
81	Read	Board Identification	Bit 0-7	See data sheet for 8254*

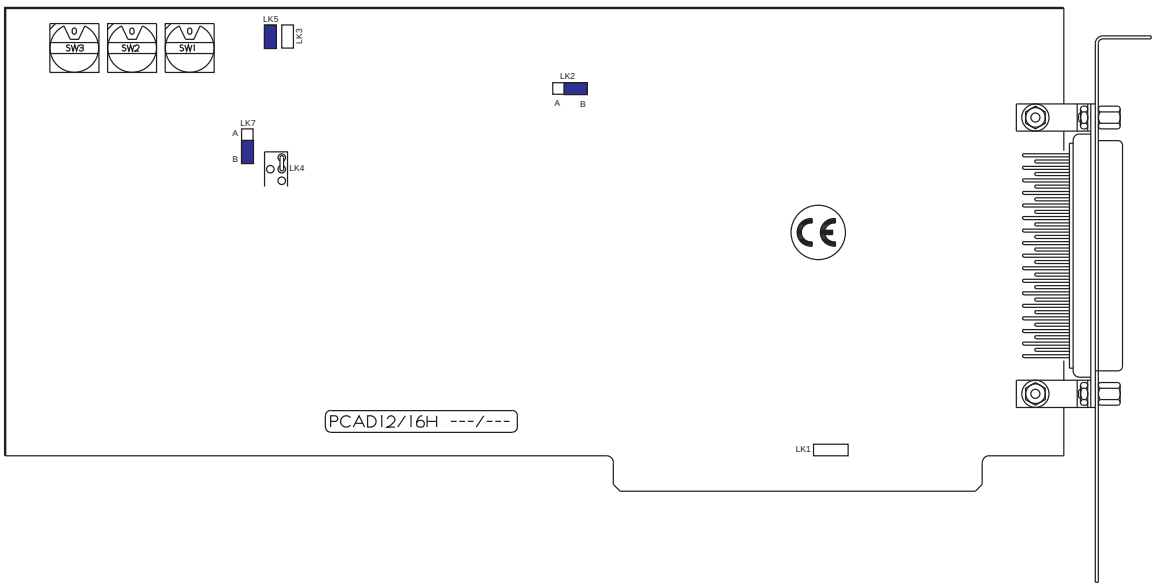
* You may obtain a data sheet from Arcom Technical Support by Telephoning:
+44 (0)1223 410 457

ADC Data Registers

Address	Register Name	Data Bit	Function
Base + 2	ADC Low Byte	Bit 0-3 Bit 4-7	MPX Channel Address ADC Data Bit 0-3
Base + 3	ADC High Byte	Bit 0-7	ADC Data Bit 4-11

Links and Switches

Default Link Position Diagram



Base Address Switches

The three rotary switches adjust the base address of the board. A hexadecimal value for the address is shown directly in the dial windows.

Board Functions

LK1 Interrupt Selection

This link is optional. If interrupts are required, fit either LK1A or LK1B.

LK1A	IRQ2
LK1B	IRQ3

LK2 Uni-polar, Bi-polar Conversion Rate

The full-scale range of the ADC is set by the program. These links determine whether the input range is 0 to full-scale or ± full-scale.

+	LK2A	Bi-polar Input Range (± full-scale)
	LK2B	Uni-polar Input Range (0 to full-scale)

LK3, LK5, LK6 Sampling Enable

One of these links must be in place for the ADC to operate. Normally only one of the three links should be fitted.

	LK3	Enable Hardware Trigger
+	LK5	Enable Software Trigger

LK4, ADC Clock Rate

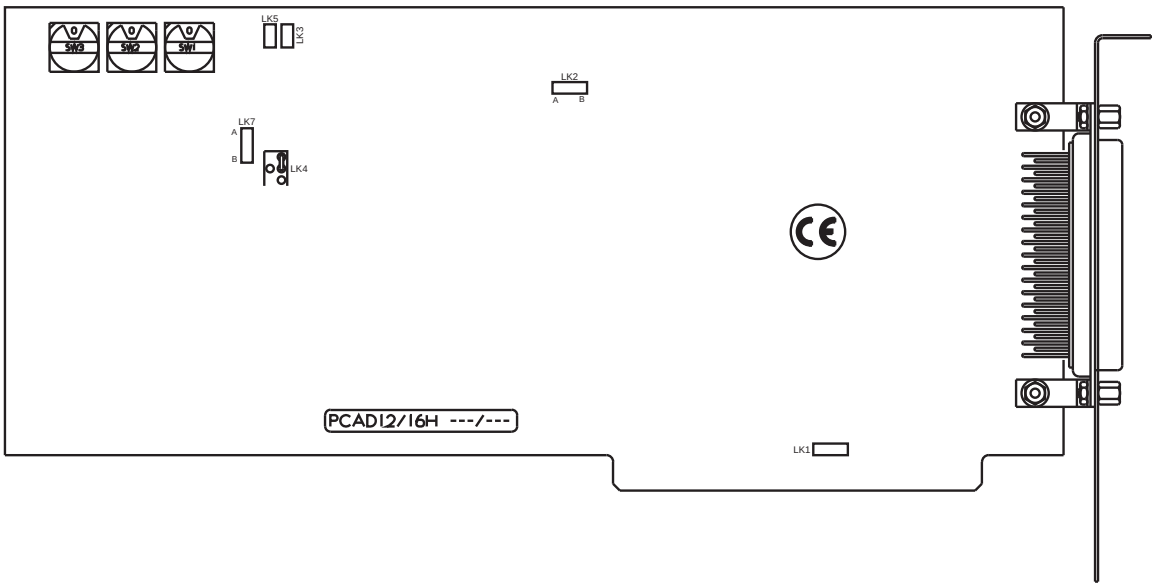
This link is hard wired at the factory to suit the speed of the ADC chip fitted.

LK7, CTC Select

Periodic triggering of the ADC is either driven from CT1, for shorter periods, or CT2, longer.

	LK7A	Trigger from CT1
+	LK7B	Trigger from CT2

User Configuration Record Diagram



Link	Default	User
LK1A		
LK1B		
LK2A		
LK2B		
LK3		
LK5		
LK7A		
LK7B		

Calibration

PCAD12/16H is accurately adjusted before leaving the factory, but may need re-calibration from time to time. The five trimmers on the board are intended to give fine adjustments only. Calibration will require a precision voltage source, a 5 digit DVM (or better) and a test program such as PCI216.BAS or ADSTAT8.C (utility disk).

VR1, VR2, Input Amplifier

- Set the board for uni-polar conversion
- Connect all inputs to analogue 0V
- Trim VR2 to a small reading e.g. 000Ch
- Switch through all gain settings and check the readings for all ranges
- Trim VR1 and VR2 progressively until all readings are the same (ideally 0000h to 0001h)

VR3, Uni-polar Gain

- Set the inputs to exactly half-scale
- Select the required gain range
- Trim VR3 until the display reading is 0800h

VR4, VR5 Bi-polar Gain and Zero

- Select the required gain
- Set the inputs to exactly 0V
- Trim VR5 until the display reading is 0800h
- Set the input to positive half-scale
- Trim VR4 until the display reading is 0C00h
- Set the input to negative half-scale

Connectors

D-50 Output Connector (PL2) Pin Assignments

Because most people will use ribbon cables with this board, the D-50 pin assignments are shown with the corresponding ribbon cable number, 1 to 50. For ease of reference, the corresponding 'D'-type connector pins are shown on the circuit diagram. The pin-out conforms to the Arcom Signal Conditioning System (SCS).

Ribbon Cable No.	D-50 Pin No.	Signal Title
1	1	0V
2	34	0V
3	18	INP0+
4	2	INP0-
5	35	INP1+
6	19	INP1-
7	3	INP2+
8	36	INP2-
9	20	INP3+
10	4	INP3-
11	37	0VA
12	21	
13	5	INP4+
14	38	INP4-
15	22	INP5+
16	6	INP5-
17	39	INP6+
18	23	INP6-
19	7	INP7+
20	40	INP7-
21	24	0VA
22	8	
23	41	INP8+
24	25	INP8-
25	9	INP9+
26	42	INP9-
27	26	INP10+
28	10	INP10-
29	43	INP11+
30	27	INP11-
31	11	0VA
32	44	SGATE
33	28	INP12+
34	12	INP12-
35	45	INP13+
36	29	INP13-
37	13	INP14+
38	46	INP14-
39	30	INP15+
40	14	INP15-
41	47	0VA
42	31	/RCONV
43	15	AX0
44	48	AX1
45	32	AX2
46	16	AX3
47	49	-12V
48	33	+12V
49	17	+5V
50	50	+5V

Installation for CE Compliance

To maintain compliance with the requirements of the EMC Directive (89/336/EEC), this product must be correctly installed. The PC in which the board is housed must be CE compliant as declared by the PC manufacturer. The external I/O cable should be the Arcom CAB50CE, or a fully screened cable to the same pattern.

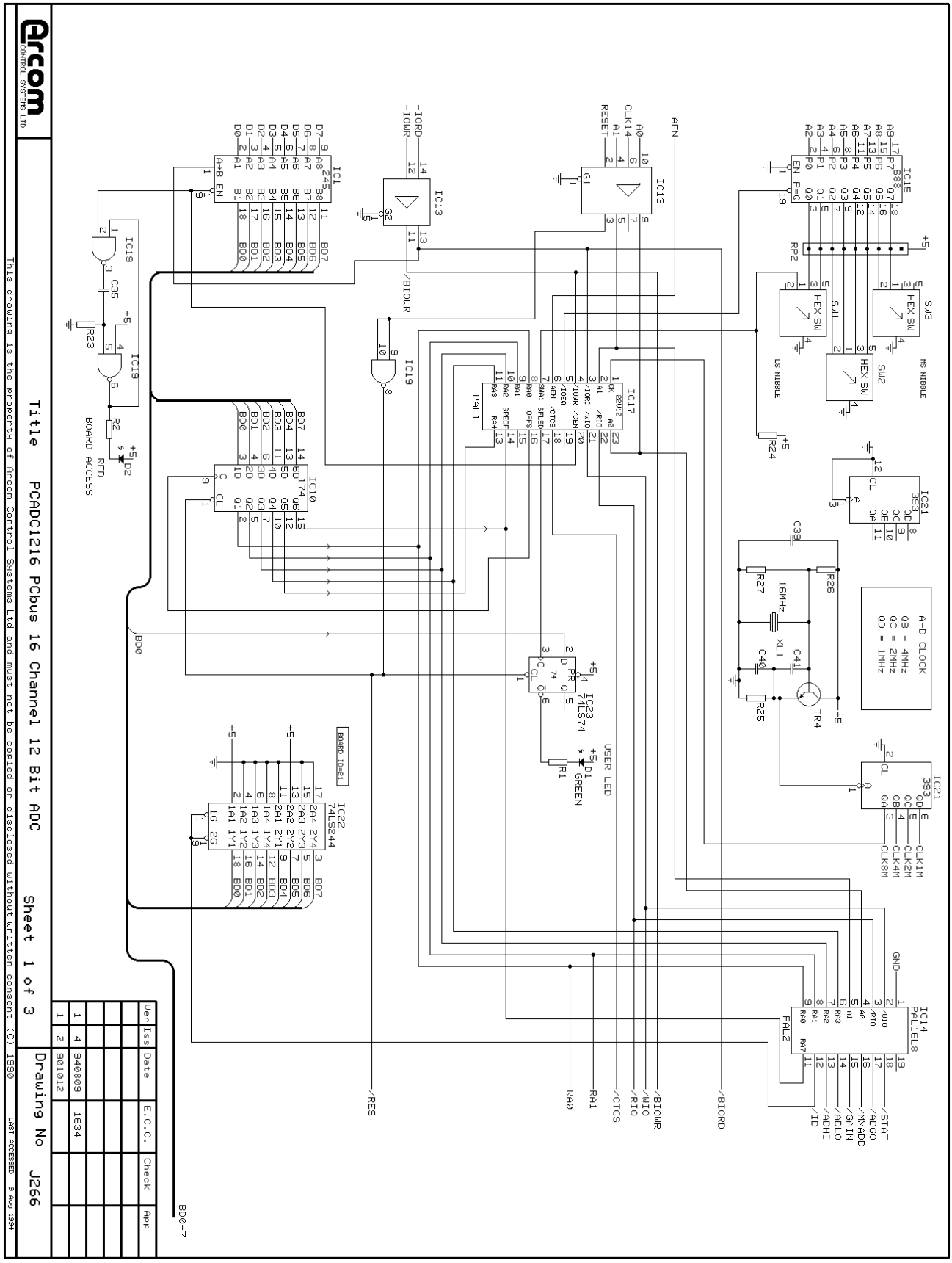
1. Remove the cover of the PC observing any additional instructions of the PC manufacturer
2. Locate the board in a spare ISA slot and press gently but firmly into place
3. Ensure that the metal bracket attached to the board is fully seated
4. Fit the bracket clamping screw and firmly tighten this on the bracket

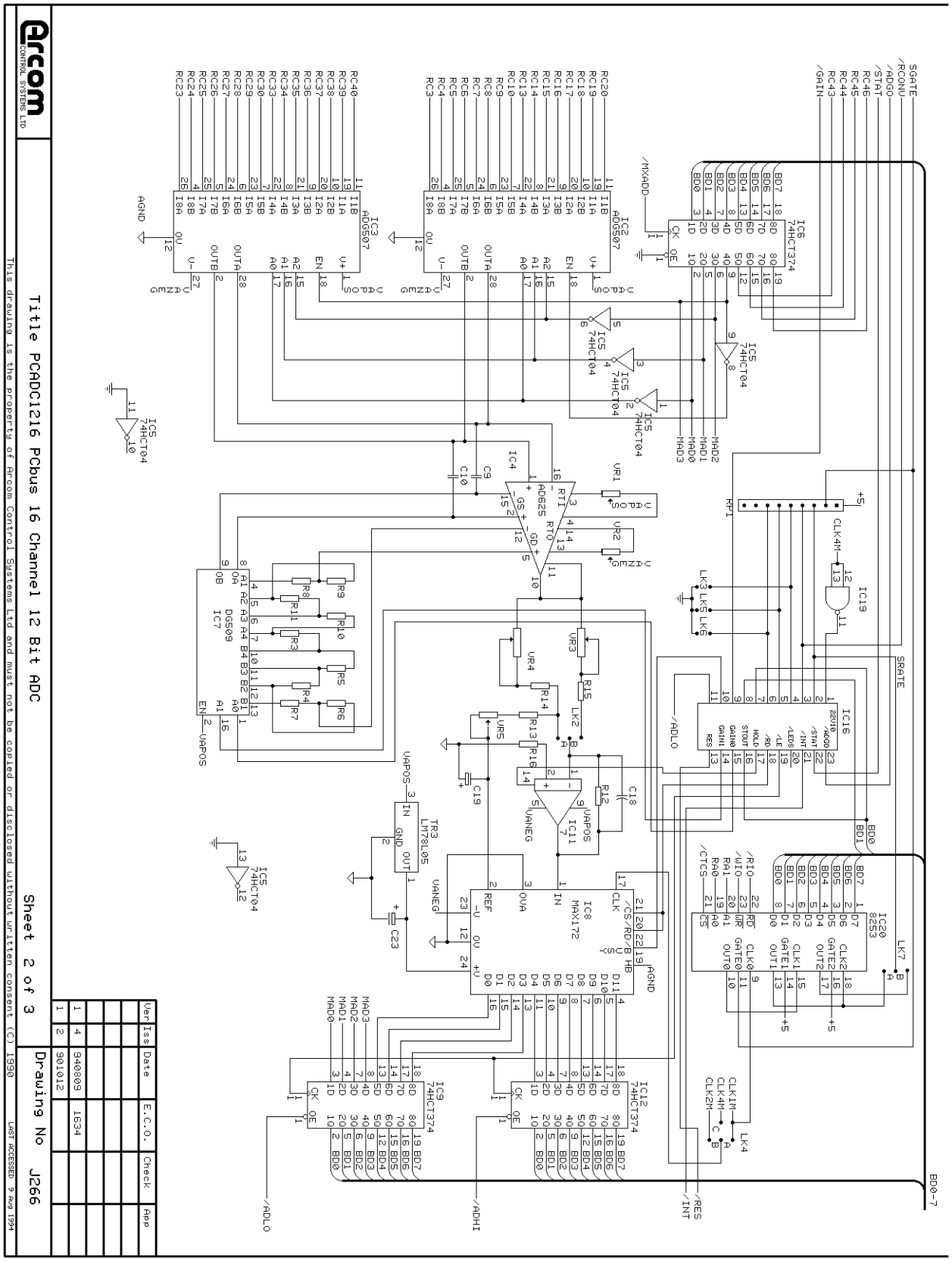
   NOTE: Good contact of the bracket to chassis is essential
5. Fit the screened I/O cable to the 50-way board connector
6. Ensure that the jack screws for the cable connector are tightened (use a screw driver)
7. Replace the cover of the PC observing any additional instructions of the PC manufacturer

The following standards have been applied to this product:

BS EN50081-1: 1992	Generic Emissions Standard, Residential, Commercial, Light Industry
BS EN50082-1: 1992	Generic Immunity Standard, Residential, Commercial, Light Industry
BS EN55022 : 1995	ITE Emissions, Class B, Limits and Methods

Circuit Diagrams




Arcom CONTROL SYSTEMS LTD
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Sheet 2 of 3
Drawing No J266
Ver Iss Date E.C.O. Check App
1 1 4 940809 1634
2 901012
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LAST ACCESSED 9 Aug 1994
SGATE
/RCONV
/ADGO
/STAT
/GAIN
/MXADD
IC6 74HCT374
IC2 ADG507
IC3 ADG507
IC4 AD625
IC5 74HCT04
IC7 DG509
IC8 MAX172
IC9 74HCT374
IC11
IC12 74HCT374
IC16 8253
IC19
IC20 8255
TR3 LM79L05
VR1
VR2
VR3
VR4
VR5
RP1
LK1
LK2
LK3
LK4
LK5
LK6
LK7
CLK4M
CLK1M
CLK2M
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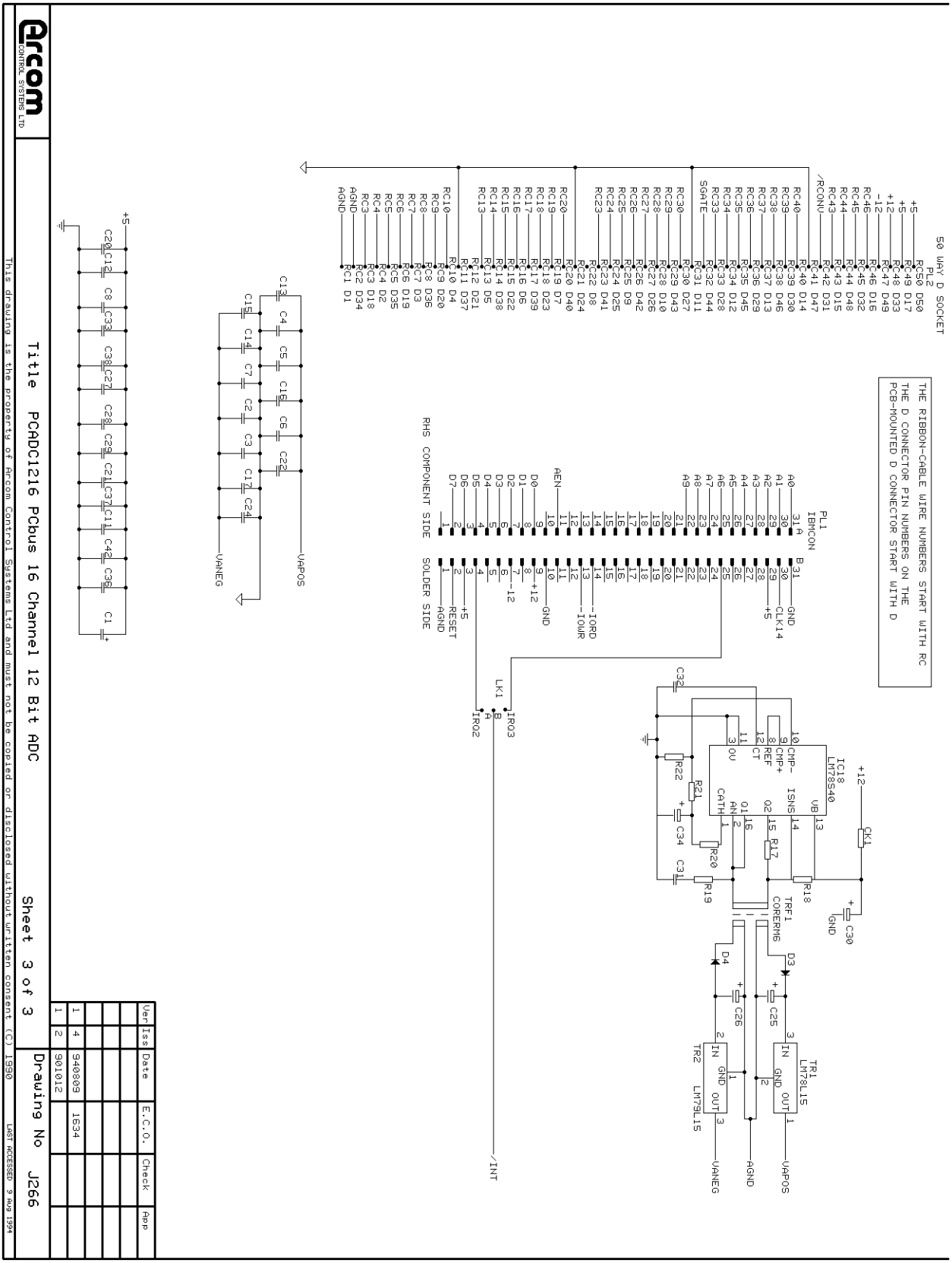
MAD2
MAD3
AGND
VAPOS
VANEG


50 WAY D SOCKET
PL2
THE RIBBON-CABLE WIRE NUMBERS START WITH RC
THE D CONNECTOR PIN NUMBERS ON THE
PCB-MOUNTED D CONNECTOR START WITH D
PL1
IBMCON
RHS COMPONENT SIDE
SOLDER SIDE
IC18
LM78S40
TR1
LM78L15
TR2
LM79L15
TRF1
CORERM6
LK1
Title PCADC1216 PCbus 16 Channel 12 Bit ADC
Sheet 3 of 3
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