PCSYSCON

PC Compatible
System Controller

Technical Manual

Product Information

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CONTROL SYSTEMS

Contents

Arcom CONTROL SYSTEMS

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Section 1. Introduction

The PCSYSCON

The PCSYSCON is a plug-in board for PC-compatibles. It can measure various conditions inside your PC and produce several sorts of alarm signals. It can also produce alarms from external analogue and digital signals, and it has eight general-purpose digital input and eight digital output lines.

The purpose of the board is to give advance warning of potential trouble in industrial PC systems. There are many possible sources of trouble, such as an aging or overloaded power supply, excessive temperature rise or programs that have crashed when controlling some critical process. The PCSYSCON can detect these conditions when properly set up.

However, a note of caution. If you are going to use the PCSYSCON to detect a potential problem, you must set it up and then create or simulate the problem. You will then be able to prove that your hardware and software can indeed detect the problem and take appropriate action. No amount of hardware is going to help if the program or operators fail to take any notice when a problem is detected.

About the PC

PC-compatibles are often used for I/O intensive applications with boards such as the PCSYSCON. Unfortunately, some features of the PC can make life difficult for users. We have tried to address these problems with the PCSYSCON. For example, it is sometimes difficult to find I/O address space in a PC - we have created a unique pointer addressing scheme which only takes up two bytes of PC I/O space but allows hundreds of I/O locations on the board. Another common problem is that of getting large numbers of cables safely into a PC. Arcom designed a signal-conditioning system which has been in use on other buses for some years; this system is also available for the PCSYSCON.

Features of the PCSYSCON

The PCSYSCON has voltage and temperature monitors, a watchdog, external optoisolated inputs and analogue input trips. It can sound an internal buzzer, switch a relay or trigger a PC interrupt on detecting an alarm condition. Alarm conditions are also output on the 50-way I/O connector, which also carries the eight general-purpose digital inputs and eight outputs.

The voltage and temperature monitors detect under-voltage and over-temperature conditions. They are designed to operate even if the program in the PC has crashed completely - they do not rely on a background program operating continuously. Their alarm levels can be set up in software.

The watchdog monitor function is intended to be integrated into your software. The principle is that your application program starts the watchdog, and must then access an I/O port at regular intervals to stop the watchdog timing out. If your program fails to do this the watchdog times out and the alarm operates, indicating that your program has crashed. Once the watchdog has been started it cannot be stopped by anything except a complete system reset. The watchdog can be set to operate with either a two second or a ten second timeout.

The two "option" inputs OPT1 and OPT2 can each be used for either an analogue or an optoisolated digital input. OPT1 can operate an alarm when the voltage is lower than that set on a potentiometer or when there is no current into the optoisolator. OPT2 works the other way round.

Each of these monitoring functions can be set individually to operate the buzzer, relay or interrupt by writing to mask registers. The status of these registers and of the monitoring functions can be read back at any time.

The PCSYSCON can also be used for digital I/O. One group of eight lines on the connector can be read directly as inputs. Another group can be written to as outputs.

It is vitally important to be able to do some form of self-test with industrial equipment. The PCSYSCON contains many features to assist in this. At the lowest level the PCSYSCON has two light-emitting diodes (LEDs). These are intended for use on initial installation, since they will not usually be visible inside the PC. The red LED flashes each time the board is accessed. This is useful to check that the board is at the correct address. The green LED can be switched on by a user program. It can be used in a power-on test routine to indicate to a technician that the board has passed. In addition, the PCSYSCON has an identifier code at a fixed location in the I/O map. This can be used to identify a board at a particular PCbus I/O location. The code for the PCSYSCON is 80 (hexadecimal) (128 decimal).

A 50-way D-type connector is used to connect to the PCSYSCON. This allows a ribbon-cable to connect to individual cable connectors or to other boards which either modify the signal in some way or contain other types of connectors. These are called signal-conditioning boards.

The 50-way connector is compatible with Arcom's signal-conditioning scheme, which lets you connect dozens of different types of signal-conditioning boards to process signals to or from the PCSYSCON.

There are two 10-way headers which may be used for some I/O inside the PC. They carry a subset of the signals on the 50-way connector.

Using Signal-Conditioning Boards

In an industrial environment there are many signals which it is unsafe to let into your PC. Examples are signals at high voltage such as mains, or signals with a lot of superimposed noise. This latter category includes most signals that exist in a factory. Another potential problem is that the PC may not be able to supply enough power to drive some equipment directly. Also the signals may be on cables which cannot be physically connected to the PC because they are just too big and cumbersome.

The Arcom signal-conditioning system was designed to solve these problems. In essence the idea is extremely simple. All Arcom digital I/O boards have a standardised connection to a 50-way ribbon cable. TTL-level signals (together with +5V, +12V and -12V) are used on this cable. The cable connects one digital I/O board to one or more signal-conditioning boards. These have a 50-way ribbon-cable connector at one end and a heavy-duty connector at the other. The heavy-duty connector can plug into a terminator mounted in a rack; the terminator can have screw terminals.

A wide range of signal-conditioning boards is manufactured by Arcom (and other manufacturers). Many functions are available - optoisolation, relay outputs, Darlington and FET drivers, switch and keyboard inputs are just a few of them.

What to do Next

If you want to see something happening as soon as possible, turn to Section 3 for information on how to install the PCSYSCON in your PC. When you have installed it, run the driver software as described in Section 4.

If you want to know more about how the PCSYSCON works, Section 5 contains details of the circuitry.

If you are going to be programming the PCSYSCON, Section 2 has information on the I/O map.

In all cases, Section 3 contains much useful information.

Note: All addresses and data values in hexadecimal in this manual are followed by the letter H.

Section 2. The PCSYSCON I/O Map

The I/O Pointer Scheme

There is a serious shortage of I/O space in most PCs. This can be a real limitation if I/O boards have lots of functions and hence lots of registers, like the PCSYSCON. The I/O pointer scheme used on the PCSYSCON and other Arcom PCbus boards solves this problem.

In outline, to access a register on the PCSYSCON you must first set up a pointer to it by writing a byte to the 'base address' of the PCSYSCON. After that, you can read from and write to the register that is pointed to, by accessing the byte at the base address + 1. The base address is the address that is set up on the address switches, subject to the constraint that it must be an even address (an odd address set up on the switches is treated by the PCSYSCON as the next lower even address).

Given that the pointer value is a byte, there are 256 possible registers on a PCSYSCON. Obviously, not all of them are actually used. In fact, on most boards very few of them are used, but the possibilities for expansion are there.

In order to allow standardisation of software some register addresses have been defined for all Arcom PCbus I/O boards. In particular, the top half of the 256 byte space has been defined as 'special function' register space, and the bottom half as 'I/O' register space. The special function registers are mostly devoted to self-test, checking, security and diagnostics. The I/O registers are the ones which the board is there for: in this case monitoring, alarm and input/output functions.

The next two sub-sections describe the register allocations in detail.

How the PCSYSCON Appears in PCbus I/O Space

The PCSYSCON occupies two bytes in PCbus I/O space. They start on an even byte boundary. The lower byte contains the pointer and can only be written to. The upper byte contains the data and can be read from or written to.

The address switches define where these two bytes are in PCbus I/O space. The switches set the address of the lower of the two bytes (the base address); the upper byte is one byte up from the lower. Another way of saying this is that the board can only be addressed at even byte boundaries and takes two consecutive bytes of I/O space.

To set the address simply rotate the switches until the desired base address is visible, reading them left to right, as text is normally viewed. For example, to set up an address of 10CH, the left-hand switch is set to 1, the centre switch to 0 and the right-hand switch to C. Note that the addresses are in hexadecimal.

The problem comes in finding what to set the switches to. Many PCs are not supplied with any information about what I/O devices are already installed at particular addresses. There are several ways round this. Firstly, try running the board at address 180H(see Section 3 for installation information). This is often unused. If you can't get any information from the PC manufacturer, run a program like Quarterdeck's Manifest, which makes a reasonable attempt to discover the addresses of common peripherals. Finally, see Section 3 for fault-finding information.

The Registers on the PCSYSCON

The following table shows the I/O registers on the PCSYSCON.

Pointer Value	Register Name	Read/write	Comments
09	STARTW	W	Start watchdog and set final timeout
08	STATUS	R	Read board status
08	RETRIGW	W	Retrigger watchdog
07	BUZM	R/W	Buzzer mask
06	RELM	R/W	Relay mask
05	INTM	R/W	Interrupt mask
04	G1IN	R	Read from group 1 inputs
04	G0OUT	W	Write to group 0 inputs
03	DACTEMP	R/W	Set temperature comparison
02	DAC-12	R/W	Set -12V comparison
01	DAC+12	R/W	Set +12V comparison
00	DAC+5	R/W	Set +5V comparison

The following table shows the special function registers on the PCSYSCON.

Pointer Value	Register Name	Read/write	Comments
81H	Board Ident	R	Reading this should always give a value of 80H for the PCSYSCON
80H	User LED	W	Writing 01 switches the green LED on. Writing 00 switches it off.

How to Write to the Registers

It is useful to remember that the pointer register only needs to be written to once if only one register is read or written. This means that I/O can then be done with byte reads and writes. However, if your program is continually changing registers it must write a new pointer value each times it accesses a new register. This can be done by writing a pair of bytes as a word, because the CPU in a PC does word writes to the bus (which is one byte wide) by writing the lower byte first, thus setting up the pointer register first.The sub-section A Quick Installation Test shows the basics of how to write to the control register.

DAC Registers

The DAC registers (DAC+5, DAC+12, DAC-12 and DACTEMP) set the levels at which an alarm can occur if the alarm mask registers are set. For example, the +5V power line in the PC is compared with the voltage produced by the DAC+5 digital-to-analogue converter (DAC). If the +5V power line is below this voltage a bit is set in the STATUS register. This can be read at any time. In addition, if the BUZM alarm mask register is programmed to allow a power fail to sound the buzzer then this will also sound.

Alarms from the three power-line monitors DAC+5, DAC+12 and DAC- 12 are combined into one signal PFAIL for the alarm mask registers. The over-temperature signal (from the DACTEMP register) is a separate bit in the alarm mask registers.

It is possible to use the DACs as analogue-to-digital converters to measure the power line voltages and temperature. To do this, simply disable the PFAIL and OTEMP alarms and write to the DAC register of interest, reading the corresponding bit in the STATUS register. The value at which the bit flips corresponds to the voltage or temperature.

To maintain reasonable accuracy, each DAC is scaled differently.

Pointer	Name	Function	Scaling
3	DACTEMP	Temperature high	1 bit=0.482C
2	DAC-12	-12V supply low	1 bit=-60.53mV
1	DAC+12	+12V supply low	1 bit=60.73mV
0	DAC+5	+5V supply low	1 bit=24.22mV

General-Purpose Digital I/O Registers

These registers are accessed at pointer value 4. Writing a byte to pointer value 4 sets bits on the 50-way connector PL2, and reading pointer value 4 reads bits on this connector. A high bit (=1) corresponds to a high TTL level on the connector pins - there is no inversion.

Mask Registers

There are three mask registers INTM, RELM and BUZM each with the same bit meanings, as follows.

Bit	Name	Function	Comments
7			Not used
6			Not used
5			Not used
4	PFAIL	power-fail	Alarm if one or more of the three power lines is below the DAC voltage.
3	OPT2	option 2	Alarm if option 2 input is triggered
2	OPT1	option 1	Alarm if option 1 input is triggered
1	WATCH	Watchdog	Alarm if watchdog timeout
0	OTEMP	Temperature	Alarm if temperature exceeded

INTM is at pointer value 5 and controls interrupt generation. The actual interrupt to be generated is set by LK1.

RELM is at pointer value 6 and controls relay operation. LK2 controls whether the relay is normally on or off.

BUZM is at pointer value 7 and controls the operation of the buzzer.

Each mask register is independent, so that, for example, the buzzer can be made to sound if the set temperature is exceeded while the relay operates if there is a watchdog timeout.

Mask registers can be read and written, so your software can check that the desired masks have been set up.

STATUS register

The STATUS register is at pointer value 8 (read). It contains information about what is happening to the board. The bit patterns are similar to those in the mask registers. In general a high bit indicates a problem.

Bit	Name	Function	Comments
7	WDIS	Watchdog	High if the watchdog has never been started
6	-12L	-12V problem	High if -12V line low
5	+12L	+12V problem	High if +12V line low
4	+5L	+5V problem	High if +5V line low
3	OPT2	Option 2	High if option 2 input triggered
2	OPT1	Option 1	High if option 1 input triggered
1	WATCH	Watchdog	High if watchdog timeout
0	OTEMP	Temperature	High if temperature exceeded

All of these signals except for WIDS are available in inverted form on the 50-way connector Pl2. WDIS is replaced by an inverted version of the buzzer signal.

Watchdog Registers

Two registers control operation of the watchdog. The STARTW register at pointer register 9 (write) starts the watchdog with either a two or a ten second timeout period. Only one bit (bit 0) has any meaning in the STARTW register. If this is a 1 the longer timeout period is selected. If it is 0 the shorter period is selected.

The RETRIGW register at pointer value 8 (write) must be written to in order to prevent the watchdog timing out. Any value may be written. Once the watchdog has started it cannot be stopped. This is because otherwise software that had crashed could have activated the routine that stopped the watchdog, thus removing the protection.

The WDIS bit in the STATUS register is a 1 until the watchdog has been started.

It is recommended that your watchdog retriggering routine has the following characteristics:

It is not callable routine or function, but is in-line code in the main program loop
It is not triggered by an interrupt
It is executed once in the main program loop

Section 3. Using the PCSYSCON

Installing the PCSYSCON

The PCSYSCON contains CMOS circuitry and can be damaged by static electricity, as can your PC. When installing, DO NOT touch the gold edge fingers, but DO touch a metal part of your PC before picking up the PCSYSCON. DO NOT place the PCSYSCON onto plastic surfaces, particularly polystyrene or polythene.

The mechanical part of installation is quite simple. In most cases it involves switching your PC off, taking its cover off, finding a spare 8-bit I/O slot and inserting the PCSYSCON into it. However, some PCs have different ways of doing this, so you must read your PC manual and follow its instructions.

Initially we suggest that you do not use interrupts, so remove LK1.

Set the switches to 180 and power your PC up. Watch the LEDs on the PCSYSCON while it powers up. You may see the red LED flash once. This simply means that the BIOS startup program in your PC is checking through I/O space to see if any boards are there, and is nothing to worry about. On the other hand, if your PC fails to boot or the red LED flashes continuously, you will need to change the PCSYSCON base address (see Addresses below for suggestions).

If your PC does fail to boot up, power down, remove the PCSYSCON and power up again to prove that the problem lies with the PCSYSCON rather than some disturbance created by your installation procedure, such as a loosened cable connector, for example.

Addresses

Although PCs differ in their available I/O address space, some generalisations are possible. There is usually space between 100H and 1FFH. Addresses 300H to 31FH are (notionally) assigned to an I/O prototyping card, so if you don't have one these are also free. Avoid addresses below 100H. Remember that many PCs 'wrap' addresses above 3FFH, so that 400H is treated as 000H, which won't work.

It is not usually necessary to remove the PCSYSCON from the PC in order to change the address. Unless your PC is very cramped internally it is possible to rotate the address switches to change address with the PCSYSCON still installed.

Installing Multiple PCSYSCONs

This is just like installing a single one, except that they must all be installed at different addresses. The most obvious scheme is to install them at consecutive addresses, remembering that each PCSYSCON takes up two bytes of I/O space. This is also what the Arcom software drivers expect. For example, install the first one at 180H, the second at 182Hand so on.

If you are installing more than one type of PCbus I/O board it makes sense to keep all boards of each type at consecutive addresses. Don't forget that other boards may take up more than two I/O address locations. If you are going to use interrupts you have two choices. Either all boards can share the same interrupt line or you can jumper one board to IRQ2 and one to IRQ3 (this implies two boards maximum). More of this later.

A Quick Installation Test

It is very easy to test the PCSYSCON with the DEBUG program to show that it is at the address you thought. Assume that the address is 180 H.

Run the DEBUG program by typing

DEBUG <RET>

At the prompt, type

o 180 80 <RET>

The red LED should flash once, showing that you have accessed the PCSYSCON. In fact, this command has made the pointer point to the green (user) LED register. To switch the green LED on, type

o 181 1 <RET>

and to switch it off, type

o 181 0 <RET>

To exit from DEBUG type

q <RET>

Links

There are two functions defined by links on the PCSYSCON: where the interrupts go to on the PC and what the normal relay state is.The links are defined by pushing little blue jumpers onto pairs of pins.

Link 1. Where the interrupts go to on the PC

This is a group of six pins just above the PCbus connector. The jumper must be inserted vertically, which means that there are four possible situations, A, B, C and no jumper inserted.

• LK1A sends the interrupt to PCbus IRQ2.
• LK1B sends the interrupt to PCbus IRQ3.
• LK1C sends the interrupt to PCbus -IOCHCHK.
(Note that this is normally intended to generate a non-maskable interrupt, and may well halt the PC.)

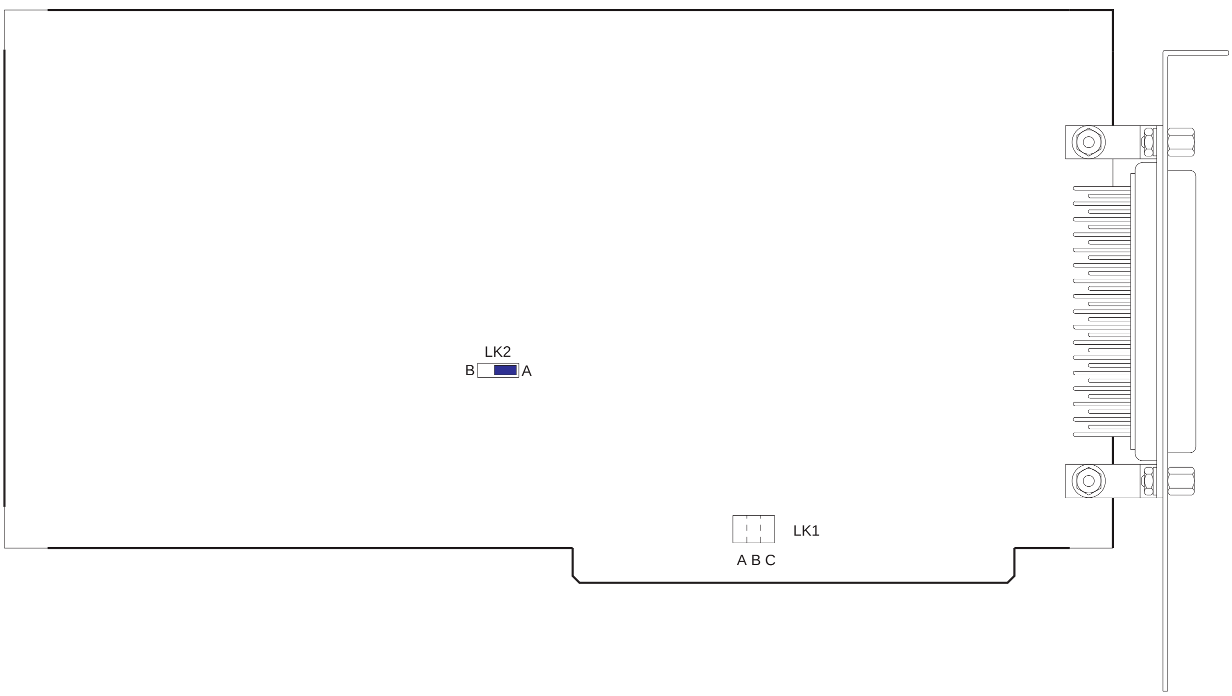
No jumper means that the PCSYSCON cannot generate any interrupts.

If you intend to use the Arcom driver software it may be necessary to insert a jumper into one of these link positions. See the section on driver software.

Interrupts can only be generated if the mask register INTM is appropriately enabled.

We recommend that you do not insert a jumper into LK1. Change this if you intend to use interrupts and are experienced at writing PC interrupt-handling software, or possibly if you are using the Arcom drivers.

Default Link Position



Link 2. Relay state

This is a group of three pins. The jumpers are also inserted horizontally, and there are two possible positions, labelled A and B. Link 2A keeps the relay on when there is no alarm and off otherwise, and link 2B does the opposite. This is so that the power-up state can be chosen without running any software.

Connections

Connections to the board are made by a 50-way D type connector. It is usual to use a ribbon-cable (insulation displacement or IDC) connector to plug into this, so that all 50 wires are connected at once. This point is mentioned because there is some confusion about how 50-way D connector pins are numbered. Before IDC 50-way D connectors became popular the conventional numbering was to number the pins incrementing parallel to the long edge of the connector. This number is often moulded into the plastic next to each pin. Ribbon cables, however, are numbered sequentially from the stripe at one edge. This is not compatible for mechanical reasons with the original D numbering system.

Because most people will use ribbon cables with this board we have given connection details in terms of the ribbon-cable pins that will be connected when an IDC 50-way D connector is plugged in. They are referred to as RCx where x is a number between 1 and 50. For ease of reference the corresponding D connector pins are also shown on the circuit diagram and in Appendix B.

Voltage monitoring

The three power-line voltages +5V, +12V and -12V are compared with the voltages from three DACs. If the power-line voltages drop below the DAC voltages bits are set in the STATUS register. The PFAIL signal is then generated which is allowed to trigger alarm signals depending on the mask bits in the MASK registers.

It is possible to set the DAC voltages very close to the actual voltages. This is a bad idea for several reasons. Firstly, voltages in a PC can fluctuate by tens or even hundreds of millivolts in normal operation, for example if a drive starts up. Secondly, digital noise on the supply lines and on the PCSYSCON board means that the instantaneous voltages measured are not necessarily the average voltages. Finally, most PCs will operate at voltages quite a lot lower than normal, especially on the +12V and -12V lines. Suggested values for setting the DAC voltages are 4.6V for DAC+5 and 11.4V for DAC+12 and DAC-12. However, it is your responsibility to set them to the values which will give most warning of power failure and least false alarms.

The sub-section about the DAC registers has the conversion factors between bytes sent to the DACs and DAC output voltages.

For example, to make the +5V monitor trigger at 4.6V, send 191 (decimal) or BE (hex) to pointer 0.

It is well worth using the DACs as explained earlier to measure the voltages in your PC. The example software has a simple program to do this.

Temperature monitoring

The PCSYSCON has a on-board temperature monitor to measure the internal temperature of the PC. This generates an alarm when the temperature is in excess of that set by the voltage from the DACTEMP DAC. The correct temperature to set depends on ambient temperature, fan cooling efficiency and PC design. It is a good idea to measure temperature rise for some hours after switch on using the program mentioned above.

Option inputs

The two option inputs can each be used with either analogue or opto-isolated digital inputs. They are intended for use with power-fail signals from power-supply units, fan-fail signals from electronically-controlled fans, or general-purpose alarm inputs. The difference between Opt1 and Opt2 is that one works in the presence of the signals and the other works in their absence. Either or both can be masked out by the mask registers.

In analogue input mode the single-ended analogue signals are fed to comparators whose trip points are set by potentiometers VR1 (for Opt2) and VR2 (for Opt1). LEDs D7 and D6 indicate when the trip points are reached. Trip points can be set for analogue voltages of 0 to +20V.

In digital mode, currents are passed through resistors to optoisolators. The resistors are suitable for input voltages of 12 to 24V.

Because the analogue and digital inputs both drive the same alarm signal, only certain combinations of signals are possible.

	Digital	Analogue	Result
Opt1			
	opto current	ignored	alarm
	no current	high	alarm
	no current	low	no alarm
Opt2			
	opto current	ignored	no alarm
	no current	high	no alarm
	no current	low	alarm

The analogue high and low refer to the input voltage compared to the potentiometer setting. With no signal wire connected to the analogue input each potentiometer can be adjusted to allow the digital input to function. Opt2 will give an alarm with nothing connected, however. If you do not wish to use this, make sure that you have masked off alarms from Opt2 in the mask registers.

Digital I/O

The PCSYSCON can be used for simple digital I/O. You can read the state of the inputs on Group 1 of the D50 connector by writing 4 to the pointer register at 180H and reading the value at 181H (for group 1). You can write to the outputs on Group 0 of the connector by writing 4 to 180H and writing the byte to 181H.

The state of most bits of the STATUS register is readable on the 50-way connector. The bit pattern is the same as in the STATUS register except that the top bit (WDIS) from the STATUS register is replaced with a BUZZ signal, so that a remote buzzer can be connected. All the signals in this group of eight (Group 2 on the 50-way connector) are active-low TTL. They can all be buffered by signal-conditioning boards to drive remote alarms or inspected with a LED32 indicator.

Interrupts

Most interrupt lines on the PCbus are already taken up by standard peripherals - IRQ2 and 3 are less likely than most to be used and they can be driven by the PCSYSCON.

There are five interrupt sources on the PCSYSCON, as defined by the bits in the INTM register.

If LK1 is not jumpered at all no interrupts will be passed on to the PC, but you can still inspect the STATUS register.

Interrupts are not latched; your interrupt routine should do an immediate read of the STATUS register to discover the interrupt source. Once it has it can mask out the interrupt source with the INTM register while it is dealing with the interrupt.

Fault finding

As described earlier, there are several diagnostic aids on the PCSYSCON. Firstly check that the red LED near the 50-way connector lights when (and only when) your program is accessing the board. If it doesn't, it is likely that the address your program is writing is not the one that the switches are set to. If this works, check that you can turn the green LED on and off by writing to its register. Try reading the board identification. If this is not correct but the LEDs have been working correctly it is possible that there is another board at the same address.

Section 4. Software

As you will probably have noticed from the examples using DEBUG, it is easy to prove that the board is in the system at the right address. However, the PCSYSCON requires a few initialisation bytes. To help you to get started, a disk with example software is supplied. In order to keep this as up to date as possible, files on the disk describe its contents.

The file READ.ME is the first one you should look at. It contains information on the disk organisation. You can either inspect it on your screen by typing TYPEA:READ ME (if you are reading from disk A), or print it to a printer. Your DOS manual has information about the various ways of doing this.

Section 5. Circuit Description

The board address is selected by IC21, an 8-bit comparator, and part of IC8. This IC, a PAL, also takes in various control signals buffered by IC14. It generates the enable signal for IC5, the data bus buffer, and strobe signals for IC19 and 13, which then decode pointer addresses for the counters and registers. It also generates strobe signals for IC6 and IC9, which holds the board identification, and IC7 which controls the green LED.

The DAC IC31 outputs are compared with the three supply rails by IC33 and with the temperature sensor IC28. IC10,11 and 12 hold the mask bits for the three mask registers, and IC16,17 and 18 allow these to be read back and compared with the input signals. Alarm signals from these ICs go to IC20 which drives the relay, buzzer and interrupts, to IC24 which is the STATUS buffer and to IC4 which buffers them onto the 50-way connector PL2. IC26 compares input analogue signals and also the ramp from the watchdog timing capacitor. The two watchdog times are selected by choosing which voltage to switch at. Digital input is via IC3 and output is from IC2.

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 type of external I/O cable can be chosen according to the note below:

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. Replace the cover of the PC observing any additional instructions of the PC manufacturer.

Cable

- Cable length 1 Metre of less :
  Ribbon cable satisfactory
- Cable length up to 1M to 3M required :
  Commercial screened cable gives the protection
- Longer cable or noisy environment :
  Use fully screened cable with metal backshells e.g. Arcom CAB50CE

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, ClassB, Limits and Methods

Appendix A. Specification

Operating temperature	0°C to 55°C
Power consumption	5V +/- 0.25V 520mA typical
Monitors	+5V, +12V, -12V supplies board temperature two analogue inputs 0-20V two optoisolated digital inputs 12-24V
Digital inputs	8
Digital outputs	8
Interrupt outputs to PC	3
Relay Contacts	24v 1A
Input and output levels	TTL
Connectors	50-way D socket two 10-way internal headers
Diagnostics	Red and green LEDs
Board identification byte	80(H)
PCbus I/O address space	2 bytes

Appendix B. Connections

Connections are made by a 50-way D socket on the PCSYSCON. It is most likely that you will be connecting to it via a ribbon-cable (IDC) 50-way D header plug. This can then be connected on the ribbon cable to one or more standard (two row) 50-way headers which will plug into the connectors on signal-conditioning boards. The diagram shows the connections as they appear on standard ribbon-cable headers, with the conventional D connector pin numbers given as well as the wire numbers on the ribbon cable. The D connector pin numbers start with D and the ribbon-cable wire numbers start with RC. The digital I/O signals are referred to as Gn.x where n is the group number and x is the bit number.

PL2 50-way D Connector

Signal Title	D Type No.	RC No
+5V	50	50
+5V	17	49
+12V	33	48
-12V	49	47
	16	46
	32	45
Relay n/c contact	48	44
Relay com contact	15	43
Relay n/o contact	31	42
0V	47	41
Opt2 analogue input	14	40
0V	30	39
Opt 1 analogue input	46	38
0V	13	37
Opt2 optoisolated +ve input	29	36
Opt2 optoisolated -ve input	45	35
Opt1 optoisolated +ve input	12	34
Opt1optoisolated -ve input	28	33
	44	32
0V	11	31
/BUZZ output	27	30
/+12V low output	43	29
/-12V low output	10	28
/+5V low output	26	27
/Opt2 output	42	26
/Opt1 output	9	25
/Watchdog output	25	24
/Overtemperature Output	41	23
	8	22
0V	24	21
G1.7 in	40	20
G1.6 in	7	19
G1.5 in	23	18
G1.4 in	39	17

PL2 50-Way D Connector Continued

Signal Title	D Type No.	RC No
G1.3 in	6	16
G1.2 in	22	15
G1.1 in	38	14
G1.0 in	5	13
	21	12
0V	37	11
G0.7 out	4	10
G0.6 out	20	9
G0.5 out	36	8
G0.4 out	3	7
G0.3 out	19	6
G0.2 out	35	5
G0.1 out	2	4
G0.0 out	18	3
0V	34	2
0V	1	1

PL3 Internal I/O Connector

Signal Title	Pin No.
+5V	10
/BUZZ output	9
/+12V low output	8
/-12V low output	7
/+5V low output	6
/Opt2 output	5
/Opt1 output	4
/Watchdog output	3
/Overtemperature output	2
0V	1

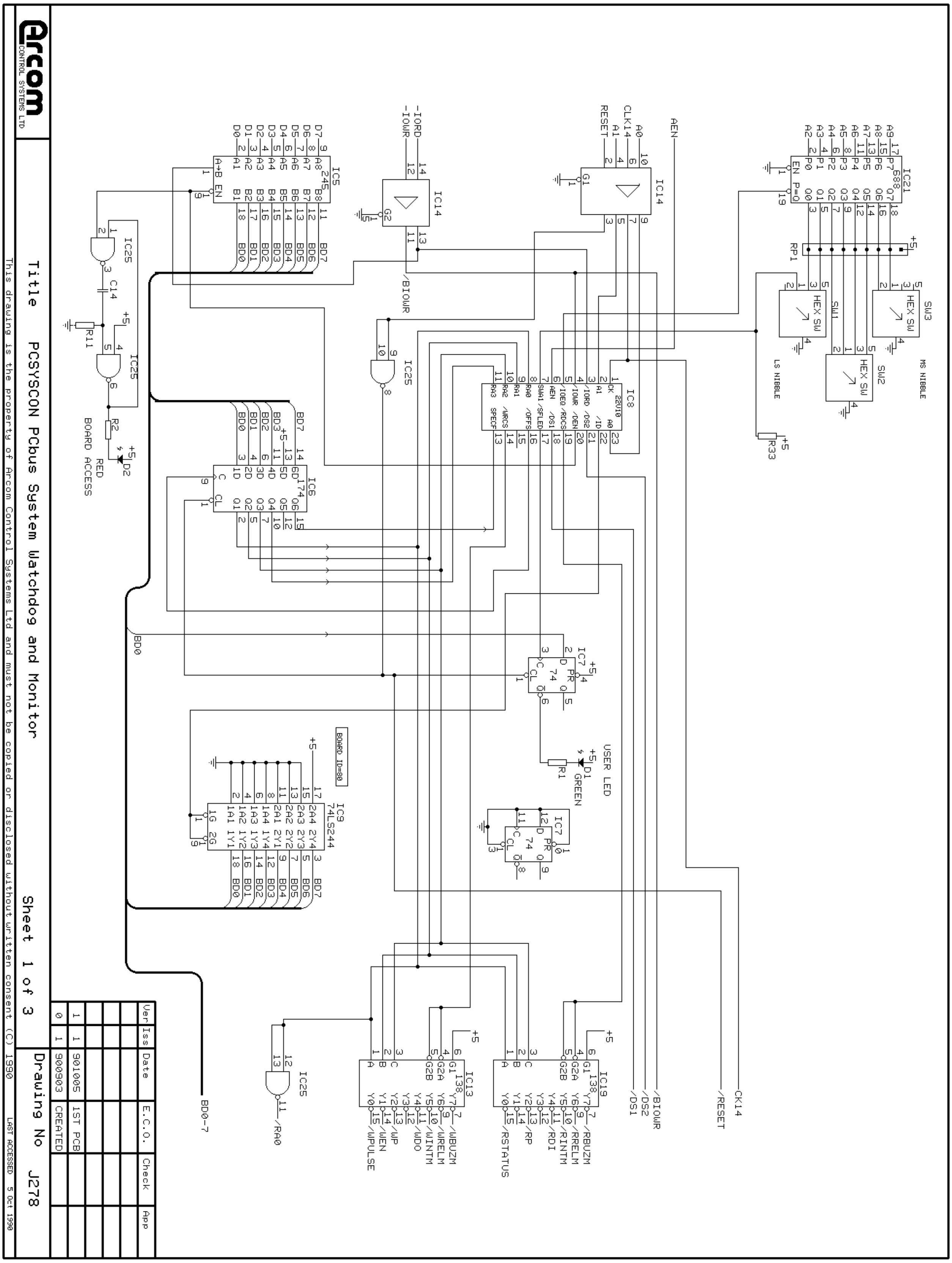
PL4 Internal I/O Connector

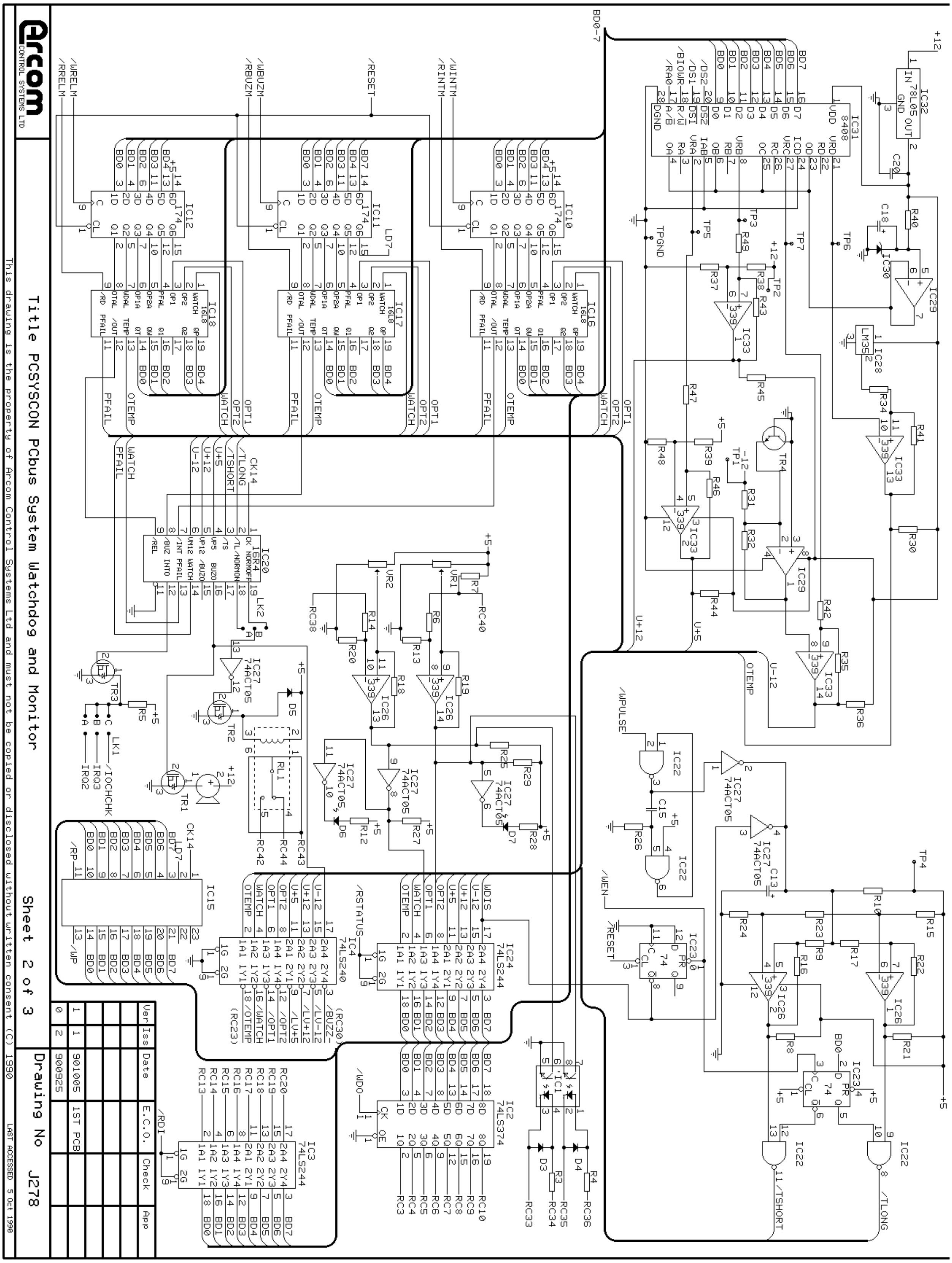
Signal Title	Pin No.
+12V	10
Opt2 analogue input	9
0V	8
Opt1 analogue input	7
0V	6
Opt2 optoisolated +ve input	5
Opt2 optoisolated -ve input	4
Opt1 optoisolated +ve input	3
Opt1 optoisolated -ve input	2
0V	1

Appendix C. Component List

IC1	PC829
IC2	HCT374
IC3,9,2224	LS244
IC4	HCT240
IC5	LS245
IC6,10-12	HCT174
IC8	PAL
IC13,19	HCT138
IC14	HCT367
IC16-18	PAL
IC20	PAL
IC21	HCT688
IC22,25	HCT00
IC26,33	LM339
IC27	ACT05
IC28	LM35
IC29	LM358
IC30	LM385
IC31	8408
IC32	78L05
R1,2,12,28	680R
R3,4,4	83K
R5,8,21,24-27,29	100K
R6,14	82K
R7	1M0
R9,17,34,42,47,49	5K6
RP1	100K
VR1,2	20K
TR1-3	2N7000
TR4	BC182

Appendix D. Circuit Diagrams




Title PCSYSCON PCbus System Watchdog and Monitor
Sheet 2 of 3
Drawing No J278
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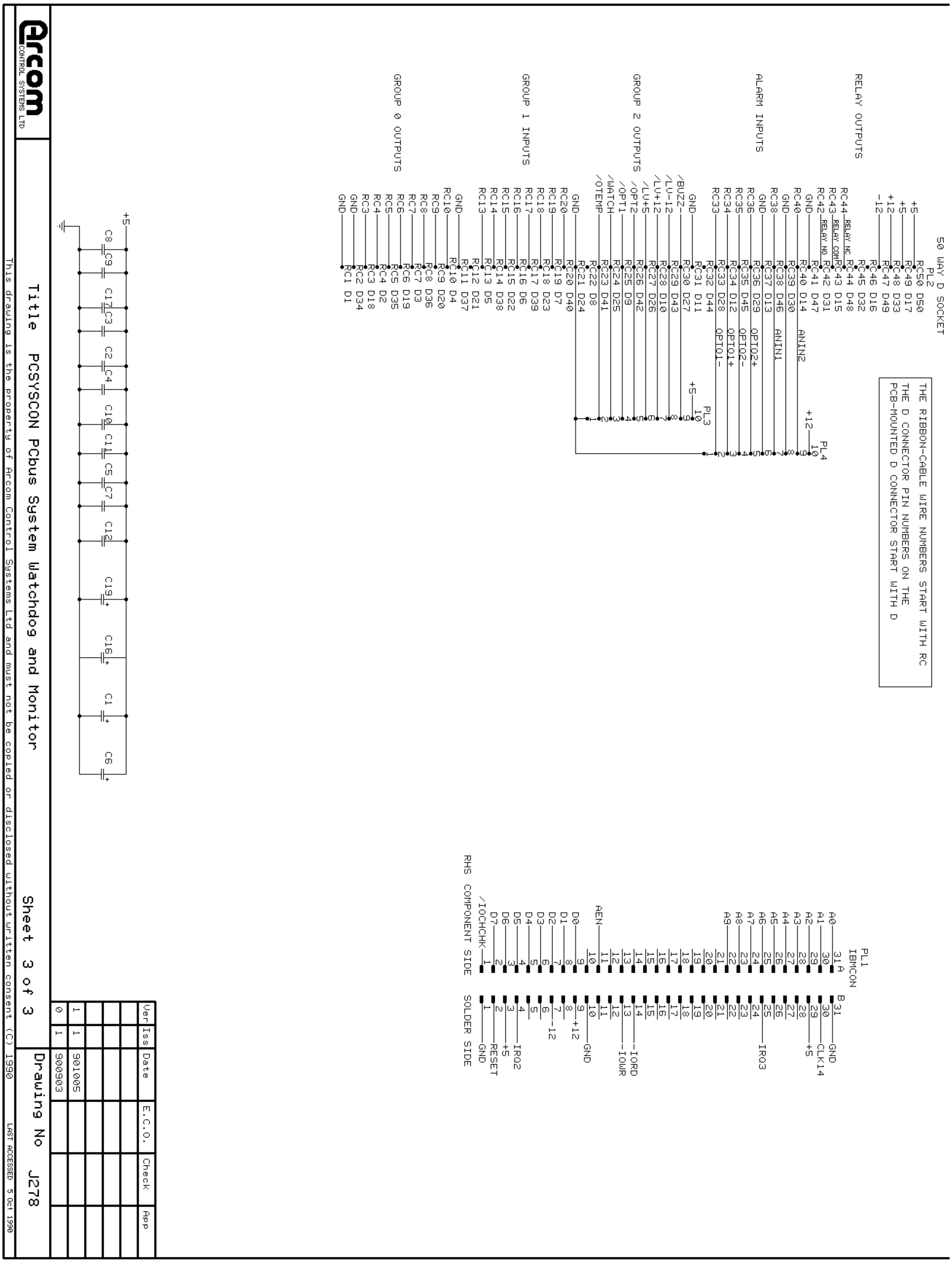
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50 WAY D SOCKET
PL2
RELAY OUTPUTS
ALARM INPUTS
GROUP 2 OUTPUTS
GROUP 1 INPUTS
GROUP 0 OUTPUTS
THE RIBBON-CABLE WIRE NUMBERS START WITH RC
THE D CONNECTOR PIN NUMBERS ON THE
PCB-MOUNTED D CONNECTOR START WITH D
PL3
PL4
PL1
IBMCON
RHS COMPONENT SIDE
SOLDER SIDE