

PC compatible controller

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Summary

A modern injection moulding machine is invariably controlled by a digital controller. A PC (personal computer) compatible controller has advantages over a non-compatible one. PC compatibility is explained as are its advantages.

1. The meaning of PC compatibility

1.1 History

PC compatibility is the short form for IBM PC compatibility.

In 1981, IBM introduced its first personal computer, a computer for the home user. Its design philosophy is to source all components from the market instead of developing the hardware and the software in-house, a practice IBM has used for its mainframes. The microprocessor in the PC is the 8088 made by Intel. It is a smaller but cheaper version of its 16-bit brother, the 8086. 8088 is not plug compatible to 8086 but is software compatible to it.

At that time, a few operating systems could run on the PC, but the operating system licensed from Microsoft, known as PC DOS or MS DOS, have come to predominate.

There are many 16-bit personal computers from different makers in the early 1980's. Due to the good name of IBM, the IBM PC soon becomes *the* standard to which clone makers build their machines and software companies write their software.

Subsequently, IBM introduced the PC AT which is based on the Intel 80286 processor. The bus used in this machine is called the ISA bus and has survived up to this day as a standard for inserting add-on cards. The ISA bus is 16-bit operating up to 8 MHz. In the early 1990's, a 32-bit bus operating up to 33 MHz called the PCI was introduced into the PC. PCI carries on where ISA is inadequate.

In the operating system arena, DOS has evolved into Windows. Three popular versions of Windows are Windows 3.1, Windows 95 and Windows 98. Windows is designed such that most DOS applications could run under Windows as is.

In the microprocessor market, Intel introduced the i386, i486, Pentium processor, Celeron processor, etc., all were designed to be software compatible to the 8086. Software designed

for the 8088 could run on the latest processor unchanged but at a much higher speed.

1.2 Software compatibility

That a controller contains an Intel processor is a necessary but not a sufficient condition for software compatibility. In PC parlance, software compatibility means DOS or Windows compatible.

1.3 Hardware compatibility

Simply put, software is program. While hardware is touchable, software exists only in a medium like diskette.

Sometimes, hardware and software compatibility are both needed. An example is the VGA standard for graphics display. The graphics card is hardware. The code to send the data in the appropriate format to the card is software.

At the microprocessor level, hardware compatibility means a processor is plug compatible. AMD is a company whose processors are designed to be hardware compatible to Intel's.

In a PC, hardware compatibility means more. Most importantly, it means the PC has ISA or PCI slots to take add-on cards. It also means peripherals like keyboard, monitor, printer and magnetic or optical storage are compatible at the plug level.

As a test, if you could attach PC peripherals to a PC-based controller and run your office software, the controller is PC compatible.

1.4 Open architecture

In its almost twenty years of history, a very big number of hardware and software designed for the PC has been accumulated and are available in the market. The open architecture of the IBM PC has made this possible. Furthermore, college graduates were educated on this platform so building hardware and writing software for the PC is general knowledge.

2. Advantages of a PC compatible controller

2.1 Choice of hardware

Many suppliers make add-on cards and peripherals for the PC, and of course the PC itself. Not only does the consumer have a choice among different manufacturers, the variety of functions is also useful in itself. If a 6-channel A/D converter ISA card is not available from a vendor, another supplier probably could provide it.

In short, PC hardware is multi-sourced. One needs not worry about a supplier going out of business or cannot deliver on time.

2.3 Choice of software

Applications written for the DOS/Windows standard abound and could be purchased off-the-shelf in computer stores.

It is true that DOS and Windows are designed for human interface and therefore not responsive enough for injection moulding machine control. The simple solution is to have two controllers, running DOS/Windows on one but a real-time operating system on the other. They communicate.

As far as the operator is concerned, he only sees the DOS/Window controller. He enters injection parameters and monitor injection moulding status the same way he uses his PC at home.

The actual control of the machine is done by the other controller which could also be PC-based. Sequential control and process control are performed in real-time speed.

2.4 Abundance of software tools

To write software, one needs software tools. A C++ compiler is an example. Programmers are probably more familiar with PC-based software tools than those on other platforms. Furthermore, due to the bigger market such tools are sold into, their prices are more competitive than those for proprietary microprocessors/platforms. Lastly, more software tools are available to the PC than to non-PC's.

2.5 Time to market

Familiarity with the software tools eliminates the learning curve which is important in shortening the development time of a program for a new injection moulding machine.

2.6 Low cost

Competition drives down price. Volume of sale is another reason why PC-based products are priced lower than comparable products for less widely used platforms.

That PC prices are going down every month is an indisputable fact. Such price reduction could be harnessed if a PC-based controller is used in an injection moulding machine.

2.7 Longevity

Microprocessors are being introduced by Intel at an ever faster rate. Older PCs are being obsoleted just as fast. Does that mean PC-based controller has a short life span? The answer is an emphatic no.

New microprocessors remain compatible to the old software. They only do the job in a shorter period of time.

If an i386 based motherboard is obsoleted, does it mean a faulty PC controller is destined for the rubbish dump? Again the answer is no. An i486 or Pentium processor based motherboard is a compatible replacement on which add-on cards and peripherals could be attached as before

Other standards in the PC are long living. They include the ISA bus, VGA graphics standard, printer port, 3.5 “ floppy disk drive, etc.

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2.8 Continued development

The phenomenal rate at which PC power is increasing is beneficial. One is assured that an injection moulding machine with a PC-based controller is ever more powerful, without development effort on the manufacturer’s part.

2.9 LAN capability

Local Area Network ties together person computers which are single-user machines. LAN makes possible sharing of data base, printer, etc. Communication among the users is of course possible.

In a moulding shop with multiple injection moulding machines, LAN allows monitoring and parameter setting from a central control station. Abnormal conditions could be flagged in which case an operator is dispatched. Production data could be updated every minute.

LAN add-on cards for the PC are available for less than HK\$100 each. Developing such a card from scratch and writing the software for it would cost at least 100 times that much.

2.10 CAN bus

Controller Area Network was initially developed for the automobile. Sensors and actuators are distributed on the various parts of a car: motorized window, fuel level gauge, rpm sensor, etc. CAN reduces the wiring needed.

In an injection moulding machine, hydraulic pump, hydraulic valves, pressure sensors and

potentiometers are available with the CAN interface. CAN makes possible remote diagnosis of an injection moulding machine down to the component level.

CAN add-on cards for the PC are available off-the-shelf.

2.11 Remote diagnosis

PC software has been available for two user's separated over a distance to watch and manipulate each other's screen. The communication is through dial-up modem.

This technology could be installed on a PC-based controller to enable remote diagnosis of an injection moulding machine. Especially for a new user, many problems reported are due to insufficient understanding of the parameters leading to the wrong settings. A technician at the machine manufacturer's factory could diagnose the problem in a timely and low cost manner.

DSVD modem allows one to share data and talk over the same telephone line simultaneously. The technician could talk to the operator to find out more about the problem, and to explain to the operator once the problem is found.

2.12 Internet craze

What was said about the modem is now implemented on the Internet. The difference is whereas modem allows only one-to-one communication, the Internet, based on packet switching technology, allows a multi-party interaction.

Video conferencing software have been available for a while. This allows a more user-friendly technician to operator interaction, and at an affordable cost.

3. Conclusion

The PC wave has swept the home user and office user market. Using PC-based controller and DOS/Windows based software on an injection moulding machine extends this wave and all its benefits to the factory floor.

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