

# ANNUNCIATOR

JANUARY 1998



SARNIA



SECTION

The International Society  
for Measurement and Control





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## Editor's Notes

**ADVERTISERS:** Please note that the deadline for the MARCH ANNUNCIATOR is February 15, 1998. Please forward information to the editor by that date in order to have items updated.

**THE DINNER MEETINGS FOR THE 1997/98 SEASON WILL BE HELD AT THE SARNIA GOLF AND CURLING CLUB**

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## Upcoming Executive Meetings

February 23, 1998 • April 27, 1998 • June 29, 1998

*All regular meetings will be held at 7:00 p.m. at the Sarnia Golf & Curling Club*

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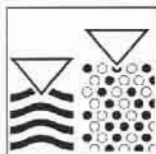
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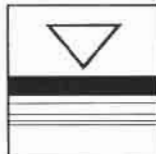


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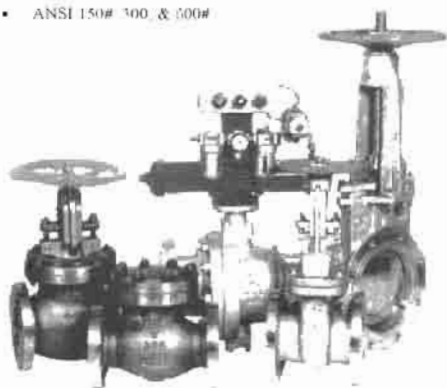
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11



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## President's Message

Happy  
New Year!

On behalf of the ISA Executive I would hope that everyone has had a good Holiday Season and wish for a happy and prosperous New Year.

I would like to ask that we all make an extra effort this month to attend the ISA dinner meeting on January 26, 1998 to ensure that it is a success. Please consider inviting a friend or co-worker to help in our efforts to increase membership.

Details of the January program are contained in this edition of the Annunciator.

Regards,

Andy Tucker, *President*

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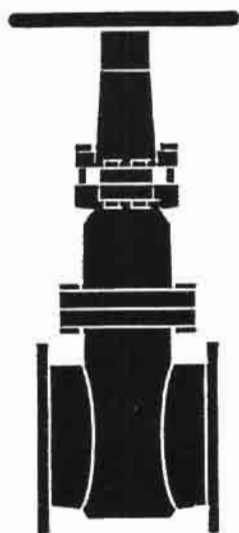
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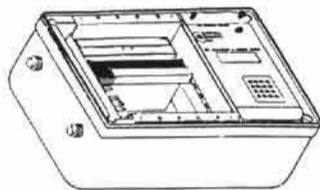


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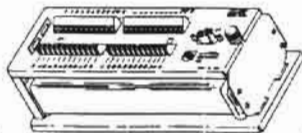
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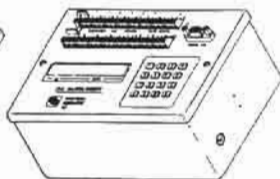
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# Delegates Report

## From the President's Fall Meeting

*The following is my report as the acting delegate for the President's Fall meeting and The District Council meeting held at ISA Tech 97 in Anaheim on October 4 - 9, 1997.*

### **The District 13 Council Meeting**

- Minutes from the District 13 Council meeting of October 9, 1996 were adopted.
- Minutes from the District 13 Council meeting of April 27, 1997 were adopted.
- All sections from District 13 were represented and all delegates were signed in.
- Diana Bouchard presented her annual report.
  - Visited seven of eight sections in the district.
  - Over 1000 hits each in the English and French version of the District Web Site.
  - Only received two section annual reports.
  - Discussion over the status of the Laval West Island Group. They were granted formative status as of the end of October 1996, they now have three years to progress to regular section status.
- Proposal for a dues increase was presented by Ron Jones, the past society president, of five dollars U.S. beginning in January 1998. Ron made a presentation with a question and answer period following.

- Another proposal to be put to the floor was in regards to member petition as a means of bringing matters before the Council of Society Delegates.
- Mike Murray was presented a District Service Plaque Award for Jim Lomax of the Sarnia Section for his dedicated service as DVP Elect, DVP, Nominator and Alternate Nominator.
- As the District Honours and Awards Chairperson, Diana hopes to ensure that the above plaque is awarded annually to a deserving District Leader.
- Diana thanked everyone for their support over the last year and a half.

### **The Council of Society Delegates**

The Council of Society Delegates approved the proposal to increase regular member dues to \$65 U.S. from \$60, effective January 1, 1998. It was generally agreed that this represents essentially a "cost of living increase."

The Council of Society Delegates also re-instituted the right of members to bring a motion before the council by petition of one hundred regular members. The sense of the meeting was that the more avenues for direct member access to ISA's governing structures, the better, and that ISA must be seen to be open to member initiatives.

After this meeting Ken Hamilton from the Hamilton Section took over for Diana Bouchard as District 13 DVP. Diana now becomes Director of Books in the Publications Department and has received a couple of task force and committee assignments, one relating to use of electronic mail by the ISA Executive Board and one to the proposed IMS 99 conference and following District 13 tradition she is also the District Nominator and District Honours and Awards Chairperson and a member of the District Standing Committee for Workshop Planning. She also wants to continue to maintain the District 13 Website.

Thanks,  
Mike Murray  
Alternate Delegate

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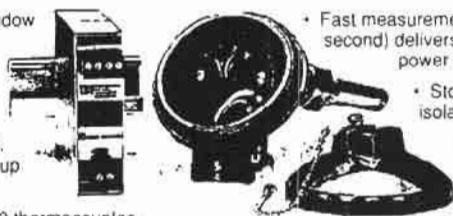
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Bangor, ME*	New England Controls
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Chicago, IL	UA Local 597
Dearborn, MI	Henry Ford Community College
Denver, CO	Colorado School of Mines
Los Angeles, CA	California Polytechnic University
Parsippany, NJ	IBEW Local 102
Pasco, WA	Columbia Basin College
Philadelphia, PA	Williamson Trade School
Pocatello, ID	Idaho State University
Portland, OR	Wacker Siltronic Corporation
Portsmouth, OH	Shawnee State University
Research Triangle Park, NC	ISA Training Institute
St. Louis, MO	Missouri Technical School
Toronto, Canada	George Brown College
Trinidad, West Indies	Ramdass School of Computing Intl.Ltd.
Tulsa, OK	Tulsa Technology Center

### 1997 Exam Dates

October 18, 1997	Levels I, II & III
December 6, 1997	Levels I, II & III
February 7, 1998	Levels I, II & III
May 2, 1998	Levels I, II & III

### Application Deadline

August 27, 1997
October 22, 1997
December 17, 1997
March 1, 1998

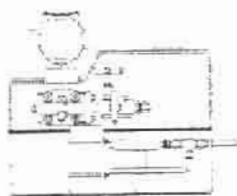
\* The exam site at Bangor, Maine will offer the examination only on the following days: October 17 and December 5, 1997.

\*\* Chattanooga, Tennessee is offering the examination only on October 18, 1997.



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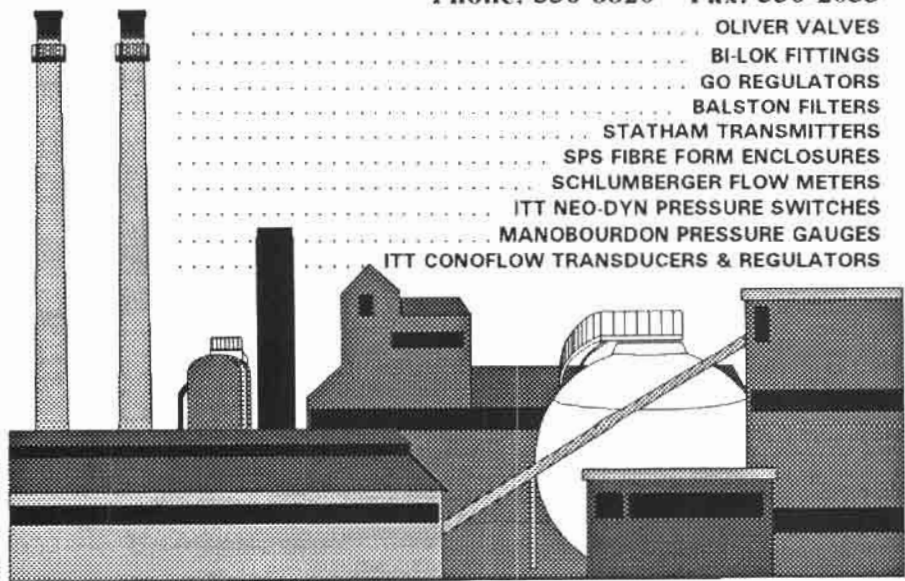
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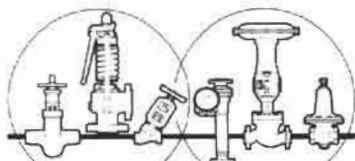
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## COMPUTER CORNER

by: Diana C. Bouchard

T

his month I'll continue to discuss issues relating to the security of your computer hardware, software, and data files.

### Authentication

Passwords are the most commonly encountered aspect of a larger computer security problem called authentication. In essence, this involves making sure that the person accessing your computer is who he/she claims to be and has the right to do so. If you need more bullet-proof access control than is provided by frequently changed passwords, you can go to *smart cards* similar to those used in banking machines, which use a password in conjunction with information encoded on the card to grant or refuse access. Of course the security provided by the card can still be compromised if you write your password on the card or keep it in an easily visible spot.

Down the road a bit, though not as far as you might think, is *biometric authentication*: using some unique aspect of your body, such as your voice, your hand print or the pattern of blood vessels in your eye, to determine identity. One persistent problem with this is that, while unique, some of these aspects are not entirely unchangeable. If you have a cold, the voice recognizer may not let you use your computer!

A related problem is *digital signatures*. Many businesses are rapidly replacing their paper forms with electronic versions to cut down on paperwork and speed up processing. But how do you sign an electronic form in a way that cannot be "faked"? You don't want your average worker on the floor to be able to sign an electronic form giving himself a 50 per cent raise. In fact, public-key encryption, which I discussed last month, offers a workable approach and is already in commercial use for this purpose.

### Virus protection

Here we have the technology (in most cases), it's just a question of applying it rigorously. Unfortunately there seems to be a never-ending supply of eager, ethically deficient programmers writing viruses and sending them out into the world. We are fortunate in that not all of these

"eager beavers" are competent and many of their viruses do not work. Many software vendors and users are also actively engaged every day in combatting the virus threat, identifying new viruses, finding ways to neutralize them, and in many cases sharing this information over the Internet. It's like the old competition between the makers of naval shells and the makers of armour plate.

The World Wide Web offers a number of sites which can help you in your fight against viruses. The vendors of anti-virus software, such as Symantec (Norton Anti Virus) (<http://www.symantec.com/>) and McAfee (<http://www.mcafee.com>), offer the latest updates to their product as well as useful information about new and old viruses. In addition, a number of non-commercial sites provide a venue for information exchange. Check out NCSA Virus Technical Labs (<http://www.ncsa.com/virus/>) and the Virus Bulletin Home Page (<http://www.virusbtn.com/Welcome.html>).

A relatively recent development has been the advent of macro viruses, mainly in Microsoft Word. These take advantage of the fact that Word files can include macros, which are small sets of executable instructions that Word understands, bundled with the file itself. Unfortunately, as executable code, they are tempting targets for virus infiltration. As embedded instructions as opposed to separate files, they are, however, more difficult for anti-virus software packages to detect and eliminate. More difficult is not impossible, however, and you can be sure that with the tremendous investment individuals and companies now have tied up in their computers, a response to this and any new virus threat will not be long in coming.

The biggest challenge for effective virus protection seems to be public education. Many users still adopt the approach that if they get a virus, they'll get somebody from information services to come clean it up. This ignores the substantial time cost of doing this (to you and to IS), plus the havoc you can cause by sending infected files to others inside or outside your

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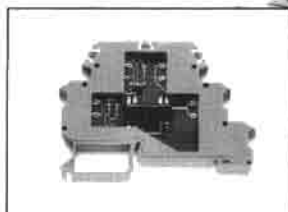
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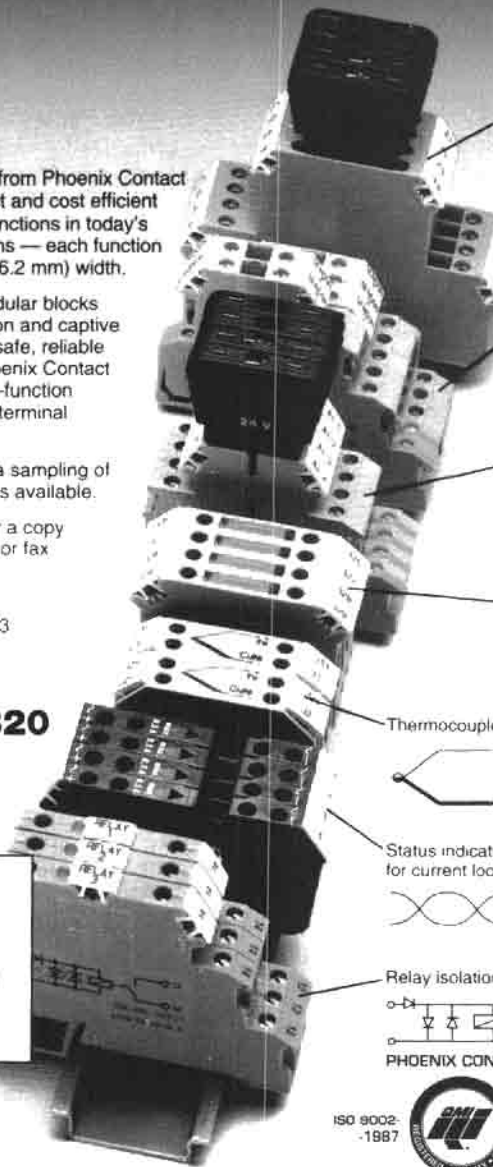
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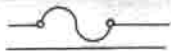
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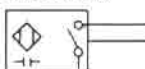
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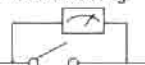
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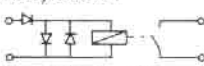
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Status indication for current loops



Relay isolation



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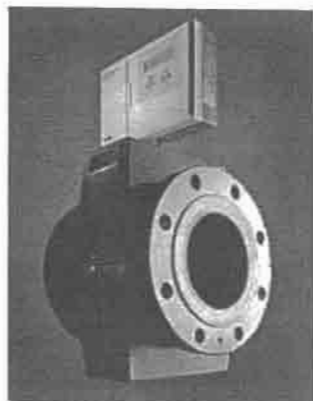
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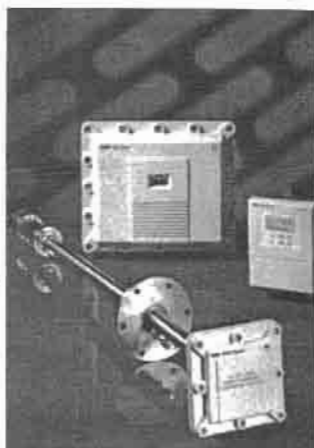
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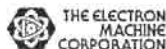
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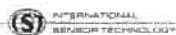
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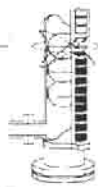


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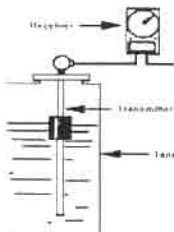
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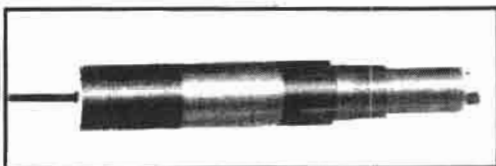
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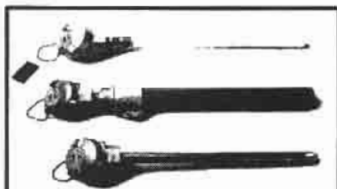
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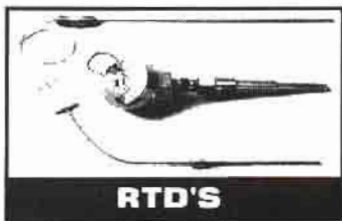
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What type of time and effort is expended on this activity at your company location?  
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— 43 —

company. Plus there's the annoyance factor: people want to get rid of their memory-resident anti-virus program to save a few seconds in their boot-up sequence, or to avoid having to deal with nagging software messages about viruses. The annoyance of having to wait hours or days without your computer, or of losing important files at an inopportune moment, has somehow dropped out of consideration!

### **Firewalls**

Firewalls are a response to the very real threat of bringing in viruses, or admitting intruders, through a company's Internet connection. The principle is that you have something (hardware, software, or both) scrutinizing all inbound traffic and removing any questionable transmissions. Firewalls may also restrict what can be sent out of a company, to reduce the chances of sensitive data being "pirated".

The most common kind of firewall is a *filtering router*. If you have an Internet connection, you probably have a router anyway, and all you need to do is program it to look at data packets as they go by and pass or block them depending on the address or information in the packet header. However, it's not quite that simple. The filtering software has to deal with the variety of Internet protocols that are now in use for various purposes. FTP (used for Internet file transfers), DNS (Domain Name System, which functions as a user directory for your network), and X11 (Unix windowing protocol), often cause problems for filtering routers. Anecdotal evidence also suggests that files attached to electronic mail messages often get corrupted or disappear as they pass through firewalls.

If you need something more sophisticated than a filtering router, go to a *host-based firewall* or *bastion host*, essentially a computer dedicated to firewall functions. These normally contain information about the applications in use on the system and the nature of the files they generate, permitting a more sophisticated screening than one based just on addresses and headers. However, since general-purpose application programs are not designed for security, firewalls often use their own secure versions with stripped-down functions, known as *service proxies*. Of course this bastion host computer is a major point of vulnerability to your network and must itself be adequately protected.

Besides protocol problems, firewalls slow down traffic into or out of your network, because of the extra processing they do on each and every

data packet. These difficulties may lead users to search for alternative means such as modem connections that bypass the firewall.

### **Security policy**

This issue has cropped up repeatedly in the preceding discussions this month and last. No hardware or software will provide security unless people use it and comply with its requirements and restrictions. Before putting in place any of the measures I have discussed, a company should define and communicate a security policy.

The first step is risk assessment. How much do you stand to lose by a breach of security, and how easily could you recover? As an individual user of a stand-alone computer, your major threat is probably from viruses and a memory-resident anti-virus program may be all the security you need. As a business user, you may be more vulnerable. For example, if you have an on-line catalogue you are showing to customers on your web site, and somebody manages to get into the web server and trash some of the files, you will experience some embarrassment and short-term loss of business, but if you have the files backed up, you can probably fix the problem within hours. Confidential production or cost data, say, is another problem. If a competitor gets hold of that, the damage is done and there is no way to undo it.

Depending on the level of threat you perceive, you then have to decide what measures to take. These may include physical isolation, such as putting a web site on a completely separate computer from anything else; file encryption, either within the company or when files are transmitted over the Internet; password protection or other authentication measures; or restrictions on use of devices like modems or import/export of files from company computers.

Be sure and talk with all the user groups who will be affected by the policy and get their input and suggestions. If your security policy prevents someone from doing something he/she needs to do in the regular course of work, the policy is likely to get bypassed or ignored, or resentment will be generated because of your perceived heavy-handed interference.

Don't forget to take time to educate users and increase their awareness of security issues. Without their ongoing cooperation, none of the above will work. Provide training for new employees when they are hired, to bring them "up to speed". And revisit the security policy regularly in the light of changes in technology or business needs.

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# Quarter-Turn Valves

## Fast action, plus emissions control, boosts quarter-turn valves in batch

By Jesse L. Yoder

### Butterfly, ball, and plug valves all gain popularity with passing of Clean Air Act amendments.

On/off quarter-turn valves are widely used in the process industries for batch applications, especially in the food and beverage, pulp and paper, pharmaceutical, specialty chemical and fine chemical industries.

In batch applications, manufacturers often need to add a specific amount of fluid to a reservoir or reactor. On/off quarter-turn valves are typically used for this purpose because they can be turned on and left open until the required amount of fluid has been added and then turned off. Quarter-turn valves also have the advantage that they can be turned on and off more

quickly than linear (or multiturn) valves such as sliding gate.

In the food and beverage industry, where batch applications predominate, special materials are used to meet sanitary requirements. Valves designed for food and beverage applications are often made from stainless steel. Many also have linings such as Teflon. Valves used in the food industry are often cleaned in place using nitric acid, and steam is sent into pipes after use for drying purposes.

#### Valve terminology explained

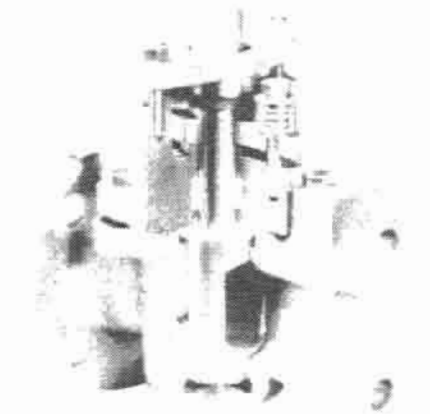
To understand quarter-turn valves, it is essential to know how they relate to other valves. Valve terminology can be very confusing.

Valves are often divided into linear motion valves and rotary motion valves. Linear motion valves use a component such as a gate that moves in a straight-line motion to permit or shut off flow. Types of linear motion valves include globe, gate, diaphragm, pinch and clamp valves.

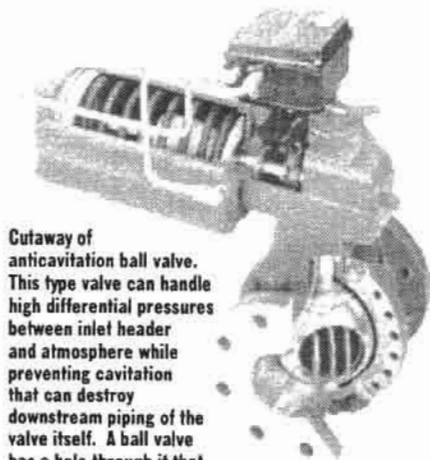
Rotary motion valves have a component that rotates to allow or shut off flow. Rotary motion valves with components that rotate 90 degrees are known as quarter-turn valves. The category of quarter-turn valves sometimes is broadened to include other rotary valves that rotate less than 270 degrees.

By definition then, quarter-turn valves are rotary valves that have a component such as a rotating disc that turns 90 degrees to move from an *on* to an *off* position. All quarter-turn valves have this feature in common.

(Continued on Page 47)



Cutaway view of plug valve. Plug valves have a tapered or cylindrical plug with a hole in the center, allowing flow when the hole is lined up with the flow path. Flow is blocked when the plug is turned 90 degrees in either direction. Plug valves are typically used for on/off applications.



**Cutaway of anticavitation ball valve.** This type valve can handle high differential pressures between inlet header and atmosphere while preventing cavitation that can destroy downstream piping of the valve itself. A ball valve has a hole through it that allows straight-through flow when it is in the open position. Rotating the ball 90 degrees to the closed position shuts off flow.

### Three quarter-turn types

There are three types of quarter-turn valves: butterfly, ball, and plug valves.

*Butterfly valves* use a circular disc or vane that has a pivot axis at right angles to control the direction of flow. This disc or vane looks somewhat like a butterfly. Butterfly valves are used for both on/off and modulating applications. Butterfly valves are often used to handle slurries or fluids that have solids in suspension.

*Ball valves* use a ball with a hole through it that allows straight-through flow when it is in the open position. Rotating the ball 90 degrees to the closed position shuts off flow. Ball valves are used for both on/off and modulating applications. Ball valves have low pressure drop and can be used with viscous and corrosive fluids, slurries and cryogenic liquids. Ball valves can also be used at high temperatures and pressures.

*Plug valves* have a tapered or cylindrical plug with a hole in the centre. Flow is permitted when the hole is lined up with the flow path. Flow is blocked when the plug is turned 90 degrees in either direction. Plug valves are typi-

cally used for on/off applications.

In addition to the distinction by type between butterfly, ball and plug valves, quarter-turn valves can also be categorized as follows: manual, automated and modulating.

*Manual* quarter-turn valves are hand operated. Manual valves open and close by means of a lever, gear, or wheel, which is called a manual actuator. An actuator opens and closes a valve by operating the valve stem and flow control element. Manual quarter-turn valves have a component that turns 90 degrees.

*Automated* quarter-turn valves have an automatic actuator with an external power source that provides the force and motion to open or close a valve automatically or remotely. Some valves are too large to operate manually. Others are located in toxic or hostile environments that make hand operation impossible. In some cases, valves have to close quickly for emergency purposes. Types of automatic actuators include hydraulic, pneumatic, and electric actuators. Most automatic quarter-turn valves are operated with either electric or pneumatic actuators.

*Modulating* quarter-turn valves can operate in a partially open state. These valves have an actuator that provides rotary motion in proportion to an electrical control signal. Butterfly valves are often used for modulating applications in lines with large diameters where pressure is low and leakage is not a major issue.

*Modulating* quarter-turn valves are a type of control valve. Other types of control valves include linear valves such as globe, gate and diaphragm. Automated on/off quarter-turn valves are not control valves since they are limited to the open and closed positions.



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Monday, January 26, 1998

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Cocktails 6:00 p.m. Dinner 7:00 p.m.

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*Topic: Bayer's Outlook for the Chemical Valley*



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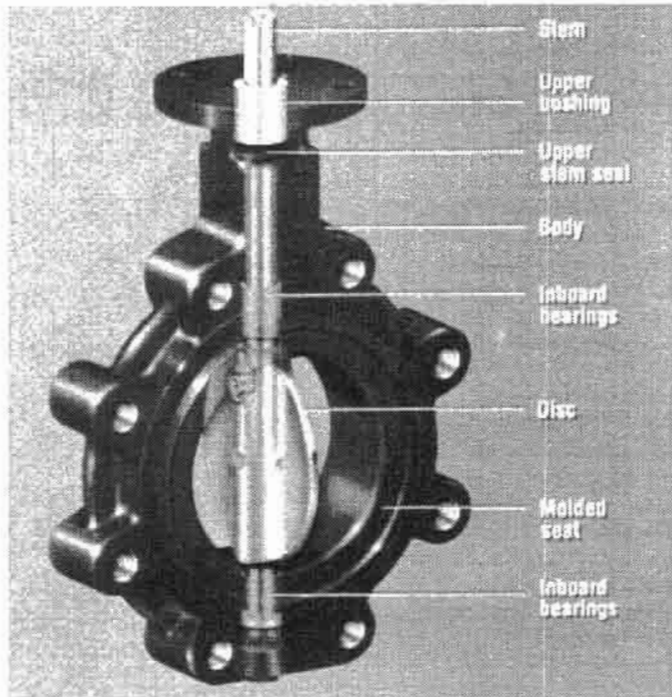
*\* For special dietary needs contact Hilda White at the Sarnia Golf and Curling Club 48 hours prior to meeting date.*

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Diaphanous illustration of butterfly valve. Butterfly valves use a circular disc or vane, which looks somewhat like a butterfly, that has a pivot axis at right angles to control the direction of flow. Butterfly valves are often used to handle slurries or fluids that have solids in suspension.

### VMA sizes market

The Valve Manufacturers Association (VMA), to which most major valve suppliers belong, tracks shipments of valves by type. In particular, the VMA records shipments of ball, industrial butterfly, and plug valves. Besides these categories, the VMA tracks automated valves as a separate category. Modulating quarter-turn valves are included in the category of automated valves, and their sales are not recorded separately. VMA figures are for shipments by U.S. suppliers, including exports but not including imports.

According to the VMA, 1996 U.S. valve shipments totalled \$1.04 billion for ball, industrial butterfly and plug valves. This number includes manual and automated ball, industrial butterfly and plug valves; it does not include modulating valves. Ball valves made up the largest percentage, with 54.2% of the total; industrial butterfly valves made

up 26.2%, while plug valves made up the remaining 19.6%.

### Manual valves affected

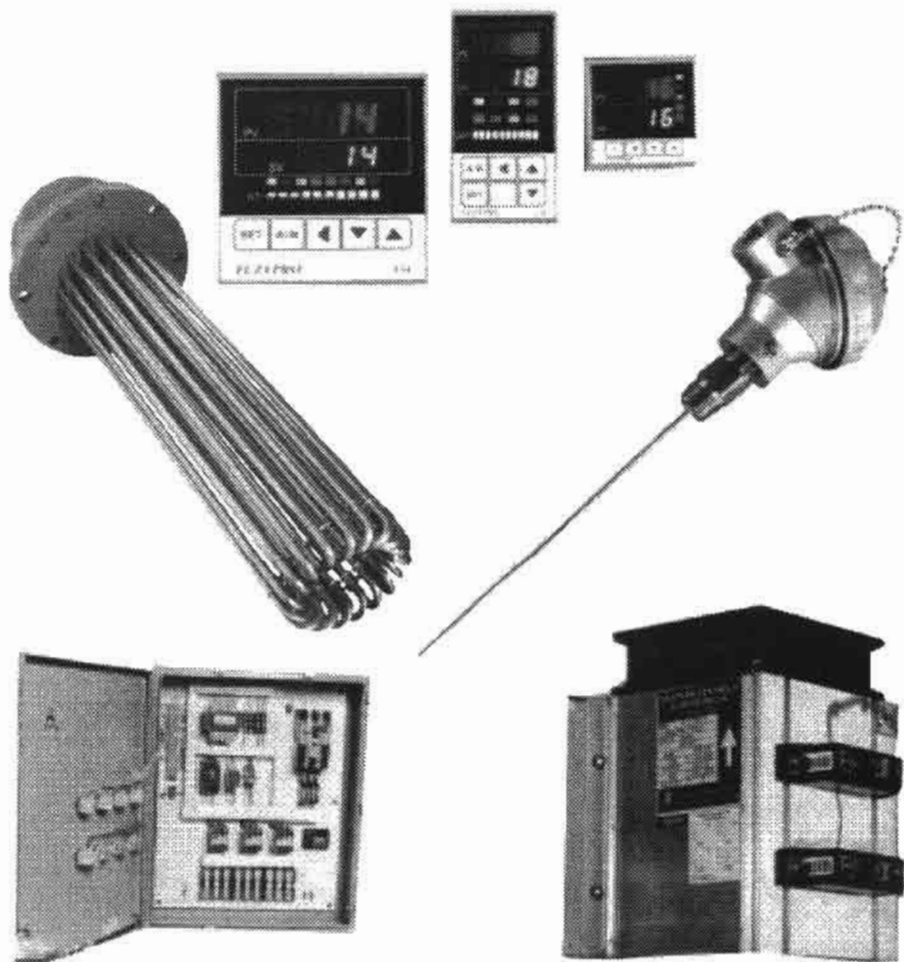
Increased automation in process plants worldwide will cause increasing demand for automated and modulating quarter-turn valves at the expense of manual valves. As a result, much of the emphasis of future technological development will be on the actuators and positioners that enable these valves to be linked to personal computers, programmable logic controllers, and distributed control systems.

Electric actuators will increasingly replace pneumatic actuators. Electric actuators eliminate the need to install and maintain air lines and compressors, and they offer tighter control for positioning applications. Using an electric actuator also does away with the conversion of electrical signals to pneumatic signals.

(Continued on Page 65)

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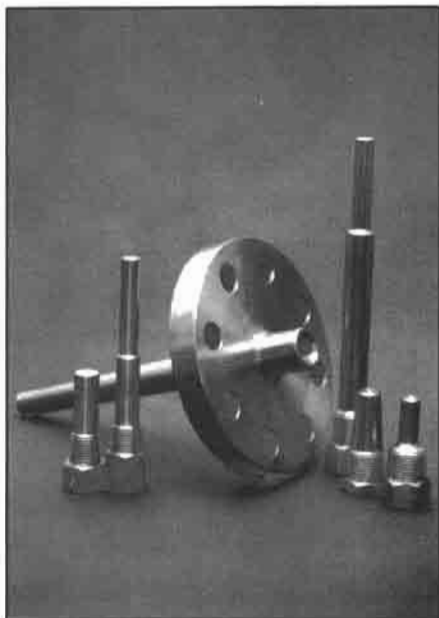
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Other developments in quarter-turn valves will focus on higher performance through improved seat design and seat materials and continued emphasis on reducing fugitive emissions. Smart valves, including servo valves that contain a control loop and act as a positioner and a controller, will be increasingly important as manufacturers seek to cut costs and increase process efficiency.

#### **Advantages vs. sliding gate valves**

Quarter-turn valves are sometimes compared to sliding-gate valves since quarter-turn valves are an alternative to gate valves in some cases. Gate valves are general-service valves used mainly for on/off, rather than modulating, applications. Quarter-turn valves have several advantages over sliding-gate valves.

For example, a linear valve's stem movement can open paths for emissions release. Quarter-turn valves, which have a rotary motion, do not have this emissions problem. In some high-temperature applications with metal-to-metal sealing, gate valves may be the most logical choice.

Preventing fugitive emissions has become increasingly important as Clean Air Act (CAA) amendments have been implemented. CAA amendments from 1990 include 189 volatile hazardous air pollutants (VHAPs), of which 150 are volatile organic compounds (VOCs). The final stage of the CAA amendments was implemented in April 1997. In addition to an earlier leak detection and repair (LDAR) program, this stage includes a quality improvement program.

Depending on the number of leaking valves at a facility, quarterly or even monthly inspections may be required.

#### **Emissions can be costly**

The net result of the CAA amendments is to increase the cost of fugi-

tive valve emission to chemical companies, refineries, and other companies using valves. The cost comes with an added benefit, however. Product losses from process lines are reduced along with the reduction in fugitive emissions from valves.

CAA amendments, and the resulting importance of controlling fugitive emissions, are encouraging suppliers of manual, automated, and control valves to look at new techniques designed to reduce valve emissions. Much emphasis is being placed on materials used in valve packing systems. Polytetrafluoroethylene (PTFE) and graphite are two materials commonly used in valve packing systems. In an effort to reduce emissions, some valve suppliers are combining perfluoroelastomer parts with PTFE and graphite in their valve packing systems.

Perfluoroelastomers need less loading force than a PTFE-based packing system, while a graphite system requires several times as much loading force as perfluoroelastomer-based systems to seal. High loading force contributes to high stem friction and wear.

By contrast to on/off valves, control valves are well-suited for continuous processes. Due to their modulating ability, control valves can maintain a set point by varying the amount of flow depending on input parameters.

In some cases, both control valves and on/off valves are required. For example, in refineries quarter-turn on/off valves are used as safety valves. A control valve may be accompanied by two manual on/off valves that are used to isolate the pipe and shut off flow when the control valve needs to be dismantled.

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Armatek Controls  
CB Engineering  
Transcat  
BEP Bestobell Canada Ltd.  
SPEC (Sarnia) Limited  
Cancoppas Limited  
Cancoppas Limited

**Manufacturer / Tradename**

Frontline  
 Fuji  
 Fuji Electric  
 Fuji Electric  
 Fujikin of America Inc.  
 Furon  
 Furon  
 Fuzzypro  
 G.W. Dahl  
 Galtek  
 Gamma Silometer  
 Gasco Gas Analysis Systems Company, Inc.  
 Gastech  
 Gastech Instruments  
 Gems Sensors  
 Gemu  
 General Eastern  
 General Radio  
 General Resistance  
 Geokon  
 George Fischer +GF+  
 GGOSCO Needle Valves  
 GGOSCO Valves  
 GH Flow Automation  
 Gitta Proximity Sensors  
 Global  
 GO Regulators  
 GO Switch (Proximity)  
 GP:50  
 GPI  
 Graham Manufacturing  
 Gralab  
 Granucor  
 Granulow  
 Granumet  
 Graseby / STI  
 Great Plains Industries  
 Greyline Instruments, Inc.  
 Griswold Separators  
 Gyrolok  
 H.D. Baumann  
 Hach  
 Halliburton  
 Hancock  
 Hanna  
 Hansen Quik Connects  
 Hardy Instruments  
 Hart Scientific  
 Hart Scientific  
 Hartman & Braun  
 Hartman-Technica  
 Harwil Corp.  
 Hathaway  
 Hathaway / Beta  
 Haven  
 Haws  
 Hayward  
 Hayward  
 HCS  
 HD Electric Company  
 Hecon  
 Hedland  
 Hedland Flowmeters  
 Heise  
 Heise  
 Hersey Flow Measurement  
 Hewlett Packard  
 Hiltap Couplers  
 Hitachi  
 Hoffer Flow Controls - USA  
 Hoke  
 Honeywell  
 Honeywell - Controllers & Recorders  
 Honeywell - Instruments  
 Honeywell - Instruments  
 Honeywell - Recorders  
 Houston Atlas  
 Huntron  
 Hybertab  
 Hycal  
 HydroGuard

**Local Sales Representative**

Transtat  
 Heaters Controls & Sensors Ltd.  
 Transtat  
 WESCO  
 Ovanum Sales Inc.  
 Great Lakes Industrial Controls  
 Intertec  
 Heaters Controls & Sensors Ltd  
 Armatek Controls  
 Romatec  
 Endress + Hauser  
 Novatech  
 Transtat  
 R.A. Kirby Sales Inc  
 IMO Industries  
 Matheson Valves  
 Willer Engineering  
 Transtat  
 Transtat  
 Campbell Scientific (Canada) Corp.  
 Brian Controls  
 Westburne Lytle  
 Hardie Industrial Services Inc.  
 Ovanum Sales Inc.  
 Heaters Controls & Sensors Ltd  
 Transtat  
 Sarnia Piping Specialties  
 Lakeside Process Control  
 Omnitronix  
 Transtat  
 Lakeside Process Controls  
 Transtat  
 Endress + Hauser  
 Endress + Hauser  
 Endress + Hauser  
 CB Engineering  
 Armatek Controls  
 Controls  
 Floval Equipment Ltd  
 Summit Controls Ltd  
 Lakeside Process Controls  
 Fryston Canada Inc.  
 Willer Engineering  
 Contro Valve Inc.  
 Transtat  
 Provincial Controls  
 CTH Industrial Controls  
 Alpha Controls & Instrumentation  
 Transtat  
 TubeTech Ltd  
 Transtat  
 Ovanum Sales Inc.  
 Line Process Controls  
 Transtat  
 Cancoppas Limited  
 Great Lakes Industrial Controls  
 CTH Industrial Controls  
 Summit Controls Ltd.  
 Great Lakes Industrial Controls  
 Transtat  
 Transtat  
 Brian Controls  
 R.A. Kirby Sales Inc.  
 BSP Instruments  
 Transtat  
 Floval Equipment Ltd.  
 Transtat  
 U & I Supply  
 Transtat  
 Lisle-Metrix Ltd.  
 Summit Controls Ltd.  
 Davis Controls  
 Provincial Controls  
 Brian Controls  
 Floval Equipment Ltd.  
 Transtat  
 R.A. Kirby Sales Inc.  
 Transtat  
 Transtat  
 Davis Controls  
 Endress + Hauser

**Manufacturer / Tradename**

Hytork  
IBM Industrial Computers  
ICC Federated  
Ice  
ICI  
IET Labs  
Imperial Eastman Fittings  
Imperial Eastman Fittings  
IMS  
Industrial Control  
Industrial Scientific  
Industrial Sensors  
Industrial Tech. Services  
Infrared Engineering  
Ingredient Masters  
Innovative Sensors Inc.  
Inor  
Instek America  
Intellution  
Intempro Controls Ltd.  
Interface  
Interface  
International Data Sciences  
International Instruments  
International Sensor Technology  
Ion Track Instrumentation (ITI)  
Ionics Instrument Division  
Iotron  
Ircan  
ISI  
Isolok  
Isotek  
ITT Barton Instruments  
ITT Conoflow Transducers & Regulators  
ITT Engineered Valves  
ITT Neo-Dyn Pressure Switches  
ITT Pomona  
IVO Industries - USA  
J.M. Canty, Inc.  
Jacoby Tarbox  
Jerguson Level Gauges  
Jewell  
Jofra  
Johnson Yokogawa  
Jordan Controls, Inc.  
J-Tec  
Julius Bauser - Germany  
JUM  
Kammer Valves  
Kane-May  
Kates  
Kavlico  
Kay Ray / Sensall  
Kaye  
Kaye Instruments  
KDG Mobrey  
Kedcco Mfg. Ltd.  
Keller  
Kenmac  
Kenwood USA  
Kep  
Kep  
Ketema  
KF Industries  
Kinetrol Actuators  
Kinetrol Actuators  
King Instrument Company  
Kipp & Zonen  
Kipp & Zonen  
Kistler-Mores  
Kitz  
KL Flow  
Klinger  
Klinger  
KNF Neuberger  
Kobold  
Kobold  
Kobold  
Koch  
Kotron Capacitance  
Kreyenborg

**Local Sales Representative**

Matheson Valves  
CB Engineering  
Transcat  
Transcat  
Cancoppas Limited  
Transcat  
Provincial Controls  
U & I Supply  
Great Lakes Industrial Controls  
Transcat  
Brian Controls  
Heaters Controls & Sensors Ltd.  
BSP Instruments  
Willer Engineering  
Ovantum Sales Inc.  
ProSigma Analytics Inc.  
Alpha Controls & Instrumentation  
Transcat  
CB Engineering  
Matheson Valves  
Durham Instruments  
Willer Engineering  
Transcat  
Transcat  
Industrial Projects Ltd.  
BEP Bestobell Canada Ltd.  
Veronics Inc.  
WESCO  
Willer Engineering  
Heaters Controls & Sensors Ltd.  
Great Lakes Industrial Controls  
Transcat  
Armatek Controls  
Sarnia Piping Specialties  
Romatec  
Sarnia Piping Specialties  
Transcat  
Lisle-Matrix Ltd.  
Cambridge Controls  
Romatec  
Romatec  
Transcat  
Transcat  
CB Engineering  
Cambridge Controls  
Brian Controls  
Lisle-Matrix Ltd.  
BSP Instruments  
Matheson Valves  
Transcat  
Westech Industrial Ltd.  
Davis Controls  
Rosemount Instruments  
Transcat  
CB Engineering  
BEP Bestobell Canada Ltd.  
U & I Supply  
Campbell Scientific (Canada) Corp.  
Great Lakes Industrial Controls  
Transcat  
Brian Controls  
Transcat  
Brian Controls  
Great Lakes Industrial Controls  
Hardie Industrial Services Inc.  
Provincial Controls  
Industrial Projects Ltd.  
Durham Instruments  
Transcat  
Ovantum Sales Inc.  
Matheson Valves  
Cancoppas Limited  
Davis Controls  
SPEC (Sarnia) Limited  
Transcat  
Cancoppas Limited  
Regional Process Equipment  
Transcat  
Romatec  
Provincial Controls  
Great Lakes Industrial Controls

**Manufacturer / Tradename**

Chemtrol  
 Chemtrol  
 Chessell  
 Cliff Mock  
 CM - Century Valve  
 Coider  
 Columbia Scientific  
 CompuFlo III  
 Computer Keyboard Systems (CKS)  
 Conant Controls Inc.  
 Conant Valves  
 Conders  
 Conerstone  
 Conoflow ITT  
 Consolidated  
 Consolidated Controls  
 Con-Tek  
 Control Instruments Corp.  
 Control Microsystems  
 ControlAir Inc.  
 ControlAir Inc.  
 Cooke  
 Cooper Instruments  
 Cosa  
 Cosa  
 CRL  
 Crowcon  
 Crowcon Gas Detection  
 Crystal  
 CSI - Microloggers  
 Cutler-Hammer  
 Cybex  
 Cybex  
 Dahl  
 Danaher Controls  
 Danfoss  
 Danfoss Mfg. Co. Ltd. - Denmark  
 Daniel  
 Daniel Industries  
 Daniel Industries Canada  
 Data Industrial Corporation  
 Data Precision  
 Datacom Technologies  
 Datatest  
 Datatran  
 Datexel  
 Davenport  
 Dekoron Unitherm  
 Delavan  
 Delphian  
 Delphian  
 Delta Controls  
 Delta F Corporation  
 Deltabar  
 Delta-M  
 Deltapilot  
 Deltavalve  
 Detector Electronics (Detronics)  
 Devar  
 DewPro  
 Dewrance  
 DeZurk  
 DGH  
 DGS - Dover Gas Technologies  
 Dickson  
 Digitec  
 Digitec  
 Digitron  
 Dixon  
 Dixon, Inc.  
 Dopak  
 Dow Plastic Lined Piping Products  
 DPL Plus  
 Drager  
 Drainall  
 Druck  
 Ducon Environmental Systems  
 Durakool  
 Dwyer  
 Dwyer  
 Dwyer

**Local Sales Representative**

U & I Supply  
 WESCO  
 Willer Engineering  
 Westburne Lytle  
 Brian Controls  
 Davis Controls  
 R.A. Kirby Sales Inc.  
 Milltronics Limited  
 CB Engineering  
 Industrial Projects Ltd.  
 Provincial Controls  
 Transcat  
 Transcat  
 Matheson Valves  
 Contro Valve Inc.  
 Transcat  
 Lakeside Process Controls  
 Willer Engineering  
 Brian Controls  
 Cambridge Controls  
 WESCO  
 Transcat  
 Transcat  
 Brian Controls  
 Transcat  
 Carcoppas Limited  
 Carcoppas Limited  
 Regional Process Equipment  
 Transcat  
 Campbell Scientific (Canada) Corp.  
 WESCO  
 CB Engineering  
 CB Engineering  
 Armatek Controls  
 J & M Engineering & Sales Ltd.  
 Davis Controls  
 Lisle-Matrix Ltd.  
 Westech Industrial Ltd  
 Controls  
 Controls  
 Cambridge Controls  
 Transcat  
 Transcat  
 R.A. Kirby Sales Inc.  
 Transcat  
 Transcat  
 Omnitronix  
 Great Lakes Industrial Controls  
 Armatek Controls  
 BSP Instruments  
 Romatec  
 CTH Industrial Controls  
 ProSigma Analytics Inc.  
 Endress + Hauser  
 Brian Controls  
 Endress + Hauser  
 Summit Controls Ltd.  
 CB Engineering  
 Transcat  
 Endress + Hauser  
 Contro Valve Inc.  
 Floval Equipment Ltd.  
 Alpha Controls & Instrumentation  
 Veronics Inc.  
 Transcat  
 Brian Controls  
 Durham Instruments  
 Transcat  
 Transcat  
 CTH Industrial Controls  
 Westburne Lytle  
 Sarnia Piping Specialties  
 Milltronics Limited  
 Draeger Canada Ltd.  
 Great Lakes Industrial Controls  
 Transcat  
 R.A. Kirby Sales Inc.  
 Davis Controls  
 Davis Controls  
 Hardie Industrial Services Inc.  
 Transcat

**Manufacturer / Tradename**

Micropilot  
MicroRanger  
Mid-West Instrument  
Mid-West Instrument  
Mihjets  
Mihproducts Division  
Mikron  
Mikron  
MillFlo  
Milltronics  
Milton Roy - Liquid Metronics Division  
Milwaukee  
MiniRanger Plus  
Mitac  
Mitsubishi  
Mitutoyo  
MKS  
Mobrey  
Modutec  
Monarch  
Monitek  
Monitor Labs  
Monitor Labs  
Moore  
Moore  
Moore Industries  
Moore Products  
M-Tek  
MTL Intrinsic Safe Barriers  
Mueller  
Multicap  
Multiglass  
MultiRanger Plus  
Mycro  
Myron L  
Nassau Instrument  
National Meter  
NBS  
NDT International  
Neilsen-Kuljian  
Neles-Jamesbury  
NemaSoft  
NICE  
Nicol  
Nivocompact  
Nivosonic  
Norriseal Butterfly Valves  
Norstat  
Northern Vibrator  
Noshok  
Novatech Engineering Group  
Numatics Cylinders  
Numatics F/R/Ls  
Numatics Solenoid Valves  
Nupro Valves  
Nusonics  
Oakton  
O'Brien Corporation  
OCM III  
Ogden  
Ogden  
Ohmart Vega  
Oil Gear  
Oilgear  
Olin Instruments  
Oliver Valves  
Optek  
Optex  
Optima  
Opto 22  
Orange Research DP Switch  
Orbe Knife Gates Valves  
Orion  
OSI Semitronic  
Pace  
Pacer Industries  
Pamark Manifolds  
Panalarm  
Panalarm  
Panametrics PCI Division  
Papailias

**Local Sales Representative**

Endress + Hauser  
Milltronics Limited  
Brian Controls  
Hardie Industrial Services Inc.  
SPEC (Sarnia) Limited  
SPEC (Sarnia) Limited  
Armatek Controls  
Transcat  
Milltronics Limited  
Milltronics Limited  
U & I Supply  
Flovial Equipment Ltd.  
Milltronics Limited  
CTH Industrial Controls  
Davis Controls  
Transcat  
Transcat  
BEP Bestobell Canada Ltd.  
Transcat  
Transcat  
Willer Engineering  
Brian Controls  
Romatec  
Moore Products Co. (Canada) Inc.  
Summit Controls Ltd.  
Armatek Controls  
Transcat  
Transcat  
Provincial Controls  
Great Lakes Industrial Controls  
Endress + Hauser  
Great Lakes Industrial Controls  
Milltronics Limited  
Moore Products Co. (Canada) Inc.  
Transcat  
Transcat  
Transcat  
Transcat  
Transcat  
Transcat  
Summit Controls Ltd.  
Davis Controls  
Cancoppas Limited  
Contro Valve Inc.  
Endress + Hauser  
Endress + Hauser  
Sarnia Piping Specialties  
Davis Controls  
Flovial Equipment Ltd.  
IMO Industries  
Novatech  
Provincial Controls  
Provincial Controls  
Provincial Controls  
Huron Valve & Fittings  
Armatek Controls  
Transcat  
CB Engineering  
Milltronics Limited  
Durham Instruments  
Heaters Controls & Sensors Ltd.  
TubeTech Ltd.  
Armatek Controls  
BEP Bestobell Canada Ltd.  
Veronics Inc.  
Sarnia Piping Specialties  
R.A. Kirby Sales Inc.  
Heaters Controls & Sensors Ltd.  
Westech Industrial Ltd.  
CB Engineering  
Provincial Controls  
Regional Process Equipment  
Transcat  
CTH Industrial Controls  
Transcat  
Transcat  
Provincial Controls  
Cambridge Controls  
Willer Engineering  
Veronics Inc.  
Great Lakes Industrial Controls

**Manufacturer / Tradename**

Parker Fluid Connectors  
Partlow  
Patriot  
Paul Mueller  
PCME  
Pelican  
Penberthy Instruments  
Penberthy, Inc.  
Penny + Giles  
Pepperl + Fuchs - USA  
Perma-cal Gauges  
Perma-Pure  
PGI  
PGI Valves & Manifolds  
Phase Dynamics  
Phipps & Bird  
PMV  
PMV  
Polymetron  
Porter Instrument Co. - USA  
Powers  
Powers Process Controls  
Powers Process Controls  
Powertronics  
Precision Digital Corp.  
Precision Digital Corp.  
Precision Digital Corp.  
Precision Digital Corp.  
Precision Digital Corp.  
Precision Digital Corp.  
Preso Meters Corp.  
Pribusin Inc.  
Pribusin Inc.  
Progressive Electronics  
Prolevel  
Promac  
Promag  
Promag  
Promass  
Proquip  
Prosonic  
Protek  
Provincial Instrument Enclosures  
Provox  
Prowirl  
Proximity Controls  
Pulsafeeder  
Purifics  
Pyromation, Inc.  
QSDM  
QSDM  
Quadtech (Gen Rad)  
Quality Control Equip.  
R.M. Young  
R.P. Adams  
Radiant Heat  
Ralston  
Ralston  
Ramsey Canada  
Raychem  
Raytek  
Raytek  
Raytek  
Raytek  
Raytek  
Raytek / UE  
RC Systems  
RdF  
RdF  
REBS  
Regal  
REK RKC  
Research Control Valves  
Rexroth  
Rezplast  
RIMCO - Raingauges  
RKC  
Robertshaw  
Rochester  
Rohrbach Cosasco Systems  
Ronan

**Local Sales Representative**

TubeTech Ltd.  
WESCO  
Durham Instruments  
Great Lakes Industrial Controls  
Westech Industrial Ltd.  
Transcat  
Hardie Industrial Services Inc.  
Brian Controls  
Durham Instruments  
Lisle-Matrix Ltd.  
Provincial Controls  
Great Lakes Industrial Controls  
Regional Process Equipment  
Provincial Controls  
Armatek Controls  
Transcat  
Cancoppas Limited  
Regional Process Equipment  
ProSigma Analytics Inc.  
Lisle-Matrix Ltd.  
Line Process Controls  
CTH Industrial Controls  
Heaters Controls & Sensors Ltd.  
Transcat  
Alpha Controls & Instrumentation  
Armatek Controls  
Cambridge Controls  
CTH Industrial Controls  
Ovantium Sales Inc.  
R.A. Kirby Sales Inc.  
Floval Equipment Ltd.  
Novatech  
Provincial Controls  
Transcat  
Endress + Hauser  
Line Process Controls  
Endress + Hauser  
Westburne Lytle  
Endress + Hauser  
SPEC (Sarnia) Limited  
Endress + Hauser  
BSP Instruments  
Provincial Controls  
Lakeside Process Control  
Endress + Hauser  
BEP Bestobell Canada Ltd.  
Romatec  
Great Lakes Industrial Controls  
WESCO  
Alpha Controls & Instrumentation  
Willer Engineering  
Transcat  
Ovantium Sales Inc.  
Campbell Scientific (Canada) Corp.  
Great Lakes Industrial Controls  
Heaters Controls & Sensors Ltd.  
Heaters Controls & Sensors Ltd.  
Transcat  
Ovantium Sales Inc.  
Great Lakes Industrial Controls  
Alpha Controls & Instrumentation  
CTH Industrial Controls  
Heaters Controls & Sensors Ltd.  
Transcat  
WESCO  
Great Lakes Industrial Controls  
Cancoppas Limited  
Transcat  
Willer Engineering  
Campbell Scientific (Canada) Corp.  
Cancoppas Limited  
Heaters Controls & Sensors Ltd.  
Lakeside Process Control  
Great Lakes Industrial Controls  
Great Lakes Industrial Controls  
Campbell Scientific (Canada) Corp.  
Heaters Controls & Sensors Ltd.  
Line Process Controls  
Transcat  
Armatek Controls  
Industrial Projects Ltd.

**Manufacturer / Tradename**

Roper Pump  
Rosemount  
Rosemount Analytical  
Rosemount Analytical  
Rosemount Combustion Control  
Rosemount RS3 Systems  
Rotek  
Rotronic  
Rotronic  
Rotronic Instruments  
Royce  
RTP  
Ruffneck Heaters  
Rustrack  
Rustrak  
S.P.S. Instrument Services  
Saab  
Saab Tank Radar Level  
Samson  
Schaevitz  
Schlumberger/Neptune Flow Meters  
Schonsted  
Sealed Unit Parts  
Seametrics Inc  
SeaMetrics Inc.  
Seepex  
Selco / Asahi  
Selco / Asahi  
Senaco Plus  
Senior Flexionics  
Sonsall  
Sensit  
Sensit  
Sensorex  
Sensorlink  
Sensortech Systems Inc  
Sensortronics  
Sensotec  
Sensycon  
Sensycon  
Sentry  
Serge-Baril  
Servomex  
Setra  
Stere  
Stere  
Shamrock Environmental  
Shan Rod Inc.  
Shand & Jurs  
Shimpo  
Showa  
Sieger  
Siemens Process Analyzers  
Sierra Monitor  
Signet Scientific  
Sigrist-Photometer Co. - Switzerland  
Silometer  
Simpson  
Sinclair Collins  
Smar  
Smartline  
SMC Knifegate  
Sno-Trik  
Solartron  
Soliphant  
Solomat  
SOR Inc.  
South-West Meters  
Southwest Valve  
Sparling  
SPL Plus  
SPM  
SPS Fibre Form Enclosures  
SSI  
SSI Equipment  
SSI Strainers  
Staeft  
Stahl  
Statham Transmitters  
Stewart Instruments  
StoneL

**Local Sales Representative**

U & I Supply  
Rosemount Instruments  
Rosemount Instruments  
Transcat  
Homatec  
Lakeside Process Control  
Transcat  
Alpha Controls & Instrumentation  
Durham Instruments  
Transcat  
Cancoppas Limited  
Davis Controls  
Great Lakes Industrial Controls  
Transcat  
OmniTronix  
Sarnia Piping Specialties  
Brian Controls  
R. A. Kirby Sales Inc.  
Samson Controls  
Durham Instruments  
Sarnia Piping Specialties  
Transcat  
Transcat  
Line Process Controls  
Veronics Inc.  
U & I Supply  
CTH Industrial Controls  
Transcat  
Milltronics Limited  
Regional Process Equipment  
Alpha Controls & Instrumentation  
Durham Instruments  
Durham Instruments  
Transcat  
Transcat  
Novatech  
Durham Instruments  
Line Process Controls  
Elsag Bailey  
Tube Tech Ltd  
Fryston Canada Inc.  
Great Lakes Industrial Controls  
Novatech  
Alpha Controls & Instrumentation  
Cancoppas Limited  
Regional Process Equipment  
ProSigma Analytics Inc.  
Flovac Equipment Ltd.  
Line Process Controls  
Transcat  
Durham Instruments  
Westech Industrial Ltd.  
Willer Engineering  
Transcat  
Hardie Industrial Services Inc.  
Lisle-Matrix Ltd.  
Endress + Hauser  
Transcat  
Summit Controls Ltd.  
BSP Instruments  
Honeywell  
Matheson Valves  
Huron Valve & Fittings  
Westech Industrial Ltd.  
Endress + Hauser  
Transcat  
Durham Instruments  
Sarnia Piping Specialties  
Flovac Equipment Ltd.  
Brian Controls  
Milltronics Limited  
Transcat  
Sarnia Piping Specialties  
Great Lakes Industrial Controls  
Flovac Equipment Ltd.  
Matheson Valves  
BSP Instruments  
Alpha Controls & Instrumentation  
Sarnia Piping Specialties  
Flovac Equipment Ltd.  
Regional Process Equipment

## Manufacturer / Tradename

StoneL  
Storage Battery Systems  
Superior  
Superior Flo  
Swagelok Tube Fittings  
Syscon  
Systematrix  
TA Instruments, Inc.  
Tapecoat Canada  
Tate-Andale  
Taylor  
TBI-Bailey  
TBI-Bailey  
TBV  
TDC-3000  
Tech Spray  
Techline  
Techmation  
Technipower  
Technova  
Technova  
Tektronix  
Tektronix  
Teledyne  
Teledyne Analytical  
Teledyne-Farris Relief Valves  
Telegan  
Telematic  
Tel-Tru  
Tel-Tru  
Tel-Tru Thermometers  
Tempco  
Tenor Industrial Control  
Test Probes  
Texas Electronics - Raingauges  
Texas Sampling  
Texas Sampling Inc.  
TFL - Torbar Flowmeters Ltd.  
The Electron Machine Corporation  
The Probe  
Theben  
Thermal Instrument Co.  
Thermax  
Thermetrics  
Thermo Electric  
Thermo Electric  
Thermo Kinetics Temperature Products  
Thermon  
Thermox  
TIF  
Time Electronics  
TN Technologies  
Tomoe Valves  
Tong Yung Valves  
Tower-Gard  
Transcat  
Transmation  
Transmation, Inc.  
Transmation, Inc.  
TRC  
Trend B-Metal Thermometers  
Trexice  
Tricentric  
Tripplett  
Tripp-Lite  
Tritron  
Trueline Valves  
TSI  
Tufline Valve  
Turbo  
TVL  
Tytronics Inc.  
U.S. Gauge (Ametek)  
UE - United Electric  
United Electric  
United Electric Controls (Canada) Ltd.  
United Sciences Inc.  
Unitherm  
Unitherm  
Universal  
Universal Analyzers

## Local Sales Representative

Summit Controls Ltd.  
Transcat  
Great Lakes Industrial Controls  
BSP Instruments  
Huron Valve & Fittings  
Heaters Controls & Sensors Ltd  
Willer Engineering  
Westech Industrial Ltd.  
Sarnia Piping Specialties  
Great Lakes Industrial Controls  
Transcat  
Elsaq Bailey  
TubeTech Ltd.  
Romatec  
Honeywell  
Transcat  
Transcat  
Lakeside Process Control  
Transcat  
Matheson Valves  
Matheson Valves  
Omnitronix  
Transcat  
Transcat  
Armatek Controls  
Provincial Controls  
BEP Bestobell Canada Ltd.  
Willer Engineering  
Brian Controls  
Transcat  
Hardie Industrial Services Inc.  
Heaters Controls & Sensors Ltd  
Heaters Controls & Sensors Ltd  
Transcat  
Campbell Scientific (Canada) Corp  
Great Lakes Industrial Controls  
BEP Bestobell Canada Ltd  
Industrial Projects Ltd.  
Industrial Projects Ltd.  
Milltronics Limited  
Davis Controls  
R.A. Kirby Sales Inc  
Transcat  
BSP Instruments  
Armatek Controls  
Transcat  
Provincial Controls  
SPEC (Sarnia) Limited  
Willer Engineering  
Transcat  
Transcat  
Romatec  
BEP Bestobell Canada Ltd.  
Regional Process Equipment  
Lisle-Metrix Ltd.  
Transcat  
Alpha Controls & Instrumentation  
Controls  
Transcat  
Transcat  
Provincial Controls  
Great Lakes Industrial Controls  
Westburne Lytle  
Transcat  
Transcat  
Great Lakes Industrial Controls  
Line Process Controls  
Willer Engineering  
Regional Process Equipment  
WESCO  
U & I Supply  
Novatech  
Transcat  
Brian Controls  
Regional Process Equipment  
Cambridge Controls  
Romatec  
Great Lakes Industrial Controls  
Intertec  
Alpha Controls & Instrumentation  
Willer Engineering

**Manufacturer / Tradename**

Universal Flow Monitors  
Unomat  
Uticor  
V.F.C. Positioners  
Vaccon Vacuum Products  
Vaisala  
Vaisala - RH, Barometric Pressure  
Valhalla  
Valdyne  
Valtek Controls Ltd.  
Valvtechnologies Inc.  
Vector-VID  
Veeder-Root  
Velan  
Viatran  
Vista Scientific  
Vitec  
Vogt Valve  
Vortec Coolers  
Vortisand  
Wabco  
Wahl Instruments  
Walker Scientific  
Wallace & Tiernan Inc.  
Wallace & Tiernan Inc.  
Warren Jones Engineering - England  
Warrick  
Waterman Industries - USA  
Watts Industries  
Watts Industries  
Wavetek  
Wedgewood Technology  
Weidmuller - Conditioners/Power Supplies  
Weschler Instruments  
West  
Westcon  
Westech  
Westinghouse  
Westlock  
Westronics  
Wey Valve  
Whesso Varec  
Whipps Inc. - USA  
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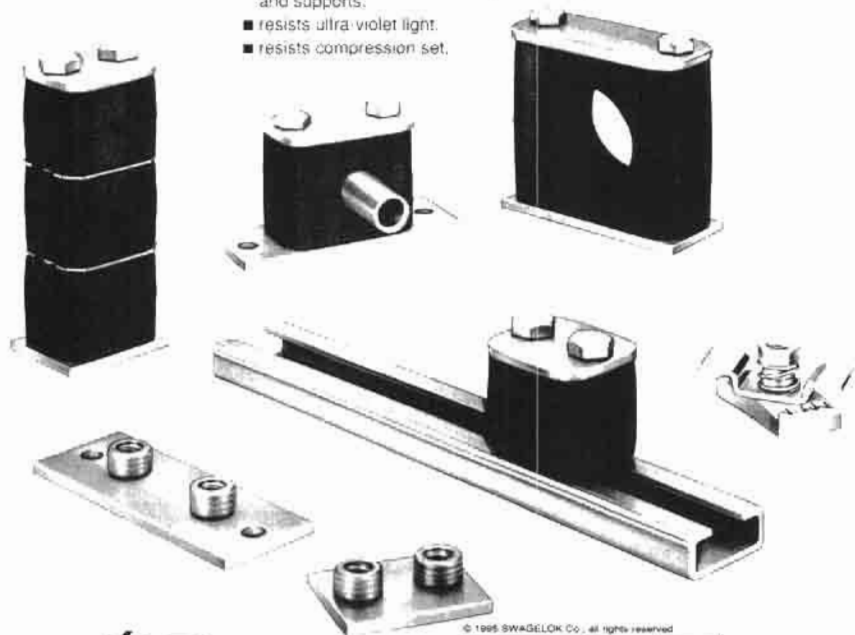
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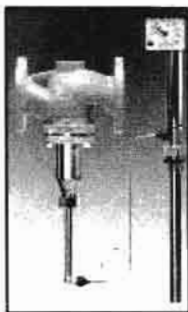
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