

## R3 (R cubed) Specifications and Data Sheet

The R cubed products primarily serve 3 Industrial applications:

- Tote/Pallet/Carrier identification of widgets through production
- Mold/Tool identification
- Automated Guided Vehicles







Certainly not limited to these 3 applications, the R cubed products excel at any industrial identification need where tough, 100% dependable systems are necessary. R cubed stands for **Rapid, Robust and Reliable**.

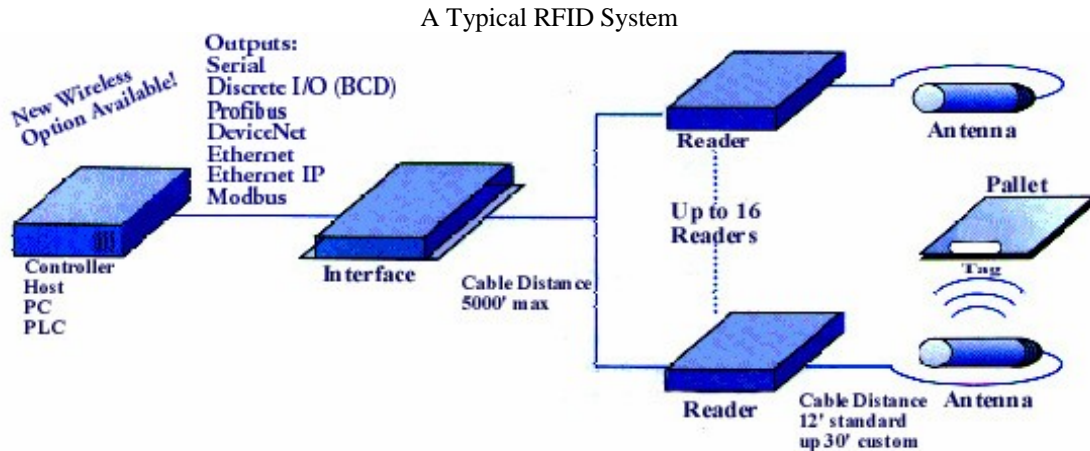
This document contains:

- |                                       |                              |
|---------------------------------------|------------------------------|
| 1. Components of an RFID System       | 6. Interface Specifications  |
| 2. How to put a Read Station Together | 7. Programmer Specifications |
| 3. Transponder Specifications         | 8. Transponder Programming   |
| 4. Read Head/Antenna Specifications   | 9. Customer List             |
| 5. Reader Specifications              |                              |

The reader of this document need not have an in depth knowledge of Radio Frequency Identification technology as also contained herein is a basic tutorial and explanation as to how RFID, Inc.'s particular technology operates.

### 1. Functional Summary – 4 Components of an RFID system.

<p>1. A <b>Tag or Transponder</b>, carrying our proprietary EEPROM IC with 8, 16, or 32 characters of memory. Once this passive device enters the Read Head's RF field it is powered up and begins transmitting its data.</p>	
<p>2. A <b>Read Head/Antenna</b>, powered by the Reader and linked via 12' of supplied cable, constantly broadcasts an RF signal and waits for a Tag's reply.</p>	
<p>3. A <b>Reader</b>, powering the Read Head, receives the digitally coded Tag data from the Read Head, filters, boosts and digitally transmits the data to the Interface up to 5000' away.</p>	
<p>4. An <b>Interface</b>, simply transfers the signal into an understandable computer language, like serial for a PC port or parallel (binary) for a PLC.</p>	



## 2. Putting Together a Read Station

Some of our products offer a combination of the four components summarized above in a single housing or PCB. For example the Read Head and Reader can be combined (Models 1880 and 1885) needing only then to be linked to an Interface. Or the Reader and Interface can be combined (Model 4000 and 5000 series) needing only then to have a Read Head/Antenna attached.

The R cubed systems are also described as being configured either simplex or multiplex. Simplex being a single Read Head/Antenna and Reader per a single Interface, and multiplex being up to 16 addressable Read Heads/Antennas and Readers per a single Interface.

Determining which **Interface and Reader** best fits your needs?

1. What protocol do you desire from the Interface?

Output	Parallel	Serial
Model	2024E	2002E, 2022E, 3030E, 4000E, 5000E

2. Do you want each individual Read Station cabled to a single port/computer or decision making device (Simplex)

Output	Simplex	Multiplex
Model	2024E, 2002E, 3030E, 4000E, 5000E	2024E, 2022E

Determining the **Tag and Read Head:**

1. Mounting Considerations, metallic or non-metallic.

**Reader.** There is an Antenna that can be mounted directly to metal, Model 5110. Flat Read Heads (5150, 5160, 5170) can be mounted directly to a metal post and still achieve maximum performance however avoid mounting a flat Read Head on a complete surface of metal, that is, covering its entire area. If necessary, space a flat Read Head half its diameter from the flat metal surface to achieve the full performance. Models 5100 and 5120 can also be mounted on metal but not screwed into a metal bracket.

**Tag.** Any Tag Model number followed by an "M" denotes Tags that can be mounted directly to metal. However, any Tag can be mounted to metal using the spacing rule of thumb, one half the Tag's diameter.

2. Read Range or Write Range, the maximum distance between the Tag and the Read Head. Your needs dictate your choice, but if your read range needs are flexible and attachment is more important, go directly to Tag Specifications and view the photos and drawings. There are read range differences between Readers powered by 24 VDC and 12 VDC. These matrixes assist in defining that choice.

### READ RANGES IN INCHES

#### (24 Volt Systems - 2002, 2022, 2024)

Read Head	5101	5110	5100	5120	1880 1885	5150	5160	5170	5140
Tag									
1774 1775	1-2	1-2	1-2	1-2	1-2	1-2	--	--	--
1771 1772 1773 1792 1796	3	4	4.5	5	6	6.5	7	5	--
1782M	3.5	3.5	4.5	6	6	6.5	8.5	6.5	--
1781M 1787 1791M	4.5	5.5	6.5	9	10	10	13	14	10
1770 1783 1785 1791 1786M	5	7.5	8.5	9.5	12	12	15	15.5	13
1795	7	11.5	13	17	18	19	24	26	37

#### (12 & 24 Volt Systems - 4000, 5000)

Read Head	5101	5110	5100	5120	5150	5160	5170
Tag							
1774 1775	1-2	1-2	1-2	1-2	1-2	--	--
1771 1772 1773 1792 1796	2	3	3	2.5	4.5	3	--
1782M	2.5	2.5	3	4	4.5	3.5	--
1781M 1787 1791M	3.5	4	4.5	6.5	7	8.5	7
1770 1783 1785 1791 1786M	4	5.5	6	6.5	9	10.5	9
1795	6	8.5	8.5	10	12	16	26

## Read Stations Illustrated

It should be noted for Readers and Interfaces, any Model number consisting of only numerics is a PCB level component only with no housing or cabling. The addition of an "E" to any Model number then denotes Enclosure and appropriate cabling.

### Simplex Systems

#### Parallel, BCD protocols

1. Model 2024E Interface + Model 1880E combo Reader/Read Head



2. Model 2024E Interface + Model 1840E Reader + any Model 51xx series Read Head



#### Serial Protocols

3. Model 2000E Interface + Model 1880E combo Reader/Read Head



4. Model 2002E Interface + Model 1840E Reader + any Model 51xx series Read Head



5. Model 4000E/5000E series combo Interface/Reader + any Model 51xx series Read Head



### Multiplex Systems

#### Parallel, BCD protocols

6. Model 2024E Interface + Model 1885E combo addressable Reader/Read Head



7. Model 2024E Interface + Model 1845E addressable Reader + any Model 51xx series Read Head



#### Serial protocols

8. Model 2022E Interface + Model 1885E addressable combo Reader/Read Head



9. Model 2022E Interface + Model 1845E addressable Reader + any Model 51xx series Read Head



### 3. General Specifications for all R<sup>3</sup> Transponders:




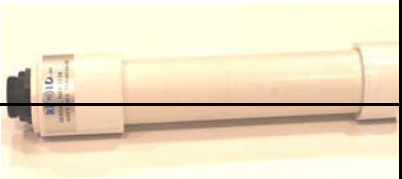




Power:	Passive, no defined term of life
Memory:	8, 16 or 32 ASCII characters, larger memory can be accommodated
Programming:	R/O or R/W
Frequency:	148 KHz receive, divide by 4 = 37 KHz return
Read Time:	12 to 50 ms, dependent upon Tag memory
Temperatures:	-60 to +199 degrees C in most cases, 246 degrees C (475 degrees F) compounds also available
Read Ranges:	Up to 1 meter, dependent on Tag and Read Head combination used. See the matrixes on page 2.
Packages:	Black Tags are usually potted epoxy in a polyurethane housing White Tags are usually hard plastic shell or laminate
Durability:	Potted Tags are extremely durable, inert to practically every acid and solution Direct hits from hammers or forklift tong cannot break the potted units

	Model 1770 "ISO Card Tag" Maximum read range of 15" Credit card size and thickness Magnetic swipe strip optional Laminated gloss or matt finish	3.75" x 2.125" x 31 mils  Ask for a mechanical drawing to be emailed to you.
	Model 1771 "35mm Disc Tag" Maximum read range of 7" Center hole Laminate	35mm diameter x 2mm, w/4mm center hole 1.38" x .0625", w/.15625 center hole
	Model 1772 "22mm Disc Tag" Maximum read range of 7" Center hole Potted	22mm diameter x 3mm thick, w/4mm center hole .875" diameter x .125", w/.15625 center hole
	Model 1773 "Key Chain Tag" Sealed Plastic	2.375" x 1.625" x .125"
	Model 1774 "Coffin Tag Tag" Extremely small architecture Plastic	.5" x .25" x .125"
	Model 1775 "Glass Ampoule Tag" Extremely small architecture	2mm diameter x 12mm length
	Model 1781M "Bar Tag" Maximum read range of 14" Potted Two mounting holes	3.5" x .90" x .90"

## Tags continued

	<p>Model 1783 “Tough Thin Tag”            Maximum read range of 15.5”            Credit card in size with thick plastic shell            Optional 1783H attachment housing pictured</p>	<p>2.13” x 3.38” x .16”</p>
	<p>Model 1785 “Medium Round Tag”            Maximum read range of 15.5”            Potted            Two mounting holes offer very secure attachment</p>	<p>.53” x 3.375” diameter</p>
	<p>Model 1786M “Hockey Puck Tag”            Maximum read range of 15.5”            Potted            Two mounting holes offer very secure attachment</p>	<p>1.19” x 3.35” diameter</p>
	<p>Model 1787 “Lipstick Tag”            Maximum read range of 14”            Potted            Cylindrical housing for in floor mounting</p>	<p>2.3” x .75” diameter</p>
	<p>Model 1791 “Deck of Cards Tag”            w/ read range of 15.5”            or            Model 1791M “Deck of Cards Tag w/read range of 14”            Potted, Two mounting holes</p>	<p>2.17” x 4.05” x .55”</p>
	<p>Model 1795 “Frisbee Tag”            Maximum read range of 37”            Potted            Two mounting holes</p>	<p>6” diameter</p>

## 4. Read Head/Antenna Specifications

<p>Inductance: 1.1 mH +/-2% @ 10 kHz          Temperature: -60 to +199 degrees C          Resistance: 3 to 8 ohms max., dependent on Model, Self Resonant          Packages: ABS, Ultradur, Noryl, PVC, Ployurethane Encapsulant          All Read Heads are sealed and watertight          Connector: 3 pin male receptacle mates with Model 5100A1 Cable          Cabling: 12' recommended as attenuated with capacitance on Reader, 1' to 30' can be customized</p>		
	<p>Model 5100 Medium Prox Read Head          Threaded proximity sensor type package          Hex nuts for securing</p>	<p>(drawing)          Ask for a mechanical drawing to be emailed to you.</p>
	<p>Model 5101 Small Prox Read Head          Threaded proximity sensor type package          Hex nuts for securing</p>	<p>(drawing)</p>
	<p>Model 5110 Hockey Puck Read Head          Mountable on metal          Several mounting holes          Highly rugged</p>	<p>(drawing)</p>
	<p>Model 5120 10.5" Tubular Read Head          Highly rugged          Potted in PVC</p>	<p>(drawing)</p>
	<p>Model 5140 4'x2' Extended Range Read Head          Sealed in PVC          Bury in the ground or stand up at gate for use in Automatic Vehicle Identification applications</p>	<p>(drawing)</p>
	<p>Model 5150 7"x7" Flat Pack Read Head          Sealed in ABS plastic          Multiple mounting possibilities</p>	<p>(drawing)</p>
	<p>Model 5160 12"x12" Flat Pack Read Head          Sealed in ABS plastic          Multiple mounting possibilities</p>	<p>(drawing)</p>
	<p>Model 5170 21"x17" Flat Pack Read Head          Sealed in ABS plastic          Multiple mounting possibilities          Perfect for underside of Forklift</p>	<p>(drawing)</p>

## 5. Reader Specifications

<p>Connectors: Angle entry terminal strips on PCB Cable glands on Enclosure</p> <p>Voltages          Simplex: Regulated DC Supply +18 to +32 V          Regulated AC Supply 24V (+10/-20%)          RMS 47-63 Hz          Multiplex: Regulated DC Supply +18 to +32 V</p>	<p>Current:          Simplex: 200 mA (max) 150 mA (typ)          Multiplex: Enabled 200 mA (max), 150 mA (typ)          Disabled 30 mA (max)</p> <p>Impedance: 75 ohms, balanced</p> <p>Temperature:          Operating -40 to +55 degrees C          Non-Operating -55 to +85 degrees</p>
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Model 1840E Simplex Reader  
 FCC Approved  
 Approximate size is 4.75" x 4.75" x 2"



Model 1845E Multiplexing Reader  
 FCC Approved  
 Addressable  
 Approximate size is 4.75" x 4.75" x 2"



Model 1841E Dual Reader (handles 2  
 non-addressable Read Heads)  
 FCC Approved  
 Approximate size is 8" x 6" x 3"

### Combination Read Head and Reader

These "combo" Readers offer a Read Head etched into their PCB, negating the need for an external Read Head. Needing to be linked only to an Interface, this unit offers a two piece Read Station Solution.



Model 1880E Combo Simplex Reader/Read Head  
 FCC Approved  
 Approximate size is 8" x 8" x 1.5"



Model 1885E Combo Multiplex Reader/Read Head  
 FCC Approved  
 Addressable  
 Approximate size is 8" x 8" x 1.5"

## 6. Interface Specifications

**Model 2002E** Simplex serial Interface

**Model 2022E** Multiplex serial Interface

Full-duplex, asynchronous data stream

RS-232-C, RS-422-A, configured DTE

Stop and parity bits selectable

110-19,200 baud rate

Three Operating Modes

Mode 1 Direct Single Report upon read

Mode 2 Polled for read data

Mode 3 Direct Multiple Report upon read

Buffered read storage:

4 readings for the 2002E, 2 reading for the 2022E

Protocols and modes selectable through commands

or via pins and shunts on PCB

Many other commands available

Connectors DB-25S, DIN 41612 Type C

Control Signals DSR, CTS, DTR

Compatible to all Readers, wired via twisted pair

Temperature range -40 to +55 degrees C operating

-55 to +85 degrees C non-operating

Power: 2002E = 5VDC (+/-5%) @ 250 mA maximum

2022E = 5VDC (+/-5%) @ 350 mA maximum

CRC algorithm allows 1 in 10 to the 14<sup>th</sup> errors



Packaged in a finned metal enclosure

**Model 2024E** Simplex or Multiplex BCD/Hex Interface

Addressable, ideal for use with a PLC

Binary coded decimal (BCD) or hexadecimal

Sixteen 24 volt data lines, current-sourcing

LED's for each line indicate signal status

Hand shaking lines

Three Operating Modes for Tag reporting

Mode 1 Simplex, 16 bits data in 4 hex characters

Mode 2 Multiplex, 12 bits data in 4 hex characters + a 4 bit address

Mode 3 Multiplex polling, 12 bits data in 4 hex characters + a 4 bit address

Stores up to 8 readings

Connection by Screw Terminals, 9 pin RS-232-C

Compatible to all Readers via twisted pair

CRC algorithm allows only 1 in 10 to the 14<sup>th</sup> errors

Power by 24 VDC +/-25% @ 150 mA max

Input impedance 10 Kohms

Input level low of 0 to 10 volts

Input level "high" of 15 to 24 volts

Protected against polarity reversal

Output leakage current level "low" of 0.1 mA max

Output voltage "high" of Vsupply -1.5 V minus (IL <=100 mA)

Output current level "high" is current limited, 100 mA (max)

Protected against load short circuit

Packaged in hardened sheet metal

Mountable into standard industrial racks

Temperature: -40 to +55 degrees C operating

-55 to +85 degrees C non-operating



**Note:** Power wiring for Models 2002E, 2022E;

5 VDC can be wired directly to Interfaces and 24 VDC directly to Readers OR

a dual power supply can be used to wire 5 VDC to Interface and 24 VDC through the Interface to Readers.

Power wiring for all Models requires use of regulated power supplies for maximum results, linear power supplies are rated as acceptable. Linear power supplies may not be used.



## Combination Interface and Reader Model 4000 and 5000 series

This Interface & Reader/Programmer combo unit requires only a Read Head to complete the system. If you require a Read Head internal as a 1 piece total solution, ask our sales department about the Desk Top Model as we have supplied several customized versions. The 4000 series is a Read Only device while the 5000 series is a Read Write device. Operating at 12 VDC or 24 VDC offers the flexibility to take advantage of whatever power may be available. There is also an option to increase the Tag Memory to 1k bits or 160 ASCII characters that has not yet been developed by us, so please inquire if needed.

<u>Model</u>	<u>VDC</u>	<u>Tag Memory</u>	<u>Model</u>	<u>VDC</u>	<u>Tag Memory</u>
4000E-RO	12	16 Characters	5000E-RW	24	8 Characters
4001E-RO	24	16 Characters	5001E-RW	24	16 Characters
4002E-RO	12	8 Characters	5002E-RW	24	32 Characters
4003E-RO	24	8 Characters	5003E-RW	12	8 Characters
4004E-RO	12	32 Characters	5004E-RW	12	16 Characters
4005E-RO	24	32 Characters	5005E-RW	12	32 Characters

The 8 character Models are designed to achieve reads at very high speeds, actual Tag speeds to 100 mph. Including the processing speeds from Tag to serial port assuming only 9600 baud, reads are achieved worst case 23.4 ms and best case 11.7 ms.

The Model 5000 series products are unique in the RFID market for being able to program Tags at 100% of the read range. See the read range matrixes at the bottom of page 2 of this document.

### Common specifications:

Half-duplex asynchronous with or w/o handshaking, DTE configured

110-19.2 selectable baud rate

Single read or Multiple reads Direct Report Modes

7 bits with even or odd parity, 7 or 8 bits with no parity selectable

Protocols selectable via pins/shunts on PCB or through commands

Signal lines of TxD, RxD, CTS, RTS, DTR

Connection via angle entry terminal strip

Temperature:

RS-232-C operating -40 to +55 degrees C

RS-422-A operating 0 to +55 degrees C

Both non-operating -55 to +85 degrees C

Packaged by watertight polycarbonate

CRC algorithm allows only 1 in 10 to the 14<sup>th</sup> errors

Automatic power up and self test message

Approximate size is 4.75" x 4.75" x 2"



## 7. Specifications for Programmer/Hand Held Reader Model 3036E

This Programmer operates stand alone, without the use of a PC, via AC connection or by use of batteries.

- No software is required to program Tags
- No future software upgrades are needed
- Saves the cost of a PC dedicated to programming
- Large programming pad area
- LCD screen
- Automatic number generator for sequential programming
- Approximate size is 9" x 5" x 1.75"
- Temperature: -40 to +55 degrees C operating  
-55 to +85 degrees C non-operating



## 8. Tag Data and Programming

With the serial Interfaces, data is sent back to a serial port in the following format: <LF>nnnnnnnnnnnnnnnn<CR>, where variable n represents data. If a multiplex system is being used the Tag data is preceded by a hexadecimal character indicating the Read Station and a space character. If you intend to have Tags programmed at our factory, please fill out a programming sheet, contained herein with instructions. Tag orders cannot be accepted until this sheet has been filled out and submitted. This sheet can also be accessed on our web site under the [R<sup>3</sup>](#) link.

With the parallel Interfaces, data is sent back in a binary format: 0000 0001 0111 1111 represents 17F as the first 4 digits are reserved for multiplex addresses if applicable.

These instructions have been made for the purpose of helping our users to order the correct programming information on their RFID Tags. When you order a Tag from us we will ask you to supply the programming numbers you wish to be encoded into the Tag's memory.

Tags have a memory that contain 8, 16 or 32 characters. All of those characters must be used. It is a common misbelief that if you want the identification number 99 (ninety-nine) all you need to tell us is "99."

Not so. We need to know how to fill in the remaining 30 characters. Most users simply desire zeros to be filled into the unused characters. Others require dashes. We also need to know whether or not you desire e number 99 to be right, left or center justified.

For example, right justified is: 000000000000000000000000000099  
Left justified is: 99000000000000000000000000000000  
Center justified is: 00000000000000990000000000000000

Tags intended for use with our Model 2024E Parallel Interface must be right justified and limited to 4 characters in the simplex mode and 3 characters in the multiplex mode, 0 thru 9 and A thru F.

If you are a current user and do not know the exact programming format your company uses, ask an engineer or technician who works with our equipment. Once you learn this, please keep it in min or noted somewhere for future orders. If you have ordered direct from RFID before, our customer service department can look up your last order and help you determine what programming format to use.

Following is a programming sheet you also need to fill out, sign, and remit with your order. 32 Character users should use 2 lines, below. 8 Character users, please fill in only 8 characters.



## 9. Customer List

### USA Medical:

Abbot Labs  
Advanced Bionics  
Ameripharma  
Anthem Prescription  
Boston Scientific  
Cardinal Health  
CDS/Procure  
Cigna Tel-Drug  
CR Bard  
CVS  
Eckerd Drug  
ExcelleRx  
FamilyMeds.com  
Kaiser Permanente  
McKesson SI/Baker  
Medtronic  
Pacifcare  
Prescription Solutions  
Rite Aid  
Rx Direct  
Smith's Medical  
Tel-Drug  
Veteran's Admin  
Walgreens  
Wellpoint  
Wyeth Labs

### USA Automotive:

Allen Bradley  
ATS  
Bendix  
Caterpillar  
Daimler Chrysler  
Decoma  
Delphi  
Detroit Diesel  
DT Industries  
Federal Mogul  
Ford Motor Company  
General Motors  
Honda  
Howmet  
John Deere  
Meridian Automotive  
Michelin  
Neaton Automotive  
Polaris Industries  
Toyota  
Trident Automotive  
Visteon  
Volvo

### USA WIP:

Alcoa  
Amana

Asyst Technologies  
AT&T/Lucent  
Avtron  
BAE Automation  
Boeing Corporation  
Borg Warner  
BW Rogers  
Cameron Barkley  
Carlton Bates  
CEI Automation  
Charbroil  
Copeland  
Cutler Hammer  
Eastman Kodak  
EI DuPont  
Electrolux  
Eskay  
Esselte Estee  
Lauder  
Flexlink Conveyors  
Frigidaire  
General Electric  
Hagemeyer  
Ingersol Rand  
Key Handling Sys  
Kim Automation  
Knapp Automation  
Krauss-Maffei  
Lear Jets  
Marshall's  
Maytag  
Motorola  
Nat'l Control Sys  
Osh Kosh B'Gosh  
Osram Sylvania  
Pepsi (Quaker)  
Proctor & Gamble  
Reliance Rockwell  
Rockwell Automation  
SCI Sanmina  
Sears  
SI/Handling Systems  
Square D Company  
Siemens  
Stanley Tools  
Swisslog  
Texas Instruments  
Schick  
Thomson Electronics  
TJ Maxx  
TRW  
Valeo Sylvania  
Wepco  
Whirlpool  
Wunderlich-Malec

### USA Discrete

#### Process Controls:

Ace Hardware  
Conagra  
Exxon Mobil  
Inland Steel  
Nestle  
Nippon Steel  
U.S. Steel

#### USA Routing/ASRS:

AGV Products  
Amerden  
Anheuser Busch  
Jervis Webb  
Lemans  
Prilgrim's Pride  
The Denver Post  
The Boston Globe  
Transbotics  
U.S. Air Force

#### USA Entertainment Customer Loyalty:

Bronx Zoo  
Electrosonic  
Hard Rock Café  
Maltbie  
NASCAR Museum  
Northwest Airlines  
Six Flags  
Techno Media  
Vail Resorts

#### USA Other:

Atmel/Temic  
Computers Unlimited  
EFI Vutek  
H.E. Butt Grocery  
Hewlett Packard  
Honeywell  
Los Alamos Labs  
Lowry Computer  
Magic Chef  
NASA  
Nokia  
Rice Lake Weighing  
Sandia National Labs  
Timken  
U.S. Navy

#### Asia:

IceGen (distributor,  
India)  
Electronic Corporation of  
India

Tata Consultancy  
Toyota (Japan)

#### Australia/Africa:

Alcoa World Alumina  
BHP Billiton Iron Ore  
Byrnecut Mining  
CMA Systems  
Dampier Salt  
Fortescue Metals  
Hamersley Iron  
Harmonic (dist, S.  
Africa)  
Logitech Consultants  
Newcrest Telfer Gold  
Mine  
Pacific Automation (dist,  
AUS)  
Port Waratah  
Queens Creek  
Robe River Iron  
Sinclair Knight Merz  
ThyssenKrupp  
Tomago Aluminum  
Voest-Alpine

#### Canada:

AMT Mach Tools (dist,  
Tor)  
Aurora Bar Code  
CIMS (distributor, BC)  
City of Fort St. John  
CraneSmart  
Dofasco  
GLC Controls  
(distributor, BC)  
Kellogg's Cereal  
Kielhauer  
LSZ Papertech  
Rotalec (distributor)  
Synergex (distributor,  
Toronto)  
Stelco Steel

#### Central & South

##### America:

EGO (distributor,  
Mexico)  
General Electric  
(Mexico)  
Hylsa (Mexico)  
IdeaNet (distributor,  
Chile)  
Lasso (distributor,  
Mexico)  
MABE Leiser (Mexico)  
SCI Sanmina (Mexico)

Retex (Peru)  
RSI (Mexico)  
TecWise (distributor,  
Brazil)  
Thomson Electronics  
(Mexico)  
Trends (distributor,  
Brazil)  
TRW (Mexico)

#### Europe:

AST (Swiss)  
Efacec (Portugal)  
FQ (distributor, Spain)  
Infos (distributor,  
Portugal)  
London Heathrow  
Airport  
Louis Vaughn  
(distributor, UK)  
MDA Systems (France)  
Moncks & Crane (UK)  
SCI Sanmina (Hungary)  
Securitas (Sweden)  
Tempore (Austria)  
TRW (UK & Germany)

#### USA Distributors:

Applied Automation  
(NY)  
Applied Controls (PA,  
MD, DE)  
Axis, Inc. (NJ, NY)  
C&E Sales (IN, OH, KY)  
Cassady Co. (AK, OK,  
LA, TX)  
Cornerstone (TN, AL,  
GA)  
Cross Automation  
(NC, SC, VA, FL, AL, GA)  
Gibson Eng. (MA, CT,  
ME, RI)  
Industrial Controls (west  
MI)  
MSI Tech (CO, UT, AZ)  
Power Motion (MO, KS)  
Power/mation (MN, IA,  
WI, IL)  
Precise Motion (FL)  
Proud (western PA)  
PRI (NY, NJ)  
RR Floody (IL, IA)  
Taylor Data (SC, NC,  
FL)

