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
2. How to put a Read Station Together
3. Transponder Specifications
4. Read Head/Antenna Specifications
5. Reader Specifications
6. Interface Specifications
7. Programmer Specifications
8. Transponder Programming
9. Customer List

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

#### 1. A Tag or Transponder
A passive device entering the Read Head’s RF field it is powered up and begins transmitting its data.

#### 2. A Read Head/Antenna
Powered by the Reader and linked via 12’ of supplied cable, constantly broadcasts an RF signal and waits for a Tag’s reply.

#### 3. A Reader
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.

#### 4. An Interface
Simply transfers the signal into an understandable computer language, like serial for a PC port or parallel (binary) for a PLC.

![A Typical RFID System](image-url)
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?

<table>
<thead>
<tr>
<th></th>
<th>Output Parallel</th>
<th>Output Serial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>2024E</td>
<td>2002E, 2022E, 3030E, 4000E, 5000E</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Output Simplex</th>
<th>Output Multiplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>2024E, 2002E, 3030E, 4000E, 5000E</td>
<td>2024E, 2022E</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Read Head</th>
<th>5101</th>
<th>5110</th>
<th>5100</th>
<th>5120</th>
<th>1880</th>
<th>1885</th>
<th>5150</th>
<th>5160</th>
<th>5170</th>
<th>5140</th>
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</thead>
<tbody>
<tr>
<td>Tag</td>
<td>1774</td>
<td>1775</td>
<td>1-2</td>
<td>1-2</td>
<td>1-2</td>
<td>1-2</td>
<td>1-2</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1771</td>
<td>1772</td>
<td>1773</td>
<td>1792</td>
<td>1796</td>
<td>3</td>
<td>4</td>
<td>4.5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1782M</td>
<td>4.5</td>
<td>5</td>
<td>6</td>
<td>6.5</td>
<td>6</td>
<td>6.5</td>
<td>8.5</td>
<td>6.5</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1781M</td>
<td>4.5</td>
<td>5.5</td>
<td>6.5</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>13</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>1770</td>
<td>1783</td>
<td>1791</td>
<td>1786M</td>
<td>5</td>
<td>7.5</td>
<td>8.5</td>
<td>9.5</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>1795</td>
<td>7</td>
<td>11.5</td>
<td>13</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>24</td>
<td>26</td>
<td>37</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Read Head</th>
<th>5101</th>
<th>5110</th>
<th>5100</th>
<th>5120</th>
<th>5150</th>
<th>5160</th>
<th>5170</th>
<th>5140</th>
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</thead>
<tbody>
<tr>
<td>Tag</td>
<td>1774</td>
<td>1775</td>
<td>1-2</td>
<td>1-2</td>
<td>1-2</td>
<td>1-2</td>
<td>1-2</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1771</td>
<td>1772</td>
<td>1773</td>
<td>1792</td>
<td>1796</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1782M</td>
<td>2.5</td>
<td>2.5</td>
<td>3</td>
<td>4</td>
<td>4.5</td>
<td>3.5</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1781M</td>
<td>3.5</td>
<td>4</td>
<td>4.5</td>
<td>6.5</td>
<td>7</td>
<td>8.5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>1770</td>
<td>1783</td>
<td>1785</td>
<td>1791</td>
<td>1786M</td>
<td>4</td>
<td>5.5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1795</td>
<td>6</td>
<td>8.5</td>
<td>8.5</td>
<td>10</td>
<td>12</td>
<td>16</td>
<td>26</td>
</tr>
</tbody>
</table>
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\(^3\) Transponders:

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

| 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 |

<p>| Model 1781M “Bar Tag”                | Maximum read range of 14” Potted Two mounting holes |
|                                      | 3.5” x .90” x .90” |</p>
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1783</td>
<td>“Tough Thin Tag” Maximum read range of 15.5” Credit card in size with thick plastic shell Optional 1783H attachment housing pictured</td>
<td>2.13” x 3.38” x .16”</td>
</tr>
<tr>
<td>Model 1785</td>
<td>“Medium Round Tag” Maximum read range of 15.5” Potted Two mounting holes offer very secure attachment</td>
<td>.53” x 3.375” diameter</td>
</tr>
<tr>
<td>Model 1786M</td>
<td>“Hockey Puck Tag” Maximum read range of 15.5” Potted Two mounting holes offer very secure attachment</td>
<td>1.19” x 3.35” diameter</td>
</tr>
<tr>
<td>Model 1787</td>
<td>“Lipstick Tag” Maximum read range of 14” Potted Cylindrical housing for in floor mounting</td>
<td>2.3” x .75” diameter</td>
</tr>
<tr>
<td>Model 1791</td>
<td>“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</td>
<td>2.17” x 4.05” x .55”</td>
</tr>
<tr>
<td>Model 1795</td>
<td>“Frisbee Tag” Maximum read range of 37” Potted Two mounting holes</td>
<td>6” diameter</td>
</tr>
</tbody>
</table>
### 4. Read Head/Antenna Specifications

| Inductance: 1.1 mH +/-2% @ 10 kHz | Model 5100 Medium Prox Read Head Threaded proximity sensor type package Hex nuts for securing | (drawing) |
| Temperature: -60 to +199 degrees C | Ask for a mechanical drawing to be emailed to you. |
| Resistance: 3 to 8 ohms max., dependent on Model, Self Resonant | |
| Packages: ABS, Ultradur, Noryl, PVC, Polyurethane Encapsulant | Model 5101 Small Prox Read Head Threaded proximity sensor type package Hex nuts for securing | (drawing) |
| All Read Heads are sealed and watertight | Model 5110 Hockey Puck Read Head Mountable on metal Several mounting holes Highly rugged | (drawing) |
| Connector: 3 pin male receptacle mates with Model 5100A1 Cable | Model 5120 10.5” Tubular Read Head Highly rugged Potted in PVC | (drawing) |
| Cabling: 12’ recommended as attenuated with capacitance on Reader, 1’ to 30’ can be customized | 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 | (drawing) |
| | Model 5150 7”x7” Flat Pack Read Head Sealed in ABS plastic Multiple mounting possibilities | (drawing) |
| | Model 5160 12”x12” Flat Pack Read Head Sealed in ABS plastic Multiple mounting possibilities | (drawing) |
| | Model 5170 21”x17” Flat Pack Read Head Sealed in ABS plastic Multiple mounting possibilities Perfect for underside of Forklift | (drawing) |
5. Reader Specifications

| Connectors: | Angle entry terminal strips on PCB |
| Cable glands on Enclosure |
| 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 |
| Current: | Simplex: 200 mA (max) 150 mA (typ) |
| | Multiplex: Enabled 200 mA (max), 150 mA (typ) |
| | Disabled 30 mA (max) |
| Output: | 75 ohms, balanced |
| Temperature: | Operating -40 to +55 degrees C |
| | Non-Operating -55 to +85 degrees |

---

**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 14th errors

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 14th 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.

<table>
<thead>
<tr>
<th>Model</th>
<th>VDC</th>
<th>Tag Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000E-RO</td>
<td>12</td>
<td>16 Characters</td>
</tr>
<tr>
<td>4001E-RO</td>
<td>24</td>
<td>16 Characters</td>
</tr>
<tr>
<td>4002E-RO</td>
<td>12</td>
<td>8 Characters</td>
</tr>
<tr>
<td>4003E-RO</td>
<td>24</td>
<td>8 Characters</td>
</tr>
<tr>
<td>4004E-RO</td>
<td>12</td>
<td>32 Characters</td>
</tr>
<tr>
<td>4005E-RO</td>
<td>24</td>
<td>32 Characters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>VDC</th>
<th>Tag Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000E-RW</td>
<td>24</td>
<td>8 Characters</td>
</tr>
<tr>
<td>5001E-RW</td>
<td>24</td>
<td>16 Characters</td>
</tr>
<tr>
<td>5002E-RW</td>
<td>24</td>
<td>32 Characters</td>
</tr>
<tr>
<td>5003E-RW</td>
<td>12</td>
<td>8 Characters</td>
</tr>
<tr>
<td>5004E-RW</td>
<td>12</td>
<td>16 Characters</td>
</tr>
<tr>
<td>5005E-RW</td>
<td>12</td>
<td>32 Characters</td>
</tr>
</tbody>
</table>

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 14th 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>nnnnnnnnnnnnnnn<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 R3 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: 00000000000000000000000000000099  
Left justified is: 99000000000000000000000000000000  
Center justified is: 00000000000009900000000000000000

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.
Transponder Programming Sheet

Customer name: ___________________________ P.O # ___________________________

Completed by: ____________________________

Unspecified characters filled with: ____________________________ Tag Model # ____________________________

<table>
<thead>
<tr>
<th>Item No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
</table>

Customer Signature: ___________________________________ Date: ____________________________
9. Customer List

**USA Medical:**
- Abbot Labs
- Advanced Bionics
- AmeriPharm
- Anthem Prescription
- Boston Scientific
- Cardinal Health
- CDS/Procare
- Cigna Tel-Drug
- CR Bard
- CVS
- Ecker Drug
- ExcelleRx
- FamilyMeds.com
- Kaiser Permanente
- McKesson SI/Baker
- Tel-Drug
- Smith’s Medical
- Rx Direct
- 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
- CFI Automation
- Charbroil
- Copeland
- Cutler Hammer
- Eastman Kodak
- El 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
- Weesco
- Whirlpool
- Wunderlich-Malec

**USA Discrete**

**Process Controls:**
- AEC Hardware
- Conagra
- Exxon Mobil
- Inland Steel
- Nestle
- Nippon Steel
- U.S. Steel

**USA Routing/ASRS:**
- AGV Products
- Ameriden
- Anheuser Busch
- Jervis Webb
- Lemans
- Pilgrim’s Pride
- The Denver Post
- The Boston Globe
- Transbotsics
- 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
- Magna Technology
- Molychem
- Mitsubishi
- Modern Automation
- Noguchi
- Precision Motion (FL)
- Precise Motion (FL)
- Robotech (distributor"
- Savant Automation
- SSI Automation
- Speedco
- Stelco Steel
- Tate Automation
- The Denver Post
- The Boston Globe
- Transbotsics
- U.S. Air Force
- Voest-Alpine

**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)

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