A Century of Quality

By Bob Smith, Director RA Brand Communication

Not many companies can trace their beginnings to a teenager's science experiment. But that's exactly how Allen-Bradley began more than a century ago.

The year was 1893. That's when 14-year-old Lynde Bradley borrowed a high school classmate's textbook on electricity and constructed an innovative new device, a speed controller for a toy lathe. Running an electric current from a storage battery through a workbench vise holding a column of graphite disks, Bradley discovered an important concept: the more he compressed the disks, the faster his lathe ran. Both Lynde and his 8-year old brother Harry marveled at what they saw." In its way," Harry recalled, "it was the first Allen-Bradley rheostat."

It was the first invention for the young science whiz, but it certainly wouldn't be the last. At age 16, Lynde earned the first of his 26 patents; at 18, he opened his own x-ray studio. Six years later, a day before his 23rd birthday, Lynde Bradley returned to the carbon disk concept, applying it to industrial crane control. His invention was the Compression Rheostat, developed with a $1,000 investment from family physician Dr. Stanton Allen. The rheostat controlled electric current as easily as today's light dimmers, and was a major advance for manufacturers needing precise electrical control of machines and equipment.

To market their product, the Bradleys and Dr. Allen formed the Compression Rheostat Company in 1903. In its early years the firm was merely a holding company. Another organization, the American Electric Fuse Company of Muskegon, Michigan, made and sold Allen-Bradley brand product on a royalty basis. After six frustrating years replete with quality and financial problems, the Bradley's returned to Milwaukee. There, they rejoined Dr. Allen and renamed their firm the Allen-Bradley Company, marketing a line of crane controllers, motor resistors and other products.

NEW PRODUCT INNOVATIONS

Over the next century, Allen-Bradley developed a reputation for innovation and excellence. It played a significant role in the First World War, supplying switchboards and other electrical equipment for shipyards and navy destroyers. In 1918, after wartime orders accounted for 70% of the company's $400,000 in sales, the Brothers expanded facilities, doubling production capacity.

The teens and early 1920s saw a growing cadre of talented engineers join the Bradleys, helping them develop a variety of noteworthy products. These included clapper-style across-the-line starters for emerging AC motors, a line of automotive battery testers for automobile garages, and charger systems for electric vehicles. Another invention, a foot-activated pedal switch was designed for Singer and other sewing machine companies to control the speed of their equipment. That innovation literally touched the lives of millions around the world and could be considered Allen-Bradley's first global product. The "foot pedal" was so successful that at one point, Singer was ordering hundreds of thousands monthly to meet its global demand.

THE RISE OF RADIO

About the same time electric sewing machines took off, radio exploded in popularity. In 1922, Allen-Bradley stepped into that market, introducing the Bradleystat. This miniature version of Lynde Bradley's 1901 invention, equipped with graphite disks the size of aspirin tablets, made tuning and volume control easier. Demand for the product was astounding, generating more than 100,000 orders in only six weeks. This posed a problem, as Bradleystats were being assembled by hand. In response, Allen-Bradley's engineers worked day and night to develop the first generation of automated production equipment – ingenious mechanical systems that automated the manufacture of millions of radio components – helping the company meet skyrocketing demand.

Soon Allen-Bradley offered radio owners a full line of Bradley-branded components, including highly regarded audio amplifiers. First sold in hobby shops and electrical supply houses, and department stores like Macys and Gimbels, they were later embedded in radio

continued on pages 6 and 7

receivers themselves. By the 30s, companies like Zenith, Philco, Crosley, RCA and Atwater-Kent had become Allen-Bradley's largest customers, ordering radio components by the millions.

BREAKTHROUGH IN ELECTRONICS

The growth of radio led Allen-Bradley to expand its research and development capabilities – not only in electronics, but in chemistry as well. These two disciplines converged in 1935 with the development of the hot molded carbon-composition fixed resistor, a major breakthrough in electronics technology. This miniature component eventually controlled electric current in millions of electronic devices and consumer products. To manufacture it, Allen-Bradley's special machine builders designed yet another generation of automated assembly equipment – including automated molding, soldering, painting and coding machines. This revolutionary equipment even tested the tiny products as they ran through the production line. Company engineers also invented a color coding system that provided visual ratings for the components, a system eventually adopted by entire electronics industry. The proprietary process for manufacturing, testing and coding hot molded fixed resistors existed no where else on earth, only in Allen-Bradley's Milwaukee plant. As a result, A-B enjoyed unparalleled efficiency and product reliability.

THE WORLD'S MOST DEMANDING APPLICATIONS

As the world's premiere resistor manufacturer, Allen-Bradley sold billions of components to consumer companies, electronics manufacturers and the U.S. military. During World War II, the resistors, along with other A-B products played major combat roles, providing battlefield reliability for such technologies as RADAR, walkie talkies, field radios, and naval and aircraft communication systems. Allen-Bradley advertising during this period proudly announced that its off-the-shelf technology met or exceeded all military specifications. In fact, so reliable were Allen-Bradley products that military orders accounted for 80% of the company's output during the war. To meet the demand, the company chose to expand its manufacturing facilities rather than farm out orders – and propriety technology – to rivals.

Contrary to expectations, the post war years only increased the demand for Allen-Bradley products. A-B electronics, now responsible for 50% of sales, were embedded in a variety of applications: in UNIVAC the world's first computer; in undersea cables for Western Electric, in America's first supersonic jet fighter, and in guidance systems for Nike intercontinental ballistic missiles.

When the space program took off, so did A-B components. Resistors went into orbit with the Telstar communications satellite, were on board the Viking and Ranger missions, and helped Surveyor navigate a soft landing on the moon. Allen-Bradley resistors also played a key role in Surveyor's camera control circuitry, facilitating the lunar surface photography that made the spacecraft famous.

NASA used Allen-Bradley products in virtually all of its manned flights as well, including the most famous of all, the first manned mission to the moon. Allen-Bradley products were on board Apollo 11's space capsule and lunar lander. And when astronauts Neil Armstrong and Buzz Aldrin brought their moon rocks back home, an Allen-Bradley Sonic Sifter sorted them. A-B products were also on board America's first space shuttles when they lifted off in the early 80s.

INNOVATIONS ON EARTH

While this was going on in space, Allen-Bradley's engineers continued to serve customers on earth. In a string of innovations starting in the late '30s, they developed a series of breakthrough products. One, the Bulletin 709 solenoid controller reduced the workings of a switch to one moving part, with silver contacts that eliminated the need for cleaning and most maintenance. In 1950, the company entered other fields, producing ferrites – compounds of iron oxide, metallic oxide and ceramics which, when compressed and cured, yielded magnetic properties. These became key components in inductors, transformers, TV picture tubes and memory cores for IBM computers.

One of the most important product developments in the early 1960s was a new **Bulletin 709 series K across-the-line starter**. It featured contacts designed with new and better materials, a radically new coil, a "snap action" switch and sleek new cabinets by industrial designer Brooks Stevens. During this era Stevens gave an elegant face lift to the entire Allen-Bradley product line, with improved packaging and an updated logo.

An early numerical control machine (right) and early PLCs (below).

THE SOLID STATE ERA

The 1970s ushered in the era of solid-state control, a major area of growth for the company. Allen-Bradley offered computer numerical controls (CNCs) for the machine tool industry, and pioneered the development of a brand new product – programmable logic controllers. In fact, Allen-Bradley gave the technology its well known acronym – the PLC.

In 1970, A-B launched a new line of Centerline Motor Control centers. It entered the drives business in 1972, and in 1976 introduced remote I/O, which gave manufacturers incredible flexibility in wiring factory floors. The company also began applying solid state technology to its standard products, with the first self-contained solid state photoelectric sensor, the 4000 model, still sold today.

Later, in an unprecedented move to encourage the adoption of a new technology, the company introduced the first plant floor network, DataHighway, then published its specifications for use by anyone in industry. Years later it took similar action when it launched DeviceNet, an open device-level network that quickly became a de facto standard.

In the 1990s, Allen-Bradley pioneered the concept of Computer Integrated Manufacturing or CIM, and fostered key developments that began the integration of plant floor data with enterprise information systems.

Today, as Rockwell Automation, the company offers manufacturers in virtually every industry a comprehensive set of solutions from power and components to control and information solutions. These Complete Automation offerings make use of innovations such as our Logix engine. It helps manufacturers achieve higher levels of production efficiency by more tightly gathering and synchronizing information across the entire manufacturing spectrum. Through its products, services and employees, Rockwell Automation helps manufacturers around the world reduce costs, streamline productivity and speed time to market.

Based in Milwaukee, in the same neighborhood where Lynde and Harry Bradley started a century ago, the company is home to more than 22,000 employees, including 4,000 in the Milwaukee area. It serves customers in 80 countries, and enjoys annual sales of $4 billion.

1903

In 2003, Rockwell Automation celebrated the 100th anniversary of its Allen-Bradley® brand – a feat less than 3 percent of the world's companies ever achieve.

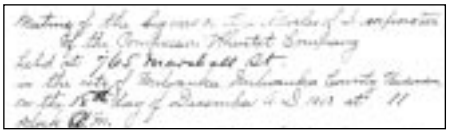
Even more remarkable, the same principles that founders Lynde and Harry Bradley encouraged a century ago – technical innovation, customer service and business ethics – remain the foundation of our success.

Today, in addition to Allen-Bradley controls and engineered services, Rockwell Automation's other brands include Dodge® mechanical power transmission products, Reliance Electric® motors and drives, and Rockwell Software®.

2003

1901 *– Lynde Bradley develops a Compression Rheostat controller using 76 carbon disks, designed to run a crane motor. Prototype completed August 18 – that was financed by Dr. Stanton Allen – a day before his 23rd birthday. The first functional controller completed October 8.*

1903 – Allen and Bradley form the Compression Rheostat Company and enter negotiations with American Electric Fuse Company in Chicago, to manufacture the "Allen-Bradley" devices.



1910 *– Introduces a reversible controller whose brushes, moving over the face plate on the front of the starter, can reverse the motor's direction.*

1903 | **1913** | **192**

1912 *– Allen-Bradley products utilizing compression resistance have grown beyond Type R crane controllers to include Type L & C DC automatic starters, automatic switches, speed regulators and battery chargers.*

1905-08 *– Introduces a 1125 watt-rated battery charging rheostat for controlling medical and dental equipment, lamp dimmers and laboratory meter testing.*

1904 *– First crane controller is exhibited at St. Louis World's Fair. 19-year Harry Bradley & 26-year old brother Lynde ship one of the first commercially manufactured crane controllers – a 3.5 horse power Type A-10 controller – for exhibition.*

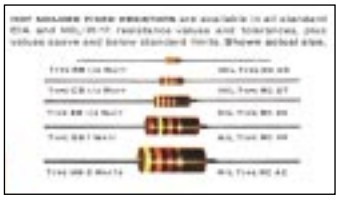
1917 *– Product Line expands to include circuit breakers, relays, pushbuttons, hand switches, control panel hardware and other electrical equipment. WWI government contract boosts sales to unprecedented levels. A-B handles overflow orders from General Electric and Westinghouse when they can't keep pace with government demand. Products are already being shipped in Europe and Latin America.*

1920s *– Develops carbon disks as small as an aspirin tablet, taking Allen-Bradley controls to the new home appliance industry.*

1922 *– Allen-Bradley introduces first multi-lingual advertising program in English and Spanish languages.*

1926 *– Allen-Bradley dashboard rheostats, installed in many major automobiles, regulate flow of electricity to the car battery.*

1934 *– Introduces Type J Potentiometer, 700 solenoid double break control relay, and 709 motor starter. Together the 709 Motor Starter and the 700 relay create a major breakthrough in machine tool controls – enabling machines to be independently driven, eliminating the need for hazardous v-belts that had run machinery in factories.*



1935 *– Industry's first hot-molded fixed resistors are launched, revolutionizing the electronics industry. These insulated resistors are color-banded to indicate resistance value and are used in electrical and electronic equipment. Sales reach an all-time high of nearly $4 million.*

1944 *– Wartime production peaks. 80% of orders are war-related and center on two broad lines of products: industrial controls, which are crucial for the faster, more automated production required to meet the military's extensive needs, and electrical components or "radio parts," which are used in a wide range of military equipment including walkie-talkies, aircraft instruments and radios.*

1956 *– Multi-unit control centers – eventually known as motor control centers – combine starters, contactors, push button stations and other devices for the complete control of equipment and machines in various industries.*

23 | 1933 | 1943 | 1953 | 1963

1933 *– Introduces the 709 Motor Starter, whose design revolutionizes the motor control. The starter's up and down motion plunger – its only moving part – eliminates bearings, hinges, flexible jumpers, pivots and lubrication. The starter's double break silver alloy contacts require no cleaning, insuring superior reliability, propelling A-B to the forefront of quality motor control.*

1928 *– Develops thermal overload relay using resistance. A fixed heating element heats the spindle, which is soldered to a spring-loaded ratchet. Excessive heat melts the solder which releases the ratchet and opens the circuit.*

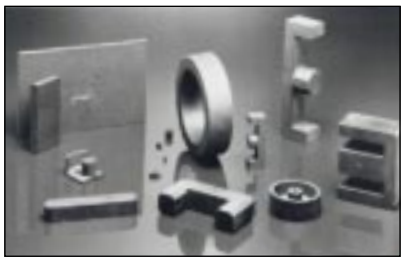
1927 *– Allen-Bradley opens what will soon become it's largest sales office in Detroit, Michigan.*

1925 *– Develops foot switch treadle controls for use in sewing machines made by Singer and other manufacturers. Applying force to the foot pedal smoothly changes resistance, which adjusts the machine's motor speed.*

1922 *– Introduces the famous Bradleystat miniature rheostat which offers "perfect filament control" for vacuum tubes used in consumer radios. When the Bradleystat knob is turned, an equalizer spring exerts force on two columns of carbon disks, which vary the resistance – and radio volume – smoothly, without steps. By 1925 Radio Component sales account for nearly 50% of company sales.*

1920s *– Allen-Bradley and its distributors offer training events to educate customers on proper installation, use and maintenance of products.*

1959 *– At age 74, Harry Bradley, company chairman, earns his last patent – for a capacitor – bringing his lifetime total to 29. Harry's brother and business partner, Lynde Bradley earned 26 patents in his lifetime.*



1950 *– Company launches Ferrites – which act as permanent magnets – they are key components in electric motors, appliances and early television picture tubes. Ferrites are compounds composed of iron oxide, a metallic oxide and ceramic, which are compressed and cured to yield magnetic properties. A-B enters into agreement with Stackpole Carbon Company, the only manufacturer of ferrite material in the country, to exchange ferrite know-how for Allen-Bradley resistor know-how.*

1948 *– A-B's dominance in fixed resistors for consumer products such as battery powered watches, television sets, etc. means the company is shipping 15 million resistors a month.*

1969 *– Allen-Bradley opens world's largest facility for high current testing, in Milwaukee.*

1971 *– Launches Centerline Motor Control Center products.*

1972 *– First Computer Interface for programmable controllers. Introduces read/write programmable controller and off-line software documentation package.*

1972 *– Enters Drives Business by purchasing TPC Drives, Inc, Cedarburg WI, from Sun Chemical Corporation, which markets press drives as well as printing ink.*

1973

1974 *– Introduces the first self-contained solid state photoelectric sensor, the 4000. For five years the 4000 is the most popular sensor in the world. It becomes the technology model for all future sensors and is still sold today.*

1970 *– A-B launches solid-state era beginning with programmable logic controllers. Within 15 years, solid-state controls increase from 2% of company sales to 62%. Eventually, solid-state technology is applied to various industrial components.*

1975 *– Introduces first A-B Standard drive. The Bulletin 1375.*

1976 *– Introduces Remote I/O.*

1979 *– Introduces Data Highway, industry's first plant floor network, facilitating communication between programmable controllers, computers and other devices via a cable system.*

1983

1983 *– Allen-Bradley retires final Compression Rheostat product descended directly from Lynde Bradley's original current controller invention 81 years previously.*

1983 *– Introduces "Intelligent Panel System" a series of operator interface modules that connect to a PLC via a serial cable, simplifying the assembly process.*

1988 *– With DEC, Allen-Bradley develops Pyramid Integrator, first system to integrate information processing with plant floor control.*

1991 *– Introduces SLC 500™ small processors.*

1993

1989 *– Introduces PanelView graphic operator interface terminals. They include built-in Remote I/O communications to a PLC and utilize offline development software for easy design and integration into a factory automation system.*

1989 *– Introduces its first Integrator Partner Program.*

1994 *– Launches DeviceNet™, an open device-level network that quickly becomes the de facto standard in North America.*

1995 *– Introduces ControlNet™ high-speed, high-performance network. Ships one-millionth PLC.*

2003

1996 *– In December, Rockwell Automation introduces Encompass, its next-generation 3rd party product referencing program, which assures customers that the products from other companies referenced are current with their needs.*

2003 – More than 600 sales and support locations in over 80 countries offer integrated "shop floor to top floor" Complete Automation solutions.

2013