Electrical and Electronics Installers and Repairers

(O*NET 49-2092.00, 49-2093.00, 49-2094.00, 49-2095.00, 49-2096.00, 49-9031.00)

Significant Points

- Knowledge of electrical equipment and electronics is necessary for employment; employers often prefer applicants with an associate degree in electronics.
- Employment is projected to grow more slowly than average for all occupations.
- Job opportunities will be best for applicants with an associate degree, certification, and related experience.

Nature of the Work

Businesses and other organizations depend on complex electronic equipment for a variety of functions. Industrial controls automatically monitor and direct production processes on the factory floor. Transmitters and antennae provide communication links for many organizations. Electric power companies use electronic equipment to operate and control generating plants, substations, and monitoring equipment. The Federal Government uses radar and missile control systems to provide for the national defense and to direct commercial air traffic. These complex pieces of electronic equipment are installed, maintained, and repaired by electrical and electronics installers and repairers.

Installers and repairers, known as *field technicians*, often travel to factories or other locations to repair equipment. These workers usually have assigned areas in which they perform preventive maintenance on a regular basis. When equipment breaks down, field technicians go to a customer's site to repair the equipment. Bench technicians work in repair shops located in factories and service centers, fixing components that cannot be repaired on the factory floor.

Electrical and electronic equipment are two distinct types of industrial equipment, although much equipment contains both electrical and electronic components. In general, electrical portions provide the power for the equipment, while electronic components control the device, although many types of equipment still are controlled with electrical devices.

Some industrial electronic equipment is self-monitoring and alerts repairers to malfunctions. When equipment breaks down, repairers will first check for common causes of trouble, such as loose connections or obviously defective components. If routine checks do not locate the trouble, repairers may refer to schematics and manufacturers' specifications that show connections and provide instructions on how to locate problems. Automated electronic control systems are becoming increasingly complex, making diagnosis more challenging. With these systems, repairers use software programs and testing equipment to diagnose malfunctions. Among their diagnostic tools are multimeters, which measure voltage, current, and resistance, and advanced multimeters, which measure capacitance, inductance, and current gain of transistors. Repairers also use signal generators, which provide test signals, and oscilloscopes, which display signals graphically. Finally, repairers use handtools such as pliers, screwdrivers, soldering irons, and wrenches to replace faulty parts and adjust equipment.

Because repairing components is a complex activity and factories cannot allow production equipment to stand idle, repairers on the factory floor usually remove and replace defective units, such as circuit boards, instead of fixing them. Defective units are discarded or returned to the manufacturer or a specialized shop for repair. Bench technicians at these locations have the training, tools, and parts needed to thoroughly diagnose and repair circuit boards or other complex components. These workers also locate and repair circuit defects, such as poorly soldered joints, blown fuses, or malfunctioning transistors.

Electrical and electronics installers often fit older manufacturing equipment with new automated control devices. Older manufacturing machines are frequently in good working order but are limited by inefficient control systems for which replacement parts are no longer available. Installers replace old electronic control units with new programming logic controls (PLCs). Setting up and installing a new PLC involves connecting it to different sensors and electrically powered devices (electric motors, switches, and pumps) and writing a computer program to operate the PLC. Electronics installers coordinate their efforts with those of other workers who are installing and maintaining equipment. (See the section on industrial machinery mechanics and maintenance workers elsewhere in the *Handbook*.)

Electrical and electronics installers and repairers, transportation equipment install, adjust, or maintain mobile electronic communication equipment, including sound, sonar, security, navigation, and surveillance systems on trains, watercraft, or other vehicles. *Electrical and electronics repairers, powerhouse, substation, and relay* inspect, test, maintain, or repair electrical equipment used in generating stations, substations, and in-service relays. These workers may be known as powerhouse electricians, relay technicians, or power transformer repairers. *Electric motor, power tool, and related repairers*—such as armature winders, generator mechanics, and electric golf cart repairers—specialize in installing, maintaining, and repairing electric motors, wiring, or switches.

Electronic equipment installers and repairers, motor vehicles have a significantly different job. They install, diagnose, and repair communication, sound, security, and navigation equipment in motor vehicles. Most installation work involves either new alarm or sound systems. New sound systems vary significantly in

Some repairers install, diagnose, and repair equipment in cars and other motor vehicles.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16 Number	Change, 2006-16 Percent
Electrical and electronics installers and repairers	—	169,000	174,000	5,200	3
Electric motor, power tool, and related repairers	49-2092	25,000	24,000	-1,100	-4
Electrical and electronics installers and repairers, transportation equipment	49-2093	21,000	22,000	900	4
Electrical and electronics repairers, commercial and industrial equipment	49-2094	80,000	86,000	5,500	7
Electrical and electronics repairers, powerhouse, substation, and relay	49-2095	22,000	21,000	-1,000	-5
Electronic equipment installers and repairers, motor vehicles	49-2096	20,000	21,000	900	5

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

cost and complexity of installation. Replacing a head unit (radio) with a new CD player is simple, requiring the removal of a few screws and the connection of a few wires. Installing a new sound system with a subwoofer, amplifier, and fuses is far more complicated. The installer builds a fiberglass or wood box designed to hold the subwoofer and to fit inside the unique dimensions of the automobile. Installing sound-deadening material, which often is necessary with more powerful speakers, requires an installer to remove many parts of a car (for example, seats, carpeting, or interiors of doors), add sound-absorbing material in empty spaces, and reinstall the interior parts. The installer also runs new speaker and electrical cables. The new system may require additional fuses, a new electrical line to be run from the battery through a newly drilled hole in the firewall into the interior of the vehicle, or an additional or more powerful alternator or battery. Motor vehicle installers and repairers work with an increasingly complex range of electronic equipment, including DVD players, satellite navigation equipment, passive security systems, and active security systems.

Work environment. Many electrical and electronics installers and repairers work on factory floors, where they are subject to noise, dirt, vibration, and heat. Bench technicians primarily work in repair shops, where the surroundings are relatively quiet, comfortable, and well lighted.

Installers and repairers may have to do heavy lifting and work in a variety of positions. They must follow safety guidelines and often wear protective goggles and hardhats. When working on ladders or on elevated equipment, repairers must wear harnesses to avoid falls. Before repairing a piece of machinery, these workers must follow procedures to ensure that others cannot start the equipment during the repair process. They also must take precautions against electric shock by locking off power to the unit under repair.

Motor vehicle electronic equipment installers and repairers normally work indoors in well-ventilated and well-lighted repair shops. Minor cuts and bruises are common, but serious accidents usually are avoided when safety practices are observed.

Training, Other Qualifications, and Advancement

Applicants with an associate degree in electronics are preferred, and professional certification often is required.

Education and training. Knowledge of electrical equipment and electronics is necessary for employment. Employers often prefer applicants with an associate degree from a community college or technical school, although a high school diploma may be sufficient for some jobs. Entry-level repairers may begin by working with experienced technicians who provide technical guidance, and work independently only after developing the necessary skills.

Certification and other qualifications. Many employers require applicants to be certified. Certification is available from various professional and education organizations, and usually requires applicants to pass an exam demonstrating their level of expertise.

Installers and repairers should have good eyesight and color perception to work with the intricate components used in electronic equipment. Field technicians work closely with customers and should have good communication skills and a neat appearance. Employers also may require that field technicians have a driver's license.

Certification and advancement. Certification can also serve as a form of advancement. Workers who become certified in a specialty area may gain additional responsibilities and be awarded higher pay.

Experienced repairers with advanced training may become specialists or troubleshooters who help other repairers diagnose difficult problems. Workers with leadership ability may become supervisors of other repairers. Some experienced workers open their own repair shops.

Employment

Electrical and electronics installers and repairers held about 169,000 jobs in 2006. The following tabulation breaks down their employment by occupational specialty:

Electrical and electronics repairers, commercial and industrial equipment 80,000
Electric motor, power tool, and related repairers 25,000
Electrical and electronics repairers, powerhouse, substation, and relay 22,000
Electrical and electronics installers and repairers, transportation equipment 21,000
Electronic equipment installers and repairers, motor vehicles 20,000

Many repairers worked for utilities; building equipment contractors; machinery and equipment repair shops; electrical and electronics wholesalers; electronics and appliance retailers; motor vehicle and parts dealers; manufacturers of electrical, elec-

tronic, and transportation equipment; and Federal, State, and local government.

Job Outlook

Employment is expected to increase more slowly than the average through the year 2016. Job prospects should be best for applicants with an associate degree, certification, and related experience.

Employment change. Overall employment of electrical and electronics installers and repairers is expected to grow by 3 percent through the year 2016, which is slower than the average for all occupations. Growth rates will vary by occupational specialty.

Employment of electrical and electronics installers and repairers of commercial and industrial equipment is expected to grow by 7 percent, which is about as fast as the average for all occupations. This equipment will become more sophisticated and will be used more frequently as businesses strive to lower costs by increasing and improving automation. Companies will install electronic controls, robots, sensors, and other equipment to automate processes such as assembly and testing. In addition, as prices decline, this equipment will be used more frequently throughout a number of industries, including services, utilities, and construction, as well as manufacturing. Improved reliability of equipment should not constrain employment growth, however: companies increasingly will rely on repairers because malfunctions that idle commercial and industrial equipment will continue to be costly.

Employment of motor vehicle electronic equipment installers and repairers is expected to grow by 5 percent, which is slower than the average for all occupations. As motor vehicle manufacturers install more and better sound, security, entertainment, and navigation systems in new vehicles, and as newer electronic systems require progressively less maintenance, employment growth for aftermarket electronic equipment installers will be limited.

Employment of electric motor, power tool, and related repairers is expected to decline slowly, decreasing by 4 percent. Improvements in electrical and electronic equipment design, as well as the increased use of disposable tool parts should suppress job growth.

Employment of electrical and electronic installers and repairers of transportation equipment is expected to grow by 4 percent, which is slower than the average for all occupations. Declining employment in the rail transportation industry will dampen growth in this occupational specialty.

Employment of electrical and electronics installers and repairers, powerhouse, substation, and relay is expected to decline slowly, decreasing by 5 percent. Consolidation and privatization in utilities industries should improve productivity, reducing employment. Newer equipment will be more reliable and easier to repair, further limiting employment.

Job prospects. Job opportunities should be best for applicants with an associate degree in electronics, certification, and related experience. In addition to employment growth, the need to replace workers who transfer to other occupations or leave the labor force will result in some openings.

Earnings

Median hourly earnings of wage-and-salary electrical and electronics repairers, commercial and industrial equipment were $21.72 in May 2006. The middle 50 percent earned between $17.18 and $26.59. The lowest 10 percent earned less than $13.43, and the highest 10 percent earned more than $30.90. In May 2006, median hourly earnings were $23.49 in the Federal Government and $19.92 in building equipment contractors, the industries employing the largest numbers of electrical and electronics repairers, commercial and industrial equipment.

Median hourly earnings of wage-and-salary electric motor, power tool, and related repairers were $15.80 in May 2006. The middle 50 percent earned between $12.56 and $20.24. The lowest 10 percent earned less than $9.97, and the highest 10 percent earned more than $25.37. In May 2006, median hourly earnings were $15.32 in commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance, the industry employing the largest number of electronic motor, power tool, and related repairers.

Median hourly earnings of wage-and-salary electrical and electronics repairers, powerhouse, substation, and relay were $27.60 in May 2006. The middle 50 percent earned between $23.62 and $32.07. The lowest 10 percent earned less than $19.42, and the highest 10 percent earned more than $35.49. In May 2006, median hourly earnings were $28.30 in electric power generation, transmission, and distribution, the industry employing the largest number of these repairers.

Median hourly earnings of wage-and-salary electronics installers and repairers, motor vehicles were $13.57 in May 2006. The middle 50 percent earned between $10.78 and $17.41. The lowest 10 percent earned less than $9.13, and the highest 10 percent earned more than $23.45.

Median hourly earnings of wage-and-salary electrical and electronics repairers, transportation equipment were $20.72 in May 2006. The middle 50 percent earned between $16.79 and $25.10. The lowest 10 percent earned less than $13.24, and the highest 10 percent earned more than $28.78.

Related Occupations

Workers in other occupations who install and repair electronic equipment include broadcast and sound engineering technicians and radio operators; computer, automated teller, and office machine repairers; electronic home entertainment equipment installers and repairers; radio and telecommunications equipment installers and repairers; electricians; elevator installers and repairers; aircraft and avionics equipment mechanics and service technicians; coin, vending, and amusement machine servicers and repairers; and maintenance and repair workers, general. Industrial machinery mechanics and maintenance workers also install, maintain, and repair industrial machinery.

Sources of Additional Information

For information on careers and certification, contact any of the following organizations:

➤ ACES International, 5241 Princess Anne Rd., Suite 110, Virginia Beach, VA 23462.
Internet: **http://www.acesinternational.org**

➤ Electronics Technicians Association International, 5 Depot St., Greencastle, IN 46135. Internet: **http://eta-i.org/**

➤ International Society of Certified Electronics Technicians, 3608 Pershing Ave., Fort Worth, TX 76107- 4527.
Internet: **http://www.iscet.org**