

Robotics

Inland Empire/Desert Region (Riverside and San Bernardino counties)

This workforce demand report uses state and federal job projection data developed before the economic impact of COVID-19. The COE is monitoring the situation and will provide more information as it becomes available. Please consult with local employers to understand their current employment needs.

Summary

- Community college manufacturing and industrial technology (TOP 0956.00) programs prepare students for employment in robotics. Training in this program leads to the electro-mechanical and mechatronics technologists and technicians occupation (SOC 17-3024), which installs, tests, or maintains robotic equipment or related automated production systems, among other work activities.
- While employment for this occupation is projected to grow by 9% through 2025, only five annual job openings are expected.
- This occupation's 25th percentile hourly earnings are \$25.98 per hour, above the hourly self-sustainable earnings standard for a single adult with one child in the region.
- Three community college programs related to robotics were identified in the region. One college program issued an annual average of 24 awards over the last three academic years.
- The Centers of Excellence cautiously recommends expanding programs related to electro-mechanical and mechatronics technologists and technicians. For more information, see the [recommendation section](#).

Introduction

This report aims to quantify regional supply and demand related to robotics in the Inland Empire/Desert Region. The California Community college manufacturing and industrial technology (TOP 0956.00) is most likely to train students for employment in robotics. This program prepares students for employment through the instruction of engineering principles and technical skills for the manufacture of products and related industrial processes and optimization theory, industrial and manufacturing planning, and related management skills. These programs include shaping and forming operations, material handling, instrumentation and controls, and quality control. These programs also include computer-aided manufacturing and robotics (Taxonomy of Programs, 2012).

The community college manufacturing and industrial technology program is related to the Classification of Instructional Programs (CIP) robotics technology/technician (CIP 15.0405) program. This CIP program prepares individuals to apply basic engineering principles and technical skills to support engineers and other professionals engaged in developing and using robots. Includes instruction in the principles of robotics, design

and operational testing, system maintenance and repair procedures, robot computer systems and control language, specific system types and applications to specific industrial tasks, and report preparation (CIP, 2021). The knowledge, skills, and abilities trained by manufacturing and industrial technology and robotics technology/technician programs lead to the electro-mechanical and mechatronics technologists and technicians occupation.

Electro-Mechanical and Mechatronics Technologists and Technicians (SOC 17-3024)

Operate, test, maintain, or adjust unmanned, automated, servomechanical, or electro-mechanical equipment. May operate unmanned submarines, aircraft, or other equipment to observe or record visual information at sites such as oil rigs, crop fields, buildings, or for similar infrastructure, deep ocean exploration, or hazardous waste removal. May assist engineers in testing and designing robotics equipment.

Sample job titles: Robotics Testing Technician, Robotic Technician Robotics Mechanic, Robot Programmer, Electro-Mechanic, Electro-Mechanical Technician (E/M Technician), Electronic Technician, Maintenance Technician, Mechanical Technician, Process Control Tech

Entry-Level Educational Requirement: Associate degree

Work Experience Required: None

Training Requirement: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 51%

Job Counts and Projections

In 2020, there were 47 electro-mechanical and mechatronics technologist and technician jobs in the region. While employment for this occupation is projected to grow by 9% through 2025, only five annual job openings are expected. Job openings include new jobs due to growth and replacement job needs. This indicates that job opportunities in the region may be scarce. Exhibit 1 displays the job counts, five-year projected job growth, job openings, and the share of incumbent workers age 55 years and greater in the region.

Exhibit 1: Five-year projections, 2020-2025

| 2020 Jobs | 2025 Jobs | 5-Yr % Change (New Jobs) | 5-Yr Openings (New + Replacement Jobs) | Annual Openings (New + Replacement Jobs) | % of workers age 55+ |
|-----------|-----------|--------------------------------|--|--|-------------------------|
| 47 | 51 | 9% | 25 | 5 | 23% |

Source: Emsi 2021.3

A search of regional employer online job advertisements (ads) over the last 12 months seeking electro-mechanical and mechatronics technologist and technician and "robotics" workers produced 36 job ad results. The search area was expanded to the entire state of California to ensure actionable job-related data was provided, resulting in a total of 375 job ads.

Exhibit 2 shows the number of job ads posted in California during the last 12 months and the average time to fill this job. On average, California employers fill online job ads for electro-mechanical and mechatronics technologists and technicians within 32 days.

Exhibit 2: Job ads and time to fill

| Job Ads | Statewide Average Time to Fill (Days) |
|---------|---------------------------------------|
| 375 | 32 |

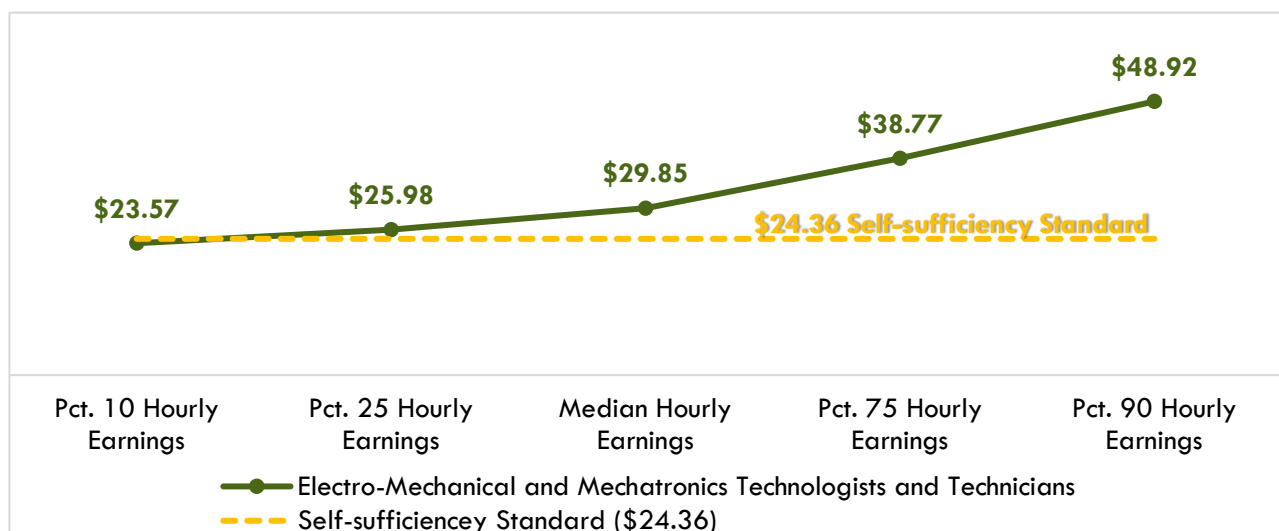
Source: Burning Glass – Labor Insights

Earnings

Community colleges should ensure their training programs lead to employment opportunities that provide self-sustainable income. The University of Washington estimates that a self-sufficient hourly rate for a single adult with one school-age child is \$24.36 per hour or \$51,452 annually in Riverside County; \$23.73 per hour or \$50,119 annually in San Bernardino County (Pearce, 2021). For this study, the higher hourly earnings requirement in Riverside County is adopted as the self-sufficiency standard for the two-county region.

The 25th percentile hourly earnings for electro-mechanical and mechatronics technologists and technicians exceed the self-sustainability rate, indicating that at least 75% of workers in the field earn a self-sustainable wage. Exhibit 3 displays the hourly earnings for electro-mechanical and mechatronics technologists and technicians.

Exhibit 3: Hourly earnings by percentile



Source: Emsi 2021.3

Advertised Salary from Online Job Ads

Exhibit 4 displays online job ad salary data for electro-mechanical and mechatronics technologists and technicians in California over the last 12 months. Online job ad salary information reveals that employers are willing to pay electro-mechanical and mechatronics technologists and technicians a median annual salary of \$52,000, above the region's \$51,452 annual (\$24.36 hourly) self-sufficiency standard. Consider the salary information with caution since only 39% (146 out of 375) of online job ads for this occupation provided salary information. The salary figures are prorated to reflect full-time, annual earnings status.

Exhibit 4: Advertised salary information

| Number of job ads | Real-Time Salary Information | | | | Median Annual Salary |
|-------------------|------------------------------|----------------------|----------------------|--------------------|----------------------|
| | Less than \$35,000 | \$35,000 to \$49,999 | \$50,000 to \$74,999 | More than \$75,000 | |
| 146 | 3% | 44% | 43% | 10% | \$52,000 |

Source: Burning Glass – Labor Insights

Employers, Skills, Education, Work Experience, and Certifications

Exhibit 5 displays the employers that posted five or more job ads for electro-mechanical and mechatronics technologists and technicians in California over the last 12 months. Showing employer names provides insight into where students may find employment after completing a program. Johnson & Johnson and Amazon posted the most job ads for electro-mechanical and mechatronics technologists and technicians in California over the last 12 months. Most of the job postings for XPO Logistics were located in the local region.

Exhibit 5: Employers posting the most job ads

| Top Employers | Job Ads |
|--------------------------------------|------------|
| Johnson & Johnson | 19 |
| Amazon | 19 |
| XPO Logistics | 16 |
| Applied Industrial Technologies | 8 |
| Space Exploration Technologies Corp. | 6 |
| Nuro Incorporated | 6 |
| Beamcut Systems | 6 |
| Relativity Space | 5 |
| OhmniLabs, Inc. | 5 |
| Flory Group Incorporated | 5 |
| All other employers | 280 |
| Total | 375 |

Source: Burning Glass – Labor Insights

Exhibit 6 lists a sample of specialized and employability skills employers' seek when looking for workers to fill electro-mechanical and mechatronics technologist and technician positions. Specialized skills are occupation-specific skills that employers request for industry or job competency. Employability skills are foundational skills that transcend industries and occupations; this category is often referred to as "soft skills." The skills requested in job ads may be utilized to guide curriculum development.

Exhibit 6: Sample of in-demand skills from employer job ads

| Specialized skills (n=371) | Employability skills |
|--|---|
| <ul style="list-style-type: none"> • Robotics • Repair • Hand Tools • Machinery • Predictive/Preventative Maintenance • Schematic Diagrams | <ul style="list-style-type: none"> • Troubleshooting • Detail-Oriented • Communication Skills • Physical Abilities • Teamwork/Collaboration • Problem Solving |

Source: Burning Glass – Labor Insights

According to the Bureau of Labor Statistics, approximately 51% of incumbent workers in this field hold a community college-level of educational attainment; "some college, no degree" and an "associate degree." Half (50%) of the job ads for electro-mechanical and mechatronics technologists and technicians sought candidates with a high school diploma or vocational training. Exhibit 7 displays the typical entry-level education, educational attainment, and minimum advertised education requirements for electro-mechanical and mechatronics technologists and technicians.

Exhibit 7: Typical entry-level education, educational attainment, and minimum advertised education requirements

| Typical Entry-Level Education Requirement | CC-Level Educational Attainment* | Number of Job Ads | Real-Time Minimum Advertised Education Requirement | | |
|---|----------------------------------|-------------------|--|------------------|-----------------------------|
| | | | High school or vocational training | Associate degree | Bachelor's degree or higher |
| Associate degree | 51% | 258 | 50% | 12% | 38% |

Source: Emsi 2021.3, Burning Glass – Labor Insights

*Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework

Exhibit 8 displays the work experience typically required and the real-time work experience requirements from employer job ads for electro-mechanical and mechatronics technologists and technicians. Approximately half of the employers sought candidates with zero to two years of work experience, while another 40% sought candidates with three to five years of work experience.

Exhibit 8: Work experience required and real-time work experience requirements

| Work Experience Typically Required | Real-Time Work Experience | | | |
|------------------------------------|---------------------------|-------------|-------------|----------|
| | Number of job ads | 0 – 2 years | 3 – 5 years | 6+ years |
| None | 270 | 50% | 40% | 10% |

Source: Emsi 2021.3, Burning Glass – Labor Insights

Student Completions and Programs Outcomes

Robotics programs are offered at three regional colleges, each coded under a different program code; electro-mechanical technology (TOP 0935.00), industrial systems technology and maintenance (TOP 0945.00), and manufacturing and industrial technology (TOP 0956.00).

According to the Taxonomy of Programs manual, the manufacturing and industrial technology (TOP 0956.00) program is closely aligned to robotics training. This program prepares students for employment through the instruction of engineering principles and technical skills for the manufacture of products and related industrial processes and optimization theory, industrial and manufacturing planning, and related management skills. These programs include shaping and forming operations, material handling, instrumentation and controls, and quality control. These programs also include computer-aided manufacturing and robotics (Taxonomy of Programs, 2012).

Norco College's industrial automation and supply chain automation programs are coded TOP 0956.00 and prepare students for employment related to programmable logic controllers, microcontrollers, and robotics (Norco College, 2021).

Over the last three academic years, from 2017 to 2020, one regional college has issued 24 awards annually in a program related to robotics. Exhibit 9 displays completion data for regional programs related to robotics. The student completion and outcome methodology are available on page 11.

Exhibit 9: 2017-20, Annual average community college awards for manufacturing and industrial technology programs related to robotics in the Inland Empire/Desert Region

| TOP 0956.00 – Manufacturing and Industrial Technology | Associate Degree | Certificate requiring 30 to < 60-semester units | Certificate requiring 18 to < 30-semester units | Certificate requiring 16 to < 30-semester units | Certificate requiring 6 to < 18-semester units | Total CC Annual Average Awards, Academic Years 2017-20 |
|--|------------------|---|---|---|--|--|
| Norco (Industrial Automation and Supply Chain Automation) | 4 | 0 | 13 | 3 | 3 | 24 |
| Total | 4 | 0 | 13 | 3 | 3 | 24 |

Source: MIS Data Mart

California program outcome data may provide helpful insight into the likelihood of success for the proposed program. About 75% of students exiting from the manufacturing and industrial technology program reported working in their field of study. The median annual earnings from all exiters was \$42,198, and 68% attained a living wage. Community college student outcome information based on the selected TOP code and region is provided in Exhibit 10. The outcome methodology is available in the appendix section of this report.

Exhibit 10: 0956.00 – Manufacturing and industrial technology strong workforce program outcomes

| Strong Workforce Program Metrics: 0956.00 – Manufacturing and Industrial Technology Academic Year 2018-19, unless noted otherwise | Inland Empire/Desert Region | California |
|--|--|-------------------|
| Unduplicated count of enrolled students (2019-20) | 101 | 5,647 |
| Completed 9+ career education units in one year (2019-20) | 40% | 41% |
| Perkins Economically disadvantaged students | 73% | 60% |
| Students who attained a noncredit workforce milestone in a year (2019-20) | - | 59% |
| Students who earned a degree, certificate, or attained apprenticeship (2019-20) | 12 | 342 |
| Transferred to a four-year institution (transfers) | - | 102 |
| Job closely related to the field of study (2017-18) | 75% | 78% |
| Median annual earnings (all exiters) | \$42,198 | \$54,660 |
| Median change in earnings (all exiters) | 35% | 53% |
| Attained a living wage (completers and skills-builders) | 68% | 71% |

Sources: LaunchBoard Community College Pipeline and Strong Workforce Program Metrics

Regional robotics training is also offered at Chaffey College and San Bernardino Valley College. Chaffey's mechatronics training programs are coded as electro-mechanical technology (TOP 0935.00) programs and prepare students to work with industrial robotics (Chaffey College, 2021). There were no awards conferred in Chaffey's mechatronics program over the last three academic years. San Bernardino Valley's industrial automation program is coded as an industrial systems technology and maintenance (TOP 0945.00) program and prepares students for employment related to programmable logic controllers, supervisory control, and data acquisition (SCADA), and robotics (San Bernardino Valley College, 2021). There were no known awards conferred in this program over the last three academic years. Please note that San Bernardino Valley offers another training program with the same TOP code as their robotics program.

The Classification of Instructional Programs (CIP) robotics technology/technician (CIP 15.0405) program prepares individuals to apply basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and using robots. Includes instruction in the principles of robotics, design and operational testing, system maintenance and repair procedures, robot computer systems and control language, specific system types and applications to specific industrial tasks, and report preparation (CIP, 2021). There are no known robotics technology/technician programs in the region.

Summary and Recommendation

Community college manufacturing and industrial technology (TOP 0956.00) programs prepare students for employment in robotics. Training in this program leads to the electro-mechanical and mechatronics technologists and technicians occupation (SOC 17-3024), which installs, tests, or maintains robotic equipment or related automated production systems, among other work activities.

In 2020, there were 47 electro-mechanical and mechatronics technologist and technician jobs in the region. While employment for this occupation is projected to grow by 9% through 2025, only five annual job openings are expected. Job openings include new job growth and replacement job needs. This indicates that job opportunities in the region may be scarce. The hourly earnings for the electro-mechanical and mechatronics technologists and technicians surpass the regional self-sustainability standard at the 25th percentile (\$25.98 per hour), indicating that the top 75% of workers earn a self-sustainable hourly wage.

Three regional community colleges offer robotics programs across three TOP codes, but only one college has reported award counts. Norco College's industrial automation and supply chain automation program issued 24 awards annually over the last three academic years. About 75% of students exiting manufacturing and industrial technology programs reported working in their field of study. The median annual earnings from all exiters was \$42,198, and 68% attained a living wage. Other colleges with robotics programs have not reported award counts.

The Centers of Excellence cautiously recommends expanding programs related to robotics. While the wages for electro-mechanical and mechatronics technologists and technicians are strong, the regional demand for these workers is low. Colleges considering this program should partner with applicable employers and establish direct connections to robotics jobs for exiting students. Colleges should also document employer demand for robotics workers and the skills needed for students to secure employment in this field.

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Appendix: Methodology

Exhibit 9 displays the average annual California Community College (CCC) awards conferred during the three academic years between 2017 and 2020 from the California Community Colleges Chancellor's Office Management Information Systems (MIS) Data Mart. Awards are the combined total of associate degrees and certificates issued during the timeframe, divided by three in this case to calculate an annual average. This is done to minimize the effect of atypical variation that might be present in a single year.

Community college student outcome information is from LaunchBoard and based on the selected TOP code and region. These metrics are based on records submitted to the California Community Colleges Chancellor's Office Management Information Systems (MIS) by community colleges, which come from self-reported student information from CCC Apply and the National Student Clearinghouse. Employment and earnings metrics are sourced from records provided by California's Employment Development Department's Unemployment Insurance database. When available, outcomes for completers are reported to demonstrate the impact that earning a degree or certificate can have on employment and earnings. For more information on the types of students included for each metric, please see the web link for LaunchBoard's Strong Workforce Program Metrics Data Element Dictionary in the References section (LaunchBoard, 2021 a). Finally, employment in a job closely related to the field of study comes from self-reported student responses on the CTE Employment Outcomes Survey (CTEOS), administered by Santa Rosa Junior College (LaunchBoard, 2021 a).

Job advertisement data is limited to the information provided by employers and the ability of artificial intelligence search engines to identify this information. Additionally, preliminary calculations by Georgetown Center on Education and the Workforce found that "just 30 to 40 percent of openings for candidates with some college or an associate degree, and only 40 to 60 percent of openings for high school diploma holders appear online" (Carnevale et al., 2014). Online job ads often do not reveal the hiring intentions of employers; it is unknown if employers plan to hire one or multiple workers from a single online job ad, or if they are collecting resumes for future hiring needs. A closed job ad may not be the result of a hired worker.

Table 1. 2020 to 2025 job growth, wages, entry-level education, training, and work experience required for electro-mechanical and mechatronics technologists and technicians in the Inland Empire/Desert Region (Riverside and San Bernardino counties combined)

| Occupation (SOC) | 2020 Jobs | 5-Year Change (New Jobs) | 5-Year % Change (New Jobs) | Annual Openings (New + Replacement Jobs) | Entry-Experienced Hourly Wage (10 th to 90 th percentile) | Median Hourly Wage (50 th percentile) | Average Annual Earnings | Entry-Level Education & On-The-Job-Training | Work Experience Required |
|---|-----------|--------------------------|----------------------------|--|---|--|-------------------------|---|--------------------------|
| Electro-Mechanical and Mechatronics Technologists and Technicians (17-3024) | 47 | 4 | 9% | 5 | \$23.57 to \$48.92 | \$29.85 | \$69,400 | Associate degree & None | None |

Source: Emsi 2021.3