



# AUTOMATION & INSTRUMENTATION TECHNOLOGY

**Associate in Applied Science (AAS)**  
**Program Code: 10-605-4**  
**Total Credits: 60**

Unique in the Wisconsin Technical College System, the Automation & Instrumentation Technology program at Mid-State prepares graduates to measure and control industrial processes in today's high-tech manufacturing environments. In this program you'll apply mathematical skill and basic laws of physical sciences to design, install, calibrate, maintain, troubleshoot, and repair industrial control systems. You'll learn to use a variety of different forms of instrumentation and have access to state-of-the-art equipment. Field trips to businesses that have process control systems as an integral part of operations extend your hands-on experience into the real world.

**Estimated tuition and fees:** [mstc.edu/programcosts](http://mstc.edu/programcosts)

## ACADEMIC ADVISOR

To schedule an appointment with an academic advisor, call 715.422.5300. Academic advisors will travel to other campuses as necessary to accommodate student needs. For more information about advising, visit [mstc.edu/advising](http://mstc.edu/advising).

## NEW STUDENT CHECKLIST

Complete the following steps to prepare for your New Student Advising appointment with your academic advisor:

- ☐ Submit a Mid-State application at [mstc.edu/apply](http://mstc.edu/apply).
- ☐ Send official transcripts to:  
Mid-State Technical College  
Student Services  
1001 Centerpoint Drive  
Stevens Point, WI 54481
- ☐ Complete the Free Application for Federal Student Aid (FAFSA) at [fafsa.gov](http://fafsa.gov). Mid-State's Financial Aid team is available to assist with your FAFSA application and to answer your financial aid questions. Contact Financial Aid or schedule an appointment at [mstc.edu/financial-aid](http://mstc.edu/financial-aid).
- ☐ Set up student MyCampus account at [mstc.edu/mycampus-assistance](http://mstc.edu/mycampus-assistance).
- ☐ Schedule a New Student Advising appointment at [mstc.edu/advising](http://mstc.edu/advising).



[mstc.edu](http://mstc.edu) • 888.575.6782 • TTY: 711



**ADAMS CAMPUS**  
 401 North Main  
 Adams, WI 53910

**MARSHFIELD CAMPUS**  
 2600 West 5th Street  
 Marshfield, WI 54449

**STEVENS POINT  
 DOWNTOWN CAMPUS**  
 1001 Centerpoint Drive  
 Stevens Point, WI 54481

**WISCONSIN RAPIDS CAMPUS**  
 500 32nd Street North  
 Wisconsin Rapids, WI 54494

# CAREER PATHWAY • BEGIN AT ANY POINT



## CREDIT FOR PRIOR LEARNING AND EXPERIENCE

### CREDIT FOR PRIOR LEARNING AND EXPERIENCE

- Certifications and Licenses
- High School Credit
- Military Experience
- National/Standardized Exams
- Transfer Credit
- Work and Life Experience

Learn about Credit for Prior Learning at [mstc.edu/cpl](https://mstc.edu/cpl).

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graph TD; D[CREDIT FOR PRIOR LEARNING AND EXPERIENCE] --> E[ASSOCIATE IN APPLIED SCIENCE (AAS)]; E --> F[BACHELOR'S DEGREE];
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## ASSOCIATE IN APPLIED SCIENCE (AAS)

### AUTOMATION & INSTRUMENTATION TECHNOLOGY

Associate in Applied Science (AAS) • 60 Credits

#### Start Your Career

- Automation/Controls Engineering Technician
- Electrical and Instrumentation Technician
- Instrument Technician
- Apprenticeship

## BACHELOR'S DEGREE

### BACHELOR'S DEGREE OPTIONS

For those interested in continuing their education, Mid-State offers transfer agreements with various four-year colleges and universities. For more information and additional opportunities, visit [mstc.edu/transfer](https://mstc.edu/transfer).

## OTHER OPTIONS

### RELATED PROGRAMS

- Civil Engineering Technology-Highway Technician
- Mechanical Design Technology

### APPRENTICESHIP OPPORTUNITIES

- Electrical & Instrumentation Technician Apprenticeship

Employers will expect you, as an Automation & Instrumentation Technology graduate, to be able to:

- ## TECHNICAL SKILLS ATTAINMENT

# STUDENT HANDBOOK

## NOTES:

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The GPS for Student Success course is required for all Mid-State program students and is recommended to be completed before obtaining 12 credits. (Not counted in the total credit value for this program.) Some students are exempt from this requirement. Please see your program advisor for more information.

**10890102 ..... 1 credit**

### ADDITIONAL COURSES AS NEEDED

# College Reading and Writing 1

**10831104 .....3 credits**

# Pre-Algebra

**10834109 .....3 credits**

Provides an introduction to algebra. Includes operations on real numbers, solving linear equations, percent and proportion, and an introduction to polynomials and statistics. Prepares students for elementary algebra and subsequent algebra-related courses.

## SAMPLE FULL-TIME CURRICULUM OPTION

Term	16 credits
10605105 Electrical Circuits I ☑	3
10605112 Process Documentation ☑	1
10605131 Process Equipment	2
10605169 Instrumentation Principles ☑	3
10801136 English Composition 1 ☑	3
10804118 Intermediate Algebra with Applications ☑	4

Term	15 credits
10462107 Industrial Safety ☑	2
10605110 Electrical Circuits II	3
10605117 Automation 1 - Beginning PLC ☑	3
10605145 Industrial Networking	2
10607106 Excel for Engineering	1
10623106 Intro to AutoCAD	1
10804196 Trigonometry with Applications	3

Term	16 credits
10462133 Electric Controls for Industrial Automation	3
10605109 Process Measurements Instrumentation	2
10605118 Automation 2 - Advanced PLC	3
10605121 Process Control Strategies	2
10804195 College Algebra with Applications ☑	3
10809198 Intro to Psychology ☑ -OR-	
10809188 Developmental Psychology ☑	3

Term	13 credits
10462131 Industrial Electric Power Applications	2
10605119 Automation 3 - HMI's & Robotics	2
10605133 Process Troubleshooting Strategies	1
10605172 Process Systems	2
10801196 Oral/Interpersonal Communication ☑ -OR-	
10801198 Speech ☑	3
10809166 Intro to Ethics: Theory & Application ☑ -OR-	
10809122 Intro to American Government ☑	3

**Total credits 60**

☑ This course has options available to receive credit for prior learning (CPL) or work experience. Visit the website at [mstc.edu/cpl](http://mstc.edu/cpl) or contact your advisor for details.

Please Note:

- This curriculum sequence is only for student planning. Actual student schedules will vary depending on course availability.
- Program completion time may vary based on student scheduling and course availability. For details, go to [mstc.edu/schedule](http://mstc.edu/schedule).

## SAMPLE PART-TIME CURRICULUM OPTION

Term	10 credits
10605105 Electrical Circuits I ☑	3
10605169 Instrumentation Principles ☑	3
10804118 Intermediate Algebra with Applications ☑	4

Term	8 credits
10462107 Industrial Safety ☑	2
10605110 Electrical Circuits II	3
10804196 Trigonometry with Applications	3

Term	6 credits
10605112 Process Documentation ☑	1
10605131 Process Equipment	2
10801136 English Composition 1 ☑	3

Term	7 credits
10605117 Automation 1 - Beginning PLC ☑	3
10605145 Industrial Networking	2
10607106 Excel for Engineering	1
10623106 Intro to AutoCAD	1

Term	8 credits
10605118 Automation 2 - Advanced PLC	3
10605121 Process Control Strategies	2
10804195 College Algebra with Applications ☑	3

Term	7 credits
10462131 Industrial Electric Power Applications	2
10605119 Automation 3 - HMI's & Robotics	2
10801196 Oral/Interpersonal Communication ☑ -OR-	
10801198 Speech ☑	3

Term	8 credits
10462133 Electric Controls for Industrial Automation	3
10605100 Process Measurements Instrumentation	2
10809198 Intro to Psychology ☑ -OR-	
10809188 Developmental Psychology ☑	3

Term	6 credits
10605133 Process Troubleshooting Strategies	1
10605172 Process Systems	2
10809166 Intro to Ethics: Theory & Application ☑ -OR-	
10809122 Intro to American Government ☑	3

**Total credits 60**

## MULTIPLE MEASURES

**Multiple Measures Writing (MMW):** High school GPA of 2.6 and successful completion of 2.0 credits of high school writing courses with a "C" or better

**Multiple Measures Math 1 (MMM\_1):** High school GPA of 2.6 and successful completion of 1.0 credits of high school math (Algebra 1 or equivalent) with a "C" or better

**Multiple Measures Science 1 (MMS\_1):** High school GPA of 2.6 and successful completion of 1.0 credits of high school lab science course with a "C" or better

**Multiple Measures Reading (MMR):** High school GPA of 2.6 and successful completion of 2.0 credits of high school literature courses with a "C" or better

**Multiple Measures Math 2 (MMM\_2):** High school GPA of 2.6 and successful completion of 2.0 credits of high school math including Algebra 1 and Algebra 2 with a "C" or better

**Multiple Measures Science 2 (MMS\_2):** High school GPA of 2.6 and successful completion of 1.0 credits of high school chemistry with a "C" or better

*Past high school and college transcripts are used in making course placement decisions.*

# COURSE DESCRIPTIONS

## Automation 1 - Beginning PLC

**10605117 .....3 credits**

An overview of programmable logic controllers (PLCs) that provides a foundation of knowledge of the programming techniques, operation, and maintenance of PLCs used in typical industrial automation.

## Automation 2 - Advanced PLC

**10605118 .....3 credits**

A lab intensive course covering advanced PLC topics and programming techniques, analog I/O, VFDs, basic HMI interfaces, industrial robotics and troubleshooting.

*Prerequisite: Automation 1 - Beginning PLC 10605117 or consent of instructor*

## Automation 3 - HMI's & Robotics

**10605119 .....2 credits**

A lab intensive course covering advanced PLC programming techniques, HMI programming, industrial robotic systems interface, networking basics and troubleshooting of automation systems.

*Prerequisite: Automation 2 - Advanced PLC 10605118*

## College Algebra with Applications

**10804195 .....3 credits**

Covers the skills needed for success in calculus and many application areas on a baccalaureate level. Topics include the real and complex number systems, polynomials, exponents, radicals, solving equations and inequalities (linear and nonlinear), relations and functions, systems of equations and inequalities (linear and nonlinear), matrices, graphing, conic sections, sequences and series, combinatorics, and the binomial theorem.

*Prerequisite: ACT Math score of 22 or Trigonometry with Applications 10804196 or Intermediate Algebra with Applications 10804118 with a "C" or better*

## Developmental Psychology

**10809188.....3 credits**

Studies human development throughout the lifespan and explores developmental theory and research with an emphasis on the interactive nature of the biological, cognitive, and psychosocial changes that affect the individual from conception to death. Application activities and critical thinking skills enable students to gain an increased knowledge and understanding of themselves and others.

*Prerequisite: High School GPA of 2.6 and MMR and MMW or Accuplacer Reading Skills of 236 and Writing of 237 or ACT of 15 Reading/16 English*

## Electric Controls for Industrial Automation

**10462133.....3 credits**

Introduces the fundamentals of industrial motor controls, relay logic, ladder diagrams, industrial automation, and integrated manufacturing systems. The purpose of the course is to familiarize students with the terminology, capabilities, applications, and limitations of automated industrial controls through classroom and lab activities.

*Prerequisite: Electrical Circuits I 10605105*

## Electrical Circuits I

**10605105 .....3 credits**

The study of Ohm's Law and its application to D.C. circuits. Major topics include: Ohm's Law, series circuits, parallel circuits, combination circuits, Kirchhoff's Laws, and power relationships.

*Corequisite: Intermediate Algebra with Applications 10804118 or College Math 10804107*

## Electrical Circuits II

**10605110 .....3 credits**

Continues the study of AC/DC circuits started in Electrical Circuits I. Introduces advanced DC circuit analysis techniques such as Thevenin's Theorem and nodal analysis. Includes discussion of voltage and power theorems used in the analysis of AC circuits consisting of both resistance and reactance. The complex plane and construction of phasor diagrams are also discussed. Concludes with an introduction to electronic filter circuits used in transmission and communication equipment. Approximately 50 percent of the course is spent in the laboratory, applying the principles and theory presented in the classroom.

*Prerequisite: Electrical Circuits I 10605105; Corequisite: Trigonometry with Applications 1080419*

## English Composition 1

**10801136 .....3 credits**

Learners develop and apply skills in all aspects of the writing process. Through a variety of learning activities and written documents, learners employ rhetorical strategies, plan, organize and revise content, apply critical reading strategies, locate and evaluate information, integrate and document sources, and apply standardized English language conventions.

*Prerequisite: High School GPA of 2.6 and MMW or Accuplacer Writing of 262 or ACT English score of 20 or completion of College Reading and Writing 1 10831104 with a "C" or better*

## Excel for Engineering

**10607106 .....1 credit**

Students learn to create, modify, and format spreadsheets and workbooks for readability and functionality in the engineering industry. Students will practice constructing workbooks to perform calculations and generate results in tabular and graphic form.

## Industrial Electric Power Applications

**10462131 .....2 credits**

Introduces concepts and applications of typical 3-phase power systems used in industry with focus on selection of overload devices, fuse sizing, wire selection, electrical motor theory and applications, and introduction to variable frequency drives through lecture and lab activities.

*Prerequisite: Electric Controls for Industrial Automation 10462133*

## Industrial Networking

**10605145 .....2 credits**

Students will study network infrastructure and communication languages commonly found in the industrial setting.

*Corequisite: Automation 1 - Beginning PLC 10605117*

# COURSE DESCRIPTIONS

## Industrial Safety ☑

**10462107 .....2 credits**

Provides an overview of safety, health, and environmental issues as they relate to industry. Various types of hazards and the controls and equipment used to reduce risks from hazards are discussed. Focuses on understanding the Occupational Safety and Health Administration (OSHA) and its function as well as other regulatory and enforcement agencies associated with industrial safety, health, and the environment.

## Instrumentation Principles ☑

**10605169 .....3 credits**

This course emphasizes a functional and mathematical approach to pneumatic and electric instrumentation used in industry. Includes survey of pressure, level, flow, and temperature instruments and their mechanisms, and an introduction to process control fundamentals. The course covers fundamental principles in math and science that applies to process instrumentation and process control. Topics covered include unit conversions, spreadsheets and graphing, linear equations, calibration principles, statistical process analysis, simple machines, basic thermodynamics, and electric motor theory.

## Intermediate Algebra with Applications ☑

**10804118 ..... 4 credits**

This course offers algebra content with applications. Topics include properties of real numbers; order of operations; algebraic solution for linear equations and inequalities; operations with polynomial and rational expressions; operations with rational exponents and radicals; and algebra of inverse, logarithmic, and exponential functions.

*Prerequisite: High School GPA of 3.0 or Accuplacer Arithmetic of 263 and QAS 234 or ACT of 19 or QAS of 245, or Pre-Algebra 10834109 with a grade of "C" or better or equivalent. Students are encouraged to bring transcripts for further evaluation if they do not meet these requirements.*

## Intro to American Government ☑

**10809122.....3 credits**

Introduces American political processes and institutions. Focuses on rights and responsibilities of citizens and the process of participatory democracy. Learners examine the complexity of the separation of powers and checks and balances. Explores the role of the media, interest groups, political parties, and public opinion in the political process. Also explores the role of state and national government in our federal system.

*Prerequisite: High School GPA of 2.6 and MMR and MMW or Accuplacer Reading Skills of 236 and Writing of 237 or ACT of 15 Reading/16 English*

## Intro to AutoCAD

**10623106 ..... 1 credit**

Learners will develop practical approaches to constructing basic 2D drawings in AutoCAD software by drawing, modifying, and assigning appropriate layer properties. Learners will also analyze length and area of shapes drawn in AutoCAD, summarize details through dimensions and annotations added to the drawings, and format the drawings for printing. Prior experience with computers is recommended.

## Intro to Ethics: Theory & Application ☑

**10809166 .....3 credits**

Provides a basic understanding of the theoretical foundations of ethical thought. Diverse ethical perspectives are used to analyze and compare relevant issues. Students critically evaluate individual, social, and/or professional standards of behavior, and apply a systemic decision-making process to these situations.

*Prerequisite: High School GPA of 2.6 and MMR and MMW or Accuplacer Reading Skills of 236 and Writing of 237 or ACT of 15 Reading/16 English*

## Intro to Psychology ☑

**10809198 .....3 credits**

This science of psychology course is a survey of multiple aspects of behavior and mental processes. It provides an overview of topics such as research methods, theoretical perspectives, learning, cognition, memory, motivation, emotions, personality, abnormal psychology, physiological factors, social influences, and development.

*Prerequisite: High School GPA of 2.6 and MMR and MMW or Accuplacer Reading Skills of 236 and Writing of 237 or ACT of 15 Reading/16 English*

## Oral/Interpersonal Communication ☑

**10801196 .....3 credits**

Focuses on developing effective listening techniques and verbal and nonverbal communication skills through oral presentation, group activity, and other projects. The study of self, conflict, and cultural contexts will be explored, as well as their impact on communication.

*Prerequisite: High School GPA of 2.6 and MMR and MMW or Accuplacer Reading Skills of 236 and Writing of 237 or ACT of 15 Reading/16 English*

## Process Control Strategies

**10605121 .....2 credits**

This course examines various methods and techniques used in process control, including control loop analysis, control tuning (PID) process and tuning methods, system gain, statistical control processes, cascade and feed forward control, split control, and other advanced control techniques.

*Prerequisite: Instrumentation Principles 10605169.*

## Process Documentation ☑

**10605112 ..... 1 credit**

This course will provide the student with the tools needed to read and understand process drawings and diagrams used in the process industries to maintain and troubleshoot industrial processes. Specific documentation includes piping and instrument diagrams (P&ID), process flow diagrams (PFD), block flow diagrams, control loop diagrams, functional diagrams, electrical diagrams, utility flow diagrams, wiring diagrams, schematics, isometric drawings.

## Process Equipment

**10605131 .....2 credits**

This course will provide students with detailed analysis of standard process equipment. Equipment discussed includes pumps, valves, piping, equipment connections, motors, tanks and vessels, basic wiring practices, compressors, regulators, boilers, containment, heat exchangers.



# COURSE DESCRIPTIONS

## Process Measurements Instrumentation

**10605109 .....2 credits**

Reviews basic principles and calibration standards and practices developed in instrument mechanics. Studies common sensing devices and components employed for the measurement of pressure, temperature, flow, level, and related phenomena.

*Prerequisite: Instrumentation Principles 10605169.*

## Process Systems

**10605172 .....2 credits**

This course will provide students with detailed analysis of standard process systems and how they are monitored and controlled. Systems examined include water/steam services (boilers and cooling towers), thermal transfer systems and heat exchangers, compressors and vacuum systems, HVAC, turbines, distillation and strippers, refrigeration, separators.

*Prerequisite: Process Equipment 10605131*

## Process Troubleshooting Strategies

**10605133 .....1 credit**

This course develops employee skills related to troubleshooting and employment strategies in area manufacturing industries by working directly with companies that have agreed to partner with Mid-State for this course. The course requires the student to work with a partnering company to assist in a problem solving or project work situation. Local companies are asked to submit a current problem or project with a narrow focus relating to industrial automation or instrumentation. The student meets with company personnel as needed, formulates the problem or project, and researches methods of solving or completing the project.

*Prerequisite: Process Control Strategies 10605121*

## Speech

**10801198 .....3 credits**

Explores the fundamentals of effective oral presentation to small and large groups. Topic selection, audience analysis, methods of organization, research, structuring evidence and support, delivery techniques, and other essential elements of speaking successfully, including the listening process, form the basis of this course. Includes informative, persuasive, and occasion speech presentations.

*Prerequisite: High School GPA of 2.6 and MMR and MMW or Accuplacer Reading Skills of 253 and Writing of 262 or ACT of 21 Reading/19 English or completion of College Reading and Writing 1 10831104 with a "C" or better*

## Trigonometry with Applications

**10804196 .....3 credits**

Topics include circular functions, graphing of trigonometry functions, identities, equations, trigonometric functions of angles, inverse functions, solutions of triangles, complex numbers, DeMoivre's Theorem, polar coordinates, and vectors.

*Prerequisite: ACT Math score of 22 or Intermediate Algebra with Applications 10804118 with a "C" or better*