

AUTOMOTIVE TECHNICAL ACADEMY (ATA)

ATA-ER100

ECU Repair & Key Programming Technology

Curriculum Framework (Version 1.0)

Programme Status: Proposed for Approval

Programme Information

Programme Code:

ATA-ER100

Programme Title:

ECU Repair & Key Programming Technology

Qualification Level:

Professional Diploma

Duration:

48 Weeks

Training Days:

5 Days Per Week

Hours Per Day:

8 Hours

Total Contact Hours:

1,920 Hours

Teaching Philosophy

- **70% Practical = 1,344 Hours**
- **30% Theory = 576 Hours**

Training is delivered through competency-based learning with extensive hands-on work on real ECUs, immobilizer systems, key programming equipment, diagnostic platforms, and OEM service procedures.

Entry Requirement

Successful completion of:

ATA-E000 – Automotive Electrical & Electronics Foundation

or

Recognition of Prior Learning (RPL) in accordance with ATA admission policy.

Programme Goal

To produce highly skilled automotive electronics specialists capable of diagnosing, repairing, programming, adapting, cloning, and testing Electronic Control Units (ECUs), immobilizer systems, smart key systems, and vehicle security electronics using professional diagnostic equipment, precision electronic repair techniques, and OEM-compliant procedures.

Graduate Competency Profile

Graduates will be able to:

- Diagnose ECU hardware and software faults.
 - Interpret ECU circuit diagrams and PCB layouts.
 - Identify and test electronic components on automotive PCBs.
 - Perform professional soldering and micro-soldering.
 - Replace damaged electronic components safely.
 - Read, write, clone, and back up EEPROM, Flash, and MCU memories.
 - Perform OBD, Bench Mode, and Boot Mode programming.
 - Program and synchronize immobilizer systems.
 - Program transponder keys, remote keys, smart keys, and proximity keys.
 - Configure replacement ECUs and perform module adaptation.
 - Carry out post-repair verification and quality assurance.
 - Maintain professional documentation and secure customer data.
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Programme Structure

Module	Title	Weeks	Hours
ER100-01	ECU Laboratory Safety, Professional Practice & Diagnostic Equipment	3	120
ER100-02	Automotive Electronics, PCB Fundamentals & Component Testing	6	240
ER100-03	ECU Architecture, Circuit Analysis & Hardware Repair	7	280
ER100-04	Micro-Soldering, PCB Rework & Precision Repair Techniques	6	240

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Module	Title	Weeks	Hours
ER100-05	ECU Programming, EEPROM, Flash & MCU Technologies	7	280
ER100-06	Immobilizer, Transponder Keys & Smart Key Systems	7	280
ER100-07	ECU Adaptation, Coding, Diagnostics & Vehicle Integration	4	160
ER100-08	Workshop Management, Data Protection, Customer Documentation & Quality Assurance	2	80
ER100-09	Integrated ECU & Key Programming Projects	4	160
ER100-10	Industrial Attachment, Capstone Project & Final Assessment	2	80
TOTAL		48 Weeks	1,920 Hours

Module 1

ECU Laboratory Safety, Professional Practice & Diagnostic Equipment

Duration: 3 Weeks

Topics

- Electrostatic discharge (ESD) protection
- Laboratory safety
- Precision workstation setup
- Electronic tool care
- Data handling and confidentiality
- OEM documentation
- Professional ethics
- Workspace organization

Practical Competencies

Students will:

- Set up ESD-safe workstations.
- Handle ECUs safely.

- Maintain electronic repair equipment.
 - Follow professional laboratory procedures.
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Module 2

Automotive Electronics, PCB Fundamentals & Component Testing

Duration: 6 Weeks

Topics

- PCB construction
- Electronic symbols
- Resistors
- Capacitors
- Inductors
- Diodes
- Transistors
- MOSFETs
- Voltage regulators
- Oscillators
- Signal tracing
- Component testing

Practical Competencies

Students will:

- Identify PCB components.
 - Test electronic components.
 - Trace electrical paths.
 - Diagnose basic PCB faults.
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Module 3

ECU Architecture, Circuit Analysis & Hardware Repair

Duration: 7 Weeks

Topics

- ECU internal architecture
- Power supply circuits
- Input/output stages
- Sensor interfaces

- Driver circuits
- Communication interfaces
- PCB fault diagnosis
- Hardware repair procedures

Practical Competencies

Students will:

- Diagnose ECU hardware faults.
 - Replace damaged circuit components.
 - Repair power and signal circuits.
 - Verify repaired ECUs.
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Module 4

Micro-Soldering, PCB Rework & Precision Repair Techniques

Duration: 6 Weeks

Topics

- Fine-pitch soldering
- Surface-mount device (SMD) rework
- Hot-air rework
- BGA awareness
- Flux selection
- PCB cleaning
- Pad repair
- Trace repair

Practical Competencies

Students will:

- Perform precision soldering.
 - Replace SMD components.
 - Restore damaged PCB tracks.
 - Produce reliable electronic repairs.
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Module 5

ECU Programming, EEPROM, Flash & MCU Technologies

Duration: 7 Weeks

Topics

- Memory technologies
- EEPROM fundamentals
- Flash memory
- Microcontrollers (MCUs)
- Data backup
- Read/write procedures
- ECU cloning
- Bench programming
- Boot Mode programming
- OBD programming
- Software verification

Practical Competencies

Students will:

- Back up ECU data.
- Program replacement ECUs.
- Clone compatible ECUs where appropriate.
- Verify software integrity after programming.

Module 6

Immobilizer, Transponder Keys & Smart Key Systems

Duration: 7 Weeks

Topics

- Immobilizer operation
- Transponder technology
- Smart key systems
- Keyless entry principles
- Remote controls
- Key synchronization
- Security modules
- Lost key procedures
- Customer key management
- System verification

Practical Competencies

Students will:

- Program authorized keys.
 - Synchronize immobilizer systems.
 - Configure replacement keys where permitted.
 - Verify proper vehicle operation after programming.
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Module 7

ECU Adaptation, Coding, Diagnostics & Vehicle Integration

Duration: 4 Weeks

Topics

- Module coding
- ECU adaptation
- Vehicle configuration
- Fault code analysis
- Live data evaluation
- Functional testing
- CAN Bus integration
- LIN Bus integration
- Post-repair verification

Practical Competencies

Students will:

- Adapt replacement modules.
 - Perform functional verification.
 - Diagnose communication faults.
 - Validate complete system operation.
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Module 8

Workshop Management, Data Protection, Customer Documentation & Quality Assurance

Duration: 2 Weeks

Topics

- Job estimation
- Customer communication
- Electronic repair records
- Data privacy

- Secure backup procedures
- Warranty documentation
- Quality inspection
- Professional ethics

Practical Competencies

Students will:

- Prepare professional quotations.
 - Maintain secure repair documentation.
 - Apply quality assurance procedures.
 - Manage ECU workshop workflows.
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Module 9

Integrated ECU & Key Programming Projects

Duration: 4 Weeks

Students complete comprehensive projects including:

- ECU hardware diagnosis and repair
 - Precision PCB repair
 - EEPROM backup and restoration
 - ECU programming and coding
 - Immobilizer synchronization
 - Smart key programming
 - Post-repair system validation
 - Complete customer documentation
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Module 10

Industrial Attachment, Capstone Project & Final Assessment

Duration: 2 Weeks

Students complete:

- Supervised industrial attachment
- Full ECU diagnosis and restoration project
- Practical trade test
- Written examination
- Technical presentation
- Professional portfolio

- Exit competency assessment
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Required Laboratories & Workshops

- ECU Electronics Laboratory
 - Micro-Soldering & PCB Rework Laboratory
 - ECU Programming & Coding Laboratory
 - Key Programming & Immobilizer Laboratory
 - Automotive Network Diagnostics Laboratory
 - Electronics Measurement Laboratory
 - Quality Assurance & Validation Centre
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Essential Training Equipment

Students should train with:

- Professional diagnostic scan tools
 - ECU bench testing systems
 - Regulated laboratory power supplies
 - Automotive oscilloscopes
 - Digital multimeters
 - Logic analyzers
 - EEPROM/Flash programmers
 - MCU programming tools
 - Precision soldering stations
 - Hot-air rework stations
 - Stereo inspection microscopes
 - PCB preheaters
 - ESD-safe workstations
 - Key programming equipment
 - Immobilizer training boards
 - CAN/LIN network simulators
 - OEM service information and wiring databases
 - Professional PPE
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Assessment Structure

ATA-ER100

Assessment	Weight
Continuous Practical Assessment	35%
Practical Trade Tests	30%
Written Examination	15%
Capstone ECU Repair & Programming Project	15%
Professional Conduct & Industrial Attachment	5%
TOTAL	100%

Career Opportunities

Graduates may work as:

- ECU Repair Technician
- Automotive Electronics Specialist
- Key Programming Technician
- Immobilizer Systems Technician
- Vehicle Diagnostic Specialist
- ECU Programming Specialist
- OEM Dealership Electronics Technician
- Automotive Electronics Laboratory Technician
- Technical Trainer
- Independent ECU Repair & Key Programming Business Owner