AC Motor Controller with VCL
The Ultimate Class III Truck Control System: Superb Performance and Value

The Curtis Model AC F2-A Motor Controller provides accurate speed and torque control of 3-phase AC induction and PMAC motors.

Model AC F2-A is fully optimized for use as a traction controller on 1.0 ton-2.0 ton Class III pedestrian-operated powered pallet trucks. It provides vehicle designers with the ability to fully define and control the detailed dynamic performance of their vehicle’s drivetrain, and also provides comprehensive vehicle management and CAN capabilities. Model AC F2-A is also suitable for traction or hydraulic pump control on other types of battery powered vehicles.

Together with the Curtis model 3141 CAN LCD display and the user-friendly Curtis Integrated Toolkit, the Curtis model AC F2-A is the ultimate Class III truck control system.

FEATURES

Fit for Purpose

▶ Compact, rugged housing with very small ‘footprint’ for its power rating.
▶ Heavy duty M6 busbars for motor and battery connectors.
▶ Sealed, 23-pin AMPseal I/O connector.
▶ Impervious to most oils, solvents, degreasers and other chemicals often encountered by industrial vehicles.
▶ IP65 and IP67 environmental protection as per IEC 60529.
▶ Exceeds latest global conformance requirements for functional safety, electrical safety and EMC.
▶ CE marked as a programmable safety device.
▶ UL583 recognized component.

Motors

▶ Easily configured to work with any AC induction motor (dependent on installed software.)
▶ Improved motor auto-characterization setup allows simple on-truck pairing with different Induction motor types.
▶ Comprehensive library of induction motor types stored in controller memory.

You Feel It When You Drive It—Maximum Torque, Minimum Losses, Full control

▶ The latest implementation of Curtis’ renowned field-oriented control algorithms and our advanced PWM switching technology assure maximum motor output torque and highest possible system efficiency across the entire torque/speed spectrum.
▶ Smooth and predictable drive control that only Curtis can deliver.
Get More Out of Your Battery—Regardless of the Technology

- High-efficiency means more of your battery’s energy is converted to motor output power.
- Fully configurable over- and under-voltage protection parameters.
- Wide operating voltage range allows use with the latest cell chemistries such as lithium ion.
- Configurable CANbus and VCL allows easy integration with the BMS (Battery Management Systems) typically found on lithium battery packs.

Powerful, High Performance Dual Microprocessors

- Ultra-fast processor speeds allows highly accurate control and regulation of voltage, frequency and current.

Customize Your Vehicle with VCL

- The Curtis VCL (Vehicle Control Language) allows Curtis AC motor controllers to perform as ‘vehicle managers’ eliminating the need for costly, additional system controllers.

Highly Flexible I/O

- All I/O pins are multi-function, and can be configured to provide up to:
  - 17 Digital Inputs
  - 9 Analog Inputs
  - 2 Potentiometer sources
  - 5 Output drivers, including proportional valve driver
  - Quadrature encoder input
  - Sine/Cosine sensor input

Comprehensive CAN Capabilities

- Configurable 11 or 29 bit protocol support for CANopen or J1939 use.
- ‘Plug and Play’ support for Curtis CAN displays and a variety of CAN tiller heads from leading manufacturers FREI and REMA.
- Fully compliant with CANopen protocol DS301 profile.
- Capable of acting as ‘CAN interpreter’ allowing 3rd party CAN devices with differing profiles to work on the same CAN network.

Improved Diagnostics

- Integrated, high visibility status LED with simplified flash code sequence for at-a-glance system troubleshooting.
- Thermal cutback, warning, and automatic shutdown provide protection to motor and controller.
- Improved error logging and fault history tables with CAN Emergency Messages.

CAN-based Programming

- Model AC F2-A is programmable directly over the CANbus. This allows simpler ‘vehicle level’ communication with many of the CAN-based service tools in use by the major industrial truck manufacturers worldwide
- Allows use of the Curtis Integrated Toolkit.
Curtis Model 3141
A cost-effective, CAN-based LCD vehicle status display in a rugged 52mm diameter housing is the ideal partner to model AC F2-A.

▶ Large, easy-to-read 16-segment format LCD.
▶ Battery Discharge Indicator, Service (Hours) Counter and Diagnostic/Message Center functions.
▶ Sealed to IP65 (IP67 optional).
▶ 12–48V nominal operating voltage range.
▶ CE compliant, UL583 recognized component.
▶ Optional backlight and heater.

The Curtis Integrated Toolkit
A fully integrated suite of development and diagnostic tools for use on CAN systems using Curtis and other 3rd party CAN-based products. It is comprised of the following tools that run in a shared environment:

▶ Launchpad
  Starting point and project editor.
▶ Programmer
  Similar in function to the 1314, used to configure parameters, view monitor values, and view the fault history.
▶ TACT
  Improved version of the stand-alone oscilloscope/datalogging tool.
▶ VCL Studio
  Editor and Compiler for VCL software.
▶ Menu Editor
  Tool to create and modify programming menus.
▶ Pack & Flash
  Downloader tool to load your software into the CAN device.

The Curtis Integrated Toolkit is compatible with many leading USB>CAN interface dongles from Peak, Kvaser, iFAC, Sontheim etc. Contact your local Curtis Sales office for further information.

MODEL CHART

<table>
<thead>
<tr>
<th>Model</th>
<th>Nominal Battery Voltage</th>
<th>Maximum Current: [S2-1 minute]</th>
<th>Maximum Current: [S2-60 minute]</th>
<th>Lifetime Current</th>
<th>Internal 120Ω CAN Termination</th>
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</thead>
<tbody>
<tr>
<td>AC F2-A 12-120-001</td>
<td>12V</td>
<td>120Arms</td>
<td>40Arms</td>
<td>30Arms</td>
<td>Yes</td>
</tr>
<tr>
<td>AC F2-A 24-120-001</td>
<td>24V</td>
<td>120Arms</td>
<td>40Arms</td>
<td>30Arms</td>
<td>Yes</td>
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<tr>
<td>AC F2-A 24-200-001</td>
<td>24V</td>
<td>200Arms</td>
<td>67Arms</td>
<td>50Arms</td>
<td>Yes</td>
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<tr>
<td>AC F2-A 24-240-001</td>
<td>24V</td>
<td>240Arms</td>
<td>80Arms</td>
<td>60Arms</td>
<td>Yes</td>
</tr>
<tr>
<td>AC F2-A 24-280-001</td>
<td>24V</td>
<td>280Arms*</td>
<td>84Arms*</td>
<td>70Arms*</td>
<td>Yes</td>
</tr>
<tr>
<td>AC F2-A 48-150-001</td>
<td>36-48V</td>
<td>150Arms*</td>
<td>50Arms*</td>
<td>38Arms*</td>
<td>Yes</td>
</tr>
<tr>
<td>AC F2-A 48-240-001</td>
<td>36-48V</td>
<td>240Arms*</td>
<td>80Arms*</td>
<td>60Arms*</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Subject to change, please contact your Curtis sales representative for more information.
All models are also available without internal 120Ω CAN termination.
Curtis 3141 CAN-based Gauge

**PINOUT CHART**

**CONNECTOR WIRING**

- **LIFT** → J1-23
- **LOWER** → J1-22
- **EMERG. REV.** → EMR_N.O. → J1-21
- **REVERSE** → EMR_N.C. → J1-19
- **FORWARD** → J1-15
- **INTERLOCK** → J1-8
- **THROTTLE** → J1-10
- **WIPER** → J1-11
- **I/O GROUND** → J1-12
- **MOTOR TEMPERATURE SENSOR** → J1-13
- **CAN PORT** → J1-20

*NOTE: KTY sensor shown. The banded end must be connected to I/O Ground.*

**Circuit Diagram:**

- **KSI COIL RETURN**
- **MAIN**
- **EMERGENCY STOP**
- **BATTERY 24V**
- **FUSE**
- **AC MOTOR**
- **ROTOR POSITION ENCODER**
- **EMR_N.O.**
- **EMR_N.C.**
- **PUMP**
- **PROP VALVE**
- **KEYSWITCH**
- **B+**
- **PHASE-A**
- **PHASE-B**
- **PHASE-C**
- **5V**
- **I/O GROUND**
- **WIPER**
- **POT HI**
- **MOTOR TEMP**
- **PARALLEL**
- **SERIAL**
- **INTERNAL 120Ω TERMINATION ON MODELS –x01**

**Connector Wiring Diagram:**

- **SWITCH 14**
- **SWITCH 13**
- **SWITCH 12**
- **SWITCH 11 / ENC1_C**
- **SWITCH 8 / ANALOG 8**
- **SWITCH 7 / ANALOG 7**
- **SWITCH 5 / ANALOG 5**
- **SWITCH 6 / ANALOG 6 / POT HI**
- **SWITCH 1 / ANALOG 1 / POT WIPER**
- **I/O GROUND**
- **ANALOG 2 / SWITCH 2 / MOTOR TEMP**
- **I/O GROUND**
- **CAN H**
- **CAN L**
- **I/O GROUND**
- **5V**
- **ENC1_A**
- **ENC1_B**

**Curtis 3141 CAN-based Gauge**

- **FUSE**
- **FUSE**
- **AC MOTOR**
- **PROP VALVE**
- **KEYSWITCH**
- **BATTERY 24V**
- **EMERGENCY STOP**
- **FUSE**
- **AC MOTOR**
- **PROP VALVE**
- **KEYSWITCH**
- **BATTERY 24V**
- **EMERGENCY STOP**

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### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>12V</th>
<th>24V</th>
<th>36/48V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nominal Input Voltage</strong></td>
<td>12V</td>
<td>24V</td>
<td>36/48V</td>
</tr>
<tr>
<td><strong>Minimum Voltage</strong></td>
<td>9V</td>
<td>12V</td>
<td>18V</td>
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<tr>
<td><strong>Brownout Voltage</strong></td>
<td>8.3V</td>
<td>8V</td>
<td>12V</td>
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<tr>
<td><strong>Maximum Voltage</strong></td>
<td>15V</td>
<td>33V</td>
<td>63V</td>
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<tr>
<td><strong>PWM Frequency</strong></td>
<td>10Khz</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum Controller Output Frequency</strong></td>
<td></td>
<td>800Hz</td>
<td></td>
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<tr>
<td><strong>Electrical Isolation to Heatsink</strong></td>
<td></td>
<td>500Vac</td>
<td></td>
</tr>
<tr>
<td><strong>Storage Ambient Temperature</strong></td>
<td></td>
<td>–40°C to 95°C</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Ambient Temperature</strong></td>
<td></td>
<td>–40°C to 50°C</td>
<td></td>
</tr>
<tr>
<td><strong>Thermal Cutback</strong></td>
<td></td>
<td>Controller linearly reduces maximum current limit with an internal heatsink temperature from 85°C (185°F) to 95°C (203°F); complete cutoff occurs above 95°C (203°F) and below –40°C (–40°F).</td>
<td></td>
</tr>
<tr>
<td><strong>Design Life</strong></td>
<td></td>
<td>8000 hours</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Duration at Maximum Current</strong></td>
<td></td>
<td>1 Minute</td>
<td></td>
</tr>
<tr>
<td><strong>Package Environmental Rating</strong></td>
<td></td>
<td>IP65/IP67</td>
<td></td>
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<tr>
<td><strong>Weight</strong></td>
<td></td>
<td>1.1Kg (2.2lbs)</td>
<td></td>
</tr>
<tr>
<td><strong>Dimensions W x L x H</strong></td>
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<td>120mm x 155mm x 53mm</td>
<td></td>
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<tr>
<td><strong>EMC</strong></td>
<td></td>
<td>Designed to the requirements of EN 12895:2015</td>
<td></td>
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<tr>
<td><strong>Safety</strong></td>
<td></td>
<td>Designed to the requirements of EN1175-1:1998+A1: 2010, EN ISO 13849-1:2015 and EN280</td>
<td></td>
</tr>
<tr>
<td><strong>UL</strong></td>
<td></td>
<td>UL recognized component per UL583</td>
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### WARRANTY

Two year limited warranty from time of delivery.