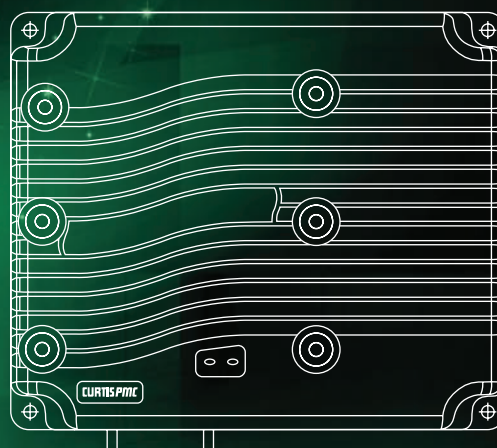
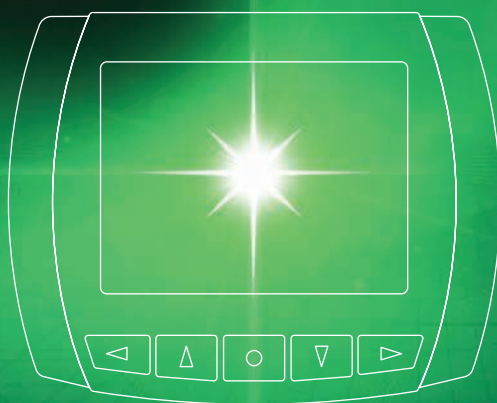
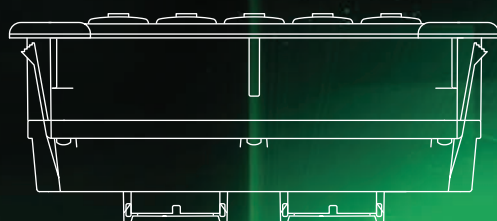


CURTIS INSTRUMENTS, INC.

Vehicle Technology



Motor Speed Controllers • Instrumentation • Throttles • Other Vehicle Products

Scan code below to visit



curtis instruments.com

The Curtis Difference

You feel it when you drive it



CURTIS



Beacons



Programmers



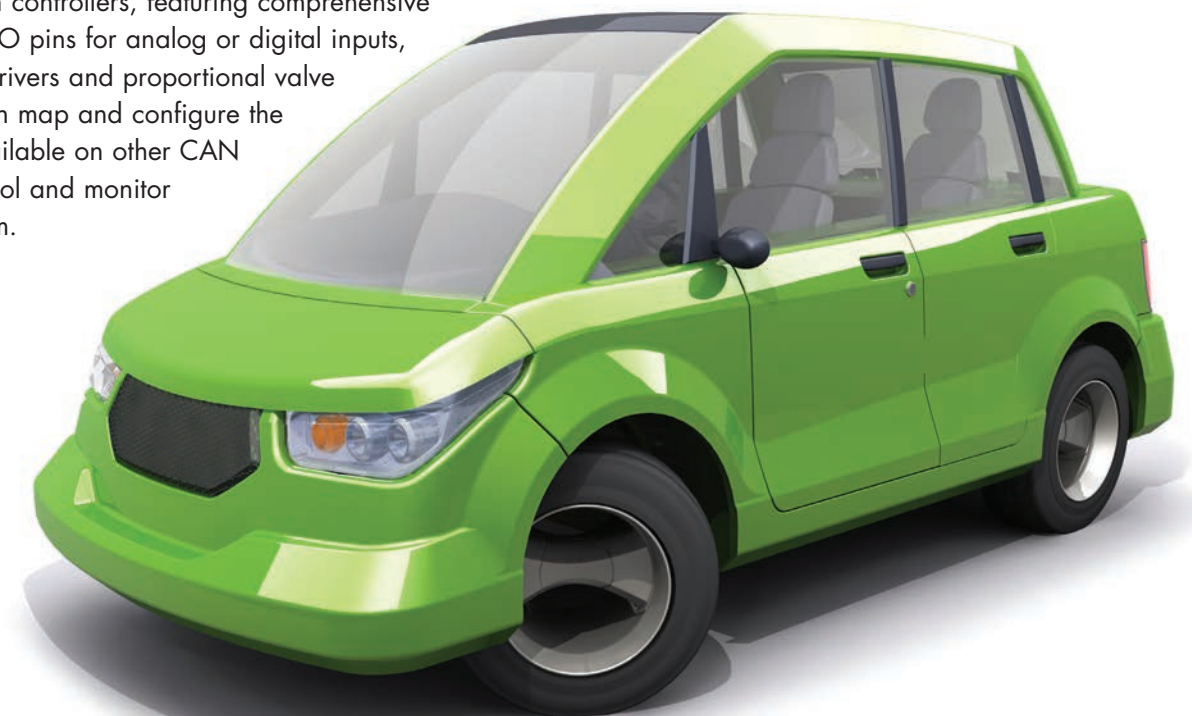
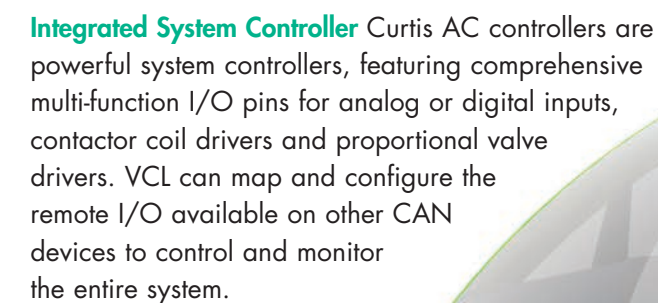
Foot Pedals



Steering Sensors



Pump Controllers



e series

The New Curtis “E-series” AC Controllers – Packed with new features and capabilities

The new Curtis AC controller series is fast, powerful and feature-rich and enables our customers to develop better vehicles quicker than ever.



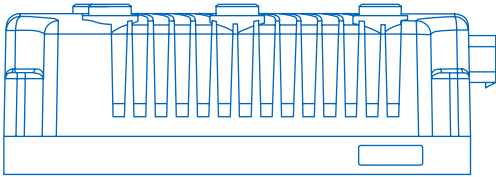
Curtis E-Series AC Motor Controllers EN ISO 13849-1 data

Model	Safety Function	Performance Level (PL)	Designated Level (PL)	MTTFd	DC
1232e	Uncommanded Powered Movement	d	Category 2	≥ 40 years	≥ 90
	Motor Braking Torque	c		≥ 16 years	≥ 90
1234e	Uncommanded Powered Movement	d		≥ 40 years	≥ 90
	Motor Braking Torque	c		≥ 16 years	≥ 90
1236e	Uncommanded Powered Movement	d		≥ 36 years	≥ 90
	Motor Braking Torque	c		≥ 12 years	≥ 90
1238e	Uncommanded Powered Movement	d		≥ 36 years	≥ 90
1239e	Motor Braking Torque	c		≥ 12 years	≥ 90

MTTFd = Mean Time To Failure (Dangerous)
DC = Diagnostic Coverage

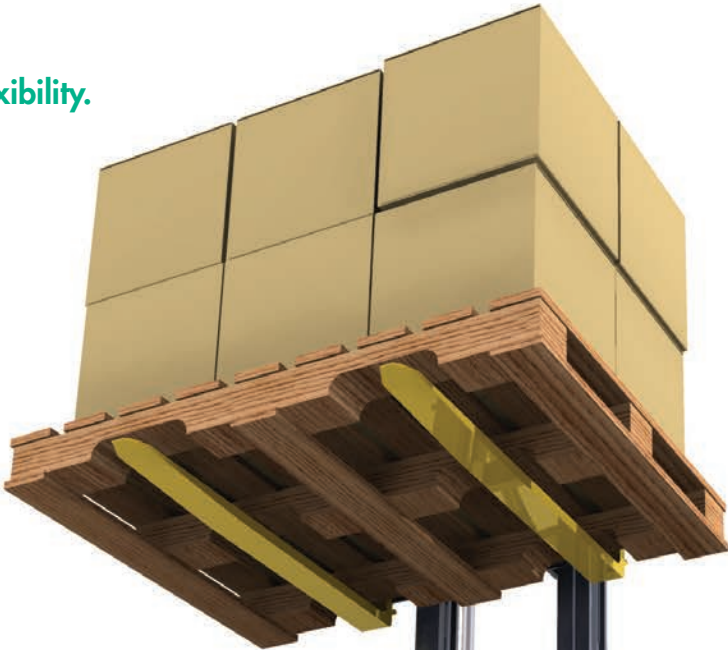
The safest.

- Dual-micro architecture delivers the highest levels of functional safety.
- CE marked as a programmable safety device under EN ISO 13849-1:2008.
- Utilizes a Category 2 designated architecture to provide a Performance Level of up to PL=D, surpassing the requirements of EN1175-1: 1998 + A1: 2010.
- Listed with Underwriter’s Laboratories (UL) as a recognized component under UL583.



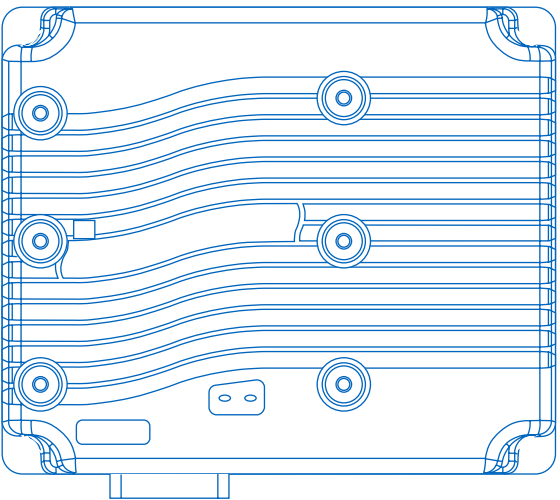
With unmatched performance and flexibility.

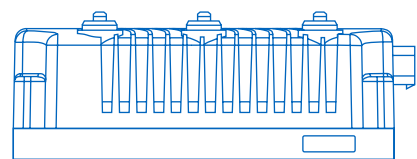
- Outlasts and outperforms with more features, improved ratings and simple motor auto-characterization routine.
- Faster 64 MHz main-microprocessor and increased FLASH memory capacity.
- Proprietary Curtis IFO Vector Control Algorithm provides the maximum possible torque and highest efficiency across the entire speed range.
- Configurable CAN master capability with proprietary Vehicle Control Language (VCL).



The most reliable.

- Decades of Curtis controller experience, by a global technology leader with millions sold, back every unit.

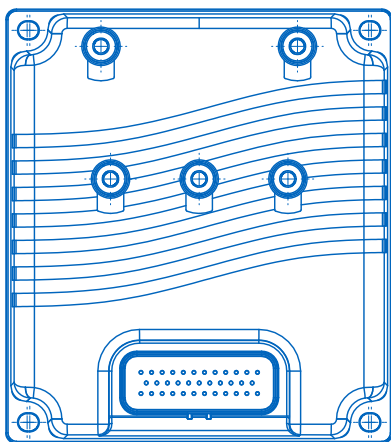
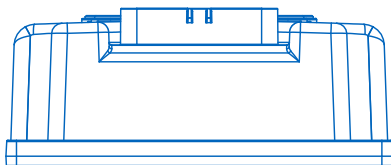









VEHICLE SYSTEMS CONTROL

1352 I/O Expansion Module

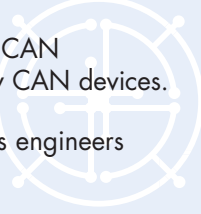
- Flexible I/O expansion module for CANopen controller networks.
- 12–36V or 36–80V.
- Nine multi-purpose I/O pins including 6 x 3A output drivers.
- Three analog inputs with 12-bit resolution.
- Suitable for 12V internal combustion applications.
- Use with Curtis AC controllers, 1310 system controller or 3rd-party CAN devices.
- Controls up to 6 proportional hydraulic valves.
- Compact, rugged housing sealed to IP 65.



AC Motor	1222	1232	1234	1298	1236	1238	1239
Models							
Application	Electric Power Steering	Traction or Pump	Traction or Pump	Combined AC Traction and DC Pump	Traction or Pump	Traction or Pump	Traction
Voltage [VDC]	24–48	24–80	24–80	24	24–80	24–96	72–144
Isolated Logic	No	No	No	No	No	No	Yes
Current (2 min) [A]	70	150–250	200–350	250–300	300–550	450–800	500–650
Control Type	Position/Speed	Speed or Torque	Speed or Torque	Speed or Torque	Speed or Torque	Speed or Torque	Speed or Torque
Control Method	IFO Vector	IFO Vector	IFO Vector	IFO Vector	IFO Vector	IFO Vector	IFO Vector
CANbus	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Auto Tuning	No	Yes	Yes	Yes	Yes	Yes	Yes
Dual Drive	N/A	Yes	Yes	Yes	Yes	Yes	Yes
IP Rating	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65

Vehicle Control Language – VCL™

- Curtis VCL is an easy to use, powerful programming language that allows vehicle developers to customize controller functionality for each application.
- Curtis AC motor controllers and the Model 1310 system controller include VCL application environments.
- VCL provides CAN communications control, I/O configuration and mapping, as well as feedback-loop process blocks, such as Proportional Integrator Differentiator (PID) functions.
- A comprehensive library of VCL commands allows the rapid development of application specific logic functions.
- For multi-controller CANbus applications, VCL enables the developer to configure the network and fully utilize all available I/Os.
- VCL allows the easy integration of CAN Instrumentation and other 3rd-party CAN devices.
- Curtis offers VCL training, or Curtis engineers will customize code as required.



1313 Handheld Programmer

- Comprehensive handheld diagnostic and programming tool designed for use in harsh field service environments.
- Color LCD, USB port, and SD memory card slot.
- Enables parameter files to be created, edited and cloned to other controllers or transferred to a PC.
- Real-time monitoring and logging of system variables.
- Displays event history logs, system timers, and fault codes with comprehensive help text.



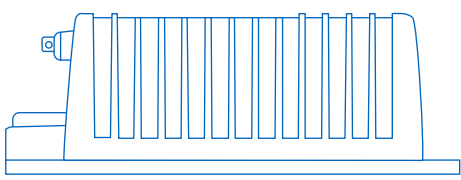
1314 PC Programming Station



- Windows® programming and troubleshooting software for Curtis control systems.
- USB to CANbus or serial interface.
- Powerful programming, full-system diagnostics and graphical monitoring and logging functions.
- Compatible with Microsoft XP, Vista and Windows 7 operating systems.



SepEx® MOTOR CONTROLLERS

- Curtis SepEx® motor controllers deliver smooth, silent and seamless control of separately excited (SEM) DC motors.
- SepEx® motor controllers eliminate the need for reversing contactors and provide regenerative braking to near zero speed.
- Curtis' renowned MOSFET power sections, combined with a sophisticated microprocessor, provide high efficiency and flexibility.



SepEx®	1243/1243CAN	1244/1244CAN	1266A/1266R	1268
Models				
Vehicle Type	Industrial	Industrial	Golf/Utility	Heavy-Duty Golf/Utility
Application	Traction	Traction	Traction	Traction
Voltage [VDC]	24–36	24–80	36–48	36–48
Armature Current (2 min) [A]	200–350	400–700	275–350	400–500
Field Current (2 min) [A]	25–35	50–60	20	50
WalkAway®	No	No	A Yes / R No	Yes
Control Method	Speed	Speed	Speed	Speed
Field Mapping	Yes	Yes	Yes	Yes
MultiMode®	Yes	Yes	Yes	Yes
VCL	No	No	No	No
CANbus	Option	Option	No	No
840 Spyglass Support	Yes	Yes	No	No
IP Rating	IP 53	IP 64	IP 53	IP 64



SERIES CONTROLLERS









- Curtis invented the world's first practical MOSFET series motor controller in the 1980s.
- Millions of units are in use worldwide, for every imaginable application.
- Curtis Series Controllers are available in a wide range of models, from simple analog controllers to sophisticated, microprocessor-based controllers with CANbus communications and comprehensive diagnostics.
- Simple, tough and easy to troubleshoot, Curtis series controllers offer excellent value for many applications and markets.

PERMANENT MAGNET CONTROLLERS

- Curtis Permanent Magnet motor controllers provide fully programmable, 4-quadrant speed control of brushed DC permanent magnet motors.
- All units offer programmable acceleration, deceleration and current limiting, load compensation, control of electromagnetic brakes, and full protection against over-temperature, under-voltage and over-voltage.
- Models are available for light industrial applications, such as sweeper-scrubbers or power-movers, and for medical mobility scooters.



Permanent Magnet	1210	1212P	1228	1229
Models				
Voltage [VDC]	24	24	24-36	24-48
Armature Current [A]	45-70	45-90	70-110	200-250
Integral line contactor	Yes	Yes	Yes	No
MultiMode®	Yes	Yes	Yes	Yes
EM brake driver	Yes	Yes	Yes	Yes
Emergency Reverse	No	Yes	No	Yes
Actuator Output	No	No	No	Yes
Push-too-fast function	Yes	Yes	Yes	Yes
BDI output	Yes	Yes	Yes	Yes
CANopen	No	No	No	Yes
UL approved	No	Yes	No	Yes
TÜV/FDA approved	Yes	No	Yes	No

Series	1207B	1204M	1205M	1209M	1221M	1221C	1231C	1253
Models								
Application	Traction	Traction or Pump	Traction or Pump	Traction or Pump	Traction or Pump	Traction	Traction	Pump
Voltage (VDC)	24	24-72	24-72	36-72	48-72	72-120	72-144	48-80
Armature Current (2 min) [A]	250-300	275-325	400-500 (1min)	400-450	550	400	500-550	600
Plug Braking	Yes	Option	Yes	Yes	Yes	Yes	Yes	No
Programmable Parameters	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Line Contactor Driver	Yes	Yes	Yes	Yes	Yes	No	No	Yes
CANbus	No	No	No	No	No	No	No	No
IP Rating	IP 54	IP 54	IP 54	IP 54	IP 54	IP 65	IP 65	IP 54



enGage® VI & VII

- The Curtis enGage® VI and VII color LCD vehicle instruments are CAN compatible with full Input/Output integration.
- Available in both cased and module versions.
- Integrates comprehensive panel functionality into a single display.
- Vehicle OEMs can design a unique, special and fully customized panel.
- Rich, vivid colors, sharp imagery, strong contrast and high-color vibrancy.
- Large and sharp, easy-to-read, high-resolution LCD screen for optimum viewing.
- Seamlessly integrates with Curtis AC vehicle speed controllers and input devices.
- Two video inputs interface directly with cameras in either PAL or NTSC format.

enGage® VI & VII Cased



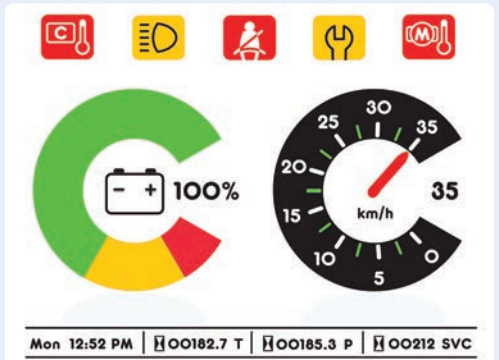
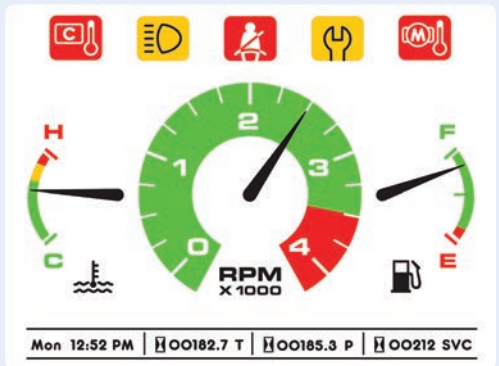
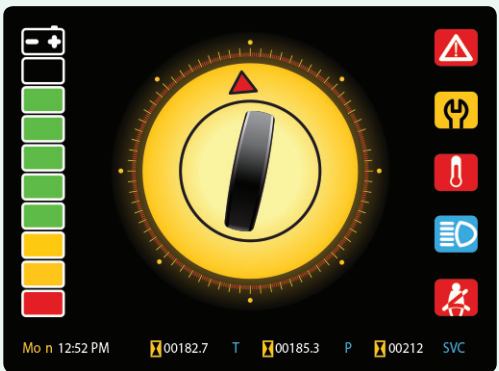
enGage VI – 3.5" LCD

enGage VII – 5.7" LCD

enGage® VII with Optional Camera








enGage® VI & VII Module



PROGRAMMABLE CAN AND SERIAL COMMUNICATION INSTRUMENTS

- CAN and Serial Communication instruments from Curtis display vehicle data and fault information, and can be used to program or configure vehicle settings.
- Easily, seamlessly and conveniently connect directly to Curtis controllers and I/O modules.
- CANbus communication enables lower vehicle cost by minimizing wiring between system components.
- Additional I/O allows all devices near the operator to be routed through a single gauge to the controllers to minimize wiring.
- Easy to read, with large displays, and sealed to meet the toughest environmental conditions.



CAN and Serial	840	enGage® II	enGage® III	enGage® IV	3501
Models					
Display	TN LCD, 8-character Dot Matrix, Monochrome	TN LCD, Fixed Segment, Monochrome	TN LCD, Fixed Segment, Monochrome	FSTN LCD, 240x128, Dot Matrix, Monochrome	FSTN LCD, 240x128, Dot Matrix, Monochrome
Serial	Yes	No	No	Yes	Yes
CANbus	No	CANopen, J1939	CANopen, J1939	CANopen, J1939	CANopen
Analog In	0	0	0	4	2 Freq.
Digital In	0	0	0	8	4
Outputs (MOSFET)	2 PWM (optional)	0	1–0.5 AMP	3–2.0 AMP	1–1.0 AMP
LEDs	3 or 6	1	8 (icons)	1 (bi-color)	6
Push-Buttons	0	2 (optional)	2 (optional)	3	5
Connector	Molex	AMP	AMP or Molex	AMP	AMP

700 SERIES

- Highly reliable solid-state hour meters and counters provide unprecedented performance, reliability and value.
- Ideal for scheduled maintenance, warranty and lease monitoring.
- Non-volatile EEPROM memory.
- Wide voltage ranges minimize stocking requirements.
- Many case styles to fit in all types of standard cutouts.
- Wide selection of miniature AC & DC modules for PC board mounting in a variety of sizes, voltages and customizable options.
- Millions in use worldwide.


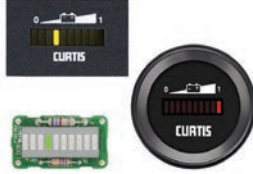
700 Series Cased



BATTERY STATE-OF-CHARGE

- Curtis Instruments has long been the global technological leader in the accurate measurement of state-of-charge of lead acid batteries for battery-powered industrial vehicles.
- Curtis offers the widest range of Battery State-of-Charge (BSOC) instruments in the industry and continues to develop new algorithms to improve accuracy as well as methods of measuring the state-of-charge of other battery chemistries and alternative fuel sources.
- Millions in use worldwide.



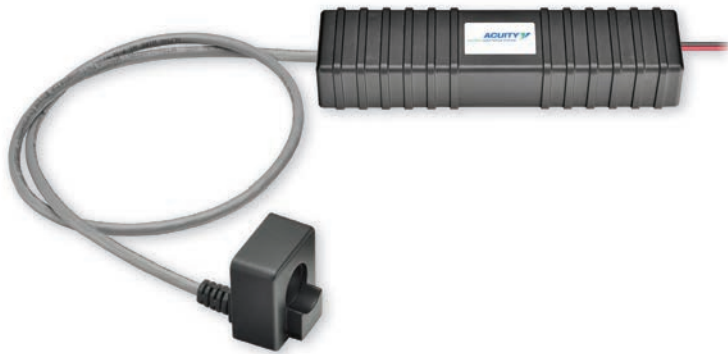
BSOC	803	906
Models		
Display	Tri-Color, 10-bar LED	Red, 10-bar LED or Tri-Color, 10-bar LED
Hour Meter	Yes	No
Output	1 Amp Relay	Logic Level 0–5V
Mounting	U-bracket	U-bracket (D,R) or Snap-fit Bracket (J,Y,Z) or Screws/Nuts (F,T)
Interconnect	Molex Connector	3/16" or 1/4" Fast-On Terminals or Packard Connector or PCB Mount Pins
Low "Fuel" Warning Adjustable	Two LED Bars Flash Alternately Yes	Two LED Bars Flash Alternately No
Housing	52mm round	52mm round (R) or 24mm x 48mm Rectangular (D) or 23mm x 36mm Rectangular (F,J,T) or 28mm x 41mm Rectangular (Y,Z)
Keyswitch Input	Yes	Yes
BDI Reset Method	CTR, OCR	CTR, OCR
Operating Voltage	12–80	12–48

ACUITY[®]

BATTERY MONITORING SYSTEM

Finally, there is a solution for one of the greatest dilemmas of fleet managers: complete and accurate battery information for the life of the battery, to help extend battery life, to improve productivity and operating efficiency – all with significant impact on the bottom line.

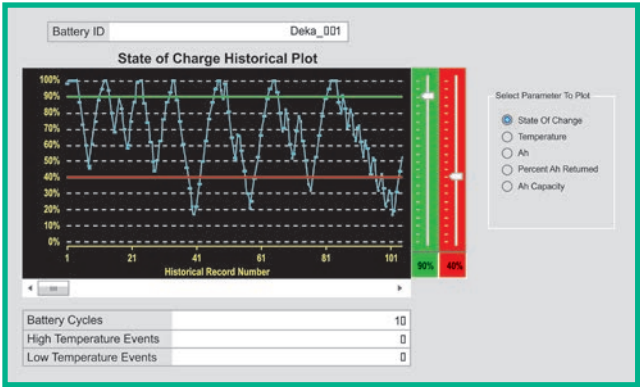
The newest innovation by Curtis Instruments, the Acuity[®] Battery Monitoring System, is the result of more than five decades of battery monitoring experience. The unit mounts directly on an industrial, lead-acid battery and measures, records and communicates critical battery performance parameters throughout the life of that battery. Acuity[®] provides the most accurate, most reliable and complete set of battery information. Fleet managers will know the true state-of-charge, whether the battery has been operated according to warranty terms, and whether the battery is being used efficiently. This is accomplished by the unique and proprietary Curtis algorithm based on the simultaneous measurement of voltage, current and temperature.



Acu-Set[™]

ACUITY[®] SOFTWARE

- Programs and configures Acuity[®] to match the battery on which it is installed.
- Retrieves historical battery data from the vehicle and transmits it to a PC.
- Stores and displays instantaneous battery data on a PC.



BATTERY

Manufacturer:	Deka	Rated Voltage:	24VDC
Model Nr:	12-D85-7	Manuf. Date:	02/09
Serial Nr:	2299DS	Service Weight:	570 lbs / 259 kg
Rated Capacity:	255 A-Hr	Specific Gravity:	1.280 - 1.295
Belongs To:	Eng Lab		

AMP HRS IN
Last Charge Cycle
215 A-hr
(0 - 255 A-hr)

AMP HRS OUT
Last Discharge Cycle
204 A-hr
(0 - 255 A-hr)

Mon 12:52 PM

STATE OF HEALTH
99%

100%

Estimated Charge Cycles Remaining: 495

Acuity screen for enGage[®] VII

CAN Unit Diagram



AMP HRS IN
215 A-hr
(0 - 255 A-hr)

AMP HRS OUT
204 A-hr
(0 - 255 A-hr)

Cycles Remaining: 495
Mon 12:52 PM

SoH
99%

100%

BATTERY

MFR:	Deka	Voltage:	24VDC
Model Nr:	12-D85-7	MFG Date:	02/09
Serial Nr:	2299DS	Weight:	570 lbs / 259 kg
Capacity:	255 A-Hr	Gravity:	1.280 - 1.295
Belongs To:	Eng Lab		

Acuity screen for enGage[®] IV

DC/DC Converters

- Available in both 250W peak (Model 1410) and 375W peak (Model 1400) ratings.
- Input: 24 to 96V.
- Output: 12, 13.5, 24, 28V.



Alarms

- Available in 12 to 72V with output of 87 to 97dB.
- 12 to 48V is available with output between 82dB and 107dB.
- Environmentally protected for indoor or outdoor use.



Steering Sensors

- Fully compatible with Curtis Model 1222 AC Steering Controller.
- Dual-sensor outputs support the redundant safety architecture of steer-by-wire systems.
- Variable torque version available to provide tactile feedback.



Beacons

- 12 to 80V range of high-efficiency LED and Xenon visual warning lights.
- Operating temperatures from -40° to +77°C.
- Universal mounting base.
- Encapsulated electronics.



DC Contactors

- High-quality Curtis/Albright contactors for vehicle and industrial applications are available at ratings of 80, 100, 125, 150 and 250A.
- Millions are in use worldwide, proven in the toughest conditions.
- Built for reliability, these units feature high continuous ratings in compact, durable packages.
- Coils are available from 6 to 240V.



Disconnect Switches

- Reliable double-pole and single-pole disconnect switches provide a rapid means of manually disconnecting batteries – or other power supplies – in the event of serious electrical faults.



Pot Boxes

- 0 to 5k Ω output for standard interface to Curtis controller throttle inputs.
- Left- or right-hand operation available.
- Integral microswitch available to enhance safe vehicle operation.
- Available with multiple cable lengths.



Pot Assemblies

- Wig-wag throttle for forward and reverse.
- Three million cycle-life rating.
- 0 to 5k Ω output for standard interface to Curtis controller throttle inputs.
- Shaft sealed to IP 65.



Tiller Heads

- Attractive and ergonomic control handles used in pallet trucks, walkie-stackers, and tow tractors.
- These tiller heads include an emergency switch, and may be equipped with a variety of functional options.
- Outputs available as CAN or analog.



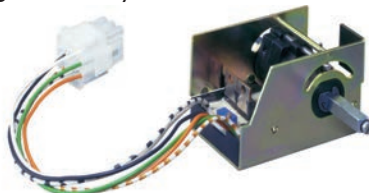
Foot Pedals

- Ideal for tough environments such as material handling, Curtis foot pedals are used with Curtis electronic motor speed controllers, as well as models by other manufacturers.
- Designed for maximum installation flexibility and durability, these pedals are made of rugged aluminum castings.



Electronic Throttle Assemblies

- Provides a CAN, voltage or resistive output proportional to throttle position as an input to a Curtis motor controller.
- Ideal for rugged environments, as major components are encapsulated to protect them from environmental stresses.
- Hall-effect technology and solid-state contactor drivers provide high reliability.



Electronic Code Switches

- Prevents unauthorized use of a vehicle.
- Wide voltage range of 12 to 120V allows one unit to be used on all industrial vehicles.
- Low power consumption (10mA) ensures that the ECS does not significantly discharge the vehicle's battery.
- IP 65 environmental protection allows use in harsh applications.
- Can store up to 99 individual access codes.



USA

Tel. 1 914 666 2971

United Kingdom

Tel. 44 (0) 1604 885201

Germany

Tel. 49 (0) 5251 50014 0

France

Tel. 33 (0) 1 53 99 95 40

Italy

Tel. 39 0254101214

Sweden

Tel. 46 (0) 302 22500

Bulgaria

Tel. 359 2 955 98 93

China

Tel. 86 10 65260683

Hong Kong

Tel. 852 21103070

Taiwan

Tel. 886 2 2910 7250

Korea

Tel. 82 10 9472 2015

Japan

Tel. 81 (0) 3 5207 3161

India

Tel. 91 20 6685 3600

CURTIS, YOUR PARTNER IN INDUSTRIAL VEHICLE SYSTEM INTEGRATION



WITH CUSTOMER SUPPORT ENGINEERS WORLDWIDE

Even the most experienced EV OEMs can be challenged by today's highly specialized, advanced EV systems technology. At Curtis, we understand that – and we have a solution. We provide an expert partner to assist you from beginning to end, at every stage of the process.

Curtis has experienced and enthusiastic customer support engineers around the world. Each member of this highly skilled team stands ready to support major OEMs in leading-edge product development. Our global network makes Curtis an extension of your own engineering department. We will partner with you to specify, design and build a complete electric vehicle control system, so you can build the best possible EV.

www.curtisinstruments.com



CURTIS

