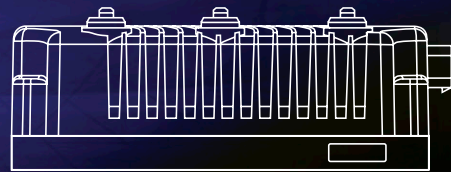
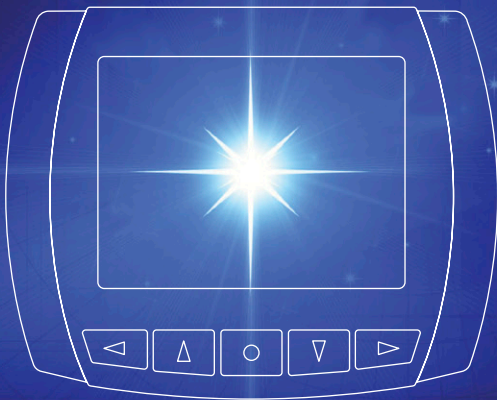
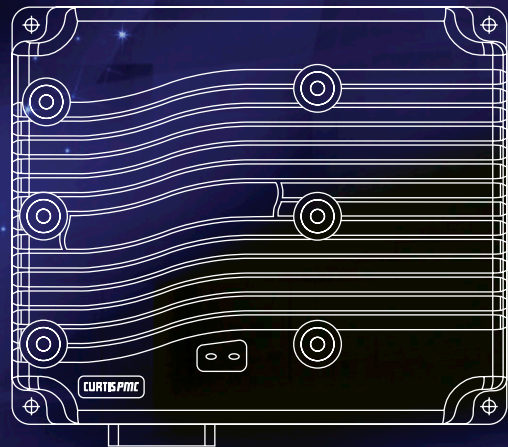
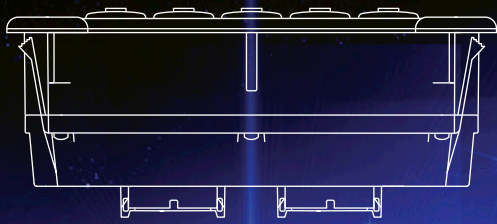


CURTIS INSTRUMENTS, INC.

# Vehicle Technology



Motor Speed Controllers

Instrumentation

Throttles

Other Vehicle Products



**CURTIS**

5	AC Motor Controllers	Electric Power Steering, 24–48V, 70A
		Traction or Pump, 24V, 150–250A
		Traction or Pump, 24–48V, 200–350A
		AC Traction + DC Pump Combi Controller, 24V, 250+300A, 300+350A
		Traction or Pump, 24–80V, 300–500A
		Traction or Pump, 24–80V, 550–800A
		Traction or Pump, 72–96V, 550–650A
6	Systems Control	CANbus Vehicle System Controller with VCL, 24–48V
		CANbus I/O Expansion Module, 12–80V
7	Programming	Handheld Programmer
		Windows PC Programming Software
8	SepEx® Motor Controllers	Traction, 24–36V, 200–350A
		Traction, 24–80V, 400–700A
		Traction, 36–48V, 275–350A
		Traction, 36–48V, 400–500A
9	Series Motor Controllers	Traction or Pump, 36–72V, 275–500A
		Traction, 24V, 250–300A
		Traction, 24–72V, 400–600A
		Traction, 72–144V, 400–550A
		Pump, 48–80V, 600A
		Pump, 24–80V, 400–700A
10	Permanent Magnet Controllers	Traction, 24V, 45–70A
		Traction, 24–36V, 70–110A
		Traction, 24–36V, 90–125A
		Traction, 24–48V, 100–250A
11	LCD CAN Vehicle Instrument	1/4 VGA Color Dot Matrix Display with CAN, Video, and I/O
13	Programmable Instrumentation	Round Gauge Serial Data Display
		Two-function Programmable Round Gauge / CAN
		Three-function Programmable Rectangular Gauge / CAN
		Full-function Panel
14	Hour Meters and Counters	Cased and Uncased Units
15	Battery Instruments	Round Gauge Battery State-of-Charge / Hour Meter with lift lockout
		Battery State-of-Charge with Error Code & Hour Meter
		Round or Rectangular Battery State-of-Charge
		Two-function Programmable Round Gauge
16	Acuity®	Battery Mounted Device to Measure, Store, and Communicate Battery Status
17	Other Vehicle Products	DC/DC Converters
		Beacons
		Alarms
		DC Contactors & Disconnect Switches
		Pot Boxes
18	Throttles	Pot Assemblies
		Tiller Heads
		Foot Pedals
		Electronic Throttle Assemblies
		Electronic Code Switches

	Model	Golf	Material Handling	Aerial Work Platforms	Sweeper/ Scrubber	On-Road EV	Ground Support	Utility	2
	1222		•		•		•		
	1232	•	•	•	•		•	•	
	1234	•	•	•	•		•	•	
	1298		•	•	•		•		
	1236		•	•	•	•	•	•	
	1238		•	•		•	•	•	
	1238R					•		•	
	1310		•	•	•	•	•		
	1352		•	•	•	•	•		
	1313	•	•	•	•	•	•	•	
	1314	•	•	•	•	•	•	•	
	1243/1243CAN		•	•	•	•	•	•	
	1244/1244CAN		•	•			•	•	
	1266	•				•		•	
	1268	•				•		•	
	1204M/1205M	•						•	
	1207A		•		•				
	1209B/1221B		•	•		•		•	
	1221C/1231C					•			
	1253		•	•			•		
	1254C		•	•			•		
	1210				•				
	1228				•				
	1225/1235		•		•				
	1227/1237		•		•				
	enGage® VII		•	•	•	•	•	•	
	840		•	•	•	•	•	•	
	enGage® II	•	•	•	•	•	•	•	
	enGage® III	•	•	•	•	•	•	•	
	enGage® IV		•	•	•	•	•	•	
	700 Series	•	•	•	•	•	•	•	
	803		•	•	•		•	•	
	841		•	•	•	•	•	•	
	906	•	•	•	•		•	•	
	enGage® II	•	•	•	•	•	•	•	
	Acuity®	•	•	•	•	•	•	•	
	1400/1410	•	•	•	•	•	•	•	
	SBA		•	•	•	•	•	•	
	Audio	•	•	•	•	•	•	•	
	Albright	•	•	•	•	•	•	•	
	PB	•	•		•	•	•	•	
	WW-1		•				•		
	TH, TM		•					•	
	FP	•	•		•	•	•	•	
	ET		•					•	
	ECS		•	•	•		•	•	



**Electronic  
Code Switches**



**Input  
Devices**



**Disconnect  
Switches**



**DC Contactors**



**Alarms**



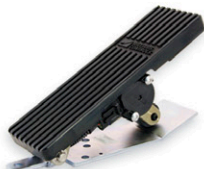
**Beacons**



**Instrumentation**



**Programmable  
Logic Controller**



**Foot Pedals**



**Vehicle Management  
Systems**



**Steering Controllers**



**Traction Controllers**



**DC/DC Converters**



**System Expansion  
Modules**



**Pump Controllers**

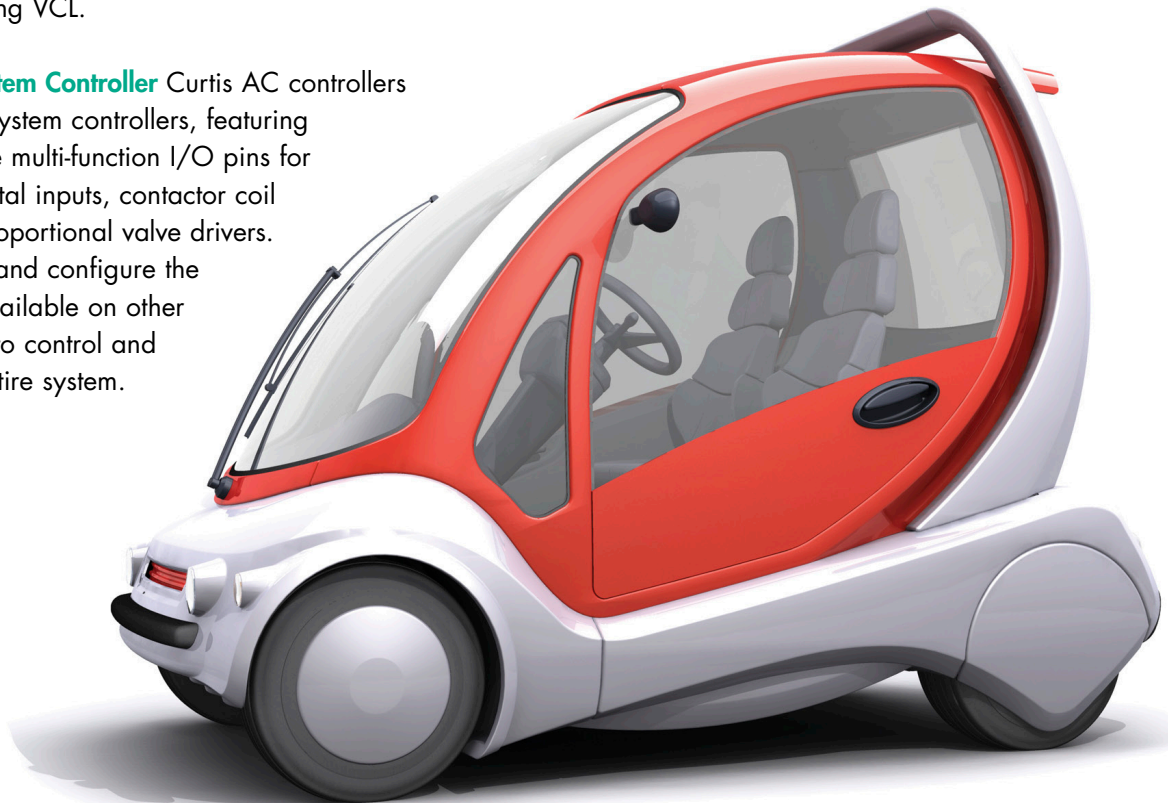


Curtis AC induction motor controllers provide OEMs with an unbeatable combination of power, performance and functionality. They are very reliable and well proven in counterbalance trucks, warehouse trucks, tow tractors and many different types of electric vehicles worldwide.





**Curtis Auto-Tune** function allows quick and easy characterization of the AC motor without the need for dynamometer testing. Curtis AC controllers are fully compatible with any brand of induction motor.

**Configurable CANopen** connection allows communication with other CAN devices. Curtis AC controllers are CANopen compatible and can be further customized and configured using VCL.

**Integrated System Controller** Curtis AC controllers are powerful system controllers, featuring comprehensive multi-function I/O pins for analog or digital inputs, contactor coil drivers and proportional valve drivers. VCL can map and configure the remote I/O available on other CAN devices to control and monitor the entire system.





AC Motor	1222	1232	1234	1298
Models				
Application	Electric Power Steering	Traction or Pump	Traction or Pump	Combined AC Traction and DC Pump
Voltage [VDC]	24–48	24	24–48	24
Current (2 min) [A]	70	150–250	200–350	250–300
Control Type	Speed	Speed or Torque	Speed or Torque	Speed or Torque
Control Method	IFO Vector	IFO Vector	IFO Vector	IFO Vector
VCL	No	Yes	Yes	Yes
CANbus	Yes	Yes	Yes	Yes
Auto Tuning	No	Yes	Yes	Yes
Dual Drive	N/A	Yes	Yes	Yes
IP Rating	IP 43	IP 65	IP 65	IP 65

VEHICLE SYSTEMS CONTROL

1310 Vehicle System Controller



- Powerful System Master with VCL for CANopen controller networks.
- 24–48V.
- Up to 32 multi-function I/O pins including 16 x 3A output drivers.
- Two quadrature encoder inputs.
- Use with Curtis motor controllers or 3rd-party CAN devices.
- Can also be used as stand-alone I/O controller or as I/O expansion device.
- Powerful and simple VCL programming language.
- FLASH memory.

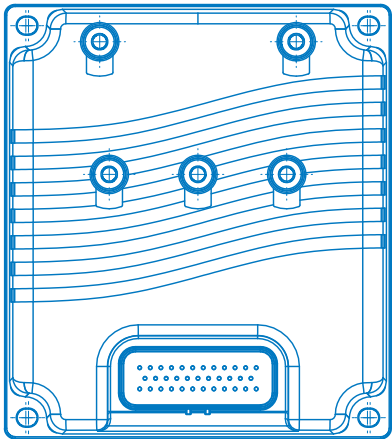
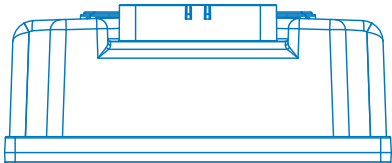


1352 I/O Expansion Module

- 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.



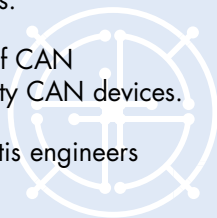
1236	1238	1238R
		
Traction or Pump	Traction or Pump	Traction or Pump
24–80	24–80	72–96
300–500	550–800	550–650
Speed or Torque	Speed or Torque	Speed or Torque
I/O Vector	I/O Vector	I/O Vector
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
IP 65	IP 65	IP 65





### 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

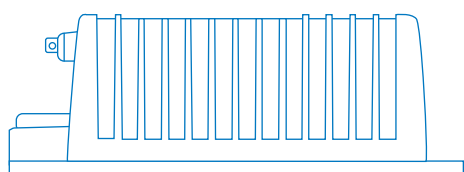
- Windows® programming and troubleshooting software for Curtis control systems.
- USB to CANbus or serial interface.
- Powerful programming, full-system diagnostics and graphical monitoring and logging functions.
- Compatible with Microsoft XP, Vista and Windows 7 operating systems.









## 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	1266	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	Yes	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

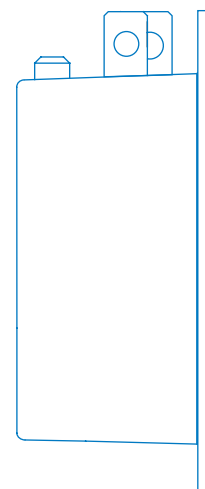
- Curtis Permanent Magnet motor controllers provide fully programmable, 4-quadrant speed control of brushed DC permanent magnet motors.
- All units offer programmable acceleration, deceleration and current limiting, load compensation, control of electromagnetic brakes, and full protection against over-temperature,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



Series	1204M/1205M	1207A	1209B	1221B
Models				
Vehicle Type	Golf/Utility	Material Handling	Utility	Utility
Application	Traction or Pump	Traction	Traction	Traction
Voltage (VDC)	36–72	24	24–72	24–72
Armature Current (2 min) [A]	275–500	250–300	400–500	500–600
Plug Braking	Option	Yes	Yes	Yes
Programmable Parameters	Yes	Yes	No	No
Line Contactor Driver	No	Yes	No	No
CANbus	No	No	No	No
IP Rating	IP 65	IP 54	IP 65	IP 65

Permanent Magnet	1210	1228	1225/1235	1227/1237
Models				
Vehicle Type	Light Industrial	Light Industrial	Light Industrial	Light Industrial
Voltage [VDC]	24	24–36	24–36	24–48
Armature Current (2 min) [A]	45–70	70–110	90–125	100–250
Integral Line Contactor	Yes	Yes	Yes	No
MultiMode®	Yes	Yes	Yes	Yes
EM brake driver	Yes	Yes	Yes	Yes
BDI output	Yes	Yes	Yes	Yes
Seat lift function	No	Yes	No	No
Push-too-fast function	Yes	Yes	Yes	Yes
UL approved	No	No	Yes	Yes
TÜV/FDA approved	Yes	Yes	Yes	Yes

1221C	1231C	1253	1254C
			
On-Road EV	On-Road EV	Material Handling	Material Handling
Traction	Traction	Pump	Pump
72–120	72–144	48–80	24–80
400	500–550	600	400–700
Yes	Yes	No	No
No	No	Yes	Yes
No	No	Yes	Yes
No	No	No	Yes
IP 65	IP 65	IP 54	IP 64





# enGage® VII

- The Curtis enGage® VII color LCD vehicle instrument is 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.

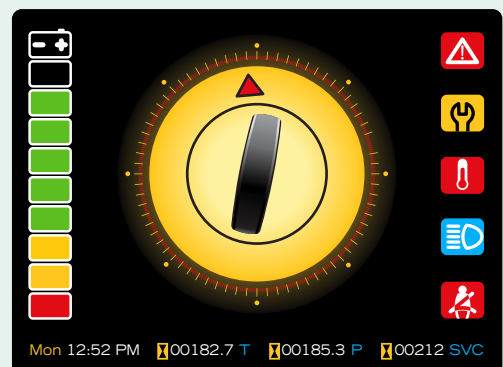
## enGage® VII Cased



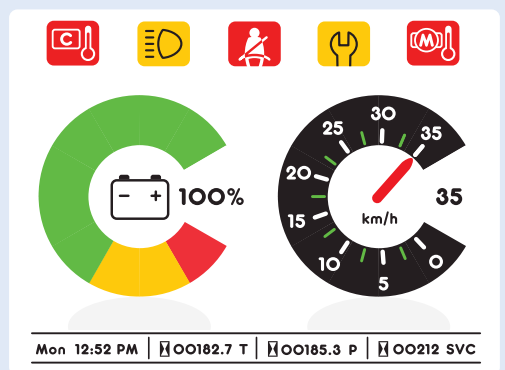
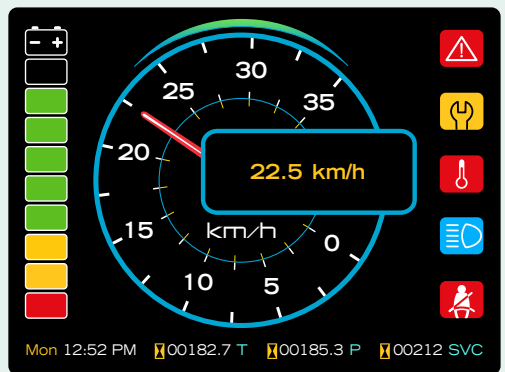
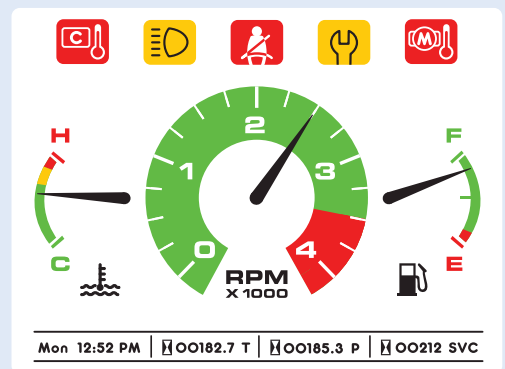
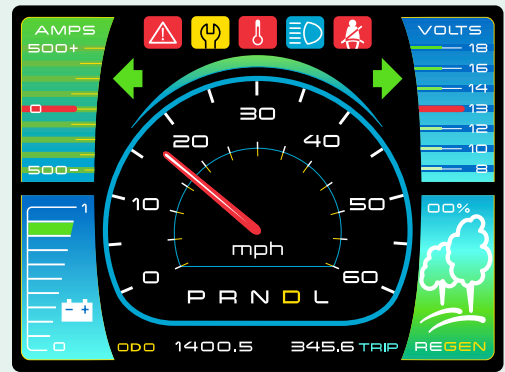
## enGage® VII with Optional Camera



## enGage® 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.

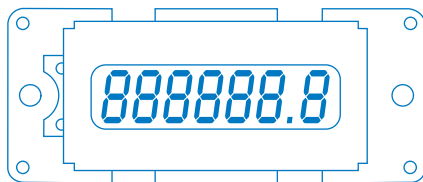


CAN and Serial	840	enGage® II	enGage® III	enGage® IV
<b>Models</b>				
<b>Display</b>	TN LCD, 8-character Dot Matrix, Monochrome	TN LCD, Fixed Segment, Monochrome	TN LCD, Fixed Segment, Monochrome	FSTN LCD, 240x128, Dot Matrix, Monochrome
<b>Serial</b>	Yes	No	No	Yes
<b>CANbus</b>	No	CANopen, J1939	CANopen,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



## 700 Series Modules



## 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.



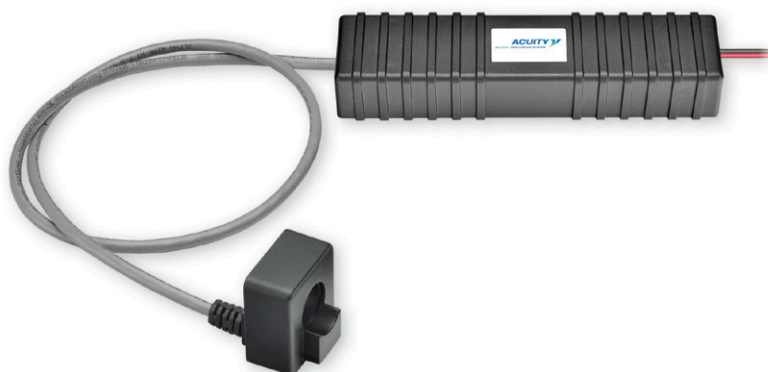
BSOC	803	841	906	enGage® II
<b>Models</b>				
<b>Display</b>	Tri-Color, 10-bar LED	8-character Dot Matrix LCD	Red, 10-bar LED or Tri-Color, 10-bar LED	Fixed Segment LCD
<b>Hour Meter</b>	Yes	Yes	No	Yes
<b>Output</b>	1 Amp Relay	1 Amp Relay	Logic Level 0–5V	0.5 Amp MOSFET
<b>Mounting</b>	U-bracket	U-bracket	U-bracket (D,R) or Snap-fit Bracket (J,Y,Z) or Screws/Nuts (F,T)	Snap-fit Bracket
<b>Interconnect</b>	Molex Connector	Molex Connector	3/16" or 1/4" Fast-On Terminals or Packard Connector or PCB Mount Pins	Amp or Molex Connector
<b>Low "Fuel" Warning</b>	Two LED Bars Flash Alternately	Amber LED 20% Red LED 10%	Two LED Bars Flash Alternately	Two LCD Bars Flash Alternately & Front-face LED Flashes
<b>Adjustable</b>	Yes	No	No	Yes (via buttons)
<b>Housing</b>	52mm round	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)	52mm round
<b>Keyswitch Input</b>	Yes	Yes	Yes	Yes
<b>BDI Reset Method</b>	CTR, OCR	CTR, OCR	CTR, OCR	CTR, OCR
<b>Operating Voltage</b>	12–80	24–80	12–48	12–80



# ACUITY®

## BATTERY MONITORING SYSTEM

- The Acuity® Battery Monitoring System is the newest, most advanced technology by Curtis, the culmination of decades of expert experience in monitoring lead-acid industrial vehicle batteries.
- Measures elapsed battery-use time, voltage, current and temperature.
- Transmits key battery operational parameters such as: unique battery ID number, state-of-charge, amperes-hours in/out, and date/time.
- The Acuity® on-battery monitor measures, stores and communicates critical battery data via CAN or Power Line Carrier.
- The proprietary Acuity® algorithm allows for the most accurate evaluation of state-of-charge data, for improved battery "warranty-witness" and productivity.
- Easy to install on top of the battery.



### 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.



### Beacons

- 12 to 80V range of high-efficiency LED and Xenon visual warning lights.
- Operating temperatures from  $-40^{\circ}$  to  $+77^{\circ}\text{C}$ .
- Universal mounting base.
- Encapsulated electronics.



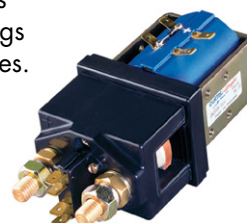
### Alarms

- 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.



### 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  $\Omega$  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.



### 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.



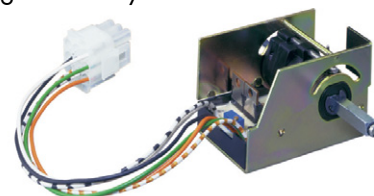
### Pot Assemblies

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



### Electronic Throttle Assemblies

- Provide a 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.



### Tiller Heads

- Attractive and ergonomic control handles used in pallet jacks, walkie-stackers, and tow tractors.
- These tiller heads include an electronic throttle mechanism and an emergency switch, and may be equipped with a variety of functional options, including switches (horn, lift, lower, coast), throttle (butterfly twist-grip) and instrumentation.



### 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.



[www.curtisinstruments.com](http://www.curtisinstruments.com)

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**CURTIS**



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