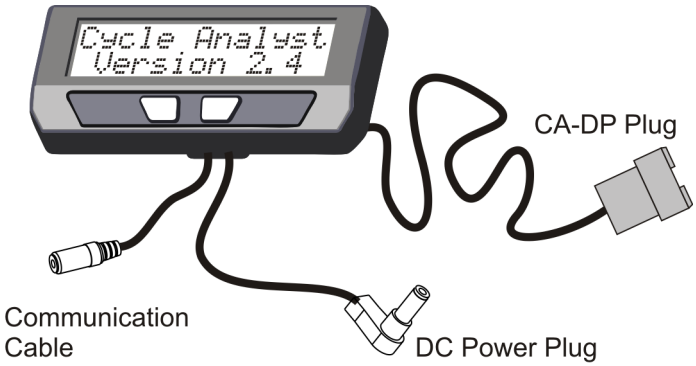
Cycle Analyst V2.4
Quickstart Guide



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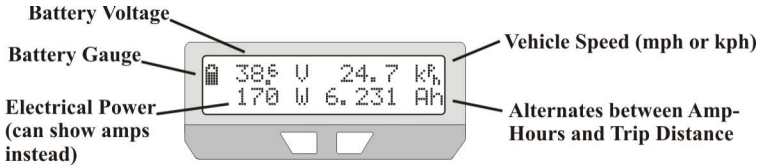
1 Introduction

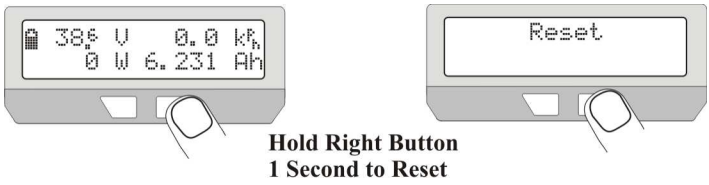
Thanks for purchasing a Version 2.4 Cycle Analyst. If you acquired it as part of a complete conversion kit, then most likely the critical settings have already been properly configured for your bike and you just need to plug it in and go.

The main display screen shows most of the pertinent information you'd care about while riding:



Pressing the right and left buttons will scroll through a series of additional display screens that show specific information that may be of interest, like your total trip time, average speed, your energy consumption in wh/km, the % range increase from regenerative braking and so forth. But normally you would always return to the primary display while riding.

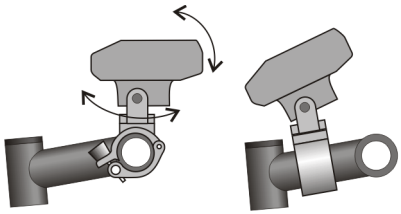
You will want to make a habit of resetting the Cycle Analyst every time you have a fresh charge in the battery. Do this by pressing and holding the right button untill the message "**Reset**" shows on the screen. This allows you to see your consumed battery amp-hours on each trip and ensures that the battery cycle statistics are accurate.



If you don't reset the Cycle Analyst when you have a fresh charge on the battery pack, then it will be harder to make use of the accumulated amp-hour information to know how much of the battery pack has been consumed.

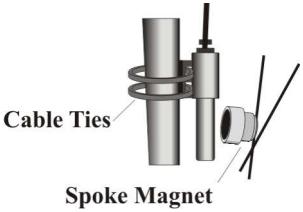
2 Installation

The Cycle Analyst includes a handlebar bracket that allows it to clamp on any tube from 21mm (7/8") to 40mm (1.5") in diameter. You can mount it directly on the handlebar, or you can swivel the base 90 degrees and clamp it to the bicycle stem for a more central display that doesn't consume bar real estate. There is also an optional steer tube mounting bracket and a ¼" threaded insert on the bottom of the enclosure for improvised attachments.

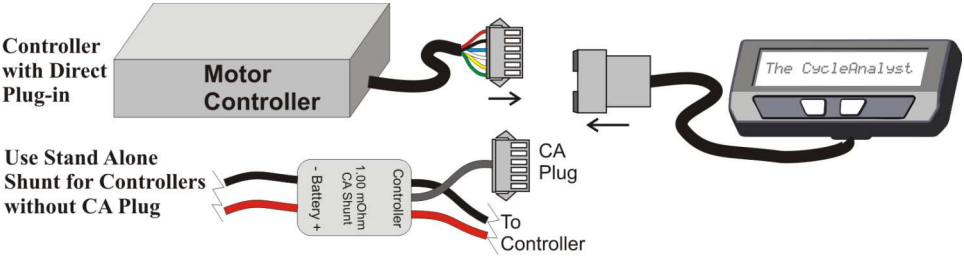


Conventional Handlebar Mount and Central Stem Mount

If you have a CA-DPS or CA-HC device which uses an external spoke magnet and speedometer sensor, then you will need to screw the spoke magnet onto your wheel and zip-tie the sensor pickup to your fork so that the magnet passes within about 5mm from the middle of the pickup sensor.



If you have a CA-DP or CA-DPS device, then the electrical hookup is simply a matter of plugging the 6-pin CA plug into your motor controller. If you have a Stand Alone CA Shunt, then you wire the shunt inline with the + and - battery leads and plug the CA into that.



There are two additional short cables coming out of the Cycle Analyst. One is a TRS communications jack that can be used for data logging or updating the CA's firmware. The other is a DC cable that has your full battery voltage on it for

powering front ebike lights, DC-DC converters, and other peripherals that can run off your full pack voltage.

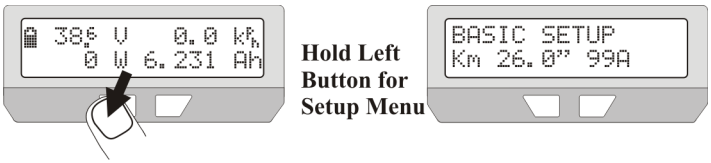
DC Cable for Front Lights and Accessories (1A Max)

TRS Communication Jack for Datalogging and Firmware Updates

This power tap is fused internally and is limited to about 1 amp. It is shipped with a rubber protective cap and you should leave this cap in place if you are not using the connector, as there is full battery voltage present on the connector pin.

3 Entering Setup Menu

If you acquired the Cycle Analyst independent of a complete system, then you may need to input several settings in the setup menu for the CA to function correctly and show accurate information. The setup menu is accessed by pressing and holding the left button for several seconds. The settings are then grouped into 3 categories; basic setup, battery setup, and advanced setup.



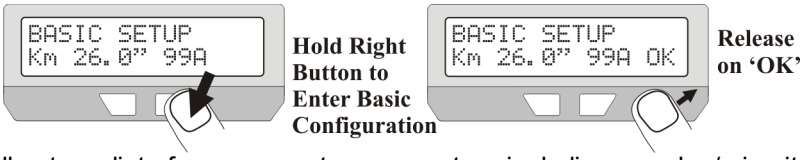
Once in the setup menu, further navigation with the two buttons is straightforward. You press the left and right buttons briefly to either scroll through screens or toggle a digit up and down. You press and HOLD the right button to save a digit or enter a submenu.

4 Set Your Wheel Size

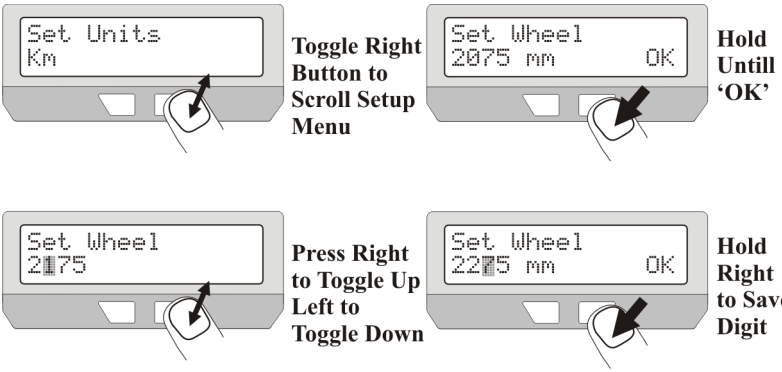
The default wheel circumference in the Cycle Analyst is 2075mm which corresponds to an exact 26.0" diameter. For the CA's speed and distance readings to be accurate, you need to set this to match your actual wheel circumference. You can measure that easily with a tape measure for best accuracy, or refer to the circumference table here for an approximate value.

Tire Size	Circumf	Tire Size	Circumf	Tire Size	Circumf
16 x 1.50	1185	24 x 2.12	1965	26 x 2.25	2115
16 x 1 3/8	1282	26 x 1 1/8	1970	26 x 2.35	2131
20 x 1.75	1515	26 x 1 3/8	2068	700 x 23	2097
20 x 1 3/8	1615	26 x 1 1/2	2100	700 x 28	2136
24 x 1 1/4	1905	26 x 1.5	1995	700 x 32	2155
24 x 1.75	1890	26 x 1.75	2035	700 x 38	2180
24 x 2.00	1925	26 x 2.0	2075	700 x 2.0	2273

In order to change the wheel size, press and hold the RIGHT BUTTON to enter the basic setup menu which shows a summary of the current settings.



You will enter a list of common setup parameters including your km/mi unit preference, wheel size etc. Hold down the RIGHT BUTTON again when you are at the screen that says "Set Wheel" in order to change the value to match your actual wheel circumference.



5 Set Your Pole Count

In addition to setting up the wheel circumference, if you have a CA-DP device which uses the motor hall signals for the speed readings, then you will also

need to set the number of magnetic pole pairs. This is a count of how many times the hall signal will toggle up and down with each wheel rotation.

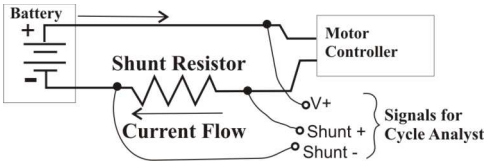
The #Poles of common direct drive motors is shown in the following table:

Table 1: Pole Pair Count of Common Direct Drive Hub Motors

Crystalyte 400 Series	8 Poles
Crystalyte 5000 Series	12 Poles
TDCM 5 Spd IGH Hub	16 Poles
Crystalyte NSM, SAW	20 Poles
Crystalyte 'H', Crown, Nine Continent, MXUS	23 Poles
Golden Magic Pie	28 Poles

You can also figure it out on any other motor by measuring the hall signal with a volt meter and counting how many times it toggles to 0V during a full turn of the wheel. If you have a CA-DPS or Stand Alone/High Current CA with its own speedometer sensors and spoke magnet, then the #poles value should be left at one (assuming you have just 1 spoke magnet on your wheel).

6 Set your Shunt Resistance



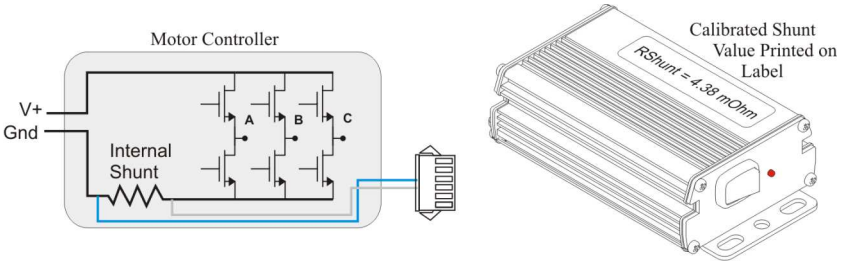
The Cycle Analyst detects the current and power flowing through your system by looking at the small voltage drop across a shunt resistor. This allows it to work over a very broad range of power levels, from small 200 watt pedalecs to 50kW electric cars. It's essential to set the RShunt value in the CA to match your actual sense resistor for accurate watts, amps, and amp-hour readings.

RShunt in the Advanced Setup Menu

The shunt resistance is configured in the Advanced Setup menu, and the correct setting depends on your particular system.

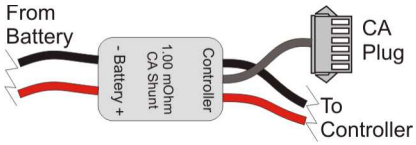
6.1 CA-DP or CA-DPS:

In these systems, the Cycle Analyst is sensing the current draw from a shunt ***internal*** to the motor controller, which is accessed via pins 3 and 4 of the 6-pin connector. On a direct plug compatible controller, the calibrated or approximate RShunt value should be listed on the controller label.



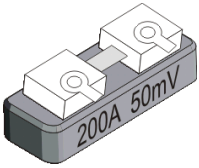
Typical 6 mosfet china controllers have ~3-6mOhm shunts, while larger 12 mosfet controllers are 2-3 mOhm. If you leave RShunt at the default value of 1.000 mOhm, then the amps and watts readings will usually be way too high.

6.2 CA-SA (Stand Alone Shunt):



The Stand Alone shunt that we offer for controllers that don't have a 6-pin CA plug is exactly 1.000 mOhm, which is conveniently the default value in the CA.

6.3 High Current Shunt:



Standard shunts used for measuring current in vehicles do not list their ratings in mOhm, rather they are rated for a given current draw that will produce a full scale reading on a 50mV (most common) or 100mV galvanometer. To calculate the RShunt from one of these devices, divide the mV full scale value of the shunt by its amps rating. For instance, if you have a 200A 50mV shunt, then your RShunt value is:

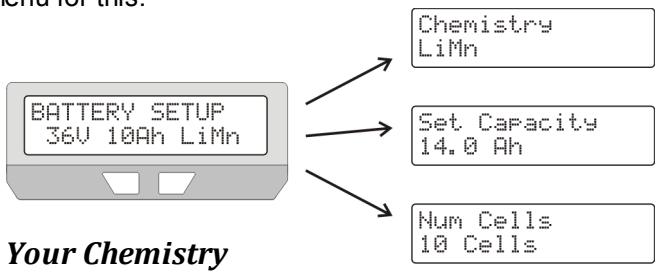
50mV / 200A = 0.250 mOhm

Note that shunt resistors are large blocks of metal that can handle significantly more current for short times than their "rated" current. So don't be concerned if you have a 75A shunt but draw 150 or 200A peak currents, in general this is fine.

When you have a high current shunt that is less than 0.8 mOhm, then the Cycle Analyst must be set to High Range (0.1A) mode first.

7 Set Your Battery Parameters

Finally, if you want the battery state of charge icon on the first display page to properly reflect the amount of charge in your battery, then it is important to tell the Cycle Analyst exactly what type of pack that you have. Go to the "BATTERY SETUP" menu for this.



7.1 Set Your Chemistry

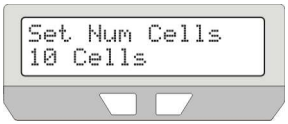
There are 6 options for the battery chemistry:

- **LiMn:** This is lithium manganese representative of most 18650 type lithium cells. The majority of ebike lithium packs are best represented by this option
- **LiPo:** This represents standard discharge rate ebike grade lithium polymer cells, which show an almost straight line drop in voltage as the battery is drained from 4.2V to 3.0 V/cell.
- **RCLiP:** This is for high discharge rate polymer batteries typically used in radio controlled models. They have a much lower drop in voltage over the course of their discharge than regular ebike grade LiPo.
- **LiFe:** This is for Lithium Iron Phosphate batteries, be they pouch cells (like PING), or cylindrical cells (Like Headway, A123 etc). Iron phosphate cells have a very flat discharge curve, but at a lower voltage than other types of lithium (3.3V versus 3.7V nominal)
- **SLA:** This is for lead acid batteries, whether sealed or AGM etc.
- **NiMH:** This is for Nickel Metal Hydride or NiCad packs.

7.2 Set Your Capacity

Here you input the nominal amp-hours of your battery pack in order to help the battery gauge icon remain accurate at tracking changes during high discharge currents. The value does not need to be exact as the CA's battery icon will always readjust itself based on the voltage reading.

7.3 Set Your Cell Count



Finally, the battery voltage is determined by the number of series cells in your pack. For lithium batteries each cell is about 3.6 volts, so a 36 volt pack has 10 cells in series. Lead cells are nominally 2.0V, so it takes 18 cells in series to make a 36V lead battery. And NiMH cells are just 1.2 volts each, so 30 of them are needed in series to make a 36V pack.

Most ebike batteries are configured in nominal 24V, 36V, or 48V modules. The following table shows the typical cell count for these nominal pack voltages, but it's increasingly common to see lithium packs made without any regards to a 12v multiple.

Table 2: # Cells Setting for Common Pack Voltages

	24V	36V	48V	50/52V	60V	72V
LiMn/LiPo	7	10	13	14	(16)17	20
LiFe	8	12	15(16)	16	20	24
SLA	12	18	24	--	30	36
NiMH	20	30	40	--	50	60

8 Enjoy Your Ride and Remember to Reset

That's it for the basics! For more details feel free to consult the V2.3 CA user manual for a full explanation of all the other setup parameters and display screens. Or just explore the device on your own to gain familiarity of the additional features.

And please don't forget to *RESET YOUR CA* ever time you have a fresh full charge on the battery. That's essential to get the most from this device, and in short order it will become 2nd nature.

9 Specifications

9.1 Electrical

Voltage Range	10-150V
Voltage Resolution	0.1V
Device Current	10mA
Current Sense Range	±240 mV/Rshunt. For instance, with a 2mΩ sense resistor, the maximum current is 120 amps. With a 0.5mΩ resistor, up to 480 amps, and so forth
Current Resolution	0.01A in low range mode, 0.1A in high range mode
Current Accuracy	Temperature coefficient and accuracy depend on the shunt and calibration. With pre-calibrated Stand Alone model, it is within 2% ± 0.06A

9.2 Cables and Connectors

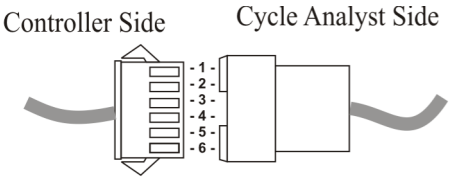
CA-DP Cable Length	150 cm
CA-DP Connector Pinout	6-pin JST-SM Series: 1 = V+, 2 = Gnd, 3 = Shunt – 4 = Shunt +, 5 = Throttle Over-ride, 6 = Speedo
Optional Speedo Sensor	90 cm, Reed Switch,
DC Output Spec	20 cm, Right Angle 5.5 x 2.1mm DC Plug.
DC Output Max Current	1 Amp
Communication Cable	TRS Jack. Tip = Rx, Ring = Tx, Sleeve = Gnd

9.3 Mechanical

Dimensions	129 x 57 x 25 mm
Weight	270 g

9.4 Certifications

CE	This device is CE compliant for use with 60V or lower ebike systems



1 = Vbatt (Red)
2 = Ground (Black)
3 = Shunt - (Blue)
4 = Shunt + (White)
5 = Speed (Yellow)*
6 = Throttle Over-ride (Green)

***In CA-DPS devices, the yellow wire is not soldered on the circuitboard, as the external speedo sensor uses the Sp pad.**