

**Manual for the UEC Lite  
5V Incremental Encoder Checker**



Version 1.2

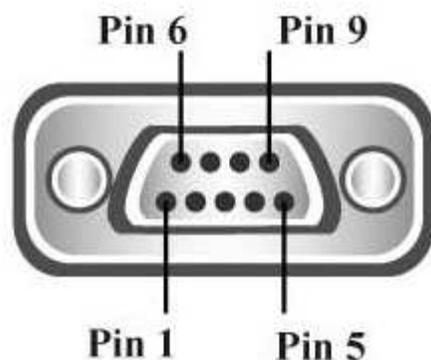
Thank you for purchasing the UEC Lite encoder checker. This unit will check 5 volt incremental encoders of any brand. The tests that can be performed are PPR, analog, phase and duty.

**Specifications:**

Battery power	9 Volts
Available encoder current	0.5 Amp (max) < 200ma recommended
Encoder voltage	5 Volts
Pull up current	20 milliamps
Pull down current	20 milliamps
Input voltage range	0 – 5.1 Volts
Digital Threshold	0.8V LOW, 2V HIGH

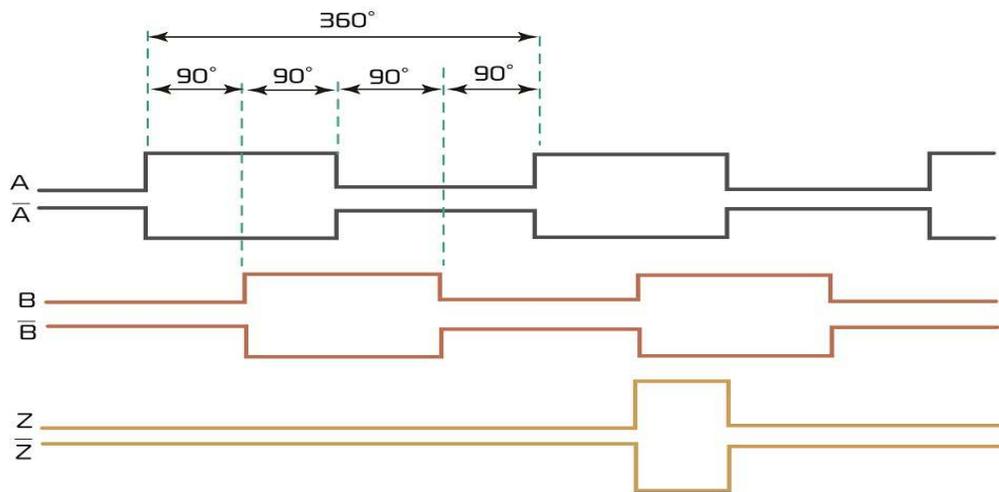
The DB9 connects the checker to the encoder. The pin-out of the connector is:

Pin number	Function	Wire Color (Custom cable)	Wire Color (molded cable)
1	A+ (or A)	WHITE	RED
2	B+ (or B)	GREEN	YELLOW
3	Z+ (index or Z)	YELLOW	BLUE
4	Not used	---	---
5	GND	BLACK	BLACK
6	A-	BROWN	ORANGE
7	B-	BLUE	PURPLE
8	Z-	ORANGE	BROWN
9	5V supply	RED	GREEN



## Encoder Operation:

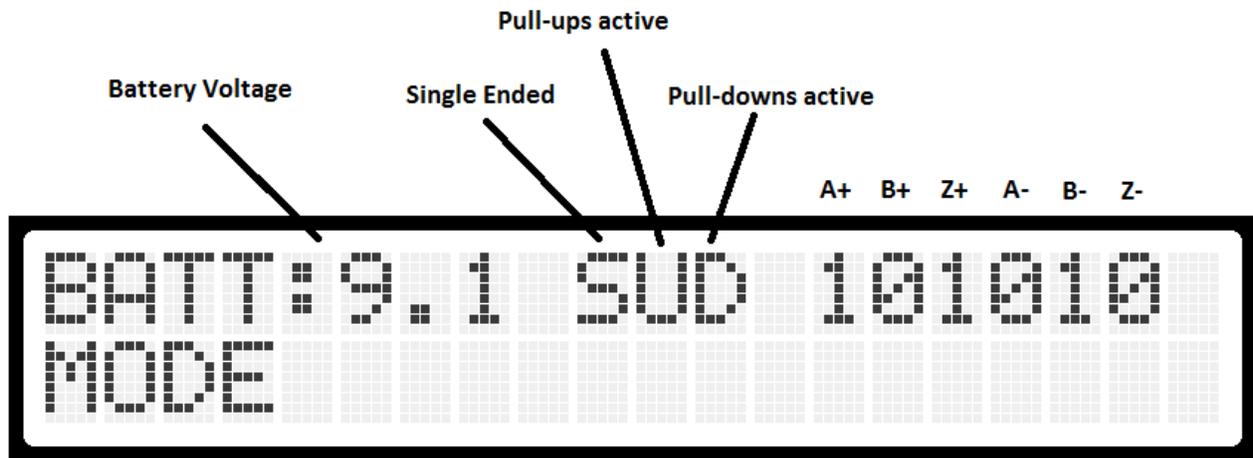
Incremental encoders output 2 signals, A and B, which are used to determine distance and direction. When a change in digital state occurs, the internal counter is incremented or decremented depending on the last state. Starting with both A and B low, if A changes to high (A leads B), 1 is added to the counter. After that, if B goes high, the count is incremented again. To continue incrementing, A would go low, and then B would go low. This is called 4X counting. If the opposite happens (B leads A), the counter is decremented. The negative (or NOT) signals, if present, have the opposite polarity. If an index signal is present (Z), this indicates one revolution (or if the encoder is linear, a specified distance) of the encoder. Most encoders are rated in CPR (counts per revolution). This is how many pulses there are for each of the A and B signals. After applying the 4X counting, the rating would be PPR (pulses per revolution). A CPR of 1200 would show 4800 PPR on the UEC.



### Testing an encoder:

The UEC Lite is designed to test an encoder that has been disconnected from the machine that it is in. Testing an encoder attached to a machine with the machine on, could cause a dangerous condition that could cause the machine to operate erratically. If the encoder is to be tested on a machine or motor, make sure the power is off to the machine or motor, disconnect the encoder electrically and power the encoder from the UEC.

After connecting the UEC to the encoder, press the ON button (third button). After startup, the main screen will show:



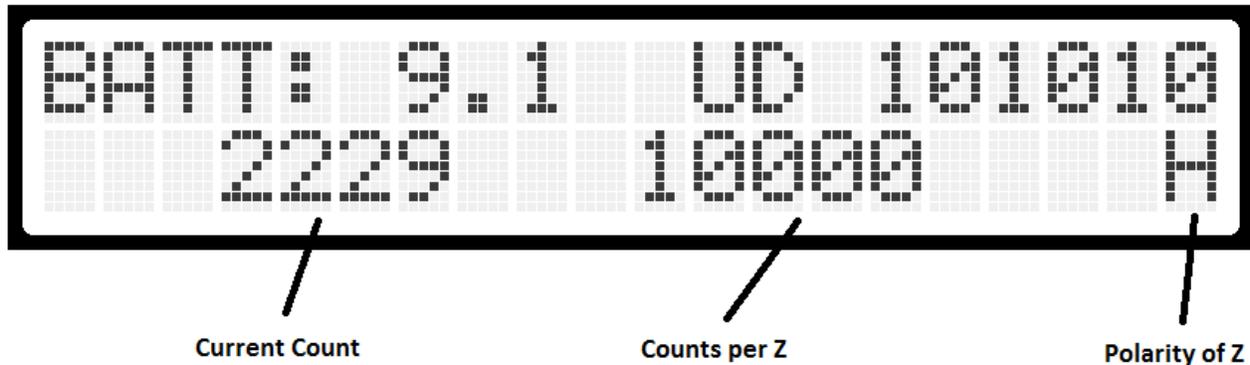
To turn off the meter, press and hold OFF (first button), for about 2 seconds. Also, the meter will cut off in about 30 seconds if no buttons are pressed and the encoder is not turned. If the OFF button is held down while turning on, the backlight for the LCD will turn on.

The top line of the screen is present on most modes and shows the battery voltage, options, and the current value of the incremental signals. The bottom line shows the menu selection and testing values. Press up and down to move through the menu and press SELECT to activate the menu item.

MODE menu:

### **Auto Count:**

This mode will test an encoder with a Z (index) signal. After selecting this mode, the screen will show "Turn Encoder". Turn the encoder in one direction until the screen shows "Keep Turning". Keep turning the encoder until the screen shows the number of counts per revolution and current count. If the screen does not change, this could mean the UEC is not receiving the index signal from the encoder. The counts per revolution, if shown, will be transferred to the PPR Setup (see below) count. Press select to exit this mode. When on the testing screen (shows current counts), keep turning the encoder several times. It is important to turn the encoder as smoothly as possible in the same direction. If the Z changes state going the opposite direction, an error may show up. This test should be performed no faster than about 8000 CPS (counts per second) (A 1200 CPR encoder would have a maximum speed of 200 RPM). It is a good idea to test again to confirm the error. Also, it is a good idea to re-run the test in the opposite direction.



The polarity of Z show the first change in state for the Z signal. If the Z is normally low, it will pulse high and show an “H” there.

The errors that can show in this mode are:

**COUNT** – This means the counts per revolution was not consistent from the last index pulse (Underflow). The number of counts in error will show on the bottom line.

**OVERFLOW** – Similar to COUNT, but the counts per revolution was over the initial count. The number of counts and the initial count will show on the bottom line.

**A POLARITY** – During testing the encoder, the A+ and A- had the same value. They should always be the opposite value. This can show up also when a single ended encoder is tested without selecting the single ended option.

**B POLARITY** – During testing the encoder, the B+ and B- had the same value. They should always be the opposite value. This can show up also when a single ended encoder is tested without selecting the single ended option.

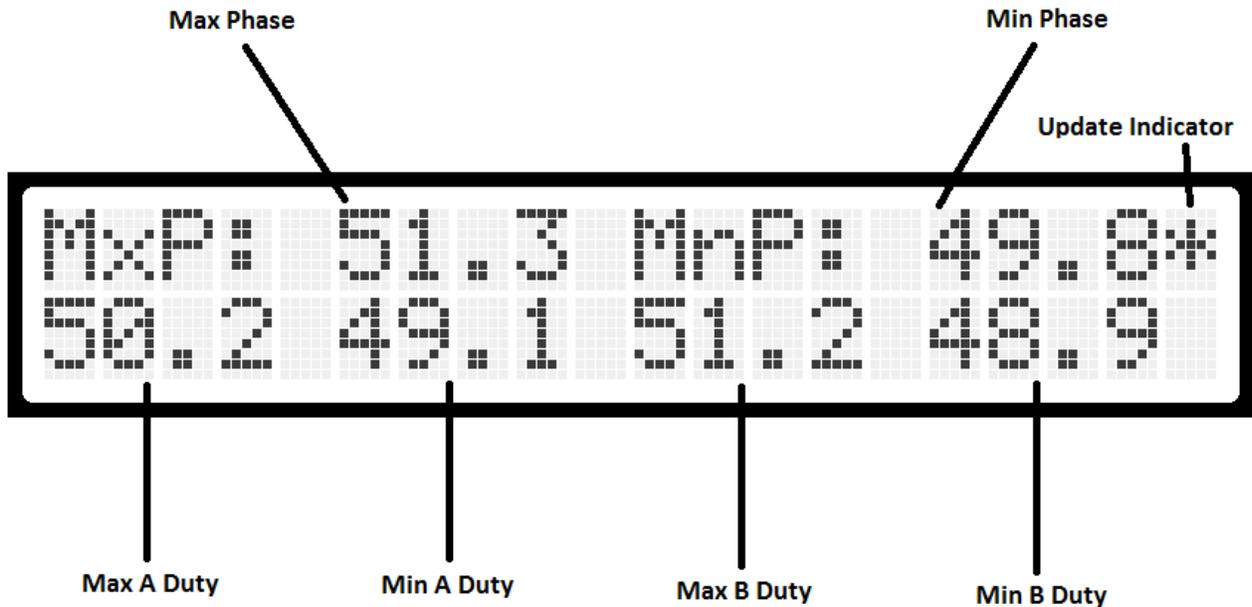
**Z POLARITY** – During testing the encoder, the Z+ and Z- had the same value. They should always be the opposite value. This can show up also when a single ended encoder is tested without selecting the single ended option.

## AUTO PHASE:

This mode will check the phase and duty of the A and B signals. The screen will show the highest and lowest phase and duty of each signal. The phase is checked on every 360 degrees so during this test, the encoder should be turned at a fairly slow pace. If the speed is too low or too high, the UEC will not update the screen. An asterisk will display in the top right if the speed is good. The defaults are for phase 60% high, 40% low. For duty it is 60% high and 40% low. The high and low thresholds can be set under the options menu. The readings are only updated when the asterisk is shown. Turning the encoder several times in both directions is recommended. If the numbers do not change, one or both of the A or B signals may be missing. Check the duty of the signals to determine which signal is missing. The phase is expressed in percentage of 180°. 50% would be 90°.

If the screen doesn't update while turning the encoder, the PPR may be set incorrectly. This can be changed under options, using the DRO mode, or using Auto Count (if there is a Z signal). The optimal speed is around 60 RPM on a rotary encoder.

The auto phase mode screen is arranged as:



Errors that can show in this mode are:

Phase High – The phase between A and B was greater than the high threshold level.

Phase Low – The phase between A and B was less than the low threshold level.

A Duty High – The A signal's duty was greater than the high threshold level.

A Duty Low – The A signal's duty was less than the low threshold level.

B Duty High – The B signal's duty was greater than the high threshold level.

B Duty Low – The B signal duty was less than the low threshold level.

### **DRO Mode:**

This mode just shows the current count. Turn the encoder to increment or decrement the count. Pressing the down arrow will reset the count to zero. Pressing the up arrow will transfer the count shown to the PPR Setup (see below) count. If no counting occurs, the A and B signals are not changing correctly. If the count bounces up and down one count, either the A or the B signal is missing. The A-, B-, and Z- are also testing in this mode.

### **Phase:**

This mode is just a quick check of the phase and duty. After entering this mode, use the up and down arrows to select A Duty, B Duty, or AB Phase. Press select to start the mode selected. Turn the encoder to update the value. The duties in this mode are shown as percentage (50% being perfect). The phase is shown in degrees (90° being perfect). Press up and down to select a different mode. Press select to exit phase mode. Maximum pulse speed is about 3000 CPS.

### **Analog:**

This mode shows the minimum and maximum voltages for the channels A+,B+,Z+,A-,B-, and Z-. Use the up and down buttons to cycle through the different displays: Maximum pulse speed is about 5000 CPS.

Minimums A+ B+ Z+  
A: 0.3 B: 0.4 Z: 0.4

Maximums A+ B+ Z+  
A: 4.8 B: 4.7 Z: 4.8

Minimums A- B- Z-  
A: 0.3 B: 0.4 Z: 0.4

Maximums A- B- Z-  
A: 4.7 B: 4.6 Z: 4.8

The A+ and B+ ( and A- and B-) output measurements are taken on the state change of other output. The high A reading is taken when B changes while A is High. The high B reading is taken when A changes while B is High. The low A reading is taken when B changes while A is Low. The low B reading is taken when A changes while B is Low.

The Z+ (and Z-) output (if present) measurement is only updated once per revolution. The encoder may need to be rotated slower for the Z pulse measurement since the Z pulse width is smaller than A or B. The Z (and Z') measurements are taken approximately 20us after the change in state.

Speed:

This mode shows the speed in RPM for a rotary encoder. The PPR must be set up either by using the AUTO mode (if there is a Z channel), using the DRO mode, or manually by entering the PPR for the encoder (CPR x 4). A 1200 CPR encoder would be set up with a PPR of 4800. The screen is updated once a second.

#### **OPTIONS menu:**

Single Ended – Press Select to toggle between Y (Yes) and N (No). If the encoder only has A, B, and Z (or just A and B), select [Y].

PULL-UPS – Press Select to toggle between Y and N to select whether or not the pull-ups are activated. The pull-ups provide 20ma to 5 Volts on each signal.

PULL-DOWNS – Press Select to toggle between Y and N to select whether or not the pull-downs are activated. The pull-downs provide 20ma to 0 Volts on each signal.

Phase Setup – Allows selection of High and Low phase and duty thresholds.

After selecting Phase Setup, press the up and down arrows to select between Phase MIN/MAX Setup , Duty MIN/MAX Setup, and PPR Setup. Press Select to enter the selected mode. In each of these modes, use the Select button to choose the digit to adjust and use the up and down arrows to select the digit. Placing the cursor on “Done” and pressing up or down will exit that mode. The functions of each mode are:

Phase MIN/MAX Setup – this allows the setup of the minimum and maximums for the Auto Phase.

Duty MIN/MAX Setup – this allows the setup of the minimum and maximums for the Auto Duty.

PPR Setup – This should be the counts per revolution of the encoder. Not having this set properly can result in no reading on the Auto Phase and the Phase modes. This number is automatically enter by: using Auto Count and getting to the point of the the counts per revolution screen or pressing the up arrow in the DRO mode with the correct counts showing (usually one full revolution).

Save & Return – Press Select to save the settings and return to the main menu.

#### **Contrast:**

Press the up and down arrow to adjust the contrast of the screen. Press Select to save the contrast value.