

# Manual for the UEC + Universal Encoder Checker



Version 1.1

Thank you for purchasing the UEC 2 encoder checker. This unit will check 5-volt incremental encoders and other types such as:

Parallel Absolute Encoders

SSI Encoders

DeviceNet Encoders

Modules can also be purchased to change the encoder voltage and provide specific loading requirements.

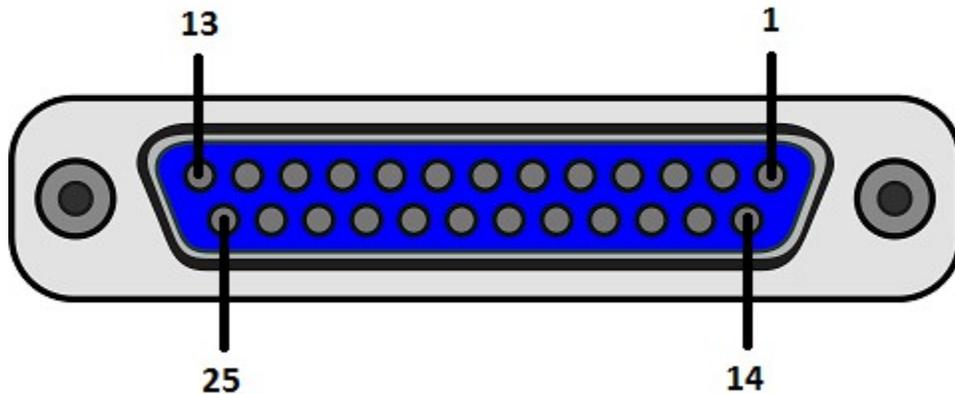
**Specifications:**

External Power	24 Volts DC (+ tip)
Available encoder current	2 Amps (max)
Encoder voltage	5 Volts (without module)
Input voltage range	0 – 5.1 Volts
Digital Threshold	0.8V LOW, 3.2V HIGH
Loading (A+,B+,Z+,A-,B-,Z-)	2 mA @ 5V
SSI signal loading (RX and TX)	120 ohms
CAN signal loading	120 ohms
Absolute maximum bits	10 bits

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

Pin number	Function	Absolute Bit	Wire Color (supplied cable)
1	A-	Bit 0	Blue w/Black
2	B-	Bit 1	Red /Black
3	Z-	Bit 2	Green w/Black
4	A+ (or A)	Bit 3	Blue w/White
5	B+ (or B)	Bit 4	Red w/White
6	Z+ (index or Z)	Bit 5	Green w/White
7	Reserved	Bit 6	White w/Black
8	Reserved	Bit 7	Orange w/Black
9	CAN L	Reserved	White w/Red

Pin number	Function	Absolute Bit	Wire Color (supplied cable)
10	CAN H	Reserved	Orange w/Red
11	SSI RXB	Reserved	Black w/Red
12	SSI RXA	Reserved	Red w/Green
13	Reserved	Reserved	n/a
14	+3.3VDC	+3.3VDC	
15	+5VDC	+5VDC	
16	TTL TX	Reserved	Orange w/Green
17	TTL RX	Reserved	Green
18	SSI TXA	Reserved	Orange
19	SSI TXB	Reserved	White
20	Encoder Supply	Encoder Supply	Red
21	Reserved	Reserved	n/a
22	Reserved	Reserved	n/a
23	Reserved	Bit 8	Black w/White
24	Encoder Ground	Encoder Ground	Black
25	Reserved	Bit 9	Blue w/Red



The color of the wires supplied can change. Refer to the cable documentation supplied for more information.

#### Basic UEC Usage:

To turn on the unit, plug the supplied power supply into the 5.2mm jack. After the power up message, the UEC will display:

The SELECT button will select the current menu item shown on the display. This key is also used to select the digit for editing and in some cases, selects the option value.

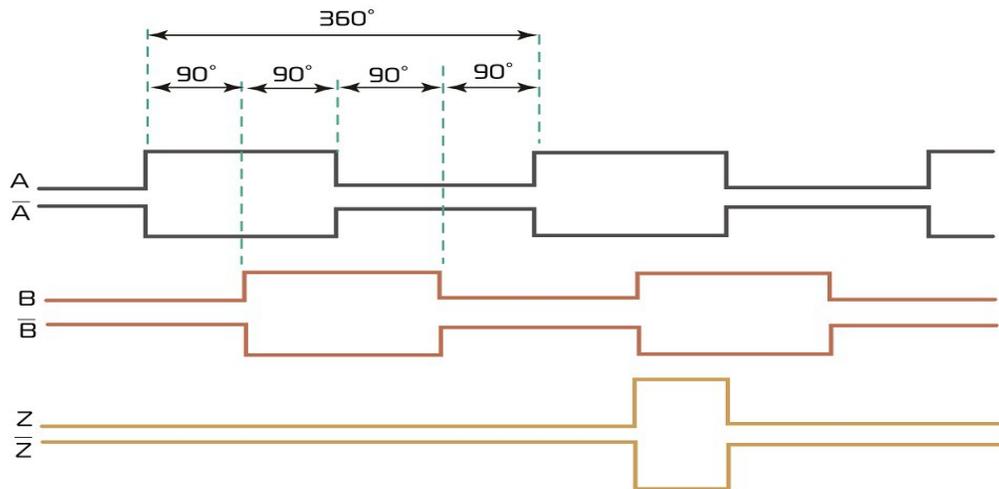
The UP arrow is mostly used to go up in the menu and to increase the value of the selected digit.

The DOWN arrow is mostly used to go down in the menu and to decrease the value of the selected digit.

The MODE menu allows the selections of tests. The Setup menu is used to select various options.

### Incremental 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.



To test this type of encoder, connect the power, ground, A, B, Z (if used) and (if present) the complements A-, B-, Z-. The types of test are:

Counts – An encoder should produce the same number of counts every rotation. This can be done manually or automatically if the encoder has a Z pulse.

Phase – This tests the relationship between the A and the B signal. This should be 90 degrees (or 50%).

Duty – This tests the on time compared to the off time of the A or B signal.

Analog – Looks at the voltage of a signal when it is high or low.

#### Absolute Encoder Operation:

An absolute encoder is generally for angle measurement and has several bit signals to relay the angle information. The number of bits determine the number of absolute steps in a rotation. If an encoder has an 8 bit output, the number of steps would be 256 (0 – 255). The UEC can use up to 10 bits (1024 steps) for testing.

To test this type of encoder, connect encoder power and ground. Bit 0 (sometimes called Bit 1) on the encoder should connect to Bit 0 of the UEC. Connect up to a total of 10 bits sequentially. If there is a parity bit, sign bit, strobe, or error bit, place these at the end of the sequence. For example:

<b><u>Encoder</u></b>		<b><u>UEC</u></b>
Bit 0	–	Bit 0
Bit 1	–	Bit 1
Bit 2	–	Bit 2
Bit 3	–	Bit 3
Parity	–	Bit 4
Strobe	–	Bit 5

Select Absolute as the Type under Setup and select the options.

#### SSI Encoder Operation:

An SSI encoder has a transmit and a receive signal to get the absolute encoder information. The transmit signal is a clock that controls the information coming back from the encoder on the receive signal.

To test this type of encoder, connect the UEC as follows:

<b><u>Encoder</u></b>		<b><u>UEC</u></b>
RXA (or Clock +)	-	TXA
RXB (or Clock -)	-	TXB
TXA (or Data +)	-	RXA
TXB (or Data -)	-	RXB

Select SSI as the type and select the options.

## CAN Encoder Operation (DeviceNET)

A CAN encoder uses one signal that is used bidirectionally to retrieve information from the encoder. Basically, the UEC will ask for the current position and then wait for the response. The bit rate is known before the transaction is performed.

To test this encoder, connect the UEC as follows:

<u>Encoder</u>	<u>UEC</u>
CAN H (or +) -	CAN H
CAN L (or -) -	CAN L

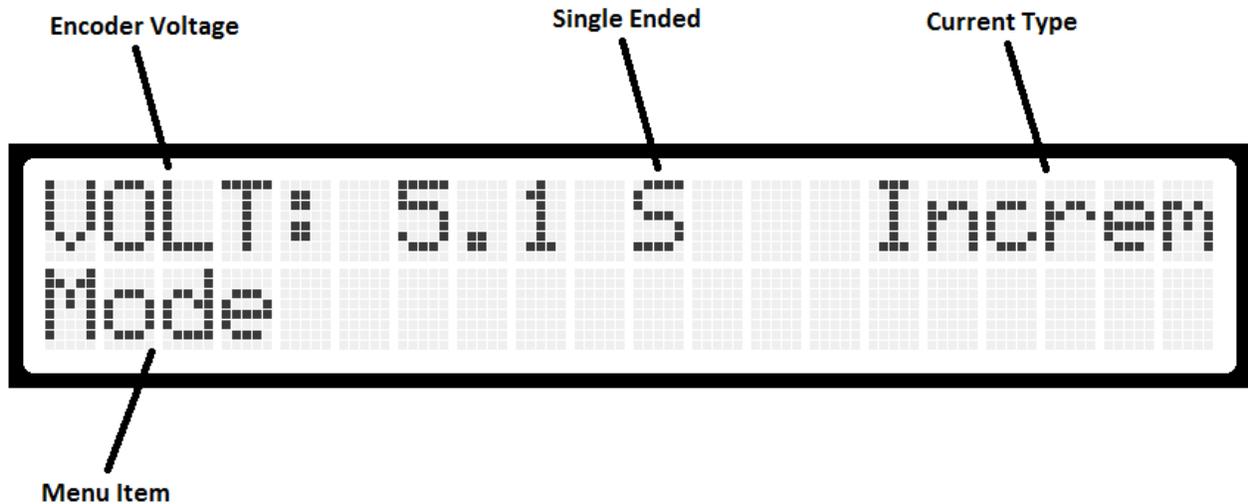
Select DeviceNET type under Setup and choose the options.

Testing an encoder:

The UEC+ 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 and power it from the UEC.

The top line of the screen is present on most modes and shows the encoder voltage, and options. 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.

An “S” appears on the top line when the option Single Ended is [Y]. An “A” will flash when an alarm condition is present.

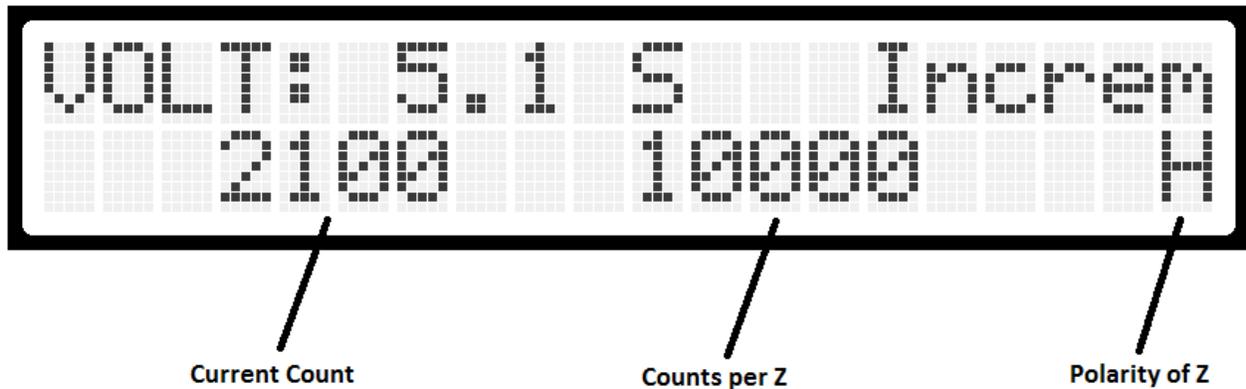


MODE menu:

**Incremental type:**

**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. 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.

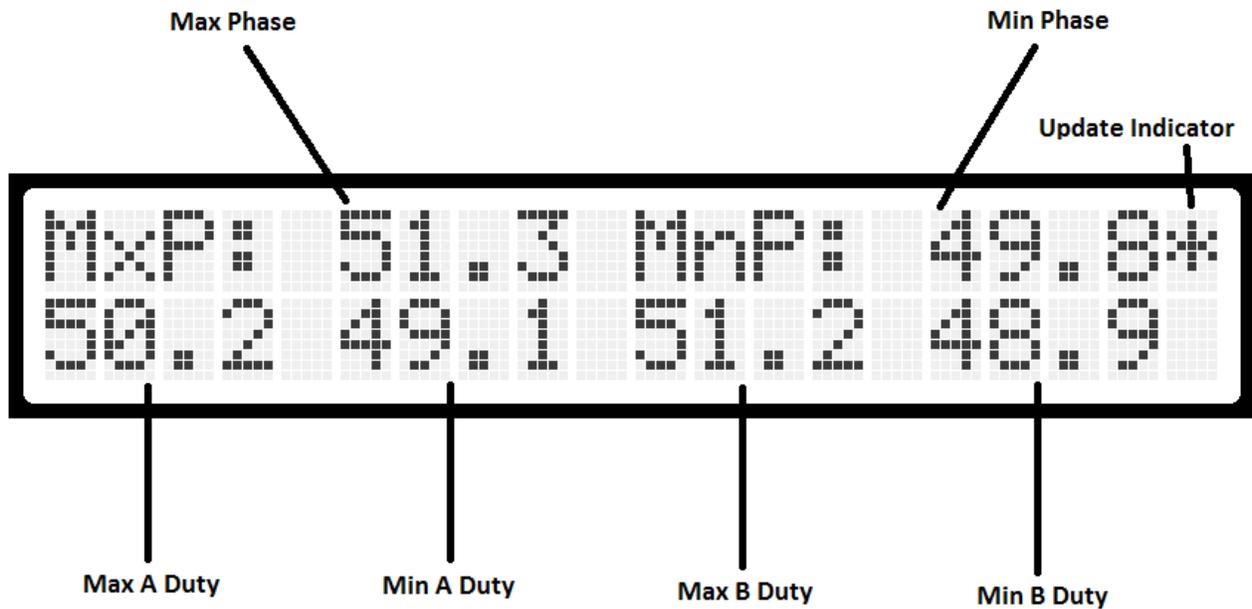
**Z POLARITY** – During testing the encoder, the Z+ and Z- had the same value. They should always be the opposite value. This can show up also when a single ended encoder is tested without selecting the single ended option.

## 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. During this mode, 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 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, and both A and B are correct, 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 auto phase mode screen is arranged as:

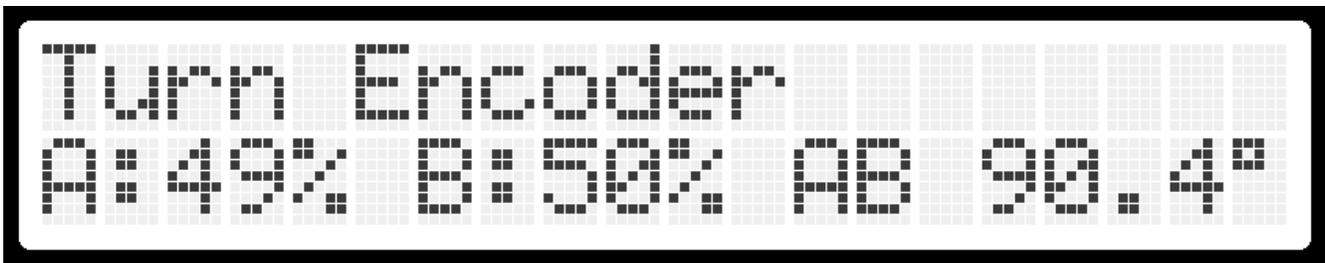


**DRO Mode:**

This mode just shows the current count. Turn the encoder to increment or decrement the count. Pressing the up arrow will reset the count to zero and transfer the current count to the PPR value. Pressing the down arrow will turn toggle the value of AUTO Z. AUTO Z will zero the count according to the PPR value. 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 if Single Ended is [N].

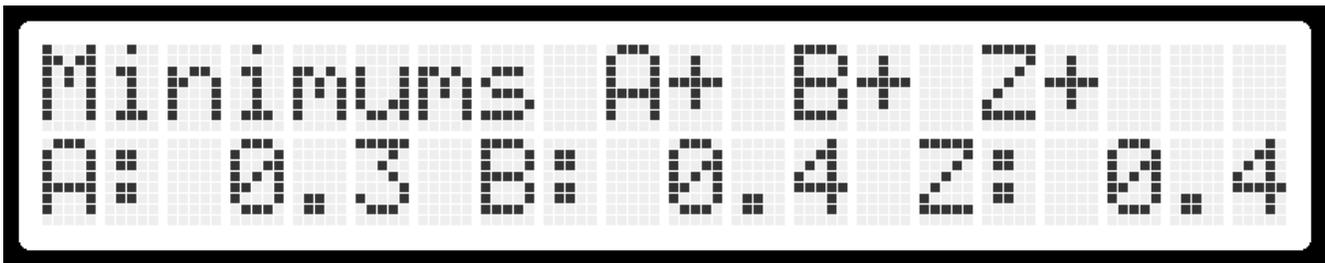
**PHASE:**

This mode is just a quick check of the phase and duty. Turn the encoder to update the values. 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.



**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:



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 3 us after the change in state.

#### SETUP MENU:

From the MODE menu press the down arrow to show the SELECT menu item. Press Select.

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].

Type – Press Select to select the type of encoder to be tested.

#### Incremental Type:

PPR – 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 counts per revolution screen or pressing the up arrow in the DRO mode with the correct counts showing (usually one full revolution).

Alarm bit (BIT6) – Bit 6 is reserved for an alarm bit. Press select to toggle between NO (no alarm), POS (voltage at BIT6 is 5V), and NEG (voltage a BIT6 is 0V)

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

### **Absolute type:**

Press Select on the MODE menu to start the query of the absolute encoder.

### **SETUP MENU:**

From the MODE menu press the down arrow to show the SELECT menu item. Press Select.

Type – Press Select to select the type of encoder to be tested.

Grey Code – Press Select to toggle between Yes and No. When Grey Code is set to Yes, the information returned from the encoder will be converted to binary before being displayed.

ABS bits – Press Select to select from 1 to 10 bits

ABS Type – Press Select to select from:

Bits – Show the value in binary

Decimal – Show the value in decimal form

Hexadecimal – Show the value in hex form

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

### **SSI type:**

Press Select on the MODE menu to start the query of the SSI encoder.

### **SETUP MENU:**

From the MODE menu press the down arrow to show the SELECT menu item. Press Select.

Type – Press Select to select the type of encoder to be tested.

Grey Code – Press Select to toggle between Yes and No. When Grey Code is set to Yes, the information returned from the encoder will be converted to binary before being displayed.

SSI bits – Press Select to edit the number of SSI bits (12 to 64 bits) to be read. See Editing a Value.

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

### **DeviceNET type:**

When the baud rate is set correctly, the UEC+ will wait on the DeviceNet encoder and after connecting, show the absolute value on the screen.

## **SETUP MENU:**

From the MODE menu press the down arrow to show the SELECT menu item. Press Select.

Type – Press Select to select the type of encoder to be tested.

Baud – Press Select to select the baud rate of the encoder. Note: if the baud rate is set incorrectly, the UEC+ will automatically (after about 5 seconds) restart with the selection of baud rate. When the baud rate is set correctly, the screen will show the absolute value of the encoder. The baud rate in the setup menu will be set to the current baud rate when the UEC+ changes the baud rate.

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

To edit a number (PPR, SSI bits, ABS bits), press select to select the digit to change. Press the up and down arrows to change the digit. Press down when the cursor is on DONE to save the changes.