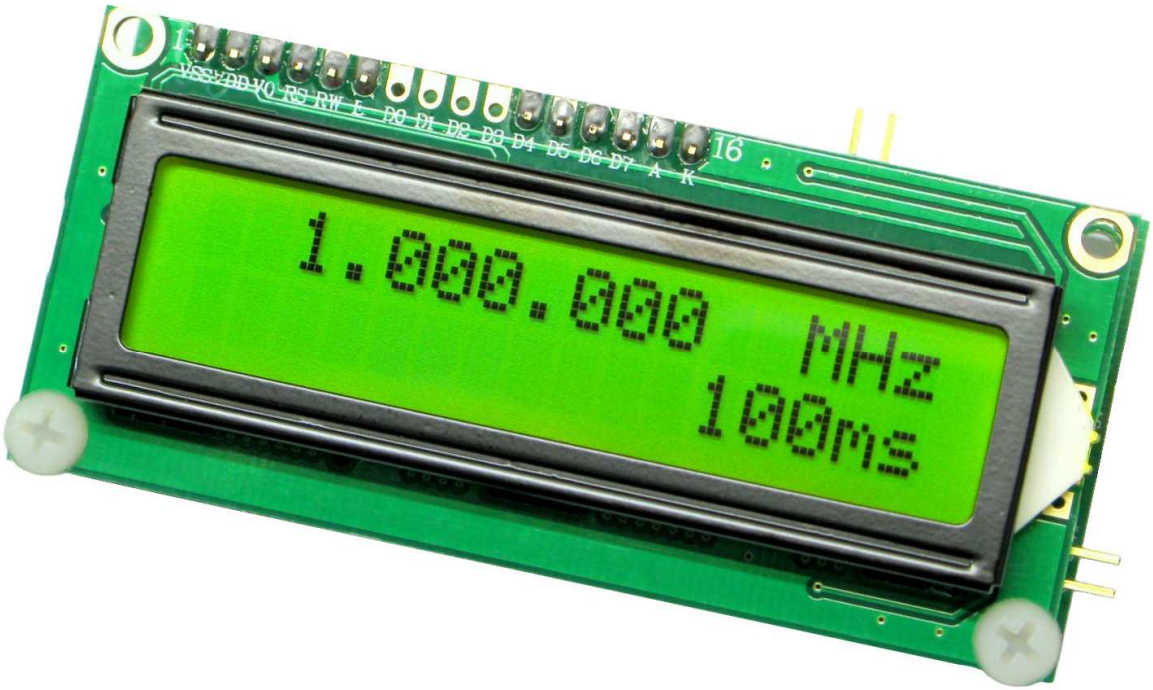
Frequency Counter DIY Kit

Ver.3.00

with prescaler option



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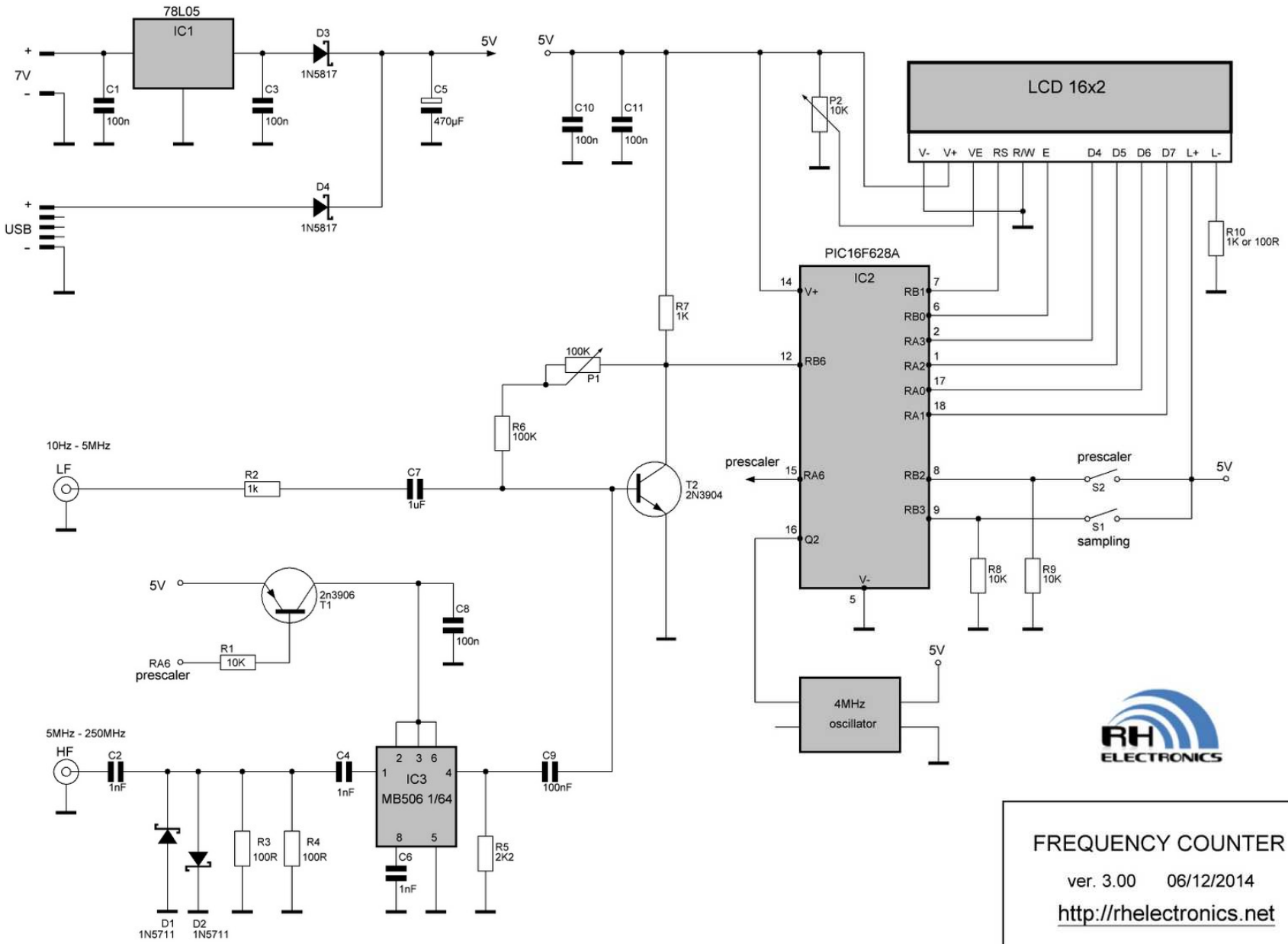
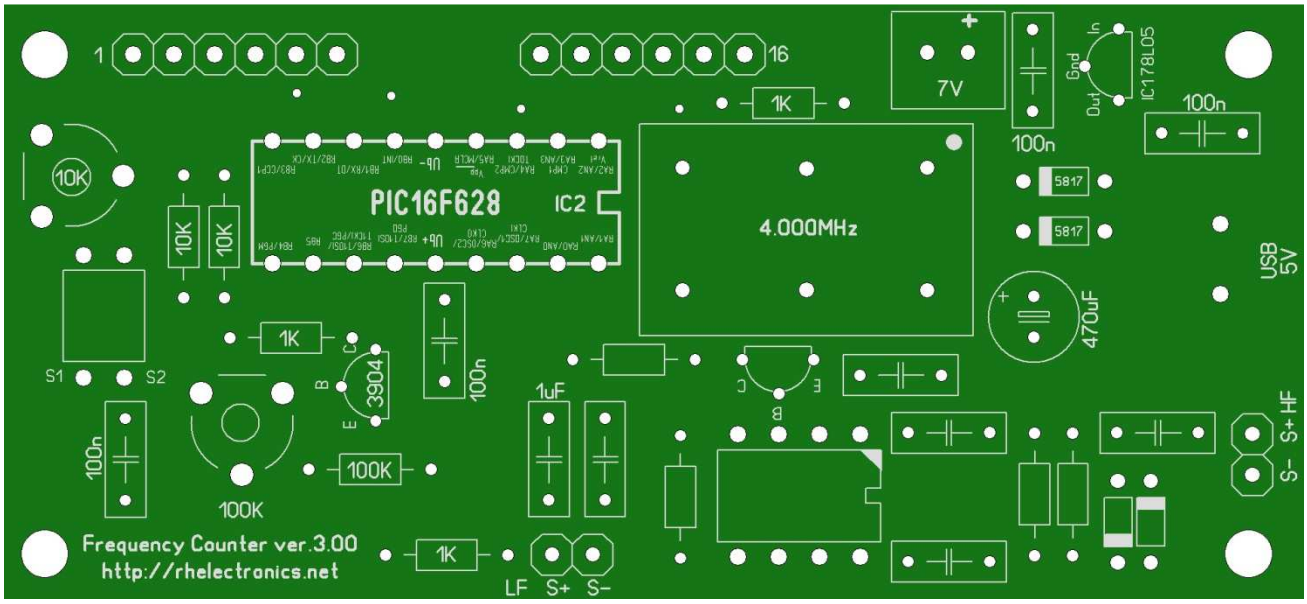

78L05
IC1
7V
C1
100n
C3
100n
D3
1N5817
5V
C5
470µF
USB
D4
1N5817
C10
100n
C11
100n
P2
10K
LCD 16x2
V- V+ VE RS R/W E D4 D5 D6 D7 L+ L-
R10
1K or 100R
PIC16F628A
IC2
R7
1K
100K
P1
R6
100K
RB6
RB1
RB0
RA3
RA2
RA0
RA1
10Hz - 5MHz
LF
R2
1k
C7
1uF
T2
2N3904
prescaler
RA6
RB2
RB3
Q2
V-
S2
S1
sampling
R8
10K
R9
10K
5V
2n3906
T1
C8
100n
R1
10K
RA6
prescaler
4MHz
oscillator
5MHz - 250MHz
HF
C2
1nF
C4
1nF
IC3
MB506 1/64
C9
100nF
R3
100R
R4
100R
C6
1nF
R5
2K2
D1
1N5711
D2
1N5711
RH
ELECTRONICS
FREQUENCY COUNTER
ver. 3.00 06/12/2014
http://rhelectronics.net

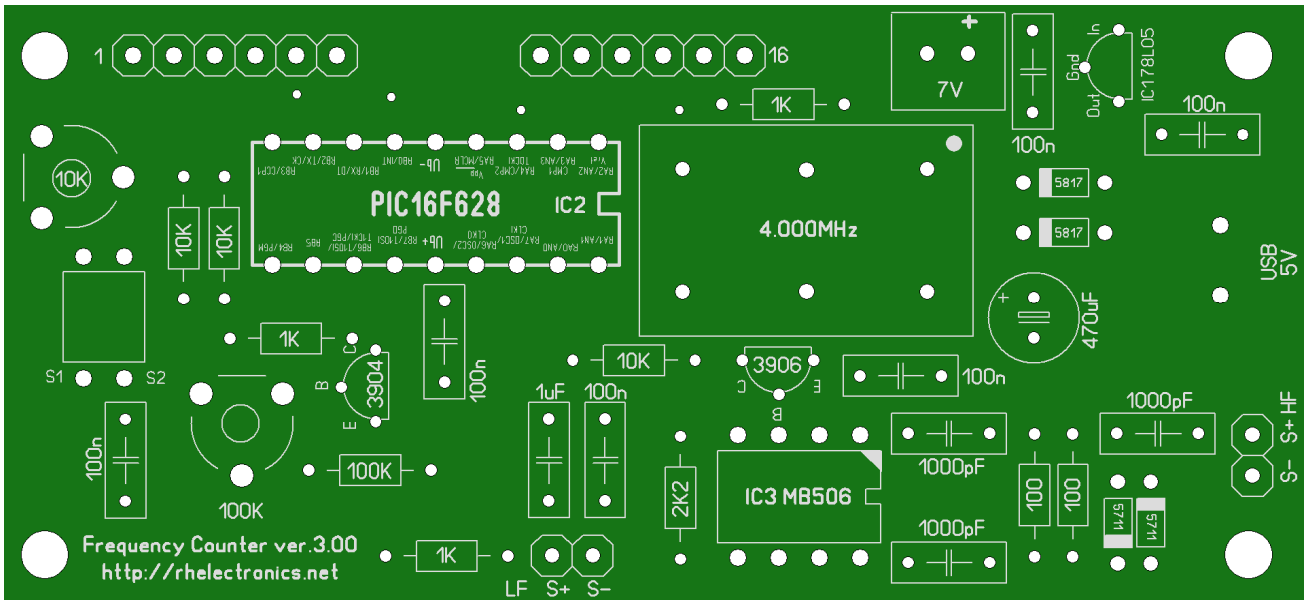
Economy Package 10Hz – 5Mhz Frequency Counter:

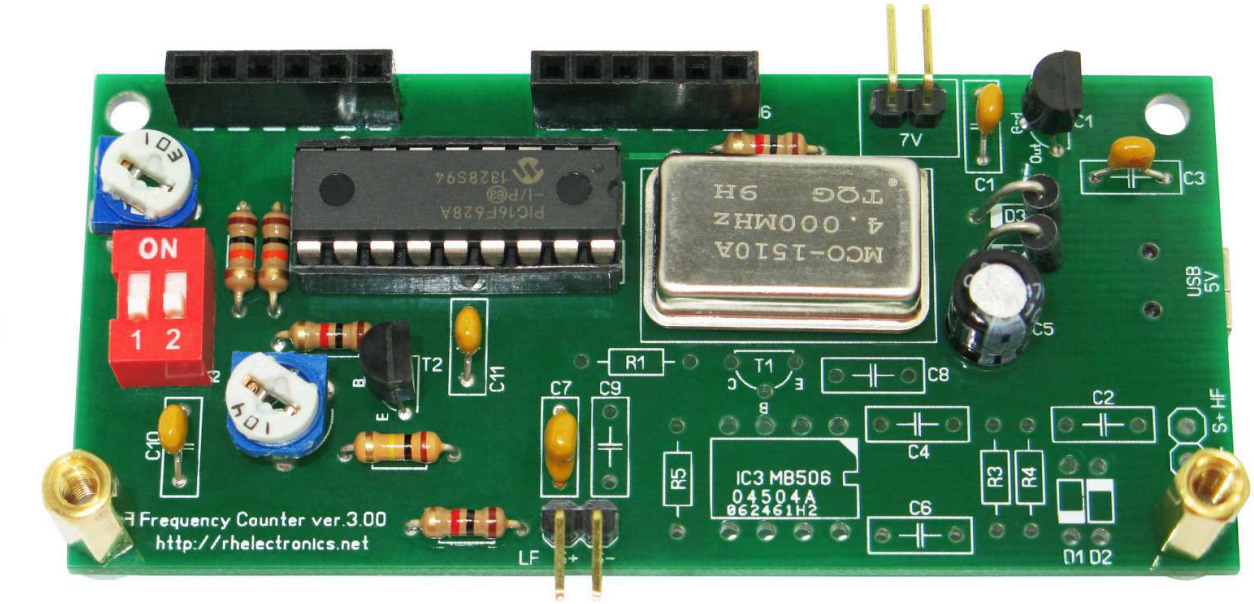
Component	Quantity	Value	Description	Note
R8, R9	2	10K	1/4W Axial Resistor	Carbon Film 5%
R2, R7, R10	3	1K	1/4W Axial Resistor	Carbon Film 5%
R6	1	100K	1/4W Axial Resistor	Carbon Film 5%
P1	1	10K (103)	6mm Trimmer	LCD Contrast
P2	1	100K (104)	6mm Trimmer	T2 Biasing
C1, C3, C10, C11	4	100nF	Multilayer Ceramic	Marking 104
C7	1	1uF	Multilayer Ceramic	Marking 105
C5	1	470uF	Electrolytic	has polarity!
D3, D4	2	1n5817	Schottky Diodes	has polarity!
S1, S2	1	DIP Switch	2 Position	Sampling/Prescaler
OSCILLATOR	1	4.000Mhz	Oscillator 5V TTL	Full or Half size
IC Socket 18 Pin	1	18 Pin	Socket	has polarity!
USB Socket	1	5 Pin	SMD Mini USB 5 Pin	SMD
6 Pin Female	2	6 Pin	Female Socket	LCD Connector
6 Pin Male	2	6 Pin	Male Pins	LCD Connector
4 Pin Male	1	4 Pin	Male Pins Right Angle	Signal / Power Connector
Standoff	2	M3 x 11	Standoff	LCD Connector
Screw	4	M3 x 6	Screw	LCD Connector
T2	1	2N3904 TO-92	NPN Transistor	has polarity!
78L05	1	78L05 TO-92	IC1 5V Regulator	has polarity!
PIC16F628A	1	PIC16F628A DIP	IC2 Microprocessor	has polarity!
PCB	1	81 x 37 mm	PCB	PCB



Full Package 10Hz – 250MHz Frequency Counter:

Component	Quantity	Value	Description	Note
R1, R8, R9	3	10K	1/4W Axial Resistor	Carbon Film 5%
R2, R7, R10	3	1K	1/4W Axial Resistor	Carbon Film 5%
R3, R4	2	100R	1/4W Axial Resistor	Carbon Film 5%
R5	1	2K2	1/4W Axial Resistor	Carbon Film 5%
R6	1	100K	1/4W Axial Resistor	Carbon Film 5%
P1	1	10K (103)	6mm Trimmer	LCD Contrast
P2	1	100K (104)	6mm Trimmer	T2 Biasing
C1, C3, C8, C9, C10, C11	6	100nF	Multilayer Ceramic	Marking 104
C2, C4, C6	3	1000pF	Multilayer Ceramic	Marking 102
C7	1	1uF	Multilayer Ceramic	Marking 105
C5	1	470uF	Electrolytic	has polarity!
D1, D2	2	1n5711	Schottky Diodes	has polarity!
D3, D4	2	1n5817	Schottky Diodes	has polarity!
S1, S2	1	DIP Switch	2 Position	Sampling/Prescaler
OSCILLATOR	1	4.000Mhz	Oscillator 5V TTL	Full or Half size
IC Socket 18 Pin	1	18 Pin	Socket	has polarity!
IC Socket 8 Pin	1	8 Pin	Socket	has polarity!
USB Socket	1	5 Pin	SMD Mini USB 5 Pin	SMD
6 Pin Female	2	6 Pin	Female Socket	LCD Connector
6 Pin Male	2	6 Pin	Male Pins	LCD Connector
6 Pin Male	1	6 Pin	Male Pins Right Angle	Signal / Power Connector
Standoff	2	M3 x 11	Standoff	LCD Connector
Screw	4	M3 x 6	Screw	LCD Connector
T1	1	2N3906 TO-92	PNP Transistor	has polarity!
T2	1	2N3904 TO-92	NPN Transistor	has polarity!
78L05	1	78L05 TO-92	IC1 5V Regulator	has polarity!
PIC16F628A	1	PIC16F628A DIP	IC2 Microprocessor	has polarity!
MB506	1	MB506 DIP	IC3 Prescaler	has polarity!
PCB	1	81 x 37 mm	PCB	PCB





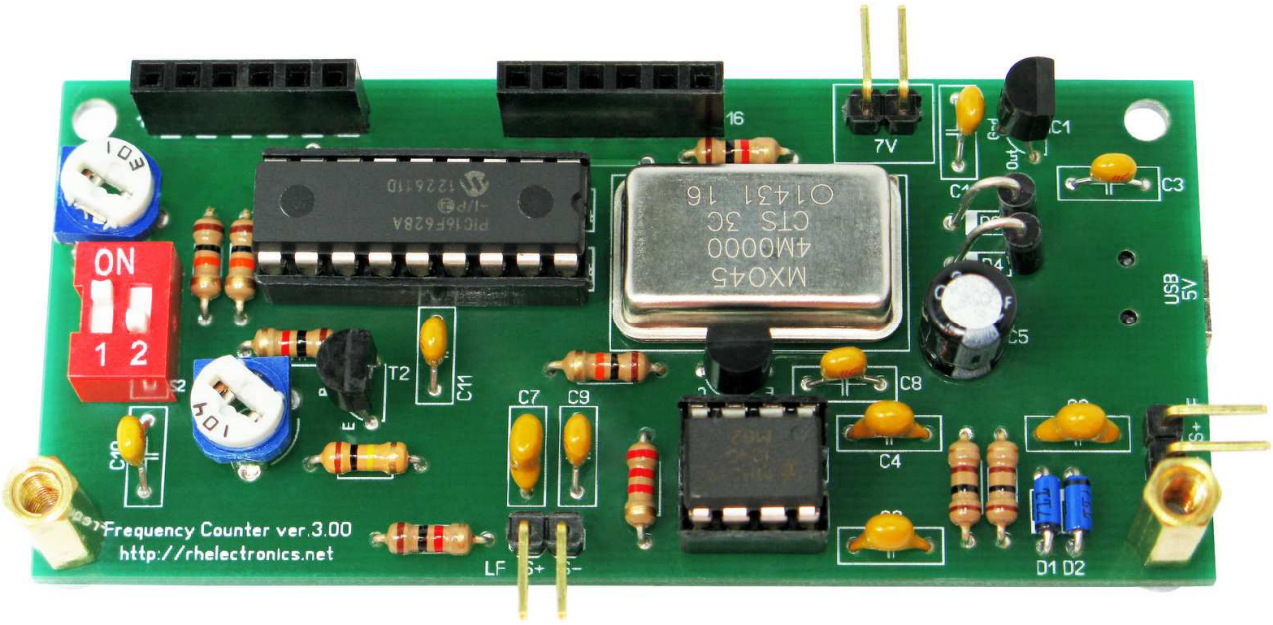
Technical specifications for Economy Package 5MHz Counter:

- Low Frequency Input “LF” 10Hz – 5MHz
- Sampling 1000ms or 100ms
- Resolution for 1000ms – 1Hz
- Resolution for 100ms – 80Hz
- Input impedance 1K
- Accuracy 1%
- Power consumption 10mA

Sampling and Prescaler settings:

1000ms for 0Hz-100KHz prescaler OFF use LF input

100ms for 100KHz-5MHz prescaler OFF use LF input



Technical specifications for Full package 250MHz Counter:

- Low Frequency Input “LF” 10Hz – 5MHz
- High Frequency Input “HF” 5MHz – 250MHz
- Prescaler MB506 1/64
- Sampling 1000ms or 100ms
- Resolution for 1000ms – 1Hz
- Resolution for 100ms – 80Hz
- Input impedance on HF 50 ohm
- Input impedance on LF 1K
- Accuracy 1%
- Power consumption 30mA

Sampling and Prescaler settings:

1000ms for 0Hz-100KHz prescaler OFF use LF input

100ms for 100KHz-5MHz prescaler OFF use LF input

1000ms for 5MHz-16MHz prescaler ON use HF input

100ms for 16MHz-250MHz prescaler ON use HF input

HF input notes.

MB506 prescaler has 50 ohm input impedance and the HF input is very sensitive for weak signals. With MB506 you can measure weak radio signals. When input is not connected, the prescaler will pick up radio frequency signals from your environment and LCD may display some values between 50Mhz-500MHz

LF input notes.

Low frequency input has good accuracy for signals up to 5MHz with minimum amplitude of 1V peak-to-peak. Economy package counter can count more than 5MHz on LF input, even 10MHz, but the accuracy is reduced.

Add the LCD:

The kit supports 16x2 HD44780 compatible LCD Display. Both packages, Economy or Full, **does not includes the LCD module** by default. You can add a LCD from our stock or supply your own. If you select "White on Blue" color LCD then it requrie 100 ohm backlight resistor instead of 1K resistor. We include 100 ohm resistor for Blue Color LCD. **Be sure you install 1K ohm for Green or 100 Ohm for Blue color LCD!**

To install the LCD use 6 pin female and 6 pin male connectors. Screws and Standoffs can fix the LCD module over the board.

P2 trimmer potentiometer intended to adjust LCD contrast. R10 control LCD backlight current and default value is 1K for Green color LCD. To increase the backlight LED current you can decrease R10 down to 100 ohm if you use Blue color LCD.

Kit Calibration:

If the board was soldered correctly then you need to adjust P2 LCD contrast and set T2 biasing with P1.

1. To set LCD contrast trim P2 10K it until you can read the values on the display.
2. To set right T1 biasing trim P1 100K until you can read 2.00V-2.50V DC on transistor collector. In some cases you'll need to modify R6 value, but it very rare.

Important Notes:

The parts are hard to unsolder! That's why check each component value and polarity before you install it. Use electrical circuit, PCB silkscreen and installation diagram from the manual.

After you finish the soldering, wash the PCB with isoprophyl alcohol or flux remover spray. Remember, clean and accurate soldering mean less technical issue later!

If you purchased the "Full Package up to 250MHz" then you have to use coaxial cable connection with BCN socket for HF input. HF and VHF are very sensitive to excess capacitance or inductance load. Make all cables connection as short as possible.

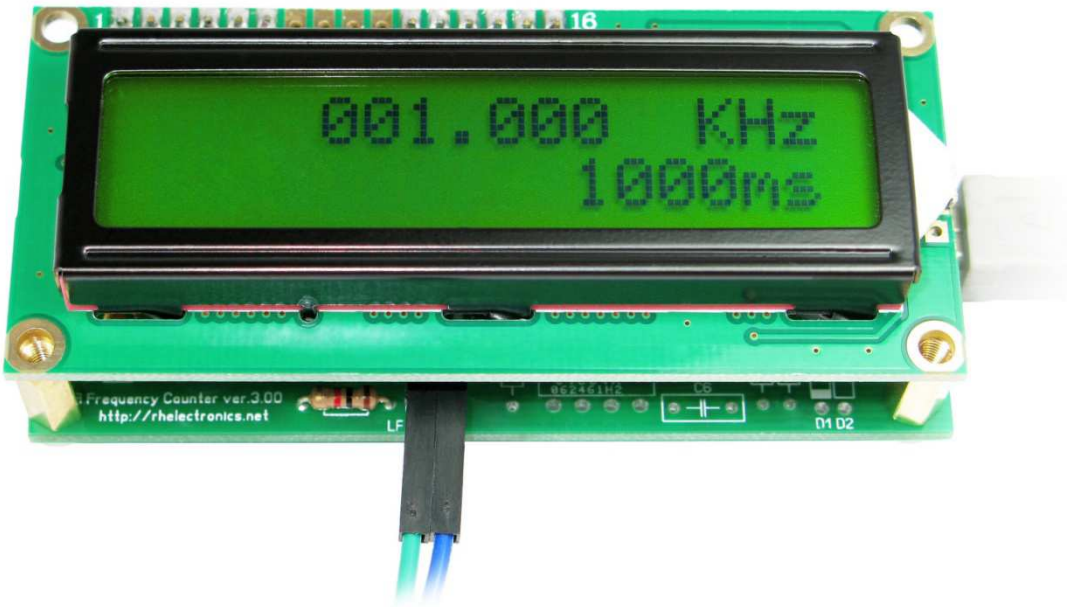
USB socket soldering tips:

The kit is easy to solder, expect one SMD USB connector! It's recommended to hold the PCB with "third hand" tool before you start with USB socket soldering. Place the socket correctly on the board surface and check that all 5 contacts are not displaced. Fix the socket with finger and apply solder on one of the contacts. Then you can solder all other points. Use solder wick (desoldering braid) to remove exceed solder between the contacts. Rosin flux may help if something is not soldered well. **Check every socket contact with multimeter short circuit test before you connect the board to the computer USB!**

Source code:

http://www.rhelectronics.net/download/freq/frequency_source_mikroe.zip

Microcontroller program written in mikrobasic compiler. The kit has open source code for education purpose. Because the code size is less than 2K you can use Mikroe Demo Basic Compiler for PIC to modify the program. The code provided as is with no technical support for its modifications. The controller sold pre-programmed and the software is compatible with both packages, economy and full.



Powering the kit:

Recommended to use power supply 5V DC with stable 100mA output. You can use power supply **7V – 12V DC** or computer **USB 5V**. If you use prescaler, and your power source is weak, then prescaler will not work! Prescaler IC consumes about 20mA that's overload the low current DC source such as 9V battery.

If you want to use battery then it suggested for **lithium 7.2V** type connected to 78L05 input. **9V battery it's not recommended if you use 1/64 prescaler.** Prescaler IC overloads the low current 9V battery.

LCD backlight LED is also current hungry element. The kit has 1K R10 backlight resistor that's balanced between smallest LED current and good backlight visibility.

Selecting sampling period:

Use DIP switch #1 S1 to select between 1000ms or 100ms sampling period. Sampling switch can be replaced with external button. Sampling can be changed on fly.

Activating 1/64 Prescaler (for full package only):

Use DIP switch #2 S2 to activate 1/64 prescaler IC. Set prescaler before you powering the board. Prescaler DIP switch can be replaced with external button.

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