

Updated Parts Lists With comments on part choices and loop recommendations, Feb 2017

With Digikey Part Numbers, for direct import to DigiKey Bill Of Materials list

Copy & paste the *quantity,part nos* like 5,221KXBK-ND into *Create New Parts List/Text File Import*  
 Note that you must change your edit/highlight selection mode from *Standard* to *Block Area* to do this.

Note that the “hard to find” parts such as the DVM, varactor diode, and trimmer cap that you might purchase with the PC board are also listed here. Also, Digikey stock is a moving target.

QTY, PART NUMBER	DESCRIPTION	RECEIVER PARTS LIST
5,27KQBK-ND	27K 5%	R39
5,220KQBK-ND	220K 5%	R29,R40
10,1.00MXBK-ND	1M 1%	R3,R4,R25,R27,R20A,R20B,R52,R52A
1,3006P-502LF-ND	5K TRIMMER	R5 (MULTI-TURN)
5,47.5KXBK-ND	47.5K 1%	R6,R7
5,10.0KXBK-ND	10K 1%	R8,R12,R17,R18
5,2.2KQBK-ND	2.2K 5%	R33,R41
10,100KXBK-ND	100K 1%	R10,R11,R24,R47-R50,R201
5,100KQBK-ND	100K 5%	R14,R28,R43,R44,R54
5,1.87KXBK-ND	1.87K 1%	R15,R45
5,715KXBK-ND	715K 1%	R16,R46
5,10KQBK-ND	10K 5%	R13,R31,R35,R53
5,5.6KQBK-ND	5.6K 5%	R19
5,20.0KXBK-ND	20K 1%	R21
5,200XBK-ND	200 1%	R55
5,2.21KXBK-ND	2.21K 1%	R23,R26,R202
5,1.0KQBK-ND	1K 5%	R30,R37
5,1.00KXBK-ND	1K 1%	R204
1,3362U-102LF-ND	1K TRIMMER	R42
5,9.1MQBK-ND	9.1M 5%	R32
5,10QBK-ND	10 5%	R36
5,4.7MQBK-ND	4.7M 5%	R51A,R51B
2,BC1098CT-ND	.033UF CER	C1,C2
6,495-2470-ND	1UF FILM	C3,C4,C21A,C21B,C22,C40
4,BC1095CT-ND	.01UF CER	C6,C7,C8,C39
10,490-8814-ND	0.1UF CER	C14,C17,C25,C30,C31,C32,C37,C38,C42,C202
4,478-1839-ND	10UF 16V TANT	C9,C15,C16,C28(CAN BE CHEAPER CERAMIC)
1,BC1025CT-ND	1000PF CER COG	C13
3,490-8646-ND	150PF CER COG	C18,C201,C203
1,SG9033-ND	10-50PF TRIMMER	C19
1,490-8700-ND	56PF CER COG	C20
1,478-1868-ND	2.2UF 16V TANT	C23 (CAN BE CHEAPER CERAMIC)
1,BC1099CT-ND	.047UF CER	C24
2,478-1833-ND	1UF 20V TANT	C5,C26 (CAN BE CHEAPER CERAMIC)
1,478-1887-ND	3.3UF 16V TANT	C27 ( “ “ )
1,P5138-ND	100UF 16V	C29
2,160-1139-ND	LED 3mm RED	D1,D6
1,160-1142-ND	LED 3mm GREEN	D7
1,1N4001-TPMSCT-ND	1A 50V DIODE	D2
3,1N4148FS-ND	1N4148 DIODE	D3,D4,D5
1,LF356N/NOPB-ND	LF356 OP-AMP	U0
2,LF412CN/NOPB-ND	LF412 OP-AMP	U1,U2

4,LF442CN/NOPB-ND            LF442 OP-AMP    U3,U4,U8,U11 (LF412 IS DIRECT SUBSTITUTE  
BUT DRAWS MORE IDLE CURRENT)

QTY, PART NUMBER	DESCRIPTION	
2,296-14128-5-ND	QUAD X-OR GATE (4070)	U7
1,LM386N/NOPB-ND	LM386 1W AUDIO AMP	U9
1,X049-ND	3.57MHZ CRYSTAL	X1
8,AE9986-ND	8-PIN DIP SOCKET	
1,AE9992-ND	16-PIN DIP SOCKET	
1,ARFX1119-ND	BNC PLUG, RG-58	(FOR LOOP)
1,A24530-ND	BNC PANEL JACK, INSULATED	(LOOP INPUT)
4,2210K-ND	0.5" STANDOFF 6-32 SCREW	(Use metric if desired)
1,987-1723-ND	100K LINEAR POT (10-turn pot not needed)	R22
1,987-1311-ND	5K LINEAR POT (10 turn pot not needed)	R9
1,296-2036-5-ND	QUAD BILATERAL CMOS SWITCH (4016)	U5
1,296-2060-5-ND	OSC-DIVIDER CMOS (4060)	U6
2,AE9989-ND	14-PIN DIP SOCKET	
2,EG2350-ND	SPDT SWITCH	S3,S6
1,EG2398-ND	DPDT SWITCH	S1
3,450-1736-ND	1/4" KNOB	
1,987-1739-ND	10K AUDIO TAPER POT & SWITCH	R34,S2
1	1/8" or 1/4" mono or stereo panel phone jack	P1
1,497-7274-ND	9V POSITIVE 100MA REGULATOR U12	(FOR DVM, IF NEEDED)
1,HM322-ND	GRAY ALUMINUM BOX 5 X4 X 3 INCHES HIGH	
4,2213K-ND	STANDOFF, 6-32 THREAD, 1.5 INCHES LONG	(Use metric if desired)
2,1295K-ND	9V BATTERY HOLDER	(IF USED)
1,497-1196-1-ND	12V 100ma positive regulator	(FOR RCVR WITH TWO 9V BATTERIES)

Only purchase the following 2 items if you want the alarm capability (which I seldom use)

1,EG2350-ND	SPDT switch for alarm	S4
1,102-1636-ND	piezo buzzer 2800Hz 3-28VDC	

Purchase the following 2 items only if you want the slow meter capability (which I never use any more)

1,EG2350-ND	SPDT switch for slow meter	S5
1,EF1475-ND	4.7uf film cap for slow meter	C41

There are two types of receiver boxes available. The original sheet aluminum box is available from DigiKey and is listed above. I have purchased (and highly recommend!) a nice cast aluminum box for the newest receivers. The only source I have found for the cast box in the USA is at <http://www.mpja.com>, part 16288-BX. The outside dimensions (in inches) are 5.51 x 3.94 x 2.95. It may be available in Europe. Hammond Company may make a cast box that will work.

The plastic LED mount is no longer available at DigiKey. Just insert each LED in a 3mm hole in the panel, and hold them in place with silicone rubber or other glue.

If a shorter standoff is used for the main circuit board, then the 9V batteries can be installed inside sheet metal box if desired. In this case, delete the 1.5 inch standoffs above and substitute these 1.25" standoffs: 4,36-1818-ND 1.25 inch 6-32 standoff

It is possible to replace the two 9V batteries with five (5) CR123A lithium primary cells, mounted inside the cast aluminum box. The cells and holders are on Ebay. Buy holders with wire leads, put

duct tape under them, and a foam pad above to help hold them in place. If this is done, delete the 9V battery holder above. Also delete the 12V regulator above and replace it with the 10V regulator here: 78L10 10V 100ma positive regulator. I have a few for sale at \$0.50 each.

My source for the digital panel meter was also mpja.com, but they no longer sell it. I looked on the internet and found several sellers. Ebay might have it. The part number is PM-128 or PM-128A. These require the 9V regulator listed above. Note that these meters have a high input impedance and require R51 to be 4.7Meg and R52 to be 2Meg. There is a different version, PM-128E that will work on 9-10V or 5VDC. It is wired differently internally. This meter has a lower 1Meg input impedance, so R52 is deleted and R51 is changed to two 4.7Meg resistors in parallel. I have recently built 2 lithium battery "Antarctic" receivers using the PM-128E, powered directly from the 10V regulator which work fine. I have a few PM128-E meters for sale for \$10.00. Circuitspecialists.com has them for \$7.86 each plus tax and shipping. Any 200mV meter will likely work. There are other panel meter available, most of which work on 5VDC. Do NOT use LED meters, which draw a crazy amount of power! A 5V regulator (78L05) would replace the 9V regulator.

The variable capacitance diode V1 is not available at DigiKey. Search the internet for the 1N5470 or the NTE-614 or the MV2109G. The approximate spec is 33pf capacitance at ~4VDC reverse voltage. This diode has been hard to find for many years but is still out there. I have a few MV2109 diodes for sale at \$1.00 each.

The receiving loop is just a simple high-impedance parallel tuned circuit tuned to 3496Hz. If doing your own design I recommend aiming for at least 100k Ohms at resonance so that the loop's thermal noise will overcome the electronic noise of the receiver. For good performance, I recommend something similar to the 22 inch (0.56 meters) diameter loop I use. It has 512 turns of #28 wire, which weighs about 2 lbs (~0.9kg). The wire is not available at DigiKey. Ebay is a good source. The turns are tightly wrapped in a bundle with tape. My inductance was roughly 432mh, which requires roughly 4600pf capacitance to resonate. The loop must be held flat in a rigid frame, or wound on a rigid form of wood or plastic, and must have a bubble level to show when it is precisely vertical. I recommend using 600V rated capacitors because hundreds of volts could be induced in the loop if it is accidentally placed very close to a beacon. I have used silver micas, but the larger values are now very expensive. Polypropylene capacitors and also variable mica or air variables can be used in any combination. I have listed an assortment here for my 22 inch loop, but you may want more or different values for another loop. Note that these capacitors can also be used to fine-tune the beacon transmit loop.

1,P10502-ND	3900PF POLYPROPYLENE	1.8KV
1,P10476-ND	3300PF	1.25KV
1,P10499-ND	2200PF	1.8KV
1,P10497-ND	1500PF	"
2,P10495-ND	1000PF	"
2,399-12616-ND	470PF	"
5,399-12614-ND	100PF	"

## LATEST CLASS-E BEACON TRANSMITTER AND LOOP PARTS LIST

NOTE: Several parts used in this beacon are identical to parts used in the receiver. They are listed separately here for those who are building just a beacon. They are not included in the quantities listed above for the receiver. **The PC board, toroid T1 and it's wire, are part of the "kit" and not listed here.**

5,100KQBK-ND	100K 5% RES	R1
5,1.0MQBK-ND	1M 5% RES	R3
1,P10285-ND	2200UF 25V ELECTROLYTIC	C5
1,BC2076-ND	1UF 63V POLYPROPYLENE CAP	C6
1,495-1281-ND	.0047 250V " "	C7
10,490-8814-ND	0.1UF CER	C8
1,SG9033-ND	10-50PF TRIMMER C11 (ADJUST FREQ AND REPLACE WITH A FIXED VALUE FOR LONG-TERM FREQ STABILITY)	
1,C317C240J5G5TA-ND	27PF COG/NPO CER C11 IF BUILDING AND USING ONLY ONE BEACON, DELETE THE TRIMMER AND INSTALL THIS CAP INSTEAD.	
1,490-8678-ND	33PF COG/NPO CER	C12
1,SB560-E3/54GICT-ND	5A 30V SCHOTTKY DIODE	D1
2,1N4148FS-ND	1N4148 DIODE	D2,D4
1,160-1142-ND	GREEN LED	D3
1,RUEF160HF-ND	1.6A POLYFUSE	F1
1,IRLIZ44NPBF-ND	MOSFET RON=0.22 OHMS, 55V, 30A, INSULATED TAB	Q1
1,296-2060-5-ND	5V OSC-DIVIDER IC	U1
1,MC78L05BP-APMSCT-ND	5V 100MA REGULATOR	U2
1,X049-ND	3.579545MHZ CRYSTAL	X1
1,AE9992-ND	16-PIN DIP SOCKET	
4,2210K-ND	0.5" STANDOFF 6-32 SCREW (Change to metric if desired)	

For first-time builders, I strongly recommend **NOT** trying to construct a ferrite beacon loop. There are many problems encountered in getting ferrite loops to work including de-tuning during transmit and shifts in tuning with temperature changes.

I highly recommend constructing a simple beacon loop such as the 22 inch (0.56m) diameter loop listed in the table at the bottom of the page:

[http://radiolocation.tripod.com/NewDQandBeaconFiles/2008DQboards/NotesOnThe2008\\_DQReceiverBoards.html](http://radiolocation.tripod.com/NewDQandBeaconFiles/2008DQboards/NotesOnThe2008_DQReceiverBoards.html) and shown in the photo with blue wire. It does require a bubble level on a string to level.

This loop is simply 37 turns of #12 (2mm diameter) solid conductor (not stranded) house wire (about 2.6kg) wound over a 0.56m diameter form, then bundled with tie wraps to form a rigid loop without a form. Mine required 1.138uf capacitance to resonate, and ran 0.55 Amps at 12.7V with a 15 turn link on the toroid. You should be able to purchase the wire locally. A tuning capacitor assortment (for the C1-C4 slots) is listed here:

1,P12232-ND	1.0UF POLYPROPYLENE 400V
1,P12229-ND	0.75UF " "
1,493-3643-ND	0.47UF " "

4,P12092-ND	0.1UF	“
5,493-3593-ND	.01UF	“

For the longest range, the 4 ft 4 inch (1.32m) diameter beacon loop (or similar) is the best, and is light weight and folds compactly. It does take a long time to set up.