80 m ARDF Peilempfänger
PRX80PRO Version 1.1

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80 m Peilempfänger PRX 80 PRO de DL3BBX

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Foreword:

Based on the concept of the 80-m-receiver PRX 80 from DF7XU, D. Schwider, the PRX 80 PRO was developed. The technical concept of this was retained, but the current sinking logic has been fundamentally over-worked. For this reason an improvement of the receiving capacity and a more effective manual control was reached. The improvement refer to 4 essential points:

- HF-regulator
- NF-filter
- NF-power amplifier
- layout of printed circuit board

Description of circuit:

The regulation of the integrated pre amplifier and the IF-amplifier will be made separately to get a better linearization of the standard characteristic, which is different from the concept before. Thereby the appraisal of the field strength is more exactly possible and therewith the distance to the receiver beacon by means of the position of the HF-regulator. The standard perimeter is 85dB minimum. To improve the receiver capacity there was a optimized NF-filter between the outgoing of the ZF-amplifier and the input of the NF-amplifier inserted.
The NF-voltage for the power amplifier can be adapted on the input of the LM386 over the two resistance R28/R29; both resistance must reach together 50kOhm. The ground amplification of the LM386 can be more elevated per fitting of the resistors R21 from V = 20 - 200 trim. .

The transistor power amplifier with the relative small NF-amplification was compensated to a modern IC-circuit (LM386). This IC gives a high NF-capacity with small distortions and offers an excellent stability. In this way it is possible to obtain sufficient sound intensities in connection with insensitive headphones. To increase the stability there were measures of coupling of by R16/C26 taken through. The layout is developed totally new. With exception of C16 there are only used less inductive capacitors in a 2,54-mm-raster. Alternative for C16 a "styroflex" capacitor can be used, because ceramic capacitors with small TK are not always available. The capacitors C16 and C17 are responsible for the stability of temperature of the oscillator and because of this they should be of type np0 (ground color gray, black point). Parallel to C16 is also C28 provided. This one will not be fit and it is only for OM`s, who like to experiment, and who want to make an exactly compensation of temperature. The trimmer C23 should be a ceramic type with low TK. As a rule only capacitors with values to 12pF requires these requirements. If necessary you must fall back upon foil trimmer, because these capacitors are not always available. Foil trimmer have a bad temperature progress and they are hygroscope. To get optimal receiving properties, the oscillator and circuit are parallel adjusted. The temperature coefficients for the capacitors of the circuit (C1, C2, C4, C22) have no worth mentioning influence to the resonance frequency, because of the band width of some kHz. In opposition to other receiver concepts

the assistance antenna is out of a small aluminum angle. The voltage there from the electric component of the EM-field will be the direction determination per switching on of the transistor amplifier T1 with the switch SW1 on the receiver input coupled, by which the antenna diagram change into a cardioide. That means it arises an unequivocal direction effect. According to the phase position of the supplied voltage of the E-field the signal will be louder or softer.

Assembly:

First of all you have to drive in the soldering nails K5-K11. Subsequent the component part, starting with the lowest, have to be equipped and soldered in, in any succession according to the equipment plan. Do not forget the two bridges!

Test:

After assembling, check if all component parts are on the designated positions soldered in with the right values (optical control). Pay attention to polarity at diodes. Please check the soldered positions, if they are orderly complexioned (optical control).

Assembly:

The assembly makes no problems because of the extensive mechanically preparation and is to make accordingly to the enclosed subscription. You must shorten the potentiometer axles according to the lengths of the delivered buttons. By no means clamp the cabinet of the potentiometers into the vise! Subsequent you have to assemble these, and make the connection to the circuitboard (K1-4, K12-18) with short cords on the solder side of the circuitboard according to the subscription. After insertion of the circuitboard into the cabinets, the ferrit and the assistance antenna have to connect into the accordingly solder pins (K5-K11). Therewith the receiver is ready to operate. The PRX 80 PRO is on by plugging in the headphones.

Control:

Check all connections if the allocation is right (optical control).

Start:

Plug in the headphone into the for that designated socket. In this way the receiver is turned on. Now you can hear a noise in the headphone.

Equalization:

adjustment before:
P1 (frequency adjustment) = left touch (lowest frequency)
P2 (HF-amplifying regulator) = right touch (maximum amplifying)
R21 = right touch (maximum amplifying).

With C23 you turn on the low frequency limit to 3.490 kHz. The higher frequency is then by 3.610 kHz. If you want the frequency to reach 3.800 kHz, you have to change the place where to switch the jumper. According to the ARDF-rules a transmitter sends between 3.500-3.600 kHz, this means the receiver should only be able to receive in this reach and the tuning will also be more sensitive. The adjustment of the frequency limit can happen with a suitable short-wave receiver through interception of the oscillator frequency.

Tip: if you cannot reach the low frequency limit of 3.490 kHz, you have to fit C28 with 10 pF!

The circuit (ferrit antenna) is to adjust to maximum sound volume by C22 of 3.580 kHz. To get this you have to use a measuring transmitter, which is coupled loose or a faint station. You can limit the maximum amplifying of the receiver by adjust regulator R21. This regulator will be adjusted on highest amplifying (right touch). For the exactly adjustment the in front of me / back relation must turned on R14. The correct equalization is only possible when the transmitter is about 200 m away. So there is becoming a compromise between near- and far bearings. For equalization hold the PRX 80 PRO so, that the operation elements show in direction to the transmitter. Turn on the receiving frequency exactly according to the transmitting frequency. Turn on HF-regulator on middle sound-volume, then switch on key SW1 and re-gulate min. sound-volume with R14. By this action the aluminum angle must not been touched.

The receiver PRX 80 PRO is now in action!

Partlist

Capacities

C1	33 pF	Kerko
C2	680 pF	Kerko
C3	100 nF	Kerko
C4	680 pF	Kerko
C5	100 nF	Kerko
C6	100 nF	Kerko
C7	100 nF	Kerko
C8	100 nF	Kerko
C9	100 nF	Kerko
C10	1 uF	Tantal
C11	1 uF	Tantal
C12	1 uF	Tantal
C13	100 nF	Kerko
C14	100 uF	Elko, radial
C15	270 pF	Styroflex
C16	39 pF	Kerko, np0
C17	100 nF	Kerko
C18	100 nF	Kerko
C19	100 nF	Kerko
C20	100 nF	Kerko
C21	100 nF	Kerko
C22	22 pF	Folientr. gr
C23	10 pF	Folientr. ye
C24	100 nF	Kerko
C25	100 uF	Elko,radial
C26	100 uF	Elko, radial
C27	10 uF	Elko, radial
C28	10 pF	show text
C29	4,7 nF	Kerko
C30	22 nF	Kerko
C31	10 nF	Kerko
C32	10 nF	Kerko
C33	3,9 nF	Kerko
C34	1 nF	Kerko

(C16 = Styroflex; down montage)

Resistors

R1	12 kOhm	
R2	220 kOhm	
R3	220 kOhm	
R4	12 kOhm	
R5	1,5 kOhm	
R6	220 kOhm	
R7	220 kOhm	
R8	82 Ohm	
R9	3,3 kOhm	
R10	3,3 kOhm	
R11	33 kOhm	
R12	4,7 kOhm	
R13	4,7 kOhm	
R14	25 kOhm	variable
R15	10 Ohm	
R16	10 Ohm	
R17	3,6 kOhm	
R18	2,2 kOhm	
R19	4,7 kOhm	
R20	2,2 kOhm	
R21	5 kOhm	variable
R22	3,9 kOhm	
R23	47 kOhm	
R24	1 kOhm	
R25	560 kOhm	
R26	12 kOhm	
R27	47 kOhm	
R28	3,3 kOhm	
R29	47 kOhm	

Dioden

D1	BB109 B (black/yellow)
D2	BB109 B (black/yellow)
D3	1N4148 (red/black)
D4	1N4148 (red/black)

Integrated Circuit

IC1	TCA440 (A244D)
IC2	78L05
IC3	LM386

Transistors

T1	BF254 (BF199)
T2	BC 547B

Other parts / components

OSC1	Oszillatorcoil
P1	10 kOhm, Potentiometer
P2	4,7 kOhm, Potentiometer
SW1	Minibutton, workkontakt

1 Spezialcase 140x60x32 mm
1 Ferritantenna, ready work
1 3,5 mm one whole mounting, open
1 Aluminiumangle
1 rotary knobs 22 mm
1 rotary knobs 18 mm
2 hold-clip 15 mm
2 protection-object 15 mm
1 Batterieclip für 9-V-Akku
4 distanz-roll 8 mm
4 sheet metal-screw 3 x 16 mm
1 Stiftleiste, 3-fach
1 Jumper
1 PZ16 precision-ic-socket
1 Print PRX 80 PRO, V 1.0

Final information:

- if the destination fixing reacts wrong, you have to exchange the connections K9 and K10 (red).

- if the bearings shows deficient sensitivity as well as no reaction of the front circle equalizer with C22 after a hard fall, so it is possible that the ferrit bar is broken. With an inductive measuring instrument you can make out a broken ferrit bar very soon. The inductivity of an intact ferrit bar is about 23,4 uH.

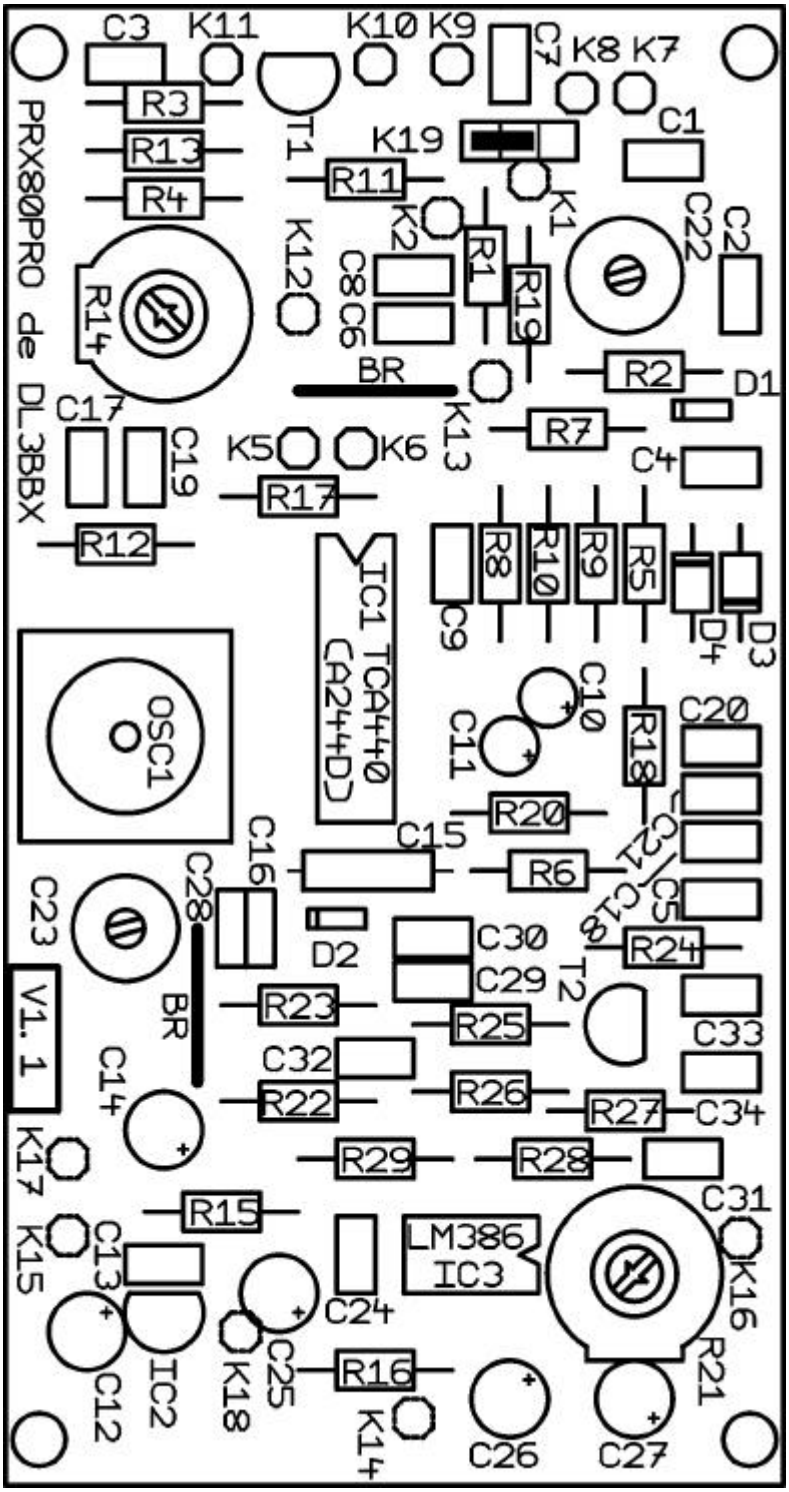
If the potentiometer causes a scratching noise while tuning, a drop of oil (for example Ballistol) can help.

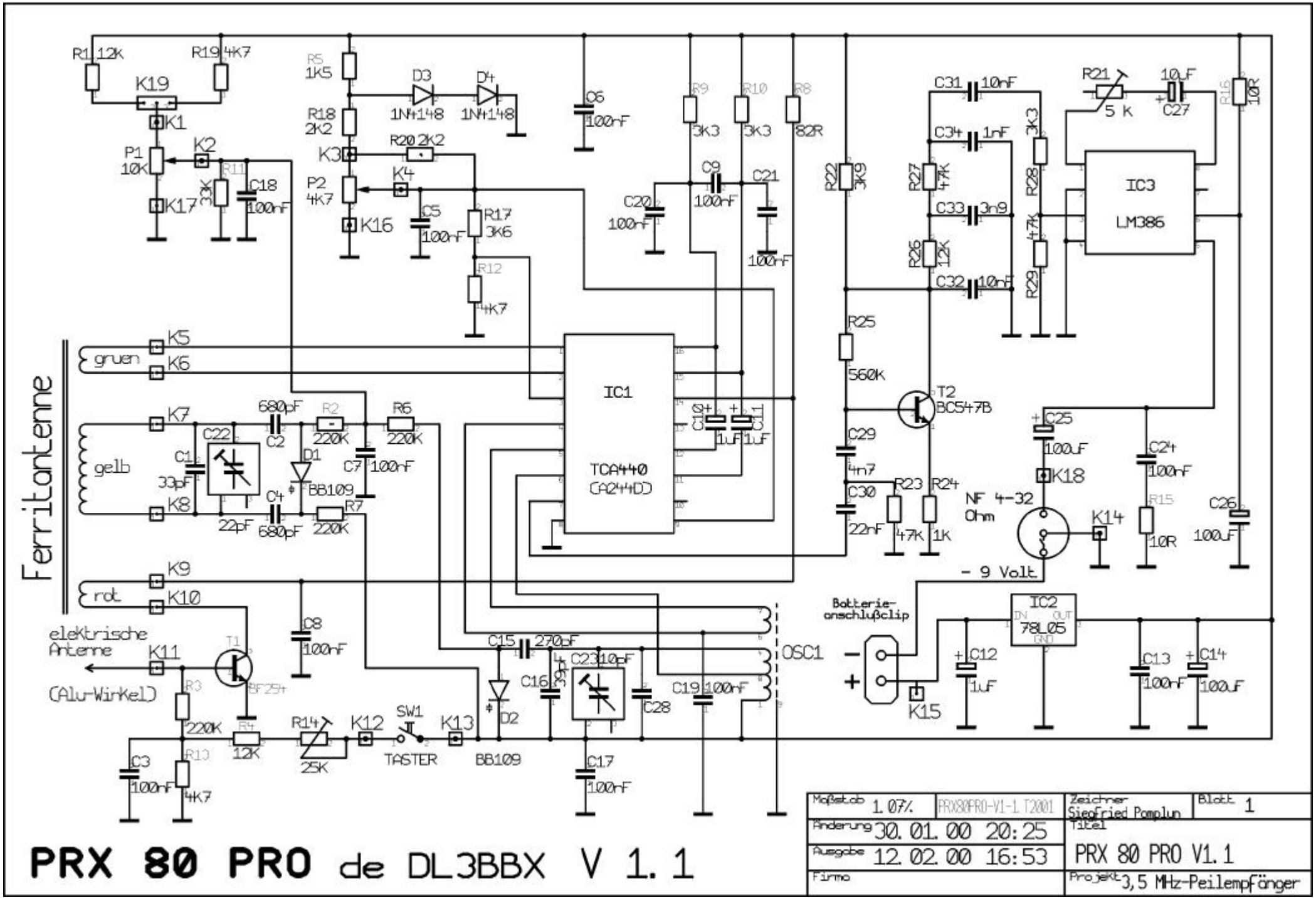
How to handle the PRX 80 PRO?

The frequency regulator has to be tuned according to the frequency of the transmitter. With the volume regulator you can find out a pleasant middle sound intensity. With a turn of 360 degrees you will have two directions, in which the received-signal is very weak (low signal). These both minimas are marked very strong and because of this they are clear to perceive. The both minimas form a straight line of the lengthening of the ferrit antenna. On this lengthening you will find the transmitter, which is beared of. The minimum bearing is ambiguous, because of this you have to find out now, on which side of the lengthening the transmitter is. For that you have to turn the receiver around 90 degrees (which means in right-angle) and press the small red-button on the left sight. If the signal stays the same sound intensity or turns louder the transmitter is right in front of the searcher. If the signal turns lower, the transmitter is behind the searcher. While side fixing you have to look on the front plate. And do not touch the aluminum angle. Now the searcher goes in the direction of the transmitter. Hereby he has to repeat the above explained bearing actions from time to time. As closer as the searcher comes to the transmitter the louder the sound in the headphones will be. For perfect bearings you have to adjust the sound intensity (HF-regulator) with the sound intensity regulator. When the sound intensity is tuned in correct you can hear the differences of the sound intensity very clear.

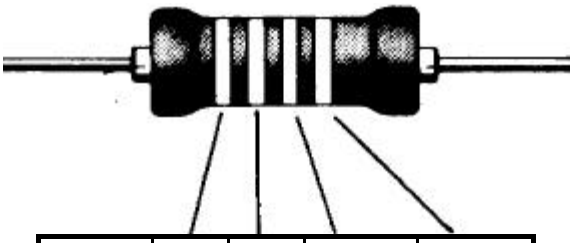
Bestückungsplan zum

PRX 80 PRO

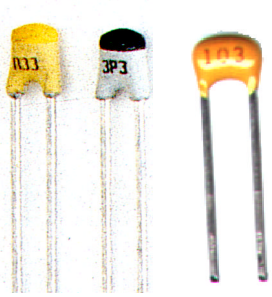



R1 12K
R19 4K7
K19
K1
K2
P1 10K
K17
R11 33K
C18 100nF
R5 1K5
D3 1N4148
D4 1N4148
R18 2K2
R20 2K2
K3
K4
P2 4K7
K16
C5 100nF
R17 3K6
R12 4K7
C6 100nF
R9 3K3
R10 3K3
R8 82R
C20 100nF
C9 100nF
C21 100nF
R22 3K9
C31 10nF
C34 1nF
R27 47K
C33 3n9
R26 12K
C32 10nF
R21 5 K
10uF
C27
R16 10R
R28 3K3
R29 47K
IC3
LM386
R25 560K
T2 BC547B
C29 4n7
C30 22nF
R23 47K
R24 1K
C25 100uF
K18
NF 4-32 Ohm
K14
C24 100nF
R15 10R
C26 100uF
- 9 Volt
K5
K6
gruen
K7
gelb
K8
C22
C1 33pF
C2 680pF
R2 220K
D1 BB109
C7 100nF
R6 220K
C4 680pF
22pF
R7 220K
IC1
TCA440
(A244D)
C10 1uF
C11 1uF
K9
rot
K10
elektrische Antenne
K11
(Alu-Winkel)
T1 BF254
R3 220K
R4 12K
C3 100nF
R13 4K7
R14 25K
K12
SW1
TASTER
K13
D2 BB109
C8 100nF
C15 270pF
C16 39pF
C23 10pF
C28
C19 100nF
C17 100nF
OSC1
Batterie-anschlußclip
K15
IC2
78L05
IN OUT GND
C12 1uF
C13 100nF
C14 100uF
Ferritantenne
PRX 80 PRO de DL3BBX V 1.1
Maßstab 1.07%
PRX80PRO-V1-1.T2001
Zeichner Siegfried Pomplun
Blatt 1
Änderung 30.01.00 20:25
Titel PRX 80 PRO V1.1
Ausgabe 12.02.00 16:53
Firma
Projekt 3,5 MHz-Peilempfänger

Bauteileübersicht über die wichtigsten der in der Schaltung verwendeten Bauteile und Kennzeichnungshinweise.



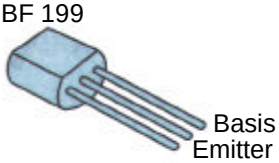
Farbe	1. Zahl	2. Zahl	Nullen	Toleranz
schwarz		0		
braun	1	1	0	1 %
rot	2	2	00	2 %
orange	3	3	000	
gelb	4	4	0000	
grün	5	5	00000	0,5 %
blau	6	6	000000	
lila	7	7		
grau	8	8		
weiß	9	9		
gold			x 0,1	5 %
silber			x 0,01	10 %
ohne				20 %



Keramische Kondensatoren
- Kennzeichnung -

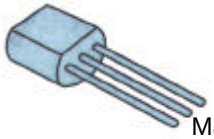
Beschriftung	Wert
n27	270 pF
3n3	3,3 nF
1n0	1,0 nF
103	10 nF
104	100 nF
473	47 nF

BF 254
BF 199



Basis
Emitter
Collektor

78L05



Eingang
Masse
Ausgang

Bei Dioden wird die Kathode durch einen Strich oder Punkt gekennzeichnet.

Universal-NF- Leistungsverstärker 0,3 bis 1 Watt, für niedrige Betriebsspannungen

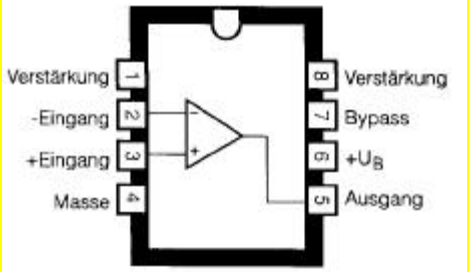
Betrieb:

Der LM 386 ist ein Audio-Verstärker für universelle Anwendungen. Durch den Versorgungsspannungsbereich (+4 V bis +12 V... Versionen N-1 bis N-3, M-1 und +5 V bis +18 V... Version N-4) und den geringen Strombedarf (24 mA bei einer Versorgungsspannung von 6 V) eignet sich dieser Baustein besonders für Batteriebetrieb. Die Verstärkung ist intern auf 20 eingestellt, läßt sich aber durch die Serienschaltung eines externen Kondensators und eines externen Widerstandes zwischen Anschluß 1 und 8 auf Werte zwischen 20 und 200 einstellen. Sind die Anschlüße offen, so stellt sich die Verstärkung auf 20 ein. Wird zwischen beide Anschlüsse nur ein Kondensator (z. B. 1O uF) geschaltet, so beträgt die Verstärkung 200. Die Verstärkung läßt sich auch durch eine kapazitive Kopplung eines Widerstandes (oder FET`s) von Pin 1 nach Masse einstellen. Bei Verstärkungen über 20 sollte der unbenutzte Eingang überbrückt werden, wodurch mögliche Instabilitäten verhindert werden. Dies geschieht je nach Widerstand der Treiberschaltung mit einem 0,1 uF-Kondensator oder einer direkten Verbindung zu Anschluß 4. Der Frequenzbereich läßt sich beeinflussen, indem weitere externe Bauteile hinzufügt werden. Bei preiswerten Lautsprechern läßt sich der Bassbereich ausgleichen, indem man zwischen die Anschlüsse 1 und 5 ein RC Glied einschaltet. Die Eingangsoffsetspannung läßt sich ausgleichen, indem man einen Widerstand vom unbenutzten Eingang auf Masse legt. Die Eingänge benutzen als Bezugspegel die Masse, der Ausgang stellt sich automatisch auf die halbe Versorgungsspannung ein. Die unten angeführten Daten beziehen sich auf den Betrieb dieses Bausteines mit einer Versorgungsspannung von +6V (Version LM 386 N 1).

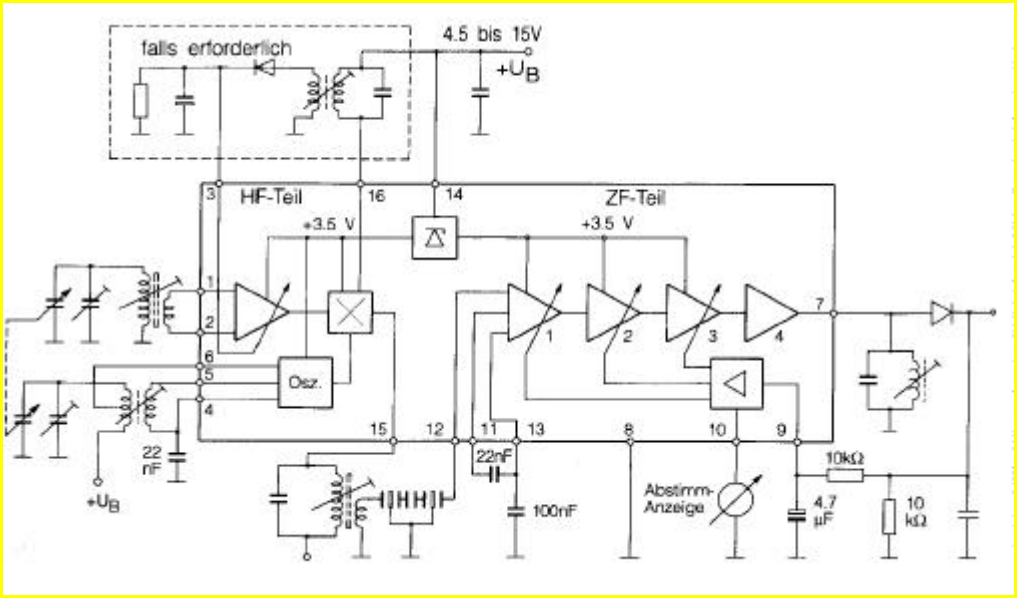
Anwendung:
AM/FM-Radios, tragbare Kassettenrekorder, Gegensprechanlagen, TV-NF-Systeme, Leistungstreiber, Ultraschalltreiber, Servotreiber, Leistungskonverter

Daten:

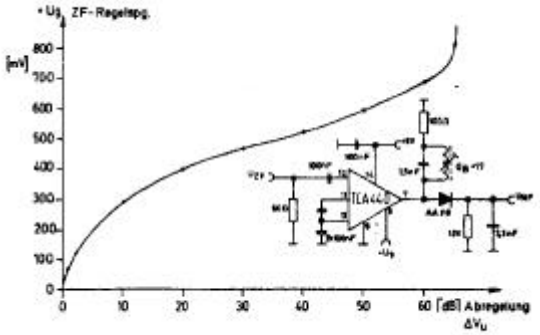
Anzahl NF-V		= 1	U_{EO}	[...V]	=	Z_A	[Ω]	=
Typ		= bipolar	I_{EO}	[...A]	=	P_A	[W]	= 0.325
U_B	[V]	= +4...+12	I_{eN}	[...A]	= 250 nA	U_R	[µV]	=
P_V	[W]	= 1.25	Z_E	[kΩ]	= 50	f_T	[MHz]	=
I_R	[mA]	= 4.0	U_E	[V]	= ± 0.4	I_P	[kHz]	= 300
T_U	[°C]	= 0...+70	A_{OL}	[dB]	= 20	k	[%]	= 0.2
CMRR	[dB]	=	U_A	[V]	= 3		bei Watt	125 mW
PSRR	[dB]	= 50	I_{AH} I_{AL}	[A]	=	kurzschlußfest		=



AM Empfängerschaltung TCA 440

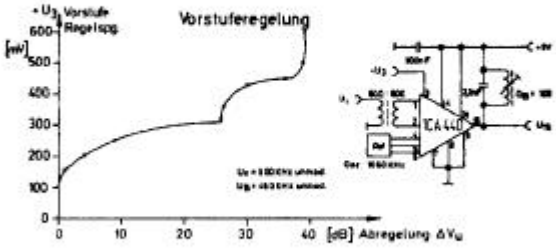


ZF-Regelung



U_{ZF} (469 kHz; m = 80%; f_{mod} = 1 kHz) wird so groß gewählt, daß sich immer eine Konstante U_{NF} ergibt (200 mV_{eff}).

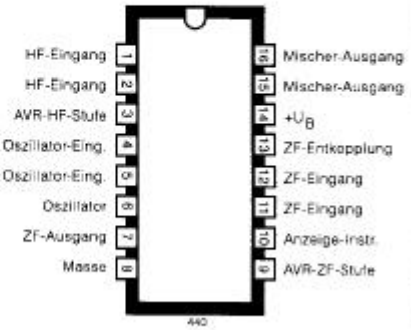
Vorstufenregelung TCA 440



Der Eingang ist nicht leistungsangepaßt und kann hochohmiger angesteuert sein. U_i ist so groß gewählt, daß sich eine Konstante U_{16} ergibt (50 mV_{eff}).

Beschreibung:
Der Baustein enthält alle Funktionsgruppen für einen vollständigen AM-Empfänger mit geregelter HF-Vorstufe, jedoch ohne Detektor.

Betrieb:
Diese integrierte Schaltung eignet sich sehr gut zum Aufbau eines AM-Überlagerungs-Empfängers für einen Frequenzbreich von 0-50 MHz (d.h. für LW, MW und KW) für Batterie- oder Netzspeisung.
Die Schaltung besteht aus einer getrennt regelbaren Vorstufe, einem multiplikativen Gegentaktmischer, einem separatem Oszillator sowie einem regelbaren ZF-Verstärker. Demodulation muß extern erfolgen.
Ab einer Betriebsspannung von ca. 4.5 V ergibt sich eine ausgezeichnete Großsignalfestigkeit. Diese wird durch die getrennte Vorstufenregelung erreicht. Die beiden Regelkreise des Bausteins sind voneinander unabhängig.
Der symmetrische Aufbau der ganzen Schaltung ergibt eine hohe Schwingstabilität und gleichzeitig einen Regelumfang von 100 dB.
Der Gegentaktmischer arbeitet multiplikativ, wodurch besonders wenig Oberwellenmischprodukte und Pfeifstellen entstehen. Der getrennte Oszillator läßt sich auch quarzgesteuert aufbauen, was z.B. bei der Verwendung des Bausteins als 9MHz-ZF-Teil vorteilhaft sein kann. An Pin 7 kann man sowohl einen AM-als auch einen FM-Demodulator anschließen. An Pin 10 läßt sich ein Instrument für eine Abstimm-Anzeige anschließen. An diesem Pin steht eine Spannungsquelle von max. 600 mV (R_i = 400 Ω) zur Verfügung. Ein Drehspulinstrument mit 500 µA wäre für eine Vollaussteuerung geeignet.
Die Außenbeschaltung ist sehr einfach und besteht nur aus den erforderlichen Selektionselementen und einigen Entkopplungs- und Siebgliedern.
Da der Baustein eine interne Stabilisierung besitzt, sind alle Kennwerte nahezu völlig unabhängig von der Versorgungsspannung.
Der Baustein wird in einem 16-poligen Standard-DIL-Gehäuse gefertigt.



Anwendung:
Aufbau vollständiger AM-Empfänger, AM/FM-ZF-Teil für Amateurempfänger (z.B. mit einer ZF von 9 MHz), Funkuhrenempfänger.

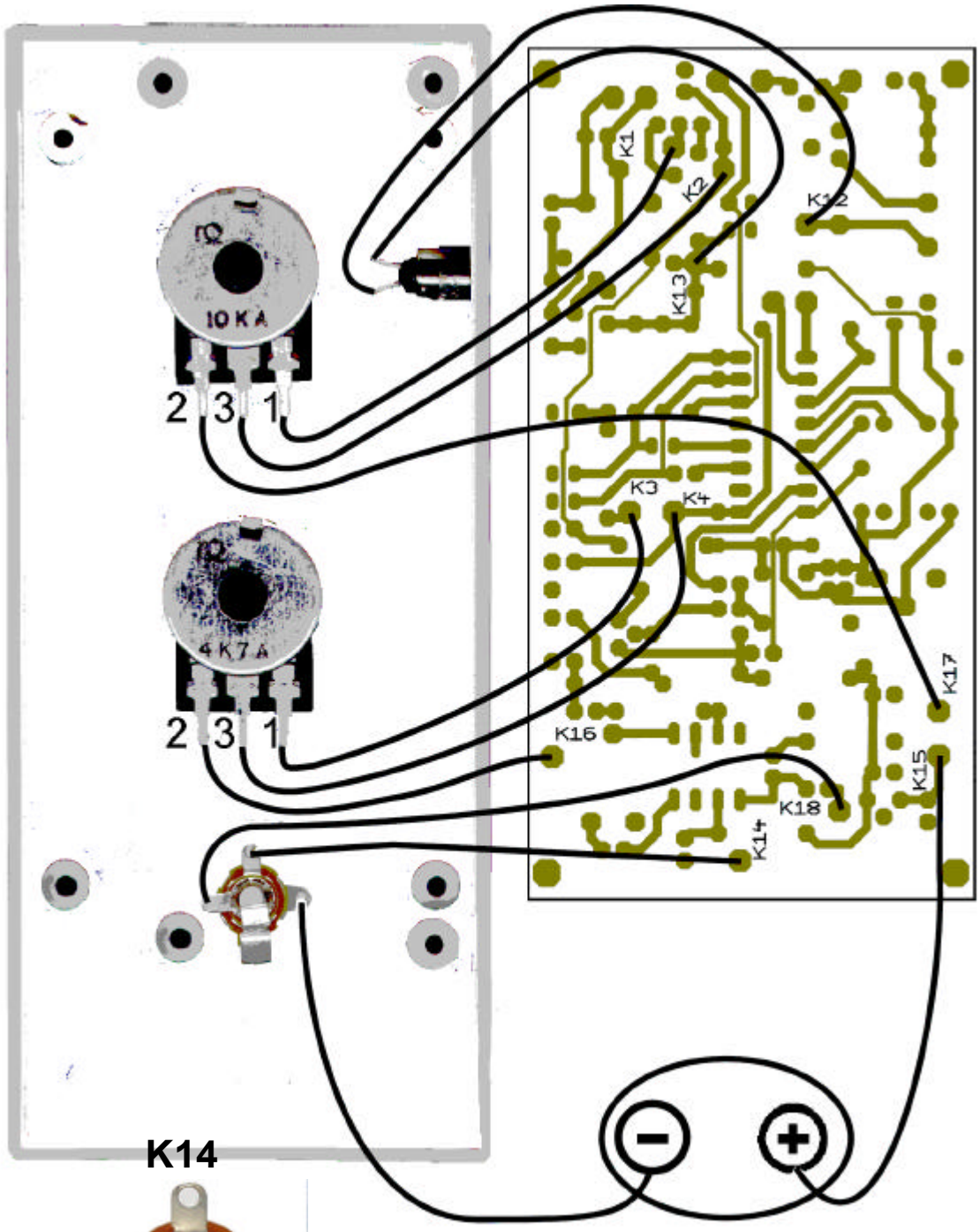
Daten:

Betriebsspannung U_B	= 4.5...15 V	Eingangsempfindlichkeit	
Arbeitstemp.-Bereich T_U	= −10...+80°C	für (S+N)/N = 6 dB	= 1 µV (an 60 Ω)
Stromaufnahme:		für (S+N)/N = 26 dB	= 7 µV (an 60 Ω)
bei U_B = 4.5 V	= 7 mA	für (S+N)/N = 60 dB	= 1 mV (an 60 Ω)
bei U_B = 15 V	= 12 mA	Regelumfang	= 32 dB (HF-Vorstufe)
Eingangs- u. Osz.-Freqs.	= max. 50 MHz		= 62 dB (ZF-Teil)
Max. HF-Eingangsspg.	= 2.6 V_{ss}	NF-Ausgangsspannung	= 50 mV (U_EHF = 20 µV)
Gesamtklirrfaktor	= 1% (U_E=300µV, m=0.3)		= 100 mV (U_EHF = 1mV)

AM-Empfänger

440		TCA 440

Verdrahtungsplan zum PRX 80 PRO



K14

K18 **- Batterie**

Perform the connections to the on this depending soldering connections on the circuit board with cords which are as short as possible according to the picture.

Now install subsequent the circuit board into the cabinet.
At the end, connect the ferrit- and relief antenna to the appropriated soldering nails; connect the marked and the little bit longer wire ends (winding ends according to the windings on the ferrit antenna) to the following soldering nails:

Red = K9 Yellow = K7 Green = K6

Urgent information (Date: April 2001)

Because of problems by transportation of the component parts there are sometimes changes necessary. For that reason you always have to use the delivered component set and observe these information!

1) The operation voltage must be minimum 7,0 Volt, if not, the stabi cannot regulate anymore.

2) Very good for this is the Monacor headphone of type ES240.

3) The sockets of headphones are delivered from the producers in different types. The connection points in opposite of the sockets must maybe exchanged. The ground contact of the socket (shorter connection banner) is to connect with K18.

4) Should the lower frequency border of 3.490 kHz is not reached, so C28 must be fit with a 10 pF-condensator (you find it enclosed to the component set).

5) Because of tolerances of component parts the tuning area cannot be exactly 120 kHz (3.490-3.610 kHz). An exactly adaption can made with the resistance R1. When the worth's are more than 12 k-Ohm the tuning window will be reduced.