

SvxLink-UDP

svxlink erlaubt die Anbindung von Audio (sowohl als "Mic", wie als "Lautsprecher") über UDP.

Dazu ist etwa folgender Abschnitt in der Konfiguration von svxlink notwendig:

```
[TxUDP]
TX_ID=TU
TYPE=Local
AUDIO_DEV=udp:127.0.0.1:4300
AUDIO_CHANNEL=0
PTT_TYPE=NONE
CARDS_CHANNELS =1
```

Die Daten werden mit zwei Kanälen mit jeweils 16 Bits kodiert. Pro Sekunde werden 48 UDP-Pakete mit einer Länge von 4032 Bytes übermittelt, dh. je Paket 1008 Samples mit einer Sample-Rate von 48.000 Samples/s, der wohl internen Sample-Rate von svxlink.

```
[2025-03-10 21:12:45.603] Received 4032 bytes from ('127.0.0.1', 53786):
8eff00006eff000037ff0000fafe0000befe000099fe000094fe0000a7fe0000cefe0000fbfe00
001eff000034ff00003cfff00003dfff000044ff00005bfff000086fff0000c2fff00000000000003500
000051000000480000001f000000deff000094ff00005aff00003fff00004cfff000089fff0000e9
ff00005b000000d90000004e010000af010000f801000026020000390200003702000022020000
ff010000d5010000a9010000810100006301000050010000490100004801000048010000410100
003101000015010000f1000000ce000000b30000000a6000000a40000000ab0000000b4000000a800
000084000000460000000e6fff000077ff000000cfff0000b0fe000079fe000072fe000095fe0000dc
fe00003dfff0000a0fff0000fafff000043000000730000008c000000970000009200000086000000
730000005400000028000000efff0000a4ff00004fff0000f9fe0000acfe000075fe00005bfe00
0067fe000095fe0000d8fe00002dfff000080fff0000c2fff0000eeff000000000000f9fff0000e2ff
0000c5fff0000abfff000096fff00008aff000085fff00007fff000076fff00006cfff000065fff00006b
fff000086fff0000c4fff00001e000000900000000f01000083010000d6010000fe010000f1010000
b60100005a010000ef000000870000002f000000ebfff0000b5fff000084fff000050fff000010fff00
00c9fe000084fe00004afe00002efe000034fe00005afe000097fe0000d8fe00000bfff00001cfff
000007fff0000d2fe00007ffe000028fe0000e1fd0000b1fd0000a3fd0000b7fd0000e3fd000020
fe000065fe0000affe0000fffe000053fff0000b6fff00002200000092000000050100006b010000
b7010000ec01000002020000fe010000ee010000d9010000c6010000c0010000c4010000c90100
00d7010000e010000e2010000e7010000ec010000f50100000b0200002c020000520200007a02
000099020000ab020000a702000091020000710200004302000017020000f3010000ce010000ac
010000890100005801000018010000ce0000007600000020000000dbfff0000a6fff00008bfff0000
8bfff000094fff00009ffff0000a2fff000087fff000054fff000011fff0000befe00006ffe000037fe00
000efe0000fbfd0000f8fd0000eeffd0000d7fd0000abfd000064fd000010fd0000befc00007dfc
00005afc00005bfc00007afc0000abfc0000dcfc000000fd000000efd000006fd0000f4fc0000e6
fc0000e9fc000000cfd00004dfd0000a0fd0000004fe000064fe0000b3fe0000f8fe000032fff0000
66fff0000aef000008000000f72000000f70000007c010000ef0100005402000097020000b50200
00c5020000c5020000bd020000c2020000cc020000d3020000e2020000e6020000da020000c802
0000aa020000840200005d020000340200007020000d8010000a30100006c01000030010000f8
000000ca000000a00000007f000000670000004200000014000000dcfff00008cfff000036fff0000
e8fe00009ffe000072fe00006afe000076fe00009bfe0000d1fe000001fff00002cfff000050fff00
0066fff00007bfff000097fff0000b9fff0000e9fff000023000000600000009a000000cb000000eb00
0000fd000000002010000020100000201000005010000160100002f0100004c0100007101000091
010000a6010000b3010000b0010000a00100008701000067010000440100002301000005010000
ea000000cf000000b100000091000000680000003900000000a000000d9fff0000adfff00008aff00
006dfff000058fff000048fff000035fff000020fff00000bfff0000effe0000d5fe0000c1fe0000acfe
00009afe000087fe00006afe000040fe00000bfe0000cbfd00008bffd000057fd000039fd00003b
fd000060fd0000a3fd0000f8fd000051fe0000a0fe0000d6fe0000edfe0000e6fe0000c4fe0000
8ffe000056fe00001efe0000eeffd0000cefd0000bffd0000bffd0000cefd0000edfd000014fe00
0048fe00007efe0000acfe0000dcfe000002fff00001bfff000036fff000050fff00006aff00008eff
0000b6fff0000ddfff00000200000001e000000290000002b0000000250000001a00000001e00000033
```

```
000000590000009b000000ee00000047010000a7010000010200004c0200008a020000b6020000
cc020000d1020000c6020000aa020000850200005d0200003b02000026020000260200003d0200
006b020000a7020000ea020000280300005803000077030000810300007d030000720300006103
0000530300004d03000041030000330300002603000007030000de020000b3020000790200003d
02000006020000ca01000093010000660100003901000012010000f9000000dc000000c2000000
ac000000810000004900000006000000a8ff00003cff0000d0fe000059fe0000eafd00008afd00
0029fd0000cfff00007dfc000024fc0000cefb000084fb000043fb00001afb000010fb00001efb
000044fb000078fb0000a8fb0000cefb0000e3fb0000e4fb0000dafb0000cefb0000cafb0000d5
fb0000f0fb00001ff000056fc000089fc0000c0fc0000f1fc000017fd00004dfd00008dfd0000
d6fd000041fe0000bcfe000038ff0000c5ff000046000000ad0000000a0100004a010000690100
007d0100007d0100006801000059010000460100002e010000290100002a0100002e0100004601
00006601000087010000b8010000ee0100002502000065020000a5020000de0200000c03000024
03000020030000f7020000ad0200004a020000d30100005c010000f7000000aa00000082000000
7f00000097000000c2000000f800000029010000550100007f010000a3010000cc010000000200
0032020000630200008d020000910200007002000027020000a90100000a01000062000000bfff
00003dfff0000f2fe0000e6fe00001cfff00008bfff00001d000000c100000060010000e301000041
0200007702000080020000640200002f020000da01000071010000fa00000006b000000d2fff0000
3cff0000aef00003dfe0000fbfd0000f0fd00001cfe000076fe0000eeffe000067fff0000c8fff00
00fefff0000000000000d1fff000077fff000008fff00009bfe000030fe0000d3fd000082fd000029fd
0000c5fc000051fc0000cdfb000049fb0000d7fa000093fa00008afa0000c0fa00003dffb0000ea
fb0000adfc000071fd00001cfe00009afe0000e4fe0000fafe0000e2fe0000a7fe000056fe0000
f7fd0000a1fd00005cfd000031fd00003dfd000082fd000000fe0000cafe0000c8fff0000dc0000
000b0200002403000009040000c30400003b050000720500008305000074050000510500002d05
000006050000db040000b10400007e0400004404000012040000e8030000ce030000d9030000fe
030000360400007c040000b5040000d4040000bf04000073040000f70300003a0300005a020000
6d0100006500000063fff000073fe000083fd0000a7fc0000eeffb000047fb0000cafa000084fa00
0064fa000076fa0000b4fa0000fafa000042fb00007efb00008bfb000076fb00004afb0000fdfa
0000b7fa00008cfa000078fa00008efa0000c8fa000019fb000078fb0000d8fb000040fc0000af
fc000024fd0000c2fd000081fe000056fff00005400000059010000440200001d030000c4030000
2c040000710400009204000096040000a7040000be040000d70400000c050000420500006d0500
009e050000c1050000d1050000e4050000ea050000ce050000d7050000b9050000840500003805
0000d30400005d040000d10300003e030000b30200001f020000920100001301000088000000ff
fff00007cfff0000e7fe000053fe0000cdfd00003efd0000bcfc000053fc0000e9fb000091fb0000
53fb00000fffb0000d5fa0000abfa000072fa00003ffa000017fa0000ebf90000cef90000c9f900
00d3f90000f5f900002bfa000069fa0000aafa0000e2fa000010fb000033fb00004afb00006fffb
0000a5fb0000f2fb000006efc00000cfd0000bcfd000088fe000051fff000000000000a60000002e
0100008d010000e70100002d020000580200008a020000af020000bd020000d2020000dd020000
da020000e9020000ff0200001a030000540300009c030000e90300004a040000a9040000fc0400
0047050000790500008e0500007c05000042050000e504000060040000c6030000290300008e02
0000b020000ae0100006c0100004d01000049010000480100004b0100004f0100004301000034
0100002a01000014010000ff000000ed000000bd0000007d00000034000000cbfff000060fff0000
0aff0000c2fe0000a6fe0000befe0000f7fe000052fff0000bfff0000250000007f000000c70000
00f7000000160100002f0100003f0100004c010000560100004d0100002e010000f40000009800
00001f00000094ff000001fff000075fe0000fcfd0000a4fd000006bfd00004ffd00004afd00004b
fd000045fd00002bfd0000f5fc0000a2fc000034fc0000bafb000046fb0000defa000092fa0000
67fa000052fa00004cfa000049fa00003cfa000021fa0000fcf90000dbf90000cdf90000dbf900
001afa000082fa000003fb00009afb00002bfc0000a0fc000003fd00004efd000087fd0000d3fd
000034fe0000a9fe00004bfff0000fdff0000a500000051010000e401000050020000bb0200001b
03000074030000ea03000067040000dc04000058050000b9050000f30500001b0600002c060000
2d0600003f06000005f0600008c060000c90600000000700001f0700001c070000ec060000930600
001706000089050000ff0400007904000008040000b30300006403000022030000ee020000a902
00006202000020020000c6010000660100000b010000950000001a000000a9fff000022fff0000a6
fe000044fe0000defd00008efd00005dfd000025fd0000fafc0000defc0000b9fc00009dfc0000
94fc000093fc0000a9fc0000dafc000015fd00005cfd0000a7fd0000e3fd000011fe000030fe00
0041fe00004dfe00005dfe00007dfe000007affe000007affe000042fff000098fff0000e3fff00002700
0000560000006c0000007c000000800000007a0000007d0000007d00000071000000630000003f
00000001000000b6fff00005aff0000f7fe0000a3fe00005ffe00002ffe00001afe000014fe0000
10fe00000bfe0000f8fd0000d8fd0000adfd00007efd000052fd00002afd00000afd0000ebfc00
00c7fc00009afc000066fc000030fc000007fc0000f9fb000016fc000062fc0000d6fc00006bfd
000007fe00008ffe0000fe000045fff000066fff000079fff00008bfff0000aaff0000ebfff000048
000000b40000002d0100009a010000ed01000033020000670200008f020000cb02000016030000
6b030000d8030000430400009c040000e70400001605000028050000280500001a050000ff0400
00db040000a60400005c040000fa0300007f030000f602000067020000e40100007f0100003401
00000c010000301000000010000fc0000000f3000000cc000000940000005600000001000000af
fff00006bfff00001ffff0000e0fe0000
```

Der digitale Kanal kann auch parallel zu einem bestehenden Kanal erstellt werden, etwa durch eine Multi-TRX-Konfiguration:

```
[MultiTX]
TYPE=Multi
TRANSMITTERS=Tx1,TxUDP
```

Einfacher Python-Code zur Ausgabe der UDP-Daten:

```
import socket
from datetime import datetime

def start_udp_server(host='0.0.0.0', port=4300):
    # Create a UDP socket
    sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)

    # Bind the socket to the address and port
    server_address = (host, port)
    sock.bind(server_address)

    print(f"Starting UDP server on {host}:{port}. Waiting for data...")

    try:
        while True:
            # Receive data from the client
            data, address = sock.recvfrom(65535)

            # Get the current timestamp with milliseconds
            timestamp = datetime.now().strftime('%Y-%m-%d %H:%M:%S.%f')[:-3]

            # Convert the data to hexadecimal format
            hex_data = data.hex()

            # Print the timestamp and the received hex data
            print(f"[{timestamp}] Received {len(data)} bytes from {address}: {hex_data}")

    except KeyboardInterrupt:
        print("\nServer is shutting down.")
    finally:
        sock.close()

if __name__ == '__main__':
    start_udp_server()
```

Einfacher Python-Code um die Daten auf 8000 Samples/s zu konvertieren:

```
import socket
import numpy as np
from scipy import signal
import wave

def low_pass_filter(data, cutoff, fs, order=5):
    nyquist = 0.5 * fs
    normal_cutoff = cutoff / nyquist
    b, a = signal.butter(order, normal_cutoff, btype='low', analog=False)
    return signal.lfilter(b, a, data)

def start_udp_server_with_processing(host='0.0.0.0', port=4300, output_file='o
```

```
utput.wav'):  
    sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)  
    sock.bind((host, port))  
  
    print(f"Listening on {host}:{port}")  
  
    out_wave = wave.open(output_file, 'wb')  
    out_wave.setnchannels(1)  
    out_wave.setsampwidth(2)  
    out_wave.setframerate(8000)  
  
    try:  
        while True:  
            data, _ = sock.recvfrom(4096)  
            samples = np.frombuffer(data, dtype=np.int16)[:2]  
  
            filtered_samples = low_pass_filter(samples, cutoff=3400, fs=48000)  
            downsampled_samples = signal.resample_poly(filtered_samples, up=1,  
down=6)  
            out_wave.writeframes(downsampled_samples.astype(np.int16).tobytes(  
))  
  
        except KeyboardInterrupt:  
            print("\nServer shutting down.")  
        finally:  
            sock.close()  
            out_wave.close()  
  
if __name__ == '__main__':  
    start_udp_server_with_processing()
```

Das Downsampling und die Ratenadaption basiert auf Samples von lediglich 20ms, damit kommt es zu Artefakten.