

Maintenance Protocol

SODAR System PCS-2000/64MF



Version 2.7
2008-05-15

1 SODAR Processing Unit PCS-2000/64/MF

1.1 Measurements of Internal Electronic Noise

Enter commands: from Sodar Access on the Windows Desktop
 A Telnet (localhost) window opens with DSD.2000> prompt.

Type	n0, n1: end	<enter>
	transmit=1502	<enter>
	ave=120	<enter>
	minh=30	<enter>
	step=20	<enter>
	maxh=210	<enter>
	noise=290	<enter>
	a1:spectra, height	<enter>

The noise intensities of the 32 FFT-lines $A(Fi3, i=0 \dots V)$ for the vertical beam are measured by the processing unit while the processing unit is disconnected from the acoustic antenna. The intensities are entered in the table below.

Table 1

Spectral Line	$A(Fi3, i=0 \dots V)$ [dB]	Spectral Line	$A(Fi3, i=0 \dots V)$ [dB]
F01	/	FG1	/
F11	/	FH1	/
F21	/	FI1	/
F31	/	FJ1	/
F41	/	FK1	/
F51	/	FL1	/
F61	/	FM1	/
F71	/	FN1	/
F81	/	FO1	/
F91	/	FP1	/
FA1	/	FQ1	/
FB1	/	FR1	/
FC1	/	FS1	/
FD1	/	FT1	/
FE1	/	FU1	/
FF1	/	FV1	/

Tolerance: $A(Fi3, i=0 \dots V) < 30\text{dB}$

1.2 Spectral Analysis

For this test, you need a special adapter cable and an 2 canal echo – window electronic.

In order to check the correct spectral analysis of the processing unit an artificial test signal is linked to the receive channel which is synchronized with the burst signal for the transmission mode. The test signal is generated by an external synthesizer at an user defined frequency. The processing unit must show the signal peak in the corresponding FFT-line and the correct radial component must be determined by the processing unit. The nominal value of the various FFT-lines is determined by the transmission frequency and the sample frequency as:

$$Fi3[Hz] = (Ftrans - Sample) / (2 + i * Line)$$

with
 Ftrans := transmission frequency (1502Hz),
 Sample := sampling rate (.....Hz),
 Linie := FFT-line increment (Sample/32 =Hz),
 i := line index(i = 0 ... 31)

The line with maximum intensity and the neighbored lines within a 6 dB range of the maximum intensity are approximated by a parabolic function. The maximum of the parabolic function determines the peak frequency and the corresponding radial component. The width of the parabolic function is given by a dynamically adjusted band pass filter.

The nominal values of the radial components are calculated as :

$$SRADI (m/s) = \left(\frac{Fxi-Fmix}{Fxi+Fmix} \right) * 20,05 * ((t+273,15)**0,5)$$

with
 Fmix := FG3 for range = center (= Ftrans)
 Fmix := F33 for range = lower
 Fmix := FS3 for range = upper
 t := PT-100- temperature

(Comment: use the Excel program for calculating the spectra line frequency and the radial component)

Enter the following commands:

n0, n1: end	<enter>
ave=120	<enter>
range=center	<enter>
volume=512	<enter>

The measurement is started by entering the commands:

a1:spectra, radial, height	<enter>
-----------------------------------	---------

The intensities of the FFT-lines and the corresponding the radial components are taken from the output data of the processing unit. The test is performed for a selected sample of frequencies , for ex. F33, F63, FA3, ..., FG3 ... FS3. As the sample frequency depends internal from the air temperature the PT-temperature must be measured:

t (PT 100) = °C

Amplitude at synthesizer: 0,4Vpp or (0,2 without 50Ω)

Table 2

Spectral Line	Frequency [Hz]	Fmax-1 [dB]	Fmax [dB]	Fmax+1 [dB]	Sradi [m/s]	Radi [m/s]	Sradi-Radi [m/s]
F01	-----	-----	-----	-----	-----	-----	-----
F11	-----	-----	-----	-----	-----	-----	-----
F21							
F31							
F41							
F51							
F61							
F71							
F81							
F91							
FA1							
FB1							
FC1							
FD1							
FE1							
FF1							
FG1							
FH1							
FI1							
FJ1							
FK1							
FL1							
FM1							
FN1							
FO1							
FP1							
FQ1							
FR1							
FS1							
FT1							
FU1	-----	-----	-----	-----	-----	-----	-----
FV1	-----	-----	-----	-----	-----	-----	-----

Tolerance: SRadi - Radi = +-0,1m/s or +-10% for Radi > 1 m/s

Deviation from average: Fmax <= +-3 dB for i = 0..9,A..V

(Fmax+1) - I (Fmax-1) <= +-1dB

1.3 Control of Mixing Frequency

In case of strong Doppler components the mixing frequency is shifted. The nominal frequency is identical to the transmission frequency (here: 1502 Hz) and appears at the FFT-line "FG". For strong positive or negative Doppler components the processing unit may use a mixing frequency at FFT-line "F3" or at FFT-line "FS". The appropriate settings of the ranges „lower“, „center“ and „upper“ is automatically controlled in standard operation mode for the tilted beams A1 and A2 but can be fixed by the user with the command "range".

The correct dynamic adjustment of the mixing frequency is checked by an artificial test signal which is linked to the receive channel and is synchronized with the burst signal for the transmission mode.

The mixing frequency is defined by the command:

```
range=xxxxxx (lower, center, upper) <enter>
```

Enter the commands:

```
end <enter>  
ave=60 <enter>  
a1:radial <enter>  
range={lower, center, upper} <enter>  
range=auto <enter>  
start <enter>
```

For the various combination of test signal frequency and adjusted mixing frequency the actual setting are taken from the output of the system command:

Enter command:

```
var <enter>
```

Table 3

Range	Upper (FS1)		Center (FG1)		Lower (F31)	
Test signal [Hz]	Range Control		Range Control		Range Control	
	Nominal	Measured	Nominal	Measured	Nominal	Measured
FS1:	upper		upper		n/a	-----
FG1: 1502	center		center		center	
F31:	n/a	-----	lower		lower	

1.4 Check of Temperature Measurement

	Temperature [°C]
Temperature SODAR	
Temperature Reference	

Tolerance: temperature deviation < [5°C]

2 Antenna Elektronik

Type: AEP005

SN:

2.1 Supply Voltages

- +/- 24 V DC, measured at terminal blocks

Nominal [VDC]	Measured [VDC]	Deviation [VDC]	Tolerance [%]
+ 24			5
- 24			5

- +/- 15 V DC, measured at voltage stabilizer

VR 5, Pin 3 = + 15 V, Pin 2 = GND

VR 7, Pin 3 = - 15 V, Pin 1 = GND

Nominal [VDC]	Measured [VDC]	Deviation [VDC]	Tolerance [%]
+ 15			10
- 15			10

- +/- 12 V DC, measured at voltage stabilizer

VR 1, Pin 3 = + 12 V, Pin 2 = GND

VR 6, Pin 3 = - 12 V, Pin 1 = GND

Nominal [VDC]	Measured [VDC]	Deviation [VDC]	Tolerance [%]
+ 12			10
- 12			10

- + 5 V DC, measured at motherboard, terminal block 2, Pin 2 und 3

Nominal [VDC]	Measured [VDC]	Deviation [VDC]	Tolerance [%]
+ 5			5

- Transmit puls, measured at switch IC 16 (SPS002)

Enter commands:

```

n0,n1:end           <enter>
minheight=30       <enter>
step=20            <enter>
maxheight=110      <enter>
noise=150          <enter>
volume=4095        <enter>
transmitfrequency=1502 <enter>
a3:reflectivity    <enter>
    
```

It is checked that the voltage level at IC16; Pin 3 (SPS002) switches from 5 VDC exact to 0 VDC during the transmit signal. o.k.

2.2 Transmit Pulse

Check of the signal shape according to diagram *"Transmit Pulse" at Amplifier MPPA-2*. The MPPA-2 must generate a Gauss-type signal with max. amplitude = 25 Vpp. (look to the technical drawings, page 8)
The transmit frequency is set to 1502Hz.

No. of MPPA	Max. Amplitude, Nominal [Vpp]	Max. Amplitude, Measured [Vpp]	Deviation [Vpp]
A1	25		
B1	25		
C1	25		
D1	25		
A2	25		
B2	25		
C2	25		
D2	25		
A3	25		
B3	25		
C3	25		
D3	25		
A4	25		
B4	25		
C4	25		
D4	25		

Tolerance = +/- 2 Vpp

2.3 Beam Selection

The correct beam selection is measured in transmit mode at the transmit amplifiers as in 2.2. Refer to the attached diagrams “Output signals of amplifiers, antenna beam a1” (look to the document SODAR-Testpoints_PCS-2000-64), etc. to find the correct phase shifts of amplitude for the various beams.

Enter commands:

```

n0, n1:end                <enter>
volume=4095              <enter>
minheight=30             <enter>
step=20                  <enter>
maxheight=110           <enter>
noise=150                <enter>
transmitfrequency=1502  <enter>
a[1-5]: reflectivity    <enter>
  
```

For the test of beam 1 the “a1” is selected, for test of beam 2 the “a2” is selected, etc. In order to stop the output for the beam selected before another one is selected, the “end” command is used to stop the output of variables.

Beam A1

Reference Amplifier	Amplifier	Nominal Phase Difference	Phase Difference complies (y/n)
A1	A1, B1, C1, D1	0	
A1	A2, B2, C2, D2	-90	
A1	A3, B3, C3, D3	-180	
A1	A4, B4, C4, D4	-270	

Beam A2

Reference Amplifier	Amplifier	Nominal Phase Difference	Phase Difference complies (y/n)
A1	A1, A2, A3, A4	0	
A1	B1, B2, B3, B4	+90	
A1	C1, C2, C3, C4	+180	
A1	D1, D2, D3, D4	+270	

Beam A3

Reference Row	Test Row	Nominal Phase Difference	Phase Difference complies (y/n)
A1	A1, A2, A3, A4	0	
A1	B1, B2, B3, B4	0	
A1	C1, C2, C3, C4	0	
A1	D1, D2, D3, D4	0	

Beam A4

Reference Amplifier	Amplifier	Nominal Phase Difference	Phase Difference complies (y/n)
A1	A1, B1, C1, D1	0	
A1	A2, B2, C2, D2	+90	
A1	A3, B3, C3, D3	+180	
A1	A4, B4, C4, D4	+270	

Beam A5

Reference Amplifier	Amplifier	Nominal Phase Difference	Phase Difference complies (y/n)
A1	A1, A2, A3, A4	0	
A1	B1, B2, B3, B4	+90	
A1	C1, C2, C3, C4	+180	
A1	D1, D2, D3, D4	+270	

Beam selection in transmit mode o.k. for:

- Beam A1:
- Beam A2:
- Beam A3:
- Beam A4:
- Beam A5:

2.4 Receive Mode

Enter command:

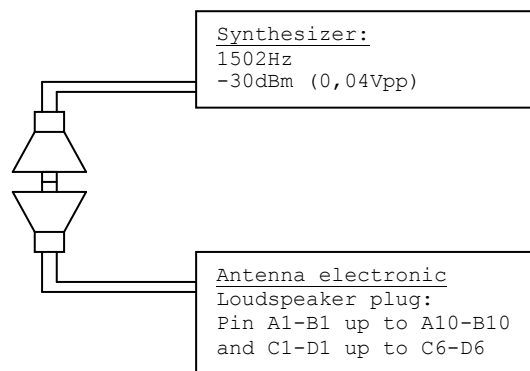
```

n0, n1:end           <enter>
volume=256         <enter>
a3: reflectivity   <enter>
stop                <enter>
    
```

The receive signal is measured at OP27, Pin 6 on MPPA-2 board, slot A 1 ... D 4.

- Check of function of receive amplifier, see column "Reception"
- Check of offset, adjustment at Poti R 7, see column "Offset"

MPPA-Slot	Reception [mVpp] >500mVpp	Offset [VDC] Nominal 0.0
A 1		
B 1		
C 1		
D 1		
A 2		
B 2		
C 2		
D 2		
A 3		
B 3		
C 3		
D 3		
A 4		
B 4		
C 4		
D 4		



3 Check of Antenna PCS-2000/64

Visual Inspection

Absorbing foam of acoustic shield	
Antenna housing	
Loudspeaker horns	
Latches, hinges	
Guy lines	

3.1 Test of Loudspeakers

Loudspeaker are checked in amplitude and phase.

Enter commands:

```

n0, n1:end           <enter>
volume=400           <enter>
minheight=30         <enter>
step=20              <enter>
maxheight=110        <enter>
noise=150            <enter>
transmitfrequency =1502 <enter>
a3 :reflectivity     <enter>

```

Loudspeaker	Amplitude >80mVpp	Phase difference to L1 [°], Nominal < 30 [°]
L1		
L2		
L3		
L4		
L5		
L6		
L7		
L8		
L9		
L10		
L11		
L12		
L13		
L14		

L15		
L16		
L17		
L18		
L19		
L20		
L21		
L22		
L23		
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L45		
L46		
L47		
L48		
L49		
L50		
L51		
L52		
L53		
L54		
L55		
L56		
L57		
L58		

L59		
L60		
L61		
L62		
L63		
L64		

Tolerance: +- 30 °

3.2 Check of Beam Selection

For the different selected antenna beams A1, A2, A3, A4, A5 the phase differences between the neighbored rows and columns are measured.

Enter commands:

```

end                                <enter>
volume=400                          <enter>
minheight=30                        <enter>
step=20                              <enter>
maxheight=110                       <enter>
noise=150                            <enter>
trans=1502                           <enter>
a[1-5]:ref                           <enter>

```

For the test of beam 1 the “a1” is selected, for test of beam 2 the “a2” is selected, etc. In order to stop the output for the beam selected before, the “end” commands stops the output of variables.

Beam A1

Reference Row	Test Row	Nominal Phase Difference	Phase Difference complies (y/n)
Row 1	Row 2	+90	
Row 1	Row 3	+180	
Row 1	Row 4	+270	
Row 1	Row 5	0	
Row 1	Row 6	+90	
Row 1	Row 7	+180	
Row 1	Row 8	+270	

Beam A2

Reference Row	Test Row	Nominal Phase Difference	Phase Difference complies (y/n)
Column 1	Column 2	+90	
Column 1	Column 3	+180	
Column 1	Column 4	+270	
Column 1	Column 5	0	
Column 1	Column 6	+90	
Column 1	Column 7	+180	
Column 1	Column 8	+270	

Beam A3

Reference Row	Test Row	Nominal Phase Difference	Phase Difference complies (y/n)
Row 1	Row 2	0	
Row 1	Row 3	0	
Row 1	Row 4	0	
Row 1	Row 5	0	
Row 1	Row 6	0	
Row 1	Row 7	0	
Row 1	Row 8	0	

Beam A4

Reference Row	Test Row	Nominal Phase Difference	Phase Difference complies (y/n)
Row 1	Row 2	+90	
Row 1	Row 3	+180	
Row 1	Row 4	+270	
Row 1	Row 5	0	
Row 1	Row 6	+90	
Row 1	Row 7	+180	
Row 1	Row 8	+270	

Beam A5

Reference Row	Test Row	Nominal Phase Difference	Phase Difference complies (y/n)
Column 1	Column 2	+90	
Column 1	Column 3	+180	
Column 1	Column 4	+270	
Column 1	Column 5	0	
Column 1	Column 6	+90	
Column 1	Column 7	+180	
Column 1	Column 8	+270	

Beam selection in receive mode o.k. for:

Beam A1:
 Beam A2:
 Beam A3:
 Beam A4:
 Beam A5:

After check, close all electronic boxes and the antenna shields and enter the command:

reset

<enter>

for starting the last stored normal operating mode



4 System Test Summary

System complies to all test procedures:

System deviates in test procedures:

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Remarks:

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Personnel:

Place / Date / Signature: