



ROHDE & SCHWARZ

SERVICE INSTRUCTIONS

Oscilloscope Module

803.1111.00

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5.1 Function Description

The oscilloscope module can be divided into three subgroups:

- Power pack, blanking amplifier and deflection amplifier
- Preamplifier
- X/Y character generation, triggering

5.1.1 Power Pack, Blanking Amplifier and Deflection Amplifier

The power pack generates from a +24-V DC voltage the voltages required for the deflection amplifier (140 V) and the blanking amplifier (+33 V) as well as the acceleration voltage (-1.7 kV) and the filament voltage (6.3 V) for the CRT. The DC voltage is converted to the required values by a pulsewidth-controlled DC push-pull converter.

The HT voltage for the CRT is regulated in order to prevent picture distortions as a result of varying beam acceleration. Since the other voltages are also controlled at the same time, the filament voltage can be adjusted by adjusting the HT voltage. The control voltage is generated using a high-impedance voltage divider from which the voltages for the intensity and focus are also tapped.

The blanking amplifier supplies the voltage required to suppress the flyback and undesired signals. A transistor switches a voltage generated by the DC converter to the cathode of the CRT for this purpose. An opto-isolator is used for the control of the cathode voltage since the cathode is at a high negative potential. The blanking frequency is increased by additional capacitive coupling of the blanking signals.

The deflection amplifier applies the voltages required for beam deflection to the CRT plates. The differential cascode amplifiers have a high cut-off frequency with a low working current. The amplifiers for X and Y deflection are almost identical in design. The X and Y positions of the beam can be adjusted by superimposing an adjustable DC voltage.

5.1.2 Preamplifier

The preamplifier adjusts the amplitude of the signals to be displayed for the Y amplifier. The signals can be applied either externally with AC or DC coupling or internally with fixed AC coupling. A total of 15 different gain settings can be selected corresponding to the signals to be displayed.

5.1.3 X/Y Character Generation and Triggering

With the oscilloscope in operation the X and Y deflection coefficients are output on the screen with the corresponding units (mV, kHz, %) in order to provide the user with information on the operating status. For this purpose the RAMs are written by the instrument processor and cyclically read out by the oscilloscope. The characters are controlled in the X direction via a 7-bit D/A converter and in the Y direction via a 3-bit D/A converter. One bit of the RAMs is used for blanking.

The characters are basically written during the flyback; the characters are thus synchronized with the standard screen display so that no gaps are produced in the individual displays as can occur in chop mode.

Triggering is automatic. Part of the signal applied to the Y amplifier controls a selectable current source via a comparator. The current source charges a capacitor which results in a linearly increasing voltage used for the X deflection. If no voltage is applied to the Y amplifier, a self-oscillating oscillator is selected which then drives the trigger circuit.

5.2 Testing and Adjustment

Note: Care must be taken when testing and adjusting the oscilloscope because of the high voltages present.

5.2.1 Adjusting the Filament Voltage and the Intensity

- Settings:**
- Switch on instrument
 - Set intensity control R28 to minimum (fully counterclockwise)
 - Allow approx. 5 min to warm up
- Checkpoints:**
- Cathode of V18 (-)
 - Cathode of V15 (+)
- Adjustments:**
- Adjust R29 so that a picture is just no longer visible
 - Adjust filament voltage to 6.2 V using R6
 - Set R28 to maximum (fully clockwise)
 - Adjust R27 until the filament voltage is 6.35 V
 - Check the dark position of R29

5.2.2 Adjusting the Astigmatism

- Settings:**
- Switch on instrument
 - Set average intensity
- Checkpoint:**
- Screen
- Adjustment:**
- Optimize the picture sharpness in the centre and at the edges alternately using the R25 (focusing) and the R43 (astigmatism)

5.2.3 Adjusting the Blanking

- Settings:**
- Switch on instrument
 - Set maximum brightness
 - Select maximum deflection frequency
 - Apply a 20-kHz sinewave signal to the external input
- Checkpoint:**
- Screen
- Adjustment:**
- Suppress the flyback using R36

5.2.4 Adjusting the Time Base and the Deflection Amplifiers

- Settings:**
- Switch on instrument
 - Apply 1 V, 1 kHz to the external input
- Checkpoint:**
- Screen
- Adjustments:**
- Position the arrow on the screen using R61 and R64 such that it is located above the labelling of the selected function
 - Adjust the X deflection coefficient corresponding to the applied frequency using R208
 - Adjust the Y position of the arrow using R84 such that it is just visible above the bottom edge of the screen
 - Adjust the Y deflection coefficient corresponding to the applied amplitude using R81

5.2.5 Adjusting the Preamplifier

- Settings:**
- Switch on instrument
 - Set maximum Y sensitivity
 - Select internal or external input
 - Set R146 (Y position) to centre position
- Checkpoint:**
- Screen
- Adjustment:**
- Position the beam in the center of the screen using R101 (internal) or R112 (external).

5.3 Logic Tables for Oscilloscope Settings

Function		D202				
		7	14	13	12	11
Time base in ms/div	20	L	L	L	H	L
	10	H	L	L	H	L
	5	L	H	L	H	L
	2	H	H	L	H	L
	1	L	L	H	H	L
	0.5	H	L	H	H	H
	0.2	L	H	H	H	H
	0.1	L	L	H	L	H
	0.05	H	L	H	L	H
	0.02	L	H	H	L	H
	0.01	H	H	H	L	H

Function		D5						
		4	5	6	7	14	13	12
X deflection in V/div (external)	10	H	H	H	H	H	H	L
	5	H	H	H	H	H	H	H
	2	H	H	H	H	L	H	H
	1	H	H	H	L	L	H	H
	0.5	H	H	H	H	H	L	H
	0.2	H	H	H	H	L	L	H
	0.1	H	H	H	L	L	L	H
	0.05	L	L	H	L	L	L	H
	0.02	L	H	L	L	L	L	H
	0.01	H	L	L	L	L	L	H
	0.005	L	L	L	L	L	L	H

Function		D5	D1		
		11	4	5	6
Switchover	Internal	L	H		
	External	H	L		
Coupling	External AC			L	
	External DC			H	
LED	On				L
	Off				H

Function	D203						
	4	5	6	7	14	13	12
X coordinate	0	0	0	0	0	0	0
	LSB						MSB
	1	1	1	1	1	1	1

Function	D203	D204			
	11	4	5	6	7
Y coordinate	0	0	0	0	
	LSB			MSB	
	1	1	1	1	
Z signal On					0
Off					1
Reset address counter	RESET	0			
	RESET	1			
Chip select	CS		0		
	CS		1		
Load RAM	LADEN			0	
	LADEN			1	

5.5 Troubleshooting

no picture

Current drain of
+24 V < 0.2 A ?

Yes No

HT voltage present ?

Yes No

Remove V1,
picture present ?

Yes No

Blanking amplifier,
deflection amplifier

N1, V1, V2, transformer

No or incorrect
character generation

Control logic
according to table,
Section 5.4 ?

Yes No

D202, D203

Address
counter (P207) OK ?

Yes No

D209, D225

Switchover pulses
at D222/12 ?

Yes No

N200, N201, D223, D225

Blanking OK ?

Yes No

N207, blanking amplifier

RAMs D206, D207, D208

