ROHDE&SCHWARZ

Manual

VECTOR ANALYZER ZPV

291.4012.93

Printed in West Germany

R 39382 - 1

Table of Contents

2. Preparation for Use and Operating Instructions

2.1 Legend for Figure 2-1

No.	Engraving	Function
1		Plug-in for ZPV
2	LOCAL COMB. REMOVE	Slide switch for selecting the local, remote or combined local plus remote control mode.
3	AMPL. STOP AUTORANGING	Pushbutton for switching on and off the amplitude autoranging facility.
4	AMPL. STOP AUTORANGING	Status indication of amplitude autoranging facility; lights up if amplitude autoranging is switched off.
5	FREQ. STOP AUTORANGING	Pushbutton for switching on and off the frequency autoranging facility.
6	FREQ. STOP AUTORANGING	Status indication of frequency autoranging facility; lights up if frequency autoranging is switched off.
7		Digital readout for one component of the test result.
8		Quasi-analog tendency indication for one component of the test result by an LED line.
9	LEVEL REF. STORE	Pushbutton for storing the voltage reference value.
10	PARAM. CAL.	Pushbutton for storing a voltage and phase reference value for vector measurements and when calibrating the test setup for parameter measurements.
11	φ, τ REF. STORE	Pushbutton for storing a phase or group-delay reference value (depending on the mode selected).
12		Digital readout for one component of the test result.
13		Quasi-analog tendency indication for one component of the test result by an LED line.
14	r, φ	Status indication of polar coordinate display; lights up if this mode is selected.

No.	Engraving	Function
15	r, φ	Pushbutton for selecting polar coordinate display.
16	X, Y	Status indication of Cartesian coordinate display; lights up if this mode is selected.
17	X, Y	Pushbutton for selecting Cartesian coordinate display.
18		Power switch
19	RECALL REF.	On/off button for displaying the reference values in readouts 7 and 12; lights up in the ON state.
20	FILTER	On/off button for stabilizing the test results with the aid of an electronic filter; lights up if the filter is switched in.
21	LIN.	Luminous button for selecting linear display of test results.
22	LIN./REF. (VSWR)	Luminous button for selecting linear display in relation to a reference value (also VSWR in conjunction with 32).
23	LOG.	Luminous button for selecting logarithmic display of test results.
24	LOG. REF.	Luminous button for selecting logarithmic display in relation to a reference value.
25	B	Luminous button for selecting voltage measurement in channel B and measurement of the phase angle between channel A and channel B.
26	A	Luminous button for selecting voltage measurement in channel A and measurement of the phase angle between channel A and channel B.
27	B/A	Luminous button for selecting ratio measurement of voltage in channel B referred to voltage in channel A plus measurement of phase angle between channel A and channel B.
28	Y	Luminous button for selecting admittance measurement.

No.	Engraving	Function
29	50 Ω o 75 Ω ☼	Luminous button for entering the characteristic impedance of the test system: On = 75 Ω Out = 50 Ω
30	Z	Luminous button for selecting impedance measurement.
31	DIR. COUPL.	Luminous button for entering information on test setup used: On = test setup with directional coupler or VSWR bridge Out = test setup without directional coupler or VSWR bridge
32	S11, S22	Luminous button for selecting measurement of s parameters s_{11} or s_{22} (reflection factors).
33	S21, S12	Luminous button for selecting measurement of s parameters s_{21} or s_{12} (transmission factors).
34	τ	Luminous button for selecting group delay measurement.
35	CAL.	Luminous button for selecting frequency deviation adjustment for automatic group delay measurement; lights up during the adjustment procedure.
36	$\Delta\tau$	Luminous button for selecting measurement of group delay deviation from a reference group delay value.
37	SET f_o + 40 kHz	Luminous button for entering the frequency deviation of 40 kHz.
38	AUTO XTAL	Luminous button for selecting automatic group delay measurement with generator deviation control. Selection of crystal measurement.
39	SET f_o + 4 kHz	Luminous button for entering the frequency deviation of 4 kHz.
40	SET f_o HIGH Z	Luminous button for entering the test start in the case of manual two-point and high-impedance Z measurements.

No.	Engraving	Function
41	SET f_o + 0.4 kHz	Luminous button for entering the frequency deviation of 0.4 kHz.
42	⏚ 47 - 420 Hz	AC supply connector
43	220 V T 0.8 B 235 V 115 V T 1.6 B 125 V	Voltage selector plus fuse holder.
44		Air filter of blower.
45	A IF/1 V	IF output of channel A.
46	B IF/1 V	IF output of channel B.
47	r SWEEP/1 V	Recorder output for the magnitude with narrowband sweeping.
48	φ SWEEP/1 V	Recorder output for the phase with narrowband sweeping.
49	r, X REC./1 V	Recorder output for the magnitude or real component.
50	φ , Y REC./1 V	Recorder output for the phase or imaginary component.
51	CONTR. ΔF	Recorder output for deviation control in the case of automatic group delay measurement.
52	ADC/10 V	DC voltage test input. (see 2.3.9.5)
53	IEC BUS	IEC bus connector (24 poles, Amphenol).

2.2 Preparation for Use

2.2.1 Exchanging the Plug-in

After unlocking the plug-in (1), it can be withdrawn and exchanged; the new plug-in should be locked again. During this procedure the ZPV must be switched off.

2.2.2 Adjusting to the Local AC Supply

The instrument is factory-set for an AC supply voltage of 220 V, the frequency range covering 47 to 420 Hz. By changing the position of the voltage selector 43, the ZPV can be operated also from a 115, 125 or 235 V supply. To this effect the fuse in 43 is unscrewed and the cover of the voltage selector withdrawn. Then the cover is reinserted such that the mark points to the desired AC supply voltage and the corresponding fuse is screwed in:

T 1, 6 B for 115 or 125 V
T 0, 8 B for 220 or 235 V.

The AC supply is connected to 42 using the supplied power cord. The instrument performance is not affected by AC supply fluctuations of ±10% from nominal. In the case of greater variations, a transformer or a voltage regulator should be connected ahead of the ZPV.

2.2.3 Setting up

The ambient temperature should not exceed 45°C; for this reason, direct insolation is to be avoided. To permit easy reading of the test results, a tilt stand can be swung out on the bottom of the instrument. The ZPV is fully isolated from the AC supply and provided with safety earthing. Chassis connection to the test item is made via the plug-in. If required, an additional ground connection can be established at the lefthand, lower screw fixing the front panel.

2.2.4 Switching on

To switch the ZPV on, button 18 is pressed; the instrument is ready for operation after about 1 s. When the ZPV is switched on, the buttons and the readout should light up.

2.3 Operating Instructions

2.3.1 General

2.3.1.1 Basic Settings

After switching the ZPV on, the voltage measurement mode in channel A is automatically set. The output of the test result magnitude and phase is linear (mV). The amplitude and frequency autoranging facilities are connected and filter 20 is switched off.

The position of the mode selector 2 is important; see 2.3.1.3.

2.3.1.2 Changing the Mode of Operation

When changing the mode of operation (vector, parameter, group-delay measurement), automatic switchover to the physical unit (linear or logarithmic, absolute or relative) previously stored in this mode is performed if meaningful. Changing the unit does not make sense when switching over from button

25 to 26; 28 to 30; 32 to 33.

The information on the test setup entered with 29 and 31 is applicable for buttons 28, 30, 32 and 33.

The states selected with 3, 5, 15, 17, 19 and 20 are not stored and are therefore maintained irrespective of any change of the mode operation.

2.3.1.3 Electronic Locking of Pushbuttons

In position REMOTE of switch 2 all pushbuttons are electronically locked, only remote control being possible.

Depending on the mode of operation, some modes of indication do not make sense or are not realized for the remaining positions of switch 2. These specific modes cannot be selected due to electronic locking of the pushbuttons. However, the modes of operation as such can be switched in (25, 26, 27, 28, 30, 32, 33, 34, and 36).

2.3.2 Vector Measurement

2.3.2.1 Voltage Measurement in Channel A

By pressing button A 26, the voltage in channel A and the phase angle between channels A and B, referred to channel A, are measured. The phase is measured as absolute phase (21 or 23 pressed) or relative to a reference value (22 or 24 pressed) and indicated in degrees. The following voltage indication modes can be selected:

a) absolute linear indication in mV by pressing button LIN. 21

b) linear indication referred to a reference value by pressing button LIN.REF. 22

c) absolute logarithmic indication in dBm by pressing button LOG. 23

d) logarithmic indication in dB referred to a reference value by pressing button LOG./REF. 24.

The voltage reference is the measured value at which button LEVEL REF. STORE 9 is pressed. The phase reference is the measured value at which button φ, τ REF. STORE 11 is pressed.

For the basic setting the voltage reference is 1 mV and the phase reference 0°.

2.3.2.2 Voltage Measurement in Channel B

By pressing button B 25, the voltage in channel B and the phase angle between channels A and B, referred to channel A, are measured. The phase is measured as absolute phase (21 or 23 pressed) or relative to a reference value (22 or 24 pressed) and indicated in degrees. For voltage indication and voltage and phase reference values the same applies as under channel A (see 2.3.2.1).

2.3.2.3 Measurement of the Voltage Ratio of Channel B to Channel A

By pressing button B/A 27 the voltages in channel A and in channel B and the phase angle between channels A and B, referred to channel A, are measured. The phase is measured as absolute phase (21 or 23 pressed) or relative to a reference value (22 or 24 pressed) and indicated in degrees.

The following modes of indication can be selected for the ratio of the voltages:

a) absolute linear ratio, dimensionless, by pressing button LIN. 21

b) linear ratio, relative to a reference ratio, dimensionless, by pressing button LIN./REF. 22.

c) absolute logarithmic ratio in dB by pressing button LOG. 3

d) logarithmic ratio in dB, relative to a reference ratio, by pressing button LOG./REF. 24.

The reference value is the voltage ratio at which button LEVEL REF. STORE 9 is pressed. The phase reference is the measured value at which button φ , τ REF. STORE 11 is pressed.

For defining reference ratio and reference phase at the same time press button PARAM. CAL. 10.

For the basic setting the reference ratio is 1/1 and the phase reference 0°.

2.3.3 Parameter Measurement

2.3.3.1 Reflection Factor Measurement (s_{11}, s_{22}, a_r, VSWR)

By pressing button S11, S22 32, the voltages in channel A and in channel B and the phase angle between channels A and B, referred to channel A, are measured. Depending on the plug-in used and the test setup, the button DIR. COUPL. 31 should be pressed (see also manual of the corresponding plug-in).

Depending on the connection of the test item, the result is, in linear display (LIN. 21 pressed), either the input reflection factor s_{11} or the output reflection factor s_{22}. The magnitude and phase (r, φ 15 pressed) or the real and imaginary components (X, Y 17 pressed) of these reflection factors can also be output.

If logarithmic display is selected by pressing button LOG. 23, the output is the reflection attenuation a_r of the test item in dB and the phase angle associated with the reflection factor. When pressing button LIN./REF. 22, the VSWR of the test item and the phase angle associated with the reflection factor are output.

For calibrating the test setup with directional couplers and VSWR bridges, a shortcircuit has to be established in the test plane and button PARAM. CAL. 10 pressed. In all other cases the test output should be match-terminated and button PARAM. CAL. 10 pressed.

2.3.3.2 Impedance Measurement

By pressing button Z 30, the voltages in channel A and in channel B and the phase angle between channels A and B, referred to channel A, are measured. Depending on the plug-in used and on the test setup, button DIR. COUPL. 31 and button 50 Ω/75 Ω 29 must be pressed.
Depending on the connection of the test item, the result is - in linear display (LIN. 21 pressed) - either the input or the output impedance in Ω. High impedances can also be measured when one of the Tuners ZPV-E1, ZPV-E2 or ZPV-E3 and an adequate test setup are used. For this measurement, press buttons Z 30 and SET f_o HIGH Z 40. (See also manual for Tuner ZPV-E1, 10 Hz to 50 MHz.)
Pressing r, φ 15 displays the magnitude and phase and pressing X, Y 17, the real and imaginary components of the test result.
By pressing button LIN./REF. 22, the impedance is normalized to the reference value of 50 Ω or 75 Ω selected with button 29.
Calibration as described under section 2.3.3.1.

2.3.3.3 Admittance Measurement

By pressing button Y 28, the voltages in channel A and in channel B and the phase angle between channels A and B, referred to channel A, are measured. Depending on the plug-in used and on the test setup, button DIR. COUPL. 31 and button 50 Ω/75 Ω 29 should be pressed.
Depending on the connection of the test item, the result is - in linear display (LIN. 21 pressed) - either the input or the output admittance in Also low admittances can be measured when one of the Tuners ZPV-E1, ZPV-E2 or ZPV-E3 and an adequate test setup are used. For this measurement, press buttons Y 28 and SET f_o HIGH Z 40. (See also manual for Tuner ZPV-E1, 10 Hz to 50 MHz.)
Pressing button r, φ 15 displays the magnitude and phase and pressing button X, Y 17 displays the real and imaginary components of the test result. By pressing button LIN./REF. 22, the admittance is normalized to the reference value of 1/50 Ω or 1/75 Ω selected with button 29.

Calibration as described under section 2.3.3.1.

2.3.3.4 Transmission Measurement (s_{21}, s_{12}, a_{21}, a_{12})

By pressing button S21, S12 33, the voltages in channel A and in channel B and the phase angle between channels A and B, referred to channel A, are measured. Depending on the plug-in used and on the test setup, button DIR. COUPL. 31 should be pressed.

Depending on the connection of the test item, the result is - in linear display (LIN. 21 pressed) either the forward transmission factor s_{21} or the backward transmission factor s_{12}.

Pressing button r, φ 15 displays the magnitude and phase and pressing button X, Y 17 the real and imaginary components of these factors.

When selecting logarithmic display with button LOG. 23, the output is the forward or backward transmission factor in dB together with the phase angle associated with the forward or backward transmission factor.

For calibrating the test setup, connect the equipment without the test item and press button PARAM. CAL. 10.

2.3.4 Group Delay Measurement

In the modes A, B or B/A (25, 26 or 27 pressed) the group delay can be measured instead of the phase.

2.3.4.1 Single Measurement

Pressing button τ 34 conditions the group delay measurement. For performing individual measurements, buttons SET f_o 40, SET f_o + 0.4 kHz 41, SET f_o + 4 kHz 39 and SET f_o + 40 kHz 37 are operated.

The test method is based on two individual phase measurements which are made at two very closely spaced frequencies. The phase difference $\Delta\varphi$ is obtained and, using the frequency difference Δf, the group delay τ is calculated from $\tau = \Delta\varphi / 2\pi\Delta f$. The three different Δf values corresponding to buttons 37, 39 and 41 permit three measurement ranges to be selected:

40 kHz: 0.001 to 9.999 µs
4 kHz: 0.01 to 99.99 µs
0.4 kHz: 0.1 to 999.9 µs

The test procedure is as follows:

a) Set the signal generator to the desired test frequency.

b) Press button SET f_o 40.

c) Depending on the expected test result, increase the signal generator frequency by 40 kHz, 4 kHz or 0.4 kHz.

d) Press button SET f_o + 40 kHz 37, SET f_o + 4 kHz 39 or SET f_o + 0.4 kHz 41 in accordance with the frequency increase.

e) The test result is indicated on readout 12; for a new measurement, start with a).

Since the accuracy of the frequency increase directly influences the test result, the signal generator should be checked, if required, using a frequency counter.

Due to the built-in frequency counter, group-delay measurements are possible at any frequency deviation when Tuner ZPV-E1 is used.

The generator frequency can be increased or decreased as required (step c), see above.

For step d), press button AUTO XTAL 38. (See also manual for Tuner ZPV-E1, 10 Hz to 50 MHz).

2.3.4.2 Continuous Measurement

Pressing button τ 34 conditions the group delay measurement.
Select continuous measurement by first pressing one of buttons SET f_o +0.4 kHz 41, SET f_o +4 kHz 39, SET f_o +40 kHz 37 and then AUTO XTAL 38. (With ZPV-E2 and ZPV-E3 button AUTO XTAL 38 may be pressed immediately after button τ 34.)

For automatic continuous measurements, the output CONTR. ΔF 51 of the ZPV is connected to the FM-DC input of a generator. As with individual measurements, the phases of two very closely spaced frequencies are measured and the group delay is calculated from the phase and the frequency differences.

However, the generator frequency is automatically varied with the aid of the ZPV. This facilitates operation considerably. The frequency variation of 0.4 kHz, 4 kHz or 40 kHz is determined by pressing buttons SET f_o + 0.4 kHz 41, SET f_o + 4 kHz 39 or SET f_o + 40 kHz 37. The Δf setting also fixes the corresponding measurement range (see 2.3.4.1).

After connecting the ZPV to the signal generator, the Δf voltage should be matched by calibrating the slope of the generator modulation characteristic. To this effect, the test item is replaced by the supplied calibrating cable and button CAL. 35 is pressed. The ZPV performs the calibration automatically, extinguishing button 35 upon termination.

The linearity and frequency independence of the generator modulation characteristic are essential for the accuracy of the test results. The modulation sensitivity of the generator should always be in the range 1 V/10 kHz to 2.5 V/10 kHz.

2.3.4.3 Measurement of Group Delay Difference

Pressing button $\Delta\tau$ 36 conditions the measurement of the group delay difference relative to a reference delay both for the single and the continuous modes. Sections 2.3.4.1 and 2.3.4.2 apply accordingly.

The reference group delay is the value at which button φ , τ REF. STORE 11 is pressed.

For the basic setting, the reference delay is 0 µs.

2.3.5 Indication of Reference Value

Pressing button RECALL REF. 19 interrupts the test cycle and causes the corresponding reference value to be displayed. When button 19 is lit, this mode is switched on. Another push of button 19 makes go out, the test cycle is continued and the test results appear in the readout.

2.3.6 Stabilization of Test Results

By pressing button FILTER 20 an electronic filter is connected for stabilizing the test results. This adaptive filter proves especially useful for low-level and noisy signals. Another push of button 20 disables the filter and the luminous button is extinguished.

2.3.7 Disconnecting the Autoranging Facilities

2.3.7.1 Disconnecting the Amplitude Autoranging Facility

For the vector measurement modes in channel A and channel B it may be necessary to disconnect the amplitude autoranging facility of the amplifier, which uses 10-dB steps. To this effect, button AMPL. STOP AUTORANGING 3 is pressed and the status indication 4 lights up. Another push of button 3 causes the luminous indication 4 to be extinguished and amplitude autoranging is connected again. In all other operating modes the amplitude autoranging facility of the amplifier cannot be switched off. Button 3 then only affects the recorder outputs REC/1 V.

2.3.7.2 Disconnecting the Frequency Autoranging Facility

If only one frequency range of the tuner is used, the frequency autoranging facility can be disconnected to increase the measuring rate and the corresponding range can be set by hand. To this effect button FREQ. STOP AUTORANGING 5 is pressed and the status indication 6 lights up. After pushing button 5 once again, the luminous indication 6 goes out and frequency autoranging is connected again.

2.3.8 Quasi-analog Indication

The quasi-analog luminous spot indication 8 is associated with the digital readout 7 and the quasi-analog luminous spot indication 13 with the digital readout 12. Although these linear luminous spot indicators feature no absolute accuracy, they facilitate the recognition of a tendency towards a maximum or a minimum value and thus prove particularly useful for alignment work. In order to increase the system speed these indications can be switched off by computer command.

2.3.9 Analog Voltage Inputs/Outputs

2.3.9.1 IF Outputs IF/1 V

The IF voltages of channels A and B are available at the two BNC sockets A 45 and B 46 on the rear panel. The IF is 20 kHz. The level and phase shifts of the IF outputs correspond to those of the RF input signals in channels A and B.

2.3.9.2 SWEEP/1 V Outputs

During sweep operation, which can be set for instance on the plug-in ZPV-E2 or ZPV-E3, a voltage corresponding to the amplitude of channel A or B or to the ratio of channel B/channel A is available at BNC socket r SWEEP/1 V 47 on the rear panel in modes A, B or B/A. The voltage present at BNC socket SWEEP/1 V 48 corresponds to the phase angle between channels A and B. These voltages are produced in a purely analog way. The amplitude and frequency autoranging facilities are disabled.

When measuring the ratio B/A the voltage in channel A must be between 35 mV and 350 mV. This is monitored by the microprocessor and any error is indicated on the display.

2.3.9.3 REC./1 V Outputs

At the rear BNC socket r, X 49 an analog voltage corresponding to the digital readout 7 is available. The analog voltage present at BNC socket φ, Y 50 is associated with digital readout 12. To increase the speed of the system, these recorder outputs can be switched off by a computer command. They are also not enabled during sweep operation since in this case outputs 47 and 48 are available (see also 2.3.9.2).

The relationship between display modes and recorder outputs can be seen in table 2-12.

2.3.9.4 ΔF CONTR. Output

For automatic group delay measurement BNC socket CONTR. ΔF 51 is connected to the FM-DC input of a generator to control the deviation frequency (see also 2.3.4.2).

2.3.9.5 DC Input ADC/10 V

From serial number 879 268 onwards, the internal A/D converter is used for checking the tuning voltage of group delay measurements with the aid of the Basic Software ZPV-K10 (internal wiring). If the external input is required, a BNC socket is mounted again on the rear panel and cable K58 is connected between the socket and the A/D converter. In addition, the 20-kΩ resistance between pins 3 and 9 of B16 on the D/A converter pcb 291.5119 must be removed.

2.4 Remote Control

2.4.1 General

The ZPV is equipped with a remote-control connector in accordance with DIN - IEC 66.22 (IEEE 488); this is the 24-pole programming connector 53 on the rear panel (for contact allocation see table 2-2). The characteristics realized according to this standard are SH1, AH1, T6, TE6, L4, SR1, DC1, DT1, RLØ, PPØ, CØ (see table 2-4).

Only ASCII characters meeting the latest recommendations are used (see table 2-3). When connecting the ZPV into an IEC bus system it is not necessary to be familiar with the functioning of the interface. It is sufficient to know the programming commands and the data output formats which are explained below.

2.4.2 Switchover to Local, Remote or Combined Operation

The front-panel switch 2 permits manual operation (LOCAL), remote control (REMOTE) and a combined local plus remote mode (COMB.) which is especially useful for producing test routines.

These three functions cannot be programmed.

2.4.3 Setting the Device Address

The talker and the listener addresses are set together in accordance with table 2-5 using switch S1 on the IEC-bus Option ZPV-B1. The factory-set address of the talker is Z and that of the listener : (corresponding to device address 26 when using the TEK 4051). The address status is indicated on the readout, either LI (listener) or TA (talker) lighting up.

2.4.4 Setting the Delimiter

Switch S2.1 to S2.4 on the IEC-bus Option ZPV-B1 permits setting of the delimiter furnished by the ZPV at the end of a data transfer (see table 2-6). This character is factory-set to CR.

2.4.5 Disconnecting the Service Request

Switch S2.6 on the IEC-bus Option ZPV-B1 permits the service request capability (SRQ) of the ZPV to be disconnected (S2.6 ON) or connected (S2.6 OFF).

2.4.6 Programming Commands

Programming of the ZPV corresponds to manual operation. Each pushbutton of the front panel can be remote-controlled by applying a combination of two ASCII characters. Figure 2-8 shows the association of the different programming commands with the ZPV front-panel controls. The on/off buttons are disabled by a letter and a 0 and enabled by the same letter and a 1.

Example:

I0 means "filter off"; I1 means "filter on".

In addition to the button functions, the amplitude ranges of the amplifier and the frequency subranges of the plug-in can be programmed in accordance with table 2-10.

Thus programming simply consists of a sequence of ASCII characters corresponding to the order of buttons pushed.

Table 2-9 gives an alphabetical list of all control characters accepted.

2.4.7 Internal/External Trigger Operation

ZPV measurements can be triggered both internally and externally. Internal triggering is selected by the programming command combination TI and external triggering by TE. When switching on, the instrument is set to internal triggering.

With external triggering, the output command combination LR or LX or the secondary talker addresses a, b or c initiate a test procedure whose result is available for outputting at the end of the test.

2.4.8 Data Cutput

2.4.8.1 Output of Lefthand Readout (7)

The output command combination LX or the secondary talker address a conditions the output of the measured component of the lefthand readout 7 in accordance with the following format example:

SP±1234E±01CR[+)]

The format is made up as follows: one space (SP), one polarity sign of the mantissa (±), four digits of the mantissa, one exponent symbol (E), one polarity sign of the exponent (±), two digits of the exponent and one delimiter (CR). The associated unit is either a basic physical unit (V, Ω, 1/Ω, degree) or, with ratios, 1/1, dB.

2.4.8.2 Output of the Righthand Readout (12)

The output command combination RX or the secondary talker address b conditions the output of the measured component of the righthand readout 12 in accordance with the following format example:

SP±1234E±01CR[+)]

For the format and physical unit see 2.4.8.1.

2.4.8.3 Output of Lefthand and Righthand Readouts (7 and 12)

The output command combination LR or the secondary talker address c conditions the output of the two measured components of the lefthand (7) and righthand (12) readouts. The output consists of the information furnished in accordance with 2.4.8.1 and 2.4.8.2 separated by a comma. See the following format example:

SP±1234E±01,SP±1234E±01CR.

For the format and physical unit see 2.4.8.1.

2.4.8.4 Output of Measurement Range of Channel A

The output command combination RA or the secondary talker address e conditions the output of the measurement range of channel A. The output consists of two digits plus one delimiter.

Example: 08CR

The two figures indicate the range No., which is explained in table 2-10.

[+)] SP and CR are the ASCII characters for space and carriage return (see table 2-3).

2.4.8.5 Output of Measurement Range of Channel B

The output command combination RB or the secondary talker address f conditions the output of the measurement range of channel B. The output consists of two digits plus one delimiter.

Example: 01CR
The two figures indicate the range No., which is explained in table 2-10.

2.4.8.6 Output of Frequency Range of Plug-in

The output command combination RF or the secondary talker address g conditions the output of the frequency range of the plug-in. The output consists of two digits plus one delimiter.

Example: 12CR
The two figures indicate the range Nos, which may have a different meaning depending on the plug-in used. For plug-ins ZPV-E1, ZPV-E2 and ZPV-E3, they are explained in table 2-11.

2.4.8.7 Output of DC Voltage at ADC Input (see 2.3.9.5)

The output command combination AD or the secondary talker address h triggers the A/D conversion of the DC voltage applied to ADC input 52 and conditions the digital output; the data format is in accordance with 2.4.8.1.

Example: SP+1234E-03CR.
The unit is V, the input voltage range covers 0 to +10 V. The measurement is performed only in one range, therefore the exponent -03 is fixed.

2.4.8.8 Output of Device Status Word

The output command combination DS or the secondary talker address d conditions the output of the device status word. The output consists of ten ASCII characters plus one delimiter.

Example: 83B58X1A87CR
This device status word contains the overall device status in coded form. It can be read in by the controller at any time and applied to the device later together with the corresponding listener command TS. Thus the controller is able to "learn", for instance, the device status set by hand.

2.4.8.9 Output of Status Byte with Serial Polling

Due to the service request capability SR1, the device is able at any time to transfer a status byte, for instance during serial polling. This is conditioned by the universal command SPE. A single byte without delimiter is output. The meaning of each bit of the status byte is explained in table 2-7.

At the end of the transfer, the controller should send the universal command SPD.

2.4.8.10 Output of Test Frequency with Tuner ZPV-E1

The frequency of the signal at the SYNC input of Tuner ZPV-E1 is output with the output command combination FV or with the secondary talker address j.

The format is the same as with the righthand and lefthand readout (2.4.8.1); the unit is Hz.

2.4.9 Programming Examples for Desktop Calculators PPC and TEK 4051/52

2.4.9.1 Programming of Device Setting

Problem: The ZPV is to be set to B/A, LIN. and the filter is to be connected.

Solution:

a) The ZPV is factory-set to the listener address: This corresponds to device address 26 with TEK 4051/52 (see table 2-5).

b) Fig. 2-8 shows the association of the programming commands with the individual pushbuttons, button B/A corresponding to command BA, button LIN. to LI and button "filter on" to I1.

c) Thus the solution reads:

```
IECOUT 26, "BALII1"    (PPC)
PRINT@ 26: "BALII1"    (TEK 4051/52)
```

2.4.9.2.1 Programming of Frequency Range (ZPV-E2 or ZPV-E3)

Problem: Plug-in ZPV-E2 is to be set to the range 30 to 60 MHz.

Solution:

a) Same as under 2.4.9.1

b) The command characters - FR - for frequency range programming are found in table 2-9 and the frequency range number for plug-in ZPV-E2 from table 2-11 - 08 - is added. This yields the setting combination FR08.

c) Thus the solution reads:
IECOUT26, "FR08" (PPC)
PRINT@26: "FR08" (TEK 4051/52)

Problem: The correct frequency range is to be adjusted on plug-in unit ZPV-E2 or ZPV-E3 by entering a frequency of 750.5 MHz.

Solution:

a) Same as under 2.4.9.1

b) The command characters - HZ - for frequency programming are found in table 2-9 and the five-digit frequency value 07505 (unit 0.1 MHz) is added. Leading zeros may be replaced by SP, the decimal point may be set at any position.

c) Thus the solution reads:
IECOUT26, "HZ07505" (PPC)
PRINT@26 "HZ07505" (TEK 4051/52)

2.4.9.2.2 Programming of Frequency Setting with ZPV-E1

The test frequency can be directly communicated to the Tuner ZPV-E1 when frequencies < 25 kHz are concerned. No signal is then required at the SYNC input. For this application, frequency autoranging must be disabled with control character Q1.

The output format is "HZ␣␣␣␣␣.␣", the unit 0.1 Hz. Transmitting of a decimal point is possible, but not necessary.

Example: IECOUT26, "TEQ1" (PPC)
IECOUT26, "HZØ1234.5"
IECOUT26, "TI"

sets the ZPV-E1 to the frequency 1.2345 kHz. (See manual for Tuner ZPV-E1)

2.4.9.3 Reading out a Complete Test Result

Problem: A complete test result consisting of the two components of the lefthand and righthand ZPV panel indication is to be read out.

Solution:

a) The ZPV is factory-set to the talker address Z. This corresponds to the device address 26 with TEK 4051/52 (see table 2-5).

b) Section 2.4.8.3 explains the two possibilities of outputting both panel readouts. Either the command combination LR or the secondary talker address c is used, the latter becoming secondary address 3 with TEK 4051/52 (see table 2-5).

c) The test result can be read in as an ASCII string (e.g. A$\emptyset$) and is available in this form for further processing.

d) Thus the following two solutions are possible:

1)	IECOUT 26, "LR"		PRINT @ 26: "LR"
	IECIN 26, A$\emptyset$	(PPC)	INPUT @ 26: A$\emptyset$ (TEK 4051/52)
2)	IECIN 26; 3, A$\emptyset$		INPUT @ 26, 3: A$\emptyset$

2.4.9.4 Transfer of Device Status Word

Problem: The ZPV is completely set by hand in the combined mode; this device setting is to be transferred to the TEK 4051/52, stored and output at a later date.

Solution:

a) As to listener and talker addresses see 2.4.9.1 and 2.4.9.3.

b) Section 2.4.8.8 explains the two possibilities of reading in the device status word. Either the command combination DS or the secondary talker address d is used, the latter becoming secondary address 4 with TEK 4051/52 (see table 2-5).

c) The status word can be read in as an ASCII string (e.g. S$\emptyset$).

d) Thus the following two possibilities of reading in exist:

1)	IECOUT 26, "DS"		PRINT @ 26: "DS"
	IECIN 26, S$\emptyset$	(PPC)	INPUT @ 26: S$\emptyset$ (TEK 4051/52)
2)	IECIN 26; 4, S$\emptyset$		INPUT @ 26,4: S$\emptyset$

Later output is caused by the command

IECOUT 26, "TS"		PRINT @ 26: "TS"
IECOUT 26, S$\emptyset$	(PPC)	PRINT @ 26: S$\emptyset$ (TEK 4051/52)