



FEATURES

- Operated from a suitable PC via RS232C serial interface or GPIB parallel interface
- Voice frequency testing of PCM channels to ITU-T Recs.O.133 or G.700
- Separate testing of PCM encoders and decoders to ITU-T Rec. G-714
- Testing of the 2048 kbit/s bit stream to ITU-T Rec. O.162
- High accuracy and stability by digital signal processing
- Wide variety of automatic and manual test sequences
- Menu operated system for selecting instructions and parameters
- User definable parameter sequences and tolerance masks
- Possibility of comparison measurements
- Storage of test set-ups and test results on the computer hard disc
- Test results displayed and documented both numerically and graphically
- Voice frequency I/O connection of a selected time slot (service channel)
- Optional 64 kbit/s interface
- Remote control over RS232C serial interface or GPIB parallel interface
- Power supply by mains adapter

APPLICATIONS

In course of developing, manufacturing and maintaining PCM transmission and switching equipment, automated instruments are frequently used for performing the large number of tests required. Due to results achieved in digital signal processing and computer science, small sized test instruments featuring low prices and offering more services are now becoming feasible.

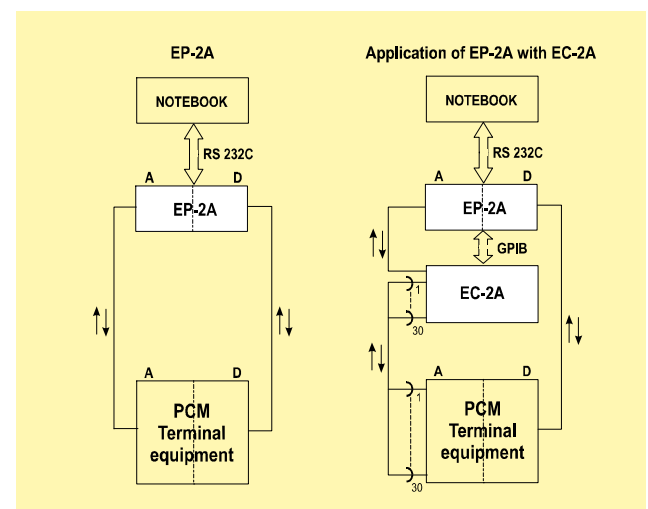
The computer controlled **EP-2A PCM Channel Analyser** developed for meeting relevant ITU-T Recs. can be used as a stand-alone instrument or as part of a test system comprising GPIB controlled instruments.

Main application fields:

- Development and manufacturing of PCM transmission, multiplexing and switching equipment
- Testing of PCM channels during operation and maintenance
- Testing of diverse voice frequency and digital signals

By utilising digitally generated and processed test signals, the EP-2A is suitable for performing automated measurements with high accuracy over analogue and digital interfaces of the PCM equipment. Once all constant and variable parameters of the test sequences are set, the results are displayed and the documentation is prepared without any user's assistance. The parameter under test can be measured either as a function of one variable (e.g. Gain over input level) or two variables (e.g. gain over frequency & channel.)

For assessing individual channel performance, the EC-2A Channel Selector is available as a separate instrument for switching the EP-2A PCM Channel Analyser sequentially to the 30 analogue I/O terminals of the multiplex equipment under test.



SPECIFICATIONS

Test modes and configurations

MEASURING ITEM	VARIABLE PARAMETER	Test configuration							
		A-A	A-D	D-A	D-D	T-T	T-D	D-T	
GAIN or LOSS/	CHANNEL	*	*	*	*				
	FREQUENCY/TONE, MTTs/	*	*	*	*				
	LEVEL/TONE, NOISE/	*	*	*	*				
	TIME	*	*	*	*				
	FREQUENCY & CHANNEL	*	*	*	*				
	LEVEL & CHANNEL	*	*	*	*				
LEVEL	CHANNEL	*	*	*	*				
	FREQUENCY	*	*	*	*				
	TIME	*	*	*	*				
RECEIVER LEVEL	CHANNEL			*					
TOTAL DISTORTION	CHANNEL	*	*	*	*				
	LEVEL/TONE/	*	*	*	*				
	LEVEL/NOISE/	*	*	*	*				
	LEVEL & CHANNEL	*	*	*	*				
WEIGHTED NOISE	CHANNEL /AUX SIGNAL/	*	*	*					
	TIME /AUX SIGNAL/	*	*	*					
FAR END CROSSTALK	CHANNEL /AUX SIGNAL/	*	*	*					
NEAR END CROSSTALK	CHANNEL /AUX SIGNAL/	*			*				
DUAL TONE INTERMOD.	CHANNEL	*	*	*	*				
RETURN LOSS	FREQUENCY/TONE, MTTs/	*							
	FREQUENCY & CHANNEL	*							
LONGITUD. BALANCE	FREQUENCY/TONE, MTTs/	*							
	FREQUENCY & CHANNEL	*							
PEAK CODE	CHANNEL LEVEL		*						
CODE OFFSET	CHANNEL LEVEL		*						
GROUP DELAY DISTORSION	FREQUENCY /MTTs/	*	*	*	*				
FRAME MONITOR/ O.162, G.821	TIME				*				
WORD TEST	TIME				*	*	*	*	
EVENT COUNTER	TIME				*	*	*	*	
BERT /G.821 /	TIME				*	*	*	*	
CHANNEL ASSOCIATED SIGNALLING STATUS	TIME				*				
SIGNALING DISTORSION					*				
DROP & INSERT			*	*			*	*	

* = indicates available test configurations
 A = 600, 900 Ω or complex, 4-wire or 2-wire analogue interface
 D = 2048 kbit/s digital interface to ITU-T Recs. G.703, G.704
 T = 64 kbit/s digital interface to ITU-T Rec. G.703 (optional)

Analogue signal generator

Sinewave signal
 Frequency range.....200 to 3600 Hz
 Resolution..... 4 Hz
 Frequency accuracy..... ±50 x 10⁻⁶
 Harmonic distortion.....>56 dB at 0dBm0
 Level range.....-60 to +5 dBm0
 Level increments..... 0.1 dB

Dual-tone signal
 Frequency range.....200 to 3600 Hz
 Resolution..... 4 Hz
 Level range.....-60 to -1 dBm0
 Level..... same for both spectral lines

Pseudo-random noise signal to ITU-T Rec.O.131
 Sequence repetition rate (period)..... 256 ms
 Bandwidth.....350 to 550 Hz
 Peak factor..... 10.5 dB
 Level range.....-60 to 0 dBm0
 Level increments..... 0.1 dB

MTTs (Multi Tone Test Signal)
 Frequency range.....200 to 3860 Hz
 Level range.....-30 to +0 dBm0
 Levels..... same for all 37 spectral lines

Output
 Impedance..... 600 Ω, 900 Ω, and complex¹⁾
 Return loss..... >36 dB(200 to 4000 Hz)
 Balance.....>50 dB (200 to 3600 Hz)
 Relative level/increments.....-15 to +5 dB/0.1 dB
 Max. d.c. voltage..... 60 V (between a/b and ground)
 Connector..... balanced, 3pole CF

Auxiliary signal generator

Sinewave signal
 Frequency range.....200 to 3600 Hz
 Resolution..... 4 Hz
 Level range/increments.....-60 to -30 dBm0/0.1 dB
 Impedance..... 600 Ω
 Connector..... balanced, 3pole CF

Output
 Impedance..... 600 Ω
 Return loss..... >36 dB(300 to 3600 Hz)
 Balance.....>46 dB (200 to 3600 Hz)
 Max. d.c. voltage..... 60 V (between a/b and ground)
 Connector..... balanced, 3pole CF

Analogue receiver

Filters
 Flat filter.....200 to 3600 Hz
 Psophometric filter.....to ITU-T Rec.O.41
 Selective filter.....between 200 and 3600 Hz,
 centre frequency settable in 4 Hz increments,
 bandwidth 30 Hz
 Filter for distortion measurement.....850 to 3250 Hz
 or 1380 to 3240 Hz
 Notch filter.....at aux. signal frequency,
 bandwidth 30 Hz

Level measuring range (minimum)
 Signal level.....-60 to +8 dBm0
 Resolution..... 0.01 dB

Noise, crosstalk.....-80 to 0 dBm0
 Resolution..... 0.01 dB
 Relative level range/increments.....-15 to +5dB/0.1dB

Group delay distortion..... 0 to 10 ms
 Resolution..... 0.1 ms

Input
 Impedance..... 600 Ω, 900 Ω, >30 kΩ and complex¹⁾
 Return loss..... >36 dB(200 to 4000 Hz)
 Balance.....>50 dB (200 to 4000 Hz)
 Max. d.c. voltage.....60 V(between a/b and ground)
 Connector..... balanced, 3pole CF

¹⁾ Complex impedance: 220 Ω in series with 820 Ω in parallel with 115 nF; other values on request



Digital signal generator

PCM frame structure.....	to ITU-T Rec.G.704
32 channel PCM frame containing	
30 telephone channels, or	
31 telephone channels.....	time slots 1 to 31
Encoding law.....	ITU-T Rec. G.711, A or μ law
Sinewave signal	
Frequency range.....	200 to 3600 Hz
Resolution.....	4 Hz
Frequency accuracy.....	$\pm 50 \times 10^{-6}$
Harmonic distortion.....	as per A or μ law
Level range/increments.....	-60 to +3.1 dBm0/0.1dB
Dual-tone signal	
Frequency range.....	200 to 3600 Hz
Resolution.....	4 Hz
Level range.....	-60 to -5 dBm0
Pseudo-random noise signal to ITU-T Rec.O.131	
Sequence repetition rate (period).....	256 ms
Bandwidth.....	350 to 550 Hz
Peak factor.....	10.5 dB
Level range.....	-60 to 0 dBm0/0.1 dB
MTTS (Multi-Tone Test Signal)	
Frequency range.....	200 to 3860 Hz
Levels.....	same for all 37 spectral lines
Level range.....	-30 to 0 dBm0
Group delay measuring signal.....	MTTS
Test patterns.....	PRBS6, PRBS9, PRBS11, PRBS15
Insertion in.....	voice channels 1 to 30
Freely selectable n x 8 bit word sequence.....	n=1 to 60
Insertion in.....	FAS, FAW, MFW, channel, signalling channel
Repetitions.....	1 to 9999 or continuous
Freely selectable FAS sequence.....	n x 7 bits, n=1 to 60
Freely selectable MFAS sequence.....	n x 4 bits, n=1 to 60
Error insertion.....	FAS, MFAS, MFW, channel, signalling channel
Error ratio.....	5×10^{-3} to 5×10^{-7}
Digital milliwatt signal.....	to ITU-T rec. G.711
Output	
Bit rate.....	2048 kbit/s
Interface parameters.....	to ITU-T rec. G.703
Line code.....	HDB3 or AMI
Unbalanced impedance.....	75 Ω
Connector.....	coaxial, BNC
Balanced impedance.....	120 Ω
Connector.....	balanced, 3pole CF
Operating mode	
Loop-through (2 Mbit/s)	
Test pattern insertion into one time slot	
Analysis of one time slot	
Generator operation	
from internal clock.....	2048 kHz $\pm 50 \times 10^{-6}$
or external clock.....	2048 kHz $\pm 100 \times 10^{-6}$
or clock derived from received signal	
Digital loops	
2 Mbit/s loop.....	all time slots switched through
2 Mbit/s loop.....	one selected time slot generated internally, remainder switched through
2 Mbit/s loop.....	all time slots switched through but channels shifted by 15
Digital receiver	
PCM frame structure.....	to ITU-T Rec. G.704
(see digital signal generator)	
Encoding law.....	to ITU-T Rec. G.711, A or μ law
Filters	
Flat filter.....	200 to 3600 Hz
Psophometric filter.....	to ITU-T Rec. O.41 up to 3960 Hz

Selective filter.....	between 200 and 3600 Hz, centre frequency can be set with 4 Hz increments, bandwidth 30 Hz
Filter for distortion measurement.....	850 to 3250 Hz or 1380 to 3240 Hz
Notch filter.....	at aux. signal frequency, bandwidth 30 Hz
Alarm detection.....	no signal, frame loss, multiframe loss, AIS, multiframe AIS, remote alarm, remote multiframe alarm
Evaluation	
Bit error count, event count, recording of transients in digital words.....	FAS, FAW, MFW, signalling channel, telephone channel
Telephone channel r.m.s value measurement.....	-80 to +6 dBm0
ITU-T G.821 evaluation.....	bit errors, FAS errors
Error results displayed as histograms	
Input	
Bit rate.....	2048 kbit/s
Interface parameters.....	to ITU-T Rec. G.703
Line code.....	HDB3 or AMI
Unbalanced input impedance.....	75 Ω or >2 k Ω
Connector.....	coaxial, BNC
Balanced input impedance.....	120 Ω or >2 k Ω
Connector.....	balanced, 3pole CF
Clock.....	from received signal
Pulling range.....	$\pm 100 \times 10^{-6}$
Measurement interval	60 s to 72 h
Instrument set-up memory	depends on PC resources available

Automatic measurement sequences

Individual measurements linked to a sequence.....	max. number depends on PC resources available
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Result documentation

Result output to external printer	
Output in table or graph formats	
Printer supported.....	EPSON 80, HP PCL or compatible
Result output as ASCII file to disk	
Result in table format can be saved to disk with printout using DOS „PRINT” command.	
Result storage and test configuration storage.....	depends on PC resources available

End-to-end measurements (in preparation)

Remote controlled end-to-end measurements (master/slave configuration) with slave station controlled via modem link	
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Telemeasuring (in operation)

Remote controlled tests at unattended far-end site controlled via modem link	
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Self-test and level calibration

Triggered automatically by opening the measurement menu	
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Codec interface/Handset interface

Input/output impedance.....	600 Ω
Connector.....	RJ11

64 kbit/s interface (optional)

Output/input.....	to ITU-T Rec. G.703
Modes.....	codirectional, contradirectional
Balanced output.....	120 Ω
Connector.....	balanced, 3pole CF
Clock output.....	120 Ω
Connector.....	balanced, 3pole CF

General specifications

Control computer for EP-2A

PC AT 486 or newer
 Win 3.1x or newer
 min. 40 MB free HD space
 VGA monitor
 serial or GPIB (National Instr.) interface

Communication interfaces of EP-2A

Serial I (for computer control).....RS232C/V.24
 Serial II (for modem connection).....RS232C/V.24
 GPIB/<IEC 625>/IEEE-488.1-1978 (for computer control)

Power supply

External adapter with a.c. line cord
 AC supply100 to 240 V, 50 to 60 Hz
 Power consumption.....25 VA

Ambient temperature range

Operating..... +5 to +45°C
 Storage and transport..... -20 to +70°C

Dimensions290 x 230 x 70 mm

Weight approx. 3.5 kg

Ordering information

PCM CHANNEL ANALISER EP-2A 278-000-000
 including
 Operating software
 Operation manual
 AC adapter
 RS232C/V.24 cable
 5 balanced cables

Options

64 kbit/s interface..... 275-000-000
 PCM CHANNEL SELECTOR EC-2A 277-000-000
 ELH 2 DC LOOP HOLDING..... 244-000-000
 PRINTER EPR 42S..... 318-000-000