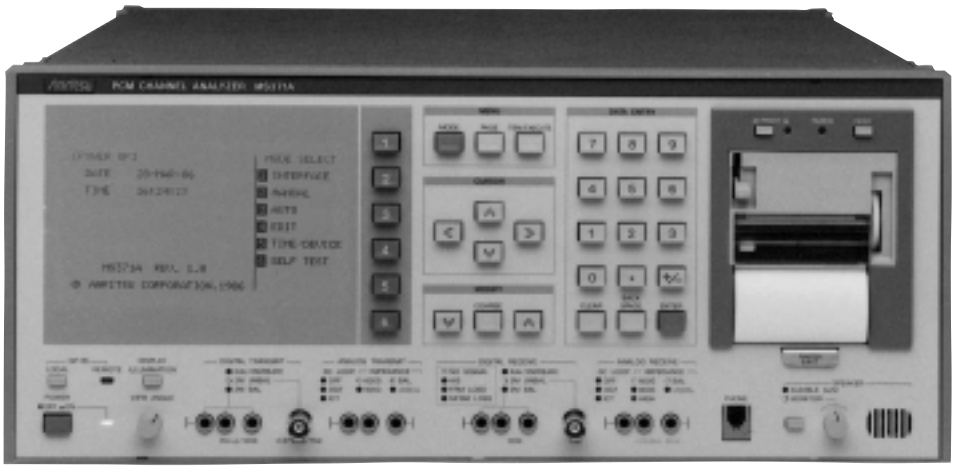
PCM CHANNEL ANALYZER
MS371A/A1

For Simultaneous Measurement of 30 Channels with MS120A



CE (MS371A1) GPIB

The MS371A/A1 is an overall measuring instrument with many measuring functions for digital primary hierarchy transmission. It can be used to measure (1) voice encode/decode performance characteristics, (2) frame alignment/alarm test, (3) bit, code, and frame errors, (4) timing jitter, and (5) signalling, etc.
The primary hierarchy (PCM) digital transmission system has been commonly used as the foundation for ISDNs. Therefore, there are many existing equipment and transmission channels to be maintained. The necessary measurements are diverse and much time and labor is needed to evaluate them when commissioning and maintaining transmission circuits and equipment. The increasing number of PCM systems has made improved measurement evaluation efficiency a necessity.
The Anritsu MS371A/A1 has most of the functions required to measure PCM systems. It is an all-purpose measuring instrument designed to improve measurement efficiency. Measurements of PCM voice encode/decode performance require much time and labor. The MS371A/A1 stores the measurement sequence and parameters in its internal memory and makes automatic measurements to markedly improve efficiency. It has a GPIB control function, which with the MS120A Channel Selector permits measurement of 30 channels in one sequence. It also compares the measured results to a reference value, judges them, and displays GOOD or NO GOOD automatically. The measured results can then be printed out on the built-in printer. Another special feature is that the report of the measured results can also be printed out an external printer.
In conventional measuring systems, the results are edited by a personal computer or some other external device. However, the MS371A/A1 performs this function internally and prints out to the external printer. This unique function can instantaneously prepare test performance sheets during installation and report the results of periodic maintenance without the need for manual or computer evaluation.

Features

- **Automatic measurement of A-A, A-D, D-A and D-D (A: analog, D: digital)**

This analyzer automatically measures most of the items stipulated in ITU-T Rec. G.712/713/714. The test sequence and parameters are stored internally, and new test sequences or parameters can be entered by the operator. Also, measurement can be done manually or via GPIB.

- **Frame alignment/alarm test**

Frame alignment and alarm tests stipulated in ITU-T Rec. G.704/O.162 can be made.

- **Error measurement**

Error rate, error count, error second, and % error-free second can be measured by detecting the bit, frame, and code errors.

- **Timing jitter measurement**

Jitter modulation is available. Also jitter amplitude and jitter immunity can be measured.

- **Signalling measurement**

Manipulation/monitoring of the signalling bit and E&M signalling distortion can be measured.

- **GPIB controller**

A GPIB controller function has been incorporated. One to thirty channels can be tested automatically and continuously through the channel selector.

- **Built-in printer**

Results are printed out by the built-in printer. In automatic measurement, all results can be printed out or the printout can be limited to results failing the evaluation.

- **External printer**

Results from channels 1 to 30 can be edited according to measuring item and printed out. A report, such as a test performance sheet, can be prepared immediately after the completion of measurements.

For product ordering information, see pages 4 – 10

Functions

• Automatic measurement mode

In the automatic measuring mode, voice encode and decode performance characteristics can be measured. Encode and decode performance characteristics in the voice frequency are recommended in ITU-T Rec. G712/713/714/792 Q.507. Many items are required for voice frequency evaluation, and many points must be measured for each item.

In attenuation/frequency distortion, some compensation of the measurement value is required for each measurement frequency because of the absolute level difference caused in the reference frequency. Manual correction requires much time and effort to obtain the correct result.

The MS371A/A1 stores the reference frequency, the level difference in the frequency, the subsequent frequency for measurement, and the procedure for compensation operations at each frequency. As a result, the corrected result is reached automatically. Then the measured result is compared to a reference value in the memory to evaluate whether or not it passes or fails; evaluation is automatic.

If it fails, the item, condition, and results can be printed out (fail-only printout or complete printout of results can be selected). In automatic measurement, the MS371A/A1 can measure the 15 items shows in the table below, including attenuation/frequency distortion. The measurement table summary indicates whether items can be measured or not by comparing the measurement configuration with measurement items. Functions that cannot be executed cannot be measured in principle.

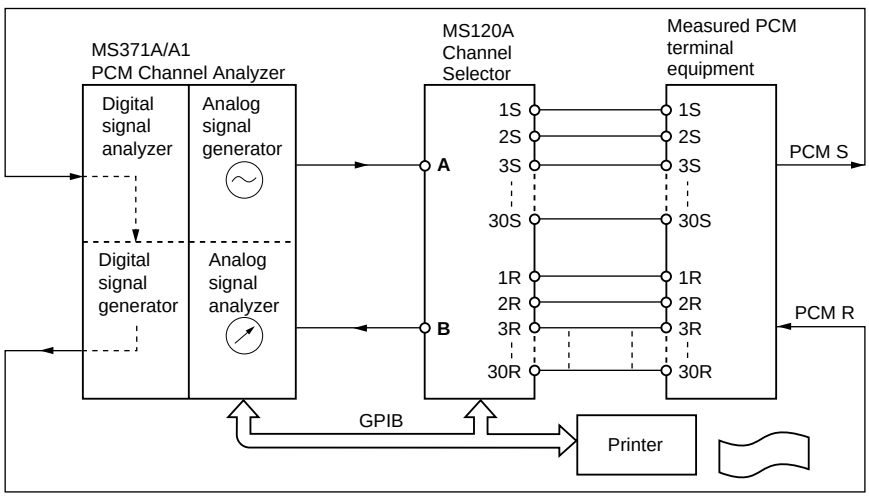
Summary of automatic measurement

Measurement item	Measurement configuration				
	A-A	A-D	D-A	D-D	A-D/D-A*2
Level setting	√	√	√	√	√
Attenuation frequency distortion	√	√	√	√	√
Variation of gain with input level (tone)	√	√	√	√	√
Variation of gain with input level (noise)	√	√	√	√	√
Total distortion including quantizing distortion (tone)	√	√	√	√	√
Total distortion including quantizing distortion (noise)	√	√	√	√	√
Idle channel noise	√	√	√	√	√
Far-end crosstalk		√*1	√*1		√*1
Near-end crosstalk	√*1			√	
Go-to-return crosstalk	√			√	
Return loss	√*1	√*1	√*1		√*1
Spurious out-of-band signal	√		√		√
Discrimination against out-of-band input signal	√	√			√
Longitudinal balance	√	√	√		√
E&M signalling distortion	√	√	√	√	√

∗1: Only when used with channel selector
∗2: Measures D/A immediately after measuring A/D

As an application example, the measurement of PCM terminal voice encode and decode performance characteristics is shown below. This measuring method is used when installing PCM terminal equipment. Measurement items shown in the table of measurement summary are executed in the measuring sequence programmed into the MS371A/A1. (The operator can set individual items to be executed or omitted.) After measurement in channel 1, the MS371A/A1 controls the MS120A Channel Selector via the GPIB, connects the measuring terminal of the MS371A/A1 to channel 2 of the PCM terminal equipment, and remeasures.

Measurement of one system portion of the terminal equipment is finished from channel 1 to 30 automatically in the same way. Upon completion of measurement, the measured results of channel 1 to 30 are edited according to each measurement item and output to the external printer. As mentioned above, voice channel measurement is fully automated, with no chance for miss operation.



The MS371A/A1 controls the MS120A Channel Selector via GPIB. Port A scans from 1R to 30R and port B scans from 1S to 30S. This permits automatic testing of 30 PCM channels (1 system).

Four-wire VF interface PCM terminal equipment automatic testing

• Manual measurement mode

Table 1 summarizes the manual measurements. Manual measurements can be classified broadly as follows: voice channel, word test, alarm simulation, error measurement, signalling measurement, jitter measurement, and order wire.

Voice channel measurement

Manual measurement is used when varying the parameters more finely than in automatic measurement or when no measurement can be made in automatic measuring sequences, as in end-to-end measurement. Manual measurement is also suited to observing changes in results over time.

Word test

Voice channel, frame, non-frame, and multiframe words can be manipulated or monitored. Thus, spare bits included in the multiframe and non-frame can be functionally tested and defined and by the circuit user. The drop insert function of the voice channel can also be tested.

Alarm simulation

Frame, multiframe, or signal loss pseudo-errors can be inserted into the signal by the MS371A/A1 to test the alarm response of the equipment.

Error measurement

Per-channel (64 kbit/s) bit errors can be measured. Bit, line code, and frame word errors at 2 Mbit/s can also be measured. The error rate, error second, and % error-free second of these errors can then be automatically calculated.

Jitter measurement

In the digital signal generator, jitter can be generated at 2 Mbit/s interface and the digital signal analyzer can measure the jitter in a received signal. Combined use of jitter generation and error measuring functions enables measurement of jitter immunity.

Order wire

The front panel of the MS371A/A1 has a phone jack. Connection of a handset permits use of the circuit to be measured as an order wire.

Table 1 Manual measurement summary

Measurement item		Measurement configuration			
		A-A	A-D	D-A	D-D
Level measurement	Tone (FLM)	√	√	√	√
	Tone (SLM)	√	√	√	√
	Noise	√	√	√	√
Gain measurement	Tone (FLM)	√	√	√	√
	Tone (SLM)	√	√	√	√
	Digital mW (FLM)			√	√
	Digital mW (SLM)			√	√
	Noise	√	√	√	√
Total distortion including quantizing distortion	Tone	√	√	√	√
	Noise	√	√	√	√
Idle channel noise		√	√	√	√
Return loss		√			
Spurious out-of-band signal		√		√	
Coder offset	Tone		√		√
	Noise		√		√
Peak code detection	Tone		√		√
	Noise		√		√
Longitudinal balance		√	√	√	
Word test	Voice channel				√
	Frame				√*1
	Non frame				√*1
	Multiframe				√*2
Alarm simulation	AIS				√*1
	Signal loss				√*1
	Frame error				√*1
	Multiframe error				√*1
	Remote end frame error				√*1
	Remote end multiframe alarm				√*2
Error measurement	Error rate				√
	Number of errors				√
	Error seconds				√
	% error free seconds				√
Signalling measurement	E&M signalling distortion	√	√*3	√*4	√*2
	Bit test				√*2
Jitter measurement	Jitter immunity				√*5
	Jitter				√*6
Order-wire circuit		√	√	√	√

∗1: When both digital interfaces of the transmitter/receiver are 2 M balanced or unbalanced
∗2: When both digital interfaces of the transmitter/receiver are 2 M balanced or unbalanced 30 channels, CAS
∗3: When the digital interfaces of the receiver is 2 M balanced or unbalanced 30 channels, CAS
∗4: When the digital interfaces of the transmitter is 2 M balanced or unbalanced 30 channels, CAS
∗5: When the digital interface of the transmitter is 2 M balanced or unbalanced
∗6: When the digital interface of the receiver is 2 M balanced or unbalanced

For product ordering information, see pages 4 –10

Specifications

Analog signal generator	Sine wave signal output	Frequency range: 200 Hz to 10 kHz Frequency resolution: 10 Hz Frequency accuracy: ±0.1% ±0.1 Hz Spurious including harmonics: >70 dB down (400 to 3500 Hz, +5 dBm), >60 dB down (200 to 400 Hz, +5 dBm), >50 dB down (3500 to 10000 Hz, +5 dBm) Level range: –80 to 13.1 dBm Level resolution: 0.1 dB
	Noise signal output Conforms to ITU-T Rec. O.131	Spectral span: 3.9 Hz Bandwidth: 200 Hz (350 to 550 Hz) Repetition rate: 256 ms Level range: –85 to 0 dBm Level resolution: 0.1 dB
	Output interface	Connector: 3-pole CF Impedance: 600, 900 Ω balanced Relative level: –20 to 10 dBr, 0.1 dB steps Max. DC isolation: ±60 V DC loop: ICT, OGT selectable Current direction: Normal, reverse selectable (ICT only)
Activating signal generator		Spectral span: 7.81 Hz Bandwidth: 200 Hz Output level: –55 dB0 nominal Output interface: Same as analog signal generator
Analog receiver	Filters	In-band pre-filter: 200 to 6000 Hz Out-of-band pre-filter: 4.2 to 72 kHz Psophometric filter: Conforms to ITU-T Rec. O.41 3 kHz flat filter: 300 to 3400 Hz Band pass filters: 200, 300, 420, 500, 600, 820, 1020, 2400 2800, 3000, 3400, 3600 Hz selectable Notch filters: 820, 1020 Hz selectable Filter for S/N meter: Conforms to ITU-T Rec. O.131
	Input interface	Connector: 3-pole CF Impedance: 600, 900 Ω, high (> 20 kΩ), balanced, unbalanced selectable Relative level: –20 to +10 dBr, 0.1 dB steps Max, DC isolation: ±60 V DC loop: ICT, OGT selectable Current direction: Normal, reverse, selectable (ICT only)
Digital signal generator	Sine wave signal output	Frequency range: 200 to 3990 Hz Frequency resolution: 10 Hz Frequency accuracy: ±0.1%, ±0.1 Hz Level range: –60 to 3.1 dBm0 Level resolution: 0.1 dB
	Noise signal output Conform to ITU-T Rec. O.131	Spectral span: 3.9 Hz Bandwidth: 200 Hz (350 to 550 Hz) Repetition rate: 256 ms Level range: –65 to 0 dBm0 Level resolution: 0.1 dB
	Digital mW signal	Conforms to ITU-T Rec. G.711
	Alarm simulation signal	PCM alarm signals: AIS, signal loss selectable Frame error signals: 1 in 2, 2 in 4, 3 in 4, 1.5 x 10^{-3}, 1.5 x 10^{-4}, 1.5 x 10^{-5}, 1.5 x 10^{-6} selectable Multiframe error signal: 1 in 2, 2 in 2 Remote end frame alarm: Alarm bit “0” or “1” settable Remote end multiframe alarm: Alarm bit “0” or “1” settable
	Word pattern manipulation	Telephone channel time slot: 00000000 to 11111111 settable Frame word: 00000000 to 11111111 settable Non-frame word: 00000000 to 11111111 settable Multiframe word: 00000000 to 11111111 settable
	Error measurement signal	Pseudo-random binary sequence for 64 kbit/s: 2^{11}–1 (ITU-T Rec. O.152) Pseudo-random binary sequence for 2.048 Mbit/s: 2^{15}–1 (ITU-T Rec. O.151)
	Signalling bit test signal	Possible to set logic “0” or “1” to selected signalling channel in any bit: a, b, c
	Signalling distortion measurement signal (possible to inject measurement signal to selected signalling channel in any bit: a, b, c, d)	Pulse speed: 10, 20 pps selectable Marker ratio: 10 to 90%, 1 % steps
	PCM output interface Conforms to ITU-T Rec. G.703, G.704 (2.048 MHz, however, CRC code is not inserted)	Output impedance: 120 Ω balanced, 75 Ω unbalanced selectable Telephone channel number: 30, 31 channels selectable Signalling: Channel associated signalling, common channel signalling selectable Coding: HDB3, AMI selectable Synchronization: Internal, external 8 kHz frame signal (TTL), external 2.048 MHz clock signal (TTL) or from digital signal receiver selectable Connector: 3-pole CF (120 Ω bal.), BNC (75 Ω unbal.)
	TTL output interface	Telephone channel number: 32 channels at 2.038 Mbit/s, signal channel at 64 kHz Synchronization: Internal, external 8 kHz frame signal (TTL), external 64 kHz (64 kbit/s interface), external 2.048 MHz (2.048 Mbit/s interface) or frame signal from digital signal receiver Connector: D-sub 25 pole (rear panel)

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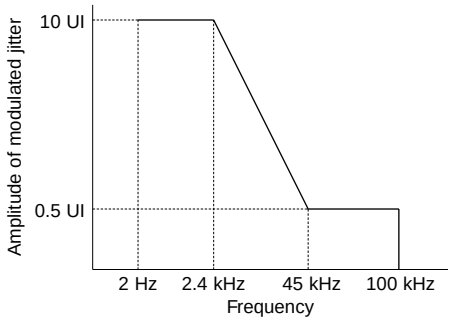
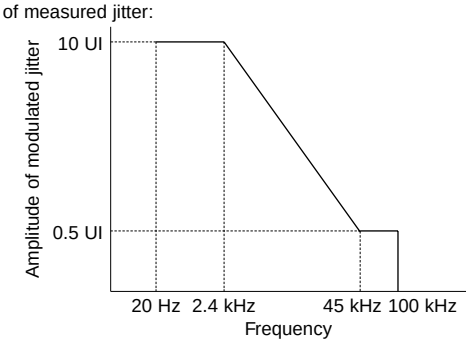
Digital receiver	Filters	Psophometric filter: Conforms to ITU-T Rec. O.41 3 kHz flat filter: 300 Hz to 3.4 kHz Band pass filter: 200, 300, 420, 500, 600, 820, 1020, 2400, 2800, 3000, 3400, 3600 Hz selectable Notch filter: 820, 1020 Hz selectable Filter for S/N meter: Conforms to ITU-T Rec. O.131
	Alarm display	Signal loss, AIS, frame loss, multiframe loss is indicated with the red LED display.
	Coder offset detection	Measurement range: –128 to +128
	Peak code detection	Measurement range: –128 to +128
	Remote end alarm detection	Remote end frame alarm, remote end multiframe alarm
	World pattern monitor	Telephone channel, frame word, non-frame word, multiframe word
	Error detection	Detectable error: Code, frame, word, bit Measurement item: Error ratio, errored second, % error-free second, error count Acceptable bit error measurement pattern (64 kbit/s): 2^{11}–1 (ITU-T Rec. O.152) Acceptable bit error measurement pattern (2.048 Mbit/s): 2^{15}–1 (ITU-T Rec. O.151) Time base: 1 to 9999 s
	Signalling bit monitor	Possible to display on selected signalling channel in a, b, c, d bit
	Signalling distortion meter (possible to measure selected signalling channel in any bit: a, b, c, d)	Acceptable pulse speed: 10, 20 pps Mark ratio range: 0 to 100%
	PCN input interface Conforms to ITU-T Rec. G.703, G.704 (2.048 MHz)	Input impedance: 120 Ω balanced, 75 Ω unbalanced selectable Number of telephone channels: 30, 31 channels selectable Signalling: Channel associated signalling, common channel signalling selectable Coding: HDB3, AMI selectable Synchronization: Regenerated frame and multiframe from incoming PCM signals Connector: 3-pole CF (120 Ω bal.), BNC (75 Ω, unbal.)
	TTL input interface	Number of telephone channels: 32 channels at 2.048 Mbit/s, single channel at 64 bit/s Synchronization: External 8 kHz frame signal Connector: D-sub 25-pole (rear panel)
Jitter detection (PCM interface only)		Frequency mode: Conforms to ITU-T Rec. O.171 Amplitude of modulated jitter:  Range: 1 UI, 10 UI selectable Amplitude and frequencies: Conforms to ITU-T Rec. O.171 Amplitude of measured jitter: 
E&M test signal generator	Measurement parameters	Pulse speed: 10, 20 pps selectable Mark ratio: 10 to 90%, 1% steps
	Interface	DC sink current: 100 mA maximum (make) Output impedance: >22 kΩ (brake) Switch voltage: 53 V maximum Connector: 3-pole CF (rear panel)
E&M signalling receiver	Measuring range	Pulse speed: 10 to 20 pps Mark ratio: 0 to 100%
	Interface	Input impedance: 3.3 kΩ internally pulldown to –48 V Connector: 3-pole CF (rear panel)

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For product ordering information, see pages 4 – 10

Others	Order wire	Voice signal output: Analog signal generator or selected digital signal generator output port Voice signal input: Analog signal receiver or selected digital signal receiver input port Headset connector: 4-pole modular telephone jack
	Loudspeaker (for audible alarm and received voice monitor)	Monitor: Selected telephone channel in digital signal or analog input signal Monitor level: Adjustable with knob on front panel
	Display	128 x 256 dots LCD with back light
	Built-in printer	Printing method: Thermal Printing letter: 20 characters/line
	Real time clock	YY, MM, HH, mm, ss (Y: year, M: month, D: date, H: hour, m: minute, s: second)
	GPIB (conforms to IEEE Std. 488-1978)	Implementation: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C27
General	Power	AC: 100 V $^{+10}_{-15}$%, 50/60 Hz, approx. 130 VA
	Dimensions and mass	425 (W) x 177 (H) x 451 (D) mm, ≤25 kg
	EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
	LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

The MS371A1 is the same as the MS371A but also has 64 kb/s co-contradirectional interface.

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MS371A	PCM Channel Analyzer	
MS371A1	PCM Channel Analyzer	
	Standard accessories	
J0162B	Balanced cable (both ends with Siemens 3P-type plug):	4 pcs
J0081	BNC cable (both ends with BNC-type plug):	2 pcs
J0586	TTL interface connector:	1 pc
	AC power cord, 2.5 m:	1 pc
J0443	DC power plug:	1 pc
F0011	Fuse, 2 A:	1 pc
F0012	Fuse, 3.15 A:	2 pcs
F0040	Fuse, 0.315 A:	1 pc
F0043	Fuse, 1 A:	3 pcs
F0044	Fuse, 1.6 A:	1 pc
F0046	Fuse, 3.15 A:	2 pcs
Z0031A	Thermal paper for printer:	2 rolls/set
W0161AE	MS371A/A1 operation manual:	1 copy
	Optional accessories	
MS120A*1	Channel Selector	
J0162A	Balanced cable, 1 m	
J0081	BNC cable (both ends with BNC-type plug, 3C-2V), 2 m	
A0006	Headset	
MB23A	Portable Test Rack	
MB24A	Portable Test Rack	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
B0169A	Transport quilting	
B0239A	Protective carrying case (for MS371A)	
B0239B	Protective carrying case (for MS371A1)	
B0043	Rack mount kit 4U (2 pcs/set)	
B0020	Protective cover (2 pcs are needed.)	

*1: Do not meet the EMC and low voltage directives of European Union.