PCM-40 PCM Channel Analyzer

PCS-40 PCM Channel Selector

- Ideal for installation, line-up, commissioning, fault localization, and repairs
- Handy, modern concept for field applications based on a lightweight analyzer module and IBM-compatible PC or notebook
- Menu operation with color (or monochrome) VGA display
- Graphical presentation of all results with flexible zooming and scaling
- User definable:
  – variable test parameters
  – automatic test sequences
  – graphical tolerance masks
- Large memory for instrument settings and test results on PC and hard disk
- Numerical and graphical result printout on PC printers with selectable conditions
- Complete digital and analog tests to ITU-T Recs. G.712 and O.133/O.162
- Complex impedances
- PCM-30 and PCM-31 frame structures including CRC error detection mode
- Comprehensive codec, frame and CAS measurement capabilities incl. G.821 BERT
- High accuracy and reproducibility of test results
- Selective measurement capability with 30 Hz filter
- Monitoring of signaling status for all 30 VF channels (CAS)
- Loop, MUX/DEMUX, and drop & insert modes for analog and 64 kb/s interface
- Optional 64 kb/s interface with co and contradirectional clock to ITU-T Rec. G.703 for D&I and BERT modes
- Control of PCS-40 channel selector

For codec and line card tests on PCM multiplexers and digital exchanges

Determining long-term stability (aging)

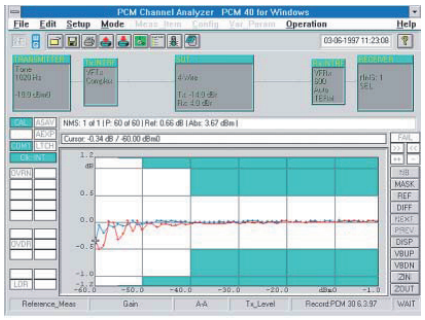
Communications systems and network elements are subjected to a wide variety of environmental influences which adversely affect component performance to a greater or lesser degree. If the effect of such influences on, say, system gain are to be recorded, the PCM-40 provides support for this application. During system line-up, the results and instrument configuration are stored so that they can easily be recalled. In the subsequent measurement, the results are displayed within the tolerance mask and the new result trace is superimposed. The instrument then determines the difference between the two measurements so that the deviation can be seen directly.

Status of connected test signal

The PCM-40 continuously monitors the connected test signal during the measurement and displays the result on the front panel and in detail on the screen. This keeps you informed of the status and prevents incorrect interpretation of the measurement results.

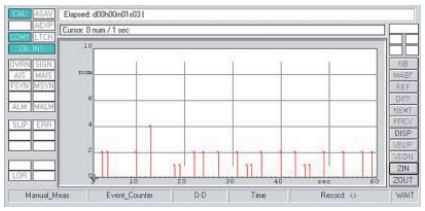
Storage of measurement configurations

The test equipment settings required for routine or specialized manually-performed measurements, along with explanatory comments, can simply be stored by the PCM-40. The number of setups which can be stored is limited only by the system resources of the computer you are using.

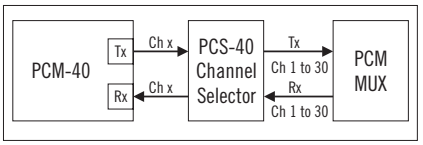


The fall-off in gain can be clearly seen. The blue trace was recorded on commissioning the system, the red trace at a later date. The "DIFF RESLT" function determines the difference between the two traces. The zoom function and cursors allow every detail to be examined.

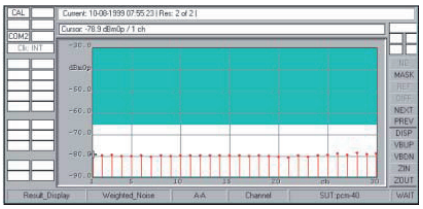
A test configuration (setup) includes all test and interface parameters required to perform a measurement. The setup name is used to relate the setup to a particular device under test.



Errors in the idle channel shown with their times of occurrence. Sporadic faults can thus be easily seen and matched in time to possible sources of interference.



Automatic sequential connection of up to 30 analog Tx and Rx ports of a PCM MUX equipment to the PCM-40 channel analyzer.



30 channel automatic sequential weighted noise measurement

Automatic test sequences

You can produce automatic test sequences by combining several test configurations together from the range of setups which you have stored. All of the measurement functions included in the PCM-40 along with any variations in test variables, parameters and tolerance limits, can be used for this in any order required. The sequence can be programmed to stop if an incorrect result is obtained or before each different measurement task.

Monitoring digital paths in through mode or via high-impedance taps

For long-term monitoring of 2 Mb/s paths, the circuit can be looped-through the PCM-40 transparently or tapped via a high impedance monitor point. If the power supply fails during loop-through measurements , the signal path is not interrupted. The following measurements can be performed:

- Frame monitoring with FAS errors recorded as histograms
- Level, frequency and coder level monitoring including audio monitoring in a selected channel
- Recording of byte changes in the selected frame or data channel
- Signaling status display for individual channels

Quality monitoring in an idle channel

Facilities for monitoring the quality of PCM systems which do not use CRC frames are limited to monitoring the frame alignment signals. The PCM-40 can, however, perform a loop-back or end-to-end measurement to ITU-T G.821 in an idle channel. The instrument transmits a test pattern which it then evaluates. The results can be shown as a table or as an error histogram.

PCM-40 as an automated measuring system

When testing PCM multiplexers, the PCS-40 channel selector connects up to 30 analog TX and RX channels sequentially to the PCM-40 analog test ports. The PCS-40 channel selector allows return loss and longitudinal conversion loss measurements on individual VF channels using the built-in bridges. Also test needing D.C. loop holding circuit or feeding bridge are possible. The result is a flexible and powerful test system well suited to production, installation and maintenance of 2 Mb/s multiplexers.

3

Test modes and configurations

Test modes	Variable parameters	Test configuration						
		A-A	A-D	D-A	D-D	T-D	D-T	T-T
Gain or loss	Channel	⊗	⊗	⊗	⊗			
	Frequency tone, MTTS/level/tone, noise/time	•	•	•	•			
	Frequency & channel level & channel	⊗	⊗	⊗	⊗			
Transhybrid loss	Frequency				• [1]			
Level	Channel	⊗	⊗	⊗	⊗			
	Frequency, time	•	•	•	•			
Received level	Channel Level			⊗ •				
Peak code	Channel Level		⊗ •					
Coder offset	Channel Level		⊗ •					
Total distortion	Channel level & channel	⊗	⊗	⊗	⊗			
	Level/tone, noise	•	•	•	•			
Weighted noise	Channel Time	⊗ •	⊗ •	⊗ •				
Far end crosstalk	Channel Level	⊗ •	⊗ •	⊗ •				
Near end crosstalk	Channel Level	⊗ •			⊗ •			
Group delay/distortion	Frequency/MTTS	•	•	•	•			
Dual tone intermodulation	Channel Level	⊗ •	⊗ •	⊗ •	⊗ •			
Return loss	Channel Frequency Frequency & channel	⊗						
Longitudinal balance	Channel Frequency Frequency & channel	⊗						
Frame monitor/O.162, G.821	Time (FAS, channel)				•			
Word test	Time				•	•	•	•
Event counter	Time				•	•	•	•
BERT/G.821	Time				•	•	•	•
Channel associated signaling status	Time				•			
Signaling distortion					•			
Drop & insert			•	•		•	•	

A = 600 Ω, 900 Ω or complex, 4-wire or 2-wire analog interface
D = 2048 kb/s digital interface to ITU-T Rec.s. G.703, G.704
T = 64 kb/s digital interface to ITU-T Rec. G.703 (optional)
• indicates available test configurations
⊗ available only with PCS-40
1) with external 2-wire termination

Specifications

Analog signal generator

Sine wave signal

Frequency range	200 to 3600 Hz
Resolution	4 Hz
Frequency accuracy	$\pm 50 \times 10^{-6}$
Harmonic distortion	>56 dB at 0 dBm0
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 complex[1]
Return loss	>36 dB (200 to 4000 Hz)
Balance	>50 dB (200 to 3600 Hz)
Relative levels/ increments	–15 to +5 dBr/0.1 dB
Max. DC voltage	60 V (between a/b and ground)
Connector	balanced, 3pole CF

Auxiliary signal generator

Sine wave signal

Frequency range	200 to 3600 Hz
Resolution	4 Hz
Level range	–60 to –30 dBm0
Level increments	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. DC voltage	60 V (between a/b and ground)
Connector	balanced, 3pole CF

Analog receiver

Filters

Flat filter	200 to 3600 Hz
Psophometric filter	to ITU-T Rec. O.41
Selective filter	between 200 and 3600 Hz, center 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	–15 to +5 dBr
Level increments	0.1 dB
Group delay distortion	0 to 10 ms
Resolution	0.1 ms

Input

Impedance	600 Ω, 900 Ω, >30 kΩ and complex[1]
Return loss	>36 dB (200 to 4000 Hz)
Balance	>50 dB (200 to 3600 Hz)
Max. DC 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

Sine wave 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	–60 to +3.1 dBm0
Level increments	0.1 dB

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 55 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
Levels	same for all 37 spectral lines
Level range	–30 to 0 dBm0
Level increments	0.1 dB
Group delay measuring signal	MTTS
Test patterns	PRBS6, PRBS9, PRBS11, PRBS15
Insertion in	voice channels 1 to 30
Freely selectable n × 8 bit word sequence	n = 1 to 60
Insertion in	FAS, FAW, MFW, channel, signaling channel
Repetitions	1 to 9999 or continuous
Freely selectable FAS sequence	n × 7 bits, n = 1 to 60
Freely selectable MFAS sequence	n × 4 bits, n = 1 to 60
Error insertion	FAS, MFAS, MFW, channel, signaling channel
Error ratio	5×10^{-3} to 5×10^{-7}
Digital milliwatt signal	to ITU-T Rec. G.711

Output

Bit rate	2048 kb/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 Mb/s)
Test pattern insertion into one time slot
Analysis of one time slot

Generator operation

from internal clock	2048 kHz ± 50 × 10⁻⁶
or external clock	2048 kHz ± 100 × 10⁻
or clock derived from received signal	

Digital loops

2 Mb/s loop	all time slots switched through
2 Mb/s loop	one selected time slot generated internally, remainder switched through
2 Mb/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, center 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

Specifications

Evaluation

Bit error count, event count, recording of transients in digital words	FAS, FAW, MFW, signaling 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 kb/s
Interface parameters	to ITU-T Rec. G.703
Line code	HDB3 or AMI
Unbalanced input impedance	75 Ω or >2 kΩ
Connector	coaxial, BNC
Balanced input impedance	120 Ω or >2 kΩ
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

Result documentation

Result output to external printer
Output in table or graph formats
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.

Self-test and level calibration

Triggered automatically by opening the measurement menu

Codec interface/handset interface

Input/output impedance	600 Ω
Connector	RJ11

64 kb/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 PCM-40

PC AT 486
WIN 3.1, WIN 95, 98, NT
min. 600 kB free conventional memory
min. 256 kB free EMS memory
min. 40 MB free HD space
VGA monitor (color or monochrome)
serial or GPIB (National Instruments) interface

Communication interfaces for PCM-40

Serial I (for computer control)	RS232C/V.24
Serial II (for modem connection)	RS232C/V.24
GPIB/<IEC 625> 8.5/IEEE-488.1-1978 (for computer control)	

Power supply

External adapter with AC line cord	
AC supply	100 to 240 V, 50 to 60 Hz
Power consumption	25 VA

Ambient temperature

Nominal range of use	+5 to +45 °C
Limits range of use (for 2 hours)	0 to +55 °C
Storage and transport	–40 to +70 °C

Air humidity

Nominal range of use	20 to 80 %,r.h. (<20 g/m³ absolute)

Dimensions

(l × w × h in mm)	290 × 230 × 70
Weight	approx. 3.5 kg

Specifications for PCS-40 PCM Channel Selector

Test ports (Ch x)

Maximum level	+20 dBm
Max. DC voltage 60 V (between a/b and ground)	
Max. DC current	100 mA
Impedance	600 Ω
Insertion loss between test port and selected Tx/Rx port (200 Hz to 4 kHz)	<0.02 dB
Connector	balanced, 3pole CF

Access ports (Ch 1 to Ch 30)

Balanced through-switching of up to 30 VF channels in Tx and Rx directions	
Connector DIN 41612 type socket, 64-way, female	
Switching time	<10 ms

Return loss measurement

Built-in bridge for return loss measurements on a selectable VF channel	
Measurement range	0 to 45 dB
Frequency range	200 Hz to 4 kHz
Accuracy	
0 to 30 dB	1 dB
30 to 45 dB	2 dB
Reference impedance	
internal	600 Ω
external (connected to auxiliary input)	600 to 900 Ω
Max. input level	
200 Hz to 300 Hz	–6 dBm
300 Hz to 4 kHz	0 dBm

Longitudinal conversion loss (LCL) measurement

Built-in bridge for LCL measurements according to ITU-T Rec. O.9 on a selectable VF channel	
Measurement range	5 to 56 dB
Frequency range	200 Hz to 4 kHz
Accuracy	
5 to 46 dB	1 dB
46 to 56 dB	2 dB
Terminating impedance	600 Ω
Max. input level	–6 dBm

DC current loop

Two built-in current loops connected to each test port	
DC current	<150 mA
Voltage drop at 20 mA (100 mA)	<5.5 V (<12 V)
Output impedance (200 Hz to 4 kHz)	approx. 30 kΩ

DC feeding bridge

Two built-in current loops connected to each test port	
Supply voltage (It = 0)	appprox. 30 V
Supply current (Rt = 400 Ω)	>20 mA
Supply current (Rt = 0 Ω)	approx. 38 mA
Output impedance (200 Hz to 4 kHz)	approx. 50 kΩ
LCL (200 Hz to 4 kHz)	>45 dB

Line status indication (TX and RX)

Line feeding voltage on
Line looped

Remote control

Control of all functions from PCM-40 Channel Analyzer or personal computer via GPIB/ IEC625/IEEE488 interface	
Interface	IEEE 488 connector

General specifications

Power supply

External adapter with AC line cord	
AC supply	100 to 240 V, 50 to 60 Hz
Power consumption	10 VA
(One adapter can supply both the PCM-40 and PCS-40)	

Ambient temperature

Nominal range of use	+5 to +45 °C
Limits range of use (for 2 hours)	0 to +55 °C
Storage and transport	–40 to +70 °C

Air humidity

Nominal range of use	20 to 80 %,r.h. (<20 g/m³ absolute)

Dimensions

(l × w × h in mm)	290 × 230 × 70
Weight	approx. 2 kg

Ordering information

EL 3039/01	**PCM-40 Channel Analyzer** Including AC adapter, RS232C/V.24 cable and operation manual (in English) A separate PC is required for operation
EL 3039/60	Calibration report for PCM-40
EL 3039/20	**PCS-40 Channel Selector** Including return loss and longitudinal conversion loss (LCL) measuring bridge, DC current loop and DC feeding bridge, cables for interconnection of PCM-40 and PCS-40, 64-way female connector set for accessing PCM MUX and operation manual (in English)
Options	
EL 3039/01	64 kb/s interface (for codirectional/contradirectional clock) for BERT and D&I
EL 3039/02	Impedance modification (replaces complex impedance)
Accessories	
EL3043/01	GH-1 DC Loop Holding/Line Feeding, OC Loop Holding ELH-2
EL 2237/01	Nylon carrying case (for PCM-40, Notebook PC and accessories)
EL 3039/203	64-way female connector set for PCS-40
EL 3039/201	IEEE interface cable for PCS-40
EL 3039/202	AC adapter for PCS-40
Documentation	
EL 3039/83	Service manual for PCM/PCS-40 (in English)

Test & Measurement Regional Sales

NORTH AMERICA
TEL: 1 866 228 3762
FAX: +1 301 353 9216

LATIN AMERICA
TEL:+55 11 5503 3800
FAX:+55 11 5505 1598

ASIA PACIFIC
TEL:+852 2892 0990
FAX:+852 2892 0770

EMEA
TEL:+49 7121 86 2222
FAX:+49 7121 86 1222

WEBSITE: www.jdsu.com