Portable 2Mbit/s communications analyser

BERcut-E1

BERcutE1 is an advanced compact handheld analyzer/generator for E1 communications. It can be used for installation, bringing into service and maintenance of 2 Mbps transmission paths and voice and data circuits, and for analysis of PCMsystems primary data stream structure. The instrument connects to the primary data transfer interface (ITUT Recommendation G.703) and can operate as a generator/supervisor for different kinds of test signals in AMI and HDB3 coding; or as a monitor/signal analyzer for PCM systems (ITUT Recommendation 0.162).

Basic functions

- Inservice and Outofservice measurements
- Comprehensive data channel performance analysis according to ITUT Recommendations G.821 and G.826/M.2100
- Test patterns generation
- Errors and alarms insertion
- Pulse shape analysis
- Jitter measurements
- Voice frequency generation and analysis
- Formation and analysis for both structured and unstructured dataflows 2048 kbit/s and nx64 kbit/s data streams support
- Builtin oscilloscope
- Jitter generator
- MTJ/JTF Analysis
- SLA Analysis
- Signalling protocols analysis in postprocessing mode More than 640 protocols are supported
- External headset support
- Coloured LCD display
- Continuous operation time in autonomous mode from the internal battery — 6 hours.
- Reliable connection
- Compact and robust design

# Metrotek

BERcut-E1

PCM analysis

BERcut-E1 has a comprehensive range of features that allow E1 circuit malfunctions to be located and identified whether they are caused by connection or equipment faults, environmental effects, or dataspecific errors.

The instrument's E1 capabilities are typically used in following areas:

- Out-of-Service installation, commissioning and "bringing into service" acceptance tests – to verify the quality of the entire digital transmission path using industry standard test methods.

- Preventative maintenance for live data transmission circuits – to alert field technicians of degrading service quality, i.e. PCM path monitoring in the InService mode for alarms, errors, clock slips, frequency and pulse shape.

- Maintenance, troubleshooting and fault isolation of disrupted services – the BERcut-E1 can be used to locate the source of the trouble quickly and efficiently using a combination of both InService and Out-of-Service test modes. This type of testing ensures that all data transmition equipment is correctly configured for the planned sequence of timeslots and that the integrity of these sequences are maintained across a network.

BERcutE1 connection modes

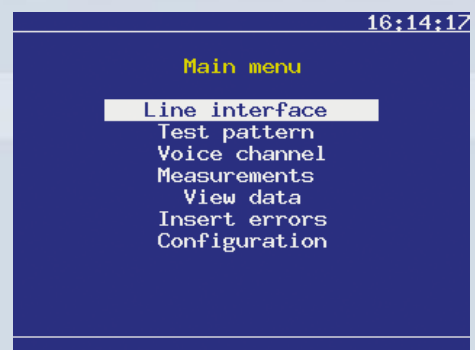**For data communication systems:**
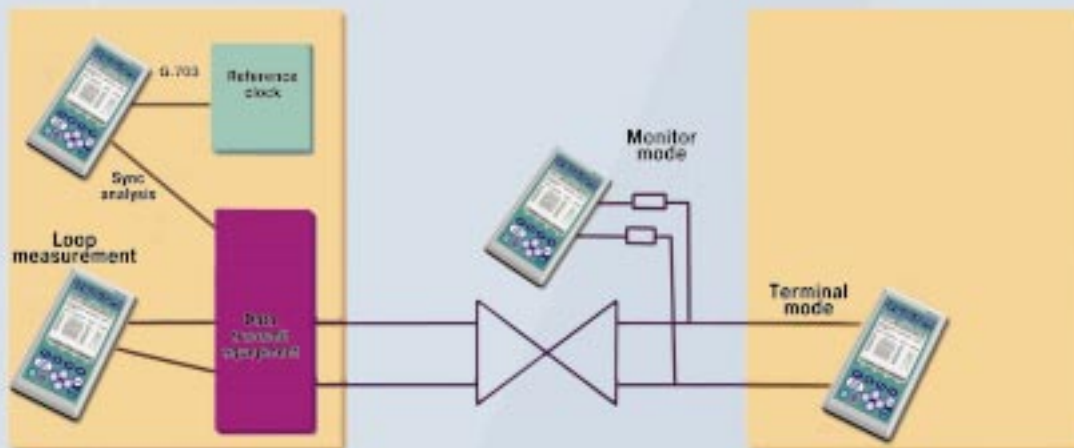
As DTE for xDSL protocols:

User interface

User interface of the BERcut-E1 analyzer is a system of menus which provides easy and quick access to any necessary at the moment instrument's function.
The set of LEDs on the analyzer's front panel allows to monitor the current state of tested equipment and react on the instant to its change.

Bit Error Rate Testing (BERT)

```
                          16:14:42
          Line interface

          Mode     Term
      Add bust     ◊
    Struct cycle   PCM30
          CRC-4    On
      Line code    AMI
      Send freq    Recv
      Deviation    On
      Long haul    On
      Test speed      Nx64/Nx64


  Term      Tranz     Monit     Tr-mon
```

BERcut-E1 provides possibility to perform BER Tests over an entire 2.048 Mbps link using either a G.703 unframed or G.704 framed HDB3/AMI signal. The ability to insert errors in the test pattern, framing and alarm bits allows the user to verify tests and examine error response.

The analyzer has an extensive range of test patterns available including: PRBS, fixed, alternative and userdefined patterns. Supported length of generated fixed word is 24 bits. The list of supported test patterns makes BERcut-E1 compatible with existing test instruments and enables the network to be tested with high load.

```
                              17:45:00

                G.821

  CODE    0.000e+00    CODER    -
  REBE            ◊    REBER    -

  US              ◊    %US      -
  AS              ◊    %AS      -
  ES              ◊    %ES      -
  SES             ◊    %SES     -

  curBER  -

  Start                  <        >
```

"End-to-end" transmission test

```
                          16:16:43

          Insert errors

      Error type   bit
          Speed    10e-1
          Count    Cont
    Start errors   Start

      Alarm type   LOS
           Time    Cont
     Start alarm   Start



  bit      E-bit     FAS        >>
```

To verify the End-to-End transmission for the data communications the BERcut-E1 can be connected to a data circuit as either DTE or DCE. Using BERcutE1 at each end of the circuit allows technicians to verify performance in both directions using the BER test mode. The extensive range of functions allows the analyzer to test the network in conjunction with existing test instruments.

VF function

Voice channels can be monitored in the InService mode as a first level check of analogue level and quality. BERcut-E1 provides capability to listen to selected voice channel and to insert voice data from connected microphone into any userselected timeslot.

```
                              16:16:20

          Voice functions

      T/S send   ◊
        Source   Off
           CAS   0000
       Sensit.   [      ]

      T/S recv   ◊
         Phone   Off
        Volume   [      ]

        Coding   ┤-law
```

G.821, G.826, and M.2100 Results

```
                          17:45:21

          G.826/M2100

  EB(block) ◊

          Near end

  BBE          ◊    %BBE     -
  ES           ◊    %ES      -
  SES          ◊    %SES     -
  AS           ◊    %AS      -
  US           ◊    %US      -

  Start                  <        >
```

BERcut-E1 provides comprehensive measurement and analysis of the E1 path parameters according to ITUT's G.821, G.826 and M.2100 Recommendations. This performance analysis is carried out simultaniously with other measurements. Also, measured parameter values can be recorded for further recall and review.

BERcut-E1

Errors and alarm analysis

BERcut-E1 monitors and counts CRC4, Code, Ebit and FAS errors, AIS indications, AIS signal in TS16, FAS, MFAS, distant FAS and distant MFAS alarms. This monitoring capability allows to determine circuit performance without disturbing the traffic flow on live 2 Mbps lines.

```
                                    16:16:33
              Base parameters

ET              00:00:00

CODE    0.000e+00    CODER    -
EBIT            ◊    BER      -
CRC             ◊    CRCR     -
FEC             ◊    FECR     -
CASMFEC         ◊    CASMFECR -
REBE            ◊    REBER    -


Start                   <        >
```

```
                                    17:44:53
              Base parameters 2

LOS             ◊    %LOS     -
AIS             ◊    %AIS     -
LFA             ◊    %LFA     -
LMFA            ◊    %LMFA    -
RRA             ◊    %RRA     -
CASRRA          ◊    %CASRRA  -
LSS             ◊    %LSS     -


Start                   <        >
```

Monitoring FAS errors, AIS and FAS distant alarms enables the technician to sectionalise E1 circuits and therefore identify the source of errors.

For example, the presence of a FAS distant alarm indicates that there is a malfunction downstream of the current analyzer connection point, whereas the accurance of an AIS alarm indicates that a problem lies upstream.

Data contents view

BERcut-E1 provides possibility to view contents of tested dataflow: contents of frame or timeslot; FAS, NFAS, CAS and MFAS words; and contents of Sbits. The timeslot contents is displayed in three forms: binary, hexadecimal and ASCIIcode.

This feature allows the user to diagnose the data transfer in tested E1 system, and monitor parameters of internal system management.
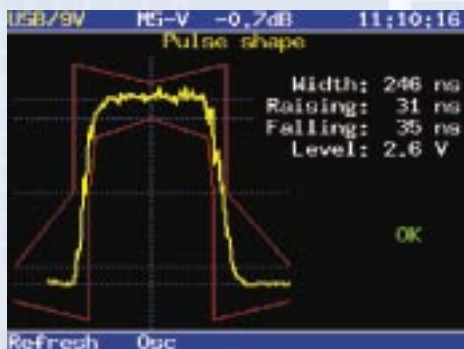
```
USB/9V   -5-V  -0,7dB    10:59:54
              Frame Monitoring

TS  BINARY     HEX  ASCII

0   00011011   1B   ( )
1   11100101   E5   (E)
2   01111110   7E   (")
3   01011111   5F   (_)
4   00000101   05   ( )
5   11000010   C2   (6)
6   00011100   1C   ( )
7   10001100   8C   ( )

Pause
```

Pulse shape analysis

```
USB/9V   MG-V  -0,7dB    11:10:16
              Pulse shape

                   Width:   246 ns
                   Raising:  31 ns
                   Falling:  35 ns
                   Level:   2.6 V


                         OK

Refresh   Osc
```

The analyzer can capture and perform analysis on the pulses produced by E1 equipment. The pulse height and overall shape are displayed against the ITUT pulse mask conformance template.
This measurement mode is used to ensure that E1 pulses are of a correct signal level.

BERcut-E1 has a number of features that provide the physical layer verification. The instrument's pulse shape conformance measurement function allows the user to ensure that the E1 output from a regenerator or a PABX is in compliance with the ITUT recommendation mask.
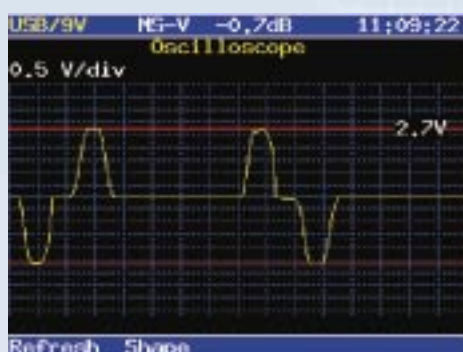
Oscilloscope

This function provided by the analyzer displays a oneshot sample of the signal for the 4 us interval with the frequency passband of 0.01..10 MHz.

The oscilloscope mode can be used in conjunction with the timeslot contents view mode to find the probable cause of monitored signal distortion.

Jitter measurement

The jitter measurement option is used for troubleshooting E1 links for timing and clock problems that may cause errors to occur. The BERcut-E1's display graphically shows the instantaneous amount of jitter over the preceding 60 seconds. Jitter measurements can be made in the InService mode by connecting to monitoring points on E1 equipment. Alternately,

BERcut-E1 can terminate the line and measure the amount of jitter in an Out-of-Service mode. The BERcut-E1 analyzer feature is a new algorithm of jitter measurements which allows to measure jitter parameters directly in a dataflow without application of additional analogdigital converters.

This innovation allowed Metrotek specialists to build Jitter analyzer into such compact handheld instrument as BERcut-E1. Besides, the value of measurement error (0.02 UI) enables to compare BERcut-E1 analyzer's parameters with those of fixed SDH analyzers.
Jitter measurements are performed in compliance with international recommendations and standards.

Digital synthesizer provides jitter parameters analysis with application of measuring filters LP, HP1 and HP2.

Jitter generator. MTJ/JTF measurements

In addition to jitter analyzer function BERcut-E1 provides the jitter generator capability. Combined usage of jitter analyzer and generator allowed to implement the MTJ (Maximum Tolerable Jitter) /JTF (Jitter transfer Function) measurements function.

MTJ/JTF measurenet results are displayed in tabular format and in graphical format in compliance with relevant ITUT recommendation masks.

BERcut-E1

Protocol analysis in postprocessing mode

BERcut-E1 's protocol analysis function is a revolutionary innovation in service and maintenance.
The instument supports an internal converter of signalling data into Ethereal software format, which allows user to analyze signalling protocols in postprocessing mode.

With two receivers (Rx and Sync ports) BERcut-E1 connects to tested equipment. At the same time analyzer is connected to PC trough USB port as a remote probe for signalling system data download and conversion.

Special software developed for PC allows user to specify timeslots with signalling information and a file to which received data will be recorded. Then BERcut-E1 starts operation as passive signalling monitor and transfer dataflow from selected timeslot to the PC. Recorded tracefile could be lately viewed and analyzed by means of the Ethereal software which provides decoding for allmost any data transfer and signalling sistens protocols.

The Ethereal is an opensource software and could be downloaded freeofcharge from its homepage in the Internet: **www.ethereal.com** . At nowadays, the Ethereal provides decoding and analysis for more up to 670 protocols including protocols of such signalling systems as ISDN, SS7, GSM, IP, etc.

Signalling data processing functions of the Ethereal software can be compared to functions of modern protocol analyzers, and include:

- Data decoding with threelevel detalization
- Signalling messages statistics
- Signalling messages fields statistics
- Signalling data can be filtered by Message Type or parameters names
- Tracefile can be sorted by any basic field
- Colourizing function: user can specify a highlight colour for different type of messages
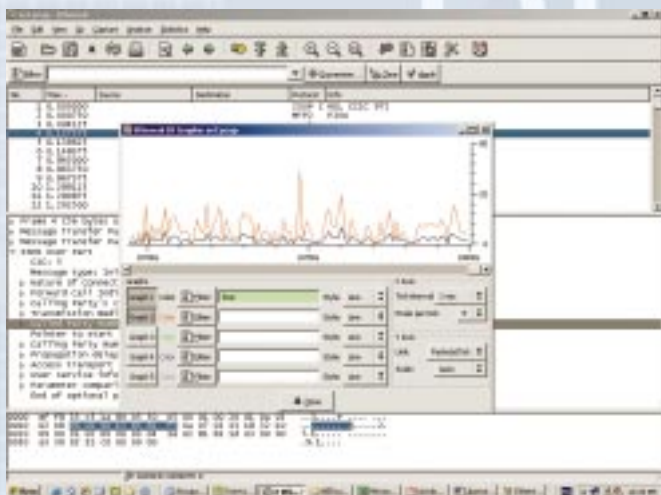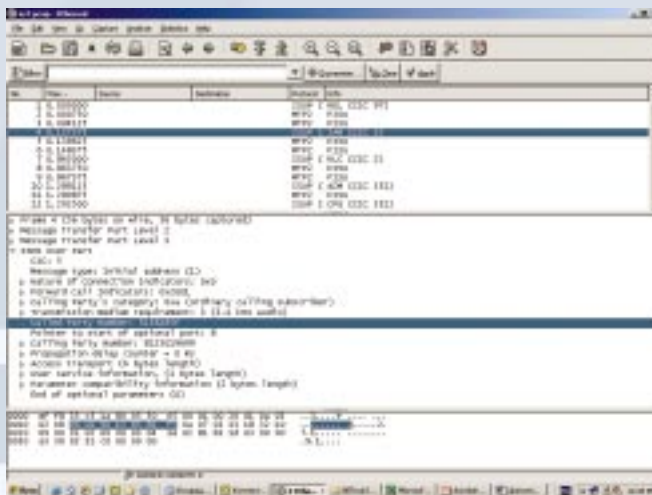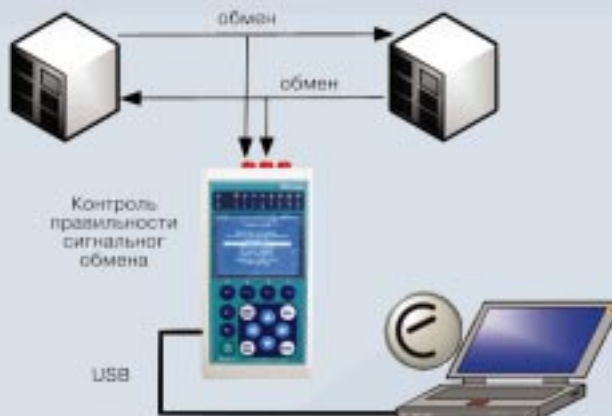
As long as BERcut-E1 provides only conjunction with opensource Ethereal software, the cost of this option is beyond compare to price of any protocol analyzer.

The application of parallel analysis method allows the simultaneous protocol analysis and E1dataflow parameters measurements (error and alarms detection, pulse shape analysis, etc.)

Specifications

Transmitter	
Interface	
Number of ports	1
Interface	G.703
Bit rate	2048 kbit/s
Output impedance	120 Ohm, ballanced; or 75 Ohm, coaxial connector
Pulse shape	G.703
Line coding	AMI, HDB3
Maximum peaktopeak output jitter	0.015 Ulpp (measurement on G.823)
Transmitter clock signal	
Signal source	clock signal from Rx port; internal; external 2048 kHz
Internal clock limp	not more than $\pm$ 3 ppm
Clock frequency offset	$\pm$ 6 kHz with 1 Hz step
Synchronization	
2048 kbit/s G.704	Frame; Multiframe with CRC4; Multiframe without CRC4; Multiframe CAS
Test patterns	
Types	PRBS; fixed: All 1, All 0, 55, user defined
PRBS	2^{6-1}, 2^{9-1} (O.153), 2^{11-1} (O.152, O.153), 2^{15-1} (O.151), 2^{23-1} (O.151)
Fixed word length	24 bits
Polarity	normal, inverted
Tone	
Code law	A-Law
Frequency	1000 Hz
Level	-3 dBm0
Operations	
Alarm generation modes	Single; continuous; with defined duration
Error insertion modes	Single; Continuous with defined errors rate
Errors rate	$10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}$
Alarm types	LOS, AIS, LOF, LOM, RDI, RMA, ARTF, LSS
Errors	bit, Ebit, FAS and MFAS errors, CRCerrors, REBE
Receiver	
Interface	
Number of ports	2 (Rx, Sync)
Interface	G.703
Bit rate	2048 kbit/s
Impedance	120 Ohm / not less then 4 kOhm at frequency of 1024 kHz, ballanced line or 75 Ohm / not less then 4 kOhm at frequency of 1024 kHz
Receiver sensitivity	to -18 dB in the normal mode; to -36 dB in the "longhaul" mode
Pulse shape	G.703
Line coding	AMI, HDB3; synchronizing signal 2048 kHz
Maximum input jitter	G.823
Receiver clock signal	
Signal source	clock signal recovered from received data stream
Synchronization	
2048 kbit/s G.704	Frame; Multiframe with CRC4; Multiframe without CRC4; Multiframe CAS
Test patterns	
Types	PRBS; fixed: All 1, All 0, 55, user defined
PRBS	2^{6-1}, 2^{9-1} (O.153), 2^{11-1} (O.152, O.153), 2^{15-1} (O.151), 2^{23-1} (O.151)
Fixed word length	24 bits
Polarity	normal, inverted

BERcut-E1

Registered events	
Alarms	LOS, AIS, LOF, LOM, RDI, RMA, ARTF, LSS, ALL0, ALL1
Errors	bit errors, Ebit, FAS and MFAS errors, CRCerrors, REBE
Pulse shape (Software option SWPS)	
Oscilloscope	Line signal at Rx port. Frequency passband 0.01 to 10 MHz Attenuation 0dB, 6 dB, 12dB
Pulse shape	Line signal at Rx port. Frequency passband 0.01 to 10 MHz
Jitter measurement (Software option SWJT)	
Interface	2048 kbit/s
Measurement method	O.171
Reference clock signal	recovered, internal, external
Range	0.05..10 UIpp
Measurement error	0.02±5% UIpp
Measurement results	
Events	Alarm counters (second with alarm); Errors counters; Error ratio
TS content monitoring	Timeslot 0 (FAS, NFAS, MFAS) Timeslot 16 in frame 0 abcd CAS bits for all 30 channels Single timeslot 0..31 All timeslots
PCM transmission performance analysis	
G.821	On test pattern Parameters: ES, SES, US, %ES, %SES, %US.
G.826	Parameters: ES, SES, BBE, US, %ES, %SES, %US.
M.2100	2048 kbit/s with CRC Parameters: ES, SES, BBE, US, %ES, %SES, %US. Alarm indication according to userdefined thresholds.
Functions	
Measurement start/stop	Manual start with programming duration.
Voice channel	Reading audio data from any selected timeslot (0..31) Transfer audio from microphone into any selected timeslot (0..31)
Through mode	Retransmition of received signal – Regenerator Timeslot 0 can be replaced by internal generator Timeslot 16 can be replaced by internal generator Alarm and errors insertion
Remote control	via the USBinterface
Hardware characteristics	
Display	colour LCD display with backlight; resolution – 320х240 pixels
LEDs	LOS, AIS, LOF, LOM, RDI, SER, RMA, LSS
Autonomic mode	at least 6 hours (with maximum display brightness)
Power	internal accumulator 1800mAh with nominal voltage of 4,8V; AC adapter; USBinterface
Dimensions	Analyser – 85x155x40mm External power unit/AC adapter – approximately 29x74x80mm
Weight	Analyser – approximately 0.4 kg External power unit/AC adapter – approx. 0.07 kg

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