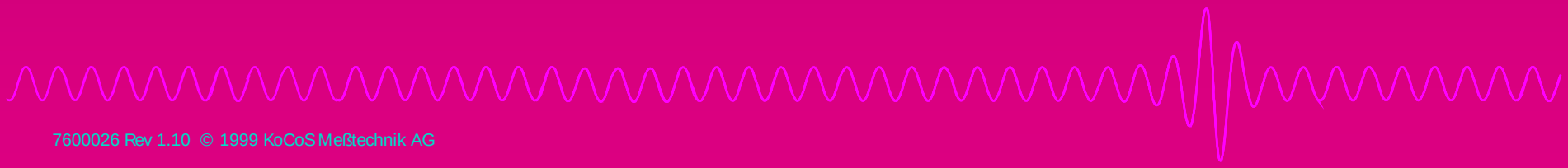
An integrated system for fixed and portable testing of circuit breakers, grounding and load switches

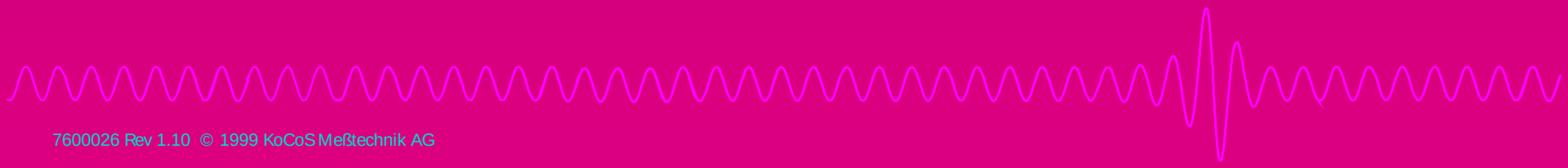
Frank Richter, KoCoS Messtechnik AG

Roger Meachem, KoCoS USA LLC



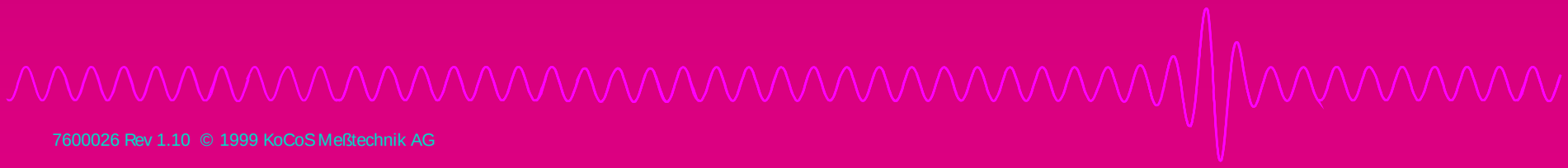
Continuous documentation for the life of the breaker

- Design and development
- Factory testing
- Commissioning
- On-going maintenance



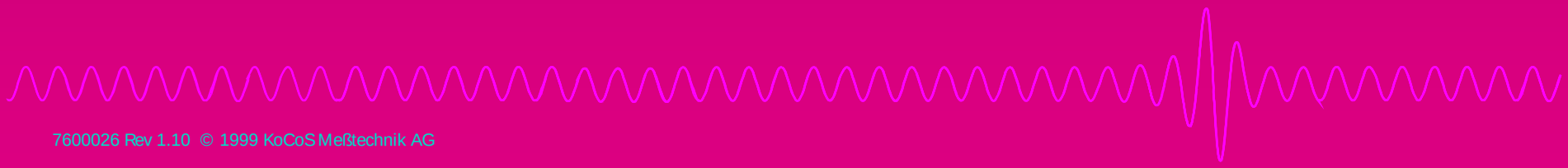
Integrated Breaker Analysis

- Keeping track of all relevant breaker parameters allows reaction to parameter changes before breaker fails
- Unique database which allows comparison of all actual and historical test results
- Export of definable order/breaker parameters and test results
- Database queries with SQL statements give detailed information about all installed breakers



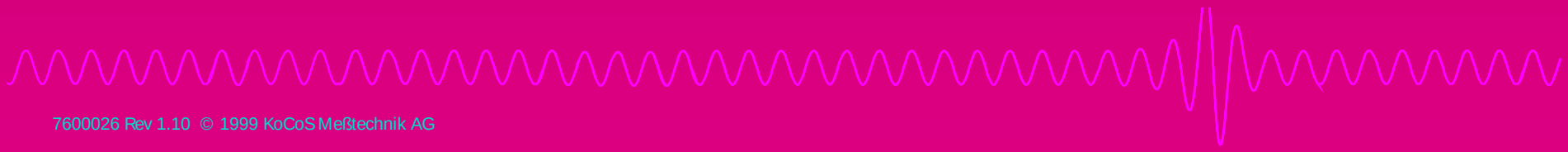
User connections

- 3x2 solid state switches with 1µsec accuracy
- 3x2 relay switches, user definable (e.g. for controlling of AC relays)
- 3x4 tri-state inputs for measurement of main and resistor contact states
- 3x6 editable, auxiliary inputs
- Analog inputs for motor and coil currents and voltage
- All inputs (binary and analog) opto-isolated 4 kV peak/2.5 kV RMS



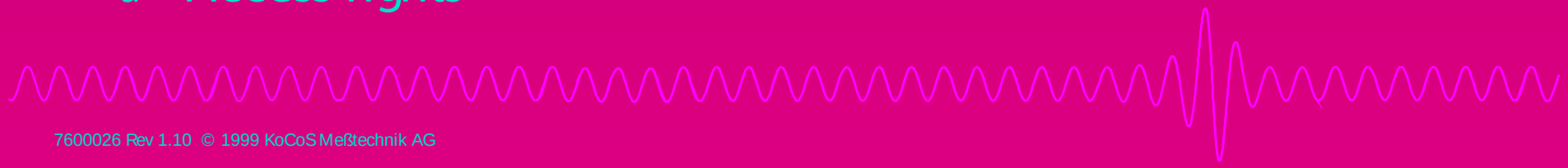
Breaker Measurements

- Mechanical:
  - Timing of main, resistor and auxiliary contacts
  - Travel measurements of main contacts
  - Travel and pressure measurements of other active elements
- Electrical:
  - Coil currents and resistance
  - Internal resistance of main contacts (Micro-Ohm test)
  - Motor currents



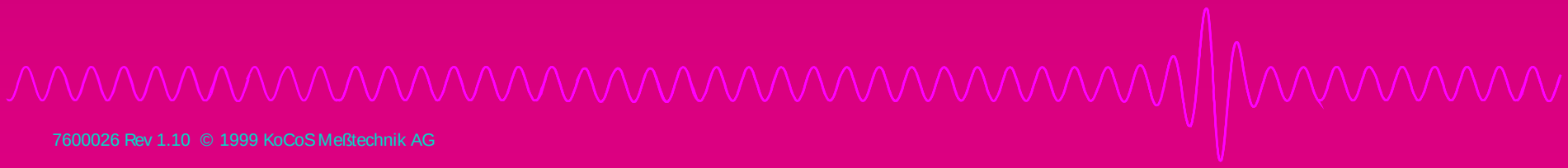
Software Modules

- Configuration and handling of test orders
- Central breaker database
  - manufacturer-specific parameters and test list
- Test monitor
  - platform for manual breaker tests and sequence tests
  - local and global (database) storage of parameters and results
  - display and comparison of actual/historic test results
  - report generation
- Editor for generation of automatic test cycles
- Fully graphical report editor
- Access rights



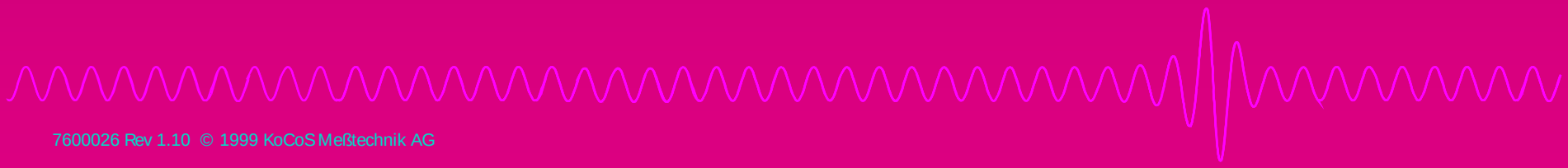
Factory Testing

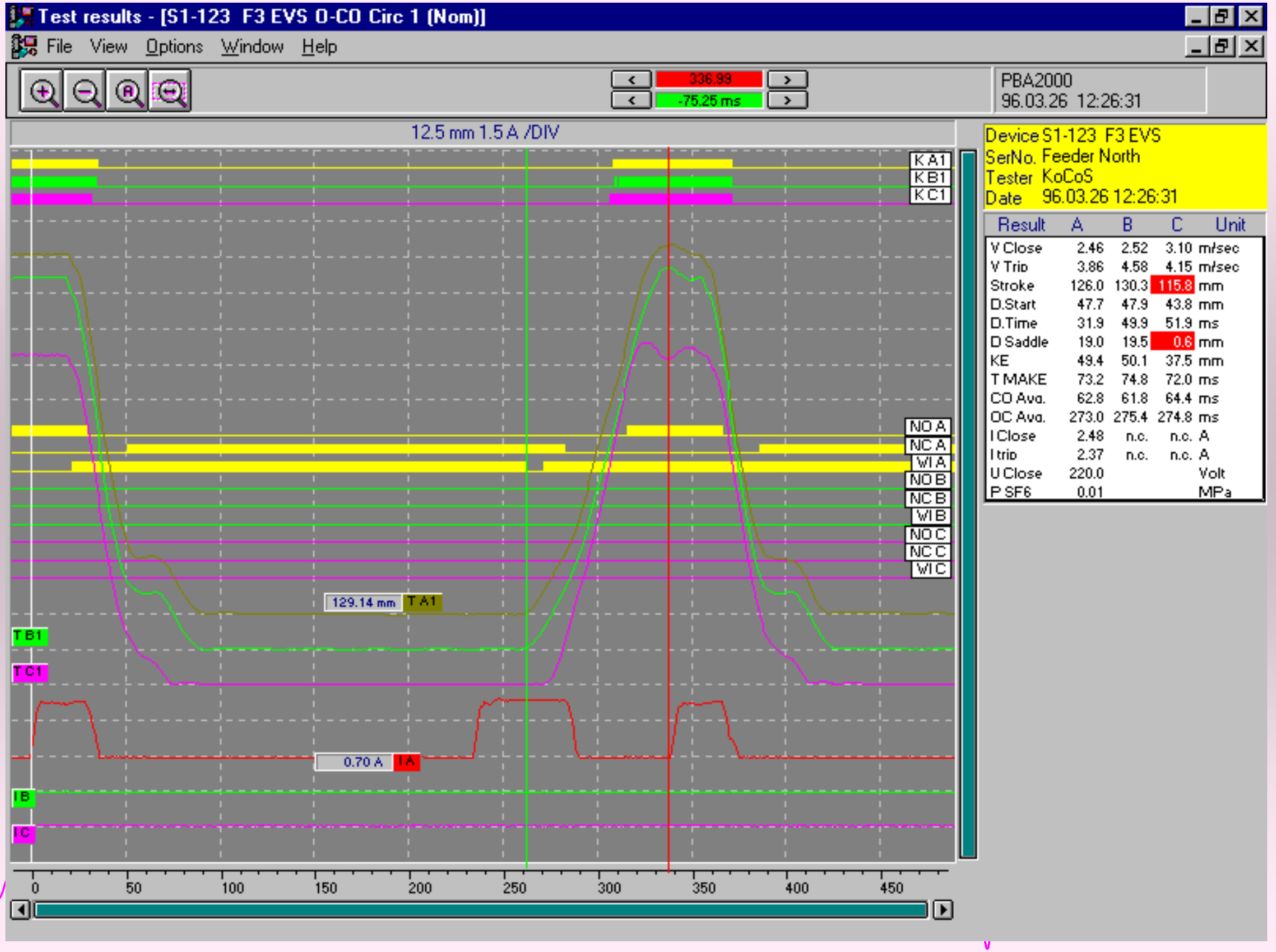
- PC with Windows® software controls system and provides user interface
- Signal recording and conditioning of up to 64 analog and 256 binary inputs
- Integration of several workstations in a network with centralized storage of all relevant parameters and results
- Software controlled PSUs for motor and coil supplies
- Definable automatic test sequences

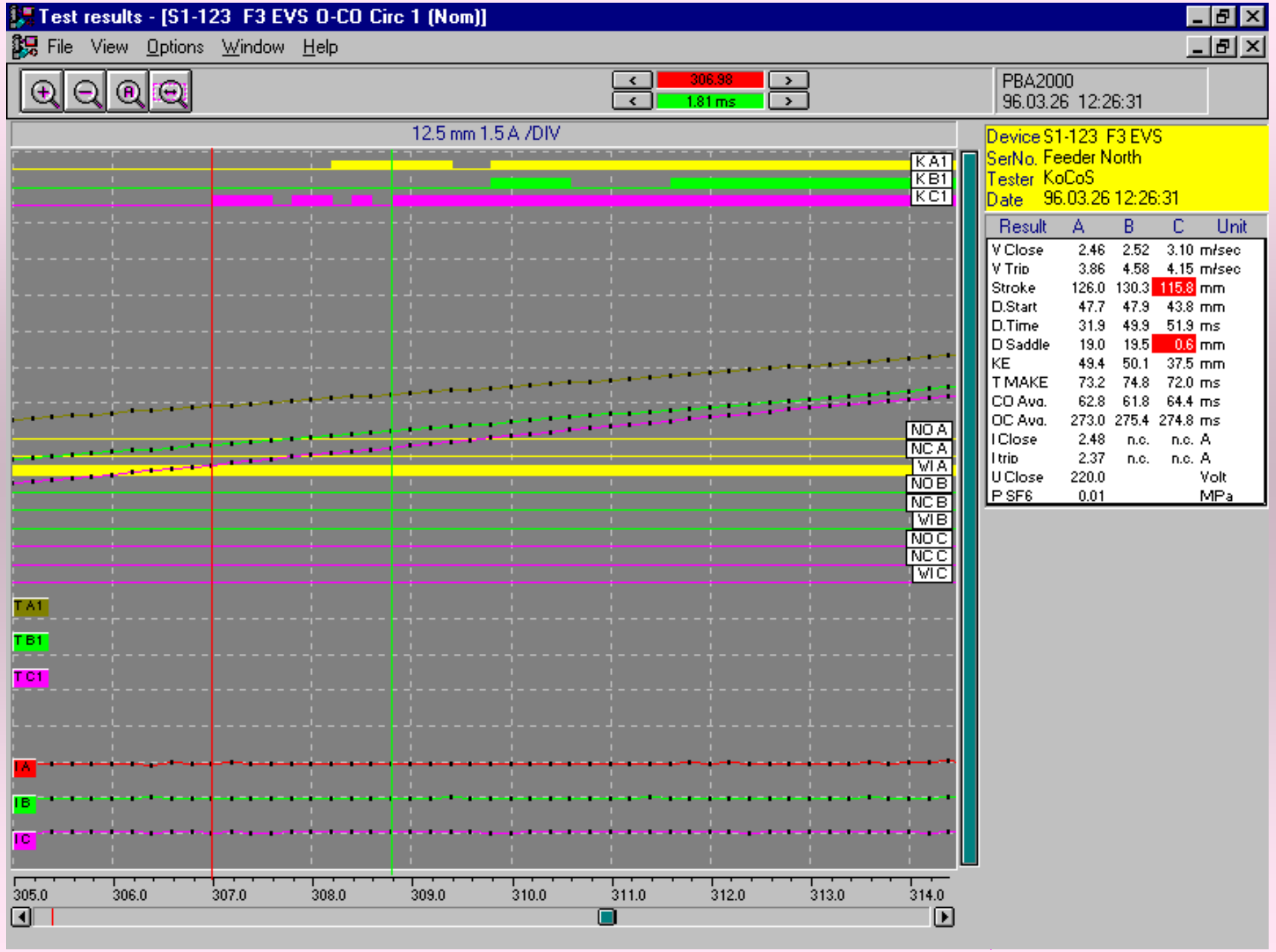


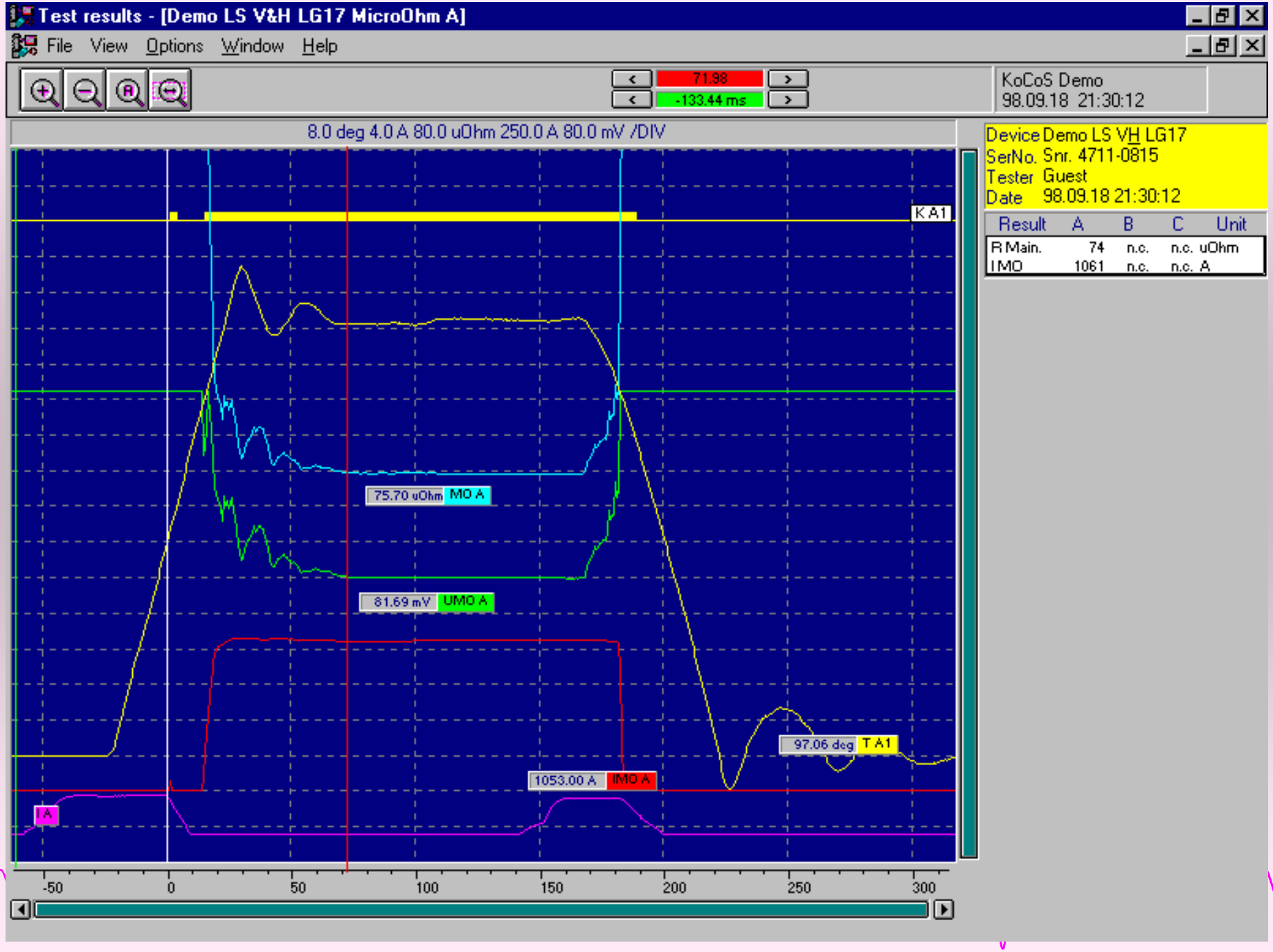
On-site Breaker Tests

- Highly integrated design in a modular and compact 4U 19" case
- Up to 16 analog / 64 binary inputs for complete 3-phase tests
- Industrial PC as MMI
- Optional integrated bubble jet printer for printing of graph results and reports
- LC Display 320x240 pixel
- 6 programmable *Hot Keys* for control of all necessary functions
- Optional outputs for control of external PSUs
- Control output for optional Dynamic Micro-Ohm equipment




Test results - [S1-123 F3 EVS O-CO Circ 1 (Nom)]
File View Options Window Help
336.99
-75.25 ms
PBA2000
96.03.26 12:26:31
12.5 mm 1.5 A /DIV
KA1
KB1
KC1
NO A
NC A
WI A
NO B
NC B
WI B
NO C
NC C
WI C
129.14 mm TA1
TB1
TC1
0.70 A IA
IB
IC
0 50 100 150 200 250 300 350 400 450
Device S1-123 F3 EVS
SerNo. Feeder North
Tester KoCoS
Date 96.03.26 12:26:31
Result A B C Unit
V Close 2.46 2.52 3.10 m/sec
V Trip 3.86 4.58 4.15 m/sec
Stroke 126.0 130.3 115.8 mm
D.Start 47.7 47.9 43.8 mm
D.Time 31.9 49.9 51.9 ms
D Saddle 19.0 19.5 0.6 mm
KE 49.4 50.1 37.5 mm
T MAKE 73.2 74.8 72.0 ms
CO Ava. 62.8 61.8 64.4 ms
OC Ava. 273.0 275.4 274.8 ms
I Close 2.48 n.c. n.c. A
I trip 2.37 n.c. n.c. A
U Close 220.0 Volt
P SF6 0.01 MPa


Test results - [S1-123 F3 EVS O-CO Circ 1 (Nom)]
File View Options Window Help
306.98
1.81 ms
PBA2000
96.03.26 12:26:31
12.5 mm 1.5 A /DIV
KA1
KB1
KC1
NO A
NC A
WI A
NO B
NC B
WI B
NO C
NC C
WI C
TA1
TB1
TC1
IA
IB
IC
305.0
306.0
307.0
308.0
309.0
310.0
311.0
312.0
313.0
314.0
Device S1-123 F3 EVS
SerNo. Feeder North
Tester KoCoS
Date 96.03.26 12:26:31
Result A B C Unit
V Close 2.46 2.52 3.10 m/sec
V Trip 3.86 4.58 4.15 m/sec
Stroke 126.0 130.3 115.8 mm
D.Start 47.7 47.9 43.8 mm
D.Time 31.9 49.9 51.9 ms
D Saddle 19.0 19.5 0.6 mm
KE 49.4 50.1 37.5 mm
T MAKE 73.2 74.8 72.0 ms
CO Ava. 62.8 61.8 64.4 ms
OC Ava. 273.0 275.4 274.8 ms
I Close 2.48 n.c. n.c. A
I trip 2.37 n.c. n.c. A
U Close 220.0 Volt
P SF6 0.01 MPa


Test results - [Demo LS V&H LG17 MicroOhm A]
File View Options Window Help
71.98
-133.44 ms
KoCoS Demo
98.09.18 21:30:12
8.0 deg 4.0 A 80.0 uOhm 250.0 A 80.0 mV /DIV
Device Demo LS VH LG17
SerNo. Snr. 4711-0815
Tester Guest
Date 98.09.18 21:30:12
Result A B C Unit
R Main. 74 n.c. n.c. uOhm
IMO 1061 n.c. n.c. A
K A1
75.70 uOhm MO A
81.69 mV UMO A
97.06 deg T A1
1053.00 A IMO A
I A
-50 0 50 100 150 200 250 300