AC-1200
MicroAC Technical Specifications

Introduction

MicroAC is designed to perform all necessary operations to adjust <u>and</u> test magnetic trip thresholds of miniature circuit breakers. Incorporating a Sinusoidal AC-Current Source, it is capable of delivering 1200 Watts (30Arms @ 40Vrms) into the primary winding of a power current transformer for up to 10 cycles.


(Move cursor over the image to see explanations)

Introduction A 32-Bit high performance flash microcontroller monitors and controls all system functions including sine-generation/modulation, load-sensing, KB-Scan, LCD-Drive, Digital I/O, Serial Communications, etc. Depending on the customer's needs, a maximum of 4 secondary windings can be configured and controlled for the power current transformer. For example:

- Pri. : 30A @ 40V
- Sec. 1: 50A @ 20V
- Sec. 2: 100A @ 10V
- Sec. 3: 200A @ 5V
- Sec. 4: 400A @ 2.5V

Current is regulated at the primary. Linearity between the primary and the secondary current is typically better than 0.2%.
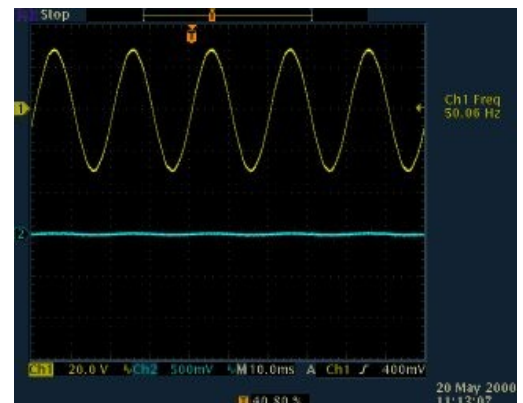
With a vertical resolution of 9 Bits and horizontal resolution of 1 degree, a high waveform purity is achieved (as can be seen on the images).Zero cross amplitude modulation prevents additional harmonics to be generated.

The full linear MOSFET output stage allows trouble-free operation at sudden load changes at the secondary of the output transformer.
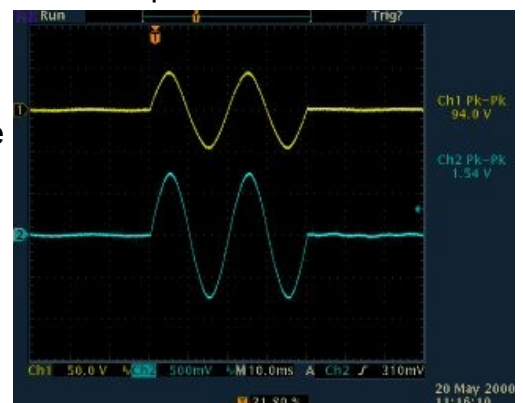
Programming

Programming of the unit is accomplished either via

- Built-in keyboard and alphanumeric LCD or
- RS-232 interface

All relevant parameters are kept in EEPROM. Menu choices and programmable parameters are :

- Reset Counters
- Number of Cycles
- Number of Retries
- Inter-Test Delay
- Calibration
- Statistical Display
- Statistical Distribution
- Reference Voltage
- Starting Edge
- No-Load Voltage
- Light-Load Voltage
- Instantaneous Values
- Test Mode
- Steady-State Current
- Type Parameters

Reset Counters allows clearing

of the statistical variables' contents such as

"Quantity of Tested / Passed / Failed DUTs".
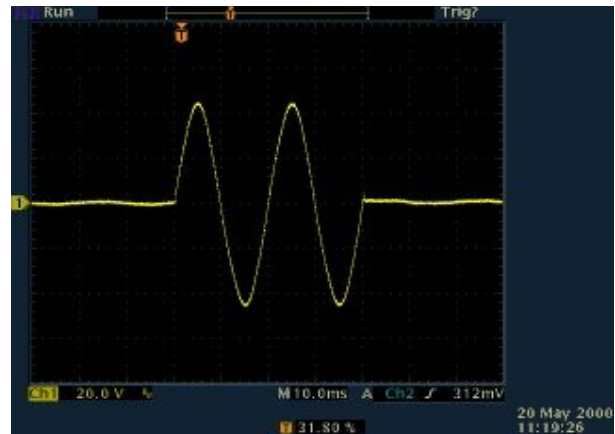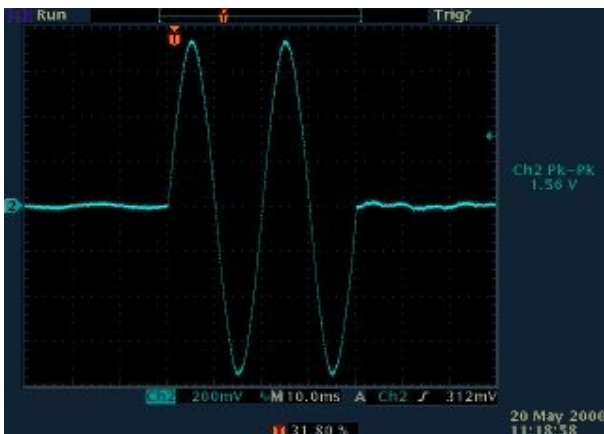
Programming Number of Cycles shows for how many cycles the programmed current will flow. **Number of Retries** determines how many times the test will be repeated if the DUT fails to respond correctly.

Inter-Test Delay is the time delay between subsequent tests.

Calibration allows the user to define and calibrate the primary and secondary currents.

The magnitude of the primary current depends on the units configuration and is typically 30.00A. The magnitude of the secondary currents depend on the external current transformer. To calibrate the unit, the user only needs to load each secondary with an appropriate calibration-grade shunt, force the full-scale current, measure the voltage across the shunt and -in case of deviation- simply reenter the measured value as the new calibration value

Statistical Display selects whether the number of total tested devices or passed devices should be displayed on LCD.

Statistical Distribution shows the number of tested, passed and failed (grouped by reason) devices.

Reference Voltage is only to be changed to compensate for minor long term gain errors.

Starting Edge determines on which edge (rising/falling) the synthesized sine should start.

No-Load Voltage defines the voltage level below which the output is assumed to be loaded; it is used to sense that the circuit breaker is installed and closed.

ProgrammingLight-Load Voltage defines the voltage level below which the output is considered to have no proper load; it is used to sense and signalize a possible connection error.

Instantaneous Values shows the voltage and current peaks of the last 20 half-cycles measured at the primary.

Test Mode has possible values of 'manual' or 'automatic'. In the automatic mode, as soon as a DUT is sensed across the output terminals, 'Ihold'/'Iopen' are forced sequentially and the state of the DUT (Device Under Test) is checked on 'closed' /'opened' respectively. In case of correct response, the DUTs are binned to 'PASSED'; if still not even after the 'Number of Retries', they are binned to 'FAIL'. Manual mode allows the user to force each programmed current for a given DUT-Type via digital inputs 'ADJUST', 'HOLD' and 'OPEN'.

Steady-State Current is the current flowing continuously through the primary of the external transformer. It is in the range of 1 to 8 LSBs corresponding to 0.4% to 2.0% of the FS (Full Scale) current.
Note: Depending on transformation ratio, the steady state current seen at the secondary will be a multiple of this small sinusoidal bias at the primary. In most cases it is even advantageous to have this bias, but it must be kept in mind when testing lower rated DUTs at very high magnetic-trip levels.

Type Parameters menu is where individual 'Ihold', 'Iopen' and 'Iadjust' currents for up to 32 different types of circuit breakers can be defined. Upon exiting, the unit assumes the last selected/modified type in this menu as the one to be tested.

Keyboard & Liquid Crystal Display

The units standard display is 2*16 character LCD with backlight (other display configurations optionally available upon request).

Items displayed on the LCD are:

- Circuit-Breaker-Type (1..32)
- Quantity of Tested or Passed DUTs (1..9999)
- Holding Current [Ihold] (0.0A .. 999.9A)
- Trip Current [Iopen](0.0A .. 999.9A)
- Transformers Current Range (a..d) and
- Warnings/Error Messages wherever applicable

Supported menu languages are English, German and Turkish (other languages optionally available upon request).The individual keys on the keyboard are:
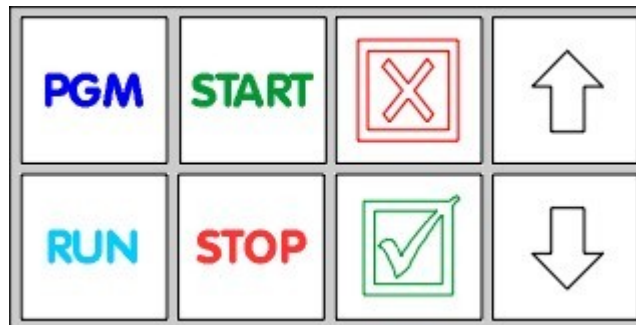
- **PGM** allows entering the program menu
- **RUN/ADJUST** enters RUN-Mode if in PGM-Mode or forces programmed "Iadj" (Adjustment Current) if already in RUN-Mode
- **HOLD** forces programmed "Ihold" (Holding Current)
- **OPEN** forces programmed "Iopen" (Trip Current)
- **ESCAPE** cancels most recent action
- **ENTER** acceps most recent change
- **UP** calls next menu item or increments by one
- **DOWN** calls previous menu item or decrements by one

Alternative KB & LC

D

The system can alternatively be equipped with uTERMINAL's control panel if more user interaction is desired (in manual mode).

Forcing the preprogrammed Ihold, Iopen and Iadj can also be initiated via optically isolated digital inputs. Digital outputs -also being optically isolated- allow output transformers range selection, status indication, etc.

Digital Inputs & Outputs

All inputs active high : LOW=0V..2V, HIGH=12V..24V
All Outputs active low : Open collector 30 mAmax / 35 Vmax

Following is the list of digital I/O :

##	INPUTS	Description	OUTPUTS	Description
1	IN0	(available)		
2	IN1	(available)	OUT1	Iopen is being forced
3	IN2	(available)	OUT2	FAIL
4	IN3	(available)	OUT3	PASS
5	IN4	(available)	OUT4	Active on Transformer Range "a"
6	IN5	(available)	OUT5	Active on Transformer Range "b"
7	IN6	(available)	OUT6	Active on Transformer Range "c"
8	IN7	(available)	OUT7	Active on Transformer Range "d"
9	IN8	(available)	OUT8	(available)
10	IN9	(available)	OUT9	(available)
11	IN10	(available)	OUT10	(available)
12	IN11	(available)	OUT11	(available)
13	IN12	(available)	OUT12	READY
14	IN13	RUN / ADJUST IN	OUT13	-
15	IN14	RUN / HOLD IN	OUT14	ERROR
16	IN15	RUN / OPEN IN		

Communications

A host computer can be used to control all operations. The communication protocol and/or control software (option) for Windows® platform can be delivered on request.
The microcontrollers communications software allows full transparency with regard to parameter modification.
Full duplex RS-232 is implemented as the standard communications interface.
Communication parameters are :

- 38400 baud, 1 Start Bit, 1 Stop Bit, No Parity

Optically isolated RS-485 interface to control multiple units simultaneously along with dedicated PC-Software is also optionally available.

For options mentioned above or other specific requirements, please contact us.

The output amplifier has a push-pull MOSFET power stage consisting of 16 parallelled power slices.
Each slices quiescent current is tightly matched to achieve both stable operation over time and very low zero cross distortion.

Simplified Block Diagram
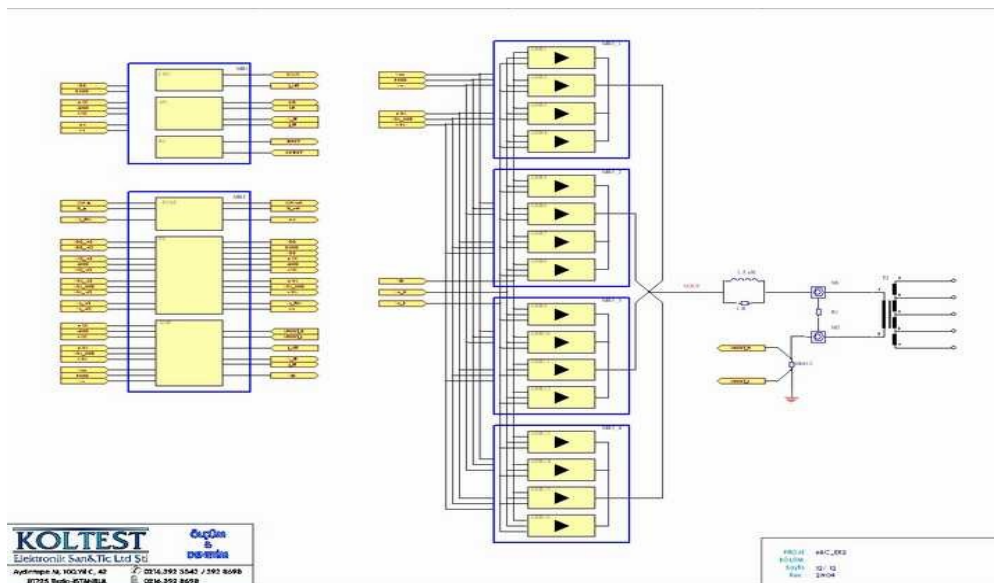
Power Supply & Dimensions

Power supply voltage is 3-phase 380V, 50Hz.
Maximum steady state input current depends on the "Steady State Output Current"-parameter and is below 50Watts.

Dimensions of the unit are :

- 84TE width (ca. 400mm)
- 9U height (ca. 400mm) and
- 400mm depth

Weight is approximately 40kg (output current transformer excluded).

Ongoing Developments

New version (MicroAC V2.0) with quiscent current stabilization and common disable is completed and is being rigorously tested.
"MicroAC V2.0" will be available Q3-2000.

Another version (MicroAC INV) where the MOSFET output stage is replaced by an inverter is under development.
This inverter-version -altough much smaller in size- will allow higher output power up to 3kW.
"MicroAC INV" will be available Q4-2000.