



e K A M

ELECTRONIC AND AUTOMATIC PRIMARY
INJECTION TEST SYSTEM UP TO 2000 A, 3000 A
AND 5000 A



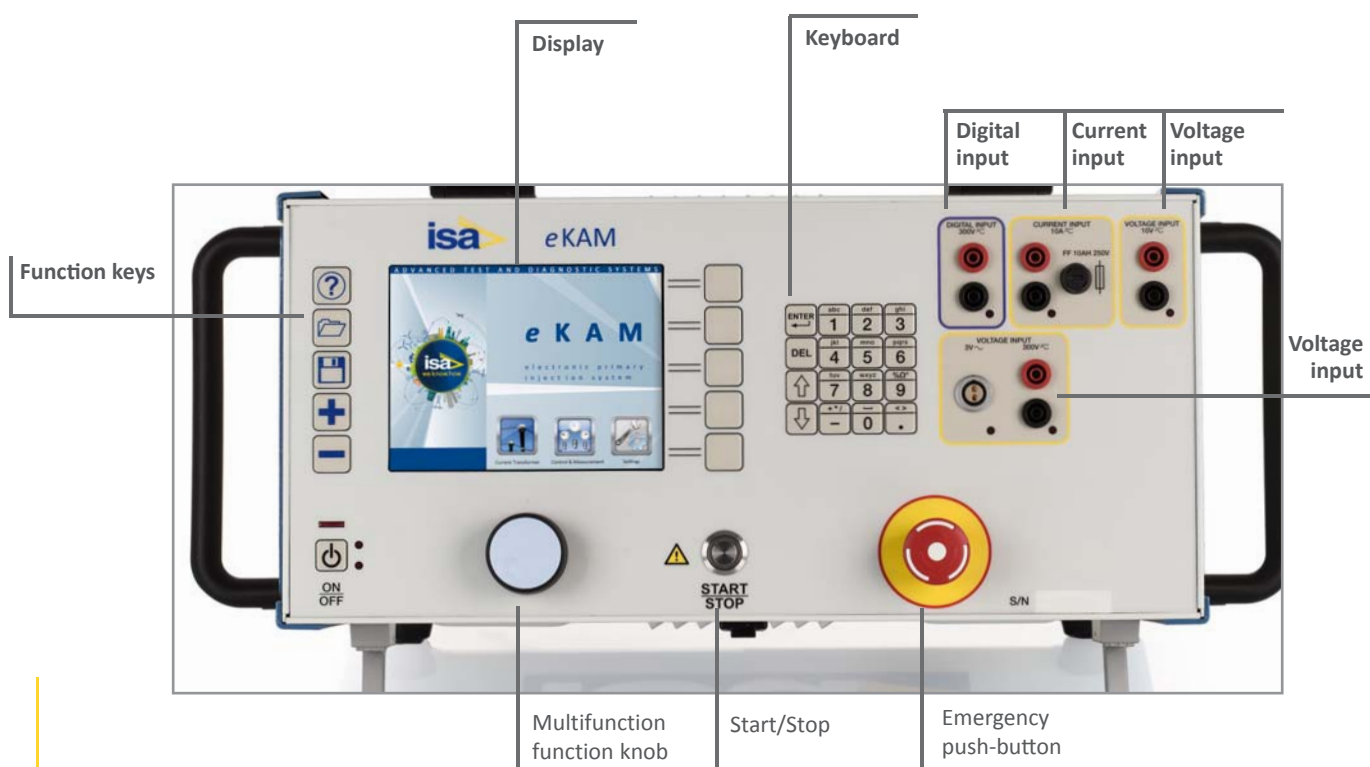
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Electronic and automatic primary injection test system

- Fully automatic
- Two portable units: control and current units
- High current output: up to 2000 A, 3000 A and 5000 A
- Variable output frequency: 15 - 500 Hz
- CT ratio, burden and polarity test
- Large graphic display
- Advanced Test & Data Management Software for test set control, results storage and analysis
- Step & touch plus ground resistance tests with STLG option
- Reduced timing test
- USB interface and Ethernet interface for PC connection
- IEC 61850-9-2 sample values protocol interface
- Compact and lightweight:
Control unit: 17 kg
Current unit: 16/20 kg according to the model

e KAM- FRONT PANEL



e KAM - SIDE PANEL

Remote start
Safety warnings

Interfaces



External booster output



BUX 2000 - BUX 3000 - BUX 5000





DESCRIPTION

e KAM test system includes two portable units: one control unit with a large graphical display that adjusts the output and one current unit (up to 2000, 3000, 5000A).

BUX 2000 (2000 A) - BUX 3000 (3000 A) - BUX 5000 (5000 A): one or more BUX current unit can be connected to e KAM (not simultaneously), they can be ordered separately when the order is placed or at a later moment.

With the control knob and the LCD display, it is possible to enter the MENU mode, that allows to set many functions, making e KAM a very powerful testing device, with manual and automatic testing capabilities and with the possibility to transfer test results to a PC via ETHERNET or Pen Drive.

The TDMS software, which comes with the test set, allows to download, display and analyze test results obtained in local mode. Remote maintenance and diagnostic of the instrument are available via Ethernet. TDMS software operates with all Windows® versions. The ease of operation has been the first goal of e KAM. This is why the LCD display is so large and the dialogue in the MENU mode is made easy.

e KAM includes three measurement inputs:

- . DC voltage (10 V DC).
- . AC voltage:
 - .. High range (300 V AC)
 - .. Medium range (10 V AC)
 - .. Low range (3 V AC)
- . Current (10 A AC or DC).

All these inputs are independent among them (unless 3V and 300V) and allow the measurement of CT outputs or of another source. In addition, a digital input (up to 300 V) is available: it can measure the timing of a wet or dry contact. The instrument is housed in a transportable aluminium box, which is provided with a cover and handles for ease of transportation. A transport case can also be supplied upon request.

IEC 61850-9-2 Sampled Values

e KAM has the facility to test CT, both conventional and non conventional, Merging Unit (MU) using the IEC 61850-9-2 (SV) protocol. e KAM generates current signal and injects these quantities into the CT under test. e KAM then reads the data from the network (Sample Values) in order to perform a variety of different tests.

- . Possibility to test CT ratio and polarity check up to 2000 A, 3000A and 5000A. Test of MU.

TDMS – Test & Data Management Software

TDMS, Test & Data Management Software, is a powerful software package providing data management for acceptance and maintenance testing activities. Electrical apparatus data and test results are saved in the TDMS database for historical results analysis.

The TDMS database organizes test data and results for the majority of electrical apparatus tested with ISA test sets and related software.

PADS - Power Apparatus Diagnostic Software

PADS - Power Apparatus Diagnostic Software is a powerful software application, included in TDMS software, that optionally allows the remote control of the e KAM and STS family: STS 5000, STS 4000, TDX 5000. The software performs various tasks, such as:

- . Controls e KAM from PC
- . Create test plan
- . Download stored test results via Ethernet cable
- . Create and customize test reports
- . Print test results

This program runs under Windows© environment.

Note: Windows is trademark of Microsoft Corporation.

TEST PLAN EDITOR

TEST PLAN EDITOR is an innovative and advanced software module allowing the operator to define and plan a sequence of tests. The operator defines the desired sequence of tests and sets the parameters of each test. TEST PLAN EDITOR creates a sequence of tests to be performed automatically. This feature is available for the test of current transformer. It is also possible to create a test sequence for primary injection.

At the end of the programming, starting the first test will execute the complete sequence. During the test, test results are stored in the memory. The test set minimizes the test Test plans can be saved or recalled, like test results. Up to 64 settings can be stored and recalled. Settings are permanently stored in the memory and new settings can be written to the same address after confirmation. During the test, test results can be stored in the memory. At the end of test, settings and test results can be transmitted to a PC provided with TDMS. The software allows saving, exporting and analysing test results

TEST OF CURRENT TRANSFORMER

• CT RATIO, POLARITY AND BURDEN

The ratio measurement is performed applying high current, coming from one of the BUX modules, to the CT primary and measuring the CT secondary current. The burden can be by-passed, or left in series for the measurement. In this instance, the voltage drop is measured. The secondary current can be measured by a clamp. Input parameters are: the nominal primary and secondary current, from which the program computes the nominal ratio and the nominal test current. The display shows:

- The actual primary current
- The corresponding secondary current
- The value of the secondary current with the nominal primary current
- Actual ratio and ratio error
- Phase shift and polarity.

When the burden is tested, the following parameters are displayed:

- The voltage drop across the burden;
- For the burden: VA rating at the nominal current, angle and power factor.

PRIMARY INJECTION TESTING AND BREAKER TESTING

	OUT IAC EXT	IN IAC	RATIO: 1	Trigger
1	545.437	0.000	1.367	-0.182
2	1094.123	0.000	2.741	-0.169
3	1641.703	0.000	4.113	-0.159
4	0.000	0.000	0.000	0.000

• CB; PRIMARY AND SECONDARY RELAY TESTS

The selection allows injecting the test parameter and measuring the relay threshold and trip delay of a MV CB or of a relay. It is also possible to measure external voltages and currents. Accordingly with the BUX model, it is possible to perform high current tests, up to 5000 A. Input parameters are:

- current range
- output current
- frequency.

It is possible to enable the time measurement on the digital input and to set the type of digital input (wet or dry). The display shows the following data:

- Test current or test voltage
- Trip time
- Closing time
- External voltage and current measurements.





e KAM TECHNICAL SPECIFICATION

INPUT MEASUREMENTS

Current and Voltage

It is possible to meter the current and the voltage of an external input. Three metering groups are available:

- . AC or DC current, up to 10 A
- . AC voltage, with two connections:
 - o High range, up to 300 V AC.
 - o Low range, up to 3 V AC.
- . AC/DC voltage up to 10 V DC.

Resolution and accuracy

INPUT	RANGE	ACCURACY reading & range
AC CURRENT	1 A; 10 A	<%0.05 <%0.05
DC CURRENT	1 A; 10 A	<%0.03 <% 0.08
HIGH AC VOLTAGE	300 mV; 3 V; 30 V; 300 V	<%0.15 <%0.05 <%0.05 <%0.05
LOW AC VOLTAGE	30 mV 300 mV 3 V	<%0.1 <%0.25 <%0.08 <%0.08 <%0.03 <%0.08
DC VOLTAGE	10 mV; 100 mV 1 V; 10 V	<%0.05 <%0.15 <%0.03 <%0.08

Binary Input - Timer

The test set allows testing protection relays. The test current or voltage can be ramped or stepped. As the output changes, a timer is started; the timer stops as the Digital input senses that the relay has tripped or the output cut is cut. Characteristics of the Digital input:

- The input may be selected as Normal Open, Normal Closed.
- The timer can start from an analog input (current or voltage).
- The timer can start and stop at the changing of the digital input, both dry or wet contact.
- Type of input: either dry or under voltage. Maximum input: 300 V AC or DC.
- Voltage thresholds: 5 V, 24 V, 48 V or > 80 V.
- Timer resolution: 1 ms.

Phase angle measurement

The test set measures the phase angle between the two AC selected parameters which are used during the test.

MEASUREMENT	RANGE	RESOLUTION	ACCURACY
PHASE	0 - 360	0.01°	< 0.15°

OTHER MEASUREMENTS:

Starting from the internal and external measurements, the test set computes the following parameters:

CT RATIO

CT POLARITY

CT BURDEN

Other measurement:

Z, P, R, X, S, Q, $\cos(\phi)$

For the CT ratio measurement, the following applies:

- . Range: 0 to 9999
- . Resolution: 1
- . Accuracy: $\pm 0.15\%$ of the reading $\pm 0.15\%$ of the range.

DISPLAY

The large graphic display has the following characteristics:

- . Pixels: 640 x 480, coloured
- . LCD type: TFT
- . View area: 132 x 99 mm
- . Backlight

LOCAL TEST CONTROL

Local test control: by the START / STOP pushbutton. After test selection, pressing it, the output is generated, according to the type of test. During ON, if a manual control test is selected, the operator adjusts the output at the desired value. Test saving:

- . Automatic save.
- . After operator confirmation.

OTHER CHARACTERISTICS

Communication interfaces:

- . ETHERNET for the PC connection
- . USB port for the USB key.

Interfaces to external modules:

- . Alarms to a flashing light
- . Remote start input.

Mains supply

100-230 V $\pm 15\%$; 50-60 Hz. Maximum supply current: 16 A.

Dimensions: 450 (W) x 400 (H) x 230 (D) mm.

Weight: 17 kg.

APPLICABLE STANDARDS

The test set conforms to the EEC directives regarding Electromagnetic Compatibility and Low-Voltage instruments.

. **Electromagnetic Compatibility:** Directive no. 2014/30/UE. Applicable Standard: EN61326-1:2013

. **Low Voltage Directive:** Directive n. 2014/35/UE. Applicable standards: CEI EN61010-1:2010. In particular:

- . Input/output protection: IP 2X - IEC69529.
- . Operating temperature: -10° to 55 °C; storage: -20 °C to 70 °C.
- . Relative humidity: 5-95% without condensing.

BUX TECHNICAL SPECIFICATION

BUX 2000, BUX 3000 and BUX 5000 - VERY HIGH CURRENT BOOSTER



The current boosters allows performing tests up to 2000A, 3000 A and 5000A.

The option is made of a module, which incorporates:

- A power transformer, which generates a low-voltage, high current output.
- A metering CT, which measures the output current and sends the metering to e KAM.

BUX 2000

TEST CURRENT A	OUTPUT POWER VA	TEST DURATION s
500	700	INFINITE
1000	1500	60
2000	5000	25

BUX 3000

TEST CURRENT A	OUTPUT POWER VA	TEST DURATION s
1000	900	INFINITE
2000	2400	300
3000	4800	60

BUX 5000

TEST CURRENT A	OUTPUT POWER VA	TEST DURATION s
1000	700	INFINITE
2000	1500	300
3000	2700	30
4000	4200	20
5000	5500	10

- Frequency: 15 Hz - 500 Hz.*
- Weight: BUX 3000 16 kg, BUX 2000 18 kg, BUX 5000 20 kg without current cables and clamps.
- Dimensions for models BUX 2000 and BUX 3000: external diameter 190 mm; height 120 mm.
- Dimensions for model BUX 5000: external diameter 200 mm; height 200 mm.

All high current boosters are supplied with:

- . high current cable, made of 4 cables, 95 sq. mm, 1.2 m long, with 2 high current clamps for BUX3000
- . 4 cables, 95 sq. mm, 2 m long, with 2 high current clamps for BUX 2000
- . 12 cables, 95 sq. mm, 0.8 m long, with 4 high current clamps for BUX 5000
- . one power supply cable , 20 m long
- . one measurement cable, 20 m long, with the output current measurement.

* The output amplitude may decrease for frequency below 50 Hz and above 60 Hz.

STANDARD ACCESSORIES

STANDARD CONNECTION CABLES

NOTE: standard cables can also be ordered separately.

- . One mains supply cable, 2 m long.
- . One grounding cable, 6 m long.
- . One interface cable for the USB port.
- . One ETHERNET interface cable.
- . One USB pen drive.
- . One cable for the 10A measurement to be connected to the secondary of the CT 2.5 sq. mm, 10 m long .
- . Four crocodiles for measurements connections (two red and two black).
- . One cable for voltage measurements 1 sq. mm, 10 m long .
- . two short cables, 2m long (red and black), for other measurements.
- . One adaptor for 10V input - measuring BUX cable.

OPTIONAL ACCESSORIES

TRANSPORT CASES

Transport cases for e KAM and BUX units are available; all of them allow transporting the device with non concern about shocks or falls up to 1 m. The case is complete with handles and wheels.

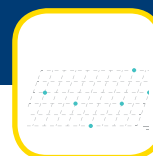
TROLLEY

The trolley eases the transport of e KAM.



e KAM transport case and trolley





e KAM

STEP & TOUCH TESTING KIT

STLG - MODULE FOR GROUND TESTING AND LINE IMPEDANCE MEASUREMENT

The option allows performing both the measurement of: soil resistivity, ground grid resistance, step and touch tests and overhead lines zero sequence and mutual coupling coefficients. STLG is a high power transformer, which increases the output current. A high current switch allows selecting the desired current range. A voltage meter displays the generated voltage. The option takes its power from the EXT. BOOSTER connector of e KAM. Output current and voltage are metered and sent back to e KAM measuring inputs; a third output allows e KAM to know the selected range. Device characteristics are the followings.

- . Input: from e KAM, via the booster connector
- . Output current ranges: 11, 22, 35, 55, 105 A AC
- . Output power: 1800 VA steady; 5200 VA peak for 10 s
- . High current range selector switch
- . Analogue output voltage meter. Meter range: 600 V AC
- . Outputs to e KAM: selected current output range, output current and output voltage.

All necessary connection cables are included in the option.

Current clamp provided: 400 A range.

Weight: 25 kg. Dimensions: 23 x 33 x 44 cm.

STSG - SAFETY GROUNDING MODULE

During tests, STSG is connected to the overhead line to be tested. The purpose of the STSG optional device is to protect the operator against possible high voltage spikes. STSG incorporates three voltage suppressors and one high current switch, to connect three lines in parallel. This option applies in conjunction with STLG. Option characteristics:

- . Nominal AC spark-over voltage: 1000 V rms
- . Impulse spark-over voltage: 2000 V peak
- . Short-circuit proof with 25 kAeff / 100 ms; 36 kAeff / 75 ms
- . Connection via three cylindrical ball studs 16, 20 or 25 mm diameter. The ball diameter must be specified at order.
- . Weight: 9.1 kg. Dimensions: 41 x 21 x 13.5 cm
- . Grounding cable included: 95sq.mm, 2m.

GROUND GRID TEST ACCESSORIES KIT

The option is the kit of connection cables, auxiliary spikes and other accessories that allows connecting e KAM or STLG to the testing devices and performing all types of tests. The kit includes:

- . Four earth spikes for the soil resistivity test and for the earth resistance test.
- . Two auxiliary earth spikes, for tests in small sites.
- . Three cables, wound on wheels, 200 m long.
- . One mains synchronizer device, to synchronize the e KAM generation to the mains.
- . Two test probes for the step and touch test.
- . One voltage meter, digital, type true RMS, for the earth resistance and step and touch tests.
- . One resistor box for the step and touch test.

OPTIONAL SOFTWARE

PADS - POWER APPARATUS DIAGNOSTIC SOFTWARE

PADS - Power Apparatus Diagnostic Software is a powerful software application, included in TDMS software, that allow the remote control of the e KAM.

ORDERING INFORMATION

CODE	MODULE
49175	e KAM control unit supplied with connection cables and TDMS software
56175	BUX 2000 Current unit
50175	BUX 3000 Current unit
63175	BUX 5000 Current unit

OPTIONAL ACCESSORIES

CODE	MODULE
10176P	PADS software (primary)- Primary, CTs, VTs test module*
37175	Transport case for e KAM
51175	Transport case of BUX unit
81175	Step & Touch testing kit: . ST-LG Line & ground grid module (100 A booster). . Cables set for STLG . Heavy duty plastic transport case for STLG . ST-SG Safety grounding module . Heavy duty plastic transport case for STSG . Step & touch, earth resistance/resistivity accessories.
72175	Stud 20 mm for Step & Touch testing kit
73175	Stud 25 mm for Step & Touch testing kit
74175	Stud 16 mm for Step & Touch testing kit
18175	Trolley for e KAM
42175	Remote safety switch
43175	Warning strobe light

*PADS - Power Apparatus Diagnostic Software is NOT included into basic unit price. It should be expressly ordered.