18 GHz, 2.2 kW KLYSTRON GENERATOR
GKP 24KP 18GHz WR62 3x400V

With its characteristics of power stability whatever the load, very fast response time when pulsed (via external modulated signal), low ripple, spectral quality, degree of protection and reliability, SAIREM's GKP 24KP is a high-performance generator designed for high-performance applications and particularly for the ions sources.

The GKP 24KP 18GHz consists of a single cabinet housing the power supply and the RF circuits. The cabinet can be easily transported on a pallet or fork-lift truck.
The generator circuits are accessible through doors on all 4 sides. The front panel features the HMI (Human Machine Interface), 8" colored PRO-FACE touch screen display.
The generator can be mounted on high-voltage platforms for ion sources; the generator is fully remotely controllable via Ethernet, RS232, RS485 etc.

The generator is equipped with a klystron tube mounted in an amplifier arrangement, driven by low-level circuit referenced to as the dielectric resonator oscillator (DRO). The solid state circuit is filtered with inter stages isolators to maintain the **frequency stability**.

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The stability of forward power over time is ensured by:

- The method used for the measurement of forward power, which is reliable whatever the phase or amplitude of the load VSWR;
- Regulation of forward power by a high-speed electronic circuit from an accurate internal reference of exact 10 V, and the static gain of the open-loop comparator.

The power level is set through the electronic circuitry by means of a PIN diode attenuator in the low-level circuit. This electronic circuitry guarantees:

- A very low ripple factor;
- A very short response providing high performance pulses;
- Minimum rise and fall times without overshoots (µs);
- A dynamic power adjustment range of more than 30 dB.

The most critical **generator systems** are also controlled by a specific electronic circuitry:

- The klystron is protected against reflected power by an isolator and through an electronic circuit which reacts when the reflected power reaches 500 W (level adjustable from 0 to 500 W). The electronic circuit reduces the forward power level to a level where the reflected power is lower than the set level in a few microseconds. This way no total power cutoff occurs but only a reduction in level. The reflected power measurement system therefore gives reliable values, whatever the VSWR level and its phase;
- A backup reflected power security circuit after klystron switch off power (in the case of faulty first interlock);
- The generator microwave components are protected by the electronic speed cutoff if arcs are detected in the waveguide;
- The electronic circuitry also controls the anode and klystron body current limiting, as well as all the standard safety mechanisms (cooling, temperature, filament, etc.).

The **high-voltage power supply** is a resonant switch mode circuit. The switching frequency is from 80 kHz to 35 kHz depending on the output voltage and current; the ripple is very low.
High voltage is adjustable and maintained constant, whatever the mains power fluctuations, by the controller. This system ensures a gradual rise to high voltage, which increases the service life of the klystron. Furthermore, when the klystron is first started, the successive phases in the rise to high voltage to form it will be easily read on HMI. High voltage value is displayed.
The high-voltage power supply module is protected against short circuits and opened circuit.

The **DC filament supply** is voltage and current controlled with a “squared” function. The control electronics (linear) ensures a total absence of ripple.
As the cathode is at the potential of the high voltage, this assembly is integrated in an isolated high-voltage unit on which the filament current / voltage values can be read (display visible when cabinet door is opened). This filament information is not displayed on HMI.

TECHNICAL CHARACTERISTICS

Klystron	: type VKU-7791A12 (CPI).
Frequency	: 17.3 GHz to 18.4 GHz, 17.9 GHz usually.

As this generator is an amplifier driven by DRO (dielectric resonator oscillator) the exact transmission frequency must be specified with your order. The *frequency stability reaches ± 1 MHz for a temperature variation of ± 10 °C.*

Output power	: 2.4 kW typical means 2.2 kW at the generator's output (reduced ~ 5 % due to isolator losses). The power value is given for a matching load in continuous wave CW).
Ripple factor	: < 0.2 % RMS at nominal power.
Power stability	: better than 0.1 % (whatever the time base).
Rise and fall time	: rise time < 3 µs and fall time < 1 µs at full power; overshoot < 5 %.
Generator control	: all parameters (analogue and logic) and set points (analogue and logic) are displayed on 8" touch screen. Moreover, all functions are available on RS232, RS485, Ethernet and analogue connector.
Power control	: from 0 to 100 %, dynamic range > 30 dB. To drive in pulse mode, choose a power level and apply a TTL modulation (0 to 5 V) to a BNC off/on socket (input impedance of 50 Ω). This input "chops" the analogue level.
Reflected power protection	: by isolator and electronics: over 500 W reflected power, forward power is automatically reduced or shut down (500 W can be adjusted and reduced or stopped mode). An extra independent protection system uses a specific coupler and a detector situated close to the klystron and switch off (i.e. if the isolator is out of order).
Analogue power parameters	: true unfiltered parameters; analogue outputs on remote control connector; FP: 0 to 10 V, voltage: 0 to 100 %; RP: 0 to 10 V voltage for 0 to 50 % of total power.
Microwave output	: on waveguide WR62.
H.V. power supply	: switch mode technology, 80 kHz to 35 kHz, efficiency > 94%, 10 kV, adjustable from 2 kV to 10 kV (preset 8.6 kV), Ia nom 1.05 A.
Filament power supply	: DC, linear, isolated HV, adjustable from 0 to 8 V and from 0 to 4 A (preset at 7.2 V and 2.5 A); 5mn preheating timer.

Air cooling	: power supply and klystron; klystron flow rate: 600 m^3/h, air input and output by flange Ø 125 mm above cabinet. Internal control phase order.
Noise	: 75 DBA at 1 meter, without chimney.
Line voltage	: 400 V 3-phase + earth 50Hz / 60Hz.
Line consumption	: 11 kVA approx.
Operating temperature	: from 10 °C to 35 °C.
Dimensions / Weight	: w x d x h = 610 x 825 x 1770 (±35) in mm, weight= 295 kg.

CONTROL DESCRIPTION

For safety, the stop push button switches off directly the high voltage and microwave generation.
The display is a color 8 inches touch screen, PRO-FACE system. All the operating and control reports, as well as every possible failure are displayed clearly on this screen. In addition to forward and reflected powers (digital display and bar graph), the power set point is pre-displayed before start up. HV and anodic current and body current are also displayed.

The main control functions on the display panel are the following:

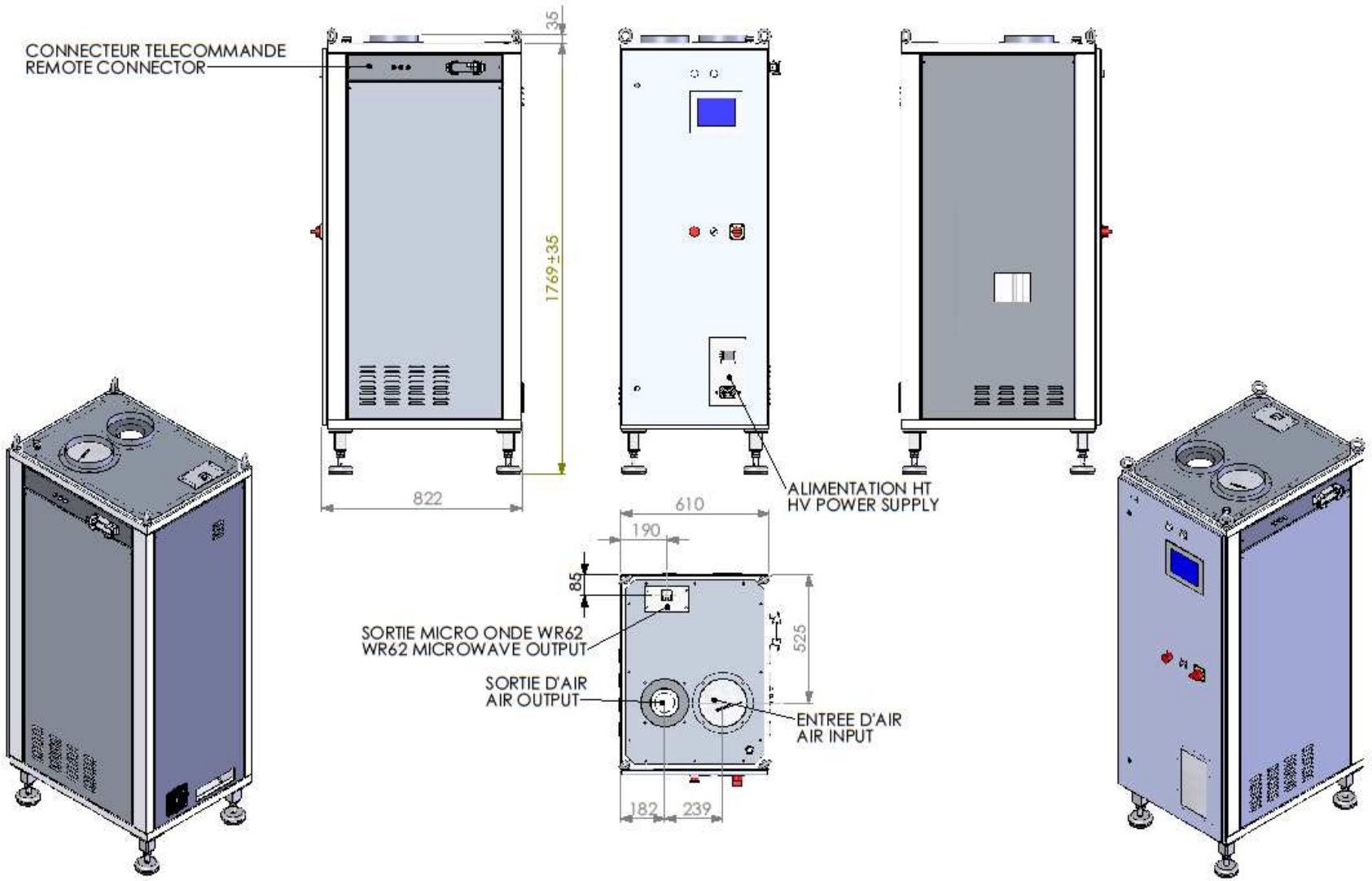
- Starting mode
  - Standard mode ON/OFF
  - Low RF power mode to save klystron time life
  - Tube forming
  - Ramp mode (0 to 30 s)

- Control mode
  - Local, ON OFF & Analogue and pulses
  - Com RS 232 (baud rate, parity adjustable…)
  - Com RS 485 (address, baud rate, parity adjustable…)
  - Com Ethernet (with Pro-Server EX from Pro-face)

- Reflected power control
  - Adjustable from 0 to 500 W
  - Disjunction mode or forward power limitation mode (sound signal)

- Various
  - Fault list, historic
  - Filament hour counter
  - PIN code (for restricted access)

- Configuration
  - Preset and load configuration
  - Language (English and French, 10 more are possible)



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WEIGHT:

TITRE: GKP24KP 17.9GHz WR62
GKP24KP 14.5GHz WR62

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