

***TOTAL POWER
MICROWAVE RECEIVERS
FOR AMATEUR RADIO ASTRONOMY***

RAL10 Series



Microwave receivers for amateur radio astronomy

For lovers of science who are interested or curious about radio astronomy, it is now possible to start an interesting amateur research although not very experts in electronics and radio technologies. RadioAstroLab, a leader in this sector, offers a wide range of products for every need and cost, to allow everyone to approach, with the necessary support, to this wonderful discipline. Even schools, universities and institutions of science education can benefit from our proposals, discovering how easy and fun it is to experience radio astronomy.

The RAL10 family consists in a series of very sensitive receivers dedicated to radio astronomy, in particular microwave radiometers (working at 11.2 GHz frequency). They are Total-Power instruments, which can measure the radiation emitted from any celestial object intercepted by the antenna. The series proposed is complete: it ranges from the kit of pre-assembled and calibrated modules for those who want to "get their hands dirty" by building a small radio telescope in their garden, to the more sophisticated and ready to use instrumentation, complete with accessories necessary to the proper tracking of radio sources. The construction of small radio telescopes operating in 10-12 GHz frequency band is today economic and simplified if you use antenna systems and components from the market of the satellite TV, available everywhere at low cost.

With such equipment it is simple to install a microwave radio telescope remotely controllable also via Internet. Of course, our kit also provides the software for the acquisition and the automatic recording of data on your PC.

We refer to other articles published on our website for further information about the functioning of a radio telescope, the structure of a Total-Power receiver and the observing possibilities of the amateur radio astronomy.

We are working on other interesting tools and they will be introduced soon, along with many scientific projects proposals: the attention of RadioAstroLab towards the amateur radio astronomy and science is constant and always up-to-date!

Our range for amateur radio astronomy

RECEIVERS



RAL10KIT



RAL10AP



RAL10MW

ACCESSORIES



RAL10BT



RAL10LNB



RAL164

RAL10KIT



It is a kit for self-builders with a minimum of practice in the electronic assembly. The package includes the radiometric module microRAL10, the USB interface to connect with the PC, the assembly instructions and the control software. The modules are pre-assembled: they only have to be enclosed in a suitable case, complete with a power supply (as specified in the instructions), with a coaxial cable and a common antenna with LNB operating in the 10-12 GHz satellite TV band. The first microwave radio telescope is thus created.

Together with the RAL10AP receiver, it represents the starting point for the first radio astronomy experiences.

RAL10AP



It is the smallest radiometer of the RAL10 series, complete, assembled and ready to use, "elder brother" of the RAL10KIT. The basic characteristics of the receiver are identical to those of the previous device, with the difference that the instrument is supplied already mounted in a robust and elegant metal case. To start working you just need to connect the antenna (with LNB), the external power supply and the PC: activating the DataMicroRAL10 software, the acquisition of the measures starts. A peculiar feature of RAL10AP is an audio output (downstream of the detector) useful for monitoring purposes. The USB interface for connection to the PC and the control software are identical to that of the previous product, the main power can be supplied via a 12V external power supply (supplied separately, on request), a rechargeable battery or our Rechargeable Battery Unit RAL10BT (available on request).

RAL10MW



The new radiometer is the most versatile, high-performance and complete instrument in the over-the-top version (installation of the radio telescope with the receiver positioned inside a laboratory, near the acquisition PC). A robust metal container houses the electronics of the highly sensitive receiver. The functions of a full-power and switching receiver have been integrated, with the possibility of programming and storing a complete set of operating parameters, including a calibration procedure for the output signal. The parameter setting and the display of the functions are performed exclusively via PC using the supplied software. The wide possibility of control and programming of the operating parameters make this receiver the flagship instrument of the RAL10 line.

External unit RAL10_LNB

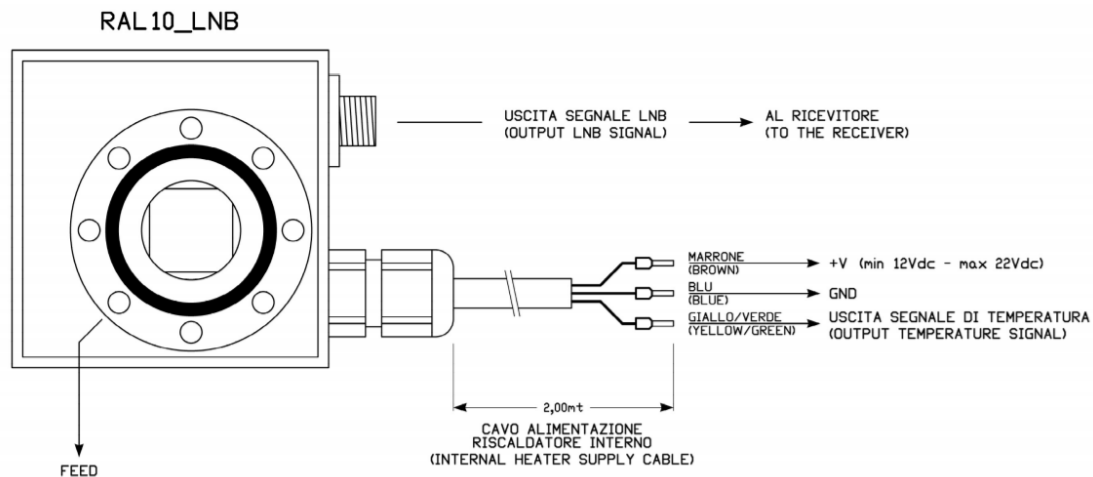
Complete with adjustable illuminator



LNB (Low Noise Block Converter) with input frequency in the band 10-12 GHz completed with adjustable illuminator is designed for radio astronomy applications where high sensitivity and stability are required.

The unit, built in a sturdy aluminum insulated frame, is thermally stabilized with an internal regulator that powers a heater: the internal temperature (around 47 ° C) is kept constant and the effects of external temperature variations are minimized. A dedicated power cable supplies the stabilization circuit (12-22 V). The best performance is obtained when the stabilization circuit is fed at a voltage close to 20 V and when the outdoor temperature hikes are kept below the internal temperature. Thermostat control does not work when the outside temperature is very high, such as in the central days of summer at low latitudes, or when the antenna is oriented toward the sun (excessive solar radiation heating). The current absorbed by the heater is about 1.5 A when it is powered at 12 V, about 3 A when it is powered at 22 V.

The device is equipped with a corrugated illuminator for circular parabolic reflector antennas, to be installed on the focus of the antenna: through a TV-SAT coaxial cable, it can be connected to all the receivers of RAL10 line. The illuminator is designed for circular parabolic reflector antennas (prime focus) and can be adapted to the LNB through a C-120 flange. The system works in the universal band 10-12 GHz, and can be used with antennas having a F/D (focal length / diameter) between 0.32 and 0.43: for an optimal operation, the size of the antenna used is not relevant, provided that the given F/D ratio is respected.



MISURA ANALOGICA DI TEMPERATURA (ANALOG MEASUREMENT OF THE TEMPERATURE)	$V_{out} = 0mV + 10.0mV/^{\circ}C$
CAMPO DI OPERATIVITA' DEL SENSORE DI TEMPERATURA INTERNO: (RANGE OF THE INTERNAL TEMPERATURE SENSOR)	$+2^{\circ}C \div +150^{\circ}C$

LNB SPECIFICATIONS

1. INPUT FREQUENCY	
LOW BAND	10.7 - 11.7 GHz
HIGH BAND	11.7 - 12.75 GHz
2. OUTPUT FREQUENCY	
LOW BAND	950 - 2150 MHz
HIGH BAND	950 - 2150 MHz
3. NOISE FIGURE	0.3dB typ
4. GAIN	50 - 60 dB
5. GAIN RIPPLE	
26MHz BANDWIDTH	< +/- 0.5 dB
LOW BAND	< 5 dB typ
HIGH BAND	< 5 dB typ
6. LOCAL OSCILLATOR FREQUENCY	
LOW BAND	9.75 GHz
HIGH BAND	10.6 GHz
7. LOCAL OSCILLATOR PHASE NOISE (typ)	
1 KHz	-65 dBc/Hz
10 KHz	-95 dBc/Hz
100 KHz	-110 dBc/Hz
8. LOCAL OSCILLATOR STABILITY (INCLUDING SETTING, AGING AND TEMPERATURE DRIFT)	+/- 1 MHz typ +/- 5 MHz max
9. CURRENT CONSUMPTION (*)	105 mA typ
10. IMAGE REJECTION	> 40 dB

11. ISOLATION	
CROSS POLAR ISOLATION	> 30 dB
12. TWO-TONE 3rd ORDER INTERCEPTION POINT (OUTPUT)	> 15 dB
13. OUTPUT CONNECTOR	FEMALE F-type
IMPEDANCE	75 Ohm
RETURN LOSS	> 10 dB
14. OPERATING TEMPERATURE RANGE	-40°C to +70°C
STORAGE TEMPERATURE RANGE	-40°C to +70°C
15. BAND POLARIZATION SELECTION	
SIGNALS APPLIED TO F-type CONNECTOR	
VERTICAL POLARIZATION SELECTION	11.5V to 14V
HORIZONTAL POLARIZATION SELECTION	15.5V to 19V
HIGH BAND SELECTION (22kHz tone)	
FREQUENCY (SQUARE WAVE CONTROLLED RISE/FALL TRANSITION TIME)	18kHz to 26kHz
LEVEL	0.4Vpp to 0.8Vpp
TRANSITION TIME	5uS to 15uS
DUTY CYCLE	40% to 60%
LOAD IMPEDENCE AT 22kHz	> 70 Ohm
LOW BAND SELECTION	NO TONE
16. SNH - 031	18.5mm Ø WAVEGUIDE, C120 FLANGE OFF-SET PARABOLA MATCHED, FREQUENCY COMPENSATED FEED HORN, 40mm DISH CLAMP

* = LNB ONLY, NOT THE HEATER

Attenuator RAL164



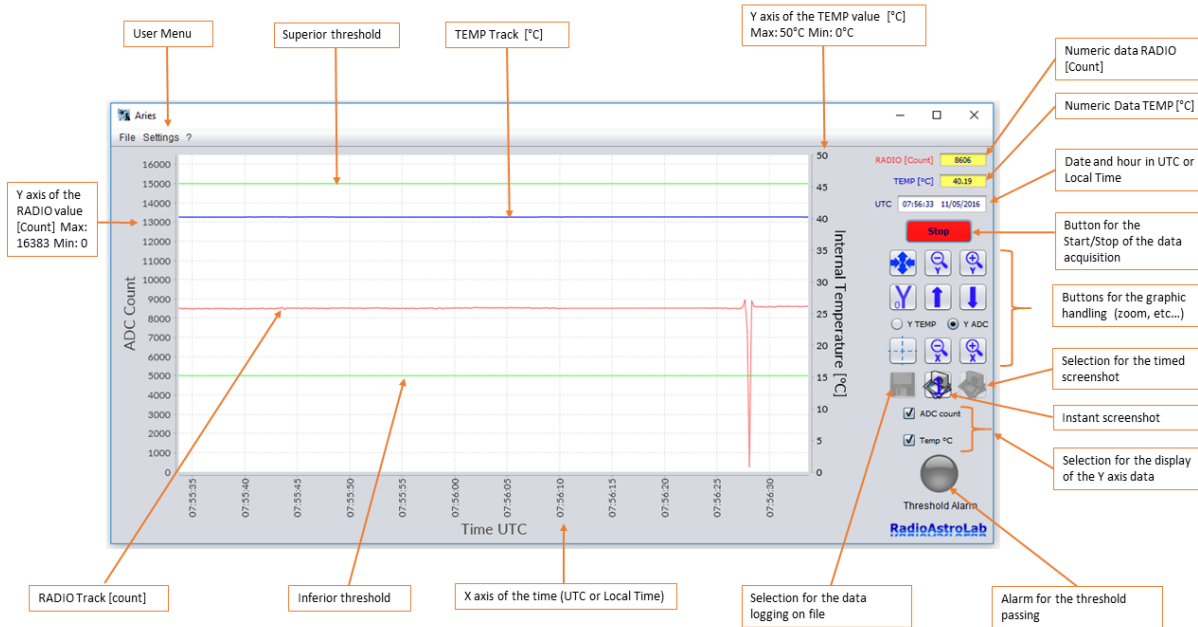
Essential accessory for observing the Sun with very sensitive instruments (eg. RAL10TS) combined with large antennas. The function of the device, which is inserted at the receiver input after the descent of the coaxial cable from the antenna, is to alleviate the powerful solar radiation, thus avoiding saturations and non-linearity in the system response.

Rechargeable battery unit RAL10BT



RAL10BT is a rechargeable power source at low voltage designed to allow the use of our tools (or any other instrument operating at 12 VDC) in areas not served by the electricity grid. The device, equipped with a hermetically sealed rechargeable battery capable of ensuring high operational autonomy, includes the charging electronic circuit at high efficiency.

ARIES software

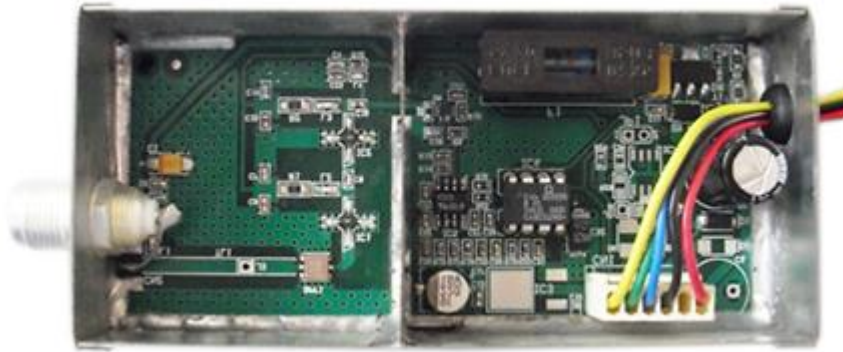


We have developed Aries, an advanced and easy to use software, to manage all the receivers of the RAL10 series.

Designed to make the most of the "robustness" and flexibility in the serial communication typical of our tools, the software controls all operating parameters of the specific model used. As a graphic recorder, Aries shows the trend of the measurements over time and stores the acquired information in different ways and formats.

With Aries you can easily set the parameters of a single receiver, or manage different and simultaneous measurement sessions with multiple devices (even of the same type) connected to a single PC: the communication protocol implemented in our tools, coupled to Aries interface, enables a very reliable communication management, perfect even in applications involving continuous measurements for a long time and in remote locations not controlled by operatives. The automatic recording of data and the ability to set appropriate alarm thresholds to the occurrence of events in the measured signal, make the kit RAL10 + Aries very versatile and practical, used with success in many areas. Aries can be used with no limits in license and/or number of installations: the program will always be provided for free with our instruments. In any case, we always guarantee the support of the application, along with the improvements that simplify and optimize the performances.

Radiometric module microRAL10



The microRAL10 radiometric module is common to all RAL10 products: is the central unit of the receivers and implements all the functions required for a microwave radiometer suited for radio astronomy. It is a radiometer managed by a microprocessor which amplifies the signal from the external unit (LNB), performs the calculation of the RF power (quadratic detector compensated in temperature), "digitizes" the detected signal with high resolution (14-bit analog-to-digital internal converter) and communicates with the PC station (USB port) via a serial data channel with proprietary protocol. The module provides power to the external unit LNB via the coaxial cable (protected with fuse against accidental short-circuits), with the voltage jump for polarization change in reception. The processor controls the parameters of the Total-Power radiometer such as the offset setting and the automatic calibration of radiometric baseline, the setting of the gain and of the post-detection constant of integration (with time from about 0.1 up to 26 seconds), the selection of the polarization in reception (if allowed by the chosen LNB).

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