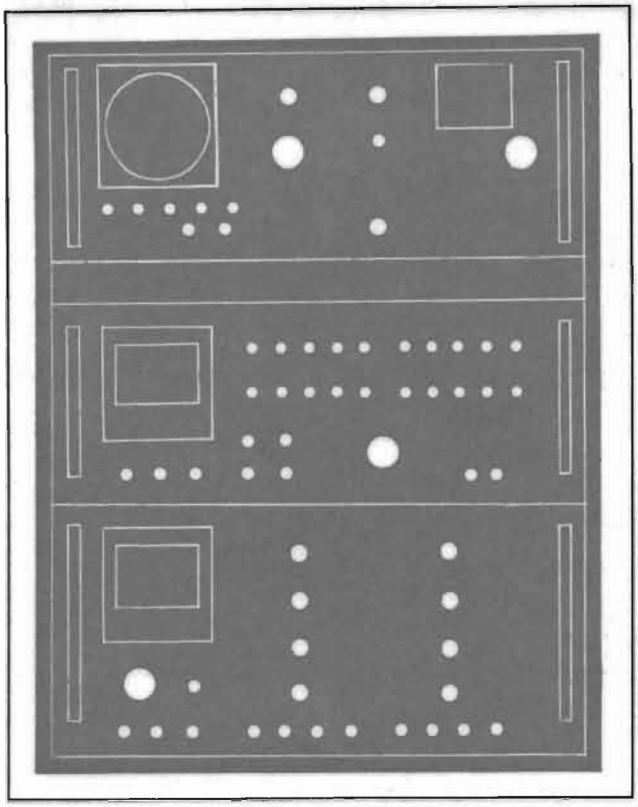
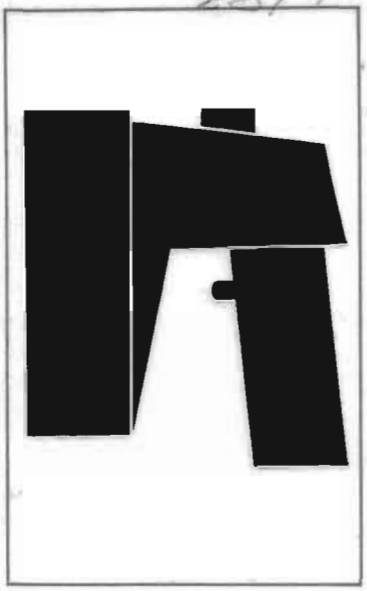
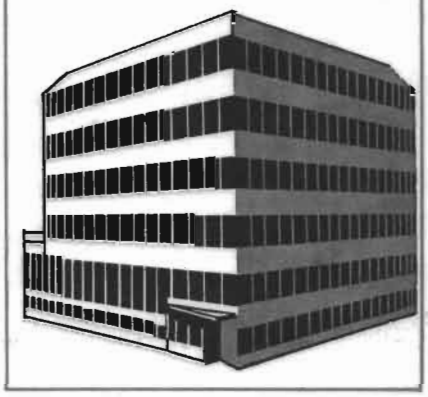
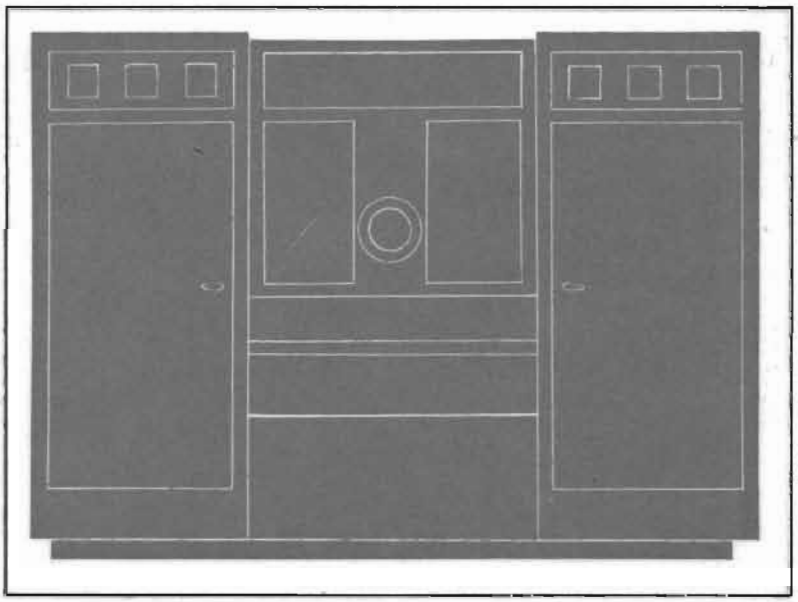
22/7-69 gm

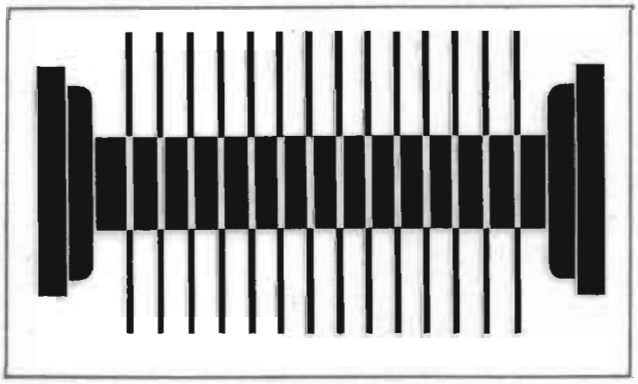




Magnetic AB
Manufacturing Division







ELECTRONIC INSTRUMENTS AND EQUIPMENT

MAGNETIC AB SWEDEN

Table of Contents

Magnetic AB
Manufacturing Division

MICROWAVE SIGNAL GENERATOR

MODEL 410

Where Used

The MAGNETIC model 410 Signal Generator is designed for use in radar stations as well as in microwave laboratories.
It is an excellent tool for testing the overall performance of radar receivers by introducing an artificial echo in the antenna transmission line. A real target at an arbitrary distance can be simulated. The echo can be moved to cover the range 300—45.000 meters (up to 90.000 meters upon requst).
Other applications for model 410 Signal Generator are:
Testing microwave components such as antennas, attenuators, swept gain circuits, travelling wave tube amplifiers. Measurement of bandwidth, attenuation, alignment, image rejection, receiver sensitivity, power gain and VSWR.

Features

— Direct reading frequency control
— Direct reading output control
— Simple operation
— High stability, high accuracy
— Sturdy and compact design
— Made to stand mil. tests

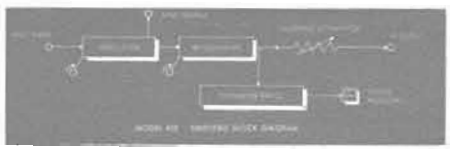
Description

Electrical

Model 410 Signal Generator combines high accuracy, versatility and simplicity of operation in one compact unit.
The RF section consists of a reflex klystron oscillator tube and an accurately calibrated attenuator.
The signal frequency is set and read directly on a large tuning dial. The reflector voltage is tracked automatically and no adjustment is necessary.
The oscillator output is monitored by a temperature compensated thermistor bridge and indicated on a meter. RF output is set and read directly. Model 410 offers pulse and square wave modulation and can be triggered internally or externally. The internal pulse repetition frequency is continuously variable from 250 to 2500 Hz and the pulse width is continuously variable from 0.25 to 10 μs. Two pulse signals are available on the front panel, one simultaneous with the RF pulse and one variable 3 to 300 μs in advance of RF pulse.

Mechanical

The MAGNETIC model 410 Signal Generator is a compact unit with a standard 19" panel, 7" high and $12^{5}/_{16}$" behind the panel. It is extremely sturdily built using the best components.
The instrument can be delivered in a rack-mount version or mounted in a cabinet.



Specifications

MODEL S410 A

Frequency Range: 2000—4000 MHz
Frequency Accuracy: 1 %
Power Output: 0 to —100 dBm into 50 Ω
Calibrated Output Range
—10 to —100 dBm into 50 Ω
Output Accuracy: ± 2 dB
Impedance: output calibrated for 50 Ω load
Internal Pulse Modulation
Repetition Frequency: 250—2500 Hz.
Pulse Width: 0.5—10 μs
Trigger Output 1
simultaneous with RF pulse, positive
Trigger Output 2
3 to 300 μs in advance of RF pulse, positive
External Trigger signal
positive or negative pulse 5—50 V, 50—4000 Hz, rise-time 0.1 μs
Delay
the RF pulse can be delayed 3—300 μs (600 μs upon request) in relation to external or undelayed internal trigger pulse
Internal Square Wave Modulation
250—2500 Hz
Power Requirements
115/220/230 V, 50/60 Hz, 150 W
Weight: approx. 17 kilograms (rack mount)

MODEL X410 B (same as S410 A except:)

Frequency Range: 8500—9600 MHz
Power Output: + 10 to —90 dBm into 50 Ω
Calibrated Output Range
0 to —90 dBm into 50 Ω
Pulse Width: 0.25 to 10 μs

MODEL C410 A (same as S410 A except:)

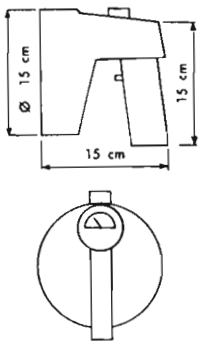
Frequency Range: 3800—7600 or 4000—8000 MHz
Power Output: +10 to —100 dBm into 50 Ω
Calibrated Output Range
—10 to —100 dBm into 50 Ω
Pulse Width: 0.5 to 10 μs

MODEL L410 A (same as S410 A except:)

Frequency Range: 950—2100 MHz
Power Output: —3 to —100 dBm into 50 Ω
Calibrated Output Range
—10 to —100 dBm into 50 Ω
Pulse Width: 0.5 to 10 μs
Trigger Output: 3 to 300 μs (600 μs on request)

Magnetic AB
Manufacturing Division

MODEL 350 MICROWAVE POWER DENSITY METER



Where Used

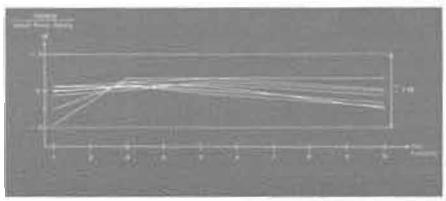
Model 350 is a necessary tool for checking the surroundings of modern high power radars to make certain that the maximum permissible power density is not exceeded. Such radars are Early Warning and Surveillance Radars, Air Traffic Control Radars, and Airborne Fire Control Radars.
It is also very useful in radar laboratories for service and maintenance work. Other important applications are checking leakage from microwave cooking equipment and side lobes from high power scattering transmitters.

Features

- Simple operation. Press button and read power!
- Easy to read, no correction factors
- Integrates all incident power regardless of polarization
- Portable. Battery permits approximately 10000 measurements
- Two measuring ranges

Description

This instrument is intended for the protection of personnel against dangerous microwave radiation. It measures completely automatically and without complicating correction factors the total microwave radiation incident upon it within the frequency range 1000 through 10000 MHz. It is extremely simple to operate and can be used by personnel without any knowledge of microwave technique.
Although the biological effects of microwave radiation are not known in detail authorities in most countries have stated a microwave density of 10 mW/cm² as the permissible upper limit for temporary exposure and 1.0 mW/cm² for continuous exposure. Model 350 therefore has two measuring ranges with a midscale reading of 10 mW/cm² and 2 mW/cm² respectively, which appears to be the best possible compromise between measuring accuracy and simplicity of operation.
Model 350 is carried in a wooden box capable of withstanding rough handling during field use. A special pocket-size case for external batteries is also placed in the box.



Specifications

Frequency Range
1000—10000 MHz

Accuracy
± 2 dB

Sensitivity, Range 1
Midscale reading 10 mW/cm²
Full scale reading 20 mW/cm²

Sensitivity, Range 2
Midscale reading 2 mW/cm²
Full scale reading 4 mW/cm²

Polarization
Vertical, horizontal, right and left hand circular

Temperature Range
—20° to +40° C

Power Consumption
About 120 mW

Batteries
Internal dry cell battery or external batteries in a separate case

Size
Transport case 245×210×200 mm

Weight Incl. Case
3.4 kg

Magnetic AB
Manufacturing Division

Introduction

Products developed and produced by Magnetic AB are with few exceptions, related to the techniques of RADAR, TELECOMMUNICATION, PROFESSIONAL RADIO and SPACE RESEARCH.

The company has long been an established leader, second to none, in the field of RADAR PERFORMANCE MONITORS. A line of measuring and test instruments combining the accuracy of laboratory equipment with the ruggedness required for field use is available and forms the base of more sophisticated MEASURING, MONITORING or CHECK-OUT SYSTEMS. When operating separately these instruments are normally used for measurements in laboratories, production lines, test rooms, service shops and in the field.

Performance Monitors of varying complexity are made by combining a number of individual instruments with a CONTROL UNIT. Facilities for REMOTE OPERATION are available. In a similar manner measuring and check-out equipment for large systems are assembled.

Magnetic AB has supplied RADAR MONITORS to more than one thousand radars all over the western world. We have also delivered a considerable number of check-out equipment for airborne radars on flight-line as well as depot levels.

In TELECOMMUNICATION our instruments are used for setting-up and periodic checks of radio links, for fault location on telephone lines and several other tasks. Our DATA MULTIPLEX EQUIPMENT transmits hundreds of data or control signals over a single channel.

The IONOSPHERE RECORDERS produced by Magnetic AB represent the most advanced vertical sounding technique available and have become the standard equipment for scientific Ionosphere Research in the western world. You will find them in operation day and night at places as widely spread as Greenland in the North, the Antarctic in the South, Pakistan in the East and California in the West.

Since the development in 1953 of our first instrument — a totally new Automatic Noise Figure Meter — the company has successively expanded its line of proprietary equipment and is today well known as manufacturer of high quality equipment in the fields of radar, telecommunication and radio. The firm has 150 employees working in a 30000 sq ft plant located in Bromma, Sweden.

The Research and Development department is an efficient organisation which combines intellectual curiosity, experience, facilities and ability to provide you with advanced instruments and systems in a minimum of time at a minimum of development costs. Many of the engineers and technicians have worked with Magnetic AB since its infancy and possess a great store of information and in some fields unequalled experience in test instruments and systems design. This technical know-how is working for you on both externally and company sponsored programs.

Our Production department is staffed, equipped and geared to work with short delivery schedules. Experienced personnel use an advanced technique and the most up-to-date equipment to provide you with quality products.

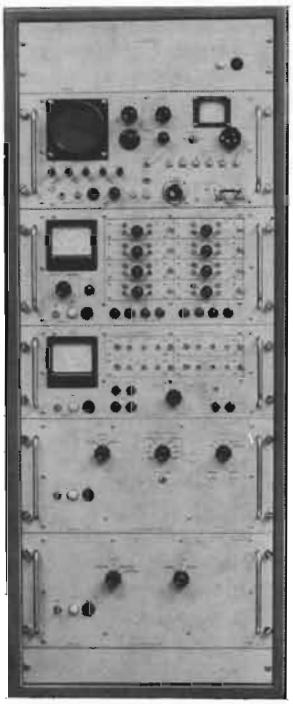
Trained sales engineers are located at our factory in Bromma, Sweden, our sales office in Munich Western Germany and at our representatives in other countries of Western Europe as well as at several other places all over the world. These engineers are at your service to assist you in the selection of instruments, in the combination of measuring systems and to furnish you with detailed teechnical information on the Magnetic AB products.

A complete list of our sales representatives will be found on the back cover of this catalog. A phone call or a letter to the nearest office will establish the link between your problem and our knowledge.

Magnetic AB
Radar instrument line

SERIES 000 and 2000

Radar Test Equipment



A series 2000 Check-Out System for measuring Spectrum, Noise Figure, Power, IF MTI and Video functions.

Introduction

The trend in modern radar systems is to extract more data from the radar, to require higher accuracy from these data and to specify better time-on-duty for the systems. This trend has had an important impact on radar instrumentation. There are many more important functions than in earlier radars. A failure of any of these functions might seriously affect the performance of the system, thus rendering large investments more or less worthless.

It has become increasingly important that the most critical functions of the radar be continuously monitored and that a distinct and immediate alarm is given in case of failure. At Magnetic AB, a pioneer in developing the philosophy of continuous check-out equipment for radars, these considerations have resulted in the series 000 and 2000.

Magnetic AB Test Equipment series 000 and 2000 is a combination of different independent instruments, subassemblies and accessories to form a complete measuring system. These systems can be adapted to measure a wide variety of functions. Nearly every specification required can be met and our engineers and specialists in this field will be glad to help you work out the specifications. On these pages we will give you some examples of custom made systems.

Philosophy

An ideal system for fault location would allow the OPERATOR to locate a fault to a special component. In this way no signal tracing by technical personnel would be required. The operator would be able to inform the technician which component is faulty.

A check-out system can only be a compromise between this ideal and the cost and complexity of the test equipment compared to the cost and complexity of the radar. The system described below is a compromise, which MAGNETIC AB has judged reasonable in terms of fault location speed to cost and complexity of the check-out system.

System Description

The performance of the radar is continuously monitored and has a system of alarms which indicates when the performance falls below a preset level. If an alarm should operate, the degree of loss in performance can be read on a check-out panel.

Once loss in performance is observed, test signals can be introduced into the receiving system and by switching the radar in various modes the receiving channel/channels can be checked. The transmitter faults are located by observing various waveforms and monitoring certain voltages and output power. A complete failure of the transmitter will result in the safety circuit removing high power and preventing further tests. For this type of failure there are alarm lamps, which indicate where the failure has occurred.

A test signal can be introduced into the IF channels in order to simulate a moving target. This target can also be changed in azimuth.

The main IF-amplifier performance is checked by introducing a pulse, which is delayed with respect to the transmitter pulse and monitoring it on the PPI or B-scope. The level of this pulse can be varied from several decibels above noise down to noise level. By this test the relative performance of each receiving channel can be checked. It also gives an indication of the operation of the video integrator. If the pulse is introduced at a suitable point the STC circuits may be checked.

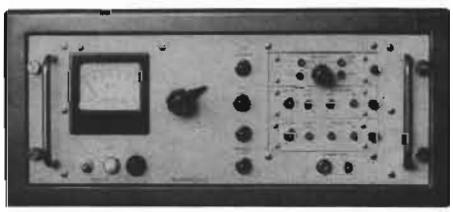
In order to test the ECCM system it is possible to introduce a jammer test signal. This signal is in the form of a very long pulse at IF. If the pulse-width discriminator functions, the IF-amplifier performance test-signal should be visible. Circuits like FTC and IAGC are also checked with this pulse.

The jammer test-signal generator may also be modulated by a noise signal in order to check the efficiency of sea return cancellation circuits, e. g. logarithmic IF-amplifiers. In order to check Dicke-Fix amplifiers the jammer generator can be modulated with very short pulses.

In order to test the MTI of the radar a clutter test signal is introduced (coherent signal), which during correct operation will not be visible on the indicators of the radar.

For setting-up and maintenance purposes a spectrum analyzer is built into the test equipment cabinet in order to evaluate the performance of the transmitter tube.

In order to adjust and signal trace the RF components of the receiver a signal generator at the microwave frequency is included in the test cabinet.



A typical Monitor in series 000 for measurement of Noise and Power.

CAT 000866

Magnetic AB
Radar instrument line

On Noise Figure Measurements

Introduction

Noise Figure is generally used to specify, in a fundamental manner, the sensitivity provided in electronic devices. The reason for this being that it compares actual output noise power with the output noise power of a theoretically ideal device. In addition to being a fundamental property, however, noise figure is much faster and easier to measure than to make equivalent measurements with signal generators. From a performance standpoint, improving receiver noise figure in a system, such as a radar, is often as valuable and more economical than increasing transmitter power an equivalent amount. A 5 dB improvement in receiver noise figure, for example, is equivalent to increasing transmitter power by 3:1.

To enable noise figure to be measured simply and accurately and with economy of equipment, Magnetic AB has developed a range of noise figure meters which both measures noise figure automatically and has a number of important conveniences not previously available. The meters can be used with receivers having IF frequencies in the range 2 to 200 MHz and have a primary measuring range from 0 to 30 dB.

Automatic Instruments

The automatic instruments are designed to operate with gas discharge noise sources for measurements on microwave devices and with temperature limited diodes on IF amplifiers and low frequency devices. A diode source and a series of high-performance waveguide noise sources have been developed for these purposes. Supply voltages for the sources are provided by the instrument.

The instruments provide additional outputs for simplifying various measurements. One of these is a voltage that increaces with the gain of the device being measured and is thus valuable in such work as adjusting twt's to the optimum gain region during the NF measurement. The second is an output for a recorder for registering the noise figure on paper, and the third is a video output which makes it possible for the operator to monitor the measurement set-up for interference.

Manual Instruments

When the speed and convenience of the automatic instrument is not required, an instrument for manual measurement may be used. Such an instrument has been designed for the temperature-limited diode noise sources, which covor the range 5—300 MHz. The instrument is intended for checking the sensitivity of electronic devices on a go/no-go basis, when no adjustments are required.

Measuring Accuracy

The basic accuracy of noise measurements depends on how accurately the noise output of the noise source is known. Two kinds of sources are used with Magnetic AB noise measuring equipment, i.e. gas discharge tubes and temperature limited diodes.

Gas-Discharge-Tube Noise Sources

The tubes are filled with an inert gas, argon or neon, and the pressure is accurately controlled. This has resulted in a very accurate source of noise. These tubes are mounted in transmission line, which couples to the plasma of the discharge. These noise sources are calibrated against what is known as a hot load, a heated termination, and the measurement is done with a modified form of Dicke's radiometer. The accuracy to be expected in the measurement of noise output with this radiometer is ± 0.05 dB. For standard production noise sources, without a calibration certificate, one can expect ± 0.2 dB. The change in noise output with life is in the order of 0.05 dB for 2000 hours.

Temperature-limited Diode Noise Sources

Theory shows that noise output from a temperature limited diode is proportional to the current through the tube. The accuracy of the noise output will then depend on how accurate this current can be monitored and also how accurate the value of the resistor, across which the noise is generated, is known. As the frequency is increased high frequency effects like resonances, lead lengths, and electron transit time will effect the noise output of the noise source. Already at 30 MHz there are difficulties in determining the impedances very accurately, especially for high impedance sources. Connecting the noise source to the input of the device to be tested is no minor problem in the frequency range 30—200 MHz. Impedance may be measured with an accuracy in the order of 2 per cent, which results in a noise figure error of 0.12 dB. Normal current meters are accurate to about 1 per cent, which corresponds to 0.05 dB. This gives a total accuracy of ± 0.2 dB.

Over-all Accuracy

In addition to the accuracies quoted above the accuracy of noise figure meters, attenuators, and directional couplers should be added. A total accuracy of 0.3—0.5 dB may be reached with careful calibration of the different parts in the measurement set-up. For units taken off the shelf one should not expect an absolute accuracy better than ± 1 dB.

Changes in noise figure of 0.1 dB are easily detected during adjustment of the tested device.

Magnetic AB
Radar instrument line

SERIES 114

Multi-Channel Noise Figure Monitors

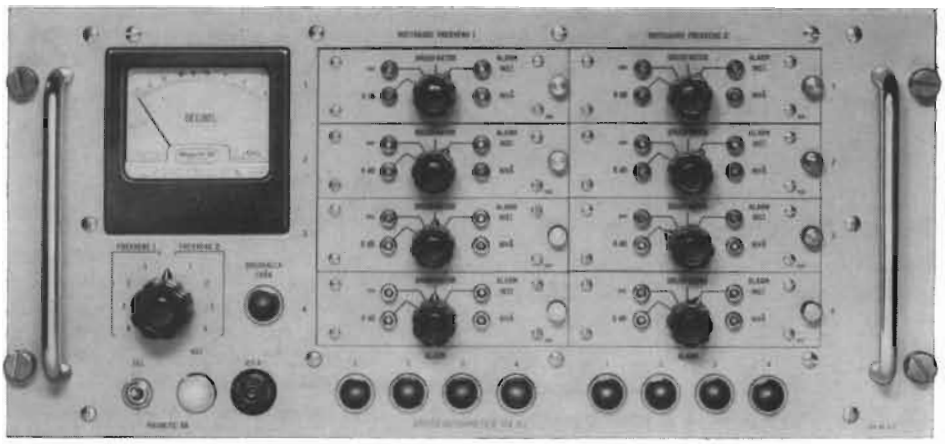


Fig. 1. Eight Channel Noise Figure Monitor series 114.

Where Used

Multi-Channel Noise Figure Monitor series 114 is a solid-state instrument intended for measurements of noise figures in advanced radar systems. The instrument continuously measures noise figures of up to 10 receiver channels simultaneously, while the radar is in operation.

The instrument is designed to meet a wide variety of individual requirements and contains several standard subassemblies. The customer can therefore order the specific type of equipment he needs at a moderate cost.

The noise is introduced at a time when no targets are displayed, thus making it possible to monitor the noise figure without degrading the performance of the receiver. Should the noise figure, in any receiver channel, rise above a predeterminded level, an alarm is actuated. The pulse circuitry in the instrument is triggered by the radar trigger generator. If the radar is jammed by a CW-jammer or a jammer with long pulses, the noise figure alarm warns the operator.

The noise figure can be read on a panel meter, which may be switched to any of the channels. The alarm circuits are in operation on all the channels simultaneously.

Features

- — Adapted for measurements on advanced radar systems
- — Available with up to 10 receiver channels
- — Designed to meet individual requirements
- — Alarm level adjustable on each channel
- — Panel meter switchable between the channels
- — Made to stand mil. tests
- — Continuously operating alarm circuitry, regardless of which channel the panel meter is connected to

Principles of Operation

The noise source, triggered by the NFM, is coupled by a 20 dB directional coupler to the RX antenna line and the output of the receiver is connected to the Noise Figure Monitor. Power for the noise source is supplied by a separate Modulator Unit which can either be mounted in the Noise Figure Monitor or mounted close to the Noise Source. The Modulator is driven by a low voltage pulse from the Noise Figure Monitor. The PRF of the instrument is triggered by the radar trigger generator. The measurements take place during a suitable time of the radar period. The noise source is started slightly ahead of the measurement gate in order to make the measurement uneffected by the noise tube starting time. A typical example for connection of a two-channel Noise Figure Monitor with the appropriate accessories for a radar station, is shown in figure 2. The principle for the Noise Figure Monitor is the same as for other Magnetic AB types of Noise Figure Meters and Monitors. The noise source is pulse modulated by the instrument. The noise figure is automatically measured by comparing the noise output of the device under test when the noise source is off, with the noise output when the noise source is on.

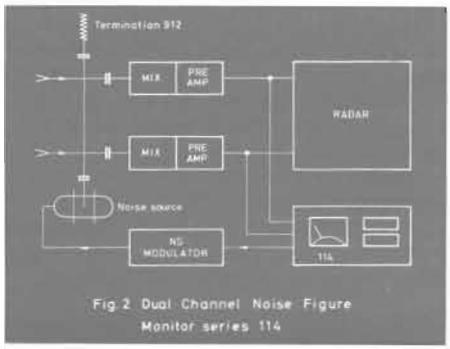


Fig. 2 Dual Channel Noise Figure Monitor series 114

Typical System Accuracy

The basic accuracy of the Noise Figure Monitor itself is better than ± 0.5 dB over the range of interest.

The directional coupler is manufactured with a coupling of 20 ± 0.5 dB. The noise output of the Noise Source has an accuracy of better than ± 0.2 dB.

Mismatch errors between the Noise Source and the Directional Coupler gives a 0.2 dB maximum error.

The noise figure will be known with an estimated accuracy of ± 0,7 dB, absolute. Changes of 0.3 dB in the noise figure will easily be detected. The accuracy "between the channels" will of course be better than

Cont.

CAT 114866/1

Plug-In and Subunits for Series 114

SERIES 114

0.7 dB. The estimated "between channel" accuracy is ± 0.5 dB. The accuracy for the alarm circuitry is ± 0.25 dB relative to indicated noise figure.
The instrument has a noise figure measurement range of 5 to 20 dB with indication to infinity. The range may be changed to 0—15 dB on special request.

Specifications

Frequency range: Depends on noise source, usually a 10 per cent band

Noise Figure Range *
5 to 20 dB, (0—15 dB), indication to infintity

Accuracy: ± 0.5 dB, 5 to 12 dB
± 1.0 dB, 12 to 20 dB

IF Input:

Frequency *	30 MHz
Bandwidth	1 MHz, nominal
Impedance	75 ohms
Sensitivity	25 μV(max)

Alarm Circuit
Accuracy relative to meter indication
± 0.25 dB 5 to 12 dB
± 0.5 dB 12 to 20 dB

Alarm: NFM provides relay contacts for remote alarm indicators.

Noise Source Modulator Trigger Pulse
Amplitude: 10 V, neg
Impedance: 75 ohms

Trigger Input
Amplitude: 10 V (5—50)
Impedance: 75 ohms
Timing: TX pulse or start of measurement gate

Remote Indication
Max 100 μA into 2000 to 4000 ohms for lowest reading; infinity reading at 0 μA

Measurement Gate
100μs or 0.075 × Trep whichever is larger.

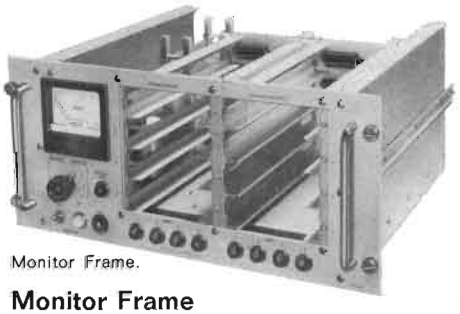
Range of Radar PRF (T_{rep}^{-1})
200 to 2000 Hz. Sampling at higher PRF's

Range of Measurement Gate Delay
300 μs to 4600 μs

The basic design of the NFM series 114 makes it possible to arrange the different subassemblies into a versatile instrument, which can cope with complex systems. The subassemblies available are as follows:

* May be changed upon request to suit customer's special requirements.

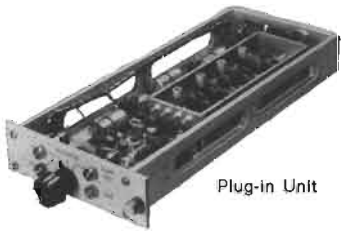
Accessories available: Noise sources. Directional Couplers. Low Power Terminations. See page 13, 14 and 37.



Monitor Frame.

Monitor Frame

This is the unit in which all the sub-units are mounted. The size depends on the complexity of the system.
The following units are mounted in the monitor frame: Plug-in unit, (number of units depends on required number of channels), Pulse generator, Power supply (depending on the system the NS modulator may be mounted in the frame).
Mounted on the panel are alarm lamps and a meter for reading the noise figure. On multichannel frames the meter may be switched between the different plug-ins for noise figure read-out.
All input and output connectors are on the back of the monitor frame. Signal connectors are of type BNC, Power and remote outputs are of type Amphenol "Blue Ribbon".



Plug-in Unit

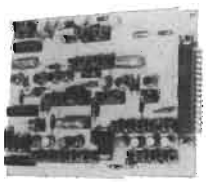
Plug-In Unit

This unit is the basic unit in the Noise Figure Monitor. Up to 10 of these plug-in units can be used in one Monitor Frame. This unit consists of a gated, tuned amplifier, a detector, a video amplifier, integration and alarm circuits.
The center frequency of the tuned amplifier must be the same as that of the IF of the radar. Customer to specify.

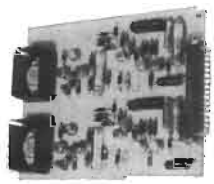
NS-Modulator.

NS-Modulator

This unit is available in several versions, depending on the lay-out of the system. In some NFM's it may be mounted within the monitor frame.
When the noise source is to be placed at some distance from the NFM, the modulator should be placed close to the noise source. This avoids transmitting the high voltage ignition pulse for the noise source, over long cables or slip-rings. The modulator is available with or without its own power supply.
Distance between NS and modulator must not exceed 2 meters.



Pulse Unit



Power Supply

Pulse Unit

This unit generates all the timing wave forms of the noise figure monitor and is in the form of a plug-in printed circuit card. Trigger for the pulse generator is taken from the radar system. It may also be operated free running.

Power Supply

This unit regulates all voltages in the NFM and is in the form of a plug-in printed circuit card. The power transformer is placed on the Monitor Frame close to the Power supply circuit card.

Magnetic AB
Radar instrument line

MODEL 112

Automatic Noise Figure Monitor

Where Used

The MAGNETIC AB model 112 Noise Figure Monitor is intended for permanent installation in radar stations. It measures automatically and continuously the noise figure of the radar receiver. This instrument makes possible a continuous check of the noise figure and consequently the sensitivity of the radar during operation. It also makes a rapid adjustment to minimum noise figure simple.

Features

- Continuous indication
- Direct reading
- Large easy-to-read meter scale
- Large dynamic input-signal range
- Made to stand mil. tests

Principle of Operation

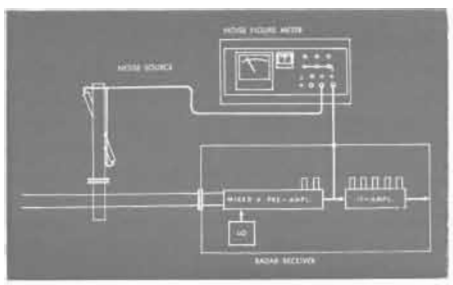
The noise source is connected to the radar waveguide system through a coupling device (20 dB), while a signal is taken from the IF pre-amplifier to the Noise Figure Monitor. Power for the noise source is supplied from the Noise Figure Monitor.
The noise measurement is made during part of the dead time of the radar receiver, i.e., the time from the completion of the radar scan to the following transmitter pulse.
The Noise Figure Meter has a pulsing system which switches the noise source on-off and also switches the signal into two different channels depending on whether the noise source is on or off. The ratio between receiver noise plus injected noise and receiver noise only is measured with a ratio meter. The ratio meter is calibrated in dB noise figure.

Description

The Magnetic AB Model 112 Noise Figure Monitor is a compact unit with a standard 19" panel, 8¾" high and 13½" behind the panel. The instrument is entirely self-contained. For suitable noise sources see special data sheet. The instrument can be delivered either in a rackmount version or mounted in a strong watertight cabinet.

Specifications

Frequency range
250—4000, 2600—26.500 MHz, depending on noise source.



Meter calibration*
6-20 dB, indication to infinity

Accuracy
±0.5 dB, 6-12 dB
±1.0 dB, 12-20 dB

Input frequency*
60 MHz

Bandwidth
1 MHz

Input impedance*
50 ohms

Input sensitivity
0.2 mV—0.1 V (AGC dynamic range)

Pulse repetition frequency*
650—1000 Hz free running of triggered

Trigger*
10 V positive, 0.5—10 μs

Measurement time
Min 220 μs

Noise pulse delay*
100-700 μs

Power requirements*
115/220/230 V. 50/60 Hz. 240 W

Weight
Approx. 18 kilograms (rack mount)

Data with asterisk (*) may be changed upon request to suit your special requirements.

Accessories available: Noise sources. Directional Couplers. Low Power Terminations. See page 13, 14 and 37.

CAT 112866

Magnetic AB
Radar instrument line

Automatic Noise Figure Meter

MODEL 113

Description

The MAGNETIC AB Model 113 Noise Firgure Meter, when used with an appropriate noise source, will automatically measure and continuously display the noise figure of amplifiers, which are tuned to frequencies in the 2.5 to 200 MHz range, (plug-in amplifiers available in this range) or of radar and other microwave receivers which have an intermediate frequency in this range. Receiver frequency ranges from 5 MHz to 26.5 GHz can be covered with available Noise Sources.

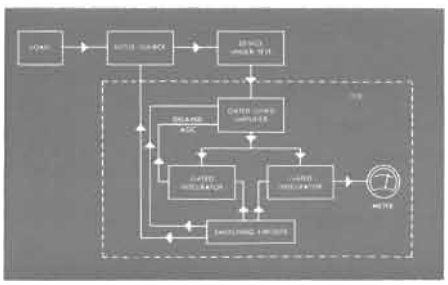
Features

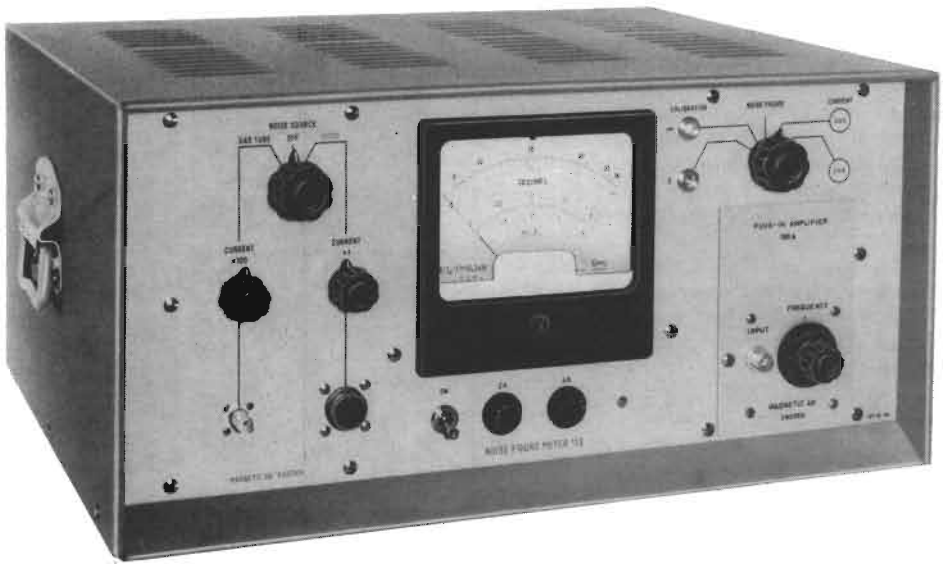
— Completely automatic measurement
— Direct reading in dB
— Simple operation
— No periodic calibration necessary
— Large easy-to-read meter scale
— Large dynamic input-signal range

Where used

Model 113 and its associated noise sources are very valuable for simplifying the selection of mixers, oscillators, crystals, TR cells and other receiver components. Circuit adjustments can also be easily and quickly performed since the effect of each adjustment or component change upon the noise figure of the system is immediately displayed on the meter.

Block diagram of model 113





Principles of operation

To make noise figure measurements, the Model 113 Noise Figure Meter, the appropriate noise source and the device under test are connected as shown in the block diagram. The Noise Figure Meter square wave modulates the noise source at about a 500 Hz rate and measures noise figure by comparing the noise output of the device under test when the noise source is off, with the noise output when the noise source is on. The input circuitry of the Model 113 consists of a gated tuned amplifier which operates at frequencies selected by a front panel switch. The output from the amplifier is applied to two integrators which are gated alternately at about 500 Hz, the same rate at which the noise source is turned on and off. When the noise source is on, the combined noise, power from the noise source and the device under test is amplified by the amplifier and integrated by the AGC integrator. The time constant of the AGC voltage, applied to the amplifier, is long enough to hold the gain of the amplifier the same whether the noise source is on or off.

When the noise source is turned off, the combined noise power from the source impedance (termination) and the device under test is amplified by the tuned amplifier, integrator and displayed on the meter. Because of the AGC action, the meter deflection is proportional to the ratio of the noise powers (source on and source off) and, since the additional noise from the noise source (excess noise) is accurately known, the meter face is calibrated directly in dB of noise figure.

The AGC action, in addition to establishing a reference, provides a wide (50 dB) dynamic range and also eliminates the necessity for periodic resetting. AGC voltages appear on a pair of terminals at the rear of the Model 113 to facilitate special applications, which require a rough adjustment of the gain of the system in relation to changes in noise figure.

The meter face is provided with two noise figure scales — a "Noise Diode" scale for use with Thermionic-Diode Noise Sources and a "Gas Tube" scale for use with Gas-Discharge-Tube Noise Sources. Current

cont

Magnetic AB
Radar instrument line

MODEL 190

Plug-In Amplifiers for Model 113

Model 113 cont.

scales are also provided to indicate the current supplied to the noise sources and thus facilitate the initial set-up of the source. A phone jack is provided on the rear to drive a remote meter or recorder, so that a permanent record of noise figure can be made, or so that a plot of noise figure versus frequency can be made of broad band receivers. Although designed for fast, accurate, automatic noise figure measurements, this Noise Figure Meter can also be used for manual measurements. A switch in the instrument converts it to an accurate square law indicator. The noise source may then be switched on or off as desired, the noise ratio noted. From this the noise figure can be calculated.

Specifications Model 113

Frequency Range
5 MHz to 26,5 GHz depending on noise source

Noise Figure Range
Diode noise source: 0—15 dB, ind. to infinity
Gas tube source: 3—30 dB, ind. to infinity

Accuracy 113 only
Diode scale: ± ½ dB, 0—15 dB
Gas tube scale:
± ½ dB, 10—25 dB
± 1 dB, 3—10, 25—30 dB

Input Frequency: see plug-in unit

Input Bandwidth: 1 MHz min

Input Voltage
0.2 to 100 mV (—60 to —10 dBm)

Input Impedance: 50 Ω nominal

Recorder Output
maximum 1 mA into max 2000 Ω to operate a recorder or remote meter

AGC Output
0—6 volts from rear bindings posts

Power Output: Will operate thermionic diode Argon/Neon disch. tube and fluorescent lamp

Power Input: 115, 220, 230 volts ± 10 %, 50—60 Hz, 200—400 W

Weight: Cabinet Mount 19 kilograms
Dimensions: W482×H222×D340 mm

MODEL 190 A PLUG-IN AMPLIFIER

Input Frequencies 30, 60, 70, 105, 200 MHz or 30 MHz and any four frequencies between 40 and 200 MHz on special order

Bandwidth
Voltage
Impedance } see specification for Model 113

MODEL 190 B PLUG-IN AMPLIFIER

Input Frequencies 10.7, 20, 30, 45, 60 MHz or 10.7 MHz and any four frequencies between 20 and 60 MHz on special order

Bandwidth
Voltage
Impedance } see specification for Model 113

MODEL 190 C PLUG-INAMPLIFIER

Input Frequency 30 or 60* MHz or any frequency between 2.5 and 60 MHz on special order

Bandwidth
Voltage
Impedance } see specification for Model 113

MODEL 190 D PLUG-IN AMPLIFIER

Input Frequency	36.15 MHz (42.0* MHz available)
Bandwidth	1 MHz
Voltage	25 μV to 10 mV
Impedance	50 Ω, nominal

MODEL 190 E PLUG-IN AMPLIFIER

Input Frequency	36.15 MHz
Bandwidth	5.5 MHz
Voltage	0.2—100 mV
Impedance	50 Ω, nominal

* If this frequency is required it has to be stated in the order.

Accessories available: Noise sources. Directional Couplers. Low Power Terminations. See page 13, 14 and 37.

Magnetic AB
Radar instrument line

Manual Noise Figure Meter

MODEL 115

Where Used

Model 115 is a fully transistorized non-automatic Noise Figure Meter designed for manual measurements of the sensitivity of receivers. Originally designed to serve as a portable service instrument for microwave link maintenance it has found wide use where the convenience and speed of model 113 is not required. Consequently it has proven excellent in factories for production tests of receivers.

The frequency range for the generator is 5 to 250 MHz and for the detector 1 to 80 MHz (with reduced sensitivity 0.5 to 100 MHz).

Features

- High accuracy
- Noise diode for the frequency range 5—250 MHz
- Broad band amplifier and detector for the frequency range 1—80 MHz (0.5—100 MHz with reduced sensitivity).
- Waterproof case
- Designed to stand mil. tests

Description

The instrument consists of a well-regulated power supply, a broad band amplifier with detector and an accurate 3 dB attenuator. A panel meter and necessary control knobs are placed on the front panel. The random noise generator is a temperature-limited diode for the frequency range 5—250 MHz. The noise generator model 123 is connected to the instrument by a cable.

The instrument is transistorized with exception of the noise diode. To enable measurements also under field conditions the instrument is built in a waterproof case.

Specifications

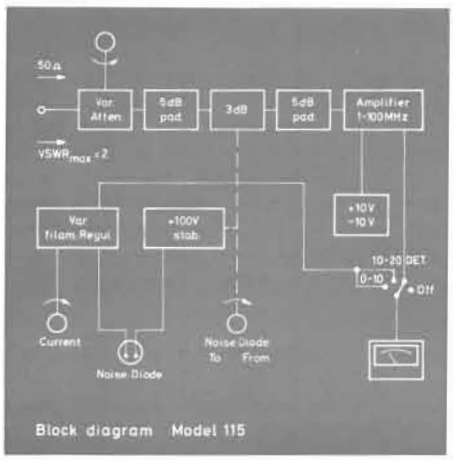
NOISE GENERATOR (model 123A)

Frequency Range 5 to 250 MHz

Accuracy in Excess Noise (including 5 % variation in mains input)
± 0.25 dB

Source Impedance
50 ohms, unbalanced

Noise Figure Range
0 to 10 dB and 10 to 20 dB



Block diagram Model 115

VSWR
1.05 max from 5—150 MHz
1.08 max from 150—200 MHz
1.12 max from 200—250 MHz

Frequency Correction of Excess Noise
+ 0.1 dB at 100 MHz
+ 0.25 dB at 150 MHz
+ 0.4 dB at 200 MHz

Output Connector BNC 50 ohms

DETECTOR

Frequency Range
1—80 MHz, 0.5—100 MHz with reduced sensitivity

Sensitivity: 500 μV

Input Impedance: 50 ohms, unbalanced

Input Connector: BNC

Accuracy, 3 dB Attenuator: ± 0.1 dB

Gain: continuously variable 50 dB

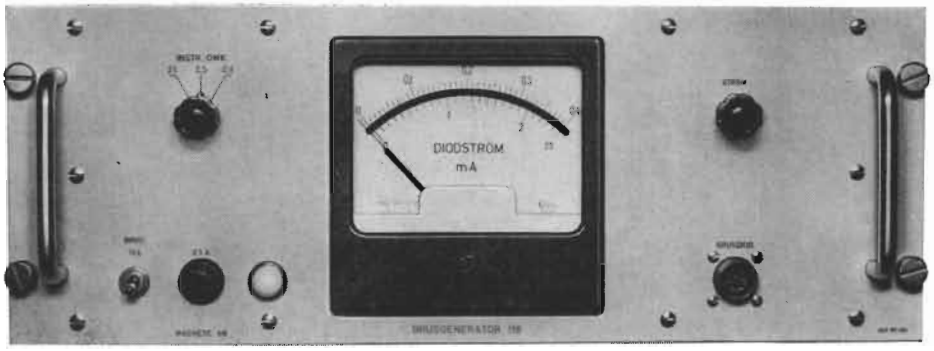
Dimensions W 340×H 220×D 280 mm

Mains Supply
115/220/230 V ± 10 %, 50—500 Hz, 50 VA

Magnetic AB
Radar instrument line

MODEL 116

Noise Generator



Model 116

Model 123 A

Model 116 B

Description

Noise Generator model 116 is a compact and convenient instrument, designed for manual measurements of noise figure and receiver sensitivity. The instrument consists of a noise generator, which is a temperature limited diode, Magnetic AB model 123, operating in the temperature-limited region, where the noise power is directly proportional to plate current. Since this current depends upon the power supplied to the diode filament a well regulated D-C filament supply is employed to ensure a stable output.

Two types of instruments are available, model 116 and model 116 B. Model 116 is designed for high accuracy measurements and includes a high accuracy noise generator model 123 C. Model 116 B is designed for normal measurements, where high accuracy is not so important. It can also be used for field measurements as it is mounted in a military transit case.

Model 116 is mounted in a standard 19″ rack and model 116 B is portable in a military transit case. Both instruments are transistorized with exception of the noise diode.

Specifications

MODEL 116 WITH NOISE GENERATOR 123 C

Frequency
30 and 60 MHz (Similar instruments may be delivered in the range 5—250 MHz)

Frequency at which the impedance is measured: 30 MHz, 60 MHz*

Noise Figure Range
0—2 dB, 0—10 dB and 10—20 dB

Accuracy in excess noise: ± 0.23 dB

Error Coused by

± 10 % mains variation	± 0.05 dB
± 1 % panel meter	± 0.05 dB
± 3 % generator imp.	± 0.13 dB

Generator Impedance
R* 200 ohm ± 0,5 % (DC)
C* 20 pF ± 5 %
*may be changed upon request between 150 to 250 ohms to suit your requirements

Frequency Correction in Excess Noise
0.015 dB

Output connector: BNC

Dimensions: W 482×H 178×D 180 mm

Mains Supply
115/220/230 V, ± 10 %
50/60 Hz, 50 VA

MODEL 116 B WITH NOISE GENERATOR 123 A

Frequency range: 5—250 MHz

Noise figure range: 0—10 and 10—18 dB

Accuracy in excess noise: ± 0.25 dB

Source impedance: 50 ohms

VSWR
5—150 MHz max. 1.05
150—200 MHz max. 1.08
200—250 MHz max. 1.12

Frequency Correction in Excess Noise
0.1 dB at 100 MHz
0.25 dB at 150 MHz
0.4 dB at 200 MHz

Output connector: BNC, female

Mains Supply
115/220/230 V, 50—500 Hz 50 VA

Weight: 12 kg

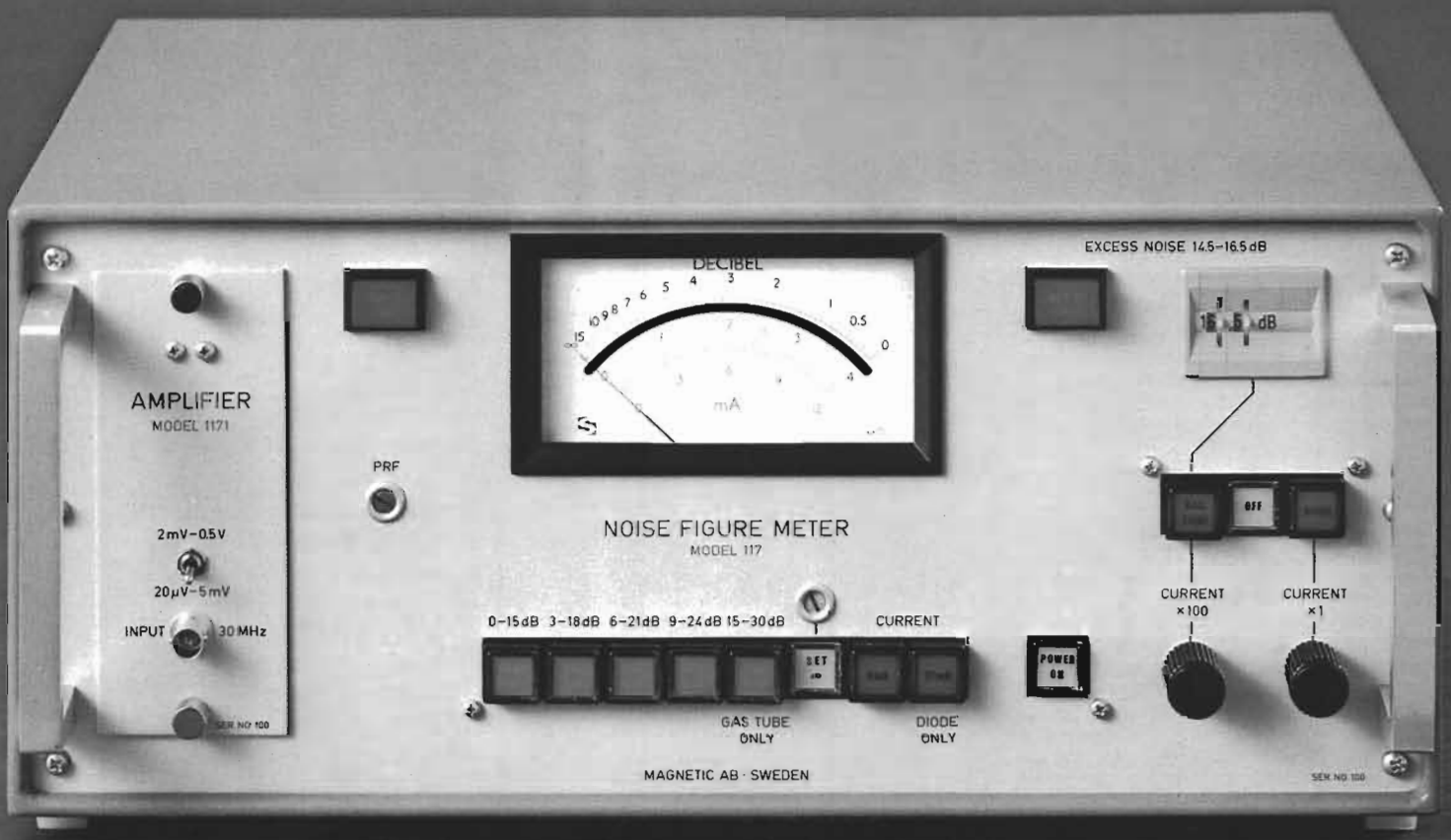
Dimensions: W 340×H 220×D 280 mm

CAT 116866

Magnetic AB
Radar instrument line

Precision Automatic Noise Figure Meter

MODEL 117



Exceptional stability
Scale expansion for high resolution
Accuracy: ±0.15 dB
Digital excess noise compensator
Compact size, modular construction
Output for recorder or remote meter
Operates gas tube, diode & solid state noise sources
Large input-signal range

The new model 117 Precision Noise Figure Meter is the successor to the popular model 113 Noise Figure Meter, a worldwide favorite in laboratories, factories and maintenance shops. In designing the new Precision Noise Figure Meter, MAGNETIC AB engineers have created a Noise Figure Meter for the future. Among the many new features two are outstanding. One is the high accuracy and stability. The other, modular construction, anticipates special needs and adaptability to complex measurement systems.

GÄRDSFOGDEVÄGEN 18
BOX 11060, S-161 11 BROMMA, SWEDEN **Magnetic AB**

CAT 117969

Magnetic AB
Radar instrument line

MODEL 117

Precision Automatic Noise Figure Meter

Description

In conjunction with MAGNETIC AB Noise Sources, the model 117 Precision Noise Figure Meter automatically measures the noise figure of amplifiers and receivers. Input frequencies from 5 MHz to 40 GHz can be covered with available noise sources.

Accuracy

With the introduction of accurate calibration facilities for noise sources, a higher accuracy in the measuring circuits was also required, especially at low noise figures. The extremely high accuracy of the model 117 Precision Noise Figure Meter makes precision overall noise figure measurements possible. Expanded scale design gives a very high resolution for indicating changes during adjustments of receivers. Long and short term stability has been greatly improved by extensive use of feed back and temperature compensation.

Simplicity of Operation

Like all other MAGNETIC AB instruments the model 117 Precision Noise Figure Meter has been designed for convenience of operation.
Simple push-button controls operate the unit, with illuminated buttons for activated functions.
Indicator warns the operator when input is too low.
By dialing the value of the excess noise of the noise source used, on a digital switch, the operator will read the correct noise figure directly.

Modular Construction

The modular construction simplifies adaptation to special systems and maintenance. For remote operation of noise sources, the modulator unit may be mounted close to the source and only a low voltage from the model 117 is required to operate the source. The amplifier and detection circuits have been made plug-in from the panel to cope with the quick transition from one measurement set up to another.

Compact Size

State of the art, all-solid-state circuitry in addition to providing increased reliability, makes possible an instrument small in size and low in weight.

PERFORMANCE SPECIFICATIONS

PRECISION NOISE FIGURE METER MODEL 117

Noise Figure Range:
0-30 dB, indication to infinity, in 5 ranges

Accuracy (model 117 only):
±0.15 dB, 0- 9 dB
±0.25 dB, 9-18 dB
±0.5 dB, 18-25 dB
±1.0 dB, 25-30 dB

Excess Noise Compensator:
Range 14.5-16.5 dB,

Frequency Range:
5 MHz to 40 GHz, depending on noise source used.

Input Frequency:
Input Voltage:
Bandwidth:
} See plug-in specification

Recorder Output: 0-4 V, Ri = 2 kΩ.

Power Output:
Will operate gas discharge and thermionic diode noise sourcec.

Power Input:
115/220/230 V, ±10 %.
50-400 Hz, 30 W.

Temperature Range:
Operating: 0 to +55° C
Storage: -40 to +75° C

Dimensions: W420 × H180 × D305 mm.
Weight: 12 kg.

PLUG-IN AMPLIFIER MODEL 1171
Input Frequency: 30 MHz*)
Input Voltage, 20 μV-0.5 V.
Input Impedance: 50 ohm.
Bandwidth: 5 MHz.
*) Others on request.

PLUG-IN CONVERTER UNIT MODEL 1172
Converter units in the range of 5 to 200 MHz under development.

Options:
NOISE SOURCE MODULATOR MODEL 1178
Intended for solid state noise sources.

Magnetic AB GÄRDSFOGDEVÄGEN 18
BOX 11060, S-161 11 BROMMA, SWEDEN

CAT 117969

Magnetic AB
Radar instrument line

Waveguide Noise Sources

MODEL 121, 124

Where Used

Magnetic AB Noise Sources are available for all frequencies between 5 and 26.000 MHz to allow measurements on all RF devices in this range.

The Model 121 waveguide sources are used when a very high accuracy is needed.

The Model 124 waveguide sources are used when a noise source of minimum size and yet a reasonably high accuracy is required, e.g. when the noise source is to be integrated into a system.

Two coaxial noise sources, Model 122 and 123 are available for frequencies below 3.000 MHz.

The sources are all designed for operation with Magnetic AB Noise Figure Meters and Monitors, such as Models 112, 113 and 114.

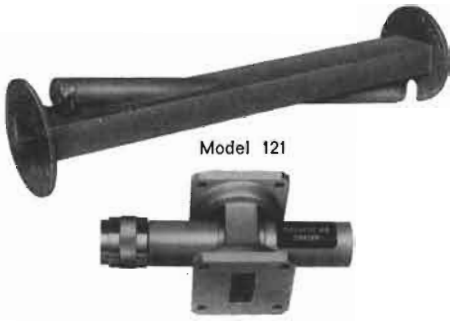
Noise Source Model 121

The Magnetic Model 121 Noise Source consists of a gas discharge tube mounted at an angle of approximately 10° in a section of waveguide. Great care has been taken in the design of the noise source to achieve the high order of performance required in the accurate measurement of noise figure. The source presents a VSWR of less than 1.2 whether the tube is turned on or off. Spurious modes present because of the necessity of cutting into the guide for the tube are suppressed. The tube used is a cold-cathode type which is rated to have an excess noise power of about 15.5 dB. The gas tube gives a noise spectrum which is flat with frequency over the waveguide band.

Each end of the waveguide section is equipped with a cover-type flange. For optimum operation the open end of the waveguide should be terminated with a low-reflection load, which has a VSWR of less than 1.02

Noise Source Model 124

Magnetic AB Model 124 Noise Source consists of a gas discharge tube mounted across a section of waveguide. Great care has been taken in the design of the noise source to achieve the high order of performance required in the accurate measurement of noise figure. There are two basic types: the transmission type and the single-ended or shorted type. The transmission type may be mounted in the receiver input line. The single-ended type must be mounted so that the noise is injected through a directional coupler as the noise source presents a short circuit when the noise tube is off. The noise tube used is of the cold cathode type and is neon filled. The excess noise from the noise tube itself is about 18 dB. The single-ended sources are tuned to a specific frequency and the source operates over a 10 per cent band around the center frequency.



Model 121

Model 124

Specifications

Waveguide Noise Sources Model 121

Model	Frequency range GHz	Waveguide IEC	RG/U	WR	Flanges IEC	UG/U	Excess noise ratio dB	Argon gas tube type	VSWR*	Cable connector	Input power	Approx Length mn.	Notes
S 121**	2.60—3.95	R32	48	284	UAR32	53	15.25 ± .2	TD-38	|	|	|	600	
G 121	3.95—5.85	R48	49	187	UAR48	149A	15.20 ± .2	TD-39	|	|	|	500	
J 121	5.30—8.20	R70	50	137	UAR70	344	15.28 ± .2	TD-39	On: 1.2 max	MHV type	Supplied	500	
H 121	7.05—10.0	R84	51	112	UBR84	51	15.62 ± .2	TD-40	1.08 Aver	UG 932/U	by	425	
X 121**	8.20—12.4	R100	52	90	UBR100	39	15.91 ± .2	TD-41	Off: 1.2 max	mates w.	113, 114 etc.	375	
P 121	12.4—18.0	R140	91	62	UBR140	419	15.91 ± .2	TD-41	1.08 Aver	UG 931/U	|	375	
K 121	18.0—26.5	R220	53	42	UBR220	595	16.0	TD-42	|	|	|	335	

* Noise Sources terminated in a well-matched load such as that provided by the 912, 913 series. ** Reference Noise Sources w. low VSWR available on request.

Miniature Waveguide Noise Sources Model

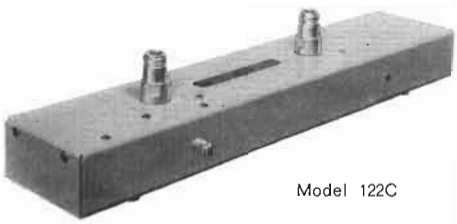
S 124	2.80—3.20	R32	75	284	UAR32	584	18.3 ± .5	XD-1096	On: 1.5 max	|	|	30	Single ended type
G 124	5.25—5.70	R48	95	187	UAR48	407	18.0 ± .5	TD-93	Off: 00	|	|	40	Single ended type
J 124*										UG931/U	Supplied		
H 124	8.50—9.60	R84	67	112	Model X124A with step trasition model X/H 914**					|	by		
X 124	8.50—9.60	R100	67	90	UBR100	135	14.3 ± .3	TD-93	On: 2.0, off: 1.25	|	113, 114 etc.	47.6	Transmission type
X 124A	8.50—9.60	R100	67	90	UBR100	135	18.0 ± .3	TD-93	On: 2.0, off: ∞	|	|	40	Single ended type

* Available midle 1967.

Magnetic AB
Radar instrument line

MODEL 122, 123

Coaxial and Diode Noise Sources



Model 122C

Coaxial Noise Source Model 122C

Magnetic AB Model 122 Noise Source uses a gas discharge tube as a noise generator. In order to get small dimensions and a wide bandwidth a helical transmission line has been used instead of the more common waveguide, which is rather awkward to handle at these frequencies. Model 122 covers the frequency range of 300 to 3000 MHz and can be used over the range of 250 to 4000 MHz with a correction curve. The noise generator is an argon-gas discharge tube (TD-40) which is inserted in a helical transmission line. The dimensions of this helix have been chosen so that its impedance is 50 ohms. In each end of the helix there are transitions to type N connectors. The impedance is constant over the frequency band. There is a slight change in impedance when the source is switched from the unfired to the fired condition.

Specifications for 122C

Frequency range: 300—3000 MHz, 250—4000 MHz with correction factor
Excess noise ratio (tube only)
15.6 dB ± 0.2 dB
Argon Gas Tube: TD-40

VSWR *	Fired	Unfired
Up to 2600 MHz	1.3	1.5 max
2600 to 3000 MHz	1.35	1.5 max
3000 to 4000 MHz	1.5	10 max

Output Connectors
Type N, female, 50 ohms
Current supply: 175 mA, current supplied by Noise Figure Meter Model 112, 113 or 114
Input cable: 1.5 m, terminated in a UG 932/U connector (BNC High Voltage)
Dimensions: 390×80×50 mm (L×W×H)
Accessories Available:
50 ohms termination, Model 951A

* Source terminated in a well matched load such as Model 951A.

Diode Noise Source Model 123

Model 123 Noise Source consists of a temperature limited diode and its associated circuitry housed in an aluminum container. Model 123 provides a wide band noise spectrum from 5 to 250 MHz. At rated current and impedance the source produces an output excess noise of 5.2 dB. The output is unbalanced to ground.
Model 123 is available in three versions: Model 123A, B or C.

Model 123

Model 123A

Model 123A is a 50 ohms source designed to operate in a 50 ohms systems. The source is unbalanced to ground but may be operated in balanced systems with the aid of a balance-to-unbalance transformer.

Specifications for 123A

Frequency range: 5—250 MHz
Excess noise ratio: 5.2 ± 0.1 dB

Frequency correction: (in excess noise)	
	100 MHz + 0.1 dB
	150 MHz + 0.24 dB
	200 MHz + 0.42 dB

Source Impedance: 50 ohms

VSWR	
5—150 MHz,	max 1.05
150—200 MHz,	max 1.08
200—250 MHz,	max 1.12

Output connector: BNC, female
Power connector: MS, 3106A—14S—5P

Model 123B and 123C

IF amplifiers designed to operate from crystal mixers require a source parallel resistance of about 400 ohms shunted by 10 to 50 pF for minimum noise figure. Usually some kind of an impedance transformer is connected between a low-impedance (50 ohms) noise source and the amplifier input, when the noise figure is being measured or a high-impedance source is used. This high impedance source is ordinarily tuned to the IF-frequency in order to make a resistive source impedance.
The high-impedance source has the disadvantage of being a narrow band device. In addition it requires a shunt capacitance. The low impedance source operates over a wide frequency range, but if the impedance transformer is of the reactive type it becomes a narrow band device. If the transformer is of the dissipative type, it attenuates the noise signal, which requires a higher noise tube current to get the same noise output. A higher tube current lowers the tube life.
Wide band operation can be obtained by selecting the correct resistance and adding the required shunt capacitance across this resistor. The noise source will then present the right impedance over a wide frequency range.

Specifications for 123B

Frequency range: 5—250 MHz
Excess noise: 5.2 dB (at specified current)

Frequency correction: (in excess noise)	
	100 MHz + 0.1 dB
	150 MHz + 0.25 dB
	100 MHz + 0.4 dB

Source (parallel) resistance
390 ohms ± 5 %
Source (shunt) capacitance
25 pF ± 10 % (Other values available)
Output connector: BNC, female
Power connector: MS, 3106A—14S—5P

Specifications for 123C**

This noise source is a high accuracy device designed to operate at the two frequencies of 30 and 60 MHz. It is provided with a test certificate, which indicates the resistance and the capacitance of the source.
Frequency:
30 and 60 MHz
Excess Noise
Depends on current (F = 20RI)
Source (parallel) Resistance
250, 200 or 150 ohms (nominal)
Source (shunt) Capacitance
15 pF (nominal)
Output connector: BNC, female
Power connector: MS, 3106A—14S—5P

** This noise source is primarily intended for NFM Model 116 but may also be used on Models 113, 115 and 116B.

CAT 122866

Magnetic AB
Radar instrument line

Miniature Noise Sources

MODEL 124

General

These sources are the latest complement to Magnetic AB series of noise sources for system operation with our noise figure monitors. The sources have smaller dimensions than earlier types and will be recommended for systems, where small dimensions and low weight are essential. Model X124B is of the transmission type, designed to be mounted in the receiver input line. Excess noise ratio is 14.5±0.5 dB. Model X124B-1 and L124 are of the single-ended type, designed to be mounted in the waveguide system by means of a directional coupler. The excess noise ratio is 18.0±0.5 dB or 15.2±0.5 dB respectively. The sources operate in a 10 % band around the center frequency.

Features

Extremely small dimensions
Single-ended or transmission type
Low weight
Ruggedized
Pressurized

L 124

X 124 B-1

Specifications:

	X124B	X124B-1	L124
Type	Transmission	Single-ended	Single-ended
Frequency range	8.5—9.6 GHz	8.5—9.6 GHz	1.25—1.35 GHz
Excess Noise Ratio	14.5±0.5 dB	18.0±0.5 dB	15.2±0.5 dB
VSWR: operating	2.1 : 1 max	2.0 : 1 max	1.35 : 1 max
non-operating	1.25 : 1 max	∞	∞
Starting voltage	900 V	900 V	2000 V
Tube operating current	100 mA (peak)	100 mA (peak)	—
Waveguide	R100	R100	R14
Flange	UBR100	UBR100	PDR14
Connector	UG-931/U	UG-931/U	UG-931/u
Noise tube	TD-93B	TD-93B	TD-142
Material	Aluminium alloy	Aluminium alloy	Brass
Dimensions	See fig. 2	See fig. 2	See fig. 1
Weight	115 grms	150 grms	3.8 kgs

Other types of noise sources see page 13.

Note: The sources can also be delivered for DC-operation.

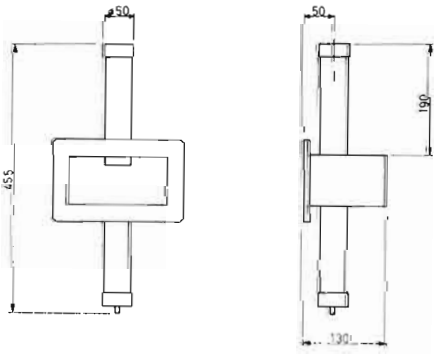


Fig. 1

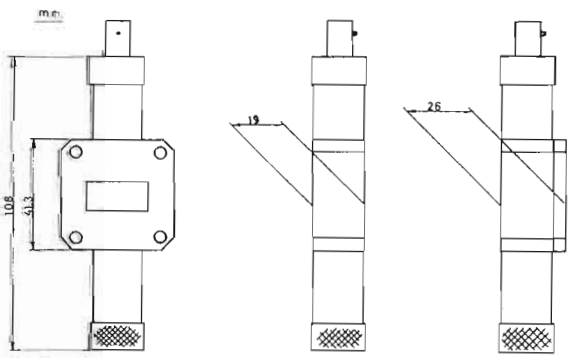


Fig. 2

GÅRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN
Magnetic AB

CAT 1241168

Magnetic AB
Radar instrument line

MODEL 121C

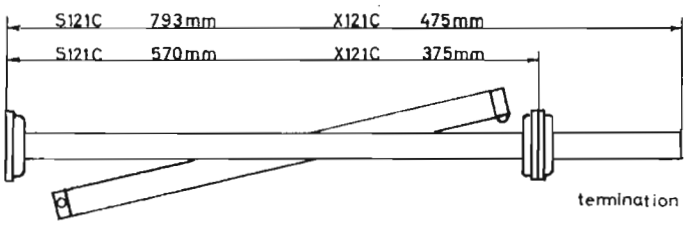
Reference Waveguide Noise Sources

General

With the increased use of noise measuring equipment and the tightening of design specifications, a reference noise standard is required in order to calibrate laboratory and production line noise measuring equipment. It is impractical and uneconomical for each user, to have his own calibration facility, which would require a hot load and a Dicke radiometer.
For this reason Magnetic AB has made a special version of its Waveguide Noise Source, which will have tighter specifications and a gold plated finish to prevent tarnish. This noise source is intended to be used as a reference noise source, against which other noise sources can be checked.

Description

The noise source consists of a gas discharge tube mounted in a section of waveguide. The small insertion angle provides a low VSWR and a large hot-attenuation. Great care has been taken in the design of the noise source to achieve the high order of performance required in the accurate measurement of noise figure. The source presents a low VSWR whether the tube is turned on or off. Spurious modes, present because of the necessity of cutting into the guide for the tube, are suppressed. The noise source is intended for DC-operation. The sources are delivered in a wooden box, giving protection for transportation. A high qualitiy low power termination is included on delivery.



Specifications:	S-band	X-band
Model no	S121C	X121C
Excess noise*	15.2 dB nom.	15.8 dB nom.
Frequency range	2.65—3.95 GHz	8.2—12.4 GHz
Waveguide	R 32	R 100
Flange	UAR 32	UBR 100
Operating Current	250 mA	200 mA
Filament Current	300 mA, max	170 mA, max
VSWR	1.15 max 1.1 max at 3.0 GHz	1.15 max 1.1 max at 9.0 GHz
Noise variation with current	—0.004 dB per mA	—0.004 dB per mA
Noise Tube	TD-12	TD-18
Cable connectors		
Anode	UG-932/U (MHV)	UG-932/U (MHV)
Cathode	UG-102/U (UHF)	UG-102/U (UHF)

* Calibration against a hot load with a modified Dicke radiometer can be offered in two classes of accuracy: 1) ±0.15 dB and 2) ±0.1 dB. The noise output is not expected to change more than ±0.05 dB over the useful life of the noise tube.

Magnetic AB GÄRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN

CAT 1241168

Magnetic AB
Radar instrument line

Adapters for Noise Figure Measurements

MODEL 195, 954, 955, 956

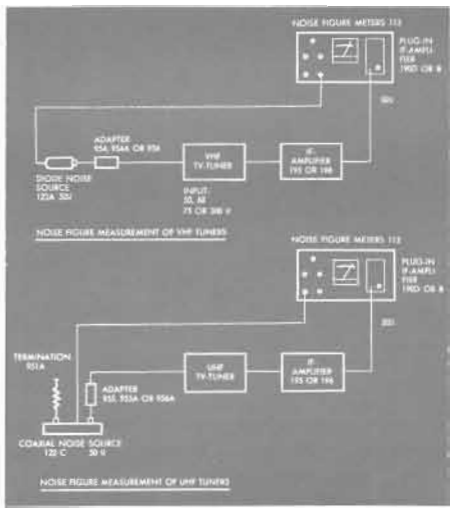
Where Used

Magnetic AB offers a complete system for measurement of the Noise Figure of VHF and UHF TV-tuners etc. The basic instrument is the automatic Noise Figure Meter Model 113, which continuously and automatically displays the Noise Figure.
This instrument together with the Noise Sources, Adapters for different impedances, IF-amplifiers etc. for an exellent and time-saving equipment for alignment of TV-tuners etc. in production.
The tuners can very quickly be adjusted to minimum Noise Figure with this equipment. The automatic Noise Figure Meter Model 113 instantly displays the actual Noise Figure when tuning the input circuit of the tuner. The time required to adjust a tuner to minimum Noise Figure is only a few seconds. Turn the frequency knob of the tuner and the Noise Figure Meter will show how the Noise Figure changes over the band. Complete control of the Noise Figure will be secured.
Diode Noise Source Model 123A, with a frequency range of 5—250 MHz/s, covers the VHF band and Coaxial Noise Source, Model 122C with a range of 300—3000 MHz, the UHF band. The output impedance of the Noise Sources is 50 ohms, but Adapters for 60—75 ohms as well as 200—300 ohms are available.
A special IF-amplifier Model 195 is used to get sufficient input voltage to the Noise Figure Meter. The input frequency of the amplifier is 36.15 or 42 MHz, Other frequencies are available on request.

IF-amplifier Model 195

The output power of the TV-tuner is usually too low to be fed directly into the Plug-in IF-amplifier 190D or B, which require a minimum of 25 μV and 0.2 mV respectively. An extra IF-amplifier to be connected between the TV-tuner and the Noise Figure Meter is therefore necessary. The amplifier is transistorized and is available with two or three stages.

Model 195



Adapter Model 954

This adapter is designed to be used when an VHF tuner with unbalanced input impedance 60 or 75 ohms has to be connected to Magnetic AB Noise Source Model 123A. When measuring the noise figure with NFM Model 113 subtract 0.8 dB and 1.75 dB respectively.

Adapter Model 955

This adapter is recommended to be used when an UHF tuner with an unbalanced input impedance 60 or 75 ohms has to be connected to Magnetic AB Noise Source Model 122C. When the noise figure is measured with NFM Model 113 subtract 5 dB.

Adapter Model 956

This adapter is recommended to be used when an VHF—UHF tuner with balanced input impedance of 300 ohms shall be connected to Magnetic AB Noise Sources Model 123A or 122C. When the noise figure is measured with NFM 113 direct reading can be made.

Specifications

Model 195

Frequency: 36,15 or 42 MHz*
Bandwidth: 1 MHz
Input impedance: 50, 60 or 75 ohms
Output impedance: 50 ohms
Gain: 20 dB
Mains supply: 220/230 V, 50/60 Hz

Model 195A

Same as 195 except
Gain: 30—40 dB

Model 954

Frequency range: 5—250 MHz
Input impedance: 50 ohms unbal.
Output impedance: 60 ohms unbal.
Connectors: 50 ohm BNC/Decifix B
Noise Figure Readings with Noise Source 123A: Subtract 0.8 dB

Model 954A

Same as 954 except
Output impedance: 75 ohms unbal.
Noise Figure Readings with Noise Source 123A: Subtract 1.75 dB

Model 955

Frequency range: 0—1000 MHz
Power: 0.5 W
VSWR: 1.15 max.
Input impedance: 50 ohms unbal.
Output impedance: 60 ohms unbal.
Connectors: Type N/Decifix B
Noise Figure Readings with Noise Source 122C: Subtract 5 dB

Model 955A

Same as 955 except
Output impedance: 75 ohms

Model 956

Frequency range: 50—250 MHz
VSWR: 1.2 max.
Loss: less than 0.2 dB
Input impedance: 50 ohms unbal.
Output impedance: 300 ohms bal.
Connectors: 50 ohm type N/2 pins (delivered with transition N/BNC for 123A)
Noise Figure Reading with 123A: Direct reading

Model 956A

Same as 956 except
Frequency range: 400—900 MHz
Connectors: 50 ohm type N/2 pins
Noise Figure Readings with 122C: Direct reading

* Other frequencies available on request.
The frequency has to be stated when ordering.

Model 954

Model 955

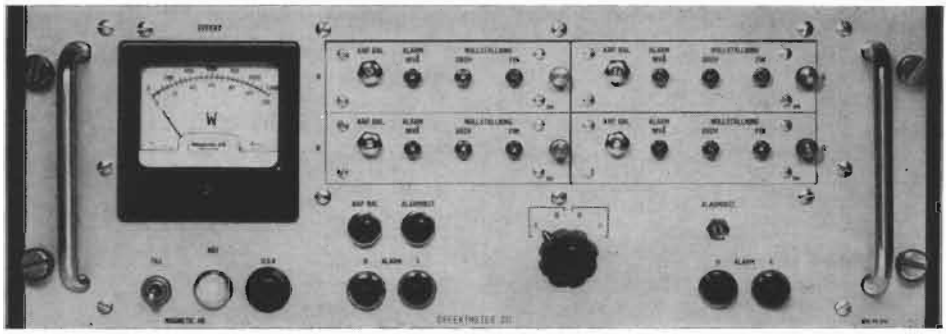
Model 956

Data subject to change without notice
CAT 195866

Magnetic AB
Radar instrument line

SERIES 311

Multi-Channel Power Meters



For channel Power Meter series 311

Where Used

Multi-channel Power Meter Series 311 is a new solid state instrument intended for continuous check-out and measurements of power in advanced radar and microwave systems. The instrument consists of two basic units, the Power Meter Frame with plug-in units and the RF-heads. The Power Meter Frame is available with from 2 to 6 channels (plug-in units) and can therefore, at the same time, check-out and measure both direct and reflected power in several transmitters continuously.

The RF-head is installed in the waveguide system and connected to the indicating unit with a cable. RF-heads are available for all common waveguide bands. Detailed specifications for the RF-heads will be found in a separate data sheet.

The Power Meter has alarms which indicate when performance of radar is out of specification. The powers are also displayed on a panel meter which may be switched between the different channels. The Power Meter has been effectively temperature compensated to minimize drift due to changes in ambient temperature. This makes zero setting during operation unnecessary, an important feature for remote control.

Features

- Multi-channels i. e. indication of power and mismatch in several transmitter channels simultaneously
- High accuracy
- No zero re-setting
- No tuning required
- Effectively temperature compensated
- Made to stand mil. tests

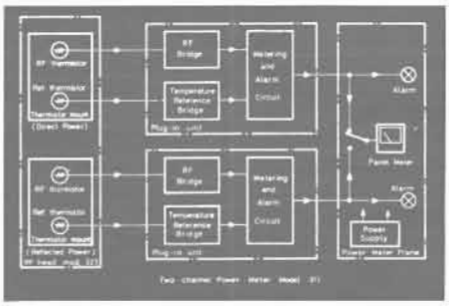
Principles of Operation

The power meter senses the RF-Power with a thermistor mount in the Waveguide system. Each thermistor mount contains a pair of thermistors, matched for thermal characteristics. The pair is enclosed in a common thermal environment, an arrangement which results in cancellations of the effects from changes in ambient temperature.

The temperature effects are reduced by about 1/30 of that in an uncompensated power meter.

The thermistors are coupled to two self-balancing bridges in the plug-in unit. This is placed in a Power Meter Frame which has necessary panel instruments, alarm indicating lamps, power supply etc.

Alarm circuits in the plug-in unit are provided to give an alarm signal when the output power decreases below and the reflected power increases above a predeterminded level. Several plug-in units can be housed in the same frame as can be seen below.



CAT 311868/1

Magnetic AB
Radar instrument line

Plug-In and Subunits for Power Meter Series 311 SERIES 311

Specifications

for a 2-channel
Power Meter Series 311
with RF-Head Model 323

Frequency Range
Any 10 % band, in the most common waveguide bands (se page 21)

Power Range, Output Range
Depends on waveguide

Reflected Power Range
Output Power/10

Directivity (Refl. Power)
25 dB, min.

Typical Accuracy
Error due to Frequency Variation
± 8 % 3.95—12.4 or ± 10 % 1.2—3.95 GHz
Error due to Temperature Variation
+20 to +35° C
± 3 %

—20 to +55° C
± 5 %

Remote Indication
Full scale, deflection 1 mA; max impedance 1000 ohms

Alarm
The Power Meter provides relay, contacts for remote alarm indicators.

Alarm Accuracy
± 4 % relative to the output power indication

Mains Supply
115/220/230 V ± 10 % 50—500 Hz, 4 W

The basic design of the Power Meter makes it possible to arrange the different subassemblies into a versatile instrument, which can cope with all complex systems available today. The different units available are as follows:

Power Meter Frame

This is the unit in which all the sub-units are mounted. The size depends on the quantity of channels required. As standard the Power Meter Frame is available for 2, 4 and 6 channels (plug-in units).

The following units are mounted in the Power Meter Frame: Plug-in unit (number of units depends on required number of channels), Power Supply.

Mounted on the panel are alarm lamps and a meter for reading the power. The meter may be switched between the different plug-ins for power read-out. All input and output connectors are on the back of the Power Meter France. The connector for the RF-head and the mains connection is of type Amphenol "Blue Ribbon".

Plug-In Unit

This unit is the basic unit in the Power Meter model 311. Up to 6 of these plug-in units may be used in one Power Meter Frame. This unit consists of two bridges which are self-balancing through separate feed back paths. Each of the self-balancing bridges has a thermistor element in one of the bridge arms.

The plug-in unit has the following controls on the panel: Zero set coarse and fine, Alarm level.

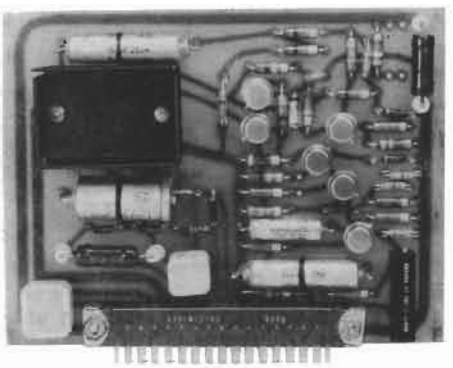
Power Supply

This unit regulates all voltages in the Power Meter and is in the form of a plug-in printed circuit card. The power transformer is placed on the Power Meter Frame close to the Power Supply circuit card.

Accessories Available: RF-heads.
Se page 21.

Power Meter Frame

Plug-In Unit



Power Supply

Magnetic AB
Radar instrument line

MODEL 310

Microwave Power Meter

Where Used

The model 310 is primarily intended for permanent installation in radar systems. It is used for continuous check of the output power and the power reflected from the antenna and waveguide system. The two power levels are indicated on separate meters on the front panel. Also the high accuracy of the power measurement makes the instrument very suitable e.g. for speeding up the testing of magnetrons.

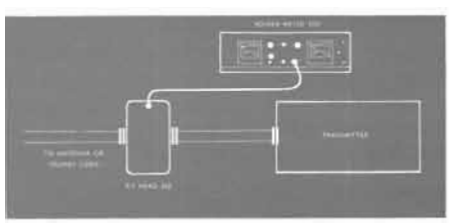
Features

- Continuous indication of power and mismatch
- High accuracy
- No tuning required
- Simple operation
- Made to stand mil.tests.

Description

The power meter consists of two basic parts, the RF-head and the indicating unit. The RF-head is installed in the waveguide system and is connected to the indicating unit with a cable.

Through holes in the RF-head the power in the main waveguide is coupled into the two auxiliary waveguides. The holes are designed so that one auxiliary guide receives a fraction of the power propagating in one direction, while the other guide receives a fraction of the power propagating in the opposite direction. After proper attenuation the two power levels are measured with thermistors. The thermistor mounts are arranged in two separate self-balancing bridges. Included in the RF-head are also two relay-operated attenuators, one allowing the meters to be zero-set during operation, the other allowing the sensitivity of the reflected power branch to be increased, thus increasing the normally very small deflection of the meter.



Mechanical

Indicating Unit

The model 310 is a compact unit with a standard 19" panel 5 7/32 high and 12 5/16 deep. It can be delivered in a rackmount version or mounted in a suitable cabinet.

RF-head

The RF-head consists of a main waveguide and two auxiliary waveguides with built-in attenuators and thermistor mounts.

Specifications

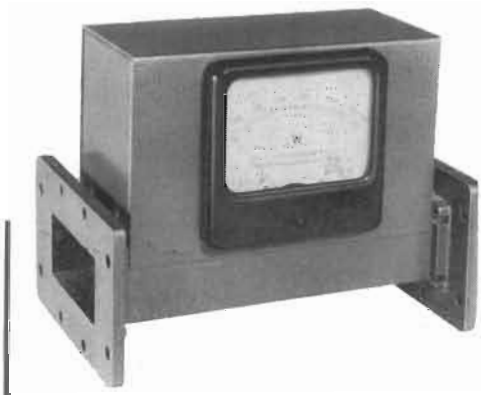
	with RF-head X320, 322	with RF-head S320, 322
Frequency Range	8.5—9.6 GHz	2.9—3.5 GHz
Power Range Output Power*	0—100 W	0—1 000 W
Power Range Reflected Power*	0—100 W and 0— 10 W	0—1 000 W and 0— 100 W
Directivity of the Reflected Power Branch	25 dB minimum	25 dB minimum
Accuracy		
Maximum error due to frequency variations within the band (full scale reading)	± 8 %	± 10 %
Maximum error due to temperature variations from —30° C to +40° C	± 3 %	± 3 %
Weight		
RF-head	2,2 kg	12 kg
Indicating Unit	11 kg	11 kg
Power Requirements	115/220/230 V ± 10 %,	50/60 Hz, 170 W

Data with an asterisk (*) may be changed upon request to suit your special requirements.

Magnetic AB
Radar instrument line

Microwave Power Monitors

MODEL 313, 314



Where Used

Power Monitor Model 313 is designed for permanent installation in radar and microwave systems to continuously indicate the output power during operation. The simple construction and small dimensions make it excellent for installation in airborne equipment or other equipment, where small size and low weight are of great importance. The monitor needs no zero set or calibration and is self contained i. e. no battery or main connection is required.

The output power is indicated on a panel instrument, which is connected to the power sensing device by means of a cable. The panel meter can also, if required, be mounted direct on the power sensing device. Model 313 is also available in aluminium alloy and has then the model number 313A.

The monitor is also available in a low power version with lower accuracy. The model number for this is 314 in brass and 314A in aluminium alloy. In this version the monitor is well adapted to be a power indicator to for example circulators and duplexers, where the relatively high power consumption of the monitor can be neglected.

Features

- Continuous indication of power
- Temperature compensated
- No calibration or zero set required
- High peak- and average power
- No battery or main connection
- Small dimensions and low weight
- Made to stand mil. tests

Description

Model 313 and 314 consist essentially of a short piece of waveguide with flanges in which small power absorbing elements are placed in well tested and approved systems. The elements absorb a very small part of the microwave power passing through the waveguide and are thereby heated. The temperature difference between these elements and the waveguide walls is measured by means of thermoelements and is indicated on a panel meter.

In the low power version of model 314 a smaller number of elements are used.

Specifications

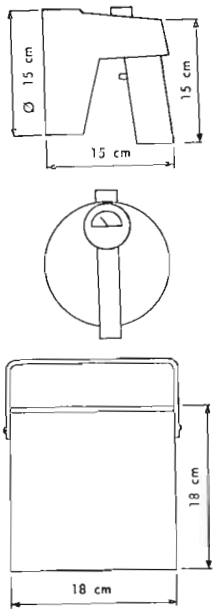
Type[1]	Freq. range GHz	Aver. Power range[1]) W	Accuracy %	Max VSWR (at spec. accuracy)	Power Consumpt. W	Temp. range °C	Waveguide IEC	Waveguide RG/U	Waveguide WR	Flanges IEC	Flanges UG/U	Length mm	Max. Peak Power Mw
L313	1.2—1.7	0—50, 500, 1000, 5000			~ 0.5		R14	69	650	PDR14	417A	300	10
S313	2.7—3.8	0—50, 250, 500, 1000, 5000			~ 0.5		R32	48	284	UAR32	53	180	2.2
G313	4.1—5.8	0—50, 100, 500, 1000	± 10	1 : 1.5	0.1—0.5	—30 to +70	R48	49	187	UAR48	149A	150	1.4
J313	5.1—7.0	0—50, 100, 500, 1000			0.1—0.5		R70	50	137	UAR70	344	130	1.1
H313	7.5—10.0	0—10, 50, 100, 300			0.1—0.5		R84	51	112	UBR84	51	80	0.35
X313	8.5—12.0	0—10, 50, 100, 300			0.1—0.5		R100	52	90	UBR100	39	80	0.2
L314	1.12—1.7	0—20			~ 0.5		R14	69	650	UDR14	417A	20—100[3]	10
S314	2.6—3.95	0—10			~ 0.5		R32	48	284	UAR32	53	20— 80[3]	2.2
G314	3.95—5.85	0—10	± 25	1 : 2	0.1—0.5	—30 to +70°	R48	49	187	UAR48	149A	20— 80[3]	1.4
J314	4.9—7.05	0—10			0.1—0.5		R70	50	137	UAR70	344	10— 70[3]	1.1
H314	7.0—10.0	0—10			0.1—0.5		R84	51	112	UBR84	51	10— 70[3]	0.35
X314	8.2—12.4	0—10			0.1—0.5		R100	52	90	UBR100	39	10— 70[3]	0.2

[1]) IN Aluminium alloy the type no is 313A resp. 314A. [2]) Other ranges may be supplied on request. [3]) With internal Low Power Termination

Magnetic AB
Radar instrument line

MODEL 350

Microwave Power Density Meter



Where Used

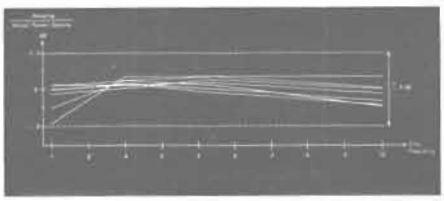
Model 350 is a necessary tool for checking the surroundings of modern high power radars to make certain that the maximum permissible power density is not exceeded. Such radars are Early Warning and Surveillance Radars, Air Traffic Control Radars, and Airborne Fire Control Radars.
It is also very useful in radar laboratories for service and maintenance work. Other important applications are checking leakage from microwave cooking equipment and side lobes from high power scattering transmitters.

Features

- Simple operation. Press button and read power!
- Easy to read, no correction factors
- Integrates all incident power regardless of polarization
- Portable. Battery permits approximately 10000 measurements
- Two measuring ranges

Description

This instrument is intended for the protection of personnel against dangerous microwave radiation. It measures completely automatically and without complicating correction factors the total microwave radiation incident upon it within the frequency range 1000 through 10000 MHz. It is extremely simple to operate and can be used by personnel without any knowlegde of microwave technique.
Although the biological effects of microwave radiation are not known in detail authorities in most countries have stated a microwave density of 10 mW/cm² for continuous exposure. Model 350 therefore has two measuring ranges with a midscale reading of 10 mW/cm² and 2 mW/cm² respectively, which appears to be the best possible compromise between measuring accuracy and simplicity of operation.
Model 350 is carried in a wooden box capable of withstanding rough handling during field use.



Specifications

Frequency Range
1000—10000 MHz

Accuracy
± 2 dB

Sensitivity, Range 1
Midscale reading 10 mW/cm²
Full scale reading 20 mW/cm²

Sensitivity, Range 2
Midscale reading 2 mW/cm²
Full scale reading 4 mW/cm²

Polarization
Vertical, horizontal, right and left hand circular

Temperature Range
—20° to +40° C

Power Consumption
About 120 mW

Batteries
Internal dry cell battery or external batteries in a separate case

Size
Transport case 18×18×18 cm

Weight Incl. Case
2 kg

CAT 350866

Magnetic AB
Radar instrument line

RF-Heads for Power Meters

MODEL 320, 322, 323

Model 320

RF-head Model 320 is designed for use together with Power Meter Model 310, described on page 18. It is available for all common waveguide bands. It consists essentially of a main waveguide on which two Cross-Guide Directional Couplers are mounted, one for output and one for reflected power. It senses the RF-power by means of two Thermistor mounts placed in the secondary arms of the directional couplers. Two solenoid operated attenuators are used for zero-setting the couplers. In the reflected power arm the sensitivity may be changed by a factor of 10 by an additional attenuator. The head is connected to the power meter with a cable of two meters length (max. 8m). Power connector is MS 3102-14s-6p.

Model 320

Model 322

Model 322 has the same data as Model 320 but is pressurized by means of two waveguide windows. These windows are placed between the Cross-Guide Directional Couplers and the solenoid operated attenuators.

Model 322

Model 323

This RF-head is designed for use together with Power Meter series 311, described on pages 16 and 17. This head consists of two Cross-Guide Directional Couplers, one for direct output and one for reflected power. The RF-head senses the RF power through two thermistor mounts. Each Thermistor mount contains a pair of thermistors, matched for thermal characteristics. The pair is enclosed in a common thermal environment, an arrangement which results in cancellation of the effect from changes in ambient temperature. Two attenuators are mounted in the secondary arms of the directional coupler for calibration. The head is connected to the power meter with a cable of 2 meters length. Connector on each thermistor mount is MS 3102-14s-5p.

Model 323

Specifications

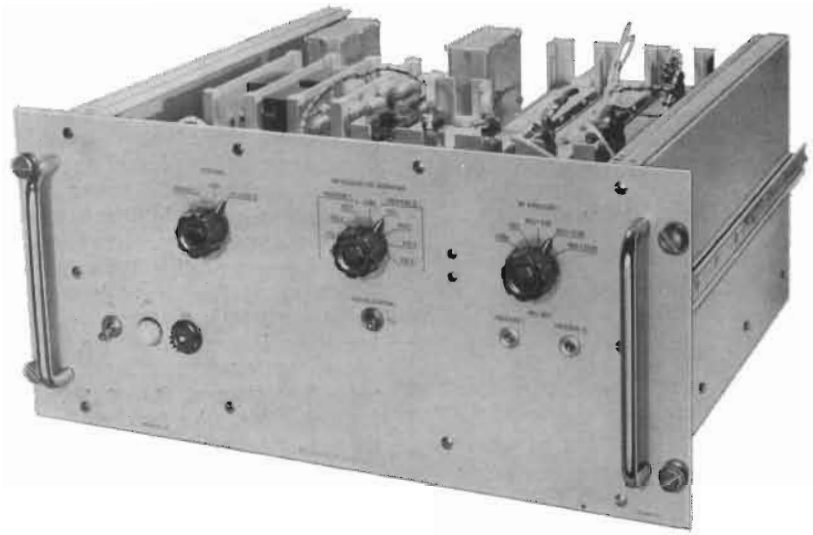
Model	Frequency range GHz	Waveguide IEC	RG/U	WR	Flanges IEC	UG/U	Power Ranges w	Directivity Refl. Power min dB	Accuracy due to temp −30 to +40°C	Accuracy due to frequency within band
L320	1.25—1.35	R14	69	650	PDR14	417A	0—60, 150, 500, 600, 2000, 3000, 10.000	25	± 3 %	± 10 %
S320	2.90—3.50	R32	48	284	UAR32	53	0—100, 300, 1000, 3000			
G320	5.25—5.75	R48	49	187	UAR48	149A	0—60, 600			
J320		R70	50	137	UAR70	344	under development, on reguest			
H320	8.50—9.60	R84	51	112	UBR84	51	0—25, 50, 250, 500			
X320	8.50—9.60	R100	52	90	UBR100	39	0—10, 25, 100, 250			± 8 %
L322	1.25—1.35	R14	69	650	PDR14	417A	Same as Model 320 but pressurized	25	± 3 %	± 10 %
S322	2.90—3.50	R32	48	284	UAR32	53				
G322	5.25—5.75	R48	49	187	UAR48	149A				
J322		R70	50	137	UAR70	344				
H322	8.50—9.60	R84	51	112	UBR84	51				
X322	8.50—9.60	R100	52	90	UBR100	39				± 8 %
L323	1.25—1.35	R14	69	650	PDR14	417A	0—20, 300, 1000, 1200, 4000, 6000	25	± 3 %	± 10 %
S323	2.90—3.50	R32	48	284	UAR32	53	0—60, 1200			
G323	5.25—5.75	R48	49	187	UAR48	149A	0—1000			
J323		R70	50	137	UAR70	344	under development, on reguest			
H323	8.50—9.60	R84	51	112	UBR84	51	0—250, 300			
X323	8.50—9.60	R100	52	90	UBR100	39	0—100, 250			± 8 %

Note: The power ranges of Model 323 may be lowered by a factor of 10 by increasing the sensitivity of the Series 311 power meter.

Magnetic AB
Radar instrument line

MODEL 480

IF Test Signal Generator



Introduction

Test Signal Generators Models 480 and 485, described on this and following pages, are special systems check-out instruments, which are normally tailored to the system in which they are used. They have been made following the same policy as our new transistorized instruments, i. e. they consist of a main frame with several sub units or assemblies. They can be remote control operated or operated from normal panel controls.

Due to the nature of the design of these instruments, no complete specification can be given. Below follows an indication of what has been done and what can be done. The sub units can easily be modified to suit the needs of a particular system.

The Signal Generators Models 480 and 485 are intended for checking out the IF and video part of a radar receiver and can test: IF gain variation, ECCM, FTC, IAGC circuits, and Coho and canceller units of the MTI. Many of these tests may be performed without disturbing the normal operation of the receiver.

IF TEST SIGNAL GENERATOR MODEL 480

General

The IF Test Generator will provide methods for testing a receiver. The test signals from this generator can be grouped in the following way.

IF Amplifier Performance Test

A test pulse of the same duration as that of the radar and delayed so that it will occur at the end of the PPI range. The pulse is introduced in all receiver channels. The output level of this pulse can be varied from the level of the system noise to 20 dB above. By means of this IF test pulse, faults in different IF-channels can be located and the relative performance of each receiving channel can be judged.

This test also doubles as an operational test to check if the radar is jammed and in which direction the jammer is located. The pulse is presented as a ring on the PPI and a gap in the ring indicates a CW-jammer. The strength of the jammer can be evaluated by varying the level of the IF test pulse.

Simulated Target Test

A test pulse of the same shape as in the IF Amplifier Performance Test and triggered by the transmitter. The delay can be varied either by hand or set to vary at a constant speed. Speeds of normally encountered targets may be set by the operator. The output of this generator is gated so that it will occur in a specific direction, which may be set by the operator.

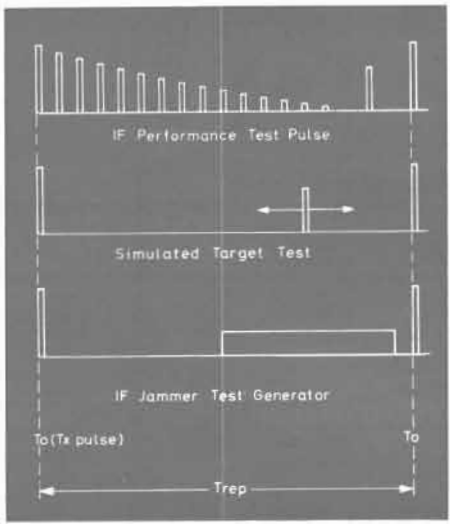
IF Jammer Test Generator

A test pulse of 400 μs duration and delayed 100 μs with reference to the transmitter pulse is introduced into all IF-channels of the receiver when commanded to do so. This oscillator is incoherent with the oscillator mentioned in the IF Amplifier Performance Test.

The jammer test generator also has a modulation mode, where the modulating signal is a noise voltage. The jammer generator has a third modulation mode, where the modulation consists of very short pulses.

Principles of Operation

The IF Signal Generator consists of two X-tal oscillators with output signals which may be modulated.



CAT 480866/1

Sub-Assemblies for Model 480

One of the oscillators may be modulated with 2 μs pulses. Two modulation units or gates are used, one opens during 2 μs at T_0 and the other opens at T_0 + (1000—1700) μs. The variable delay may be set with a pre-set control behind the panel.
The output pulse from the gate, which opens at T_0, is fed to a 10 μs delay line which generates a train of IF pulses with decaying amplitude, the separation between the pulses being 20 μs. After generation these pulses are fed to an attenuation unit with two outputs. One output has a constant output voltage of 2.8 V ptp. The other output may be lowered from 2.8 V to 12 dB below 2.8 V.
The output pulse from the gate, which is delayed with respect to T_0, is fed to another attenuator which may be set so that the output signal may be varied from the noise level in the system to 20 dB above. The output signal is continuously variable over a 10 dB range by a panel control.
The other X-tal oscillator, which differs 10 kHz from the first one, may be modulated by a 800 μs pulse. This pulse starts at T_0 + 900 μs.
The signals mentioned above are fed to a distribution unit which connects the correct signal to the chosen beam or channel in the radar.
The instrument may be operated by the panel controls or by remote control signals consisting of grounded wires (+48 V ground return).

Main Frame Model 480

The Main Frame has power supplies and operating controls for three different generators and a distribution unit with all local and remote control circuits.
The signal generating parts are built into completely screened units which are exchangeable. These units are driven by pulse generators which are built on plug-in printed circuit cards. The power supplies are also built on plug-in printed circuit cards.
All outputs and inputs are on the rear of the chassis which is built in a standard 19 in, relay rack size.

SUB-ASSEMBLIES FOR MODEL 480

LONG PULSE GENERATOR

Output

Pulse length: 800 ± 100 μs
Timing: T_0 + 500 ± 100 μs
Amplitude: 140 mV ± 3 dB ptp ± 0.5 dB between channels
Frequency: 29.995 MHz ± 4 kHz
Load impedance: 75 ohms
Trigger (System trigger)
Amplitude: 5—60 V, pos.
Impedance: 75 ohms
Timing: T_0 — 44 μs
Pulse length: 2 μs

PULSE TRAIN GENERATOR

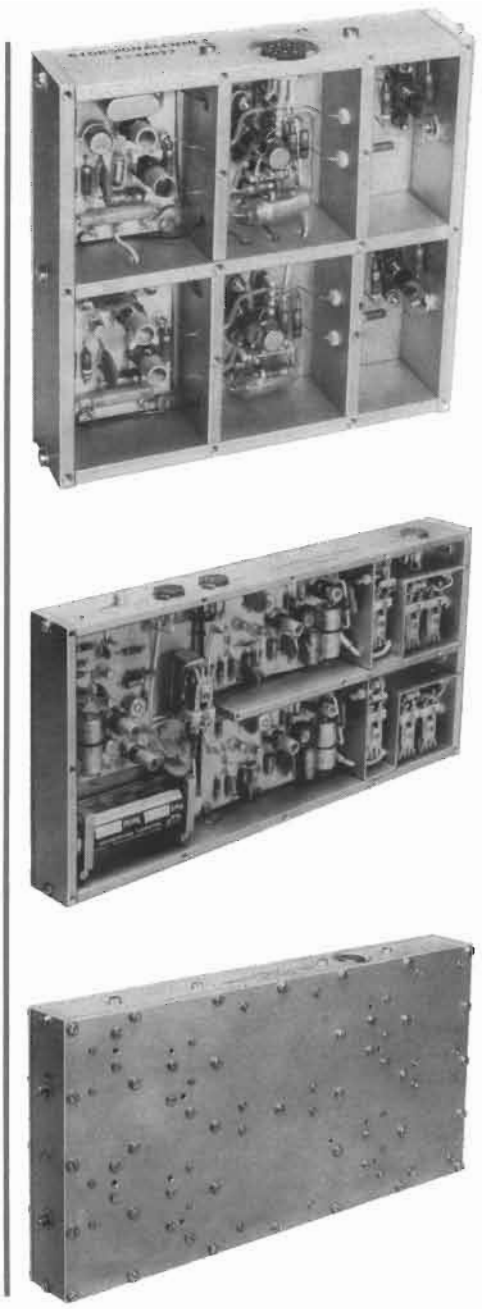
Output

Pulse length: 2 μs ± 10 %, pulses separated 20 μs and decaying in amplitude
Timing: T_0 + 20 μs (1 :st reflected pulse)
Amplitude:
Level 1: 2,8 V ptp, min.
Level 2: 2,8 V — 7.2 dB ± 0.2
Level 3: 2.8 V — 12 dB ± 0.2
Amplitude Decay: 1 dB ± 0.15 dB per pulse
Frequency: 30.005 ± 4 kHz
Load impedance: 75 ohms
Trigger:
Same as for Long Pulse Generator

SHORT PULSE GENERATOR

Output

Pulse length: 2 μ ± 10 %
Timing: T_0 + 1000 to 1700 μs (adjustable)
Amplitude:
Level 1: Noise level to+10 dB (adjustable)
Level 2: (Level 1) + 6 dB ± 0.5 db.
Level 3: (Level 1) + 12 dB ± 0.5 dB
Level 4: (Level 1) + 20 dB ± 0.5 dB.
Frequency: 30.005 MHz ± 4 kHz
Load impedance: 75 ohms
Trigger:
Taken from the Long Pulse Delay Generator
Timing: T_0 + 500 μs



Magnetic AB
Radar instrument line

MODEL 485

MTI Test Signal Generator

MTI TEST GENERATOR MODEL 485

General

The IF pulse generator derives a clutter signal from the coho lock pulse. The lock pulse is amplified and fed to a 10 μs delay line, which will generate a burst of clutter signals. (These are coherent signals.) The separation between the clutter burst is 20 μs. The output of this generator is fed into the receiver at an appropriate point.
For normal operation no signal from this generator will be visible. Should the coho fail, the signals will show up and warn the operator.

Principles of Operation

The MTI Test Generator consists of two parts. One part generates the IF signals and the other part the video signals.
The IF signal part makes a clutter signal from the coho lock pulse.
The last part of the lock pulse (magnetron decay time) is cut off with a gate. The signal from the gate is amplified and fed to a 10 μs delay line which generates a train of clutter pulses. The separation between these pulses is 20 μs. The output signal is fed to a distribution unit, which is mounted in the IF Signal Generator Model 480. This unit distributes the signals to the correct channels in the radar receiver.
The Video Signal part is triggered by the radar system trigger and generates three types of signals: 1) Optimum Velocity Pulses consisting of alternate amplitude pulses with the same PRF as the radar; 2) Clutter Pulses, positive and 3) Clutter Pulses, negative. The clutter pulses have the same PRF as the radar.

Main Frame

The Main Frame has power supplies and operating controls for MTI IF and Video test signals with all local and remote control circuits.
The IF signal generating units are built into completely shielded units which are exchangeable. The pulse generating circuits, the video test signal generator and the power supplies are built on plug-in printed circuit cards.
All the outputs and inputs are on the rear of the chassis which is built in a standard 19 inches relay rack size.

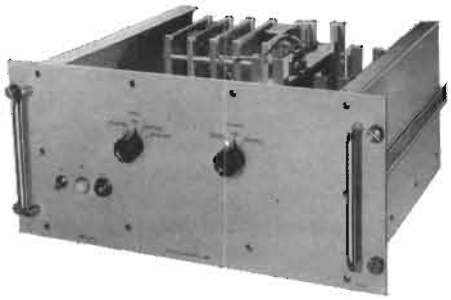
SUB-ASSEMBLIES FOR MODEL 485

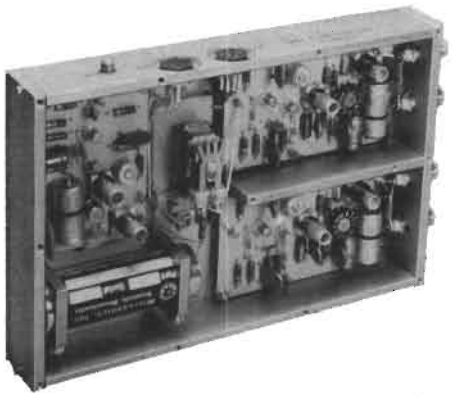
IF Clutter Signal Unit

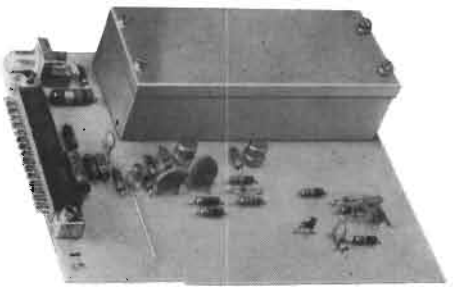
Input
Coho lock pulse: Two inputs, one for each transmitter
Amplitude: 1 V, ptp (min)
Impedance: 75 ohms
Output
Amplitude: 8 V, ptp (1:st reflected pulse T_0 + 20 μs)
Pulse length: 2 μs (Pulses separated 20 μs)
Load impedance: 75 ohms
Trigger:
Two inputs, one for each transmitter
Amplitude: 10—30 V, pos
Impedance: 75 ohms
Timing: T_0 and T_0 + 2.7 μs
Pulse length: 2 μs

Test Video Unit

Output
Load impedance: 75 ohms (coax)
Pulse for Optimum Velocity Target
Pulse length: 4 μs ± 10 %
Amplitude: ± 2 V, alternate polarity pulses
Timing: T_0 + 120 μs ± 5 %
The pulses mentioned above are fed to the appropriate inputs in the radar when the panel switches are set to the position of the wanted signal. The instrument may also be operated from a remote location by remote control signals, which consist of grounded wires (+ 48 V ground return).
Clutter Pulse
Pulse length: 4 μs ± 10 %
Amplitude: 2 V ± 0.1, pos or neg
Amplitude stability: ± 10 mV
Timing: T_0 + 120 μs ± 5 %
Jitter: <10 ns, relative to the system trigger







Trigger (System Trigger)
Amplitude: 5—60 V, pos
Timing: T_0 — 44 μs
Impedance: 75 ohms

Many of the parameters above like pulse lengths, pulse repetition frequencies and output amplitudes may be changed to suit system requirements.

CAT 485866

Magnetic AB
Radar instrument line

MODEL 423

Radar Jamming and Target Simulating Equipment

General

The jamming and target simulating equipment model 423 is intended for training of radar operators under operating conditions on live radars. It will thereby train the operator to use all ECCM and anti-jamming circuits available in the radar.
The equipment permits background as well as self screening jamming. Frequency sweep modulated jamming and echo pulse generation are available for both cases. The sweep modulated signal may be varied in output power, center frequency, swing and sweep frequency. The simulated target can be varied in frequency, size and range to completely simulate a moving target.
The equipment is also an excellent tool for evaluating ECCM receivers in the field and during design stage in the laboratory as well as measurements and check-out of modern ECCM receivers. It is designed for mobile use and will withstand environmental tests as per DEF 133 L1. In laboratories it can also be used as a high power RF-testgenerator with an output of about 10 W.

Jamming Transmitter Unit

The high frequency part consists of an voltage tuned magnetron (VTM) with associated components. Output power is appr. 10 W. The desired jamming signal level may be set by means of a variable attenuator.
The modulator gives sine wave modulation with frequencies 2 or 5 MHz and sawtooth modulation variable within the range 5—500 kHz. The frequency deviation is continously variable between 20 and 500 MHz. The center frequency can be varied continously over the range 2900—3500 MHz, (others on request). The actual operating frequency is indicated on the frequency dial.

Target Generating Unit

This unit contains a tunable receiver for radar pulses, a distance generating unit, a pulse modulator and two tunable solid state microwave sources.
The receiver is used for receiving radar pulses for synchronizing of the target generators and for determining the frequency of the radar pulses. It is also used for accurate tuning of the target generators.
Radar pulses with the following characteristics can be received:

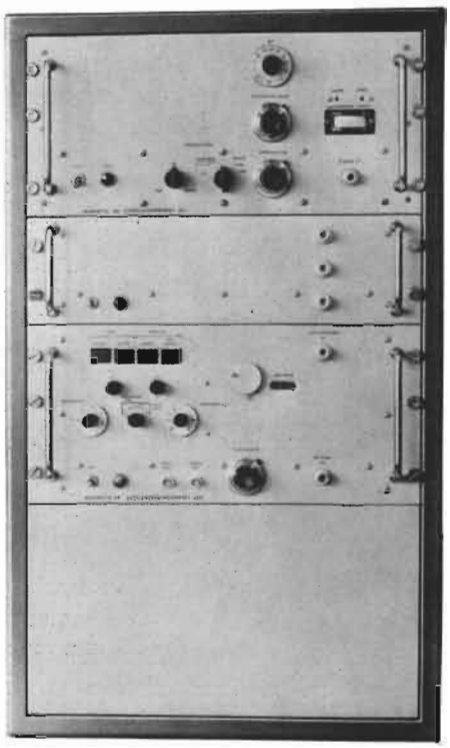
Frequency: 2900—3500 MHz

Pulse Frequency: 500—2000 Hz

Pulse Width: 0.5—3 usecs.

Pulse Power into receiver: 20—2000 W

The receiver is tunable and extremely selective within the frequency range 2900—3500 MHz.
The pulse power from the target generators, which is normally fed to the transmitting antenna, is appr. 5 mW. The input signal from the receiving antenna (pulse power 20—2000 W) passes through a variable attenuator and a 10 dB directional coupler and the signal can thus be adjusted to a level of the same order of magnitude as the target pulses. The target generating unit delays the incoming radar pulse with an amount corresponding to a distance of 5—60 km. The magnitude of the delay is set in the target generating unit, delay module.
This unit generates also a one-shot or repeated time function corresponding to the approach to the radar by a target flying with a speed of 50—500 m/s. This time function controls together with the attenuation unit the rise in amplitude of the target and jamming signals and also controls the delay of the pulse generators, thus simulating the approach of an aeroplane with a self screening jammer.
Either one or both microwave oscillators can be operating in a pulse modulated mode. The pulse modulation originates in a separate modulator. If both generators are operating, the one working at the higher frequency will have its pulse output delayed by 1.5 to 5 us relative to the other.
The modulator will be controlled from the target generating unit, thus being in synchronism with the incoming signal. However, the modulator may also for tuning purpose be triggered from an internal trigger generator with a pulse frequency of 1000 Hz.
The microwave oscillators are tunable over the band 2900—3500 MHz and give an output of 50 mW. The signals from the oscillators are combined in a 3 dB hybrid. The signal from the hybrid is fed to a front panel connector for connection to the attenuation unit.



Model 423

Attenuation Unit

This unit makes the target and jamming signals rise proportionally to the $1/R^4$—and $1/R^2$—law respectively, where R is the simulated target range. R is variable between 60 and 5 km. This unit also contains the fluctuation generator, which modulate the target signals via the distribution module. The fluctuation signal is a saw tooth signal with a rep. rate of 1 Hz.

GÄRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN Magnetic AB

CAT 423569

Magnetic AB
Radar instrument line

Radio Jamming Simulator

MODEL 422

Where used

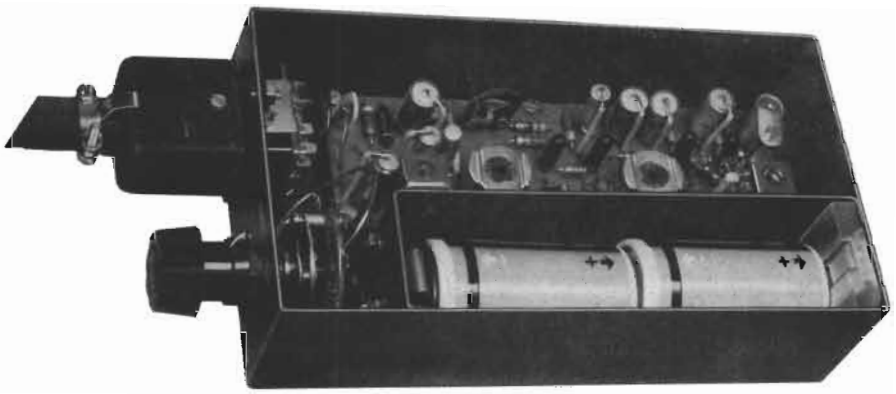
Jamming Simulator model 422 is designed for training radio operators in handling radio stations under conditions of enemy jamming. The unit injects a noise signal into a radio station and modulates the transmitter. The Simulator is a compact, fully transistorized, portable unit connected to the radio station by means of a cable, which is terminated with two connectors of the same type as used in the radio station. Model 422 is driven from two batteries of 1.5 volts connected in series. The batteries are placed in a separate compartment of the unit. The dimensions are small, the weight low and the unit is designed for used under field conditions. It is extremely simple to operate and can be used by personnel without any technical knowlegde. A common switch will operate both the simulator and the transmitter to which it is connected.

Features

— Simple operation
— Fully transistorized
— Portable, low weight and small dimensions
— Made to stand military tests

Description

A silicone diode generates the noise, which is amplified by two temperature stabilized transistors. The temperature stabilization is made by means of two thermistors. The signal is fed to three additional transistors before being fed to the output connector. The output can be adjusted by means of a screw driver control. An on-off switch which is connected in series with the batteries, will also operate the transmitter.



Specifications

Frequency Range
300—3000 Hz

Output Power
min. 1 mW into 100 ohms

Temperature Range
—20° C to +50° C

Batteries
Two dry cell batteries 1.5 volts, type B 1.15, in series

Power consumption
About 25 mA

Dimensions
180×100×50 mm

Weight excl. cable and connector
1 kg

Transistors
OC 75, OC 72, CS 3 B, OA 150 (2 pcs)

Data subject to change without notice
CAT 422866

Magnetic AB
Special Test and Systems Equipment

MODEL 450

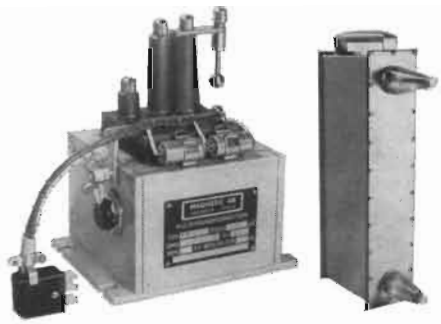
High Power Modulator

Features

- — A general purpose magnetron modulator for high power high quality pulses.
- — Automatic protection of Modulator and Tubes from shorts and other tube failures, overloads and errors by the operator.
- — Exchangable pulse transformers for most commercially available magnetrons with a peak power up to more than 3 MW.
- — Automatic operation for production testing by non-skilled personnel.
- — A wide variety of operating modes for advanced R & D work.
- — Switch-off interlocking for protection of personnel and equipment.
- — Complete — compact — easily movable — selfcontained.

Where Used

High Power Modulator Model 450 is designed for a maximum combination of applications. Consequently it is designed for research and development work in microwave laboratories as well as for production testing of magnetrons and other microwave components. It is also designed to be used by civil and military organizations for incoming inspection of new magnetrons, components etc. and is an excellent tool for aging of magnetrons in store.



Pulse Transformer Series 470

Pulse Forming Networks Series 460

Description

This Modulator was developed to satisfy the stringent military needs for testing magnetrons. It is a very versatile and useful instrument capable of supplying high output power and a wide range of pulse widths and pulse repetition frequencies. The output pulse is well defined and of high quality. This instrument contains adequate arrangements for protection of personnel and equipment and operates partially automatically. It consists of two main units: The Power Supply Unit and the Modulator Unit. Pulse Forming Networks of plug-in type are used to obtain desired pulse widths. Two different pulse-forming networks can simultaneously be plugged into the Modulator. By means of a motor operated switch either of the two networks can be put into operation. High quality pulse transformers are available, and output impedances are selectable corresponding to most commercially available magnetrons.

The following panel meters are provided:

Power Supply Unit output voltage
Power Supply Unit output current
Magnetron peak anode voltage
Magnetron average anode current
Magnetron filament voltage
Magnetron filament current
Mains input phase voltages
Elapsed time meter for high voltage operation time

The voltage from the Power Supply Units is controlled by a motor operated variable transformer. The transformer thus controls the pulse power from the Modulator Unit. When the Modulator is switched on, the motor turns the transformer and raises the voltage at an approprate speed. Motor operation is possible in two modes. In "Auto" the motor will turn the transformer, after push buttons "Increase" or "Decrease" have been pressed, until a preset value has been reached or the "Stop" button is pressed. In "Manual" mode the motor will drive the transformer only as long as the corresponding

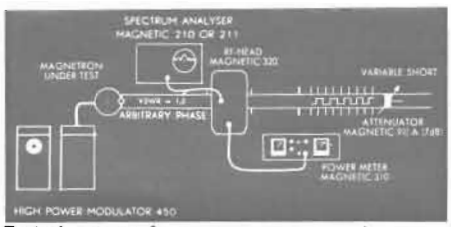
cont.

Magnetic AB
Special Test and Systems Equipment

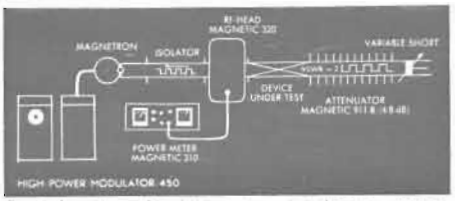
High Power Modulator

MODEL 450

push button "Increase" or "Decrease" is pressed. The speed of the motor may be set by a potentiometer.
Magnetron filament voltage is controlled by a servo loop. Full filament voltage is applied when high voltage is off. When magnetron current is flowing the servo automatically reduces filament voltage to a lower value. This value can be set according to magnetron specification.
A time relay which can be preset to any delay time between 5 and 30 minutes, has been included to secure enough warm up time of the magnetron. The high voltage cannot be switched on unless the delay time has elapsed. Even after a short brake of the mains switch the relay starts a new timing cycle and prevents the high voltage from being switched on immediately.



Typical set up for testing magnetrons by means of Magnetic AB Instruments.



Typical set up for high power breakdown studies by means of Magnetic AB Instruments.

The Modulator is equipped with several protective arrangements. If parts of the cabinets are opened, interlock switches break the high voltage and the motordriven transformer controlling the high voltage returns to its zero position. The high voltage is also disconnected when the inverse current pulse through the pulse transformer exceeds a certain value due to malfunction of the magnetron.

Guide for ordering Pulse Transformer and Pulse Forming Network

To design a suitable pulse transformer the following information is required:
1. Magnetron peak operating voltage (max value) in kilovolts
2. Magnetron peak operating current in amperes
3. Pulse width in μs
4. Pulse repetition frequency in Hz
5. Magnetron duty cycle in $^0/_{00}$
6. Magnetron filament current during warmup (max value)
7. Magnetron filament current during normal operation
8. Magnetron filament voltage during warmup
9. Rise time or rate of rise of voltage (RRV) 15—85 % of voltage pulse
10. Magnetron type number

The impedance of the pulse forming network is 50 Ω for magnetron impedances in the range 800—1200 and 25 Ω for magnetron impedances in the range 400—800.
Magnetic AB will design the pulse transformer and suggest the most suitable combination of transformer and pulse forming network for the various magnetrons to be used.

Specifications

MODULATOR UNIT MODEL 452

Pulse Power: 0 to 3 MW

Load Impedance
Depends on exchangeable pulse transformers series 470

Pulse Width
0.1—4 μs pulse forming networks series 460

Rise Time
Depends on pulse width, normally 10 % of pulse width

Duty Cycle: Max 1.2 per mille as standard
PRF: 200—4000 Hz

Filament Power to Magnetrons
Max 4 A, Max 25 Volts

Variation in Pulse Amplitude at the Pulse Peak: ± 7 %

Max Inverse Voltage at Magnetron: 20 %

Dimensions: 54×108×81 cm (W×H×D)

Weight: 135 kg

POWER SUPPLY UNIT MODEL 451

Output: 12 KV, 500 mA maximum
Input
380/220 V or 220/127 V three phase 50/60 Hz
Power Consumption: Appr. 7 KVA
Dimensions 54×108×81 (W×H×D)
Weight 240 kg

PULSE TRANSFORMERS SERIES 470

Max Secondary Voltage: 35 KV (magnetron voltage)
Output Impedance: 400—1200 Ω
Pulse Width: 0.1—4 μs
Max Duty Cycle at Max Working Voltage: 0.0012
Bifilar Filament Current Rating: 4 A

PULSE FORMING NETWORKS

	Series 460—50—Y*	Series 460—25—Y*
Impedance	25 Ω	50 Ω
Pulse Width	0.11—4 μs	0.5—4 μs

* Y = pulse width in μs. State value.

Magnetic AB
Radar instrument line

MODEL 211

Spectrum Analyzer

Description

The MAGNETIC AB Model 211 Spectrum Analyzer is a self contained portable instrument consisting essentially of a superheterodyne receiver which displays its detected output as a plot of signal amplitude vs. frequency on a CRT. The instrument covers the frequency range 1000—16000 MHz without additional units. All controls have been calibrated in order to make operation as simple as possible.

Features

— Completely transistorized.
— Direct-reading tuning dial with tracked reflector voltage.
— Frequency accuracy better than 1 %.
— Covers the frequency range without extra plug-ins.
— Dispersion in directly calibrated steps.
— 50 MHz dispersion.

Where Used

The MAGNETIC AB Model 211 Spectrum Analyzer is built for field and laboratory use. The instrument is completely transistorized (for the exception of the CRT and the Ist LO) in order to make the dimensions small and the weight low. It is used for observation of the character and quality of microwave signals.

RF Unit

The rf tuning assembly provides power to heterodyne with incoming signals over the frequency range 1000 to 16000 MHz. This range is covered in four bands. Each band has a scale for indicating input signal frequency.

The signal plus power from the first local oscillator is applied to the first crystal mixer. With the tuning dial set to the frequency of the incoming signal, the fundamental or harmonic output of the Ist local oscillator differs from the signal by 190 MHz.

Wide Band Amplifier

The 190 MHz difference, which is the mixer output, is fed to the wide band amplifier. This amplifier is 50 MHz wide and centered at 190 MHz. Output from the wide band amplifier is applied to a second crystal mixer for heterodyning with the sweeper oscillator to provide a frequency conversion to 80 MHz.

Sweeper Oscillator

The sweeper oscillator converts the sawtooth waveform of the sawtooth generator into a variable frequency signal centered at 270 MHz. An electronically variable capacitor is used to vary the frequency of the sweeper oscillator.

Narrow Band Amplifier

A narrow band amplifier amplifies the 80 MHz signal from the second crystal mixer and produces a final frequency conversion to 2 MHz. The bandwidth of this amplifier is 100 kHz or 20 kHz. The output of the narrow band amplifier is detected by a crystal diode before it is fed to the video amplifiers.

Video Circuits

The video circuitry amplifies the vertical deflection voltage, intensifies the video signals displayed on the CRT and blanks the sweep retrace.

Marker Oscillator

The function of the marker oscillator is to provide a variable-frequency marker pip on the CRT display for calibrating the spectrum and for making vernier frequency measurements. The marker oscillator can be modulated by an external signal source from accurate calibration of the dispersion ranges.

Specification

Frequency Range: 1000—16000 MHz in four bands.
Frequency Accuracy: ± 1 %.
Frequency Dispersion: 0,5 to 50 MHz, adjustabile in seven steps (0.5, 1, 2, 5, 10, 20 and 50).
Resolution Bandwidth: 20 and 100 KHz.
Sweep Repetition Rate: 2 to 50 Hz.
Sweep Synchronization: Power line frequency or external pulse. 10 volts pos or more.
Sweep Calibrator: Provides an adjustable marker which may be modulated.
Adjustable: ± 3 MHz.
Int. mod: 5 MHz (x-tal controlled).
Ext. mod: up to 10 MHz.
Sensitivity (mds):
75 dBm, 1000— 1200 MHz.
80 dBm, 1900— 2000 MHz.
70 dBm, 2000— 4000 MHz.
65 dBm, 4000— 7600 MHz.
55 dBm, 4000—16000 MHz.
RF attenuator: 35—135 dB.
IF attenuator: 0—41 dB in 1 dB steps accurate to ± 0.1 dB/dB.
Detector Law: Linear.
CRT: DN — 18 — 10, normally supplied: longer or shorter persistance screens available.
Intensifier: Provids intensification of trace on fast rise and decay.
Power Requirements: 115/220/230 V ± 10 %, 50/60 Hz, 50 W.
Dimensions: 432×266×400 mm (W×H×D). Can be mounted in a 19" rack by means of special brackets.
Weight: 18 kg (36 pounds).
Operating Temperature Range: —20 to +60 degrees C.

Data subject to change without notice
CAT 211866

Magnetic AB
Radar instrument line

Microwave Spectrum Analyzer

MODEL 210

Where Used

The MAGNETIC model 210 Spectrum Analyzer is built for field use and primarily intended for permanent installation in radar stations. It is used to permit an observation of the character and quality of microwave signals. An important and very useful application of the instrument is to show the condition of the radar transmitter tube. Such effects as arcing, missing pulses, parasitic oscillations, and magnetron pulling under operating conditions are easily observed.
It is also possible to observe the LO and AFC operation at the same time as the radar transmitter spectrum if the IF of the Spectrum Analyzer is selected to be one half of the IF of the radar. The IF of the Spectrum Analyzer should however not be lower than 4/pulselength.
Model 210 is naturally very useful also for the microwave laboratory.

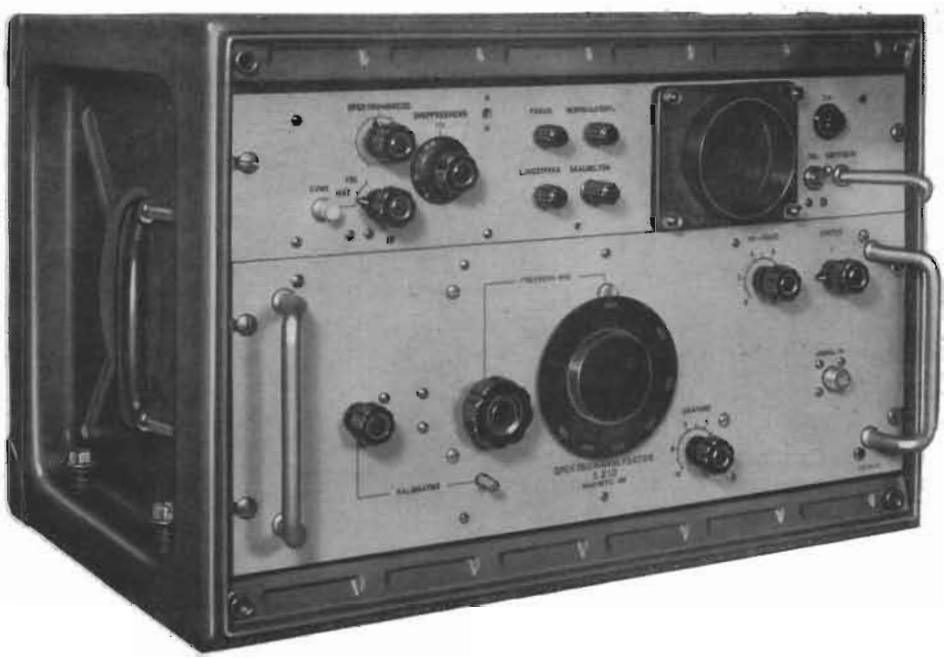
Features

- Direct-reading tuning dial with tracked reflector voltage
- Frequency accuracy better than 1 %
- Self-contained frequency marker
- Simple operation
- Internal, external and power line sync operation
- 3″ flat face CRT
- Made to stand mil. tests

Description

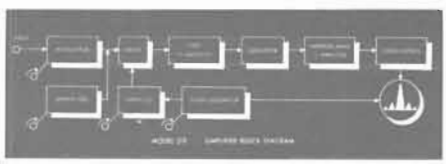
Electrical

The MAGNETIC AB model 210 Spectrum Analyzer is a portable RF analysis instrument. It is highly sensitive, reliable, and simple to operate, and provides a CRT display of signal amplitude as a function of frequency. The incoming signals are fed through an attenuator to a crystal mixer, where they are mixed with the frequency swept output of the local oscillator. The resultant heterodyne signals are amplified in the first IF-amplifier, converted to a lower frequency and amplified in a narrowband amplifier. The video detector is linear in order to exaggerate the side lobes of the spectrum. The CRT screen is calibrated in percent of power.



Mechanical

Model 210 is a compact, extremely sturdily built unit with a standard 19″ panel, 10 ½″ high and 12 5/16″ behind the panel.
The instrument is entirely self-contained. It can be delivered in a rackmount version, mounted in a strong watertight cabinet or in a light laboratory cabinet.



Specifikations

MODEL S210

Frequence Range: 2900—3500 MHz
Frequency Accuray: 1 %
Frequency Dispersion: 0,5 to 10 MHz
Sensitivity (mds): —80 dBm
Rf Attenuation: max. 100 dBm
Input Connector
Type N (type C upon request)
IF-Frequency
30 MHz (15 or 22,5 MHz upon request)
Resolution Bandwidth: 50 KHz
Frequency Markers
1 MHz (others upon request)
Sweep Frequency Rate: 10—50 Hz
Synchronization
Internal line frequency, external pulse, free run
Cathode Ray Tube: 3″ flat face
Power Requirements
115/220/230 V, 50/60 Hz 250 W
Weight: approx. 28 kilograms (rack mount)

MODEL X210 (same as S210 except):

Frequency Range: 8500—9600 MHz
Frequency Dispersion: 0.5 to 30 MHz
RF Attenuator Range: max. 80 dBm
Frequency Markers
5 MHz (others upon request)
Imput Flange: UG-39/U M4 thread
(Type N or Type C adapter available)
IF Frequency: 45 MHz (other upon request)

Model 210 can also be used for the second harmonic i. e. the frequency ranges 5800—7000 MHz and 17000—19200 MHz respectively.

Magnetic AB
Radar instrument line

MODEL 812

Militarized Oscilloscope

Where Used

Model 812 Oscilloscope is ideal for service of radar stations. The short rise time (0.025 μs) and the high sweep speed (0.04 μs/cm at maximum sweep expansion) are essential for any work dealing with fast pulses, while the DC amplifier and the slow sweep speed (down to 5 s/cm) makes the oscilloscope suitable for servo work. The instrument is built to stand military tests which makes it especially suitable for field use.
The high performance of model 812A makes it very useful for service and laboratory work in nucleonics and guidance system.

Features

— DC coupled amplifier
— Automatic sweep triggering
— 4-inch flat face CRT
— Made to stand military tests, operating at —30° C to +60° C

Principles of Operation

Model 812 is equipped with a DC coupled amplifier which is free from drift and has equal DC and AC gain. The accurately calibrated input attenuator gives direct reading of AC or DC input voltages from 100 mV/cm to 50 V/cm.
Any of 22 calibrated sweep speeds from 0.2 μs/cm to 2 s/cm can be selected with a direct reading control. A sweep expansion control gives a magnification of 5 times. Lower sweep speeds can be obtained with a continuous control.

The automatic triggering is a special feature making the instrument simple to use. To start the sweep at any arbitrarily selected point on the input waveform selective triggering can be used.

Description

Model 812 Oscilloscope is a rugged and compact unit in a rackmount case. The instrument is built with quality components to ensure the highest degree of dependability

Specifications

Sweep

Range
0.2 μs/cm to 2 s/cm. Slower speeds can be obtained
Calibrated
22 calibrated sweeps 1, 2, 5 and 10 sequences
Expansion
5 times
Triggering
Automatic for repetitive signals up to about 4 MHz
Trigger Level
Control selects any point on the input signal slope (for repetitive, random or single shot triggering)
Trigger Selector
Positive or negative. Internal or external

Vertical Amplifier

Sensitive Range
100 mV/cm to 50 V/cm
Input Attenuator
9 calibrated ranges 1, 2, 5 and 10 sequences
Pass Band
DC to 15 MHz (—3 dB)
Input Impedance
1 megohm shunted with 45 $\mu\mu$F
Rise Time
0.025 μs
Max. Vertical Deflection
4.5 cm

General

Voltage Calibrator
Stabilized 0.05—100 V p.t.p. 1, 2, 5 sequences 1 KHz sq. wave
Cathode Ray Tube
4" flat face DN 10—18. Available with P2, P7, P11 or P31 screen
Power Supply
115/220/230 V 50—60 Hz
Weight
Approx. 20 kg
Size
Mounts std 19" rack, height 177 mm, depth 445 mm
Available Accessory
Probe, 10 megohm shunted with 10 $\mu\mu$F

This oscilloscope is also available in a dual-trace version called Model 813. Both channels of the vertical amplifier in Model 813 have identical characteristics.

Model 812 is also available with a delay network in the vertical amplifier. The model number is then 812A. This oscilloscope permits observation of the leading edge of the waveform that triggers the sweep.

CAT 812866

Magnetic AB
Special Test and Systems Equipment

Linearity Meter

MODEL 430

Where Used

The Linearity Meter Model 430 is designed to measure the amount of differential phase and gain in Wide Band Transmission Systems, e. g. transmission systems for colour television signals.

Nonlinearities in any of the transmission equipment parts cause changes in the gain and phase shift of the transmission channel as the instantaneous amplitude of the video signal varies. It is thus of great importance for the total distortion in the transmission signal to adjust the differential phase and gain to a minimum.

The Linearity Meter Model 430 consists of two units, the Transmitter Unit Model 431 and the Receiver Unit Model 432. The operating principle of the system is in short as follows:

The Transmitter generates a test signal which consists of a sine wave measuring signal superimposed on a sine wave sweep signal. The sweep signal has a relatively low frequency (15.625 KHz) and a high amplitude. The measuring signal has relatively high frequency (4.4296875 MHz) and low amplitude. The high frequency signal will thereby be swept over the band for the equipment being tested and a nonlinearity of the equipment will phase respectively amplitude modulate the measuring signal.

In the Receiver unit the signal will be examined and the amount of differential phase and gain introduced in the signal will be determined by means of phase and amplitude detectors.

A cathode ray oscilloscope is required as indicator. The presentation of the measurement will be a straight horisontaline on the scope. Any curvature on this line is a measure of differential phase or gain.

To enable measurements for example on a part of a microwave link the transmitter and receiver are physically independent of each other. The only connection between them is the circuit under test, that is the link itself.

The units are designed to fulfil requirements for use under field conditions.

Specifications

Over all Accuracy

Diff. gain above 0.2 dB
± 10 % of actual diff. gain ± 0.02 dB

Diff. gain below 0.2 dB: ± 0.02 dB

Diff. phase above 1°
± 10 % of actual diff. phase ± 0.1°

Diff. phase below 1°: ± 0.1°

Transmitter Model 431

Sweep Signal

Frequency (sinusoidal): 15.625 KHz

Frequency accuracy: ± 1 %

Distorsion: < 3 %

Residual hum: < 0.1 %

Amplitude, variable in 0.1 dB steps
+ 6 to —15 dB (0 dB = 1 V p-p)

Amplitude accuracy at zero level
± 0.2 dB across 75 Ω

Attenuator error: ± 5 % between steps
max cumulative ± 2,5 % of tot. att.

Sync pulse width: 5—10 μs

Sync pulse rise time: < 1 μs

Sync pulse polarity: negative

Sync pulse amplitude
> 1/3 of sweep ampl.

Measuring Signal

Frequency (sinusoidal): 4.42968705 MHz

Frequency accuracy: ± 0.01 %

Distorsion: < 3 %

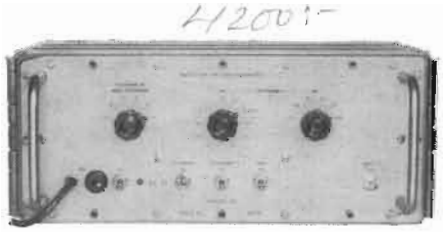
Residual hum: < 0.1 %

Amplitude, variable in 2 dB steps
0—26 dB below sweep amplitude

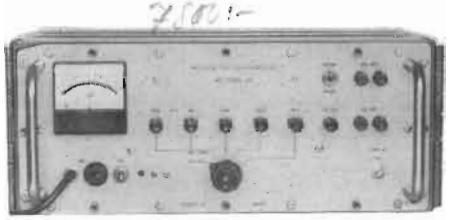
Amplitude accuracy at zero dB
± 0.2 dB across 75 Ω

Attenuator error: < 5 % between steps
max cumulative ± 2,5 % of tot. att.

Output impedance for combined signal
75 Ω ± 10 % unbal.



Transmitter Model 431



Receiver Model 432

Combination Signal

Sweep signal, measuring signal and sync pulse are added

Power 115—220—230 V ± 10 %
50 Hz ± 10 %, 30 W

Dimensions L×H×D 440×177×330 mm

Weight 9,5 kg

Receiver Model 432

Input impedance: 5 Ω ± 10 %

Sensitivity: 75 mV p-p

Sweep output amplitude
15 V across 100 k Ω

Sweep output phase: at zero input level

Calibrating voltage: Adjustable ± 30°
Corresponding to 1 dB of diff.
gain or 5° of diff. phase (≈ 50 mV)

Accuracy of calibrating voltage: ± 10 %

Residual diff. gain: < 0.02 dB

Residual diff. phase: < 0.1 °

Power: 115—220—230 V ± 10 %
50 Hz ± 10 %, 30 W

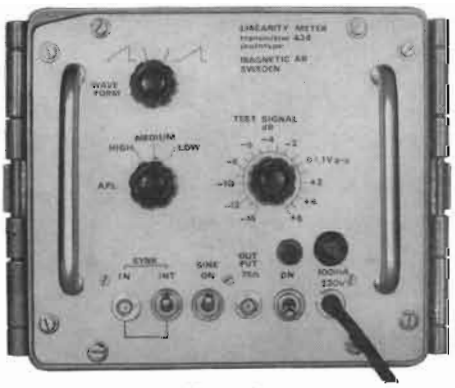
Dimensions L×H×D
440×177×330 mm

Weight: 9.5 kg

Magnetic AB
Special Test and Systems Equipment

MODEL 433

Linearity Meter



Model 434

The Linearity Meter Model 433 is used to measure the amount of differential gain and phase of Wide Band Transmission Systems for Color Television. The unit fullfills the requirements of the CCIR Recommendation. 421 Test Signal No 3.

The equipment consists of two units, the Transmitter Model 434 and the Receiver Model 435.

Both units are intended for laboratory as well as field use. They are fully transistorized and extremely light weight. They are water tight (immersion proof) and capable of withstanding severe field conditions.

Transmitter Model 434

The transmitter generates two basic OUTPUT WAVEFORMS, selectable by a front panel switch, Sawtooth and Staircase (Fig. 1).

A MEASURING SIGNAL is superimposed on the output wave form in that part of the amplitude interval which corresponds to levels between black and white.

The average level of the composed signal (APL = average picture level) may be set to three different values by a front panel switch (Fig. 2). In position MEDIUM each period of the signal contains the basic waveform. In positions HIGH and LOW, respectively, every fourth period contains the basic waveform whereas the three periods in between, consist of rectangular pulses with amplitudes 35 % and 100 % respectively of the white level amplitude.

Specifications Model 434

Repetition Rate of Sweep Signal: 15.6 kHz ± 1 %

Amplitude of Sweep Signal: +6 to —14 dB adjustable in 1 dB steps (0 dB = 1V)

Amplitude Accuracy of Sweep Signal: ± 0.2 dB at zero level into matched load

Accuracy of Attenuator: ± 5 % between steps. Max cummulative error 2.5 % of total attenuation

Width of Sync Pulse: 4.7 ± 0.2 μs

Rise and Fall Time of Sync Pulse: 0.3 ± 0.1 μs

Amplitude of Sync Pulse: 30 % of sweep voltage amplitude

Fall Time of Sawtooth Voltage: 0.3 ± 0.1 μs

Rise and Fall Time of Staircase Voltage 0.3 ± 0.2 μs

Number of Steps of Sawtooth Voltage: 5 (may be changed on request)

Amplitude Accuracy of the Steps: ± 5 %

Length Accuracy of the Steps: ± 25 %

Frequency of Measure Signal: 4429.7 kHz ± 0.01 %

Distortion of Measure Signal: 5 %

Amplitude of Measure Signal: 10 % of sweep voltage amplitude in to matched load (adjustable by a potentiometer inside the cabinet)

Amplitude Accuracy of Measure Signal at 0-level: ± 0.2 dB (matched load)

Transients in Measure Signal at Sweep and Step start: < 2 μs

Output Impedance: 75 ohms ± 10 %

External Sync: 2 ± 1V

Input Power: 115, 220, 230 V ± 10 % 50 Hz ± 10 %

Fuse: 0.1/0.2A

Power Consumption: 10 Watt

Weight: 6 kilograms

Receiver Model 435

In the receiver the input signal is separated into its waveform and its measuring signal components by a filter. The measuring signal component will contain an amount of modulation from the waveform due to the differential gain and phase of the system under test. The amplitude and phase modulations are separated and their values are displayed on a meter movement in the receiver. For more detailed analysis, the detected signals are applied to the vertical amplifier of an oscilloscope and the output waveform, which is also available in the receiver, is used for horisontal display. Available mid 1967.

Specifications Model 435

Frequency of Input Signal: 4429.7 kHz

Amplitude of Input Signal for a Composite Signal Amplitude of IV ± 6 dB: 0.1V ± 6 dB

Input Impedance: 75 ohms ± 10 %

Accuracy

Differential Gain above 0.2 dB: 10 % of reading ± 0.02 dB

Differential Gain below 0.2 dB: ± 0.02 dB

Differential Phase above 1°: ± 10 % of reading ± 0.1°

Differential Phase below 1°: ± 0.1°

Display: On a built-in direct calibrated meter movement or an external oscilloscope

Sync Pulses for Oscilloscope: > +2V, into 100 kohms

Output Voltage for Oscilloscope: 1V equal to 1 dB or 5 °

Calibration: Internal signal equal to 1° differential phase

Residual Differential Gain: < 0.02 dB

Residual Differential Phase: < 0.1°

Input Power: 115, 220, 230 V ± 10 % 50 Hz ± 10 %

Fuse: 0.1/0.2 A

Weight: 6 kilograms

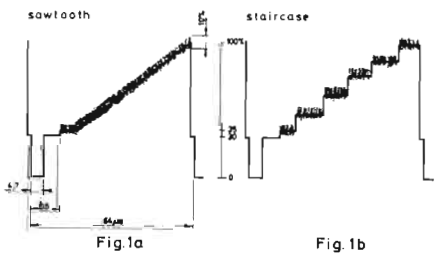


Fig. 1a Fig. 1b

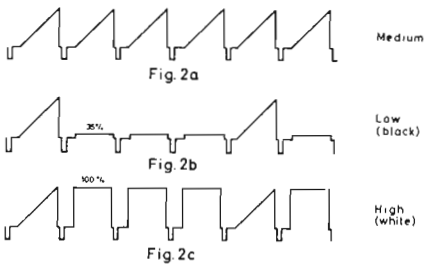


Fig. 2a
Fig. 2b
Fig. 2c

Data subject to change without notice
CAT 433866

Magnetic AB
Communication Equipment

Transfer Oscillator for Radio Links

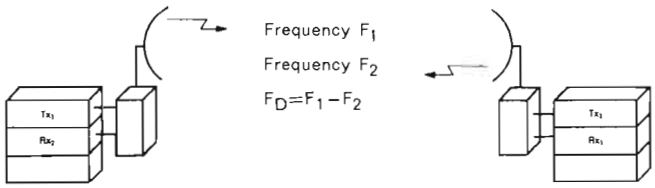
MODEL 436

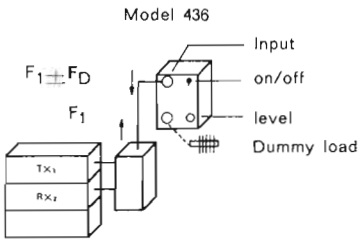
How to use

Transfer Oscillator model 436 is a simple and extremely useful instrument for all kinds of work concerning radio links in duplex operation.
The instrument is equally useful for Design—Production testing—Setting up—Fault location and Tuning.

Description

The oscillator is connected to the antenna connector of the duplex filter. The transmitter signal of frequency F1 radiated from TX1 is mixed in the oscillator with a chrystal controlled frequency equal to F_D generating the difference and sum frequencies $F_1 - F_D$ and $F_1 + F_D$ of which one is equal to F2. The output power from the transmitter is dissipated in a 50 ohm terminator belonging to the model 436. A minor part of the power is fed to a mixer diode, which is of Hot Carrier type. The new frequencies generated in the mixer is transfered back to the link branching filter at a level which can be varied from —30 to —60 dBm.
The chrystal frequency is chosen around 30 MHz and at a frequency which gives a multiple equal to F_D. F_D is to be specified when ordering and has to be chosen within the frequency range 25 to 100 MHz.
The oscillator is battery operated and the power consumption is very low. The battery will last for about 80 hours. Dimensions and weight are very small, why the unit also is excellent for field work.





Model 436 transfers the signal from T_{x1} at frequency F_1 to a signal of frequency $F_1 \pm F_D$ which can be received by R_{x2} in the same terminal.
F_D is the duplex distance frequency.
Model 436 thus makes possible checking, tuning, adjusting and repair of one radio terminal without the need for the corresponding terminal.

Specifications:

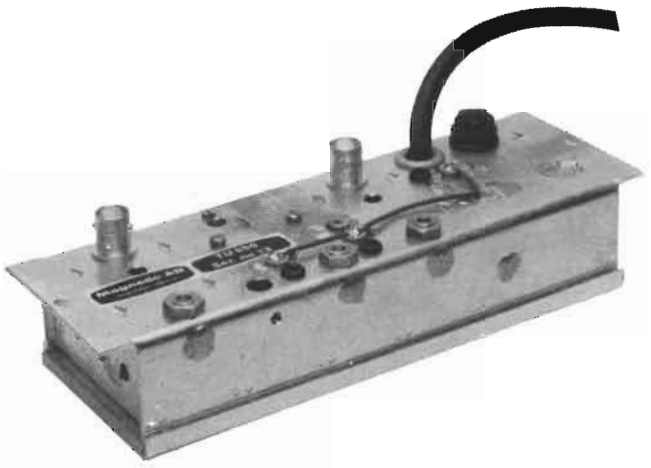
Input power	20—35 dB
Output power adjustable	—60 to —30 dBm
Power supply	9 V battery, 12 mA
Frequency	specified by the customer
Dimensions	140×95×55 mm
Battery life time	appr. 80 hours
Duplex distance frequency	specified by the customer
Weight	1 kg with batteries

GÄRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN Magnetic AB

CAT 436169

Magnetic AB
Communication Equipment

SERIES 656 Low Noise Preamplifiers 30-860 MHz



Model 656-2

General

Magnetic AB, since a long time ago leading the field of noise figure measurements, is introducing a line of ultra low noise preamplifiers. Connected before your present receiver they can uprate your communications system performance through a NF improvement of up to 10 dB with a correspondingly improved S/N ratio or sensitivity.

Typical application

Antenna preamplifier
Two Way Radio
Aeronautical
Distant telvision reception
Radio Links
Troposcatter systems

The 656 series of preamplifiers is customer's designed and optimized for best noise figure improvement for the customer, with respect to requirements of operating frequency, bandwidth, input VSWR and crossmodulation. With a loss in NF they can be delivered with a VSWR down to 1,2 at bandwidths of up to 1 octave and with improved crossmodulation performance.

The table below shows typical performance for narrow band noise optimized FET-amplifiers.

Frequency range MHz	NF dB max.	Gain dB min.
30—100	2.0	20
100—174	2.5	20
174—225	3.0	20
225—400	3.5	15
400—470	4.0	15
470—860	5.5	10

The amplifiers take advantage of the latest state of the art in semiconductor and circuit technology and use the best germanium, silicon or FET transistors, depending on application. Each amplifier is complete and contains its own stabilized power supply, ready to be connected ahead of your receiver.
Contact Magnetic AB with your specific requirements if you want to get less noise and better signals out of your receivers.

Low Noise Amplifier model 656-2

Specifications:

Frequency ..... 146—175 MHz, tunable
Bandwidth ..... min. 4 MHz, at —3 dB
NF ..... max. 2.5 dB
Gain ..... min. 20 dB
Impedance in/out ..... 50 ohms nominal
Connectors in/out ..... BNC female, UG 1094/U
Transistors ..... 2×FET
Mains supply ..... 220 V ±10 % 50 Hz
Mains fuse ..... 50 mA 5×20 mm
DC-output ..... —15 V
DC-tests points 3
Dimension chassis ..... 175×61×35 mm
Fixing holes ..... diam. 4.5 mm, 168 mm c-c
Temperature range ..... 0° to +50° C
MTBF ..... min. 40.000 h

Delivered with mounting adapter for fixing to a flat surface with two M4 screws. Mains cable appr. 2 m long with 3 wires grounded 2-pole mains connector.

Magnetic AB GÄRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN

CAT 656169

Magnetic AB
Radar instrument line

Microwave Fixed High Power Attenuator MODEL 911

Coaxial High Power Attenuator L911A-1

This Coaxial High Power Attenuator together with a movable short is used to introduce a fixed standing wave ratio in a transmission line. By means of a movable short, the phase of the standing wave can thereby be varied in the same way as for our earlier attenuators for waveguides. The attenuator can be delivered with other types of coaxial connectors on request.

Specifications

Frequency range	1220—1350 MHz
Attenuation	7 dB*
Accuracy	± 0.5 dB
Average power max	600 W
Peak power max	600 kW
VSWR max	1.1
Dimensions, Diameter	125 mm
Length	415 mm
Connector	Spinner $1\frac{5}{8}$"*

* May be changed on request

Waveguide Attenuator model 911

Magnetic AB series of Microwave Fixed High Power Attenuators as shown on data sheet CAT 911866 have been completed with new attenuators for other frequency bands and with other attenuations than our earlier attenuators. They are used to introduce a fixed standing wave ratio in a waveguide transmission line. The attenuators have the same features as earlier models i.e. will withstand high average power and high peak power, small dimensions and can be pressurized as the waveguide system itself. The new models with data will be found in the list below.

Specifications

Model[1] no	Attenuation dB	Freq. range GHz	Accuracy dB	Aver Power** (max) Watts	Max* VSWR	Waveguide IEC	Waveguide RG/u	Flanges IEC	Flanges UG/u	Approx Length mms
C911C	6.0	4.7— 7.0	±0.5	400	1.05	R58	—	PDR58	—	230
C911C-1	9.0	4.7— 7.0	±0.5	400	1.05	R58	—	PDR58	—	230
J911C	6.0	5.3— 8.2	±0.5	375	1.05	R70	50	UAR70	344	230
J911D	12.0	5.3— 8.2	±0.5	375	1.05	R70	50	UAR70	344	230
X911C	10.0	8.4—12.4	±0.5	300	1.05	R100	52	UBR100	39	300
X911C-1	10.4	8.4—12.4	±0.5	300	1.05	R100	52	UBR100	39	300
P911A	7.0	12.0—18.0	±0.5	150	1.05	R140	91	UBR140	419	90

* The attenuator terminated in a well matched load. ** Max. Peak Power of the attenuator is equal to the peak power of the waveguide.

[1] From Jan 69 the attenuation will be indicated by /7dB . . . /10dB etc.

GÄRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN Magnetic AB

CAT 311569

Magnetic AB
Radar instrument line

MODEL 913B, B-2

Microwave High Power Terminations

General

Magnetic AB line of High Power Terminations now includes new types of terminations. The most interesting one is the new convection-cooled termination in cast aluminium with the cooling fins parallel to the waveguide. By this arrangement forced air-cooling is simplier. A type with built in fan is also available. These terminations have the same low VSWR as our earlier series, but will withstand higher average power. Some of the new types are designed on customer's requirements and show our flexibility in manufacturing. If you have special requirements e.g. concerning air or water cooling, air-pressure, dimensions etc. please make contact with us.

Model S913B

SPECIFICATIONS:

Frequence range	2.70—3.95 GHz*
Waveguide	R32, Aluminium alloy
Flange	UAR32, Aluminium alloy
VSWR, max	1.05
Average power, max	2.5 kW
Peak power, max	Equal to peak power of waveguide
Dimensions, Lenght	402 mms
Width	140×140 mms
Cooling	Convection air cooling
Weight	6 kgs
Material	Cast aluminium alloy
Colour	Black

Description

The actual dissipation and power takes place in a thin layer on the walls of the waveguide. The lenght of the waveguide where most of the power is dissipated is essentially empty and does not contain any objects which might reduce the peak power capacity. This capacity is equal to that of the empty guide itself and can be increased in the same way as the empty guide by pressuration.

The average power handling capacity of the termination is restricted by the requirements that the temperature of the dissipation material should not exceed 300° C. Because of the excellent thermal conduction between the dissipative material and the waveguide wall, forced air will greatly increase the power handling capacity of the terminations.

Model S913B-2

SPECIFICATIONS:

Frequence range	2.70—3.95 GHz*
Waveguide	R.32 Aluminium alloy
Flange	UAR32, Aluminium alloy
VSWR, max	1.05
Average power, max	3.0 kW
Peak power, max	Equal to peak power of waveguide
Cooling	Forced air cooling
Fan	220 V 50—60 Hz
Power connector	MS 3102 A—14S—1 P
Dimensions	502×144×144 mms
Weight	9 kgs
Material	Cast aluminium alloy
Colour	Black

Typical example of terminations designed to customer's specifications.

Model P913-2

SPECIFICATIONS:

Frequency range	16.0—17.0 GHz*
Waveguide	R140, Aluminuim alloy
Flange	UBR140, Aluminium alloy
VSWR, max	1.05
Average power, max	250 W
Peak power, max	6.5 kW
Cooling	Water 2 l/min
Dimensions, Lenght	155 mm
Diameter	41 mm
Colour	Black

Model G913-2

SPECIFICATIONS:

Frequency range	4.50—5.85 GHz*
Waveguide	R48, Al-alloy
Flange	UER48, Al-alloy
VSWR, max	1.1
Average power, max	1500 W
Peak power, max	Equal to peak power of waveguide
Cooling	Convection air cooling
Ambient temperature	—42° to +75° C
Operating temperature	—32° to +55° C

* Terminations of the same type but for other frequency bands available on request.

Magnetic AB GÄRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN

CAT 9131168

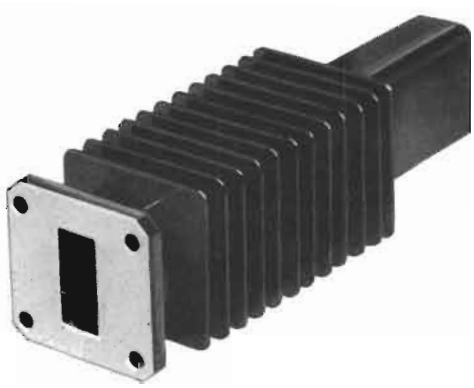
Magnetic AB
Radar instrument line

Microwave High Power Termination

MODEL 910, 913

Where used

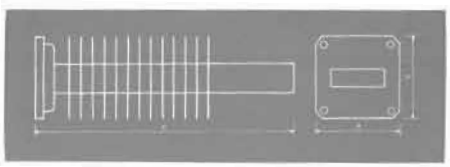
These broad band terminations are intended to be used as dummy loads for high-power microwave transmitters. They are capable of dissipating large amounts of power without producing undesirable reflections in the waveguide system. Their low VSWR, small dimensions, and low price also make them suitable for use in the laboratory as low power terminations.



Features

- High average power
- High peak power
- Low VSWR
- Small dimensions
- Pressurized on request
- Negligible energy leakage
- Low cost

Specifications



Typical VSWR for Model X910 B

High Power Terminations Model 910 (Brass)

Model	Frequency range GHz	Waveguide IEC	RG/U	WR	Flange IEC	UG/U	Max VSWR	Aver** Power Watts	Dimensions mm A	B	C
L910	1.14—1.73	R14	69	650	PDR14	417A	1.20	2500	No cooling fins		500
L910A	1.14—1.73	R14	69	650	PDR14	417A	1.05	5000	"		1000
L910B	1.14—1.73	R14	69	650	PDR14	417A	1.05	10000	150	300	1000
S910*	2.70—3.95	R32	48	284	UAR32	53	1.05	1500	134	134	540
S910A	2.50—3.75	—	—	(WG10A)	—	(W9076)	1.05	1000	60	119	540
S910B	3.30—4.90	R40	—	229	PDR40	(CPR229)	1.05	1000	62	97	440
S910D	2.70—3.95	R32	48	284	UAR32	53	1.20	500	80	120	210
G910*	3.95—5.85	R48	49	187	UAR48	149A	1.05	1000	92	120	300
J910*	5.85—8.20	R70	50	137	UAR70	344	1.05	375	57	57	230
J910A	5.85—8.20	R70	50	137	UAR70	344	1.05	800	75	110	290
H910	7.05—10.0	R84	51	112	UBR84	51	1.05	250	48	48	160
H910A*	7.05—10.0	R84	51	112	UBR84	51	1.05	350	60	90	160
H910B	7.05—10.0	R84	51	112	UBR84	51	1.05	600	60	90	240
X910*	8.20—12.4	R100	52	90	UBR100	39	1.05	250	41	41	140
X910A	8.20—12.4	R100	52	90	—	(Z830004)	1.05	250	41	41	140
X910B	8.20—12.4	R100	52	90	UBR100	39	1.05	500	60	90	200
P910	12.4—18.0	R140	91	62	UBR140	419	1.05	150	50	50	90

High Power Terminations Model 913 (Aluminium)

L913	1.14—1.73	R14	103	—	PDR14	418A	1.20	2500	No cooling fins		500
L913A	1.14—1.73	R14	103	—	PDR14	418A	1.05	5000	"		1000
L913B	1.14—1.73	R14	103	—	PDR14	418A	1.05	10000	150	350	1000
S913	2.60—3.95	R32	75	—	UAR32	584	1.05	2500	135	135	540
S913A*	2.60—3.95	R32	75	—	UAR32	584	1.05	2000	135	135	440
G913	3.95—5.85	R48	95	—	UAR48	407	1.05	1000	92	120	300
J913	5.85—8.20	R70	106	—	UAR70	441	1.05	375	57	57	230
J913A	5.85—8.20	R70	106	—	UAR70	441	1.05	800	75	110	290
H913	7.05—10.0	R84	68	—	UBR84	138	1.05	250	48	48	160
H913A*	7.05—10.0	R84	68	—	UBR84	138	1.05	350	60	90	160
H913B	7.05—10.0	R84	68	—	UBR84	138	1.05	600	60	90	240
X913*	8.20—12.4	R100	67	—	UBR100	135	1.05	250	41	41	140
X913B	8.20—12.4	R100	67	—	UBR100	135	1.05	500	60	90	200
P913	12.4—18.0	R140	91	—	UBR140	419	1.05	150	50	50	90

* Normal stock standard ** Max Aver Power Rating is doubled by forced air cooling.

High power terminations for other frequency-bands available upon request.

Max. Peak Power of the load is the equal to the peak power of the waveguide.

If other flanges than those specified are desired, please specify the required flange.

Magnetic AB
Radar instrument line

MODEL 911

Microwave Fixed High Power Attenuator

Where Used

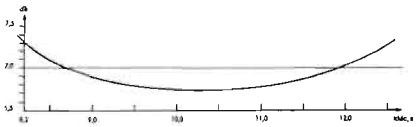
This high power attenuator, together with a movable short, is used to introduce a fixed standing wave ratio in a waveguide transmission line. By means of the movable short the phase of the standing wave can be varied.

This set up is very suitable for determining the characteristics of high power magnetrons and klystrons, and for studies of breakdown in high power systems and components.

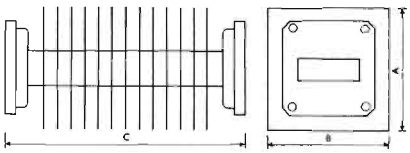
When the attenuator is terminated with a short, the VSWR introduced in the transmission line for 7.0 dB is 1.5 and for 4.8 dB 2.0. The VSWR 1.5 and 2.0 are typical values for testing magnetrons and klystrons.

Features

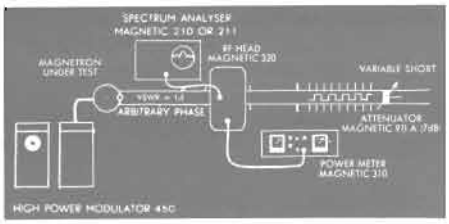
— High average power
— High peak power
— Small dimensions
— Can be pressurized



Typical attenuation for X 911 A

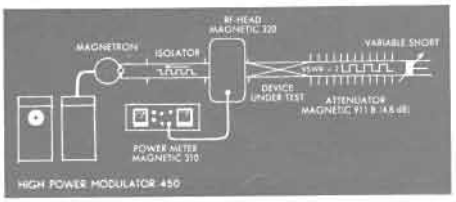


Testing of magnetrons



The magnetron tested is loaded with the specified VSWR. The phase of the standing wave is varied by means of the variable short. Variation in power, frequency and spectrum is measured.

High power breakdown studies



The device under test is checked with a required pover and standing wave. The phase of the standing wave is slowly varied by the movement of the short, and an eventual breakdown is observed.

Specifications

Model no	Attenuation dB	Freq. range GHz	Accuracy dB	Aver Power** (max) Watts	Max* VSWR	Waveguide IEC	Waveguide RG/u	Waveguide WR	Flanges IEC	Flanges UG/u	Dimensions mm A	Dimensions mm B	Dimensions mm C
S911A	7.0	2.6—3.95 2.9—3.5	± 0.5 ± 0.3	1000	1.05	R32	48	284	UAR32	53	134	134	400
S911B	4.8	2.6—3.9	± 0.3	1000	1.05								
H911A	7.0	7.05—10.0 8.5—9.6	± 0.5 ± 0.3	400	1.05	R84	51	112	UBR84	51	90	60	230
H911B	4.8	7.05—10.0	± 0.3	400	1.05								
X911A	7.0	8.4—12.4 8.5—10.0	± 0.5 ± 0.3	300	1.05	R100	52	90	UBR100	39	90	60	210
X911B	4.8	8.4—12.4	± 0.3	300	1.05								

* The attenuator terminated in a well matched load. ** Max. Peak Power of the attenuator is egual to the peak power of the waveguide.

Magnetic AB
Radar instrument line

Low Power Terminations/Directional Couplers/Transitions

MODEL 912, 916 951A, 942, 943 914, 914A

Low Power Terminations Model 912, 916

Considerable care has been taken in design and manufacture of Model 912 and 916, to ensure a Low VSWR. The terminations are designed for termination of Magnetic AB Noise Sources, but are also suitable for other measurements, where a termination, which has a negligibly small reflection coefficient is required.
The terminations are available in Brass or Aluminium waveguide and have the Model no:s 912 and 916 respectively.

Coaxial Low Power Termination Model 951A

This termination is primarily designed for termination of Coaxial Noise Source Model 122C but has also found wide use in other laboratory applications, where good VSWR's are required.

Specifications

Model[1])	Frequency Range, GHz	Waveguide IEC R	Waveguide JAN RG/U	Flanges IEC	Flanges UG/U	Average Power (max) W	Max. VSWR	Length mm
S912	2.90— 3.50	32	48	UAR32	53	1.0	1.02	220
G912	3.95— 5.85	48	49	UAR48	149A			180
J912	5.85— 8.20	70	50	UAR70	344			140
H912	7.05—10.00	84	51	UBR84	51			110
X912	8.2—12.40	100	52	UBR100	39			100
P912	12.40—18.00	140	91	UBR140	419			80
951A	0—4, 4—7	Coaxial		N-male	50 ohms	1.1, 1.15 respectively		

[1]) In Aluminium alloy the Model no. is 916

Cross-Guide Directional Couplers Model 942, 943

Magnetic AB Cross-Guide Directional Couplers are specially designed to meet the requirements of high coupling accuracy over frequency ranges required for noise figure measurements.

Specifications

Model[1])	Frequency Range, GHz	Waveguide IEC R	Waveguide JAN RG/U	Flanges IEC	Flanges UG/U	Coupling[2]) dB	Coupling Accuracy, dB
S942	2.60— 3.95	32	48	UAR32	53	20	± 0.5
G942	3.95— 5.85	48	49	UAR48	149A	20	± 0.5
J942	5.85— 8.20	70	50	UAR70	344	20	± 0.5
H942	8.5 — 9.6	84	51	UBR84	51	20	± 0.5
X942	8.5 — 9.6	100	52	UBR100	39	20	± 0.5

[1]) In Aluminium alloy the Model no. is 943. [2]) May be changed upon request.

Waveguide Transition Model 914A

These components provide transitions from waveguide R84/RG51 to R100/RG52 with flanges UG51/UG39. The lengths of the transition is 50 millimetres and VSWR is better than 1.04. Transitions between other waveguide sizes are available on request.

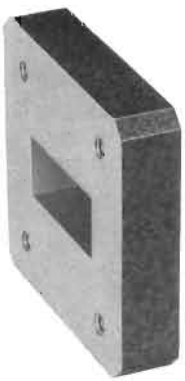
Waveguide Step Transition Model 914

A new Step Transition Model 914 is available for transitions from waveguide R84/RG51 to R100/RG52. This transition has a length of only 10.4 millimetres and VSWR better than 1.04. The transition is only available in Aluminium alloy.

H 912

H 942

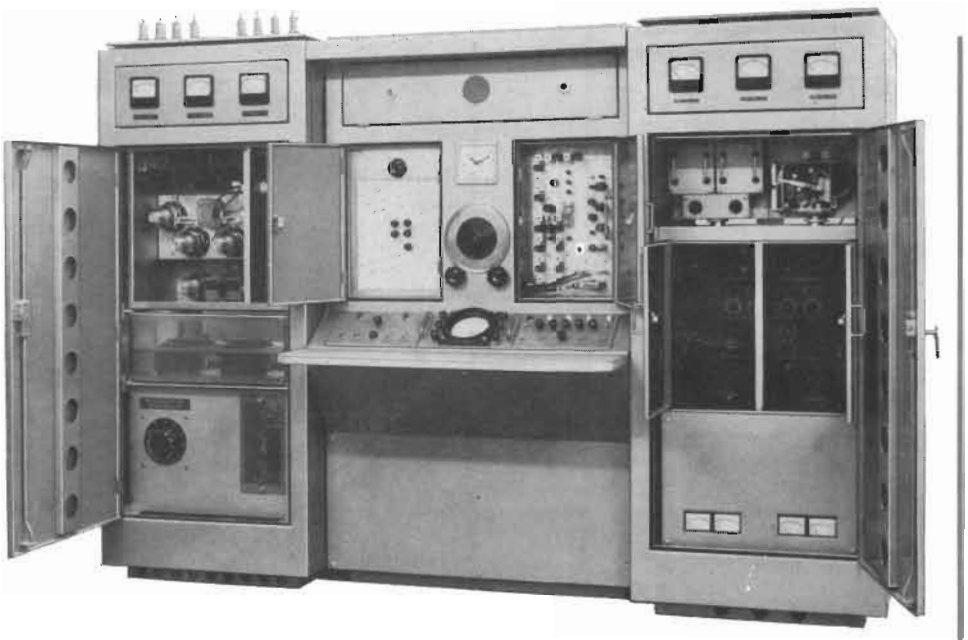

X/H 914 A


X/H 914

Magnetic AB
Space instrument line

SERIES 1000

Ionosphere Recorders



Series 1000

This series was designed to become a versatile, State of the Art scientific instrumentation for basic and applied ionospheric research as well as for radio communication survey.

SERIES 1000 IS NOT JUST ONE MODEL OF IONOSPHERIC RECORDERS. IT IS A MODULE SYSTEM OUT OF WHICH A LARGE VARIETY OF INSTRUMENTS CAN BE BUILT.

The series contains the five basic units for all ionosondes:

SERIES 1010, Signal Generating Equipment
SERIES 1020, Transmitting Equipment
SERIES 1030, Receiving Equipment
SERIES 1050, Height and Frequency
SERIES 1050, Measuring Equipment
SERIES 1060, Recording Cameras

Plus the following Auxiliary Equipment:

SERIES 1070, Programming Equipment
SERIES 1080, Power Supplies and
SERIES 1080, Special Equipment

Continuous development work is going on at Magnetic AB to broaden and improve the line of equipment available.

As a result of the modular design a customer will have the possibility to modernize his equipment as technique advances.

SOME OF THE BASIC FEATURES OF THE SERIES 1000 ARE:

— Very High Accuracy in Frequency and Virtual Height
— High Power
— Elaborate Programming Capabilities
— High Reliability and long Maintenance Intervals

On the following pages you will find a description of MODEL 1005 W, A Vertical Incidence Ionospheric Recorder for Scientific Applications which has been produced in a fairly large number. This instrument represents one of many combinations possible with equipment from the SERIES 1000.

MODEL 1005 W

Model 1005 W is a highly advanced vertical incidence ionospheric sounder representing State of the Art performance in accuracy and reliability. It is intended as a stationary or trailer mounted recorder for preprogrammed recording of the ionosphere at regular intervals, as well as for special investigations by manual operation.

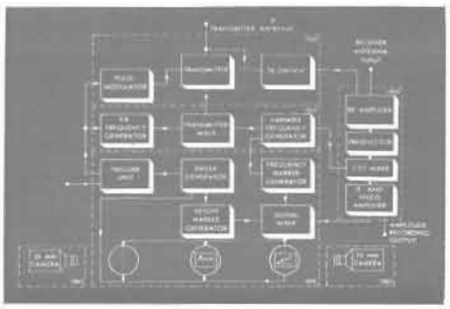
Characteristic Features of Model 1005 W are

— High Output Power
— Excellent Low Frequency Response
— Sophisticated Programming Capabilities
— Standardized, Easy-to-Evaluate Recordings

Description

The heart of Model 1005 W is the Model 1015 Signal Generating Unit, which generates a pulse modulated signal variable in frequency between 0.25 and 20 MHz. In normal operation the frequency is automatically swept across this range and varies with time as an extremely accurate logarithmic function. The sweep time can be set to several values in the range 30 seconds to 3 minutes, or larger on special order. — The frequency tuning may also be accomplished by manual operation of a front panel knob.

The pulsed output signal from the 1015 signal generating equipment is fed to the transmitter unit Model 1025. This unit is a broadband power amplifier, which amplifies

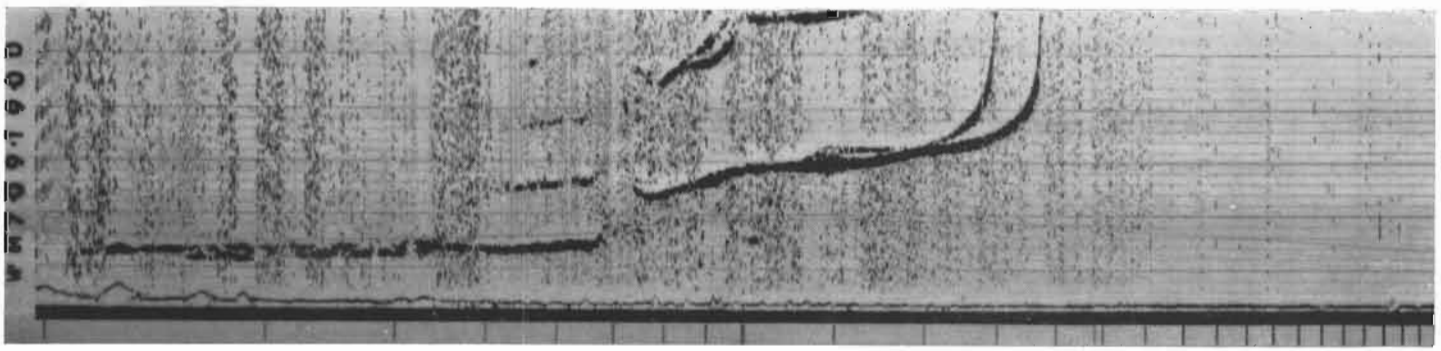


Cont.

Magnetic AB
Space instrument line

Ionosphere Recorders

SERIES 1000



the signal to approximately 30 KW peak power. The output signal from the transmitter is available at several output connectors, each representing a certain impedance. This feature makes possible the use of various types of antennas.

When radiated in a vertical direction the transmitted signal is at certain frequency bands reflected from the various ionized layers in the ionosphere. The reflected signal is picked up either by the same antenna that radiates the transmitted signal, in which case a duplexer is required, or by a separate antenna, and fed to the receiver unit Model 1035.

The receiver unit Model 1035 contains a preselector circuit to reduce cross-modulation from interfering broadcasting and radio communication transmitters. The receiver is a normal double superheterodyne with a 1:st intermediate frequency of 4 MHz (8 MHz in the frequency band 2.25 MHz to 6.75 MHz) and a 2nd intermediate frequency of 455 KHz.

The receiver has a variable bandwidth selectable in steps within the range 10 KHz to 30 KHz, and a variable pulse differentiation selectable in the range 20 to 100 microseconds or undifferentiated.

The receiver has two primary output channels:

One is the channel required for the presentation of echoes in the form of intensity modulation of cathode ray tubes. An important consideration in this case is to utilize the limited dynamic range of the cathode ray tube and camera film combination in an optimum way. Since it is required that the sensitivity given by the noise figure of the receiver is to be preserved throughout the recording system, the brightness of the cathode ray tube representing receiver noise is set at a value giving maximum signal sensitivity of the whole system. The video signal is then compressed and clipped in a suitable way.

The second output channel gives an undifferentiated output, which is substantially linear or logarithmic over a wide dynamic range, this range being adjustable as required. This channel is intended for amplitude recording of the reflected signal.

The received signals are displayed on three different cathode ray tubes for different types of recordings:

Display A is obtained by applying only height sweep to the cathode ray tube. The frequency scan is obtained by moving the film in a camera at a rate synchronously with the frequency sweep past the stationary line image projected on it by the camera lens. The record so produced is on standard 35 mm film and requires, in normal operation, 100 mm length of film for the entire frequency sweep of each record.

Display P (Panoramic) is made by applying both height and frequency sweeps to the cathode ray tube and photographing the image by a standard 16 mm motion picture camera, which provides single-frame time exposure.

A monitor display can be used for checking both displays A and P during exposure. Moreover, the monitor contains facilities for operating as a radar a-scope when displaying height on the horizontal axis, amplitude on the vertical axis, and height markers as intensity modulation of the trace.

Both records A and P contain complete date-time information consisting of year, month, day, hour, minute and two-letter station identification.

Figure 1 shows a circuit diagram of the programming unit Model 1075. Programs are set up by inserting small plugs in the time program matrixes (hour program, day program, month program) and in the function program matrixes. The reader will get a good idea of the wide variety of programming possibilities by taking a look at the actual program set up in Figure 1. This program gives:

Normal soundings every full hour with three soundings five minutes apart at three different gain levels (gain run), and 1000 km height range. During sunrise and sunset soundings every ten minutes but gain run only at full hours. 250 km and 2000 km height ranges once every hour; at night high gain. During three days a month soundings every quarter of an hour. Gain runs at full hours.

Figure 2 to 5 will give the reader an idea of the carefulness applied to the design of the important circuits of Model 1055 Height and Frequency Measuring Unit. These circuits feature the most advanced pulse tech-

Magnetic AB
Space instrument line

SERIES 1000

Ionosphere Recorders

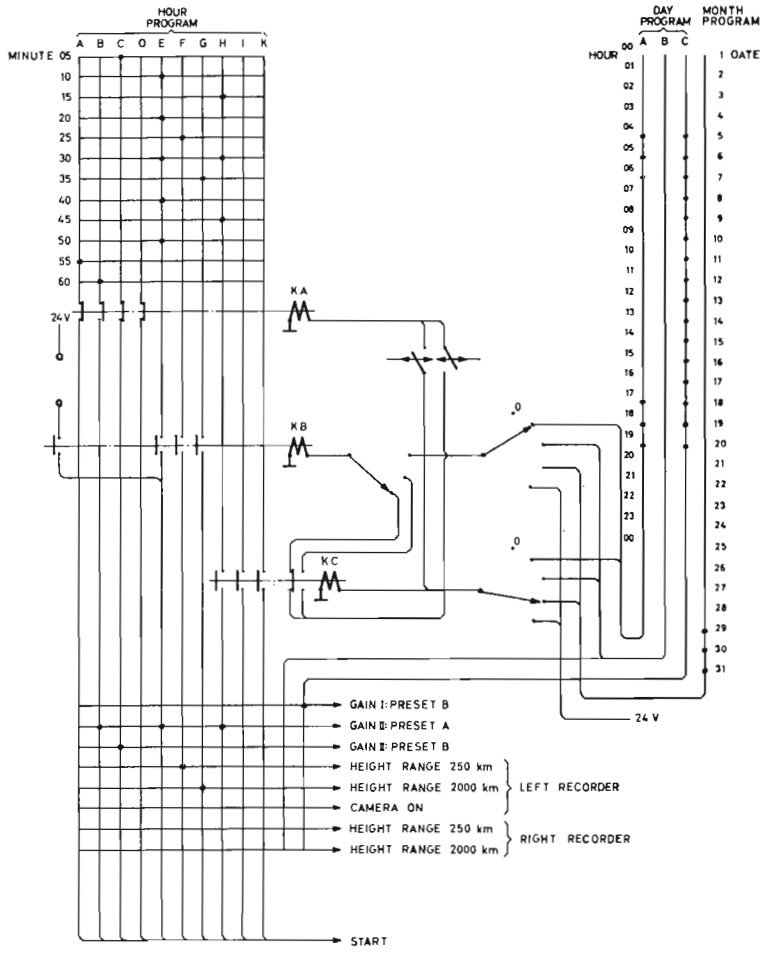


Figure 1

Programming Unit 1075
Circuit Diagram

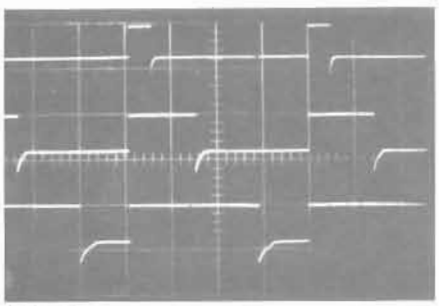


Figure 2

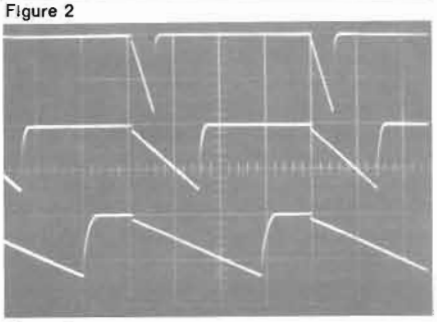


Figure 3

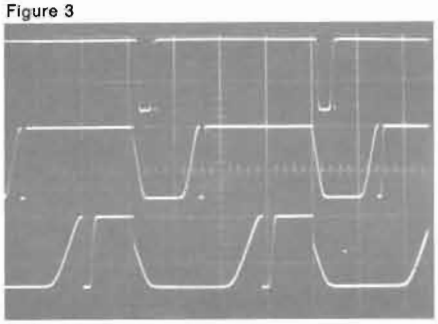


Figure 4

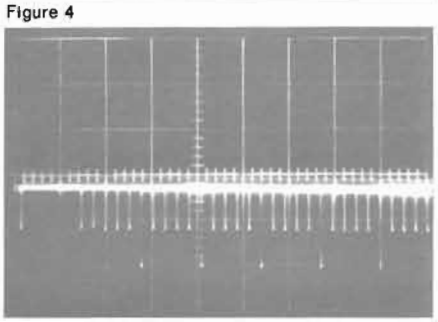


Figure 5

Data subject to change without notice
CAT 1000866/3

Ionosphere Recorders

SERIES 1000

nique and serve as the base for the high over all accuracy obtained on actual records.

Fig. 2 and 3 show the generation of the extremely linear Miller run-down sweeps which are used throughout the recorder. Figure 4 shows the unique "Dynamic Focus" which gives pin-point sharpness along the whole trace.

Fig. 5 shows the height marker pulse train of 20 km and 100 km markers. These markers are derived from a X-tal controlled oscillator synchronized to the transmitter pulse frequency. This method combines the accuracy of X-tal controlled markers with the absence of jitter obtainable with markers derived from a carefully triggered oscillator. The Zero Height Marker is effectively locked to the ground echo by a servo loop. The suppression of the markers below zero height where frequency markers are introduced is clearly seen in fig. 5.

Specifications

for Ionosphere recorder Model 1005 W

Frequency Range
0.25—20 MHz

Frequency Scale
Logarithmic

Frequency Markers
Every 0.25 MHz (0.25— 2 MHz)
Every 1 MHz (2 —20 MHz)

Output Power
Minimum 25 kW at 600 ohms output
(Normally 30—40 kW)

Pulse Repetition Frequency
Internal Trigger
Line frequency or half the line frequency

External Trigger
25 Hz—60 Hz

Pulse Width
70—100 μs

Pulse Rise Time
7 μs

Height Ranges
0— 250 km
0—1000 km
0—2000 km
others upon request

Height Scale
Linear

Height Markers
100 km and 20 km

Recording Time (provided by two alternative gearboxes)

Gearbox A

High speed	Low speed
30 secs	120 or 90 secs
60 ,,	240 or 180 ,,

Gearbox B

30 ,,	240 or 180 ,,
60 ,,	480 or 360 ,,

(Low speed or High speed selectable by a front panel switch)

Film speed

The 35 mm film camera is provided with four selectable film speeds

1. 33 mm/min. Gives
100 mm record with 180 sec sweep time
2. 67 mm/min. Gives
33 mm record with 30 sec sweep time
3. 100 mm/min. Gives
100 mm record with 60 sec sweep time
4. 133 mm/min. Gives
67 mm record with 30 sec sweep time

Receiver Noise Figure
Approximately 10 dB

Receiver Bandwidth
10 KHz, 20 KHz, 30 KHz

Receiver Differrentiation Time Constant
10 μs, 20 μs, 50 μs, 100 μs
(others upon request)

Power Consumption
2 kW

Size
Width 2400 mm
Height 1700 mm
Depth 590 mm (excl. desk)

Weight
750 kg

Accuracy

Frequency as well as height markers are produced in crystal controlled generators. Height markers at 20 km and 100 km height intervals are presented electronically, selectable by a front panel switch. Accuracy of markers is $\pm$ 0.5 %.
The height marker generator is a pulsed type in order to run synchronously with the transmitter pulse frequency without time jitter.
The zero of the height scale time base is accurate and stable to at least $\pm$ 3 μsecs. In order to keep the ground echo from the transmitter in coincidence with the zero pulse from the height marker generator the outgoing pulse from the transmitter is automatically time controlled by means of a servo loop circuit. This circuit will guarantee long time stability of the transmitter pulse signal position on the height scale.
The over all height scale accuracy depends on the oscilloscope tube resolution rather than the optics and film material. Therefore the recorder can be equipped with two A-displays and 35 mm cameras. One of these should be used with a short range time base when great accuracy in the 100 km region is important. On the 100 km level the accuracy will then be of the order of $\pm$ 0,5 %. The cathode ray tube normally used for Display P is utilized for this purpose.
The frequency markers are derived from harmonic X-tal oscillators with an accuracy of 0.1 %. The markers are presented below the zero height line on the ionogram with a constant width of 1 % in frequency. The over all accuracy in determining radio frequency is $\pm$ 0.5 %.

Magnetic AB
Space instrument line

MODEL 1906

Ionosphere Sounding Antennas for Vertical Incidence

Description

THE MAGNETIC AB model 1906 LOG PERIODIC AND FOLDED DIPOLE SYSTEM is a highly advanced antenna system developed in cooperation with National Bureau of Standards, Boulder, Colo. U.S.A.
It is exclusively made for vertical incidence sounding where high efficiency is a demand over the entire frequency range from the very low frequency end of 0.25 MHz and up to 20 MHz. It consists of two antennas.
— One folded dipole antenna covering the range of 0.25—2.3 MHz.
— One log periodic antenna covering the range of 2.3—20 MHz.
The gain is 6 to 8 dB in the vertical direction.

Electrical Specification

Frequency Range:
Folded Dipole 0.25—2.3 MHz
Log Periodic 2.3—20 MHz
Polarization: Horizontal
Input Impedance:
600 ohms balanced (log periodic matched with an 80 m (260 feet) taper feeder from 180 ohms
Gain:
6 dB or better in the vertical direction over an isotropic antenna.
VSWR: 2 to 1 maximum

Folded Dipole Antenna

The unfed section of the Folded Dipole consist of four paralelled wires in order to match the characteristic impedance to 600 ohms. The fed section is a single wire. The length of the dipole antenna is successively cut in 14 steps as the frequency Sweep advances. The division is made in a logarithmic scale in decrete steps. This is accomplished by means of relays which are linked in the antenna. These relays are made in accordance with the following specification.

Antenna Relays

In order to cut the two elements in the folded dipole a relay unit consisting of three contacts is needed. (See fig.)
Relay Contacts: High vacuum Reed switches
Contact Rating: 10 kV 2 A
Operating Voltage: 24 V
Operating Current: 60 mA maximum
Closing Time: 5 ms maximum
Lightning Protectors: Gas-filled spark gaps

The relay operation is synchronized to the pulse rate of the ionosonde to ensure that no contact shift will take place during the time for an outgoing pulse.
The realy set is entirely potted in epoxy resin to withstand all weather condition. The operation cable is perpendicularly connected to the set with a watertight MS connector.

Log Periodic Antenna

This antenna consists of 17 elements on each side, logarithmically spread in order to cover the frequency range. The antenna is carried by unstretchable glassfibre side ropes.

Physical Specifications

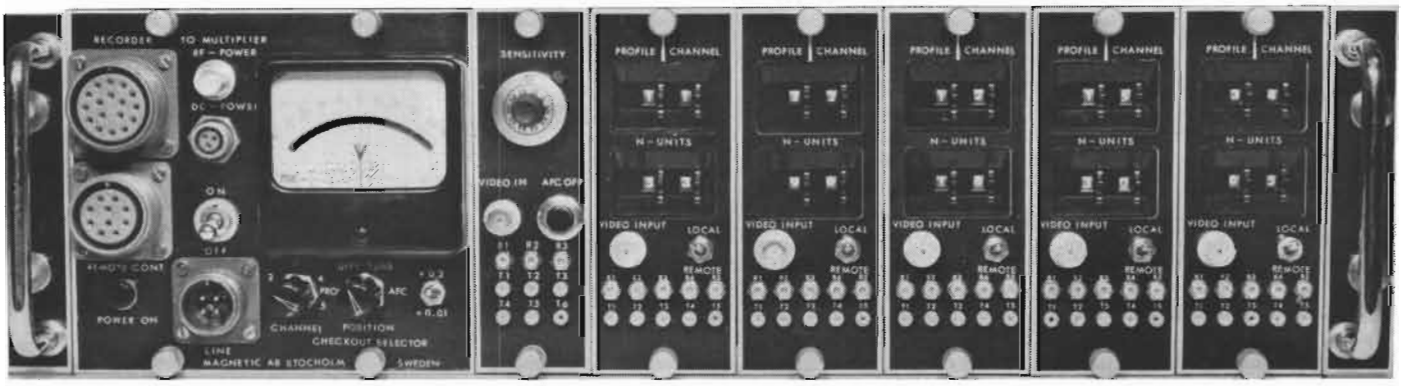
Dimensions:
FOLDED DIPOLE:
Folded Dipole Masts:
10 pcs 20 m high steel tubes
Dipole: Lenght 509 m (1670 feet)
Height 20 m above ground
Antenna Wire: No 12 copperwelded steel
LOG PERIODIC:
Log Periodic Center
Tower: Height 72 m
Construction Crossbar design
Cross Section 1 m in square
Antenna Top Height over Ground: 71.7 m
Antenna Base: 96.6 × 67.0 m
Height for Lowest Element over Ground: 18 m
Antenna Wire: No 12 copperwelded steel

Antenna Relay unit

Magnetic AB
Space instrument line

Microwave Refractometer

MODEL 1100



Features

— Predictions of radar wave path for fire control and missile tracking radars.
— Scientific studies of the athmosphere with radio meteorology.
— Path studies for radio link systems.

This new Refractometer was developed by Magnetic AB in close cooperation with the Environmental Science Service Administration in Boulder, Colorado, and the Research Institute of National Defence, Stockholm.

Background—Application

The importance of the refractometer index of air for the propagation of electro-magnetic waves has long been known. Changes in the refractive index along a propagation path anables scattering link connections but often they cause difficulties for instance in the technique of height measurements with radars, where completely erroneous height information may be obtained. Another less common but very important effect is the loss of radar contact with an aeroplane as a result of bending of the radar wave.
The factor of importance for the propagation in air is the difference in refractive index between different points. Such differencies may be large scale effects resulting in slowly varying refractive gradients or small scale effects, with fast varying gradients, normally the result in turbulence phenomena. An important application of the large scale effect is the propagation of radar and radio link waves in ducts. Scattering link propagation is typical for the small scale effects.

How to use

The refractometer may be mounted in a mast on the ground or in an aeroplane. It measures simultaneously the refractive index at five different spots. The sensing elements are open microwave resonant cavities through which air passes freely. To measure the refractive index of the air in the cavities these are fed by a microwave signal.
The operation is based on the fact that the resonant frequency of a microwave cavity of fixed dimensions is determined by the refractive index of the material contained within the cavity. Consequently, the measurement of the resonant frequency can be considered as a measurement of the index of the sample. The instrument further contains a closed reference cavity where the refractive index is stable. Electronic circuitry in the refractometer makes a computation of the refractive index at each measuring point by comparing the resonance frequency of the cavity at the point with that of the reference cavity.

GÅRDSFOGDEVÄGEN 18,
BOX 11060 161 11 BROMMA, SWEDEN Magnetic AB

CAT 1100169

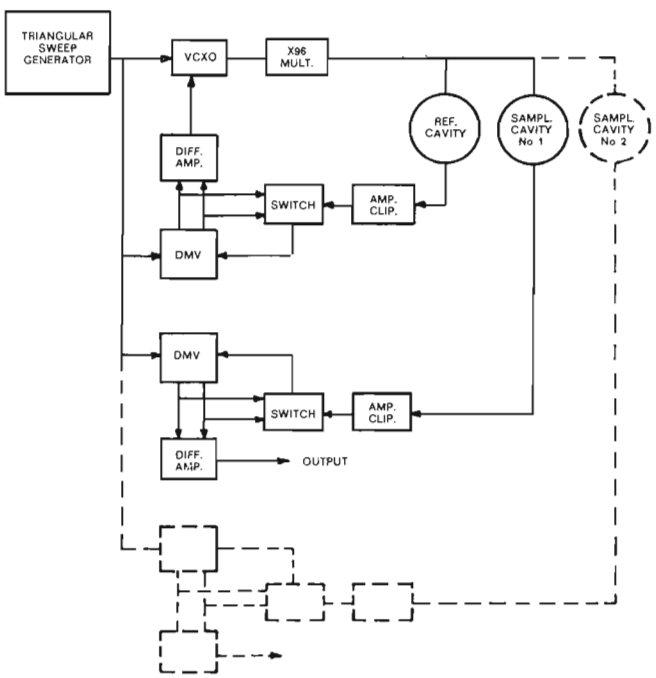
Magnetic AB
Space instrument line

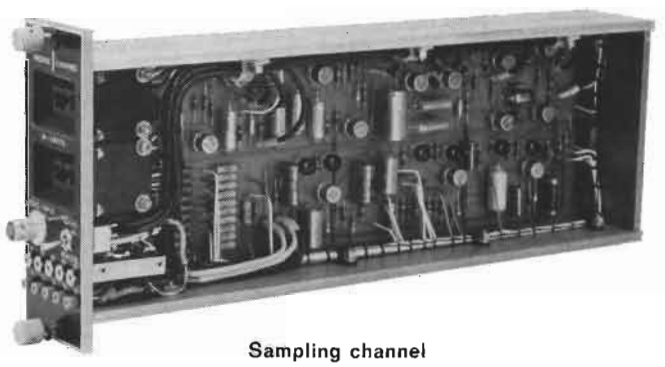
MODEL 1100

Microwave Refractometer

Principles of Operation

In order to achieve a good enough frequency stability the measuring frequency is generated by a voltage controlled Crystal Oscillator, which is linearly frequency modulated to provide a frequency sweep of 200 PPM.
The oscillator frequency is 15.8 MHz. It is multiplied by 6 in a step recovery circuit and further multiplied in a solid state X96 multiplier to give an output of 10 mW at 9100 MHz.
The frequency is swept over the resonant points of the reference and the sampling cavities. The reference cavity is integrated in a closed loop circuit which centers the frequency sweep to its own resonant frequency.
When the sweep passes the resonant frequency of the reference cavity a detected pulse resets a flip-flop multivibrator that was set by the sweep start. As the cavity pulse appears at the center of the sweep the flip-flop generates a symmetrical square wave. The sweep also passes the resonant points of the sampling cavities. Each sampling channel has its own flip-flop circuit, which is set and reset in the same way as in the reference channel. A certain refractive index subtracted from the reference channel index, which unequals zero, causes an unsymmetrical square wave proportional to the measured refractive index. The square wave is averaged and fed to a differential amplifier which produces a DC-voltage output. The DC-voltage is proportional to the refraction index.





Sampling channel

Specifications:

Number of measuring channels	5
Measuring range	200 N-units
Resolution	0.2 N-units
Measuring accuracy	2 %
Profile sensitivity	0.1 V/N
Center frequency	9100 GHz
Each channel is provided with outputs for profile, differential and turbulence measurements	
Power Consumption	27—30 V, 1 A DC or 220 V, 0.25 A AC, 50/60 Hz
Mechanical dimensions	W 19″ × H 6¾″ × D 12″

Magnetic AB GÅRDSFOGDEVÄGEN 18,
BOX 11060 161 11 BROMMA, SWEDEN

CAT 1100169

Magnetic AB
Special Test and Systems Equipment

Electronic Keyer

MODEL 600

Where Used

The Magnetic AB Electronic Keyer is a completely transistorized unit for use wherever a need for generation of a continuously repeated signal in International Morse Code exists.

The unit was originally designed for generation of identification signals in transmitters for Civil Aviation Radio Navigation Aids.

Since the Keyer employs no moving parts it has a very high degree of reliability, proven by long term field tests carried out by the Swedish Telecommunications Administration. The Administration is exchanging all old keyers in ILS, VOR, NDB and Locator transmitters for this new solid state device.

Description

The unit is built up on printed circuit boards mounted in a small box easy to install in all common types of transmitters. The output stage is a transistor switch intended for grid or cathode keying of a transmitter tube. The switch is operated by a Morse Code DC pulse train generated by a combination of counter and logic gate circuits. The coding is performed by connecting a number of resistors into the circuit. To set up the code is just as easy as to solve a simple crossword.

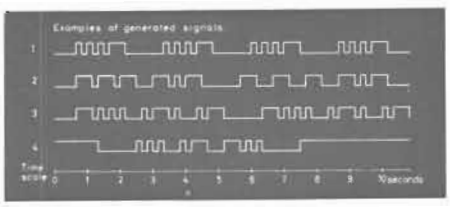
Features

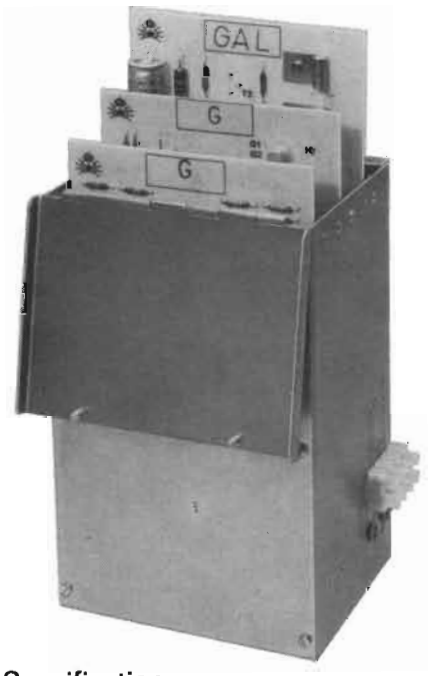
— Fits into all common transmitter types.
— High reliability — no moving parts.
— Adjustable repetition cycle time.
— Codeable for one, two, and three letter International Morse Code combinations — except for the longest, and normally unwanted, three letter combinations.
— For A0/A1 NDB's an extra PC board extends the cycle time to 30 seconds and generates the A0 interval.
— ICAO Standard speed — 7 words per minute.
— Easy to code.
— Easy to change code.
— Easy to install.
— Low power consumption.

Principles of Operation

The counter consists of a chain of bistable flip-flops and has a maximum capacity of 64, by feed-back reduceable to any even number. The counter time-interval unit equals a Morse Code dot at 7 wpm. By inserting resistors in the Code Matrix according to a scheme over the desired signal character the gates in the Logic are activated during the correct intervals of time and the Logic combines the interval signals into a DC pulse train containing also pauses of correct length and — when needed — a continuous 25 second signal for use primarily in A0/A1 NDB's according to ICAO Standard. The combined signal is then fed to the output switch the polarity of which can be selected to suit the circuits of the transmitter in question.

Examples of generated signals:





Specification

Size: H215×W140×D110 millimeters

Weight: 2 kilogram.

Power consumption: 3 W at 220 V 50 Hz.

Word speed: 7 words per minute corresponding to a dot length of app. 180 milliseconds.

Code capacity: 32 time units (lengths of a dot).

Cycle time: Selectable up to maximum 64 time units (= 11 seconds) alternatively fixed 30 seconds.

Magnetic AB
Radar instrument line

MODEL 442

X-Band Radar Check-Out Generator

Where used

Model 442 is a modern approach to the problem of simple, quick, and accurate check-out of range tracking radar receivers. Although originally designed for airborne radars, it can also be used to advantage for ground based fire control radars, rocket tracking radars, etc.

Features

— Portable
— High short-time and long-time stability
— Extremely quick and simple operation
— Well defined pulses
— Built to Mil spec:s for outdoor use

Where to use

— Manufacturers test rooms
— Development laboratories
— Flight-line maintenance
— Depot maintenance
— Central workshops

Principle of operation

Model 442 is principally a pulsed signal generator of high stability in frequency and output power. When triggered by an external signal the generator will transmit a pulsed microwave signal in the frequency band of 8.5—9.6 GHz. The actual frequency, power level, and pulse width are pre-set by the operator and remain stable. Other pulse characteristics are factory adjusted.

A block diagram of the transponder is shown in Fig. 1.

The trigger pulse from the target simulator triggers the pulse generator with a maximum pulse delay of 80 nanoseconds. The pulse generator generates a pulse which can be set to any width in the range of 0.1—1.0 microseconds. This pulse is then shaped in the pulse shaper to match the pulse modulation characteristics of the microwave oscillator. This oscillator has a short and long time frequency stability better than ±1.5 MHz. The oscillator output is a pulsed microwave signal with a peak power of approximately 10 mW. This signal is fed to a level setting attenuator of high stability, which brings the power down to a level in the range of —40 dBm to —70 dBm. The low level signal radiates through a horn antenna with a gain of 10 dB which is pointed in the direction of the radar.

The trigger signal originates from a target simulator which generates trigger pulses with variable pulse distances. In this way the transponder can transmit signals which simulate targets with variable speed and acceleration. The pulse repetition rate is in the range of 1000 to 3000 Hz.

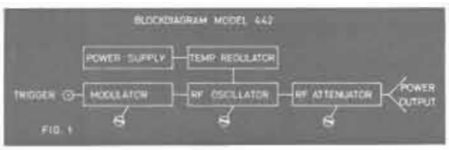


FIG. 1

Description

Model 442 is housed in a strong but light steel cabinet. It is easily portable and weighs only 13 kgs.
The antenna horn is protected by a metal cylinder and a low loss dielectric window. Cable connectors and power switch are mounted on a small recessed panel at the back. In a typical check-out arrangement the instrument is placed in the rear of a metal screen with the antenna horn penetrating the screen pointing in the direction of the radar at 30 feet distance. The instrument can stand ambient temperatures between —30° C and +60°C without loosing its specified accuracy in frequency and power level. The trigger signal is fed from the target simulator via a coaxial cable, type RG55, or equivalent, to a connector at the rear of the instrument. Frequency and output level are adjustable by screw driver controls inside the cabinet.

Specifications

Electrical

Frequency range: 8.5—9.6 GHz continuously tunable by a screw driver control.

Frequency stability: Better than ± 1,5 MHz during six months for temperature variations within the range —30°C to +60°C (—22°F to +140°F) and for power line variations of ±10 %.

Output power: —40 dBm to —70 dBm at antenna horn flange continuously variable by a screw driver control.

Output power stability: Better than 2 dB during six months for temperature variations within the range —30°C to +60°C (—22°F to +140°F) and for power line variations of ±10 %.

Antenna: Linear polarization. Gain 10 dB ±1 dB at 9 GHz.

Trigger: 15V positive pulse. Pulse width 0.5—1 microseconds. Pulse repetition rate 1000—3000 Hz.

Jitter: Better than ±15 nanoseconds.

Pulse width: Adjustable 0.1—1.0 microsecond. Stability ±20 nanoseconds.

Time delay: Less than 80 nanoseconds with a jitter better than ±15 nanoseconds.

Power requirements: 220V ± 10 %, 50 Hz ± 5 %, 70W.

Mechanical

Dimensions: Width 240 mm × Height 200 mm × Depth 350 mm. Weight: 13 kgs.

Environmental: According to DEF 133 or better.

Data subject to change without notice

CAT 442647

Magnetic AB
Radar instrument line

S-Band Radar Check- Out Generator

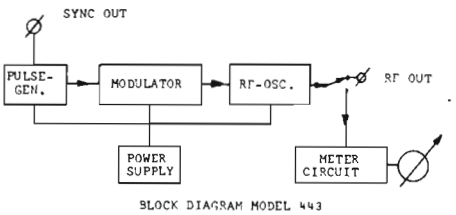
MODEL 443

General

This S-band generator covers the frequency band 2.4—4 GHz. It is primarily designed to meet customer's requirement of a test gear for evaluating radar antenna azimuth accuracy.
The generator with a test antenna will be placed at a reference point in the neighbourhood of the radar antenna under test. As the generator has high frequency stability and output power accuracy, it can be used as an aid for antenna diagram evaluations when testing lobewidth, sidelobes, etc. It is also an excellent tool in laboratories, production test lines and elsewhere, where a highly stable S-band generator is required.

Description

The instrument is fully transistorized with except for the klystron. The frequency is adjustable with an internal control and an output attenuator together with a calibration meter enable output power calibration. A built in ferrite isolator protects the klystron from mismatch and the generator can be used in systems with an VSWR of 1.3. By means of a calibrated potentiometer the repitition rate of the RF-pulses can be set to any value within the range 200—2000 Hz. A negative output trigger 0.1—3 μs ahead of the RF-pulse is available on the front panel. All circuits are fed from an extremely well stabilized power supply for connection to 220 V, 50—60 Hz.



BLOCK DIAGRAM MODEL 443

Specifications

Frequency range: 2.4—4 GHz, adjustable with internal screws
Frequency stability: ± 1 MHz after 15 min heating (normal environment)
Output power: 40 mW, min.
Output power accuracy: Calibrated output power ± 0.5 dB
VSWR: 1.3 max.
Modulation: Pulse modulated
Pulse length: Fixed within the range 0.5—10 μs (adjustable min: max = 1:2 with internal control).
Pulse frequency: 200—20000 Hz, other ranges on request
Pulse frequency accuracy: ± 50 Hz
RF pulse rise and fall time: Max 0.2 μs
Overshoot (square law detection): Max 10 %
Unintentional frequency modulation: Max 100 kHz
Trigger output: min 3 V negative over 50 kohm in parallel with 500 pF
Trigger timing: 0.1—3 μs ahead of RF-pulse
Trigger pulselength: 0.5—1.5 μs
Mains: 220 V ± 10 %, 50—60 Hz
Power consumption: 50 VA
Dimensions: W 370 × H 200 × D 300 mm
Weight: **13.5 kg**

GÄRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN **Magnetic AB**

CAT 443669

Magnetic AB
Radar instrument line

MODEL 715

Radar Blocking Receiver

Where used

This instrument is designed on customer's requirement. It can be used for many applications but mainly it is designed to be used for blocking your own microwave system during the time when RF-pulses from a radar station operating in the vicinity are received. This blocking is made to avoid interference and disturbance.

The equipment is tunable within respective S-, C- and X-band and have very high sensitivity. The output pulse can be delayed and the length and amplitude varied within a wide range to fit any system.

Each band is built up as a separate sub-receiver and can consequently be delivered separately on request.

The receiver is intended for shipborne and land mobile use and fulfils environmental requirements as per DEF 133 N1 and L1. Guaranteed MTBF is 7500 hours.

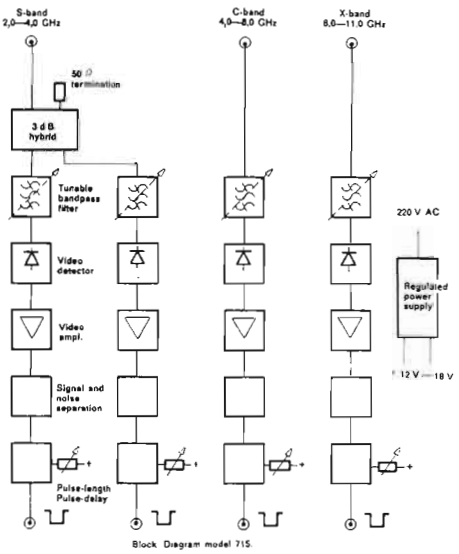
Description

Model 715 is designed to fulfil the most stringent requirements on performance and reability. The different units in the instrument are consequently built up with integrated circuits and semiconductors and incorporates the latest design technology. It is built by four separate sub-receivers. Two of these are used for S-band and are combined by means of a 3 dB hybrid. The other two are used for C- respectively X-band. Other combinations of bands are also available.

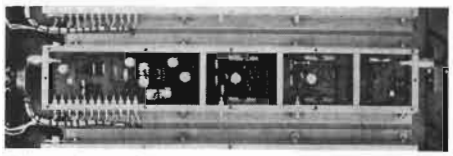
Each receiver has a tunable precision band pass filter followed by a video detector with extremely high sensitivity. The input of the video stage is also designed for extremely low noise generation thereby enable the high sensitivity (Tangential Signal Sensitivity better than -50 dBm). A two stage video amplifier will follow the detector and thereafter signal and noise separation, pulse length and delay output circuits.

A common, well regulated, power supply is used for connection to 220 V, 50/60 Hz. The instrument is a compact unit with a 19" standard panel, 222 mm high and 520 mm behind the panel. Mounted on the panel are separate controls for pulse delay, pulse length and output level on each sub-receiver. The input connectors are of type N and the output connectors of type BNC.

Block diagram for model 715 will be found below.



Block Diagram model 715.



Sub-receiver unit

Specifications

Frequency ranges: 2.0—4.0 GHz (2 Rx) *) 4.0—8.0 GHz *) 8.0—11.0 GHz *)

Sensitivity: -43 dBm (dynamic range 60 dB) The receiver video bandwidth is optimized for 1 μs pulse width.

Pass band: (filter bandwidth)
At 3 dB point less than 1 %
At 28 dB point less than 5 %

Output blocking pulse:

Polarity: Negative

Rise time: less than 0.3 μs

Amplitude: Continuously variable from 0—17 V into 50 ohm.

Pulse width: Continuously variable 5 to 60 μs. *)

Delay: Continuously variable 300 to 5000 μs from the received signal. *)

Long Term Stability: 1‰ per hour or 1 μs whichever is larger.

Temperature Stability: Within the temperature range 15°—35°C with resp. to 25°C. Max 5‰ or 5 μs whichever is larger.

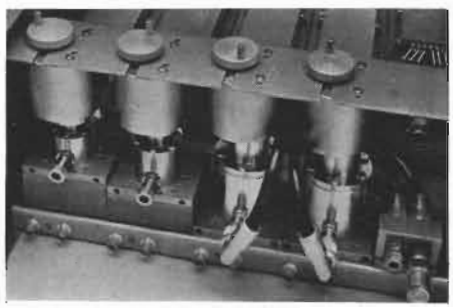
Within the temperature range 0—15°C and 35—50°C with resp. to 15°C and 35°C. Max 2 % or 20 μs whichever is larger.

Environmental conditions: According to DEF 133 N1 and L1.

Dimensions: L 482 × H 222 × D 520 mm

Weight: 18 kg

*) May be changed upon costomer's request.



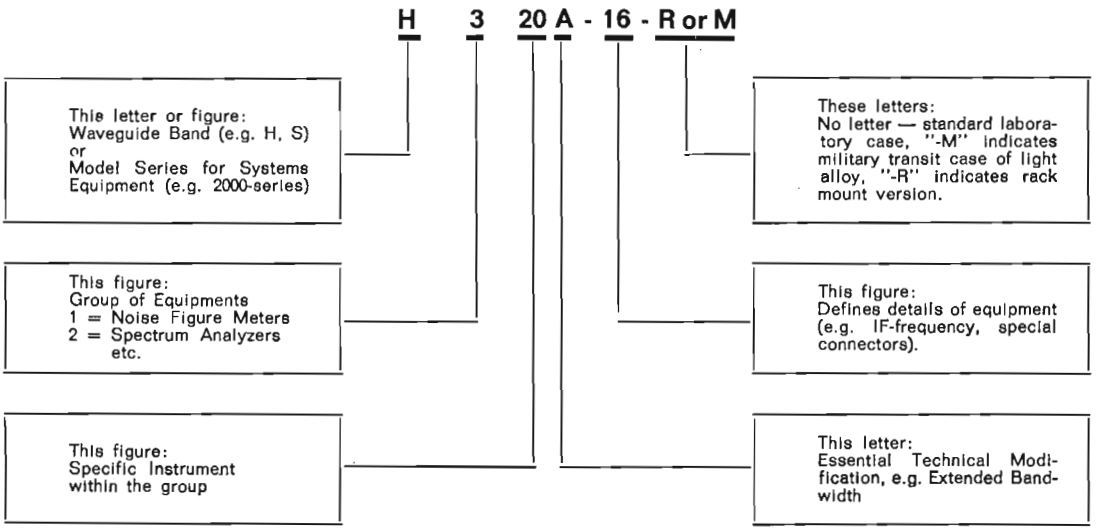
The bandpass filters

Magnetic AB GÄRDSFOGDEVÄGEN 18,
BOX 11060, 161 11 BROMMA, SWEDEN

CAT 715669

How to order

Please direct your inquiries and order to the Sales Office of your territory. A list of Sales Offices are found at the back cover. Specify the catalog model number and name of instrument desired. Do not forget to include all essentail details as IF-frequency, waveguide, flanges etc. Magnetic AB model numbering system has been set up as follows.



Guarantee

Magnetic AB guarantees each equipment and component of its manufacture to be free from defects in material and workmanship for a period of 12 months. Our obligation under this guarantee is limited to servicing or adjusting any instrument returned to our factory for that purpose and to making good at our factory and parts thereof — except tubes, fuses, batteries, semiconductors and bolometers — which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid and which, upon examination by us shall appear to have been thus defective, providing misuse or malhandling can not be proved.

Repairs

When returning instruments or components for repair, or for any other reason, please contact the company for shipping instructions. To expedite repair service, it is very important to provide **type number, serial number,** and a **detailed description of the reason for the return of the instrument.**

Sales and Service Representatives

ANGOLA
Telectra-Empresa Técnica de
Equipamentos Eléctricos, SARI
Rua de Barbosa Rodriques, 42-1º
P.O. Box 6487
Luanda-Angola
(Portuguese West Africa)

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469—475 Kent Street
Sydney, N.S.W.

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Koamicho, Chou-Ku
Tokyo

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Odd Tvedt & Co. A.s.
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Bergen

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Juanacatlan 15 Mexico II DF

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Lisbos 1

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Atalo Ingenieores
Enrique Larreta 12
Madrid 16

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Triad International
Marketing Co. S.A.L.
P.O. Box 4884
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Cable: Magnetic, Stockholm
Telex: 19037

LAYOUT: ROLAND THELESKOG/ TRYCKERI BALDER AB 80499

För distr. utomlands