marconi instruments

Instruments Catalogue 1985

Instruments Catalogue 1985

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NATO Catalogue Numbers

(Marconi instruments in this Catalogue which have been allocated NATO Stock Numbers.)

Note
Codification is a continual process, and while every effort has been made to provide a complete list, it may not be exhaustive, since our products are under continuous consideration for use by the armed services.

For further information please contact the:
Military Sales Department,
Marconi Instruments Limited, St. Albans.

Marconi Type No.	*Military Designation*	*NATO Cat. No.*
893B	Wattmeter Absorption Audio Frequency (Navy)	6625-99-541-2891
2000	Oscillator Audio Frequency (RAF)	5845-99-923-7246
2005R	Signal Generator Assembly (RAF)	6625-99-952-0447
2090B	White Noise Test Set (Army)	6625-99-117-6778
2091B	Noise Generator	6625-99-118-3447
2092B	Noise Receiver	6625-99-118-3448
2163S	Attenuator Variable CT 553 (Navy)	6625-99-519-9976
2304	Automatic Modulation Meter (Norwegian Army)	6625-25-126-7640
2305	Modulation Meter	6625-99-46-5601
2370	Analyser Set Spectrum CT 571/11 (Navy & RAF)	6625-99-529-1124
2373	Frequency Extender (Navy)	6625-99-543-1640
2374	Probe, Zero Loss (Navy & RAF)	6625-99-651-6380
2438	Universal Counter Timer	6625-99-966-3987
2700	Impedance Bridge	6625-99-104-3861
2952	Test Set Radio Telephone (RAF)	6625-12-173-8093

Microwave Equipment

Marconi Type No.	*Military Designation*	*NATO Cat. No.*
6000/3	Broadband Crystal Detector SF (WG 16)	5840-99-115-5826
6002/1	Coaxial Crystal Detector I/P Plug Type N	4935-99-223-3268
	When fitted with CV 2154	5820-99-450-6925
	When fitted with CV 2155	5820-99-652-1657
6003/3	Crystal Detector SF (WG 16)	5985-99-194-5527
6005/4	Short Circuit SF (WG 16)	6625-99-636-0383
6006/2	Stub Tuner SF (WG 16)	5840-99-450-6983
6019/2	Calibrated Attenuator Grade 2 SF (WG 18)	5985-99-633-1676
6019/4	Calibrated Attenuator Grade 2 SF (WG 16)	5985-99-195-6170
6020/4	Variable Attenuator SF (WG 16)	5985-99-537-8152
6021/5	Pre-set Attenuator SF (WG 16)	5985-99-144-7577
6025/2	'E' Bend SF (WG 18)	5940-99-195-6148
6026/2	WG Bend H Plane 90° SF (WG 18)	5985-99-656-3862
6030A/8	Multi-hole Directional Coupler, 3 dB, SF (WG 16)	5985-99-654-0820
6030A/10	Multi-hole Directional Coupler 10 dB, SF (WG 16)	5985-99-648-6106
6032/2	Short Matched Termination SF (WG 16)	5985-99-527-1086
6032/4	Short Matched Termination SF (WG 15)	5985-99-450-6939
6033/3	Broadband Isolator SF (WG 16)	6625-99-450-6982
6036/4	Waveguide Horn SF (WG 16)	5985-99-119-1016
6037/1	Coaxial To Waveguide Transformer SF (WG 18)	5950-99-924-3518
6037/2	Coaxial to Waveguide Transformer RF (WG 16)	5985-99-914-6933
6037/3	Coaxial to Waveguide Transformer SF (WG 16)	5985-99-521-4633
6037/5	Coaxial to Waveguide Transformer RF (WG 14)	5985-99-142-7799 or 5985-99-618-0425
6037/6	Coaxial to Waveguide Transformer RF (WG 12)	5985-99-195-5487
6037/7	Coaxial to Waveguide Transformer RF (WG 10)	5985-99-105-0860
6052/3	Rotary Vane Attenuator SF (WG 16)	5985-99-111-5210
6055B	Signal Source Freq. Range 850-2150 MHz	6625-99-634-7528
6056B	Signal Source Freq. Range 2·0–4·0 GHz	6625-99-647-8175
6058B	Signal Source Special Freq. Range 8.0–12.5 GHz	6625-99-529-2952
6059A	Signal Source Special Freq. Range 12.0–18 GHz	6625-99-529-2951
6060	Wideband Detector Freq. Range 10 MHz–12·4 GHz	5820-99-523-6335
6061A	Gunn Diode Oscillator Freq. Range 8·0 to 12·5 GHz	6625-99-651-7153
6237/1	Transformer WG to Coaxial 12·4–18 GHz (WG 18)	5985-99-637-9587
6237/3	Transformer WG to Coaxial 8·0–12·4 GHz (WG 16)	5985-99-637-9585
6420	Coaxial tft Head 0·01 to 12·4 GHz	6625-99-639-4339
6422	Coaxial tft Head 0·01 to 12·4 GHz	6625-99-758-1616
6423	Coaxial tft Head 0·01 to 12·4 GHz	6625-99-642-2903
6426	WG tft Head, 10 mW	6625-99-639-4338
6440N/I	tft Power Head, 10 mW	6625-99-637-9584

NATO Catalogue Numbers

Marconi Type No.	*Military Designation*	*NATO Cat. No.*
6440N/I	tft Power Head, 10mW	6625-99-643-8693
6460S	Complete tft Power Meter System consists of: Power Meter Type 3888-001 complete	6625-99-643-8689
	with Case and Storage covers 3888-002	6625-99-637-9583
	Including: Mains Lead, 3 m long Part No. 2400-035;	5995-99-637-9586
	20 dB Coaxial Attenuator, Type 6534/4	5905-99-520-8780
	tft Power Head, Type 6440 N/1	6625-99-643-8693
	Coaxial-to-Waveguide Transformer, 12·4 to 18 GHz Type 6237/1	5985-99-637-9587
	Battery Pack, Part No. 2200-186	6140-99-649-4905
CT 596	Complete Wattmeter Absorption	6625-99-637-9519
	Consists of: Power Meter Type 3888-001 complete with Case and Storage Covers 3888-002	6625-99-637-9583
	Including: Mains Lead, 3 m long, Part No. 2400-035	5995-99-637-9586
	20 dB Coaxial Attenuator, Type 6534/4	5905-99-520-8780
	tft Power Head, Type 6440N	6625-99-637-9584
	Coaxial-to-Waveguide Transformer, 3·8 to 12·4 GHz Type 6237/3	5985-99-649-4905
	Optional extra: Battery Pack, Part No. 2200-186	6140-99-649-4905
6460N	Wattmeter Set (Navy Version)	6625-99-541-6389
	Comprising: Power Meter Type 3888-001 complete with Case and Storage Covers 3888-002	6625-99-637-9583
	Including: Mains Lead, 3 m long, Part No. 2400-035	5995-99-637-9586

Marconi Type No.	*Military Designation*	*NATO Cat. No.*
	20 dB Coaxial Attenuator, Type 6534/4	5905-99-520-8780
	tft Power Head, Type 6440N	6625-99-637-9584
	Coaxial-to-Waveguide Transformer, 12 to 18 GHz, Type 6237/1	5985-99-637-9587
	1 set fuses, 160 mA	5920-99-956-1504
	Operators booklet	
6478	Flange Adapter Square to Round (WG 16)	5985-99-638-5899
6478/1	Flange Adapter Square to Square (WG 16)	6625-99-636-0384
6531/1	Precision Fixed Coaxial Attenuator 3 dB	1430-99-522-6443
6531/2	Precision Fixed Coaxial Attenuator 6 dB	5840-99-523-1088
6531/3	Precision Fixed Coaxial Attenuator 10 dB	5905-99-223-4026
6531/4	Precision Fixed Coaxial Attenuator 20 dB	1430-99-522-6445
6531/5	Precision Fixed Coaxial Attenuator 30 dB	5905-99-112-8669
6531/6	Precision Fixed Coaxial Attenuator 40 dB	5985-99-119-1980
6533/1	Precision Coaxial Termination DC–12·4 GHz	5935-99-450-6974 or 5935-99-523-6333
6533/2	Precision Coaxial Termination DC–12·4 GHz	5935-99-450-6975
6534/1	Precision Fixed Coaxial Attenuator 3 dB	5905-99-111-3095
6534/2	Precision Fixed Coaxial Attenuator 6 dB	6625-99-111-3096
6534/3	Precision Fixed Coaxial Attenuator 10 dB	5985-99-525-6902
6534/4	Precision Fixed Coaxial Attenuator 20 dB	5905-99-520-8780
6587	Levelling Amplifier	6695-99-0408
6599/2	Educational Test Bench SF (WG 16)	6625-99-111-2592

The Testing World of Marconi Instruments

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Marconi Instruments lives in the testing world of electronics and communications. Where speed, accuracy and reliability are vital watchwords. Where production standards need to be kept at a constant pitch through modern instrumentation and automatic test equipment. This is a world where Marconi Instruments excels: developing, calibrating and servicing innovative instruments, automatic test equipment, computer aided engineering systems, electronic warfare support systems and trainers and simulators.

Pioneering Past

Marconi Instruments has been in the forefront of electronic measurement since it was founded nearly 50 years ago. As its name suggests, the company owes its origin to the "Father of Radio", Guglielmo Marconi, and has maintained his pioneering, inventive spirit since the start.

Progressive Present

Marconi Instruments has grown into the largest European manufacturer of test and measurement equipment, employing nearly 3000 people in 11 locations in the UK, France, Germany and the USA. Its current turnover is approaching £100 million with a high level of re-investment for research and development to ensure its competitive edge in the forefront of technology.

It is part of Britain's largest electrical and electronics company, the General Electric Company p.l.c., forming part of a multi-billion pound organisation producing goods as diverse as power stations, consumer appliances, and sophisticated aircraft electronics. This gives it access to key corporate research and financial resources.

An example of the resources it can call upon is its access to GEC's prestigious Hirst Research Centre at Wembley where current activities include studies of large-scale integrated circuits, microwave devices, materials science and optical communications. It also has a research facility for computer-aided engineering and automatic testing in the Marconi Research Centre near Chelmsford. Customers can thus continue to have access to the most advanced, proven technology from Marconi Instruments.

Marconi Instruments has five sites in the UK each offering unrivalled facilities for their specialized work.

Sophisticated production and test facilities at Marconi Instruments' plants make use of latest manufacturing techniques.

St. Albans

The main plant at the St. Albans headquarters, about 20 miles north of London, houses the Instruments Division, with its comprehensive facilities for developing and manufacturing a wide range of test equipment for radio communications, television and telecommunications applications. In addition, a second St. Albans plant houses the automatic test equipment facility. This develops complex modern systems for board, in-circuit and functional ATE systems for production testing and maintenance of printed circuit boards (p.c.b.'s).

Stevenage

A specialist Microwave Products facility is located about ten miles north of St. Albans. It has modern, well-equipped facilities for original design development and production work – for microwave instruments, components and sub-systems. The plant here is capable of functioning at the highest levels of demand for both commercial and government customers.

Donibristle

At Donibristle, near Edinburgh, Scotland, Marconi Instruments has a comprehensive array of research, development, design and production capabilities for supplying trainers and simulators, functional automatic test equipment, systems for electronic warfare support and Special Test equipment for military and commercial applications.

One particular skill here is the ability to perform complex project management for multi-disciplinary projects. Such skills are vital in handling the complexities of large and fixed price projects, particularly when outside companies or sub-contractors are involved.

Ferndown

The company's computer aided engineering division is based in Ferndown, Dorset. Its advanced computerized facilities for ATE and CAD/CAM combine with a highly technically trained workforce to manufacture sophisticated equipment for computer-aided design and manufacture, plotting and drafting.

Current work involves integration of the electronic CAD capabilities on this site with complementary capabilities in the ATE Division.

Luton

Over 120 specialist staff based in up-to-date facilities at Luton are engaged in the servicing and maintenance of test equipment, not only from Marconi Instruments, but also from other manufacturers. The site also houses full training facilities for this important work.

People

As befits such a high-technology company, Marconi Instruments employs a large proportion of graduate engineers: forming one sixth of the 3000 staff. This high level of expertise helps us to continue developing and supporting innovative products for this rapidly moving field.

Training for staff, distributors and customers forms an important part of Marconi Instruments philosophy.

Standards and Calibration

Comprehensive calibration facil-

ities, traceable to national and international standards, ensure that equipment from Marconi Instruments meets the highest possible requirements for accuracy in both production and measurement. These facilities include Measurement Standards Laboratories, which are maintained at St. Albans, Stevenage, Luton and Donibristle.

The laboratories at St. Albans, Stevenage and Luton are approved by the British Calibration Service (BCS), and they are subject to their rigorous controls and monitoring procedures. The BCS lays down exact definitions for the laboratory environment and all measurement methods and procedures are approved and monitored by the BCS. Measurement Standards are traceable to the UK National Physical Laboratory, with its world-wide reputation for excellence in measurement. Calibration work can also be carried out to defence standards such as the British DEF STAN 05-26/2.

Quality Assurance

Marconi Instruments follows the highest manufacturing standards in terms of quality assurance, and production is carried out to British DEF STAN 05-21.

Service Division

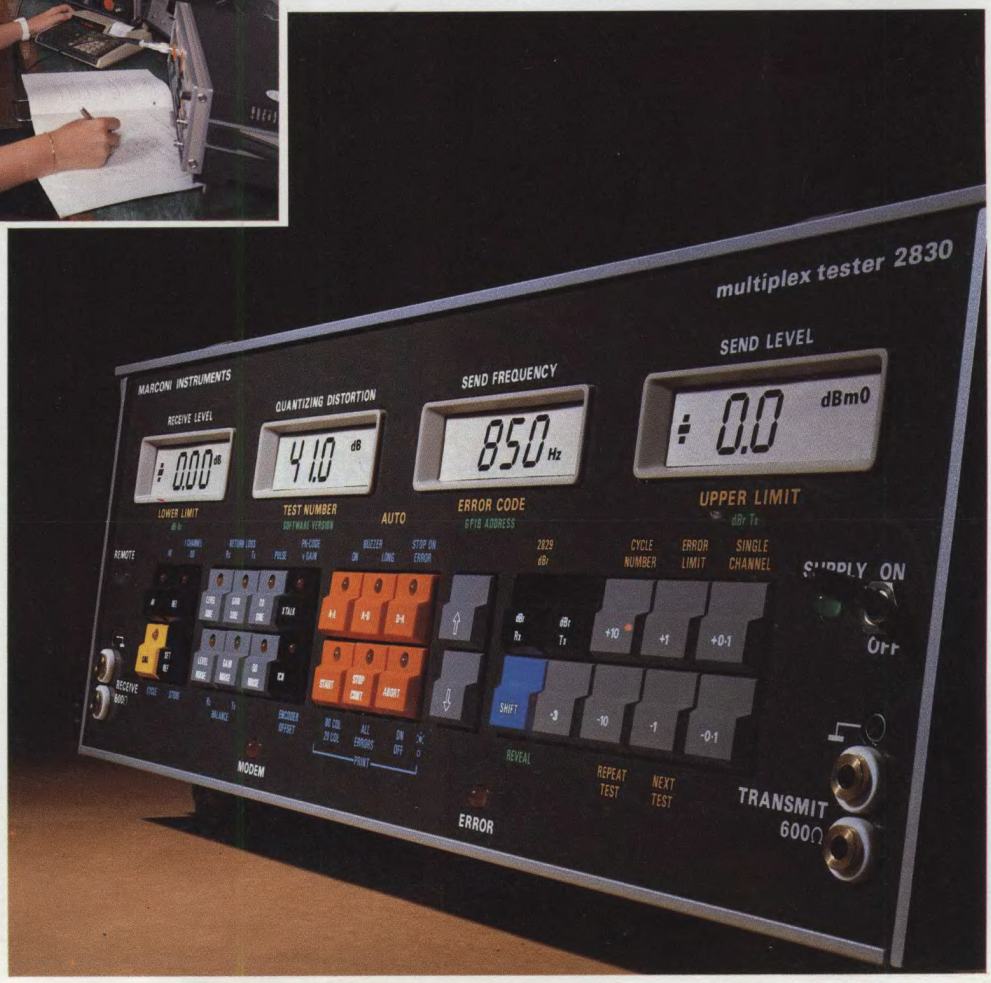
The Service Division based at Luton Airport and also at Donibristle operates on the principle that no customer should ever be simply sold a product; the sale is backed up by world-wide service and maintenance throughout the life of the equipment, through distributors in over 70 countries. Servicing is carried out with speed and efficiency, not only on our own products, but also on other manufacturers' test equipment. The specialist staff can undertake work from the simplest calibration to the most complete overhaul.

The Service Division plays a full part in the Company's training activities, teaching service technicians from all over the world how to maintain our equipment.

Exports

38% of Marconi Instruments' sales go to export markets, which includes nearly half the output of the Instruments Division.

Sales and service facilities are also available from associated companies and sales offices in a further 70 countries world-wide; from Abu Dhabi to Zimbabwe, from arctic Canada to the desert of Qatar.



High calibration standards are built into advanced instrumentation.

Instruments

Marconi Instruments makes advanced, cost-effective, test and measurement instrumentation for wide application in the radio and telecommunications industries.

For design and type approval, instruments are designed to be accurate and versatile; for production they offer speed of operation, reliability and ease-of-use, and for service and maintenance they provide rugged reliability at low cost.

The range includes signal generators and radio test sets, oscillators, modulation meters, counter-timers and frequency meters, spectrum and network analyzers, power meters, white noise test sets, digital error rate monitors, p.c.m. multiplex testers, line monitors and general measuring equipment.

It is a range that continues to expand into new applications and grow in breadth as new instruments are developed for these sophisticated markets.

Automatic Test Equipment

Marconi Instruments manufactures a series of automatic test systems, all designed to speed the test and location of production faults on electronic equipment. This equipment ranges from the simplest of electronic assemblies to the latest in complex, high density, high technology printed circuit boards. To provide a total capability, systems employing both 'In-Circuit' and 'Functional' techniques are manufactured by Marconi Instruments.

In-Circuit Testing System 80

The 'System 80' consists of three in-circuit systems all compatible with each other and using a common test language 'INCITE'.

Further expansion and upgrade ability is provided for by the provision of networking facilities and common software. System 80 provides full characterization of analog, digital, hybrid circuits on printed circuit boards.

It is designed for ease of use by the operator and for simple incorporation into a production environment. Its high reliability reflects its importance as a production tool.

The software, an important element of any successful test automation programme, is based on Marconi 'INCITE' language. This is a high level language specifically developed for automatic test systems, designed to make short work of in-circuit testing and to minimize programming effort.

Functional Testing

In addition to its range of in-circuit testers, Marconi also manufactures functional testers that are second to none.

The System 8060 will characterize even the most complex and sophisticated of today's electronic assemblies. The testing of analog and digital electronics is simplified

Automatic test systems 80X and 8080 speed the test and location of production faults on electronics.

CAD/CAM systems from Marconi Instruments include the Quadrant 2 drafting equipment and the Emma 80 photoplotter.

by the use of 'CLIMATE' our software language designed to simplify the programming task of functional test systems. This enables programs to be written by test engineers rather than software specialists, and leads the way for 'CLIMATE' to halve the normal cost of programming, verifying and debugging on system using languages such as ATLAS.

System 8080 is a functional ATE system, purpose-built to test the extremes of board complexity found with today's VLSI and microprocessor circuits. With the in-built ability to generate up to one million test patterns, 8080 is designed to cope with the test demands of the future as well as the present. 8080 is the world's first ATE system to take advantage of 'scan design techniques' which are currently employed by the designers of complex digital devices to aid the testing of tomorrow's components.

To minimize integration time Marconi offers a complete package of ATE including hardware, software and systems engineering. We will even program your boards and design and build custom made fixtures.

Trinet

Today's growth industry is communications, and Marconi Instruments' ATE systems are no exception to this trend. By the use of Trinet (a three-layer networking system) the testers can communicate to enhance production and management efficiency.

At level one 'Trinet' enables ATE systems to share common plant resources such as computer-aided repair facilities. The Marconi Computer Aided Repair (CAR) facility utilizes fault data from the test systems via the network link, together with pre-programmed details of the board layout, to highlight pictorially exactly where a fault is located on the board. CAR also collates a fault and repair listing of each board, important to control 'rogue samples'.

With the real-time fault analysis software, production test reports, fault lists and data statistics can be instantly displayed on a manager's colour display, as well as providing the normal printed copy.

At the second level, Trinet brings ATE into the 'factory of the future'. It provides the link to integrate CAD, CAM and robotics into a local area network. The provision of 'CADlink' software enables CAD systems to download design data directly to the board test and repair facilities, minimizing duplication of effort and eliminating errors when producing test programs.

At level three Trinet provides global communications via the X.25 gateway to plants or offices spread world-wide.

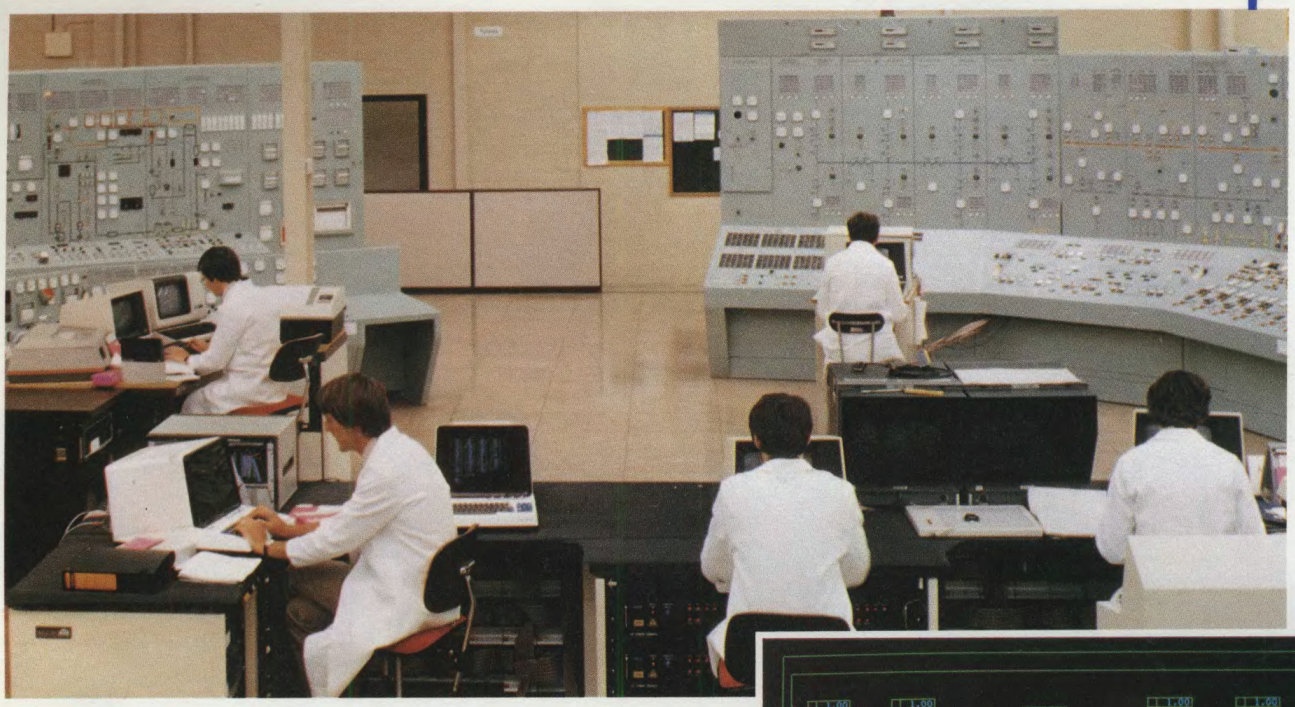
Fixturefast

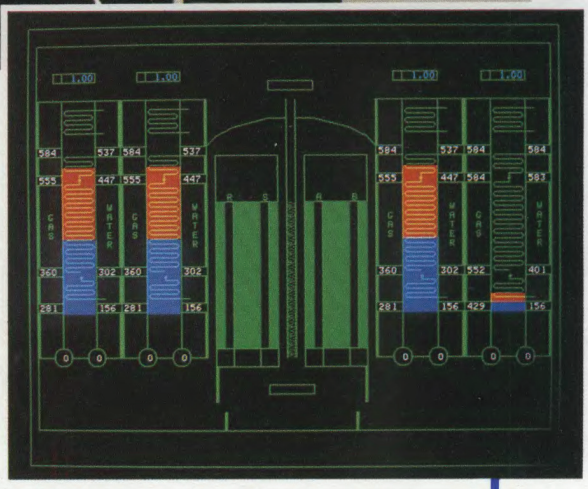
An integral part of Marconi Instruments' ATE facilities is the supply of custom made fixtures. A range of kits is available for the customer who wishes to drill and wire his own fixtures, or alternatively Marconi offers a complete fixture customizing service with a very rapid turnaround. This is based on advanced computerized techniques and is called Fixture-Fast.

This service is just part of Marconi Instruments' total solution to your printed circuit test problems.

CAD/CAM Systems

It is not only in test and measurement that the electronics industry is reaping the benefits of Marconi's computer-based automation. In design and manufacture, too, computerized methods bring increased throughput and effi-





Trainers and simulators are used in critical areas such as nuclear power station operation.

ciency; lowering lead times and reducing production costs. And there is significant logic in combining test functions with CAD/CAM systems to avoid duplication of effort. That is the logic behind Marconi Instruments' CAE facility, providing leading-edge products in computer-aided engineering.

In addition to sophisticated work stations for computer-aided design and manufacture, the Division supplies intelligent drafting and plotting peripherals, high-resolution digitizers and fast data storage equipment. It also offers the necessary software to suit customers' requirements. The work stations feature an easy-to-use ergonomic design based on advanced research using computer-based analysis methods.

The addition of CAM outputs on CAD equipment means that results from computer-aided design can be used in manufacturing, so building into a fully automated 'factory of the future'. This capability is extended even further by CADlink, the TRINET software that allows CAD information to be used by Marconi Instruments' testers in production applications.

Trainers and Simulators

The Trainers and Simulators Division has immense experience in building simulation equipment, so it can offer an unrivalled level of expertise to solve a variety of problems in training and simulation.

The Trainers and Simulators Division is engaged in the design, development and manufacture of training equipment for a wide range of complex applications. A large dedicated workforce specializes in:–

- mathematical modelling
- real-time computing on both microcomputers and mainframes
- the use of multi-computer configurations
- design and manufacture of general and special purpose interfaces
- translation of trainer requirements into representative training or simulation systems
- production of feasibility studies for the customer
- carrying out system definition studies and preparing proposals for simulators
- provision of turnkey systems – complete packages of hardware and software – to customer's specifications.

Simulators created by Marconi Instruments have found applications in many commercial and military fields.

- Power plant control room trainers are used for nuclear power stations, where it would be too costly or risky to provide training on real systems.
- The full ASW Nimrod aircraft mission simulator can re-create, with a high degree of realism, the environmental and tactical operations encountered by a tactical air crew during a mission.
- The Master Driver trainer covers all aspects of railway driving operation, including the safe driving procedures, fuel efficient driving procedures, route familiarisation and all normal and emergency procedures. The trainer has a revol-

utionary visual system, together with realistic sound effects and cab controls that have an authentic feel. Unrivalled flexibility ensures that the trainer can be configured for any network or type of train.

Interactive video systems provide highly cost effective methods of training. Interactive video is a combination of computer-based training, video training, and simulation. It utilises videodiscs, microcomputers, colour graphics and sophisticated human interface. Applications of interactive video systems include basic academic training, equipment operation and procedures, and advanced and skill development training. This method of training is coupled with ease of use by means of Marconi's authoring systems.

Special Test Projects

The Special Test Projects Division has over 17 years experience in test systems, including requirement analysis, system development, production and after-sales support.

It is the extensive range of resources available at Donibristle that gives Special Test Projects its unique capability in supplying Automatic Test Systems to meet customer's own requirements. The Division has some 200 engineers and technical staff working on these requirements, and can also call on further know-how for specific test projects from the various system companies within Marconi and the total GEC group.

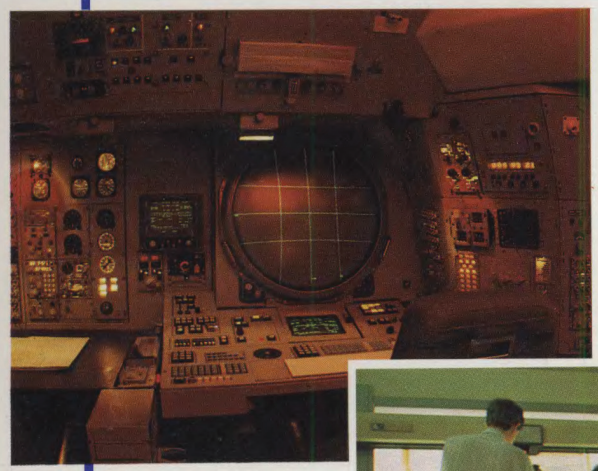
The hardware is based on products from Marconi Instruments, together with other computer and instrumentation suppliers as appropriate to the application. Systems use the successful CLIMATE software, developed in-house for functional testing.

The main strength of Special Projects is its background in the defence electronics industry. The unit has executed projects for testing an extensive variety of military hardware: including battle tank electronics, airborne radar and advanced lightweight torpedoes. Civilian projects include ATE's for high volume testing of p.c.m. systems and p.c.b.'s for the telecommunications industry.

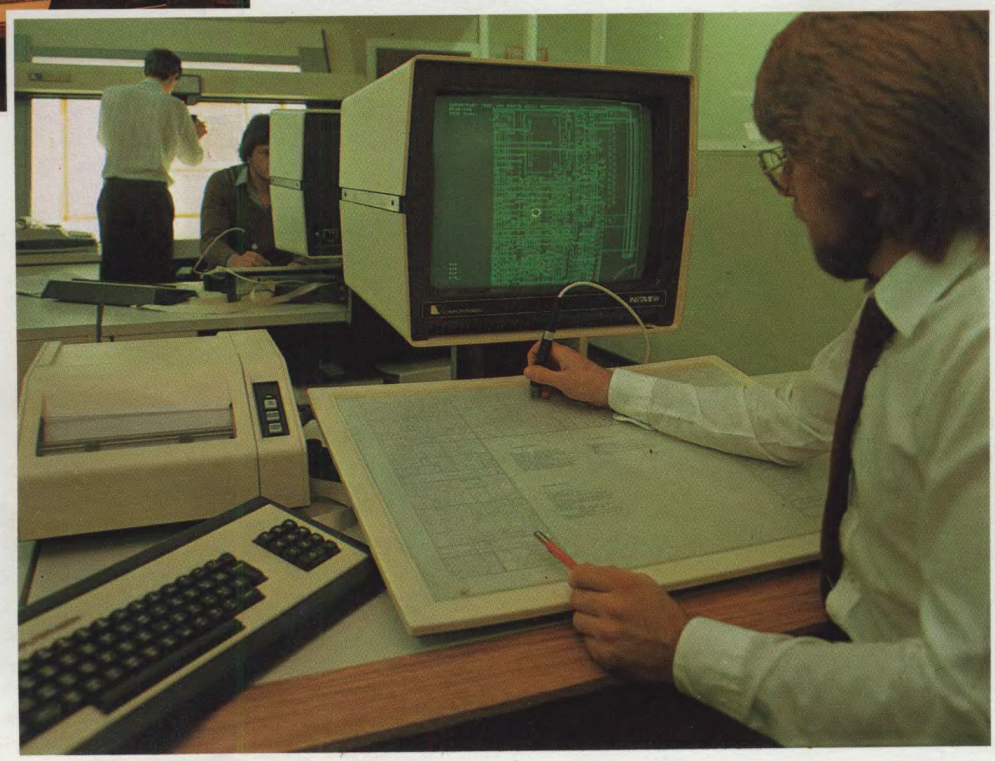
A typical ATE project goes through the following stages:—

- early discussion with either the manufacturer of units to be tested, or with the eventual user, to determine the test requirement and depth of test.
- full and detailed analysis of the test problem and the repair/maintenance philosophy required.
- development and production of the required hardware and software.
- delivery of the final product, which often includes ATE hardware, a total software package and special-to-type interfacing hardware.
- full training to allow smooth hand-over of equipment.
- in-service support including development of customer resources for independent support.

All this adds up to total capability in specialized ATE, from project conception to completion.



Sophisticated design methods help in development of advanced test and simulation systems for airborne electronics.



EW Support

The depth of Marconi Instruments' commitment to excellence has ensured that it is among the world's leading suppliers of both test and simulation systems for electronic warfare applications.

This world is one of extremes: signals which cover the spectrum from DC through microwave to daylight, at levels lying anywhere from fractions of a microvolt to lightning strikes, where the security, accuracy, speed and versatility of the electronics systems is of paramount importance and where it is vital that the equipment is tested and maintained to the highest standards.

The EW Division was formed using specialist expertise from both the Special Test Products and Trainer and Simulator Divisions. It has full capability for promoting the security and effectiveness of electronic warfare systems through the definition, development production and software proving stages to operator training and maintenance. In particular it offers:

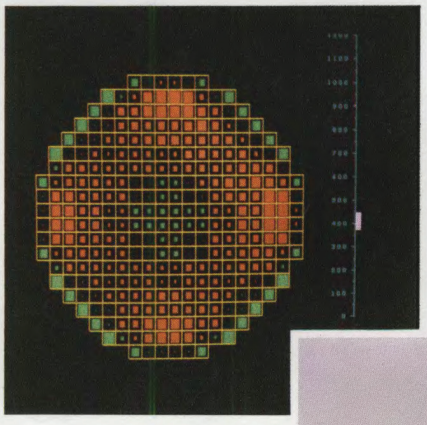
- Specialist expertise in all aspects of EW simulation and related subjects.
- A turnkey service for the supply of test equipment and validation equipment for EW systems.
- Multi emitter microwave scenario generation capability.
- Response analysis instrumentation.

Over 100 personnel, mainly engineers and scientists, are exclusively committed to solving electronic warfare problems and a further 100 or so staff from the centralised resources also provide support to the EW Division.

Examples and Applications

Systems from Marconi Instruments are used by civil and military organisations all over the world.

- The Royal Air Force chose Marconi Instruments' modulation meter for measurements on ILS beacons in the UK, and have subsequently given it a General Purpose status.
- Microwave Scalar Analyzers are used in production and final test of satellite electronics by the French Company Thompson C.S.F.



- The high-capacity in-circuit ATE is applied to production testing of complex circuit boards for super-minicomputer systems by the American manufacturer, Apollo.
- An advanced simulator has been developed for training railway drivers on the subway system of the Korean capital, Seoul.
- CERN, the high-technology European nuclear research centre, uses CAE systems and photoplotters from Marconi Instruments.
- The Canadian Department of Defense purchased Marconi signal generators to test their military communications systems.
- Satellite TV services such as the European "Sky Channel" are among customers for Marconi's pioneering television measurement equipment, which is used in over 50 countries world-wide.
- The RAF chose Marconi Instruments EW Automatic Test and Simulation Systems for Sky Shadow and the Radar Homing Warning Receiver.
- The Australian common carrier uses Marconi Instruments' p.c.m. digital measuring equipment for commissioning new telecommunications links.

Signal Generators

Introduction

Signal Generators

Marconi Instruments' signal generators may be used in a wide range of applications in the l.f., m.f., h.f., v.h.f. and u.h.f. bands and all units provide comprehensive modulation facilities. The comparison table shows the major performance parameters of the different instruments and indicates the typical applications the units should be used in.

A fundamental aspect of signal generator design is the r.f. attenuator which the user relies on for low level measurements on receivers. Marconi Instruments has always attached great importance to attenuator design and in the current range of signal generators many new features have been introduced to maintain the highest possible accuracy. Microprocessor correction of the output level flatness ensures the best possible accuracy and a rigorous test routine, which checks the attenuator pads both singly and in combination, confirms the overall performance qualities.

Production test facilities are frequently compared against reference standards maintained in the company's Standards Laboratory where the precision attenuation measurement system is housed. This system takes the form of a sophisticated piston attenuator unit (developed by the UK National Physical Laboratory) in which the movement of the piston is measured by a laser distance measuring technique and which is capable of an overall resolution of better than 0·001 dB.

Reverse Power Protection

All Marconi generators include reverse power protection as a standard feature to prevent accidental damage to the attenuator when testing transceiver units. The protection takes the form of an in-line relay element which is held in the closed position when the generator is operating normally, but which switches to an open circuit position if power is applied to the output socket. A simple operator reset facility is provided to enable the normal output to be restored when the power source has been disabled, and as a further safety feature the relay automatically relaxes to the open position when the a.c. supply power is removed. Careful design of the in-line components minimizes insertion loss and v.s.w.r. problems and allows excellent overall level accuracy specifications to be maintained.

Non-Volatile Memories

Marconi Instruments has pioneered the use of true non-volatile memories in signal generator design and three of the current generators use these memory devices to retain both user and calibration information. The advantages of storing regularly used instrument settings are realized in faster and simpler everyday operation as they allow the user to quickly call up a set of measurements with only a few key-strokes. This facility is particularly important in equipment used in radio maintenance applications as the user can often store complete details of all the routine tests in the memories. Storing the calibration data in the same non-volatile memory also brings cost-saving benefits as it allows the calibration to be updated without the need to remove the instrument case.

Applications

The traditional applications for signal generators have been in the testing of radio receivers and Marconi generators are well suited to such uses, and include performance features specifically aimed at these important areas. The range of applications is constantly being expanded and the availability of a series of options for the 2018 and 2019 series generators extends their uses into the testing of radar and avionic navigational equipment. Other areas of use include satellite systems where the low carrier noise allows the output frequency of the 2018 or 2019 series to be multiplied up, to act as an input or local oscillator frequency for system testing.

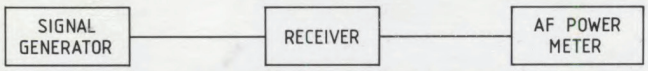
The following are typical receiver measurements.

2022 – a cost effective 10 kHz to 1000 MHz AM/FM Signal Generator for service and maintenance applications.

2019A – 80 kHz to 1040 MHz AM/FM Signal Generator with high performance and simple operation.

SENSITIVITY

The measurement of sensitivity is one of the most important tests that are carried out on receivers as it defines the ability of the receiver to detect weak signals. The basic measurement technique requires a signal generator to provide a low level r.f. signal and an audio power meter with a SINAD ratio measuring capability to determine the receiver output conditions.



Maximum Sensitivity (a.m. receivers)

Definition: The input level required to produce a given receiver output (usually 50 mW) with the receiver set for maximum gain.

Method of Measurement: Modulate the signal generator with 30%a.m. at a modulating frequency of 1 kHz and set the output to the lowest level. Adjust the receiver gain control to maximum and increase the signal generator output until the power meter reads 50 mW.

Noise Limited Sensitivity (broadcast receivers)

Definition: The input level required to produce a 20 dB signal to noise ratio in the receiver output.

Method of Measurement: Modulate the signal generator with a 1 kHz tone to produce 30%a.m. depth for a.m. receivers or 22·5 kHz deviation for f.m. receivers and apply the signal to the receiver. Adjust the receiver gain control for an output of 50 mW and then switch off the modulation. Note the decrease in the receiver output and if necessary adjust the r.f. level until the ratio of the receiver output powers in the modulated and unmodulated conditions is 20 dB.

Noise Limited Sensitivity (narrowband receivers)

Definition: The input level required to produce a 10 dB signal to noise ratio in the receiver output.

Method of Measurement: Modulate the signal generator with a 1 kHz tone to produce 30%a.m. depth for a.m. receivers or a deviation of 60% of the rated system deviation for f.m. receivers and apply the signal to the receiver. Adjust the receiver gain control for an output power of 50% of the rated maximum and then switch off the modulation. Note the decrease in receiver output and if necessary adjust the r.f. level until the ratio of the receiver output powers in the modulated and unmodulated conditions is 10 dB.

Usable Sensitivity (narrowband receivers)

Definition: The input level required to produce a SINAD ratio of 12 dB at the receiver output (SINAD ratio is the ratio of the total output to the output due to noise and distortion).

Method of Measurement: Modulate the signal generator with a 1 kHz tone to produce 30%a.m. depth for a.m. receivers or a deviation of 60% of the rated system deviation for f.m. receivers and apply the signal to the receiver. Adjust the receiver gain control for an output of 50% of the rated maximum and measure the SINAD ratio. Adjust the r.f. level until the SINAD ratio is 12 dB.

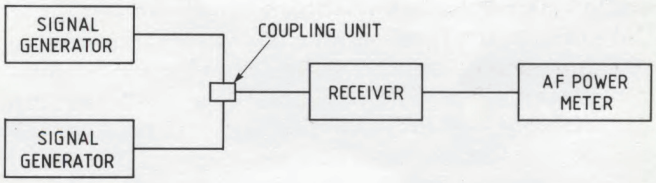
Quieting Sensitivity (f.m. receivers)

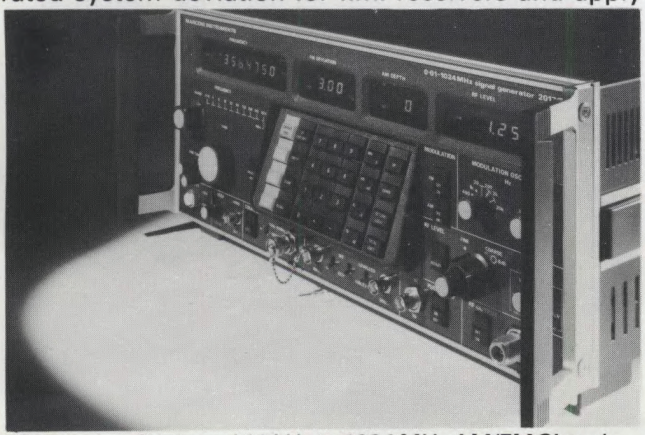
Definition: The unmodulated input level which causes the receiver output noise to fall by 20 dB from the no input condition.

Method of Measurement: In the absence of an input signal adjust the receiver gain control for an output power of 50% of the rated maximum. Apply the unmodulated r.f. signal and adjust the level until the power meter reading is 20 dB below the previous reading.

SELECTIVITY

Selectivity measurements test the ability of the receiver to reject unwanted interfering signals and are an important assessment of the performance in situations where many simultaneous transmissions are likely to be present.



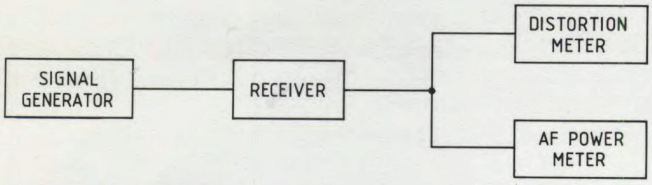


2017 – a cavity-tuned 10 kHz to 1024 MHz AM/FM Signal Generator for stability and low noise.

6812 – a versatile X-band Microwave Signal Generator.

OVERALL PERFORMANCE

Whilst sensitivity and selectivity tests assess the ability of the receiver to detect signals and reject interference, they do not give any guidance on the quality of the receiver output signal. Other measurements must therefore be made to ensure that the received signal has the required level of intelligibility.



Signal to Noise Ratio

Definition: The ratio of the receiver outputs with modulated and unmodulated signals for an r.f. input level of 1 mV.

Method of Measurement: Set the signal generator output to 1 mV and using a 1 kHz tone modulate it to produce 30%a.m. depth for a.m. receivers or a deviation of 60% of the rated system deviation for f.m. receivers. Adjust the receiver gain for an output power of 50% of the rated maximum and then switch off the modulation. The reduction in output power (measured in dB) is the signal to noise ratio.

Audio Frequency Response

Definition: The variation in audio output level with modulating frequency.

Method of Measurement: For a.m. receivers modulate the signal generator with a 1 kHz tone to produce 30% depth and set the output to 1 mV. Adjust the receiver gain control for an output power of 50% of the rated maximum and then vary the modulating frequency and note the variations in output.

For f.m. receivers modulate the signal generator with a 1 kHz tone to produce an f.m. deviation of 20% of the rated system deviation and set the output to 1 mV. Adjust the receiver gain control for an output of 10% of the rated maximum and then vary the modulating frequency and observe the variations in output. Note that for a narrowband f.m. receiver the output will be expected to decrease at a rate of 6 dB/octave as the frequency increases and this should be allowed for when assessing the response.

Harmonic Distortion

Definition: The ratio of the r.m.s. sum of the harmonics present in the receiver output to the fundamental, expressed as a percentage.

Method of Measurement: Modulate the signal generator with a 1 kHz tone to produce 30%a.m. depth for a.m. receivers or a deviation of 60% of the rated system deviation for f.m. receivers and set the output to 1 mV. Adjust the receiver gain control for the required output level (usually between 10 and 50% of the rated maximum) and measure the distortion using a distortion factor meter or a spectrum analyzer.

Adjacent Channel Selectivity

Definition: The ratio of the modulated r.f. signal level in an adjacent channel to that of the wanted signal when a 12 dB SINAD ratio has been degraded to 6 dB.

Method of Measurement: Modulate generator 1 with a 1 kHz tone to produce 30%a.m. depth for a.m. receivers or a deviation of 60% of the rated system deviation for f.m. receivers and tune the generator to the receiver channel frequency. Modulate generator 2 with a 400 Hz tone to the same a.m. depth or f.m. deviation and tune it to the next channel frequency above or below the wanted channel. Set both generators to minimum output and then increase the output of generator 1 to achieve a 12 dB SINAD ratio at the receiver output with an audio output power of 50% of the rated maximum. Increase the output of generator 2 until the SINAD ratio is reduced to 6 dB. The ratio of the two signal generator outputs is equal to the adjacent channel selectivity.

Spurious Response Rejection

Definition: The ratio of the modulated interfering r.f. signal level to that of the wanted signal when a 12 dB SINAD ratio has been reduced to 6 dB.

Method of Measurement: Modulate the two signal generators as for the measurement of adjacent channel selectivity. Increase the r.f. output of generator 1 to achieve a 12 dB SINAD ratio at the receiver output with an audio power output of 50% of the rated maximum. Note the generator level and set the output of generator 2 to be 80 or 90 dB above this level. Adjust the tuning of generator 2 across its full range and note the frequencies at which responses are obtained. Ignore any responses which occur at sub-multiples of the receiver channel frequency and for the remaining responses adjust the r.f. level of generator 2 until the SINAD ratio is equal to 6 dB. The ratio of the two generator output levels is the spurious response rejection.