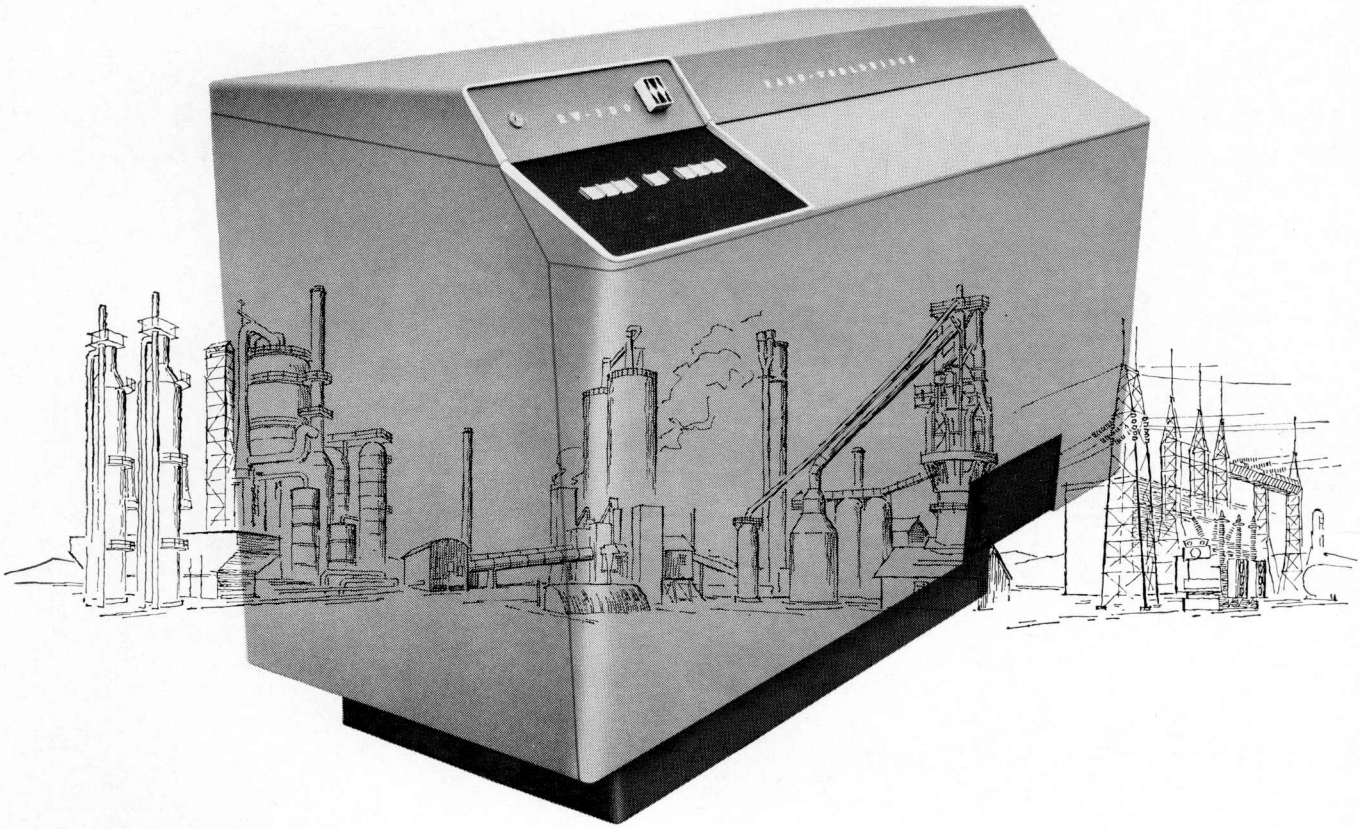
# *In a Class by Itself*

## FOR CLOSED-LOOP CONTROL AND AUTOMATIC DATA REDUCTION



# *The* RW-300

## DIGITAL CONTROL COMPUTER

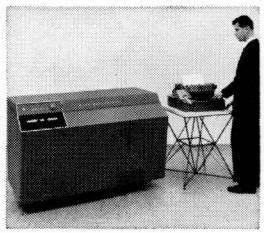
OPERATING SYSTEMS incorporating the RW-300 for on-line control and data reduction are demonstrating these tangible benefits: *reduced costs, increased output, improved quality.*

HIGH RELIABILITY, inherent in the advanced design of the RW-300, is being proven by thousands of hours of dependable operation.

SYSTEMS ENGINEERING staff, experienced in the analysis of complex control and data reduction problems, is assisting industry with applications of the RW-300 in chemical, petroleum, steel, cement, electric power, and other fields.

NATION-WIDE SERVICE organization is providing skilled maintenance for this completely developed, production engineered, and thoroughly tested piece of *industrial* equipment.

For further information, call or write: Director of Marketing, The Thompson-Ramo-Wooldridge Products Company, P.O. Box 90067 Airport Station, Los Angeles 45, California, OSborne 5-4601.



**THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS COMPANY**

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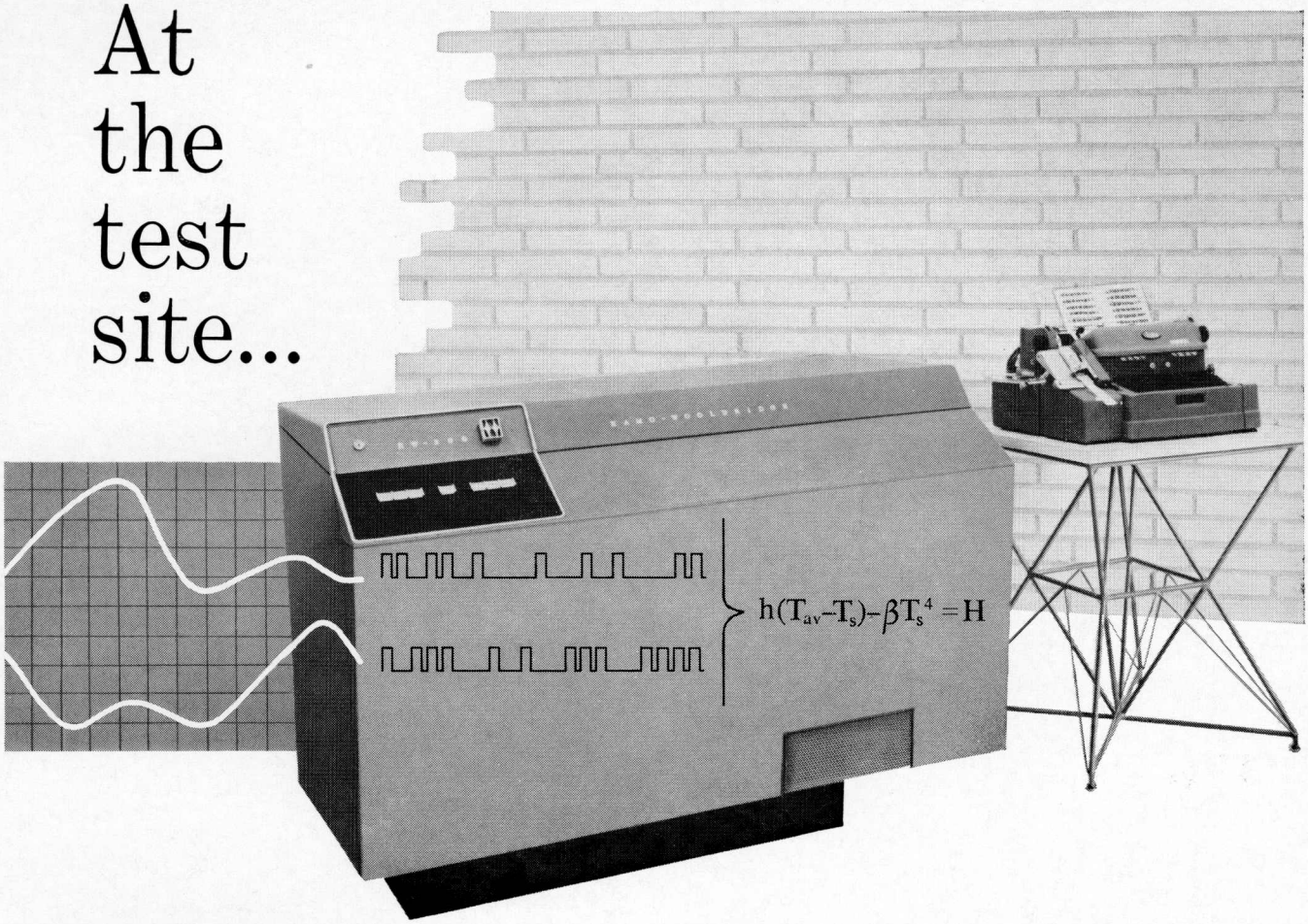
# At the test site...




# reduce test data completely

## with the RW-300 DIGITAL CONTROL COMPUTER

*Wind Tunnels*

*Engine Test Stands*

*Environmental Test Facilities*

*Structural Test Facilities*

*Guidance and Control System Test Laboratories*

*Missile and Aircraft Check-Out Facilities*

*Nuclear Reactor Instrumentation*

*Data Reduction Centers*

Complete data reduction requirements—acquisition, conversion, recording, computation, and presentation—can be met with a compact RW-300 system located *at the test site.* The computer with its integral analog-digital conversion equipment will automatically scan measuring instruments, convert their readings to digital form, store this data on magnetic tape if necessary, and perform complete calculations with the data. Quick-look data will be presented during a test and complete data and results will be made available in meaningful form within minutes after the test is finished. Therefore, the RW-300 will speed up entire test programs, with resulting savings in technical manpower and in cost.

While testing is not in progress, the RW-300 can be used to perform scientific and engineering calculations.

The RW-300 computer also has unique capabilities for open-loop and closed-loop *control.* With the test sequence stored in its magnetic drum memory, the RW-300 will automatically control the test equipment, utilizing input data to compute feedback control signals.

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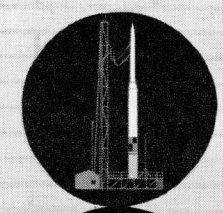
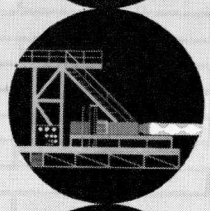
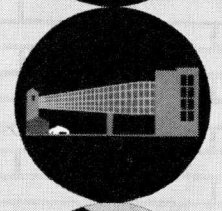


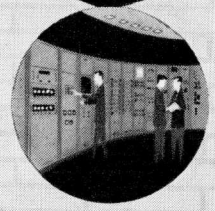
MISSILE CHECK-OUT



TEST STAND OPERATION

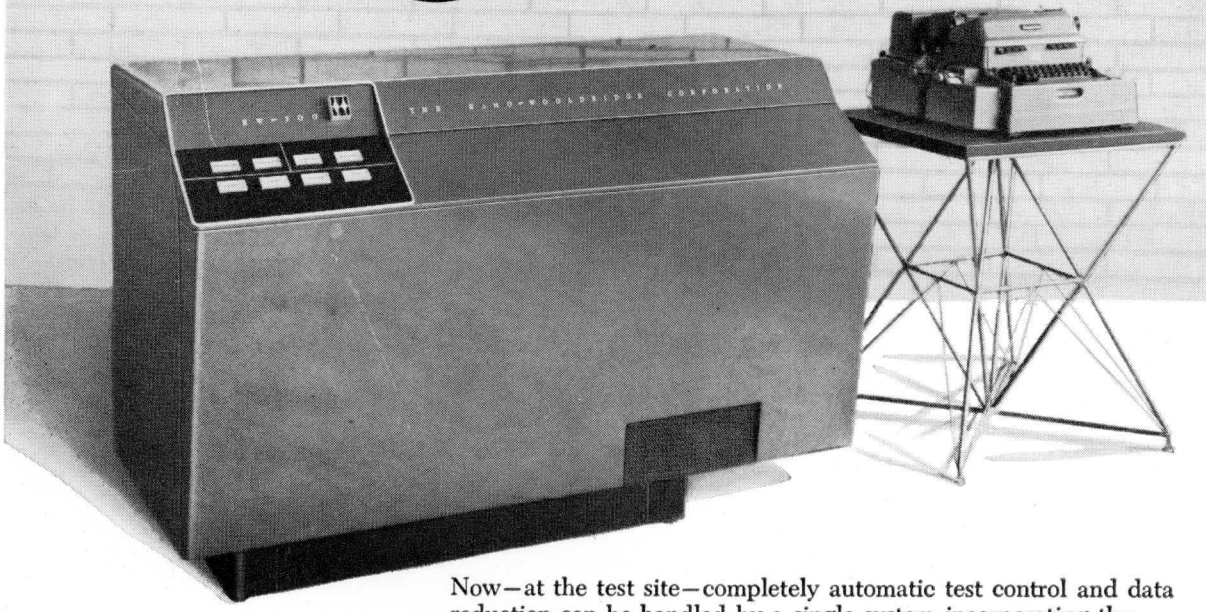


WIND TUNNEL INSTRUMENTATION



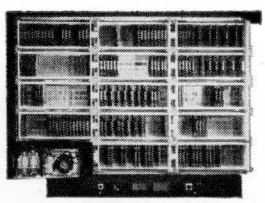
TELEMETRY DATA REDUCTION

# The RW-300 is the first digital computer for test control and data reduction



Now—at the test site—completely automatic test control and data reduction can be handled by a single system incorporating the Ramo-Wooldridge RW-300 Digital Control Computer. The new RW-300 can schedule and closely control test routines, and it can collect, analyze, and record test data.

The versatile RW-300 utilizes input data as feedback to modify control actions, thus substantially shortening many test routines. In addition, the RW-300 directly logs both instrument data and complex relationships among these data. Thus, test results are available immediately. The time-consuming task of processing raw data through a separate computer, often remote from the test facility, usually can be eliminated.



For technical information on automatic test control and data reduction with the RW-300 and with special digital systems which utilize solid-state components exclusively, write: Director of Marketing, The Thompson-Ramo-Wooldridge Products Company, P.O. Box 90067, Airport Station, Los Angeles 45, California, or call OSborne 5-4601.

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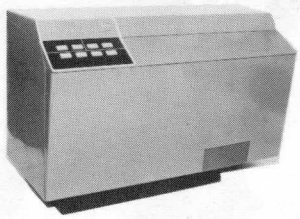
# Maintainable Computer



RELIABILITY, simplicity and adaptability were designed into this transistorized industrial computer. The result is a unit that provides completely automatic control for process plants with a 500-hour mean time between failures. When a failure does occur the circuit malfunction can be detected and repaired within minutes.

As a preliminary approach, Ramo-Wooldridge Corp., 5500 W. El Segundo Blvd., Los Angeles adopted modular design techniques for the RW-300 computer. Each switching circuit is mounted on a printed wiring board called an *insert;* all switching circuits necessary to perform a particular function are installed in a single printed *module;* the modules are plugged into *subframes;* and the subframes are interconnected with cables. It is plain that the addition or subtraction of input-output—analog-digital—units is a simple procedure, and contributes to the ease with which the computer may be adapted to meet special conditions.

Four engineering goals were kept in mind during the design of the computer: reliability, maintainability, rapid serviceability, adaptability. The techniques used are not new, but the fact that they were applied, in the best reliability tradition, from the inception of the unit design and carried through to the finished product merits attention.

*Reliability.* Experience in the design of reliable equipment for military applications was applied. Each component—resistors, transformers, capacitors, wire and printed circuit base laminates—had to meet special qualification tests. The quality of components is exceptionally high for a commercial equipment, but the reliability required in industrial process control justifies these standards.

Circuits were designed to operate with maximum tolerance to component variation. Improved bond strength between the copper and resin in the printed circuits is provided by a flush circuit technique. The copper is embedded in the epoxy resin. Component replacement is easier as a result, and boards can be handled or stacked without damaging the circuitry. The printed circuits used in the module have dip soldered connections.

*Maintainability.* The modular design described above represents the kind of thinking that went into the mechanical construction of the computer. Quick release panels permit rapid exposure of any portion of the electronic assembly. Handles for the panels are accessible and located out of sight beneath the main computer frame.

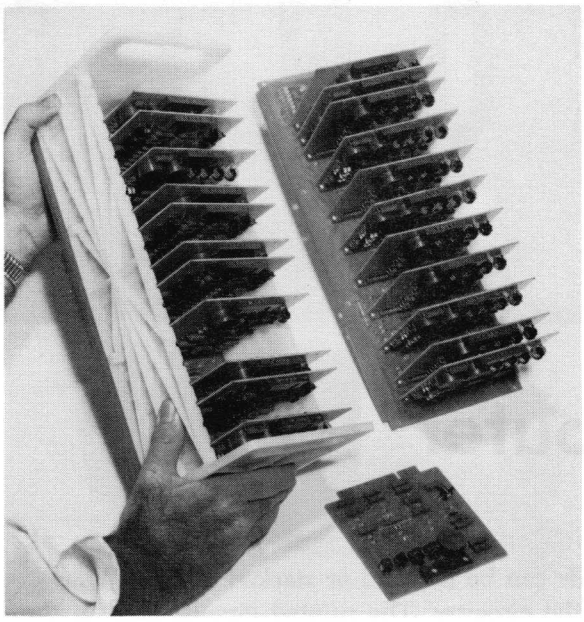
Any subframe can be reached and removed as an independent unit. The analog-digital unit can be reached by removing the side panel. The computer subframe is accessible by removing the back, and the magnetic drum is removable by the use of slides after the front panel is removed. Each module in a subframe can be removed and serviced independently, to minimize computer "down time."

*Serviceability.* The RW-300 includes a test and maintenance unit. This unit provides manual control of the speed at which the program runs, for program checkout and computer test and maintenance. The entire system can be checked at this reduced speed, during initial computer checkout and periodic preventive maintenance.

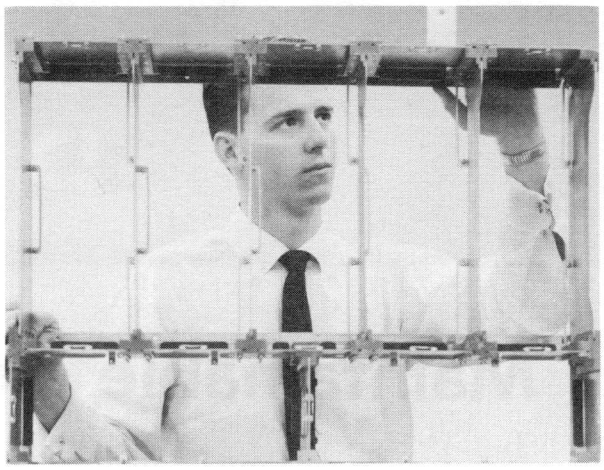
The test unit also includes a built-in oscilloscope which can be switched to any of the circulating arithmetic and control registers or other points, and a bank of neon lights which can be connected by switch to various groups of flip flops to determine their static condition. There are marginal checking controls and program breakpoint switches in addition.

Trouble-shooting is accordingly simplified. The test unit, in conjunction with the modular design, keeps repair time to a minimum.

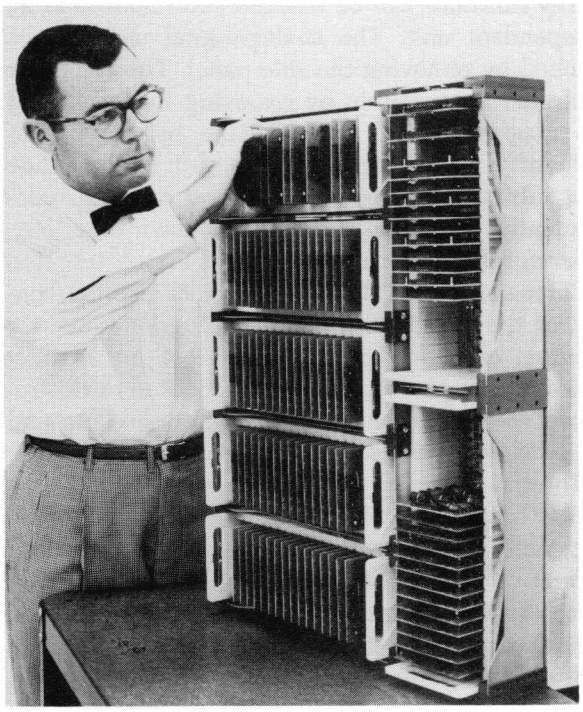
*Adaptability.* The computer can be tailored to fit specific applications with few equipment changes. Input-output units can be added easily. With only instruction program and external connection changes the computer functions can be altered to modify and improve its control actions.



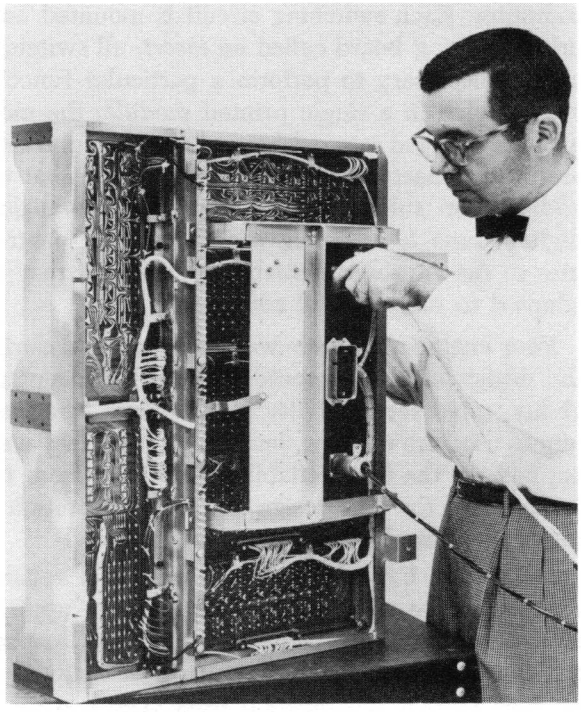
**1.** Computer inserts consist of active circuits mounted on printed circuit boards. These inserts, also constructed with printed circuit techniques, are attached to the modules, which are fitted with plastic racks and handles for easy handling.



**2.** Modules are plugged into subframes like this analog-digital unit. It is here that analog inputs are converted to digital information for use by the computer assembly, and digital outputs of the computer into quantities for process control. Construction is simple; the frames are of a size suitable for handling.



**3.** Analog-digital subframe with modules inserted. Individual modules can be serviced independently or replaced by spare modules during servicing to minimize computer "down time." Any subframe in the RW-300 can be exposed by removing a quick release panel and can be removed as an independent unit.



**4.** Rear view of the input-output subframe shown in (3). The modular design eliminates extensive hand wiring, printed circuits being used as extensively as practicable. Subframes in the computer are interconnected by cables as in the photograph. Simply unplugging the cables and freeing the unit is all that is required for removal.

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