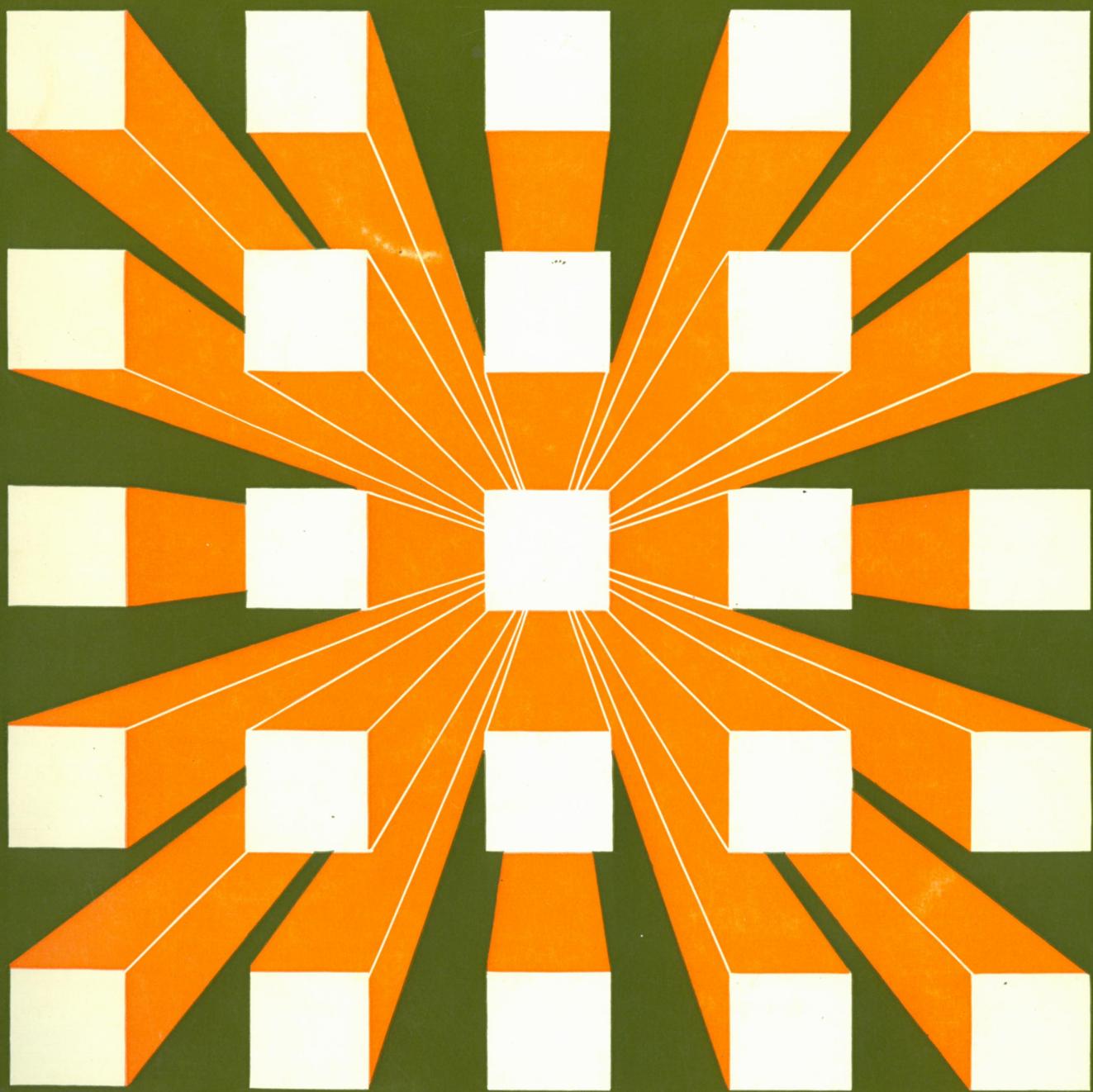


FERRANTI

# argus computer equipment





## Introduction

This brochure lists the standard range of Ferranti Argus equipment for on line digital control and communication systems. Ferranti Limited have over ten years' experience of the supply and installation of industrial control equipment; they also manufacture a large proportion of the total U.K. production of silicon microcircuits.

The world's first Direct Digital Control (D.D.C.) system was installed by the Ferranti Automation Systems Division at I.C.I. Fleetwood in 1962. Since then Argus computer systems have been installed throughout the process control industry, for use in the manufacture of steel, chemicals and paper; in oil refining, power generation, research, and many other applications. In the communications field, Argus equipment is widely used by financial institutions, transport undertakings and public utilities.

The complete range of equipment has been designed around the Argus 500 microminiature computer, and draws on Ferranti's unique experience to produce a highly effective and economic control computer system. Every item of equipment makes use of the most modern design and constructional techniques to achieve efficient operation and exploit the extreme reliability and low cost possible with microminiature circuits.

The Argus 600-2 is a small and versatile 8 bit computer which permits low-cost automation in many control and communication applications.

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## Modern Techniques

Full use is made of single and multi-layer printed circuits. All circuits use the most reliable modern components available.

## Expansion

Ease of expansion is ensured by the use of a completely flexible modular system; input/output equipment may be added virtually without limit.

## Standard Input/Output Interface

One standard input/output interface (Interface A) is used for all Argus 500 systems. The Argus 600-2 has an interface which is an 8 bit subset of the interface A.

## Comprehensive Range

Standard modules are available for analogue and digital input selection, analogue and digital output generation, D.D.C. (direct digital control) outputs, analogue amplification, analogue-digital conversion and line communication. Also available are many peripheral devices such as tape-readers and punches, teleprinters, and tape and disc backing stores.

## Powerful Central Processors

The Argus 500 computer adds the speed and reliability of modern microcircuits to powerful design features developed from long experience with process control and information systems.

## Software

A large library of proven software is available, including a selection of real-time operating systems and many on-line programs. Programs may be written in ASTRAL, a symbolic assembler language with powerful macro features, or FORTRAN. CORAL 66 is available for off-line programs.

## Displays

The Argus range contains a number of flexible C.R.T. display systems for communication with operators and management.

# Computers

The Argus 500 is a microcircuit computer specifically designed for on-line real-time applications. It uses parallel working, high-speed storage, and powerful time-sharing facilities to provide the computing power required for the most sophisticated system.

\* 24-bit word length. Gives ample accuracy for most applications without the need for double-length working and allows direct addressing of 12288 store locations (block addressing facilities allow access to 61440 locations).

\* Multiple accumulators. Each of eight blocks of accumulators provides seven arithmetic registers, three of which may be used as modifying registers. The system avoids the time-wasting disadvantages of single-accumulator working without introducing the complexity of a full two-address system.

\* Powerful order code. The instruction code available to the programmer is based on the Argus 100 and 300 order code and includes a full range of arithmetic and logical functions.

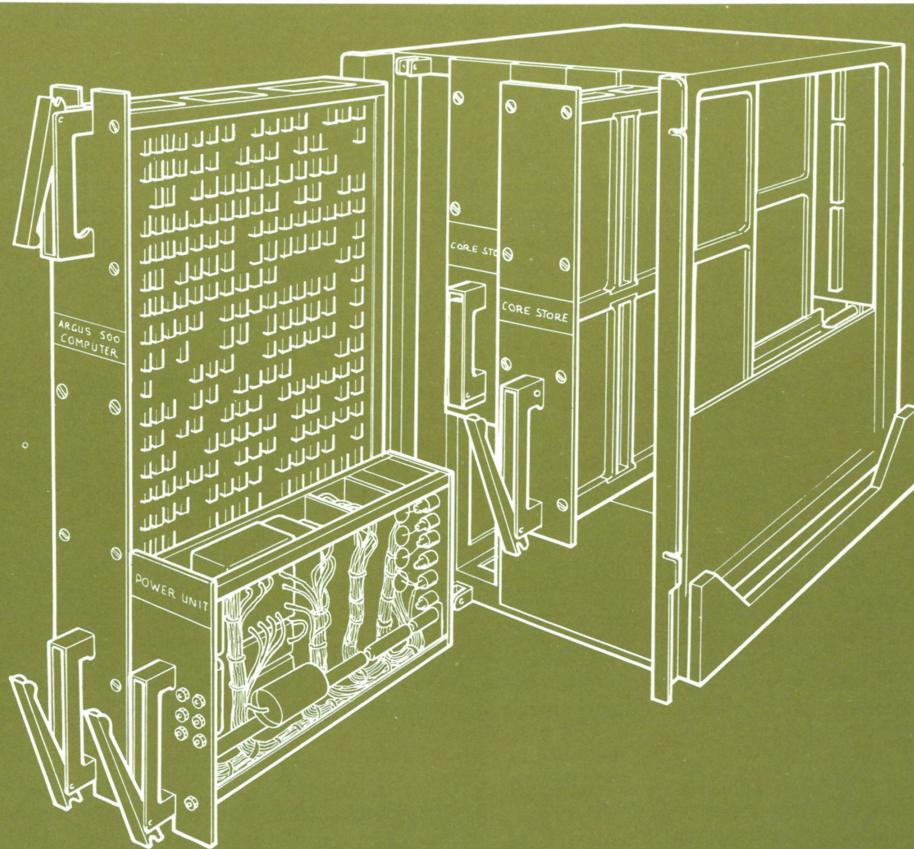
\* Modular storage. Core storage up to the maximum can be supplied in multiples of 4096 at any time before or after installation of the computer.

The user may choose stores with cycle times of 2 microseconds (Argus 500 model 1) or 1 microsecond (Argus 500 model 2). All Argus 500 stores are completely interchangeable, and may be replaced by faster stores at any time.

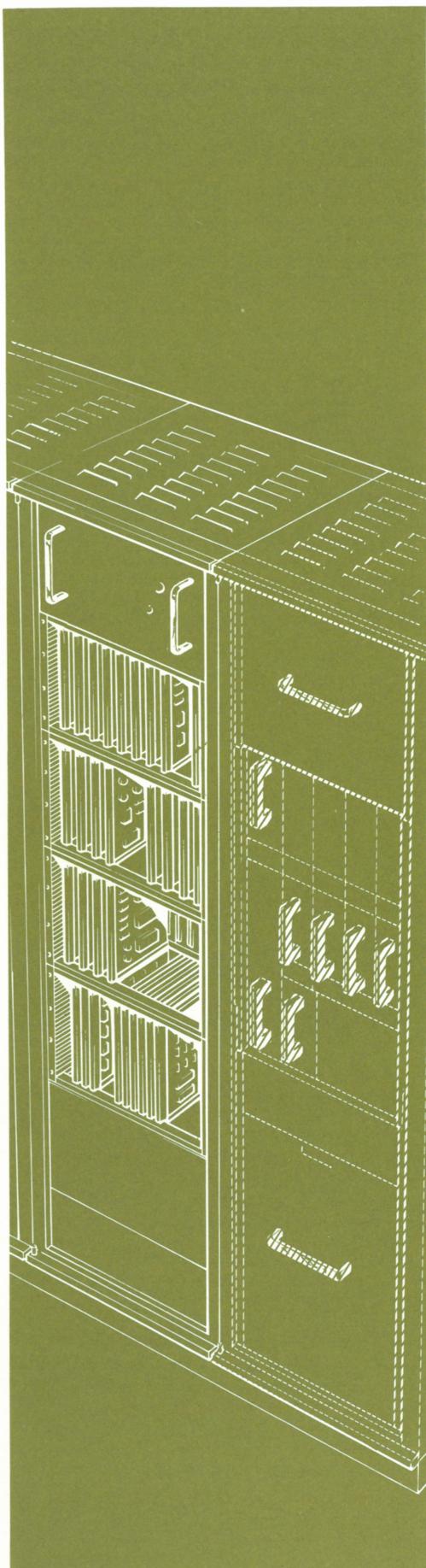
\* Direct store access (D.S.A.). Allows data to be transferred between the computer core store and an external system, at the command of the external system and without intervention by the computer program. May be used for input, output, or in a counting mode in which the number on the data input lines is added to the contents of a store location.

\* Interrupt. An eight-channel system which allows external equipment to interrupt the current program, setting a flag bit to indicate which line has caused the interruption. Individual channels may be enabled and disabled by program, and there is an overall lock-out.

\* The Argus 600-2 is a small, 8 bit machine designed for use as a computer or controller. Store comes in 4K blocks,  $1\mu$  sec cycle time, expandable to a maximum of 8K for programs, and an optional further 8K for data.



# Argus Input/Output Modules



Argus uses a completely flexible input/output system based on the use of a standard interface and a range of modules which can be added to as required.

\* A module comprises all those items external to the computer which are required to perform some particular input/output function.

\* All signals to or from input/output modules pass through the standard interface A.

In order to economise on the use of space and components, modules are not manufactured as self-contained units, but are built up from separate items.

\* Each input or output signal or item of peripheral equipment is served by an appropriate circuit or circuits mounted on a printed circuit module card.

\* Each module card communicates with the computer interface A through a buffer card; one buffer card may serve one or many module cards.

\* Module and buffer cards are mounted in boxes.

\* Boxes are mounted in input/output racks.

In order to specify the hardware required to fulfil any particular module function it is necessary to know the capacity (e.g. number of inputs etc. available) of the appropriate module card, and the number of module cards which can be mounted in a box. This information is given in the list of equipment contained in the following pages.

Items listed fall into the following categories:

\* Boxes. These include the box with its printed circuit backwiring, sockets, and buffer cards and may house one or more different types of module card.

\* Module cards not associated with external devices, or module cards directly controlling process signals.

\* Peripheral equipment with controlling module cards (e.g. tape readers, teleprinters).

\* Large items of peripheral equipment, mounted in separate cabinets (e.g. disc store).

\* Component parts of the Argus 500 computer.

# System Assembly

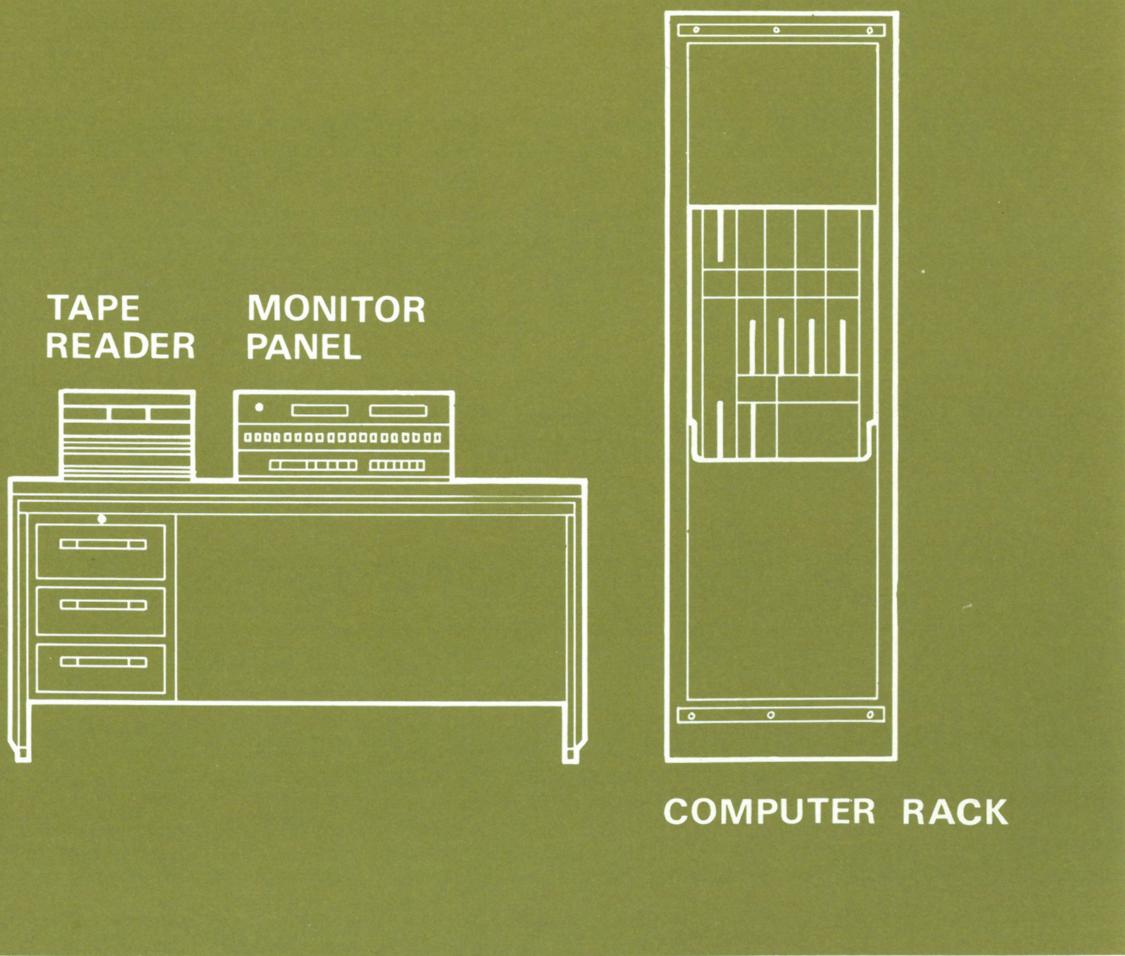
A basic rack-mounted computer assembly consists of the following items:

- 1 Wired unit assembly (MR 5).
- 2 Argus 500 control processor (MAC 51).
- 3 Core store units (MAC 10—MAC 15).
- 4 Processor power supply (MAC 21).
- 5 Mains power supply and main cooling fan unit (MR 11).
- 6 Cabinet (MR 1).
- 7 Monitor panel (MAC 27 or 28).
- 8 Tape reader (MAC 37).

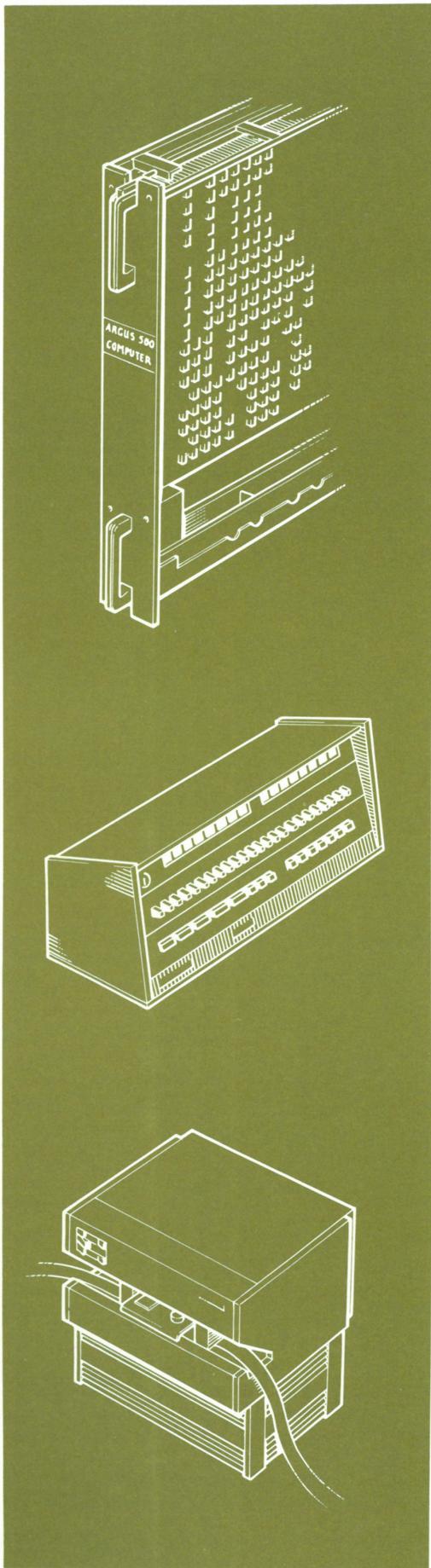
Normally the system contains a desk (MAC 26) but this may be omitted provided that the rack-mounted monitor panel (MAC 27) is specified, and alternative means are provided for mounting the tape reader.

Core store is supplied in blocks of 4096, 8192 and 16384 words; the wired unit assembly will accept four blocks in any combination of sizes. Argus 500 will accept stores with speeds of 2 or 1 microseconds (MAC 10—MAC 15); all store blocks in a given machine must be of the same speed.

For most systems several boxes holding input/output cards are required, and are mounted in input/output rack assemblies. Each rack holds up to six boxes and includes a booster fan for cooling, using air ducted from the main fan assembly (MR 11 or 22). The necessary power supplies are mounted in the computer rack. Cables carrying signals between plant and an Argus system are usually terminated in termination units separate from the input/output racks. However, light cables (14 x 0.0076 in. or less) may be terminated directly in taper pins on the input/output racks.



# Argus 500 Computer Sub-Assemblies



## CENTRAL PROCESSORS

MAC 51 Argus 500 processor unit.

## CORE STORES

- MAC 10 2 microsecond cycle time. 8 K words store ( $K = 1024$ ).
- MAC 11 2 microsecond cycle time. 4 K words store.
- MAC 12 2 microsecond cycle time. 16 K words store.
- MAC 13 1 microsecond cycle time. 8 K words store.
- MAC 14 1 microsecond cycle time. 4 K words store.
- MAC 15 1 microsecond cycle time. 16 K words store.

## MONITOR PANELS

- MAC 27 Rack mounted panel for use with Argus 500.
- MAC 28 Desk mounted panel for use with Argus 500.

These panels may be sited up to 10 feet away from the central processor unit.

## PROCESSOR POWER SUPPLY

- MAC 21 Power supply operated from 23 V d.c. intermediate supply.  
To drive Argus 500 model 1 processor unit and core stores.
- MAC 22 Power supply operated from 23 V d.c. intermediate supply.  
To drive Argus 500 model 2 processor and core stores.

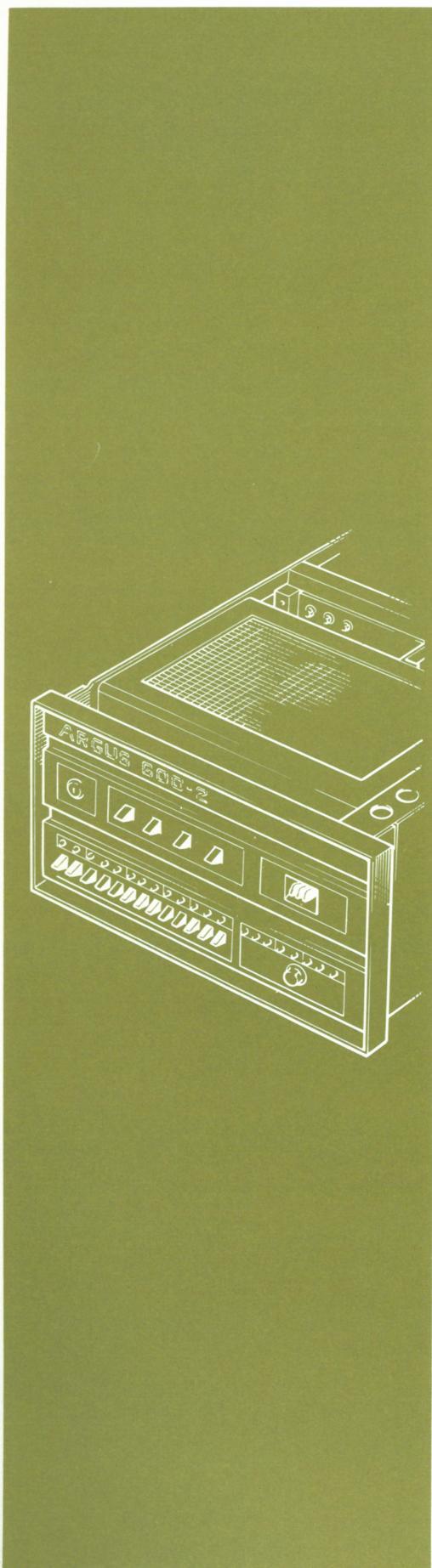
## PROCESSOR TAPE READER

- MAC 37 300 characters/second. 5, 7 or 8 hole paper tape reader.

## DESKS

- MAC 26 Desk to support monitor panel, tape reader and page printers.





The Argus 600-2 interfaces to all input/output equipment that handles 8 bit data. The interface is a sub-set of the Argus 500 standard interface A. In its simplest form the computer consists of a control panel, central processor and power unit (MAC 71). If a built-in monitor panel is required then the unit is called MAC 74. A monitor panel (MAC 75) can be supplied as a separate plug-in unit if more than one Argus 600-2 is to be serviced.

The standard modules of the Argus 600-2 system are:

MAC 71 Central Processor Unit plus power unit, without monitor panel, without input/output.

MAC 72 4 K (1  $\mu$ s) core store unit.

MAC 73 As MAC 71 but with built-in input/output unit.

MAC 74 Central Processor Unit plus power unit, with monitor panel, and without input/output.

MAC 75 Self-contained monitor panel. (Service panel).

MAC 76 Teletype card. Mounts on Processor Board.

MAC 77 As MAC 73 but with built-in monitoring.

MAC 78 Cooling Fan.

MAC 79 Input/Output expansion frame.

MAC 80 Argus 600-2 maintenance kit A.

MAC 81 Bootstrap Loader.

MAC 86 Argus 600-2 maintenance kit B.

# Argus 600-2

## THE MODULES THAT CAN BE INTERFACED TO THE ARGUS 600-2 are:

### PERIPHERALS

Peripheral control box	MP 1
Tape reader	MP 2
Paper tape punch	MP 6
Page printers	MP 7
	MP 8
	MP 9
	MP 10
Incremental plotter	MP 11
Keyboard input cards	MP 12
	MP 17
	MP 23
	MP 25
Decimal displays	MP 28
	MP 29
	MP 30

### ANALOGUE OUTPUT EQUIPMENT

High accuracy analogue output cards	MOA 5
	MOA 6
	MOA 14

### DIGITAL INPUT EQUIPMENT

Digital input cards	MID 21
Input filters	MR 110

### MISCELLANEOUS EQUIPMENT

### DIGITAL OUTPUT EQUIPMENT

Digital output unit	MOD 1
Semiconductor output card	MOD 3
Relay output unit	MOD 4
Relay output card	MOD 5
Expansion unit	MOD 7

### Interrupt expander card

MG 5  
MG 40  
to  
MG 46

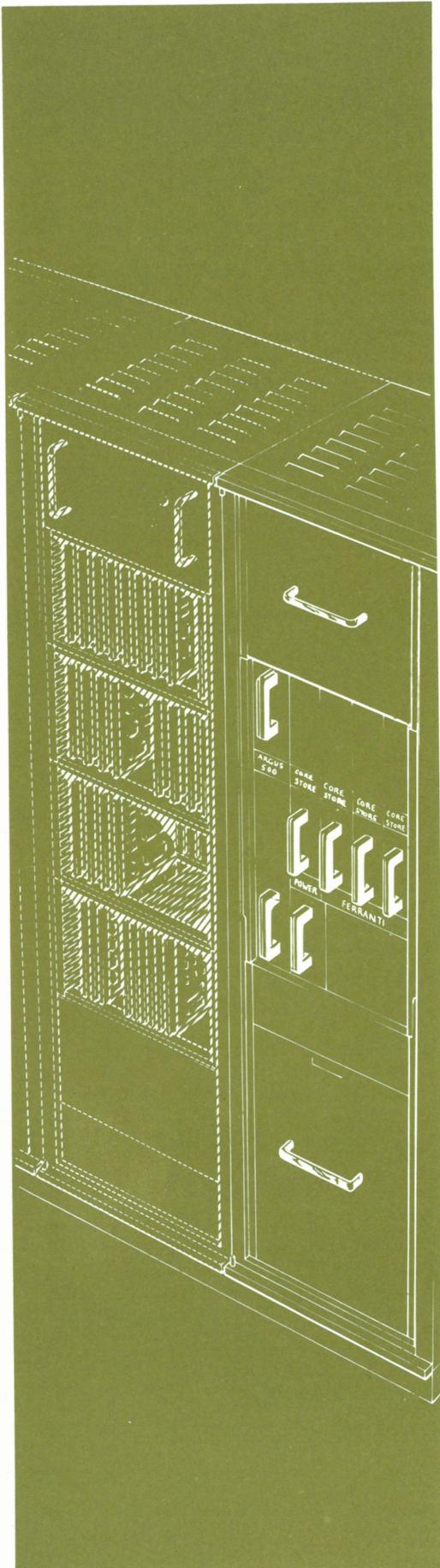
### ANALOGUE INPUT EQUIPMENT

Amplifier and Control	MIA 60
Analogue to digital converter	MIA 61
8-channel input selection plus 4	MIA 65
raise/lower outputs	

### C.R.T. DISPLAYS

Alpha-numeric C.R.T. display	WD 101
	WD 103
	WD 105
	WD 120
	WD 122

# Rack Assemblies, Power Supplies and Fan Units



## COMPUTER RACK

MR1 6 ft. high 19" standard rack to house the constituent parts of an Argus 500 computer with power and main fan unit.

## WIRED UNIT ASSEMBLIES

- MR 5 A wired unit to accept the following: MAC 51: MAC 21 or MAC 22. Up to 64 K words core storage (selected from MAC 10 to 15).  
MR 6 A variant of MR 5 with different core store addressing up to 32 K words.

## COMPUTER MAINS POWER SUPPLIES

- MR 11 Input: 230 V 50 Hz.  
Output: 23 V d.c. to drive MAC 21 (small standby battery included). A main fan unit is included in the assembly, and supplies sufficient cooling air for two input/output racks.

## BOOSTER FAN UNIT

- MR 21 Input: 230 V 50 Hz. To be used in individual input/output rack assemblies.

## MAIN FAN UNIT

- MR 22 Additional main fan unit.

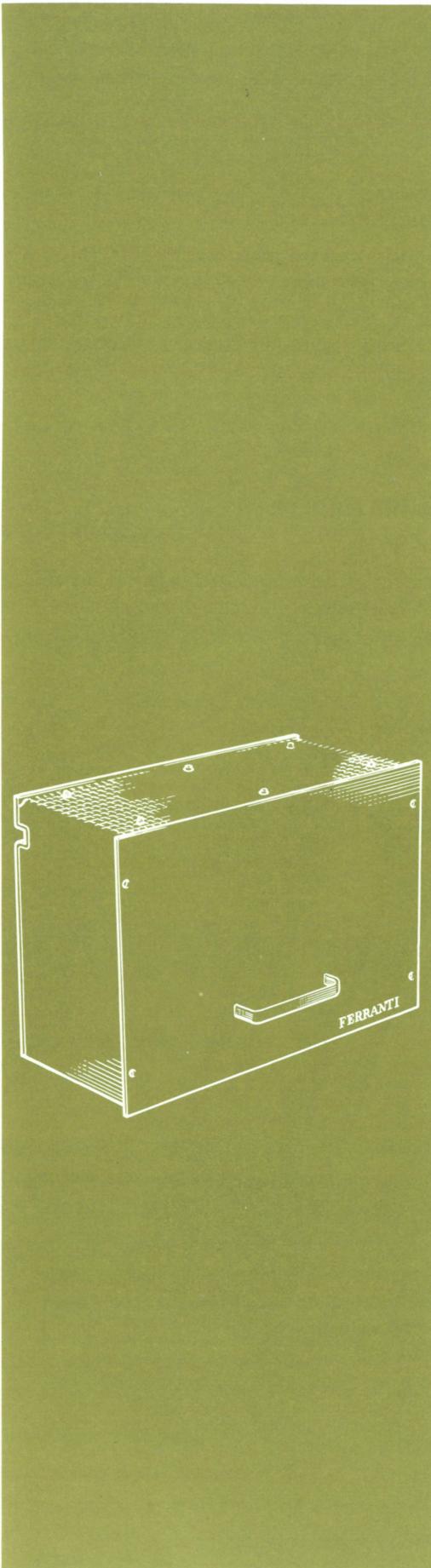
## INPUT/OUTPUT RACK ASSEMBLIES

- MR 26 6 ft high 19" standard rack to accept up to six 10½ inch logic boxes. Includes Interface A wiring and a booster fan unit (MR 21).  
MR 27 6 ft high 19" standard rack to be used to house power supplies, peripherals units, etc. Effective panel height available is 68½ inches.

## TERMINATION BAYS

- MR 31 6 ft high 19" standard T/bay for 128 termination blocks.  
MR 32 T/bay for 256 termination blocks.  
MR 33 T/bay for 512 termination blocks.

# Rack Assemblies, Power Supplies and Fan Units



## INPUT/OUTPUT POWER SUPPLIES

MR 137 Power supply box. Mounts in MR1 or MR27. Provides d.c. outputs of.

5V	30A
12V	2A
24V	10A
25V	30mA
50V	1A
-12V	2A
-24V	1A

MR 40 Input: 230 V, 50 Hz.  
Output: 24 V d.c. 10A. Occupies  $\frac{1}{2}$  width of MR 37.

MR 41 Input: 230 V, 50 Hz.  
Output: 24 V d.c. 30A.  
Mounts directly in MR 1 or MR 27.

MR 42 Input: 230 V, 50 Hz.  
Output: 50 V d.c. 1A. Occupies  $\frac{1}{4}$  width of MR 37.

MR 43 Input: 230 V, 50 Hz.  
Output: 12 V d.c. 3A, stabilized.  
Occupies  $\frac{1}{4}$  width of MR 37.

MR 44 Input: 230 V, 50 Hz.  
Output: 12 V d.c. 10A, stabilized.  
Occupies  $\frac{1}{2}$  width of MR 37.

MR 45 Input: 230 V, 50 Hz.  
Output: 50 V d.c. 10A.  
Occupies  $\frac{1}{2}$  width of MR 37.

MR 46 Input: 230 V, 50 Hz.  
Output: 30 V d.c. 1A.  
Occupies  $\frac{1}{4}$  width of MR 37.

MR 47 Input: 250 V, 50 Hz.  
Output: 16 V d.c. 2A.  
Occupies  $\frac{1}{4}$  width of MR 37.

# Analogue Input System

## Summary

Analogue input signals over a wide range of voltages are accepted. The analogue input system filters, selects, amplifies and converts these signals into the digital form required by the computer. Three types of selection system are provided in the Argus range — semiconductor switches, relays for d.c. signals, and a rectification and semiconductor switch unit for a.c. inputs.

The system also provides a fast semi-conductor analogue-digital converter, and a range of buffer amplifiers. With program-controlled systems, the action of calling an input automatically selects the desired signal, routes it to the appropriate buffer amplifier, and initiates the analogue-digital conversion. A further order then transfers the converted data into the computer. Autonomous systems carry out a similar process without program intervention, transferring data in a fixed sequence by D.S.A.

## Input Selection

Semiconductor and relay input switches are mounted on module cards which may be plugged, in any combination, into an analogue input control box. Both D.S.A. and program controlled analogue systems can be supplied, and can be extended to monitor 512 input signals through one analogue-digital converter. All switching modules are provided with input filter circuits.

The MIA 42/10/52 system utilises the following primary selection modules:

1. High level semiconductor switch card — MIA3 and 4.

2. Low level semiconductor switch card — MIA5.

3. Relay switch card — MIA7.

The MIA 43/53 system utilises the following primary selection modules:

1. Dry reed relay, uni- and bi-polar filters — MIA48 and 49.

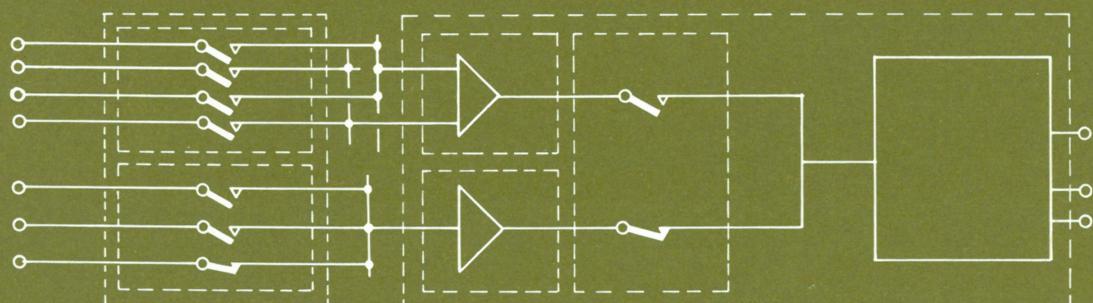
2. Mercury-wetted relay, uni- and bi-polar filters MIA 50 and 51.

The D.S.A. or program control card may be chosen to suit slow, high common-mode or fast, low common-mode requirements.

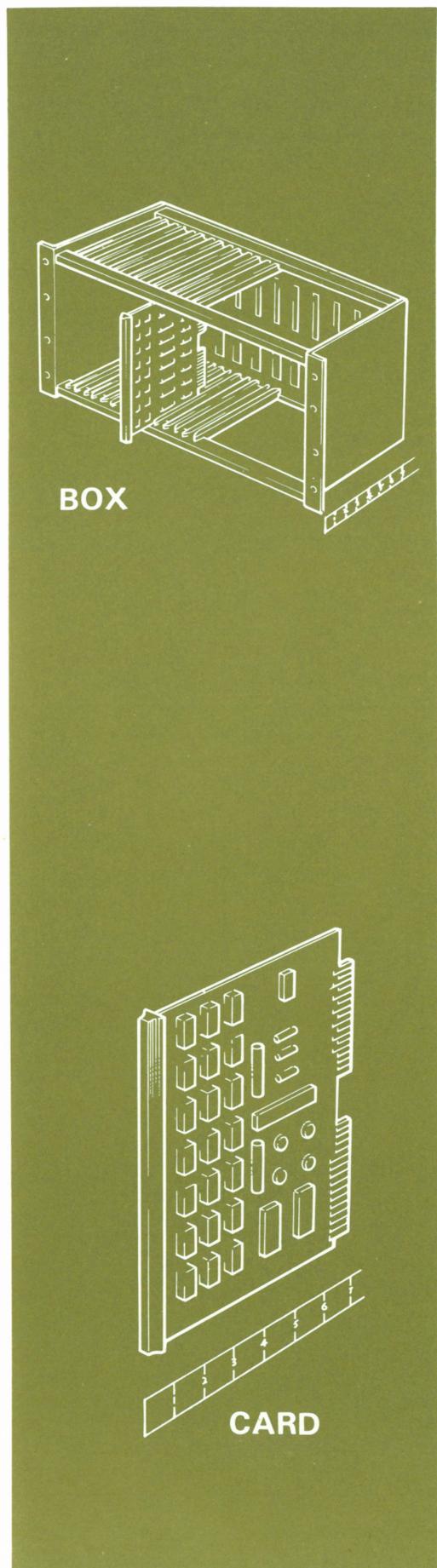
The MIA 60 series may be used for limited analogue input facilities. The modules are plug compatible with the MP1 peripheral box. A maximum of 96 primary selections may be made to one ADC (MIA 61).

## Scaling and Conversion

Analogue input signals must be amplified to a standard level (10 volts full scale) before being fed to an analogue-digital converter. Inputs of similar level must therefore be grouped together and fed to a buffer amplifier of suitable gain. Three types of buffer amplifier are available; high gain (range 10 to 1000, MIA 20), low gain (range 1 to 15, MIA 23), and high gain, high tolerance to common mode (gain 3 to 1000, MIA 24). Signals from the buffer amplifiers are switched by amplifier selection cards (MIA 27), under the control of the switching modules.



# Analogue Input Units



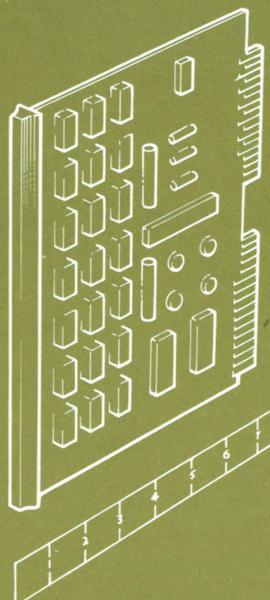
## ANALOGUE INPUT UNITS

- MIA 42 Operates by either program or D.S.A. control. Holds A.D.C. amplifier, primary and secondary selection modules. 128 primary switches can be accommodated and a maximum system for one A.D.C. is 512 selections.
- MIA 10 128 primary switch extension to MIA 42.
- MIA 52 256 primary switch extension to MIA 42.
- MIA 43 Operates by either program or D.S.A. control. Holds A.D.C., amplifier; primary and secondary selection modules. 256 primary switches can be accommodated and a maximum system for one A.D.C. is 512 selections.
- MIA 53 256 primary switch extension to MIA 43.

## ANALOGUE SWITCH CARDS

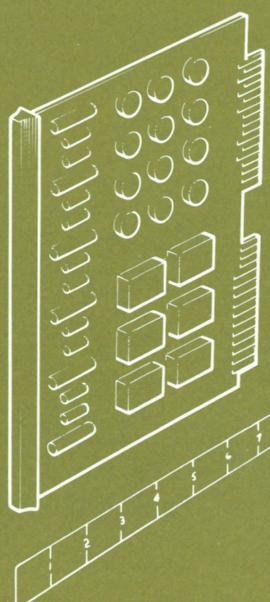
- MIA 3 High-level semiconductor switch card for 16 single-pole inputs.
- MIA 4 High-level semiconductor switch card for 16 double-pole inputs.
- MIA 5 Low-level semiconductor switch card for 16 double-pole inputs.
- MIA 6 Relay switch card for 16 double pole bipolar inputs.
- MIA 7 Relay switch card for 16 double-pole inputs of fixed polarity.
- MIA 48 Dry reed relay switches for 32 unipolar inputs.
- MIA 49 Dry reed relay switches for 32 bipolar inputs.
- MIA 50 Mercury-wetted relay switches for 32 unipolar inputs.
- MIA 51 Mercury-wetted relay switches for 32 bipolar inputs.

# Analogue Input Units



## ANALOGUE DIGITAL CONVERTER

MIA 41 11 bits plus sign resolution of analogue signal.



## BUFFER AMPLIFIERS

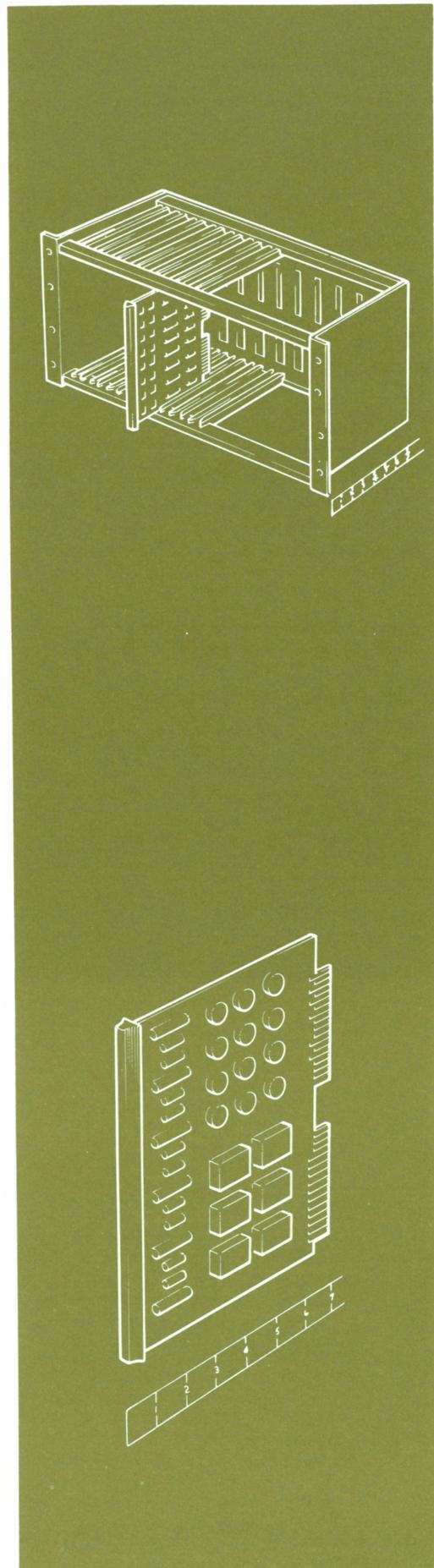
MIA 23 Low gain buffer amplifiers, two amplifiers per card.  
Gain 1 to 15. Settling time 20  $\mu$ s.

MIA 24 High-gain buffer amplifier. Gain 3 to 1000. Settling time  
300  $\mu$ s. Maximum common-mode 300V.

## AMPLIFIER SELECTION CARD

MIA 27 Amplifier selection card. Connects one of four amplifier  
output signals to converter input.

# Analogue Output Units



## ANALOGUE OUTPUT UNIT

MOA 1 Autonomous unit with D.S.A. facilities. The unit will drive up to 3 additional expansion units MOA 4 and control 8 cards MOA 3 within each unit.

## MULTIPLE INTEGRATOR OUTPUT CARD

MOA 3 8 integrator circuits per card.  
Output:  $\pm 5$  volts, 10 millamps.  
Accuracy:  $\pm 0.1\%$ .

## EXPANSION UNIT

MOA 4 Allows expansion of the analogue output unit to a maximum of 4 units per system.

## HIGH ACCURACY ANALOGUE OUTPUT CARDS

MOA 5 Program controlled output. 8 bit resolution.  
Output: 0 to 20 or  $\pm 10$  millamps into a virtual earth.  
Accuracy:  $\pm 0.1\%$ .  
MOA 6 As MOA 5 but output  $\pm 5$  volts, 10 millamps.  
MOA 14 4-bit extension to give MOA 5 or 6 a 12-bit resolution  
MOA 5, 6 and 14 fit in MOD 1 or MP 1.

Analogue output units (MOA 1) can control up to 256 integrator output circuits, each giving an analogue output with a full scale value of 5 V, 10mA. Each output card (MOA 3) carries eight output circuits; eight cards are mounted in the control unit and eight in each of three expansion units (MOA 4).

The desired value for each output is calculated and stored by program. The output unit extracts each value in turn by D.S.A., compares it with the actual output, and corrects the output to the desired value.

High accuracy analogue output cards (MOA 5 and MOA 6) are directly program controlled, and must be mounted in a digital output control unit (MOD 1) or a peripheral control unit (MP 1). Each card accepts an eight-bit output from the computer and gives an output accurate to 0.1%. A four-bit extension card (MOA 14) may be mounted with cards MOA 5 or MOA 6 to give an output with 12-bit resolution.

# D.D.C. Output Systems

## Summary

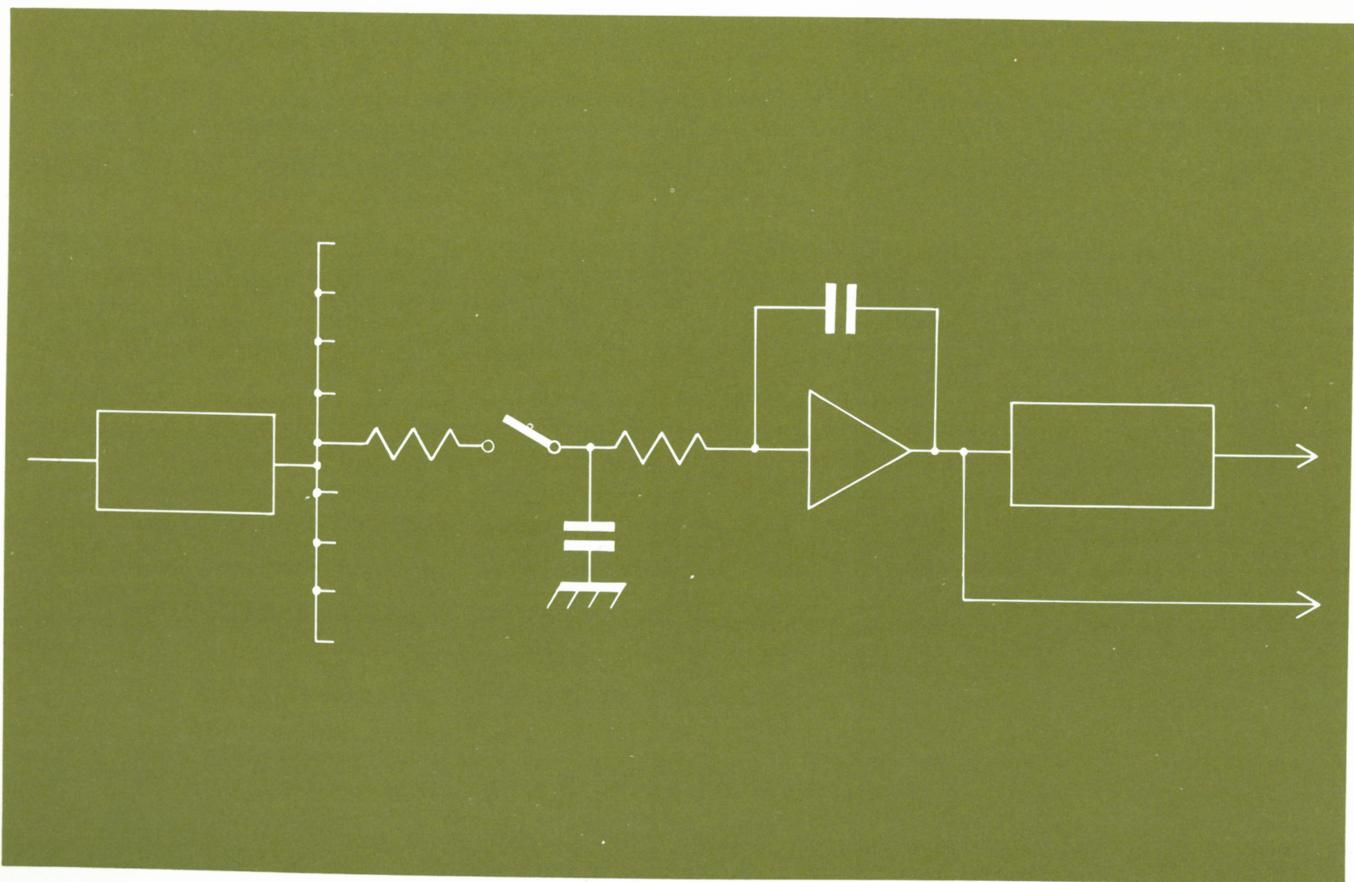
D.D.C. output systems provide the control signals required to position process valves. The output signals are fail-safe in that the valve position is frozen in the event of a computer failure; standby facilities can be included from manual panels and conventional two or three-term controllers. Two systems are included in the standard module range, one based on the use of equipment interfacing to pneumatic outputs, and one giving electrical outputs.

## Interface to Pneumatic Outputs

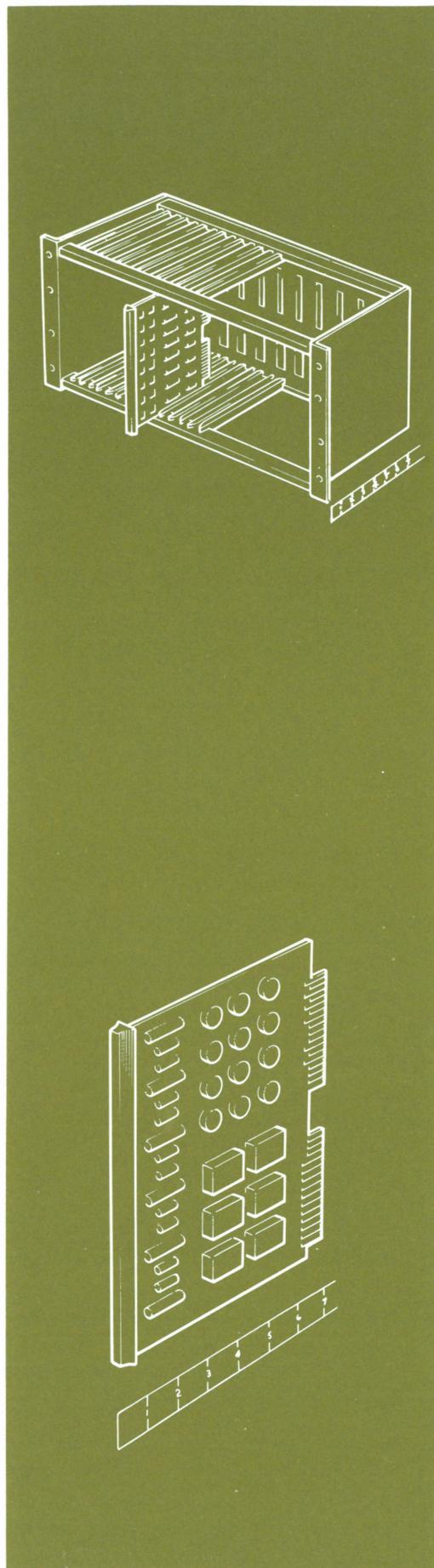
The system is based on pneumatic output units fed by electrical signals of controlled duration to give any desired change in output. Outputs are in the range of 3 to 15 p.s.i., and are applied directly to pneumatic valve positioners. The pneumatic units are mounted externally to the racks, usually close to the associated valves.

## Electronic D.D.C. Output System

The electronic output system provides electrical current signals to operate valve positioners. Outputs can be provided in the ranges 0–10 mA, 4–20 mA and 10–50 mA and with end-to-end travel times of 4 seconds, 8 seconds, 16 seconds and 32 seconds. The computed incremental value for each valve is fed to the output unit (MOA 60) as an eight bit number (seven bits plus sign) and is converted into a voltage by a digital-analogue converter. This voltage is applied through a semiconductor switch for approximately 150 microseconds to charge the selected integrator input capacitor. At the end of the charging period the switch is opened and the input capacitor is allowed to discharge into the integrator feedback capacitor, causing the output voltage of the integrator to change by an amount proportional to the value of the computed increment. The values of the input and feedback capacitors are chosen so that the maximum increment demand changes the output of the integrator by 10% of full scale in the interval between successive increments.



# D.D.C. Output Units



## Interface to Pneumatic Output Devices

### ARGUS – D.C.C. INTERFACE CARD

MOA 20 Services up to 256 pneumatic outputs. Consists of a single card fitting in the peripheral control unit MP 1.

### D.D.C. OUTPUT UNIT

MOA 21 The unit holds a secondary buffer and up to 16 MOA 25 counter cards providing 64 output channels.

### ADDITIONAL SECONDARY BUFFER

MOA 22 Mounts in MOA 21 to permit dual computer access.

### STANDBY BUFFER CARD

MOA 23 Mounts in MOA 21 to permit manual control of the outputs.

### OUTPUT COUNTER CARD

MOA 25 Mounts in MOA 21 and has four channels for connection to synchronous motor drives.

The modules above are suitable for synchronous motor drives only. A similar set of modules MOA 26, 27, 28 and 29 (equivalent to MOA 21, 22, 23 and 25 respectively) are compatible with stepping motor drives.

## Electronic D.D.C. output system

### D.D.C. OUTPUT UNIT

MOA 60 Program-controlled unit: includes power supplies. Provides space for up to 16 integrator cards and controls up to 3 expansion units MOA 68.

### INTEGRATOR CARDS

Each card carries two complete integrator circuits.

MOA 64 End-to-end travel time 4 secs. Output 4–20 mA.

MOA 65 End-to-end travel time 8 secs. Output 4–20 mA.

MOA 66 End-to-end travel time 16 secs. Output 4–20 mA.

MOA 67 End-to-end travel time 32 secs. Output 4–20 mA.

MOA 74–77 As MOA 64–67 but Outputs 0–10 mA.

MOA 84–87 As MOA 64–67 but Outputs 10–50 mA.

### EXPANSION UNIT

MOA 68 Allows expansion of the D.D.C. output unit to a maximum of 4 units per system.

# Digital Input Units

## PULSED DIGITAL INPUT UNIT

- MID 1 Program-controlled unit.  
MID 2 Autonomous unit with D.S.A. facilities.  
Each unit accepts 7 input cards MID 3.

## INTERROGATION INPUT CARDS

- MID 3 Interrogates up to 384 plant relay contact closures. The isolating diodes necessary are not included on this card.

## MATRIX INPUT UNIT

- MID 5 Program-controlled unit; accepts 6 input cards MID 6-20.

## DIGITAL INPUTS

Two types of module are supplied to allow Argus computers to receive digital information.

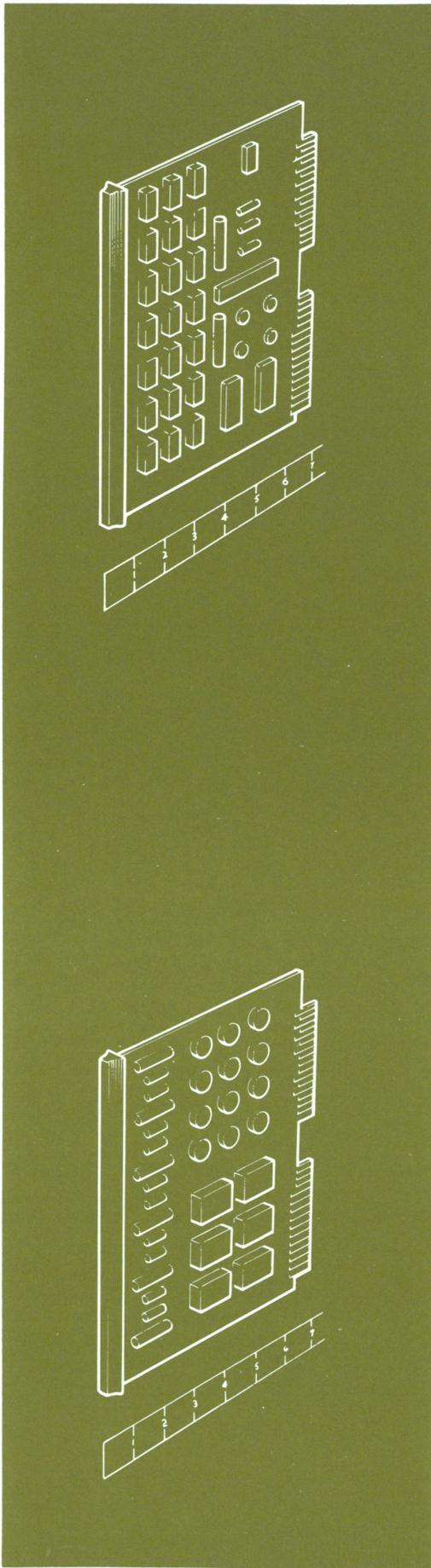
The pulsed digital input units allow the computer to interrogate and determine the state (open or closed) of up to 2688 plant contact closures. One unit, which may be program controlled (unit MID 1) or autonomous with D.S.A. facilities (unit MID 2), accepts up to seven interrogation input cards (MID 3), each controlling signals to and from up to 384 contact closures. Using MID 1, the computer can call in a word which defines the state of 24 contact closures by a single program order. One isolating diode is required for each input; these are not included in the module. The matrix input unit (MID 5) holds up to six semiconductor input cards (MID 6-20), which accept 32 binary voltage signals and marshals them to form words of up to 24 bits for input to the computer.

MID 6-20 can also be mounted in a peripheral control unit (MP 1), but data can then only be read into the computer 8 bits at a time.

## DIGITAL INPUT CARDS

Module	Input	Response	Threshold	Logic '1'	Logic '0'
MID 6	Low Logic Level	Fast	1.6 V	0-0.75 V	3-24 V
MID 7	Contacts	Slow	5.5 V	0-4 V	8-24 V
MID 11	Contacts	Medium	5.5 V	0-4 V	8-24 V
MID 12	Contacts	Fast	5.5 V	0-4 V	8-24 V
MID 16	High Logic Level	Medium	5.5 V	0-4 V	8-24 V
MID 17	High Logic Level	Fast	5.5 V	0-4 V	8-24 V
MID 20	Low Logic Level	Medium	1.6 V	0-0.75 V	3-24 V

# Digital Output Units



## DIGITAL OUTPUT UNIT

MOD 1 Program-controlled unit. Accepts 8 output cards MOD 3.

## RELAY OUTPUT UNIT

MOD 4 Program controlled unit. Drives up to 3 additional expansion units and controls 8 cards MOD 5 within each unit.

## RELAY OUTPUT CARD

MOD 5 16 remanent reed relay outputs per card. Contact closure: 1 amp, 50 volts maximum.

## EXPANSION UNIT

MOD 7 Allows expansion of the relay output unit to a maximum of 4 units per system.

## SEMICONDUCTOR OUTPUT CARD

MOD 13 16 outputs per card.  
Output: 0 volts to +24 volts, 0.2 amperes. Each output is equivalent to an earthing switch.

## DIGITAL OUTPUTS

Digital output signals to drive external equipment are controlled by semi-conductor switches or by reed relays, operated by direct program control. Semiconductor switches, on semiconductor output cards (MOD 13), may be mounted in a digital output unit (MOD 1), or, for smaller numbers, in a peripheral control unit (MP 1). Up to eight cards, giving a total of 128 outputs, may be mounted in one digital output unit. No expansion units are available; larger numbers of outputs require more output units. Relay output cards (MOD 5) are mounted in relay output units (MOD 4), each of which may control up to three expansion units (MOD 7). Each card carries 16 reed relays, and one unit may accept up to eight cards.

If space is available, the digital output unit can be used to house high accuracy analogue output cards (MOA 5, 6 or 14).

# Communications Equipment

The equipment listed below will handle a variety of data transmission tasks in systems where the extensive facilities of a communications multiplexer are not required.

## LOCAL FAST DATA LINK

MDT 3 Fast D.S.A. data link: 10,000 – 24 bit words/sec. Used for local ARGUS to ARGUS communications, half duplex operation. Two MDT 3 units are required to form a complete link, maximum distance between them – 50 ft.

## D.S.A. PERIPHERAL CONTROL UNIT

MDT 6 Control Unit, using D.S.A.

## BRITISH STANDARD INTERFACE UNITS

MDT 8 B.S.I. Voltage acceptor, 50 ft.  
MDT 9 B.S.I. Voltage source, 50 ft.  
MDT 10 B.S.I. Voltage acceptor, 200 ft.  
MDT 11 B.S.I. Voltage source, 200 ft.  
MDT 12 B.S.I. Voltage acceptor, 500 ft.  
MDT 13 B.S.I. Voltage source, 500 ft.  
MDT 20 Serial data transmit card.  
22 Asynchronous format. Full range choice of b.p.s. data rate.  
MDT 21 Serial data receive card.  
23 Asynchronous format. Full range choice of b.p.s. data rate.  
MDT 26 One end of half-duplex synchronous data link. Data rate up to 48,000 b.p.s. (MDT 27 with and MDT 26 without barriers).  
MDT 28 One end of full-duplex synchronous data link. Data rate up to 48,000 b.p.s. (MDT 29 with, and MDT 28 without barriers).  
29

## LOCAL PERIPHERAL UNIT

MDT 50 Rack mounting box with space for seventeen cards controlling printers and keyboards.

## KEYBOARD BUFFER CARD

MDT 51 Buffers up to eight printer drive, and four keyboard drive cards.

## KEYBOARD INTERROGATE CARD

MDT 52 One required in each MDT 50.

## PRINTER DRIVE CARDS

MDT 53 Kleinschmidt – one required to drive each printer.

MDT 54 Olivetti SV 40 – one required to drive each printer.

## KEYBOARD DRIVE CARD

MDT 56 Used in MDT 50 and MDT 71.

## KEYBOARD READ CARD

MDT 57 Used in MDT 50 and MDT 71.

## COMMUNICATIONS UNIT

MDT 58 Rack mounting box with space for 17 cards.

## COMMUNICATIONS BUFFER CARD

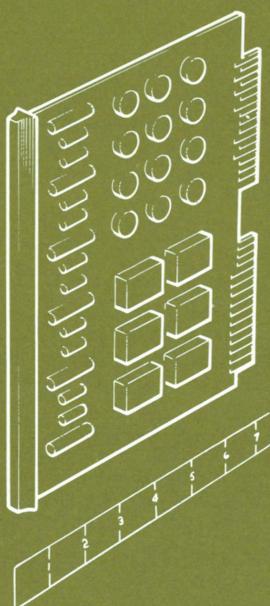
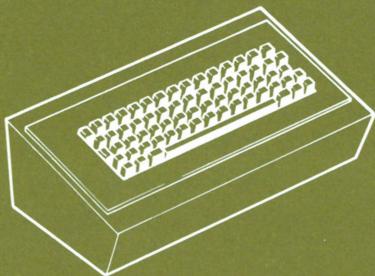
MDT 59 One required in each MDT 58.

## HIGHWAY RECEIVE CARDS

MDT 60 Interfaces receive half of synchronous modem to MDT 59 (2400/4800 baud) 6 bit character code.

MDT 61 Interfaces receive half of synchronous modem to MDT 59, MDT 73 or MDT 74. (2400/4800 baud) I.S.O. 7 + parity.

# Communications Equipment



## HIGHWAY TRANSMIT CARDS

- MDT 62 Interfaces transmit half of synchronous modem otherwise as MDT 60.
- MDT 63 Interfaces transmit half of synchronous modem to MDT 59 or MDT 72 (2400/4800 baud). I.S.O. 7 + parity.

## TERMINAL RECEIVE CARDS

- MDT 64 Interfaces receive section of one 50/300 baud asynchronous modem, VFT equipment or telegraph relay to MDT 59. Code I.S.O. 7 + parity.
- MDT 87 Interfaces receive section of one 400/2400 baud VFT channel or modem to MDT 59. Asynchronous using I.S.O. 7 bit code + parity.

## TERMINAL TRANSMIT CARDS

- MDT 65 Interfaces transmit half of line equipment, otherwise as MDT 64.
- MDT 88 Interfaces transmit half of line equipment, otherwise as MDT 87.

## POWER UNIT

- MDT 70 Power supply for one MDT 50 + one MDT 58 also MDT 71 or MDT 76.

## REMOTE PERIPHERAL UNIT

- MDT 71 Rack mounting box with space for 20 cards controlling keyboards and displays.

## MULTIPLEXER CARD

- MDT 72 Interfaces MDT 63 to MDT 56 and MDT 57. Located in MDT 71.

## DISPLAY BUFFER CARD

- MDT 73 Interfaces MDT 61 to MD 4 in configurations containing a maximum of 6 remote displays, but no printers.

## MAINS FILTER

- MDT 81 Provides filtered output for MDT 70 when used in remote locations.

## KEYBOARD

- MDT 82 Alpha-numeric keyboard for data insertion and editing purposes. 58 keys with built in latching unit.

## TELEGRAPH ADAPTOR UNIT

- MDT 89 Accepts up to 13 telegraph adaptor cards to interface low speed lines to telegraph lines.

# Communications Multiplexer and Fan-Out Equipment

## Introduction

The Ferranti Communications Multiplexer (CMX) is in essence a solid state scanning device designed to enable an Argus computer to service a large number of various speed digital data channels with minimum loading of the computer.

Scanning up to 512 external data channels, and operating at line speeds in the range 50 to 48 K baud, the Multiplexer allows maximum utilisation of its associated Argus computer by off-loading to the Multiplexer a major portion of the data handling and channel control functions.

The Multiplexer also provides a convenient method of driving a large number of peripheral devices, such as hard copy printers, CRT display terminals and line telegraph equipment. Peripherals can be connected directly or via telephone links.

## Scanning Function

Use of the maximum 512 channels permits operation of 256 peripheral devices operating on either duplex or half duplex lines. Transmission may be in either synchronous or asynchronous mode.

Two facilities are provided to assist the multiplexer accommodate lines of widely varying speeds:—

- (i) The address range of 512 channels is divided into three groups. Group 1 (8 addresses) is scanned more regularly than Group 2 (66 addresses) which in turn is scanned more regularly than Group 3 (the remaining addresses). Scanning of various combinations of Groups 1, 2 and 3 by the micro-program can be arranged.
- (ii) Individual channels are buffered with channel buffer cards and versions are available to buffer single bits, single bytes or 3 bytes of data for a particular channel.

## Autonomous Control

The CMX is controlled by a micro program held in a read only memory. Address scanning, input and output of data, etc., can proceed without intervention by the computer program which takes no part in the operation, after initiating transmission or acknowledging the start of a received message. Control is autonomous until the CMX initiates an interruption detection of certain pre-determined conditions.

## Cyclic codes

Cyclic checks can be carried out on the data to correct corruption due to defective or noisy lines. There are seven generator polynomials stored on a printed circuit card within the CMX. Cyclic check codes can be single or double character lengths.

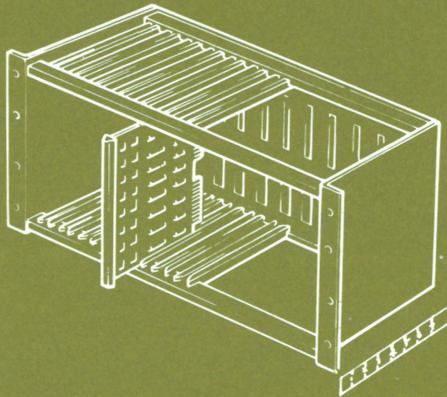
## Direct Store Access

The CMX is directly connected to the core store of the Argus processor. For each active channel scanned, the CMX transfers data to or from the Argus core store in packed 24 bit words using the Direct Store Access facility. An area of the store is reserved for the intermediate storage of input or output data, and this area is subdivided into blocks of fixed length which are allocated on demand to input or output messages, and later released, by the CMX or the computer program. Blocks may be "chained" together so that, subject to sufficient store blocks being available at a given time, there is no restriction on message length.

## Physical Layout

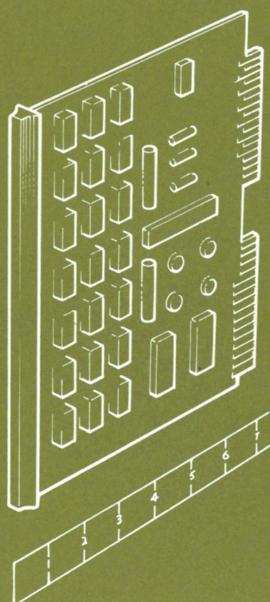
Standard 19" rack mounting, the number of units depending on the number of lines required.

# Communications Multiplexer and Fan-Out Equipment



## CONTROL UNITS

- WDT 7 Multiplexer control unit containing logic cards for 256 channels.
- WDT 8 As WDT 7 but for 512 channels.



## EXPANDER UNITS

- WDT 9 Multiplexer expander unit contains a multiplexer buffer card and space for 16 single-bit transfer channel buffer cards.
- WDT 10 As WDT 9 but for up to 16 8-bit or 24-bit transfer channel buffer cards.

## COMMUNICATION BUFFER CARDS

- WDT 12 Multiplexer communication buffer card. Input/output at 50-300 baud. Contains 2 input and 2 output channel addresses. Asynchronous. Single bit transfer. Fits in WDT 9.
- WDT 13 Multiplexer communication buffer card. Input/output at 400-2400 baud. Contains 1 input and 1 output channel address. Asynchronous. 8-bit transfer. Fits in WDT 10.
- WDT 14 As WDT 13 but synchronous.
- WDT 17 Multiplexer communication buffer card. Input only at 400-2400 baud. Asynchronous. Selectable 1-24 bit transfer.

## ADDITIONAL MODULES

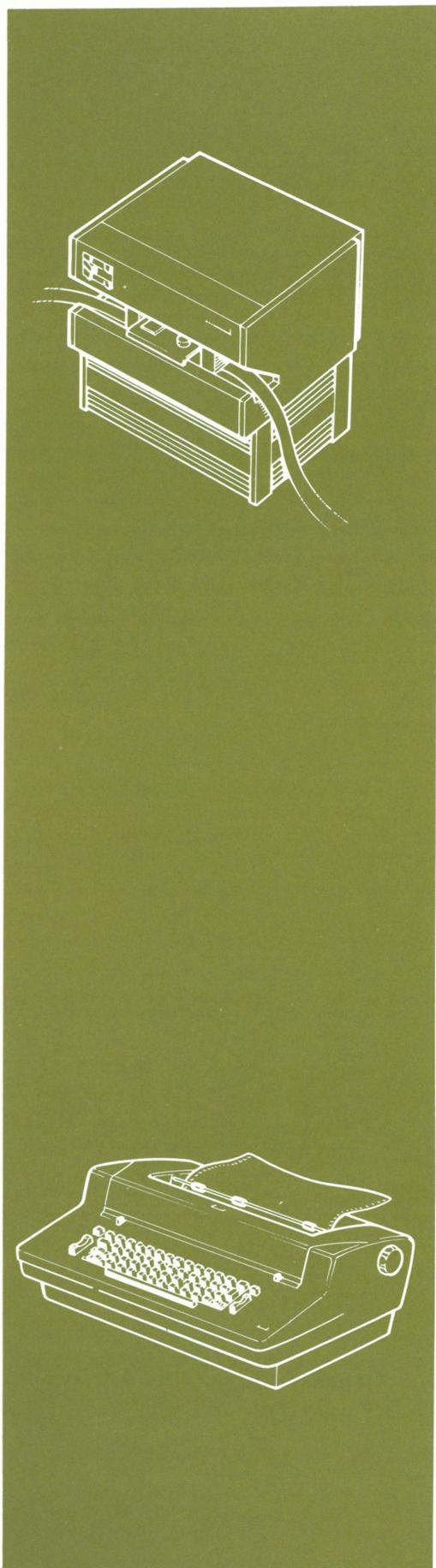
Modules have been designed and specifications are in preparation for units to provide facilities which include 24-bit channel buffering and CCITT to 80-0-80 current interfacing.

## FAN-OUT EQUIPMENT

### FAN-OUT UNITS

- WDT 1 Fan-out card Type A. For local use in MP 1 unit. Asynchronous. Will drive up to 8 display terminals.
- WDT 2 Fan-out Unit Type A. Free-standing unit for remote use. Accommodates 1 or 2 of WDT 3. Asynchronous.
- WDT 3 Fan-out card for use in WDT 2. Functionally identical to WDT 1.

# Peripheral Equipment



The standard range of modules includes such peripheral equipment as tape readers (additional to that supplied with each computer), punches, printers, card readers, decimal displays, and magnetic tape stores.

Each of these modules consists of an item of free-standing or rack-mounted equipment, and a module card which carries control and drive circuits, together with all necessary interconnecting wiring. Up to 15 module cards (plus two cards for which special positions are provided, MG 6 and MG 9) may be mounted in a single peripheral control unit. For convenience in programming and design, all data transfers to or from a peripheral control unit are in multiples of eight bits.

Certain module cards not associated with peripheral equipment are also mounted in the peripheral control unit.

Cards which must be housed in a peripheral control unit are:

MG 5      Interrupt expander

MG 6      Isolate and interrupt timer

MG 14      Interrupt timer

MG 30      D.D.C. control panel (four cards)

MG 31      D.D.C. control panel (four cards)

MG 9      8-channel D.S.A. multiplexer

MG 10      Lock-out expander

MD 32      C.R.T. tracker ball controller counter card.

Cards which may be mounted in peripheral control units when space permits are:

MID 21      Semiconductor digital inputs

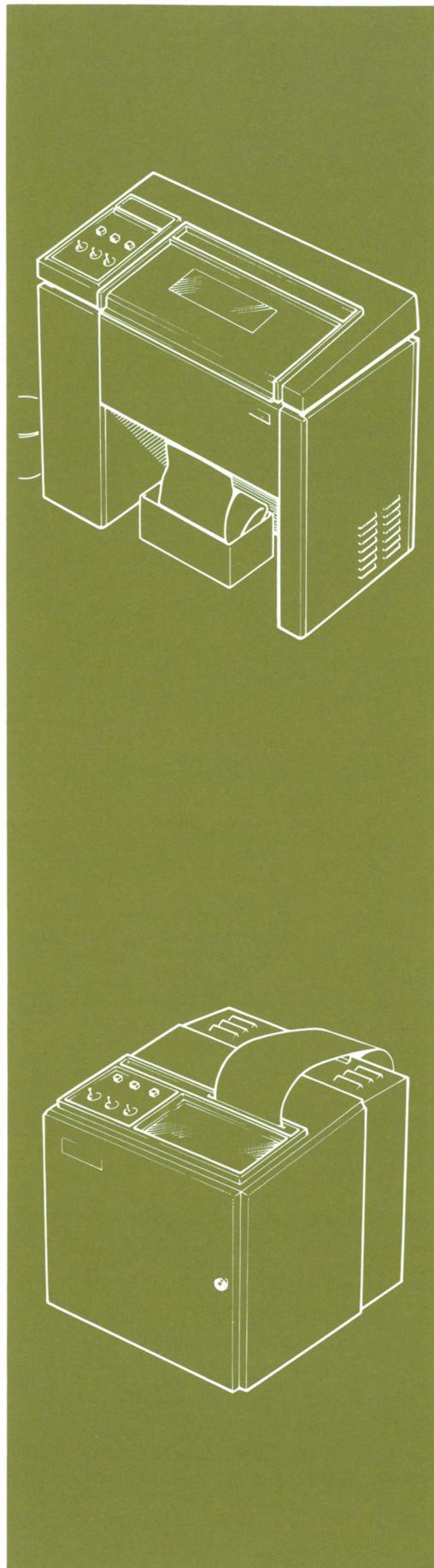
MOA 5      8-bit,  $\pm 10\text{mA}$  analogue outputs

MOA 6      8-bit,  $\pm 5\text{ V}$  analogue outputs

MOA 14      4-bit analogue extension

MOD 13      Semiconductor digital outputs

# Peripheral Equipment



## PERIPHERAL CONTROL UNIT

- MP 1      Accepts up to 15 cards for peripheral control by program.  
(See MDT 6 for D.S.A. peripheral control unit)

## TAPE READERS

- MP 2      300 characters/second, 5, 7, or 8 track tape,  
photo-electric reading.

## PAPER TAPE PUNCHES

- MP 5      120 characters/second, 5, 7, or 8 track tape, check verify  
facility. Rack mounted.
- MP 6      150 characters/second, 5, 7, or 8 track. Desk mounted.

## PAGE PRINTERS

- MP 7      10 characters/second I.S.O. 7 code. Printer only.
- MP 8      10 characters/second I.S.O. 7 code. Tape reader, punch,  
and keyboard mechanisms included.
- MP 9      15 characters/second. Keyboard mechanism included.
- MP 10     10 characters/second I.S.O. 7 code. Heavy duty printer;  
tape reader, punch and keyboard mechanisms included.
- MP 11     As MP 10; keyboard mechanism included.
- MP 12     As MP 10; printer only.
- MP 31-  
33     ASR and RO heavy duty printers with red/black ribbon  
option.
- MP 34     80 column line printer 356-1100 lines per minute.
- MP 35     136 column line printer 245-1100 lines per minute.

## KEYBOARD INPUT CARDS

- MP 23     Enables input of information directly to computer from  
reader and keyboard of MP 8 or MP 11.
- MP 25     Enables input of information directly to computer from  
keyboard of MP 9.

## INCREMENTAL PLOTTER

- MP 17     Incremental plotter.  
300 steps per second in X and Y axes.  
Increment size: 0.005 inch.

## DECIMAL DISPLAYS

- MP 28     Buffer logic card for 8 decimal display windows.
- MP 29     Box for 14 MP 30 relay cards.
- MP 30     1 relay memory card and 2 decimal display windows.  
Driven from MP 28.

## CARD READER

- MP 36     300 c.p.m. mounts in MP 1 for program control.

## ARGUS

Argus computers can be used to operate any of the Ferranti computer controlled C.R.T. display systems, which provide completely flexible high speed data presentation facilities.

The MD — series of display systems provide high quality alpha/numeric characters and special symbols; line drawing, circle drawing, and graph plotting facilities allow information to be represented pictorially.

Keyboard and joystick units can be added to provide manual control facilities. Display control modules can drive a number of display modules, which may present different information or operate in parallel. Control modules are connected directly to the computer Interface 'A'. Each system includes a display control module, mounted in an input/output rack, and the required number of display modules and control units. The method of character drawing in all cases is cursive stroke writing, and the presentation is under direct program control.

## WD SERIES

The WD series of display terminals employ standard television techniques to present characters on a 10 x 7 matrix. An MOS read only memory is used to store 64 fixed character matrices, and a shift register store is used for text which may contain up to 1056 characters on 16 lines of 66 characters per line. Versions are available for local use with the computer and for remote operation over telephone lines and modems. The keyboard unit may be separated from the display for operator convenience.

An ASCII/ISO sub-set communication code is used and there are provisions for hard-copy printer drive.

## PROJECTION

Rear Projection Displays are available for local and remote use. These enable optical images from a 64 frame film strip to be projected with the electronic data on the rear of the CRT screen. In other respects these displays are similar to the WD series.

## TDM SERIES

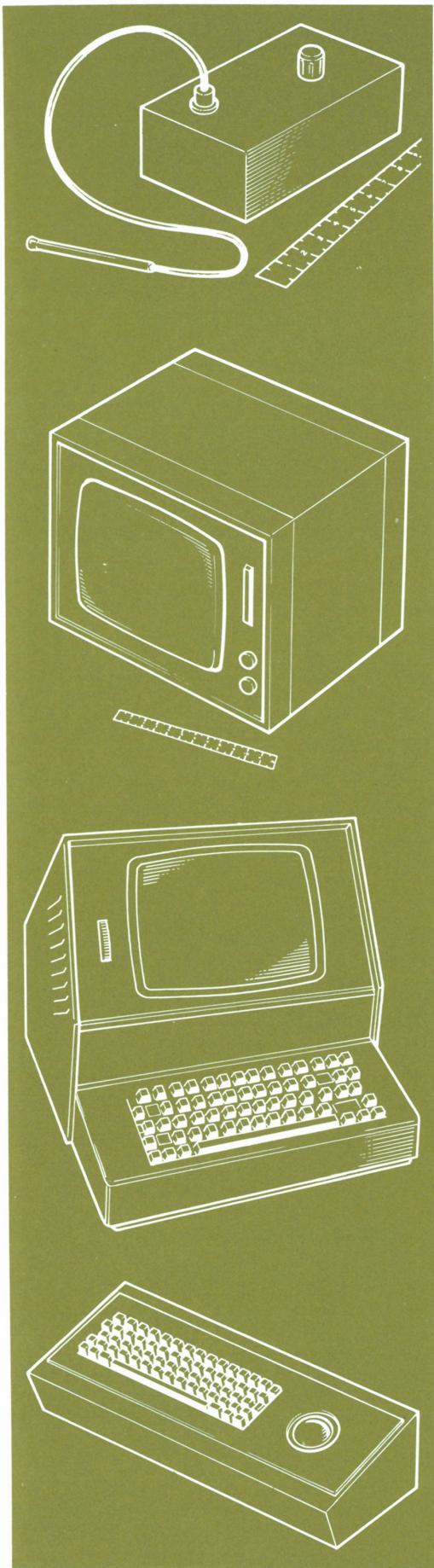
The TDM series of stand alone display terminals use a sub-raster scanning technique which presents characters of an exceptionally high quality using a 14 x 10 matrix. MOS character and text stores are used, the total text storage capacity being 2080 characters on 26 lines of 80 characters per line. Synchronous and asynchronous versions are available, with and without printer drive facilities.

## PATENTS

Certain aspects of the MD display system are patented in Great Britain, Canada, France and the U.S.A. Patents pending in Germany and Holland.

# C.R.T. Display Units

(using cursive stroke writing techniques)



## DISPLAY CONTROL MODULES

- MD 3 Alpha numeric and graphic — drives 12 displays — no store — variable format.  
MD 4 Alpha numeric and graphic — drives 12 displays — store — variable format.

## DISPLAY MODULES

- MD 11 11 inch (28 cm.) diagonal C.R.T. Integral power unit. Fixed format.  
MD 12 As MD 11 but random access.  
MD 14 14 inch (35 cm.) diagonal C.R.T. Use with MD 27 power unit. Random access. Single video.  
MD 15 As MD 14 but dual video.  
MD 21 21 inch (53 cm.) diagonal C.R.T. Use with MD 27 power unit. Random access. Single video.  
MD 22 As MD 21 but dual video.  
MD 25 26 inch (66 cm.) diagonal C.R.T. Use with MD 47 power unit. Random access. Dual video.  
MD 26 As MD 25 but single video.

## KEYBOARD

- MD 28 Alpha numeric keyboard for data terminals, editing etc. Read by MD 33 or digital input module.

## TRACKER BALL

- MD 29 Tracker ball unit read by MD 33 or digital input module (16 bits). Used in MD 40 (Includes MD 32).

## JOYSTICK SKETCH UNIT

- MD 30 Panel mounted joystick with keyboard providing facilities for creating and modifying graphical displays. Read by MD 33 or digital input module (26 bits).

## JOYSTICK

- MD 31 Read by MD 33 or digital input module (18 bits). Used in MD 30.

## POSITION COUNTER CARD

- MD 32 Contains two 8 bit forward and backward counters. Used in MD 29.

## LOGIC CARD

- MD 33 Fits into control modules MD 3, or MD 4; receives information from keyboard, tracker ball or joystick.

## SWITCHING UNIT

- MD 34 Highway Switching Unit — used in duplicate computer installations for highway switching.

## LIGHT PEN

- MD 36 Light pen for use with MD 3 or MD 4 control modules. Read by MD 37 or MD 38.

- MD 37 Light pen address logic. Fits in MD 3 or MD 4.

- MD 38 Light pen address and X-Y position logic. Fits in MD 3 or MD 4.

## TRACKER BALL SKETCH UNIT

- MD 40 As MD 30 but with a tracker ball controller in place of the joystick.

## ACCESSORIES

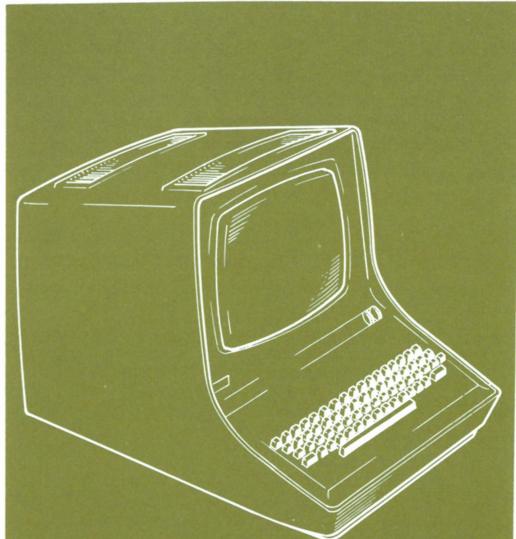
- MD 42 Display Control Module Fan Unit (max. 2 DCM's with stores).

## DISPLAY POWER UNIT

- MD 47 115/240 volt 50/60 Hz power unit.

# C.R.T. Display Terminals

(using raster or sub-raster T.V. scanning).



## STANDARD TELETYPE ALTERNATIVES (Software editing)

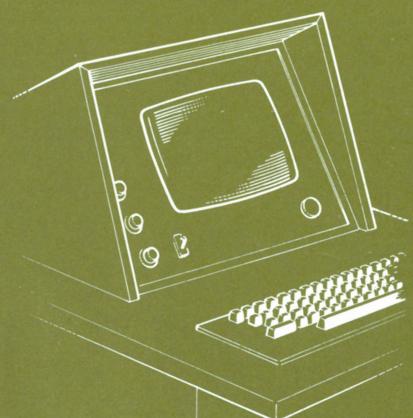
- WD 101 11" Monitor containing drive logic, keyboard and power unit. 1056 characters. No hard copy.
- WD 102 As WD 101 but without keyboard.
- WD 103 11" Monitor containing drive logic, keyboard and power unit. 1056 characters. Printer drive circuits.

## ARGUS TELETYPE ALTERNATIVES (Software editing)

- WD 105 11" Monitor containing keyboard and power unit. Supplied with two logic drive cards for mounting in MP 1 unit. No hard copy.
- WD 106 As WD 105 but without keyboard.

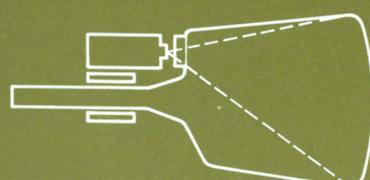
## LOGIC DRIVE CARDS (Software editing)

- WD 109 Two cards as supplied with WD 105 and WD 135 for mounting in MP 1 unit.



## STAND-ALONE DISPLAY TERMINALS – WD SERIES (Hardware editing)

- WD 120 11" Monitor containing keyboard, drive and editing logic and power unit. 1056 characters. No hard copy.
- WD 121 As WD 120 but without keyboard.
- WD 122 11" Monitor containing keyboard, drive and editing logic and power unit. 1056 characters. Printer drive circuits.
- WD 126 As WD 120 but with addition of insert/extract line editing facility.
- WD 128 As WD 122 but with addition of insert/extract line editing facility.



## DISPLAYS WITH OPTICAL REAR PROJECTION

- WD 134 11" (equivalent) monitor containing keyboard, drive and editing logic and power unit. 1056 characters. No hard copy. Projector and film magazine for 64 formats rear-projected on C.R.T. screen.
- WD 135 11" (equivalent) monitor containing keyboard and power unit. Projector and film magazine for 64 formats rear-projected on C.R.T. screen. Supplied with two logic drive cards for mounting in MP 1 unit. No hard copy.

# C.R.T. Display Terminals

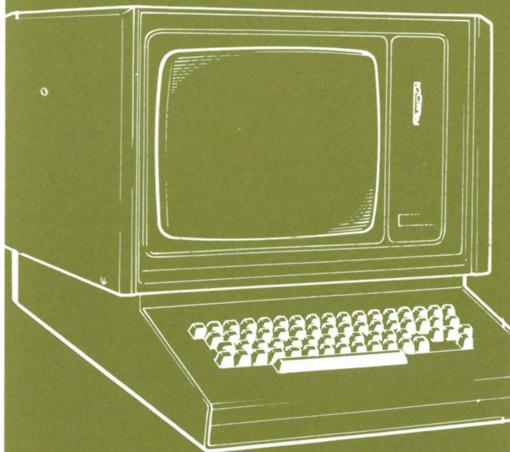
## STAND-ALONE DISPLAY TERMINALS – TDM 2000 SERIES (Hardware editing)

TDM 2000 12" Monitor containing keyboard, drive and editing logic /522 and power unit. 2080 characters. Synchronous interface. Printer drive circuits.

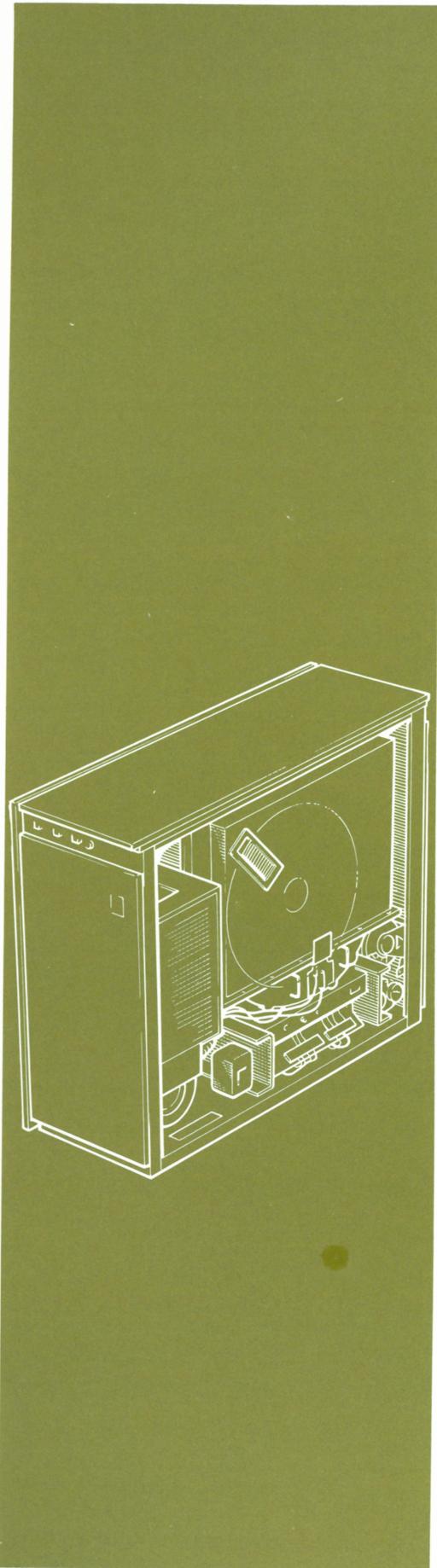
TDM 2000 As TDM 2000/522 but without printer drive circuits.  
/523

TDM 2000 12" Monitor containing keyboard, drive and editing logic /525 and power unit. 2080 characters. Asynchronous interface. Printer drive circuits.

TDM 2000 As TDM 2000/522 but without printer drive circuits.  
/526



# Backing Stores



A range of disc and magnetic tape backing stores is available. In every case the data are transferred in blocks between backing store and the computer core store using the D.S.A. facility, under the control of a backing store organiser program.

Each item is free standing and is connected to the computer Interface A through a unit containing control logic.

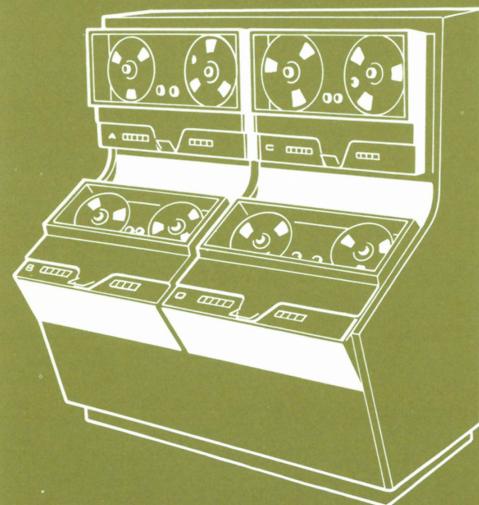
## DISC STORE

- MS 6      Storage capacity: 640,000 words of 24 bits. Average access time: 17.2 milli-seconds. Data transfer by D.S.A. Environment: 5 to 38°C. Can control two additional disc units MS 7.
- MS 7      Additional disc unit.

## MAGNETIC TAPE BACKING STORE

- MS 19      Buffer electronics for use with TM 7212 or TM 7292 tape systems.
- MS 20      TM 7212 7 track tape system in cabinet. 1 deck. Cabinet capacity 4 decks. Requires MS 19.
- MS 21      As MS 20, but 2 decks.
- MS 22      As MS 20, but 3 decks.
- MS 23      As MS 20, but 4 decks.
- MS 24      Extension 7 track tape deck. For use with existing MS 20, MS 21, MS 22 to increase number of decks, with limit of 4 decks total.
- MS 25      TM 7212 7 track tape system. 1 deck, in a rack. Requires MS 19.
- MS 26      As MS 25, but 2 decks (and 2 racks).
- MS 27      As MS 25, but 3 decks (and 3 racks).
- MS 29      Extension 7 track tape deck in a rack. For use with existing MS 25 or MS 26 to increase number of decks, with limit of 3 decks total.

# Backing Stores



- MS 30 TM 7292 9 track tape system in cabinet. 1 deck. Cabinet capacity 4 decks. Requires MS 19.
- MS 31 As MS 30, but 2 decks.
- MS 32 As MS 30, but 3 decks.
- MS 33 As MS 30, but 4 decks.
- MS 34 Extension 9 track tape deck. For use with existing MS 30, MS 31, MS 32, to increase number of decks, with limit of 4 decks total.
- MS 35 TM 7292 9 track tape system. 1 deck, in a rack. Requires MS 19.
- MS 36 As MS 35, but 2 decks (and 2 racks).
- MS 37 As MS 35, but 3 decks (and 3 racks).
- MS 39 Extension 9 track tape deck in a rack. For use with existing MS 35 or MS 36 to increase number of decks, with limit of 3 decks total.

## DRUM STORE

- MS 40 Magnetic Drum — 300,000 bits of storage. Programmed transfers.
- MS 42 As MS 40 with 1.3 million bits of storage.
- MS 44 As MS 40 with 4 million bits of storage.
- MS 46 As MS 40 with 8 million bits of storage.

# Miscellaneous Items

## TAPE EDITING SETS

A tape editing set (MG 3 or MG 4) is necessary for the production of new program tapes and for the correction of tapes in the program development stage. If the on-line system includes a similar teleprinter (MP 8, 10, 11, 12), the teleprinter of the editing set may serve as a standby machine.

## INTERRUPT EXPANDER CARD

This card allows eight input/output devices to share one computer interrupt line. Full masking facilities are provided. The card must be fitted in the peripheral control unit (MP 1).

## ISOLATE AND INTERRUPT TIMING CARD

Used in conjunction with an on-line test program, this card disconnects the computer from the controlled process if a fault occurs. It also includes two timing circuits which can be used to generate interrupt signals at known intervals. The first circuit gives mains-locked signals at the rate of 100 per second, the second is variable in the range 200 to 1000 signals per second. The card must be fitted in the peripheral control unit (MP 1), and controls the isolate relay, mounted on a separate chassis (MG 8).

## D.S.A. MULTIPLEXER CARD

This card allows a system to contain more than one module with D.S.A. facilities by enabling the computer to distinguish between simultaneous D.S.A. demands. Priorities are allocated to the modules when they are connected to the multiplexer card. The card must be fitted in a peripheral control unit (MP 1).

## LOCK-OUT EXPANDER CARD

The input/output lock-out facility in an Argus 500 system enables the input/output equipment to be locked out from selected programs. The basic machine provides a single lock-out bit; the expander card MG 10 increases the facility so that up to eight blocks of input/output equipment can be separately and selectively inhibited.

The card must be fitted in a peripheral control unit (MP 1).

## MANUAL BACK-UP PANELS

The range of back-up panels MG 21 to MG 26 provides manual standby facilities for individual loops or groups of ten loops, and is compatible with the Argus D.D.C. output system.

The panels can be mounted either in 6 foot racks forming part of the input/output equipment, or in the main plant control console.

Each panel requires facilities for a single bit input to and a single bit output from the computer. The system must, therefore, include suitable digital input and output modules.

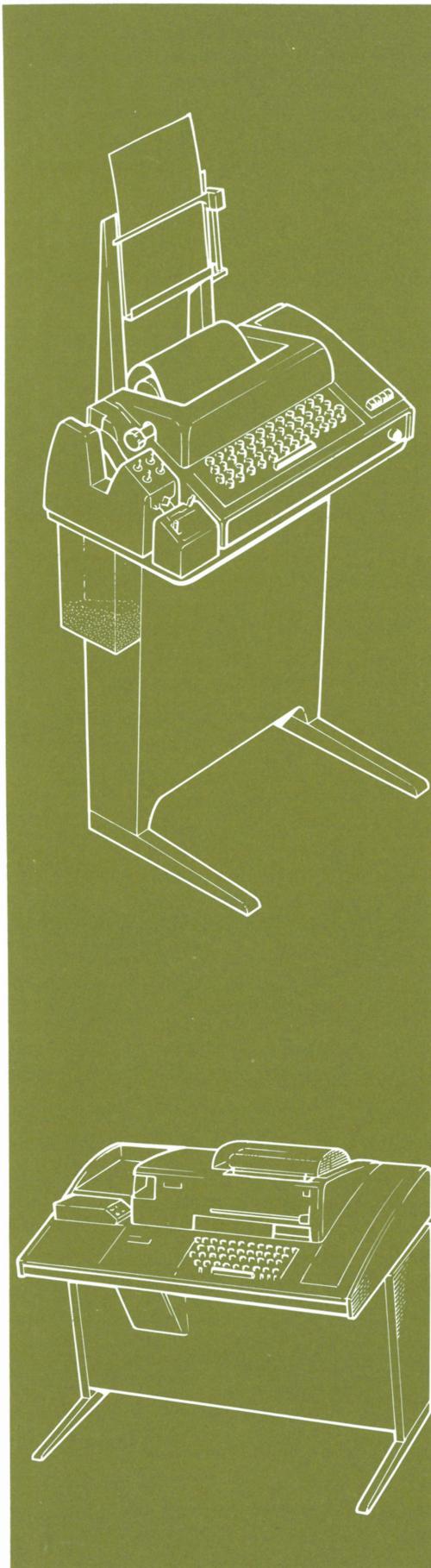
## D.D.C. OPERATORS CONTROL PANEL

The D.D.C. operators panel provides a means of communication between the process operator and the controlled process.

The panel itself is supplied for mounting in the main plant control console.

The input selection logic required to read the settings of the panel switches, and the drive logic for the panel displays, is mounted on four cards which must be fitted in a peripheral control unit (MP 1). The control panel module MG 30 contains both the panel and its associated control logic.

# Miscellaneous Items



MG 1 General purpose box.

## INTERFACE A TERMINATION

MG 2 Termination assembly for Interface A wiring. Mounts in MR 26.

## EDITING SETS

MG 3 8 track paper tape. ISO. 7 code plus even parity bit. 10 characters per second.

MG 4 8 track paper tape. ISO.7 code plus even parity bit. 10 characters per second. Heavy duty printer. Additional editing facilities.

## INTERRUPT EXPANDER CARD

MG 5 Allows expansion of a single interrupt line by a factor of 8. Full masking facilities included. The card is fitted in the peripheral control unit.

## ISOLATE AND INTERRUPT TIMING CARD

MG 6 Provides three facilities: 1. Plant isolation if on-line test program fails. 2.Timing interrupts at a rate of 100 per second, derived from the mains supply. 3.Timing interrupts at a rate of 200–1000 per second. The card is fitted in the peripheral control unit.

## ISOLATE RELAY CHASSIS

MG 8 Driven by MG 6.

## TAPE EDITING SUNDRIES

MG 40–46 Miscellaneous items for paper tape handling:  
hand tape spooler (MG 40), motor tape spooler (MG 41),  
12 tape centres (MG 42), tape trough (MG 43), tape bin  
(MG 44), uni-punch (MG 45), adhesive tape dispenser  
(MG 46).

## D.S.A. MULTIPLEXER CARD

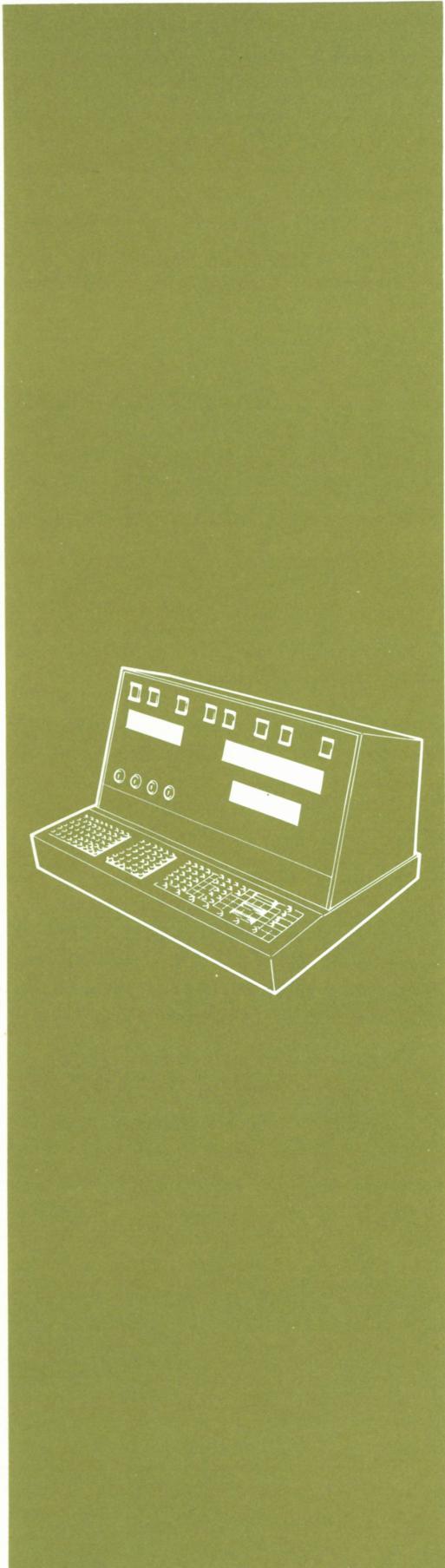
MG 9 Expands computer D.S.A. facility to allow up to 8 D.S.A. channels. The card fits in the peripheral control unit MP 1.

## LOCK-OUT EXPANDER CARD

MG 10 Allows expansion of the input/output lock-out feature of the Argus 500 computer by a factor of 8. The card fits in the peripheral control unit.

MG 14 Interrupt timer.

## Miscellaneous Items



### MANUAL BACK-UP PANELS

- MG 21 'Single control loop' panel for use without an automatic standby controller. The panel includes: measured value and valve position meters, computer/manual and valve raise/lower switches and a loop alarm lamp.
- MG 23 'Cascaded control loops' panel for use without automatic standby controllers. It contains: As MG 21 plus primary measured value meter.
- MG 25 'Ten control loop' shared station for use without automatic standby controllers and cascaded loop facility. It contains: Measured value and valve position indicators, loop select and valve raise/lower switches, and ten auto/manual switches plus indicator lamps.
- MG 26 'Ten control loop' station for use without automatic standby controllers, with cascaded loop facility. It contains: As MG 25 plus primary measured value meter.
- MG 29 Box with fan and filter for MG 30 or MG 31.

### D.D.C. OPERATOR'S CONTROL PANEL

- MG 30 Designed for use with the Consul D.D.C. control software but can be used with any Argus installation. The panel allows an operator to monitor and modify process values and control parameters. It includes a full alpha-numeric keyboard and special function keys, decimal displays, and warning lights.
- MG 31 As MG 30 but does not include an alpha-numeric keyboard.



## SYSTEM DESIGN AND MANAGEMENT

Ferranti have wide experience in the application of computers to industrial processes and can undertake the overall design and installation of complete computer control systems, including instrumentation.

Ferranti specialists can undertake programming and systems studies on a contract basis. Comprehensive simulation and computer facilities are available for this work.

## STANDARD SOFTWARE

An extensive library of fully-proven standard software is available, supplemented where necessary by individual programs geared to specific customer requirements.

## USER SUPPORT

Extensive services are available to purchasers of ARGUS systems to provide continuing advice, training, and benefits.

## TRAINING

A comprehensive training department exists to familiarise customer staff with the operation of their systems. Training courses cover Argus equipment and control systems, while programming courses provide instruction in ASTRAL, FORTRAN and CORAL languages, and the special techniques required in on-line work. The courses are fully documented, and include practical work on a service computer.

## DOCUMENTATION

Every ARGUS system is fully documented, with handbooks, logic and circuit diagrams.

## INSTALLATION

Competent engineers remain with the system to install and test. Thereafter their services can be retained at a reasonable charge, whilst the user's staff familiarize themselves with the system.

## MAINTENANCE

Routine maintenance is required only on electro-mechanical units, alternators and batteries and can be carried out without taking the computer off-line. In the event of a fault, down-time is minimized by plug-in replacement of major units; for example the computer processor, core store blocks and power supply units are all plug-in units. Spares can be held either by the customer or by Ferranti. Since major units are involved particularly in the case of the computer, Ferranti will hold, for a small annual charge, spares which are available in the event of faults. Customers having a number of computers may prefer to hold their own spares to eliminate travelling time.

Repair of faulty units is normally carried out in the Ferranti factory where special test equipment is available. Such repairs are free of charge during the warranty period. The range of maintenance services available for Argus computer systems includes a full 24-hour 7 day/week on-call service. Provision is also made for routine maintenance visits, the repair of faulty units, and a spares holding at a Ferranti Service Centre.

# Argus Sales Offices

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Argus maintenance facilities are centred at Manchester, London (City), South Wales, Bracknell and Edinburgh. Similar facilities are available through overseas agents listed above, all of whom are experienced and equipped to provide a comprehensive maintenance service similar to that available in the U.K.



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