

**Introduction
to
MERA 400
general
purpose
mini-
computer
system**

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SYSTEM'S OVERVIEW

MERA 400 is general-purpose, 16-bit minicomputer representing state-of-the-art in logic design and technology of computer system. Unique system interface connecting processors, memory modules and I/O channels as well as asynchronous communication between modules are the main features of MERA 400 architecture. Expanded instruction set provides the effective tool for data manipulation of different formats.

The high reliability of MERA 400 is guaranteed by the technology — MSI and SSI integrated circuits mounted on double layer PC boards and proven mechanical design permitting easy mounting of functional modules. CPU and peripheral devices are not requiring air-conditioning.

Easy and quick access to all system components and extensive diagnostic hardware and software guarantee effective maintenance and service.

The wide range of available software, including multi-task interactive operating system SOM-3, high-level languages FORTRAN IV and BASIC and library of application programmes, together with reliable hardware, make MERA 400 an attractive tool for wide range of applications.

APPLICATIONS

MERA 400 minicomputer can be successfully used in several applications like:

- o scientific and engineering calculations
- o business data processing
- o real-time data processing
- o remote batch data processing
- o data acquisition
- o process control

Modularity of hardware and software allows user to easily expand or reconfigure his system in the future.

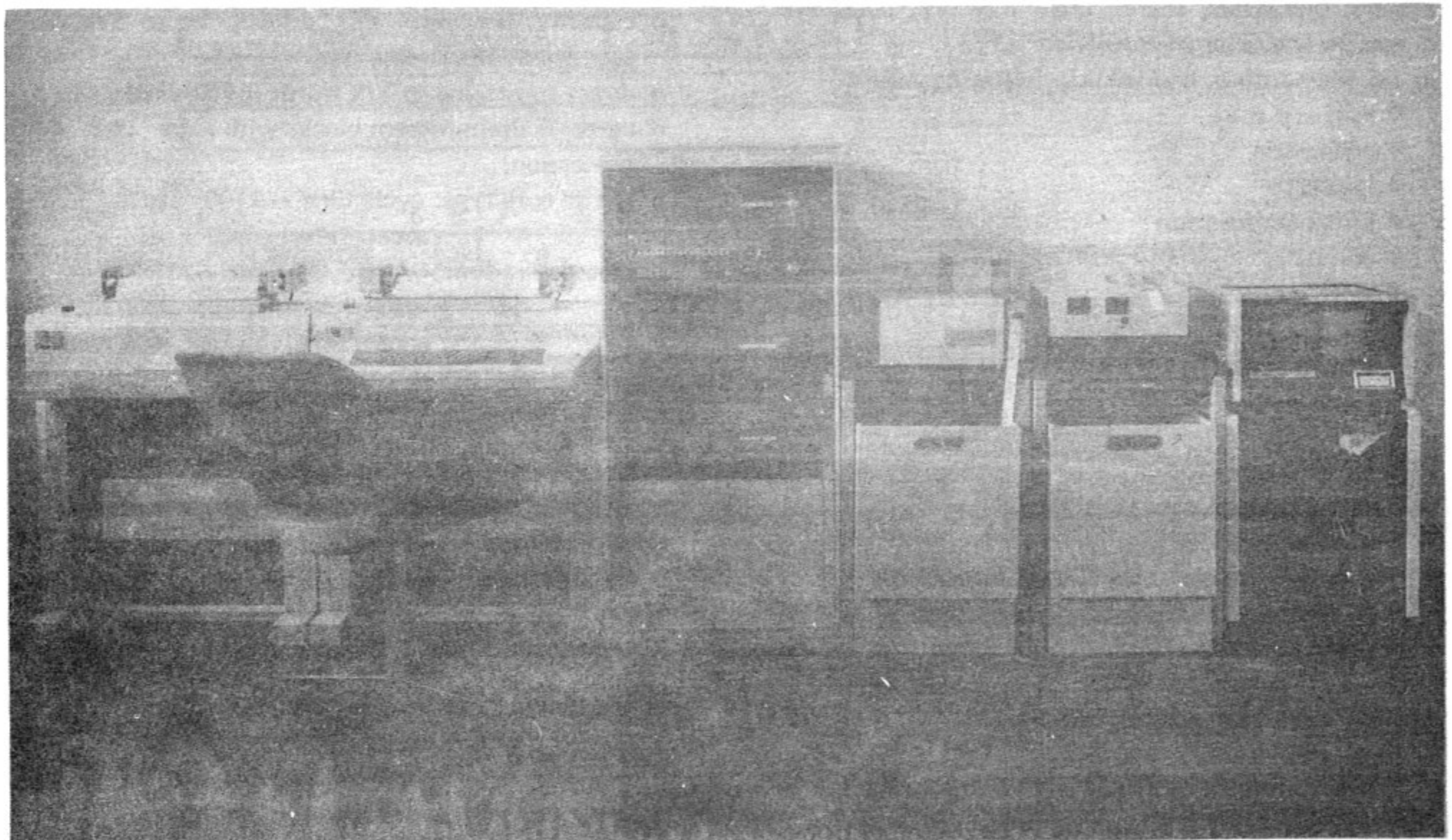
FUNCTIONAL SPECIFICATION

System interface

- o main communication path connecting all system functional modules;
- o maximum system configuration: 2 processors, 17 memory modules 32k words each, 16 I/O channels;
- o interlocked, asynchronous communication between functional modules;
- o simultaneous and parallel transfer of data, addresses and control informations;
- o bus requests serviced on geometical priority principle;

Processor architecture

- o 16 bit word length;
- o eight 16 bit general-purpose registers, that can be used as accumulators or index registers (B-modifiers);
- o 32 line, 11 level interrupt system. 10 levels are individually program masked;
- o interrupt service priority independent of bus requests and system configuration;
- o hardware interrupt stack with automatic storing of interrupt specification;
- o real time clock;
- o automatic program loading (bootstrap);
- o power fail detection and automatic program restart;
- o memory capacity: 32 k words 16 bit with 1 parity bit;
- o direct addressing to 32 k words (64 k bytes);
- o ferrite core memory cycle: 1100 nsec $\pm$ 10 %;
- o memory division on user program blocks;
- o instruction execution time: 2 μ sec (register-register);



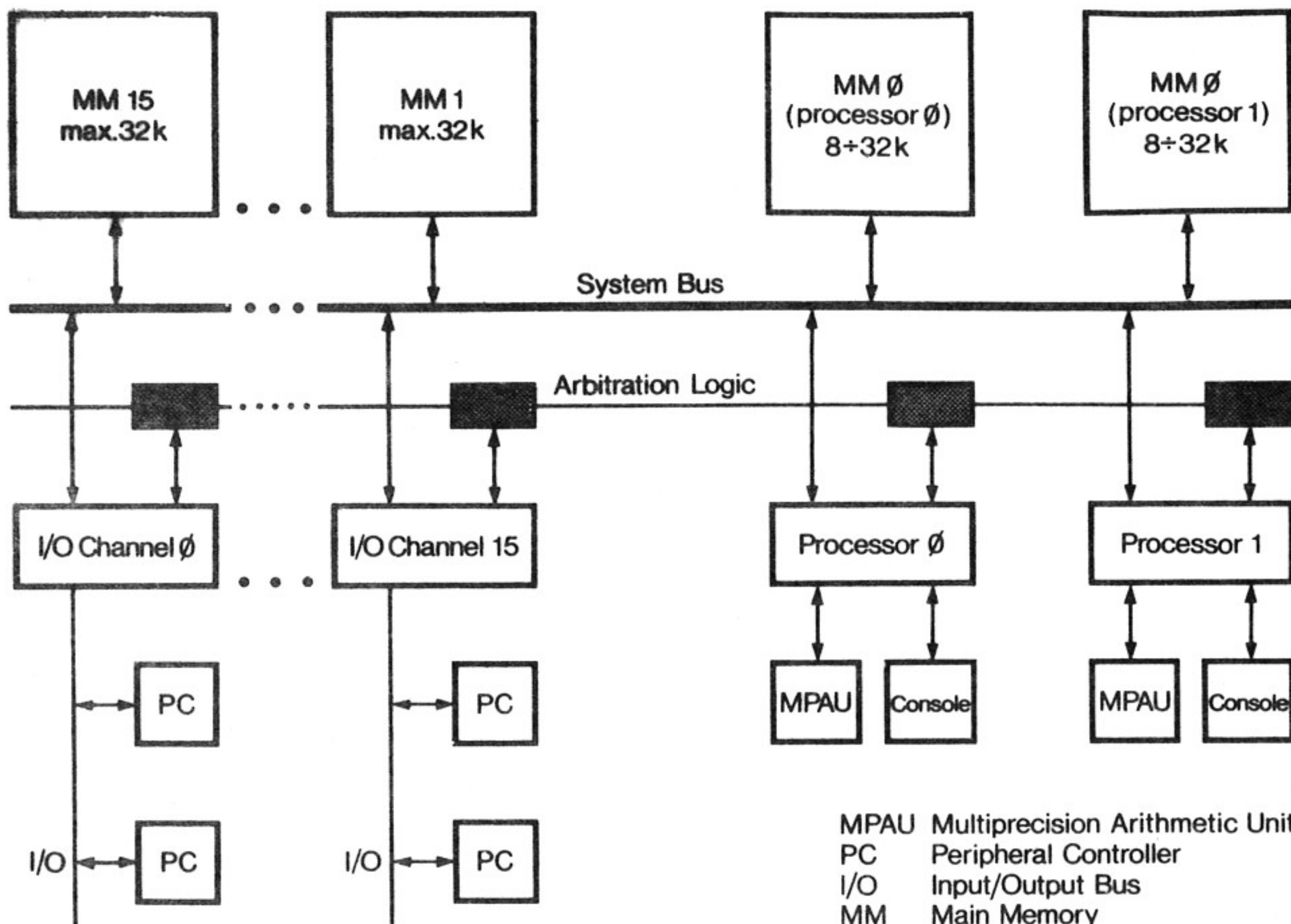


Fig. 1. MERA 400 architecture (maximal configuration)

Fig. 2. MERA 400 information formats

- o dual processor operation: direct communication between processors, shared main memory, peripheral devices and external memories;
- o 132 instructions, divided into following groups
 - load and store
 - arithmetic
 - logical
 - byte manipulation
 - compare
 - shift/rotate
 - jump
 - test and branch
 - input/output
 - extracode
 - system control
- o binary 2's complement arithmetic
- o 3 addressing modes
 - premodification (using special instruction)
 - B-modification (using index registers)
 - D-modification (indirect addressing)

Multiple-precision arithmetic unit

- o long fixed-point and floating-point operations: addition, subtraction, multiplication, division and normalisation

Main memory

- o capacity: maximum 17 modules, 4k to 32k word each (with 4k increments);
- o direct addressing to 32k words (64k bytes)
- o up to 15 user program blocks with read and write protection;
- o ferrite core type: cycle time — 1100 nsec
access time — 600 nsec
- o plated wire type: write cycle time — 1200 nsec
read cycle time — 900 nsec
access time — 400 nsec

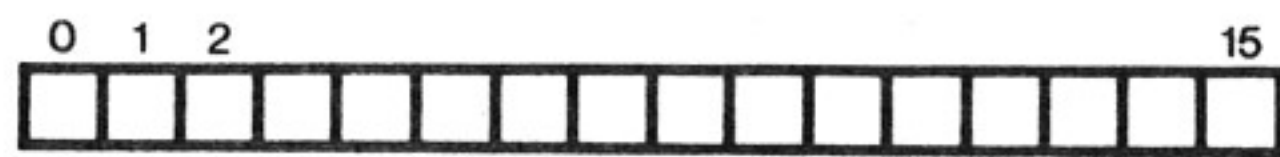
External memories:

- o cartridge disc MERA 9425
- o magnetic tape PT 305 (under development)
- o cassette tape PK-1
- o floppy disc SP 45 DE

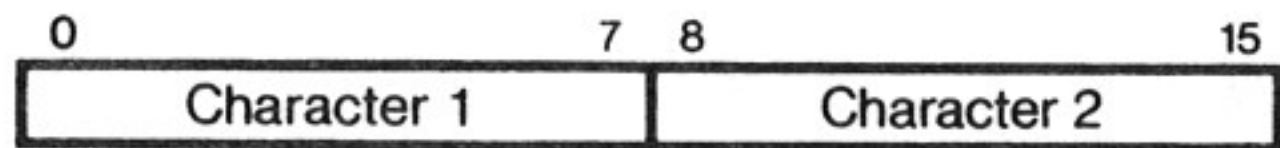
Power supply

- o line power 220V/+10%–15%, 50 Hz / ±1 Hz/
- o thermal overload protection
- o output voltages: +5V, +15V, –5V, –15V
- o overvoltage and overcurrent protection
- o memory protection with power on/off sequence

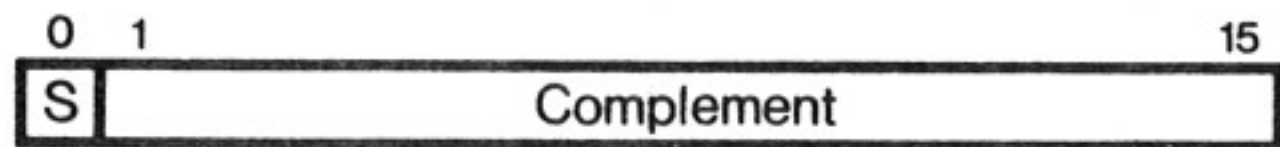
Data formats



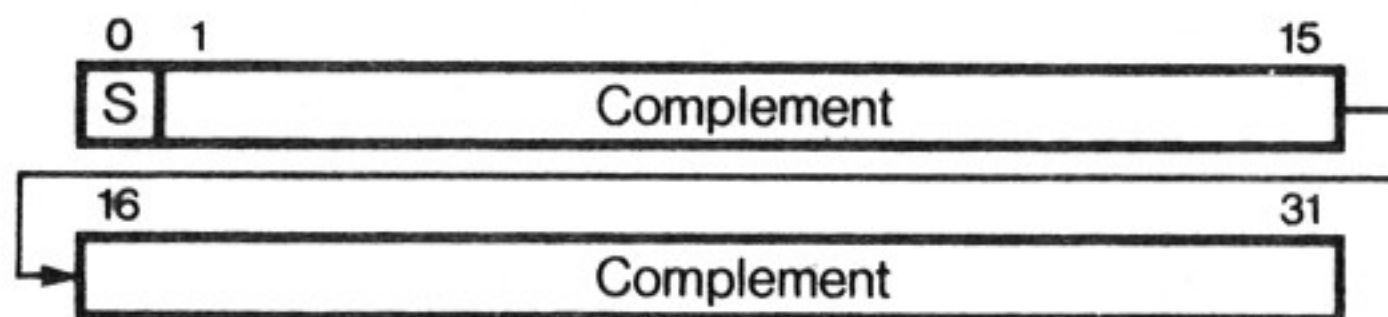
Logical data



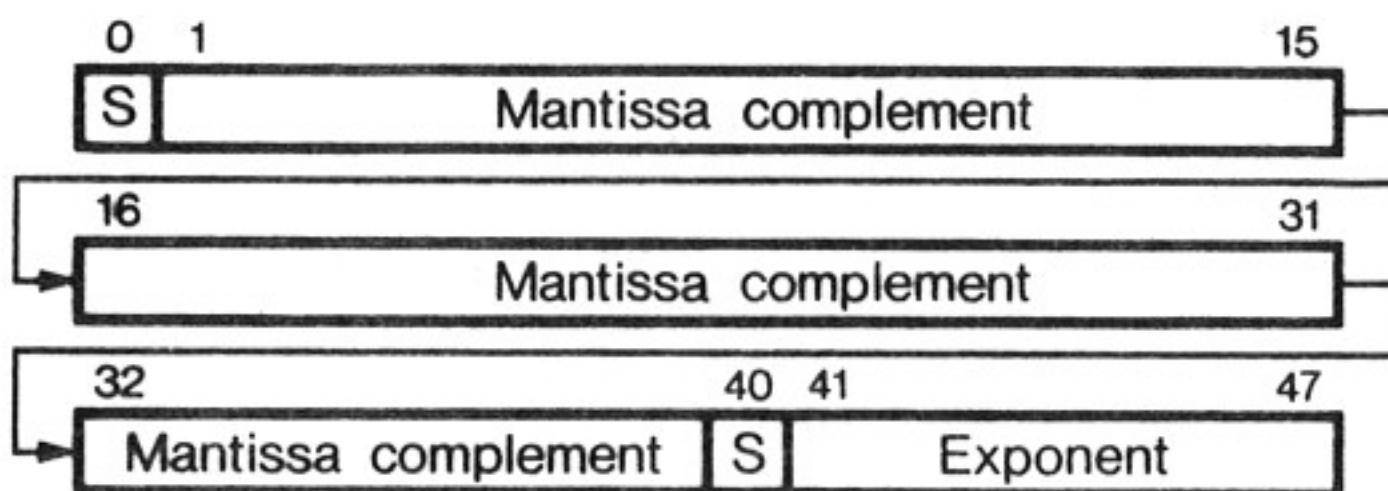
Alphanumerical characters



Short, fixed-point number

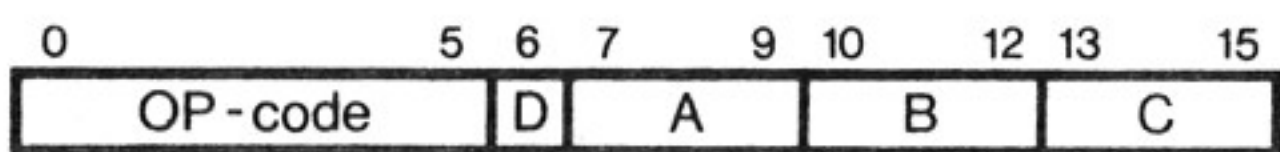


Long, fixed-point number
(two words)

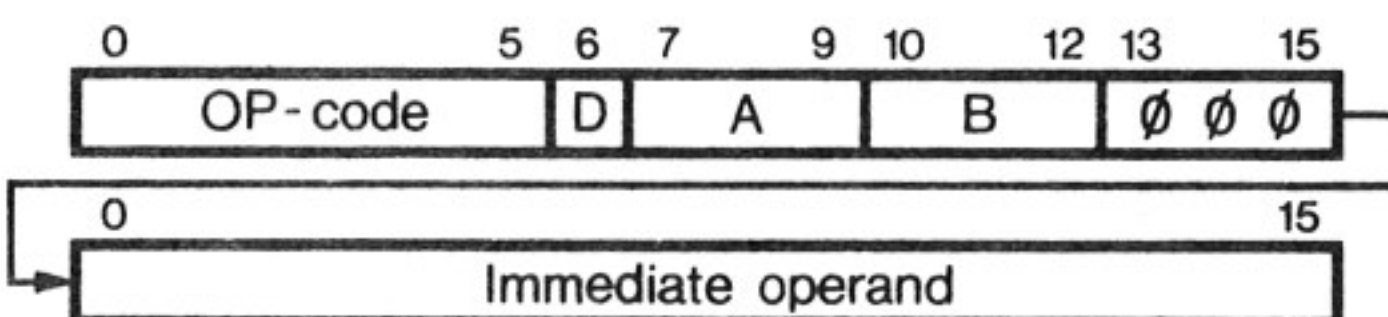


Floating-point number
(three words)

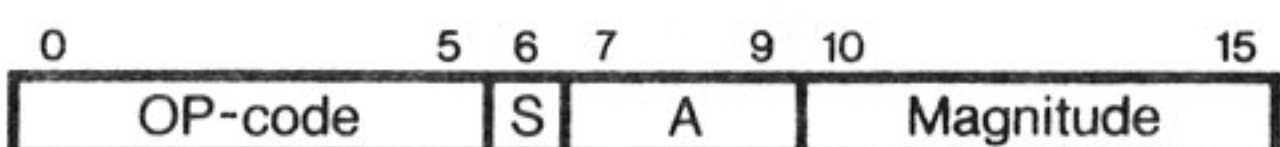
Instruction formats



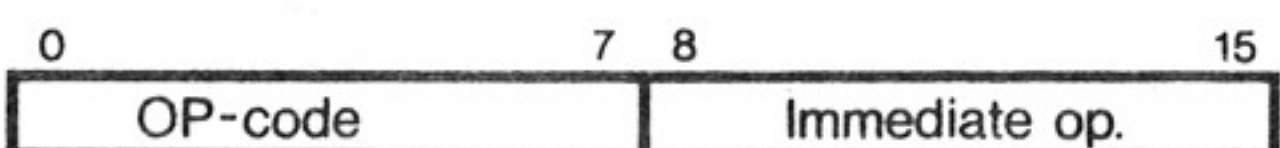
Standard instruction word



Long-immediate

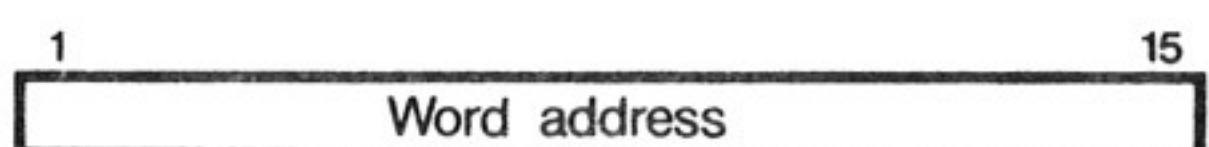


Short-immediate

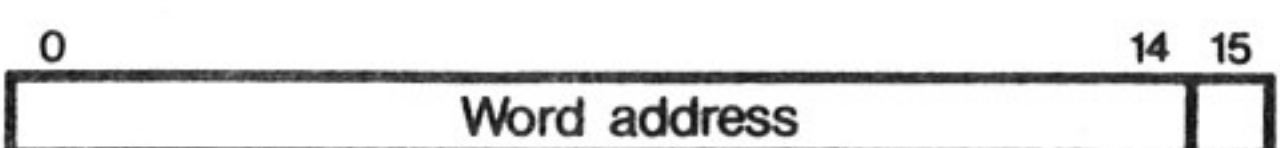


Byte-immediate

Address formats



Word address



Byte address

↑ Ø points high byte, 1 points low byte

Input/output channels

- o programmed (character) channel with addressing space for 8 peripheral controllers. It allows to transfer bytes/words between processor registers and peripheral device under program control. Usually, to the programmed channel are attached slow peripheral devices operating in start-stop or synchronous mode. Maximum data transfer rate is from 20k word/sec (under operating system) to 200k word/sec.
- o DMA (memory) channel with addressing space for 8 external memory controllers. It allows to transfer data between main memory and external memories (disc or tapes). Maximum data transfer rate is 500 words/sec.
- o PI channel, connecting "Inteldigit-PI" process control subsystem to MERA 400. Up to 16 PI cassettes may be attached to the channel.

Peripheral devices

- o paper tape reader CT 1001 A
- o paper tape reader CT 2100
- o paper tape punch DT 105 S
- o paper tape punch FACIT 4070
- o mosaic printer DZM 180
- o line printer DW-3 (under development)
- o terminal DZM 180 KSR
- o alphanumerical display VIDEOTON S 40
- o alphanumerical display MERA 7952 (under development)
- o teletype DD 390
- o graphic display MMG 300 (under development)
- o asynchronous line controller, conforming to CCITT V.24 recommendation
- o telegraph line controller UPSTg
- o X - Y plotter DIGIGRAF 1008
- o X - Y plotter EC 7053 (under development)

ENVIRONMENTAL SPECIFICATION

The following specification apply to the CPU without peripheral devices:

- o temperature
 - operating + 5°C . . . + 40°C
 - storage - 10°C . . . + 55°C
- o relative humidity 40% . . . 95% at 30°C (non condensing)
- o vibration
 - non-operating 0,15 mmp-p, 5Hz. . . 35 Hz, 1 axis

SOFTWARE

- o multi-task, real-time operating system SOM-3 which can be specifically tailored to the application requirements and hardware configuration
- o powerful system processors
 - Job Control Language for batch processing
 - Link Editor which produces executable program module from object programmes
 - Cataloger for creating files of source modules
 - Library Update that allows user to create update and modify library files
 - Source Update for creating and updating source program files
 - Debugger which enable user to troubleshoot program errors
- o language processors supported by SOB-3
 - macroassembler
 - interactive BASIC
 - FORTRAN IV (extended) which permits user to utilise all operating system capabilities
- o scientific library in BASIC and FORTRAN

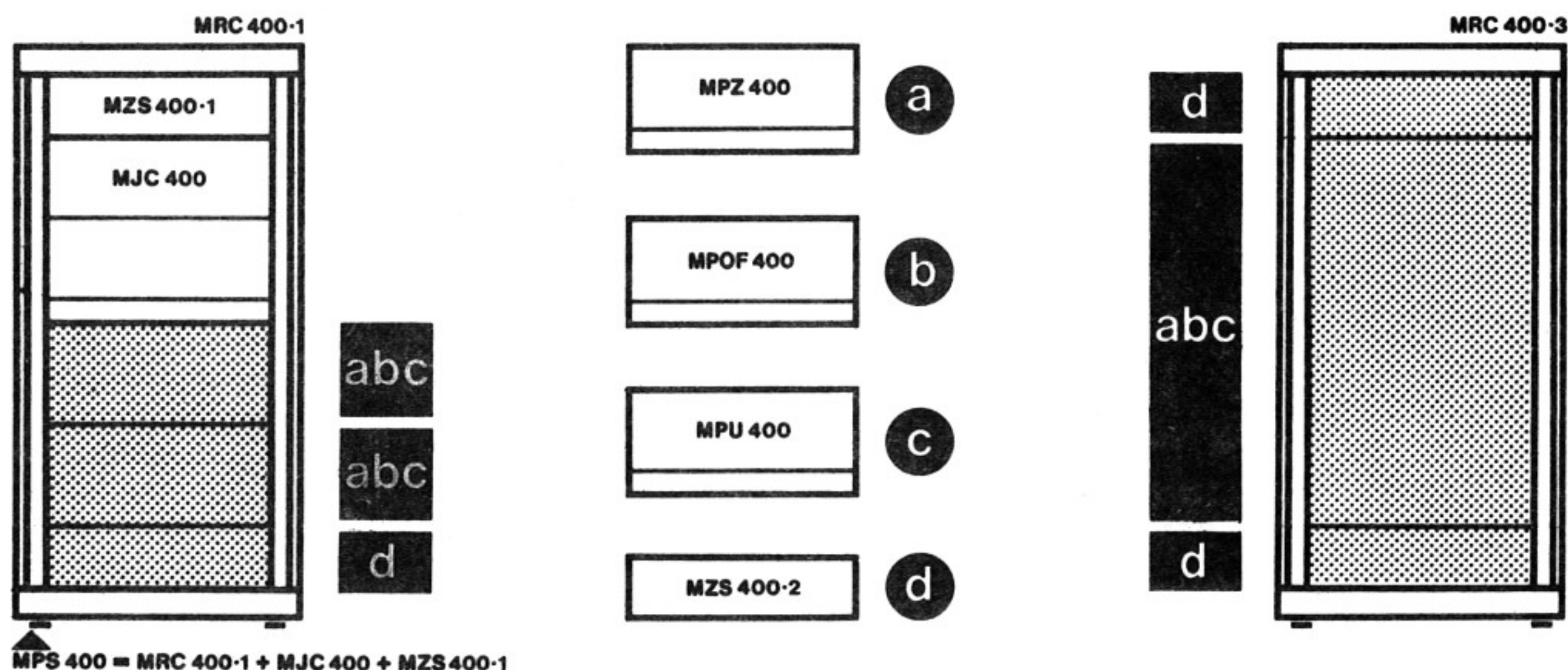
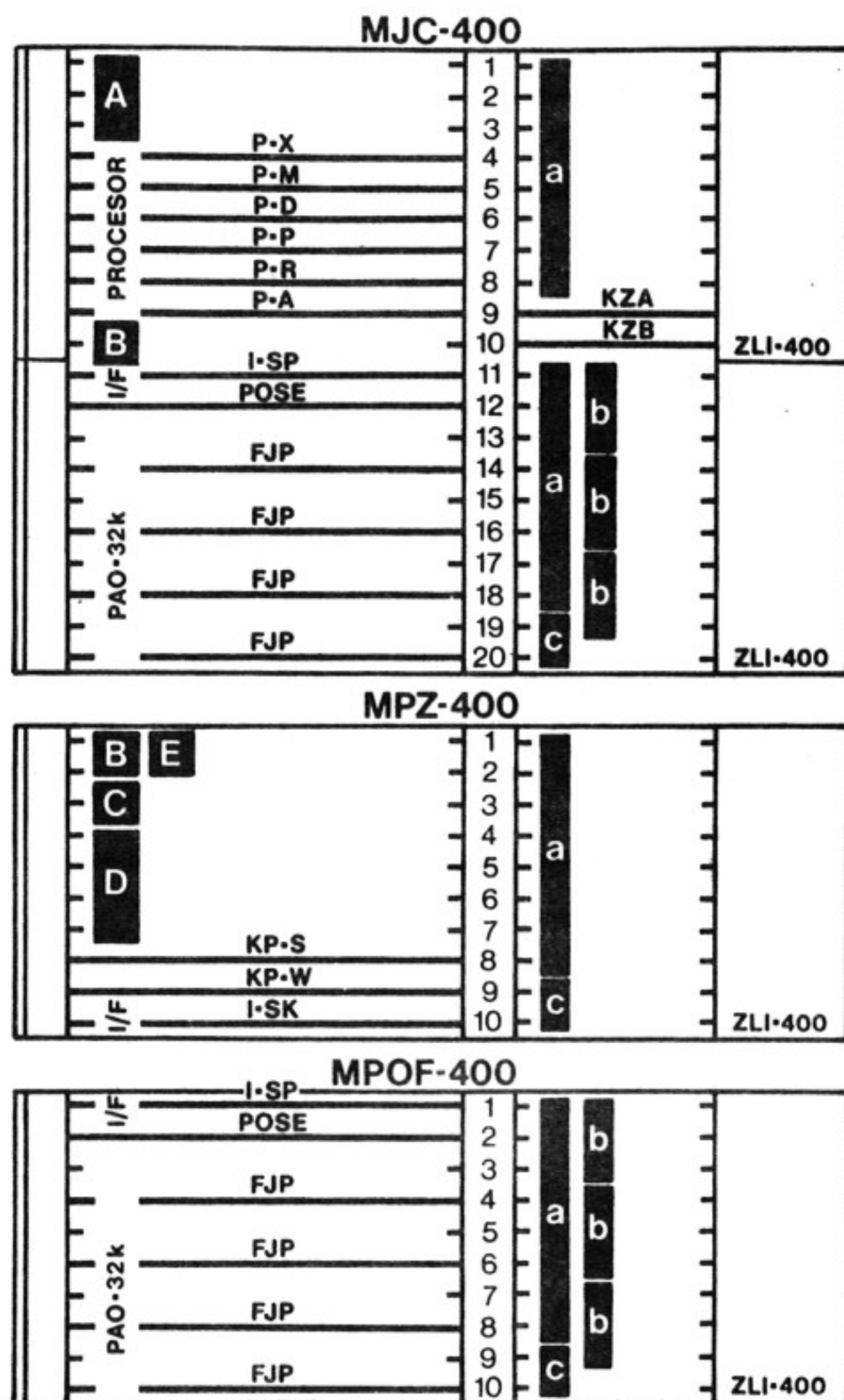
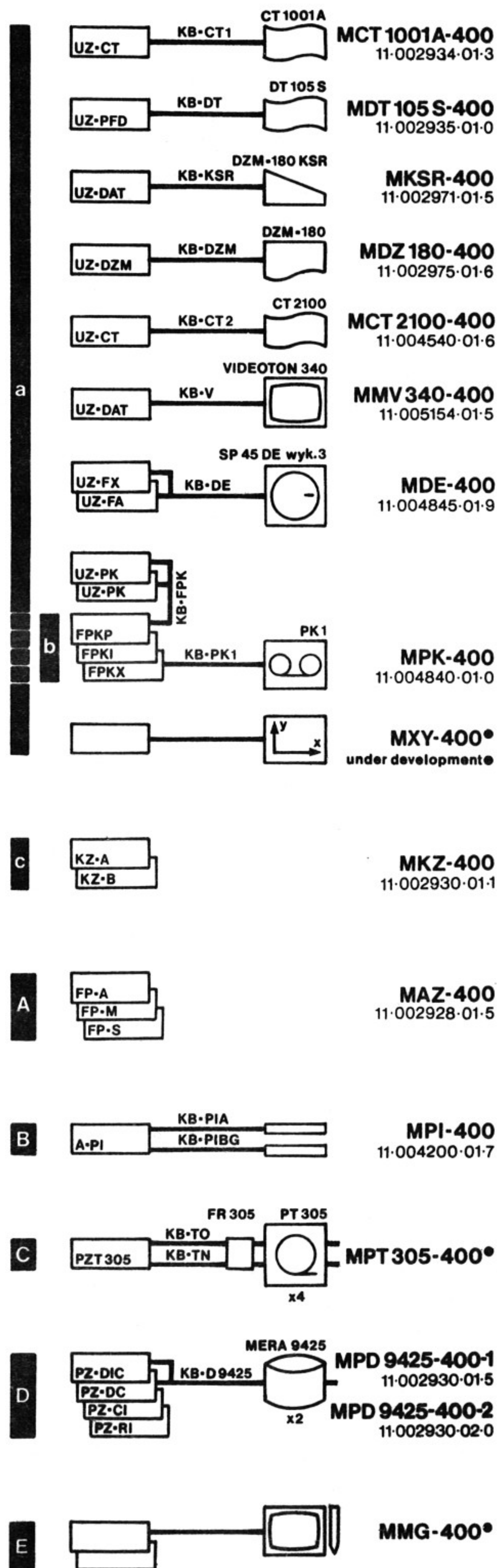


Fig.3. MERA 400 Assembly Units (racks and cases)

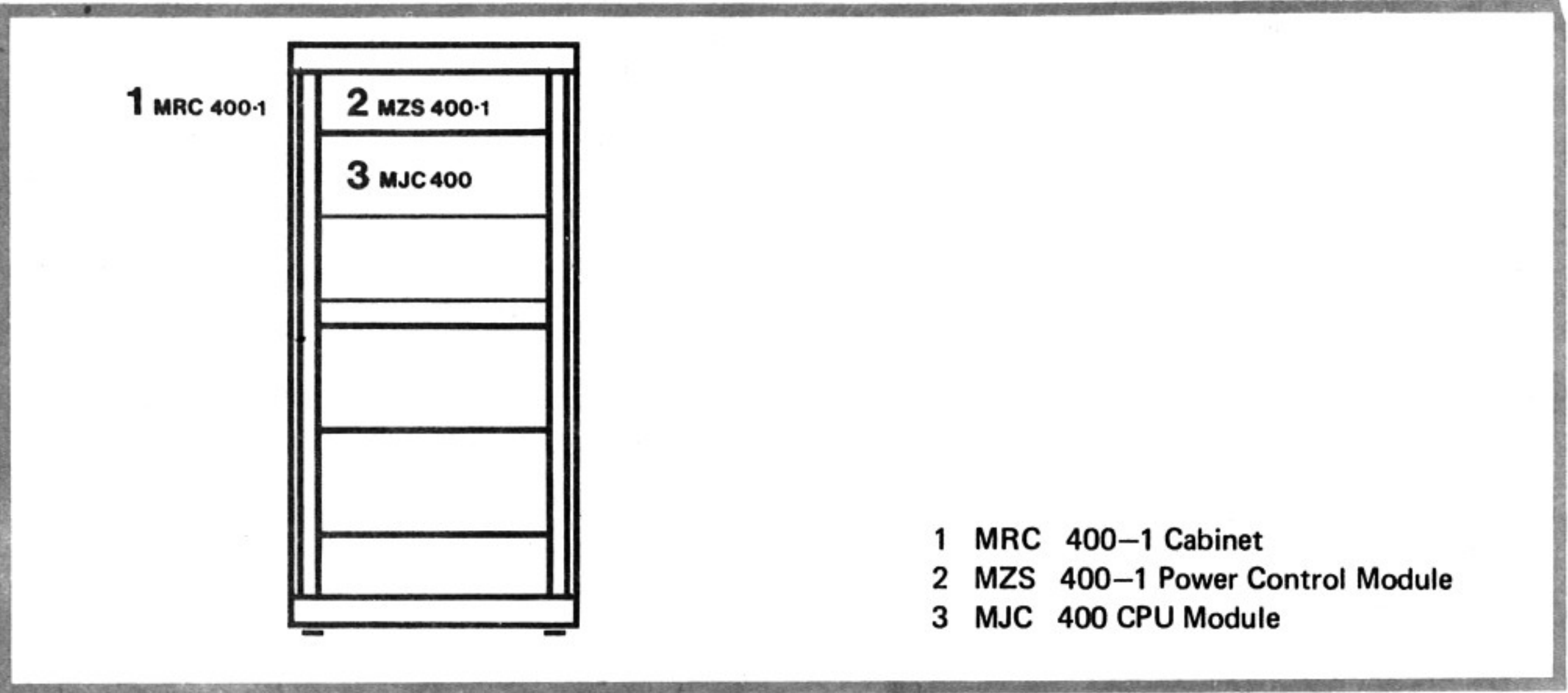


MJC 400 CPU Module
 MPZ 400 External Memory Module
 MKZ 400 Programmed Channel Module
 MAZ 400 Multiple-precision Arithmetic Unit Module
 MPOF 400 Main Memory Module (ferrite core)
 MCT 1001A-400 CT 1001 A Paper Tape Reader Module
 MDT 105S-400 DT 105S Paper Type Punch Module
 MKSR 400 DZM 180 KSR Terminal Module
 MDZ 180-400 DZM 180 Mosaic Printer Module
 MMV 340-400 V 340 Alphanumeric Display Terminal Module
 MDE 400 SP45DE Floppy Disc Module
 MPK 400 PK 1 Cassette Tape Module
 MXY 400 X-Y Plotter Module
 MPI 400 PI - Inteldigit Controller Module
 MPT 305-400 PT 305 Magnetic Tape Module
 MPD 9425-400 MERA 9425 Cartridge Disc Module
 MMG 400 Graphic Display Module
 MCT 2100-400 CT 2100 Paper Tape Reader Module

Fig.4. MERA 400 Assembly Units (peripheral devices and external memories)



MPS 400 BASIC SYSTEM MODULE



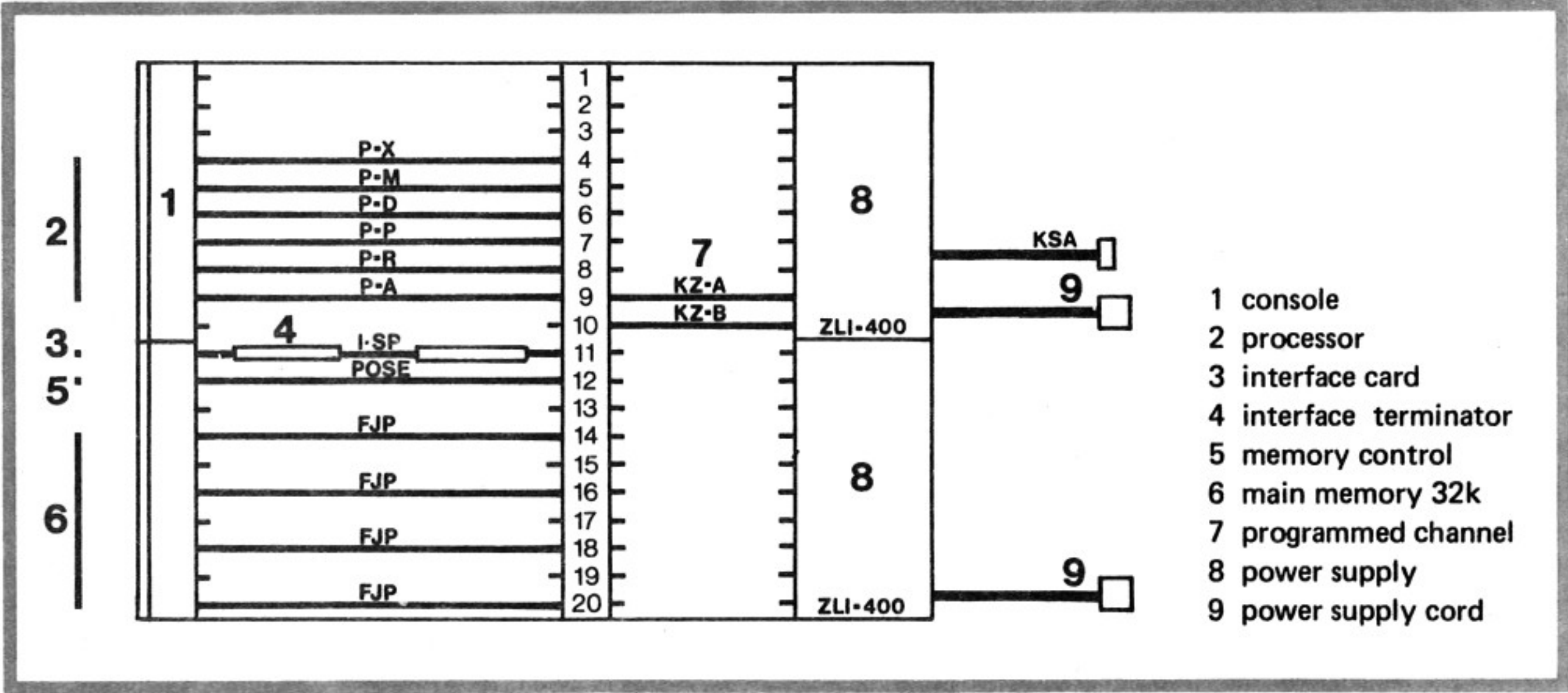
Functional Characteristic

MPS 400 Basic System Module is the central processor of the MERA 400 system. It is also the main common assembly unit of the all system configuration. Other modules i.e. I/O channels cases or controller s PC board are mounted in MPS 400 module.

Technical Data

MPS 400 module consists of MRC 400-1 rack, MZS 400-1 power control module and MJC 400 CPU module. The last two modules are housed in the MRC 400-1 rack.

MJC 400 CENTRAL PROCESSING UNIT MODULE



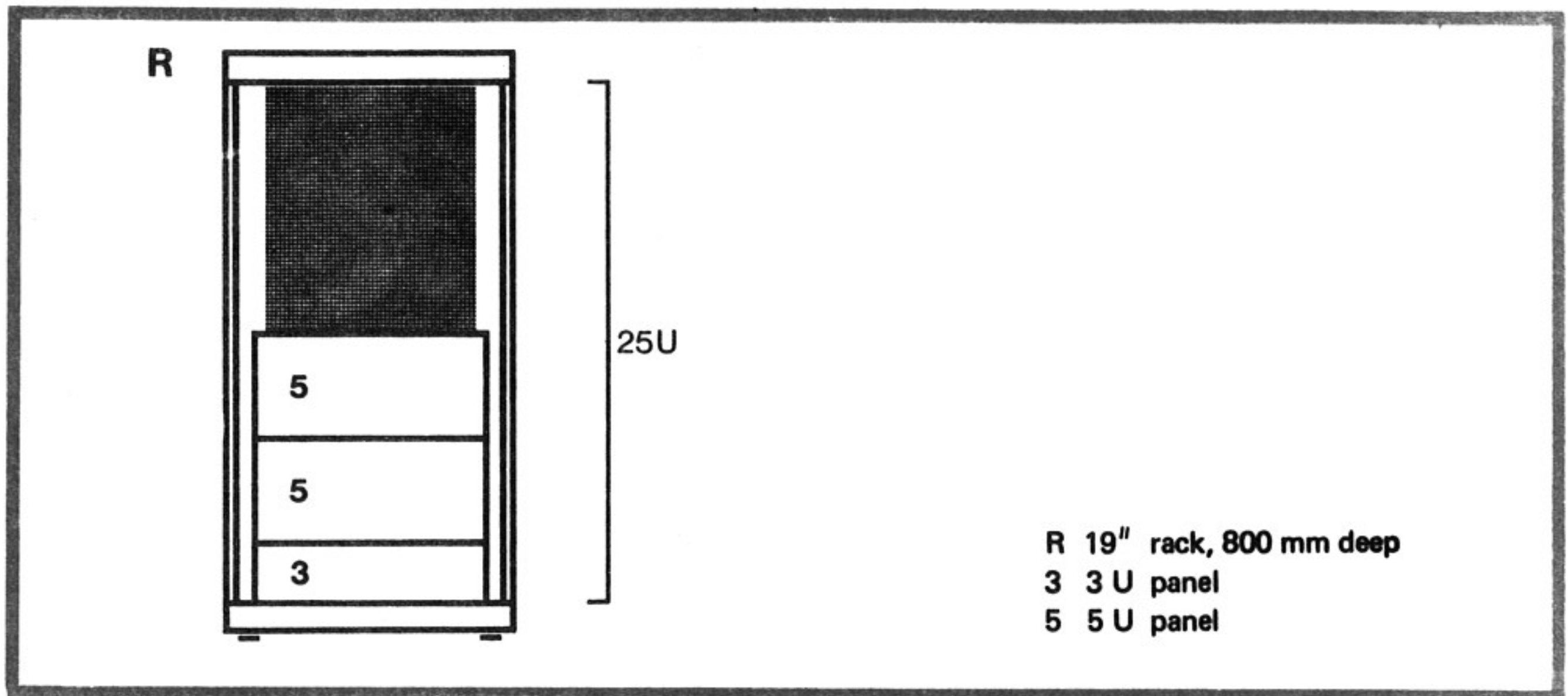
Functional Characteristic

MJC 400 module is a central processing unit of the MERA 400 system. MJC 400 executes all program instructions and stores operating system and user programmes.

Technical Data

MJC 400 is housed in 9U, slide chassis case and contains processor, 32k word of ferrite core memory, programmed channel, interface card, console and power supplies.

MRC 400-1 STANDARD CABINET MODULE



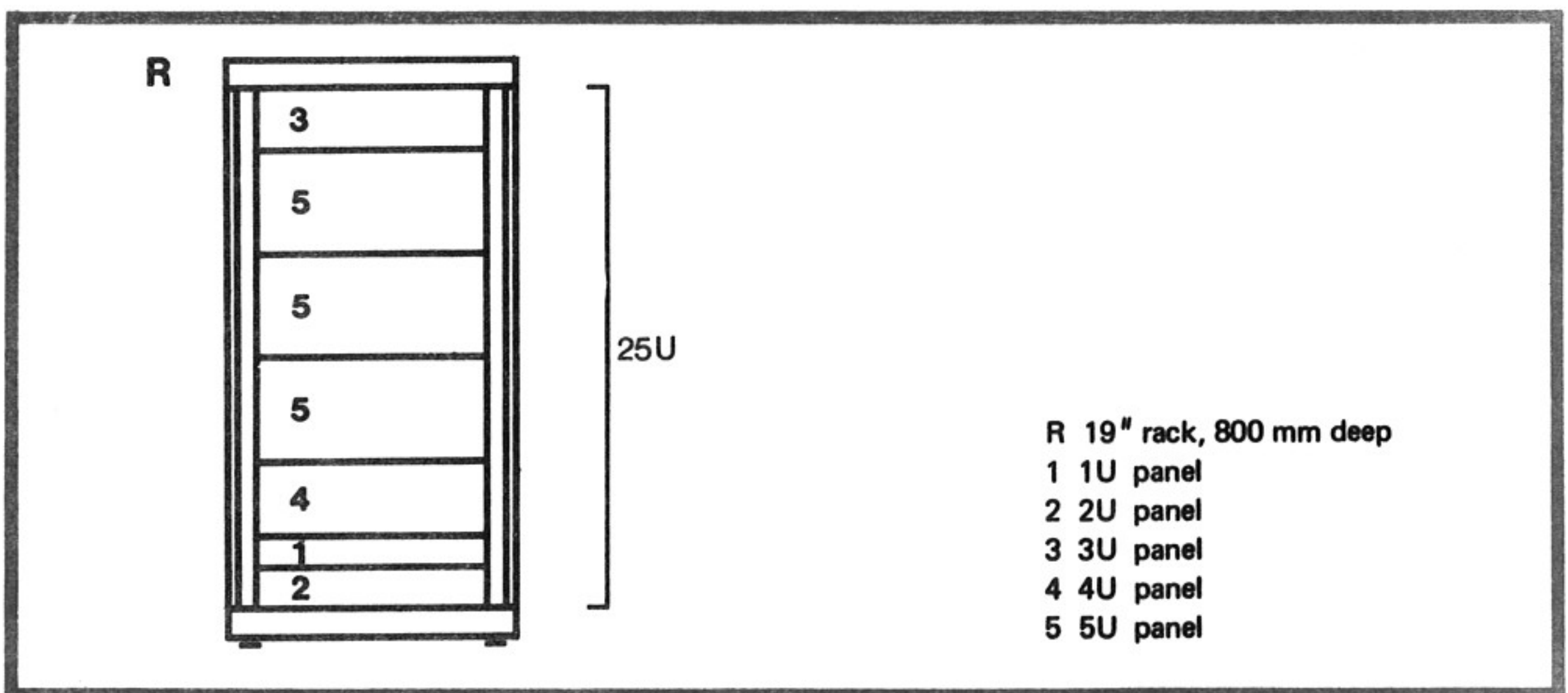
Functional Characteristic

MRC 400-1 standard cabinet module is used for mounting MZS 400-1 power control module and MJC 400 CPU module. There is also enough space for mounting two 5 U cases and one 3 U case ($U = 44,4 \text{ mm}$)

Technical Data

- MRC 400-1 module is 19" rack, 25 U high.
- The cabinet has removable side and back covers.
- The back cover is perforated
- All cases in the cabinet are slide mounted

MRC 400-3 STANDARD CABINET MODULE



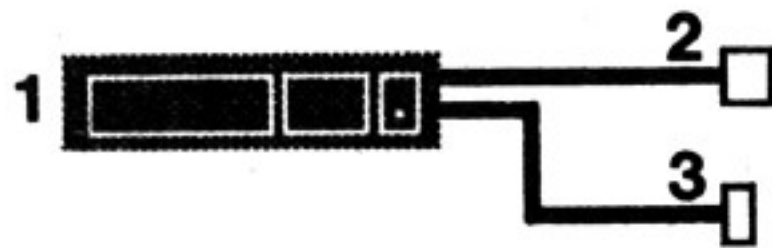
Functional Characteristic

MRC 400-3 Standard Cabinet Module is used for mounting cases housing functional modules like MZS 400-2, MPZ 400, MPOF 400 or MPU 400. MRC 400-3 module is used in systems requiring more space than in standard MPS 400 module.

Technical Data

MRC 400-3 module is supplied with several blank front panels. They allow to mount any combination of 3U and 5U cases, providing, that there is always one 3U cases, as MZS 400-2 module. Other technical data is the same as for MRC 400-1 module.

MZS 400-1 POWER CONTROL MODULE



- 1 3U high case
- 2 power cord
- 3 KSA cable

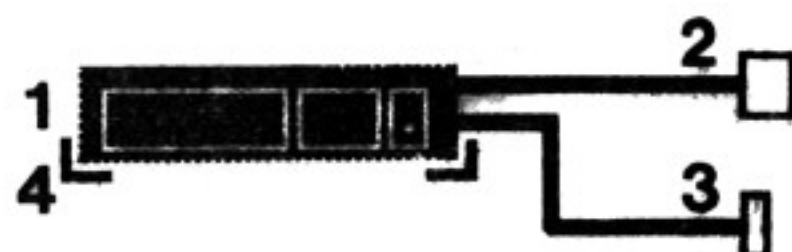
Functional Characteristic

MZS 400-1 power control module controls turning power off and on in the all equipment within MRC 400-1 cabinet. Model 1 MZS 400-1 module is mounted in MPS-400 module.

Technical Data

MZS 400-1 provides 20A, 220V AC power for up to twelve modules in MERA 400 system. On the back-panel there are 12 sockets labeled Z1 to Z12. Six of them, Z1, Z2, Z5, Z6, Z9 and Z10 are connected to the filters. These sockets are usually used to power MPZ 400, MPOF 400, MJC 400 and MPU 400 modules. In every system power is turned on/off using a special lock in MJC 400 CPU module. KSA cable connects the lock with MZS 400-1 module.

MZS 400-2 POWER CONTROL MODULE



- 1 3U high case
- 2 power cord
- 3 KSA cable
- 4 slides for rack mounting

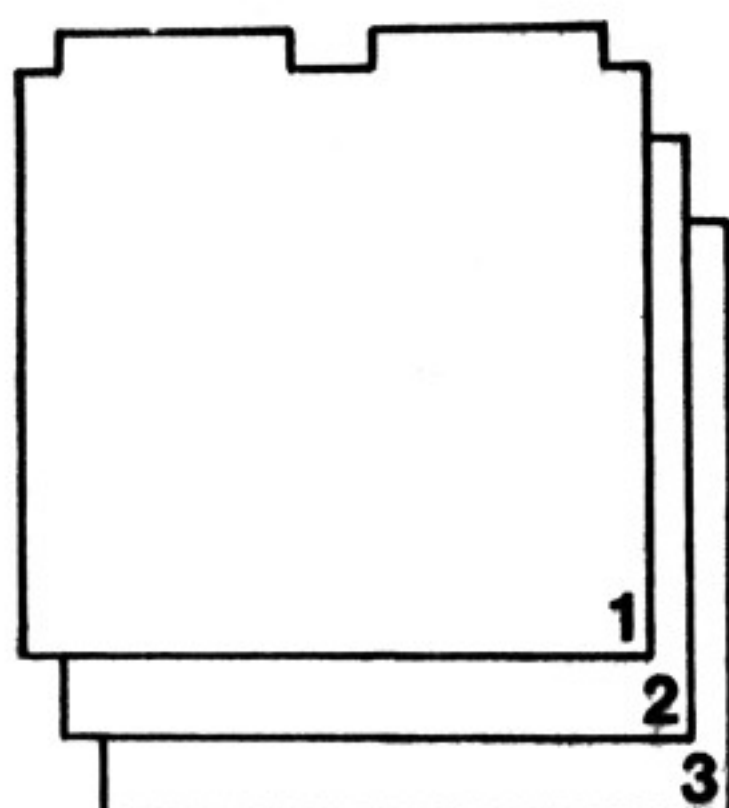
Functional Characteristic

MZS 400-2 Power Control Module is used as an extension of MZS 400-1 module, when system power consumption is greater than 20A or number of required power slots is greater than 12. The number of MZS 400-2 modules in the system is not limited.

Technical Data

MZS 400-2 modules are supplied with the special KSA cable and slides for mounting in MRC 400 module. CPU lock, MZS 400-1 and MZS 400-2 modules are connected in series with KSA cables and power is sequentially switched on/off in all modules. Other technical data are the same as for MZS 400-1 module.

MAZ 400 MULTIPLE-PRECISION ARITHMETIC UNIT MODULE



- 1 FP-A card
- 2 FP-M card
- 3 FP-S card

Functional Characteristic

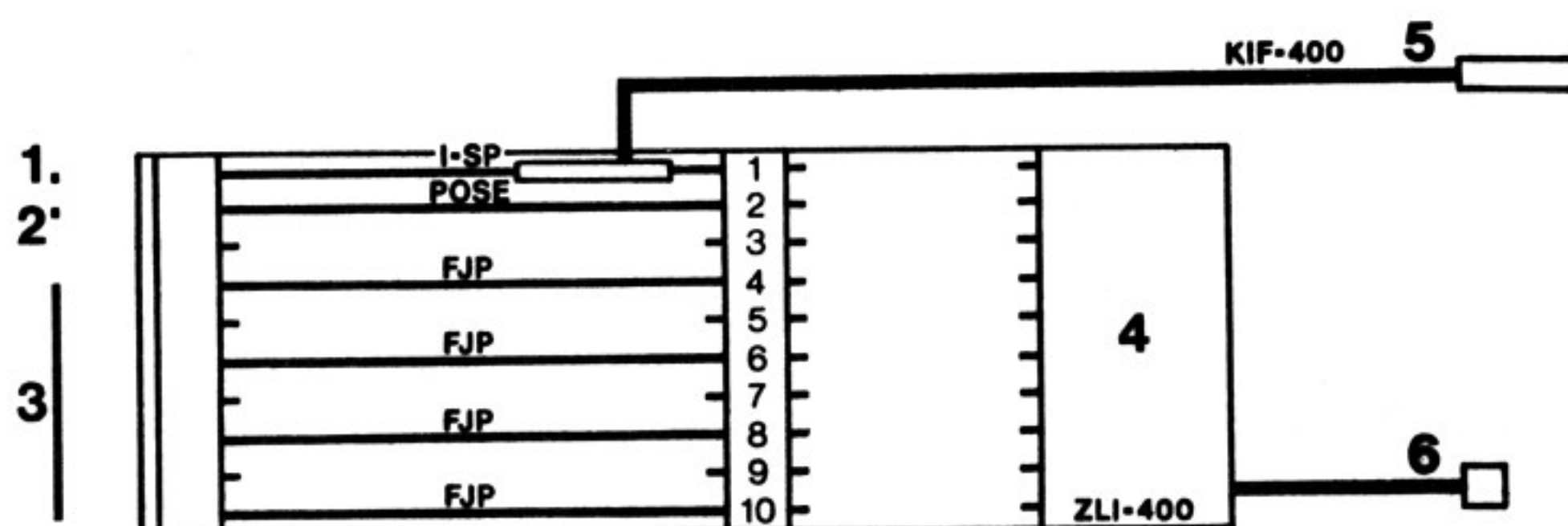
MAZ 400 multiple-precision arithmetic unit extends the CPU arithmetic capabilities with hardware floating-point and double word operations.

Technical Data

MAZ 400 module are 3 PC board mounted in predetermined places in MJC 400 module as processor option. MAZ 400 operations:

- addition and subtraction of the long (double word) fixed-point numbers
- normalisation, addition, subtraction, multiplication and division of the floating-point numbers. Mantissa is 40 bit long, exponent is 8 bit long.

MPOF 400 MAIN MEMORY MODULE (FERRITE CORE)



- | | |
|------------------------------|-------------------|
| 1 interface card | 4 power supply |
| 2 memory control card | 5 interface cable |
| 3 ferrite core memory (32 k) | 6 power cord |

Functional Characteristic

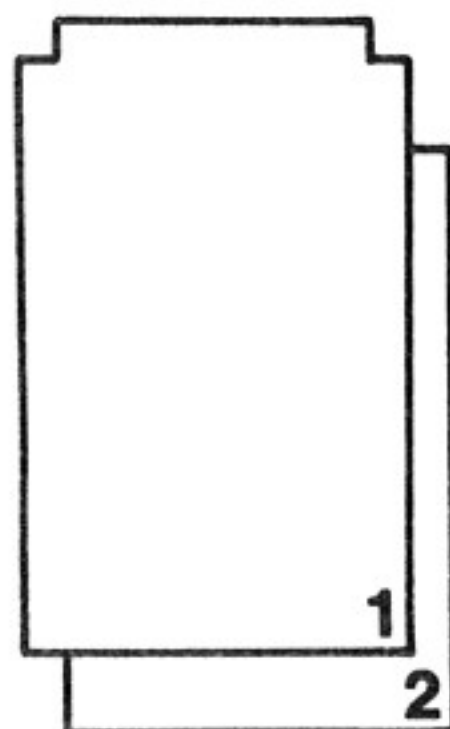
MPOF 400 main memory module is used as CPU memory extension over 32 k.

Maximal number of MPOF 400 s in a system cannot exceed 15.

Technical Data

Memory capacity	— 32 k
Word length	— 16 bits + 1 parity bit
Type	— ferrite core
Cycle time (system interface)	— 1,6 μ sec $\pm$ 10%
Programmed division on user blocks	

MKZ 400 PROGRAMMED CHANNEL MODULE



- 1 — KZ-A card
- 2 — KZ-B card

Functional Characteristic

MKZ 400 programmed channel module is used to connect slow start-stop or synchronous peripheral devices to MERA 400 system.

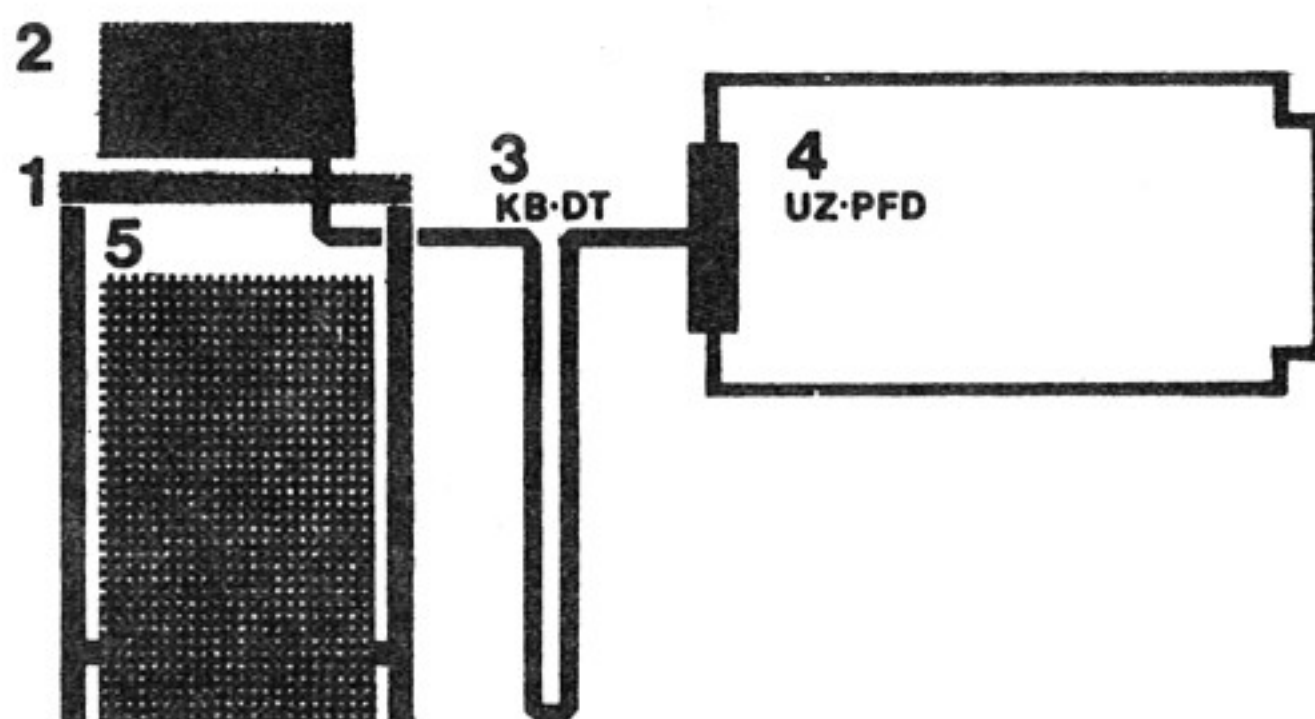
Technical Data

MKZ 400 module was developed on the two cards, that can be inserted into any case in the system (except MZS 400).

Specification

- programmed channel where every data transfer requires one I/O instruction
- data is transferred to and from processor general-purpose registers
- data format: 8 bit character or 16 bit word
- maximal data transfer rate:
 - 20 k word/sec (under operating system)
 - 200 ÷ 500 k word/sec (directly)
- channel addressing max 8 peripheral device controllers.

MDT 105S-400 DT 105S PAPER TAPE PUNCH MODULE



- 1 desk
- 2 DT 105S paper tape punch
- 3 KB-DT cable
- 4 interface card
- 5 paper bin

Technical Data ►

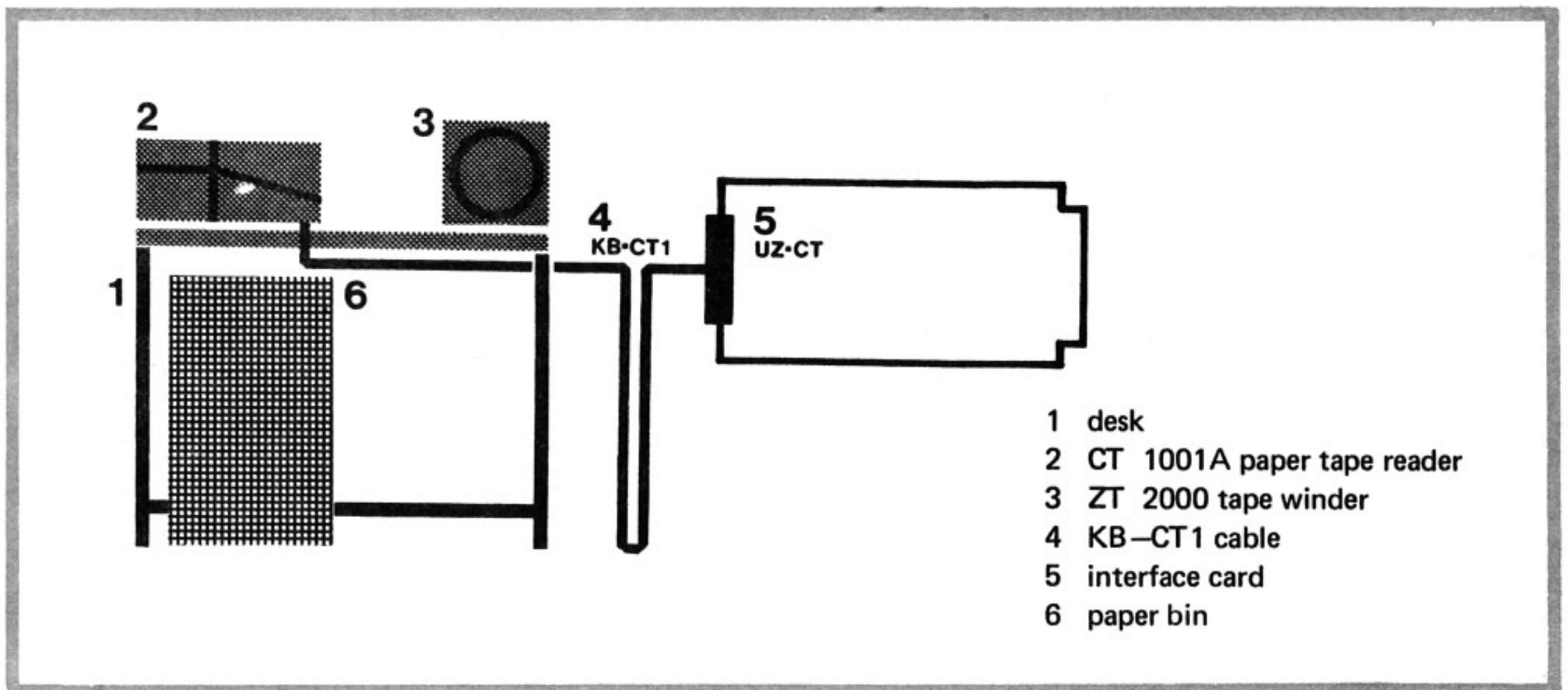
- reading speed — 105 characters/sec
- medium — 8 row paper tape
- code — 7 bit with even parity
7 bit with odd parity
8 bit
- code selection — programmed

Functional Characteristic

MDT 105S-400 paper tape punch module is used for outputting data from the computer on paper tape.

MDT 105S-400 module is attached to the programmed channel.

MCT 1001A-400 CT 1001A PAPER TAPE READER MODULE



Functional Characteristic

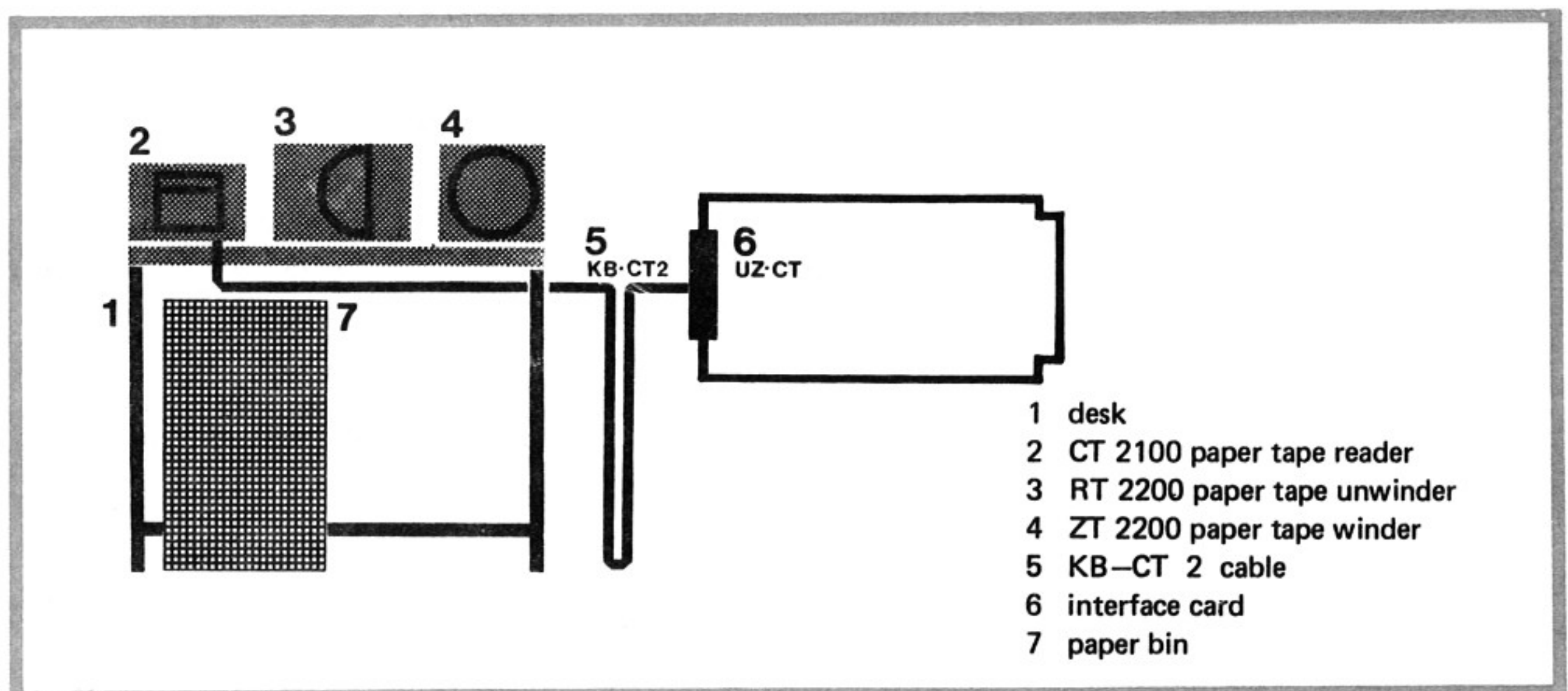
MCT 1001A-400 module is used for loading data and programmes from paper tape.

MCT 1001A-400 module is attached to the programmed channel.

Technical Data

- reading speed — 1000 characters/sec
- operation — start-stop
- medium — 8 row paper tape
- code — 7 bit with even parity
7 bit with odd parity
8 bit
- code selection — programmed

MCT 2100-400 CT 2100 PAPER TAPE READER MODULE



Functional Characteristic

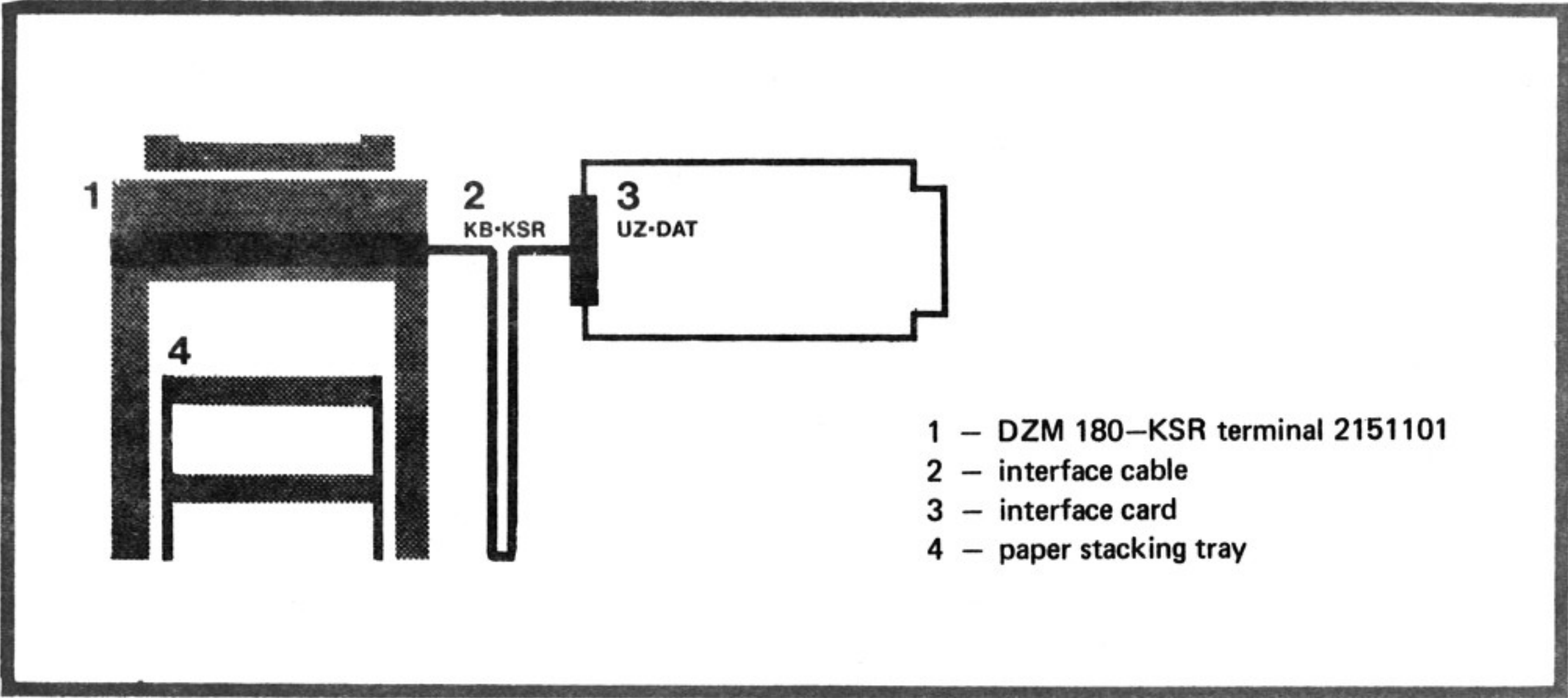
MCT 2100-400 paper tape reader module is used for loading data and programmes from paper tape.

MCT 2100-400 module is attached to the programmed channel.

Technical Data

- reading speed 500/1000 characters/sec
- operation start/stop
- medium 8 row paper tape
- code 7 bit with even parity
7 bit with odd parity
8 bit
- code selection programmed

MKSR 400 DZM 180—KSR TERMINAL MODULE



Functional Characteristic

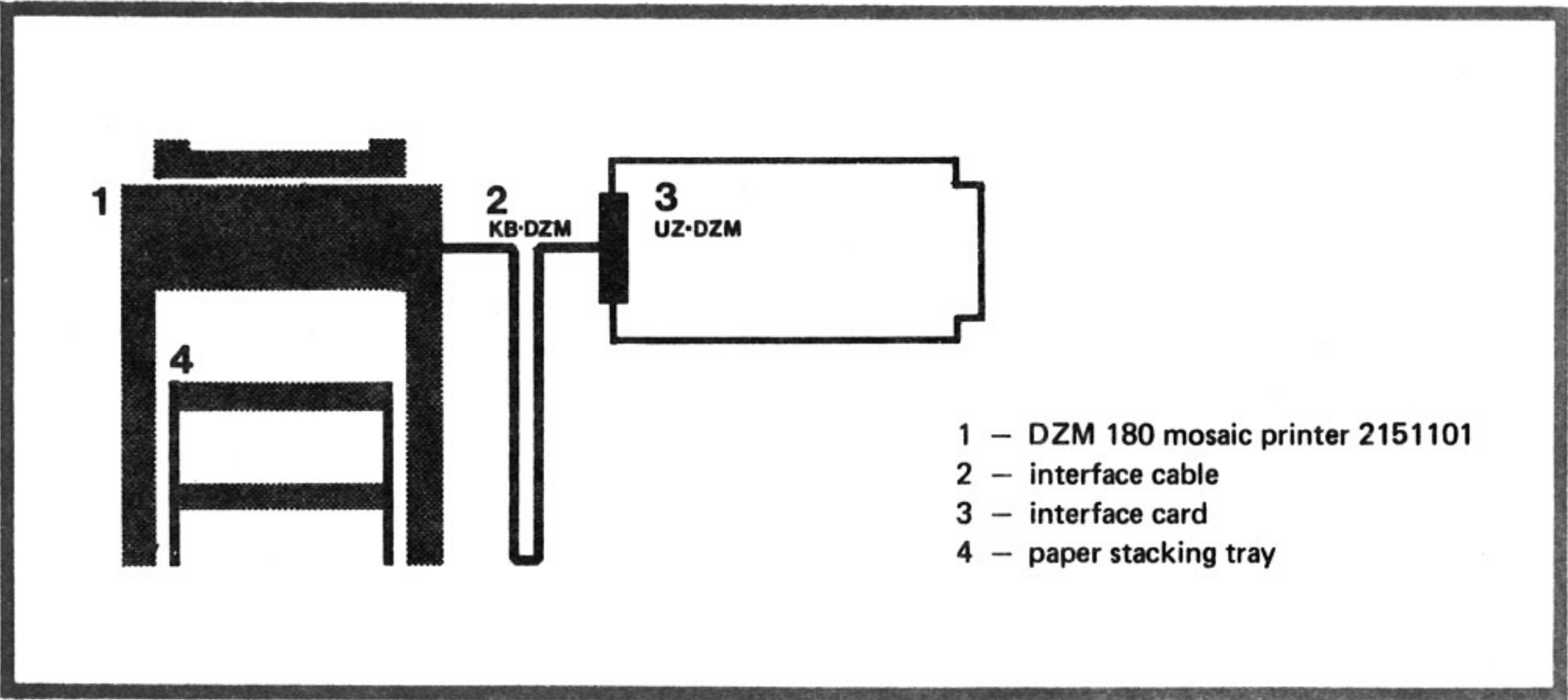
MKSR 400 terminal module is used as a system console or, in multi-access systems, as a user terminal. Data is printed on a paper driven by two pin-feed adjustable tractors and entered via alphanumeric keyboard.

Technical Data

Character set	ISO 7
Printing speed	55 . . . 60 lines/min
Line width	158 characters
Line spacing	4,23 mm
Number of copies	1 master + 4 copies
Paper transport	pin-feed
Interface	V 24 (CCITT)

MKSR 400 module is attached to the programmed channel.

MDZ 180—400 DZM 180 MOSAIC PRINTER MODULE

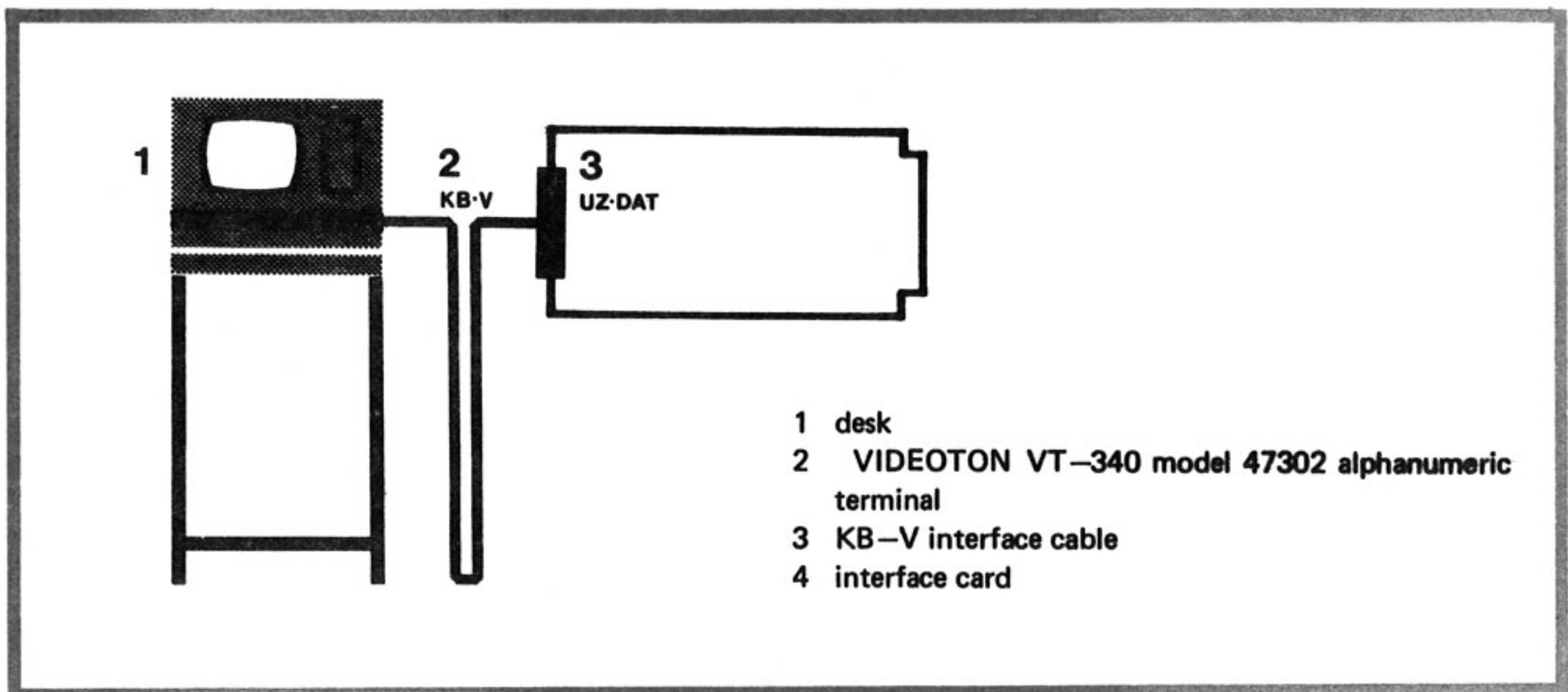


Functional Characteristic ► MDZ 180—400 mosaic printer module is used for printing data in MERA 400 system.

Technical Data

Character set	ISO
Printing speed	180 ch/sec
— full lines	55 lines/min
— half lines	100 lines/min
Number of copies	1 master + 4 copies

MMV 340-400 ALPHANUMERIC DISPLAY TERMINAL



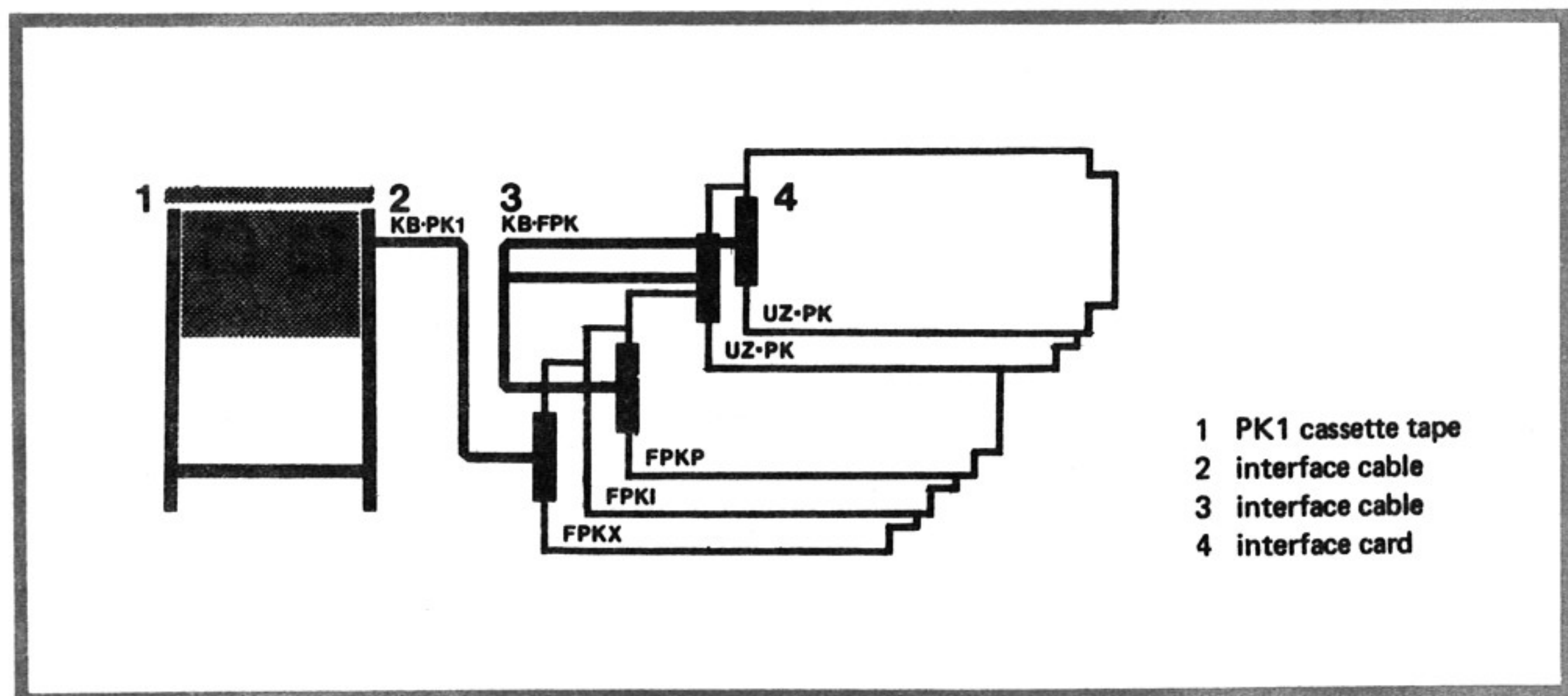
Functional Characteristic

MMV 340-400 alphanumeric terminal consists of CRT display and self-contained keyboard. It can be used to display and update information in MERA 400 system.

Technical Data

- code ISO 7
- interface V.24 (CCITT)
- speed 75 ÷ 1200 baud
- CRT screen size 11"
- number of lines 16
- number of columns 80

MPK 1-400 PK1 CASSETTE TAPE MODULE



Functional Characteristic

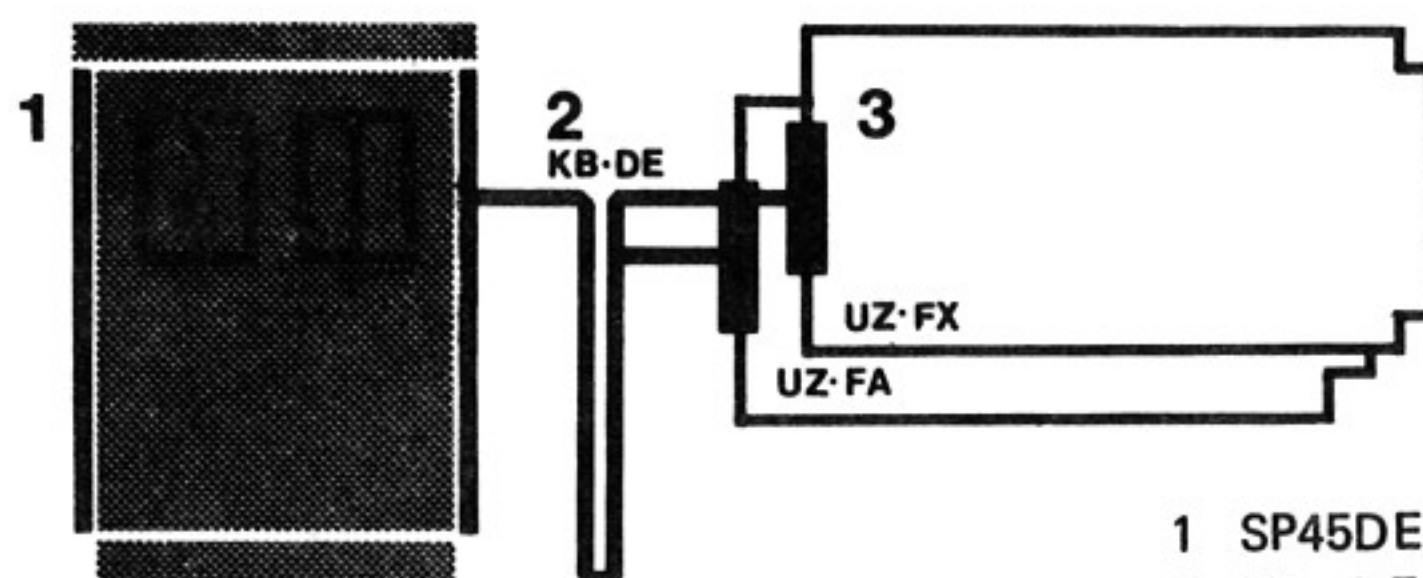
MPK 1-400 cassette tape module is used for loading and storing data and programmes on magnetic cassettes.

Technical Data

- number of drives — 2
- recording density — 32
- read/write speed — 12,7 mm/sec
- rewind speed — 2,5 m/sec

- cassette capacity — 500 k bytes (90 meter tape)
- cassette read/write time — 12 min
- medium — 0,150 wide magnetic tape in cassette (BN-77/3104-09)
- recording sides — 2
- recording method — ECMA 34

MDE 400 FLOPPY DISC MODULE



- 1 SP45DE model 3 floppy disc subsystem
- 2 KB-DE interface cable
- 3 controller cards

Functional Characteristic

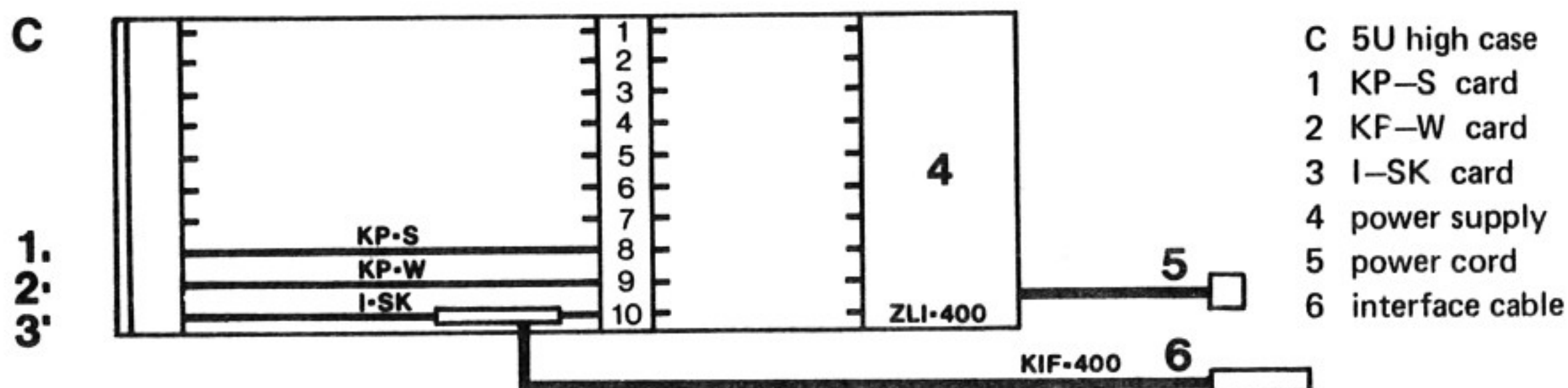
MDE 400 floppy disc module is an auxiliary memory for storing and loading data and programmes (through diskettes).

Technical Data

- diskette type — IBM 3740
- data format — ISO 97/11N149/IBM3740)
- unit capacity — 1943552 bytes (4 diskettes)
- average access time — 205 msec
- transfer rate — 55 k bytes/sec

MDE 400 is attached to the MERA 400 programmed channel.

MPZ 400 EXTERNAL MEMORY MODULE



Functional Characteristic

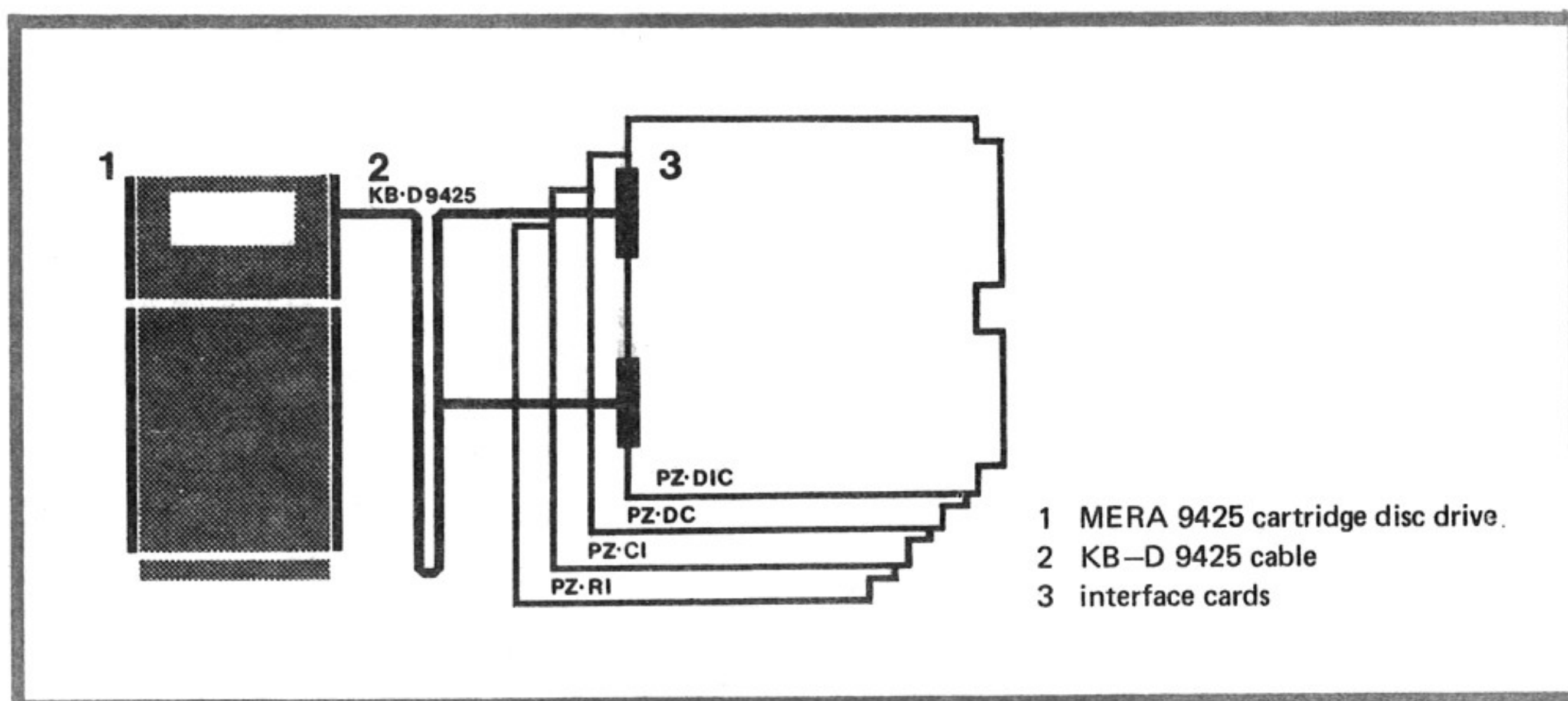
MPZ 400 external memory module is used for attaching external memory subsystems to MERA 400. MPZ 400 is 5U high case with DMA channel and prewired slots for MERA 9425 cartridge disc controller and PT 305 magnetic tape controllers. Except that there are prewired slots for programmed channel cards and peripheral device controllers as well as two

system interface slots. Cards and slots layout is given on module drawing.

Technical Data

MERA 400 DMA channel allows for maximal data transfer rate up to 500 k words/sec. Up to 8 mass memory devices can be attached to DMA channel.

MPD 9425-400-1 MERA 9425 CARTRIDGE DISC MODULE



Technical Data ►

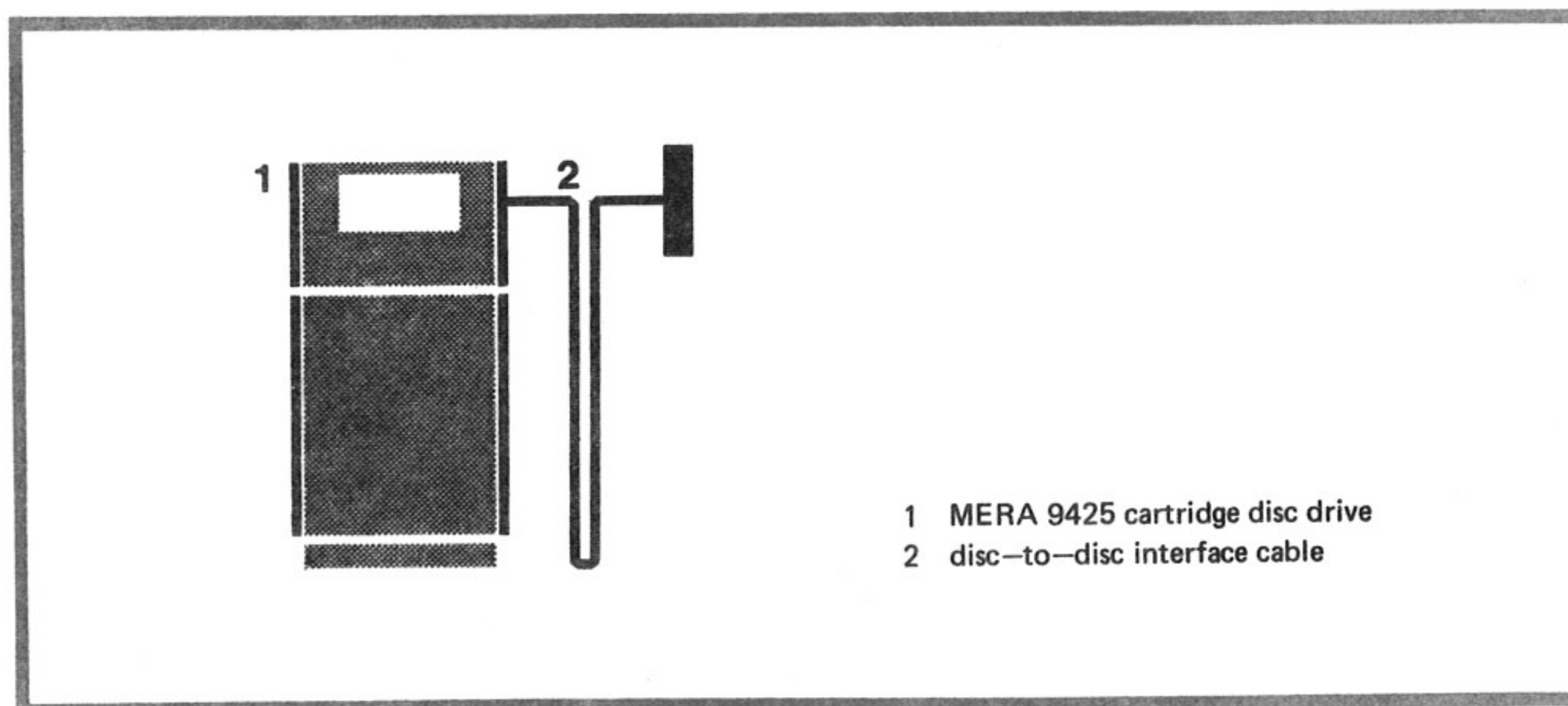
Functional Characteristic

MPD 9425-400-1 cartridge disc module is a basic external memory in MERA 400 system. It consists of four card controller and one disc drive. MPD 9425-400-1 module is attached to MERA 400 DMA channel.

- number of tracks 200 + 4 spare
- capacity 5 M bytes
- average access time 35 msec
- data transfer frequency 2,5 MHz
- number of cartridges 2 (one removable)
- number of sectors 24
- data format MERA 400

MPD 9425-400-1 controller is mounted in MPZ 400 module.

MPD 9425-400-2 CARTRIDGE DISC MODULE



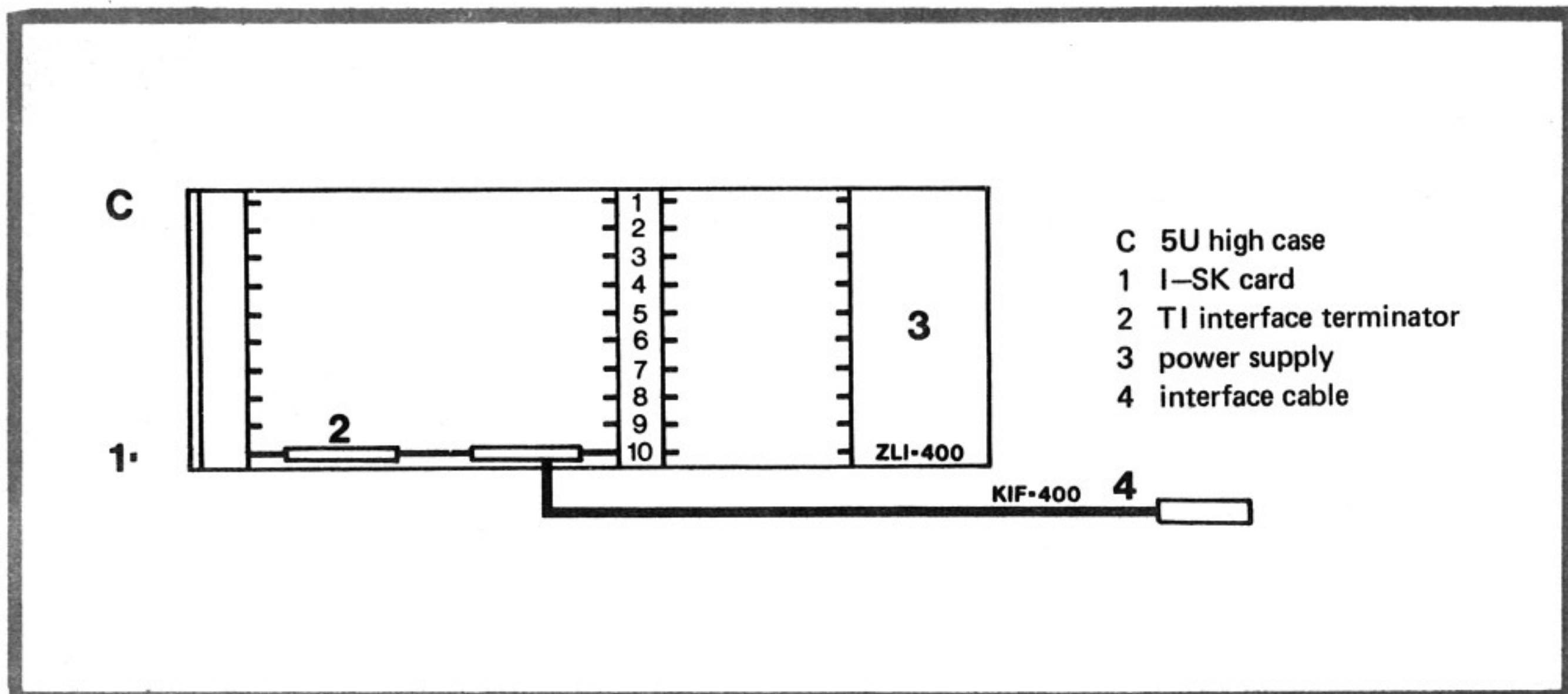
Functional Characteristic

MPD 9425 400-2 cartridge disc module is a free-standing disc drive that can be attached to the MPD 9425-400-1 controller.

Technical Data

The same as for MPD 9425-400-1 module.

MPU 400 EXTENSION MODULE



Technical Data

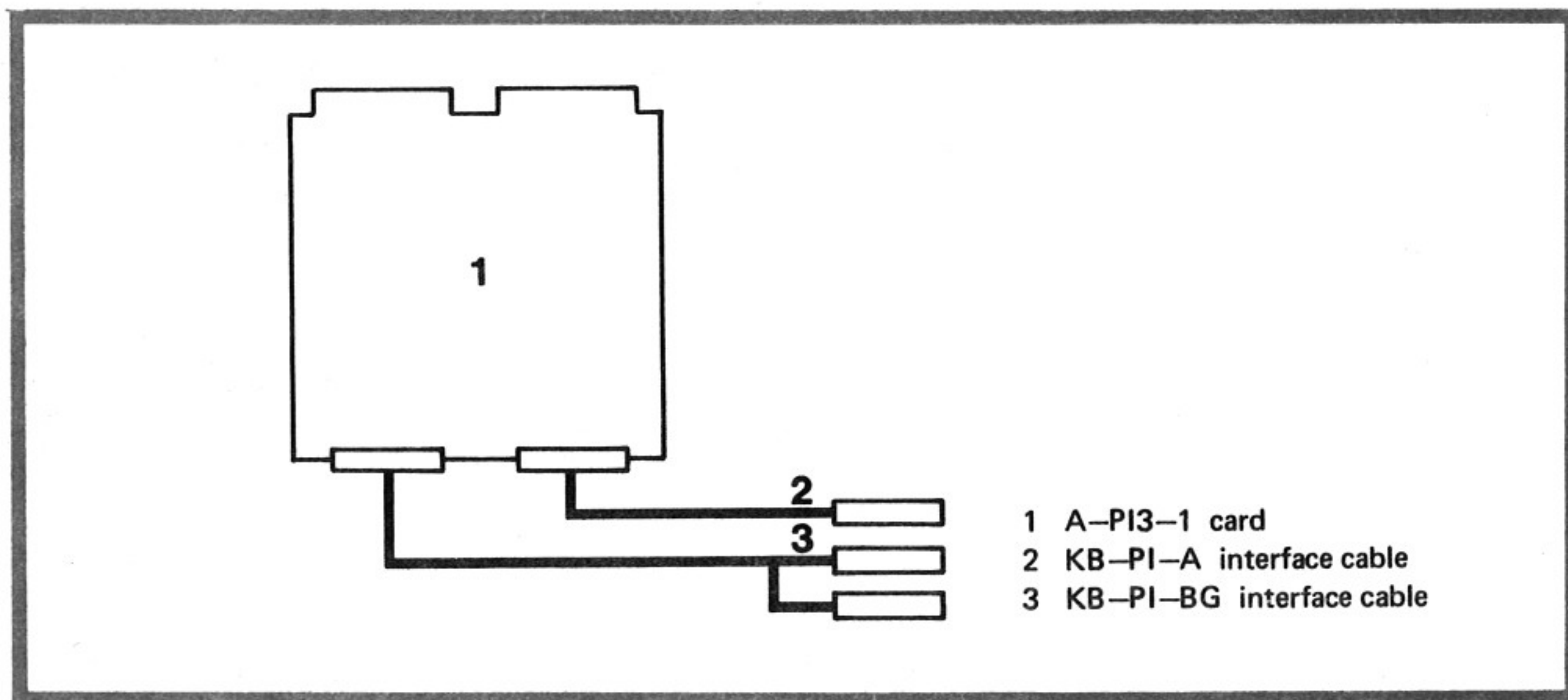
MPU 400 module is 5Z high case with ZLI 400 power supply, I-SK interface card and KIF 400 interface cable. Free slots allow to install 9 cards in 300 x 300 mm standard and 10 cards in 150 x 300 mm standard. Power supply provides following DC sources

Functional Characteristic

MPU 400 extension module provides means for installing user developed channels and controllers.

+ 5 V 30 A
- 5 V 1,2 A
+ 15 V 1,0 A
- 15 V 1,2 A

MPI 400 PI-INTELDIGIT CONTROLLER MODULE



Technical Data

Functional Characteristic

MPI 400 PI-Inteldigit controller is used in data acquisition and control system based on MERA 400. Types and numbers of MERA 400 system modules and PI cassettes are specified by the user.

MPI 400 module links "PI-Inteldigit" interface to MERA 400 programmed channel. A-PI3-1 card can be installed in MPZ 400 or MJC 400 modules. One MPI 400 module can control up to 16 "PI-Inteldigit" cassettes. Up to 8 MPI 400 modules can be attached to the MERA 400 system.

