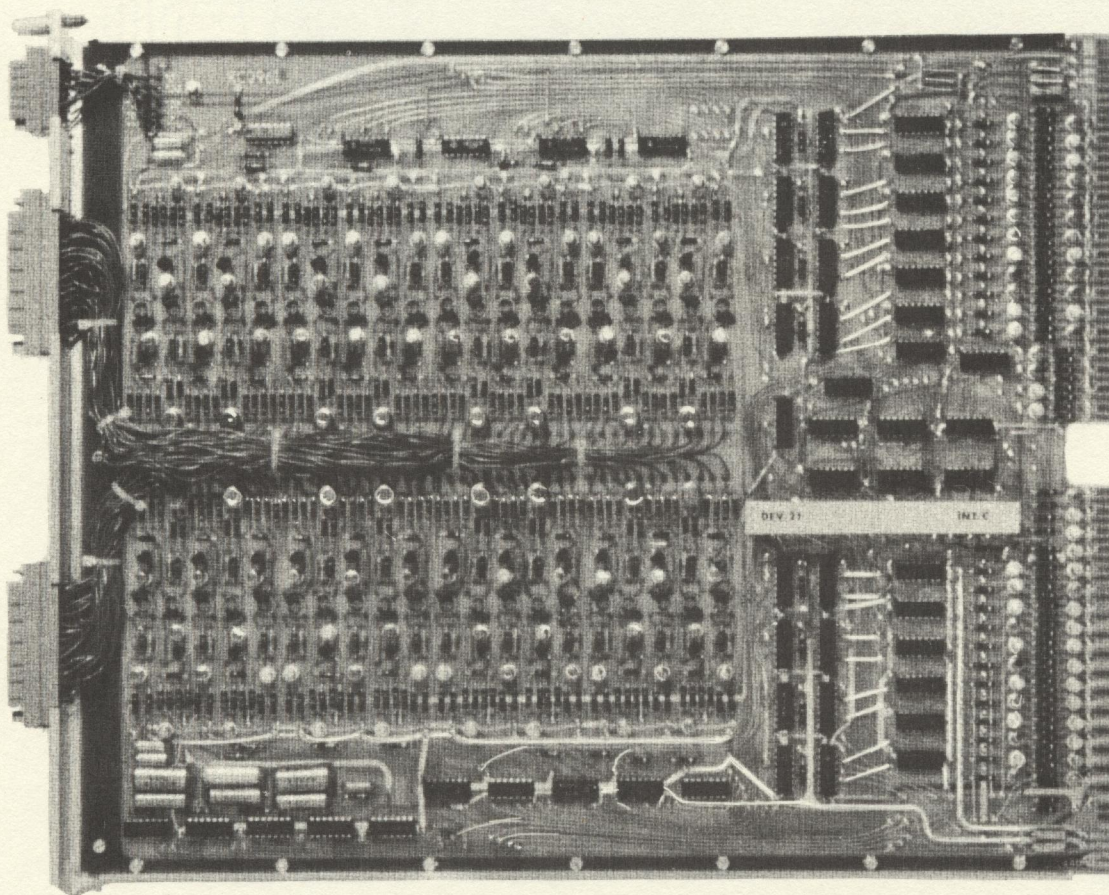


RC 4000 PROCESS CONTROL EQUIPMENT



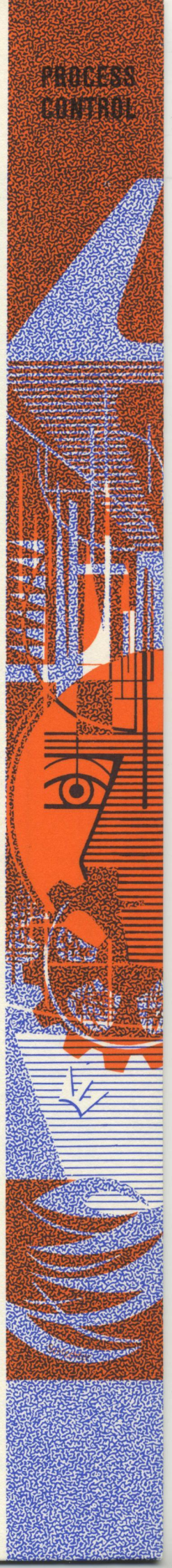
Setpoint Station Terminal SPT 401

RC 4000 process interface equipment consists of a modular series of input/output units covering practically all industrial control applications.

Construction is based on state-of-the-art technology, for example, exclusively solid-state multiplexing, dynamically programable amplification, and the use of advanced linear

and digital integrated circuits. The modular structure of the units in the series is illustrated inside the specification.

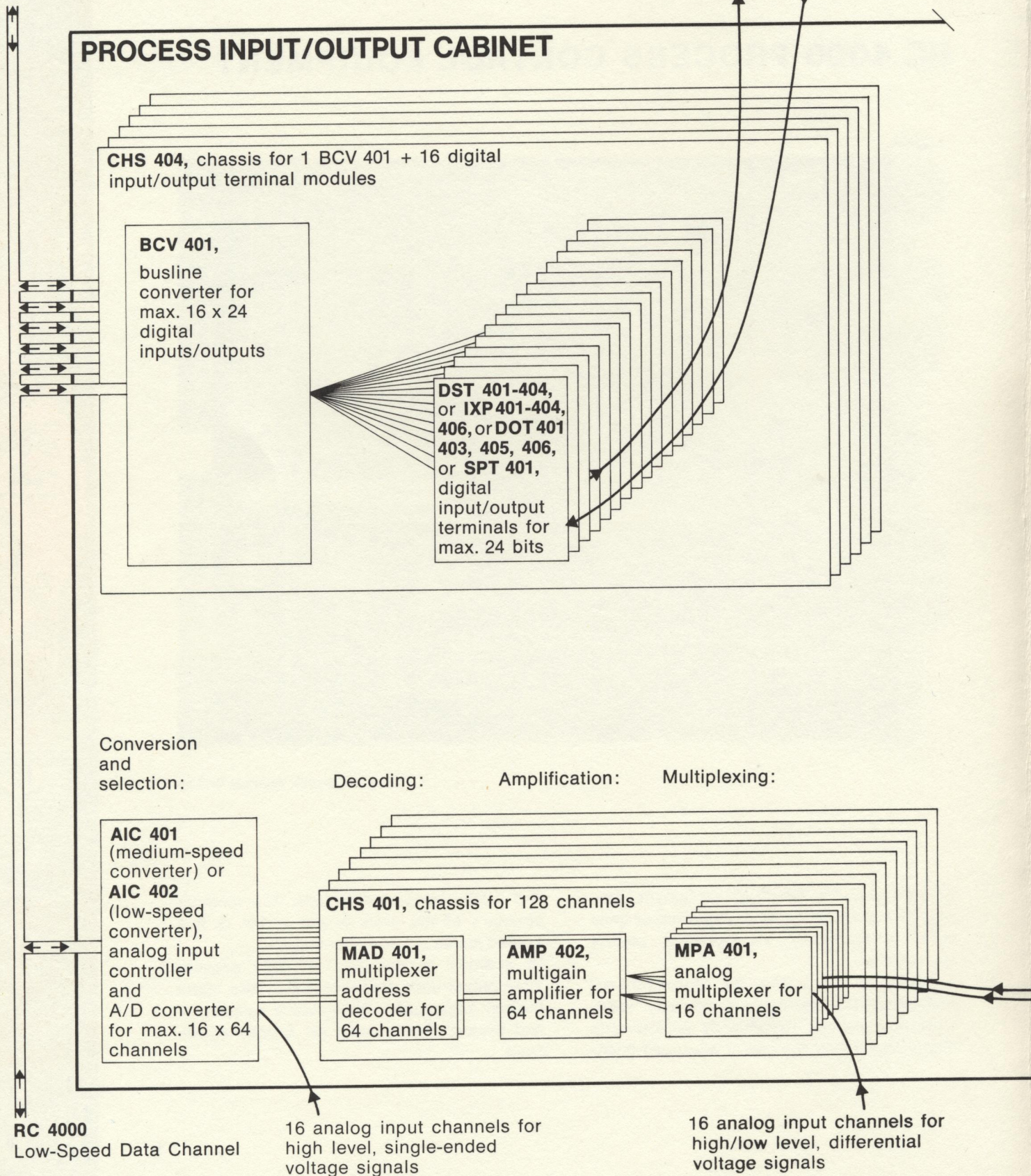
In addition to standard RC 4000 process input/output units, Regnecentralen also offers custom engineering, consultative assistance, and project management on special agreement.



RC 4000 PROCESS INPUT/OUTPUT UNITS

RC 4000
Low-Speed Data Channel

24 digital outputs 24 digital inputs



ANALOG INPUT

The input of analog voltage signals from industrial processes can take place either under direct program control (via the low-speed data channel of the RC 4000) or by direct transfer to the core store on a cycle-stealing basis (via the high-speed data channel). In both cases, either the medium-speed or the low-speed analog input unit can be employed.

Analog Input Unit:

General Characteristics

- solid-state multiplexing of voltage signals from ± 10 micro V through ± 10 V
- up to 1,024 input channels per A/D converter unit
- overvoltage protection
- modular construction at 16, 64, and 128 channel levels
- 10,000 Mohm input impedance, 1 nA input current
- 110 dB common mode rejection at 50 cps
- 4 different voltage ranges dynamically selectable for each channel
- range and channel address information combined within 12-bit byte

- converted analog value given as 12-bit integer
- 0.25 % overall accuracy
- 0.05 % resolution

Medium-Speed Input:

Special Features

- conversion time: 150–750 microseconds per channel (including amplifier settling time)
- A/D converter type: successive approximation
- one noise filter per channel required for normal mode rejection

Low-Speed Input:

Special Features

- conversion time: 23–43 milliseconds per channel (including amplifier settling time)
- A/D converter type: dual-slope, integrating
- 46 dB normal mode rejection at 50 cps
- noise filters normally not required

Signal Conditioning Equipment

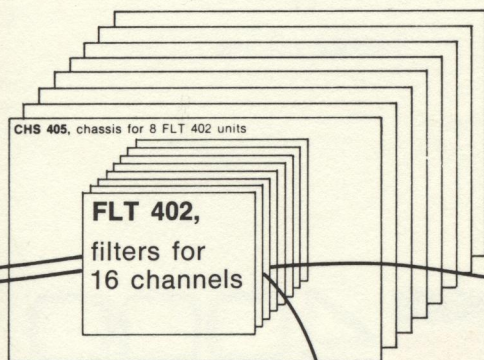
The analog input units can be equipped with signal conditioning modules containing the following:

- noise filters, 40 dB at 50 cps
- resistance bridges for R-to-V conversion
- cold junction units for thermocouple signals
- series resistances for I-to-V conversion

DIGITAL INPUT/OUTPUT UNITS

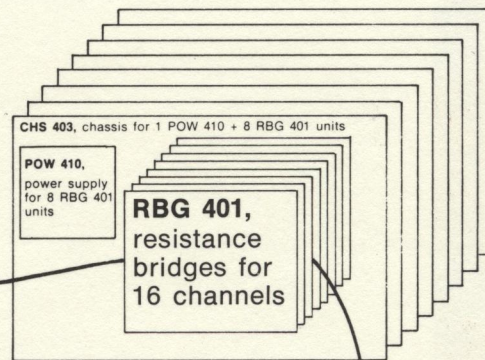
ANALOG INPUT UNITS

Filtering:



16 analog input channels for high/low level voltage signals

Signal conditioning:



16 analog input channels for resistance signals

DIGITAL INPUT/OUTPUT

Digital process signals are input and output by means of I/O instructions, which transfer one 24-bit pattern at a time under direct program control. The selection of 24-bit groups is controlled by device addresses in a manner similar to that of other peripherals. Construction is modular at 24-bit and 384-bit levels. Digital input/output terminal modules are available in various types and models as outlined below.

Digital Input

Three basic types of digital input terminal modules are available:

- 24-bit unbuffered digital inputs for sensing (digital sense DST)
- 24-bit buffered digital interrupt inputs (interrupt expander IXP)
- two 12-bit counters for high-speed pulse counting

All types can be equipped with input circuits for:

- floating contact closures (e.g. isolated alarm contacts), or
- non-floating or floating current input to Ga-As isolator, or
- non-floating or floating voltage input to transformer coupled isolator

Digital Output

Two basic types of digital output terminal modules (DOT) are available:

- 24-bit buffered digital outputs with unlimited storing time
- 24-bit buffered digital outputs with automatic buffer clearing (pulse signal) 1 millisecond – 1 second (preselected) after data transfer to buffer

Each output is equipped with a galvanically isolated transistor switch, which can be connected either to an internal power supply to provide voltage output (e.g. 24 V / 0.2 A) or as a polarized contact-closure output for connection to external equipment.

For output for stepping-motors, see "Analog Output" below.

Analog Output

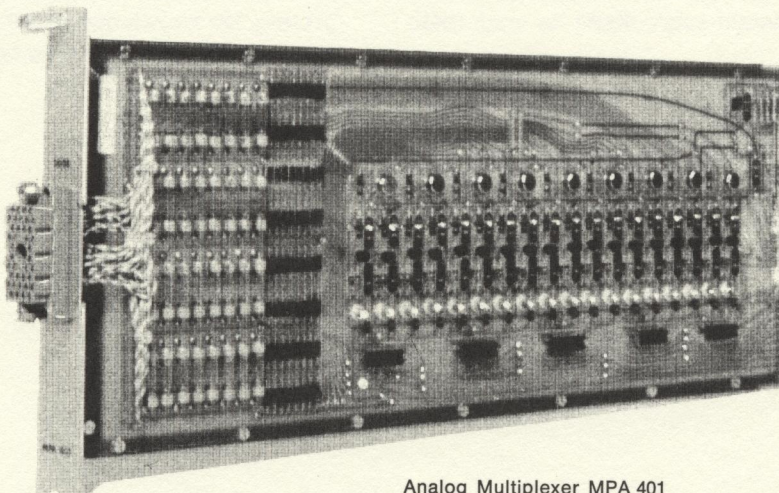
Analog output to industrial processes can be accomplished by means of up/down commands to stepping-motor driven potentiometers placed, for example, in the control room. The use of this technique provides reliable back-up (mechanical memory) and bumpless transfer between "computer control" and "manual control".

For this purpose, a motor potentiometer terminal module (SPT) and driver program with the following main characteristics is available:

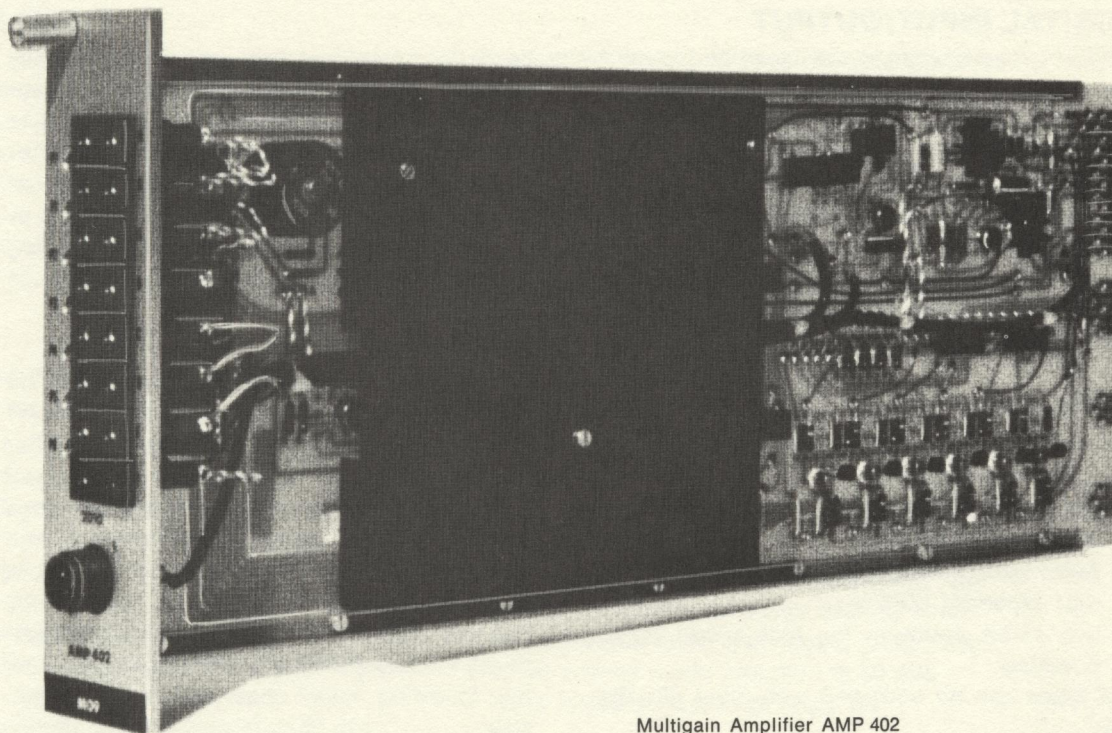
- Eight stepping-motor driven potentiometers can be activated by one I/O instruction.
- Three status bits can be sensed per motor potentiometer.
- Input and output circuits are galvanically isolated from the rest of the equipment.
- Up/down pulse duration: 20 milliseconds or optional (max. 2 seconds).

For other applications, for example, hybrid computers, electronic D/A converter modules with buffer registers and the following characteristics are available:

- 12-bit digital input
- 5 microsecond conversion time
- ± 10 V analog output range



Analog Multiplexer MPA 401



Multigain Amplifier AMP 402

RC 4000 PROCESS CONTROL SOFTWARE

Regnecentralen offers process control software for the RC 4000 computer on the operating system level as well as standard program level.

The writing of user programs is greatly facilitated by special process control interpreters developed for the RC 4000. The interpreters form the core of the standard programs and contain subroutines for such tasks as:

- data acquisition
- flow integration
- pulse counting
- alarm scanning
- trend logging
- self-checking of hardware

A user program – or task file – consists of calls of the standard functions to be carried out, and is simply treated as data by the interpreters. No knowledge of actual programming is needed in order to write task files.

OPERATING SYSTEM FOR REAL-TIME PROCESS SUPERVISION WITH SIMULTANEOUS BACKGROUND PROCESSING

When using the RC 4000 computer for real-time process supervision and simultaneous background processing, the RC 4000 Operating System for Real-Time Process Supervision can be employed. Here, the RC 4000 is under the control of the monitor, administrator, foreground job control program, and background job control program. The program organization is illustrated below.

The monitor and administrator are core resident and occupy about 8 K words of the core store. The monitor may be regarded as an extension of the equipment, containing the input and output drivers and buffers, interrupt facilities, and facilities for starting and stopping the active programs according to a modified round-robin technique.

The administrator is the operating system, that is, the program in which the operation strategy is embedded. The administrator contains facilities for reservation and starting of peripheral devices, the swap timer, and the swap mechanism.

The foreground and background job control programs are drum or disc resident and serve to load and execute their respective programs.

In this system, process control application programs are initiated at regular intervals in the following manner:

At the end of a preset time interval, the swap timer of the administrator orders the swap routine of the administrator to interrupt the running background program and transfer it to background storage in exchange for the foreground programs, that is, the process control programs. These are then processed. When processing is completed, a message is sent to the swap timer of the administrator, which initiates a new swap operation. The background programs are now run again until the preset time interval from the start of the last process control scan cycle has elapsed.

RC 4000 OPERATING SYSTEM FOR REAL-TIME PROCESS SUPERVISION

