

RC DATA LOGGING SYSTEMS: AN INTRODUCTION

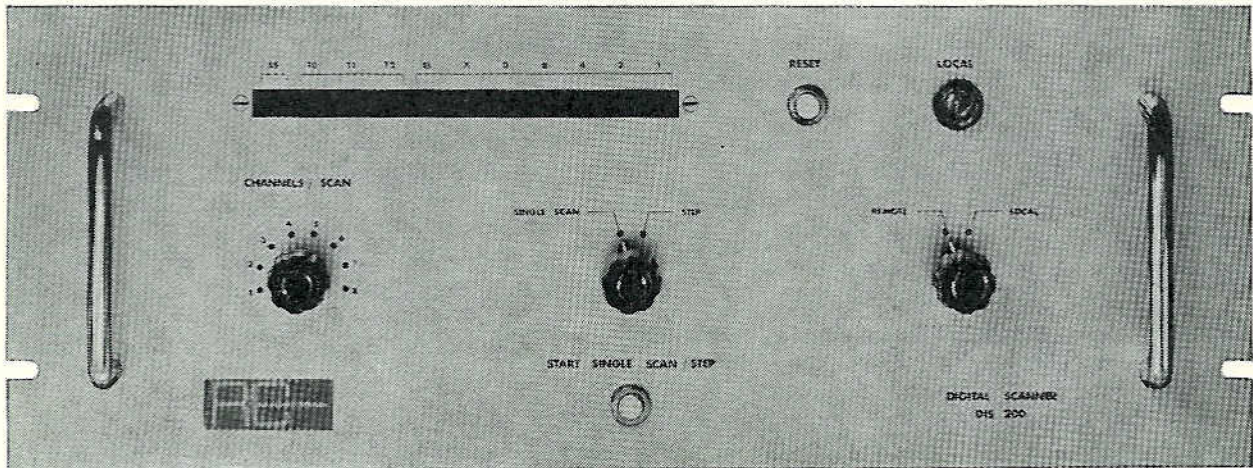
The RC Data Logging Modules comprise a line of compatible modules, developed especially for constructing data logging systems. Modular design allows for varying requirements with respect to acquisition rates, measurement precision, and form of output data as well as for altering and extending the system to meet new data logging needs.

A data logging system consists of a number of modules such as scanner, A/D converter, digital clock, recording equipment, and the like plus a supervisory module, the Master Control, which controls the operation of the sub-modules. The total system is provided with power from a central power supply unit and is mounted on a standard 19-inch rack.

The central power supply provides supervision and protection of the power supply to the modules. In event of overload on one of the voltages, it disconnects the power to all modules. It further provides thermal supervision of the system with automatic close-down, if the temperature in the system becomes too high.

A set of standard digital logic modules, RCLM-500, is used for the construction of the data logging modules. The logic modules consist of diode-transistor logic circuits with high noise-rejection margins, which are capable of operating from D.C. to 500 kc/s. The circuit design is based on a worst-case stack-up of tolerances, and highly reliable performance is obtained by use of professional components throughout. The circuits are mounted on pluggable printed circuit cards.

A sub-module, e. g. an A/D converter, contains the circuits needed to perform the functions of the module. The module is provided with standard connectors for power input and interface. Normally, a number of the modules are delivered without front panels (some modules, e. g. certain scan controls, always have front panels); a front panel for manual operation of the sub-unit is then available as an option. The front panels are provided with a switch for selection of the mode of operation, local or remote. In "local mode" the module can be operated from the front panel, e. g. for trouble shooting. In "remote mode" the module can only be operated from the master control.



DIGITAL SCANNERS DIS 200, 201, 202

GENERAL

The DIS 200, 201, and 202 are all solid-state scan controls and digital multiplexers with 8, 16 and 32 7-bit input channels respectively. By means of these units it is possible to serialize parallel information to characters of 7 bits.

SCAN PROGRAM

The scan program is set up on a semi-permanent patch board, which makes it possible to determine the number and sequence of channels in a scan, to set up formatting characters, and to add flag bits to the characters. To some extent it is also possible to encode the input data. The scan rate is controlled by an external oscillator or the recording device, in which case the scanner advances to a new channel, when it receives a ready signal from the latter.

The scanning is started by an external start signal. The first channel in the program is selected and a "start recording" signal is sent to the recording device. When the

recording cycle is completed, the next channel is selected and a new recording cycle is initiated. When the last channel has been scanned a "scan end" signal is generated and the scanning stops automatically.

FRONT PANEL

The DIS 200, 201, and 202 may be equipped with front panels for manual operation of the units. The front panels have controls for selection of number of channels per scan, release single scan, release single step, and reset. In addition, there is display of the selected channel number and data on the output lines as well as indicators for scan on and local mode of operation.

MECHANICAL CONSTRUCTION

All circuits are mounted on pluggable printed circuit cards. The modules are constructed for mounting on 19-inch racks. The front panel is connected to the card module by cable and plug.

DIGITAL SCANNERS DIS 200, 201, 202

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SPECIFICATIONS

Data Input

DIS 200: 8 channels of 7 bits in parallel
DIS 201: 16 channels of 7 bits in parallel
DIS 202: 32 channels of 7 bits in parallel

Data Output: characters of 7 bits

Scan Program: number and sequence of channels determined by means of semi-permanent patch board
It is possible to set up formatting characters and add flag bits.

Scan Rate: up to 100,000 channels/sec (normally restricted by the recording device)

Control Inputs: start scan signal
select next channel (external oscillator or ready signal from recording device)

Control Outputs: start signal to recording device
scan end signal

Logic Signal Levels: 0 V and - 10 V

Ambient Temperature Range: 0° C to + 45° C

Power Requirements:
- 30 V \pm 5 %
- 10 V \pm 10 %
+ 24 V \pm 5 %

Card Module Dimensions: width 483 mm (19")
depth 305 mm
height 178 mm

OPTIONS

Front Panel (DIS 01)

The front panel includes:

operating mode selector, local/remote;
selector for number of channels per scan;
single scan/single step selector;
push-buttons for single scan/single step and reset;
display of selected channel number and data on output lines; and
indicators for scan on and local mode of operation.

Switch Panels

The DIS 200/201/202 can be provided with a switch panel for manual control of the input data to one or more of the input channels. Different types of switches, e.g. binary and decimal, are available. The switch panels are custom made.

FERRITE CORE STORE FCS 100

GENERAL

The FCS 100 is a coincident current core store with a cycle time of 12 μ sec and a capacity of 512 words of 8 bits, one of which is reserved for parity checking.

The store consists of a core stack with complete decoding, read/write, and timing circuits. The system includes an input selector network for selecting one out of two input channels, each consisting of an 8-bit data input and a 9-bit word address input. The data output is supplied via a flip-flop buffer register. The core store may be operated in the following modes: clear/write, read/restore, write without previous clearing, or read without subsequent restoring.

PARITY CHECKING

An automatic parity check is performed during each read operation with subsequent indication, if an error has occurred.

The parity bit (odd parity) may be generated either externally or within the FCS 100.

In the former, the parity of the selected 8-bit data input will be checked, and if there is even parity, a special indi-

cator signals that an input error has occurred. In the latter, only seven bits of the input data channel are used. The occurrence of parity errors will normally not affect the storage operation, but will only be indicated. If desired, the store system may be blocked, when parity errors arise. The FCS 100 is supplied with a front panel containing indicators showing operating state, contents of the output buffer register, and error situation.

RELIABILITY

The FCS 100 is constructed for high reliability and broad operating margins. The drive currents for the core stack are temperature regulated to allow a temperature range in the ambient air of 10° - 45° C. The circuits used are the RC Logic Modules Series 500 and 1000.

MECHANICAL CONSTRUCTION

All circuits are mounted on pluggable printed circuit cards. The card panel and the front panel are constructed for mounting on a 19-inch rack. The front panel is connected to the card panel by cables and plugs.

FERRITE CORE STORE FCS 100

January, 1966

SPECIFICATIONS

Capacity: 512 words of 8 bits

Access Mode: random

Cycle Time: full cycle 12 μ sec, access time 5 μ sec
half cycle 7 μ sec, access time 5 μ sec

Operating Modes: clear/write
write only
read/restore
read only

Digital Signal Levels:
0 V and -10 V

Inputs

Data Lines: channel R, 8 bits
channel W, 8 bits
Address Lines: channel R, 9 bits
channel W, 9 bits
Controls: selection of operating mode
selection of input channel
selection of parity mode
output parity error suppression
start signal
master clear for control and error
circuits

Outputs

Data Lines: 8 bits
Controls: input parity error indication
output parity error indication
busy signal

Power Requirements:

- 50 V \pm 5 %, 0.1 A
- 30 V \pm 5 %, 5.0 A
- 10 V \pm 10 %, 2.0 A
+ 1.6 V \pm 5 %, 1.5 A
+ 24 V \pm 5 %, 1.5 A
supply for 15 DM 160 indicator tubes

Card Module Dimensions:

width 483 mm (19")
depth 305 mm
height 445 mm

Front Panel Dimensions:

width 483 mm (19")
depth 152 mm
height 133 mm



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The total system is operated and supervised by the Master Control module, which in fact is a small computer with a wired-in program. The program is wired on semi-permanent plugs, which allows changes in the program to be made rather easily.

The unit has controls for operation of the data logging system, start, stop, release single scan, etc. It is further

provided with an error-check for the total system. An error in one of the sub-units will give rise to a visual and/or an audible alarm signal. If desired, the error-check can also be used to stop the system.

Construction based on a number of submodules supervised by a master control has the advantages of centralized control of the data logging system.

A/S REGNECENTRALEN
FALKONERALLE 1
COPENHAGEN F. · DENMARK

A/S SCANIPS
SORGENFRIGATE 11
OSLO · NORWAY

ING.UGO DE LORENZO & C.
VIA BELLARMINO 29
MILAN · ITALY

GIER ELECTRONICS GmbH
SCHILLERSTRASSE 33
3000 HANNOVER · GERMANY

MASTER CONTROL UNIT MAS 200

GENERAL

The MAS 200 is an all solid-state program unit for controlling the acquisition and recording of analog and digital data. The unit includes scan controls for analog multiplexer and digital multiplexer, a digital multiplexer, and a buffer for one character. The MAS 200 can control an A/D converter with analog multiplexer and a recording device, e. g. a paper tape punch.

The MAS 200 controls an analog multiplexer with up to 6 inputs, and collects data from 3 digital input channels, A, B, and C, each of 7 bits. One of the digital input channels (B) is connected to the A/D converter, which means that a 7-bit number from the A/D converter can be recorded. If recording of a greater number of bits is required, it is possible (by including an option) to record 2 7-bit characters per analog input channel. A 7-bit buffer between the digital multiplexer and the recording equipment makes it possible to achieve the highest scanning rate for a for a given recording device.

The MAS 200 can be provided with a front panel, Option MAS 02, for manual control of the unit.

SCAN PROGRAM

The digital channels are scanned in the order A, B, C. Channel B remains selected during the time the analog input channels are scanned and recorded.

A scan program can comprise a different number of channels. The number of analog input channels can be varied

from 1 to 6. Both digital input channels are normally included.

The scan sequence for one scan is then: A, B₁, B₂, . . . B_n, C. A and C are the digital channels and B_n the nth analog channel.

The data from the digital channels is frequently constant and common to a complete series of measurements. Because of this, the system is constructed so that it is possible to include A and C only in the first and the last scan respectively. The scan sequence for more than one scan is then: A, B₁, B₂, . . . B_n, B₁, B₂, . . . B_n, C.

The scanning rate is controlled by an external oscillator. An internal oscillator with modifiable frequency is available as an option. The maximum scanning rate is determined by the conversion time for the A/D converter and the recording speed of the recording device.

ERROR CONTROL

The MAS 200 can collect and process error signals from the sub-units. An incoming error signal can occasion a visual or audible warning signal and if desired, stop of scanning after completion of the running scan.

MECHANICAL CONSTRUCTION

All circuits are mounted on pluggable printed circuit cards. The unit is constructed for mounting on a 19-inch rack. The front panel is connected to the card module by cables and plugs.

MASTER CONTROL UNIT MAS 200

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SPECIFICATIONS

- Sub-Units:** A/D converter with 6 analog input channels
recording device, e. g. paper tape punch or magnetic tape station
- Scanning and Recording Rate:** dependent on sub-units
- Control Inputs:** start scan signal
signal for skipping channel A and C
ready signal from A/D converter
ready signal from recording device
error signal from A/D converter
error signal from recording device
- Control Outputs:** ready signal (input data transferred to buffer)
scan end signal
error signal (sum of error signals from sub-units)
start signal to A/D converter
start signal to recording device
address to analog multiplexer (1 out of N code)
- Data Inputs:** 3 7-bit digital input channels (A, B, and C)
B normally connected to A/D converter output register
modifiable with option MAS 02
- Data Output:** 7-bit digital output to recording device
- Logic Signal Levels:** 0 Volt and - 10 Volts
- Ambient Temperature Range:** 0° C to + 45° C
- Power Requirements:** - 30 V ± 5 %
- 10 V ± 10 %
+ 24 V ± 5 %
- Card Module Dimensions:**
width 483 mm (19")
depth 305 mm
height 178 mm

OPTIONS

Front Panel (MAS 01)

The front panel includes:
selector for number of analog channels per scan;
push-buttons for reset, release single clock pulse, and start and stop of scanning;
display of the number of the selected analog channel; and
indicators for error and scan on.

Power Requirements: supply for 6 DM 160 indicator tubes

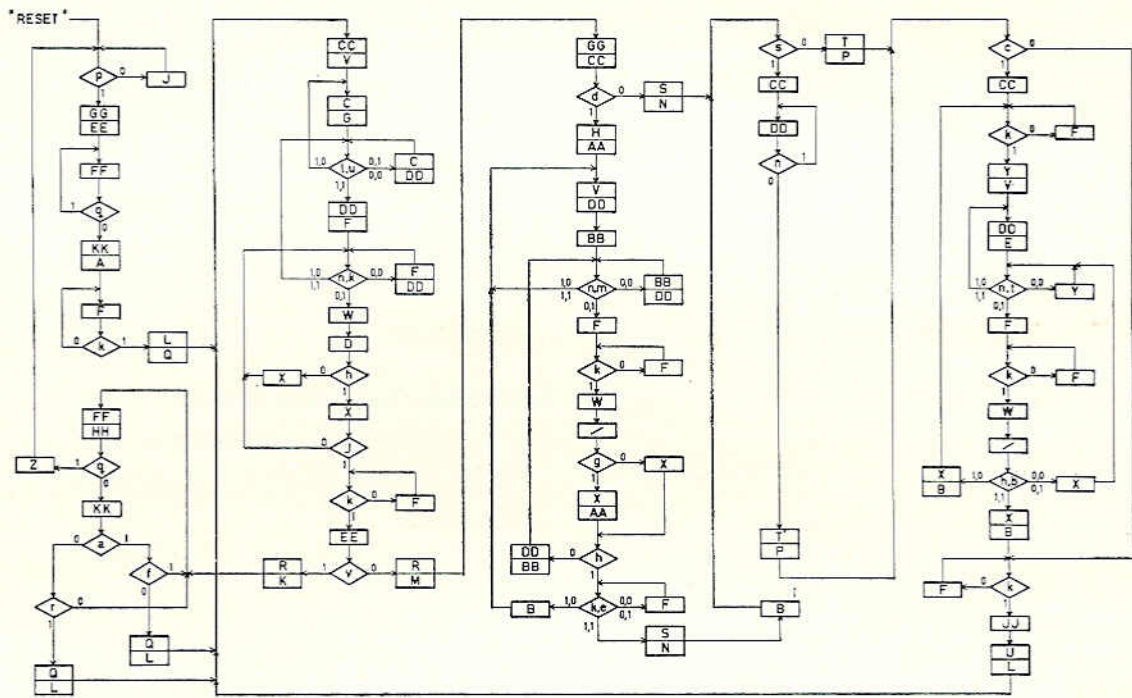
Dimensions: width 483 mm (19")
depth 64 mm
height 133 mm

1 Additional 7-Bit Digital Input Channel (MAS 02)

By including this option, it is possible to record 2 characters of 7 bits each per analog channel.

Clock Pulse Generator MAS 03

The clock pulse generator has modifiable frequency and is used to control the scanning rate.



General Program
Flow Chart Example*)

Time Scan

Fast Scan

Slow Scan

Digital Scan

MASTER CONTROL UNIT MAS 300

GENERAL

The MAS 300 is an all solid-state control unit, which can control a number of sub-units, e. g. in a data logging system.

The MAS 300 is in principle a small computer with a semi-permanent stored program. The program is wired on interchangeable plugs, which allows changes in the program to be made rather easily.

The microprogramming of the MAS 300 for a specific purpose is normally done by A/S Regnecentralen in accordance with the specifications of the system as prepared jointly by the customer and A/S Regnecentralen.

PROGRAM

The MAS 300 performs conditional branch instructions at a rate of 1 instruction every 3 μ sec. (300 kc/s clock rate). Each instruction specifies one or two activities and an address for the next step in the program. Each step in the program can specify up to 4 conditional instructions, only one of which will be performed depending on 1 or 2 Boolean conditions. One or two activity elements can be activated at each step, and the same element can be activated at one or more steps. The output from an activity element can be used to generate a control signal for a sub-unit, e. g. start of a scan unit, or to perform internal functions in the MAS 300, e. g. control of an auxiliary register. The MAS 300 can perform up to 100 different instructions.

DATA INPUT and OUTPUT

The MAS 300 is equipped with a 6-bit busline system for

receiving data from sub-units. There are 6 parallel 6-bit inputs to the busline system. A parity bit (odd parity) is automatically generated. Output from the busline system is in 7-bit characters.

FRONT PANEL

The MAS 300 is equipped with a front panel for manual operation and control of the program. A display shows the actual step of the program. Push-buttons located below the display permit a random step in the program to be selected. It is possible to proceed in the program from the selected step either normally or manually step by step.

In addition the front panel has switches for operation of the total system, such as start, stop, continuous scan, single scan, and total system alarm indicator. By means of switches it is also possible to omit sub-units from the program without changing the microprogram wiring.

MECHANICAL CONSTRUCTION

All circuits are mounted on pluggable printed cards. The unit is constructed for mounting on a 19-inch rack. The front panel is connected to the card module by cables and plugs.

* The above illustration shows an example of a flow chart for a data logging system controlled by the MAS 300. The program comprises 20 independent conditions (a - v) and controls 34 activity elements (A - KK).

MASTER CONTROL UNIT MAS 300

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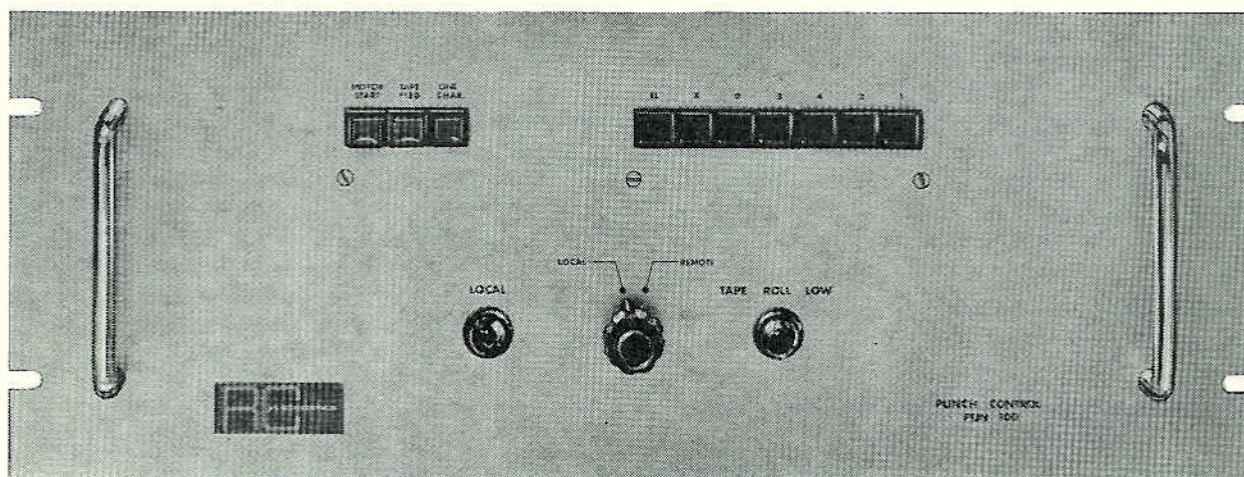
SPECIFICATIONS

Number of Instructions:	max. 100
Operation Speed:	1 instruction/3 μ sec
Clock Rate:	330 kc/s
Data Input:	6 parallel input channels, each of 6 bits
Parity:	odd parity bit automatically generated
Data Output:	characters of 7 bits
Logic Signal Level:	0 V and -10 V
Ambient Temperature Range:	0° C to +45° C
Power Requirements:	- 30 V \pm 5 % - 10 V \pm 10 % + 24 V \pm 5 % supply for 36 DM 160 indicator tubes
Card Module Dimensions:	width 483 mm (19") depth 410 mm height 578 mm
Front Panel Dimensions:	width 483 mm (19") depth 140 mm height 356 mm

OPTIONS

Cable Drivers/Transmitters (MAS 01)

This option comprises installation of up to 24 cable drivers and/or cable receivers, which allows approximately 100 meters of cable to be used between the MAS 300 and other units.



PUNCH CONTROL/ PUNCH POWER SUPPLY UNIT PUN 100/POW 500

GENERAL

The PUN 100 and the POW 500 comprise an all solid-state control and power supply unit for the Teletype BRPE 11 Tape Punch (110 char/sec).

The PUN 100 accepts digital data on 7 input lines. (Option PUN 02 performs scanning of up to 8 channels of 7 bits). A parity bit is automatically generated for each character. Data is recorded in 8-track code. The unit can operate in both synchronous and non-synchronous modes.

An external signal, "punch", releases a punch cycle, during which the necessary synchronization and timing is performed automatically. A "busy" signal is present, until the punch cycle is completed. The punch motor can be started and stopped by means of a control signal, "motor start". During the start of the punch motor, the unit is "busy", until the motor has reached full speed. An alarm

signal indicates that the tape supply is low.

The POW 500 supplies -28 VDC for the punch solenoids and 110 VAC for the punch motor.

The PUN 100 may be equipped with a front panel, PUN 01, for manual operation of the punch. The front panel has controls for start and stop of the punch motor and for tape feed and switches for setting up and punching single characters. In addition, there are indicators for punch motor on, local mode of operation, and tape supply low.

MECHANICAL CONSTRUCTION

The PUN 100 and the POW 500 are constructed as two separate modules for mounting on 19-inch racks. All logic circuits are mounted on pluggable printed circuit cards. The front panel is connected to the card module by cables and plugs.

PUNCH CONTROL/ PUNCH POWER SUPPLY UNIT PUN 100/POW 500

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SPECIFICATIONS

- Punching Rate:** synchronous operation, max. 110 ch/sec
non-synchronous operation, min. 55 ch/sec
- Data Input:** 7-bits, parallel
- Parity:** odd (or even) parity bit automatically generated
- Control Inputs:** punch command (initiates one punch cycle)
start signal for punch motor
- Control Outputs:** busy signal
alarm signal for tape supply low
drive signal for punch solenoids (Teletype BRPE 11)
- Logic Signal Levels:** 0 V and - 10 V
- Ambient Temperature Range:** 0° C to 45° C
- Power Requirements:** - 30 V \pm 5%, 0.45 A
- 10 V \pm 10%, 0.60 A
+ 24 V \pm 5%, 0.25 A
220 VAC \pm 10%, 1.5 A, 50 c/s \pm 5%

Dimensions

- PUN 100: width 483 mm (19")
depth 305 mm
height 178 mm
- POW 500: width 483 mm (19")
depth 203 mm
height 222 mm

OPTIONS

Front Panel (PUN 01)

The front panel includes:

- operating mode selector, local/remote;
- switch for punch motor, on/off;
- push-button for punching one character (set up by means of 7 push-button switches on the front panel);
- push-button for tape feed (blank tape);
- indicator for local mode of operation;
- indicator for punch motor on; and
- indicator for tape supply low.

- Dimensions: width 483 mm (19")
depth 64 mm
height 178 mm

Scanner (PUN 02)

By means of this option it is possible to serialize information from up to 8 parallel input channels of 7 bits each. The number of channels included in a cycle is determined by the insertion of wires in a semi-permanent plug.

Rack Mounting Unit for Punch (PUN 03)

The Teletype BRPE 11 Tape Punch for punching 8-track paper tape at a speed of 110 char/sec can be mounted on a 19-inch rack by means of Option PUN 03. *The punch is completely enclosed, and feeds the punched tape out through a tape guide in the middle of the front plate. The tape guide provides tape tear-off with an arrow-shaped tape-end that indicates the reading direction. The punch mounting allows the punch to be swung out for insertion of the paper tape roll.

- Dimensions: width 483 mm (19")
depth 229 mm
height 400 mm

Rack Mounting Unit for Punch (PUN 04)

The PUN 04 is similar to the PUN 03 except that the former is intended for mounting on the hinged frame option, RAC 02, of the 19-inch rack, RAC 100. The punch is then accessible for paper tape insertion by swinging out the hinged frame.

- Dimensions: width 483 mm (19")
depth 229 mm
height 400 mm

* Not all types of racks are applicable as the mounting is non-standard.

SCAN CONTROL UNITS SCA 100, SCA 101, SCA 102

GENERAL

The SCA 100, SCA 101, and SCA 102 are all solid-state control units for the A/D Converter and Transistor Multiplexer ADC 300 for high-speed scanning of analog input channels. The three models differ only in the maximum number of multiplexer channels they control. The SCA 100, SCA 101, and SCA 102 can control 12, 18, and 24 channels respectively.

By means of the Control Unit it is possible to control the number and sequence of channels in a scan. The program is set up with a set of multi-switches on the front panel, which allow changes in the program to be made very easily.

The scanning rate is controlled by an external oscillator, e. g. a digital clock. The maximum possible scanning rate is determined by the conversion time of the A/D Converter and the recording speed of the associated equipment.

The Scan Control Units provide the A/D Converter and Transistor Multiplexer with start signals and the multiplexer address (1 out of N code). The address of the selected channel is available in binary code for recording.

OPERATING MODES

The Scan Control Units may be operated by external sig-

nals or from the front panel. The mode of operation is selected by a mode selector on the front panel.

Remote Operation

The scanning is started by an external start signal. If the scan frequency is 100 c/s for example, a new channel will be selected every 0.01 second, until the last channel in the scan program is reached; this is indicated by a "scan end" signal, and the scanning stops automatically.

Local Operation

By means of push-buttons on the front panel, it is possible to go through the scan program step by step and observe the result of the conversion of each channel on the A/D Converter display.

A display on the front panel shows the number of the selected channel.

MECHANICAL CONSTRUCTION

All circuits are mounted on pluggable printed circuit cards.

The modules are designed for mounting on 19-inch racks. The front panel is connected to the card module by cables and plugs.

SCAN CONTROL UNITS

SCA 100, SCA 101, SCA 102

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SPECIFICATIONS

Number of Channels:

SCA 100 - up to 12
SCA 101 - up to 18
SCA 102 - up to 24

Scanning Rate: determined by external oscillator

Control Inputs:

start scan signal
ready signal from A/D Converter
error signal from A/D Converter
scan frequency

Control Outputs:

ready signal (A/D Converter and Scan Control Unit ready)
scan end signal
error signal (sum of errors from A/D Converter and Scan Control Unit)
multiplexer address (1 out of N code)

Data Output: address of selected channel in binary code

Front Panel Controls:

switches for scan program set-up (sequence and number of channels)
operation mode selector, local/remote
channel reset, manual start, and manual clock pulse

Front Panel Indicators:

display of selected channel number
control lamps for scan frequency error and local mode of operation

Logical Signal Levels: 0 V and - 10 V

Ambient Temperature Range: 0° to + 45° C

Power Requirements:

- 30 V \pm 5 %
- 10 V \pm 10 %
+ 24 V \pm 5 %
supply for 15 DM 160 indicator tubes

Card Module Dimensions:

width 483 mm (19")
depth 305 mm
height 178 mm

Front Panel Dimensions

SCA 100: width 483 mm (19")
depth 140 mm
height 356 mm
SCA 101: width: 483 mm (19")
depth: 140 mm
height: 394 mm
SCA 102: width: 483 mm (19")
depth: 140 mm
height: 489 mm

SCAN CONTROL UNIT SCA 200

GENERAL

The SCA 200 is an all solid-state control unit for the Relay Multiplexer RMP 100. It can control up to 32 RMP 100 modules with a total of 1024 relays (analog input channels). The SCA 200 provides the relay multiplexer with the address (10-bit binary number) of the relay to be selected.

SCAN PROGRAM

A scan comprises a number of consecutive channels. The number of the first and the last channel in a scan is selected by means of two 10-bit push-button switches on the front panel.

A scan is initiated by a "pre-set" signal that selects the first channel. A new channel is selected each time the scan control receives a "count" signal. A "ready" signal is generated, when the activated relay has settled and the measurement can be made. When the last channel in the scan program is reached, a "scan end" signal is generated.

The relays are activated only if an "enable" signal is present along with the multiplexer address. It is thus possible to avoid activating relays outside the scanning periods.

OPERATING MODES

The SCA 200 can be operated by remote signals as described above or manually (local mode) from the front panel. The mode of operation is selected by a switch on the front panel. The local mode of operation allows manual selection of individual channels by a 10-bit push-button switch.

MECHANICAL CONSTRUCTION

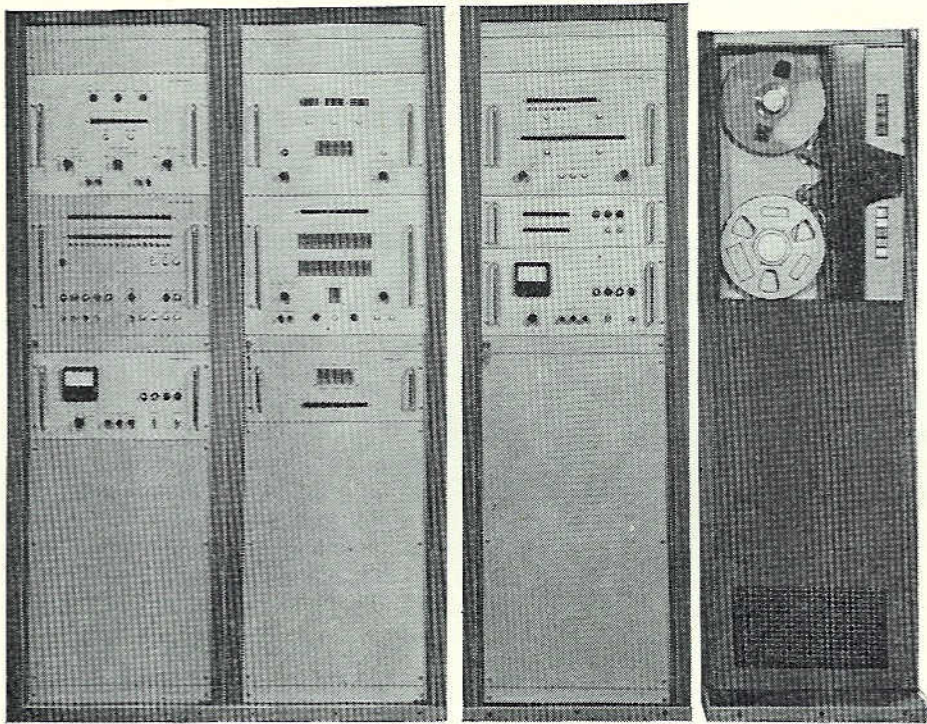
All circuits are mounted on pluggable printed circuit cards. The unit is constructed for mounting on 19-inch racks. The front panel is connected to the card module by cables and plugs.

SCAN CONTROL UNIT SCA 200

January, 1966

SPECIFICATIONS

Number of Channel Addresses:	up to 1024	manual selection of individual channels
Control Outputs:	channel address (10-bit binary number) enable signal ready signal scan end signal	Front Panel Indicators: display of selected channel number indicator for local mode of operation
Control Inputs:	pre-set signal count signal enable signal	Ambient Temperature Range: 0° C to + 45° C
Data Output:	address of the selected channel (10-bit, parallel)	Power Requirements: - 30 V \pm 5 % - 10 V \pm 10 % + 24 V \pm 5 % supply for 10 DM 160 indicator tubes
Logic Signal Levels:	0 V and - 10 V	Card Module Dimensions: width 483 mm (19") depth 305 mm height 178 mm
Front Panel Controls:	mode of operation selector, local/remote 10-bit push-button switches for selection of first and last channel in a scan 10-bit push-button switch for	Front Panel Dimensions: width 483 mm (19") depth 152 mm height 178 mm



SHORT CATALOG

Low-Speed Multiplexing of Low Level Signals

RMP 100 32 three-wire inputs can be scanned at speeds of 100-300 channels/sec maximum. Up to 32 RMP 100 units can be interconnected, providing up to 1024 input channels. 3 different types of relays can be used, depending on the noise limits required, the most effective type giving noise well below 5 μ V peak to peak.

Input network can be inserted for each channel to provide noise filtering, voltage division, or current-to-voltage conversion.

SCA 200 This unit provides addresses and sequencing signals for RMP 100 units. A scan program, consisting of a lower and an upper limit for channel numbers to be scanned, is set up by front panel switches.

High-Speed Multiplexing and Analog to Digital Conversion

ADC 100 Accuracy and overall stability are $\pm 0.8\%$. Scanning and conversion can be performed at 15,000 channels/sec. Ranges 1 V or 10 V; other ranges can be ordered. Up to 6 analog input channels can be scanned.

ADC 200 Equivalent to ADC 100 except that the accuracy is $\pm 0.1\%$ and the speed 10,000 channels/sec.

ADC 300 Equivalent to ADC 200 except that up to 66 channels can be scanned and a self-check facility is included. An output buffer register can also be included.

SCA 100/101/102 The scanning sequence and number of channels per scan can be programmed arbitrarily by letting this unit control the multiplexer in the ADC 100/200/300. The program is set up by means of thumb-wheel switches on the front panel.

RES 100/101/102 Combined relay and transistor multiplexing for medium-speed scanning of low-level signals allows several inputs to share the same input amplifier. In conjunction with an ADC 300, for instance, provided with a 10-channel transistor multiplexer, the RES 100 provides an average scanning speed of 1000 channels/sec maximum for 20 channels. RES 101 and 102 are equivalent to RES 100 except for the number of channels, which is 30 and 40 respectively. All RES units require only 10 input amplifiers (e.g. AMP 100). Scanning is performed in groups of up to 10 channels. The number and sequence of channels in a group, as well as the number of groups included in a scan, are programmed by switches on the front panel. The maximum scanning rate inside a group is 10,000 channels/sec.

AMP 100 This low-level differential amplifier with shielded inputs and high common mode rejection (min. 120 dB) can be included as a preamplifier for ADC 100/200/300. Measuring ranges as low as 10 mV can be obtained, giving a resolution of 10 μ V.

DVM 100 Digital voltmeter for medium and slow speed A/D conversion with extremely high resolution (1 μ V) and 5 significant decimals. An integrating measuring principle gives efficient noise immunity, especially against 50 Hz serial mode noise. The common mode noise rejection is 120 dB minimum.

Scanning of Digital Data

DIS The outputs from SCA 100/200 and ADC 100/200/300, combined with outputs from a digital clock, operator's switch-panel, and the like, form a number of digital data channels. DIS 200 collects and converts all these data to series of characters for recording. By means of a patch-panel, the data can be suitably formatted, and identification characters and flag bits can be inserted. Different types of switch-panels for manual insertion of data are available as options.

PCT 100/101 Pulse counting can be performed at very high rates. Facilities are available for preset counting and frequency/time measurements.

FFR 100 Buffer storage of digital data for up to 40 bits is performed in 4 individual 10-bit flip-flop registers.

Digital Clock for Time Records

RTC 100/101 The time of day is given in hours, minutes and seconds (optionally, hundredths of a second) as binary coded decimal numbers. Time is shown on the front panel by an in-line decimal display. The clock can be driven either from the 50 Hz mains or from the crystal controlled oscillator SFS 100.

SFS 100 The Standard Frequency Source provides a number of frequencies from 1 MHz down to 50 Hz. Overall stability is better than $\pm 10^{-6}$.

RTC 200 Real-Time Digital Clock for systems where time-records in binary form are required. A 24-bit counter indicates the time of day, counting at 100 Hz derived from the mains supply. Every 24 hours the counter is reset and increments a 5-bit counter for the day of the month. The month and year number is manually set by switches. The RTC 200 is equipped with a separate power supply for continuous operation.

Ferrite Core Store for Buffering Data

FCS 100 When data are collected at high speeds and/or must be recorded at high speeds, e. g. on magnetic tape, an intermediate store may be necessary. The FCS 100 is a coincident cur-

rent core store of 512 8-bit words with a cycle-time of 12 μ sec.

Complete decoding, read-write, timing circuits, and automatic parity checking facilities are included.

Output Recording of Data

PUN 100 An 8-track paper tape is punched at a speed of 110 char/sec. The unit receives 7-bit input characters and adds an eighth parity bit. Blank tape and single push-button coded characters can be inserted from the front panel.

PUN 200 Equivalent to PUN 100 except that the punching speed is 18 char/sec.

STP 100 Data can be printed on a strip of paper at a speed of 50 lines/min. Each line contains either a time-record or a measured value plus channel number. Up to 12 char/line.

STP 200 Equivalent to STP 100 except that the speed is 1200 lines/min with 12 char/line.

MAG 100 Recording is performed in digital form on magnetic tape at rates up to 25,000 char/sec using standardized formats. The tape transport used is the AMPEX TM-7 equipped with a data electronic unit. The MAG 100 constitutes a special 19-inch rack, and a special tape control unit may be included according to the system's specifications.

MAG 200 Incremental recording is performed on magnetic tape at rates up to 300 char/sec for asynchronous or 1200 char/sec for synchronous recording in standard computer tape formats. The incremental recording method is particularly advantageous, where medium-speed, asynchronous recording is required for large amounts of data, since buffer storage of data blocks is unnecessary.

BTC 100 Buffer storage of data in the ferrite core store FCS 100 for high-speed recording with the magnetic tape unit MAG 100 can be performed with this unit. Asynchronous recording of up to 5000 char/sec is performed in blocks of variable length with automatic insertion of inter-record gaps. The BTC 100 transfers data to or from tape via the core store, thus permitting data to be read from or written on tape in a character-by-character manner. Block formatting and tape handling can be controlled remotely. The BTC 100 contains a complete tape control unit for operating the MAG 100, which includes read-after-write checking as well as a longitudinal and transverse parity check facility.

TYP 100 Drive unit for controlling an IBM spherical typehead typewriter (Type 73) for typewriter output. The speed is 14 char/sec and the line-width 130 char/line.

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TYP 200 Drive unit for output typewriter equivalent to TYP 100 except that this unit permits the typewriter to be used for input as well.

Digital-to-Analog Conversion

DAC 100 Digital to analog conversion can be performed in 5 μ sec with an accuracy of 0.1%. Output range is ± 5 V, other ranges on order. DAC100 contains 2 10-bit flip-flop registers and from 2 to 6 D/A converters including 2 highly stabilized voltage supplies.

Where more than 2 D/A converters are used, the converter must be controlled by the Flip-Flop Register Unit FFR 100, containing up to 4 10-bit registers, which thus provide a set of fully buffered analog output signals.

DGC 100 This unit is intended for automatic control of graphical displays, such as cathode ray oscilloscopes and analog XY-recorders. DGC 100 accepts 7-bit characters from a tape reader or a computer, for instance, and accordingly the recording device can be operated in a fully automatic manner, including operations such as pen up/down and light on/off. The front panel includes switches for insertion of coordinates to allow manual operation. The overall accuracy of the XY-output voltages is better than ± 0.1 %.

Master Control of Total Systems

MAS 100 A modular Master Control Unit for centralized control of equipment built from a number of subunits. The semi-permanent patch-panel defines the format of the recording as well as the overall system performance.

MAS 200 Centralized Control Unit for a small-scale system consisting, for example, of an A/D converter, transistor multiplexer, switch-panel, and paper tape punch.

MAS 300 Centralized Control Unit for a large-scale system consisting, for example, of an A/D converter, relay multiplexer, transistor multiplexer, switch-panel, ferrite core store, and magnetic tape station, with facilities for switching to the computer for subsequent data handling.

The above-mentioned Master Control Units facilitate system operation and supervision by providing a centralized control and error-detecting facility. If a sub-unit is switched to "local mode", it can be operated from its own front panel, and the Master Control Unit will then indicate "error", if a total system start-up is attempted.

Power Supply Units and Racks

POW 100/200/300 A series of Power Supply Units for supplying DC voltages to RC Data Logging Modules.

The centralized power facility makes possible effective supervision of the DC voltages as well as controlled start-up and close-down sequencing of the supplies. In event of overload or excess temperature, the power is automatically switched off and an alarm signal is given.

RAC 100 Standard 19-Inch Rack constructed for mounting of card modules. Can be supplied with rigid swing-out frame for front panel mounting to provide a highly compact system. The Racks are normally equipped with fan and filter unit.

Special Equipment

Besides the above-mentioned units, A/S Regnecentralen is developing special equipment to supplement the standard modules. Some examples are:

Semi-Automatic Testing Equipment for Logic Modules

Testing of logic circuits is controlled by a closed-loop punched paper tape. The terminal switching network is constructed from hermetically sealed Reed Relay contacts.

Noise Detector for Supervision of Mains Supply

Transients and half-wave drop out in the mains supply may disturb the functioning of electronic equipment, if it is not supplied via a motor-generator set. The noise detector counts the number of disturbances exceeding pre-set limits.

Transistor/Diode/Zener Diode Tester TRT 100

A compact and versatile instrument for measuring static parameters.

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