

FACIT

PAPER TAPE READER

MANUAL

PE 1000

ÅTVIDABERGS

FACIT electronics

Fack Solna 1 Sweden



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GENERAL

The FACIT PE 1000 paper tape reader is designed for use as input device with electronic data processing machines or as terminal equipment for high-speed data transmission links. High speed, reliable operation and compact construction combine to qualify the PE 1000 for many applications within other data processing fields as well.

The paper tape reader is a single complete unit containing tape transport, feed mechanism and reading head plus reading and feed circuitry. A reel holder for 500 characters per second operation is available as accessory item.

The PE 1000 is easily convertible for 5, 6, 7 or 8-channel standard tapes. A selector switch sets maximum speed at either 500 or 1000 characters per second. At either speed the braking distance is so short that tape can be stopped between two characters. Thus reading speed can be varied arbitrarily throughout the entire 0 - 1000 characters per second range.

Tape is fed when a pinch roller presses the tape against a continually rotating capstan. Tape is braked when a brake armature presses tape against the tape pathway. These motions are sufficiently slight to reduce starting and stopping times to a minimum thus assuring quick starts and short braking distances. See Fig. 1 - 1.

Reading is dielectric. Tape passes a reading head comprising nine pins (one for every channel, including the feed-hole) and a main electrode. Each pin, in combination with the main electrode, creates a capacitor, the capacitance of which changes when a hole passes by. Thus, information punched into the tape can be read by sensing the variations in capacitance.

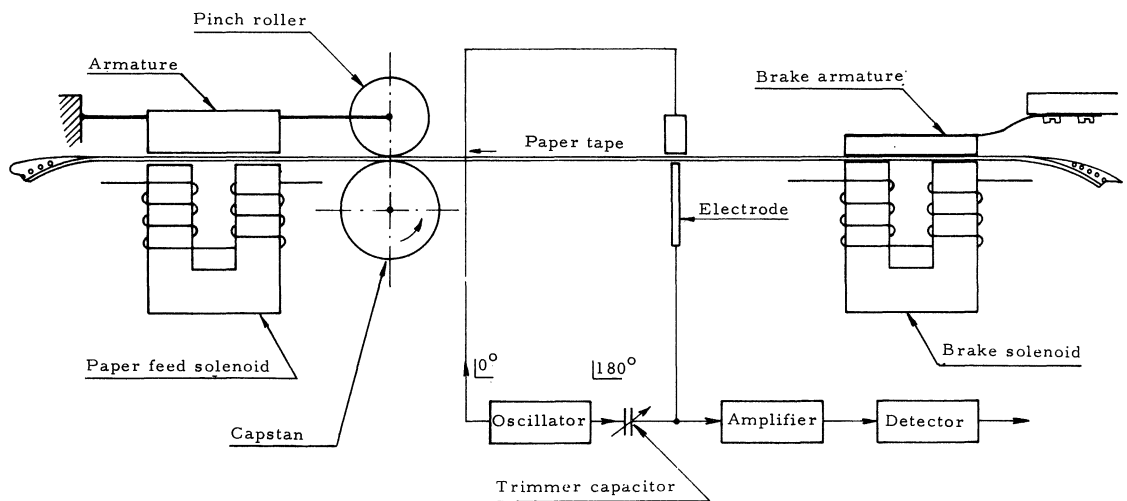


Fig. 1 - 1 Functional diagram

The paper tape reader comprises a power supply unit and an electronic unit which contains printed circuit boards with semiconductor circuits.

The FACIT PE 1000 is available in four modifications. The designation FACIT PE 1000 applies to all of them. See table 1 for full designation of each modification.

Table 1

Designation	Mains voltage	Mains frequency
FACIT PE 1001	220 V, single phase	50 cycles
FACIT PE 1002	115 V, single phase	50 cycles
FACIT PE 1003	220 V, single phase	60 cycles
FACIT PE 1004	115 V, single phase	60 cycles

SPECIFICATIONS

2.1 TAPE

Tape material: Paper, oiled paper.

Type of tape: 8-channel punched tape conforming with Electronic Industries Association (EIA) Standard RS-227. 5, 6 and 7-channel tapes punched in conformance with same standard.

Tape width:

5-channel	11/16 inch	17.5 mm
6-channel	7/8 inch	22.2 mm
7-channel	7/8 inch	22.2 mm
8-channel	1 inch	25.4 mm

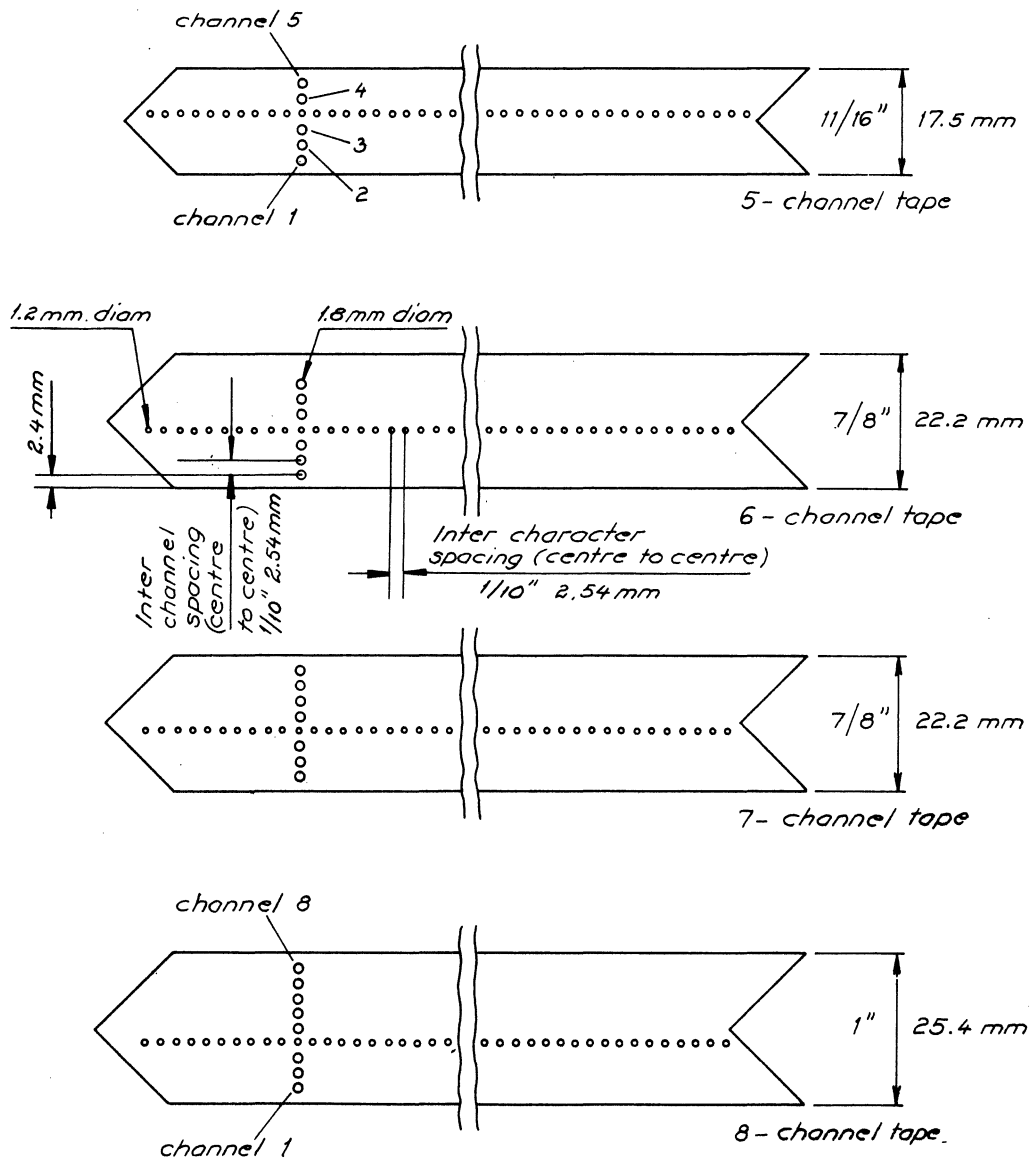


Fig. 2 - 1 Tape types

Thickness of tape: Max. 0.15 mm (0.006 in.)
 Min. 0.05 mm (0.002 in.)
 Maximum splice thickness 0.2 mm (0.008 in.)

Inter-character spacing: 2.54 mm (0.1 inch), center to center. Max. permissible reduction, 10 %.

Outer diameter of tape reel: Max. 200 mm (8 in.)

Inner diameter of tape reel: 51 mm (2 in.)

2.2 ELECTRICAL DATA

Mains supply: FACIT PE 1001, 220 V, single phase 50 cycles, 120 W
 FACIT PE 1002, 115 V, single phase 50 cycles, 120 W
 FACIT PE 1003, 220 V, single phase 60 cycles, 120 W
 FACIT PE 1004, 115 V, single phase 60 cycles, 120 W

Start pulse: Negative 0.05 – 0.5 ms. If the start signal remains continuously negative the characters will be read consecutively.
 Upper level, min. + 1 V, max. + 25 V.
 Lower level, min. – 4 V, max. – 25 V.
 Input impedance 5 kilohms.

Information pulses: Parallel output from all channels including the feed-hole channel. A hole triggers a negative pulse ranging from + 1 V to – 10 V. Pulse duration depends on tape speed. Rise and fall times, max. 10 μ s. At no hole, positive voltage is + 1 V. Output impedance 1 kilohm.

Ready signal: From – 10 V to + 1 V at max. 10 μ s after start pulse.
 From + 1 V to – 10 V at trailing edge of information pulses.
 Rise and fall times, max. 10 μ s.
 Output impedance 1 kilohm.

2.3 MECHANICAL DATA

Reading speed: Max. 1000 characters per second – can be changed over to max. 500 characters per second.

Braking distance: Stops after every character.
 Stopping distance at 1000 characters per second, less than 1 mm (0.004 in.)
 Stopping distance at 500 characters per second, less than 0.5 mm (0.002 in.)

Feed: Externally controlled pinch roller and continually rotating capstan.

Dimensions: Length: 425 mm (16 3/4 in.)
 Width: 280 mm (11 in.)
 Height: 195 mm (7 3/4 in.)

Weight: 15 kg (33 lb.)

Accessory item: Reel holder for 500 characters per second.

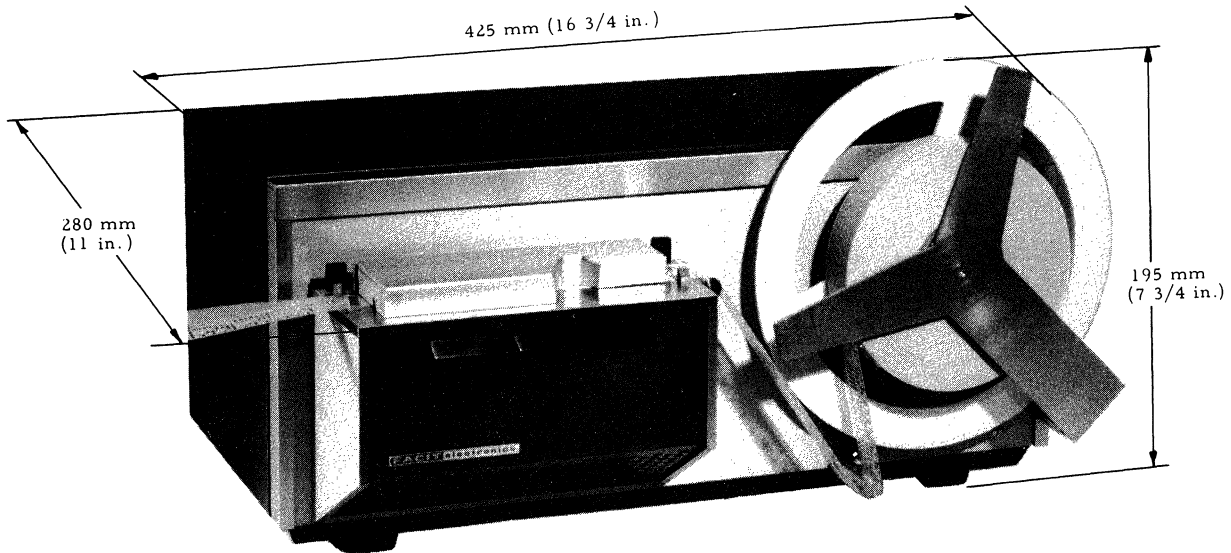


Fig. 2 - 2 Dimension drawing

2.4 CONTROL SUMMARY

2.4.1 Rear

ON-OFF power switch: For mains voltage

Main fuse: Glass fuse, 2 A, 20 mm (3/4 in.).

Speed selector switch: Two positions, 1000 characters per second and 500 characters per second

2.4.2 Front

Channel selection: The left and right paper guides are designed with hand grip for fast resetting of the inner guides. See Fig. 2 - 3.
 Forward position, 5 channel.
 Center position, 6 and 7-channel.
 Rear position, 8-channel.

Inserting tape: Lid lifts to insert tape.
 Press right-hand key to lift lid.

Tape feed: Press left-hand key to feed tape.

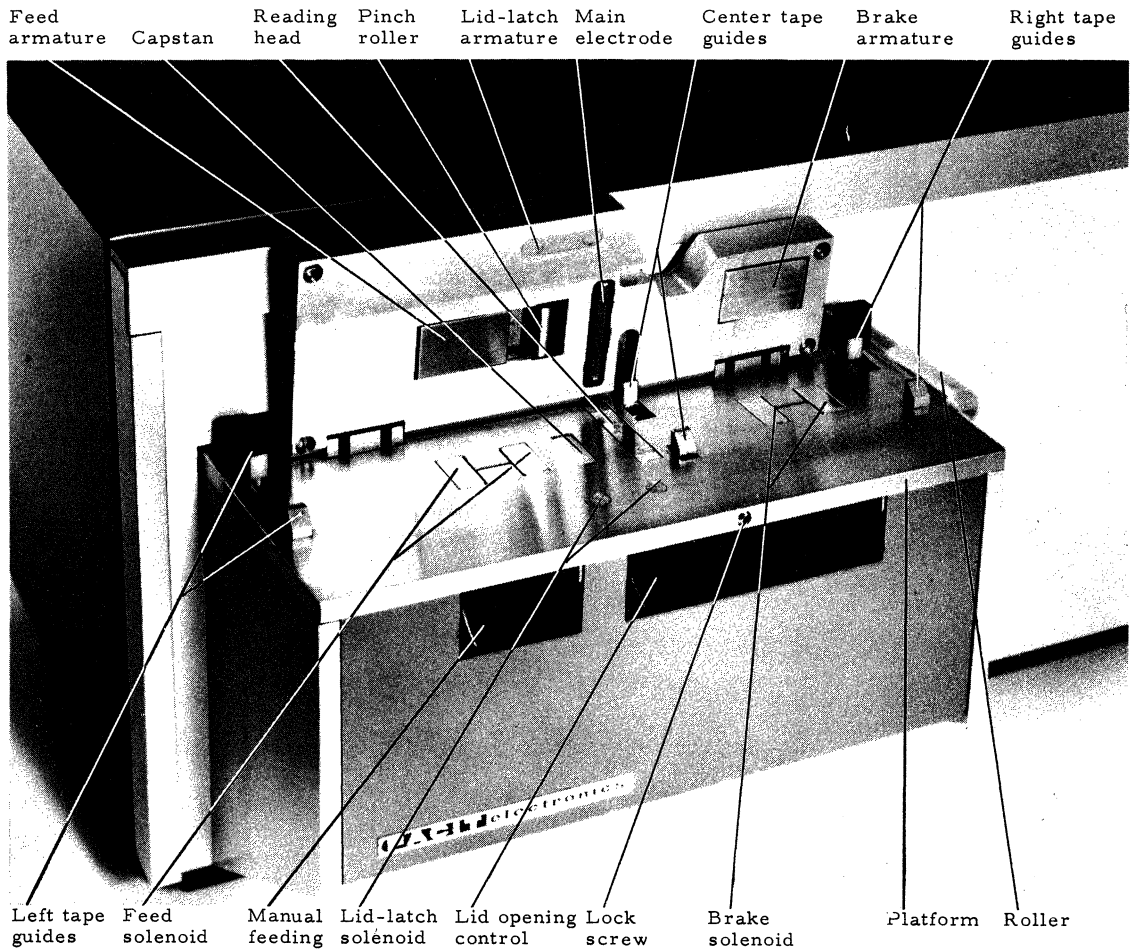


Fig. 2 - 3 Controls on the front of the reader

MECHANICAL CONSTRUCTION

3.1 MOTOR COMPARTMENT

In the left-hand portion of the reader cabinet viewed from the front is the motor compartment. See Fig. 3 - 1. In addition to the motor and its fan, most of the power supply components are located here (Appendix 2). The power transformer (T1) and filter coil (L1) are mounted at the bottom. The left-hand side wall is provided with mounts for two filter coils (L2 and L3) and eight diodes (D1-D8). At the rear of the motor compartment are mountings for the ballast resistors included in the brake and feed circuits (Appendix 6). These resistors are positioned in the fan air-stream. Beneath the ballast resistors and to the left, viewed from the front, is the speed selector switch for 1000 - 500 characters per second, the ON-OFF power switch, the main fuseholder, and the power inlet. The right hand wall of the motor enclosure separates it from the electronic enclosure and holds the contacts for the printed circuit boards.

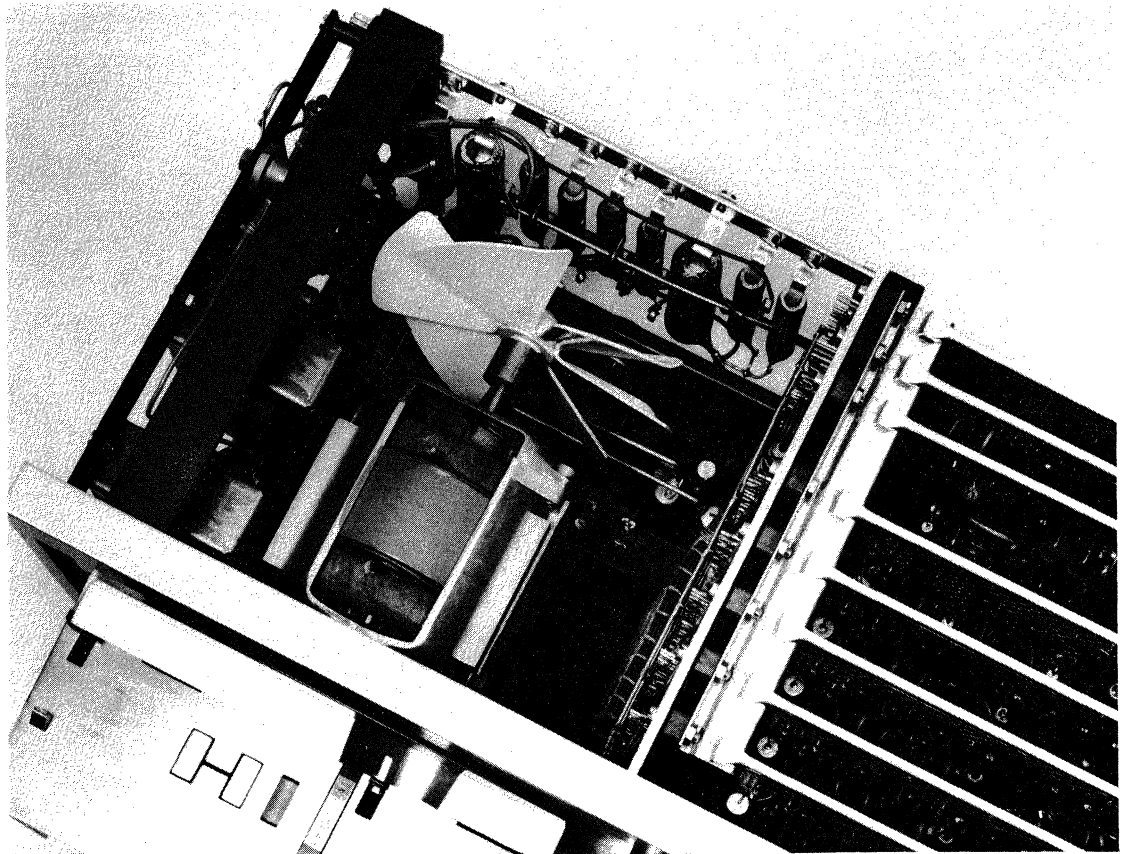


Fig. 3 - 1 Motor compartment

3.2 CIRCUITRY COMPARTMENT

In the right-hand portion of the reader cabinet is the circuitry compartment in which seven printed circuit boards are positioned. See Fig. 3 - 2. Eight reading amplifiers are mounted on the first four boards (Appendix 3). The fifth holds mainly the feed-hole amplifier (Appendix 4). Board 6 holds the control circuits (Appendix 5) and board 7 the brake and feed circuits (Appendix 6). Beneath the printed circuit boards is a panel with brackets for the filter capacitors (C2 - C6) and the motor capacitor (C1). See appendix 2.

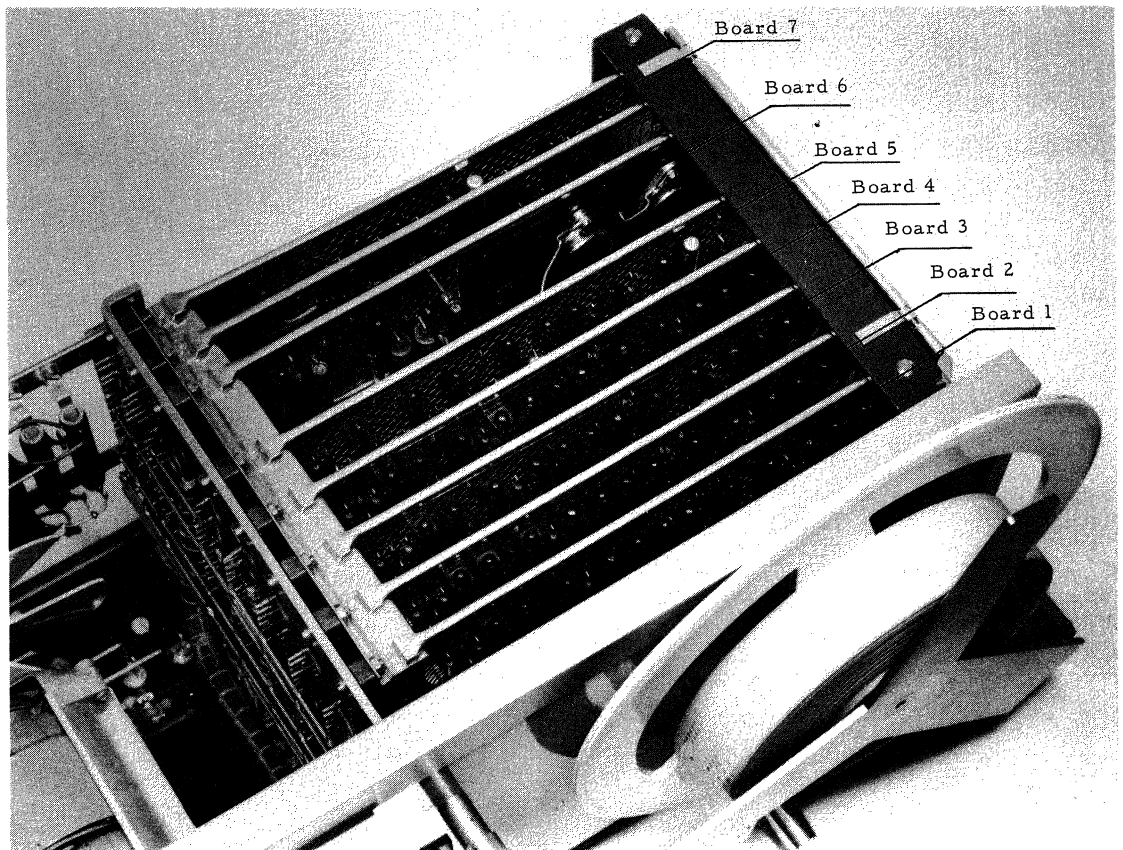


Fig. 3 - 2 Electronic compartment

3.3 READING UNIT

The reading unit is in front of the motor compartment. Its principal components are the platform, lid, trimmer unit and oscillator. The lid is above the platform. The trimmer unit and oscillator are within the casing beneath the platform. See Fig. 3 - 3.

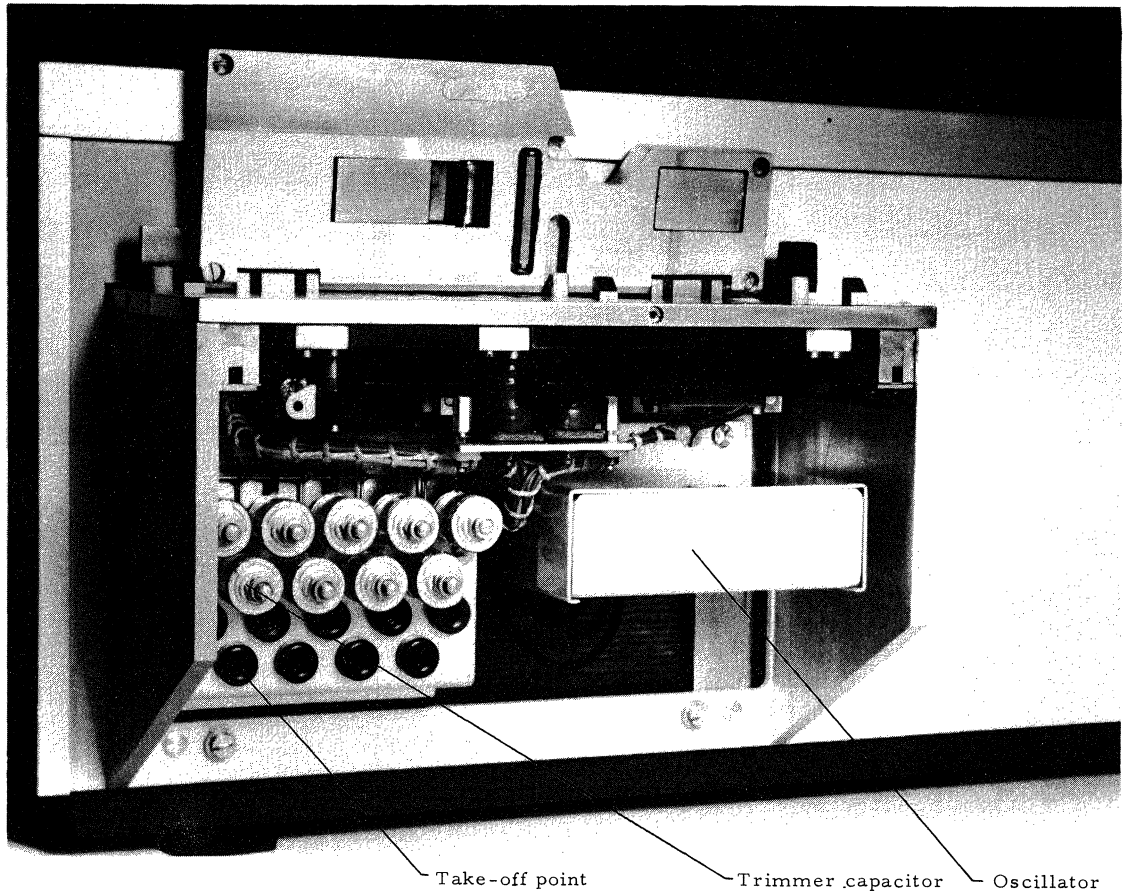


Fig. 3 - 3 Trimmer unit and oscillator

3.3.1 Platform

On the hard chromium plated platform are three pairs of tape guides. These determine the tape pathway and are designated left, center and right tape guides. The tape guides closest to the front panel are called the inner tape guides and the others are called the outer tape guides. See Fig. 2 - 3. The inner tape guides can be moved in parallel to three different positions to convert for 5, 6, 7 or 8-channel tape. The left-hand inner tape guide activates two micro-switches when it is moved so that the output from channels 6, 7 and 8 are connected or disconnected. The two center tape guides are individually movable for fine adjustment when a lock screw is loosened. All tape guides are faced with ceramic material which resists wear from tape edges.

Starting from the left along the tape pathway on the platform are the feed solenoid, capstan, reading head and brake solenoid. See Fig. 2 - 3.

The reading head has nine pins. The eight pins for the information channels are 1.0 mm (0.039 in.) in diameter and the ninth pin for the feed-hole channel is 0.4 mm (0.016 in.) in diameter. Insulation 0.1 mm (0.004 in.) thick surrounds the pins. There is a lid-latch solenoid located near the front edge of the platform to keep the lid when reading. On each side of the solenoid is a key-operated switch. The left switch runs out tape and the right releases the lid latch. See Fig. 2 - 3.

3.3.2 Lid

The lid, made of light alloy, is carried in two nylon hinges mounted on the platform. The feed solenoid armature is attached to the lid with a leaf spring. The pinch roller which feeds tape is attached to the feed armature. Pressure exerted by the pinch roller on the capstan can be adjusted by means of an adjustment screw. Two nylon dampers inhibit the mechanical oscillation of the feed armature. The distance from the dampers to the feed armature is adjusted by means of shim washers.

Above the reading head is a single electrode common to all nine channels, called the main electrode. When the lid is down, cleats on the electrode rest against insulation panels at the side of the reading head, thus creating a gap of 0.2 mm (0.008 in.) between the main electrode and the reading-head pins. The main electrode is connected to one terminal of the oscillator via a spiral spring beside the right-hand hinge.

The brake armature is directly in front of the brake solenoid. The surface it presents to the tape offers suitable friction. The brake armature is mounted by means of a leaf spring. The lid also carries the armature of the lid-latch solenoid which keeps the lid against the platform.

3.3.3 Trimmer unit and oscillator

The trimmer unit contains trimmer capacitors and take-off points for balancing signals to the reading amplifiers. A name-plate indicates the position of the trimmers and the take-off points. The oscillator is mounted on a separate etched printed circuit board which is shielded by a casing. See Fig. 3 - 3.

3.4 CABLE HARNESS

The cable harness is divided into three main branches. One for mains voltage, one primarily for power supply to the various circuits and one for signals.

ELECTRONIC OPERATION

4.1 INTRODUCTION

A start order in the form of a pulse as shown in Fig. 4 - 1 starts the tape reader. The input impedance for this pulse is 5 kilohms.

When a character passes the reading head the information is fed out in parallel on the same number of lines as there are channels on the tape, including the feed-hole channel. The lines carry +1 V when no information is being transferred and -10 V when information is transferred. The duration of the information pulses depends on the speed of the tape.

An additional line gives out a ready signal when each character is read. This line carries +1 V from the leading edge of the start pulse to the trailing edge of the information pulses, after which voltage drops to -10 V again.

The output impedance of the information lines and the ready signal line is 1000 ohms. Rise and fall times of pulses is less than 10 μ s.

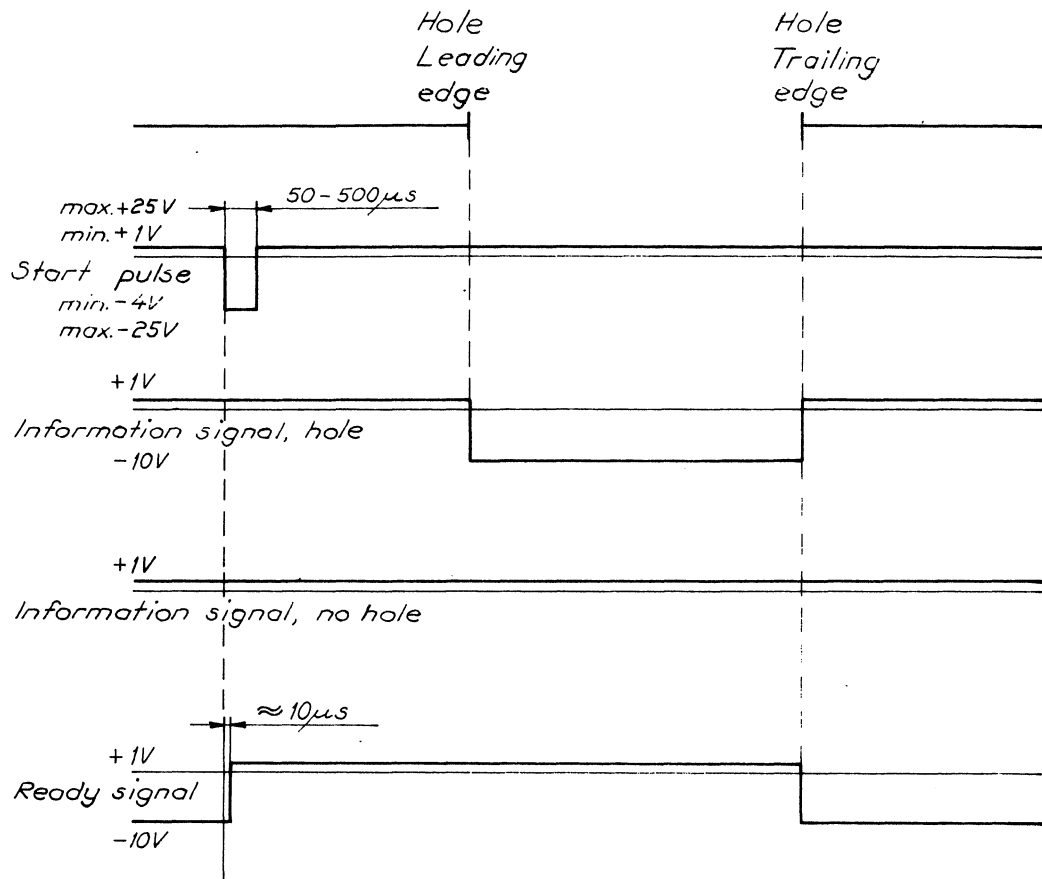


Fig. 4 - 1 Pulse diagram

After the ready signal, tape is braked and stops before the next character reaches the reading-head if not a new start order has been received. If, however, a new start order is received in less than 50 μ s after the ready signal, tape is not braked at all. By letting the start signal remain negative over a considerable interval, it is possible to read characters consecutively without interruption.

A start pulse of 50 - 500 μ s will provide a sufficient margin of safety when reading a character at a time. When reading blocks, the start pulse should be completed no later than 500 μ s after the ready signal has gone positive for the last character in the block. There are no special rise and fall time requirements for the start pulse.

4.2 START AND READING

A start pulse sets the start flip-flop to the one state. See appendix 1. As a result the brake releases and tape feed commences.

Nine reading capacitors are created by the nine pins in the reading head and the single main electrode facing them on the other side of the tape. Each of the reading capacitors, together with a trimmer capacitor is connected to the input of an amplifier. The oscillator which emits a 200 kc sinusoidal wave is connected between the main electrode and the common side of the trimmer capacitors. The trimmers are adjusted so that balance of the high frequency bridge is obtained when there is no tape in the reader; as a result no signal is sent to the amplifiers. When tape is placed in the reading head the circuit becomes unbalanced and a signal is sent to the amplifiers. Thus, when tape is fed through the head, the amplified, rectified signals indicate either hole or no hole.

Information on the feed-hole line can be gated out 0.4 ms after the start order. This insures that the tape will have acquired sufficient speed for reliable reading. Two conditions must be met to gate out information on the other lines and for the generation of a ready signal: the feed-hole and at least one other hole must have been read. However, a jumper can be attached at the connector plug eliminating the last condition and a ready signal will always be sent even if only feed-holes have been read. On delivery this jumper is normally attached between pin a3 and a4 in the connector plug, and must be removed if a ready signal is to be obtained only after the feed-hole and at least one other hole have been read.

For 5-channel tape, lines 6, 7 and 8 are blocked. For 6 and 7-channel tape, line 8 is blocked. When tape is fed manually, information is not gated out. When the lid is raised current is interrupted through the lid-latch solenoid and through any one of the brake solenoid or the feed solenoid which is carrying current at the moment.

4.3 OSCILLATOR

The oscillator, emitting 200 kc sinusoidal voltage, contains two transistors, V1 and V2, working in push-pull. See Fig. 4 - 2. The transformer contains a Ferroxcube core and is wound with litz wire. The secondary output H (200 turns) feeds 600 V peak to peak to the main electrode and from output L (1 turn) approx. 3 V peak to peak to the common side of the trimmers.

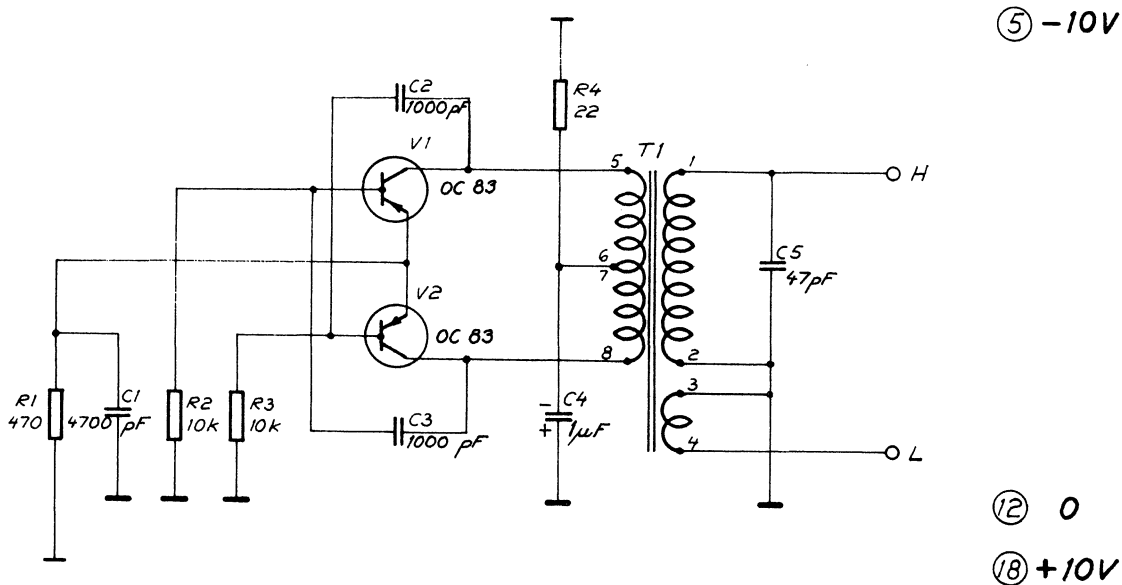


Fig. 4 - 2 Oscillator

4.4 GATING OUT INFORMATION

Amplifiers for the eight character lines are mounted on printed circuit boards 1 - 4, two on each board. See appendix 3. Amplification is accomplished in three resistance-coupled stages. The first stage with feedback by an unbypassed emitter resistor, has an input impedance of approx. 10 kilohms which is suitably matching it with the reading unit and the coaxial cable which carries the signal. The feedback of the two following stages is accomplished by R17-18 and R19-20. Amplification is preadjusted to the proper value by varying the resistance of R19-20.

After the third stage the signal is rectified in a voltage-doubler type detector (D1-2 and D3-4). The output voltage of the detector is connected to the take-off point of the trimmer unit. When balancing the reading capacitors, the voltage at the take-off points can be read with a high impedance voltmeter, for example, and adjusted to a minimum with the trimmers. The signal obtained from the detector is also used to control a Schmitt trigger which serves as a pulse-forming network. The hysteresis of the trigger makes it insensitive to the ripple on the signal from the detector.

After the Schmitt trigger comes the output stage for the information pulses. The diode D7 (or D8) comprises an OR gate which sets conditions for the ready signal. A gate pulse is sent via D9 (or D10) which times the gating out of information. A blocking signal from the channel selector switch is sent via D5 (or D6) if the amplifier is for channel 6, 7 or 8 and the switch is set for 5-channel tape – or if the amplifier is for channel 8 and the switch is set for 6 or 7-channel tape.

4.5 GATING OUT FEED-HOLE INFORMATION

The feed-hole amplifier is on printed circuit board five. See appendix 4. Since the signal from the feed-hole channel is weaker than from the other channels, an additional amplifier stage is needed. Otherwise design and construction are, on the whole, similar to the other amplifiers.

Line 17 goes to the AND gate which monitors the gating out of information and ready signals. Line 19 brings in the condition for the out-gating of feed-hole pulses. An emitter follower, V8 sends + 2 V to the Schmitt triggers. Two stages (V9 and V10) serve as driver stages for the brake and feed circuits.

4.6 FEEDING AND BRAKING TAPE

It can be seen on the logical diagram (Appendix 1) that the start pulse comes in on line 7 and sets the start flip-flop (V2, V3, appendix 5). As a result the start order is immediately connected to the output stage for the ready signal (V13) which then indicates that the reader has started by delivering + 1 V to line 14. The signal continues through two stages on board 5 to the brake and feed circuits on board 7 and tape is fed.

After a 0.4 ms delay the signal is connected via stages V4 and V5 (Appendix 5) to line 19. This leads to the output stage of the feed-hole line where gating out conditions are determined.

The signal is also lead to AND gate V6, V7, V8. Voltage at the output of this gate is low if 0.4 ms have elapsed since the start order and the signal from the feed-hole line indicates a hole (high voltage on line 17) and at least one information line indicates a hole (high voltage on line 3). On delivery, line 9 is grounded at the connector plug by the jumper between a3 and a4, and as a result this last condition is always met. The gating results in a gate pulse (high voltage on line 6) which permits information to be gated out. At the trailing edge of the gate pulse, start flip-flop V2, V3 is set to the zero state via V12, the ready signal output stage V13 delivers - 10 V and the tape is braked.

4.7 POWER AMPLIFIERS

A Start order causes voltage on line 1 on the power amplifier board (Appendix 6) to rise from a negative value to zero and V1 is cut off. (The same result is obtained if tape is fed manually.) In such case a negative pulse is sent to V2 which together with the feed solenoid, acts as a blocking oscillator with a collector voltage of -25 V. The blocking oscillator triggers and current through the main winding of the solenoid rises to approx. 3 A, after which the blocking oscillator is cut off.

Transistor V3 whose emitter is at -15 V now takes over the current passing through the solenoid winding. This process results in a relatively short rise time for the current through the solenoid and provides low power consumption since the solenoid is activated by 25 V but current is delivered at 10 V.

When the feed solenoid is activated, transistor V6 is cut off and current through the brake solenoid is interrupted. The back emf thus obtained is damped by circuit D7, R12-13, C5-6.

After the ready signal, line 1 becomes negative, current in the feed solenoid is interrupted and the brake solenoid is activated. The feed and brake circuits function similarly in principle. However, more power is required for the feed circuit than for the brake circuit.

Lifting the lid short circuits the lid-latch solenoid (K3, approx. 320 ohms). V1 and V4 are activated simultaneously, thus releasing the power of the brake and feed solenoids.

Emitter follower V7 delivers +1 V to all output stages of the reader.

4.8 POWER SUPPLY

The power supply (Appendix 2) delivers +10 V, -10 V, -15 V and -25 V. +10 V and -10 V are used for low-power circuits while -15 V and -25 V are used in the brake and feed circuits. The power transformer can be adapted for 115 V, 127 V and 220 V by moving one of the primary connections. However, the motor must always be connected to the 220 V transformer terminal.

4.9 CABLE CONNECTIONS

The reader output cable terminates in a Tuchel type connector; connector pins are numbered as follows:

Pin

a 1	Start pulse
a 2	Ready signal
a 3	Ground
a 4	Ground (connected to a3 with jumper)
a 7	+ 10 V (used only for service)
a 9	- 10 V (used only for service)
c 1	Information signal from channel 1
c 2	Information signal from channel 2
c 3	Information signal from channel 3
c 4	Information signal from channel 4
c 5	Information signal from channel 5
c 6	Information signal from channel 6
c 7	Information signal from channel 7
c 8	Information signal from channel 8
c 9	Information signal from feed-hole channel

OPERATING INSTRUCTIONS

5.1 INSERTING TAPE

Mount the supply reel on the reel holder, so that the reel turns counter-clockwise when paper is fed. Channel 1 should be nearest you (on the outside). Run tape in a loop beneath the roller on the take-up arm and then between the tape guides. When the lid is lowered see to it that the tape lies properly in the guides and that all information on the tape is to the right of the reading head. (The reading head is located immediately to the left of the center tape guides.) See Fig. 5 - 1 and 5 - 2.

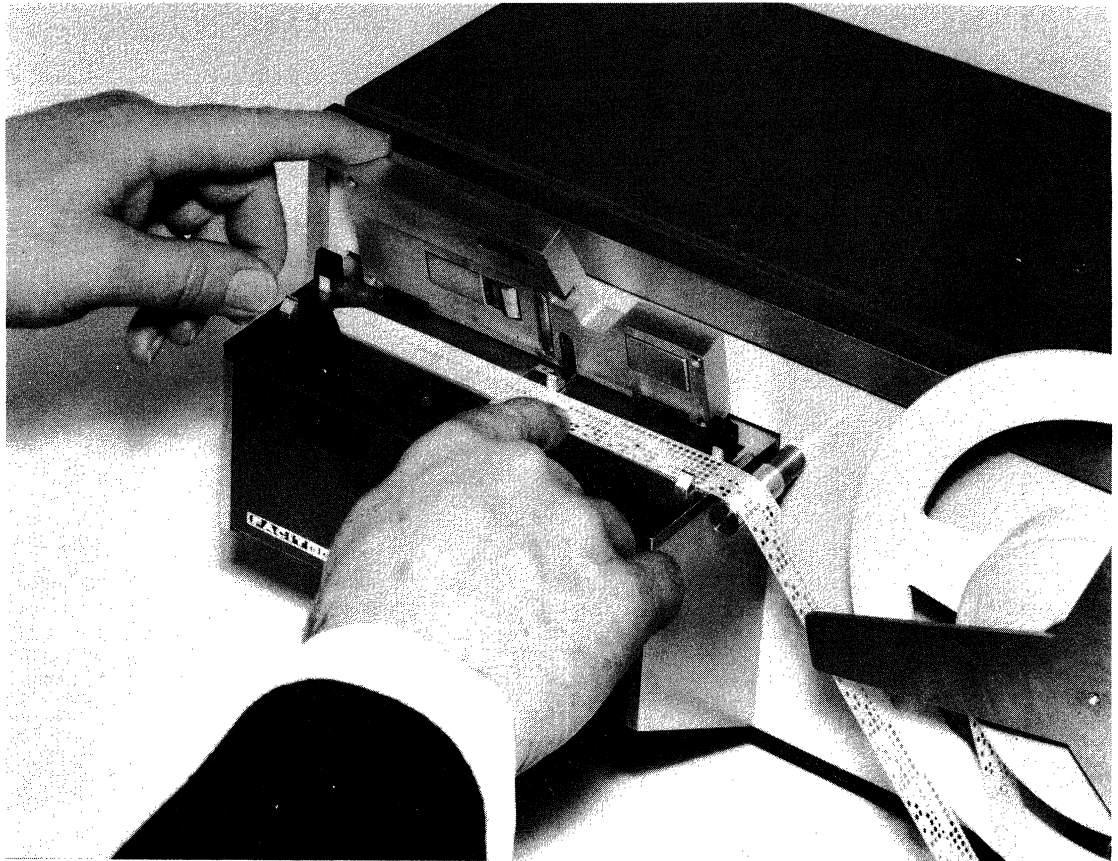


Fig. 5 - 1 Inserting tape

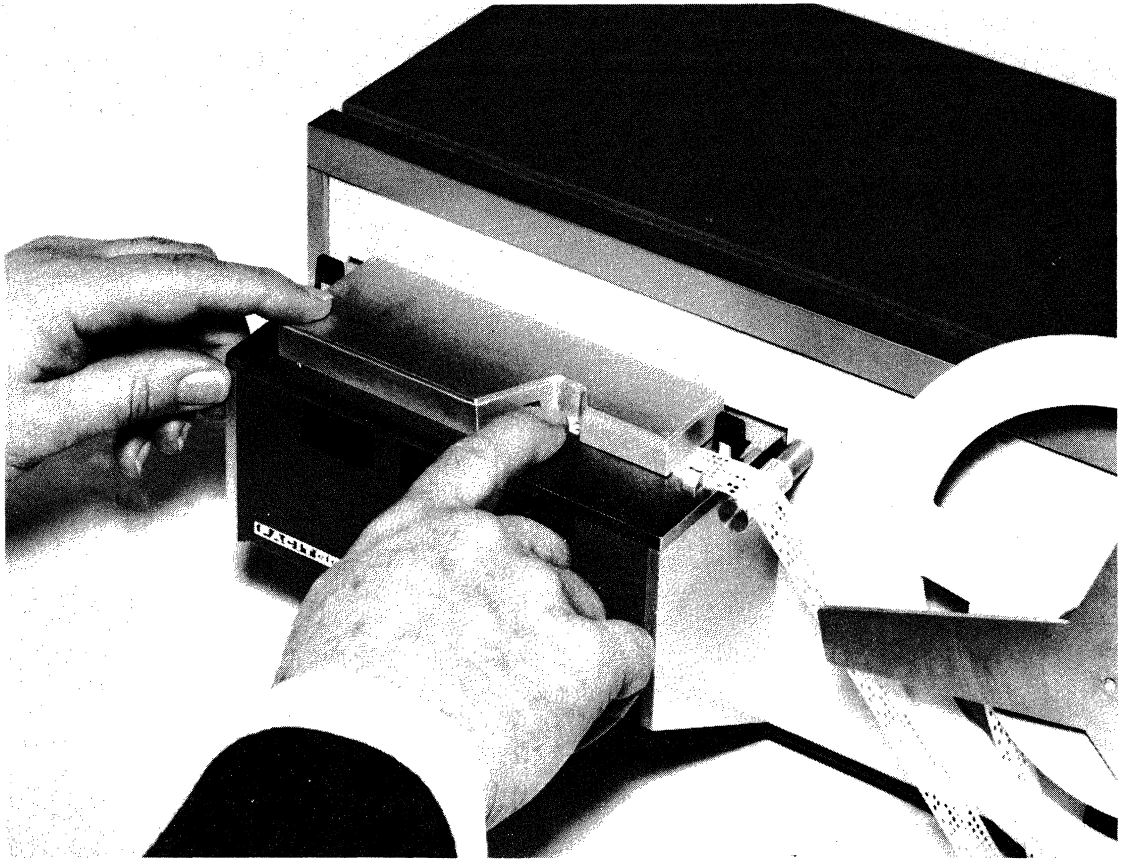


Fig. 5 - 2 Closing the lid

5.2

REMOVING TAPE

To remove tape, press the right-hand key on the reading unit, opening the lid, see Fig. 5 - 3 and 5 - 4. If you only wish to check the position of the tape, place one finger at the notch in the lid to hold tape in position while pressing the right-hand key. The lid should always be kept open if there is no tape in the reader. Otherwise the feed mechanism is worn needlessly.

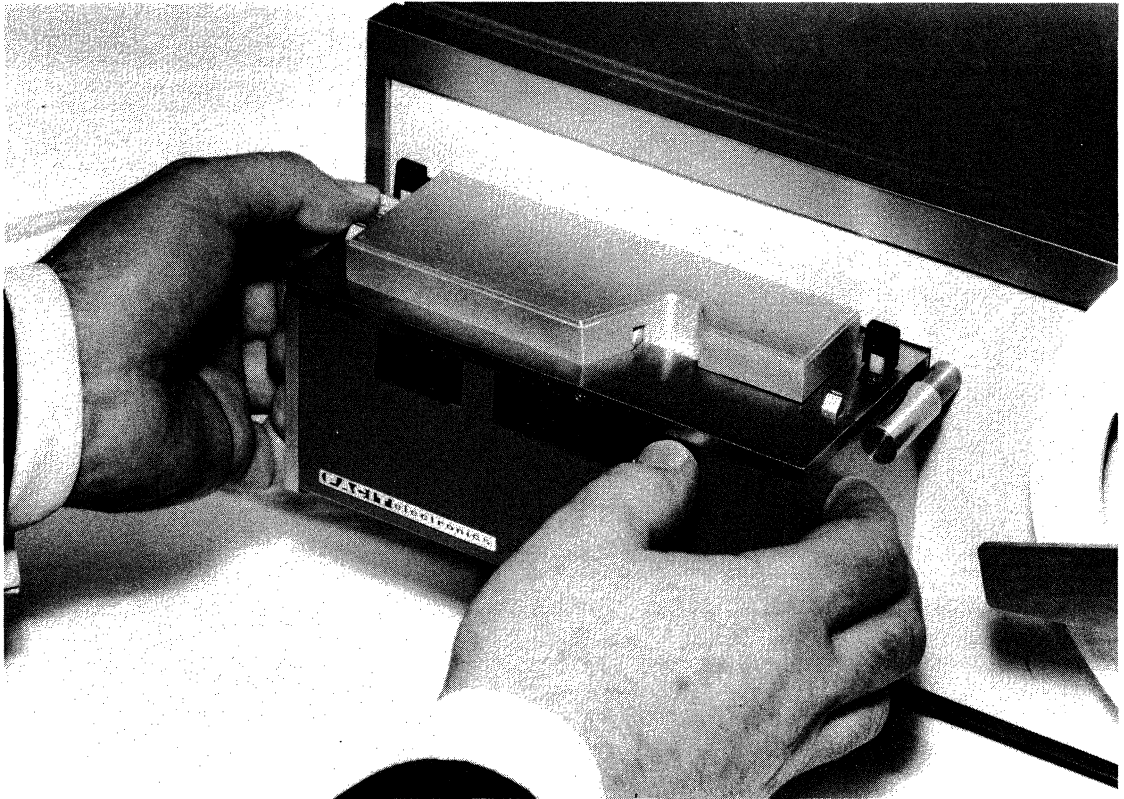


Fig. 5 - 3 Opening the lid



Fig. 5 - 4 Removing tape

5.3 RUNNING OUT TAPE

If reading is not to begin for some distance in from the tape end or if a certain amount of tape is to be skipped, tape can be run out by pressing in the left-hand key on the reading unit.

5.4 CHANGEOVER TO DIFFERENT TAPE WIDTH

The reader can be converted for different tape widths.

Both reading unit and the reel holder must be readjusted.

On the reading unit, the left and right inner tape guides are designed with a hand grip for re-positioning for different tape widths. To re-position press down both tape guides simultaneously, then move them forward or backward for the desired tape width. See Fig. 5 - 5

Forward position	5-channel	11/16 inch
Center position	6 and 7-channel	7/8 inch
Rear position	8-channel	1 inch



Fig. 5 - 5 Changeover to different tape width

The reel holder can be shifted axially to three different positions with a simple hand motion. As on the reading unit the outer position is for 5-channel tape, the center position for 6 and 7-channel tape and the inner position for 8-channel tape.

5.5 LATERAL ADJUSTMENT OF TAPE

The tape guides are set for reading standard punched tapes on delivery. If, however, extremely narrow tapes or tapes with poorly centered holes have to be read, both center tape guides can be set individually to fit the tape used. The tape guides can be moved to the desired position after loosening a lock screw on top of the platform.

As a rule this adjustment is not needed in most application. Be sure that the adjustment is not undertaken unnecessary.

Amos

SERVICE

6.1 INTRODUCTION

Vorbereitung
 Preliminary instructions for trimming the reading head and adjusting tape tension are given in this chapter. *Wichtig/Sparsam*

6.2 TEST EQUIPMENT

Prüfgerätschaft
 The following equipment is required for checking and making the adjustments listed in the instructions below.

- Frühlingsfeder - meßgerät (Eingegabst)*
 Spring tension gauge, 1 kg (2.2 lb.).
- Oscilloscope or 20,000 ohms/V voltmeter.

6.3 TRIMMING READING HEAD
 (Oscilloscope or 20,000 ohms/V voltmeter)

2.1 Abgleichung Leser-Kondensator mit einem guten Holzspanner
 To balance reading capacitors proceed as follows:

Remove cover plate in front of reading unit by backing off two retaining screws. Switch on power and lower lid without inserting tape. Make certain that reading-head electrode and pins are free of dust. Check DC voltage between take-off point and ground using an oscilloscope or a 20,000 ohms/V voltmeter. Trim to minimum voltage. Trim with a wrench made of non-conducting material.

6.4 ADJUSTING TAPE TENSION
 (Spring tension gauge)

Tape tension is set at the factory and normally requires no readjustment.

However, if desirable, use a *gewinnschlüssel* socket wrench and *schraubendreher* screw driver to turn the feed-armature adjustment screw, thus *so andrehend* altering tape tension. After making adjustment, readjust the feed armature using shim washers until the dampers only just contact the feed armature with tape inserted.

6.5 LATERAL ADJUSTMENT OF TAPE

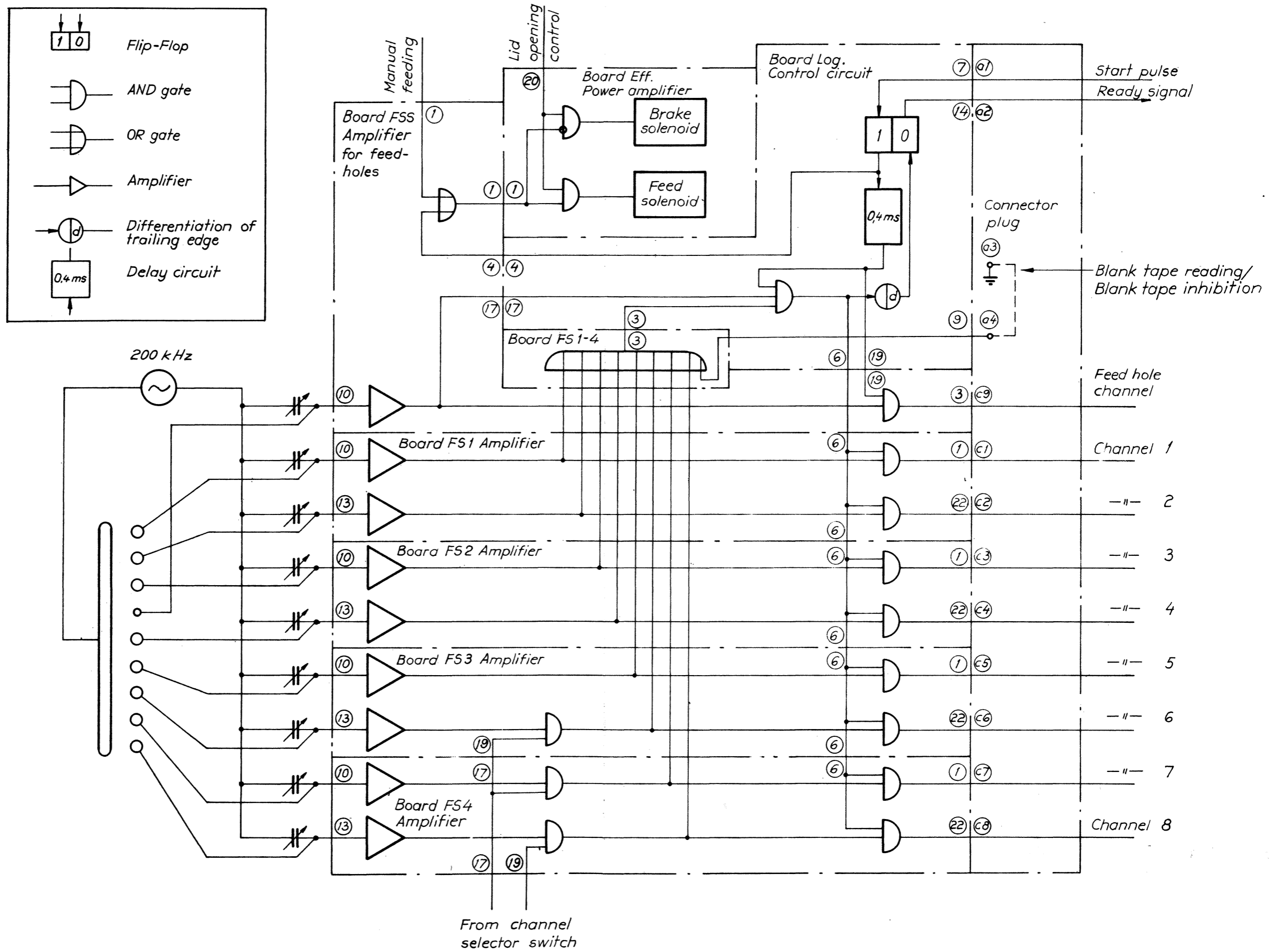
Seiten
 A poor reader output may be due to a lateral displacement of the tape. This in turn may be caused by a previous adjustment as mentioned in chapter 5.5 or by wear on the tape guides. The adjustment procedure should be as described in point 5.5

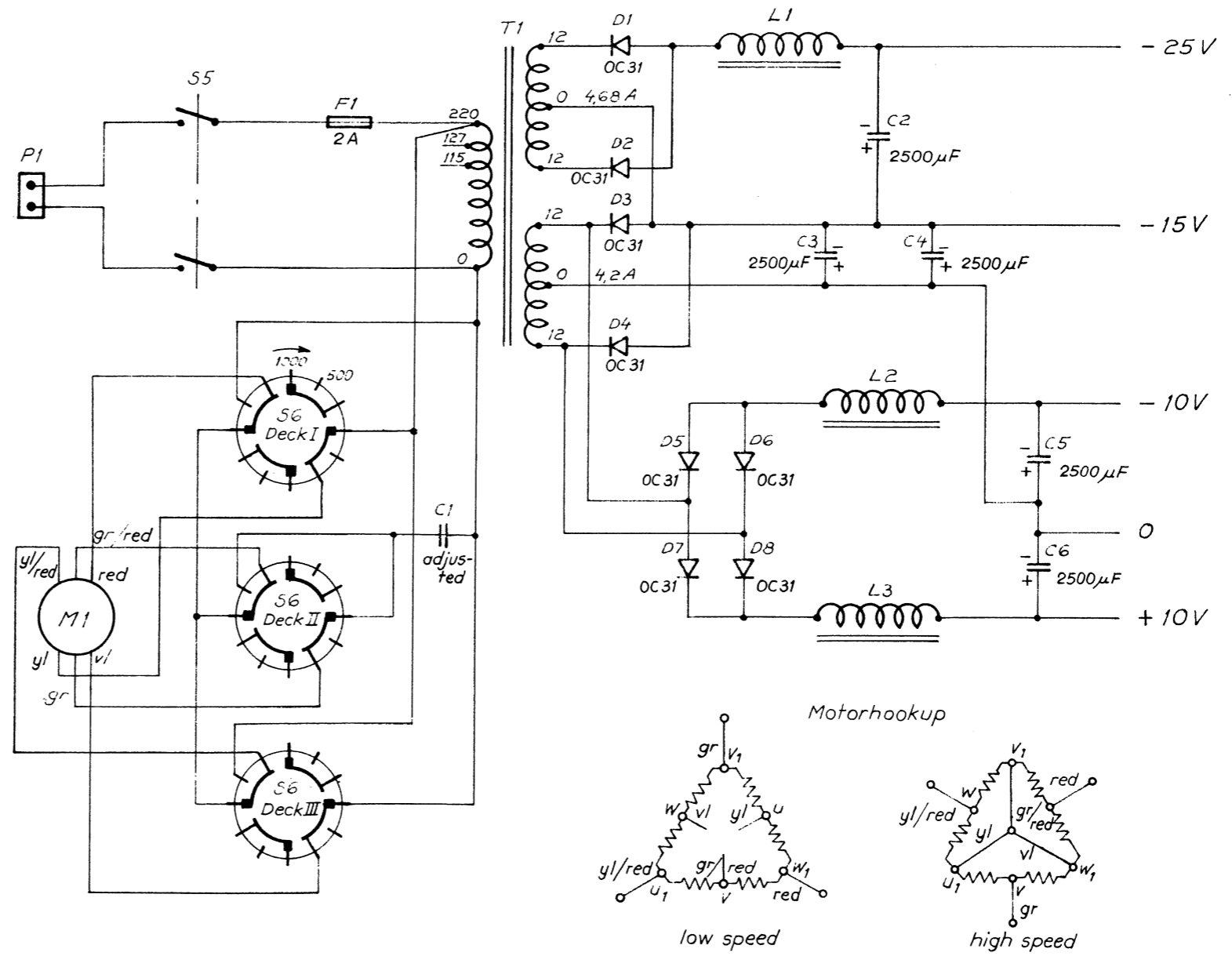
APPENDIX

- 1 Logical diagram
- 2 Power supply, Schematic diagram
- 3 Amplifier FS, Schematic diagram
- 4 Amplifier for feed-holes, FSS, Schematic diagram
- 5 Control circuit, Log., Schematic diagram
- 6 Power amplifier, Eff, Schematic diagram

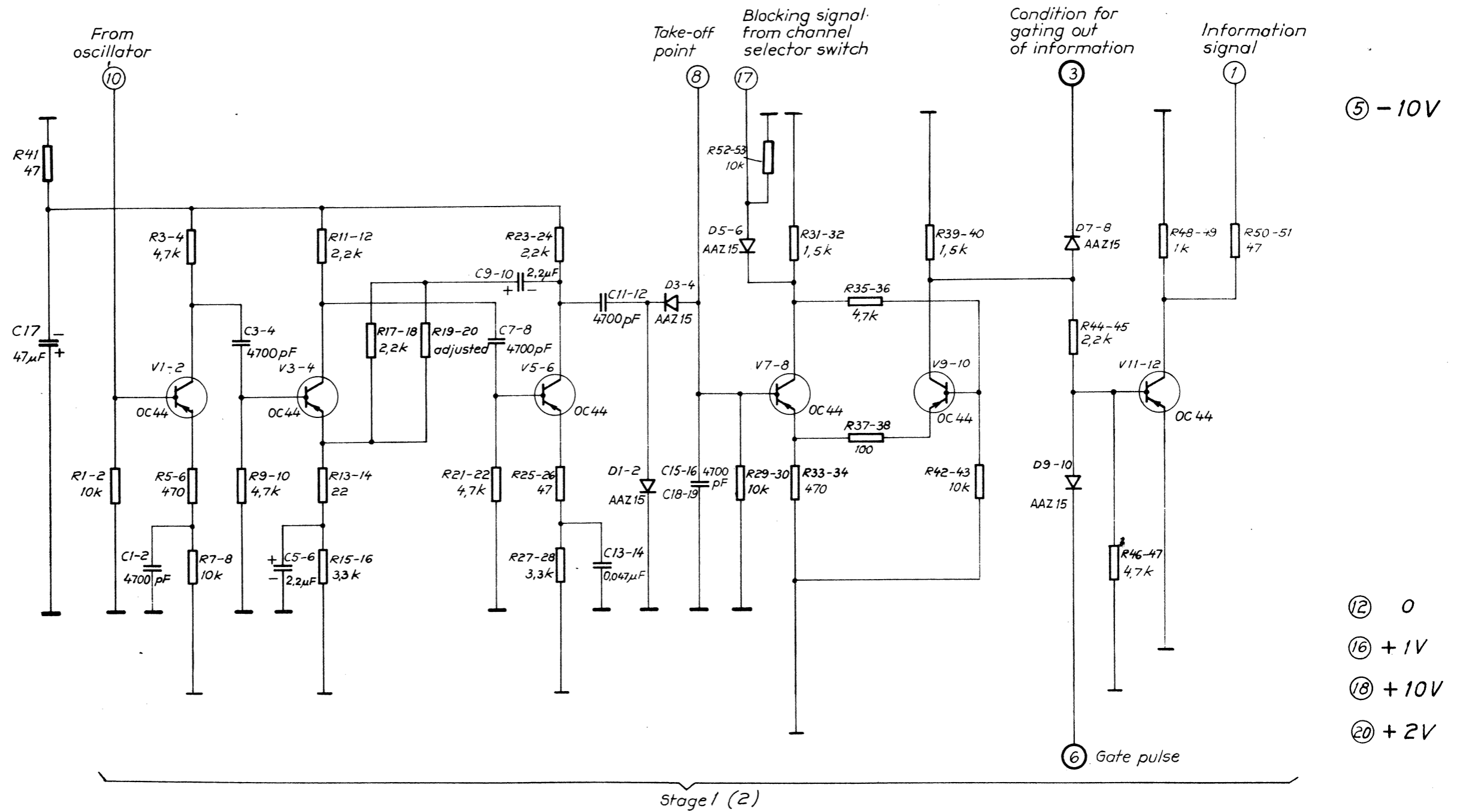
Revisions

No.	Date	Description	Remarks



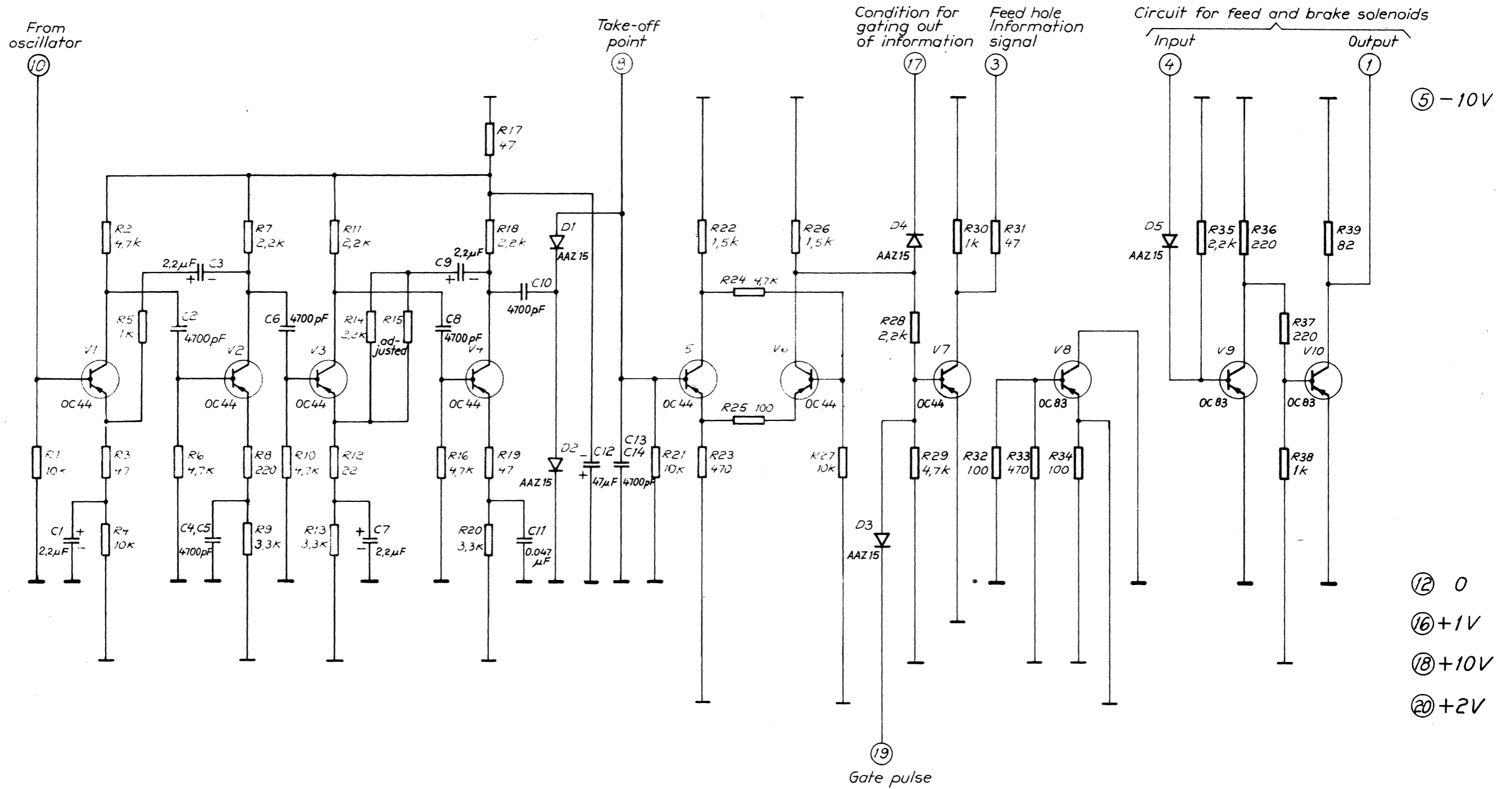


APPENDIX 2. Power Supply. Schematic diagram

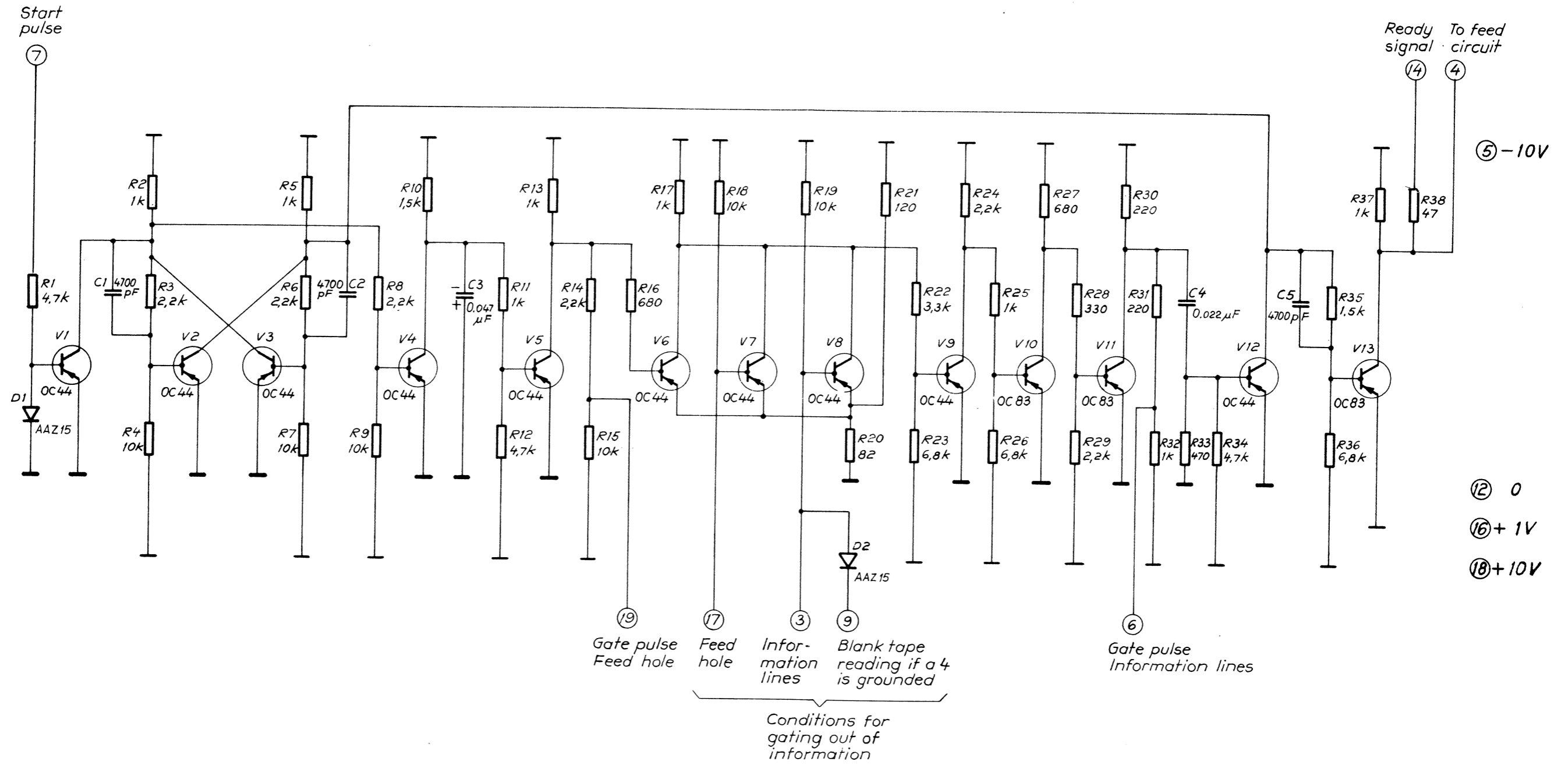


Corresponding points in the various stages				
Stage 1	10	8	1	17
Stage 2	13	15	22	19

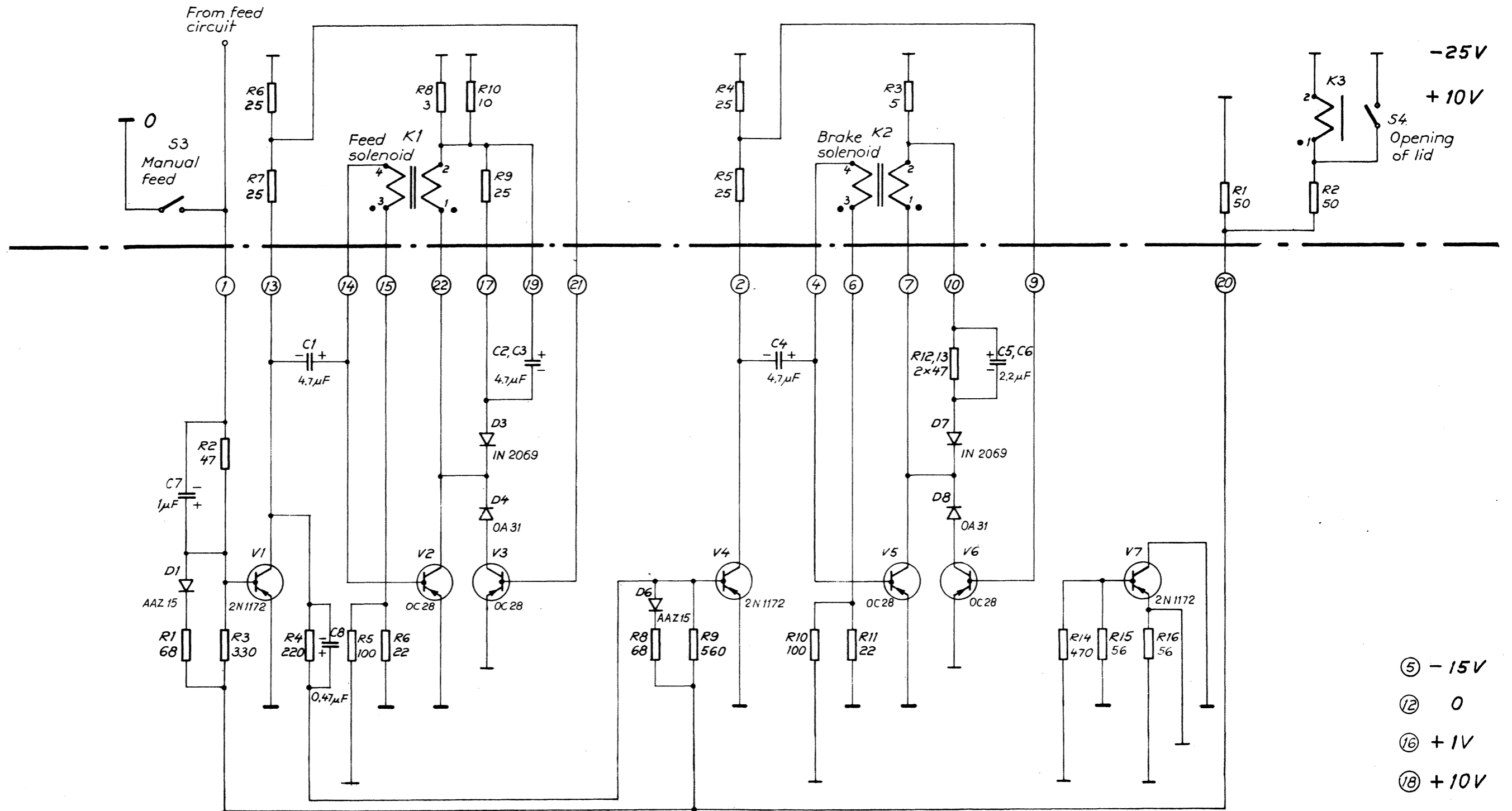
APPENDIX 3. Amplifier FS. Schematic diagram



APPENDIX 4. Amplifier for feed-holes, FSS. Schematic diagram



APPENDIX 5. Control circuit, Log. Schematic diagram



APPENDIX 6. Power amplifier, Eff. Schematic diagram