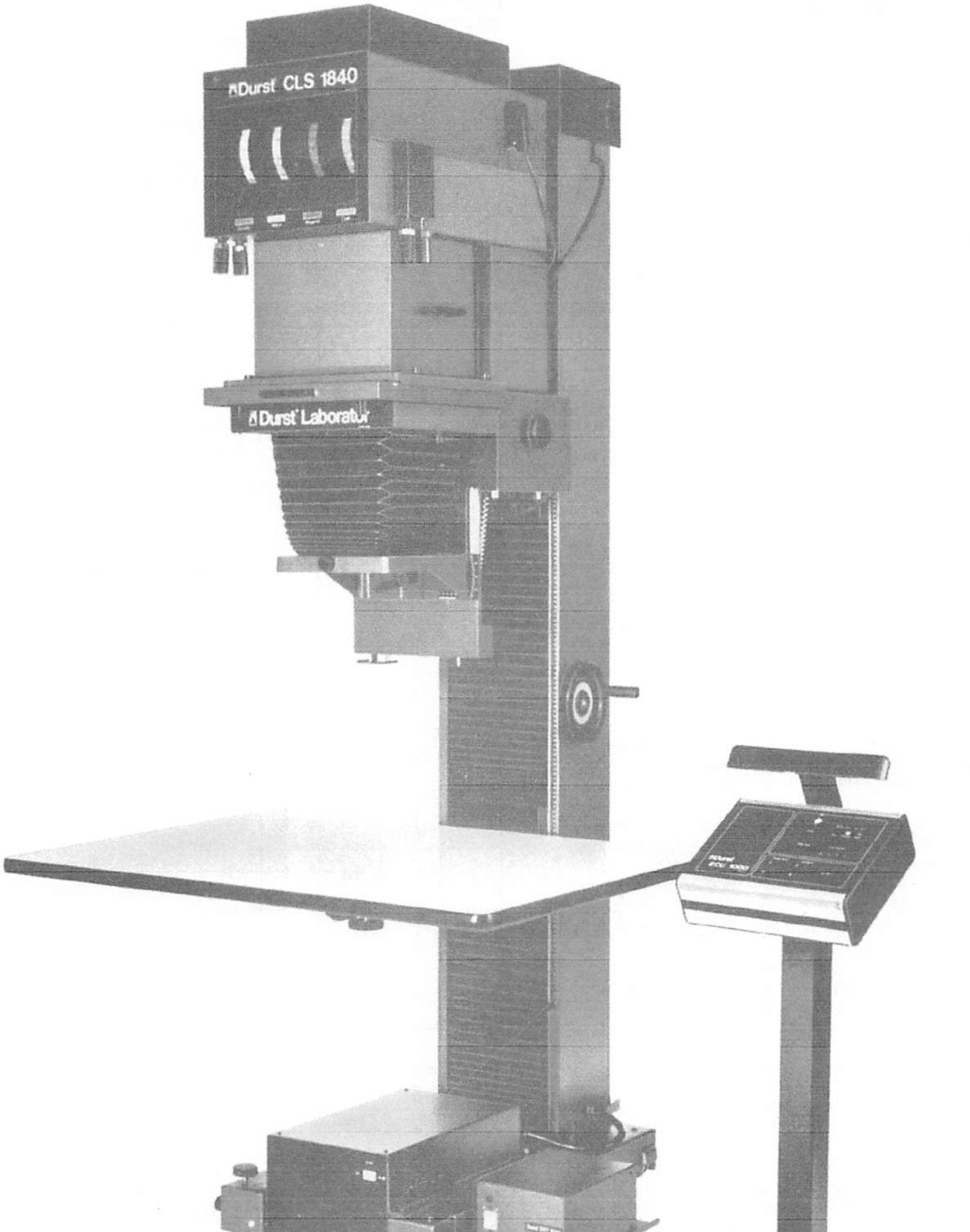
Durst LABORATOR 1840

REPAIR INSTRUCTIONS



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1.) General description

2.) Description of components

The following circuit diagrams are enclosed:

AC 81.800	Circuit diagram L 1840	
AC 81.706	Wiring plan	EPU 1000
AC 81.705	Circuit diagram of circuit boards 1, 2, 3	EPU 1000
MA 81.600	General circuit diagram	ECU 1000
29.303	General circuit diagram	EST 1000
CA 81.800	General circuit diagram	CLS 1000
MD 81.300	Circuit diagram	DESKMES
ML 81.205	Circuit diagram	DESKIL
Table A		L 1840

1.) General description

1.1) Unit components
The L 1840 consists of five sub-assemblies:
Enlarger stand L 1840
Illumination head CLS 1840
EST 1C00
Power unit EPU 1000
Control panel ECU 1000

A 26-pole cable connects the power unit to the control panel. A 39-pole DIN-plug connects the power unit to the enlarger stand.

1.2) Systems description
In order to reduce the number of cable connections between single components, multiplex-transmission based upon data circuits « DATA 1 » and « DATA 2 » and seven address circuits Q 1 - Q 7 has been adopted. This is done by using multiplexer, demultiplexer as well as an address generator. The address generator is a 7-step binary counter. It is being controlled by an external oscillator (of approx. 4 Khz). The outputs Q 1 - Q 7 count up from 0 - 128; as soon as it reaches the highest value of 128, the counter reverts to 0 and starts the counting-up sequence again. These seven addresses now control multiplexer and demultiplexer via the address circuits. Multiplexers are needed for switching over one or more inputs to one output. The input to be switched over to the output is chosen at address inputs S 1, S 2, S 3 by means of address information.

It therefore is a multi-pole electronic selector switch having n inputs and one output.
The multiplexer's input data is therefore transferred – after being multiplexed – to the demultiplexer's input via a data circuit.

Demultiplexers, also known as decoders, are controlled by the same address circuits as the multiplexer belonging to it.

Their function is the distribution of multiplexed data at the input stage, depending upon the address information at the address inputs, to the outputs. They thereby produce a logical signal at the output being chosen by the address circuits. This signal corresponds to the information being simultaneously available at the input. This logical signal will stand until the reset sequence to be effected via the data circuit takes place upon the corresponding address information.

If for example the « HEAD UP » touch button is depressed, an L-Signal will appear at the demultiplexer's input after the corresponding address information. This L-signal sets the output selected by the address information. This output remains set until the « HEAD UP » touch button is released, which causes an H-signal to appear at the input after the corresponding address information.

1.2.1) Multiplexer and demultiplexer control in the L 1840 system
1.2.1.1) The data circuit's « DATA 1 » multiplexer 1 is controlled via address circuits Q 2, Q 3, Q 4 and Q 7. Q 2, Q 3, Q 4 reach address inputs S 1, S 2, S 3. Q 7 controls the multiplexer via input (Pin 15) « ENABLE ». Only upon Q 7 becoming active, one of the multiplexer inputs is switched to the output according to the address information.

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$\overline{Q7}$	Q2	Q3	Q4	
EN	S1	S2	S3	I
L	L	L	L	I1
L	H	L	L	I2
L	L	H	L	I3
L	H	H	L	I4
L	L	L	H	I5
L	H	L	H	I6
L	L	H	H	I7
L	H	H	H	I8
H	L	L	L	X
H	H	H	H	X

The following table B shows the sequence of inputs appearing at the output, depending upon the address information.
The data circuit's « DATA 2 » multiplexer 2 is only controlled by address circuits Q 2, Q 3, Q 4. The « ENABLE » circuit is always free, thus carrying an L-signal.

1.2.1.2) The data circuit's « DATA 1 » demultiplexer 1 is controlled – as in the case of multiplexer 1 – by address circuits Q 2, Q 3, Q 4, Q 7.
Q 2, Q 3, Q 4 again reach address inputs S 1, S 2, S 3. Q 7 controls input « WRITE DISABLE ». This input is simultaneously being controlled also by Q 1. Thus the demultiplexer's output can only be rewritten as long as Q 1 is at L.
This step is necessary to avoid overriding the component.
The following table C informs about the demultiplexer's control.

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Q1	$\overline{Q7}$	Q2	Q3	Q4	
WD		S1	S2	S3	0
L	L	L	L	L	X
H	L	L	L	L	X
L	H	L	L	L	1
L	H	H	L	L	2
L	H	L	H	L	3
L	H	H	H	L	4
L	H	L	L	H	5
L	H	H	L	H	6
L	H	L	H	H	7
L	H	H	H	H	8

Demultiplexer 2 is controlled by address circuits Q 1, Q 2, Q 3, Q 4. Q 2, Q 3, Q 4 control address inputs S 1, S 2, S 3 and Q 1 controls input « WRITE DISABLE ».

The following illustration gives an overall view of the data transfer system *(see also enclosed table A)*.

2.) Description of components

2.1) EPU 1840 power unit

(see circuit diagram AC 81.706)

The power unit consists of the following components:
- one wiring board
- one 220 V motor control for the head support motor
- one 240 V motor control for the lens support motor

The power unit also features plug St. 1 for mains connection, mains switch S 1 for the entire system, fuses S 1 - 5, jack BU. 1 for the timer output, mains jack « AUX » BU. 2 for hooking up accessories, connection jack BU. 3 for the stand and a connection cable plug for the control panel.

2.1.1) Wiring board

(see enclosed circuit diagram AC 81.705 and table A)

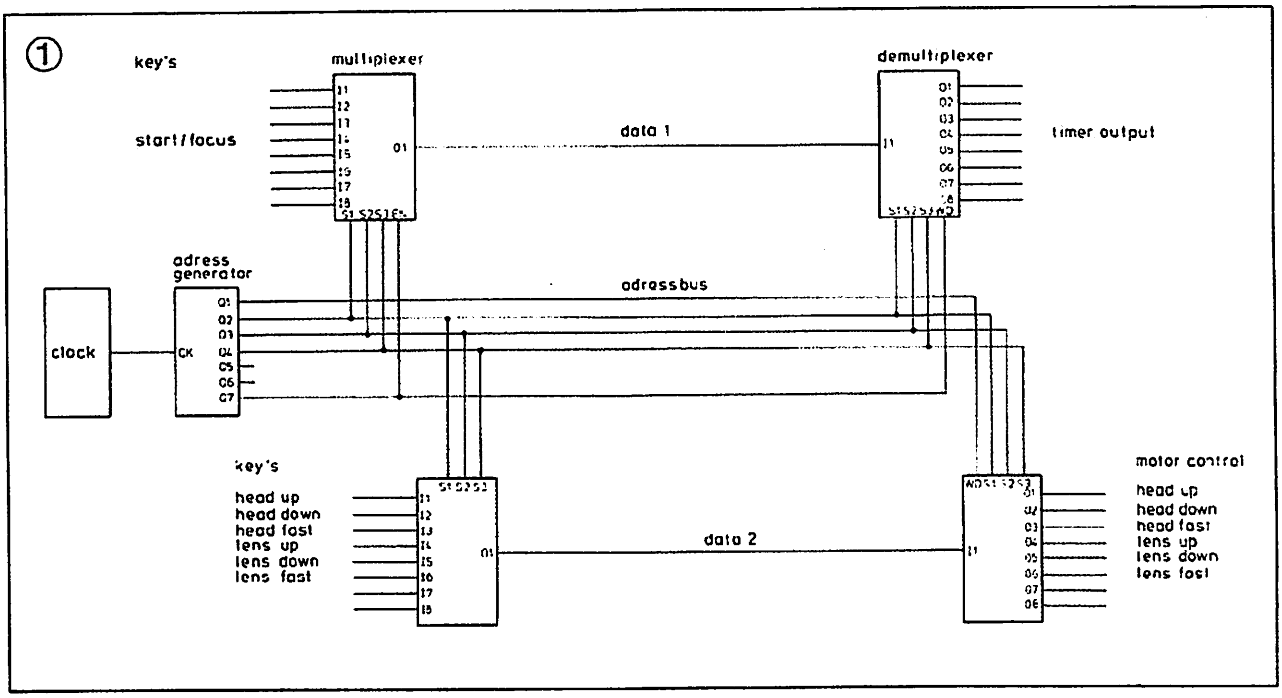
On the wiring board there is the + 15 V voltage supply for the entire system.
At inputs 3, 4, 5, 6 there are the + 24 V being stabilised to + 15 V by IC 1; these voltages can be measured at measuring point M 1.

The break-down diode Z 1 has the task of rectifying the alternating-current voltage of approx. 44 V and to stabilise same to + 15 V, 50 cycles/60 cycles.
This voltage reaches the control panel via output 1; it is needed to control the timer component.

IC 1 and IC 3 are demultiplexer. They decode and distribute the multiplexed information obtained via data circuits DATA 1 and DATA 2 to the appropriate control circuits. During this process, IC 2 and IC 3 are controlled by address circuits Q 1, Q 2, Q 3, Q 4 and Q 7.

2.1.1.1) Testing instructions

2.1.1.2) Circuit boards 1 and 2 and the control panel are disconnected for the time being.



Hook up mains cable and switch on power unit by means of the mains switch.

Check the following on the wiring board:

- clamp 3, 4, 5, 6, + 29 V ± 1,5 V (at 220 V input voltage)
- clamp 13, 14, 15 — 29 V ± 1,5 V (at 220 V input voltage)
- plug A Pin 9, 10 + 15 V ± 0,8 V
- plug A Pin 1 + 15 V, 50 cycles/60 cycles

2.1.1.3) Hook up control panel and chek level fluctuation at outputs IC 2 and IC 3 on the wiring board when activating the appropriate touch buttons on the control panel, relying on the following table D.

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MEASURING POINT	KEY	LEVEL
IC 2/9	head up	H → L
IC 2/10	head down	H → L
IC 2/11	head fast	H → L
IC 2/12	lens up	H → L
IC 2/13	lens down	H → L
IC 2/14	lens fast	H → L
IC 3/12	start / focus	L → H

2.1.2) 220 V motor control
(see circuit diagram AC 81.705)

2.1.2.1) The motor control breaks down into two groups: The control unit and the power unit.

In order to assure constant speed regardless of the motor's load, the speed is automatically stabilised. At each zero passage of the mains voltage the motor's electromotive force is measured and compared to a nominal value (the size of which depends upon the pre-selected speed). The motor is then started sooner or later, depending upon the magnitude of this difference.

A control logic has the task of distributing the ignition pulses - depending upon the desired direction of rotation of the motor - to the four Triacs in the output stage.

These four Triacs form, strictly speaking, a bridge rectifier circuit. This bridge circuit makes it possible to run a D.C. motor, as used in this case, on A.C. current. The following description shows how this is being done *(the Triacs having been sketched as switches).*

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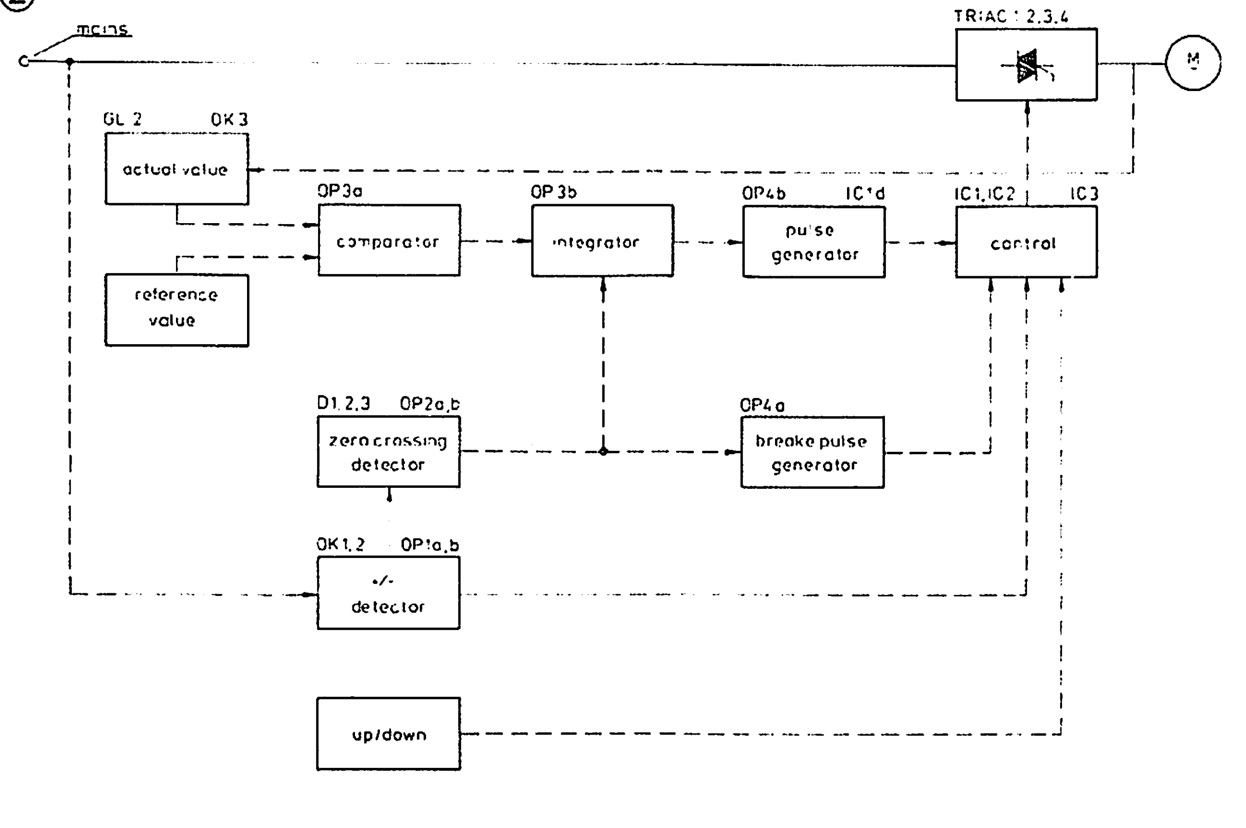
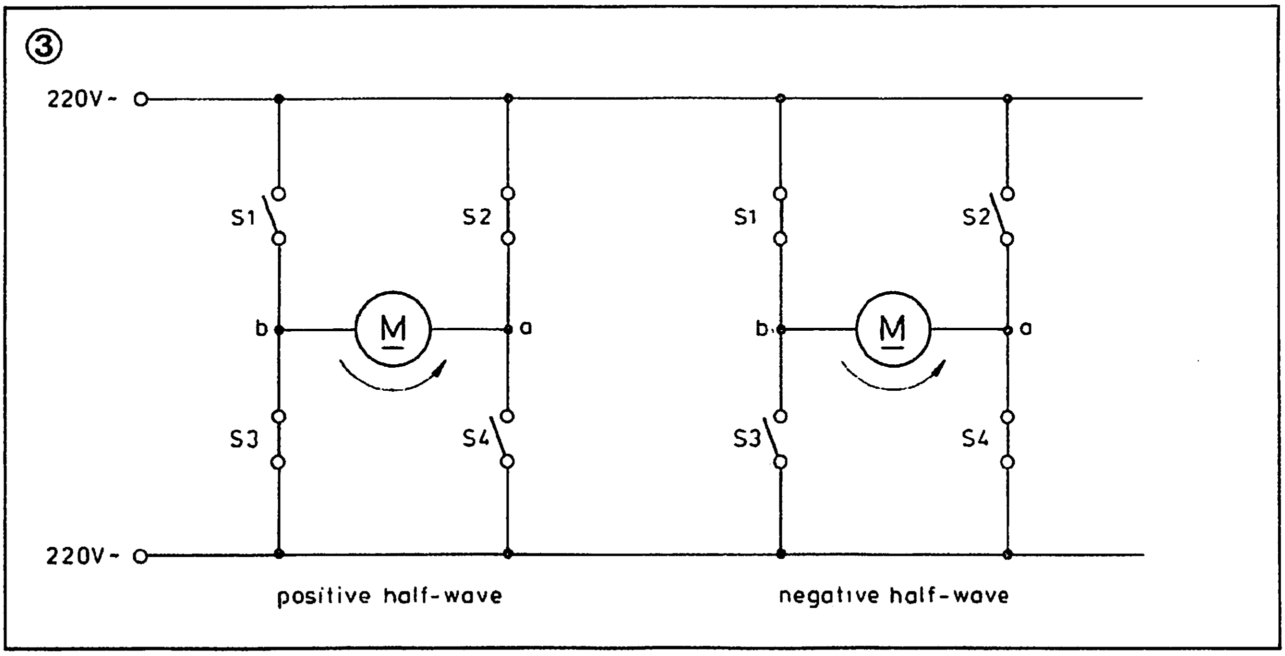
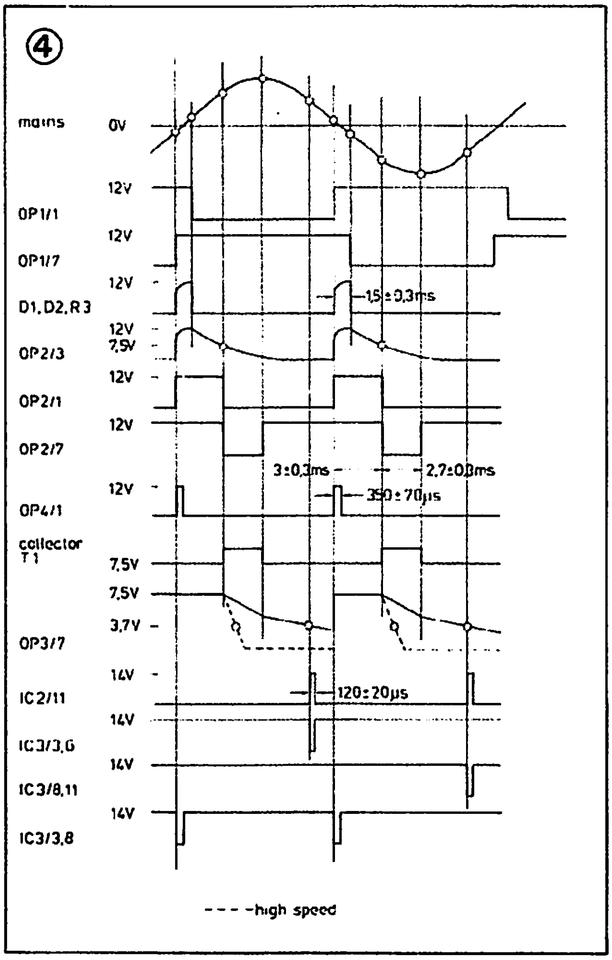






In the left-hand illustration the positive half wave rests against the motor. The control logic shuts off S 2 and S 3. The current's direction goes from a to b and the motor rotates counter-clockwise. In the right-hand illustration the negative half wave rests against the motor. The control logic now shuts off S 1 and S 4. The current's direction has remained unchanged and thus also the motor's direction of rotation. If now the direction of rotation were to be changed, only the switching cycle would have to be changed via the control logic.
(S 1 and S 4 shut off in case of positive half wave)
(S 2 and S 3 shut off in case of negative half wave)
For braking the motor, S 3 and S 4 are shut off, thus short-circuiting the motor.

2.1.2.2) Operational description

The mains voltage being at inputs 16a and 30a is stabilised to approx. 47 V by break-down diodes Z 1 and Z 2 (depending upon the half wave's polarity) and reaches the inputs of optical couplers OK 1 and OK 2. The output (Pin 5) of OK 1 is connected to OP 1a (Pin 3), the output (Pin 5) of OK 2 to OP 1b (Pin 5). In case of L-signal being at output (Pin 7) of OP 1b, the positive half wave will be found at the mains input. In case of L-signal at output (Pin 1) of OP 1a the negative half wave will be found at the mains input *(see illustration 4)*.

Two circuits connect these outputs of function amplifiers OP 1a and OP 1b to the control logic (consisting of IC 1, 2, 3) and tell the latter which of the two half waves is at the mains input, thus defining the Triacs' switching sequence depending upon the polarity. On the other hand the function amplifiers' OP 1a and OP 1b outputs are knotted together in the And-link (made up by D 1, D 2, D 3 and R 3). If both outputs carry an H-signal, i.e. the mains voltage is 0 V, the And-link's output will also carry an H-signal. If one of the two half waves should be at the mains input, the And-link's output reverts to L-signal.

This means that for each zero passage of the mains voltage, an H-signal will appear at the output of the And-link *(see illustration 4)*.
This H-signal reaches input (Pin 3) of monoflop OP 2a and triggers the latter. The H-pulse of 3 ms ± 0,3 ms appearing

at output (Pin 1) of OP 2a controls transistor T 7. T 7 discharges integrator condensator C 8. Thus the output (Pin 7 / measuring point M 4) of integrator OP 3b jumps to + 7,5 V.

At the end of the 3 ms the output (Pin 1) of OP 2a drops from H- to L-signal. The dropping flank triggers a second monoflop, consisting of OP 2a, C 2, R 7, R 6 and D 4. At output (Pin 7 / measuring point M 3) there appears an L-signal lasting about 2,7 ms + 0,3 ms and controlling transistor T 1. During these 2,7 ms the difference between nominal and actual motor revolution values, formed in OP 3a, reaches input (Pin 6) of integrator OP 3b.

Let us first have a look at the circuit needed for forming the difference between nominal and actual motor revolution values. The motor's electromotive force, whose magnitude is proportional to the motor's rpm level, is measured and rectified by rectifier GL 2. The rectified voltage controls the photo-transistor in optical coupler OK 3. OK 3 has the task of physically separating the electronics from the mains voltage. At output (Pin 4) of OK 3 we obtain a voltage value equal to the motor's actual rpm value. In comparator OP 3 this actual value is compared to a nominal voltage at input (Pin 3).

The nominal value is formed on the distributor plate and reaches – via circuit No. . . . N 3 – input (Pin 3) of comparator OP 3a. If at input 6a a low voltage (about 7,5 V) were to be found, the low speed has been chosen.

If a high voltage (about 13 V) were to be found, the high speed has been chosen.

The voltage value appearing at output (Pin 1) of comparator OP 3a corresponds to the difference between nominal and actual values.

This difference now charges condensator C 8; thus output (Pin 7) of integrator OP 3b starts to drop from its + 7,5 V stationary value towards 0 V. Pin 7 of OP 3b is connected to input (Pin 5) of comparator OP 4b which forms a threshold of approx. 3,7 V.

As soon as the integrator's output voltage falls below this threshold, an L-signal will appear at the comparator's output (Pin 7). This L-signal is differentiated by C 9, R 20, R 21 and inverted by IC 1d. The pulse appearing at output (Pin 11) of inverter IC 1d is the ignition pulse for the Triacs.

The timing of this ignition pulse depends upon the speed at which the integrator's output voltage is dropping off; this is finally determined by the difference between nominal and actual values.

This ignition pulse reaches inputs (Pin 2, 9, 5, 12) of the control logic from where it is distributed to the four Triacs. With control logic « UP » and « DOWN » the motor's direction of rotation may be pre-selected. The circuit thus chosen carries L-signal. If no direction of rotation were to be pre-selected, the brake pulse created by OP 4 for each zero passage would reach Triac 3 and 4 via IC 1b/c. Thus the motor would be short-circuited and electrically braked.

2.1.2.3) Checking and calibration procedures

Voltage measured at M 1 against M 0 = + 7,5 V ± 0,5 V

Voltage measured via C 15 = — 7,5 V ± 0,5 V

Voltage measured via C 21 = + 7,5 V ± 0,5 V

Pulse duration at point D 1, D 2, D 3 and R 3 = 1,5 ms ± 0,3 ms
(if necessary, change R 5 by ± 1 value of the E 12 line)

Pulse duration at Pin 1 of OP 4a = 350 μs ± 70 μs
(if necessary, change R 5 by ± 1 value of the E 12 line)

Pulse duration at Pin 11 of IC 1 = 600 μs ± 100 μs
(if necessary, change R 4 by ± 1 value of the E 12 line)

Pulse duration at Pin 1 of OP 2a (measuring point M 2)
= 3 ± 0,3 ms
(if necessary, change R 4 by ± 1 value of the E 12 resistor line)

Pulse duration at Pin 7 of OP 2b (measuring point M 3)
= 2,7 ± 0,3 ms
(if necessary, change R 6 by ± 1 value of the E 12 resistor line)

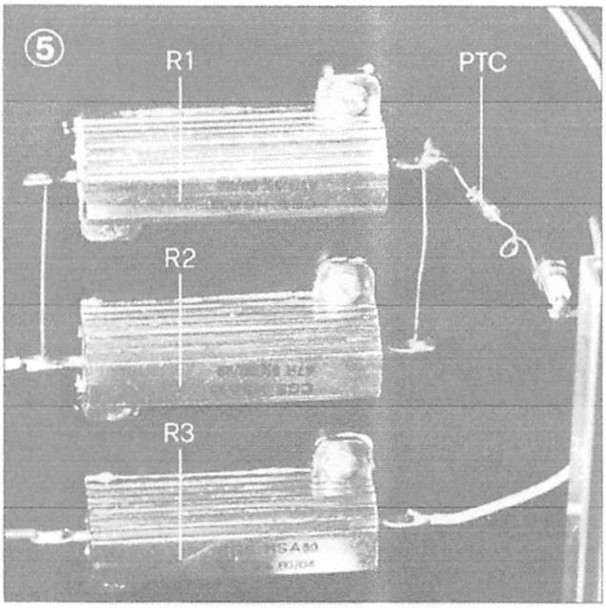
Check low speed. It should amount to approx. 300 rpm. If this shouldn't be the case, adjust by decreasing or increasing R 13 (R 13 mustn't exceed 22 k; otherwise OK 3 must be replaced). Lock motor shaft and measure motor current while depressing « UP » or « DOWN » touch button (low speed). The current value should read 1,8 ± 0,2 A. The adjustment may be made with R 16 (± 1 value of the E 12 resistor line). The motor current may be adjusted – within the stated pulse time tolerances – also with R 4 and R 6.

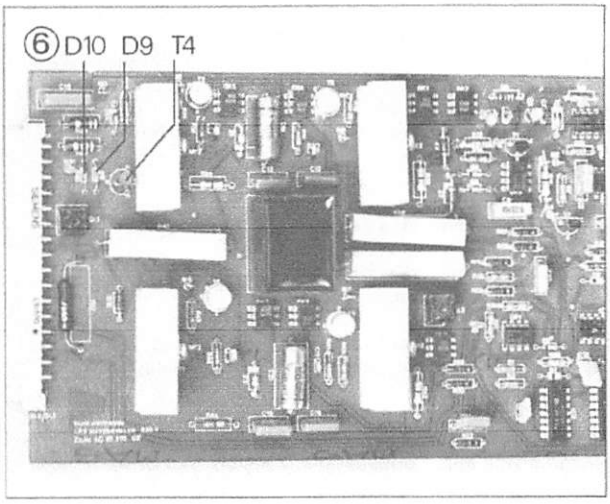
Attention
There exist two different versions of the « STARAPIED » and « LARAPIED » power units. The older version has a thermal fuse (PTC-resistor) placed on the external resistances *(see photo 5 « PTC »).*
The new versions do not feature this thermal fuse.

Kindly note:
In order to use the old-style « motor governor 220 V » circuit boards also in the new version, the components D 9, D 10 and T 4 must be soldered out *(see photo 6).*

The new versions (without thermal fuse) are without these components.

The circuit boards of the new versions may be used without any modifications in the old versions.





2.1.3) Motor governor 24 V

(see enclosed circuit diagram AC 81.705)

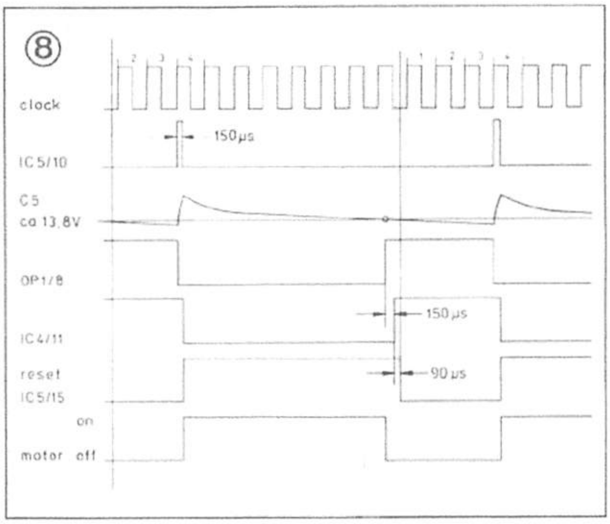
The motor governor's output controls a 24 V D.C. motor. « UP » or « DOWN » and « FAST » may be pre-selected by means of three control circuits. In order to achieve constant low speed under varying load conditions, the speed is stabilised. The motor is therefore pulse-driven. The duration of these drive pulses is determined by the difference between nominal and actual value. A comparator compares these two values to the actual value being derived from the motor's electromotive force. The size of the electromotive force is proportional to the motor's rpm. The drive pulse is distributed, in accordance with the pre-selected direction of rotation, to the output stages by means of a control logic.

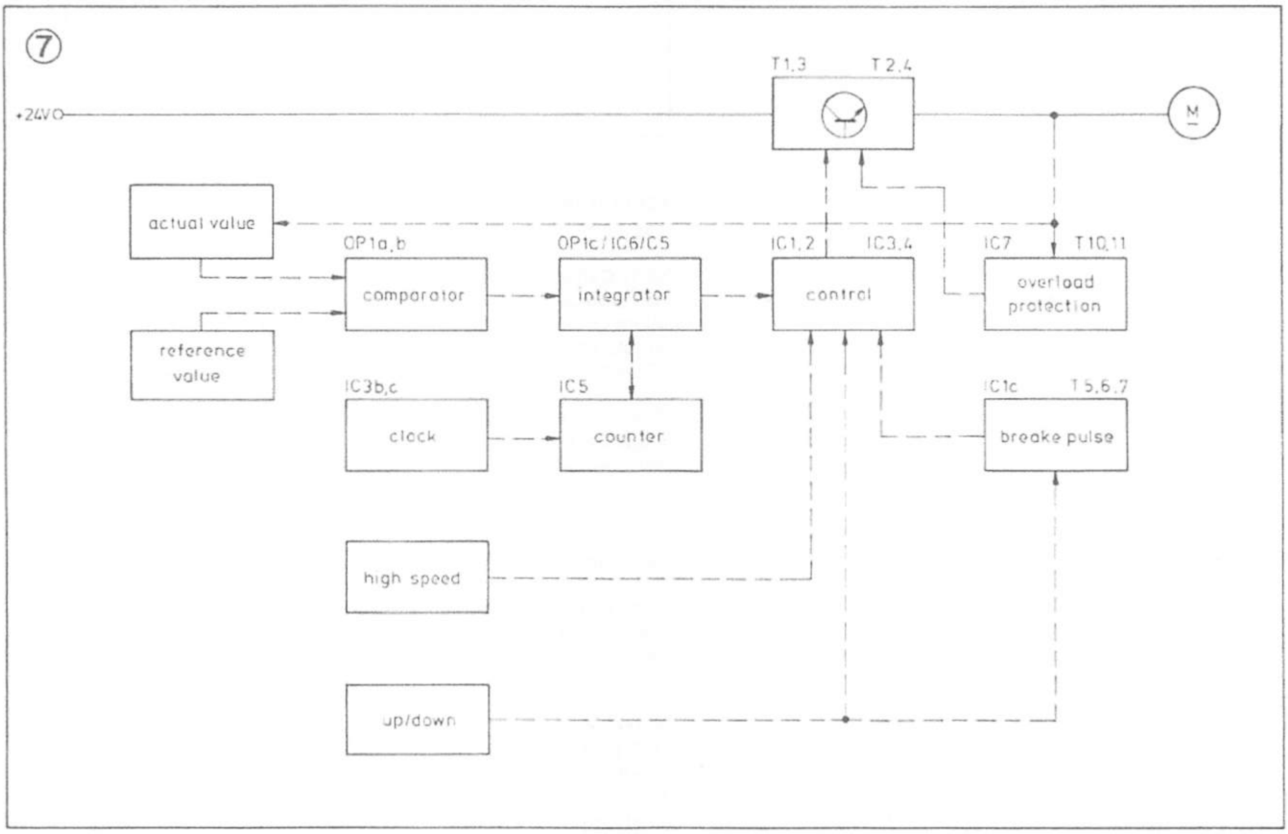
This adjustment does not take place during high speed operation. The motor is driven continuously.

If no « UP » or « DOWN » command is given, the motor is short-circuited and thus braked. The circuit has an overload protection as well. If too high a current flows through the motor, the circuit is interrupted. It is restarted automatically after a certain delay. If the current is still too strong, the circuit will again cut out. This sequence is repeated until the short circuit is eliminated.

2.1.3.1) Detailed operational description

(see enclosed circuit diagram AC 81.705)





The low speed is automatically stabilised so as to obtain a constant speed level under varying load conditions. This is done in the following manner:

The motor's electromotive force is picked off between motor connections A (M 4) and B (M 5). The sum-and-difference amplifier OP 1a forms the difference between the electromotive force and the reference voltage of + 15 V. At the output (Pin 1) of OP 1a we obtain a voltage value of + 15 V, depending upon the motor's direction of rotation.

This value's deviation from the + 15 V reference voltage depends upon the electromotive force's strength, i.e. upon the motor's speed.

OP 1b is an inverter tripped by the « UP » command. At measuring point M 7 the voltage will thus always drop from the + 15 V stationary value towards 0 V, regardless of the motor's direction of rotation.

With the FET-switch IC 6 being conductive (IC 6 is controlled by counter IC 5), condensator C 5 is simultaneously charged to the bias between nominal and actual value. The higher the rpm, the smaller the condensator voltage after charging, since the voltage will significantly drop towards 0 V from the + 15 V stationary value in case of high rpm. The charging lasts for approx. 150 µs. At the charging period's end, C 5 starts to discharge through resistor network R 29, R 30, R 43, R 44.

The motor's drive period starts at the same time. OP 1c is a comparator. At the first input there is the threshold, formed by R 29, R 30, R 44 of + 13,8 V. At the second input there is the condensator voltage. As long as this voltage exceeds the threeshold of 13,8 V, the output (Pin 8) of OP 1c is on L-signal. This L-signal reaches input (Pin 13) of IC 1d via IC 4a, IC 4d as well as the master reset input of counter IC 5 via inverter IC 4c. This causes counter IC 5 to be temporarily locked.

At input (Pin 12) of IC 1d there is an H-signal, unless the high speed has been pre-selected. H- and L-signal at the inputs results in L-signal at the output. This L-signal reaches the inputs (Pin 4 and 2 resp.) of IC 2b and IC 2a resp. Together, IC 2b and IC 2a form the control logic. The inputs (Pin 5 and 8 resp.) of these two IC's are connected with the limit switches « TOP » and « BOTTOM ». Note that the limit switches are closed when at rest. Via the remaining inputs (Pin 3 and 1 resp.) of IC 2b and IC 2a resp. it will now be determined which of the two output stages shall receive the drive pulse. This is controlled by touch button « UP » and inverter IC 3a only. If touch button « DOWN » is depressed, touch button « UP » is bypassed and the drive pulse reaches the left-hand output stage via IC 2a. Upon depressing touch button « UP » the drive pulse reaches the righthand output stage via IC 2b.

If then the condensator voltage falls below the threshold of + 13,8 V, output (Pin 8) of OP 1c jumps to H-signal. Thus the motor's drive period is finished.
The clock pulses lined up at counter input (Pin 14) of IC 5 now start to count up counter IC5, since the reset-input (Pin 15) has been freed.

The counter now counts up, at digit 5 the output (Pin 10) jumps to H. IC 6 becomes conductive and condensator C 5 charges to the bias between nominal and actual value. Thus a new drive sequence is started.

At high speed the stabilising effect will be suppressed. A constant drive pulse reaches – depending upon the pre-selected rpm level – one of the two bridge branches via IC 1d.
If at IC 2a and IC 2b there is no command concerning up- or down-movements, the motor's brake sequence will be started via IC 2c after a delay formed by IC 1c, R 8 and C 2. This means that T 5 and T 6, controlled by T 7 via D 5 and D 6, become conductive; the motor is short-circuited.

The components located around T 9, T 10, T 11 and IC 7c, a form an electronic current limiter. Upon exceeding the value of approx. 5 A via resistor R 12, T 10 switches through, thus setting monoflop IC 7c/d, and interrupts the current's flow through T 11 and T 9. This interruption lasts approx. 70 ms. The circuit is interrupted. This cyclic sequence is repeated until the overload's elimination.

2.1.3.2) Directions for checking and calibration

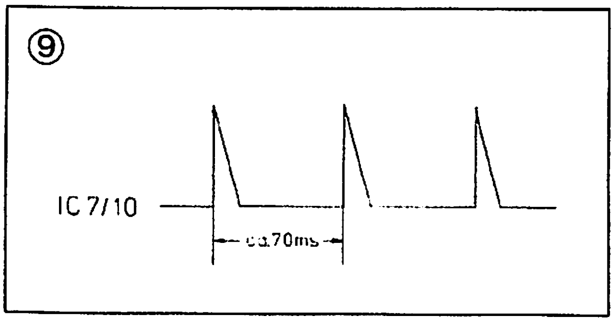
2.1.3.2.1) Insert a 22 Ω 50 W resistor between 26,28 b and 22,24 B in place of the motor.

2.1.3.2.2) Check cycle frequency at measuring point M 11 = 600 ± 70 µs (if necessary, change R 41 by ± 1 value of the E 12 resistor line).

2.1.3.2.3) Check drive and idle time against M 10 by depressing « DOWN » or « UP » touch buttons at low speed. The drive time should amount to 2,9 ± 0,3 ms, the idle time to 2,7 ± 0,6 ms (if necessary, change R 44 by ± 1 value of the E 12 resistor line, bearing in mind that:

- a larger R 44 equals shorter drive time
  a smaller R 44 equals longer drive time)

2.1.3.2.4) Remove resistor, connect motor and lock same. Depress « UP » or « DOWN » touch button (high speed). At output (Pin 10) of IC 7 the following signal must appear:



2.2) ECU 1840 control panel

(see enclosed circuit diagram MA 81.600)

2.2.1) General description

The control panel contains timer board LP 1, timer pre-selection board LP 5, board LP 2 for motor control and two boards LP 6 with motor control touch buttons « UP » or « DOWN » and « FAST » for lens and enlarger head motor.

There are, furthermore, two connection jacks, one for remote control « DESKMES » (see enclosed circuit diagram MD 81.300) and one for the « DESKIL » illumination unit connection (see enclosed circuit diagram ML 81.205).

2.2.2) Timer board LP 1

2.2.2.1) General operational description

Exposure times may be pre-selected from 0 up to 999,9 seconds with 0,1 second steps; the exposure times may be read off directly from the displays.

Pre-selection is achieved via four BCD-switches located on the LP 5 circuit board « TIMER PRESELECTION ». The time runs off after depressing the « START » touch button and is counted down until reaching 0 seconds. The exposure sequence may be stopped by depressing the « STOP » touch button.

By depressing the « INTERRUPT » touch button, the exposure sequence may be interrupted. Upon depressing the « START » touch button, the exposure sequence may be re-started.

Upon reaching 000,0 seconds the timer output service to its idle position and the time display shows the pre-selected value. The focussing light is switched on or off by means of the « FOCUS » switch.

2.2.2.2) Detailed operational description

The LP 1 timer circuit board features the most important circuitry component of the entire system, i.e. the address generator. It consists of the 7-step binary counter IC 7 and an oscillator, formed by IC 8c, d. The oscillator supplies a cycle frequency of about 4 kHz, this cycle frequency reaches cycle input (Pin 1) of IC 7. At outputs Q 1 - Q 7 we get 128 different address combinations. All multiplexers and demultiplexers are controlled via address circuits Q 1 - Q 7.

The counter component IC 4 is at the heart of the timer circuit. It contains a programmable storing register, a counter, a multiplexer with its cycle oscillator. The BCD pre-selector switches are in parallel; they are decoupled with diodes 1 - 16. In the multiplex, the BCD switches' data being available at inputs (Pin 4, 5, 6, 7) of IC 4 is transferred to the storing register or to the counter. The storing register's contents are continuously compared to the counter. If new data is fed into the storing register, the counter gets it too. If new data were to be fed into the storing register during a counting sequence, it would be temporarily stored there before being transferred to the counter at the end of the counting sequence. Outputs (Pin 21, 22, 23, 25, 26, 27, 28) carry the multiplexed data for the four 7-segment indicators DL 1 - 4. The counter position showing the highest value will be the first one to be indicated.

The internal oscillator supplying the frequency for controlling the indicator multiplexer works at a 10 kHz cycle frequency.

Outputs D 1 - 4 (Pin 15, 16, 17, 18) control the cathode displays as well as the other BCD pre-selector switches. The counter itself is being controlled by the mains frequency via IC 5. IC 5 is a 5-step counter. The mains frequency is at input (Pin 14). Upon activating the « START » touch button, IC 5 is released via control input (Pin 3). At output (Pin 1 for 50 cycles, Pin 5 for 60 cycles) a 10 cycle frequency will appear. This frequency gets to input (Pin 8) of IC 4 and controls the latter.

The timer circuit functions as follows: The « START » touch button is depressed. The signal at output (Pin 13) of F.F. 1 on IC 3 switches from H- to L-level. IC 5 is temporarily released via input (Pin 13). The cycle pulses get to the cycle input (Pin 8) of IC 4 which starts the counting sequence.

Transistor T 1 becomes conductive via inverter IC 6b. Output (Pin 9) of IC 2b switches from H- to L-level. This L-signal is fed – via data circuit DATA 1 – into the power unit, where it sets the timer relay. The colour head lamp is thus switched on. Upon depressing the « START » touch button, F.F. 2 will also set. Output (Pin 9) switches from L- to H-signal. Output (Pin 15) of IC 5 immediately resets F.F. 2. Thus an H-pulse will appear at output (Pin 9) of IC 3. This pulse causes F.F. 3 to reset. At output (Pin 10) of IC 3 the level changes from H to L. This output is connected with input (Pin 12) of IC 4. The L-signal at input (Pin 12) prevents the counter from taking over the storing register's contents. Thus, once the counting sequence has been started, it becomes impossible to change the pre-selected time.

After depressing touch button « INTERRUPT », F.F. 1 sets. At output (Pin 13) the level changes from L to H. IC 5 is locked (the cycle pulses at the cycle input of IC 4 are interrupted), but the counter is not reset.

T 1 loses its conductivity via IC 6b – the colour head lamp is switched off. By again depressing the « START » touch button, F.F. 1 resets and the counting sequence restarts from where it had been interrupted.

After the count down to 0, the level at output (Pin 2) of IC 4 changes from H to L. Then, as in the case of « INTERRUPT », F.F. 1 will temporarily set, i.e. the signal at output (Pin 3) of IC 3 changes from H to L. IC 5 locks and T 1 becomes nonconductive. F.F. 3 sets, too. At output (Pin 10) of IC 3 the level swings from L to H. IC 5 will thus be able to transfer the storing register's contents into the counter and to check both contents.

Upon depressing the « STOP » touch button, the counting sequence ends prematurely and counter IC 4 is reset.

IC 1 is a multiplexer controlled by control circuits Q 2, Q 3, Q 4 and Q 7. At the inputs (Pin 6 and 4) we obtain a) the data for the « BASEBOARD FAST » function and b) « LIGHT ON ». This multiplexed information is passed on to data circuit « DATA 1 », depending upon the address combinations *(see enclosed table A).*

2.2.2.3) Checking and calibration procedures

2.2.2.3.1) Check correct position of bridge for 50 resp. 60 cycles.

2.2.2.3.2) Check + 15 V ± 0,8 supply voltage at jack B.

2.2.2.3.3) Check, via C 10, + 5 V ± 0,5 V supply voltage for IC 4.

2.2.2.3.4) Check frequency at cycle input (Pin 1) of IC 7, T = 230 ± 50 μs (if necessary, change R 2 ± 1 value of the E 12 resistor line).

2.2.2.3.5) Check frequency at output Q 7 (Pin 3) of IC 7, T = 29,5 ± 6,5 ms.

2.2.2.3.6) Check frequency at cycle input (Pin 8) of IC 4, T = 0,1 sec.

2.2.3) LP 2 motor control

Upon slightly depressing « UP » or « DOWN » touch buttons, one obtains the low speed. The high speed is achieved by pressing harder on the same touch buttons.

IC 1 is a multiplexer controlled by the Q 4, 3, 2 addresses. The motor control data is available at inputs I 1 – I 8. L-signal at input means that the function is cleared. If for example an L-signal were to be at input I 1 (Pin 1), the enlarger head would move upwards at low speed. If an L-signal were to be at inputs I 1 and I 3, the head would move upwards at high speed.

All data being available at the inputs is transferred multiplexed on data circuit « DATA 2 », depending upon the address combinations.

The « DESKMES » remote control may be connected to jack A (see enclosed circuit diagram MD 81.300). The remote control's function is identical to that of the motor control in the control panel.

2.2.3.1) Testing instructions

The « DATA 2 » data circuit must carry an H-signal as long as none of the touch buttons are depressed. Upon depressing one or more touch buttons, the « DATA 2 » circuit is temporarily at 0 V; check enclosed table A about the duration of this 0 V phase.

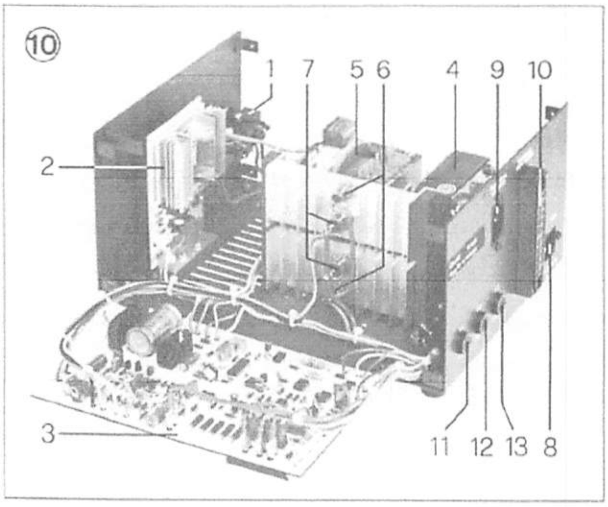
2.3) EST 1000

2.3.1) Technical data

Mains voltage	: 220/240 V — 15% + 10%
Power consumption	: 1000 VA
Output voltages	: 120 V colour head lamp
	15 V (approx.) preliminary heating
	24 V shutter motor
	24 V scale illumination
	220 V blower
Blower coasting	: approx. 2,5 min.

2.3.2) The following picture shows:

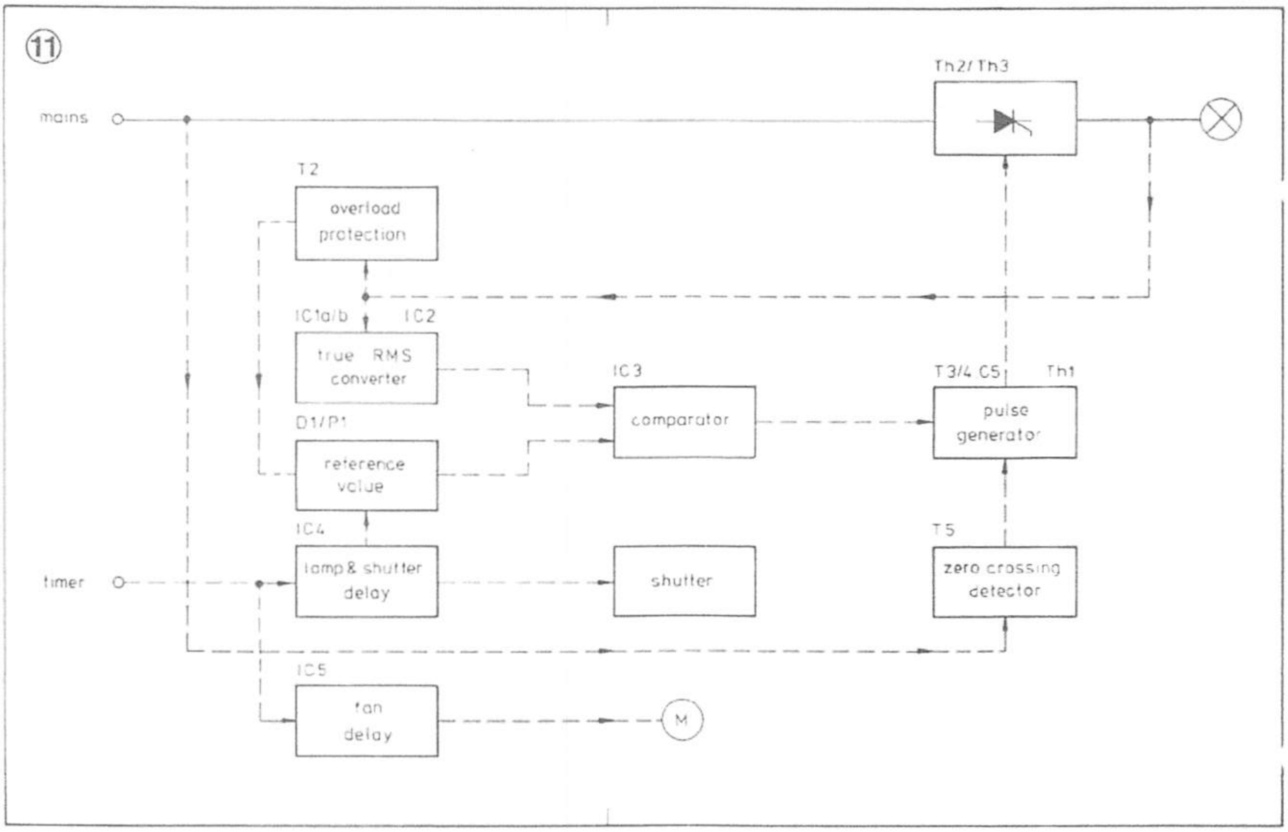
Main switch (ON – OFF) (1)
LP 2 – voltage stabiliser FK 322c (2)
LP 1 – lamp stabiliser FK 352a (3)



Transformer Tr 1 (4)
Coil DR 1 (5)
Diode D 24, D 25 (6)
Thyristor Th 2, Th 3 (7)
Plug for mains connection (8)
Plug for timer connection (9)
20-pole DIN-jack for colour head connection (10)
Fuse F 1 (11)
Fuse F 2 (12)
Fuse F 3 (13)

2.3.3) General operational description

The EST 1000 should not be connected to stabilised mains. After switching on the stabiliser with mains switch, a switch-on time delay of approx. 4 seconds will result. In case a signal should already be available at the timer input, this delay prevents a sudden rise of the output resp. lamp voltage. The output voltage amounts to approx. 15 V (pre-heating) only; the output's nominal value is only reached after the time delay's end.
This measure is an efficient protection of the colour head's lamp, whose working life will thus be lengthened.
The stabilised output voltage (lamp voltage) is protected against overloads. If overloads do occur in the lamp circuit, an overload detector automatically cuts the output voltage down to 0 V.
If the timer is activated, the lamp comes on and the shutter opens after a switch-on delay of approx. 1 second. At the end of the exposure time sequence the external timer switches off. The lamp keeps on burning and the shutter remains open. The shutter will be closed only at the end of the switch-off delay, the duration of which corresponds exactly to that of the switch-on delay; the lamp is switched off. Thanks to this exposure sequence the shutter eliminates the effects of colour temperature changes during the lamp's pre-heat and afterglow phases.



2.3.4) Description of circuitry

The circuit consists of thyristors Th 1 and Th 2. The actual value voltage is picked off thyristors Th 1 and Th 2 and transferred to the input of the R.M.S. converter IC 1a/b, IC 2. In comparator IC 3 the D.C. voltage provided by the R.M.S. converter is compared to the nominal value voltage, produced by D 1 and adjusted at P 1. The control voltage at the output of comparator IC 3 is proportional to the lamp's brightness in the colour head; it is transferred to the pulse generator.

The pulse generator produces, depending upon the output voltage's size of comparator IC 3, the ignition pulses required for controlling the two thyristors Th 1 and Th 2.
It is synchronised with the mains frequency by transistor T 5.

The circuit contains, in addition, a current overload monitor formed by R 50, 51, 30, 31, 32, 34, D 8, 9, 10, C 8 and T 2.

The switch-on and switch-off delay circuit is made up by two timing circuits (IC 4d, C 11, R 41, P 2 and IC 4, C 12, R 42).

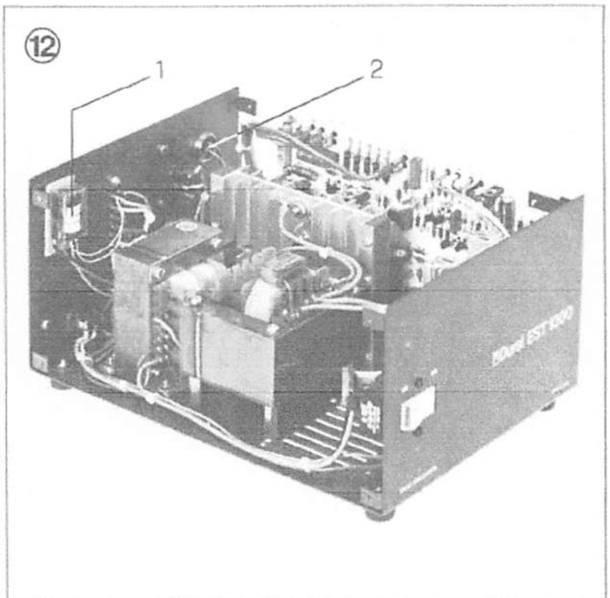
To assure the shutter's correct opening also during mains voltage drops, the shutter motor's supply voltage is stabilised (circuit board FK 352c). This voltage can be adjusted with trimmer P 2.

The blower's delay is determined by IC 5 and C 24. Upon switching on the lamp, thyristor Th 4 becomes conductive and thus completes the blower's circuit. Switching off the lamp triggers IC 5; at the end of this delay Th 4 becomes nonconductive and switches off the blower.

Modification

So as to be able to use the Durst L 1840 enlarger also in combination with roll paper cassettes, the EST 1000 incorporates (as of series no. 81.000.101) the following modifications: Fitting of relay (1) and 3-pole jack (2). The relay is switched parallel to the shutter relay. If the shutter opens, the relay will set. Upon closing the shutter the relay drops.

A two-way contact of this relay leads to jack (2). This two-way contact is potential-free so as to be able to control all roll paper cassettes regardless of control voltage values.



2.3.5) Detailed description
(see enclosed circuit diagram EST 1000)

The + 15 V and — 15 V supply voltages are formed by T 10 and T 11 and may be measured at their emitters.
The output voltage's actual value is picked off via D 24 and D 25 and inverted by IC 1a. This inverted voltage value gets to input (Pin 1) of IC 2. IC 2 is a R.M.S. converter. The R.M.S. value of the actual value voltage appearing at output (Pin 4) is rectified by IC 1b and reaches input (Pin 2) of comparator IC 3. On the other input (Pin 3) there is the nominal value voltage which is stabilised by D 1 as well as D 2 and adjusted at P 1. Switching on the stabiliser by means of mains switch causes this nominal value to be grounded by C 2; then it goes up as C 2 charges. Thus the stabilisers output voltage is gradually adjusted to the nominal value rather than rising suddenly.

At the output (Pin 6) of IC 3 there appears the difference between nominal and actual value. This difference is then transferred to transistors T 3 and T 4 for the pulse generation. Condensator C 5 operates, in combination with PUT (Th 1), the pulse generation. The current supplied by T 4 charges condensator C 5. As soon as the condensator voltage reaches the value of the Th 1 gate voltage (approx. 6 V), Th 1 cuts through. The pulse generated by Th 1 is amplified by transistor T 6 and led to the gates of thyristors Th 2 as well as Th 3.

Transistor T 5, whose basis is directly connected to the mains voltage via R 23 and R 24, has the task of fully discharging condensator C 4 during each zero passage of the sine wave. During the sine wave the basis is at — 15 V via R 25; transistor T 5 becomes conductive and discharges C 4.

The control loop features also a protection against overload currents. R 50, 51, 30, 31, 32 are switched in series with the colour head lamp. The voltage drop at the resistors is directly proportional to the lamp voltage.

With the lamp voltage's rise, the voltage drop at the resistors will simultaneously also be increased. This voltage drop gets to the basis of transistor T 2. Too high a current flow will make T 2 conductive. The nominal value at input (Pin 3) of comparator IC 3 is grounded. The lamp voltage drops to a harmless level.

R 34 and C 8 prevent the monitoring system's activation in the case of a momentary current surge (e.g. when switching on the lamp).

2.3.6) Time-delay circuit for lamp and shutter

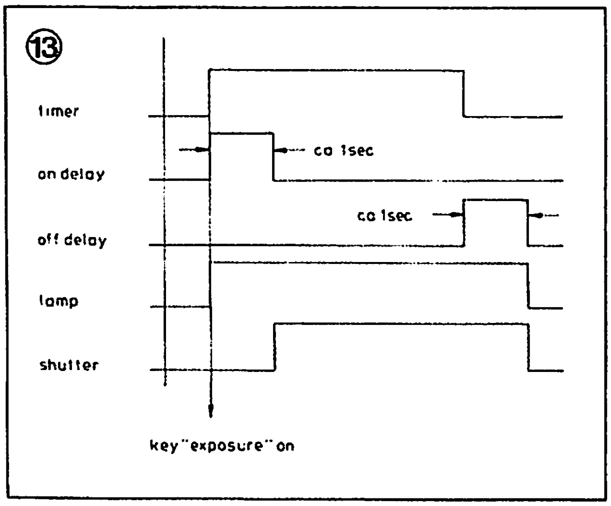
Transistor T 7 will be locked in the « STAND BY » mode. This is also the case for the photo-transistor in optical coupler OK 2. Transistor T 1 is at + 15 V via R 15 and thus conductive. The nominal voltage at input (Pin 3) of IC 3 is grounded. But this transistor circuit has been designed in such a way so as to prevent the stabiliser's output voltage from dropping to zero – there remains a residual value of approx. 15 V for pre-heating the lamp.

If a timer signal reaches timer input (plug 2), the photo-transistor in OK 1 becomes conductive. Output (Pin 11) of IC 4d jumps to L-signal. Initially T 7 is made conductive via R 40. The photo-transistor in OK 2 becomes conductive and locks T 1. The nominal value reaches the comparator and the output voltage rises to its nominal value. The lamp is on. Switch-on delay C 11, R 41, P 2, IC 4c will also be triggered. Output (pin 10) of IC 4c remains at L-signal. It jumps from L- to H-signal at the delay's end. Output (Pin 4) of IC 4b drops from H- to L-level. This signal is inverted by IC 4a and transferred to the basis of T 8. Both T 8 and T 9 become conductive and open the shutter.

Upon the signal's disappearance at the timer input (plug 2), the photo-transistor in OK 1 does not become conductive. Output (Pin 11) of IC 4d rises to H-level and output (Pin 10) of IC 4c drops to L-level. Switch-off delay C 12, R 42 and IC 4b is triggered. Output (Pin 4) of IC 4b is still at L-signal. T 7 remains conductive via R 44 and the lamp is switched on; the shutter is kept open via IC 4a, T 8, T 9.

At the delay's end output (Pin 4) of IC 4b rises to H-signal. T 7 becomes nonconductive. The lamp is switched off. Output (Pin 3) of IC 4a drops to L-signal and T 8, T 9 become nonconductive. The shutter is closed.

The same cycle occurs in the focus mode, but the signal at the timer input is controlled by the focus touch button.



2.3.7) Blower delay
Upon switching on the lamp, IC 5 triggers via OK 3. At output (Pin 3) of IC 5 there appears an H-signal. Thyristor Th 4 triggers and completes the circuit for the blower motor. When IC 5 is triggered, T 12 becomes conductive. T 12 prevents C 24 from charging, i.e. the delay's activation during exposures or while in the focus mode.

If the signal at the timer disappears, T 12 becomes nonconductive. C 24 may charge. At output (Pin 3) of IC 5 there continues to be H-signal. If condensator C 24 reaches the threshold formed by R 53, C 22 the H-signal will disappear from output (Pin 3) of IC 5. Th 4 is no longer triggered, the blower's circuit is interrupted and the blower stops.

2.3.8) Stabilising supply voltage of shutter motor
(circuit board FK 352c)
The shutter motor's supply voltage has been stabilised so as to assure correct shutter openings during mains voltage drops that may occur. The supply voltage's actual value is picked off at P 3 and compared to the nominal value formed by R 66, R 67. The difference controls transistor T 16 which becomes more or less conductive. This + 24 V voltage supply is stabilised within the 180 to 260 V input voltage bracket.

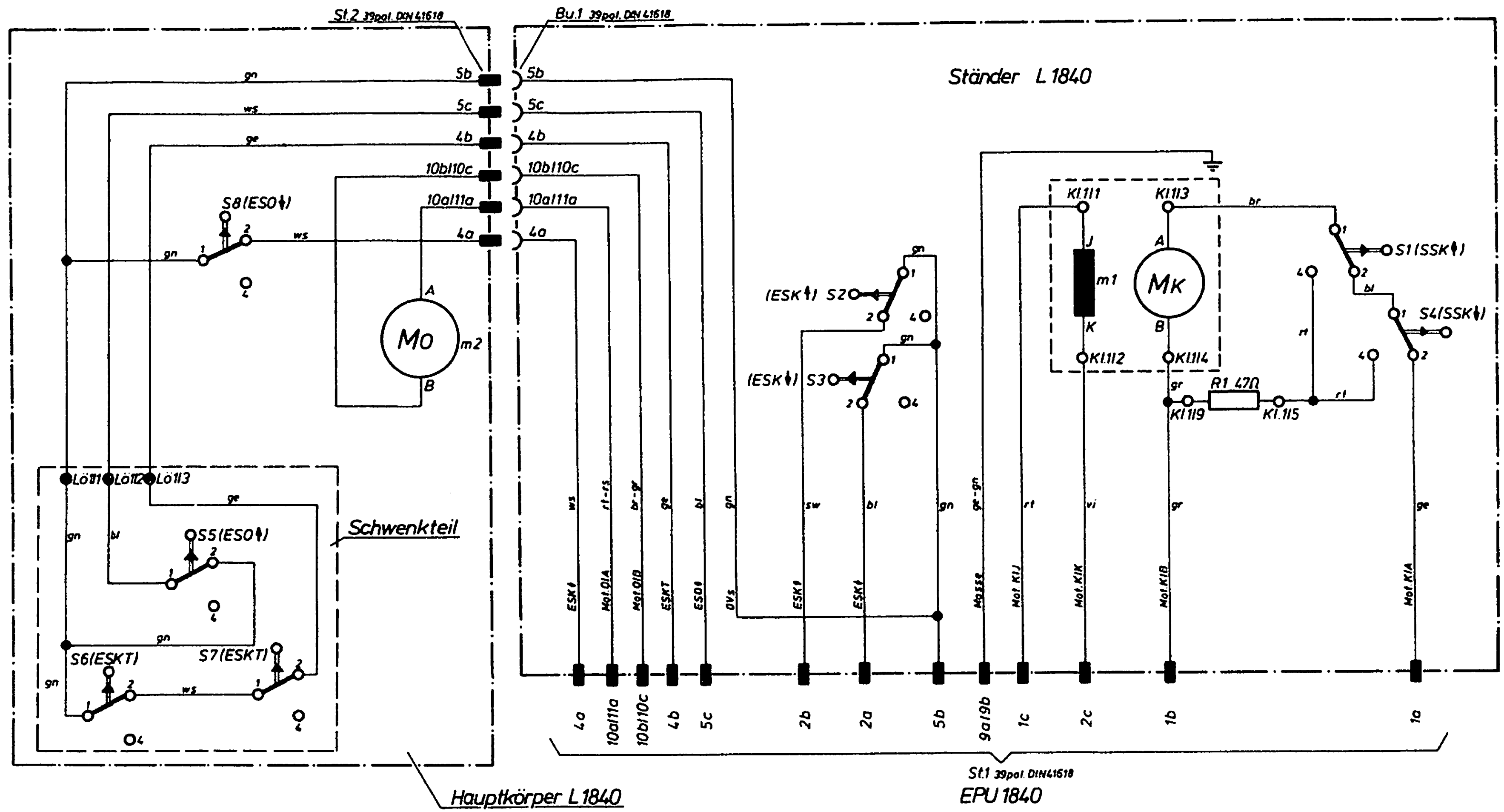
2.3.9) Calibration
The 120 V output voltage of EST 1000 may be set by turning potentiometer P 1.

2.3.10) Note
The measurement must be taken off the lamp holder. The stabiliser output must be charged. As this is a phase-angle controlled A.C. voltage, a true R.M.S. voltmeter must be used. The delay of both shutter and lamp is adjusted by means of trimmer P 2, a precise timer and a stop watch. With the latter one checks whether the actual exposure time (shutter) corresponds exactly to the time selected on the timer. Corrections that may become necessary are made with trimmer P 2.
Trimmer P 3 is used to adjust the + 24 V supply voltage for the shutter relay. This voltage may be measured at R 63.

2.4) Stand
(see enclosed circuit diagram AC 81.800)

The stationary section (column) contains a 220 V D. C. motor (M 1) for enlarger head support movements. The motor is protected by two limit switches – S 2 for the head's top position and S 3 for the head's bottom position – cutting off the motor, if necessary. If the limit switches were to fail, the motor would be stopped by the two safety switches S 1 and S 4.

The head support contains a 24 V D.C. motor (M 2) for lens carrier movements. Also this motor is protected by limit switches, i.e. S 5 for the lens carrier's top position and S 6 as well as S 7 for the lens carrier's bottom position.
The baseboard height is adjusted manually.



m1		Type 220V in Nebenschlußschaltung EM94160K
		mit Getriebe E31 10:1 Fa. Groschopp
m2		Gleichstromgetriebemotor
		Baureihe 0427 Type 401 801 Fa. SWF
Kl.1		9pol. Type 272-309 Fa. Reiter
R1		nach WNEL
Lö.1		LLKA 35.54.100 3pol. Fa. RIM
S1..S8		Type 83.160.3-W3-153E-10A I 250V
St.1, St.2		39pol. Type C42334-A49-A5
Bu.1		39pol. Type C42334-A49-A6

	Tag	Name		Maßstab
Bearb.	27.5.1980	T.M.	Schaltbild L1840	
Gepr.				
Norm				
Durst AG Bozen – Bolzano			AC81.800.0D	Larapied

Zusatzblatt zur Bedienungsanleitung Durst LABORATOR 1840

Durst PHOTOTECHNIK

Siehe Seite 4, Kapitel „B) Ausstattung und Aufstellen des Vergrößerungsgerätes", vorletzter Absatz

Die zwei Öffnungen (5) dienen zum zeitweiligen Ölen der Spindeln. Dabei müssen der Gerätekopfträger (11) sowie der Tischträger ganz nach unten gebracht werden. Vergewissern Sie sich, daß das Messingrohr im Inneren des Stativs mit den beiden Öffnungen (5) übereinstimmt.

Supplement Durst LABORATOR 1840 Instruction Manual

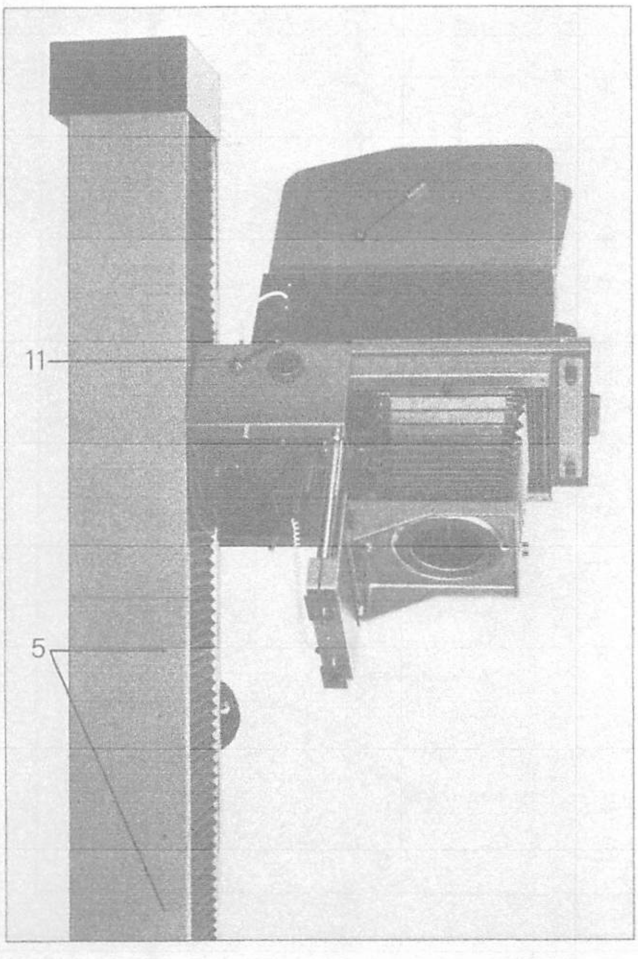
Page 4, section „B) Features and setting-up of the enlarger", penultimate paragraph

The two openings (5) serve for the temporary lubrication of the spindles. This requires the enlarger head support (11) as well as baseboard support to be lowered as much as possible. Make sure the brass tube at the inside of the enlarger stand coincides with the two openings (5).

Addenda au mode d'emploi Durst LABORATOR 1840

Voir page 4, chapitre „B - Equipement et installation de l'agrandisseur" - avant-dernier alinéa

Les deux ouvertures (5) servent au graissage régulier des pivots. A cet effet, il faut porter en leur position la plus basse le support de la tête de l'appareil (11) ainsi que le support du tableau. Assurez-vous que le tube en laiton à l'intérieur du pied coïncide avec les deux ouvertures (5).



Foglio aggiuntivo alle istruzioni per l'uso Durst LABORATOR 1840

Vedi capitolo „B) Caratteristiche e messa in opera dell'ingranditore", penultimo capoverso a pagina 4

Di tanto in tanto le due viti senza fine devono essere oleate attraverso gli appositi fori (5). A tale scopo il braccio di supporto della testata (11) come pure il braccio di supporto del piano di proiezione devono essere portati nella loro posizione più bassa, accertandosi che il tubicino di ottone all'interno dello stativo si trovi in corrispondenza dei due fori (5).

Hoja adicional de las instrucciones de uso Durst LABORATOR 1840

Ver página 4 capitulo „B) Equipo y montaje de la ampliadora" penúltimo párrafo

Los dos orificios (5) sirven para la lubrificación periódica de los husillos. En este caso es preciso bajar completamente el soporte del cabezal del aparato (11) y el soporte de mesa. Cerciórese de que el tubo de latón en el interior de la columna de soporte coincida con los dos orificios (5).