BOSCH TRANSISTOR AMPLIFIER

TR 15 / 25

CONNECTIONS
INTEGRATION INSTRUCTIONS

3585/E2-12/81

- technical modifications and errors excepted -

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BOSCH DRIVE

cont'd

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BOSCH DRIVE

III. INTEGRATION cont'd

CONNECTIONS

TECHNICAL DETAILS

BOSCH transistor amplifiers of the TR 15 series are available as 2, 3 or 4 axis units in 2 power versions.

a) POWER MODULE

- nominal current, without ventilator : 15 A
- nominal current, with ventilator : 25 A
- peak current, without ventilator : 30 A
- peak current, with ventilator : 50 A

Max. DC output voltage : 140 V or 230 V ± 10 %

Connecting voltage with AC supply:
140 V - version : 3 x 60/104 V, ± 10 %
230 V - version : 3 x 96/165 V, ± 10 %

Connecting voltage with DC supply (e.g. battery):
140 V - version : 150 V DC ± 10 %
230 V - version : 240 V DC ± 10 %

Form factor : 1.005

Cycle frequency : 200 Hz to 10 KHz, depending on operating conditions

b) REGULATOR MODULE

- Current supply : via switching power supply from the DC link
- DC output voltage : ± 15 V, stable, ⩽ 30 mA
- Speed command value 1 : 0 V to ± 10 V, adjustable by input attenuator to 0 V - ± 5 V
- Speed command value 2 : 0 V to ± 10 V, fixed
  - encoder : DC tacho generator
  - input voltage: max. ± 75 V
  - setting range of input amplifier: 60 % to 160 %
- Auxiliary inputs:
  - axis allow, H = + 24 V DC
  - + 24 V DC provided externally as supply for fault displays
- Auxiliary outputs:
  - ready to run (BTB), H = + 24 V DC , max. load 50 mA
  - I^2T, H = + 24 V DC , max. 50 mA
  - |I| , 0 V to + 10 V, max. 5 mA

c) PROTECTIVE FUNCTIONS (FAULT DISPLAYS VIA RED L E Ds)

- I^2t monitoring
- Tacho monitoring (interruption, short circuit)
- Under-voltage
- Over-voltage
- Driver monitoring (over-current)

CONNECTIONS BOSCH DRIVE

d) VENTILATION

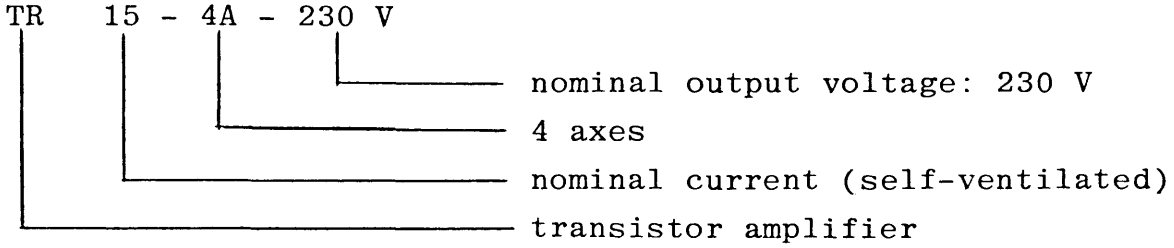
- Basic version : self-ventilation
- Add. equipment : forced ventilation by a ventilator assembly
  - ventilators : 2 axial fans
  - connecting voltage : 1~230 V or 1~115 V
  - current intake : approx. 0.2 A for 230 V approx. 0.35 A for 115 V
  - delivery efficiency: approx. 300 m^3 / h

e) OPERATING CONDITIONS

- Maximum ambient temperature : for operation: - 25 °C to + 45 °C
  for transport and storage: - 25 °C to + 85 °C
- Operational height above sea level: max. 1000 m
- Protection standard IP)) to DIN 40050 and IEC 144
- Admissible humidity: class F to DIN 40040
- When fitting the amplifier it must be ensured that the airflow through the power module is not impaired by any other devices
- Chokes and transformers must be located at a distance > 300 mm below the amplifier
- The amplifiers must be fitted into cabinets to standard IP54 or IP44 with dust filters in front of air inlets and outlets.
- If necessary forced ventilation is to be provided to eliminate the dissipation loss from the cabinet.

  Dissipation loss: approx. 5 % of the nominal power

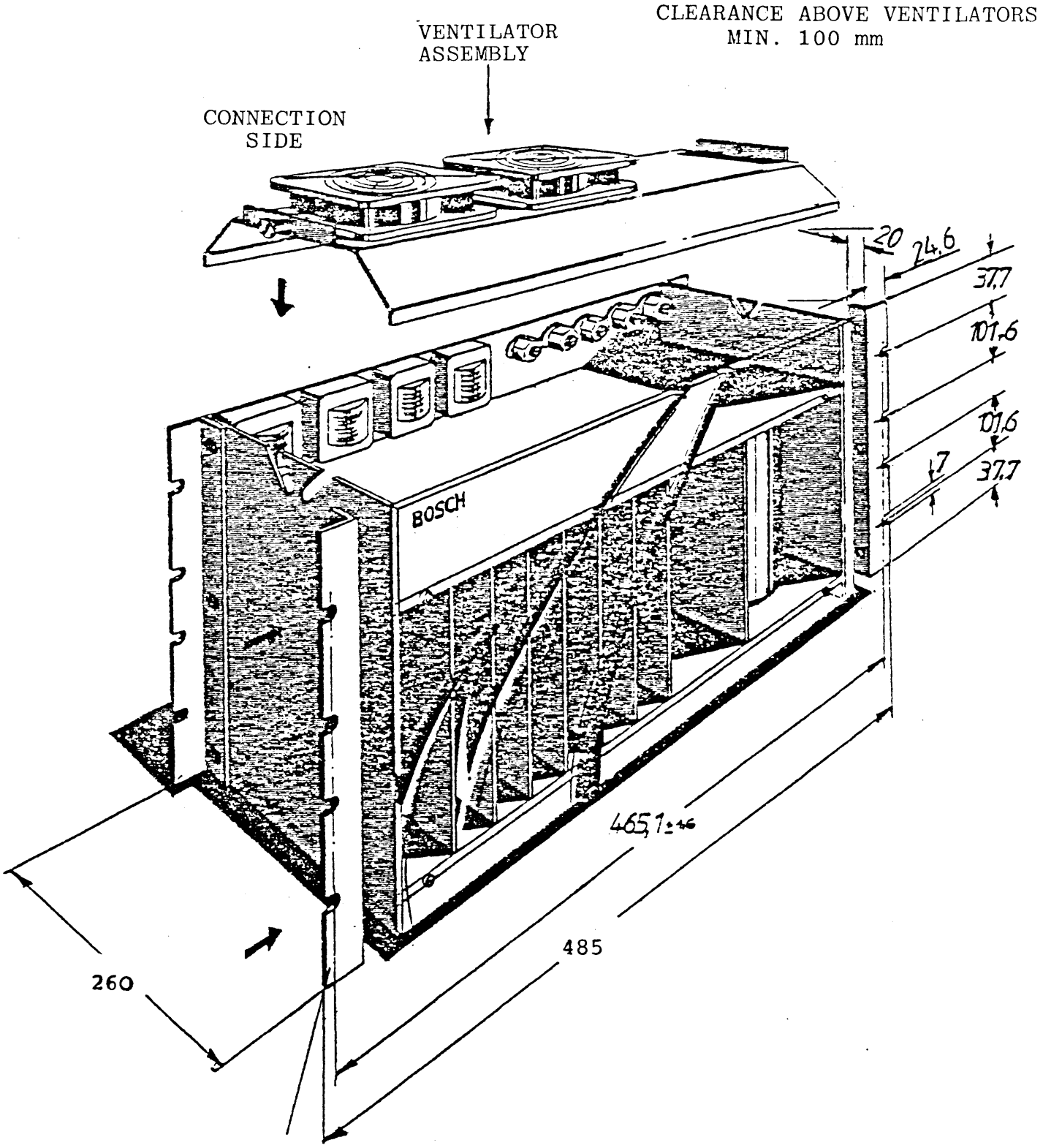
f) KEY TO TYPE NOTATION (example)



CONNECTIONS

BOSCH DRIVE

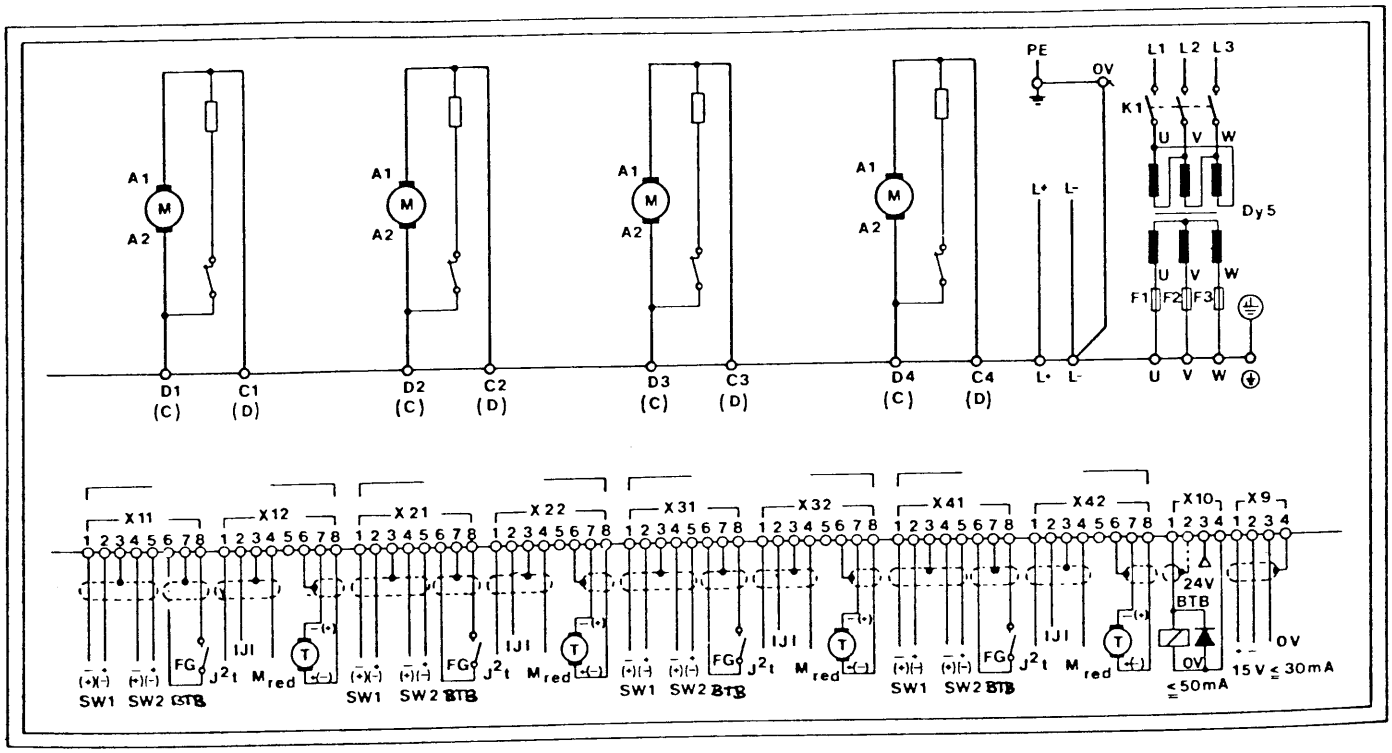
TR 15 / 25 DIMENSION DRAWING



The mounting brackets can be fitted for either front or rear mounting.

CONNECTIONS

CONNECTION DIAGRAM



SW = command value

BTB = ready to run

FG = enable

CONNECTIONS BOSCH DRIVE

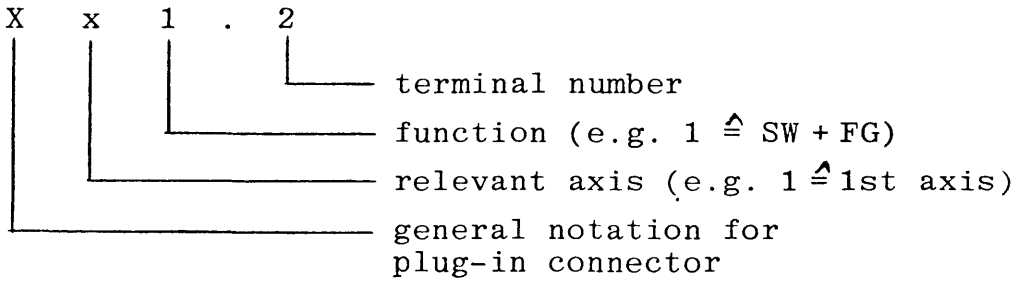
1. CONTROL CONNECTIONS

Function and axis related terminal strips are provided a the under-side of the amplifier for the connection of the control signals.

X 09	• output $\pm$ 15 V, stable
X 10	• output "Ready" (BTB)
	• input + 24 V, external
X 11 , X 21 , X 31 , X 41	• command 1 (SW1) & command 2 (SW2) for axes 1 to 4
	• enable (FG) for axes 1 to 4
X 12 , X 22 , X 32 , X 42	• tacho axes 1 to 4
	• output I^2t axes 1 to 4
	• output $\|I\|$ axes 1 to 4
	• input M_{red} axes 1 to 4

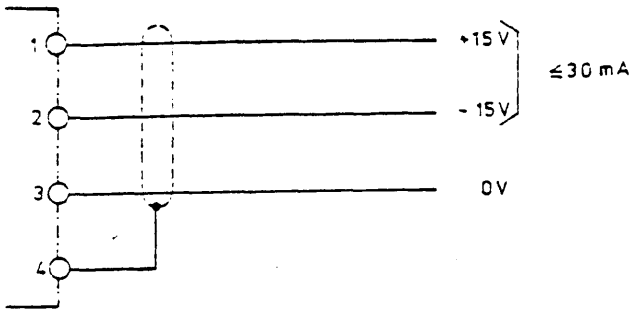
In the following text axis related connectors will be referred to in the following notation:

example:



CONNECTIONS BOSCH DRIVE

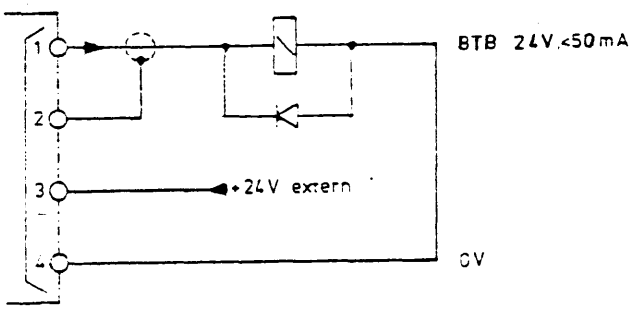
X09 : ± 15 V VOLTAGE SUPPLY



At connector X09.1 and 2 there are + 15 V and - 15 V available.
Max. load: 30 mA each

Function: voltage supply for command value generation etc.

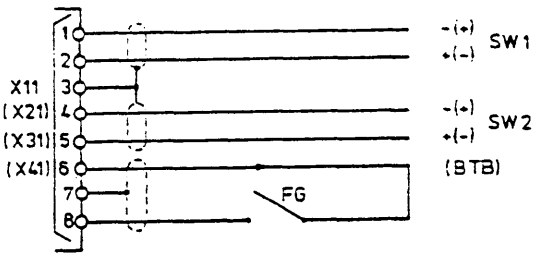
X10 : READY TO RUN (BTB)



At X10.1 the "Ready" signal (BTB) is output. The signal has + 24 V level when none of the monitoring functions have been triggered. If one is triggered the signal immediately goes to 0 V level.
Display via green LEDs on the "Power Supply" board.
The "BTB" signal must be incorporated into the hold-on circuit of "E.STOP".

X10.3 serves for the connection of + 24 V from an external supply (e.g. 24 V power supply in the interface cabinet). This will ensure that any active fault displays (red LEDs on the "Power Supply" board) will be maintained in the event of an "E STOP" condition, when the supply to the amplifier is cut acc. to the connection instructions.

X11, X21, X31, X41 : COMMAND VALUES (SW), ENABLE (FG)

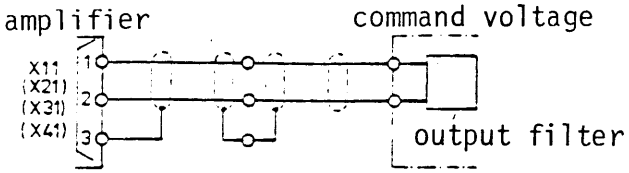


COMMAND CONNECTION:

Use twisted, screened 2-core cable only.
The screen must only be connected on one side, either at the command output or at X.x1.3 on the amplifier.
Both inputs are designed as differential inputs.

CONNECTIONS BOSCH DRIVE

The command voltage, which is used, must be earthed at the command output. The voltage relating to ground potential should not exceed ± 1 V in order not to impair the regulating accuracy.



The ground connection of the command output must be good enough to ensure that the maximum admissible difference in potential is not exceeded, even during switching operations in the mains supply. The ground connection of the command output and the ground connection of the amplifier must both be connected to the central ground busbar at the same place in the interface cabinet.

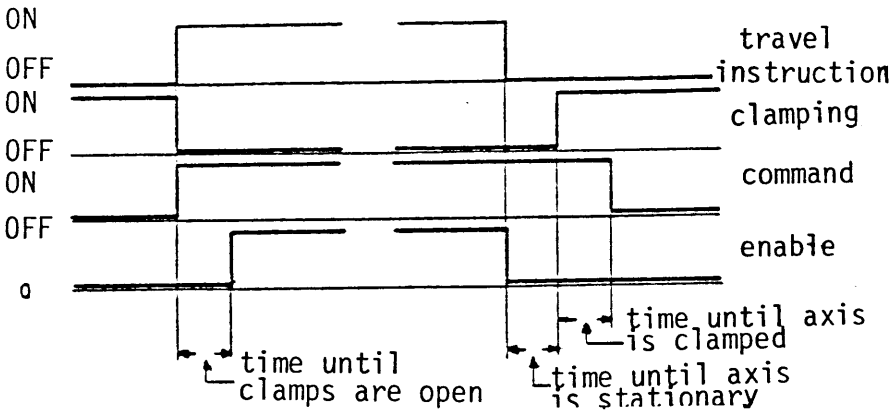
ENABLE (FG)

When the unit is ready to run there is + 24 V available at term. X.x1.6. It is advisable to connect a potential-free contact between X.x1.6 and X.x1.8 to enable the unit when it closes. Other conditions can be included in the enable circuitry (clamping, oil pump etc.).
If there is no + 24 V available at X.x1.8 operation of the unit is inhibited.

CLAMPING

With axis clamping the enable must be switched off once the axis has been clamped, so that the amplifier does not work against the clamping.

The diagram below shows the switching sequence for command, clamping and enable signals.



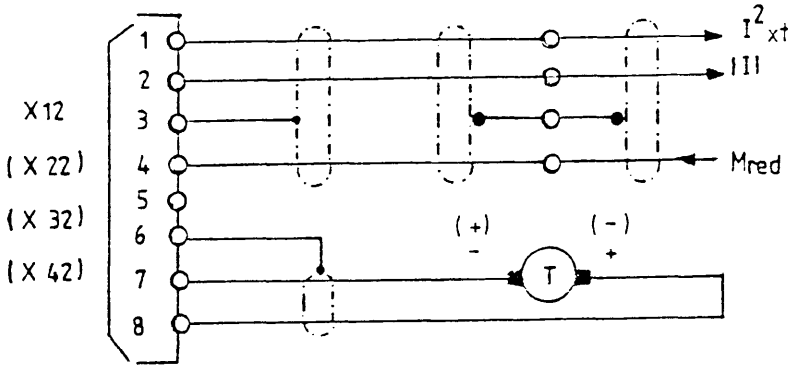
Enable should never be switched off during normal drive operation, since the motor would otherwise not be decelerated under control.

Exception: "E.STOP"

In this case the enable signal must be switched off immediately. It must be ensured that the axis is stopped by a brake or by short-circuit braking.

CONNECTIONS BOSCH DRIVE

X12 , X22 , X32 , X42 : TACHO , M_{red} , |I| , $I^2 x t$



TACHO CONNECTION

With respect to the cable the same applies as for the command connection. The screen must only be connected to X.x2.6 on the amplifier. On the tacho side the screen must be insulated. The screen must always be routed separately. Intermediary connections must therefore always be 3-pole.

I_A MONITORING

In order to monitor the armature current (e.g. for a measuring device in the operating panel) there is a DC voltage available at X.x2.2, which is proportional to the normalised motor current. The voltage for the maximum admissible motor current is + 10 V.
Internal resistance of the measuring device: $R_i \geq 2.2\ k\Omega$

TORQUE REDUCTION M_{red}

Through the supply of + 24 V to term. X.x2.4, a torque reduction function can be realised, depending on a resistor on the "Regulator" board.

CURRENT LIMITATION $I^2 x t$

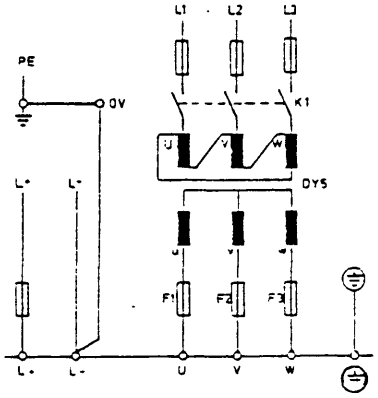
Once the current limit $I^2 x t$ has been exceeded there will be + 24 V available at X.x2.1.
(The signal can be used for an external display in the operating panel.)
At the same time the red LED on the "Regulator" board will light up.

CONNECTIONS BOSCH DRIVE

2. MAINS CONNECTION

Only one voltage is required for the current supply to the amplifier, since the logic is supplied via a power supply from the D.C. link.

There are two possibilities for the current supply:
- via transformer from the AC mains, with the connection being made at terminals U, V, W.
  The phase relationship is of no importance.
- by DC voltage connection to terminals L+ and L-, with the voltage being approx. 10% higher than the nominal voltage of the particular unit.



fuse protection

a) for AC connection:
   primary: 2 preferred values above the nominal current of the transf. primary
   type: slow

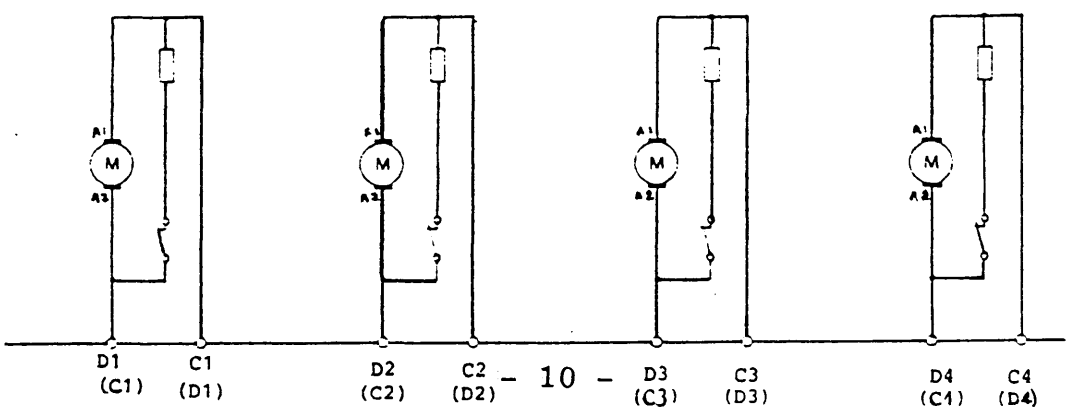
   secondary: 1 preferred value above the nominal current of the transf. sec.
   type: fast
   max. 63 A

b) for DC connection:
   corresponding to the cross-sectional efficiency to VDE table.
   type: slow (purely cable protection)

3. VENTILATOR CONNECTION

If the ventilator assembly is used an auxiliary voltage must be made available for it. The connection is made directly on the ventilator assembly.
(connection values: see Technical Details)

4. MOTOR CONNECTION



If the armature inductance of the motor does not fall below a certain minimum value the motor can be connected directly to term. C_x and D_x of the amplifier.

Required minimum inductance:

for 140 V units: $L_{min} = \frac{35}{I_1}$ (mH)

for 230 V units: $L_{min} = \frac{140}{I_1}$ (mH)

I_1 = current limit at n = 0 (A

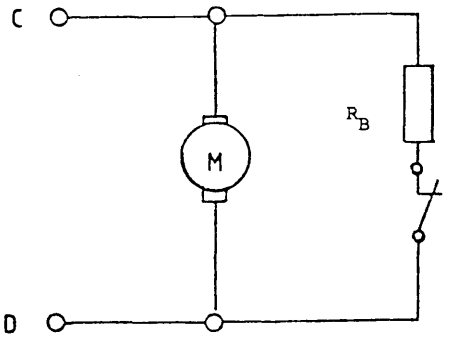
If the connected motor does not have an inductance of at least "L_{min}", the additionally required inductance must be supplied by an additional choke in the armature circuit. This is, for instance, the case with disk armature motors.

5. MOTOR PROTECTION

The $I^2 x t$ current limitation, which is standard to this unit , ensures optimum motor protection.
It is, however, advisable to use a thermal contact provided in the motor.

6. SHORT-CIRCUIT BRAKING

In order to allow fast braking of permanently excited DC motors in emergencies the use of short circuit braking is advisable.
For short-circuiting the motor one magnetic relay contactor (normally closed) - or several switched in parallel - is used together with a resistor for current limitation.



The load capacity for the contact of the braking relay must be suitable for the maximum admissible braking current of the motor. It is calculated as follows:

$$R_B = \frac{E_{max}}{I_{max}} - Ra \; [\Omega]$$

E_{max} = motor EMF at max. speed [V]
I_{max} = max. admissible current limit [A]
Ra = armature resistance of motor [Ohm]

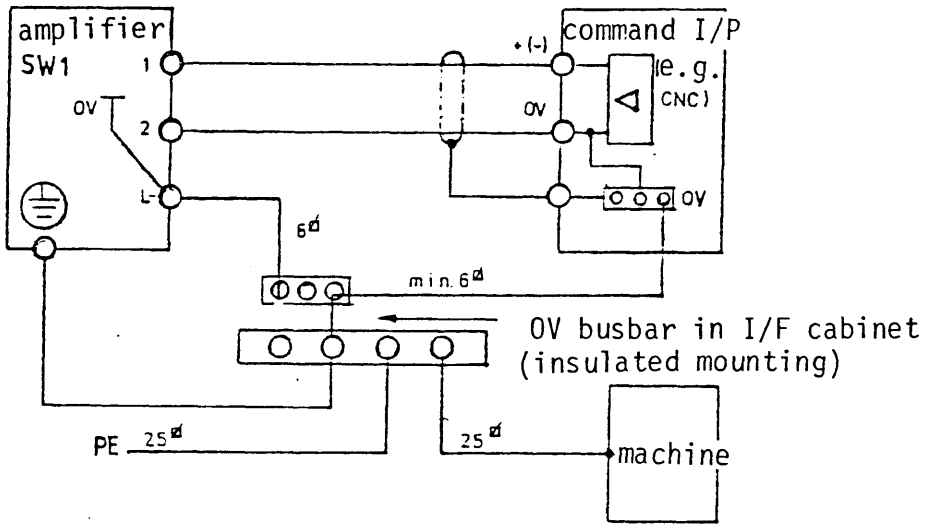
The power of the resistor should be at least 50 W .

7. GROUNDING

The amplifier has one connection each for "Ground" (Schutzleiter) and "L - "

a) Ground connection for the housing (protection against contact).
The cross-section of the connecting cable must be at least 6 mm^2.

b) Terminal L- at the power connection (0V potential) - cross-section as under a).
The reference potential of the command output (0V) must also have an electrical connection (6 mm^2) to the 0V busbar in the interface.



INTEGRATION BOSCH DRIVE

1. PREPARING THE INTEGRATION

All components of the drive and their fitting must be checked against the customer specification.
This also applies to parts which are not supplied by Bosch, and which are marked with an asterisk (*) in the specification:

The following points are to be compared with the data given in the specification:

1.1 Motor data
1.2 Tacho data
1.3 Transformer data
1.4 Amplifier type, part no., AB. no.
1.5 Choke data (if required)

→ see type labels

1.6 Check optimisation data on the regulator card.

Where the specification gives special instructions regarding connection, fitting or adjustment, these override the relevant information given in the connection manual.

1.7 If no optimisation values are entered, they can be calculated according to the following procedure:

- acceleration current: $R\ 90 = \frac{1.9 \cdot 10^3}{I_1} = (K\Omega)$
- tacho input resistors: $R\ 73/74 = U_{T.RAP} \cdot 1.71\ (K\Omega)$
- N-regulator: R 80 = 10 KΩ, R 79 = 300 KΩ, C 23 = 0.1 µF → rough values
- tacho monitoring: R103 =, R151 =, C 33 = → see 2.10
- speed-dependent current limitation: R 99 =, R101 = → see 1.8
- torque reduction for I^2xt / for M_{red}: R 93 =, R 98 = → see 1.9
- current display |I|: R 94 = 12 KΩ ≙ 10V for I_1 at X.x2.2

Abbreviations:

I_1 = acceleration current
$U_{T.RAP}$ = tacho voltage at rapid

1.8 DETERMINING THE SPEED DEPENDENT CURRENT LIMITATION

1.8.1 If no speed-dependent current limitation is required the following components are to be fitted:

R 99 = 10 kΩ

R101 = __ kΩ

1.8.2 If speed-dependent current limitation is required it must be determined as follows:

a) In the drawing of the speed - torque - characteristic a line indicating M_{limit} (in our example 2 x $M_{nom.}$) is to be drawn.

b) The next line to enter is a tangent to the commutation limit curve. This will give point U_{T2}.

c) A straight vertical line should then be drawn from the intersection of line 1 and 2. This will give point U_{T1}.

d) The amplification U of the normed tacho signal is to be calculated as follows:

$$U = \frac{6.8\ V \cdot 1.2}{U_{T2} - U_{T1}}$$

e) U_{T3} to be calculated as follows: $U_{T3} = \frac{12\ V}{U}$

f) A vertical line should be drawn upwards from U_{T3}. At the intersection with line 2 an horizontal line (line 3) should be drawn.
If line 3 cuts the commutation limit, line 2 must be drawn flatter and the calculations repeated from b).
If it does not, resistances R 101 and R 99 should be calculated:

$$R\ 101 = \frac{R\ 100}{U} = \frac{100\ k\Omega}{U} =$$

$$R\ 99 = 10\ K \cdot \frac{15\ V}{6.8\ V + U_{T1} \cdot \frac{R100}{R101} : \frac{10}{12}} =$$

abbreviations:

U_{T1} = tacho voltage at intersection $U_{T1} = \frac{n_1}{n_{nom.}} \cdot 10V$

U_{T2} = tacho voltage at intersection $U_{T2} = \frac{n_1}{n_{nom.}} \cdot 10V$

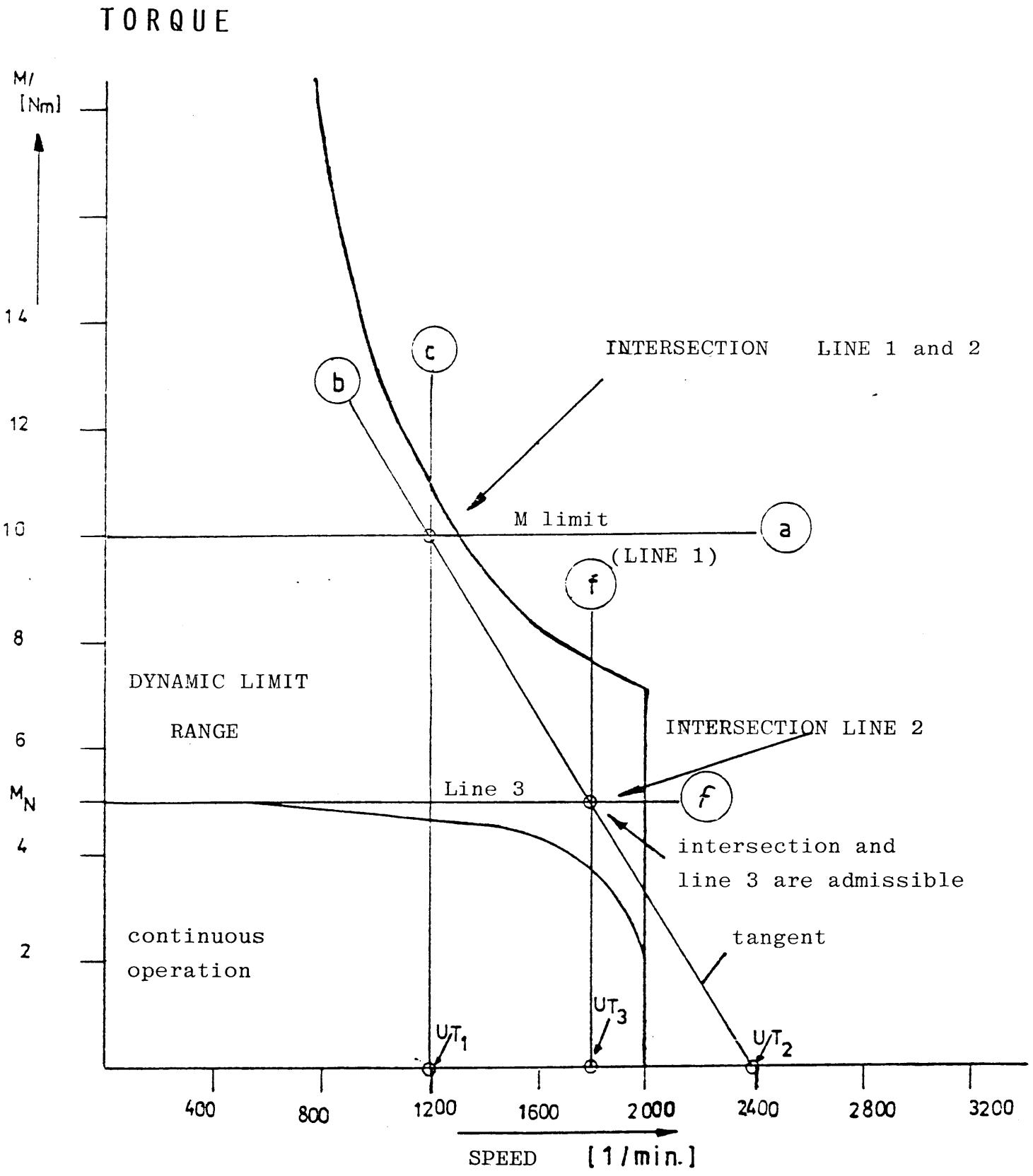
DETERMINATION OF THE SPEED DEPENDENT CURRENT LIMITATION

- If tacho - EMF_{1000} = 20 V, n = 2000 rpm

$$U = \frac{6.8V \cdot 1,2}{U_{T2} - U_{T1}} = \frac{8.16\ V}{12V - 6\ V} = 1.36 \qquad U_{T3} = \frac{12V}{U} = \frac{12V}{1.36} = 8.8\ V$$

8.8 V = 1760 rpm

INTEGRATION BOSCH DRIVE



1.9 TORQUE REDUCTION

R93 = M_{red} for $I^2 \cdot t$

R98 = M_{red}

Since there is always a 20 KΩ resistor fitted as a parallel resistor the values to be fitted for R93 ($I^2 \cdot t$) and R98 (M_{red}) have to be determined with the help of R_X:

Simplified formula for R_X

$$R_X = \frac{9.3}{1 - 0.453 \cdot \frac{I_{red\,\%}}{100\ \%}} = [\ K\Omega\ ]$$

Calculation for R93 and R98

$$R = \frac{20\ K \cdot R_X}{20\ K + R_X} = [K\ \Omega]$$

The following reductions can be obtained with the resistance values of the E 24-range:

R [KΩ]	reduction to
33	55% - I_B
30	50% - I_B
27	40% - I_B
24	33% - I_B
22	25% - I_B
20	20% - I_B

Abbreviations:

I_{red} = indicates to how many % - in relation to the acceleration current - the amplifier is to reduce to.
value in %.

1.10 CHECKING THE CONNECTIONS

A detailed check of the installation from the MTB drawings must be carried out, to ensure that everything adheres to the connection instructions. This applies particularly to installations where our amplifiers are used for the first time.

1.11 CHECKING THE GROUND CONNECTIONS

- There must be one 6 mm^2 cable leading from the ground terminal of the amplifier to the central ground start point (PE) in the interface. No other cables must be connected to this terminal. Also, terminal L- must be connected to the central 0V bus-bar in the interface.
- As per connection instructions the screens of command, tacho and any ±15V cables should only be connected at one end.
- Lines within the screened cable, which are not used must be connected to the screen at both ends.

2. INTEGRATION OF THE TRANSISTOR AMPLIFIER

2.1 CHECK VOLTAGES

- remove all printed circuit boards from the unit
- disconnect control command value and connect a variable command source
- remove fuses F1 - F3
- switch on voltage (main switch)
- measure transformer voltages (see spec. for correct voltages)
- switch off main switch, reinsert fuses F1 - F3, switch main switch on again
- measure D.C. link voltage at term. L+ and L- (for correct value: see max. output voltage in specification)
- on units with forced ventilation the functioning of the fan should be checked
- switch main switch off

2.2 CHECK BTB SIGNAL (ready to run)

- insert braking chopper card and power supply card
- switch on drive
- the green LED on the power supply card must be on and there must be +24V present at X10.1
- switch off drive

CAUTION ! Never insert or pull out printed circuit boards while the amplifier is switched on. When the main switch has been switched off boards must only be inserted or pulled out once all LEDs have gone out (approx. 10 sec. after switching off).

2.3 ADJUSTMENT OF THE REGULATOR CARD

2.4 On pre-optimised units only items 2.5, 2.6, 2.7 and 2.16 need to be carried out.

2.5 CHECKING COMMAND ADJUSTMENT, DIRECTIONS OF ROTATION AND TACHO POLARITY

- remove the TU bridge on the regulator card
- a 10 KΩ resistor must be fitted in R80
- fit resistor in R90 acc. to the calculation instructions or the specification
- R73/74 must only be soldered in on one side
- insert regulator and power supply cards
- switch on drive, without giving an enable signal
- introduce command voltage corresponding to rapid feedrate, (e.g. $\pm$7.5 V) and adjust to $\pm$10V at measuring point "SW 1" with pot R144
- introduce 0V and give enable (FG)
- slowly increase command voltage
  the axis must move in positive direction with positive command values
- should the direction be incorrect: change motor polarity
- for positive command values at X.x1.2 the tacho voltage at X.x2.8 must be positive with respect to X.x2.7
- should this polarity be incorrect: change tacho polarity
- switch off drive
- solder in R73/74

2.6 SPEED ADJUSTMENT

- activate N-regulator, $\longrightarrow$ remove R80 = 10 kΩ and connect RC-decade via R79 - C23 (rough values 300 kΩ, 0.1 μF)
- switch on drive, give enable (FG)
- introduce command value corresponding to 50% of the expected rapid speed
- measure speed, and set to 50% of the rapid speed with pot R143
  (measure either with a tachometer on the motor, or via the tacho voltage at terminal X.x2.7-8)
- when the speed adjustment has been completed $\pm$10V at measuring point "T" correspond to the rapid speed

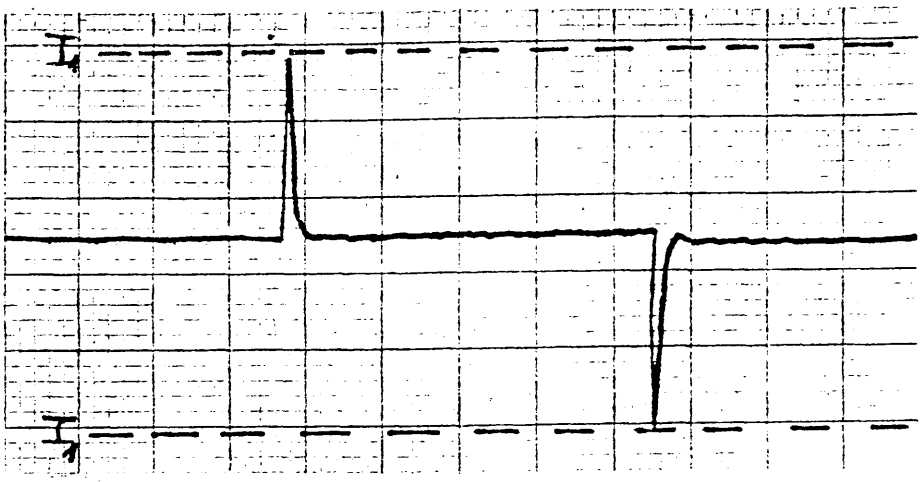
2.7 DRIFT ADJUSTMENT

- introduce speed command value 0
- if the motor drifts noticibly, reduce the drifting as much as possible with pot R146 (down to 0, if possible)

2.8 OPTIMISATION OF THE SPEED REGULATOR

- introduce command value as E-function the time constant T should lie approx. 10% below the expected final time constant
- the amplitude of the command value should be such that the regulator works just below the current limit during acceleration and deceleration
- the signal measured at point "UN" should ideally be as follows:

  R79 = 390 kΩ ; C23 = 0.1 µF



test point "UN"
adjustment
3 V / div.

signal standardisation ≙ 8 V $\hat{=}$ current limit

2.9 CHECKING THE SPEED DEPENDENT CURRENT LIMITATION (if required)

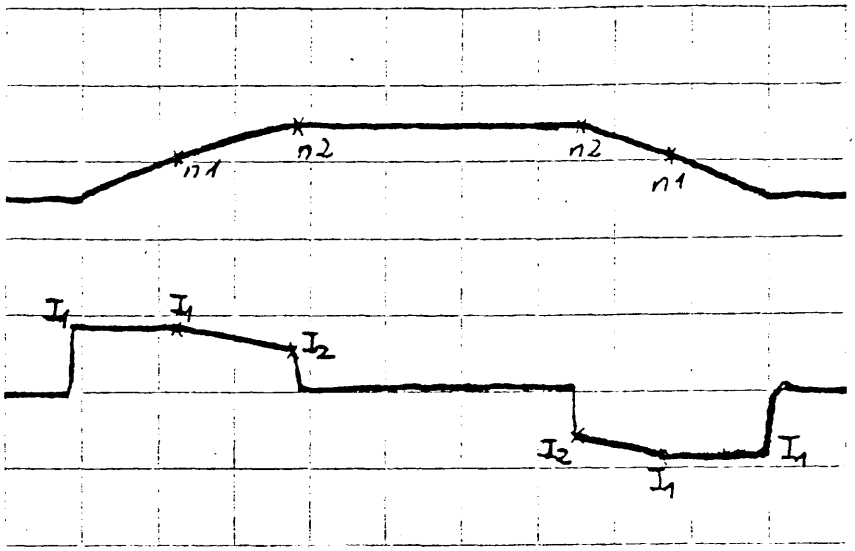
- check the tacho signal characteristic (measuring point T) and the current command value characteristic (measuring point UN) against the values entered for I_1, I_2, n_1 and n_2 in the specification.

  please note that both signals are standardised, i.e.

  - at measuring point "T" → 10 V $\hat{=}$ RAPID = n_2
  - at measuring point "UN" → 8 V $\hat{=}$ current limit = I_1

2.9 cont'd

example of a speed dependent current limitation



adjustment
10 V / div.

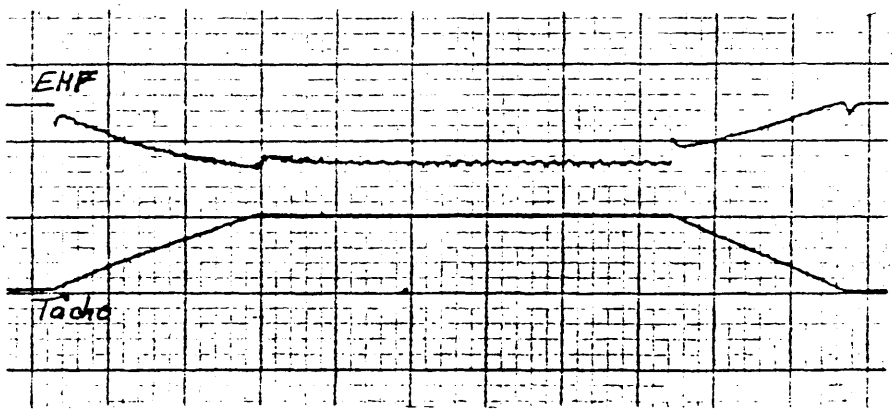
current limit value	I_1	=	50 A	≙ 8 V
motor speed	n_1	=	1500 rpm	≙ 5 V
current limit value	I_2	=	35 A	≙ 5.5 V
motor speed	n_2	=	3000 rpm	≙ 10 V

2.10 OPTIMISATION OF THE TACHO MONITORING

example

- TU bridge not connected up yet
- optimisation sequence:
  1) R103
  2) R151 - C33

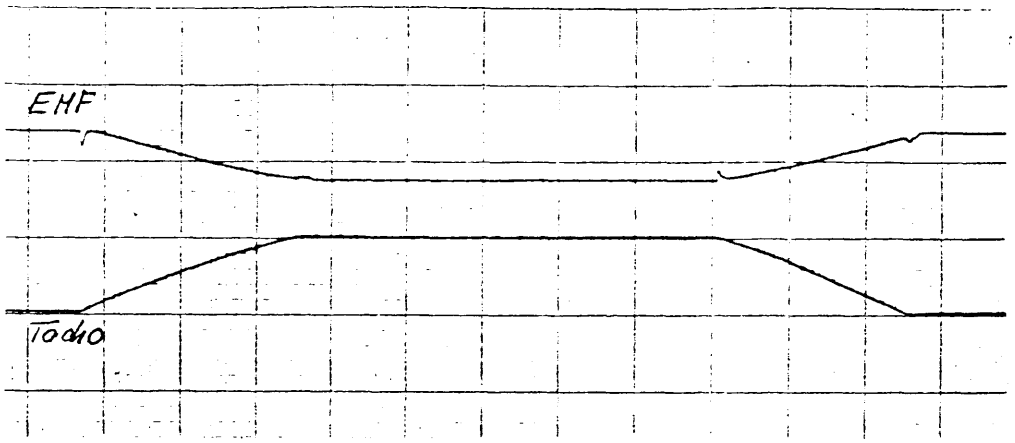
2.11 DIAGRAM OF AN UNOPTIMISED E M F



adjustment
10 V / div.

R103 =
R151 =
C 33 = } no components fitted

2.12 Use R103 to adapt the EMF curve to the tacho signal (rough value approx. 10 k)

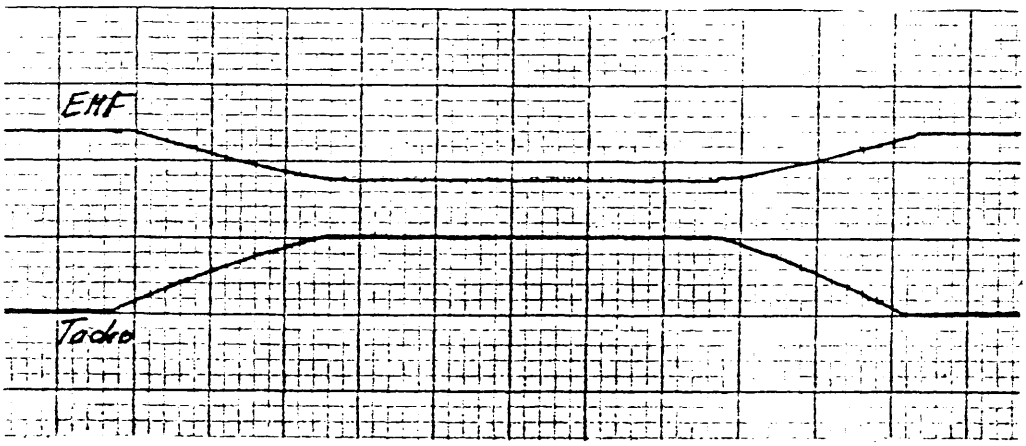


R103 = 18 k
R151 = - k
C 33 = - µF

adjustment
10 V / div.

2.13 Use R151 - C33 to eliminate any remaining spikes. Start by trying low values (R = 3 kΩ, C = 22 nF).

Sequence:
1) Eliminate the remaining spikes by changing the capacitor value.
(if the capacitor value is chosen too high spikes will appear in the opposite direction)
2) The final fine adjustment is done by changing the value of the resistor.



R103 = 18 k
R151 = 3.6 k
C 33 = 0.47 µF

adjustment
10 V / div.

2.14 Solder in the values determined for R103, R151 and C33. Plug in TU bridge and check the tacho monitoring function.

2.15 The above procedure is to be carried out for each axis.

2.16 CHECKING AMPLIFIER IN CONJUNCTION WITH CONTROL

- connect final command value source
- switch on drive and give enable signal
- introduce command equivalent to "0" speed

  should the motor drift adjust as close as possible to "0" with pot R146

  on installations with positional servo loop: adjust LAG down to "0"
- introduce command equivalent to max. motor speed

  on installations without positional servo loop: use a manual tachometer to adjust the motor speed to the command speed (pot R143)

  on installations with positional servo loop: set the required KV factor with pot R143:

$$KV = \frac{|V|}{|S|}$$

V = axis velocity $\frac{m}{min}$

S = lag mm

example:

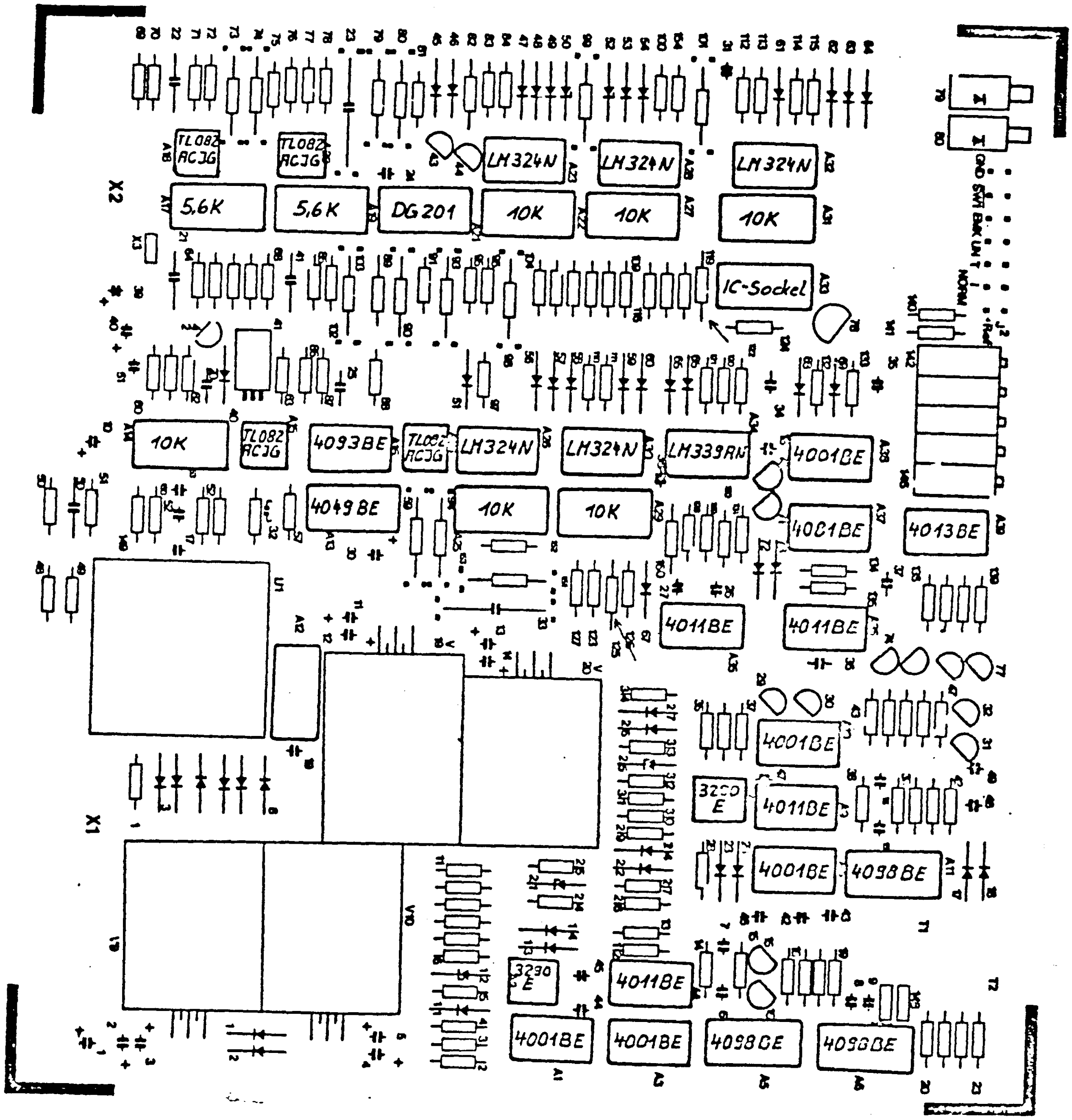
V = 10 m/min
S = 10 mm

$$KV = \frac{10}{10} = \underline{1}$$

- switch off drive

3. COMPLETING THE INTEGRATION

- solder in all values which were determined with the RC decade as fixed values in the amplifier and notify VES3
- seal all potentiometers



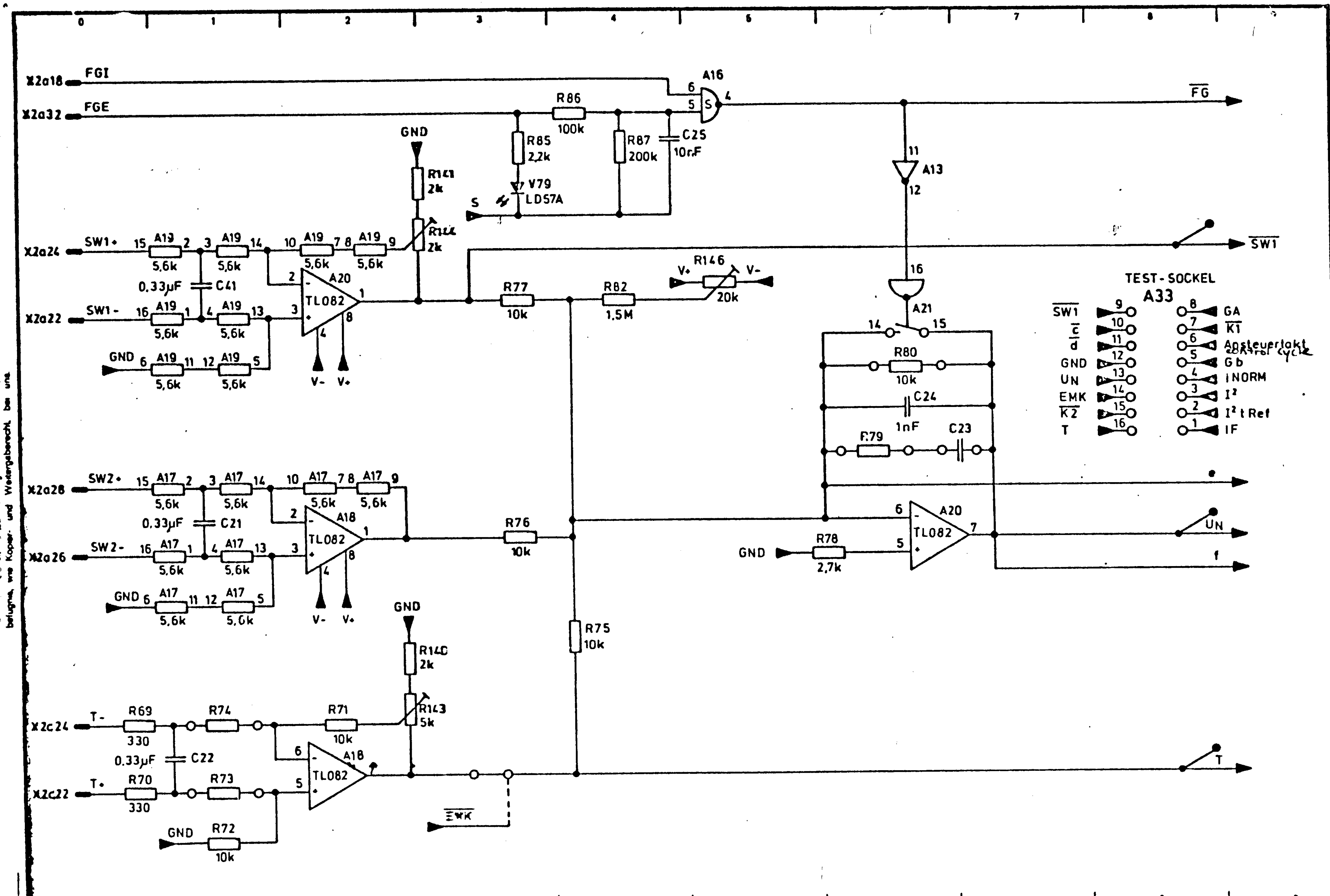
ROBERT BOSCH GMBH
Industrieausrüstung
6122 ERBACH O/W.

Benennung: REGULATOR 140 V
Regler

Z.Nr.: 041458 101303

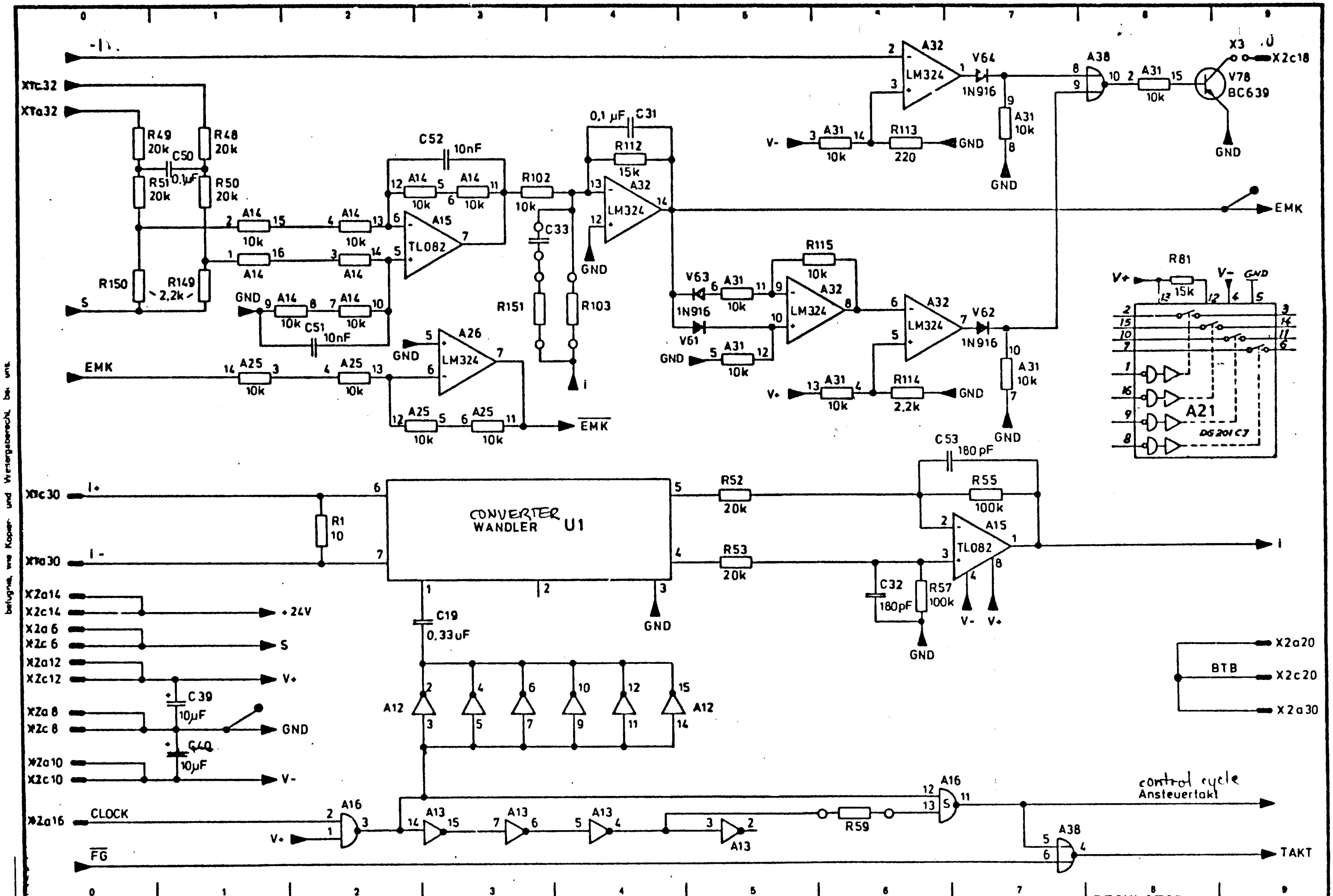
Blatt 1

Blätter 7

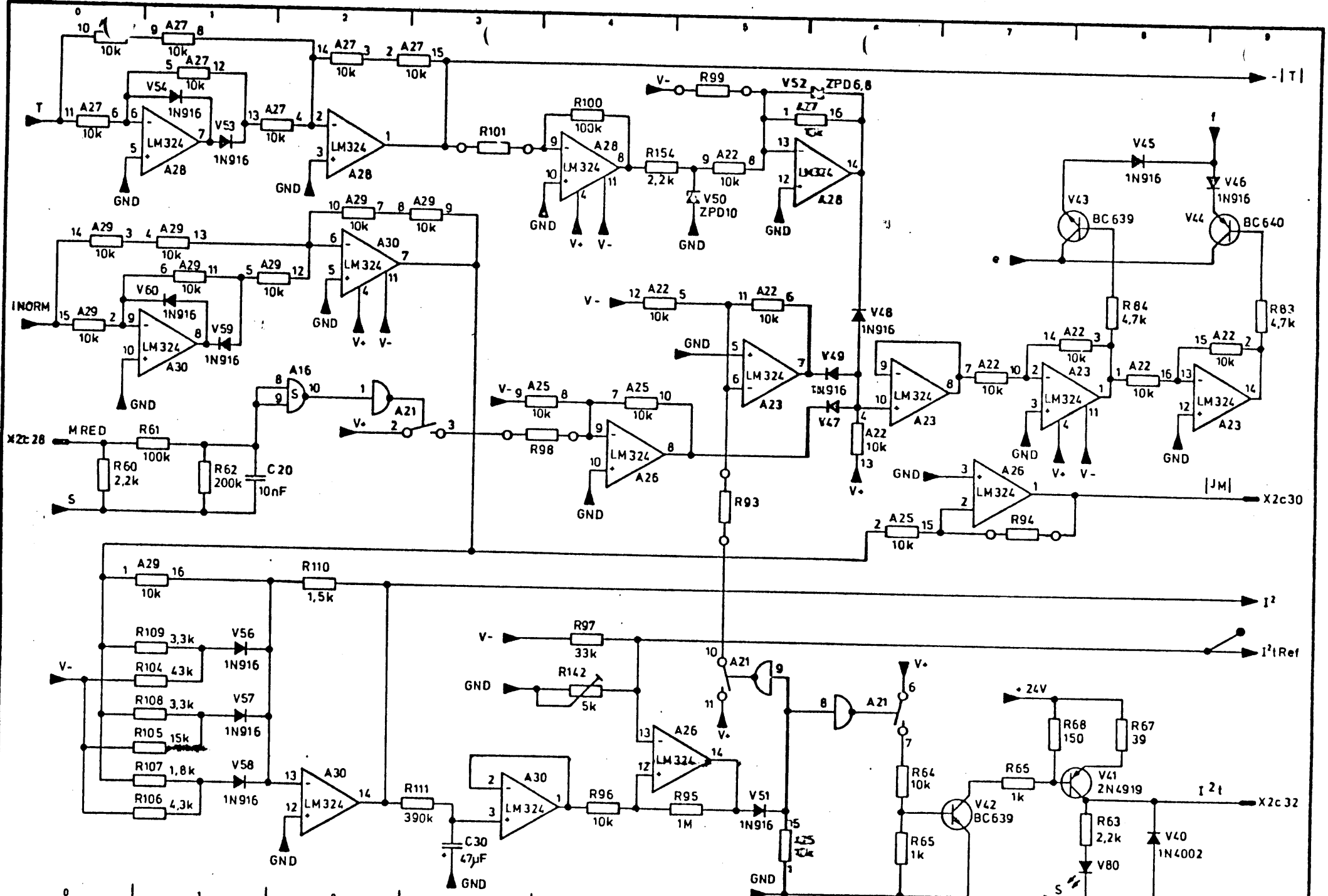


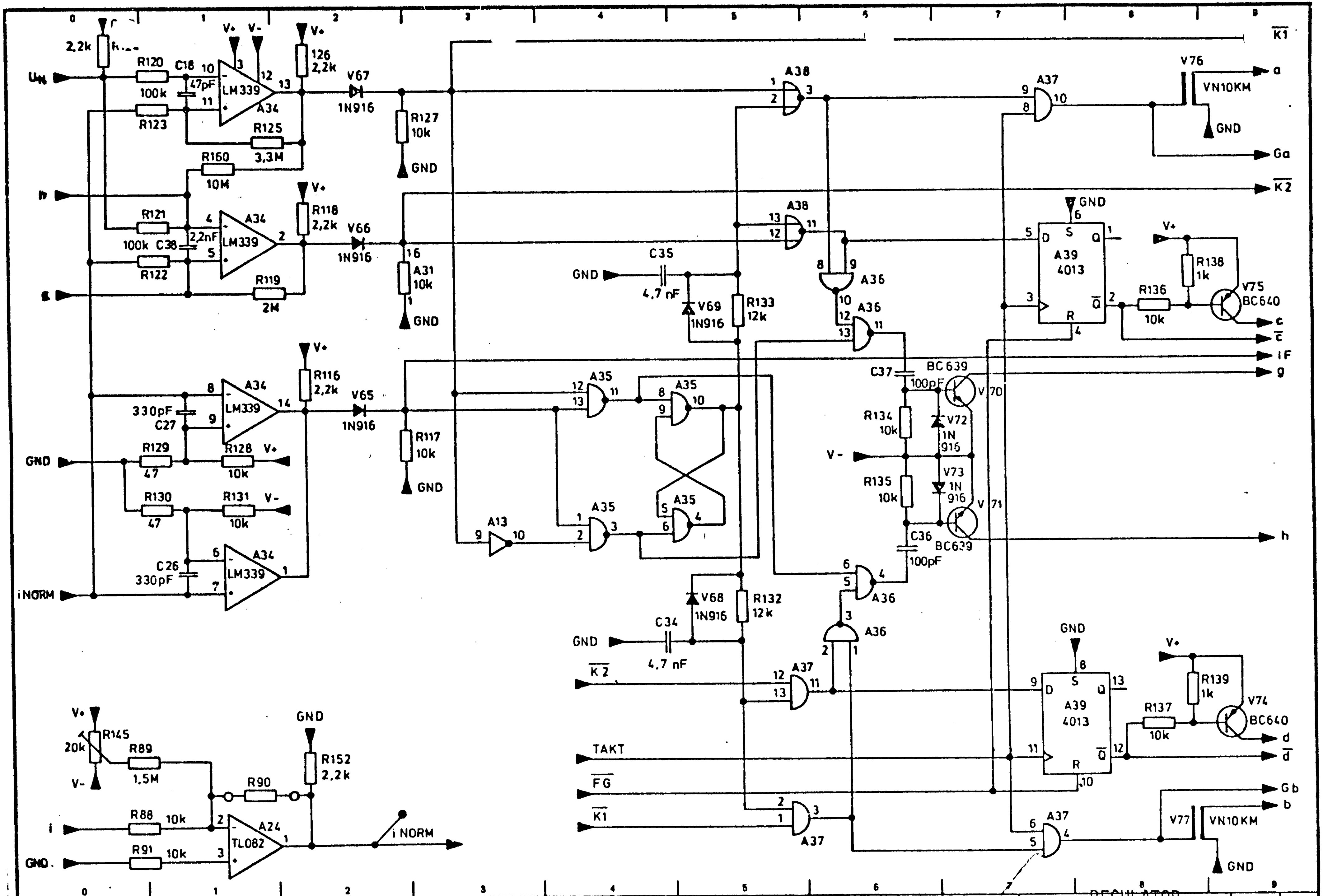
BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Benennung: REGULATOR Regler 140 V	Blatt 2
Ers. für / Ers. durch	Z Nr 041458 -	Blätter

Änd. | Mittlg | Datum | gez. | gepr. | Änd. | Mittlg | Datum | gez. | gepr. | Tag | gez. | Z gepr. | N gepr.



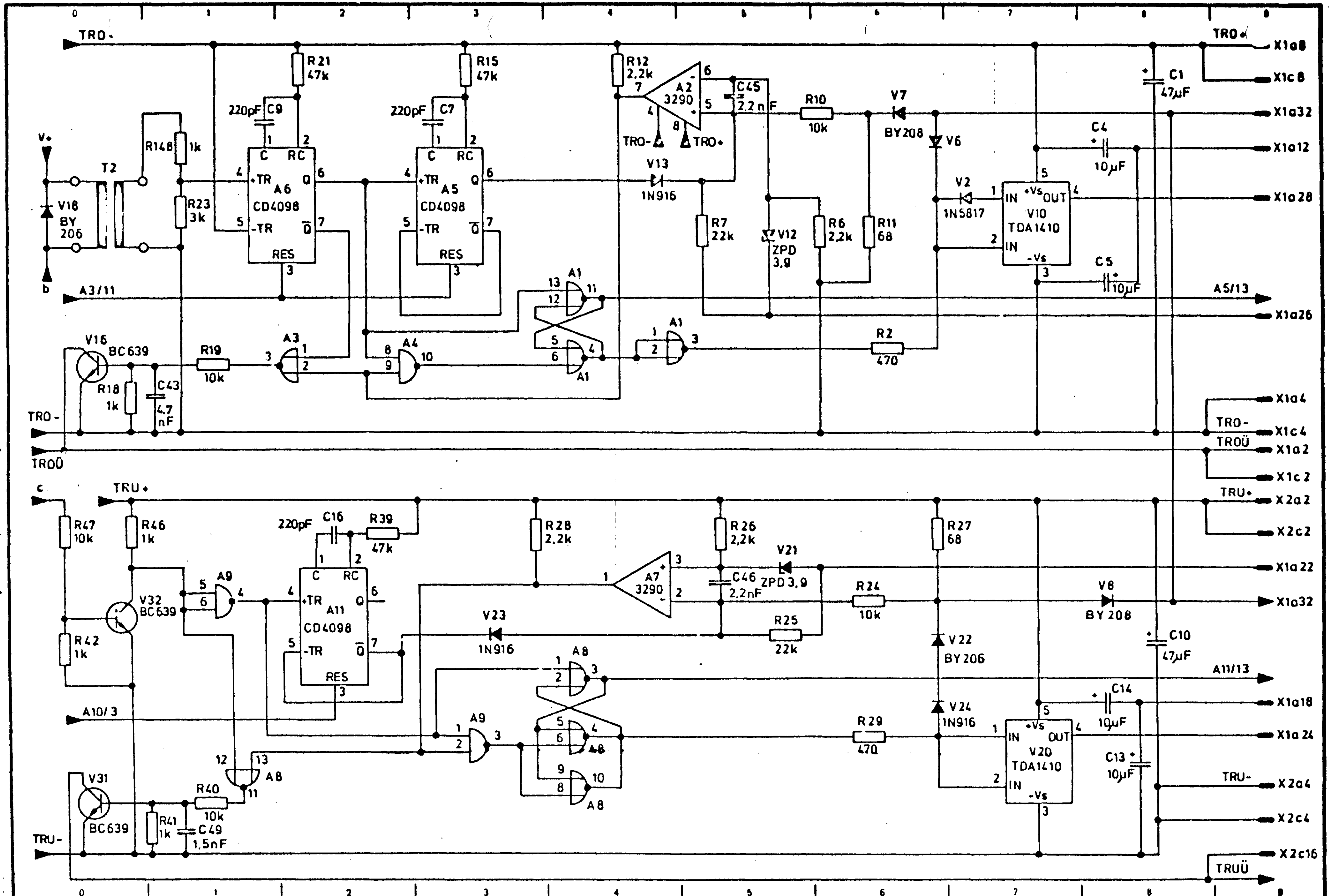
Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd / Mitlg. / Datum / gez / gepr / Änd / Mitlg. / Datum / gez / gepr	Tag gez. Z. gepr N. gepr	Benennung REGULATOR Regler 140 V Z. Nr 041458 -	Blatt 3 Blätter	Anschluß Blatt


T
-|T|
V-
R99
V52
ZPD6,8
R100
100k
R101
R154
2,2k
V50
ZPD10
V45
1N916
V46
1N916
V43
BC639
V44
BC640
R84
4,7k
R83
4,7k
INORM
MRED
X2c28
R61
100k
R60
2,2k
R62
200k
C20
10nF
S
R98
R93
V48
1N916
V49
1N916
V47
1N916
R94
|JM|
X2c30
R110
1,5k
I²
I²tRef
R97
33k
R142
5k
R109
3,3k
R104
43k
R108
3,3k
R105
15k
R107
1,8k
R106
4,3k
V56
1N916
V57
1N916
V58
1N916
R111
390k
C30
47µF
R96
10k
R95
1M
V51
1N916
R64
10k
R65
1k
R68
150
R67
39
V41
2N4919
V42
BC639
R63
2,2k
V40
1N4002
V80
I²t
X2c32
+24V
GND
V+
V-
A16
A21
A22
A23
A25
A26
A27
A28
A29
A30
LM324
1N916
BC639
BC640
2N4919
1N4002
ZPD6,8
ZPD10
BOSCH INDUSTRIEAUSRÜSTUNG
Industrielle Steuerungselektronik
6120 ERBACH/ODW
Ers. für
Ers. durch
Benennung
REGULATOR
Regler 140 V
Z Nr.
041458 -
Blatt
4
Blätter

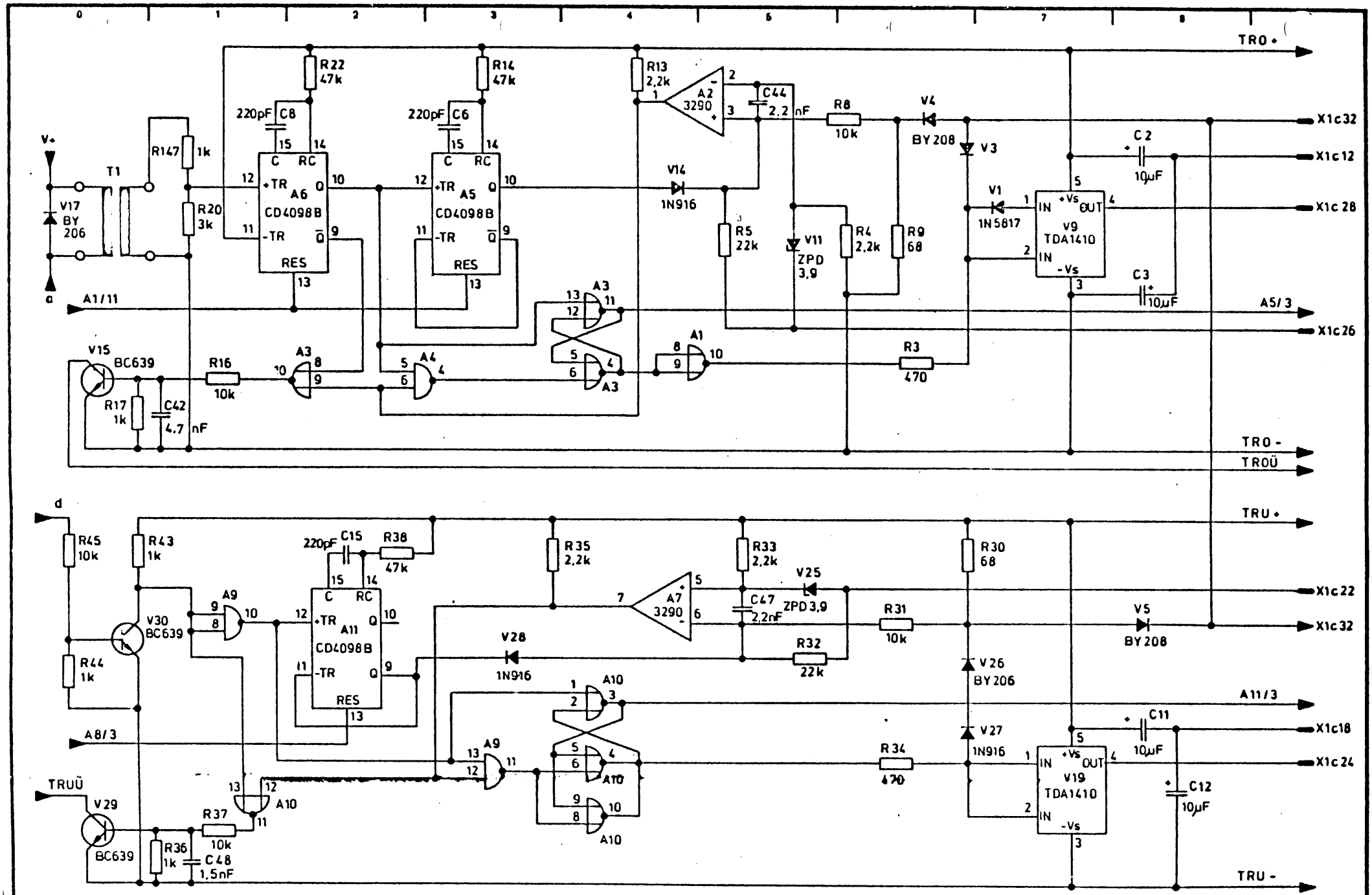


U_N
R120 100k
C18 47pF
R123
LM339 A34
R125 3,3M
R160 10M
R121 100k
C38 2,2nF
R122
R119 2M
126 2,2k
V67 1N916
R127 10k
GND
R118 2,2k
V66 1N916
A31 10k
R116 2,2k
V65 1N916
R117 10k
330pF C27
R129 47
R128 10k
R130 47
R131 10k
C26 330pF
iNORM
R145 20k
R89 1,5M
R90
R152 2,2k
R88 10k
R91 10k
TL082 A24
i NORM
A13
A35
A38
A36
A37
C35 4,7 nF
V69 1N916
R133 12k
C34 4,7 nF
V68 1N916
R132 12k
C37 100pF
BC639 V70
V72 1N 916
V73 1N 916
R134 10k
R135 10k
C36 100pF
BC639 V71
V-
K2
TAKT
FG
K1
A39 4013
R136 10k
R138 1k
V75 BC640
R137 10k
R139 1k
V74 BC640
V76 VN10KM
V77 VN10KM
a
Ga
K2
c
c
IF
g
h
d
d
Gb
b

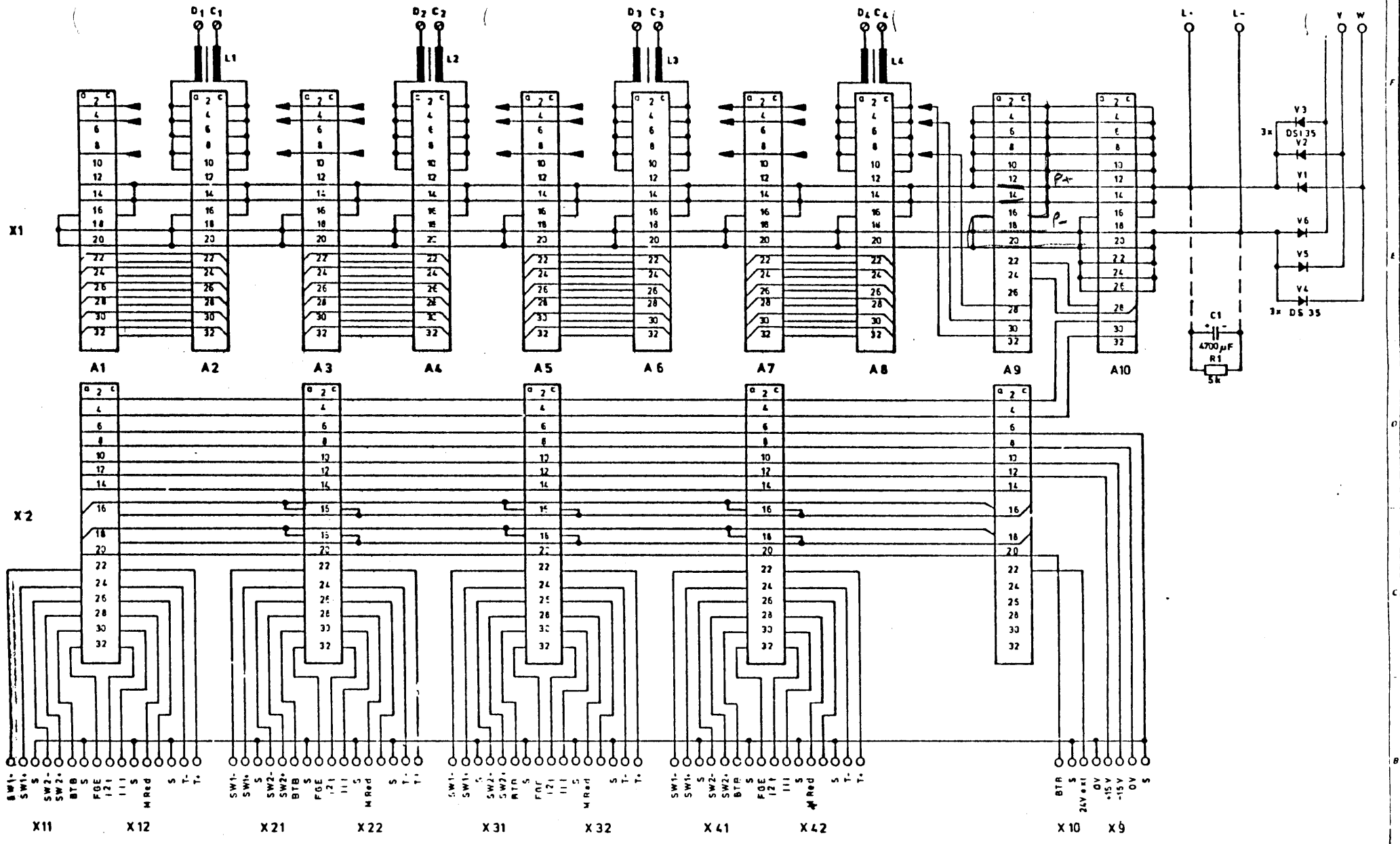
Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd. / Mitteilg. / Datum / gez. / gepr. / Änd. / Mitteilg. / Datum / gez. / gepr.
Tag / gez. / Z. gepr. / N. gepr.	Benennung: REGULATOR Regler 140 V	Blatt 5 / Blätter	Anschluß Blatt
	Z. Nr. 041458 -		



BOSCH INDUSTRIEAUSRUSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Benennung REGULATOR Regler 140 V	Blatt 6
Änd. / Mitteilg. / Datum / gez. / gepr.	Tag / gez. / Z. gepr. / N. gepr.	Z. Nr. 041458 -	Blätter



Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd	Mittlg	Datum	gez.	gepr.	Änd	Mittlg	Datum	gez.	gepr.	Tag gez. Z. gepr. N. gepr.	Benennung REGULATOR Regler 140 V Z. Nr. 041458 -	Blatt 7 Blätter	Anschluß Blatt



Änd.	Mdfg.	Datum	gez.	gepr.	Maßstab

Benennung: MUTTERKARTE
MOTHER CARD

Z. Nr. 038033 - 101203

Fert. Hinweis Nr.

Tag 11.6.1981

gez.

Z. gepr.

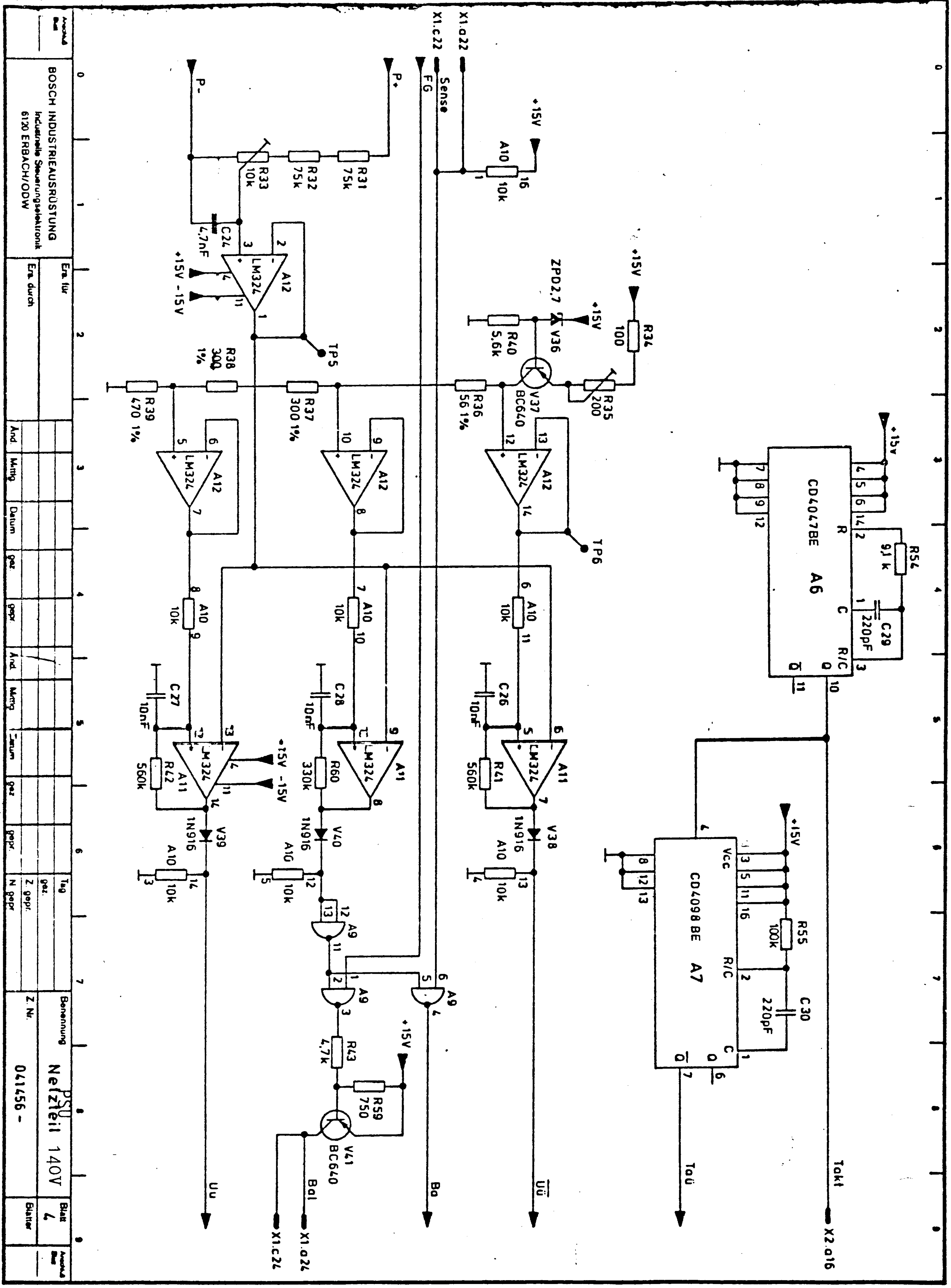
N. gepr.

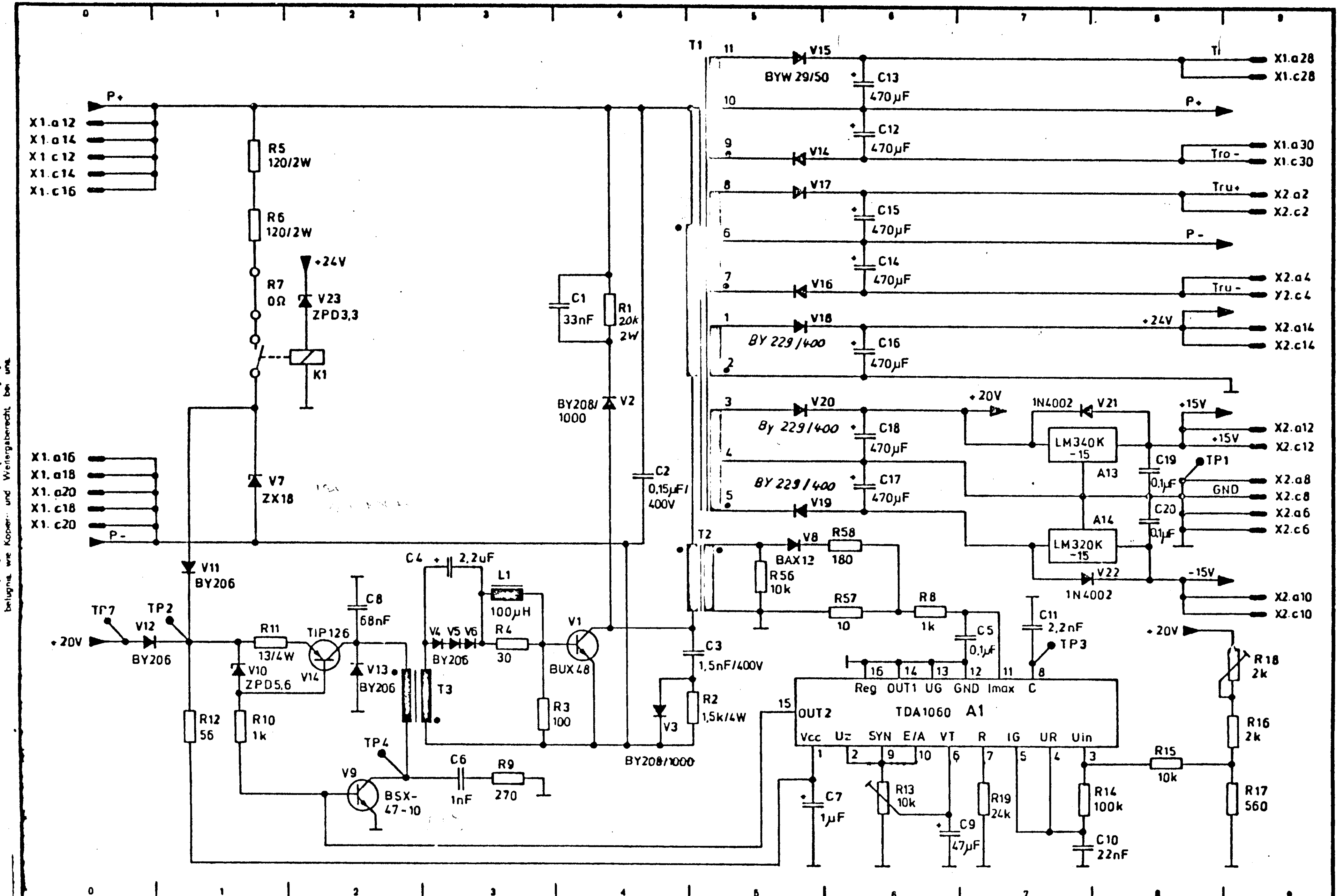
Variator Nr. 72

BOSCH INDUSTRIEAUSRÜSTUNG
Industrielle Steuerungselektronik
6120 ERBACH/ODW

Verteiler Nr. ______

Fall von Schutzrechtsanmeldungen. Jede Verfügungsbefugnis, wie Kopier- und Weitergaberecht, bei uns.



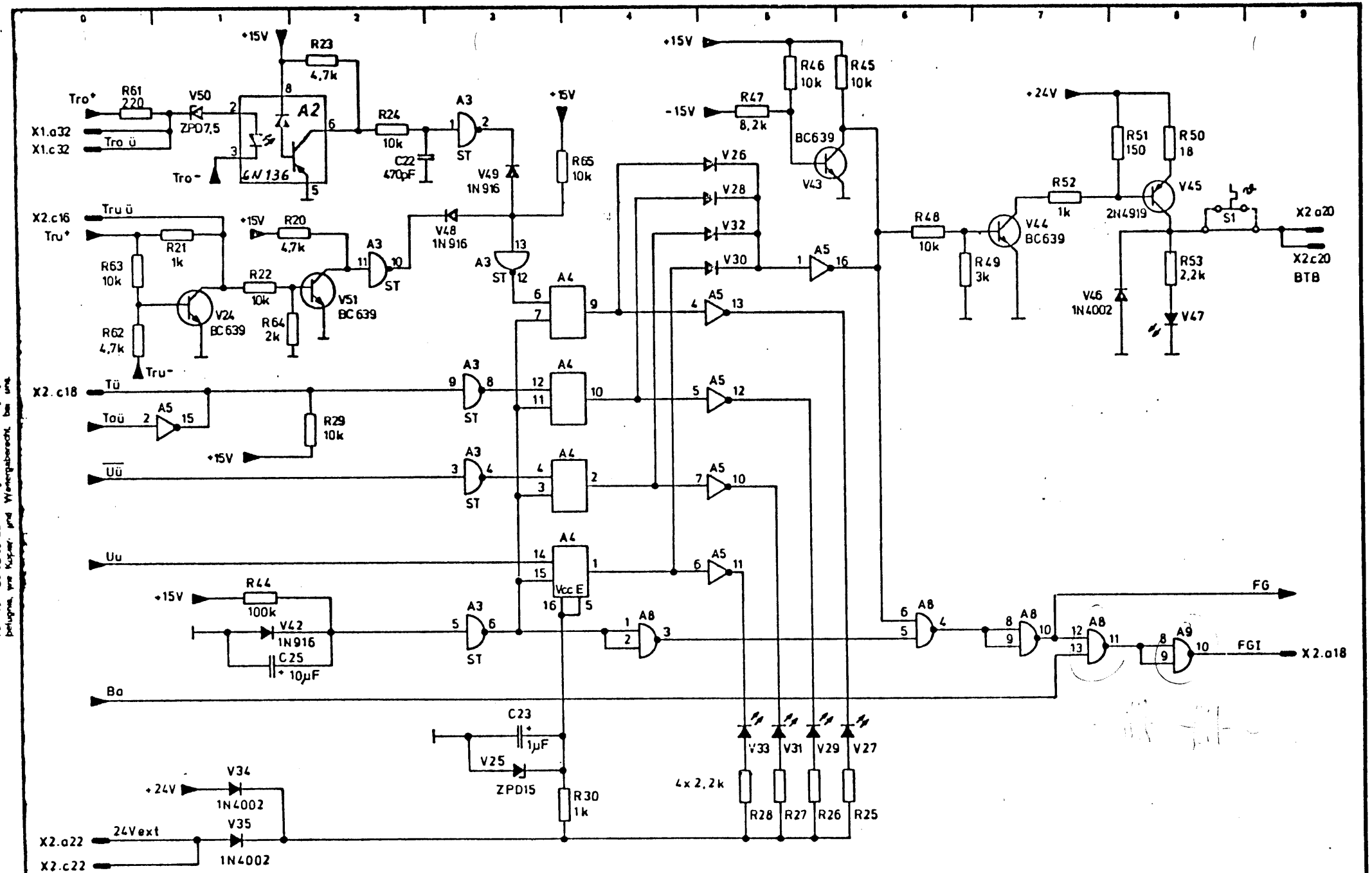


Fall von Schutzrechtsanmeldungen, jede Verfügungsbefugnis, wie Kopier- und Weitergaberecht, bei uns.

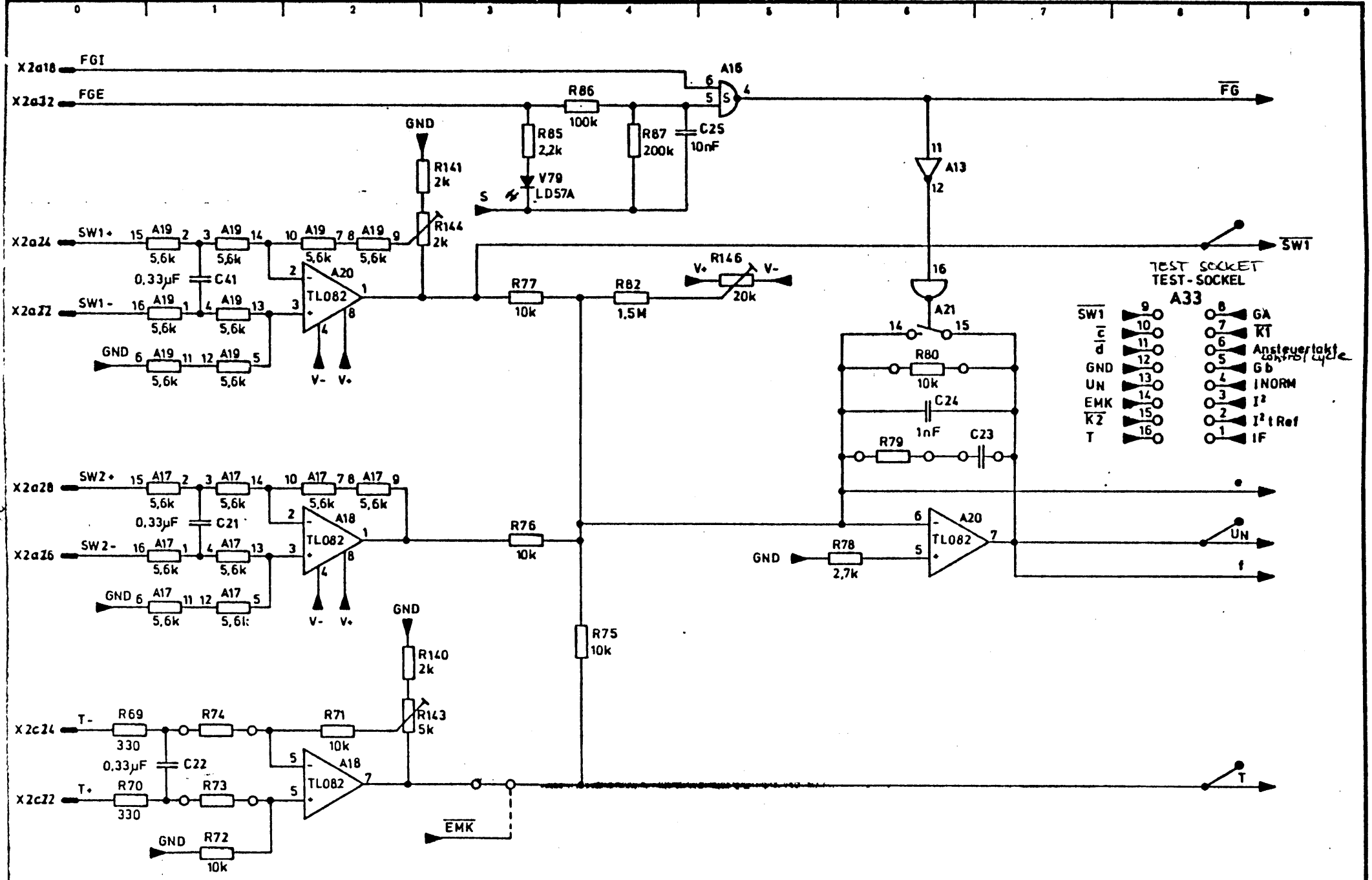
- 32 -

Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd.	Mitteilg.	Datum	gez.	gepr.	Änd.	Mitteilg.	Datum	gez.	gepr.	Tag gez. Z. gepr. N. gepr.	Benennung PSU Netzteil 140 W Z. Nr. 041456 -	Blatt 2 Blätter	Anschluß Blatt

Verteiler Nr.

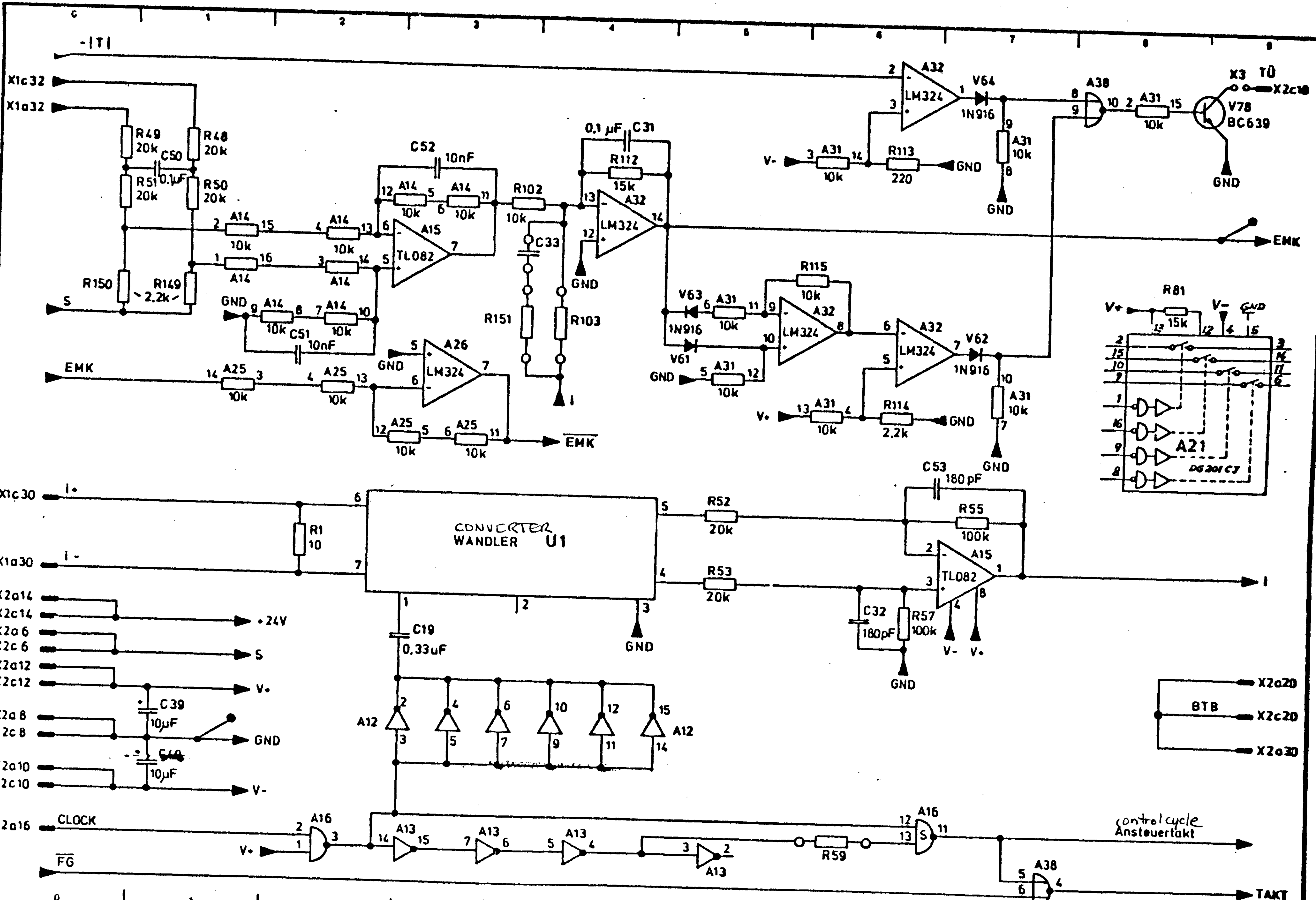


Anschluß Blatt	BOSCH INDUSTRIEAUSRUSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch											Tag gez Z. gepr N. gepr	Benennung	PSU Netzteil 140W	Blatt	3	Anschluß Blatt
				And.	Mittlg.	Datum	gez	gepr.	And.	Mittlg	Datum	gez.	gepr.	Z. Nr.	041456-	Blätter		



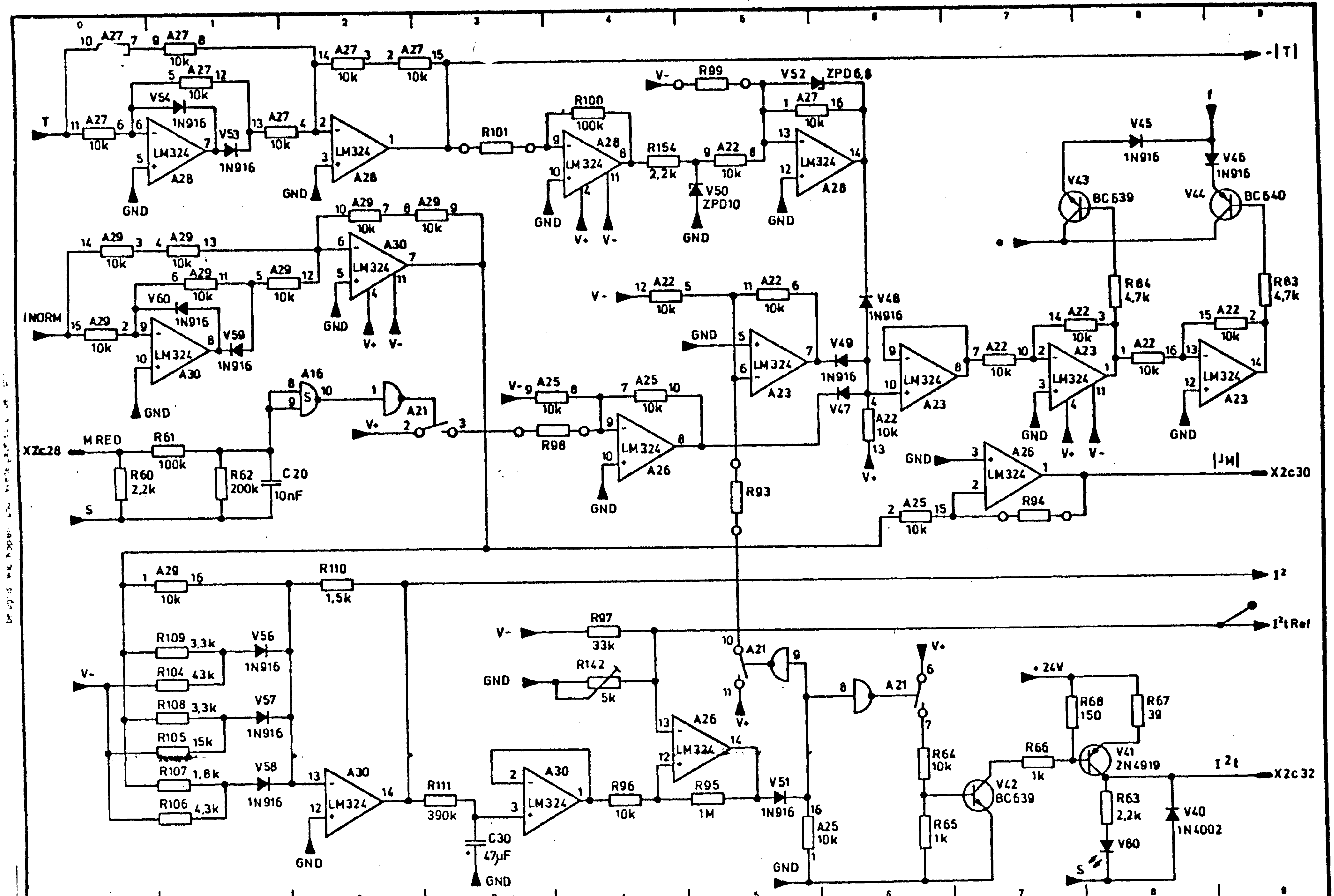
	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch											Tag gez. Z. gepr. N. gepr.	Benennung REGULATOR Regler 230 V Z. Nr. 038030 -	Blatt 2 Blätter	
			Änd.	Mittlg	Datum	gez	gepr.	Änd	Mittlg	Datum	gez.	gepr.				

36

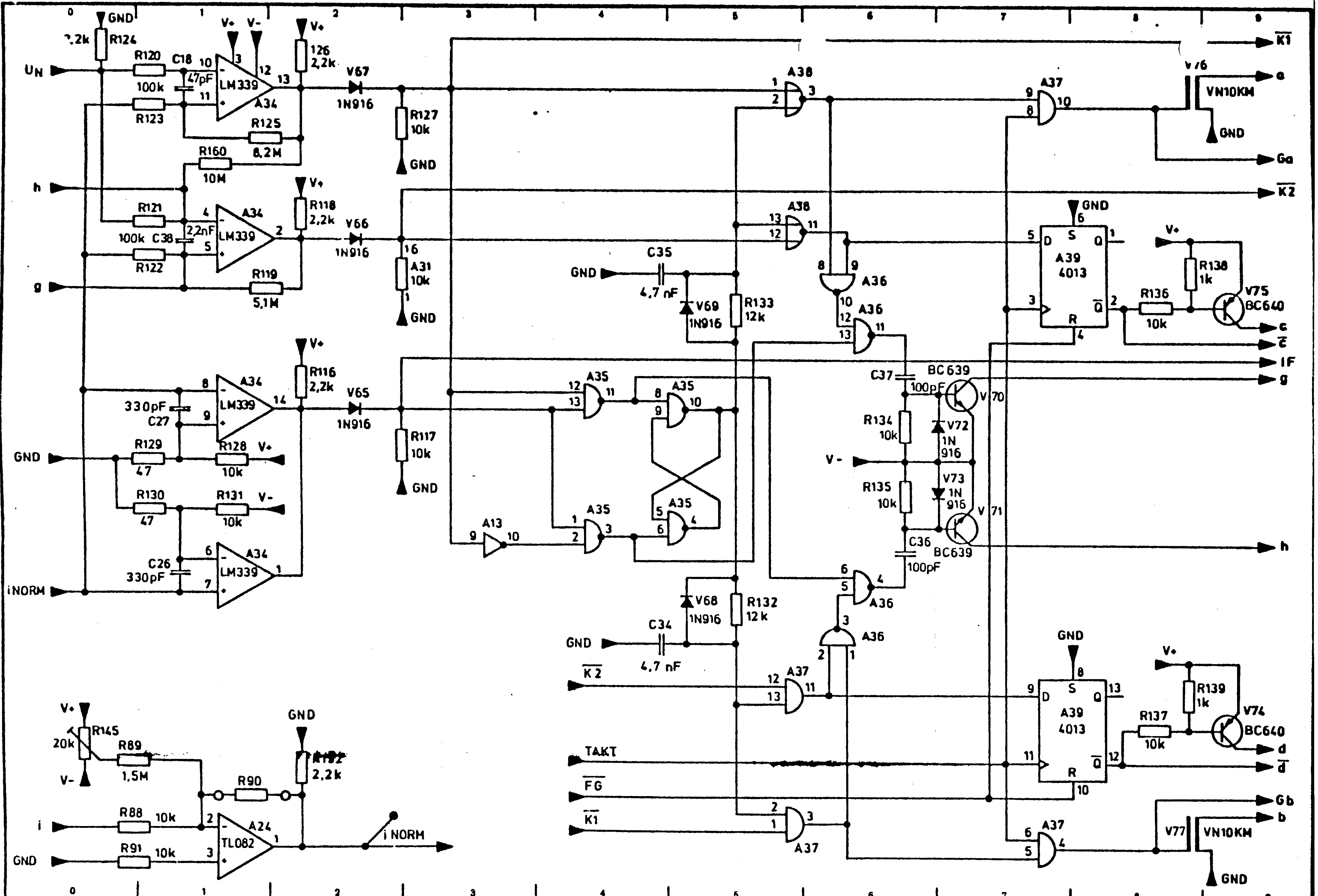


Ursprung Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd. / Mitltg. / Datum / gez. / gepr. / Änd. / Mitltg. / Datum / gez. / gepr.
Tag / gez. / Z. gepr. / N. gepr.	Benennung REGULATOR Regler 230 V	Blatt 3	Blätter
Z. Nr.	038030 -		

Verteiler Nr.



Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd.	Mittlg.	Datum	gez	gepr.	Änd.	Mittlg.	Datum	gez.	gepr.	Tag gez. Z. gepr. N. gepr.	Benennung REGULATOR Regler 230 V Z. Nr. 038030 -	Blatt 4 Blätter	Anschluß Blatt



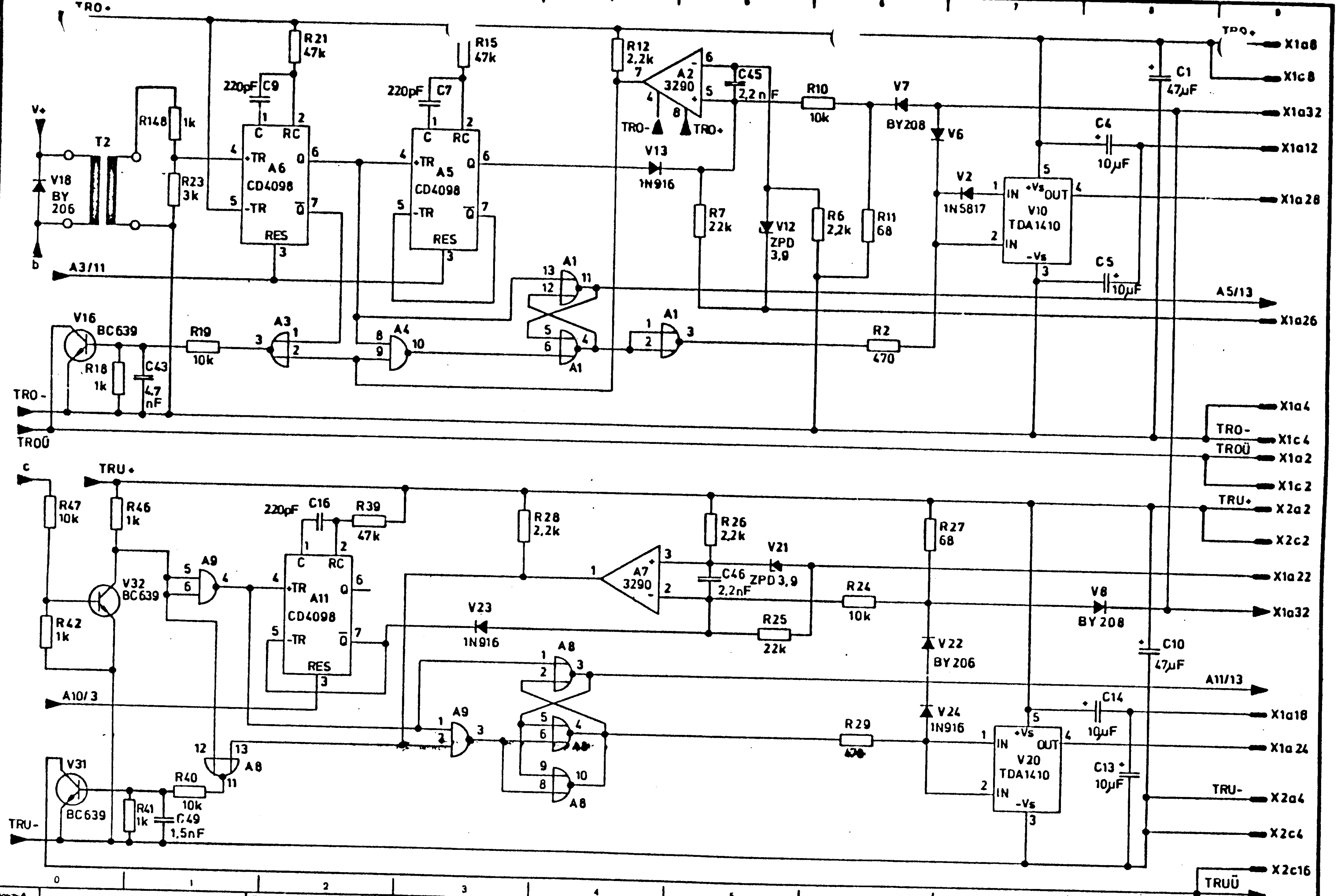
GND
R124
2,2k
U N
R120
100k
C18
47pF
R123
LM339
A34
R125
8,2M
V+
V-
126
2,2k
V67
1N916
R127
10k
R160
10M
h
R121
100k
C38
2,2nF
R122
R118
2,2k
V66
A31
10k
g
R119
5,1M
330pF
C27
R116
2,2k
V65
R117
10k
R129
47
R128
10k
R130
47
R131
10k
C26
330pF
i NORM
A38
A37
10
VN10KM
V76
Ga
K2
A36
C35
4,7 nF
V69
R133
12k
D
S
Q
R
A39
4013
R138
1k
R136
10k
V75
BC640
c
IF
A35
A13
C37
100pF
BC639
V70
R134
V72
1N 916
V73
R135
V71
C36
100pF
V68
R132
12k
C34
4,7 nF
K1
K2
TAKT
FG
R139
1k
R137
10k
V74
d
Gb
b
V77
R145
20k
R89
1,5M
R90
R182
2,2k
R88
10k
R91
10k
A24
TL082
i
a

Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd.	Mittlg.	Datum	gez.	gepr.	Änd.	Mittlg.	Datum	gez.	gepr.	Tag gez. Z. gepr. N. gepr.	Benennung REGULATOR Regler 230 V Z. Nr. 038030 -	Blatt 5 Blätter	Anschluß Blatt

Verteiler Nr.

Wohne Rastat 49 1028

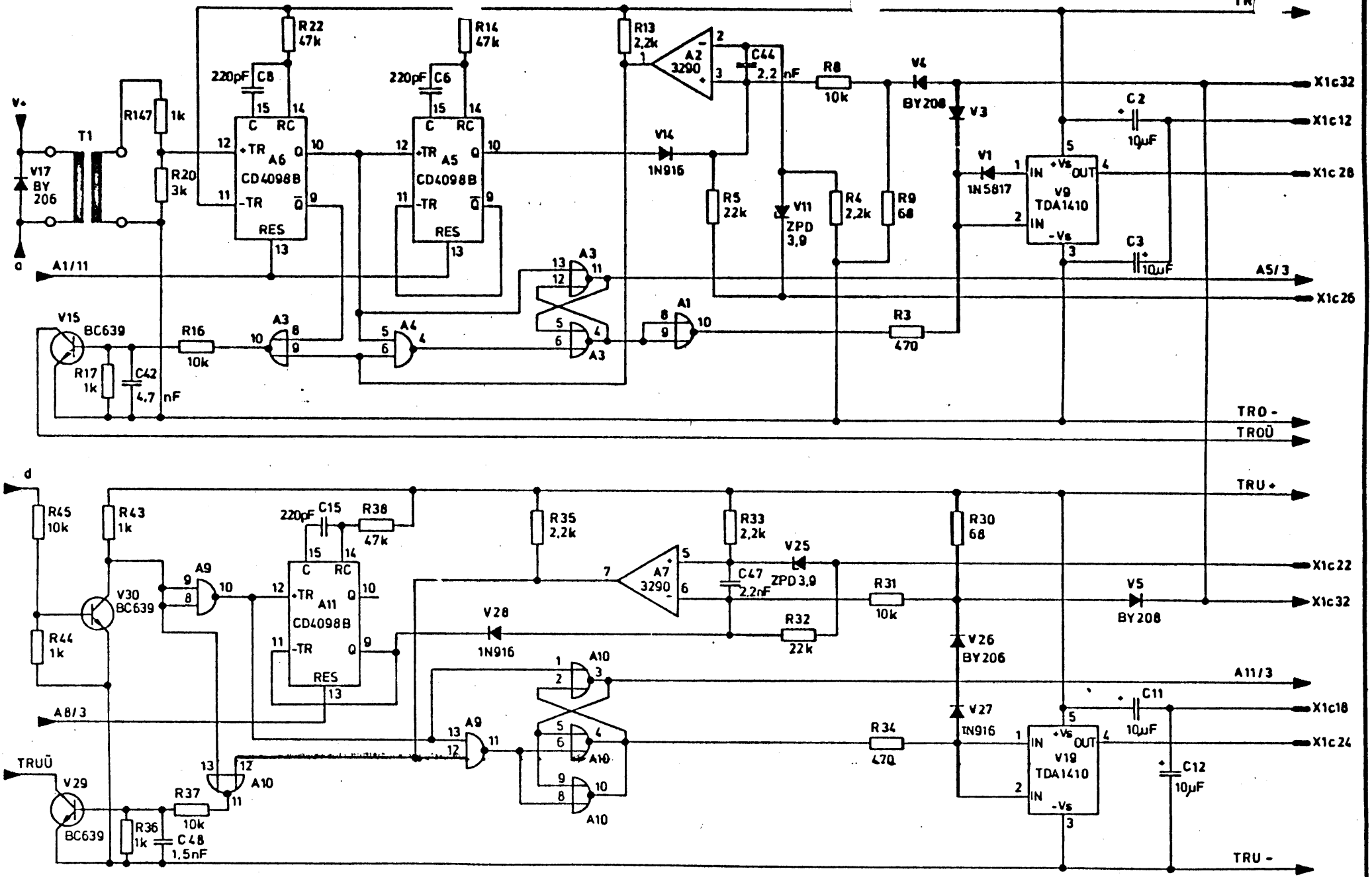
823001-183311



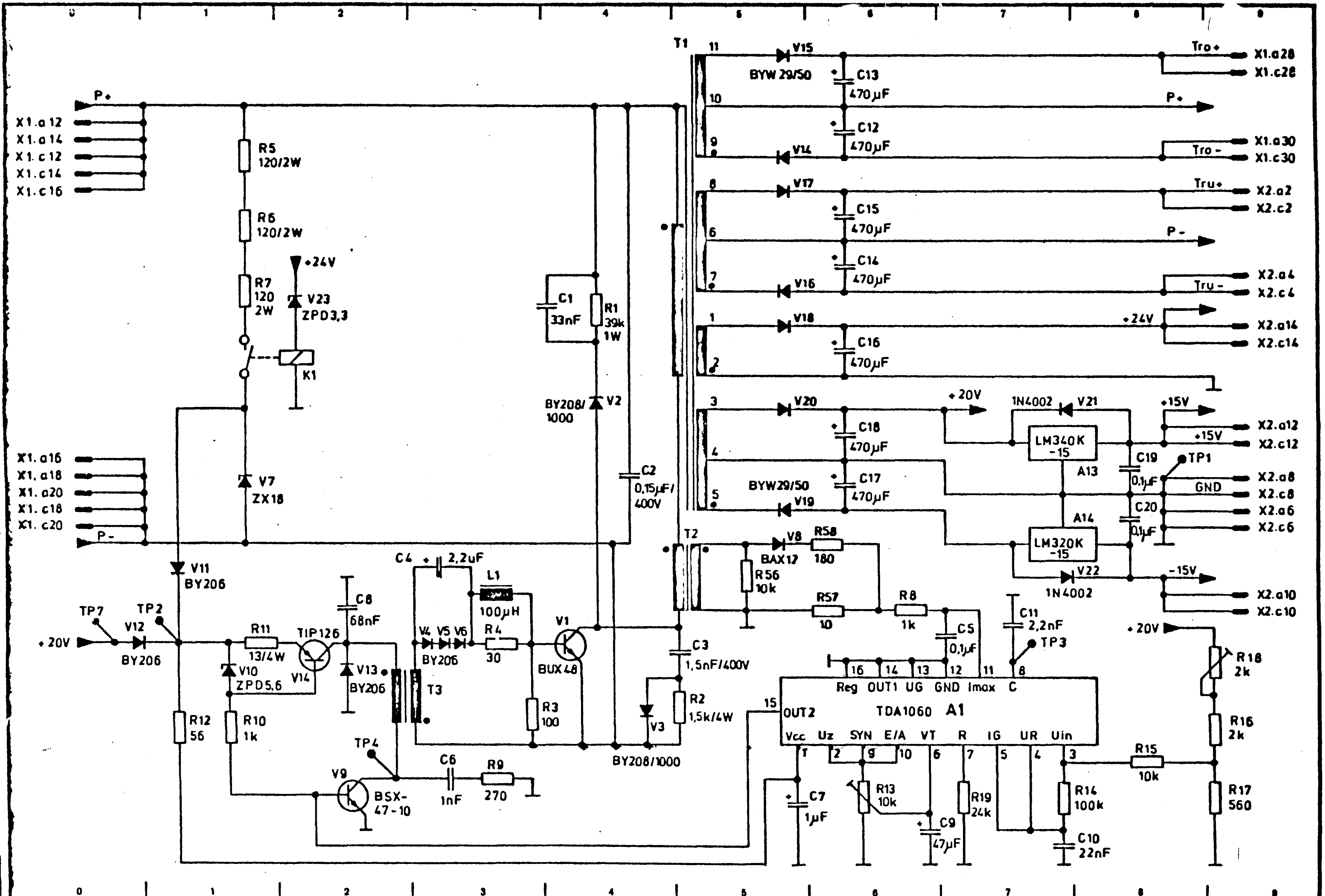
0 1 2 3 4 5 6 7 8 9

Anschluß Blatt	BOSCH INDUSTRIEAUSRUSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd.	Mittlg.	Datum	gez.	gepr.	Änd.	Mittlg.	Datum	gez.	gepr.	Tag gez. Z. gepr. N. gepr.	Benennung REGULATOR Regler 230 V Z. Nr. 038030-	Blatt 6 Blätter	Anschluß Blatt

Verfasser Nr.



Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd.	Mittlg.	Datum	gez.	gepr.	Änd.	Mittlg.	Datum	gez.	gepr.	Tag gez. Z. gez. Z. gepr.	Benennung REGULATOR Regler 230 V Z. Nr. 038030 -	Blatt 7 Blätter	Anschluß Blatt



Fall von Schutzrechtsanmeldungen. Jede Verfügungsbefugnis, wie Kopier- und Weitergaberecht, bei uns.

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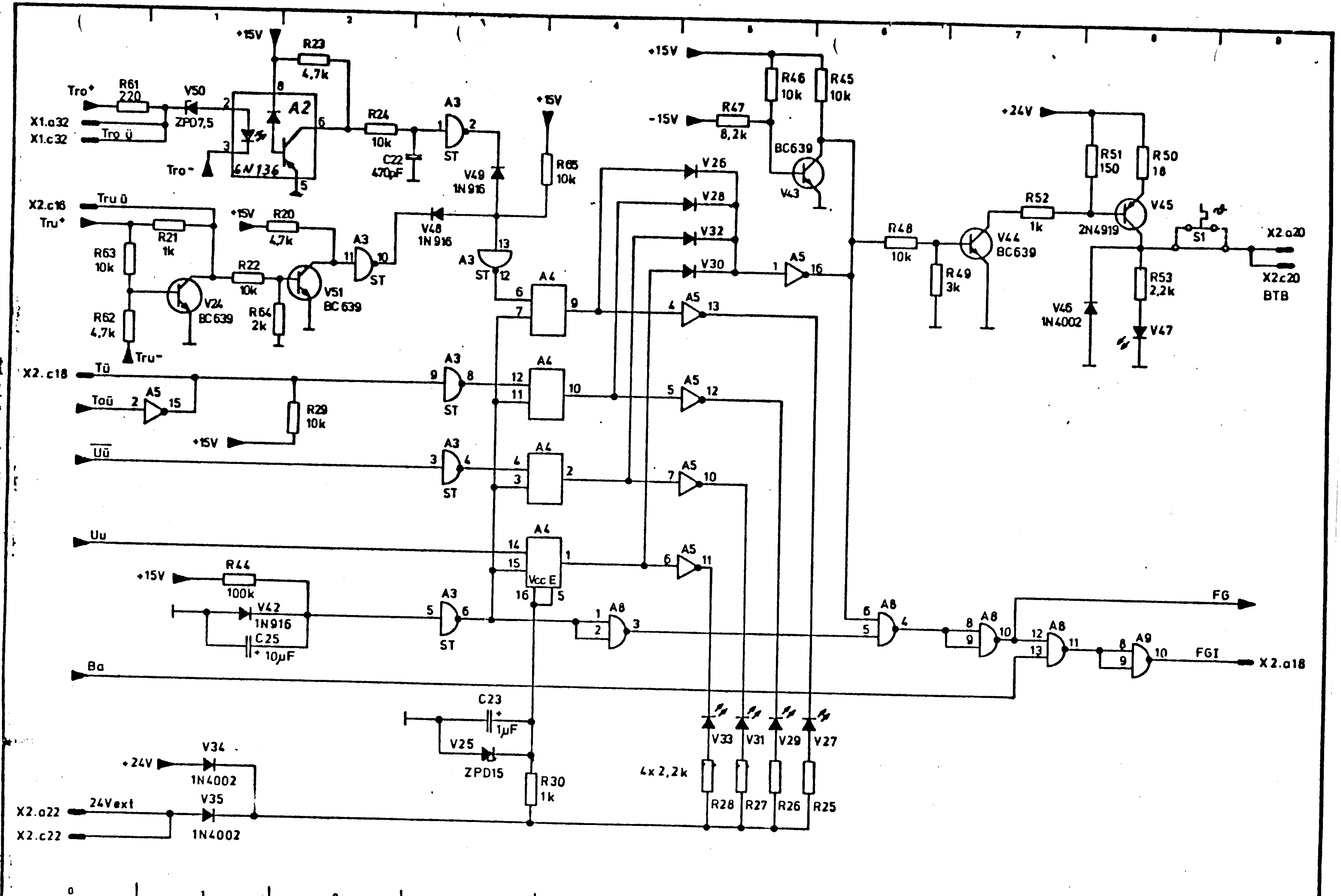
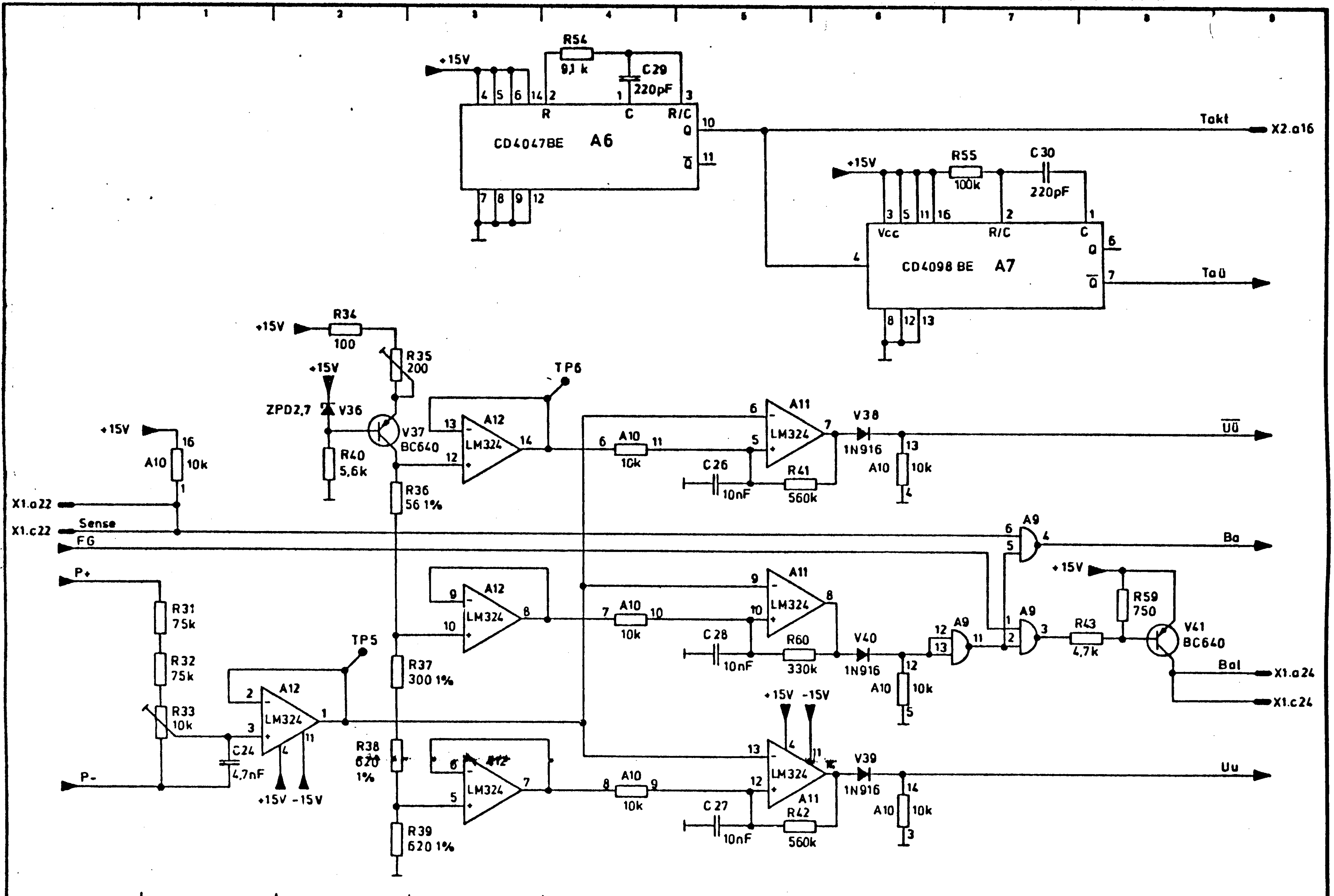
BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Benennung PSU Netzteil 230 V	Blatt 2
	Z. Nr. 038035 -	Blätter

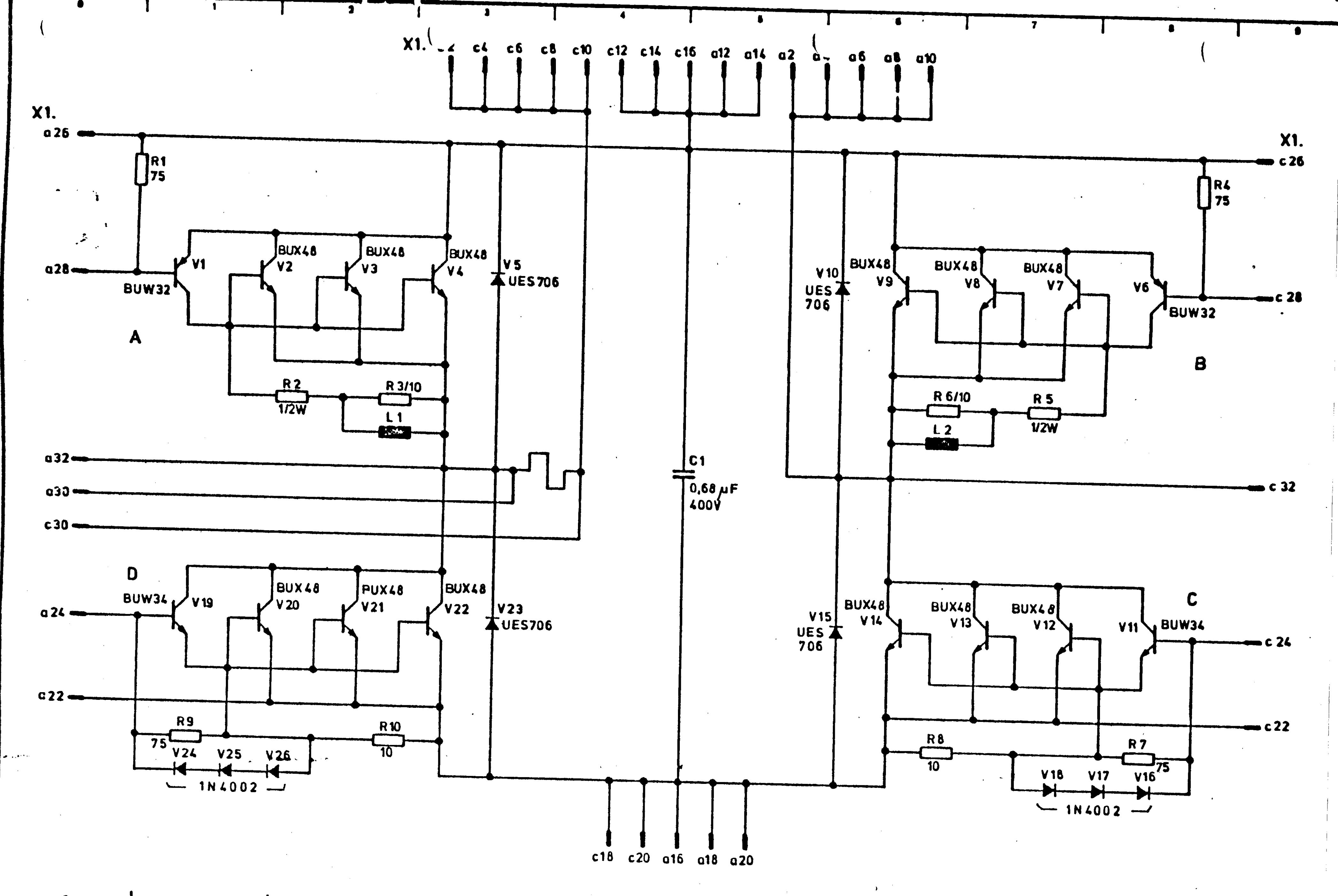


Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	333 202	Tag gez. Z. gepr. N. gepr.	Benennung PSU Netzteil 230V	Blatt 3 Blätter	Anschluß Blatt
			Änd. / Mittlg. / Datum / gez. / gepr. / Änd. / Mittlg. / Datum / gez. / gepr.		Z. Nr. 038035 -		



Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd.	Mitteil.	Datum	gez.	gepr.	Änd.	Mitteil.	Datum	gez.	gepr.	Tag gez. Z. gepr. N. gepr.	Benennung PSU Netzteil 230V Z. Nr. 038035 -	Blatt 4 Blätter	Anschluß Blatt

Verteiler Nr.



Verteiler Nr.

Anschluß Blatt

BOSCH INDUSTRIEAUSRÜSTUNG
Industrielle Steuerungselektronik
6120 ERBACH/ODW

Ers. für

Ers. durch

Änd.	Mittlg.	Datum	gez.	gepr.	Änd.	Mittlg.	Datum	gez.	gepr.
					102	18573	21.5.81		

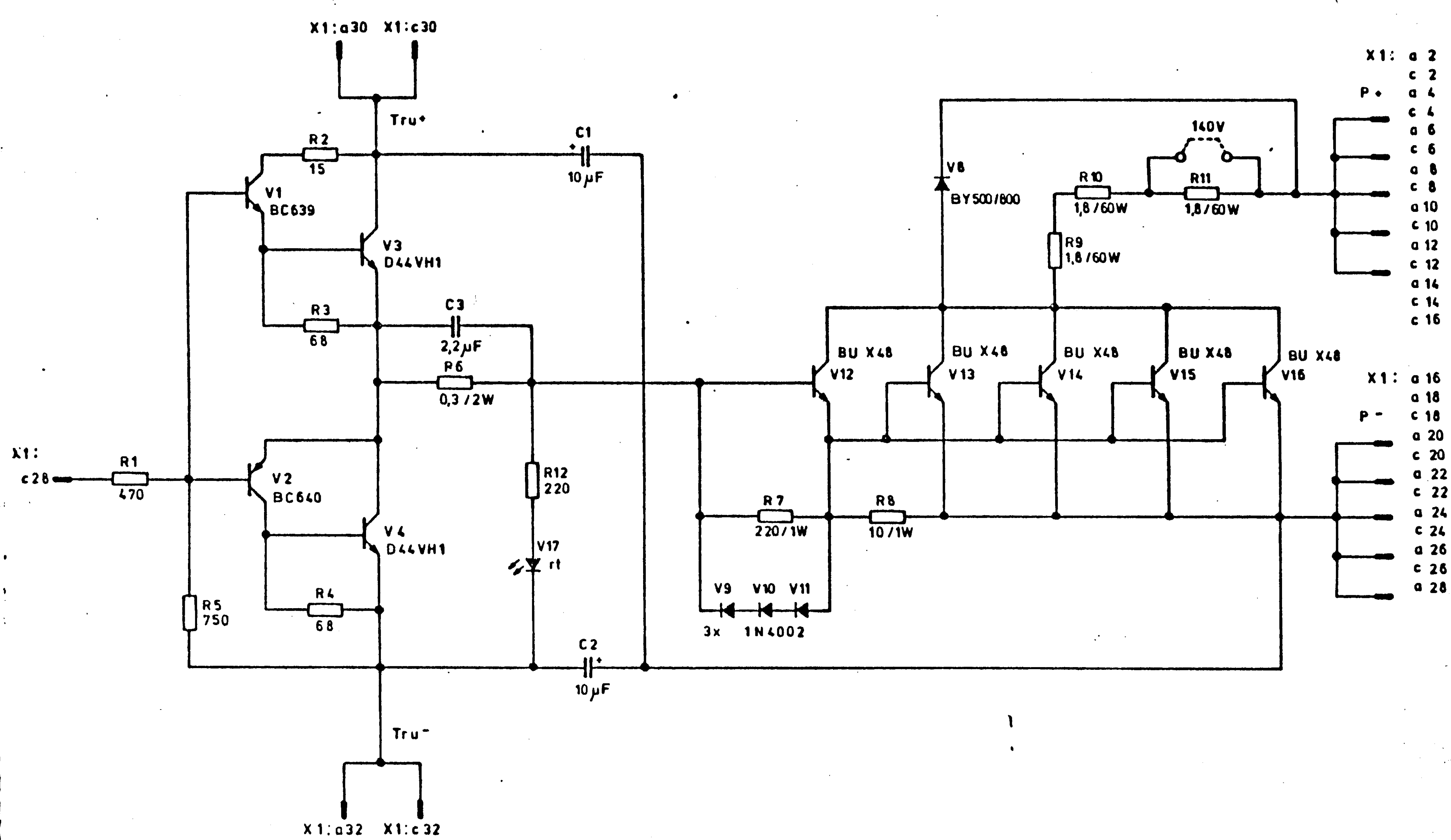
Tag 7.4.81
gez. Steiger
Z. gepr.
N. gepr.

Benennung POWER STAGE
Leistungsstufe

Z. Nr. 038028 – 102303

Blatt 1

Blätter 1



Anschluß Blatt	BOSCH INDUSTRIEAUSRÜSTUNG Industrielle Steuerungselektronik 6120 ERBACH/ODW	Ers. für Ers. durch	Änd.	Mittlg.	Datum	gez.	gepr.	Änd.	Mittlg.	Datum	gez.	gepr.	Tag gez. Z. gepr. N. gepr.	Benennung BRAKING CHOPPER Ballastschaltung Z. Nr. 038072-201303	Blatt 1 Blätter	Anschluß Blatt

Verpwer Nr.