



The SIMPLATRON d.c. converters of the 440 range with anti-parallel circuit fully controlled a.c. bridge, are designed for circulating current free regenerative operation. The main application area is the speed control of d.c. shunt-wound motors in four quadrant operation.

The 440 range comprises five controllers 441...445, which operate in the power range from 1.3...11 kW. All of the units have the same mechanical dimensions.

Special characteristics of these units are:

- Programmable controller characteristics
- Adaption in the current control circuit improves the response characteristics and gives minimum excitation times
- Protection against earth fault and power-stack overloading
- Built-in set-value integrator
- Built-in field rectifier, field fuse surveillance
- Self-synchronization, no readjustment required when changing from 50 Hz to 60 Hz mains
- Automatic adjustment of the impulse end stop limit with a control circuit
- Connection possibility for a standstill brake via internal standstill logic
- Display of the most important operational states with LED's
- Operation without tachogenerator with armature voltage feedback and $I \times R$ compensation is possible
- Internal surveillance logic when the mains are switched on or off
- Quick stop possible with control inhibit
- Current ratio controls

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Änderungen:
modifications:

Bearb. DRAWN	St/st	1.10.79	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr. MB 33.0408/1 GB c	Drawing-No.
Geprüft: checked:					

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Geprüft: checked:			LENZE KG 3250 HAMELN	MB 33.0408/2 GB	



Technical description of the
SIMPLATRON 440 range

Lenze
Elektronische Antriebstechnik

Table 1

Electrical data	441	442	443	444	445	
Article No.						
Chassis unit	308 655	308 656	308 657	308 658	308 659	
Article No.						
Encased unit	309 135	309 136	309 137	309 138	309 139	
Unit power output P_{el}	1.3	3.5	6	8	11	kW
Mains voltage U_{LN}	200...260	200...260	200...260	200...260	200...260	
50...60 Hz $L1L2$	-	-	340...460	340...460	340...460	V
2-phase						
Field voltage U_F	$0,9 \cdot U_{LN}$					V
Field current I_F	2	2	2	3.5	3.5	A
Armature voltage with choke U_A	150	150	260	260	260	V
Armature current I_A	8.5	23	23	31	43	A
Speed potentiometer R_1	10	10	10	10	10	k Ω
min. speed n_{min}	0...0.25	0...0.25	0...0.25	0...0.25	0...0.25	rpm
max. speed n_{max}	1...0.75	1...0.75	1...0.75	1...0.75	1...0.75	rpm
Current limit I_{max}	0.8...8.5	2...23	2...23	3...31	4...43	A
Nominal tacho voltage U_{TN}	10...180	10...180	10...180	10...180	10...180	V
Nominal master voltage U_{LN}	10...180	10...180	10...180	10...180	10...180	V
Ambient temperature T_U	0...45					°C

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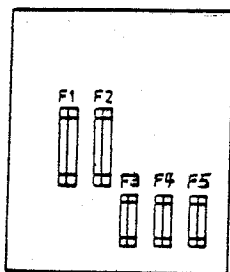
MASCHINENFABRIK STAHLKONTOR WESER
LENZE KG 3250 HAMELN

Zeichnungs-Nr. Drawing-No.
MB 33.0408/3 GB b

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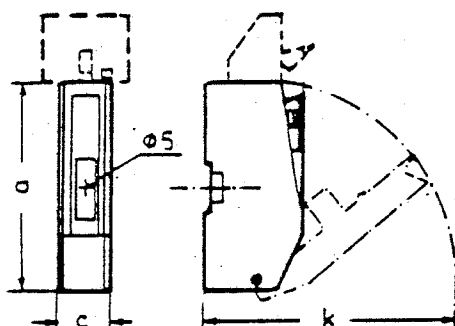
Änderungen:
modifications:

Electrical data		441	442	443	444	445
Power stack fuses F ₁ , F ₂ and external armature fuse	Si	<u>Ferraz</u> 600CPURE 14/20 <u>Siba</u> 5005806/20 Art. No. 305 321	<u>Ferraz</u> 600CPURE 14/32 <u>Siba</u> 5005806/32 Art. No. 307 943	<u>Ferraz</u> 600CPURE 14/32 <u>Siba</u> 5005806/32 Art. No. 307 943	<u>Ferraz</u> 600CPURE 22/50 <u>Siba</u> 5005806/50 Art. No. 307 173	<u>Ferraz</u> 600CPURE 22/80 <u>Siba</u> 5005806/80 Art. No. 307 174
Field supply fuses F ₃ , F ₄	Si	6.3x32 FF4/500 Art. No. 308 054	6.3x32 FF4/500 Art. No. 308 054	6.3x32 FF4/500 Art. No. 308 054	6.3x32 FF4/500 Art. No. 308 054	6.3 x32 FF4/500 Art. No. 308 054
Electronics fuses F ₅	Si	5x25 F1A/450 Art. No. 307 290	5x25 F1A/450 Art. No. 307 290	5x25 F1A/450 Art. No. 307 290	5x25 F1A/450 Art. No. 307 290	5x25 F1A/450 Art. No. 307 290



Position of the internal fuses on the principle print.

2.1 Armature fuse holder



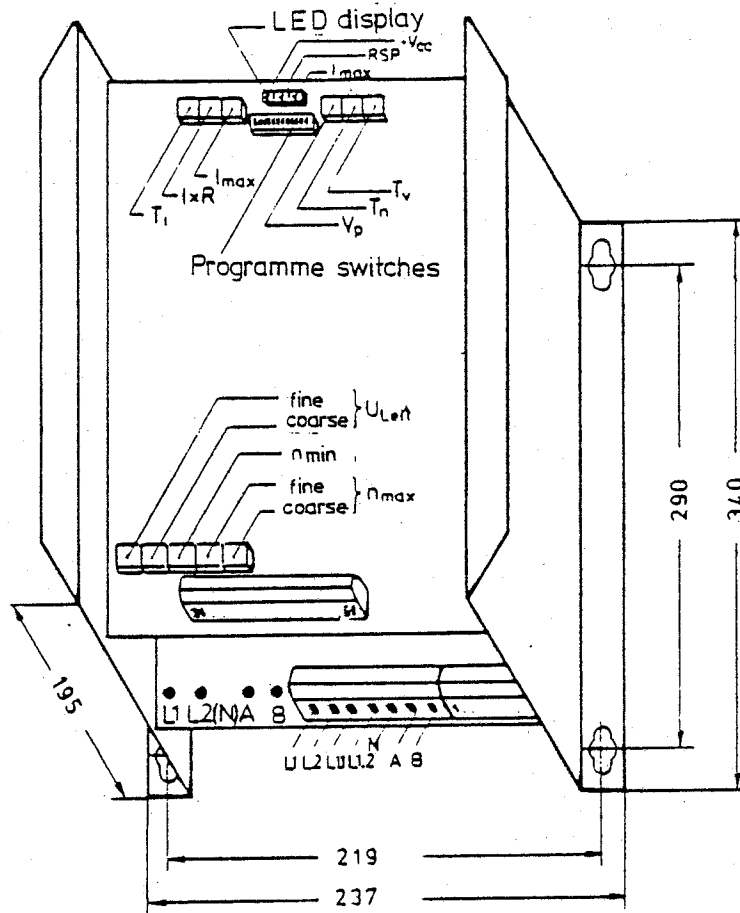
Unit	Holder Article No.	Dimensions mm		
		a	c	k
441... 443	308 290	110	27	132
444... 445	308 291	125	35	132

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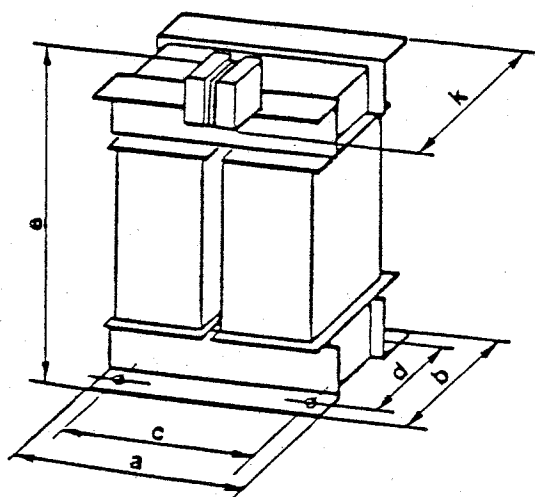
2.2 Chassis units 441 E...445 E

All five units 441 E to 445 E have the same dimensions.



2.3 Mains and armature chokes

Mains chokes



Unit	Art.-No.	L/mH	I/A	Dimensions mm					
				a	b	c	d	e	k
441	008 121	1x2,5	18	96	78	84	62	90	95
442	008 122	1x0,98	35	80	88	62	70	128	88
443	008 123	2x0,84	35	80	76	62	58	128	76
444	008 124	2x0,615	45	80	100	62	82	128	100
445	008 125	2x0,44	65	80	100	62	82	128	100

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Armature chokes selection table

Art.-No.	L/mH	I/A	Dimensions mm					
			a	b	c	d	e	k
308 579	60	5	150	106	122	86	135	110
	40	10						
310 332	40	10	150	124	122	101	132	-
	12	18						
308 580	46	15	175	128	155	105	290	150
	24	25						
310 334	18	23	152	128	140	90	221	-
	8	35						
308 581	28	26	200	140	175	115	325	165
	20	35						
310 335	29	35	240	204	210	122	368	-
	12	54						

2.4 Items delivered with the chassis unit:

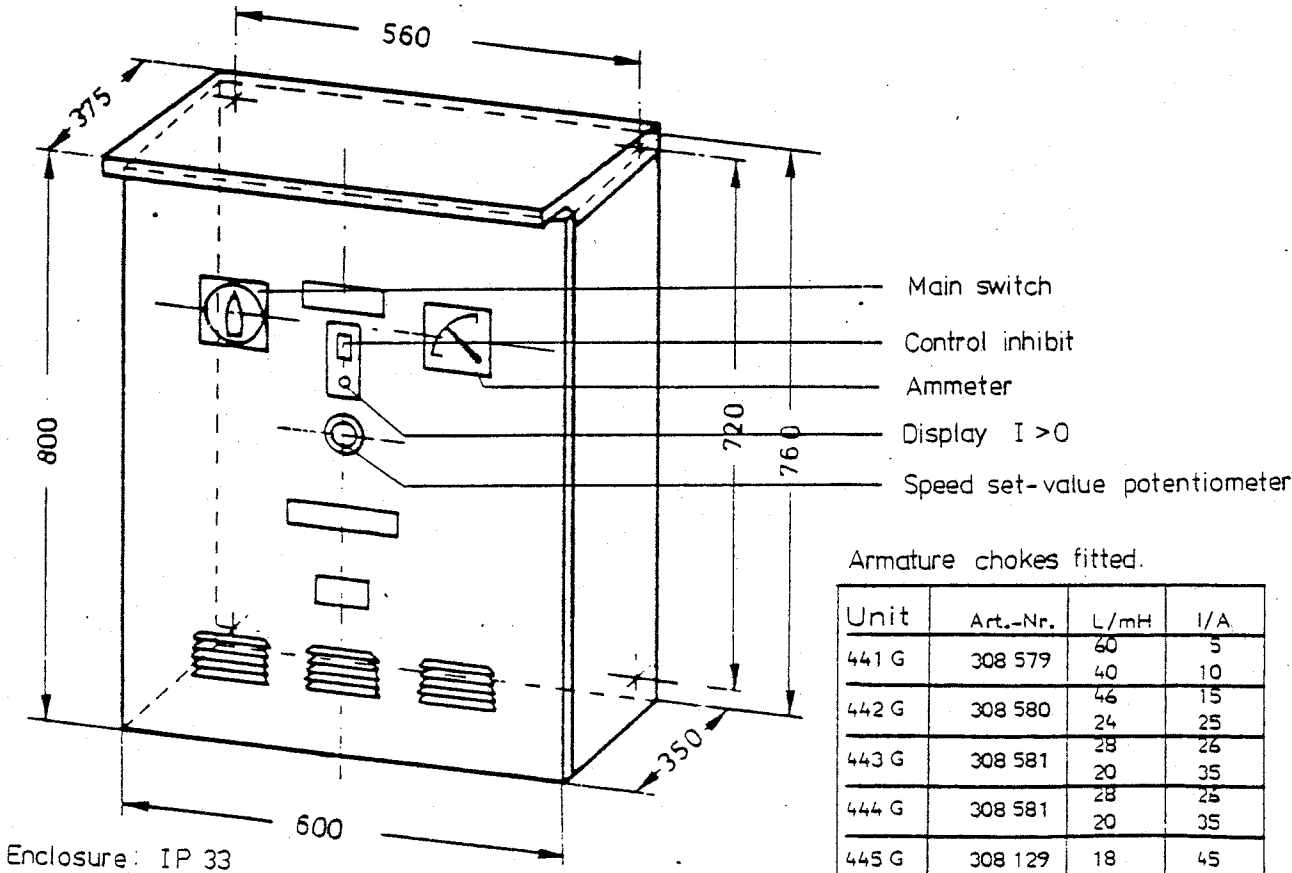
Set-value potentiometer 10 kOhm linear

Items which must be ordered separatly:

Mains choke, armature choke, turning knob and scale for set-value potentiometer, armature fuse and holder

2.5 Encased units 441 G...445 G

All five units 441 G to 445 G have the same dimensions



Armature chokes fitted.

Unit	Art.-Nr.	L/mH	I/A
441 G	308 579	60	5
		40	10
442 G	308 580	46	15
		24	25
443 G	308 581	28	26
		20	35
444 G	308 581	28	26
		20	35
445 G	308 129	18	45

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Geprüft: checked:					



2.6 Items delivered with the encased unit

Main switch, set-value potentiometer, turning knob and scale
Armature fuse with holder
Mains choke, armature choke
Ammeter with centre zero position
Control inhibit switch, yellow display "I=0"
Encased unit enclosure IP 33, completely wired and ready for connection
Built-in mains cut-out surveillance:

In order to prevent short circuit of the two bridges when operating with 4Q-controllers, the mains must only be disconnected during the drive phase or the braking phase when the motor is current free. This is displayed with the built-in surveillance. The following switch-off procedure must be used:

1. Switch control inhibit to zero
2. Wait until the yellow display signal extinguishes
3. Operate the mains switch

3. Mains choke - armature choke

Mains choke

According to VDE 0160, part 2 thyristor units should be connected to the supply mains via mains chokes (commutating chokes) with a relative short-circuit impedance of 4%. The inductances in table 2.3 have been chosen in accordance with this.

Armature choke

The armature choke reduces the form factor of the d.c. (441 and 442 F_F permissible = 1.2 , 443...445 F_F permissible = 1.1).

It must be noted, that with increased form factors, the effective value of the current in the mains supply increases also, so that the fuses get too hot.

Definition: $F_F = \frac{\text{Effective value of the armature current}}{\text{Arithmetic mean value of the armature current}}$

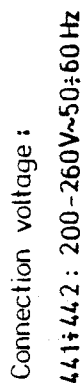
The effective value can be measured with a moving iron instrument, the arithmetic mean value with a moving coil instrument.

4. Armature fuse

In order to protect the controllers when the reverse rectifier flips over (short-circuit in the d.c. circuit), a fuse is necessary in the d.c. circuit. The type of fuse used must be the same type as that used in the power stack (F_1 , F_2) of the controller being used.

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5.1 Connection diagram for the controllers 441 and 442



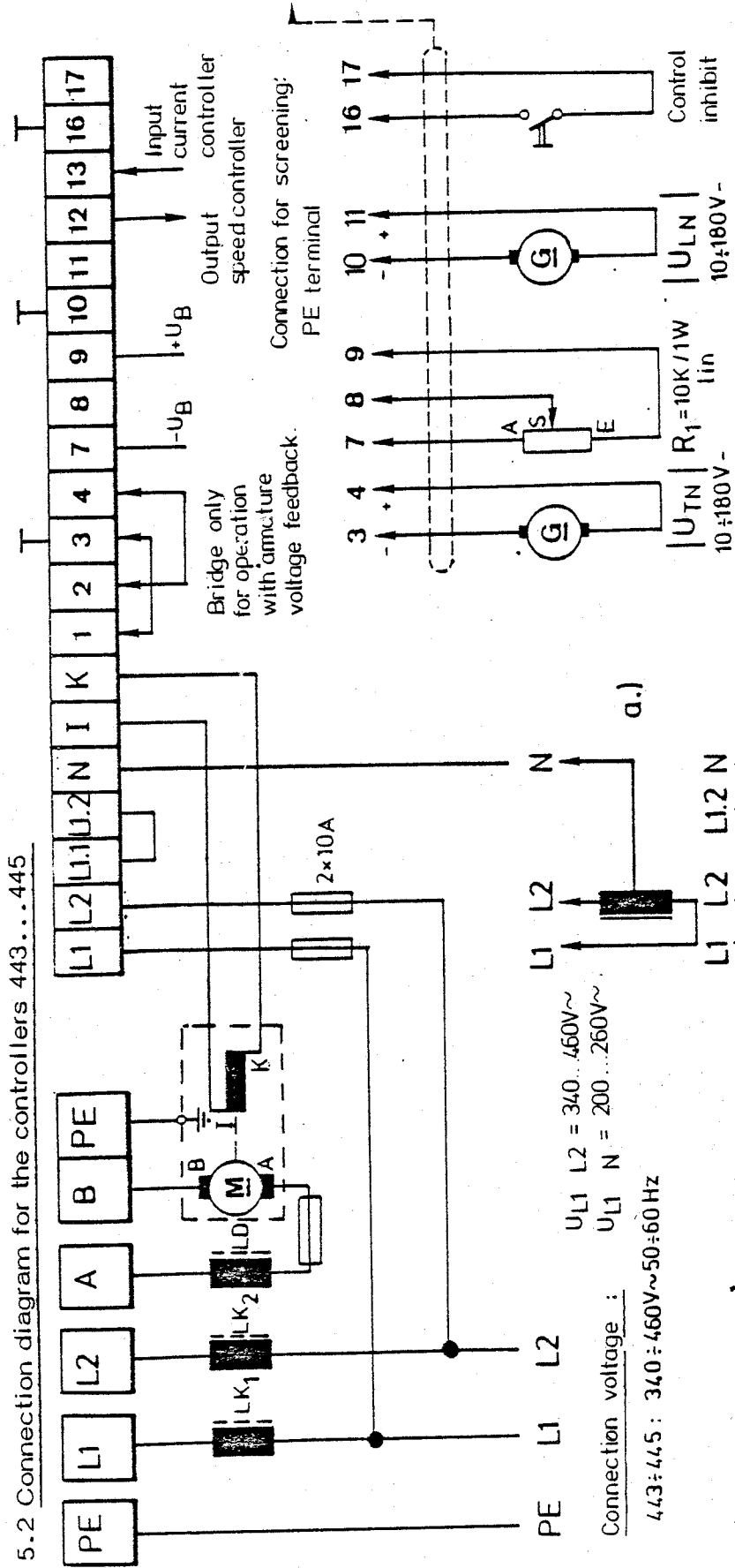
With thyristor drives, which allow reverse rectifier operation, the a.c. mains supply must only be switched off, when the drive is at a standstill and in a current free state.

For switching sequence see 8.6.2.

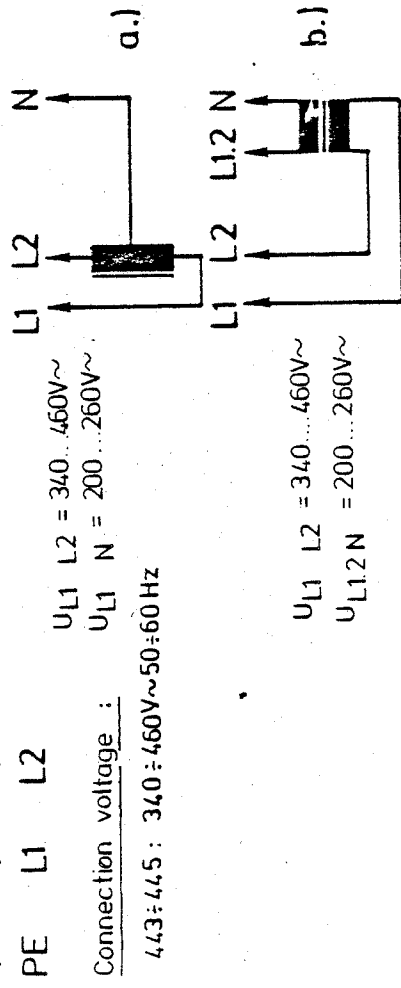
SWH / E / RS / 5 / 12.76 LuK



5.2 Connection diagram for the controllers 443...445



If a loadable N (Neutral) is not available for the field supply circuit, a.) or b.) should be chosen.
With circuit b.), the bridge from L 1.1 to L 1.2 must be removed.



Caution:
With thyristor drives, which allow reverse rectifier operation, the a.c. mains supply must only be switched off when the drive is at a standstill and in a current free state.

For switching sequence see 8.6.2.

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Zeichnungs-Nr. Drawing-No.
MB 33.0408/9 GB c

6. Field connection

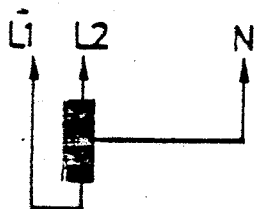
6.1 Field connection with loadable N (Neutral)

Field exciting power:	Controller 441	400 W
	Controller 442	400 W
	Controller 443	400 W
	Controller 444	700 W
	Controller 445	700 W

Field voltage: 200 V —

If a loadable mid-point conductor is available from the mains, then it must be connected to terminal N. The terminals L 1.1 and L 1.2 must be connected with a 1.5 mm² cross-section wire bridge. If a loadable mid-point conductor is not available, the field can be supplied via an auto-transformer or an isolating transformer.

6.2 Field connection via an auto-transformer

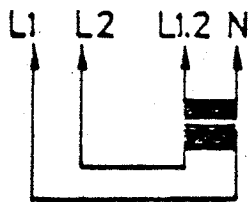


Voltage between L 1 . and L 2 340...460 V ~

Voltage between L 1 and N 200...260 V ~

The bridge between L 1.1 and L 1.2 remains in place

6.3 Field connection via an isolating transformer



The bridge between L 1.1 and L 1.2 is removed

Voltage between L 1 and L 2 340...460 V ~

Voltage between L 1.2 and N 200...260 V ~

The transformers must be chosen for the field exciting power being used.

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7. Modes of operation

7.1 Speed control with d.c. tacho

The d.c. tacho is connected to terminals 3 (-) and 4 (+). In order to achieve the nominal speed of the drive, the nominal value of the tacho voltage can be in the range from + 10 V to + 180 V. The polarity of the tacho voltage depends on rotational direction. Therefore the polarity must be considered when the tacho is connected. The speed drop between no load and nominal load is lower than 5 r.p.m. within the whole speed range. The control range is larger than 1 : 40.

7.2 Speed control with armature voltage feedback and $I \times R$ compensation

If the controller is to operate without tacho feedback, then it can be operated with $I \times R$ compensation. With this mode of operation, the speed regulator is supplied with a set-value which is proportional to the armature current. In this way a reduction in the speed to torque characteristic drop, caused by the internal voltage reduction of the d.c. motor is possible. The set-value increase necessary for $I \times R$ compensation is taken care of internally by the controller with the respective correct polarity. Because of this, 4-quadrant operation is also possible with the 440 range with this operating method.

In order to couple the armature voltage with the speed regulator, two bridges must be made at the terminal block between terminals 1 and 3 and between terminals 2 and 4.

This procedure nullifies the isolation from the mains. If however, isolation is required, then an isolation amplifier must be used instead of the wire bridges.

The compensation is adjusted exactly to the drive with the $I \times R$ trimmer. The control range is larger than 1 : 20.

7.3 Armature current control

The set-value of the current is set between I_{min} and the units nominal current with the " I_{max} " trimmer. Because the motor torque with constant flux is proportional to the armature current, a torque control with the armature current is possible.

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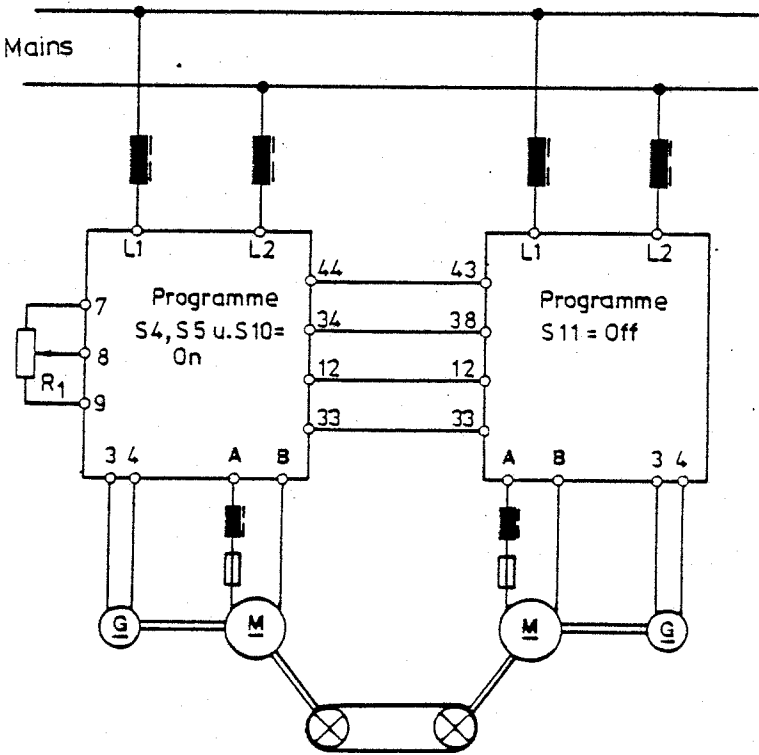
7.4 Impulse positioning limit I_{min}

The pulse positioning with rectifier operation and with reverse rectifier operation are adjusted automatically with a control circuit.

The maximum control angle must be limited to 150° at rated current, whilst considering the release time and the commutating duration of the thyristors. At lower currents the release time and commutating duration are shortened. The control angle limitation is current dependant and has an internal control circuit. Operating range of the control circuit: $150^\circ \text{ el} \dots 170^\circ \text{ el}$. Because of the impulse positioning limitation, the current I_{min} is achieved when the current set-value = 0.

7.5 Current ratio control

If several drives are connected together mechanically, the torque direction signal is given by the master drive only. On all consequent drives, the programme switch S 11 must be opened to the position "OFF" (0). Terminal 44 of the master drive must be connected to terminal 43 of the subsequent drives. The programme switch S 4 must be at "ON" (1) on the master drive and at "OFF" (0) on the subsequent drives.



7.6 Master voltage operation

Instead of the set-value potentiometer, an external master voltage can be connected to adjust the speed. The master voltage is connected to terminals 10 (-) and 11 (+). In order to achieve the nominal speed of the drive, the maximum value of the master voltage can be between $\pm 10 \text{ V=}$ and $\pm 180 \text{ V=}$. The master voltage is adjusted to the drive with the trimmer "U_{Leit} coarse". If an exact synchronization is required with a multi-motor drive, an exact

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adjustment can be made with the " $U_{Leit\ fine}$ " trimmer.

The potential of the master voltage at terminal 11 determines the potential of the other connected units.

7.7 Galvanic isolation

If the controller is to operate together with other electronic units, a galvanic isolation from the mains is necessary. The actual value of the armature current is sensed potentially free by means of an a.c. transformer with the 440 range. When operating the controller with armature voltage feedback, the armature voltage must be fed back potentially free via an isolation amplifier.

8. Functions

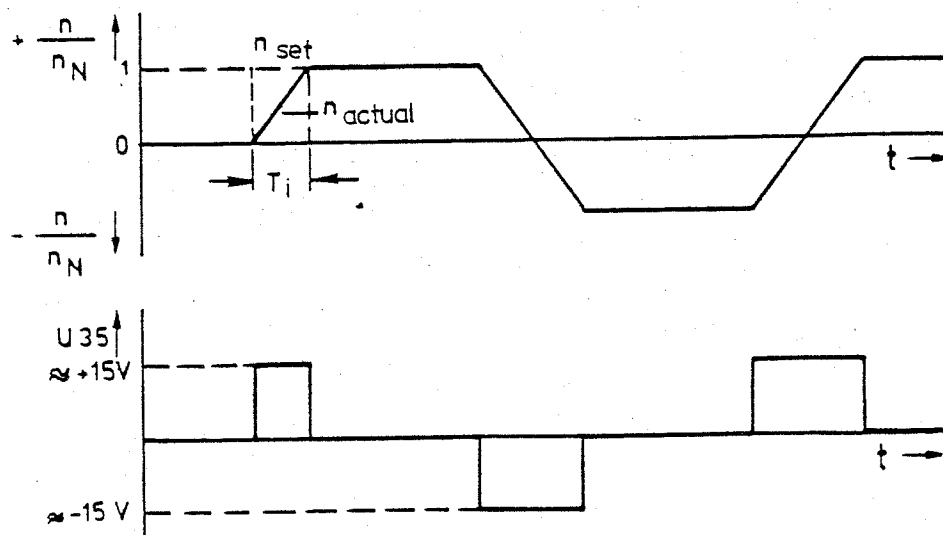
8.1 Set-value integrator "SWI"

With speed controlled drives, an adjustable acceleration or deceleration time is often a requirement.

The serially built-in set-value integrator "SWI" delivers a linear acceleration and deceleration function within the whole speed range. The time constant is adjustable with the " T_i " trimmer. The range can be additionally enlarged by a factor of 10 with the programme switch (S 2).

S 2 off (0): $T_{i0} = 0.5\text{ s} \dots 5\text{ s}$

S 2 on (1): $T_{i1} = 5\text{ s} \dots 50\text{ s}$



Set-value step n_{set} and speed response n_{actual}

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A signal is formed in the set-value integrator, which gives the direction of the acceleration of the drive. At terminal 35 a positive signal is achieved while the drive is accelerating and a negative signal while decelerating.

At the end of the acceleration phase, a voltage of 0 V is aquired. The output resistance is 20 kOhms, the signal deviation ± 15 V.

This signal can be used in winding plants as an acceleration (retarding) bonus signal. During the acceleration phase the winding drive can be given an acceleration or retarding bonus signal $\pm dn/dt$.

8.2 Response of the controller adaption

The current controller has been designed as a permanently connected PI-controller. The various controlling behaviours of the current regulating circuit are compensated for with a self-correcting control circuit (adaption). Soldering positions are available for special applications.

The speed controller is designed as a PID-controller.

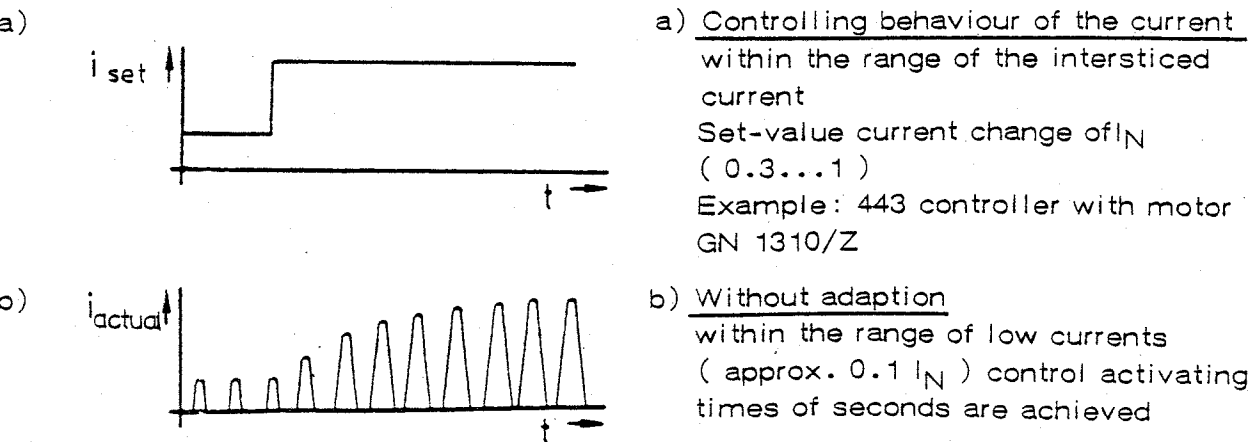
Choice of PI -controller
or PID-controller

Programme switch 6 "OFF" (0)
Programme switch 6 "ON" (1)

The proportional amplification can be adjusted on the V_p trimmer, the integration time on the T_n trimmer and the rate time on the T_v trimmer. The controlling parameters can be adjusted individually and independant from each other.

The parameters of the control system of a current rectifier drive change with the change-over from intersticed to continuous armature current. Whereas with continuous armature current operation, the current flows continuously, a pulse-type current is formed with intersticed operation. This operating mode has no armature circuit constant, which means, that a speed controller, which is adjusted for continuous current, shows very poor control response with intersticed current. This has the worst effect on low armature currents. This disadvantage is avoided with an adaption, which always produces constant parameters in the current regulating circuit.

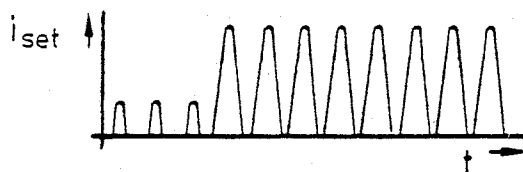
The following diagram shows the quality advantages of the adaption.



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c)



c) With adaption

constant control activating times similar to those with continuous current operation are achieved even with very low currents. The control activating times are shorter by a factor of approx. 10 than the times without adaption.

8.3 Adjustment range of the speed controller

1. V_p : Continual variation of the proportional amplification in the ratio of 10 : 1 on the V_p trimmer

Programme switch 9 in the "OFF" (0) position $V_{pmax} = 200$

Programme switch 9 in the "ON" (1) position $V_{pmax} = 20$

2. T_n : Variation of the integration time in the ratio of 50 : 1 on the T_n trimmer

Programme switch 1 in the "OFF" (0) position $T_{nmax} = 16 \text{ ms}$

Programme switch 1 in the "ON" (1) position $T_{nmax} = 1200 \text{ ms}$

3. T_v : Pre-stopping time T_v (D-component)

Programme switch 6 in the "OFF" (0) position no D-component

Programme switch 6 in the "ON" (1) position D-component circuited

The pre-stopping time can be varied in the ratio of 10 : 1 on the T_v trimmer

Programme switch 3 in the "OFF" (0) position $T_{vmax} = 60 \text{ ms}$

Programme switch 3 in the "ON" (1) position $T_{vmax} = 700 \text{ ms}$

4. From the control parameters of the PI-controller

V_p : Proportional amplification

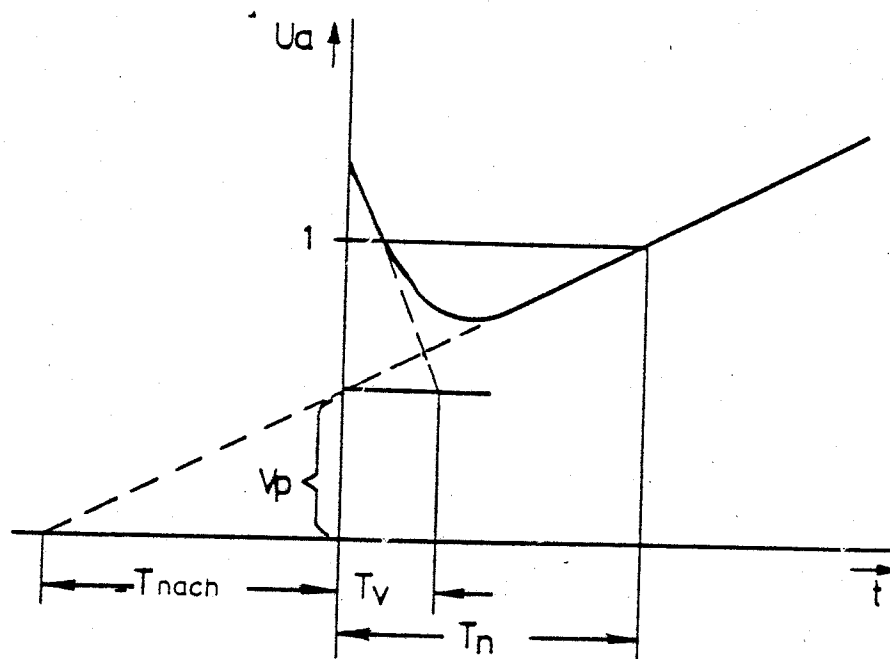
T_n : Integrating time and

T_{nach} : Reset time

$T_{nach} = V_p \times T_n$ is aquired

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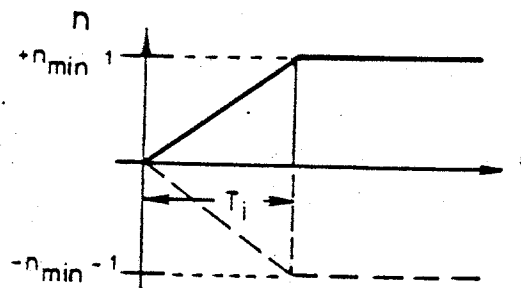
Jump response of the speed controller (PID)



8.4 Minimum speed n_{min}

If the d.c. motor is to run at a certain speed when the mains are switched on but the set-value selected is 0 V, this minimum speed can be selected with the n_{min} trimmer (rotational direction depending on the polarity of n_{min}).

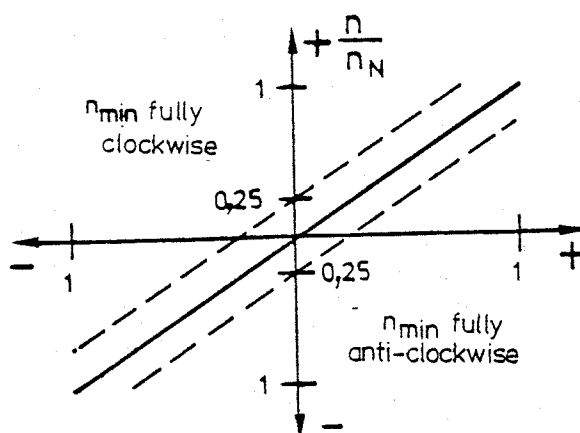
Programme switch S 8 = ON (1)



With this mode of operation, a speed set-value which is adjustable on the n_{min} trimmer is supplied to the speed controller via an acceleration integrator. The adjustment of the time T_i is made on the T_i trimmer (see 8.1). $n_{min} = 0$ r.p.m. can be achieved, when the programme switch S 8 is in the OFF (0) position.

With this programme switch position S 7 = OFF (0) and S 8 = ON (1), the master voltage or potentiometer characteristic is shifted parallel with the n_{min} trimmer.

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER	Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:			LENZE KG 3250 HAMELN	MB 33.0408/16 GB	



With the programme switch S 7 ON (1) and S 8 OFF (0), the offset adjustment of the speed controller can be made with the $n_{\min}$ trimmer.

8.5 Voltage and temperature surveillance

Programme switch S 12 in the ON (1) position

The mains voltage and the positive supply voltage are observed internally within the controller. If the mains voltage falls below 200 V~ (441, 442) or 340 V~ (443...445), or if the positive supply voltage + V_{CC} which normally has a value of + 15 V-, reaches a value of < 12 V-, the internal control inhibit is operated. The voltage surveillance has not got self-holding.

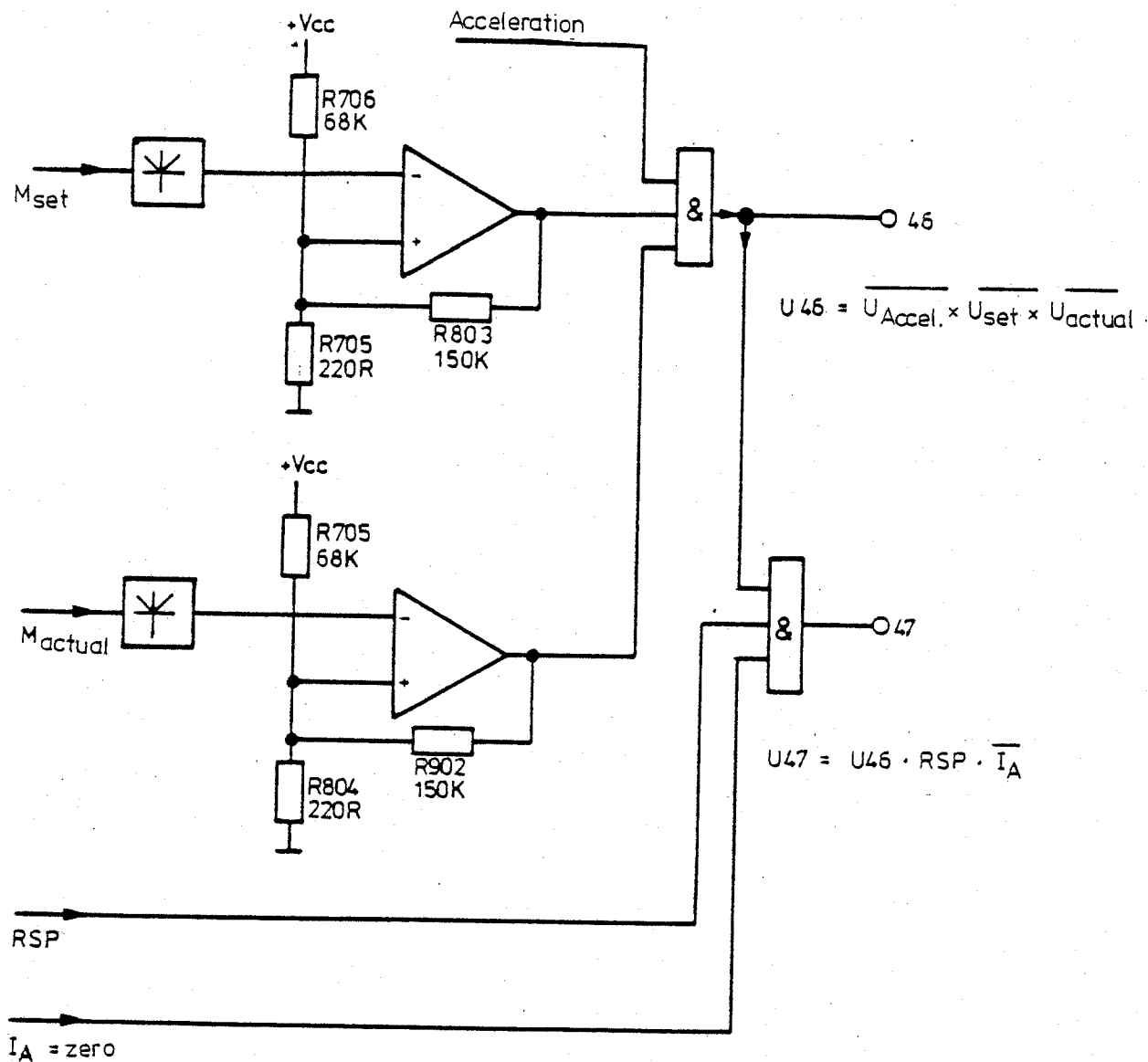
The temperature of the power semi-conductors are observed by a temperature sensor. If the temperature of the cooling block exceeds the temperature limit $\vartheta_{\text{limit}} = 90^{\circ}\text{C}$, the control inhibit "RSP" is operated internally within the controller. The LED "RSP" reports the temperature exceedance. An electrical blocking system prevents the unit from switching on again, even when the unit has cooled down again. Before putting the controller back into operation, the mains must be switched off and the cause of the temperature increase corrected. When the mains are switched on again, the controller is ready for operation.

Programme switch S 12 in the "OFF" (0) position see 8.11, terminal 41.

The 440 range is designed for an ambient temperature of from $0^{\circ}\dots45^{\circ}\text{C}$.

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr. MB 33.0408/17 GB	Drawing-No.
Geprüft: checked:					

8.6 Standstill logic and mains cut-out surveillance



8.6.1 Standstill logic

The 440 controller range has a standstill logic. If the speed set-value, speed actual value and acceleration are zero, a standstill brake can be activated via terminal 46. When the control inhibit is operated, the signal is given when the drive is at a standstill.

8.6.2 Mains cut-out surveillance

With thyristor drives, which allow reverse rectifier operation, the supply mains a.c. voltage must not be switched to a currentless state until the drive is at a standstill, otherwise a short-circuit in the d.c. circuit can occur via the power stack. With the 440 range, the mains contactor can be locked via the internal mains cut-out surveillance.

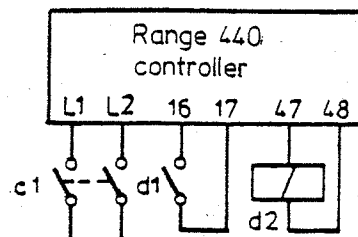
Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:				MB 33.0408/18 GB	



Caution: When the fuses F_1 , F_2 (power stack) blow, this latching system is not neutralized.

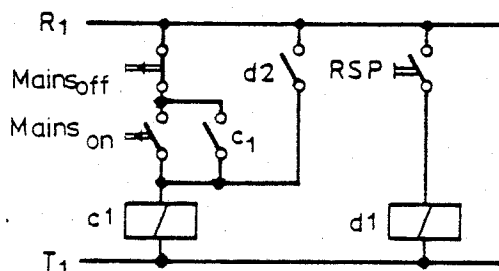
Switching sequence:

Switching on the mains, operate "mains on" push button, open the control inhibit switch "RSP", the drive accelerates to the speed set on the set-value potentiometer.



Switching sequence:

Switching the mains off, close the control inhibit switch "RSP", the drives brakes down to standstill with $i = I_{max}$. The mains can be switched off, when d_2 has deactivated.



8.7 Status display on the 4018 module

The most important operational states are displayed with three LED's. In this way commissioning as well as the adjustment and the servicing are considerably simplified.

1. Positive supply voltage + V_{cc}

The "+ V_{cc} " LED lights up, when the supply voltage + $V_{cc} = + 15 V$.

2. LED "RSP"

The "RSP" LED lights up, when the control inhibit is operated. To check this function, terminals 16 and 17 are short-circuited. The control inhibit is also operated by other internal surveillance functions, but only, when programme switch S 12 = ON (1). They are:

- a) Temperature surveillance of the cooling block
- b) Mains voltage and field surveillance

3. Current limit I_{max}

The " I_{max} " LED lights up, when the controller is in the current limit.

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr. MB 33.0408/19 GB	Drawing-No.
Geprüft: checked:					

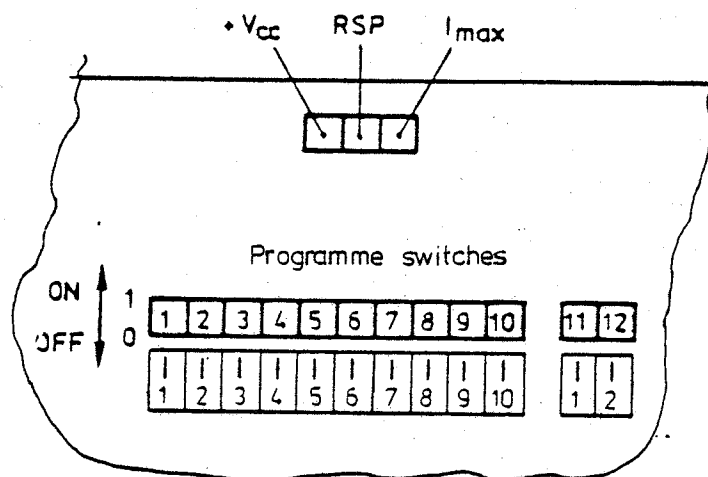
8.8 Control inhibit

The control inhibit "RSP" is operated by closing a low current contact between terminals 16 and 17. This causes an internal setting of the speed set-value to zero, which in turn causes the drive to brake with I_{max} .

8.9 Self-synchronization

The controllers feature self-synchronization. When changing from a 50 Hz mains to a 60 Hz mains, an adjustment of the thyristor firing control system is not necessary.

8.10 Function of the programme switches



Switch	Position	Function
S 1	on (1)	Integration time of the speed controller
	off (0)	long integration time of the speed controller $T_{Nmax} = 1200 \text{ ms}$ short integration time of the speed controller $T_{Nmax} = 16 \text{ ms}$
S 2	on (1)	Set-value integrator T_i
	off (0)	$T_i = 5 \dots 50 \text{ s}$ $T_i = 0.5 \dots 5 \text{ s}$
S 3	on (1)	10-fold value of the pre-stopping time $T_{vmax} = 700 \text{ ms}$
	off (0)	1-fold value of the pre-stopping time $T_{vmax} = 60 \text{ ms}$
S 4	on (1)	Normal operation with internal adjustment of the current limit
	off (0)	External adjustment of the current set-value, n-controller inoperable, n-controller can be used to limit the max. speed

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER	Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:			LENZE KG 3250 HAMELN	MB 33.0408/20 GB	



Technical description of the
SIMPLATRON 440 range

Lenze
Elektronische Antriebstechnik

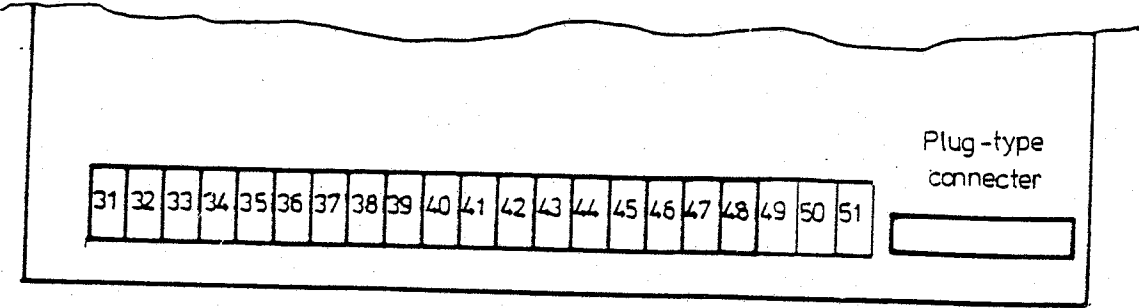
Switch	Position	Function
S 5	on (1)	Quick controller response, limited amplification of the n-controller
	off (0)	High controller accuracy, large amplification of the n-controller
S 6	on (1)	Addition of D-component, adjustment of the pre-stopping time on the T_V trimmer
	off (0)	No D-component (D = Differential)
S 7	on (1)	The n_{min} trimmer is used as an offset adjustment on the speed controller
	off (0)	No offset adjustment
S 8	on (1)	The minimum speed is supplied to the speed controller via the set-value integrator (adjustable on n_{min})
	off (0)	Minimum speed = 0
S 9	on (1)	Reduction of the proportional amplification $V_{pmax} = 20$
	off (0)	$V_{pmax} = 200$
S 10	on (1)	The standstill logic inhibits the I-component in the speed controller (prevent drifting with a set-value of zero) (I = Integral)
	off (0)	Speed controller operates independent of the standstill logic
S 11	on (1)	Normal operation
	off (0)	Torque direction supply activated, terminal 43, the internal torque comparator disconnected from the reversing logic (current ratio control
S 12	on (1)	The internal surveillance functions, mains undervoltage and temperature surveillance operate the control inhibit
	off (0)	Internal surveillance functions are switched off. When these functions report faults the control inhibit is not automatically operated

Bearb. DRAWN	St/st	78-11-10
Geprüft: checked:		

MASCHINENFABRIK STAHLKONTOR WESER
LENZE KG 3250 HAMELN

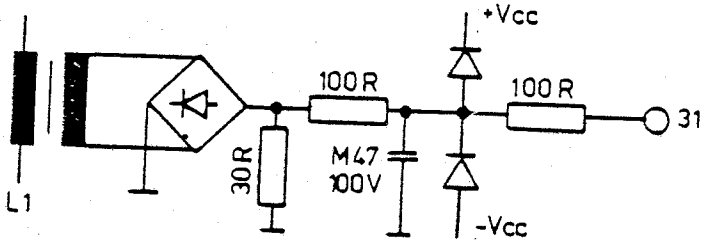
Zeichnungs-Nr. Drawing-No.
MB 33.0408/21 GB

8.11 Functions of the supplementary terminals on the 4018 module

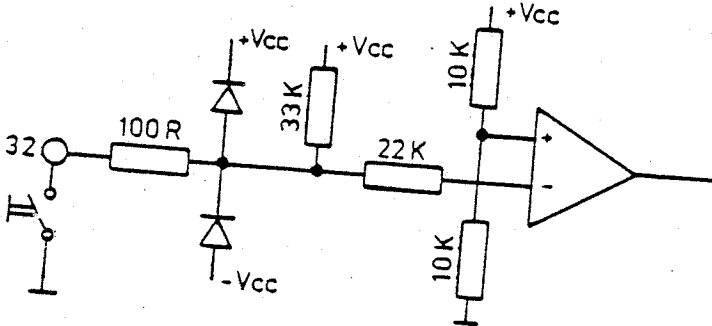


In able to increase the application range of the 4018 module, a number of controller functions have been taken out onto a terminal block.

Terminal 31 Actual current value = - 2.5 V at $I_A = I_{Amax}$

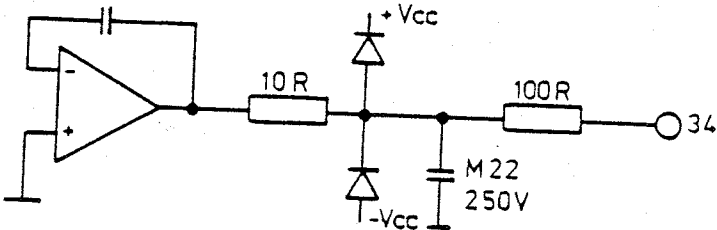


Terminal 32 By connecting this terminal to GND, the set-value integrator can be externally reset.



Terminal 33 GND (system earth)

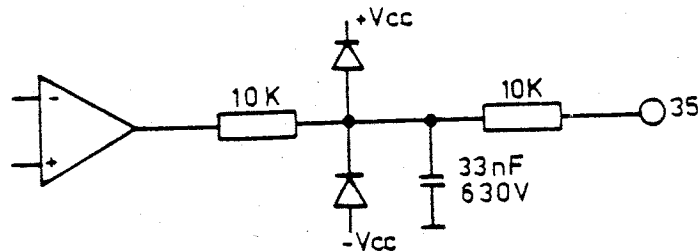
Terminal 34 Output of the set-value integrator ± 10 V



Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr. MB 33.0408/ 22 GB	Drawing-No.
Geprüft: checked:					

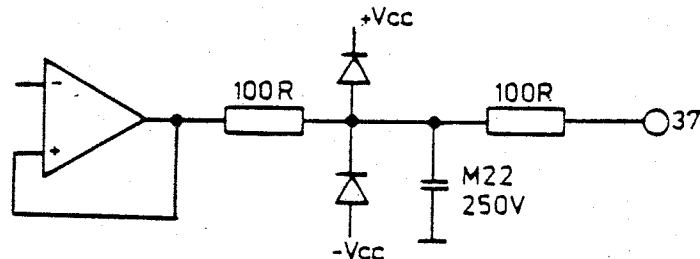


Terminal 35 Acceleration identification $\pm 15\text{ V}$

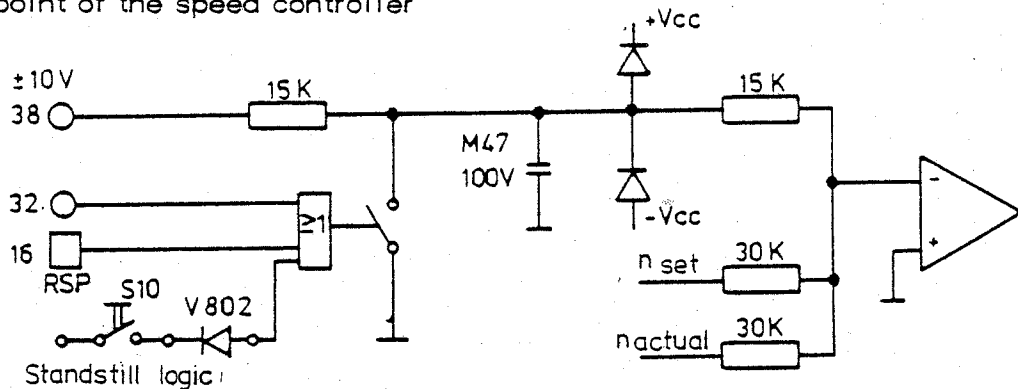


Terminal 36 GND

Terminal 37 Actual speed value $n_{\max} \hat{=} \pm 10\text{ V}$



Terminal 38 Freely usable input, which is connected to the summation point of the speed controller



Input 38 is switched off, when control inhibit "RSP" (terminal 16) is operated, or when the acceleration integrator is externally set to zero via terminal 32, or when the standstill logic has activated (programme switch S 10 on (1)).

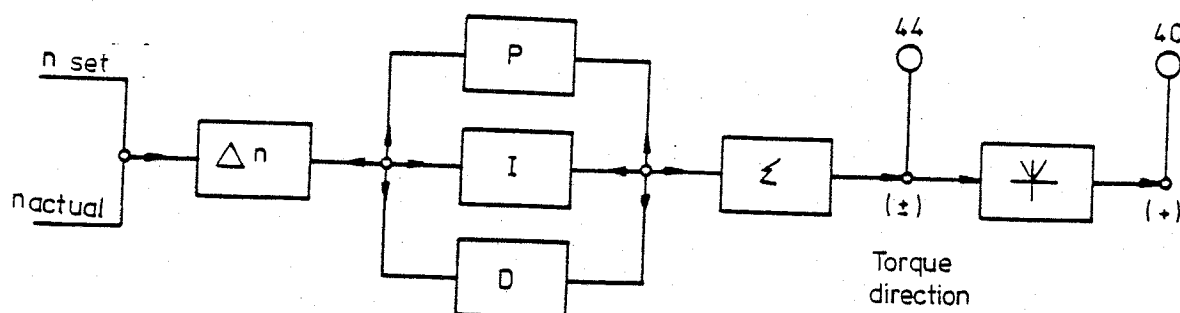
Terminal 39 GND

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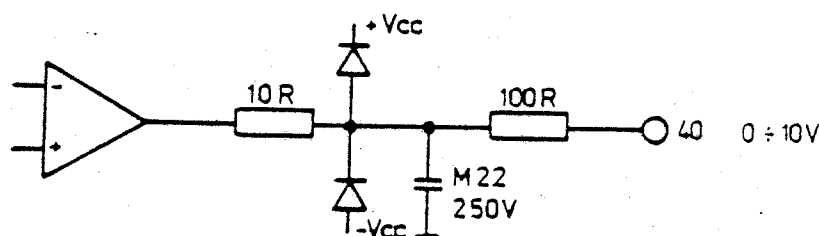
Änderungen:
modifications:

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr. MB 33.0408/23 GB	Drawing-No.
Geprüft: checked:					

Terminal 40 Output of the speed controller 0...+ 10 V



The actual current value is sensed with only one polarity (-). Therefore a switchable absolute value former is installed behind the speed controller, which always supplies a positive current set-value independent of the output signal of the speed controller. The control of the absolute value former is made by the switch-over logic.



Terminal 41 Calling control inhibit

With the controller range 440, the following internal surveillance circuits cause the control inhibit to operate

- a) Half-wave surveillance, mains under-voltage
- b) Surveillance of the positive stabilized supply voltage + Vcc
- c) Temperature surveillance of the power semi-conductors (self-holding, can only be neutralized by switching the mains off and then on again)

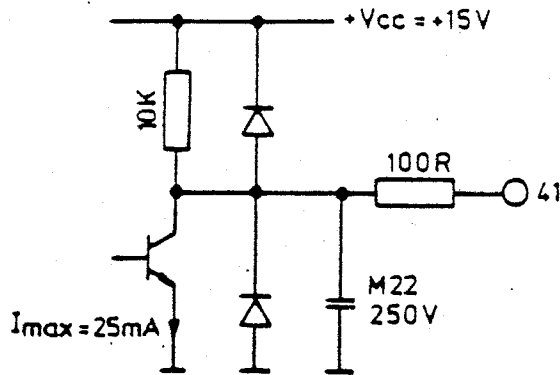
With programme switch S 12, it can be programmed, whether the control inhibit is operated (the drive brakes to a standstill with $I_A = I_{Amax}$) when these surveillance circuits activate, or if an interference report should be brought out, in which case the drive carries on running.

S 12 in the ON (1) position "RSP" is operated

S 12 in the OFF (0) position Drive carries on running

Independent of the S 12 switch position, an interference report signal is given out on terminal 41. Only when the temperature surveillance activates, does the signal have self-holding (continuous signal).

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER	Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:			LENZE KG 3250 HAMELN	MB 33.0408/24 GB	

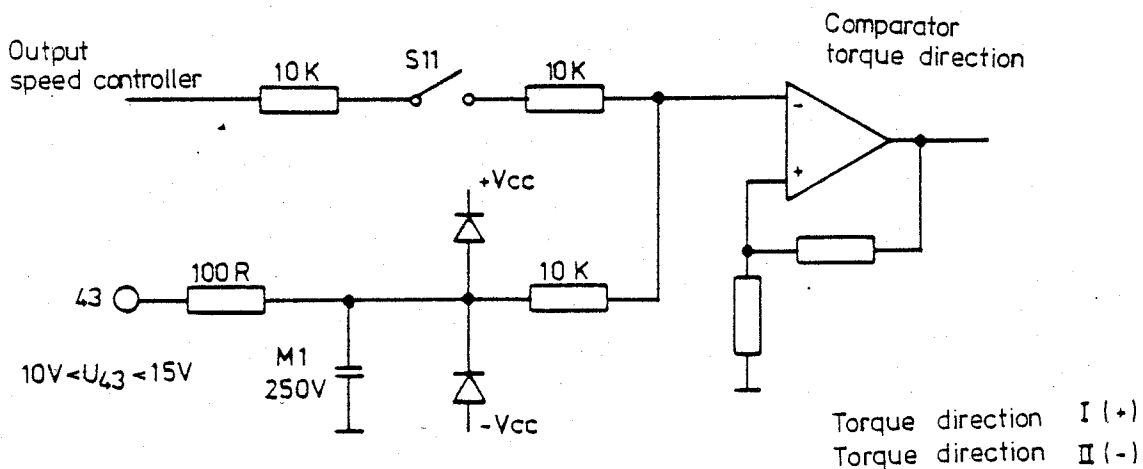


Transistor conducting, internal surveillance
functions not activated. Terminal 41
 $\approx 0\text{ V}$

Transistor blocked, internal surveillance
functions have been activated. Terminal 41
 $\approx 15\text{ V}$

Terminal 42 GND

Terminal 43 External output of the torque comparator



With normal operation, the programme switch S 11 is in the on (1) position. The direction of the torque is supplied by the output of the speed controller. In special application cases (current ratio control, positioning control circuits) the torque direction can be supplied externally (S 11 in the off (0) position).

+ 10 V ... + 15 V terminal 43 $\hat{=}$ positive armature current
current flow $A \rightarrow B$

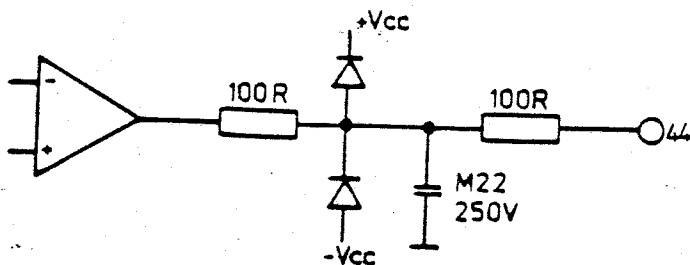
- 10 V ... - 15 V terminal 43 $\hat{=}$ negative armature current
current flow $A \leftarrow B$

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Änderungen:
modifications:

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr. MB 33.0408/25 GB	Drawing-No.
Geprüft: checked:					

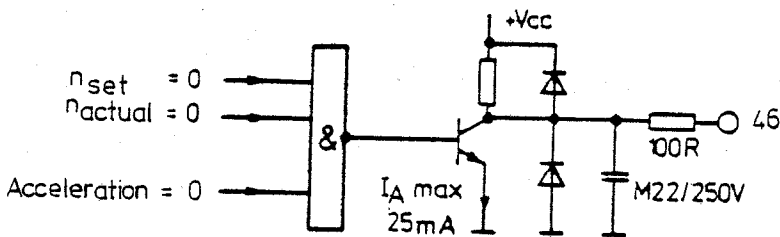
Terminal 44 Output of the speed controller $\pm 10\text{ V}$ ($\hat{=}$ direction of torque)



With current ratio controlled drives, terminal 44 of the master drive must be bridged with terminal 43 of the supplementary drive. The programme switch S 11 of the supplementary drive must be switched off (0). The current ratio of the two drives can then be set via the current limit.

Terminal 45 GND

Terminal 46 Outputstandstill logic, possibility for the connection of a standstill brake



Transistor conducting: Standstill logic not activated
Transistor blocked: Standstill logic activated

To prevent the speed controller from drifting while at a standstill, the I-component in the speed controller can be cut out with programme switch S 10.

S 10 in the ON (1) position I component cut-out

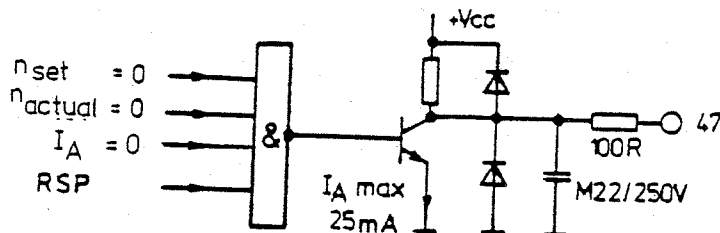
S 10 in the OFF (0) position I-component not cut out

When the standstill logic reacts, the freely switchable input 38 is inhibited via the diode V 802 (on soldering points on the module 4018). If this is not desirable, then the diode must be removed.

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:				MB 33.0408/26	GB



Terminal 47 Signal for switching the 4-quadrant controller from the mains



In order to prevent the reverse rectifier from firing through 4-quadrant drives should only be separated from the mains when at a standstill and armature current = 0.

Transistor conducting: Switch off signal not activated

Transistor blocked: Switch off signal activated

Terminal 48 + V_{CC} = + 15 V

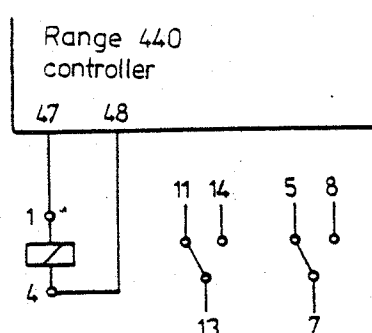
maximum load together 60 mA

Terminal 49 + V_{CC} = + 15 V

To enable the signals on terminals 41, 46 and 47 to be further processed, relays can be used, e.g. relays:

Manufacturer	Zettler
Type	AZ 421-08-8
Article No. LEA	305 383
Switching voltage	220 V ~
Switching current (max.)	3 A
Switching load	20 VA
Coil resistance	600 R
No. of contacts	2 change-over contacts
Holder manufacturer	Lütze
Type	RPS-2k/4W (for 2 relays)
Article No. LEA	308 621

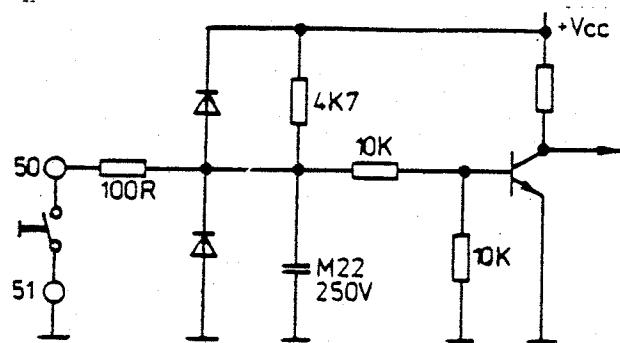
Connection



Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER	Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:			LENZE KG 3250 HAMELN	MB 33.0408/27 GB	

Terminal 50 Impulse shifted in the alternating rectifier limit position

If terminal 50 is connected to GND, the firing pulses run into the reverse rectifier limit position. The drive becomes currentless and runs down without power or brake.



Terminal 51 GND

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Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER	Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:			LENZE KG 3250 HAMELN	MB 33.0408/28 GB	



9. Adjusting instructions

9.1 Connect according to the connection diagram.

9.1.1 Turn " T_i ", " $I \times R$ ", " V_p ", " T_n ", " T_V ", " $U_{Leit\ coarse}$ " and " $n_{max\ coarse}$ " trimmers fully anti-clockwise.

Turn " $U_{Leit\ fine}$ ", " n_{min} " and " $n_{max\ fine}$ " trimmers to mid-value.

Programme switches S 1, S 9, S 10 and S 11 = on (1)

Programme switches S 6, S 4 = off (0)

With U_A control ($I \times R$) programme switch S 5 must be on (1).

9.1.2 Switch on the mains

Set the set-value potentiometer to maximum or the master-voltage to its nominal value. Adjust the " $U_{Leit\ coarse}$ " trimmer until (+) or (-) 10 V is registered between terminals 33 (GND) and 34.

Use a measuring instrument with $\geq 100\ k\Omega$.

Switch off the mains

then switch programme switch S 4 = ON (1)

9.2 Setting the current limit

(only necessary if the motor's nominal current is lower than the unit's)

9.2.1 Connect a moving coil instrument in the armature line, whereby the polarity must be considered.

With positive set-value, terminal A is (+) and terminal B is (-)
with negative set-value, terminal A is (-) and terminal B is (+).

9.2.2 Block the armature or disconnect the field in a voltage free state.
Trimmer " I_{max} " fully anticlockwise.

9.2.3 Switch on the mains.

Programme switch S 8 = on (1)

Turn the " n_{min} " trimmer fully clockwise

9.2.4 Turn the " I_{max} " trimmer clockwise until the desired limit current is flowing.
The blocking current set must not exceed the maximum permissible unit's nominal current.

441 = 8.5 A

442 = 23 A

443 = 23 A

444 = 31 A

445 = 43 A

9.2.5 Programme switch S 8 = off (0).

9.2.6 Connect the field in a voltage free state and then switch on the mains.

9.3 Setting the top speed

Bearb. DRAWN	ST/Wei	15.07.80	MASCHINENFABRIK STAHLKONTOR WESER	Zaichnungs-Nr.	Drawing-No.
Geprüft: checked:			LENZE KG 3250 HAMELN	MB 33.0408c/	29 GB

9.3.1 Connect a moving coil instrument (voltage measuring range) to terminals A and B.

Caution: Maximum permissible armature voltage
Controllers 441 and 442 = 150 V
Controllers 443, 444, 445 = 260 V

Then the speed is set to approx. nominal value by adjusting the "n_{max} coarse" trimmer. The fine adjustment of the top speed is made with the "n_{max} fine" trimmer.

Caution: The maximum armature voltage must not be exceeded when adjusting.

9.4 "n_{min}" trimmer

9.4.1 Programme switch S 8 = on (1)

With a set-value of 0 V, the desired minimum speed can be selected on the "n_{min}" trimmer (right half of the "n_{min}" trimmer clockwise, left half of the "n_{min}" trimmer anti-clockwise when the motor connection is correct).

9.4.2 Programme switch S 7 = on (1)
Programme switch S 7 = off (0)

The offset (zeropoint) of the speed controller can be adjusted on the "n_{min}" trimmer.

9.5 Controller response and I x R compensation

9.5.1 Programme the programme switches

	V _p	T _n	T _v	I x R	S1	S3	S5	S6	S9
d.c. tacho, high control accuracy	right	right	--	fully left	o/1	o	o	o	o/1
d.c. tacho, high control response	right	right	right	opti-mise	o	o/1	1	1	o
U _A control with I x R influence, high control accuracy	right	right	--	opti-mise	o/1	o	o	o	o/1
U _A control with I x R influence, high control accuracy	opti-mise	opti-mise	--	left	o/1	o	1	o	o/1

Bearb. DRAWN	ST/Wei	15.07.80	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN		Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:					MB 33.0408c/	30 GB



9.5.2 Adjust the speed stability at operating speed on the "I x R" trimmer. Turning the trimmer clockwise, reduces the speed drop with increasing load. Keep the influence of the I x R compensation as low as possible when high control response is required.

9.5.3 Adjust the " V_p " and " T_v " trimmers, so that with the smallest torque the speed remains stable with the whole speed range and the needle of the ammeter does not swing.

9.6. Set-value integrator "SWI"

With a jump in the set-value, the speed will follow on a programmed ramp. This ramp can be adjusted in steps with the programme switch S 2 and continuously within the range set on trimmer T_i .

9.7 Control inhibit

The control electronics can be switched with a low current contact between terminals 16 and 17. When the switch is closed, the firing impulses run into the reverse rectifier limit position. The "RSP" LED lights up.

When control inhibit is operated, the drive is braked to standstill with $I_A = I_{Amax}$.

When external current set-value is used, the braking to standstill is made only with the selected current.

10. Limits on the operation of a circulating current free reversing drive

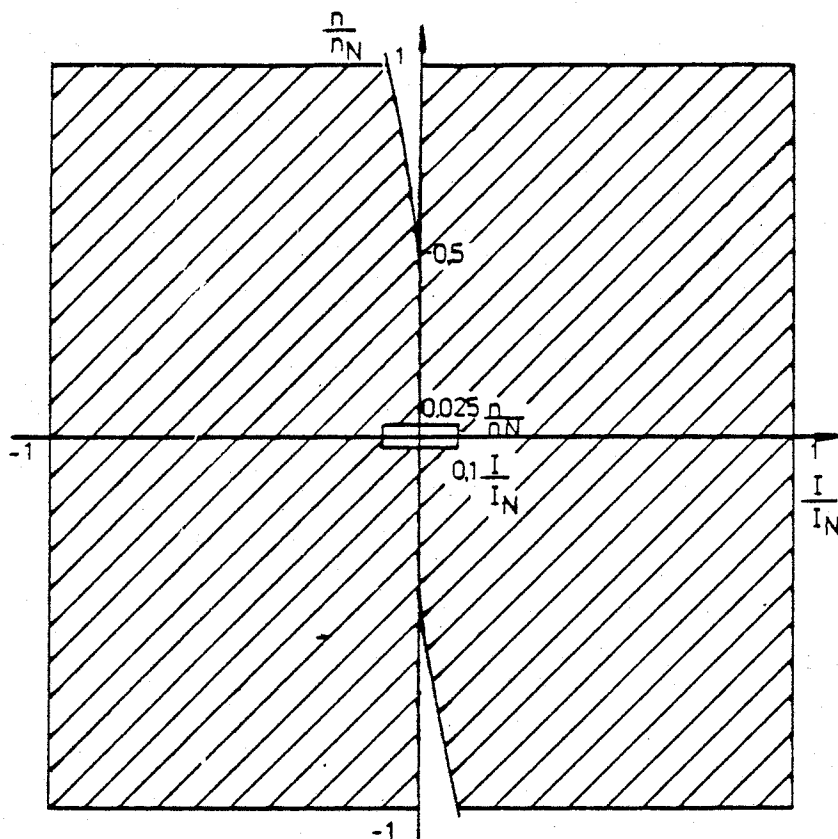
With circulating current free current rectifier controllers, the direction of the torque (armature current) is determined by the speed controller. For this reason a well defined signal level of the speed controller is necessary.

With low speeds ($< 0.025 n_N$) and low currents ($< 0.1 I_N$) the bridges can be being continuously reversed (from drive to brake and vice-versa) because of the ripple of the speed controller.

Reasons for this are for instance the high P-amplification in the speed controller, mains voltage variations as well as load changes. This is shown by rapid speed changes.

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER LENZE KG 3250 HAMELN	Zeichnungs-Nr. MB 33.0408/31 GB	Drawing-No.
Geprüft: checked:					

Limits of the safe and sure operating range



In the range from 0.5...1 $\frac{n}{n_N}$ $I = 0$ cannot be attained because of the impulse position limit.

With mains undervoltage this range is increased. If the armature inductivity given in the technical documentation is doubled, the unsure operating range is reduced by half.

A further increase of the inductivity is however, of no significance.

Bearb. DRAWN	St/st	78-11-10	MASCHINENFABRIK STAHLKONTOR WESER	Zeichnungs-Nr.	Drawing-No.
Geprüft: checked:			LENZE KG 3250 HAMELN	MB 33.0408/32	GB