7.3 Integration

7.3.1 Power Supply

- Remove fuses for the supply module on the mains side.
- Unplug connector X1 on the supply module.
- Disconnect one coil connection at contactor K01 (see VM connections).
- Switch on power (main switch).
- There must be +24 V present between X1.6 and X1.5 of the supply module.

Note:

If a simple external +24 V supply with B6 rectifiers is used an electrolytic capacitor of at least 4700 μF must be connected to the output terminals (24V).

- Measure the mains voltage at the main fuses with a multimeter.
  Admissible range: 340 V to 455 V.
- Switch on drive. Contactors K01 and K02 must **not** pull in!
- Switch off main switch.
- Plug connector X1 in on supply module.
- Reconnect coil connection at K01.
- Switch on main switch.
- Switch on drive.
- K01 and K02 must pull in, for as long as the button is depressed, and they must fall off again when the button is released.
- Switch off main switch.
- Reinsert fuses.

7.3.2 Ready

- Switch on main switch, do not give enable signal.
- Switch on drive.
- On the supply modules the green LEDs "Ready 1" (BTB 1) and "Ready 2" (BTB 2) must light.
- K01 and K02 must remain pulled in once the ON button is released.

7.3.3 Command Adjustment

Introduce a command voltage which corresponds to the intended maximum operating voltage on terminals X6.5 and X6.6 of the servo module.

Admissible range: ±7 V to ±11 V.

DIP switch S6 on the optimisation card must be switched off.

Adjustment on the SM-optimisation. Use pot. SW 1 on the front plate of the SM-optimisation card to set the voltage on test point "SW 1" (command) to 7.5 V against "⏚" (turn counter-clockwise to achieve higher voltage on test point "SW 1")

Switch on switch 6 (optimisation card).

Slope limitation for command steps with R62. The parameters are the scanning frequency of the NC and the largest command step per scanning interval.

The value of R62 must be determined by trial and error since the quantity "largest command step per scanning interval" is usually not known. R62 is to be increased (resistance decade) to the highest possible value before the tacho voltage starts to show some overshoot. This adjustment must be made after the speed regulator optimisation.

Standard value for R62 = 1 kΩ.

7.3.4 Direction of Motor Rotation

On motors with disk brake the brake must be released before the enable is switched on!

- Switch PI/1 : 1 (S1) on the regulator card must be set to 1 : 1.
- Set command input to 0 V.
- Switch S6 on the optimisation card must be closed.
- Give enable signal (green LEDs FG and FG I come on).
- Carefully increase command until the axis starts moving.
- Observe the direction of axis rotation!
  A reversal of the direction of rotation can be effected by swapping the command connections on X6.5 and X6.6.
- Switch off enable signal.
- Set switch PI/1 : 1 (S1) to PI.

7.3.5 Speed Adjustment

- Give enable signal.
- Introduce exactly 50 % of the intended max. command on X6.5 and X6.6.
- Measure the speed (if possible with a manual revolution counter).
- Use pot. T (optimisation card) to set the speed to exactly 50 % of the max. speed (clockwise turning --> higher speed).
- If it is not possible to measure the speed with a separate revolution counter it can be approximated by measuring the tacho voltage.
  At test point "T" there is a voltage of 2.7 mV/rpm ±5 % available, i.e. at a speed of 1000 rpm the tacho voltage is approx. 2.7 V (for range SE-B2: ... mV/rpm).

7.3.6 Speed Drift

- Command input to 0 V and short circuiting of terminals X6.5 and X6.6.
- The motor drift can then be reduced to a minimum with pot. OFFSET (optimisation card).

  Note:
  It is usually not possible to eliminate the drift altogether without the positional servo loop being active.
- Undo the short circuiting of terminals X6.5 and X6.6 and switch DIP switch S6 back ON.

7.3.7 Speed Monitoring (with Option Diagnostics)

Speed recognition or monitoring via diagnostics output (n<nx) and LED.

- Determination of the recognition speed by selection of the value for R4 on the speed regulator optimisation card according to the following formula:

$$R4 = \frac{n' \cdot 750\ k}{76.4 - 76 \cdot n'} \quad [k\Omega]$$

$$n' = \frac{n\,x}{n_{rapid}}$$

$n\,x =$ recognition speed
$n_{rapid} =$ rapid speed

Standard value for R4 = 10 kOhm = 1500 rpm with n_{rapid} = 3000 rpm.

- Definition of the speed recognition function as standstill display by fitting R72 = 0 Ohm on the optimisation card.

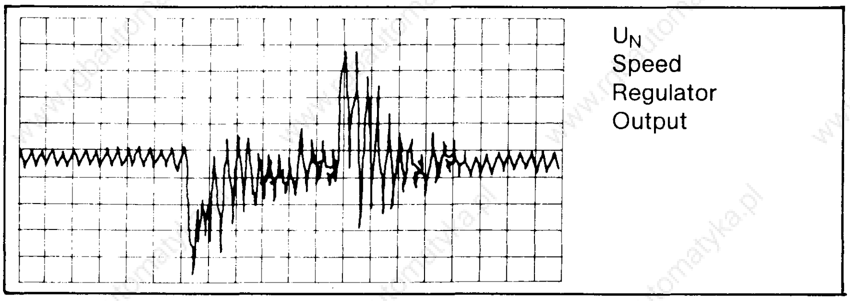
7.3.8 Speed Regulator Optimisation

In 90% of all applications the standard optimisation of the speed regulator (R77 = 301 kOhm, C9 = 22 nF) is suitable for machine tool axes. Should problems arise the optimisation can be checked as follows:

- Switch off main switch.
- Connect an RC decade instead of R77 and C9.
  Starting values: R = 301 kOhm; C9 = 22 nF.
- Connect an oscilloscope to test point "U_{N+}".
- Switch on main switch and drive. Give enable signal.
- Introduce a command step as a function.
  The time constant should lie approx. 10% below the time constant excepted during future operation.

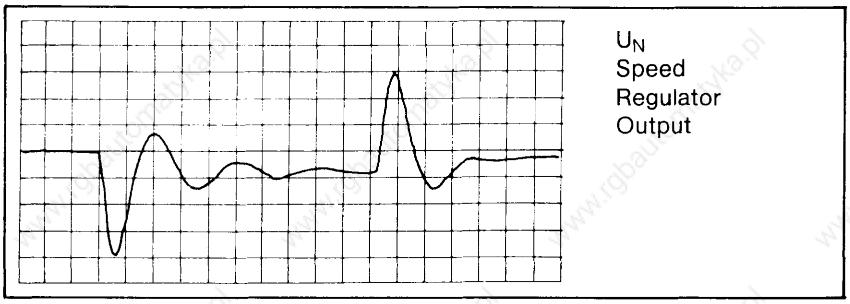
  Example:
  Planned KV factor: KV = 1
  Time constant: T_m = 60 msec
  Set the command for the optimisation to T = 55 msec.
- Select the level of the command signal so that the speed regulator (test point "U_{N+}") operates just below the limit (the limit lies around 8 V).
- The regulator output signal on test point "U_{N+}" can be influenced by changing R77 (P-portion) and C9 (I-portion) as illustrated in the following diagrams:

If the P-portion is too large or the I-portion too small the speed regulator becomes unstable:

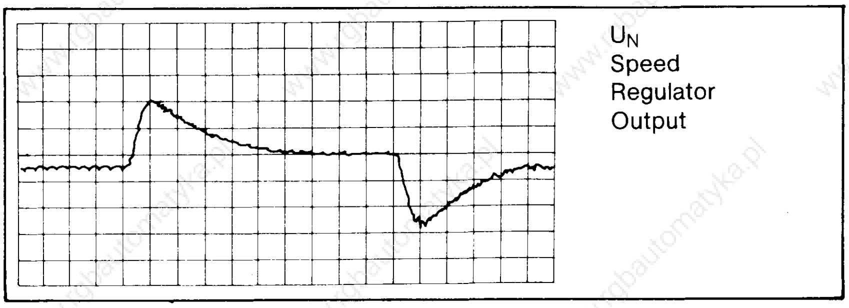


The instability is mainly a result of the excessive tacho ripple.

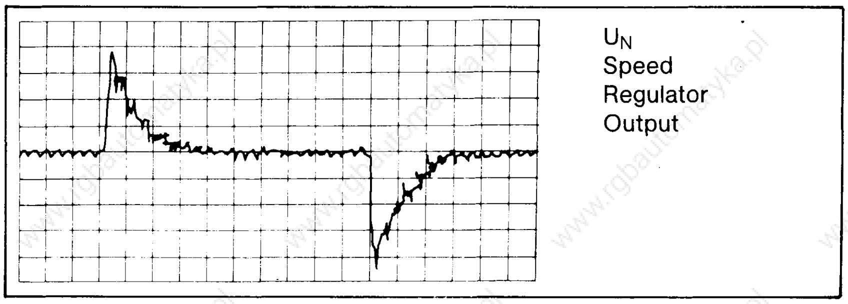
If the p-portion is too small the speed regulator is also unstable, but at a very low frequency.



If the I-portion is too large the speed regulator is stable, but its response is sluggish due to the resulting high time constant in conjunction with a low P-amplification.



When the speed regulator is adjusted correctly the signal will look as foollows:



Once the required values have been determined solder the appropriate components in for R17 and C9.

Derivative Action

For special cases an additional derivative action can be achieved with C13.

Note: Additional active filter at the tacho input.

If R75 is made 0 Ohm an active filter can be connected, which will improve the stability of the servo loop for motors with large inertia in most cases.

7.3.9 Adaption to the Positional Servo Loop

- Connect command source.
- Switch on drive, give enable signal.
- Introduce command "0 V".
- Adjust the lag (following error) to "0" with the appropriate potentiometer on the control (on some types of CNC this is done via parameter input!).
- Drive the axis at a defined feedrate (such as 1 m/min) and measure the resulting lag. The lag depends on the K_V-factor and the axis velocity.

$$LAG = \frac{v}{Kv} = [mm]$$

v = axis velocity [m/min]
K_V = K_V factor [10^3/min]
LAG = lag [mm]

Example:

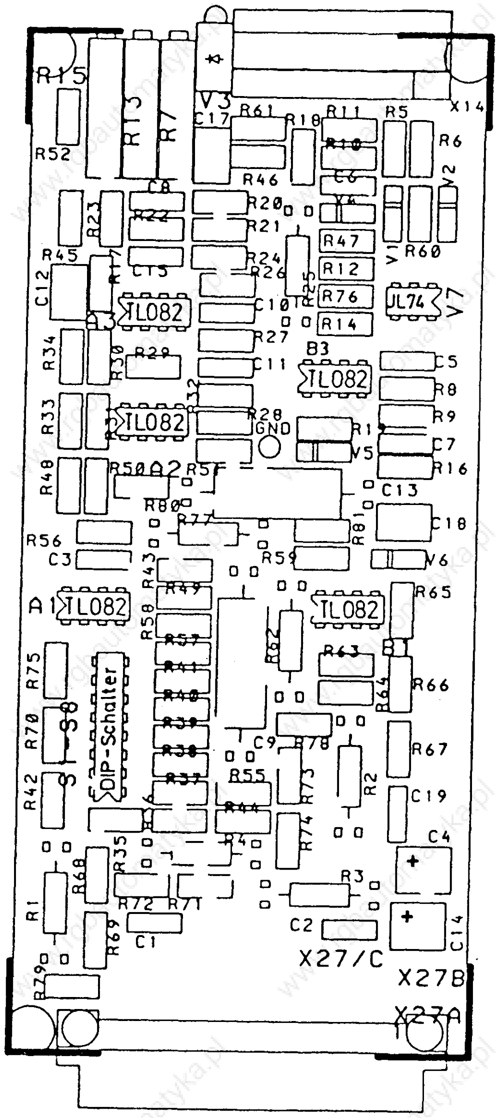
$$V = 1 \frac{m}{min}$$

$$Kv = 1{,}2 \frac{10^3}{min}$$

$$LAG = \frac{v}{Kv} = \frac{1}{1{,}2} = \mathbf{0{,}83\ mm}$$

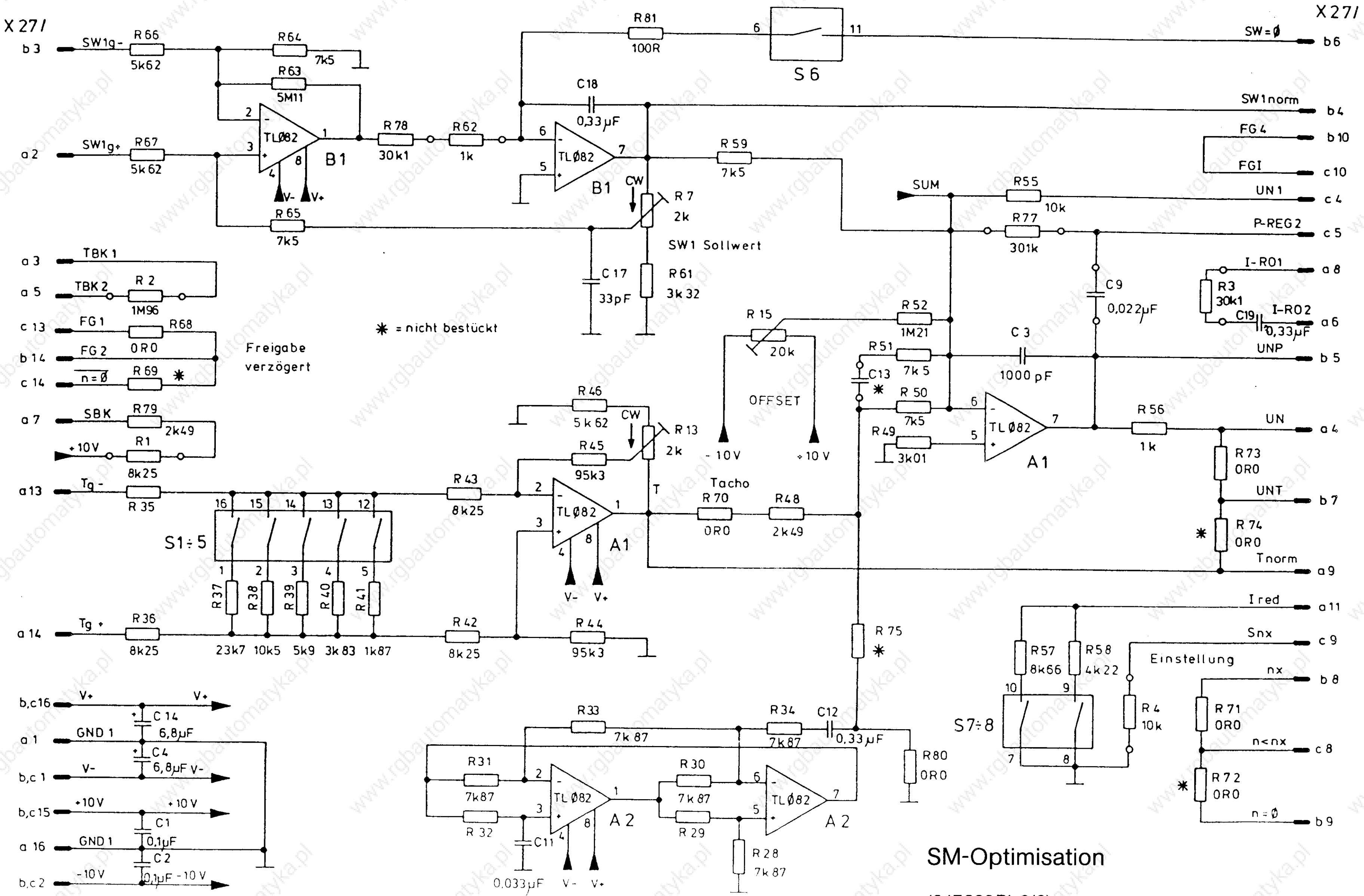
The lag must be set on the CNC with the appropriate potentiometer or by parameter input.

7.4 Component Layout



Optimisation card

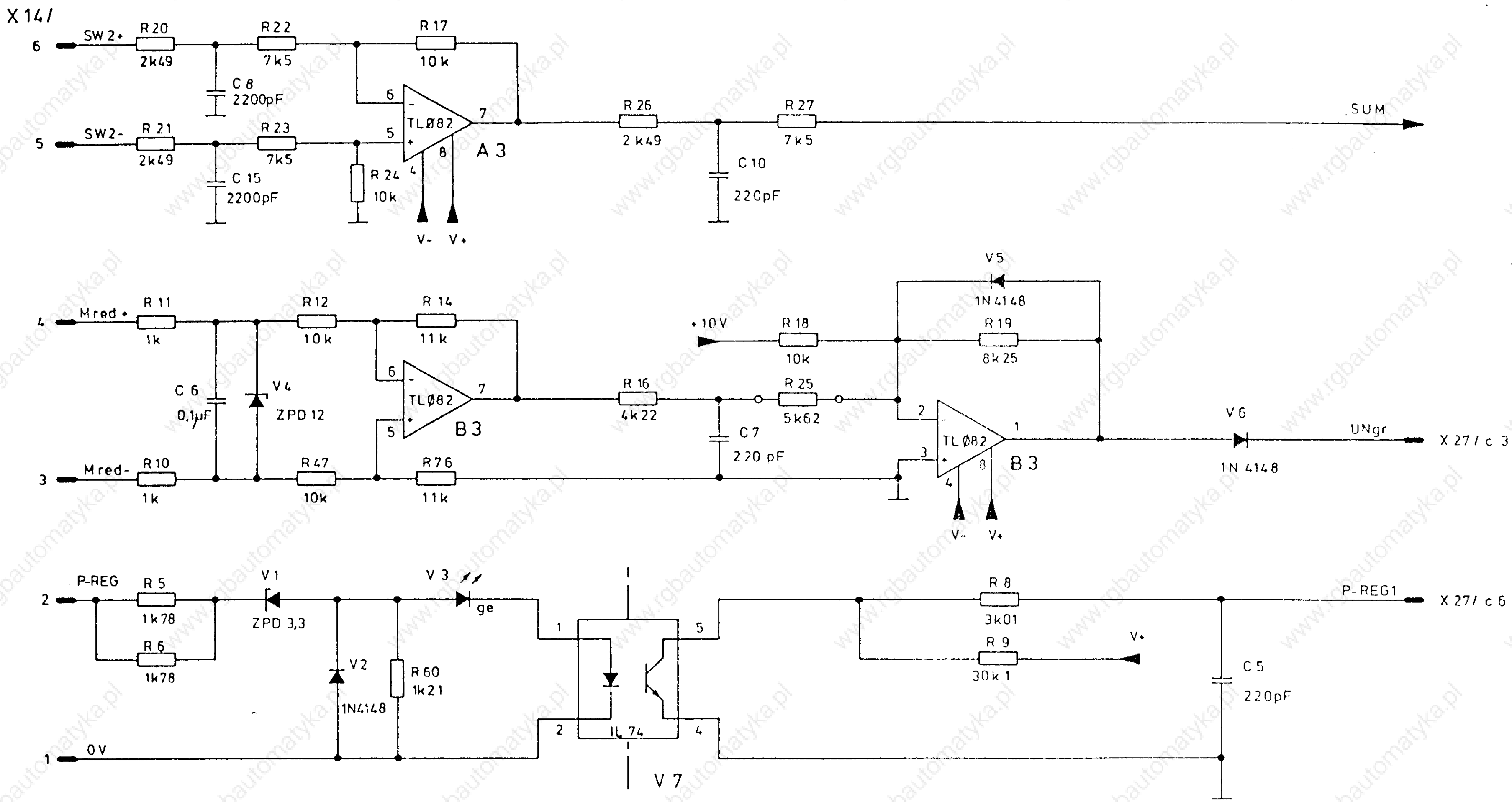
(047830–402303)



SM-Optimisation

(047830Bl. 2/3)

7.5 Circuit drawing



SM-Optimisation

(047 830 Bl. 3/3)

Kursübersicht

■ = Inhaltsschwerpunkte
□ = Sonstige Inhalte

Produkt-Gruppe	Kurz-Zeichen	Bosch-Produkt	Kursthema	Produktinfo.	Bedienen	Programmieren	Projektieren	Inbetriebnahme	Diagnose	Instandhaltg.	Det. s.S.	Tage Dauer
Numerische Steuerungen	A3-P	CNC Alpha 3	Bedienen, Progr.	□	■	■					–	5
	A2-P	CNC Alpha 2	Bedienen, Progr.	□	■	■					–	5
	A2/3-C	CNC Alpha 2/3	CPC-Progr.		□	■					–	5
	M8/5-B	CNC micro 8/5	Bedienen	□	■	■					6	5
	M8/5-W	CNC micro 8/5	Wartung					□	■	■	6	10
	CC-GL	CC 100	NC-Basiskurs	□	□	□				□	7	5
	CC 100-B	CC 100	Bedienen, Progr.	□	■	■					8	5
	CC 100-I	CC 100	Inbetriebnahme	□				■		□	8	5
	CC 100T-B	CC 100T (Drehen)	Bedienen, Progr.	□	■	■					9	5
	CC 100T-I	CC 100T (Drehen)	Inbetriebnahme	□				■		□	9	5
	CC 200-B	CC 200 (Drehen)	Bedienen, Progr.	□	■	■					10	5
	CC 200-C	CC 200 (Drehen)	Progr. in CPL		□	■					11	5
	CC 200-I	CC 200 (Drehen)	Inbetriebnahme	□				■		□	10	5
	CC 300-B	CC 300	Bedienen, Progr.	□	■	■					11	5
	CC 300-C	CC 300	Progr. in CPL		□	■					11	5
	CC 300-I1	CC 300	Inbetriebn. (Teil 1)	□	■	□		□	□	■	12	10
	CC 300-I2	CC 300	Inbetriebn. (Teil 2)				□	■		□	12	5
Roboter-Steuerungen	R1-B	rho 1	Bedienen	□	■						13	2
	R1-I	rho 1	Bed., Inbetriebn.	□	■	□		■		□	13	5
	R-OP	rho 2, rho 1	Offline-Progr.	□	□	■	□				14	5
	R2-I	rho 2	Inbetriebnahme		■		□	■	□	□	14	5
Schweiß-Steuerungen	PS 2000	Schweißsteuerung	Bedienen	□	■	□						3
		PS 2000	Bedienen, Insthlt.	□	■	□		□		■	15	5
	E81	Schweißsteuerung	Bedienen	□	■	□						2
		E 81 mit KSR	Bedienen, Insthlt.	□	■	□				■	15	5
Speicher-programmierbare Steuerungen	PC-GL	SPS-Familie	SPS-Basiskurs	□		■	□			□	18	4
	CL 100	CL 100 mit PG3	Programmieren	□		■	□	□		■	18	5
	PC 400-P	PC 400/200 m. PG3	Projektieren	□		■	■				19	5
	PC 400-I	PC 400/600 m. PG3	Instandhaltung	□		□		■		■	19	5
	CL 300-P1	CL 300 mit PG4	Projektieren	□		■	■				20	5
	CL 300-P2	CL 300 mit PG4	Aufbaukurs	□		□	■				20	5
	CL 300-I	CL 300 mit PG4	Instandhaltung	□		□		■		■	21	10
	PC 600-P1	PC 600 mit PG4	Basiskurs (Teil 1)	■		■	□				22	5
	PC 600-P2	PC 600 mit PG4	Aufbaukurs (Teil 2)	□		□	■				22	5
	PC 600-P3	PC 600 mit PG4	Diagnose (Teil 3)	□		■	■		■		23	4
	PC 600-I	PC 600 mit PG3	Instandhaltung	□		□		■	■	■	23	10
	PG 4-W	PG4	Bedienen, Progr.	□	■	□					24	3
	PU 400	PU 400	Instandhaltung		□	□				■	24	3
Servo-antriebe	GA-GL	Servoantriebe	Basiskurs				□	□			25	3
	SD-SY	Servodyn	Systemkurs	□			□	□		□	25	3
	SD-C	Servodyn C	Inbetriebnahme	■			□	□		□	26	2
	SD-T	Servodyn T	Inbetriebnahme	■			□	■		□	26	3
	SD-V	Servodyn, ASM	Inbetriebnahme	■				□		□	–	2

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