Service-Instructions
HEIDENHAIN TNC 114

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Telex 56831 · Telegrammanschrift DIADUR Traunreut

Customer Service

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T N C 1 1 4
SERVICE INSTRUCTIONS

stand: 01.10.83

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Subject to change (without notice)

HEIDENHAIN is constantly working on further developement of its TNC controls. It is therefore possible that details of a certain control may differ slightly of the control version which is being described herein. For this reason it may be necessary to request an updated service manual from us.

Note

The TNC 114 contains sub-assemblies with CMOS elements. Although MOS IC's are equipped with an input protection diode network to eliminate the build-up of static charges, care must be taken when handling these elements.

The following requirements in the work area must be met:

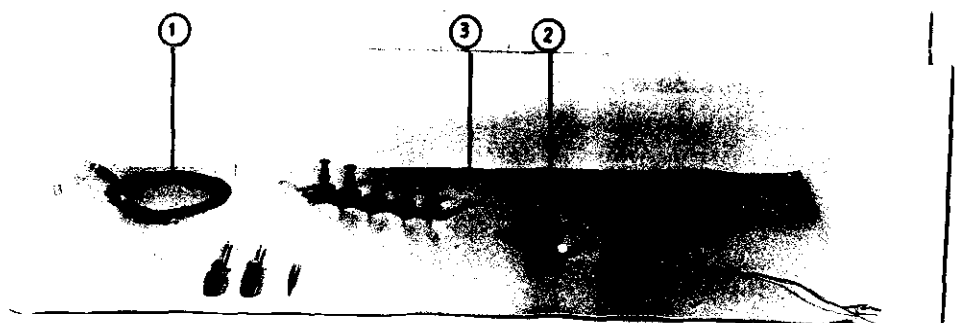
Prior to working with CMOS components or with assemblies equipped with CMOS elements, all table coverings, all operated instruments and/or tools, as well the work personnel, must be properly grounded.

A portable "MOS-HANDLING-SET" for field service is necessary when exchanging the operating software and/or servicing the TNC 114.

1) a cable that equalizes potential differences between conductive work surface and ground

2) a wristband that provides an electrical connection between person and conductve work surface

3) a conductive work surface



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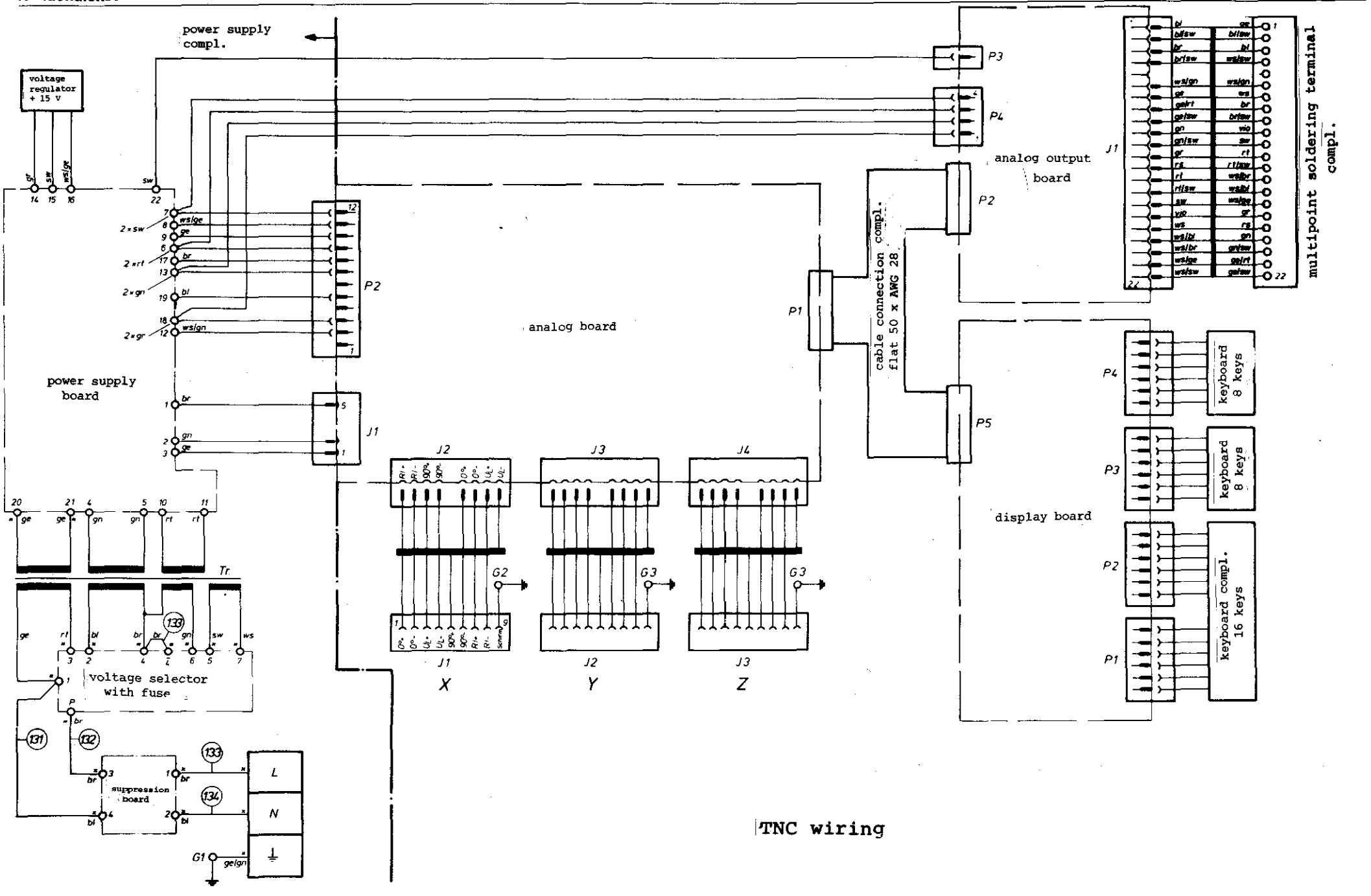
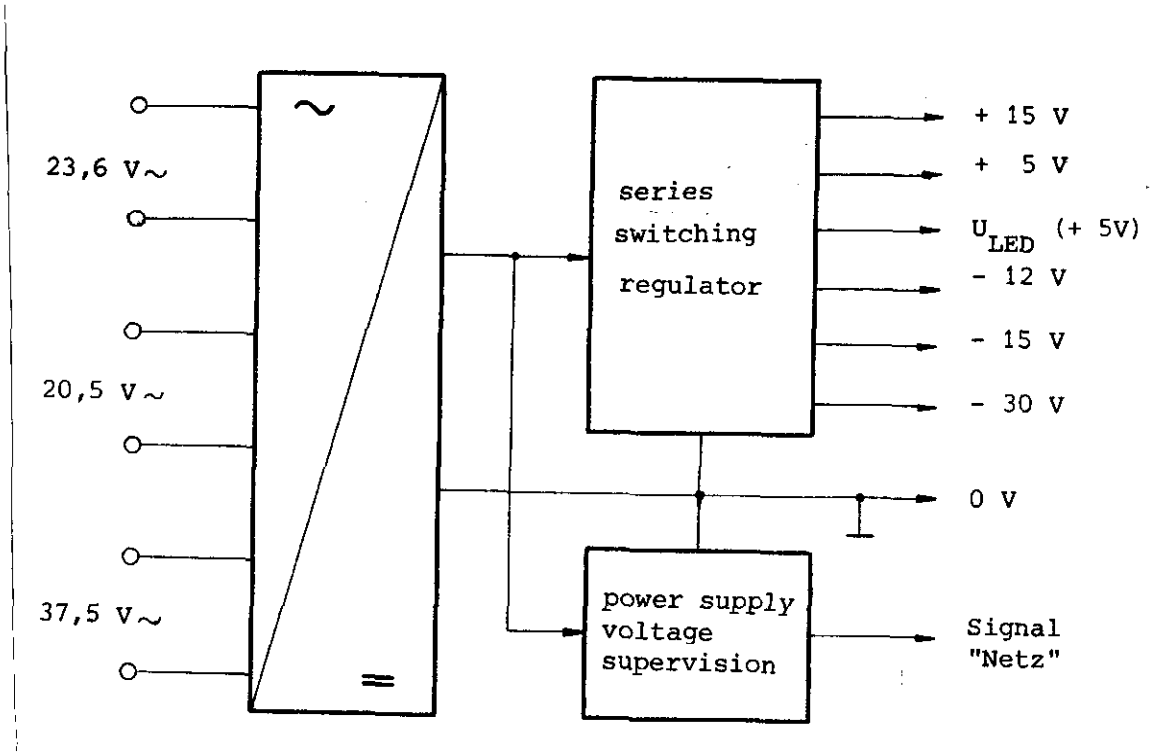
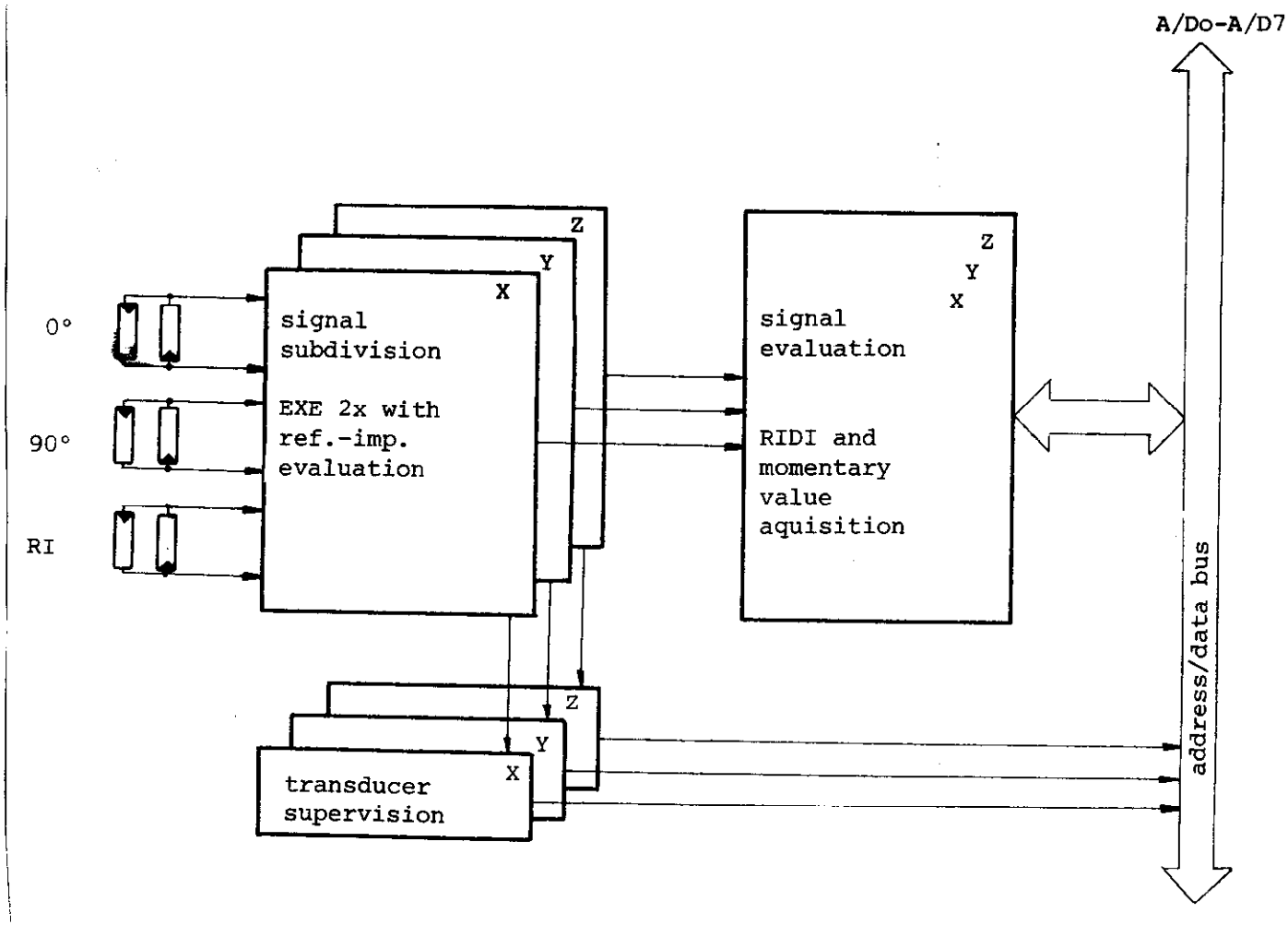


TNC wiring

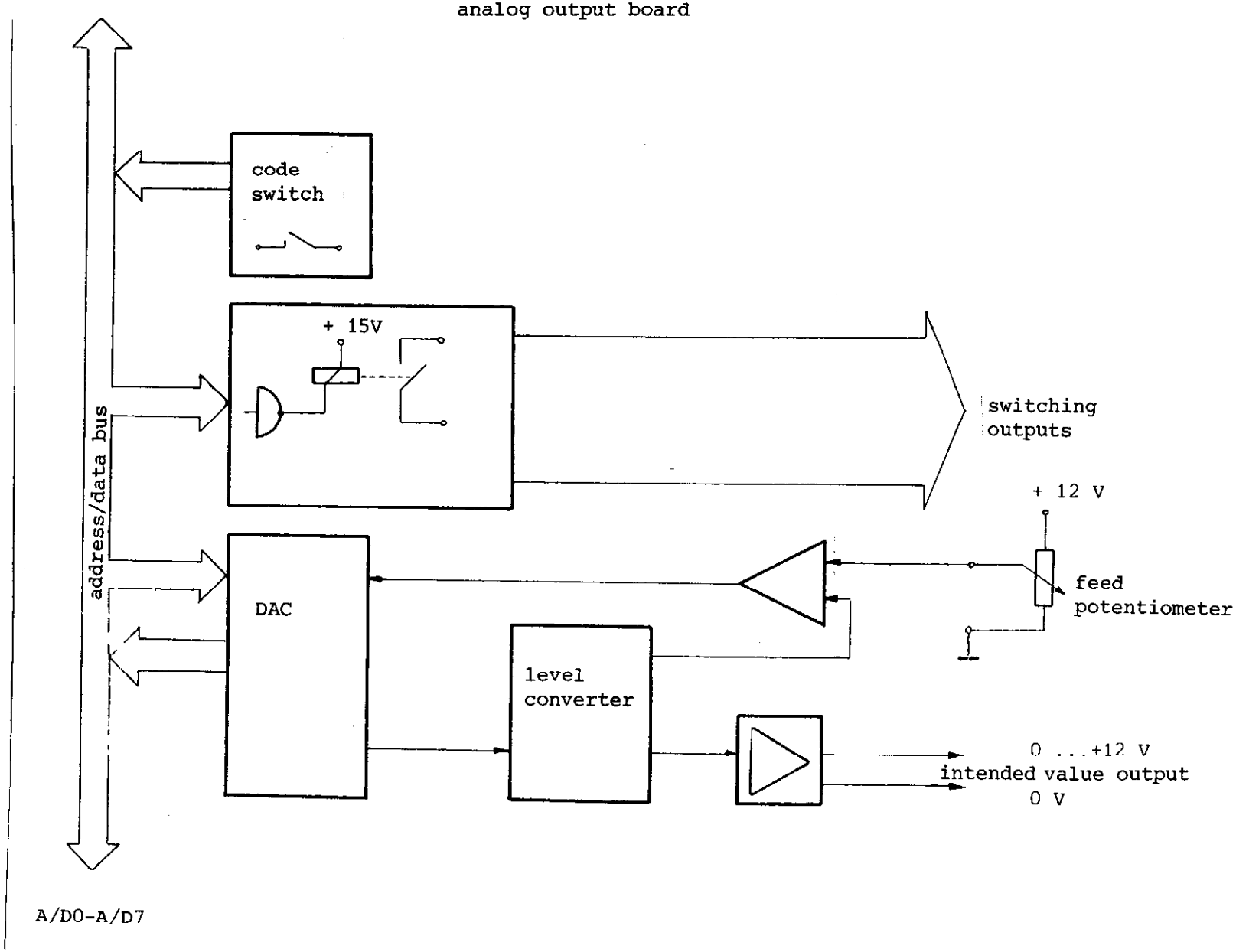
power supply board

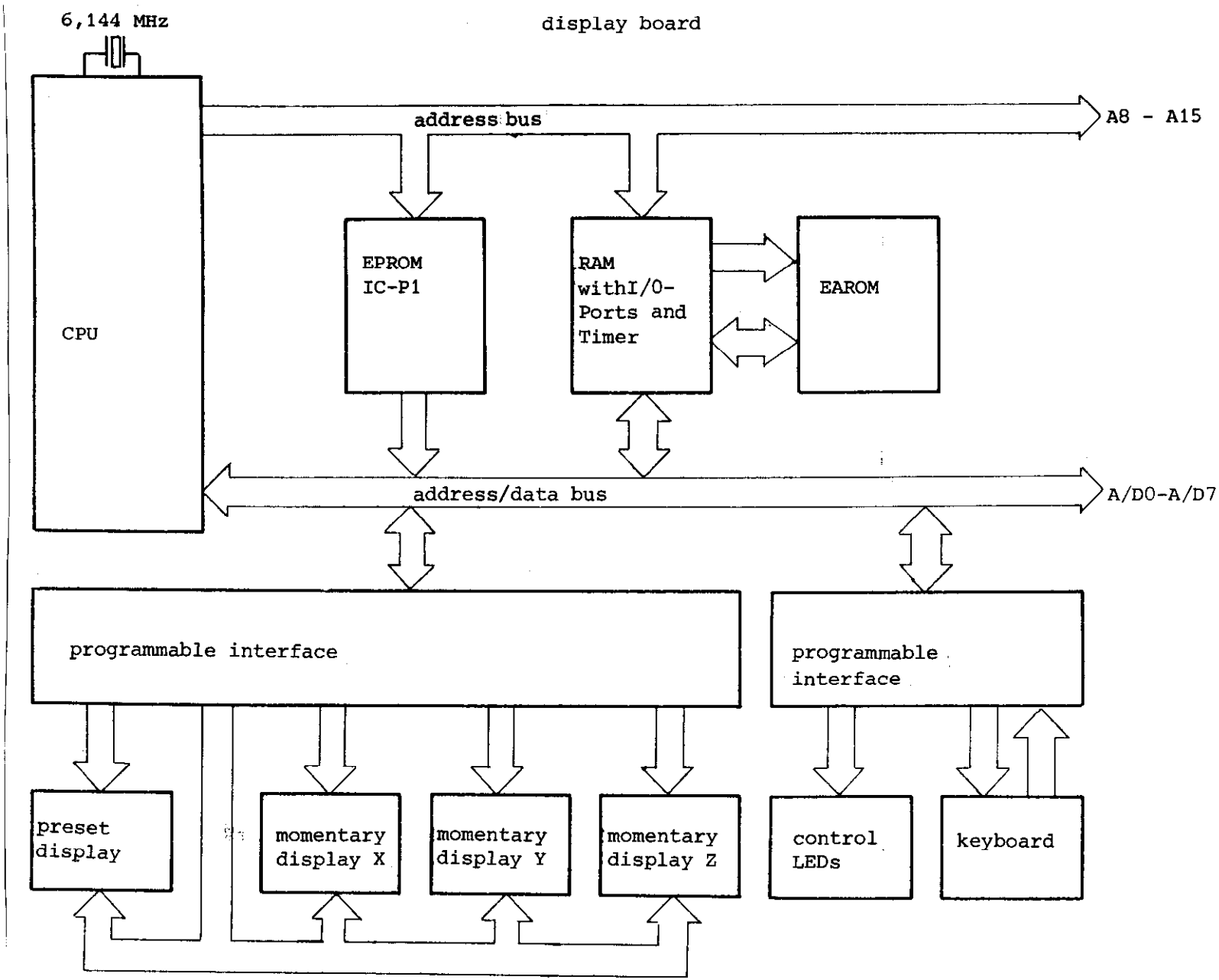


analog board



analog output board




6,144 MHz
display board
CPU
address bus
A8 - A15
EPROM
IC-P1
RAM
withI/O-
Ports and
Timer
EAROM
address/data bus
A/D0-A/D7
programmable interface
programmable
interface
preset
display
momentary
display X
momentary
display Y
momentary
display Z
control
LEDs
keyboard

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1. Automatic fail diagnostics

With operating faults, an automatic fault message is issued by the TNC 114 which simultaneously opens the regulator release contact.

a) Transducer is defective
The accompanying momentary position LED will blink with a transducer defect.
Erasing the message:
Switch-off line voltage: switch-on line voltage after fault has been remedied.

b) Defect in the electronic
Faults of this type are coded by the TNC 114, the lamps over the reference point keys will illuminate.
Erasing the message: if after switching-on the fault message reappears, the TNC 114 must then be sent to the factory for repair. (with noted lamp fault coding)

c) Positioning direction error
If for a selected positioning direction the machine coupling lever is switched in the false direction the feed will be switched-off after 200 µm of traversing.
A U-shaped symbol will appear in the display.
Erasing the message: press the CE key: restart and bring the coupling lever in the correct position.

2. Internal test program

The internal test program will begin after switching-on.

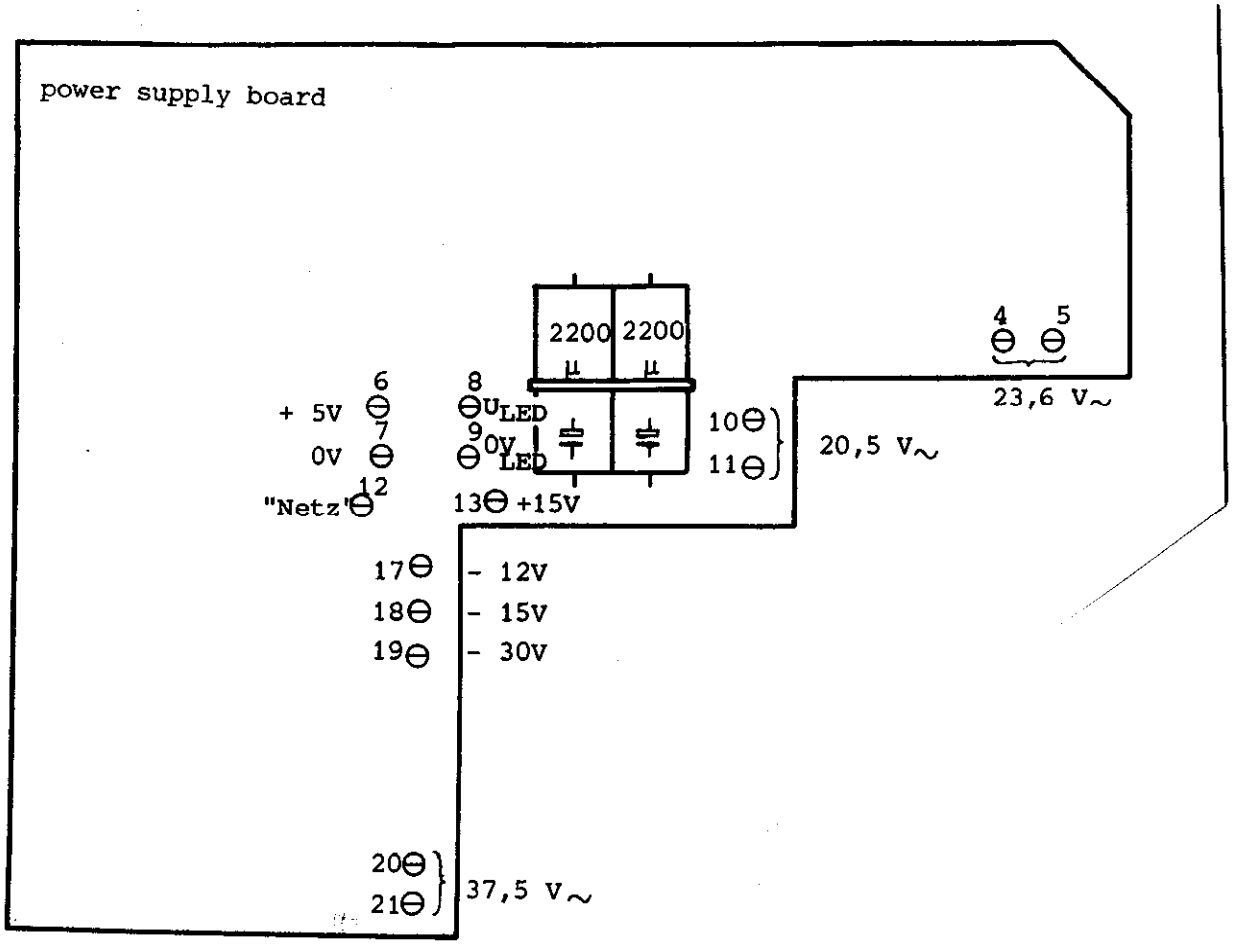
Visual control

- All segments of the momentary position value and the preset display must illuminate together with the same intensity.
- All decimal points of the preset value must illuminate. The decimal points of the momentary position value must illuminate from the second decade.
- After approx. 3 sec. the preset values will be in the axis display, the present value display = 0. Operating mode | with | is selected.
- The momentary test condition will be displayed in a coded manner with the LED's of the 1, 2, 3, 4 keys. The lower LED row will blink with a fault.
  The following ICs are tested one after another: ROM, RAM, TIMER.
  The following fault conditions may occur:

1	2	3	4	
X	0	0	0	ROM error
0	X	0	0	RAM error
0	0	X	0	timer 1 (Q22), counter 0 (Pin 9-X forwards)
X	0	X	0	timer 1 , counter 1 (Pin 15-Y ")
0	X	X	0	timer 1 , counter 2 (Pin 18-Z ")
X	X	X	0	timer 2 (Q26), counter 0 (Pin 9-X backwards)
0	0	0	X	timer 2 , counter 1 (Pin 15-Y ")
X	0	0	X	timer 2 , counter 2 (Pin 18-Z ")

3. Failure localization

The following directions are only valid if the prerequisite that all secondary power supply voltages are present, is met!



soldering terminal	voltage
6	+5V
7	0V
8	U_{LED}
9	$0V_{LED}$
13	+15V
17	-12V
18	-15V
19	-30V
4,5	23,6V ~
10,11	20,5V ~
20,21	37,5V ~

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For reasons of complexity of the interdependent control functions, the following information regarding the possible fail source location serves as guide only.

Occuring fault	Possible fault location
- transducer supervision system addressed	transducer system/analog board
- counting error	analog/display board
- counting direction switch-over not functioning	power supply/analog board
- no reference impulse	transducer system/analog board
- key does not function	display board
- control LED dark	display board
- momentary position display faulty/undefined	display board
- preset display faulty/undefined	display board
- set function faulty	display board
- reference values are not/faulty stored	display board
- direction supervision does not respond	power supply/analog board/analog output board
- no standstill supervision	display/analog board
- no/faulty momentary value output	manual feed potentiometer/analog output board
- no EMERGENCY OFF/traversing direction/axis relays X,Y,Z closed loop release/speed momentary value internal, external	analog output board
- approach behaviour faulty	analog output board
- coded failure display after switch-on:	

1	2	3	4	
x				display board
	x			display board
		x		analog board
x		x		analog board
	x	x		analog board
x	x	x		analog board
			x	analog board
x			x	analog board

4. Test instructions

4.1 Necessary equipment

For testing purposes, the following equipment is required:

- digital multimeter
- rotary encoder with photo-element signal output (e.g. MINIROD 450)
- 2 dummy connectors for transducer inputs

4.2 Testing the set function of an assembled control

Operating mode "HAND" and key [11] .

Input:	Key:	Preset:	Axis display:
11111.111	X, Y, Z	11111.115	11111.115
	X, Y, Z		
15555.555	X, Y, Z	15555.555	15555.555
16666.666	X, Y, Z	16666.670	16666.670
	X, Y, Z		
19999.990	X, Y, Z	19999.990	19999.990
.1	X, Y, Z	0.100	0.100
1.	X, Y, Z	1.000	1.000
11.	X, Y, Z	11.000	11.000
111.	X, Y, Z	111.000	111.000
1111	X, Y, Z	1111.000	1111.000
11111	X, Y, Z	11111.000	11111.000
11111	X, Y, Z	-11111.000	-11111.000
-19876.543	X, Y, Z	-19876.545	-19876.545
-12345.678	X, Y, Z	-12345.680	-12345.680
	0,01/0,005 mm	-12345.680	-12345.68
	Inch	- 486.0504	- 486.0505
	0,01/0,005 mm	- 486.0504	- 486.0504
	CE/X, Y, Z	0.0000	0.0000
0.0001	X, Y, Z	0.0002	+ 0.0002
0.0009	X, Y, Z	0.0010	+ 0.0010
	Inch	0.025	+ 0.025
10	D/2	5.000	
100	-D/2	95.000	
	+D/2	100.000	
	Inch	3,9370	+ 0.0010

Storage function	Switch-off line voltage then switch-on again. After switch-on select the INCH operating mode. The following values must be displayed:
1. Level	1. Level
X-axis set to 11111.115	X-axis 437.4454
X-axis set to 12222.225	Y-axis 481.1900
Z-axis set to 13333.335	Z-axis 524.9344
2. Level	2. Level
X-axis set to 14444.445	X-axis 568.6788
Y-axis set to 15555.555	Y-axis 612.4234
Z-axis set to 15555.665	Z-axis 656.1678
3. Level	3. Level
X-axis set to 17777.775	X-axis 699.9124
Y-axis set to 18888.885	Y-axis 743.6568
Z-axis set to 19999.995	Z-axis 787.4014
4. Level	4. Level
X-axis set to 10000.000	X-axis 393.7008
Y-axis set to 12345.675	Y-axis 486.0502
Z-axis set to 19876.545	Z-axis 782.5410

Control function

- Position a positive and negative value in absolute dimensioning (e.g. + 100, - 100)
- Position several values in incremental dimensioning in both positive and negative directions, in all axis.
- Traverse a larger value (1000), test feed potentiometer during the positioning as well as the STOP key and traverse functioning.

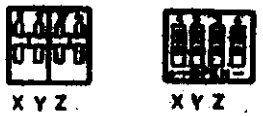
4.3 Testing the dessembled control

Supervision function

Disconnect transducer connections for X, Y and Z axes: The momentary value display must blink in the same order of disconnection.

Counting function

Connect rotary encoder to X-axis input dummy connectors on X and Z axis. Test the counting function in positive and negative directions of all axis and decades.
On the backside of the unit, the counting direction for every axis can be selected using the DIL switch 1, 2 and 3. The counting direction is positive when switch is closed.



counting direction positive

Repeat the test for Y- and Z-axis.

Reference pulse evaluation

Select operating mode "HAND". Set axis to reference. Press the REF key, REF diode must luminate. Rotate rotary encoder shaft over reference impulse, (REF LEDs off) press REF key, press again and hold.
Rotate rotary encoder shaft until reference impulse stops the display.

The displayed value must evaluate to:

impulse count x signal subdivision x evaluation x counting step

example: MINIROD 450
100 impulse/rotation

TNC 114:

signal subdivision	2 x
evalution	4 x
counting step	5 µm

100 x 2 x 4 x 5 µm = 4.000 (displayed value)

Axis supervision

The axis supervision is active on all 3 axes within a distance of 205 µm. The standstill of the remaining axes that are momentary not controlled is supervised. The direction of the momentary controlled axis is supervised.

Direction supervision test

Connect rotary encoder to transducer system input X-axis and dummy connections on transducer input X- and Z-axis. Select operating mode "absolute dimensioning". For example:
enter + 1000 and initiate traversing with the X-key.
Rotate rotary encoder counter clock-wise (minus direction).
With a value > - 205 µm the segments b, f, and g must luminate on the preset display for all decades. (▯▯▯▯▯▯▯▯)

Repeat the test with negative positioning values and positive rotation directions.
Repeat test for Y- and Z-axis.

Standstill supervision test

Connect rotary encoder on transducer system X-axis input and dummy connectors on transducer Y- and Z-axis inputs.
Start X-axis postioning.
Connect rotary encoder to transducer system Y-axis input and rotate shaft.
The error message (▯▯▯▯▯▯▯▯) appears in the preset display for a displayed momentary value of > 205 µm.

Repeat the test in positive and negative directions for all axes.

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1. General

Caution!

Do not disconnect connectors under voltage

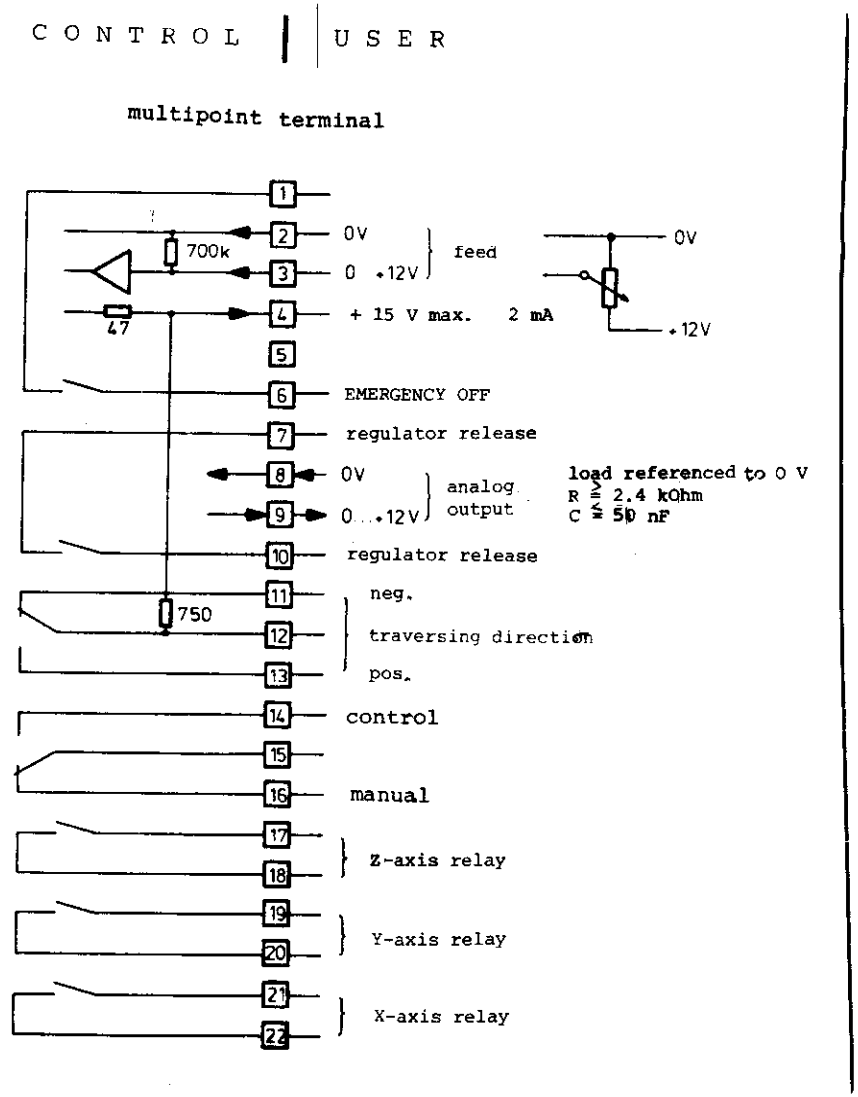
All inputs/outputs must only be connected to circuits having voltages produced according to VDE 0100/5.73 §8. (low protection voltage)

Control inputs:
- input resistance approx: 100 kOhm
- voltage input to determine feed rate
- regulated voltage of 0 to + 12 V is required.

Momentary position output:
- loading with respect to 0 V: R ≧ 2.4 k , C ≦ 50 nF
- analog voltage: 0 to + 12 V.

Control switching outputs:
- contact loading: 48 V / 0.3 A max. switching power 10 W
- working contacts: axis release X
- working contact: regulator release
- switch-over contact: traversing direction
- switch-over contact: momentary traversing speed internal/ external.

2. Interface wiring



3. Exchange

1. Note operating program-nr. and ident-nr. of the control!
2. Disconnect mains coupling of the control.
3. Isolate connections on the multipoint terminal.
   Order (1-22) and note wire colors.
4. Disconnect transducer systems for X, Y, Z.

Assembly in reverse order.

Important: Observe correct positioning of the line voltage selector!
Fusing: T 0.4 A

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1. General
Observe MOS protection procedures.

2. Exchange

1) Remove the 4 Phillips mounting screws of the control backside.

2) Service block including:
- front plate
- display board
- analog board
remove from frontside.

3) Disconnect DIL-switch connector located on the analog board.

4) Disconnect grounding connector, located on the analog output board.

5) Disconnect transducer system connector for X, Y, Z, located on the analog board.

6) Disconnect flat cable connector for control input/ outputs, located on the analog output board.

7) Disconnect the supply voltage to the analog board.

8) Remove the 5 Phillips mounting screws of the analog output board.

9) Disconnect flat cable connector located on the analog output board.

10) Remove analog output board.

11) Disconnect the analog board supply voltage.

12) Remove the 5 mounting bolts of the analog board.

13) Disconnect flat cable.

14) Remove analog board.

15) Remove the 5 mounting bolts of the display board.

16) Disconnect the 4 keyboard connectors.

17) Remove display board.

Assembly in reverse order.

Observe the correct location of the LEDs when assemblying.

The power supply is offered complete inclusive line transformer and inclosure backwall as replacement part.

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1. General

The operating program for the TNC 114 is contained in an EPROM (IC-P1, Q28) on the display board:

program ident number

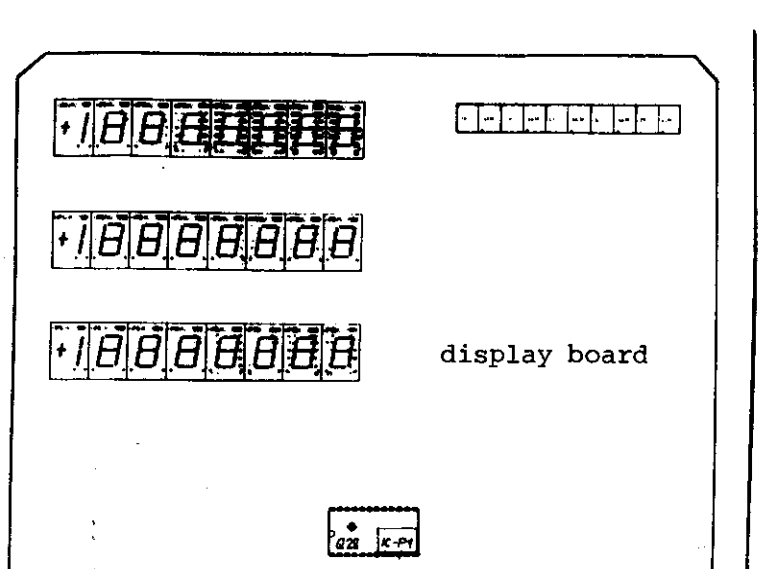
xxx xxx xx

programm nr. current stand

IC program ident number

xxx xxx xx

IC program nr. pos. nr. current stand



2. Program

program description:	standard program
program ident number:	212 927 02
IC program ident number:	212 927 1B
issue:	04.09.1981

3. Characteristic curve description

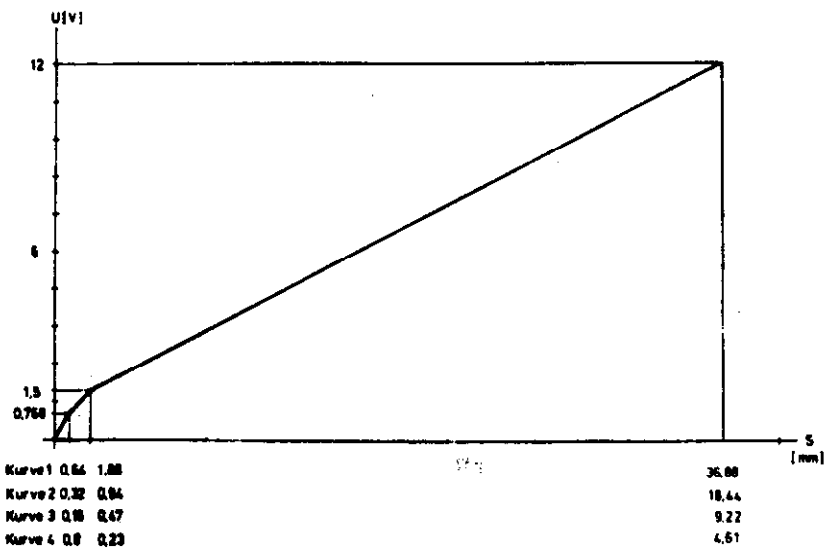
The ramp characteristic curve can be adjusted by the DIL switches S1/2 and S1/3 on the analog output board.
(4 different ramp lengths are possible)

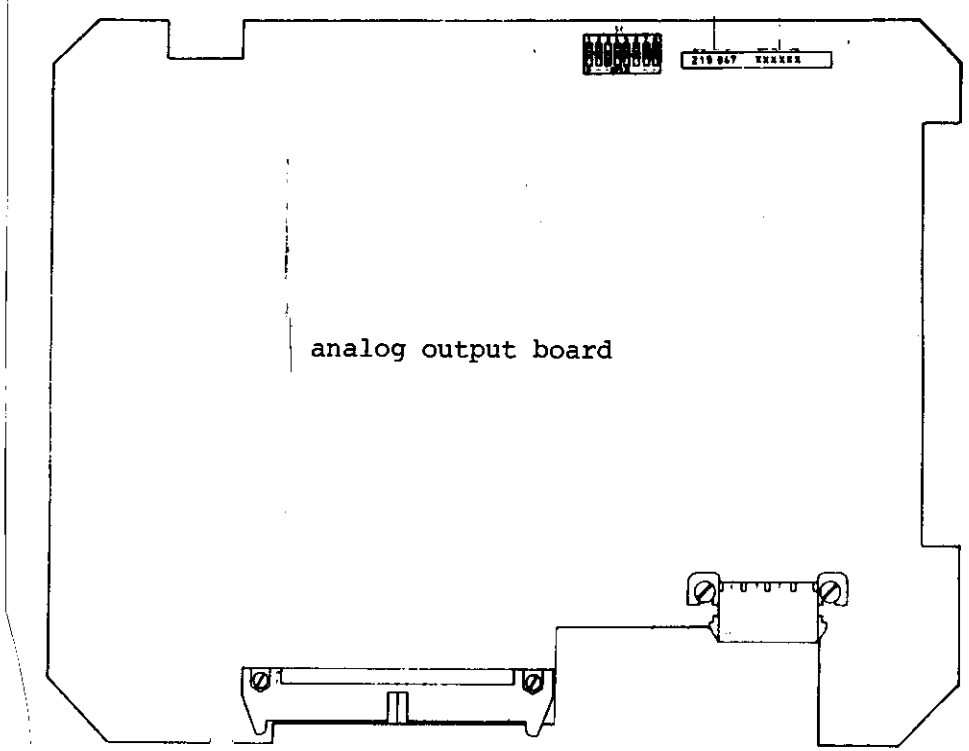
DIL switch up : switch closed

DIL switch down: switch open

DIL switch 2 and 3 up : curve 1
DIL switch 3 up : curve 2
DIL switch 2 up : curve 3
all DIL switches down : curve 4

Ramp characteristic curve TNC 114





4. Program exchange

Important: observe MOS protection procedures.

In order to exchange the operating program, the display board must be demounted from the control.

Necessary tools: - IC extract/insertion tool
- small screwdriver

- remove EPROM from display board using extraction tool
- place EPROM onto MOS protection mat
- insert new EPROM correctly using insertion tool

Important: - The inserted IC must be pointing in the same direction as the remaining IC's on the display board. 

- Before installing the board into the control, visually check if all the IC pins are contacting the IC socket.

After an operating program exchange the program nr. has to be changed on the backside of the control.