

Service-Instructions
Point-to-point with straight cut control
TNC 131



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Customer Service

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1. Wiring Diagram

Subassemblies contained in the control and their connections.

- TNC 131 consists of:
- power supply
 - analog component board with inputs for measuring systems
 - display board including keyboards
 - CPU board with V.24 interface
 - input board
 - output board
 - terminal board
 - interface board

1.1 Power supply

The power supply comprises:

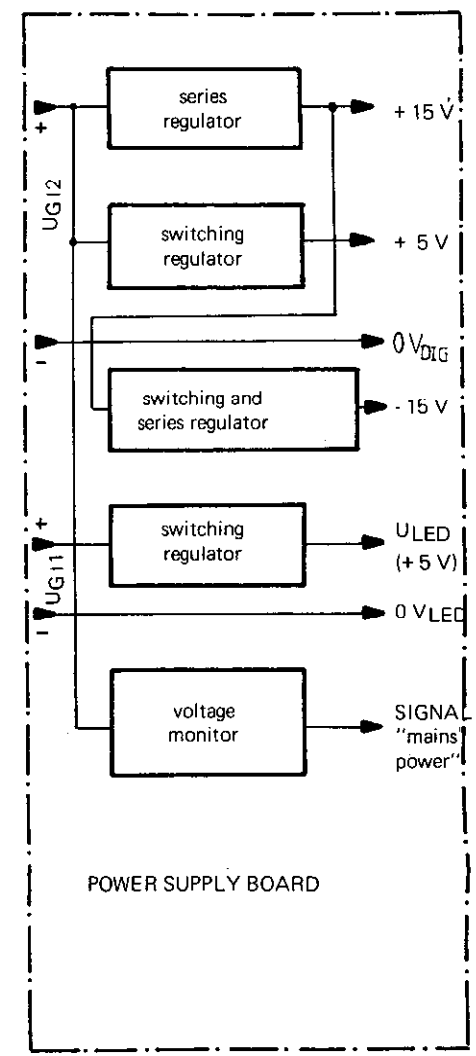
- filter board
- voltage selector with built-in fuse
- safety transformer
- heat sink with +15 V regulator and two bridge rectifiers
- power supply board

Specifications:

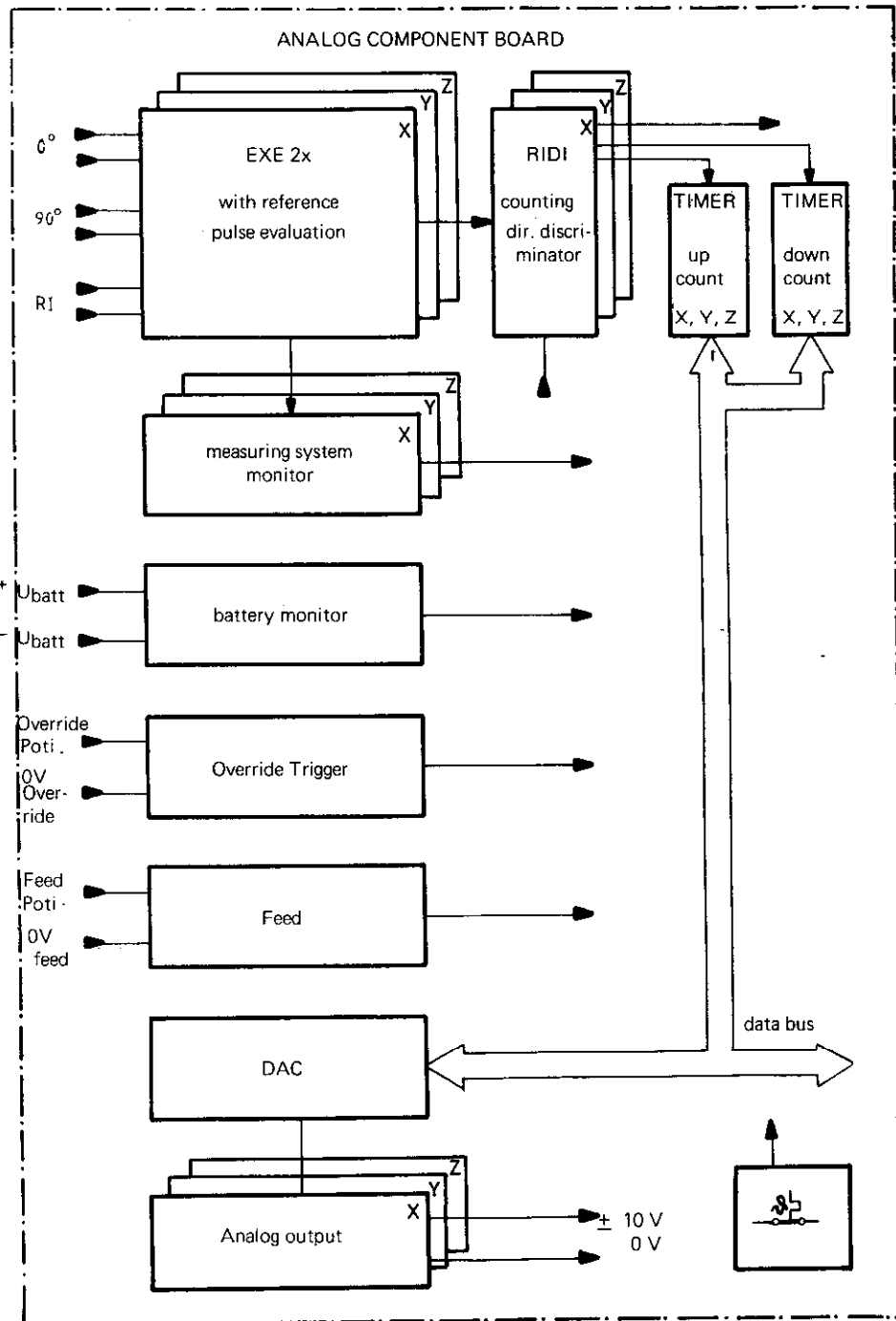
voltage	selectable 100/120/140/200/220/240 V
voltage tolerance	+ 10 %, - 15 %
frequency range	48 ... 62 Hz
power consumption	66 W approx.
efficiency	$\eta \geq 50 \%$
mains fuses	100/120/144 V : 1.0 A slow blow 200/220/240 V : 0.8 A slow blow

2. Block diagram

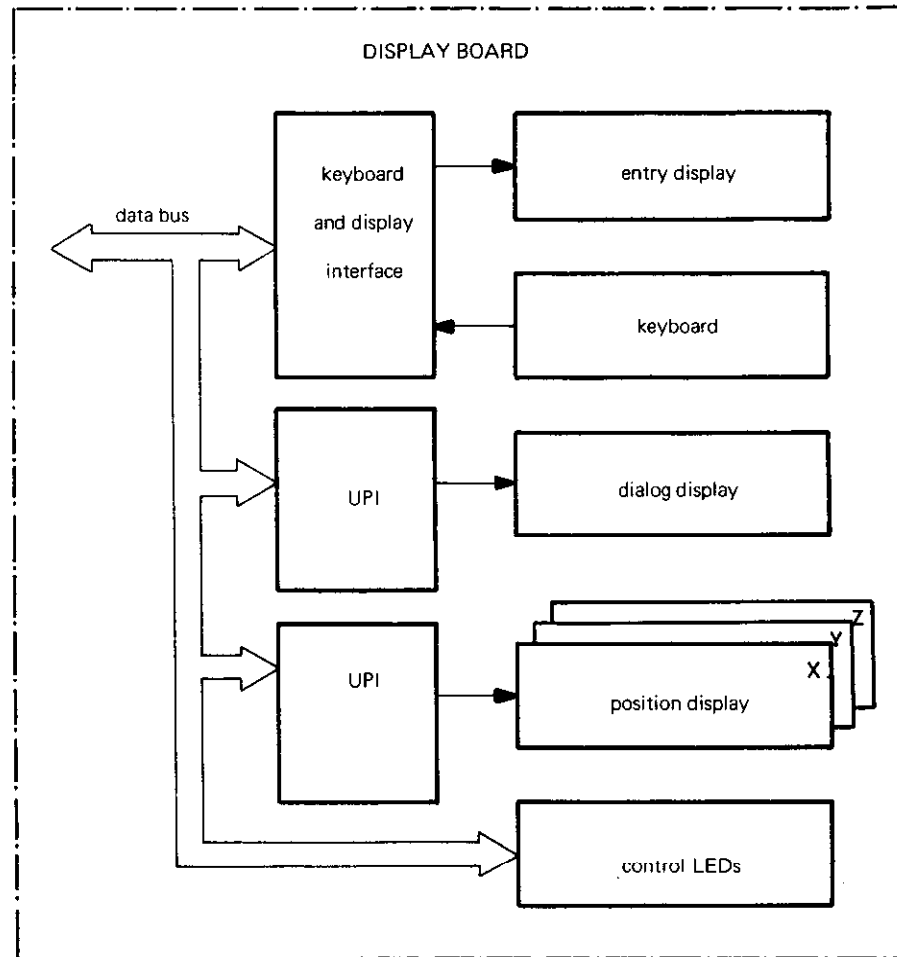
2.1 Power supply board

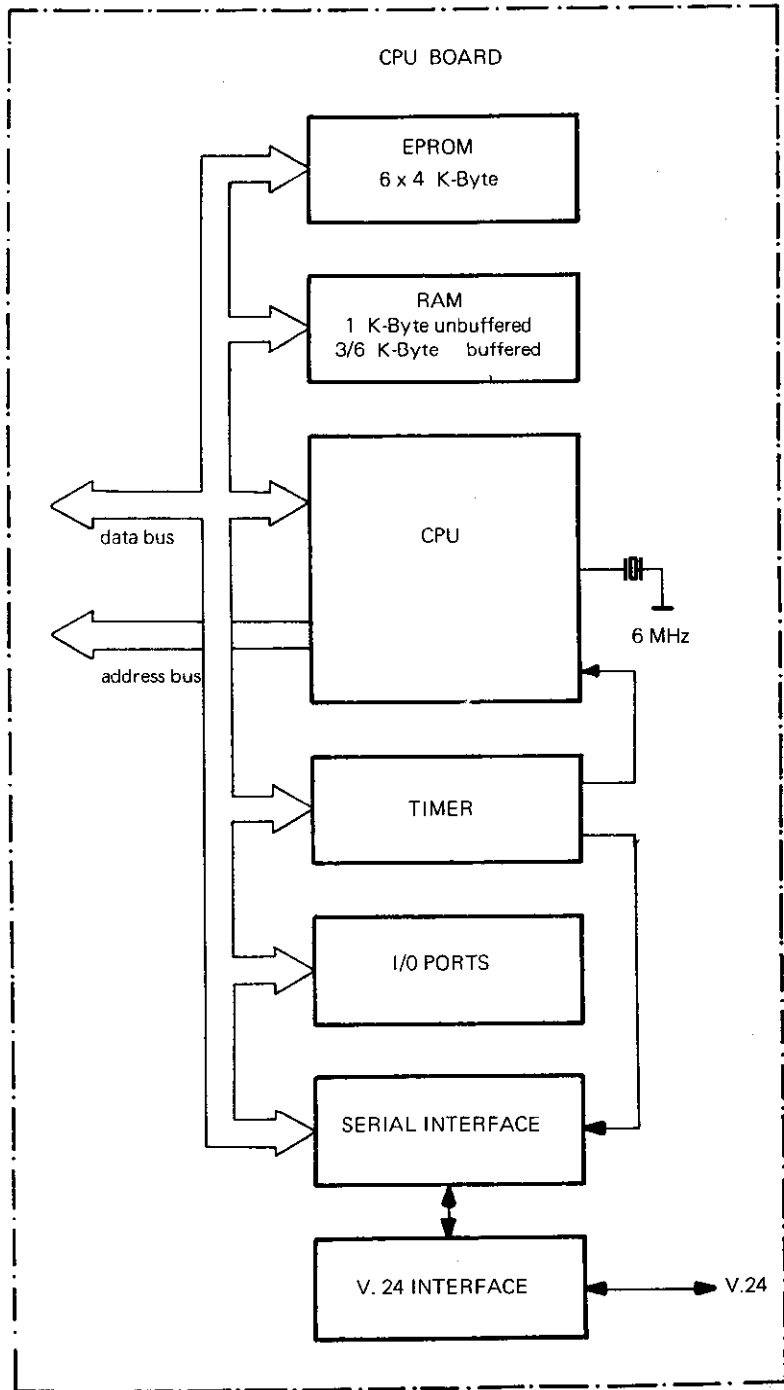


2.2 Analog component board

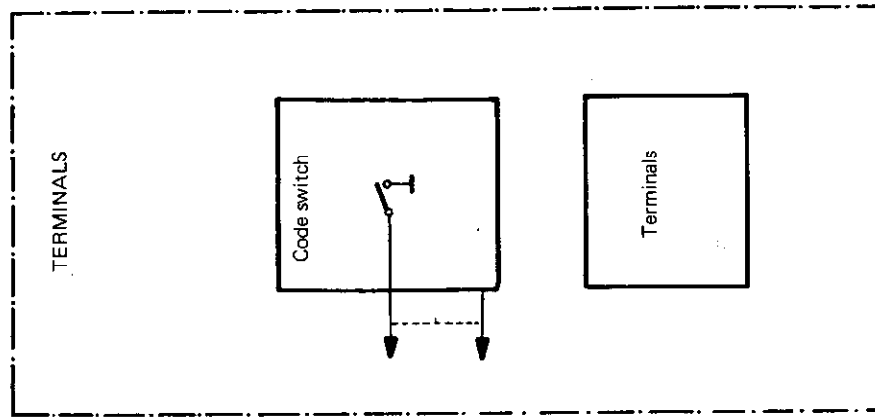


2.3 Display board

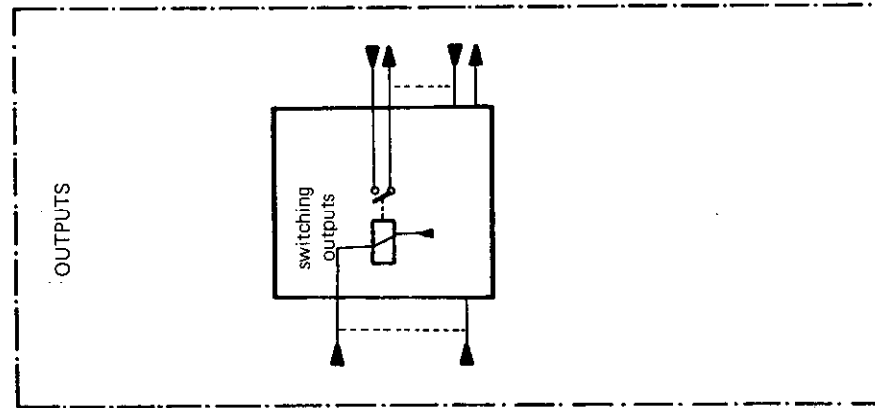




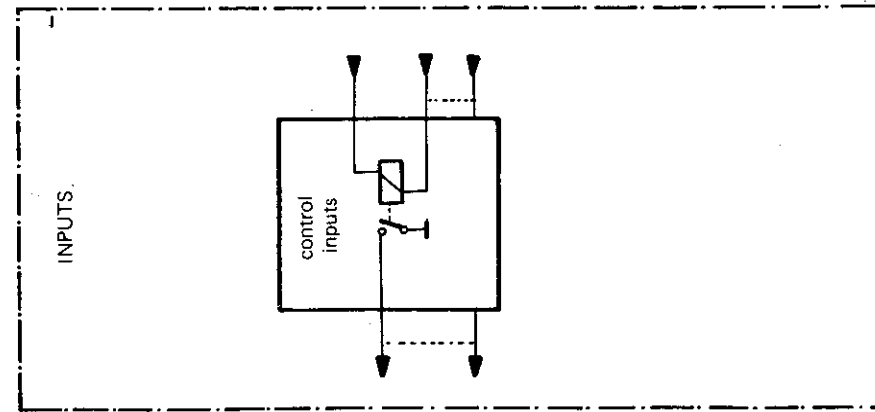
2.7 Terminal board



2.6 Output port pcb



2.5 Input port pcb



To 2.1 Power supply board

The following voltages are generated:

- +15 V (series regulator)
- 15 V (switching regulator with transverse choke)
- + 5 V (switching regulator with longitudinal choke)
- + 5 V (switching regulator with longitudinal choke)

To 2.2 Analog board with inputs for measuring systems

3 measuring system inputs (9 pole chassis mount) to connect the linear measuring systems or rotary encoders without built-in pulse shaper level (on TNC 131 S, TNC 131 ST).

Photocell signals 7 . . . 40 μ A

Grating constant (pitch) 40 μ m

.25 pole chassis mount for square wave signals U_{a1} , U_{a2} , U_{a0} , U_{aS} (on TNC 131 R, TNC 131 RT).

The analog board consists of:

- one each analog input part (2 x EXE with reference pulse evaluation for X, Y and Z axes - on TNC 131 S, TNC 131 ST).
- 3 x square wave input for signals U_{a1} , U_{a2} , U_{a0} and U_{aS} with differential line receiver per RS-422 (on TNC 131 R, TNC 131 RT).
- one each: direction discriminator (RIDI) with counting direction switch-over possibility (via code switch on Terminal board) for X, Y and Z.
- two timers to process the up-down counting pulses of X, Y and Z axes.
- battery monitor
- Override and feed trigger
- temperatur monitor
- a D/A-converter for the output of the analog output voltages of the programmed feeds of X, Y and Z by means of the sample-hold-amplifier levels.

To 2.3 Display board

The display board consists of:

- one keyboard and display interface to interrogate the keyboard and operate the entry display
- 1 UPI to operate the three position displays X, Y and Z
- one control-LED-output

To 2.4 CPU board

The CPU board consists of:

- the CPU (micro processor 8085)
- 6 EPROMs (8 x 4 K-Bits) for program storage
- 1 K-Byte RAM unbuffered (work storage)
- 3 K-Byte RAM (TNC 131 S, TNC 131 R)
- 6 K-Byte RAM (TNC 131 ST, TNC 131 RT)
- Storage for user program and for required data for program flow.
- one input/output port for control inputs and outputs
- one timer to generate time signals for CPU and serial interface
- one serial interface with line driver and line receiver for V.24 specification.

To 2.5 Input port PCB

The control inputs are connected via floating relays on the input board.

To 2.6 Output port PCB

The control outputs are supplied via floating relay contacts on the SE-output board.

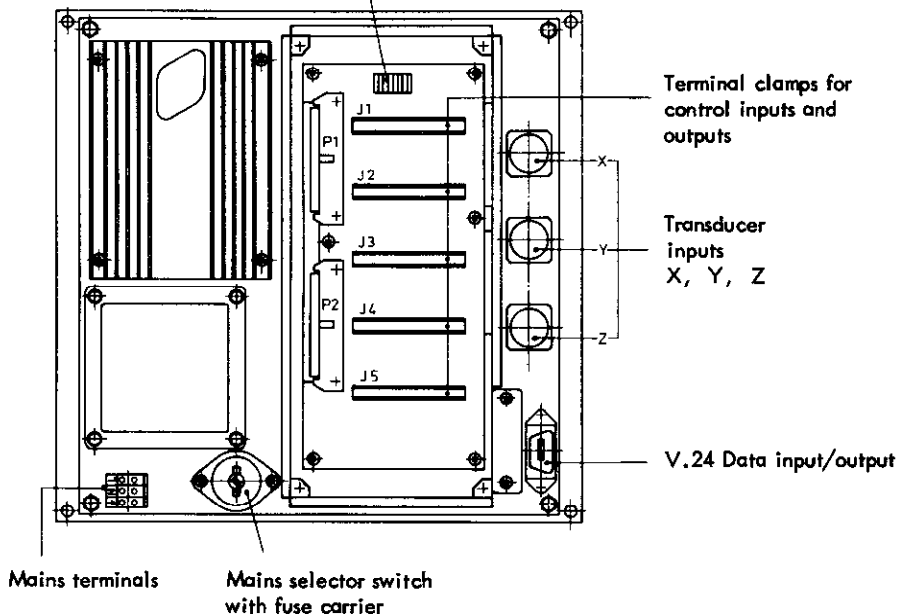
To 2.7 Terminal board

All control inputs and outputs are connected on terminals J1 to J5 of the terminal board. On the terminal board are also the code switches for ramp shape and length, as well as the display types.

3. Terminals

3.1 Open terminal box on rear of control

Code switches for counting directions and controlling voltage



3.2 Interface

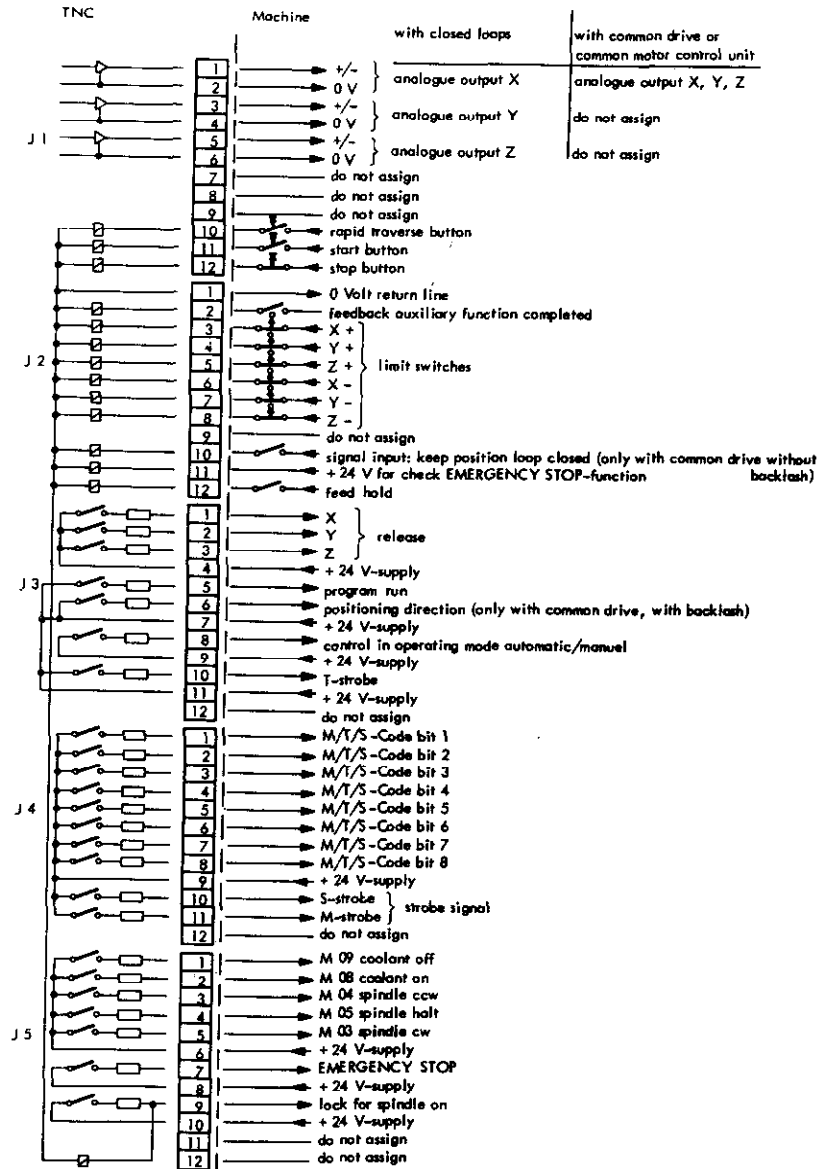
The interface between control and positioning system consists of the following signals:

- .analog output X or X, Y, Z
- .analog output Y with permanently closed positioning loop
- .analog output Z (with permanently closed positioning loop)
- .relay output release X
- .relay output release Y
- .relay output release Z
- .relay output positioning direction
- .input limit switch X+
- .input limit switch Y+
- .input limit switch Z+
- .input limit switch X-
- .input limit switch Y-
- .input limit switch Z-

Depending on the operating software (test program) the control works either with a position control circuit that is switched over to the individual axes, or with 3 permanently closed position control circuits.

3.2.1 Description (reference "Mounting Instructions and Interface TNC 131)

3.2.2 Layout of terminal box



4. Trouble shooting control/machine

It is of the greatest importance for the trouble shooting control/machine that the behaviour of the complete system is analyzed. Only then can the location of the error be pinpointed.

The following are aids for trouble shooting:

- .a monitoring system within the control
- .a "BURN-IN-TEST PROGRAM"
- .the following check list for trouble shooting control/machine

Check list for trouble shooting control/machine

4.1.1 Tests prior to machine switch-on:

Check correct setting of voltage and fuse in TNC: for 100/120/140 V : fuse 1.0 A slow blow for 200/220/240 V : fuse 0.8 A slow blow	<input type="checkbox"/>
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4.1.1.1 Check measuring systems:

The measuring systems (connector housing) must have a conductive connection to the machine grounding via the cable shield and the encoder head.	<input type="checkbox"/>
a) The connection is provided for X axis	<input type="checkbox"/>
b) The connection is provided for Y axis	<input type="checkbox"/>
c) The connection is provided for Z axis	<input type="checkbox"/>
The inner shield (pin 9) of the measuring system must not have connection to the connector housing.	<input type="checkbox"/>
a) No connection at X axis	<input type="checkbox"/>
b) No connection at Y axis	<input type="checkbox"/>
c) No connection at Z axis	<input type="checkbox"/>
All other connector pins of the measuring system must not have connection with the connector housing or with pin 9.	<input type="checkbox"/>
a) No connection at X axis	<input type="checkbox"/>
b) No connection at Y axis	<input type="checkbox"/>
c) No connection at Z axis	<input type="checkbox"/>

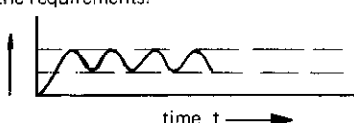
4.1.1.2 Test wiring on terminals

a) Check that all cables on J1 – J5 are properly secured.	<input type="radio"/>
b) Wiring in accordance with dwg.: "Terminal layout in terminal box of control (reference 3.2.2)	<input type="radio"/>
c) The inputs of the servo amplifiers must be directly connected to the respective analog output of TNC 131. No resistors must be interconnected.	<input type="radio"/>

4.1.1.3 Test 0V lines and their grounding

The 0V return line of the external DC voltage must be grounded in the adapter cabinet.	<input type="radio"/>
The 0V connections of the servo inputs must be grounded on the servo amplifiers. (connections on connector J1 Pin 2/4/6)	<input type="radio"/>

4.1.2 Tests after the switch-on of the adapter cabinet

Measure external DC voltage. Does it meet the requirements? 	<input type="radio"/>
Check function of limit switch range and emergency stop limit switch.	<input type="radio"/>
4.1.3 Tests prior to switch-on of TNC 131	<input type="radio"/>
Remove battery from TNC and check battery voltage. $U_{batt\ min} = 4\ V$	<input type="radio"/>
Measure battery current: $I_{batt} = 20 - 70\ \mu A$	<input type="radio"/>

4.1.4 Tests after the switch-on

4.1.4.1 Error indications

TNC 131 features an extensive monitoring system to prevent entry or operating errors and to diagnose technical defects in the machine and control system.

Monitored are:

.Programming and operating errors

- e.g. error indications
- BUTTON NON-FUNCTIONAL
- TOOL NUMBER WRONG
- WHOLE NUMBERS ONLY

.Internal electronics of control

- e.g. error indications
- PROGRAM STORAGE DEFECT
- TNC-OPERATING TEMP.EXEDED
- EXCHANGE BUFFER BATTERY

.Certain machine functions

- e.g. error indications
- GROSS POSITIONING ERROR
- DEFECT ON X-MEAS.SYSTEM
- RELAY EXT. DC VOLTAGE MISSING


Cancellation error of display

The control is inhibited while an error indication is active, i.e. to continue operations the error indication must be cleared.

The control TNC 131 distinguishes between two types of error indication:

.minor errors

- e.g. BUTTON NON-FUNCTIONAL

These errors are displayed without flashing and can be erased by simply pressing the  key.

.faults

such as faulty measuring systems, drives and defects on important electronic control functions.
With these major faults simultaneously the machine is stopped via the Emergency Stop contact of the control. These faults are indicated by a flashing display; the power supply must be switched off and the fault remedied.

Note:

In case of inquiries specify program number!

Error indication "EXCHANGE BUFFER BATTERY"

When "EXCHANGE BUFFER BATTERY" appears, new batteries should be installed (discharged battery holds the storage content for at least one week). The buffer batteries are behind the control panel in a removable battery carrier. Observe the correct polarity when changing battery (symbols are marked on the carrier).

Three "miniature cells" marked "LR6" of the "leakproof" type are required. Such batteries are commercially available.

We strongly recommend the use of Mallory Alkaline batteries type MN 1500.

If the buffer batteries are discharged or missing, program storage is supplied by the mains power. Operation may continue, however, a mains power failure will erase the stored program:

If during a battery change (discharged or missing battery) a mains power failure occurs the machine parameters must be reprogrammed (reference paragraph B 3 Operating Instructions).

4.1.4.2 Test control functions	<input type="radio"/>
Switch on TNC 131 as set out in paragraph B 2 of Operating Instructions. Dialog displays in accordance with paragraph B 2?	<input type="radio"/>
If required, program machine parameters (see paragraph B 3 of Operating Instructions).	<input type="radio"/>
4.1.4.2.1 Test keyboard	<input type="radio"/>
Do the values entered via the decimal keyboard correspond with the entry display?	<input type="radio"/>
Are the values correctly transferred into the position display of the respective axis by pressing the axis key X, Y or Z and ENT?	<input type="radio"/>
4.1.4.2.2 Check the analog inputs and the counting function	<input type="radio"/>
Monitoring of measuring system: Is the error indication flashing:	<input type="radio"/>
"DEFECT ON X-MEAS.SYSTEM" after disconnecting the measuring system of X axis?	<input type="radio"/>
"DEFECT ON Y-MEAS.SYSTEM" after disconnecting the measuring system of Y axis?	<input type="radio"/>
"DEFECT ON Z-MEAS.SYSTEM" after disconnecting the measuring system of Z axis?	<input type="radio"/>
In the case that one axis does not count: Determine the source of error on measuring system/control by interchanging the connection cables of measuring systems and traversing the respective machine axes by hand.	<input type="radio"/>
4.1.4.2.3 Check the setting of the code switch (reference "Mounting Instructions and Interface")	<input type="radio"/>

5. Test Programs

The following program serves as an aid in trouble shooting

Program of BURN-IN-Test on complete control.

For the tests with testing programs the control must be completely disconnected from the machine!
(Safety measures, e.g. EMERGENCY STOP, Stop etc. not active)

5.1 BURN-IN-Test TNC 131/135

The following applies to both TNC 131 and TNC 135:

Unit	Test program	Ident.-No.
TNC 131 B, 500 blocks (4K-RAM)	BURN-IN TNC 131 4K	212 920 01
TNC 131 B, 1000 blocks (7K-RAM)	BURN-IN TNC 131 7K	212 935 01
TNC 135, 500 blocks (4K-RAM)	BURN-IN TNC 135 4K	212 919 01
TNC 135, 1000 blocks (7K-RAM)	BURN-IN TNC 135 7K	212 934 01

5.1.1 Required equipment or test fixtures

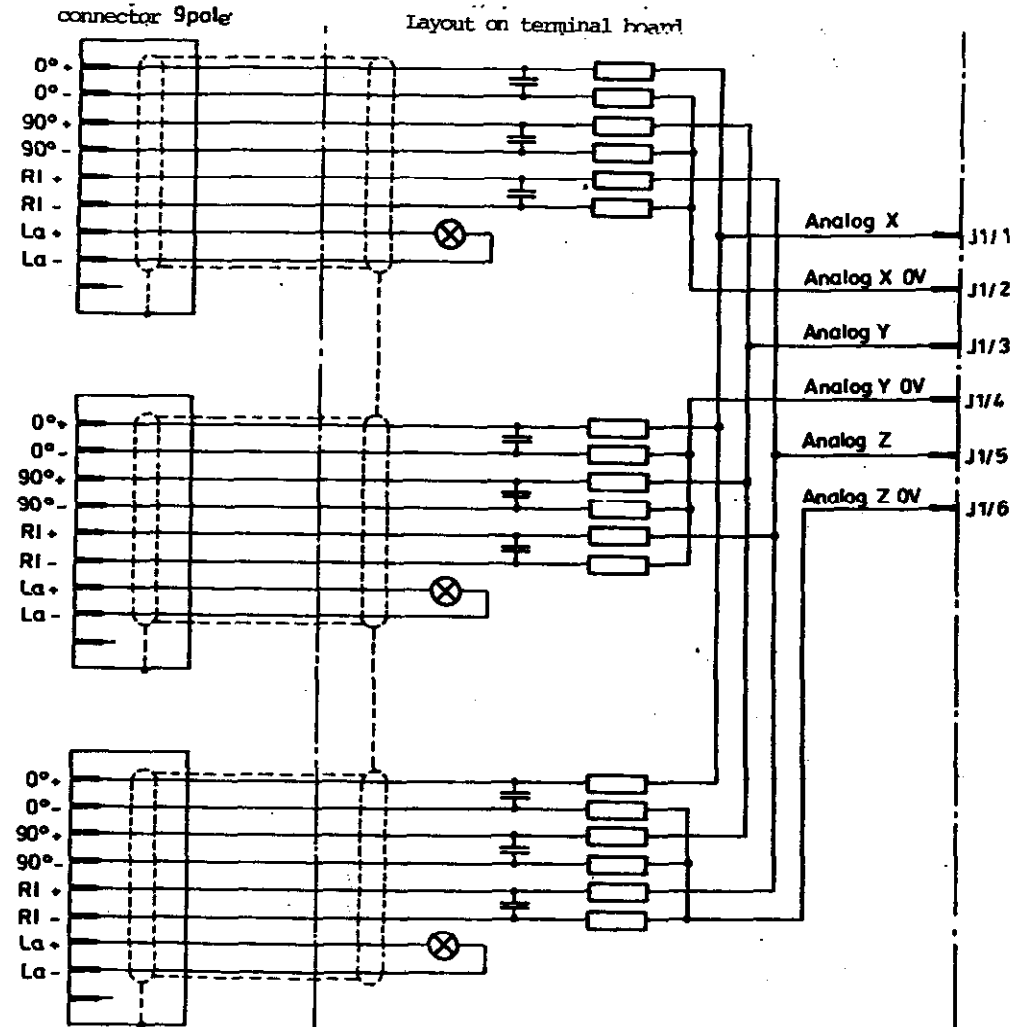
ME 101/102 with data transm. cable

Cassette "BURN-IN TNC . . . K"

"Test connector for control inputs and outputs and analog input" (picture 1 and 2)

Test connector RS-232C (picture 3)

Pict.1 Test connector for analog input



cable LiYCY 4x2x0,14

resistors R = 18x130 kOhm

capacitors C = 9x1000 pF

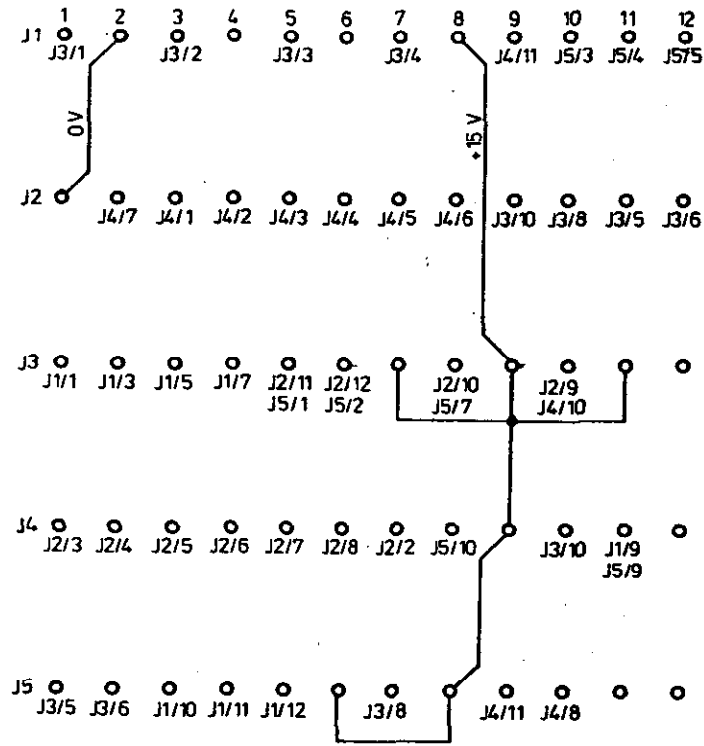
Id.Nr. 363 NE 200 854 01

Id.Nr. 410 NE 200 909 47

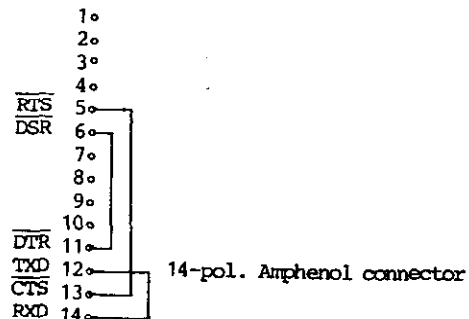
Id.Nr. 471 NE 200 751 35

F21 BA 212 281

Pict.2 Test connector for control inputs and outputs

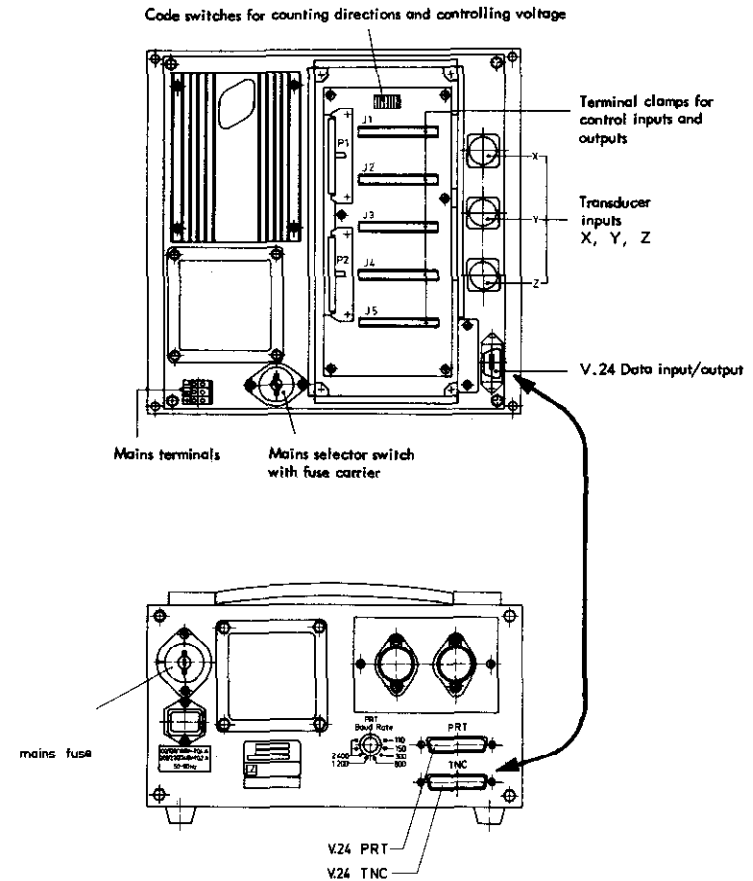


Pict.3 Test connector V.24-interface (ext.data inputs and outputs)

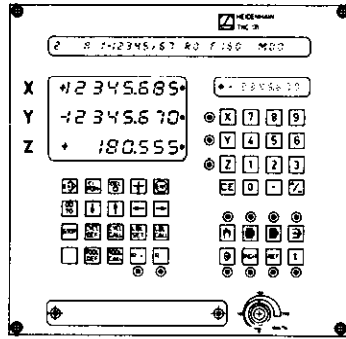
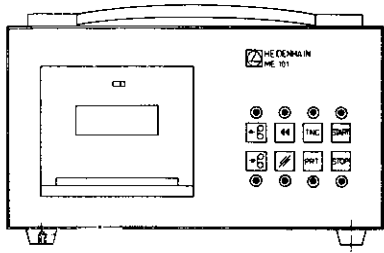


5.1.2 Preparation

1. Switch off power supply!
2. Remove TNC
3. Remove 4 mounting screws of terminal box on rear of control and take off cover.
4. **Disconnect** terminals J1-J5 for ext. connections.
5. Write down switch position of DIL switches!
6. Set DIL switches 1-8 upward
7. Connect "test connector J1-J5 with analog input" on terminals J1-J5 and analog inputs X, Y and Z. (Observe marking!)
8. Connect ME-TNC.



5.1.3 Testing sequence



1. Switch on ME:
all LEDs of ME light up;
all LEDs turn off after abt. 3 sec, except LED STOP

2. Press TNC keys and simultaneously

3. Turn on power supply for TNC:
In dialog display: TNC 131: 32 alpha numeric digits

External Data entry appears

4. Data transfer ME - TNC

- a) press ME key
- b) press ME key
- c) press ME key
- d) press ME key

The program is re-recorded in the TNC.
This procedure lasts abt. 1 minute at 4K and abt. 2 minutes at 7K.

5. After the test program is re-recorded in the RAM, the data is checked (**check-sum-test**).
If data transfer is wrong the error indication 00-FFFF starts flashing in the entry display.

6. After the transmission of the data disconnect the data transm. cable on TNC and connect test connector V.24. **KEYBOARD OVERRIDE TEST** appears in the dialog display.

7. Override Test

With the override potentiometer check on TNC whether the value from 0 to 145 can be controlled and then set it to exactly 100 ± 1 (visible in the entry display). (The marking on the knob must match the marking on the front panel exactly; if necessary the knob must be readjusted).

8. Keyboard test

Keyboard 1

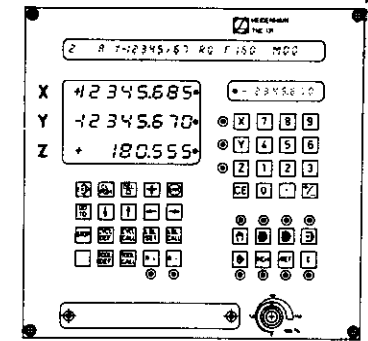
- Start with then 7-8-9
 then 4-5-6
 then 1-2-3
 then 0-±

Keyboard 2

Start with then sequence as under keyboard 1

Keyboard 3

Start with manual then sequence as under keyboard 1



If all keys are o.k., the dialog display will display for each activated key "??".


A keyboard error (defective key code, wrong sequence) effects a "?" in the dialog display. After abt. 3 sec. "KEYBOARD OVERRIDE TEST" appears in the dialog display.

The keyboard test can be started again.

After a faultless keyboard test "BURN IN TIME CLEAR ? WITH DIL SWITCH" appears in dialog display.

9. Set-back of BURN IN TIME and test DIL switch

The set-back of the BURN IN TIME should be done once after the read-in of the test program, after the keyboard test was completed. For the set-back of this time display the DIL switches on the terminal board (rear of control) in the sequence 1 to 8 one after another should be set from the "upward" position "downward" (position "down" on slide switch equals "open" on switches with rockers). For each switch max. 10 sec. time are provided. The malfunction of the switch effects a flashing error indication: EE - EEE.E in the entry display.

In this case the test program must be entered again. The entered program is cleared with the  key. The dialog display will display: POWER FAILURE

10. Automatic test flow

After the BURN IN time set to 000.0 the cyclic BURN IN test starts automatically. The entry display will display the test status and the BURN IN time.


Example: Entry display	18 -	0.48.2
	test status	BURN IN TIME in hours
	(error code)	display step 0.1 hrs.

One test cycle lasts abt. 65 sec. at 4K (abt. 6 min. at 7K). The entry display starts flashing when an error is recognized. The BURN IN time stops and the error code is displayed.


.After the BURN IN test the DIL switches must be set in the original position.
.Disconnect test connectors J1 - J5 and analog inputs, as well as V.24 test connector.

5.1.4 Jump into control program

(Clear test program symbol)

By pressing the  key a jump from the test program into the control program is effected.


5.1.5 Test repeat in case of error

By pressing the  key a test repeat, starting with the DIL switch test (dialog display: BURN IN TIME CLEAR? WITH DIL SWITCH), can be activated.

By reactivating the DIL switches 1-8, as in paragr. 5.1.3-9, the BURN IN time can be reset to 0.

5.1.6 Interruption of BURN IN tests

The cyclic BURN IN test can be interrupted by switching off the power supply.

When the power supply is turned on again and the  key is pressed, the cyclic test flow starts again. BURN IN time and a possible error indication (flashing entry display) are not lost through a power failure. During the RAM test the power supply should not be interrupted (test status 11-17).

The error display

CC - XXX.X

indicates that the power supply was interrupted during the RAM tests. A new read-in of the test program is necessary.

5.1.7 Error code/Test status
BURN IN program TNC 131 4K

	error code test status	description
a)	00 FF EE CC UU	Check sum RAM wrong after loading with ME (probable address error) Keyboard error DIL switch error Power failure during RAM test CPU test program not in EPROM 2
Start of cyclic tests		
b)	Test EPROM (test check sum)	
	01 02 03 04 05 06	EPROM 1 CPU board Q 10 or address selection / interrogation EPROM 2 " Q 6 " EPROM 3 " Q 2 " EPROM 4 " Q 9 " EPROM 5 " Q 5 " EPROM 6 " Q 1 "
c)	Test RAM (4K - RAM)	
	11 12 13 14	RAM Q15/Q16 CPU board address range 6000H - 63FFH (1K) RAM Q21/A22 " 6400H - 67FFH " RAM Q27/Q28 " 6800H - 6BFFH " RAM Q29/Q30 " 6C00H - 6FFFH "
d)	Test CPU 8085 A	
	18	CPU Q35 CPU board
e)	Test TIMER, START/STOP -Flip Flop	
	20	Test status Test Timer and Start/Stop-flip-flop
	21	Error TIMER analog board Q26/9
	22	" " Q26/15
	23	" " Q26/18
	24	" " Q22/9
	25	" " Q22/15
	26	" " Q22/18
	27	Error Start/Stop " Q 1/Q18
	28	" " " Q 1/Q18

Test MONOFLOP, analog outputs X, Y, Z feed input INPUT/OUTPUT Ports and relays (with test connector picture 2)

Test No.	Starting condition	OUTPUT-PORTS	INPUT-PORTS	Relays	Notes	
29	OFF	Q20, Q26, Q32, Q44/4	Q4, Q7	on 0 Volt, relays on 5 Volt.		
30	MONOFLOP CPU board Q 51 (TIME PERIOD)					
31	Analog output	X	J1/1-J3/1	Rel. 9	J 3/4 - J 1/7 connection on feed input	
32	"	Y	J1/3-J3/2	Rel. 21		
33	"	Z	J1/5-J3/3	Rel. 10		
34	Outp./Inp.	7C/Bit 4	Q 20/Q4	J3/6-J2/12	Rel. 11	Rel. 3
35	"	"	5	J3/5-J2/11	Rel. 22	Rel. 11
36	"	"	6	J3/8-J2/10	Rel. 23	Rel. 4
37	"	"	7	J3/10-J2/9	Rel. 12	Rel. 12
38	"	"	8	J5/9-J1/9	Rel. 1	Rel. 1
41	"	7D/Bit 1	Q26/Q7	J4/1-J2/3	Rel. 7	Rel. 15
42	"	"	2	J4/2-J2/4	Rel. 8	Rel. 7
43	"	"	3	J4/3-J2/5	Rel. 20	Rel. 14
44	"	"	4	J4/4-J2/6	Rel. 19	Rel. 6
45	"	"	5	J4/5-J2/7	Rel. 24	Rel. 13
46	"	"	6	J4/6-J2/8	Rel. 6	Rel. 5
47	"	"	7	J4/7-J2/2	Rel. 18	Rel. 8
48	"	"	8	J4/8-J5/10	Rel. 5	Rel. 16
51	"	7E/Bit 1	Q32/Q4	J5/5-J1/12	Rel. 14	Rel. 10
52	"	"	2	J5/4-J1/11	Rel. 3	Rel. 2
53	"	"	3	J5/3-J1/10	Rel. 15	Rel. 9
54	"	"	4	J5/2-J2/12	Rel. 4	
55	"	"	5	J5/1-J2/11	Rel. 16	
56	"	"	6	J5/7-J2/10	Rel. 2	
57	"	"	7	J4/10-J2/9	Rel. 17	
58	"	"	8	J4/11-J1/9	Rel. 13	
59	"	7D/all Bit + 7E/all Bit				

Note: Relay test 1,1 ms for 2 relays in series (max. pick-up time 0.4 ms, max. bounce time 0.15 ms)

5.1.7 Error code/Test status
BURN IN program TNC 131 7K

Test V.24 Interface (external data input/output with test connector (pict. 2))		
60	error RTS-CIS Q36 CPU board	
61	error RS 232 data transmission TxD-RxD	
62	error RS 232 parity	
63	error RS 232 overflow	
64	error RS 232 stop bit	
65	error DTR-DSR	
Test feed override, battery, temperature		
66	Test override poti on 100 + 1k _Ω	
67	battery	
68	excessive temperature (no test with DIL switch position)	
Test contamination switching, RI - Start/Stop-Flip/Flop (4 K - RAM)		
axis display via axis LED X, Y, Z		
70	Test contamination trigger and 0° signals	
	LED	test condition
	R+/R-	test all contamination triggers simultaneously
	R-	no contamination, test track 0° negative
R+	no contamination, rest track 0° positive	
71	Test 90°-Signal	
	R-	no contamination test track 90° negative
R+	no contamination test track 90° positive	
72	Test Diode connection to U ₀	
	R-	test with test track 0°/90° negative
R+	test with test track 0°/90° positive	
73	Test RI input, Start-Storp-FF	
	R-	test with input D = 0
R+	test with input D = 1	
Test inputs of meas.systems, EXE and RiDi no test when packed with 4K-RAM		

	error code test status	description
a)	00 FF EE CC UU	Check sum RAM wrong after loading with ME (probable address error) Keyboard error DIL switch error Power failure during RAM test CPU test program not in EPROM 2
Start of cyclic tests		
b)	Test EPROM (test check sum)	
	01	EPROM 1 CPU board Q 10 or address selection + interrogation
	02	EPROM 2 " Q 6 "
	03	EPROM 3 " Q 2 "
	04	EPROM 4 " Q 9 "
	05	EPROM 5 " Q 5 "
	06	EPROM 6 " Q 1 "
c)	Test RAM (7K - RAM)	
	11	RAM Q15/Q16 CPU board address range 6000 H-63FFH (1K)
	12	" Q 21/Q22 " " " " 6400 H-67FFH "
	13	" Q27/Q28 " " " " 6800 H-6BFFH "
	14	" Q29/Q30 " " " " 6C00 H-6FFFH "
	15	" Q33/Q34 " " " " 7000 H-73FFH "
	16	" Q38/Q39 " " " " 7400 H-77FFH "
	17	" Q40/Q41 " " " " 7800 H-7BFFH "
d)	Test CPU 8085 A	
	18	CPU Q35 CPU board

e) **Test TIMER, START/STOP – Flip Flop**

20	Test status	Test Timer and Start/Stop-flip-flop
21	Error TIMER	analog board Q26/9
22	" "	" Q26/15
23	" "	" Q26/18
24	" "	" Q22/9
25	" "	" Q22/15
26	" "	" Q22/18
27	Error Start/Stop	" Q 1/Q18
28	" "	" Q 1/Q18

Test MONOFLOP, analog outputs X, Y, Z feed input INPUT/OUTPUT Ports and relays (with test connector picture 2)

29	Starting condition OUTPUT-PORTS Q20, Q26, Q32, Q44/4 on 0 Volt, relays OFF, INPUT-PORTS Q4, Q7 on 5 Volt.				
30	MONOFLOP CPU board Q 51 (TIME PERIOD)				
31	Analog output X		J1/1-J3/1	Rel. 9	J 3/4 - J 1/7 connection on feed input
32	" Y		J1/3-J3/2	Rel. 21	
33	" Z		J1/5-J3/3	Rel. 10	
34	Outp./Inp. 7C/Bit 4	Q 20/Q4	J3/6-J2/12	Rel. 11	Rel. 3
35	" "	5 "	J3/5-J2/11	Rel. 22	Rel. 11
36	" "	6 "	J3/8-J2/10	Rel. 23	Rel. 4
37	" "	7 "	J3/10-J2/ 9	Rel. 12	Rel. 12
38	" "	8 "	J5/9-J1/ 9	Rel. 1	Rel. 1
41	" "	7D/Bit 1 Q26/Q7	J4/1-J2/3	Rel. 7	Rel. 15
42	" "	" 2 "	J4/2-J2/4	Rel. 8	Rel. 7
43	" "	" 3 "	J4/3-J2/5	Rel. 20	Rel. 14
44	" "	" 4 "	J4/4-J2/6	Rel. 19	Rel. 6
45	" "	" 5 "	J4/5-J2/7	Rel. 24	Rel. 13
46	" "	" 6 "	J4/6-J2/8	Rel. 6	Rel. 5
47	" "	" 7 "	J4/7-J2/2	Rel. 18	Rel. 8
48	" "	" 8 "	J4/8-J5/10	Rel. 5	Rel. 16
51	" "	7E/Bit 1 Q32/Q4	J5/5-J1/12	Rel. 14	Rel. 10
52	" "	" 2 "	J5/4-J1/11	Rel. 3	Rel. 2
53	" "	" 3 "	J5/3-J1/10	Rel. 15	Rel. 9
54	" "	" 4 "	J5/2-J2/12	Rel. 4	
55	" "	" 5 "	J5/1-J2/11	Rel. 16	
56	" "	" 6 "	J5/7-J2/10	Rel. 2	
57	" "	" 7 "	J4/10-J2/9	Rel. 17	
58	" "	" 8 "	J4/11-J1/9	Rel. 13	
59	" "	7D/all Bit + 7E/all Bit			

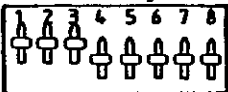
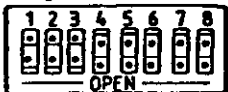
Note: Relay test 1,1 ms for 2 relays in series (max. pick-up time 0.4 ms, max. bounce time 0.15 ms)

Test V.24 Interface (external data input/output with test connector (pict. 2))

60	error RTS-CTS Q36 CPU board
61	error RS 232 data transmission TxD-RxD
62	error RS 232 parity
63	error RS 232 overflow
64	error RS 232 stop bit
65	error DTR-DSR

Test feed override, battery, temperature

66	Test override poti on 100 \pm 1%
67	battery
68	excessive temperature (no test with DIL switch position)


or


Test the contamination switching and RI inputs, Start/Stop-flip/flop (7 K RAM)

Error indication via additional LED's																			
70	contamination switching 0° signals																		
71	contamination switching 90° signals																		
	<table border="1" style="width: 100%;"> <thead> <tr> <th>LED</th> <th>type of error</th> </tr> </thead> <tbody> <tr> <td>X,Y,Z</td> <td>axis display of errors</td> </tr> <tr> <td>R+</td> <td>no trigger point for pos. diode voltage*</td> </tr> <tr> <td>R-</td> <td>no trigger point for neg. diode voltage*</td> </tr> <tr> <td>R+/REF</td> <td>trigger value for pos.diode volt. outside tolerance*</td> </tr> <tr> <td>R-/REF</td> <td>trigger value for neg.diode volt. outside tolerance*</td> </tr> <tr> <td>R+/I</td> <td>hysteresis with pos. diode voltage</td> </tr> <tr> <td>R-/I</td> <td>hysteresis with neg. diode voltage</td> </tr> </tbody> </table> <p>* Polarity of diode voltages are referenced to U₀ .</p>	LED	type of error	X,Y,Z	axis display of errors	R+	no trigger point for pos. diode voltage*	R-	no trigger point for neg. diode voltage*	R+/REF	trigger value for pos.diode volt. outside tolerance*	R-/REF	trigger value for neg.diode volt. outside tolerance*	R+/I	hysteresis with pos. diode voltage	R-/I	hysteresis with neg. diode voltage		
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R+/I	hysteresis with pos. diode voltage																		
R-/I	hysteresis with neg. diode voltage																		
72	Test diode connection to U ₀																		
	<table border="1" style="width: 100%;"> <thead> <tr> <th>LED</th> <th>type of error</th> </tr> </thead> <tbody> <tr> <td>X,Y,Z</td> <td>axis display of errors</td> </tr> <tr> <td>R+</td> <td>polarity error of diodes with anode on U₀</td> </tr> <tr> <td>P-</td> <td>polarity error of diodes with cathode on U₀</td> </tr> </tbody> </table>	LED	type of error	X,Y,Z	axis display of errors	R+	polarity error of diodes with anode on U ₀	P-	polarity error of diodes with cathode on U ₀										
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73	Reference input, Start/Stop-flip/flop																		
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Test inputs of meas. systems, EXE, RIDI (7 K - RAM)

77	Test with counting direction forward
78	Test with counting direction reverse
LED	
X Y Z	axis display of errors
R+	test timer forward
R-	test timer reverse
[Hand icon]	Trigger 0°
[45° icon]	Trigger 45°
[90° icon]	Trigger 90°
[135° icon]	Trigger 135°
[180° icon]	Trigger 180°
[225° icon]	Trigger 225°
REF	Trigger 270°
I	Trigger 315°

6. Exchange of TNC 131

6.1 General remarks

Do not engage or disengage connectors whilst unit is under power!

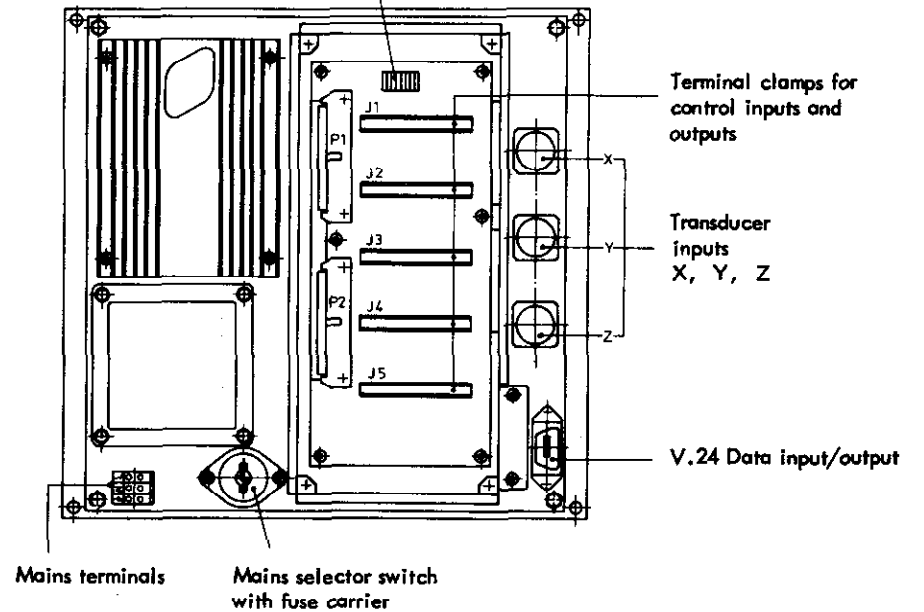
.NC machines also require those safety devices as used on manually operated machines (e.g. limit switches, "Emergency Stop" buttons etc.).

The proper function of these devices should be checked **before commencing** operation!

3. Terminals

3.1 Open terminal box on rear of control

Code switches for counting directions and controlling voltage



6.1.1 Work area requirements

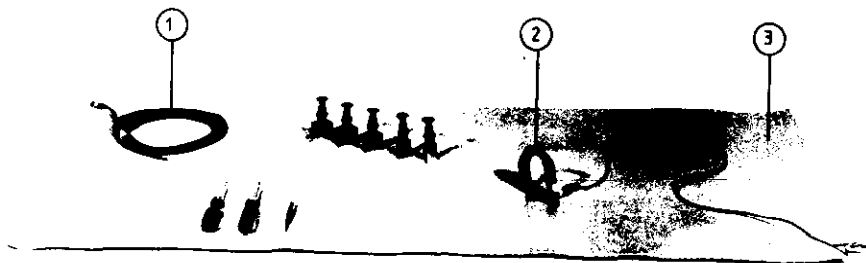
TNC 131 contains subassemblies with C-MOS elements. Although C-MOS circuits are provided with an input safety network to eliminate the build-up of a static charge-up, they must be handled with utmost care.

The following requirements in the work area must be met:

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

A handy portable "MOS-HANDLING-SET" for field service is available, which is a **MUST** for every service kit.

- 1) a cable that equalizes potential differences between conductive work surface and ground
- 2) a wristband that provides an electrical connection between person and conductive work surface
- 3) a conductive work surface



6.2 Exchange of TNC 131

Caution:

Prior to exchange of the control the machine parameters must be written down.

1	Switch off power supply of system	Removal of defective control
2	Remove mounting screws of control	
3	Take TNC carefully out of control cabinet	
4	Disconnect power supply on TNC; watch non-fused earthed conductor	
5	Disconnect measuring systems; mark X, Y, Z	
6	Remove cover from terminal box	
7	Disconnect J1 to J5, don't remove individual wires	
8	Write down setting of code switches !!!	
9	Check correct voltage setting	
10	Check power fuse 100 . . . 140 V = 1,0 A; 200 . . . 240 V = 0,8 A	Installation of new control
11	Check program number	
12	Remove covers from cooling vents, if necessary, splashwater protection?	
13	Check code switch positions and set, if necessary	
14	Connect terminal J1 to J5	
15	Mount cover of terminal box; watch cable run	
16	Connect measuring systems; note X, Y, Z	
17	Connect power supply, watch non-fused earthed conductor	
18	Insert and mount TNC carefully. Watch cables!	
19	Check machine parameters and reenter, if necessary	
20	Check TNC with machine	

6.3 Exchange of the service block TNC 131

1	Remove the 4 mounting screws from control housing (7 mm socket wrench) and lift front panel (Service-Block)
2	Disconnect the inputs of the measuring systems X, Y, Z (J1, J2, J3) on the analog board
3	Disconnect connecting cable P3 and P4 to the input port and output port PCBs on the CPU board
4	Disconnect power supply P2 on CPU board
5	Disconnect connecting cable RS-232C interface
6	Check program ident.number of new service block
7	Assemble in reverse sequence

6.4 Exchange boards

6.4.1 Exchange boards of service block TNC 131

1	Disconnect the battery connecting cable J3 on CPU board
2	Disconnect the connecting cable J1 to analog board
3	Disconnect the post connector P1 on CPU board
4	Remove the 5 mounting bolts of CPU board
5	Disconnect the connecting cable to override pot on analog board
6	Remove the 5 mounting bolts of analog board
7	Remove the 3 mounting bolts and the 2 mounting screws on display board
8	Disconnect the 5 keyboard connections P1 to P5 on display board
9	Assemble in reverse sequence

6.4.2 Exchange of boards in terminal box

1	Remove the 4 mounting screws of cover
2	Remove the 6 mounting screws of terminal board
3	Disconnect the 2 connecting cables P1 and P2 on the terminal board
4	Remove the 6 mounting bolts of the output port PCB
5	Disconnect the connecting cable P2 to CPU board
6	Remove the 6 mounting bolts of SE input board
7	Disconnect the connecting cable P2 to CPU board
8	Assemble in reverse sequence