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USERMANUAL

Minipos M11 – M88

(starting with version 2.34)

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1. Miscellaneous

1.1 LIST OF G-FUNCTIONS

G00	RAPID TRAVERSE
G01	LINEAR INTERPOLATION
G04	DWELL TIME
G09	SKIP REST OF TRAVEL
G11	ADDITIONAL FUNCTIONS F,S,T
G13	ADDITIONAL M-FUNCTIONS
G20	JUMP TO PROGRAM
G22	CALL PROGRAMM
G23	CALL PROGRAMM WITH CONDITION
G53	DISPLACEMENT OFF
G54	DISPLACEMENT ON
G67/68	SOFTWARE LIMIT SWITCH
G74	REFERENCE POINT
G75	SCALE FACTOR ON
G76	SCALE FACTOR OFF
G88	LINEAR SEGMENTATION
G89	FREE CYCLE
G90	ABSOLUTE INPUT
G91	INCREMENTAL INPUT
G92	SET ACTUAL VALUE

1.2 LIST OF M-FUNCTIONS

M00	PROGRAMMED STOP
M02	PROGRAM END
M27	WAIT FOR “IN POSITION“
M30	PROGRAM END
M1xx	USE I/O CARD 1
M4xx	USE I/O CARD 2

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1.3 LIST OF ERROR MESSAGE

Error:	***Hint:***
INTERPOLATOR	Interpolatorcard gives no answer, Switch control off and on again.
CHECKSUM	Checksumerror during serial transmission. Repeat transmission
KEYBOARD	Keyboard out of order, a key is pushed after switching on, EXT START is active
	EPROMError in the eprom. Exchange the Minipos
MEMORIZED PROGRAMS	Error in one of the memorized programs. Clear the complete memory and transmit the programs again via serial interface.
P NOT FOUND	This program number is not in memory.
N NOT FOUND	This bloc number is not in memory.
T NOT FOUND	This T-number is not in P9900.
NO F	Add a bloc with G11 F.... to your program
CHECK BLOC	Syntax error while memorizing a bloc
MEMORY FULL	No more memory free. Transmit some of your programs via serial interface.
TOO MANY SUBPROGRAM CALLS	Look at the description of G22.
P CANNOT BE EXECUTED	P0 or P9900 cannot be used for execution.
MOVING DISTACE =0	A movement of the distanc e 0 cannot be executed.
IN POSITION	Look at machinedata N803
LAGMAX	Look at machinedata N804
LAG ERROR	AXIS cannot follow with the programmed feedrate.
DATAFORMAT	Dataformat of serial transmission not OK.
V24	Parity or Framing Error durung serial transmission.
LIMIT SWITCH	Axis touched limit switch while moving.
SOFTW. LIMIT SWITCH	Softwarelimitswitch violated.
WAY OFF LIMIT SWITCH	Look at machinedata M712
INTERRUPT	E1 on IO4 was activated.
B-BUS ERROR	Data transmission between INTER-POLATOR and DILAG failed.
INTERPOLATOR ERROR	Data transmission from CPU to INTER-POLATOR failed.

Error messages must be acknowledged with 

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2. OPERATING MODES

After switching on, the display shows:

MENUE
MINIPOS 11 V2.42 (version number)

or **MINIPOS 22** equal to the implemented axes.

Modes who can be selected:



Manual mode (manual input, pushing the key 2 times)



Teach In



Automatic Mode



External data



Clear memory



Menu (= Stop in the Automatic Mode)



Input mode

These operating modes can be selected by pressing the correspoding key.

By pushing the key "REF" a restart of the MINIPOS is initiated, just as if RESET were pushed.

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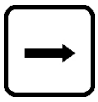
Further functions key´s:



Search block, single Stepp in automatic mode



Clear



Move cursor right



In insert mode: scroll down
In hand mode: switch axles



Home position. By pushing the key a restart of the MINIPOS is initiated.

2.1 Manual mode

After pushing "MANUAL", the MINIPOS selects "MANUAL MODE".

Pushing the key 1 (<<<) will move the X-axis with maximum speed in the positive direction, with 4 (>>>) in the negative direction.
Key 2 (<<) and 5 (>>) move with 10% of the maximal feedrate, key 3 (<) and 6 (>) with 1 %.
The axis moves until the key is released. The actual counter displays the position of the axis.

Exiting the manual mode

To exit the manual mode, the key "STOP" can be selected. The mode "MANUAL INPUT" can be selected by pushing key "MANUAL" once more.

Display of lagerror

During a movement, the lagerror can be displayed by pushing the key "±". This is only possible with servoamplifiers.

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2.2 Manual input

This operating mode allows to input and execute single G- functions and parametrical functions. Also cycles like G87 and programm calls cam be executed.

Pushing "→" positions the cursor to the next data input area.

The key "START" executes the programmed block. The execution of the block can be interrupted with "STOP". A new G-function can be entered.

Jogging mode

1.Switch to incremental input with G91.
2. Select G00 and input a distance in X, Y or Z.
3. By pushing "START", the block will be executed.
   By pushing "START" one more time, the block will be executed again.

Move to a position

1. Switch to absolute input with G90.
2. Select G00 and input a position in X, Y or Z.
3. Move to the desired position with "START".

2.3 Teach in

The MINIPOS requests the user to input a program number, which can be acknowledged by "→". Then the TEACH IN mode is invoked. TEACH In allways will be done G90.
A complete block input buffer for G01 is displayed. With "→" single words can be selected and updated.

Programming will be done as follows:

Move your axes like "MANUAL MODE". The actual position will be displayed in the block buffer. The block will be stored in memory by pushing the key "INPUT".

2.4 Clear memory

This mode allows to delete single programs or to clear the complete memory.
Single programs can be deleted by inputing the program number and then pushing "→".
To delete a range of blocks of a program, enter the program number and then "↓". The MINIPOS requests the starting and the ending block numbers. All blocks in this range will be deleted.

The whole memory can be cleared by pushing "C" and then "→". Here the code defined in the machine is requested, even if the code is 0. P0000 remains in memory. Program P0000 cannot be deleted.

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2.5 Automatic mode

When invoking the automatic mode, the MINIPOS proposes a program number. The proposed program number will be the one processed at last. Another program number can be input if desired.

The program will be executed by pushing "START". If the program number is acknowledged by "→", the MINIPOS proposes a block number. Another block number can be entered.

To acknowledge the block number, push "→". Then the first block of the program will be displayed.

With "START" the automatic program execution is activated. Single stepping can be activated during program run by pushing "SEARCH BLOCK". At the end of the next block, the MINIPOS stops awaiting a new "START". Pushing "SINGLE BLOCK" again disables single stepping.

The automatic mode is exited with "STOP".

If a limit switch is detected during program execution, the MINIPOS will stop all axes immediately and an error message will be displayed.

Autostart P9999

After switching on the MINIPOS, a check for the presence of P9999 is done. If it is present, it will be executed immiedetly. This function allows for example to preset the initial state of

G90/G91:
P9999
N0001 G90

After switching on, P9999 will not be executed, if the key "→" is pressed and hold down.

Error handling P9998

If an error f.e. "Limit switch" or "External interrupt" occurs during the AUTOMATIC MODE, P9998, if present in the memory, will be invoked.
This allows for example to set the I/O's in a definite state.

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2.6 External data

The operating mode "EXTERNAL DATA" permits input or output of programs to the serial interface.

Program printout with serial port

Select "EXTERNAL DATA" and then push key "1". The MINIPOS proposes program number for printout. To produce a printing of all the programs in memory, first push "C" and then "→".
If the programm number is acknowledged with "↓", a formfeed is generated at the end of the programm.
The printer must be able to interpret the following control sequences:

CR (=0DH), LF (=0AH), FF (=0CH), TAB (=09H)

Serial input/output

Same procedure as read/write discette. The programm will be stored with the programm number which was first input and confirmed with "→". When "ALL PROGRAMMS" were selected, the respective programm numbers are not changed.

Data format

First the programm number f.e P0001 must be transmitted. Then the programm blocks will follow, each starting with a block number (N1..). After a complete programm or "%" (25H) or NUL (00H) can follow. If NUL was recognized, the program first read in will be memorized, an eventually existing program with the same number will be cleared, and the MINIPOS will wait for further data.
If "%" was recognized (end of data transfer) the data transfer is finished.

Example:
P0001 CR
N1G0X12Y-15Z+4,15 CR
N2...
.
.
N999G1Z0 CR
CR

No spaces are allowed between the characters. The blocks should be numbered correctly, otherwise they cannot be edited in the INPUT MODE.

We offer a service program for a PC, allowing to receive, memorize, edit and send back CNC programs.

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2.7 Input mode

The input mode allows to input and edit programs. After selection of this mode, a program number will be proposed. For selection of another program number, push "C" and enter the desired program number.

If a program with this number already exists in memory, the last blocks of this program will be displayed by pushing "→". By pushing "↓", the first blocks of the program will be displayed. Entering a block number and then "↓" will display the next block starting with the entered number.

If the entered program number doesn't exist, N001 will be proposed as first block number. Acknowledgement will be made with "→". The cursor moves to "G..". After entering a G-function and then "→", the words corresponding to the G-function are displayed.

When all necessary words of a block have been entered, the block can be stored by pushing "INPUT". The block number is incremented automatically. An error message will be displayed when trying to memorize an uncomplete block.

Alter block:

If a block already stored must be altered, it can be put into the input buffer by typing the block number and then pushing "SEARCH BLOCK". With "→", the cursor can be moved to the word to be corrected. Then the block must be stored again by pushing "INPUT".

Delete block:

The block to be deleted must be searched with "SEARCH BLOCK". Then push "DELETE BLOCK".

Insert block:

Type in the new block number to be inserted and then "→". Select the G-function and complete the block. Push "INPUT" to store the block. It will be inserted automatically and the following block numbers will be incremented.

Program overview:

After selecting the "INPUT MODE", an overview of all programs in memory will be displayed by pushing key "C" and then "→". If a program is marked with "!", this programm has a "CHECKSUM ERROR".

Program duplication:

If the request for program number is acknowledged with "C" and then "INPUT", the MINIPOS will ask for the program number to be duplicated and for the new program number. Also P0000 can be duplicated.

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Tool table:

The program number P0000 is reserved for the tool table and machinendata. Up to 99 tools (T001 - T099) can be stored with radius and length. These data will be called up by the T-word and are used by the path and the length compensation algorithms. Starting with N700, the machine data can be stored.

Reserved program numbers:

Do not use program 8000-9999! These Programs are reserved for internal use.

P0000 Tool table, machine data.
P9998 Error handling in the automatic mode.
P9999 Autostart.

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2.8 Sample programs

The Minipos shows Menu. A program P0010 is to be prepared, which does not exist in the memory.



When invoking the automatic mode, the CNC proposes a program number. The proposed program number will be the one processed at last. Another program number can be input if desired.



A different bloc number, (f.e. 1 0; = P 0010) to start with can be entered if desired. To acknowledge the bloc number, push →. The Minipos displays N1.



To acknowledged the program number, push →.



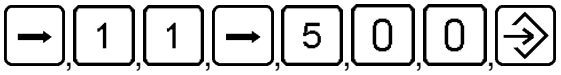
push 9,1 for G91 Incremental Input and acknowledged with →. After this store with Input. The Minipos displays N2.



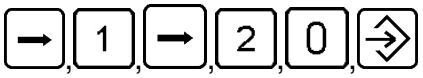
confirm N2 with →, acknowledged G0 Rapid Traverse with →, the Minipos displays X.…



input 10 (f.e. for X10) and store with Input. The Minipos displays N3.



acknowledged N3 with →, push 11 for G11 and acknowledged with → and than 500 for F500 and store with Input. The Minipos displays N4.



acknowledged N4 with →, push 1 for G1 → and than 20 for X20 and store with Input. The Minipos displays N5.



acknowledged N5 →, push 1 for G1 → and than ±,3,0 for x-30 and store with Input. The Minipos displays N6.

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The program is now completely entered. For control you can list it again.

1, ↓ ↓ hold pushed, the Minipos diplays:

N0001 G91, release ↓ the Minipos displays N2.

↓ N0002 G00 X+..10,000. release ↓
↓ N0003 G11 F000500. release ↓
↓ N0004 G01 X+..20,000. release ↓
↓ N0005 G01 X-..30,000. release ↓

Now the programm should be started in Automatic mode.

STOP/MENU change in OPERATING MODES .
START/AUTOMAT change in AUTOMAT MODE.
1,0, START 1,0 give for P10, START for starting the program 10.

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3. PROGRAM STRUCTURE

Each programm consists of a program number and up to 9999 blocks.
Each block has a block number N and a G-function. This function tells the MINIPOS what to do in this block, for example a linear interpolation or a movement to the reference point.
.

3.1 The G-Functions

This part will explain the G-functions and the corresponding block structures.

G00 RAPID TRAVERSE
N... G00 X....,... Y....,... Z....,... U....,... V....,... A....,... B....,... C....,...
All three axes can be moved together. The feedrate is determinded by Fmax in the machine data memory.

G01 LINEARINTERPOLATION
N... G01 X....,... Y....,... Z....,... U....,... V....,...A....,... B....,... C....,... F.....
Up to 8 axes can be moved together. The feedrate (mm/min.) can be programmed before the block with G11.

Option:
G02/03 CIRCLE INTERPOLATION CLOCKWISE / COUNTERCLOCKWISE
N... G02 X....,... Y....,... Z....,... U....,... V....,...A....,... B....,... C....,... I....,... J....,...
XY, are the endpoint of the circle segment, IJ are the coordinates of the circle center. The circle center must be programmed relative to the starting point of the circle segment, even if the endpoint is defined in absolute coordinates.
Of course, the programmed endpoint must be a part of the circle.
This is the case, when $(X-I)^2 + (Y-J)^2 = I^2 + J^2$
A complete circle can be programmed as follows:
N.... G02 X...0,000 Y...0,000 I...20,000 J....0,000
A helix interpolation will result if additionally one or more axes are programmed.

G04 DWELL TIME
N... G04 H ....,...
Dwell time programming between 0,010 and 9999,990 seconds.

G09 SKIP REST OF TRAVEL
N... G09 X....,... Y....,... Z....,... U....,... V....,...A....,... B....,... C....,... M....
The linear interpolation will be done just like a G01 block. However, if the input programmed with M (M16, M161-168, M171-178) becomes active, the interpolation will stop and the next block will be executed. Input min. 100ms.
Possible uses:

- recognization of tool fracture
- digitization of workpieces

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G11 ADDITIONAL FUNCTIONS F,S,T,M
N... G11 F..... S..... T.... M....
These functions allow programming of F, S, T and M.

G13 ADDITIONAL M-FUNCTION
N... G13 M.... M.... M.... M.... M.... M.... M.... M.... M....
G13 allows to program several M-functions in one block.

G20 JUMP TO PROGRAM
N... G20 P.... N....
This function executes a jump to the program "P" and continues with the starting block number "N". If only N is programmed, the jump will be done into the actual programm. If only P is programmed, the jump will be done to the first block in program P.

G22 CALL PROGRAM WITH REPETITION FACTOR
N... G22 P.... N.... W....
The program "P" will be called, starting with block number "N". It will be repeated as programmed with "W". If the program is to be executed only one time, W00 must be programmed.
Up to 6 programm calls can be stacked.

Note:
An error "too many calls" will be reported in the following case:
P0100
N001 G..
.
N010 G22 P0100 N0001 W0001

G23 JUMP/CALL PROGRAM WITH REPETITION FACTOR AND CONDITION
N... G23 P.... N.... W.... M....
Program "P" will be called, if condition M is true. If W is not programmed, a jump to program P will executed. The condition M can be all waits for input f.e. M161. The jump or call only will be executed if input 1 in I/O card 1 is active.

G53 DISPLACEMENT OFF (Initial state)
G54 DISPLACEMENT
N... G54 X....,... Y....,... Z....,... U....,... V....,... A....,... B....,... C....,...
With G90, the values programmed in G54 will be added to all the following movements.
With G91, the displacement will only once be added to the first movement in the appropriate axis.

Example:
The program P0010 is programmed in absolute coordinates.
P0010
N0001 G90 Absolute input
N0002 G00 X.... 0,000 Y 0,000
N0003 G01 X...20,000 Y 0,000
N0004 G01 X...20,000 Y...20,000
N0005 G01 X.... 0,000 Y 0,000

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The actual position of the MINIPOS is X,Y. P0010 now should be executed in the position (100,50).
.
.
.
N0010 G90
N0011 G54 X..100,000 Z...50,000
N0012 G22 P0010

During the execution of P0010, the absolute coordinates are displayed.

G67/68 SOFTWARE LIMIT SWITCH -/+
N... G67 X....,... Y....,... Z....,... U....,... V....,... A....,... B....,... C....,...
If these limits are passed, the MINIPOS will stop and display the error message SOFTWARE LIMIT SWITCH.

G74 REFERENCE POINT
N... G74 X....,... Y....,... Z....,... U....,... V....,... A....,... B....,... C....,...
This function moves the axes to the corresponding limit switches while the direction will be determined by the sign of the programmed value. This value will be set into the actual value counter.
Example:
N.... G74 X....0,000 Y-...1,000
X will be moved to the positive, Y to the negative limit switch.

Note: The axes always will be moved separatly to the reference point.

G75 SCALE FACTOR ON (Initial state)
G76 SCALE FACTOR OFF
N... G75 X....,... Y....,... Z....,... U....,... V....,... A....,... B....,... C....,...
This modal function allows increase, decrease and reflection of the following programs. All the following movements will be multiplied by the values programmed in X, Y and Z. A negative value will switch the polarity of the movement. Scaling factors for X and Y can be differeent. G02, G03 will then become an ellipse.
.
G88 LINEAR SEGMENTATION
N... G88 X.....,... Y.....,... Z.....,... O..... P.....
A linear 3D interpolation programmed in X, Y, Z is divided into O segments. After each segment, the program P is called. In this program, the user can define the functions to be executed after each segment.

Example:
P0001
N0010 G88 X...50,000 Y...30,000 Z....0,000 O.....7 P.....2

P0002
N0001 G00 X....5,000
N0002 G00 X-...5,000

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G89 FREE CYCLE
N... G89 X....,... Y....,... Z....,... U....,... V....,... A....,... B....,... C....,...
Will put the values programmed in X,Y,Z,U,V,A,B,C in the registers #80 - #87. After each movement then the program P9989 will be invoked.

G90 ABSOLUTE INPUT
N... G90 absolute input
This function switches from incremental to absolute input. All the following inputs will be interpreted as absolute values.

G91 INCREMENTAL INPUT (Initial state)
N... G91 incremental input
This function switches from absolute to incremental input. All the following inputs will be interpreted as incremental values.

G92 ZERO OFFSET
N... G92 X....,... Y....,... Z....,... U....,... V....,... A....,... B....,... C....,...
The programmed values are taken into the actual value counter. If G54 or a tool is active, these values are calculated to the actual counter. So, the value programmed in G92 will not necessarely appear on the screen.

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3.2 The M-functions

The M-functions have the following meaning:

M00	programmed stop
M02	program end

Use of the I/O cards 1 or 4

M0140	set all outputs on I/O card 1
M0141 - M148	set output 1 - 8 on I/O card 1
M0150	reset all outputs on I/O card 1
M0151 - M0158	reset output 1 - 8 on I/O card 1
M0160	wait for all inputs to go active on I/O card 1
M0161 - M0168	wait for input 1 - 8 to go active on I/O card 1
M0170	wait for all inputs to go inactive on I/O card 1
M0171 - M0178	wait for input 1 - 8 to go inactive on I/O card 1
M0180	invert all outputs on I/O card 1
M0181 - M0188	invert output 1 - 8 on I/O card 1

The waiting functions M16, M0x60 - M0x68 and M0x70 - M0x78 can be skipped with START.This however can be inhibited by M2347. The I/O card 4 can be programmed with M04xx to M04xx.

Use of the signals MOTOR ON for servoamplifiers

M2140	Remove the signal MOTOR ON to all axes
M2141 - M2148	Remove the signal to the axes X - C
M2150	Activate the signal MOTOR ON for all axes
M2151 - M2158	Activate the signal for axes X – C

Special M-functions

M2247	(M27)	move to IN POSITION
M2251 - M2258		will reset the preceeding functions.
M2344	(M34)	by pressing "MENU" go to P9999
M2347	(M37)	the "wait for input" cannot be left by pressing "START"
M2351 - M2358		will reset the preceeding functions.

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3.3 The F-function (feedrate)

The feedrate will be programmed with the F-function. Possible values are 1 to 999999 mm/min. The MINIPOS will only move at values below or equal to Fmax defined in the machine data.

Example:
N.... G11 F1000
N.... G01 X..100,000 Y..100,000
The X and Y axes will not move with 1000 mm/min. each, but only with 1000:1,4=714 mm/min. Because both axes are moving, the resulting feedrate will be 1000 mm/min.

3.5 The T-function (tool call)

With the T-function up to 99 tools (T01 - T99) can be programmed. Invoking G41, G42 the data of the just activated tool will be read out of the tool table P0000. If another tool is to be used, programming can be made with the T-function.

The desired tool must be called before programming a path or length compensation. The T-function automatically activates the tool length compensation, which can be switched off with T00.

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6. THE MACHINE DATA

The machine data allow an easy adaptation of the MINIPOS to different mechanics. The machine data memory is addressed by P0000 starting with N699. The data concerning one axis can be programmed for each axis separatly. An interpolation will be done with for example the lowest feedrate F of all participating axes.

The value in brackets is the default. Only if a different value for an axis is needed, it must be programmed.

N699XYZUVABC CORRECTION REFERENCE POSITION (0)
This value will be moved after the referencepulse with the feedrate programmed in N902A.

N700XYZUVABC F MAX (1000)
Maximal feedrate in millimeter/min. The maximal interpolationfrequency of the MINIPOS is 30KHz with steppingmotors and 600 KHz with servomotors. The resulting frequency with given FMAX and STEPS/MM is calculated as follows:

$$f(Hz) = \frac{FMAX}{60} \times (STEPS/MM) \qquad FMAX = 60 \times f(Hz) / (STEPS/MM)$$

N701XYZUVABC F START (100) N702XYZUVABC F STOP (100)
Start and Stop frequency in mm/min of an interpolation. The smallest programmable value ist 1.

N703XYZUVABC B START (500) N704XYZUVABC B STOP (500)
Acceleration and deceleration in mm/sec².

N705XYZUVABC F OFF REF (200)
After a reference movement, this feedrate is used for moving the axis off the limit switch.

N706XYZUVABC* STEPS per *.... (200)
N707XYZUVABC .... MM or DEGREE (1)
These 2 parameters define both together for each axis the resoltion of the system. The MINIPOS needs the following information for stepping motors:
How many steps (N706) give a movement of how many millimeter (N707)?

Example:
A stepping motor for the X axis makes 1000 steps per rotation and is connected to a 5 mm spindle. The resulting values are:

N706 X...1000
N707 X.....5

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With a rotary table (N790 X2) the number of steps per rotation of the table must be input.

Example:
A stepping motor with 800 steps drives a rotary table with a gear of 18:1. The resulting values are:
800 steps x 18 = 14400 steps for 360 degrees.
N706 X..14400
N707 X....360

For servomotors the resolution of the measuring system multiplied by 4 must be input.
Example: A transducer on the X axis gives 250 pulses per (1) mm.
N706 X...1000
N707 X.....1

By this kind of input also values like 200 steps per 3 millimeters can be processed.

N708XYZUVABC MODULO (0)
Modulo function for the position display.
Linear axes: 0, rotary axes: 360000.

N710XYZUVABC F REFERENCE (500)
Feedrate in mm/min for G74.

N711XYZUVABC WAY OFF FROM LIMIT SWITCH (1000)
In G74, this value in µm will be moved off the limit switch with the feedrate programmed in N705.

N712XYZUVABC MAXIMAL WAY OFF (50000)
If the limit switch is not desactivated in between this value in µm while moving away from the limit switch, the MINIPOS stops and displays an error message.

N713XYZ MAXIMAL DISTANCE FOR STOP (0)
If this value is programmed, a movement is stoped within this maximal distance, when a limit switch is reached.

N714XYZ BACKLASH in µm (0)
This value in µm will be added to the following movement at each change in the moving direction.

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N790XYZUVABC AXISDEFINITION (771)

This value is composed for each axis separatly from the sum of the following options:

01: "Main axis". A main axis will influence the feedrate during an interpolation. In most cases X,Y,Z will be main axes.
02: "Linear axis" with + and - limit switches which always will be active. A rotary axis will react to the limit switch only during G74.
04: A rotary axis will move off the limit switch in negative direction.
08: Axis with spline interpolation. (Option)
16: Axis driven by a servomotor and not a stepping motor.
32: Search of referencepulse. With G74 and after moving to and then off the limit switch, the distance programmed in N711 will be moved in the same direction with the feedrate N705. Then the axis moves on with the speed F REFPULS (N902A) until the reference pulse of the transducer is detected. Here the internal counters of the MINIPOS are zeroed.

Conclusion:

Value	Function
01	Main axis
02	Linear axis
04	Negative moving off direction with rotary axis
08	Spline (Option)
16	Servomotor
32	Referencepulse search
64	Referencepulse search without first going to limit switch
128	
256	Limitswitch + connected
512	Limitswitch - connected
1024	Limitswitch + is normally open
2048	Limitswitch - is normally open
4096	Invert moving direction

SUM	

The input for each axis can be calculated by adding the values of the desired functions.

Default for X,Y,Z = 771 (1+2+256+512), other axes = 770 (2+256+512).

.

The following machine data refer to the DILAG with the axes X,Y,Z,U. For a DILAG with the axes V,A,B,C, the machine data must be programmed accordingly in N820-N833 XYZU.
N790 must be programmed with 16 (Servomotor).

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N800XYZU / N820XYZU P-FACTOR (20)
In the Dilag (digital closed loop) a PID algorithm is implemented. If the I- and D-factors are 0, it is a normal proportional closed loop. The output voltage to the servoamplifier is then proportional to the lag error.

The maximal output voltage of ±10V will be reached with an lag error

$$\text{of f.e.} \quad \frac{32000 \text{ (constant)}}{20 \text{ (P-factor)}} = 1600 \text{ increments.}$$

N803XYZU / N823XYZU IN POSITION (10)
When M27 is active, the MINIPOS waits at the end of a movement, until the lag error has become smaller than the value IN POSITION.

N804XYZU / N824XYZU LAGMAX (1600)
If the lagerror becomes graeter than this value, the MINIPOS stops and displays an error message.

N813X SERVO ON (0) N833X ENABLE DILAG EXT
Activates the SERVO ON output of the DILAG.

value	activated axis
1	X
2	Y
4	Z
8	U

N813Z / N833Z FATAL LAGERROR (32000)
If the lagerror of one axis exceeds this value, the servoamplifiers are disabled. This value should always be greater than N804XYZUVABC.

N900X CODE (0)
When going to INPUT MODE, EXTERNAL DATA, TEACH IN and CLEAR MEMORY, the MINIPOS requests a usercode, which can be determined here. A value of 0 disables this request.

N901Z DIGITS AFTER DECIMAL POINT (3)
Number of digits between 1 and 5. However one axis can be fixed to 3 digits by adding 256 for X, 512 for Y, 1024 for Z, 2048 for U.

N902X MISCELLANEOUS CONTROLCODES I
The date N902X is composed from the following numbers:

01:	Ignore error message after RESET.
02:	Disable keyboard control via V24.
04:	Positioning (Refer also to connector X8, I/O4)
08:	Set SINGLE STEP in the AUTOMATIC MODE.
128:	STOP input (E2) on I/O 4 active, when no signal applied.
256:	No cycles, G81 to G99 can be freely used.

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N902Y MISCELLANEOUS CONTROLCODES II

02: In G90 and with rotary axis, only the programmed sign defines the direction of the movement.
08: An active G54 or tool will not influence the actual value counter.
32: For EXT Start on IO4 only a short pulse is necessary.
64: Generate "PARITY EVEN" for serial output in EXTERNAL DATA.
1024: Initial state G90

N902Z LANGUAGE (0) (option)

0: German
1: English
2: French
3: Dutch

N902U,V INITIAL VALUE M23xx, M22xx (0)

M2341 corresponds to the value 1, M2342 ¸ 2, M2343 ¸ 4, M2344 ¸ 8.
With the value 256, no initialisation will be done.

N902A F REFPULSE (20)

Feedrate in mm/min. for search of referencepulse on transducer, if N790 is programmmed with 16.

N903XYZUVABC I/O-INITIAL VALUES (0)

These values will be put to the ouputs of the I/O cards 1-8, when switching on or when changing to MENU. If a value of 256 is programmaed, the corresponding IO card will not be initialized.

When N902X4 is active, N903C will represent a variable delay after START and N903V will represent a delay at the end of a movement between CLAMPING ON and MOTOR OFF.

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In the following list the customized machinedata can be registered:

N699 X___ Y___ Z___ U___ V___ A___ B___ C___CORREKTUR REF. POSITION
N700 X___ Y___ Z___ U___ V___ A___ B___ C___ F MAX (1000)
N701 X___ Y___ Z___ U___ V___ A___ B___ C___ F START (100)
N702 X___ Y___ Z___ U___ V___ A___ B___ C___ F STOP (100)
N703 X___ Y___ Z___ U___ V___ A___ B___ C___ B START (500)
N704 X___ Y___ Z___ U___ V___ A___ B___ C___ B STOP (500)
N705 X___ Y___ Z___ U___ V___ A___ B___ C___ F OFF REF (200)
N706 X___ Y___ Z___ U___ V___ A___ B___ C___ STEPS per (200)
N707 X___ Y___ Z___ U___ V___ A___ B___ C___ MM or DEGREE (1)
N708 X___ Y___ Z___ U___ V___ A___ B___ C___ MODULO (0)
N710 X___ Y___ Z___ U___ V___ A___ B___ C___ F REFERENCE (500)
N711 X___ Y___ Z___ U___ V___ A___ B___ C___ WAY FROM LIMIT SWITCH (1000)
N712 X___ Y___ Z___ U___ V___ A___ B___ C___ MAXIMAL WAY OFF (50000)
N790 X___ Y___ Z___ U___ V___ A___ B___ C___ AXISDEFINITION
N800 X___ Y___ Z___ U___ XYZU P-FACTOR (20)
N820 X___ Y___ Z___ U___ VABC P-FACTOR (20)
N803 X___ Y___ Z___ U___ XYZU IN POSITION (10)
N823 X___ Y___ Z___ U___ VABC IN POSITION (10)
N804 X___ Y___ Z___ U___ XYZU LAGMAX (1600)
N824 X___ Y___ Z___ U___ VABC LAGMAX (1600)
N813 X___ SERVO ON (0) N833 X___ ENABLE DILAG EXT
N813 Z___ FATAL LAGERROR (32000) N833 Z___ FATAL LAGERROR (32000)
N900 X___ CODE (0)
N901 Z___ DIGITS AFTER DECIMAL POINT (3)
N902 X___ MISCELLANEOUS CONTROLCODES I
N902 Y___ MISCELLANEOUS CONTROLCODES II
N902 Z___ LANGUAGE (0) Option
N902 U___ V___ INITIAL VALUE M23xx_ M22xx (0)
N902 A___ F REFPULSe (20)
N903 X___ Y___ Z___ U___ V___ A___ B___ C___ I/O-INITIAL VALUES (0)

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7. GENERAL INFORMATIONS

Program archiving

Programs are valuable and cost a lot of time to generate them. That is why that at least 2 copies of each programm should exist outside the MINIPOS, one copy from the preceeding day and one of the day before.

Handling of "checksum errors"

Each block in the memory of the MINIPOS has a checksum byte. When the block is readout the memory, this byte is checked. If an error is detected the message "CHECKSUM ERROR" is displayed, an the block where the error occured is marked with "!". The AUTOMATIC MODE will be interrupted.
Possible causes forthe occurance of this error:
- spike on the powerline during the moment of memorizing.
- dataloss caused by a voltage too low of the buildin accumulator.
- memorizing a block when the memory contents are already bad.
- erroneous memory chip.

Help:
- clear the complete memory as often as possible.run a memory test.
- If only one block has an error, the block can be erased and then memorized one more time.
- filter the powerline.

Error handling P9998

If P9998 is in memory, it will be invoked in the AUTOMATIC MODE if an error has occured (limit switch, external interrupt..).

Initialization of the MINIPOS

In the MENU push shortly the key "REF" and immediatly afterwards the key "↓" until the message "CODE" appears on the screen. Then push the key "MENU", all internal registers of the MINIPOS are cleared.

MINIPOS displays "LAG ERROR"

- at the end of a displacement.
  The MINIPOS does not succeed to reduce the lag error of an axis to a value lower than "IN POSITION".

- during a movement.
  The value FMAX in the machine data is to high, or the P-FACTOR is not correctly input.

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Keyboard simulation with V24 interface

The V24 connection (X21) allows to simulate the MINIPOS keyboard on an external computer.

External computer	generated function computer	external	generated function
@	+X	O	CLEAR MEMORY
A	-X	P	SEARCH BLOCK
B	+Y	Q	DELETE BLOCK
C	-Y	R	EXTERNAL DATA
D	+Z	S	
E	-Z	T	
F	SINGLE BLOCK	U	
G	START	V	"↓"
H	STOP	;	±
I	MANUAL	<	MENU
J		=	→
K	AUTOMATIC	>	CLEAR
L	MANUAL INPUT	.	.
M	TEACH IN	0-9	0-9
N	REFER.CE POINT	$	SOFTWARE RESET

ENTER, ?	INPUT MODE or STORE into memory
/	returns given position, status, operating mode, error status. The status corresponds to the output of I/O card 4.
!	returns actual value from the DILAG cards. This is the actual value of the axes XYZU and VABC with a time jitter of 500.
&	returns given position in HEX format.
"	returns the numbers of the programs in memory.

Programs can be sent to the MINIPOS over the V24 interface (X21). This can be done for example by sending the following data to the MINIPOS:

R7>=
P0001 CR
N1G0X55 CR
% CR

R : Switch to EXTERNAL DATA
7 : Select input from V24 interface
= : →

Then follows the program to be transmitted.

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The following BASIC program allows to send data from the keyboard of a PC to the MINIPOS:

```
10      CLS:OPEN "com1:9600,n,8,1,RS,CS,DS,CD" AS #1
80      REM Keyboard scan
90      A$=INKEY$:IF A$=""THEN 90
110     GOSUB 130:GOTO 90
120     REM subprogram to send the character string
130     FOR A%=1 TO LEN(A$)
140     REM Wait until MINIPOS is ready for receiving data
150     IF (INP(&H3FD)AND 64)=0 THEN 150
160     IF (INP(&H3FE)AND 16)=0 THEN 160
170     PRINT MID$(A$,A%,1);: PRINT #1,MID$(A$,A%,1);:NEXT:RETURN
```

Using the I/O cards

The MINIPOS is to move to position X100, Y50. There a cylinder with a magnet valve (24V) should be activated. The cylinder will move down where it activates limit switch nr 1.
Then the cylinder should move upwards until limit switch nr 2 is activated.
Then the MINIPOS has to move to position X200, Y100.

Connections:
Connect limit switch nr 1 to I1 of the I/O card 1.
Connect limit switch nr 2 to I2 of the I/O card 1.
Connect the magnet valve to O1 of the I/O card 1.

Program:

```
N001 G90                ; Absolute input
N002 G00 X100 Y50
N003 G13 M0141          ; Magnet valve on
N004 G13 M0161          ; Wait for limit switch nr 1 to go active
N005 G13 M0151          ; Magnet valve off
N006 G13 M0162          ; Wait for limit switch nr 2 to go active
N007 G00 X200 Y100
```

The blocks N003 to N006 can be concatenated as follows:
N003 G13 M0141 M0161 M0151 M0162

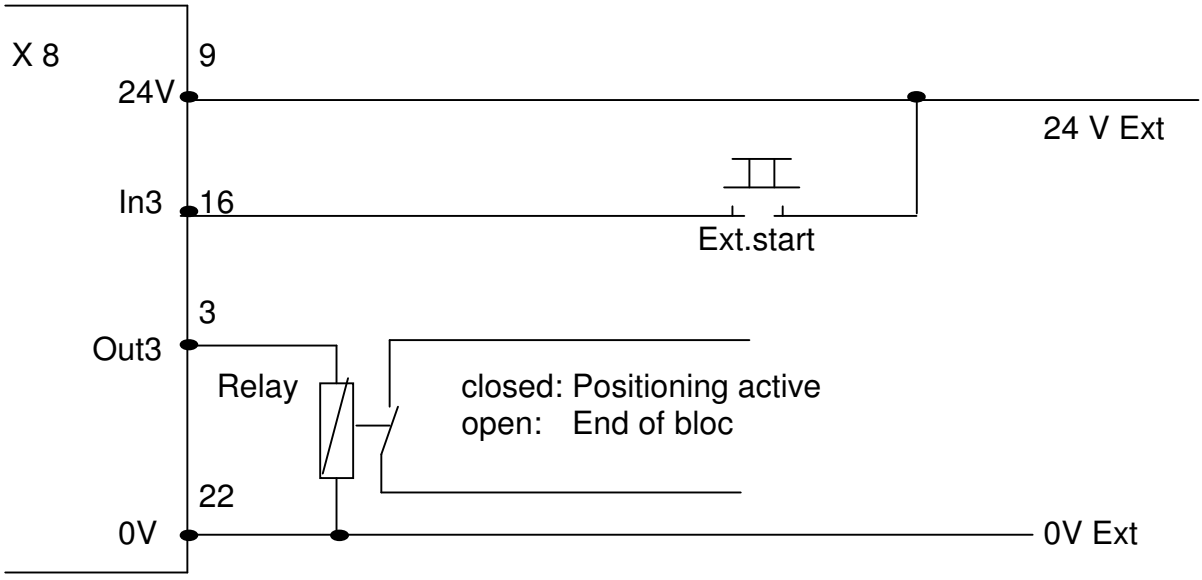
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POSITIONING CONTROL

This mode is intended for moving to a position, then to activate a motor brake, and to send a signal "Position reached" or "End of bloc" to a master control. The the CNC waits for an "External Start", Then opens the brake and moves to the next position. In order to select this mode, the machine datum N902 X12 V2 must be programmed. The inputs and the outputs on the I/O card number 4 have the following meaning:

In 1 External Interrupt	Out 1 Clamping X
In 2 External Stop	Out 2 Clamping Y
In 3 External Start	Out 3 Positioning=1 / End of bloc=0
In 4 Keyboard off, only ext. Start/Stop activ	Out 4 Brake X
In 5 Wait for pressure down	Out 5 Brake Y
In 6 Wait for pressure X	Out 6 Pulse if position reached
In 7 Wait for pressure X	Out 7 Programm started = 1 / Programmend = 0
In 8 Wait for pressure Y	Out 8 Error during movement = 1

Simple connection:



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9. CONNECTORS

A MINIPOS is not necessaryly equipped with all the connectors mentioned here. The number of connection depends upon the purchased MINIPOS and options.

ATENTION:
When connecting the MINIPOS, the national security requirements must be fullfilled.
Especially, the MINIPOS must be automatically switched off in an emergency situation. The power supply is 230V, ±5

X1 POWER

Pin	signal	Pin	signal
1	6V AC	6	GND
2	6V AC	7	+5V DC
3	0V AC	8	+15V DC
4	14V AC	9	-15V DC
5	28V AC		

The transformer must be located near the MINIPOS, the cabling must be as short as possible!

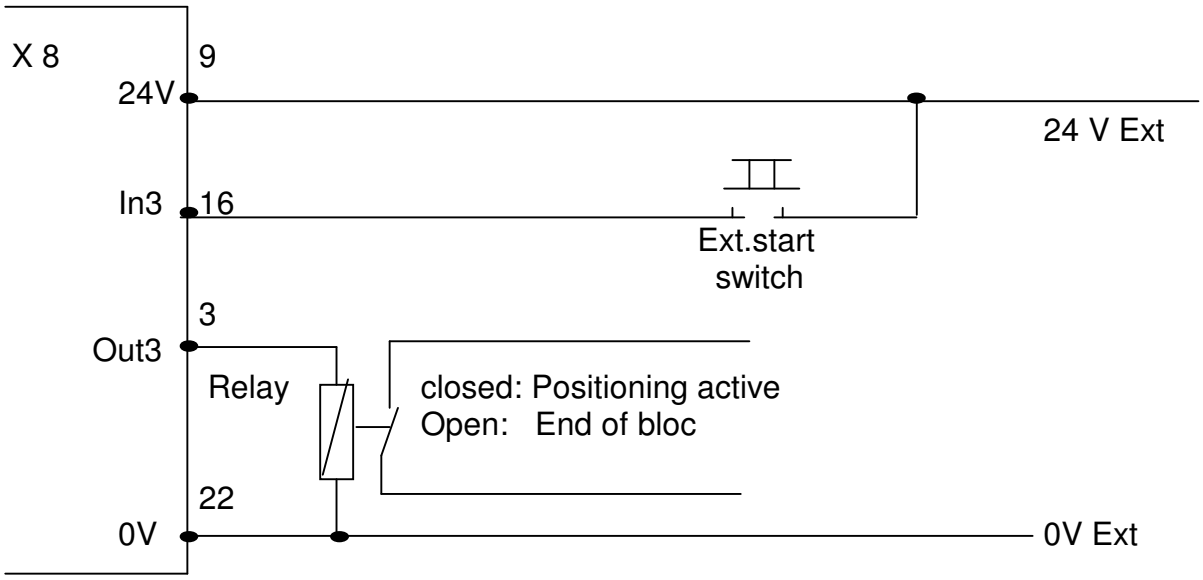
X8 INPUT/OUTPUT

pin	signal	pin	signal
1 (a1)	output 1 (white)	14 (c1)	input 1 (white)
2 (a2)	output 2 (yellow)	15 (c2)	input 2 (yellow)
3 (a3)	output 3 (green)	16 (c3)	input 3 (green)
4 (a4)	output 4 (brown)	17 (c4)	input 4 (brown)
5 (a5)	output 5 (grey)	18 (c5)	input 5 (grey)
6 (a6)	output 6 (black)	19 (c6)	input 6 (black)
7 (a7)	output 7 (rose)	20 (c7)	input 7 (rose)
8 (a8)	output 8 (violet)	21 (c8)	input 8 (violet)
9 (a9)	24V EXTERNAL	22 (c9)	0V EXTERNAL
10	24V EXTERNAL	23	0V EXTERNAL
12	code pin	24 ⌐	closed = I/O 1
		25 ⌐	closed = I/O 4

Pin 24 and 25 connect directly at the plug

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Simple connection:



All 8 inputs and outputs are optocoupled.
The outputs can source 0,5A max. A clamp diode (1N4001) should be connected in parallel to the relay.
The overall capacity of one I/O card is 2A.
The inputs are activated by a signal of 24V, ± 10%, 5mA.

The card I/O4 has the following predifined inputs and outputs:

In 1: External interrupt	Out 3: Positioning =1/ block end =0 (AUTOMATIC MODE, SINGLE STEP)
In 2: External stop	Out 7: Programm running =1, Programm finished =0
In 3: External start	Out 8: Error during a program run =1

The input In1 must not be used as emergency input without switching off the mains power supply.

If the machine date N902X04 is activated, the following I/O's also are predefined:

In 4:	Keyboard off, only external start is active.
In 6	Wait for pressure X
In 7:	Wait until pressure X present.
In 8:	Wait until pressure Y present.
Out 1:	Clamping X
Out 2:	Clamping Y
Out 4:	Brake X
Out 5:	Brake Y
Out 6:	Pulse when in position.

Additionally N902X08 can be programmed, which selects automatically
SINGLE STEP: the MINIPOS waits for a START before each movement.

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X21 V24

CNC MINIPOS		PC-25 pol.	PC-9 pol.	Epson FX850
1	GND	7	5	7
2	TxD (Out)	3	2	3
3	RxD (In)	2	3	/
4	RTS (Out)	5	8	/
5	CTS (In)	4	7	20
		6 ┐	6 ┐	
		20 ┘	4 ┘	
8	Kodierung			

Output RTS = "L" = -12V: The peripheral unit must stop sending data.
Input CTS = "L" = -12V: Transmissing of data via TxD is stopped.

Data format: 9600 Baud, No Parity, 1 Startbit, 8 Datenbits, 1 Stopbit.
(The Baudrate is fixed to 9600 !)

X29 TRANSDUCER (measuring system)

pin		signal	connection of a transducer ROD 420	
1	red	+5V	2,12	blue, brown 0.5
2	grey	0V	10,11	white, white 0.5
3	brown	Ua1	5	brown
4	violet	Ua2	8	grey
5	white	Ua1*	6	green
6	blue	Ua2*	1	rose
7	green	Ua0	3	red
8		Ua0*	4	black
9		code pin		

The inputs Ua1 - Ua1*, Ua2 - Ua2*, Ua0 - Ua0* are connected to the inputs of an optocoupler. If the transducers are powered externally, the are completely galvanically isolated.

Note: - Use shielded cable. Connect shield to the case of the MINIPOS to the ground connection.
- Use transducer with TTL output!
- With a 12V transducer, additional external resistances of 220 Ω must be connected in series with Aa1, Ua2, Ua0.
- All connected transducers together can use maximal 0.2A from the 5V line.

To invert the counting direction of the measuring system, exchange Ua1 with Ua2 and Ua1* with Ua2*.

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X84 SM SIGNAL (OPTION)

pin	signal	pin	signal
1	0V Internal	14	clock X
2	R/L X	15	clock Y
3	R/L Y	16	clock Z
4	R/L Z	17	clock U
5	R/L U	18	clock V
6	R/L V	19	clock A
7	R/L A	20	clock B
8	R/L B	21	clock C
9	R/L C	22	code pin

All signals are TTL 5V with positive polarity.

We recommend to connect only stepping motor drivers with optocoupled inputs.

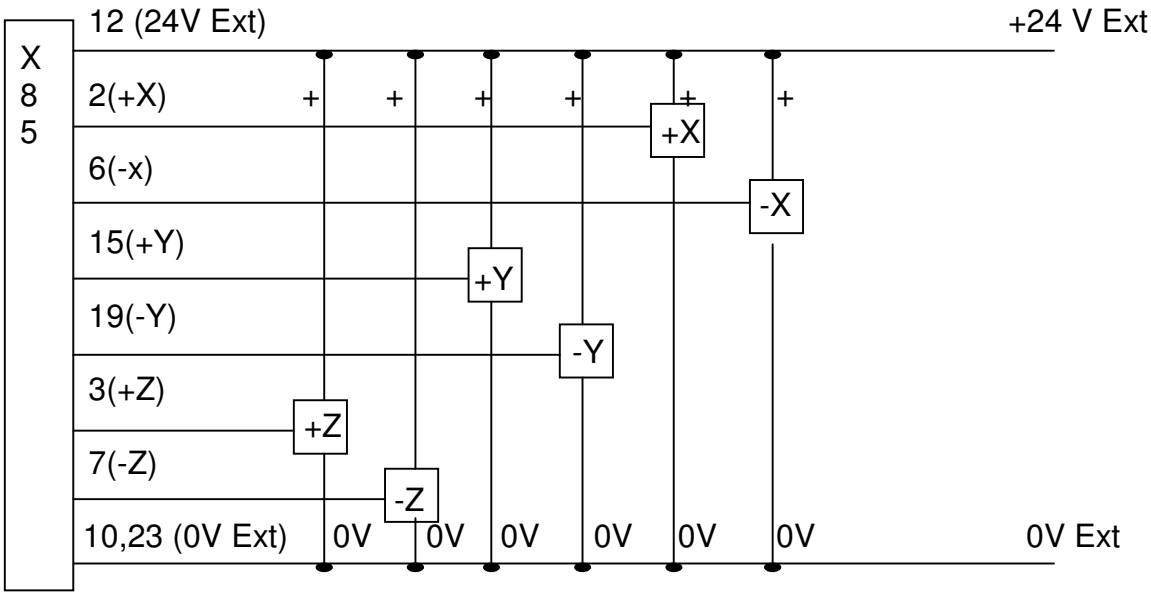
X85 LIMIT SWITCH

pin	signal	pin	signal
1		14	
2 (a2)	+X	15 (c2)	+Y
3 (a3)	+Z	16 (c3)	+U
4 (a4)	+V	17 (c4)	+A
5 (a5)	+B	18 (c5)	+C
6 (a6)	-X	19 (c6)	-Y
7 (a7)	-Z	20 (c7)	-U
8 (a8)	-V	21 (c8)	-A
9 (a9)	-B	22 (c9)	-C
10 (a1)	0V External	23 (c1)	0V External
11	code pin	24	
12		25	

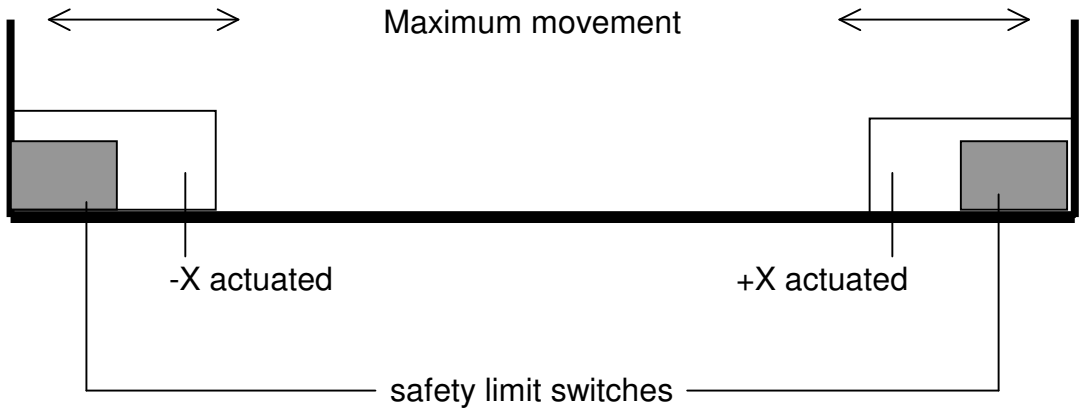
The inputs need 24V, 5mA and are optocoupled. The machinedatum N790 defines for each axis separately if the limitswitches used are opener or closer and if 1 or 2 limit switches are connected.

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Connection for X, Y and Z



If the MINIPOS should fail, no danger causing movement is allowed to result. Therefore, safety limit switches generating an emergency stop with power shut down, should be located after the normal limit switches.

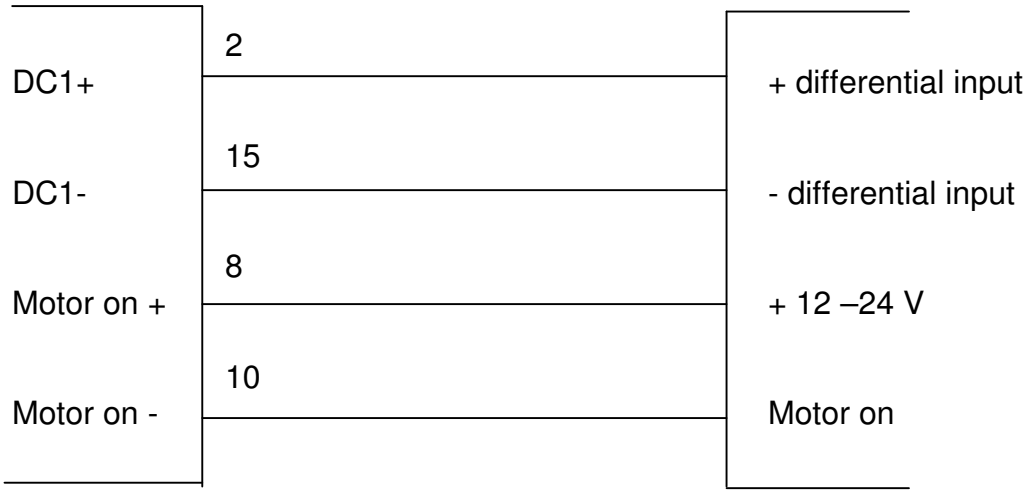


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X90A/X91A SERVO OUTPUT (OPTION)

pin	signal	pin	signal
1		14	
2	DC1+ (±10V)	15	DC1-
3	DC2+ (±10V)	16	DC2-
4	DC3+ (±10V)	17	DC3-
5	DC4+ (±10V)	18	DC4-
6		19	
7		20	code pin
8	Motor on 1+	21	Motor on 2+
9	Motor on 3+	22	Motor on 4+
10	Motor on 1-	23	Motor on 2-
11	Motor on 3-	24	Motor on 4-

DILAG X90A ***SERVOAMPLIFIER***



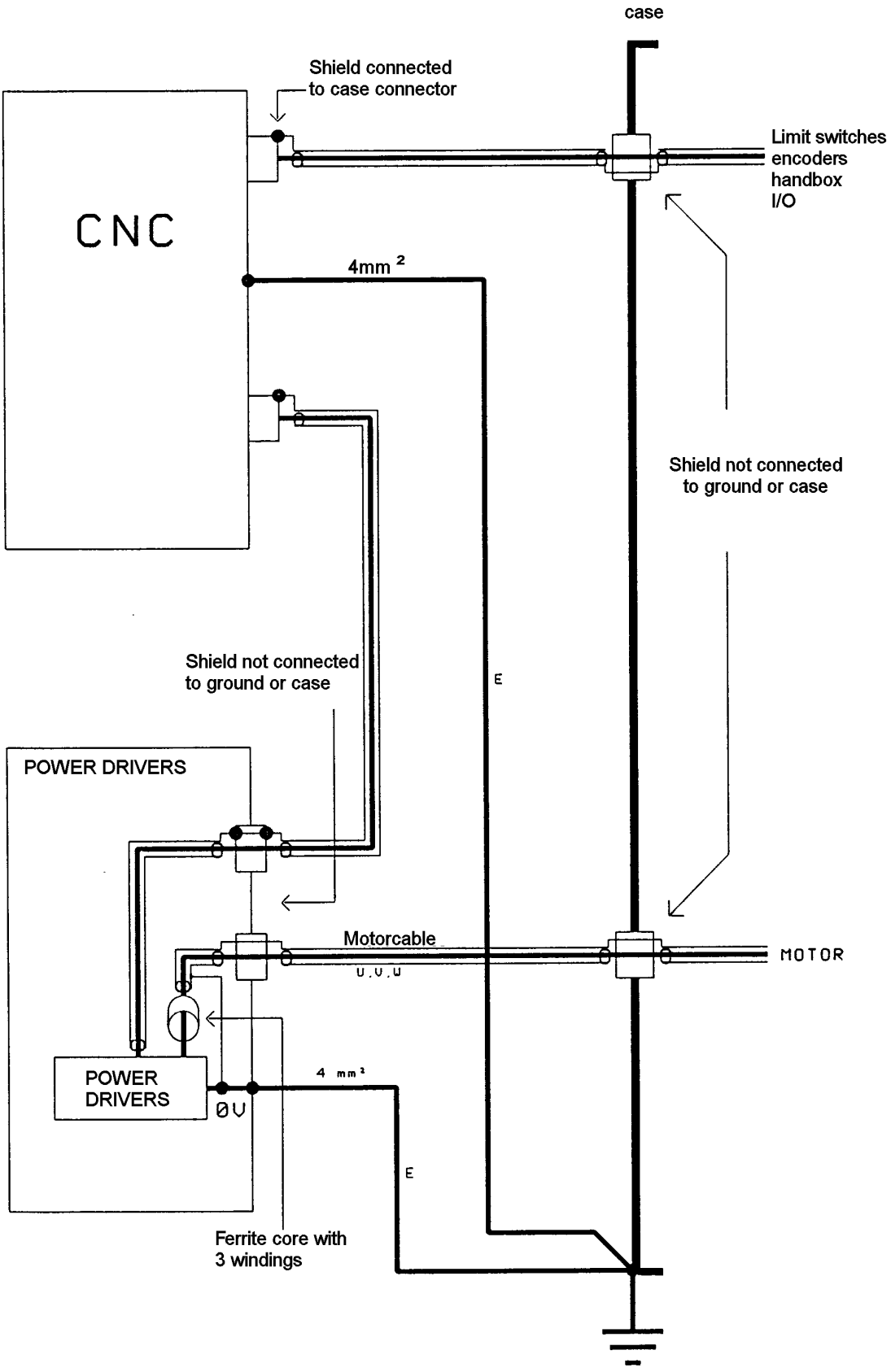
The ouputs MOTOR ON 1 - 4 are optocoupled and can switch 24V, 20mA.
The servoamplifier must have a **differential input ± 10V**. The connection from the MINIPOS to the amplifier should be shielded and grounded on one side to the MINIPOS.

Hints for selection of machine data for servo mode:

- Switch N790 to servo mode (add the value 16).
  Activate N813X f.e. 7 = 1 + 2 + 4 = axes X,Y,Z.
  The axes now can now be moved at low speed, if connector X90 and X29 are correctly cabled.
- Input N700, N706, N707 correctly for each axis.
- By pushing the key "2" in the MANUAL MODE, the lagerror for each axis is displayed.

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Shielding Plan



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