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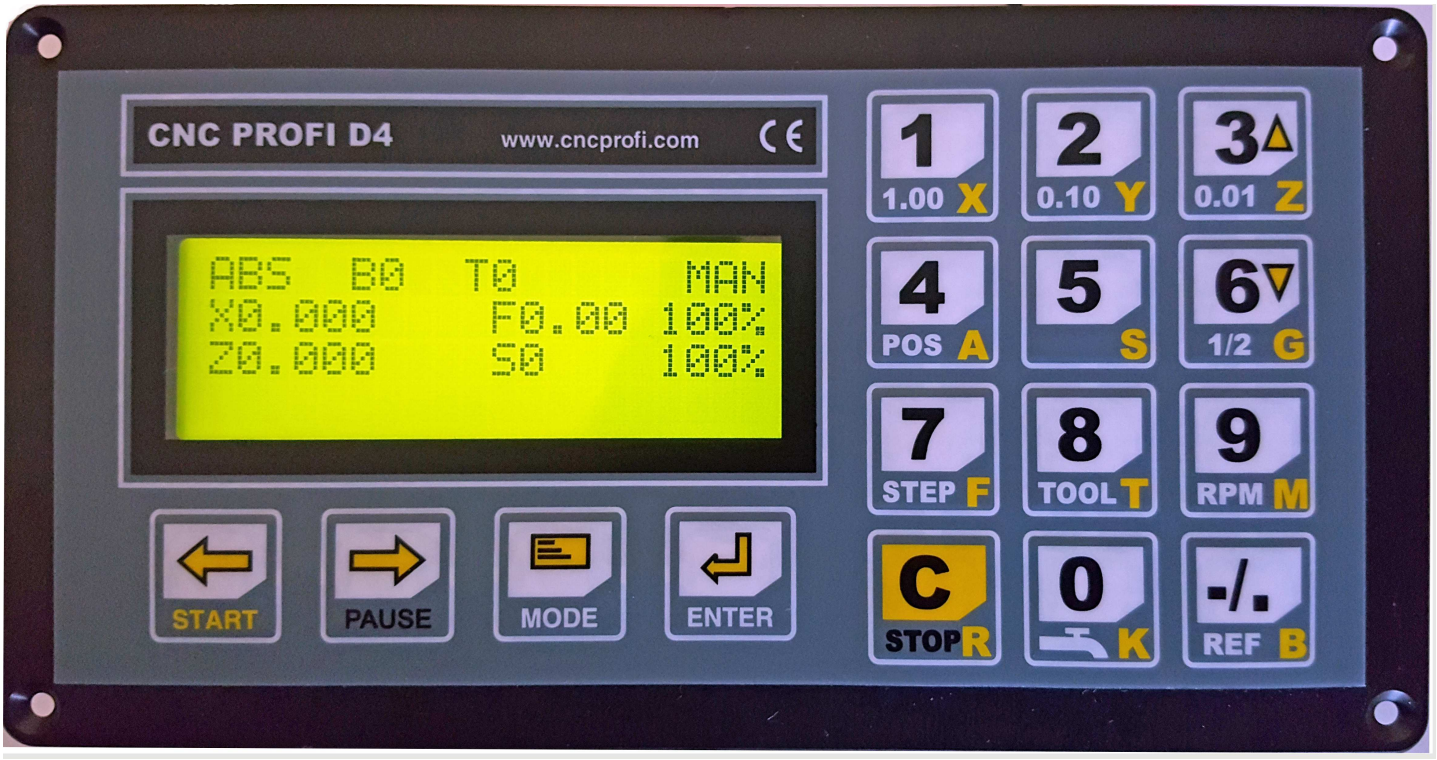
CNC-CONTROLLER D4
4-AXIAL



INSTRUCTION MANUAL

CNC-Profi KJ LTD & CO KG

Inhaltsverzeichnis

1 Allgemeines 4
2 Urheberschutz 4
3 Entsorgung 5
4 Lieferung, Transportschaden, fehlende-Teile 5
5 Garantiebedingungen 5
6 Elektrische-Anschluss-Einbau und Sicherheit 8
7 Persönliche Schutzausrüstung 8
8 Inhalt der Betriebsanleitung 8
9 Verfahren im Falle eines Unfalls oder einer Panne 8
10 Changes between several Mode, by [MODE] and control key 9
11 All possible Mode and Menu of the Controller and theme application 10
12 Start-up of the Controller 11
13 Controller- Settings 12
13.1 Menu of general settings 13
13.2 Menu of the axis settings 15
14 Axis setting, calculation of Numbers transmitted Impulse pro mm 16
14.1 Calculate number of impulse per mm (without reduction or transmission ratio) 16
14.2 Calculate of Impulse per mm for gear drive and gear belt drive 17
14.3 Calculate of Impulse per mm for rack and pinion drive 17
15 REF- Modus, approach reference point and or initiate of each axis Encoder and initiate Tool length measurement system 18
15.1 Approach reference- switch. Referencing with reference- switch 18
15.2 Referencing without reference- switch 19
15.3 General use, referencing with Z-Signal of Axis- Encoder 19
15.4 Setup Referencing of XYZ Position for Tool measurement- Sensors 19
16 Menu Feedrate setting 20
16.1 Menu Spindle 22
16.2 Menu of Tool (Tool length measurement) and Tool change 24
17 Measurement of the tool height with assistance of the measure sensor 25
17.1 Menu Output settings 25
17.2 Menu of Input settings 28
18 manual operating mode (MODE MAN) 31
19 Mode MDI 32
20 Mode MPG 34
21 Edit Mode 35
22 AUTOMATIC MODE 37
22.1 AUTO MODE STEP 39
22.2 AUTO MODE CONTINOUSE 39
22.3 Interruption, stop, resume, abort of the automatic mode plus access in a program with certain Position 40
22.4 Resumption of automatically run, after an alarm abort rund 40
23 SD- Card- Programme, Optional 41
23.1 navigation through the directions structure and Files of SD-Card 42
23.2 Sight of SD- Card program and automatically mode 42
24 Controller-Diagnosis 42

25 Lookahead to "G- Function" G12- storage of positions variable 42
26 several G- Code commands 43
26.1 G0, G1, G2 and G3 movement 45
26.2 G0 fast feedrate, rapid 45
26.3 G1 working feedrate 46
26.4 G2 G3 – circle interpolation 47
26.5 G4 Delay 50
26.6 G13– clamp respectively release of chuck 50
27 Special Points at Coordinate- system G28 51
27.1 G30 motion to the first till sixth Origin, which are definable 52
27.2 G50 G92 definition of a programmable coordinate- system respectively limit Spindle speed in RPM 53
27.3 G54 – G59 Coordinate system and Offset table 53
27.4 G90, G91 – absolute and incremental coordinate interpretation 55
28 M- commands, additional commands 56
28.1 M6 Tool change 57
28.2 M12 clamp of material at the chuck 57
28.3 M13 release of material of chuck 58
28.4 M30 finishing program, with shift to the begin 59
28.5 M02 finishing program without shift to the begin 59
28.6 M32- lubrication on 60
28.7 M33- lubrication off 60
28.8 M97- invoke a line number at the actual program as transfer target 60
28.9 M98- invoke of an external Subprogram 61
28.10 M99 return to the calling address 63
29 Programmable inputs and outputs plus 2 integrated relays for output. 64
30 Setting the Workplace and machine environment 65
31 Positions- Variables 66
32 Program examples 67
33 Drill cycles 69
34 Digital inputs 74
35 Analogues inputs 74
36 Encoder inputs ENC1, ENC2 74
37 keyboard 74
38 digital outputs 74
39 Analogues outputs 75
40 axes - outputs 75
41 Alarm- table and Layout 76

1 Allgemeines

- *Die Bedienungsanleitung ist ein Teil der Benutzerinformation. Beim Betrieb des Gerätes ist diese so aufzubewahren, dass sie jederzeit dem Betreiber und dem Bediener zugänglich ist.*
- *In allen Lebensphasen sind die Hinweise in den Betriebs- und / oder Bedienungsanleitungen (auch der Zulieferer) zu beachten. Lesen Sie dazu die entsprechenden Kapitel in der Betriebs- und Bedienungsanleitung sorgfältig durch, bevor Sie mit der Arbeit beginnen.*
- *Alle Angaben und Hinweise in dieser Betriebsanleitung wurden unter Berücksichtigung der geltenden Vorschriften, dem Stand der Technik sowie unserer langjährigen Erkenntnisse und Erfahrungen zusammengestellt. Druckfehler und Irrtümer können jedoch nicht ausgeschlossen werden. Sollte einem aufmerksamen Leser ein Fehler auffallen, so wären wir sehr Dankbar wenn er uns darüber, mit einer kurzen Mail, informieren würde.*
- *Berühren sie keine beweglichen Teile der Werkzeugmaschine und halten Sie eine sichere Entfernung zu dieser ein, wenn den Motoren Spannung zugeführt wird. Alle beweglichen Teile sind potenziell gefährlich. Das Gerät sollte nicht an Orten verwendet werden, wo eine Gefahr der Verletzung, Todesfälle oder finanziellem Verluste besteht.*
- *Für Schäden und Betriebsstörungen übernehmen wir keine Haftung.*
- *Es muss innerbetrieblich klar und unmissverständlich festgelegt sein, wer für die Maschine zuständig ist (Betreiber) und wer an ihr arbeiten darf (Bediener).*
- *Für das Personal, das für Transport, Aufstellung, Rüsten, Einrichten, Bedienung, Pflege, Wartung und Instandhaltung eingesetzt wird, müssen die entsprechenden Zuständigkeiten klar festgelegt werden.*
- *Maßgeblich für die Richtigkeit des Inhaltes ist ausschließlich die Betriebs- und Bedienungsanleitung in der Originalfassung (deutsch).*
- *Die textlichen und bildlichen Darstellungen entsprechen nicht unbedingt dem Lieferumfang. Die Abbildungen und Grafiken entsprechen nicht dem Maßstab 1:1. Der tatsächliche Lieferumfang kann bei Sonderausführungen, der Inanspruchnahme zusätzlicher Bestelloptionen oder auf Grund neuester technischer Änderungen unter Umständen von den hier beschriebenen Angaben und Hinweisen sowie den bildlichen Darstellungen abweichen.*
- *Bei Fragen wenden Sie sich bitte an den Hersteller oder Lieferanten.*
- *Technische Änderungen am Produkt im Rahmen der Verbesserung der Gebrauchseigenschaften und der Weiterentwicklung behalten wir uns vor.*
- *Für Bestimmungen, die in den beschriebenen Bedingungen nicht enthalten sind, sind AGB-Bestimmungen des Firma CNC Profi KJ Ltd. & Co. KG anzuwenden.*
- *Die AGB-Bestimmungen befinden sich auf unsere Homepage: http://www.cncprofi.eu/ AGB*
- Der Käufer hat davon Kenntnis genomen und werden durch Auftragserteilung oder Annahme der Lieferung anerkannt.

2 Urheberschutz

Die Betriebsanleitung ist vertraulich zu behandeln. Sie ist ausschließlich für die Personen bestimmt, welche mit dem Controller und der zu steuernden Maschine, arbeiten.
Alle inhaltlichen Angaben, Texte, Zeichnungen, Bilder und sonstigen Darstellungen sind im Sinne des Urheberrechtsgesetzes geschützt und unterliegen weiteren gewerblichen Schutzrechten. Jede missbräuchliche Verwertung ist strafbar. Weitergabe an Dritte sowie Vervielfältigungen in jeglicher Art und Form – auch auszugsweise – sowie die Verwertung bzw. Mitteilung des Inhaltes, sind ohne schriftliche Zustimmung des Herstellers nicht gestattet.
Zuwiderhandlungen verpflichten zu Schadenersatz. Weitere Ansprüche bleiben vorbehalten. Alle Rechte der Ausübung von gewerblichen Schutzrechten behalten wir uns vor.

3 Entsorgung

Soll die Steuerung nach Ablauf ihrer Lebensdauer verschrottet werden, so sind alle Bestandteile nach Materialklassen zu trennen, um Wiederverwertung oder differenzierte Verschrottung zu ermöglichen.
Bei der Entsorgung sind die internationalen Vorschriften und die, im Bestimmungsland, herrschenden Normen zu beachten und alle einschlägigen Umweltschutzbestimmungen.

***Achtung:** Elektroschrott, Elektronikkomponenten, unterliegen der Sondermullbehandlung*

4 Lieferung, Transportschaden, fehlende-Teile

Nach Erhalt des Gerätes, beachten Sie folgendes:

- überprüfen ob während des Transports Schäden an der Lieferung nicht eingetreten sind und die Komponenten nicht beschädigt wurden.
- b*ei ersichtlichen Verpackung Beschädigung müssen Sie sofort eine schriftliche Schadensmeldung vom Zusteller verlangen und ein Schadensprotokoll erstellen. Verständigen Sie auch sofort Ihren Lieferanten!*

5 Garantiebedingungen

1. *Als Garantiegeber fungiert die Firma CNC Profi KJ Ltd. & Co. KG*
   Anschrift: Deutschland, Biesdorfer Weg 21, 12683 Berlin.
2. *Die Garantie beträgt 12 Monate ab Kaufdatum (Garantie Verlängerung ist optional möglich).*
3. *Die Garantie umfasst ausschließlich Qualitätsmängel, die auf einem Verschulden des Herstellers beruhen.*
4. *Der Einbau und Anschluss des Gerätes muss auf jeden Fall nach der Beschreibung erfolgen und von fachkundigen Personal ausgeführt werden. Ein Anschluss des Gerätes entgegen den Richtlinien, welche in diesem Handbuch beschrieben sind, kann zur Beschädigung des Gerätes und zum Garantieverlust führen.*
5. *Von der Garantie sind ausgenommen:*
   - Schäden, die auf unsachgemäßer Benutzung, Wartung , Transport und Lagerung beruhen,
   - Mechanische Beschädigungen,
   - Alltäglicher, nutzungsbedingter Verschleiß,
   - Reparaturen, welche auf mangelhaften Einstellung von Maschine und Controller beruhen,
   - Arbeiten, welche in dieser Anleitung vorgesehen sind, und zu deren Ausführung sich der Betreiber mit eigenen Mitteln sowie eigene Kosten verpflichtet hat.
6. *Von der Garantie sind ebenfalls Schäden ausgenommen, die durch unsachgemäße Handhabung und Montage, sowie durch eigenwillige Abänderung oder Reparatur verursacht sind.*
7. *Die Reparatur wird innerhalb von 14 Tagen, ab Schadensanzeige durchgeführt. Voraussetzung, das Gerät wird rechtzeitig an uns zurückgeliefert, sodass eine Reaktionszeit innerhalb dieser Zeit möglich ist.*
8. *Die Reparaturfrist kann geändert bzw. um die Zeit verlängert werden, die für die Lieferung von Ersatzteilen benötigt wird, falls sie vom Garantiegeber beim Hersteller bestellt werden.*
9. *Der Garantiegeber trägt keine Verantwortung an Folgeschäden, welche insbesondere für verlorenen Nutzen des Betreibers sowie für Beschädigungen, die direkt oder indirekt durch den Betrieb des Controllers entstanden sind.*
10. *Firma CNC Profi haftet für keinerlei Schäden und / oder finanzielle Verluste, welche durch fehlerhafte Funktion des Geräts, bzw. durch fehlerhafter Anweisungen, zurückzuführen wären.*
11. *Folgen, verursacht durch unsachgemäßem Betrieb, mangelhafte Wartung oder Lagerung, sind von der*

Garantie ausgenommen.

12. *Für Bestimmungen, die in den oben genannten Bedingungen nicht enthalten sind, sind AGB-Bestimmungen des Firma CNC Profi KJ Ltd. & Co. KG anzuwenden.*
13. *Die AGB-Bestimmungen befinden sich auf unsere Homepage: http://www.cncprofi.eu/ AGB*
14. Der Käufer hat davon Kenntnisgenomen und erkennt dieses durch Auftragserteilung oder Annahme der Lieferung an.

Übergabe der Maschine durch den Verkäufer an den Betreiber: ***Datum*****.....** ***Unterschrift*** **.....**	***Stempel***
Anzeigedatum **.....** ***Reparaturdatum*****.....** ***Reparaturumfang*** **.....** **.....** **.....** **.....** ***Stempel und*** ***Unterschrift*****.....**	***Anzeigedatum*** **.....** ***Reparaturdatum*****.....** ***Reparaturumfang*** **.....** **.....** **.....** **.....** ***Stempel und*** ***Unterschrift*****.....**
Anzeigedatum **.....** ***Reparaturdatum*****.....** ***Reparaturumfang*** **.....** **.....** **.....** **.....** ***Stempel und*** ***Unterschrift*****.....**	***Anzeigedatum*** **.....** ***Reparaturdatum*****.....** ***Reparaturumfang*** **.....** **.....** **.....** **.....** ***Stempel und*** ***Unterschrift*****.....**

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KONFORMITÄTSERKLÄRUNG (CE)

betr. Anbringung der CE-Kennzeichnung auf dem Produkt

Hiermit erklären wir, dass der Controller:

Bezeichnung :
Typ: ***CNC PROFI D4***
Baujahr: ***2017***
Serien-Nr.: ***D4v5***
Name und Anschrift des Verkäufers:

CNC PROFI
ul. GŁÓWNA 10
55 – 010 ŚW. Katarzyna Polen

auf die sich die folgende Erklärung bezieht, die Anforderungen der

EG-Richtlinie (CE)

Niederspannungsrichtlinie (Low voltageequipment) 2006/95/WE
EMV-Richtlinie (Electromagnetic compatybility) 2004/108/WE b

sowie folgende Grundvoraussetzungen in Polen erfüllt.

Gesetzblatt 2003 Nr. 49 Pos. 414 vom 12.03. 2003 der Verordnung des Ministers für Wirtschaft, Arbeit und Sozialpolitik über die Grundanforderungen für Elektrogeräte. Gesetzblatt 2003 Nr. 90 Pos. 848 vom 02.04.2003 der Verordnung des Ministers für Infrastruktur über die Prüfung der Konformität mit den Anforderungsregeln für EMV und die Art ihrer Kennzeichnung.

Angewandte harmonisierte Normen:

PN-EN418 Not-Aus-Ausstattung.

Die vorliegende EG-Konformitätserklärung (CE) verliert ihre Gültigkeit, wenn das Gerätt, umgebaut oder der Betriebsanleitung nicht gemäß gebraucht wird.

Ort/Datum: Wroclaw Polen 30.10.2016

PROFI PROFRAMM K&J
Krzysztof Maciejewski

6 Elektrische-Anschluss-Einbau und Sicherheit

ACHTUNG! Anschluss der Stromversorgung darf nur durch Fachpersonal - Elektriker durchgeführt werden, Verletzungs- und Stromschlags - Gefahr!
Der Controller ist ein Modul, vorgesehen zum Einbau in kompletten Systemen. Bei Betrieb kann er Elektronische Störungen verursachen. Die Intensität der Störungen hängt von mehreren Faktoren wie: Kabellänge, Stromstärke, Motorendrehzahl, Kabelqualität usw. ab. Deshalb muss, um den Vorschriften nach EN89/336 (EMV Gesetz) zu entsprechen, die Anlage unter normalen Arbeitsbedienungen geprüft werden. Der Einbau muss auf jeden Fall nach Beschreibung erfolgen und von fachkundigen Personal auszuführen. Siehe Verbindungszeichnung am Ende diese Bedingungsanleitung. *Je nach Ausführung kann der Controller mit Verschiedenen Geräten zusammenarbeiten. Pinbelegung sind auch auf der Platine gekennzeichnet. Es dürfen nur passende Steckverbindungen mit Erdung verwendet werden. Eine Schutzverkleidung (Gehäuse) gegen unbefugte Eingriffe sowie Schmutz- und Wasserabweisung, muss installiert werden. Kabel müssen gegen mechanische Beschädigung geschützt sein.*
Nichteinhaltung der angegebenen Sicherheitshinweise und Anweisungen in dieser Betriebsanleitung sowie der für den Einsatzbereich geltenden Unfallverhütungsvorschriften und allgemeinen Sicherheitsbestimmungen ist jegliche Haftungs- und Schadenersatz- Anspruch, gegen den Hersteller oder seinen Beauftragten ausgeschlossen.

ACHTUNG! Warnung! Gefahr durch elektrischen Strom: Die elektrischen Energien können schwerste Verletzungen verursachen. Bei Beschädigungen der Isolation oder einzelner Bauteile besteht Lebensgefahr durch, elektrischen Strom oder Mechanischer Einflüsse.

7 Persönliche Schutzausrüstung

Bei Arbeiten an und mit der Maschine sind grundsätzlich folgende Gebote zu beachten:
Arbeitsschutzkleidung:
Eng anliegende Arbeitskleidung (geringe Reißfestigkeit, keine weiten Ärmel, keine Ringe und sonstiger Schmuck usw.).
Bedienung mit langen Haaren ohne Haarnetz verboten!
Sicherheitsschuhe für den Schutz vor schweren herabfallenden Teilen. Sicherstellung eines rutschfestem Stands.
Gehörschutz für den Schutz vor Gehörschäden.

8 Inhalt der Betriebsanleitung

Jede Person, die damit beauftragt ist, Arbeiten an oder mit dem Controller auszuführen, muss die Betriebsanleitung vor Beginn der Arbeiten gelesen und verstanden haben. Dies gilt auch, wenn die betreffende Person mit einem solchen, oder ähnlichen, Controller bereits gearbeitet hat oder durch den Hersteller geschult wurde. Die Kenntnis des Inhalts der Betriebsanleitung ist eine der Voraussetzungen, um Personal vor Gefahren zu schützen sowie Fehler der Bedienung der Anlage zu vermeiden. Somit kann die Maschine sicher und störungsfrei betrieben werden. Dem Betreiber wird empfohlen, sich vom Personal die Kenntnisnahme des Inhalts und des Verständnisses der Betriebsanleitung nachweislich bestätigen zu lassen.

9 Verfahren im Falle eines Unfalls oder einer Panne

Die Maschine muss mit mindestens einem oder mehreren Notausschaltern ausgestattet sein.
Im Falle eines Notfalls, sollte sofort einer der Notausschalter betätigt werden, oder die Taste [C] auf der Controller Tastatur gedrückt werden. Auf diese Weise stoppt der Controller alle angeschlossenen Baugruppen.
Bei Bedarf, sollte die Service- Abteilung über diese Situation informieren werden.
Vor Beginn der Arbeiten mit der Anlage, muss sich der Bediener über den Ordnungsgemäßen Zustand überzeugt haben

10 Changes between several Mode, by [MODE] and control key

The general function for each mode is explained in the following chapter.

First we will explain the function of the [MODE] button. It has diverse functions in use of these Controller.

- With this button, the operator is able to switch between mode
- The operator is able to change, in combination with an other button, from a mode in a Menu
- to change from a sub- menu in the next higher section, till the controller is back in the basis mode
- with this button, the operator is able, not confirmed inputs to cancel.

First it is explained the change from mode to mode
every mode, in which the controller is actually working, is to identify with the status- line.(right upper corner).
Let us assume the controller is actually working in MAN mode.
We describe this in future with **corner = "MAN"**

The controller will setup in two different kinds, depends on either the SD- Card is connected or not .
Without SD_Card the controller is setup in ground mode MANUEL: CORNER = "MAN"
With SD_Card the controller is setup in ground mode SD:AUTO: CORNER = "SD: AUTO"

Now we will switch trough all mode, to get a feeling about them sequence of MODE. **Important: The controller must be just switch on!**

Sequence of the mode without SD-Card: Controller starts in Mode MAN: CORNER = "MAN"

- push the [MODE] button, then the controller change into AUTO-Mode: CORNER = "AUTO"
- another push on [MODE], the controller change to MAN mode: CORNER = "MAN"

Sequence of the mode with SD-Card: Controller starts in Mode SD: AUTO: CORNER = "SD: AUTO"

- push the [MODE] button, then the controller change into MAN mode: CORNER = "MAN"
- another push on [MODE], the controller change to AUTO mode: CORNER = "AUTO"
- another push on [MODE], the controller change to SD: AUTO mode: CORNER = "SD: AUTO"

To push SD- Card during running controller:

- requirement no program is running, controller switches immediatelyto mode SD: AUTO: CORNER = **„SD AUTO"**

SD- Card remove during running controller, :

- If the actually mode is : CORNER = **„SD AUTO"** an alarm stops every action
  - this alarm can be cancelled with the button [C]
- is the controller in an other mode working, it's possible to remove the SD-CARD without any alarm.

There are so- called SUB-Modi which are accessible by control- key, out of a certain Mode.

That are the mode:

- **EDIT:** this Mod will be started out of the Mod AUTO
  - just choose a program by cursor and push [ENTER]
    - now, we are in mod **CORNER = „EDIT"**
- **MPG:** This Modus can be reached through mod MAN.
  - Just push in these mode the button [7] for a time, ca. 1 Second.
    - now you are in Mode **CORNER = „MPG"**
- REF: this Modus is available through mod MAN or MPG.
  - Just push the button [-/.]ca: one second

- now you find yourself in MOD CORNER = **„REF“**

- **STEP:** these mode is available trough mod AUTO bzw. SD: AUTO .
  - Out of one of the named modes, a short press on button [7]
    - **Now you are in Mode CORNER = „STEP“ oder**

11 All possible Mode and Menu of the Controller and theme application

Please, read this chapter exactly.
But before you do this,
Connect all wire with the controller correctly. You can see it in the instructions of the next following chapter.
Chapter 12 till chapter 16.2

What is a modus, and for what are them use to?
A mode is a so-called operation category, ore operation mode.
In each mode, the controller offers available certain limited associated functions, which is to use in a benefit way, for this special operation category.
Other functions, which are not needed at this time, are blocked.

In chapter 10 is described, how to change the several mode. In these chapter we will describe how to use them.
Following mode are available.

Manual MODE: (MAN)

- this mode can drive each Axis by directions- key.
- From this mode mode the controller is able to start the MPG mode
- From this mode mode the controller is able to start MDI- and REF- **(REF)**Mode.

MDI Mode:

- in these mode, the operator can create and execute single CNC- program lines.

Ref- Modus:(has to be activated out of the MODE MAN) :

- in these mode, the operator is able to run each axis on ref point. This function is necessary, to find the 0-Position of each Axis of machine again. This is required after a shut down of Controller.
- Also the position of the Measure- sensor is stored after command.

Editing- Modus:

- In this mode, a new CNC- program can be created
- also a already existing CNC- program can be changed

Auto- running sequence Modus respectively single line (STEP):

- in this mode, CNC- programs are be able to run in sequence.
- With adjustment of Sub- Mode, the operator are able to run the same program in single line.
- Entry point, each program can be started at any line.

AUTO- SD- Card Mode:

- in this Mode, a program, which is only on SD- Card stored, can be execute in automaticity mode
- also, as described in AUTO-running Mode its also possible to run in single line
- last not least, the entry- function is also available in this SD- Card mode

All menus:

The menu is used to initiate all offered parameters to communicate between controller and machine, or to initiate the controller intern.
Those menus can be started, excepted the Diagnose- menu, from each Mode.

Setup- Menu: [MODE] + [5]. This is main- menu which managed cooperation from controller and Machine

- in these Menu, all different Sub- Menu can be invoke to set every Parameter, which the controller need,

to drive the machine.

- Following, to this chapter, all Menus and there entries will be exactly described. These Tables, parameters and information it which are expected represented a very important Part of the command centre of the controller. Wrong informations could lead to an malfunction. In either case, it wouldn't run perfectly. This could be cause for injury of persons and or damaged the machine or controller.

Offset- Menu: [MODE] + [8]

- In this menu, can a Offset- switch or Positions- Variables are become defined
  - **Offsets are be stored, to define Working- Points respectively Positions- Variable.** Working Points are used to define the exact position at the machine.

Diagnose- Menü [MODE] + [9]: is only callable out of the manual Modus

- In these menue, the operator can proof the several logical or current- level of the out- or incoming signals.
- The keyboard can be proofed about functionality

12 Start-up of the Controller

After connect the controller to current give the controller time, till it has the last reached mode, which was active while closed down.

Such a start represents, a so- called Basis Start.

The controller is also enable to start in an initializer start. With this function it is possible to reset special kinds of storage of the controller.

To execute an initialization, it is necessary to push appropriate combination of buttons, while start up controller. Push it as long, till a text “Initialization” appears on display. After this, wait a while and on display appears an Information, which adjustment was executing at Controller.

The following Table shows the possibilities, with which button combination, which sector of the controller will be reset.

TASTE	*BEREICH*	*FUNKTION*
[C]+[ENTER]	*Storage of the Controller Setup*	*Sets the Setup Data to factory settings.* *Additional reset this function the storage of Positions- Variable (B0- B19). Each Axis is set to 0. The Controller configuration on file at Storage will remain.* *The password will be eliminated, except the password in stored configuration on file.*
[0]+[ENTER]	*CNC- Program Storage.*	*Erased, while Setup, all CNC- Programs*
[-/.]+[ENTER]	*Storage of Zero- Points- Table*	*Erased while Setup the storage of Zero- Points- Table. All axis of Points will be set to 0. (G54 - G59)*
[8]+[ENTER]	*Storage of Positions- Variables*	*Sets all axis of Positions- Variables to 0 (B0 - B19)*
[MODE]+ [ENTER]	*All setup informations, CNC- Storrage inclusive Zero- Point Table, Positions- Variable*	*Sets all Controller set- up to factory settings, all CNC- programs will be erased. All axis of Positions- Variable Inclusive Zero Point Table will be set to 0. If exist, all configurations on file will be also erased. All passwords will*

		be erased.

13 Controller- Settings

The Controller enables the operator the configuration all peripheral devices of the controller, inclusive the choice of the particular algorithm control of the devices, which are online with the controller.

The operator is able, to reach the basis functions to change, the menus, through push of the buttons [MODE] +[5]. If the inputs are protected with password, the controller is waiting for password- input. The given password must be confirmed with the button [ENTER]

The display shows the Line "SETTINGS", plus several Items, which are enables the operator, to reach a few functions groups, collected in particular Menus.
The following table shows the button- combination with which the various Menus are to be enter, while the controller works in the Mode [MODE]+[5].(System- Menu)
The buttons are duplicate coated in there meaning, depending on the actually mode. That means, Practice makes perfect.

TASTE	*FUNKTION*
[1] - Halten	*The controller enables the storage of the actual configuration on file on the intern Controller- Storages.* *The controller ask:* ***Do you want to save settings in user memory?*** *[ENTER] generate a configuration on File. Certainly a already stored configuration will be overwrite.* *[MODE] would return to menu without storage.* *The setting of the actual configuration on controller wouldn't change.*
[2] - Halten	*The controller enables in this mode to load a stored configuration file, if exist.* *The controller asks: Do you* ***want*** *to load user settings?* *[ENTER] loads the configuration file, if exist.* ***If doesn't exist, the controller loads factory settings.*** *[MODE] return to pre menu, without loading.*
[C] - Halten	*The controller enables to load factory settings.* *[ENTER] loads factory settings. The password will be erased.* *[MODE] return to pre- menu without any action.*
[3]	*Motion of the cursor in menu upstairs.*
[6]	*Motion of the cursor in menu downstairs.*
[ENTER]	*Choice and opening of the marked Group of settings*
[MODE]	*Return to the pre menu*

Is the controller standing in the selected Parameter group, it is possible to move the cursor by button [3]or[6] between the Parameter of this group.

To change the value of the choose Parameter push [ENTER]

- *define the value by keyboard and accept it through pushing [ENTER]*
  - *some parameter cant define by numbers, so they can change by using [START] and [PAUSE]. The value has to accept trough [ENTER]*

- *Should the old value remain, push [MODE]. The actual value remain.*

The following Table shows the different Meaning several Parameter of the group of general Parameters

13.1 Menu of general settings

GRUPPE	***GENERAL SETTINGS***			
PARAMETER	*actual Controller-settings*	*MIN | MAX*	*Factory-settings*	*Description*
No. 1 *Controller language*		*POLISH, ENGLISH, GERMAN*	*POLNISH*	*Language, in which all the Interface of the controller is described. Should the controller be initialized in factory setting, the language is in polish. To define the English language, please choose* ***"ANGIELSKI"***
No. 2 *Settings Password*		*EXIST NOT EXIST*	*NOT EXIST*	*The Parameter enables the definition of a Password* ***for setting access*** *After definition to "EXIST", the controller expect the definition of a Password. Which has to accept with pushing the button [ENTER]. Once defined EXIST, a Password has to be defined. To change it, set this Parameter after defined the Password to "NOT EXIST". Now the Password is deleted again.*
No. 3 *Programs Password*		*EXIST NOT EXIST*	*NOT EXIST*	*The Parameter enables the definition of a Password* ***for Program access*** *After definition to "EXIST", the controller expect the definition of a Password. Which has to accept with pushing the button [ENTER]. Once defined EXIST, a Password has to be defined. To change it, set this Parameter after defined the Password to "NOT EXIST". Now the Password is deleted again.*
No. 4 *Resuming work Auto*		*YES, NO*	*YES*	*The definiton to "YES", offers the user the possibility, during the program-interruption, generated through an alarm, which is generated from the controller, the reopening of the corrected program to initialized.* ***These function is described in Chapter 21.3 ff***
No. 5 *Axis Return sequence*		*XYZA, XYAZ, XZYA, … ZYAX*	*XYZA*	*Parameter, which is determine the order of AXIS-Number to the exit- Point of the program.* ***Also this function is described at Chapter 21.3 ff detailed.***
No. 6 *Circ. Interp. step*		*0.01/1.00*	*0.03 [mm]*	*This Parameter defined the value of the calculated chord length for circles. Even smaller even exactly the circle will be calculated. A short*

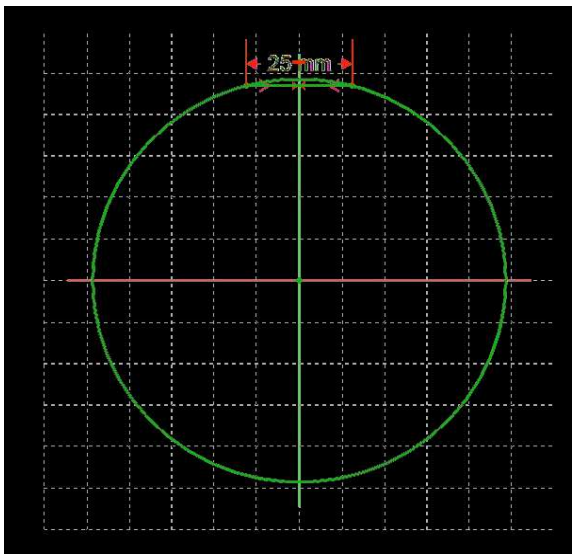
				graphic is signed after this table.
No. 7 *Control mem. EEPROM*		*NO CONTROL, READ CONTROL, WRITE CONTROL, READ AND WRITE*	*NO CONTROL*	*Parameter, which enable the control, during connection with the intern storage of the controller.* *"NO CONTROL": No control of write and read* *"READ CONTROL": Control only for reading data from RAM* *"WRITE CONTROL": Control only for writing data to RAM* *"READ AND WRITE": Control for reading and writing data from / to RAM* ***Note:****The control function of reading and writing of storage means a long communications length of time.*
No. 8 *d param for G83 G73*		*0 - 1000 [mm]*	*1 [mm]*	*This is the retract value during cuts at Cycle G73 respectively the allowance from cutting depth and returning depth between cuts.*

Description to No. 4 and No. 5
This controller is able to continuous a abort program, exact at this place at which it was finished by alarm or by user. In general, the abort will be generated by controller in case of a Program fault. (Alarm)

The user has now the possibility to correct the program and contentious the program. If Parameter No.4 has the value "YES", the user is at the next start of the program execution asked, whether he wants to contentious the program. YES = [ENTER] or NO = [MODE]

- *IF YES:Controller positioned the axis, in the order of No. 5 to the abort- Point. After it has reached it, the controller contentious the program.*
- *IF NO: The program starts form the beginning.*

Skizze zu Parameter Nr. 6 eingestellt auf 25mm



13.2 Menu of the axis settings

AXIS- SETTINGS				
Group		Axis - X, Y, Z, A		
PARAMETER	actual Controller-settings	MIN / MAX	Factory-settings	Description
No. 1 Number imp/mm		1 / 1000000	1000 imp/mm	Number of impulse, which the CNC- controller has to send to the Engin- controller to move the particular axis about 1mm. The formula to calculate this function is following after this table.
No. 2 Axis-Direction		0/1	1	Determine the run direction of the engine.
No. 3 Referenc. Direction		0/1	0	Determine the direction, in which the axis should referencing.
No. 4 Backlash		-10.0/10.0	0.000 [mm]	Parameter, which specified the Backlash value of the particular axis. This is the backlash between shift in directions. This Value exist in each Axis.
No. 5 Referencing offset		-1000000.0/ 1000000.0	0.000 [mm]	This value defined a general shift of axis. This Number is active till the change. It has the reference at the 0 Coordinate of this axis.
No. 6 Len.of release limit		-1000.0/ 1000.0	10.0 [mm]	Interval, which is move in the opposite direction , after the Axis archive the end switch, by referencing. Function: to travel the particular axis free from end switch
No. 7 Axis Z Encoder sign.		EXIST NOT EXIST	NOT EXIST	With such an encoder the axis is controlled exactly. The adoption and thereby connected arrangement is described at the end of this table.
No. 8 Max. axis feedrate.		1.0/ 10000000.0	10000000 .0 [mm/min]	This Parameter defined the maximum of feed mm/min, which is able to achieve with the axis drive. This Parameter is also a maximum of feed, which is able to generate by controller at these axis. The controller bordered this axis to this limit, and prohibit a higher feed.

14 Axis setting, calculation of Numbers transmitted Impulse pro mm

The D4 Controller has no primary effect for precision. It depends on the accuracy function of Machine and Axis which is used.
But if these Components will work accurately, the controller assist as well as the machine and there components are working.
The precision are generate exclusive of the relationship between motor- end stage and Spindle- handling

First we to trim the machine, independent from the D4 controller, to the desired precision.
The precision of the construction depends extremely on quality of all components.

- *Dynamic stiffness*
- *precision of guiding elements*
- *and so on*

14.1 Calculate number of impulse per mm (without reduction or transmission ratio)

Calculate of arithmetical precision movement Spindle / Impulse

- *pitch of the Spindle*
- *----------= lowest arithmetical step in mm*
- *((Number of Engine steps / Revolution) * Engine setup)*

Calculation of Number of Impulse, which are have been generated from D4 per mm

- *1*
- *---------- = Number of Impulse per mm*
- *lowest arithmetical step in mm*

Following is to do, to calculate the number of Impulse / mm, of the Parameter No. 1

Lets have a look to X- Axis and the possible arithmetic precision, which could be archive.

- *This X- Axis is equipped with a stepping motor end phase, which needs 200 Impulse per revolution.*
- *The stepping motor end phase is adjust to a division ratio of 1/5*
  - *that means, we have 1000 Steps per revolutions.*
- *The mounted Spindle has on the other hand a pitch of 5 mm per revolution. The spindle is driven with the proportion 1:1. E.g. with a clutch mounted on engine.*

Calculate of arithmetical precision movement Spindle / Impulse

- *5*
- *---------- = 0.005mm*
- *200 * 5*

Calculation of Number of Impulse, which are have been generated from D4 per mm

- *1*
- *--------- = 200 Impulse pro **mm***
- *0.005*

Now input these result in Parameter No. 1. This result should be proof with an independent measurement equipment!

Note:
This configuration is usable at step motors as well as at sevomotor.
At the several Engin is notice, that with the configuration with Axis and number of Steps, a dependence is developing between precision and quickness. Especial to attend with step- motors:

- *even higher the impulse Rate, even slower became the process.*
- *even higher the impulse Rate, even precise became the process.*

Its on your own, which relationship you prefer. To achieve a fortunate 3D Result, we recommend a Impulse Rate of minimum 1000 Impulse per mm.

In the same kind we are setting Y, Z and if applicable A- Axis. ***Note, its possible that every Spindle of each axis has an other pitch, respectively the motors delivers different Number of Steps.***

14.2 Calculate of Impulse per mm for gear drive and gear belt drive

Calculate of arithmetical precision movement Spindle / Impulse

Berechnung zur rechnerischen Genauigkeit des zurückgelegten Wegs der Spindel / Impuls

- *pitch of the Spindle*
- *---------- = lowest arithmetical step in mm*
- **(((**Number of Engine steps / Revolution**) * (**Engine setup**) * ((**Number of Tooth driven Wheel**) / (**Number of Tooth drive Wheel**)))**

Calculation of Number of Impulse, which are have been generated from D4 per mm

- *1*
- *---------- = Number of Impulse per mm*
- *lowest arithmetical step in mm*

14.3 Calculate of Impulse per mm for rack and pinion drive

Calculate of arithmetical precision movement pinion / Impulse

*The pitch circle can be calculated with following Calculation: (Number of Tooth) * Module*

- *(pitch circle) * PI*

---------- ----------= lowest arithmetical step in mm

- ((Number of Engine steps / Revolution) * Engine setup)

Calculation of Number of Impulse, which are have been generated from D4 per mm

- *1*
- *---------- = Number of Impulse per mm*
- *lowest arithmetical step in mm*

Example:

following components are plugged in a machine

- *one gear rack with module 1*
- *a gear with **36 tooth**,*
  - *cause it is Module 1, the pitch circle correspond to 36mm*
- *The step motor has a number of steps per revolution about 200 Impulse*

first calculation:lowest arithmetical step in mm

$$\frac{36 * 3.1415926 \text{ usw.}}{(200) * 25} = 0.0226 \text{ mm}$$

Calculation of Number of Impulse, which are have been generated from D4 per mm

- *1*
- *---------- = 44.2*
- *0.0226*

15 REF- Modus, approach reference point and or initiate of each axis Encoder and initiate Tool length measurement system

If the machine has once slow down, it will loose all information about Machine- Coordinate- System(not to mix with Table of Coordinate- Systems G54 G59).
There are two methods, to find this Machine- Coordinate system again.
First method

- *The machine has to approach the reference. Switch of each axis.*
  - *For this procedure, each axis of the machine has to plug a reference- switch.*
- *Initiate each axis at a specific place*
  - *no reference- switch necessary*

Please read this chapter 15. till 15.4 completely before executing anything.

15.1 Approach reference- switch. Referencing with reference- switch

The reference- drive of each axis.
Each single axis execute an approach in direction of reference- switch.
To define the direction for reference run is choosable with the parameter in the menu of each axis in setup menu Parameter No. 3.
The direction is defined: out from each valid workspace, in direction to the reference switch, of the particular axis.
After achieving the reference- Point, the controller stops the particular axis. The coordinate will be intern initiate added also the Value of the parameter No. 5 and attaching a move, the axis will be driven in the other direction about a value, which is definable in Parameter No. 6. This move is performed with a Feedrate, which is definable in the menu for Feedrate settings parameter No. 6. This parameter is valid for all axis.

*To execute the reference- move: Ensure the controller is running in Mode manual. Push Button [-/.] for at least 1 second. The controller is switching in Reference- Mode. To show up on right top corner with the text **REF**.*
Reference- run:

- *The controller has to switch into the reference- mode.*
- *Through the push of the button [X][Y][Z] and, if exist [A] the particular axis is running to reference- Point. As described above.*
- *Caution: only these axis, which are fitted with reference- switches and defined Incoming Parameters are able to archive the ref. point.*

15.2 Referencing without reference- switch

Should the machine not be completely, or halfway equipped with reference- switches, which could be approach, each of those axis will be initiate with the value which is defined in menu axis Parameter No. 5

***Recommendation:** A axis with missing reference- switch should at the and of operation, driven on a par- position before switch of. These function is not implemented, but is easily implemented by yourself. This position serve as own reference- point, and an be defined with axis- menu Parameter No. 5 (Referencing offset) The next power up you are able to initiate the particular axis on these position. So the machine has an virtual Reference- point.*

If the machine is driven without end switches and ref switches on each side, you have to watch about achieve the maximum and minimum of Axis range. Possibility, the engines are as strong so that the machine will be physically damaged while achieving the fence of each axis.

15.3 General use, referencing with Z-Signal of Axis- Encoder

requirement:

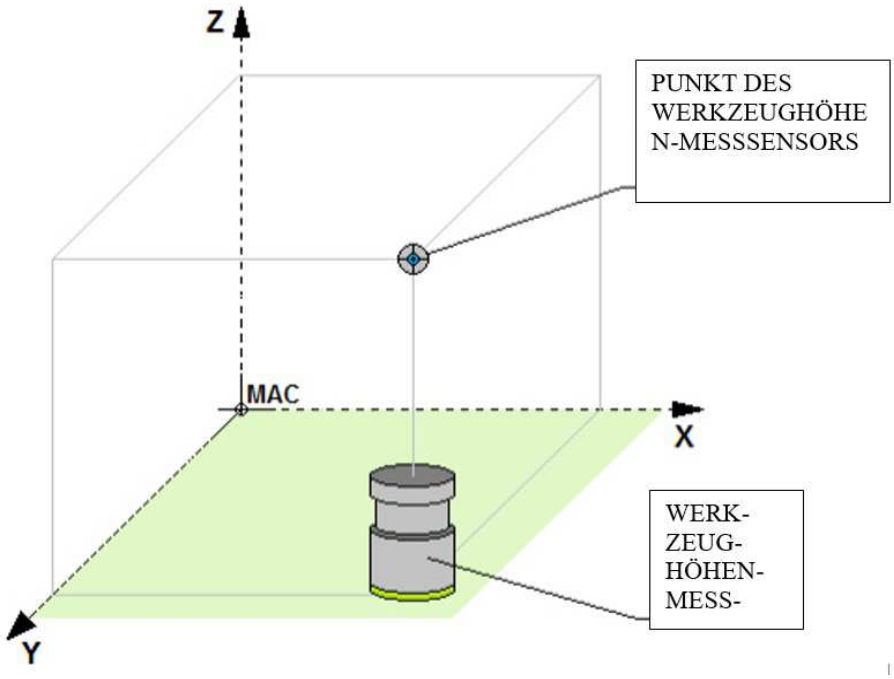
- *should be compatible with a TTL 5V signal*
- *the encoder has to be connect to the same ground (GND) as the controller.*
- *The encoder has to be connected to the interrupt- signal of the controller.*
- *The parameter No. 7 (axis menu) has to be defined to EXIST*

while referencing, the controller synchronise itself with the encoder, so the reference- coordinate is accuracy determine. Based on this encoder signal, the controller is able to throw a ERROR message. That avoid the risk of a possibility loss of steps respectively Impulse.

15.4 Setup Referencing of XYZ Position for Tool measurement- Sensors

The measurement Sensor for Tool length control can be mounted at each place of Machine- Table.
However, ensure that the position on which it is positioned, is not a critical or trouble spot, which can be responsible to a damage. Of the machine or process.
To ensure the controller, to find the measurement position again, the position has to be stored.
So the following action is necessary.

- *Requirement:*
  - *the menu Controller setup->Tools must be completely initiate.*
  - *All involved axis mus be referenced.*
  - *Controller as described above switch in REF- Mode.*
  - *Approach the measure position in X and Y*
  - *The Z- Axis should be on a stresses high to avoid collisions.*
  - *So through simple push on button [8], the position is stored in controller and is available for execute.*
  - *Following the controller execute once a test. The measurement device has to be reached absolutely, otherwise a collision is to be expected.*



16 Menu Feedrate setting

Group		Federate- setup		
PARAMETER	actual controller setting	MIN | MAX	Value factory settings	Describtion
No. 1 Max. feedrate MANUAL		0/ 10000000.00	3000.000 [mm/min]	Maximum of feedrate for manual Modus, which the controller admit while manual control. **Note**, The controller can't drive the particular axis higher than the value, which is defined in setup of the named axis, Item No.8
No. 2 MAX. Feedrate AUTO		0/ 10000000.00	3000.000 [mm/min]	Maximum of feedrate for auto Modus, which the controller admit while auto control. **Note**, The controller can't drive the particular axis higher than the value, which is defined in setup of the named axis, Item No.8
No. 3 Feedrate G0		1.00/ 10000000.00	3000.000 [mm/min]	Rapid Feedrate. Fastest Feed with which normally no cutting is performed.
No. 4 Return		1.00/ 10000000.00	200,000 [mm/min]	Feedrate, with which the axis are approach the interrupt point of a program, to continuous itself

feedrate				
No. 5 *Feedrate Ref. 1*		*1.00/ 10000000.00*	*2000.000 [mm/min]*	*Feedrate which is used to approach the reference- . Switch.*
No. 6 *Feedrate Ref. 2*		*1.00/ Feedrate Ref. 1*	*60.000 [mm/min]*	*Feedrate, while departure from Reference- Point.*
No. 7 *Acceleratio n MANUAL*		*0/2000.000*	*400.000 [mm/s^2]*	*Acceleration with which the axis are accelerate and slow down while manual mode. The setting 0 in this Parameter, cause the axis is acceleration as fast as possible respectively slow down as fast as possible.* *Caution:The value 0 can cause an mechanically Damage, Which is often become notice through strokes or knocking while acceleration or slow down of the machine.* *This kind of controlling of machine can cause to a bigger reversing play.*
No. 8 *Acceleratio n AUTO*		*0/2000.000*	*400.000 [mm/s^2]*	*Analogues to Parameter No. 7 Acceleration MANUAL but in this case for automatic.*
No. 9 *MPG pulse source*		*CONTROL PANEL, MPG-UNIT*	*CONTRO L PANEL*	*This Parameter define the source of input device, which can be used to control the MPG- Controller modus.* *If the user is chosen **Control Panel**, its possible to serve the process through the integrated panel.* *If the user is chosen **MPG-Unit**, its possible to serve the process through an external device, which is able to be connected to D4 controller.*
No. 10 *Feed change source*		*CONTROL PANEL, AIN1, AIN2*	*PANEL*	*Enables to define the device, with which is able to serve the value of adjustment of feedrate in Procent. Standardly the CONTROL PANEL is actively. Controlled with Button [3] and [6].* *AIN1 and AIN2 enable alternatively the choice of one of the analogues input.*
No. 11 *Lower Percentage th.*		*0.0/500.0*	*0.000 [%]*	*lowest value of the percentage feedrate index*
No. 12 *Upper Percentage th.*		*0.0/500.0*	*150.000 [%]*	*Highest value of the percentage feedrate index*
No. 13 *Percentage change.*		*0/100*	*10 [%]*	*Defined the adjustment value of the feedrate in percent*

16.1 *Menu Spindle*

Tooling Spindle setup				
Group		*SPINDLE*		
PARAMETER	*actual controller setting*	*MIN | MAX*	*Value factory settings*	*Describtion*
No. 1 *Max. speed*		*0.0/100000.0*	*1000.000 [rpm]*	*Maximum speed per revolution per min with an triggering of 10V. The inverter has to be connect to the controller, to ensure the the device can be controlled through the D4 controller.* *The inverter has to have an input- voltage from a value of 0 to 10V.* *The Rotation speed will be proportionate generated from 0 to 10V.* *10V = S max* *0V = S0* *Should the inverter work automaticity these setting is not necessary.*
No. 2 *Max. speed MANUAL*		*0.0/100000.0*	*2000.000 [rpm]*	*Maximum of speed which the controller may control in manual Mode*
No. 3 *Max. speed AUTO*		*0.0/100000.0*	*2000.000 [rpm]*	*Maximum of speed which the controller may control in automatic Mode*
No. 4 *Spindle*		*EXIST,* *NOT EXIST*	*EXIST*	*This Parameter initiate the controller depending the setted Value of this parameter.* ***EXIST:*** *the controller will the Spindle control as described under No. 1 and No. 3* ***NOT EXIST:*** *Is this value setted, the Spindle module will be disabled. In this configuration, the output can be used for other devices, such as proportionate valves.*
No. 5 *Spindle chuck*		*EXIST,* *NOT EXIST*	*NOT EXIST*	*Determine whether the brace of a lathe chuck can be controlled trough an external signal.*
No. 6 *Spindle chuck time*		*0.0/60.0*	*3.000*	*Period, in which the Chuck has to be span respectively release*
No. 7 *Spindle rotation dir*		*RIGHT-CW* *LEFT-CCW* *RIGHT-CCW* *LEFT-CW,*	*RIGHT-CCW* *LEFT-CW*	*This Parameter defines the rotations direction of the Spindle.* *„RECHTS-CW“ clockwise, M03* *LINKS-CCW” counter clockwise, M04*

Tooling Spindle setup				
No. 8 Spindle-Inverter		NOT EXIST, EXIST	EXIST	This Parameter defines if the controller should work with or without inverter. **EXIST** determine that the spindle is controlled trough an output signal of the output INV in an interval of 0 till 10V. **NOT EXIST:** determine the spindle- speed is not controlled.
No. 9 Speed measurement		NO MEASUREMENT, ENCODER	ENCODER	This Parameter determine, if an Encoder to measure of the Spindle Speed is available or not
No. 10 Encoder resolution		1/100000	1024 [imp/U]	Number of given impulse when the spindle turns once a full 360 degrees motion
No. 11 Auto. Gear selection		YES, NO	YES	**YES:** determines that the controller should check the Spindle- speed. Only possible, if Parameter No. 9 is setted to ENCODER **NO:** no Spindle- speed control
No. 12 Acceleration time		0.0/60.0	5.000 [s]	Necessary time, to reach the maximum Speed of revolutions per minute
No. 13 Decleration time		0.0/60.0	5.000 [s]	Necessary time, to break the maximum Speed of revolutions per minute to 0 revolutions per minute
No. 14 Speed measure. error		0.0/3000.0	10.000 [rpm]	Tolerance, from which the controller is readjust the Spindle speed during turning if Parameter No. 11 is set to NO, and the controller is throwing an alarm, after a while
No. 15 Speed Control thresh		0.0/100.0	10.0 [%]	Determine the percentage of variance of the Spindle Speed control. If this value is exceeded the controller is throwing an alarm. The spindle stops. If this value is set to 100, the control is disabled.
No. 16 Speed stability		0.0/100.0%	4.000%	Parameter, which determine the stability of the Speed in percent. A to small value causes that the controller is waiting till the Spindle Speed is running constant in the defined interval of adjustment. Just now, the controller begins to execute the operation. A generous value enables a faster automatic operation time.
No. 17 modeling accuray		0.0/100.0	2.000 [rpm]	Precision while automatic transmission selection. The controller change as often as necessary the gear, till the determined precision is ensured

Tooling Spindle setup				
No. 18 FEED change source		CONTROL PANEL, AIN1, AIN2	CONTROL PANEL	Enables to define the device, with which is able to serve the value of adjustment of Spindle Speed in Procent. Standardly the CONTROL PANEL is actively. Controlled with Button [3] and [6]. AIN1 and AIN2 enable alternatively the choice of one of the analogues input.
No. 19 Lower percentage th.		0.0/500.0	60.000 [%]	Lower Value of the percentage Spindle Speed index in percent.
No. 20 Upper percentage th.		0.0/500.0	150.000 [%]	Upper Value of the percentage Spindle Speed index in percent.
No. 21 Percentage change		0/100	10 [%]	Defined the adjustment value of the Spindle Speed in percent

16.2 Menu of Tool (Tool length measurement) and Tool change

TOOL CHANGE SETUP				
GROUP		Tool		
PARAMETER	actual controller setting	MIN | MAX	Value factory settings	DESCRIBTION
No. 1 Tool length sensor		NOT EXIST, EXIST	EXIST	This parameter determine if a Tool- length sensor is present or not. Below this Table, this function is described detailed.
No. 2 Measurement dir Z		0/1	1	Determine the direction of the Z- Axis, in which the measure operation is execute.
No. 3 Feedrate to sensor		1.00/ 1000000	1000.000	Approach Feedrate to sensor, while the measure- operation is running
No. 4 Feedrate from sensor		1.00/1000	60.000	Departure Feedrate from sensor, after measure-operation.

17 Measurement of the tool height with assistance of the measure sensor

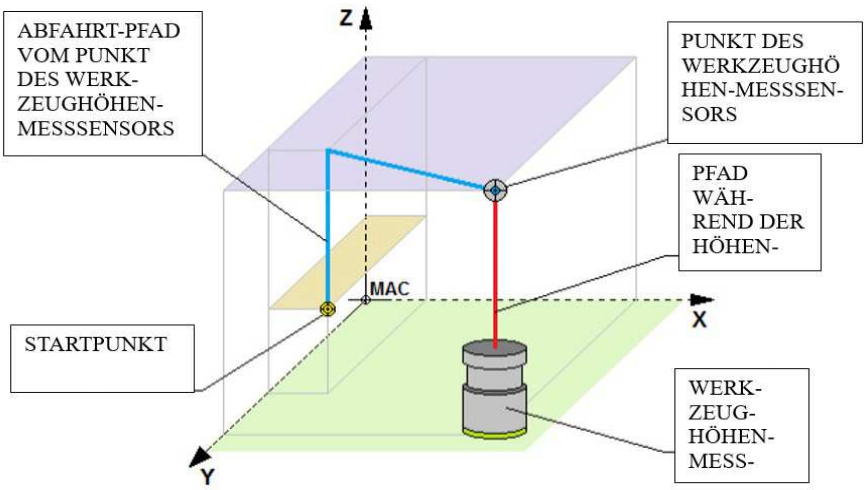
The measurement of the tool- length enables the work with tools having different length. The user can execute the measuring with the M6 command, which is a NC- Code command.

The controller will generate a message, which request the user, to accept the tool change.

If the controller is configured with an existing Sensor, please proceed as following:

Through confirmation with [START] the procedure is starting. First the Z- Axis is pull to the highest position. Afterwards the X and Y axis are approaching the measurement Point. The highest point of the tool should be positioning over the measure sensor. If it's not the case, please position the sensor under the highest Point of the tool tip. For example, a face mill, which is hollow at the centre, can't be measure in the centre, because no flute is over the measure centre. Please shift the measure device directly under a flute of the tool, so that the tool can be measured at the highest point.

Following the tool is typed on the measure device with an feedrate, which is defined in (Parameter No. 3 menu Tool). After that the tool is retract to the highest point of Z. with Feedrate (Parameter No. 4 menu Tool). The tool length is determined, the measure operation is finished.



17.1 Menu Output settings

OUTPUT SETUP				
GROUP		OUTPUT		
PARAMETER	actual controller setting	MIN | MAX	Value factory settings	DESCRCIPTON
No 1 – No.10 Normal state OUT1		NO- CLOSER NC-OPENER	NO- CLOSER	Concern Output OUT 1 till Output OUT 10 NO- Closer means Closer-> unactuated open NC-Opener means Opener-> unactuated closed switch has to be connected with Ground (GND)
No. 11 – No.12 Normal state RELAY1		NO- CLOSER NC-OPENER	NO- CLOSER	Concern Relay 1 and Relay 2 NO- Closer means Closer-> unactuated open NC-Opener means Opener-> unactuated closed switch has to be connected with Ground (GND)
No. 13 – No. 22 Function OUT1		NO FUNCTION {Function}	NO FUNCTION	Parameter enable allocation of defined controller functions of the digital OUTX output Controller functions of the OUTX Output

FUNKTION	BESCHREIBUNG
NO FUNCTION	Keine Funktion
ALARM	Function is switching the Output OUTX to on, if the controller throws any alarm
FINISH	Function is switching the Output OUTX to on, if the controller finished the automatic program in automatic mode. The signal is only one second present
SPINDLE_CW	Function is switching the Output OUTx to on, if the controller indicates the command Spindle CW
SPINDLE_CCW	Function is switching the Output OUTX to on, if the controller indicates the command Spindle CCW.
COOLANT	Function is switching the Output OUTX to on, if the controller indicates coolant on
LUBRICATION	Function is switching the

OUTPUT SETUP				
				Output OUTX to on, if the controller indicates lubrication on
				CHUCK OPEN — *Function is switching the Output OUTX to on,if the controller indicates chuck open (G13 M13)* ***Note: This signal remain on this actual level, in case of an emergency shutdown or of an alarm.***
				CHUCK CLOSE — *Function is switching the Output OUTX to on,if the controller indicates chuck close (G13 M12)* ***Note: This signal remain on this actual level, in case of an emergency shutdown or of an alarm.***
				WORK — *Function is switching the Output OUTX to on,if the controller indicates no alarm signal*
No. 23 - No. 24 *Output funct. RELAY1*		*NO FUNCTION {Function}*	*NO FUNCTION*	*Parameter enables the assignment to the RELAY1 and RELAY2 of the several controller functions which are described above, at the description of the digital outputs.*
No. 25 *Min.output vol 0-10V*		*0/"Max. voltage. output. 0-10V"*	*0.000 [Volt]*	*Minimum of Voltage, which are able to occur on INV- Output of the controller*
No. 26 *Max.output vol 0-10V*		*"Max. voltage output 0-10V"/10*	*10.000 [Volt]*	*Maximum of Voltage, which are able to occur on INV- Output of the controller*

Note: following is remarked to chuck and its signal condition

In the several menus are the following settings have to be conduct

- *menu SPINEL:*
  - *Parameter No 5 is setted to EXIST*
  - *the value in Parameter No 6 is set to the expected opening, respectively closing time*
- *menu OUTPUT*
  - *Parameter No 13 – No 22*

- *a not defined output has to be setted to CHUCK OPEN*
- *a not defined output has to be setted to CHUCK CLOSE*

- *menu INPUTS.* ***Only, if a Pedal should be used, to open respectively to close the chuck***
  - *Parameter No 15 – No 27*
    - *a not defined Input has to be setted to CHUCK PEDAL,*

Attention:

- ***while working in automatic running mode, the controller offers no possibility to use the external pedal.***
- ***Before starting of a program, the chuck has to be clamp. Otherwise the automatic mode will be stopped by alarm***

17.2 *Menu of Input settings*

GROUP	*INPUT SETUP*			
PARAMETER	*actual controller setting*	*MIN | MAX*	*Value factory settings*	*DESCRIPTION*
No. 1 *Normal state ESTOP*		*NO-CLOSER, NC-OPENER*	*NO-CLOSER*	*"NO-CLOSER" means unactuated open* *"NC- Opener" means unactuated closed* *Switch has to be connected with Ground (GND)*
No. 2 – No. 14 *NORMAL state INCx*		*NO-CLOSER, NC-OPENER*	*NO-CLOSER*	*Concern Input2 IN2 till Input14 IN14* *"NO-CLOSER" means unactuated open* *"NC- Opener" means unactuated closed* *Switch has to be connected with Ground (GND)*
No. 15 – No. 27 *Function INx*		*NO FUNCTION, {Funktion}*	*NO FUNCTION*	*Parameter enables the assigned several functions, which are usable, on the digital Inx Input.* *Please note the configuration of NC or NO of the particular Input item No.2 till No.14* *Controller functions has to be connected with Ground (GND)*

FUNKTION	*BESCHREIBUNG*
NO FUNCTION	*no function*
START	*Input INx switches the function START. Enables the start of an automatically program, a MDI-execution, Stepwise program or the continuation of a program*
PAUSE	*Input INx switches the function PAUSE:, Enables to hold the program in automatically mode*

GROUP	INPUT SETUP				
				RESET	Input INx switches the function RESET: enables the abort the Program or delete current alarms
				SAFTZEY KEY	Input INx switches the function SAFTZEY KEY: enables the lock function to the controller settings and the lock functions to edit or execute programs at editor or automatic mode
				X-MOVEMENT X+MOVEMENT Y- MOVEMENT Y+MOVEMENT Z-MOVEMENT Z+MOVEMENT A-MOVEMENT A+MOVEMENT	Input INx switches the particular function: Motion of named axis by choose external, direction Keys. Note the direction
				SPINDLE_RIGHT	Input INx switches to the function M3. If the user actuated the button again, the controller accept the input not until half delay Time braking duration. Following cases are possible: If M3 is active, the spindle will stop M5, respectively run again in M3. If M4 is active, the spindle will switch to M3.
				SPINDEL_LEFT	Input INx switches to the function M4. If the user actuated the button again, the controller accept the input not until half delay Time braking duration. Following cases are possible: If M4 is active, the spindle will stop M5, respectively run again in M4. If M3 is active, the spindle will switch to M4.
				SPINDEL_STOP	Input INx switches the function M5. If the function M5 is already active, no effect will appear.
				COOLANT	Input INx switches the function (M8). The coolant- pump starts to work. If the pump is already running,

GROUP	INPUT SETUP				
					these will switch it of (M9).
				LUBRICATION	Input INx switches the function lubrication (M32) If the lubrication pump is already running, it will switch of (M33)
				SAFETY DOOR	Input INx indicates the function Safety Door. These will stop the automatic mode. A guard door is open
				REF._SWITCH_X REF._SWITCH_Y, REF._SWITCH_Z, REF._SWITCH_A	Input INx indicate the level of the particular reference- switch of the named axis. If the switch would be actuated or not.
				LIMIT_SWITCH_X LIMIT_SWITCH_Y LIMIT_SWITCH_Z LIMIT_SWITCH_A	Input INx indicate the level of the particular limit- switch of the named axis. If the switch would be actuated or not.
				ALARM_X, ALARM_Y, ALARM_Z, ALARM_A	Input INx indicate the status of the named axis, whether an alarm is active or not
				OIL PRESSURE	Input INx indicate the status of the lubrication pump. If oil pressure at hydraulic system is insufficient, an alarm occur.
				ALARM_EXTRA 1	Input INx indicate the status of an extra integrated device or sensor. If it is throwing an alarm. Signal ALARM_EXTRA1 becomes active
				ALARM_EXTRA 2	Input INx indicate the status of an extra integrated device or sensor. If it is throwing an alarm. Signal ALARM_EXTRA2 becomes active
				CHUCK PEDAL	Input INx switches the function to clamp or release the chuck
				LENGTH SENSOR	Input INx indicate the valid measure- point contact of the

GROUP	INPUT SETUP			
				Length sensor to tool.
No. 28 Prog. Input reaction		IMPULSE, STATE	IMPULSE	IMPULSE: Mode, with which the process is stopped till an impulse will be given. Only an Impulse is enough to run the program contentious. This Signal has to be given in Input No. x. STATE: Mode, which is running, while the Signal is permanently present (high). If signal changes level to low, the process will stop immediately.
No. 29 Iput response time		0.007/0.337	0.007 [S]	Minimum of time to accept input signal as given. If the signal has a minimal period of this time, it will become a valid state.
No. 30 u No.32 Max. input vol AIN1 and AIN2		0.10/10.00	10.000 [V]	Maximum of voltage of the analogous input of AIN1 respectively AIN2 which is given.
No. 31 u No.33 Min.. input vol AIN1 and AIN2		0.100/10	0.100 [V]	minimum of voltage of the analogous input of AIN1 respectively AIN2 which is given.

The functions of the programmable inputs and outputs are more precise described in Chapter 11

18 manual operating mode (MODE MAN)

Well, if you reached this chapter, it should be ensured that the controller is connected and configured correct. In an later chapter, we will describe the usage of the integrated diagnose device.

Now back to ***Mode Manuel.***
This Mode is the usage with which the particular axis can be moved by controller. Either with the integrated Panel, or, if connected, with external Switches, which are connected and configured as described in already previous chapters.
To move an axis, please proceed as described:
requirement The mode Manual is active.

- *Move axis with integrated Panel. Note, only one axis can be driven in this method:*
  - *first select the wished axis by integrated panel*
    - *select the axis, which should be moved. Push on of the address- keys for ca. One second. If the controller selected the axis, the letter begins to twinkle in display.*
  - *Move the selected axis by panel*
    - *Now the user is able to move the particular axis, with direction keys on integrated panel.*

[START] for a movement in direction -, [PAUSE] for a movement in direction +

- *Move with external axis- switches.*
  - *just push those Key, which moves the wished axis and direction. With external Switches it's possible to move more than one axis simultaneous.*

- *Adjust the driven Feed by panel and precent value*
  - *in manual mode, the highest Feed, which can be driven, is defined in the particular axis Setup in item **No.8**. That value defined the highest feederate, which can be driven with this axis. That means the feedrate can't be higher than in this definition defined. Is 2000 mm/min limited, the axis can reached this feedrate. It also depended, which feedrate at the moment is actually valid.*
  - *Additional, the feedrate can also be decreased respectively increased the percent value with the button [6] or [3]. The user has to take care about the particular device, which is actually setted active for altering.*
    - *If the **Feedrate** is active, the **F** in display is twinkling at display*
    - *If **Spindle speed** is active, the **S** in display is twinkling at display*
    - *To switch the chosen device, a short push on **Button [9]** the devices (**S or F**)can be changed.*
  - ***Exception**, it is possible, to limit the the feedrate once again. In setup Feedrate, Item **No. 1** (Max. feedrate manual as described at Table FEEDRATE SETUP) for manual mode boundary. It wouldn't rise over this value in manual Modus.*

- *Control the Speed of Tooling spindle by percent value:*
  - *To control the spindle speed of tooling spindle, please switch to Spindle control, S has to twinkle. Now the user is able to change the spindle speed by reducing respectively raise the percent value of active spindle speed through pushing Button [6] or [3]. The user can follow the adjustment in percent value at display for S*
  - *consider before control spindle speed, ensure the spindle is turning. If not, the result of the action is only viewable at display. To start spindle, the user has to change mode to MDI mode, which is described in chapter MDI. Chapter19 it is the following chapter.*

19 Mode MDI

*Over the **manual Modus**, described above, it is possible to reach the **MDI Modus**. In this mode, it is possible to execute single NC- Lines. The controller switches in MDI Mode, and after execution or abort of the NC-line, it changes automatically back to manual mode.*
Trough pushing of [ENTER], the controller switches to line editor -> MDI- Mode. The user is able to give an NC- Line and after is able to execute with [START] or abort these line.

Explanation of the procedure to use MDI- Modus correctly:

- *MDI- Mode is able to execute, single NC- instructions*
  - *therefore the lines have to be created.*
    - *To create one NC- Line in MDI mode, push [ENTER], while the controller is running in manual Mode*
      - *an arrow with twinkling Cursor appears at the lower corner left side of display.*
      - *Create a valid NC- Line(as described further down) with help of integrated Panel*
    - *This line can be execute with Button [START] or can be abort with Button [mode]. After that, the controller switches automatically back to Manual Mode*

- *While the controller execute the line, the user has the absolutely control with the controller Buttons, to stop, increase or decrease the feed or speed while executing this line. After that the display returns to the normal manual mode face.*

Different to some other Controller this is a mixed Mode, which changes modes automatically between manual and MDI.
Each Panel button, in the right entering field, has multiple meanings. There are addresses, numbers and possibly a Symbol.
If a button is pushed for ca. 1 second, the controller creates first an Address at the display. Now the user is able to input with the same or other button a number to define a determine Value to the address.

The multiple configuration of the buttons is described in chapter 21 (Edit Mode). In this chapter is, among others, the multiple meaning of buttons, for example [T], [P], [Q] USW described.

Is an address is defined, a forcing Number has to be defined. That means. The panel switches after given an address to the layout numbers. Following, a Button has to be pushed, to create the next address, followed from a number or a decimal point or a minus sign, and so on. This procedure is to repeat, till the whole NC- Line is written. To execute this sentence the user has to push [Enter]. After verification the controller execute this line. Is a mistake of syntax or coordinate mistake is discovered, the controller initiate an alarm and the line won't be executed.
This mode is reachable only over manual Mode. It is possible to generate single NC- Code lines and execute them.

On this point, we had to make a decision. To describe MDI it is necessary to have an minimum on understanding about G- Codes. Its also necessary to have a minimum of automatically procedures.

We want to open a small window to G- Codes. We limit the offer of G- code to: G0, G1, S, M3, M4, M5, M8, X, Y, Z.

G0

- *Is a motion Command, to get as fast to defined position as fast the machine is able to. In general, no cutting motion. That means motion out of the material. G0 is in general the fastest motion, which the machine can be offer. The tempo are stored in Machine- data. All axis are able to move simultaneousness.*

M3

- *This is the function, which causes the rotation of the Tool spindle in clockwise direction, with a Value of revolutions / min which is defined before.*

M4

- *Same function as M3 with the reverse motion → Counter clockwise.*

M5

- *Spindel Stop:causes 0 revolution / min*

M8

- *Coolant on*

M9

- *coolant off*

S

- *Number of rotations speed. Is useful with an function M3 or M4*

G1

- *Is an function with an defined F value mm/min. This command is useable to cut with tool. The way is an line.*

F

- *is the parameter, which defines the Feed / min. It also could be an other unit for example mm/round. However, we stay at unit mm / min. This is more common at milling. For example F100 what means 100 mm / min feedrate.*

X, Y, Z

- *This are the axis- addresses, under which the particular axis is addressed to move to any coordinate. X100 means. Move the x- axis from the actual place to X100mm*

Following Situation:
the actual position of a tool machine is: X100 Y50 and Z30.
The workpiece is beginning at X0 Y0 Z0 and has its endpoint at X200 Y200 Z-30. The Spindle has stopped.

N1: We wont to move machine as fast as possible to X0 Y0
N2: following we activate the spindle with an speed of 1000 rev/min cw.
N3: The z- axis is moved to Z2, so 2 mm over Material. In the same line we activate coolant.
N4: we moving the Z- Axis with an Feedrate of 50mm / min to Z-2
N5: following we moved machine with a feedrate 200mm / min to X100 Y100 Z-3
N6: the fore last step, the machine is driven with the actually feedrate of 200 mm / min to Z2
N7: Spindle off, coolant off and with rapid to Z30.

We are pushing in manual Mode the button [Enter]. In the last line left edge at display is twinkling a Cursor. This is our command line, with which we want to execute our scenario, line for line, we described before. After creating each line, we have to push [START], to execute the given line by machine.
Is the line executed, the next line has to be opened by [ENTER], to edit the following line. And so on. This procedure has to executed until the end (N7). Should happened a mistake while editing, we can correct the line by button [C].
Every sign, which we want to delete, till we reached the mistake, we have to push the [C] button once. This causes the deleting of the next left sign. Have we reached the mistake, we have to edit it right till the instruction is done.
Now we editing following lines and execute every line by pushing [START].
N1: G0 X0 Y0
N2:S1000 M3
N3: Z2 M8 (G0 ist noch wirksam)
N4: G1 F50 Z-2
N5: F200 X100 Y100 Z-3
N6: Z2
N7: G0 M5 M9 Z30

20 Mode MPG

In this mode, the controller enables the user to move each axis incremental, step by step, to the position which should be reached. The user has many possibilities to execute this procedures. It depends on the configuration of the controller.
This mode, the user can reached from manual mode. Easily to push in mode manual the button [7] for ca. 1 second and the controller field will show MPG.
To move the certain axis, the user has to push the address of the wished axis for ca. 1 second. If the Address letter is twinkling at display, the axis is chosen.
Now its able to move the axis by increment.

Following increments are choosable. Note only by twinkling F can the increment be chosen.

- *0.001 mm / impulse*
- *0.010 mm / impulse*
- *0.100 mm / impulse*

*Ensure that the Letter F is twinkling. If **S** is twinkling, push [9] to switch to **F***
To push [3] or [6] the user is able to switch between different increments as shown above.
One of the addresses X, Y, Z or A must be chosen.
Only one axis can be chosen.
To move the certain axis please push[STATR] for -direction or [PAUSE] for + direction.
*For each impulse the user is generating, the certain axis will move about one increment, which is selected before, in the direction which the button, with which the move command has be given. **If using the integrated Panel, one push causes one impulse.***
If a hand wheel is used, one digit on wheel causes one Impulse so one increment..

21 Edit Mode

With these chapter, the focus is the correct syntax, and the functional commands of shown programs.
The training and understanding, how tu use the panel, which has an automatism, which is necessary cause the multiple meanings of buttons.
The edit mode, is reachable over the auto Mode.
The auto mode offers 999 Program- numbers and programs, which can have either information or not.
The user is able to recognize it over the comment "NO PROGRAM" which shows an empty program.
if this comment is missing, the program has Information. It might be able to run, if the program is written correctly.
To choose a program, please select it with the keys [3] or [6]. After the wanted program is displayed push [ENTER]. The editor invokes with the chosen program and their informations.
Now the user is able to edit these program, which is runnable in auto mode, when all information are written correctly.
This editor is a line editor, in which one line after the other can be entered and written.

To write a new program, proceed as follows

- *As soon as the controller runs in edit mode, the first line is marked with a not twinkling Point.*
  - *In the display, the user can discover another to informations.*
    - *Left side ahead there are the line counter which displays Program number and line number. E.G. P7.1. 7 is the program number, the 1 is the line number, in which the cursor is located.*
    - *Ahead in the middle, the value of the consumed storage, of the controller, is shown in percent.*
- *The state of a not twinkling cursor indicates, the selected line, which is not yet ready to edit.*
  - *If the program should be a new program, or a program which wasn't use last time, the cursor is positioned at the first line not twinkling.*
  - *If the program is the last used program, the cursor positioned at the last edited line, not twinkling.*
- *The state of an twinkling cursor indicates that the actual line is ready for edit.*
- *To edit this line, push [ERNTER].*
  - *An Arrow marks the line, left side, and the cursor is twinkling at the right end of the line.*
  - *The cursor is marking the horizontal position, at which the next letter will be created.*
  - *This line can be created, altered or completed.*
    - *If the line should be stored, push [ENTER]*
    - *If the old information should be recover, before entering the line, push [MODE]*
  - *the cursor positioned its self in the next line, not twinkling.*
    - *Exception: if the line was an already existing line, the cursor stays in the same line. The user has to move it by himself.*

- *If the program is complete, the last line is finished, the edit mode can be left, with key [MODE]. Now, the controller, runs in auto mode again. This just written program can now be driven by automatic mode, which is described in the following chapter.*

Lets view the complete program and analyse, how to use the editor, to create this program in a textual correct form. We indicate to G- Code description, which becomes an important meaning at this position. These information, you will find it in chapters: 26 – 26.7

Look at the below shown NC- Line Line No.1 (N1).
View the command structure of each single command. The function always construed the same way. Its always an address followed with an Value.
N1 G0 G54 G90 G17 S600 M3 Z10

G = Address, 0 = value
G = Address, 54 = value
G = Address, 90 = value
G = Address, 17 = value
S = Address, 600 = value
M = Address, 3 = value
Z = Address, 10 = value

The line editor create each command in the same way:

- *First choose the address Key, in our cases [G] or [M] or [S] push for ca. One second. The address will be created*
- *followed from a value [0] or [8] or [6][0][0] , when the address has be created*

It would be attract attention, that because the multi functional keyboard all keys have two respectively three meanings, which are reachable in cooperation with the panel logic.

[C]and [R],
[T], [P], [Q]
[M], [L]
[K], [I], [J]

- *That means, you are able to generate the Address Q through triple actuated of the [T] key*
- *first push [T] for ca. One second till the address T appears.*
- *Then push the same key [T], twice for a short time. The result is the address Q over P*
- *The other multifunctional keys are working similar.*
- *The value, you are able to create as used to.*
  - ***Exception**, if the first digit of the value, after the address which was been created, has to implement with the same key, which is used to create more than one address, wait a short while before actuated. Else, the key will create the next address, which wouldn't be purpose.*
- *Should an axis to be defined with a negative value (coordinate) e.g. (X-10.8), so the user has to define the minus Key [-/.] immediately after the address. To create the decimal point the key has to use another time at the right place (after 10).*
- *Each value without sign is considered as positive value.*

Some helpful functions in editor:
Button [C]: cancel function.

- *Shortly actuated within a line, in editor or MDI line is cancelling the left standing sign.*
- *With [C] is also possible, to delete a whole, not activated line, in editor. Just positioned the cursor in editor to the deleting line, actuated the key for ca. 1 second. The line will be cancelled. All following*

lines will be shifted upwards.

Button [1] insert a line

- *place the cursor in front of an inactive line. Push key [1] for ca. 1 second. A line is created which is insert before the chosen line. The following lines are shifted down.*

The shown program is a valid NC- program. Please try to create it, as explained above
***Note: in each line, the D4 controller can keep only one M command**. That means, if the user needs more than one M command, he has to create a new line.*

Programm 1

N1 G0 G54 G90 G17 S600 M3 Z10
N2 X10 Y10 G98 M8
N3 G81 R2 Z-15 F100
N4 M98 P3
N5 M5
N6 M9
N7 G0 G28 Z0
N8 M30

The following table gives an additional overview about possible quick Key- commands, about which are in editor mode are enable.

KEYS	*FUNCTION*
[1]– hold ca 1 secund	*To insert a new line in program. The line is insert above the cursor position. Each existing line after the insertion- place is shifting down.*
[3]	*Select the line number by cursor. Direction downwards*
[6]	*Select the line number by cursor. Direction upwards*
[ENTER]	*Activation of the current line in editor, respectively enter program*
[C]–hold ca 1 secund	*Canceling of the chosen line. Al liens which are below are shifting upwards*
[START] – Halten oder Signal START	*This function causes a program access at this position. If these key is used, the controller ask: do you start the program from the given line ?* *YES – START NO-MODE* *The actuation of the [START] button causes the starting the program at this line.* *The actuation of the [MODE] button is cancelling the procedure.*

22 AUTOMATIC MODE

It's able to protect this mode with password. But it don't has to be. The factory settings are without protection. If the mode t is password protected, and the wrong password is input, the controller wouldn't permit the access to this mode.

The controller enables the definition of many several programs. The number is depending on the taken program- storage.
The syntax conforms the in this documentation described G- Code.
After this mode is switched, on the display is shown a table, which is indicates the several programs, respectively program numbers which can be used to run automatically, or can be used to programming if the program is empty.

In the left middle field of the Display is an information, whether the program is filled with code or not.
If the Note "NO PROGRAM" is displayed, the program is empty, and is not qualified to run.
If this information is missing, the program, if the code is written correctly, is runnable. Requirement the program is no subprogram. Subprogram means, it is not able to ran at its own.
The following table shows the short commands, which are useable while operating in auto mode while the controller is not run a program automagically .

Keys	*FUNCTION*
[2]- hold ca. 1 second	*Copy of the program which is actually chosen.*
[5]- hold ca. 1 second	*Insert the last copied program. Attention, the controller has no buffer memory, so the copied program mustn't be cancelled before inserting. It can be insert in a empty program number. It doesn't work with an already existing program.*
[4]	*The controller is expecting a program number. After entering the user can confirm with [ENTER], the controller jumps to the given program number. If the Key [MODE] is actuated, noting will happened.*
[3]	*Select the program number by cursor. Direction downwards*
[6]	*Select the program number by cursor. Direction upwards*
[8]- hold ca. 1 second	*Not clear yet* *Eingang zu den Einstellungen des Werkbereichs*
[C]-hold ca. 1 second	*Erase of the actually program*
[0]- hold ca. 1 second	*Not clear yet* *Inbetriebnahme der Segmentierung der Programmspeicher. Der Controller wurde mit einem Werkzeug zur Speichersegmentierung ausgerüstet. Die Segmentierung erlaubt die Aufrechterhaltung des Programmspeichers auf möglichst optimale Weise.*
[START]	*Start the actually program in automatically mode*
[MODE]	*Return to manual mode*
[ENTER]	*Opening the program in edit mode*

If the user has created a program, and want to run it immediately automatically, so he has to change by [MODE] from edit mode in automatic mode.
After that he is able to start the program automatically by pushing [START]
In automatic are two sub modes are existing:

- *CONTINOUSE Mode right upper corner AUTO*
  - *Normally the program runs from the beginning till the end automatically without any stop. Except a M0 or a M01 or other special functions are programmed, which are affect the program.*
- *STEP mode right upper corner STEP*
  - *With the key **[7] step** it affects the kind of running. The automatic mode is executeing one line after the other, but the user has to start the cycle for each line at once by button [START]. M0 and M01 wouldn't have an affect, the controller stops anyway at each sentence.*

In all modes of automatic, the controller enables the change of the view.

In all modes the controller enables the switch to several views. Following views are aviable:

- *Programming view*
  - *shows the program, which is actually running*
- *Process view actually*
  - *shows*

• process view

*In allen Modi des **Automatikbetriebs** erlaubt der Controller die Änderung der **Ansicht**.*
Uns stehen die Programmansicht, Ansicht der aktuellen Prozessparameter, sowie die Ansicht der soll Prozessparameter zur Verfügung.
In beiden Positionsanzeigen kann der Bediener die prozentuellen Vorschub- Geschwindigkeitswerte sowie die Spindel-Geschwindigkeitswerte manipulieren.
Die nachstehende Tabelle zeigt die Funktionen der Tasten im Modus des Automatikbetriebs an.

KEY	FUNCTION
[1]	Switching between program view, and process view1 and process view 2
[7]	Switching between Auto respectively Step mode (AUTO/STEP)
[3]	Percentage increase of chosen speed respectively feed, if the panel is initiated as device, which is able to change value
[6]	Percentage decrease of chosen speed respectively feed, if the panel is initiated as device, which is able to change value
[9]	Switch, witch which the user is able to choose the device to change parameters for percentage value Switching between mode Speed and feed is possible
[C], externes Signal RESET	Abort of process. Reset switch of controller, to reset the functions.
[PAUSE]panel, or external Signal	To hold the automatic operation. Process can be continuous by actuated [START] button or external switch again
[START] panel, external Signal	Start the controller in automatically mode, respectively restart after PAUSE or program aboart.

22.1 AUTO MODE STEP

Step mode in automatically mode:
Controller stops after each line the automatic run. To continuous the run, the [START] button has to be actuated at once. This is so often to repeat, till the program end is reached, or the mode is switch to auto run.

22.2 AUTO MODE CONTINOUSE

This mode runs the auto program automatically contentious till the program end is reached. Exeption M0, M01 or any other programmable effect has programmed.

22.3 Interruption, stop, resume, abort of the automatic mode plus access in a program with certain Position

- *Interrupt of automatically run*

Each alarm, except the alarm of housing, which is throwing from controller, interrupt the automatically run. The user is also able, to interrupt the automatically run by [C] key or the external Reset switch. The interruption causes the return to display of the automatic mode. ***That causes the complete abort of the automatically process.***

- *Stop of the automatically run*

If the alarm of the housing appears, the controller stops all procedures, which it is controlling. The user can also stop the run with the panel button [PAUSE] or the external switch [PAUSE]. This is no abort of the automatically process. ***But while pause is active, it is possible to abort the automatically rung with panel Button [MODE]. It causes to abort all automatically process, change modes in manual mode.***

- *Resumption of the automatically run*

While the automatically run stops (not abort) it can resume again with [START] button. It will Continuous at the place it has been stopped before. Requirement, the process wasn't abort wit any actions which would break the run.
The Resumption, of automatically run, is with open housing not possible. It would be possible after the housing has been closed. After such revival, the controller returns to the automatically cycle.

- *finishing of the automatically run*

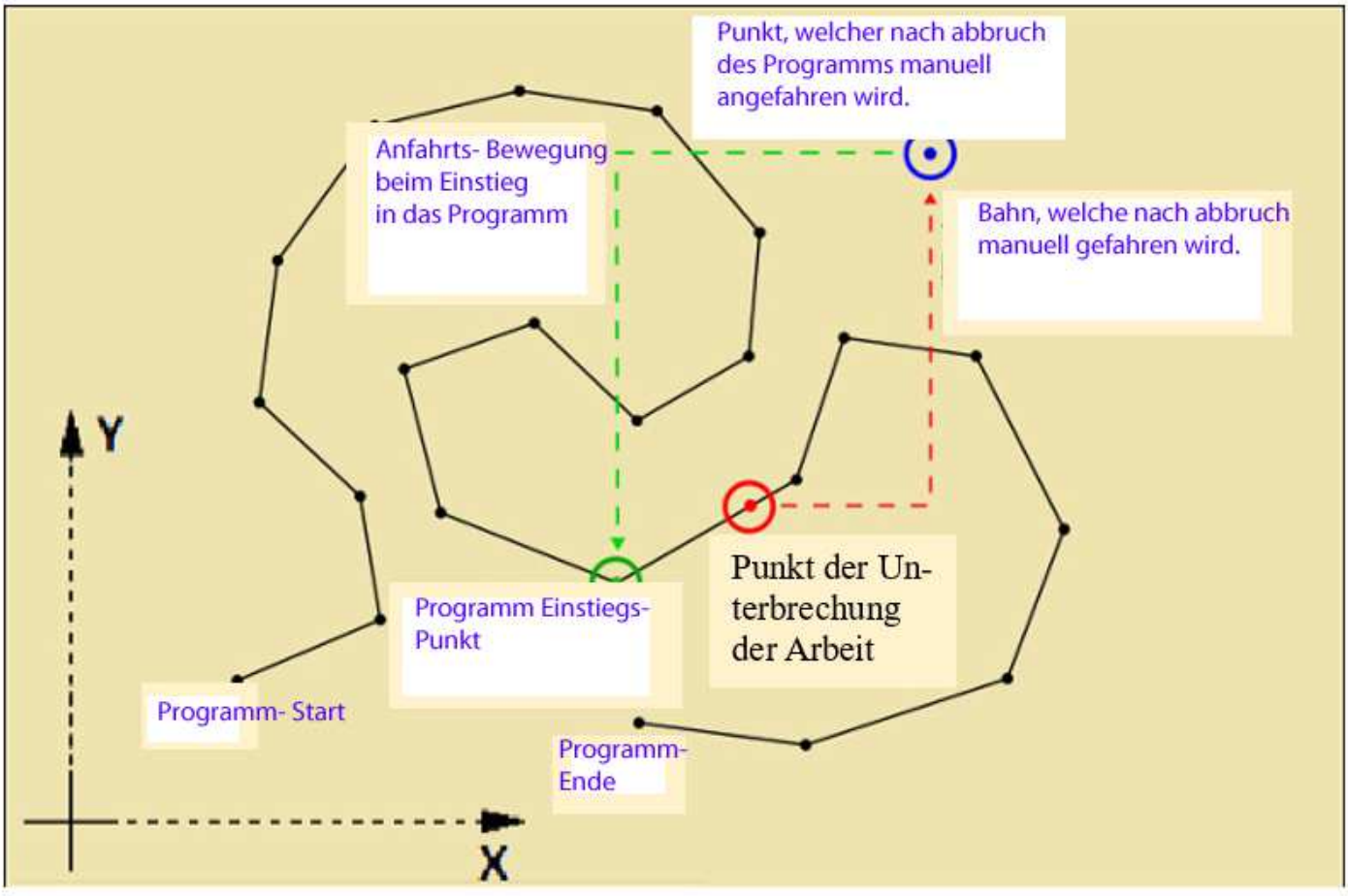
The controller is finishing the automatically process at the end of program, when its end is reached. Exception, the program is running as endless loop.
After finishing the program correctly, the controller stops all devices and is sending, if this signal is configured, a signal end of work (FINISH). The signal M30 or M02 is working intern and has no cause external. But if the controller is connected to some other controllers or devices, which have to control other machines, the possibility to use this controller is growing up.

- *Start of automatically run of an defined Program line*

To start the program from any program line, switch into the editor in the chosen program. Afterwards choose with the cursor the wished line, to start. Then the user has to actuated simultaneous the [start] + [ENTER] button, or external switches if exist. The controller starts the program from the chosen line.

22.4 Resumption of automatically run, after an alarm abort rund

The once abort automatically run, by alarm, is able to continuous. Requirement, the controller is initiated to. The item No. 4 (resuming work) in general settings has to defined to YES. The controller will ask, whether the run should be continued or not.



If the user answers with yes, the controller is starting the procedure to resume the program. In the rule of the Process resuming the several axis are moving to the resumption Point. The sequence of the order of axis is defined in item No.5 in general settings. The controller is moving to the position, from which are the program was braked before.

23 SD- Card- Programme, Optional

*The controller CNC- PROFI D4 has the **optional** possibility to run programs which are stored at micro SD-Card.*

With this device, it is possible to run large programs, as surface finishing contours in 3D or similar storage quantities, which would the intern controller storage overexert.

Should a program generated with CAD- CAM, so it is to ensure, that the post processor is compatible with D4 controller.

If the controller is defecting such a card, the quick switch to SD- Card mode is possible.

After inserting of a SD-Card in the slot, which is located in front of the controller , the controller recognize this automatically.

The user is also able to switch by his one, through several actuations of [MODE] key, to reach this mode. Recommended a card is stuck.

Such a program can't be altered by controller. It has to be edited extern.

Should an alarm appears, depending of readability of the card, so continuous the process by pushing [C] key

23.1 navigation through the directions structure and Files of SD-Card

After switching to SD-Card the upper line of display, displays SD: AUTO
The the actual path of SD- Card is shown.
Right side, Symbol are displayed, which are give information about the function of the item.

- *Direction, dark rectangle*
- *File, empty cyrcle*
- *return upper direction, Arrow shows left side*

23.2 Sight of SD- Card program and automatically mode

After choosing of any program, which is stored at SD- Card, the user is able to change the different lines of the program plus start the automatically run from chosen line at the program. The navigation is the same as in edit or automatic mode.
It exist also an indication, which is shown the program line, similar to edit mode (above left side).
In this mode, it is also possible, to start a program again after throwing an alarm.

24 Controller-Diagnosis

The CNC Profi D4 controller is quipped with a Diagnosis tool, which is able to

- *recognize the faulty function of controller.*
- *The interface enables the display of the data condition of inputs or outputs*
- *While viewing the diagnosis, the user is able to control all devices by controller in manual mode.*

It is necessary to stay in manual mode, to switch to the diagnosis tool. The user has to push [MODE] + [9] simultaneous. The display shows several menu items, between which the controller is able to switch.
Following table shows the different possibility, what is able to analyse.

NAME	*PERIPHERIE*
Digital inputs	*Module of digital Inputs*
Analogue inputs.	*Module of analogue Inputs*
ENC1_2 inputs	*Encoder - Inputs ENC1 and ENC2*
Keyboard	*Keyboard at panel*
Digital outputs	*Module of digital Inputs inclusive Realise*
Analog outputs	*Module of digital Outputs*
Axes	*Module of outputs of STEP/DIR controlled Axis*

In chapter will be described how to use and several function of the controller diagnoses. Some Examples are be shown. There the user can the data of controller view visualised and proof.

25 Lookahead to "G- Function" G12- storage of positions variable

The function G12 is storing the actual coordinate depending to the actual coordinate system in a positions coordinate, defined through No. B determined variable.

Example: G12 B1.1111 or G12 B1.xyza or G12 B1

G12 B1.1111 is able to write with the integrated editor of the controller.

G12 B1.xyza can exclusively be written with an external editor, on SD- Card

G12 B1 is able to write with both possibilities.

The binary respectively alphanumeric addresses which is suffixed on the parameter Bx. determine which axis have to be stored.

So means G12 B1.xyza:

- *following axis values, which are the actual positions referenced to the actual coordinate system, should be stored in variable B1. The named address, B1, is written in table of positions variables. The command is following interpreted, Axis value xyza are being stored.*
- ***Momentousness, the controller is storing only complete variable correctly.***
  - *G12 B1.1111 or G12 B1.xyza for storage*
  - *B1.1111 or B1.xyza for reading*

Example	*DESCRIPTION*
G12 B5	*All actual positions are stored in positions variable B5*
G12 B5.1111	*All actual positions X, Y, Z and A are stored in positions variable B5*
G12 B5.xyza	*All actual positions X, Y, Z and A are stored in positions variable B5*

In following chapter, on suitable positions, is particular explained how to work with positions variables

26 several G- Code commands

The controller enables the use of G- Code commands, which are defined in ISO. The following table shows the G-commands, which the controller sports.

Only the described commands are provided.

G- codes are shared in several groups. In these groups the codes, which are belong together. The one code is overwrite the function of the other.

***To example:** G90 and G91 are member of a group of G-code. If G90 is active and G91 is setted, so the function G90 replaced from the function G91.*

From each group, only one command cam be active. Is an other code from same group setted, so the previous command is replaced

The G-code is a modal acting command. That means, the code is as long active as he isn't redefined from an other code, same group

to any time, a code of each group is active. This functions are initiate at each set up of controller. Each M30 or M02 initiate also the commands.

G-code		*DESCRIPTION*
		Group of transfer functions
		Group of moving commands
G0	*G00*	*Rapid linear move of linear axes or rotations axis*
G1	*G01*	*Motion in linear movement with linear. Axis, or rotations axis with mm per*

		Minute respectively degree per minute.
G2	*G02*	*Movement in circle interpolation clockwise with feed per minute*
G3	*G03*	*Movement in circle interpolation counter clockwise with feed per minute*
		Delay
G4	*G04*	*Delay: possible to program address T and P.: T = Second, P = Millisecond*
		Non ISO- Code, Controller manufacturer CODE
G12		*Storage of coordinate value at potions variable*
		Group of chuck brace code
G13		*Chuck open respectively close. Depends on predefined code (M12 M13)*
		Group of work pattern
G17		*Choosing Pattern XY and Z as Tool Axis*
G18		*Choosing Pattern XZ and Y as Tool Axis*
G19		*Choosing Pattern YZ and X as Tool Axis*
		Group of concrete Machine Points
G28		*Move to Machine reference point*
G30		*Move to a second position, which is defined*
		Group of reference points
G50		*Programmable coordinate system. Move the coordinate system, depending on the actual valid coordinate system(G53 – G59). If a new coordinate system is specified, the G50 is cancelled.*
G54		*Specify the coordinate- system G54 as actual valid coordinate- system*
G55		*Specify the coordinate- system G55 as actual valid coordinate- system*
G56		*Specify the coordinate- system G56 as actual valid coordinate- system*
G57		*Specify the coordinate- system G57 as actual valid coordinate- system*
G58		*Specify the coordinate- system G58 as actual valid coordinate- system*
G59		*Specify the coordinate- system G59 as actual valid coordinate- system*
		Group of cycles
G81		*Drilling cycle, simple drill*
G82		*Drilling cycle, simple drill with delay*
G83		*Drilling cycle, deep hole drill*
G73		*Drilling cycle, pecking drill*
G80		*Cancel each cycle*
		Group of coordinate interpretation
G90		*Choosing of absolute coordinate interpretation*
G91		*Choosing of incremental coordinate interpretation*
G92		*Programmable coordinate system*

	Group of Feed interpretation
G94	*Feed unit mm/minute respectively degrees/minute at rotations axis*
G95	*Vorschub in Einheiten [mm/U], bzw. bei Rundachsen [Grad/U]*
	Group of cycle help-functions
G98	*Retraction to the initial pattern*
G99	*Retraction to clearance- pattern (R)*

26.1 G0, G1, G2 and G3 movement

valid, in general, for coordinate interpretation:

- *The given coordinates are interpenetrated agreeing to the actual valid mode G90, G91*
- *Should an axis not be given, the position stays constant in the valid coordinate system*
- *within of a line, with these commands:* ***G0, G1, G2, G3*** *a positions- variable can be given to reach the defined target.*

valid, in general, for Feedrate interpretation:

- *The given value of Feedrate and the execution of, are depending on the actual valid functions G94 or G95. Momentousness only XYZ an A is able to address.*
  - ***G94*** *mm/min*
    - *rotations axis Degrees / min*
  - ***G95*** *mm/revolutions*
    - *rotations axis Degrees/revolutions*
- *if Feedrate declaration is in the actual line missing, the last actual Feedrate value is valid, if already given. If no Feedrate value is given before, the controller puts a hard programmed default value of 1000. This value is interpreted as described before.*

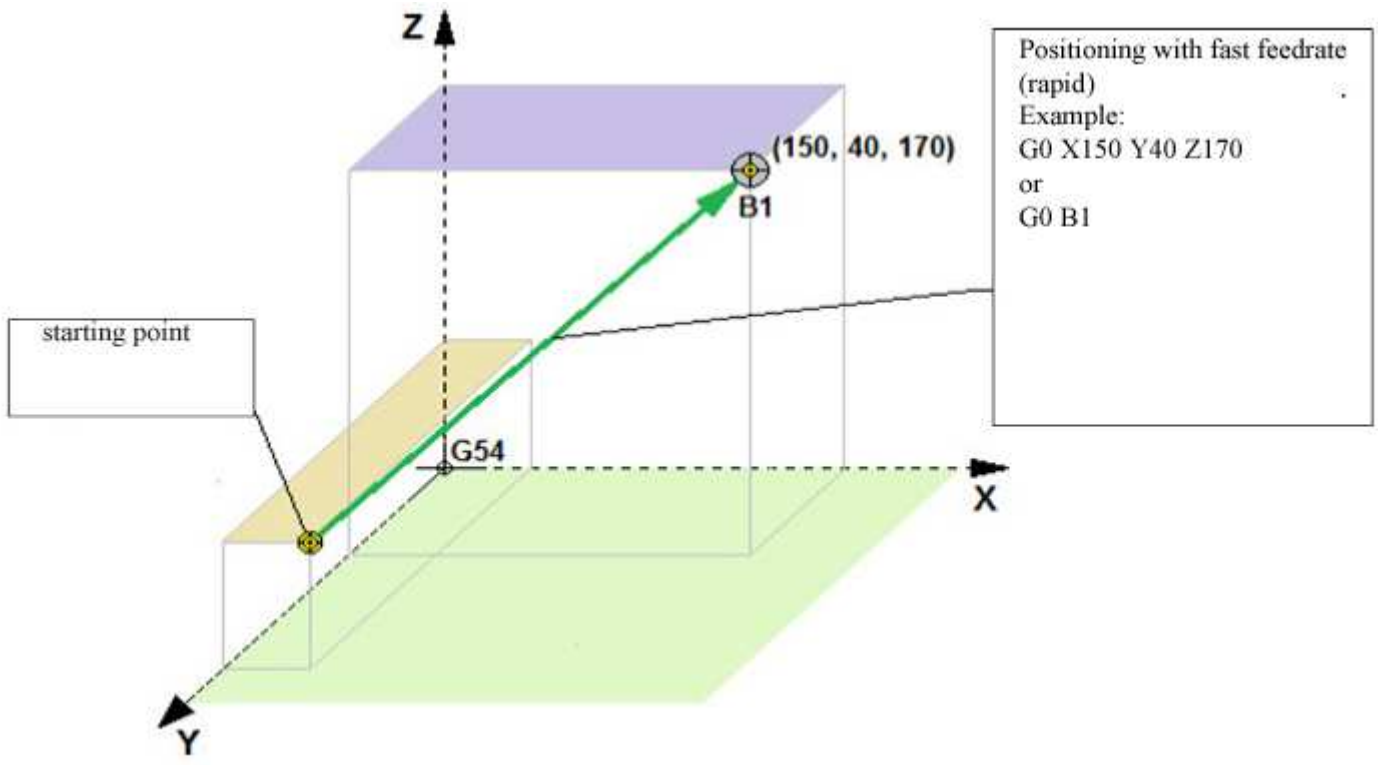
26.2 G0 fast feedrate, rapid

The command G0(Rapid) generate a motion to the defined position X, Y, Z, A. The used Feedrate is the Feedrate defined in Menu Feedrate, item No. 3. The rotations axis A, B, C are move with the maximum of rotations feed.

This command is normally used, to reach a position fast, with out cutting.

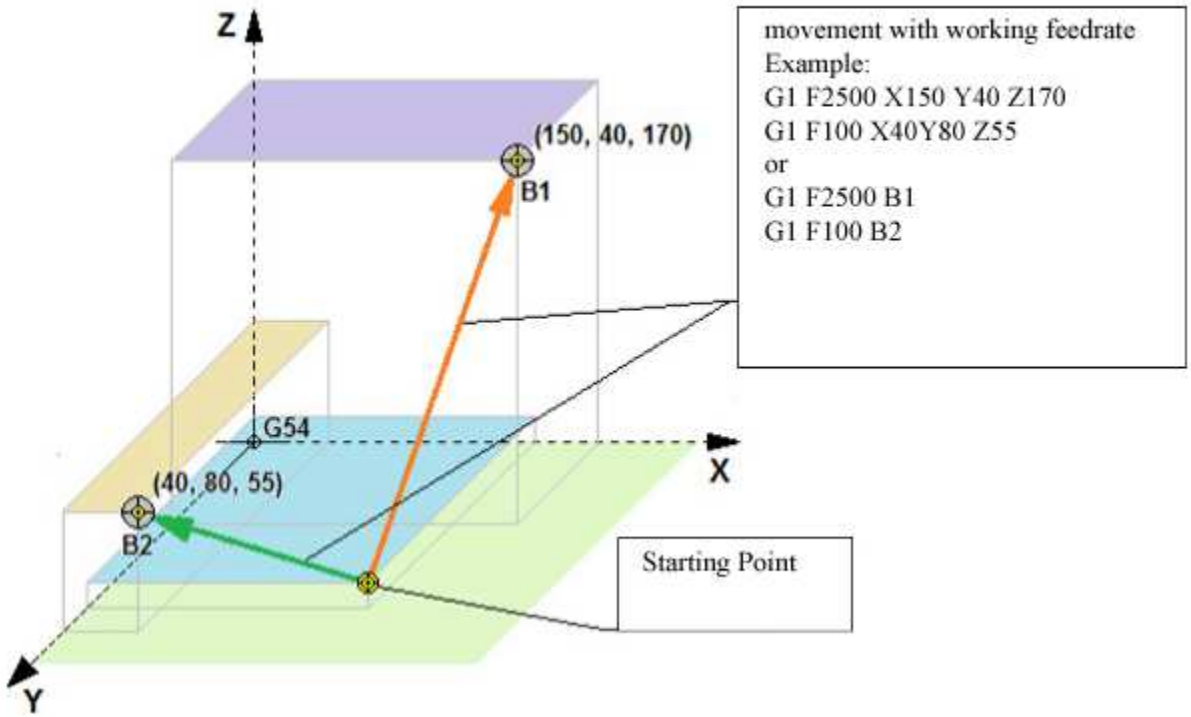
The following graphics shows the movement G0 with program example.

Positioning:



26.3 G1 working feedrate

The G1 command specified the movement with an defined feedrate, to the defined position X, Y, Z, A. This feedrate is defined by program, addressed under Parameter "F". This execution depends on the functions G94 G95.:



The Picture shows the ability to change feed rates. The position of the first line (position B1)is reached with a faster feedrate then second Line (position B2). Line 1 has the feedrate F2500, line 2 has a feedrate of F100.

26.4 G2 G3 – circle interpolation

*The command Circle interpolation, **G02 G03**, generate a Circle or circle segment on the working pattern.*

G02 = Circle clockwise

G03 = Circle Counter clockwise

*With this command, a circle can be driven, according as available data with **I, J, K** vectors or **R**- Radius.*

Note, this command is only used for circles or circle segment, which are placed on working plain G17, G18 or G19.

The value I, J, K are interpreted as incremental value from starting point to centre point of Circle.

The I Value defined the distance at X

The J Value defined the distance at Y

The K Value defined the distance at Z

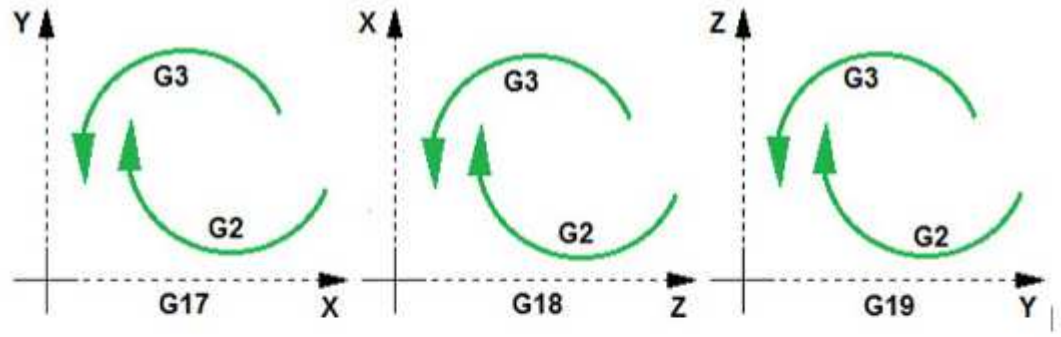
A circle, which begins at X10 Y0, has the centre point at X0 Y0 and the endpoint at X10 Y0 is thusly to program: The pre and post line are completed.

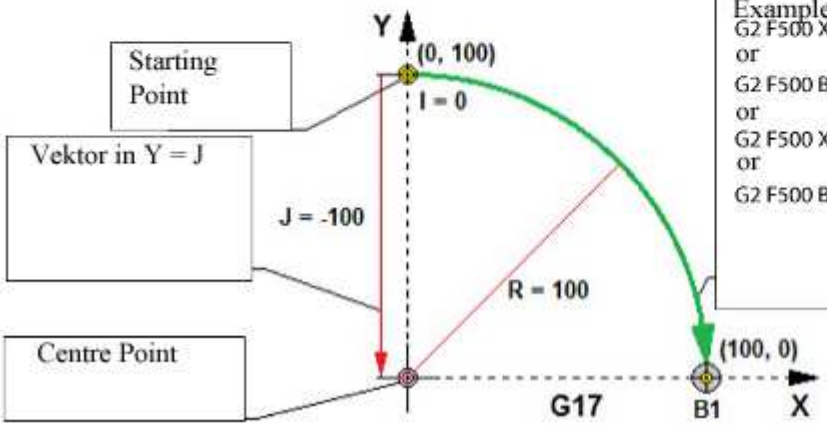
Pre line G1 X10 Y0 F200 linear line

Circle line: G2 X10 Y0 I-10 J0 circular line

Post line: G1 X20 Y0 linear line

For example, a circle segment, which begins at X0 Y100, ends at X100 Y0 should be driven clockwise. The centre point is located at X0 Y0





cutting on Plane XY along the circle in clockwise

Example

G2 F500 X100 Y0 R100

or

G2 F500 B1 R100

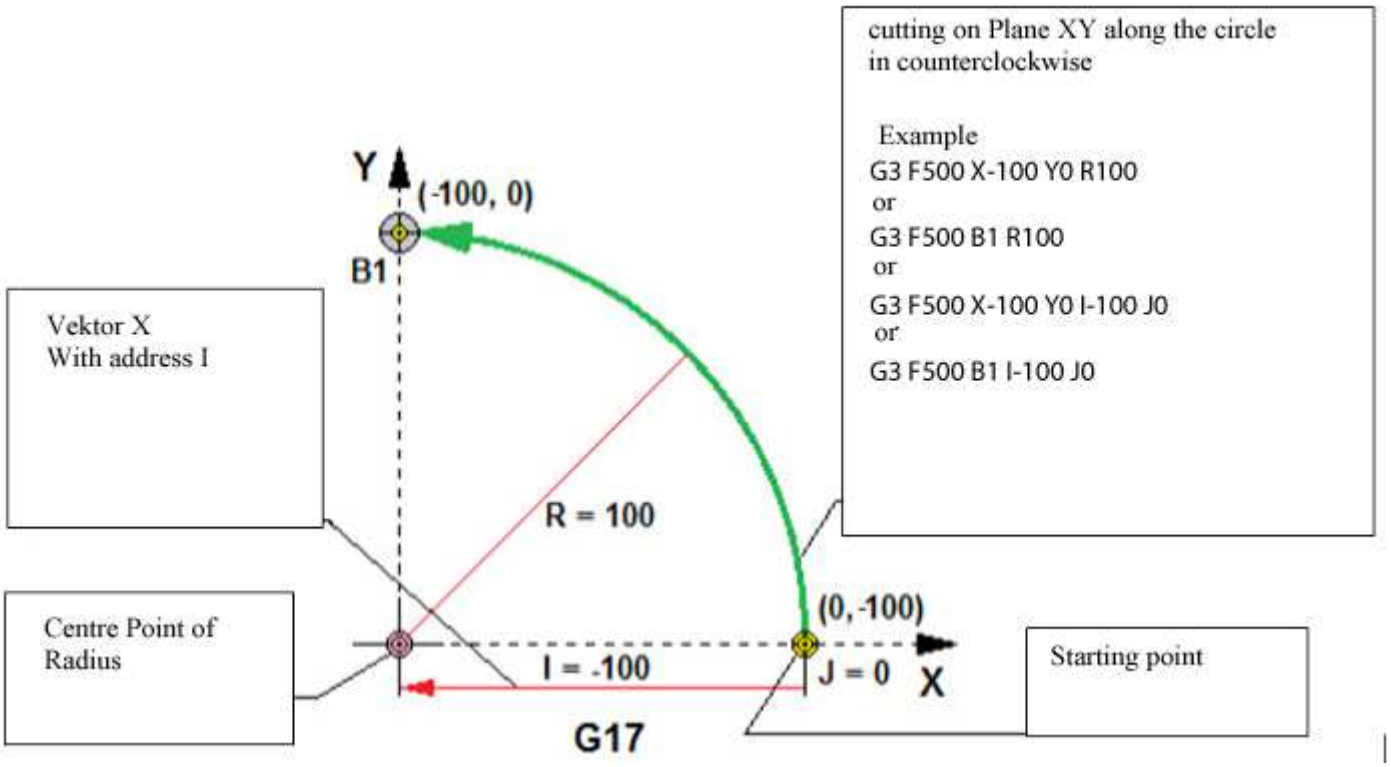
or

G2 F500 X100 Y0 I0 J-100

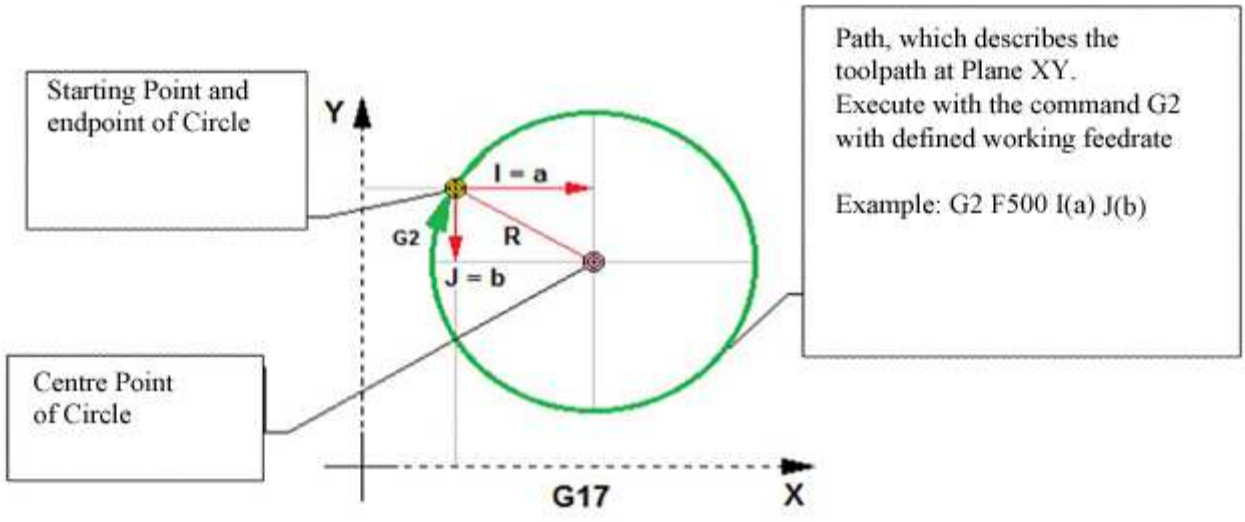
or

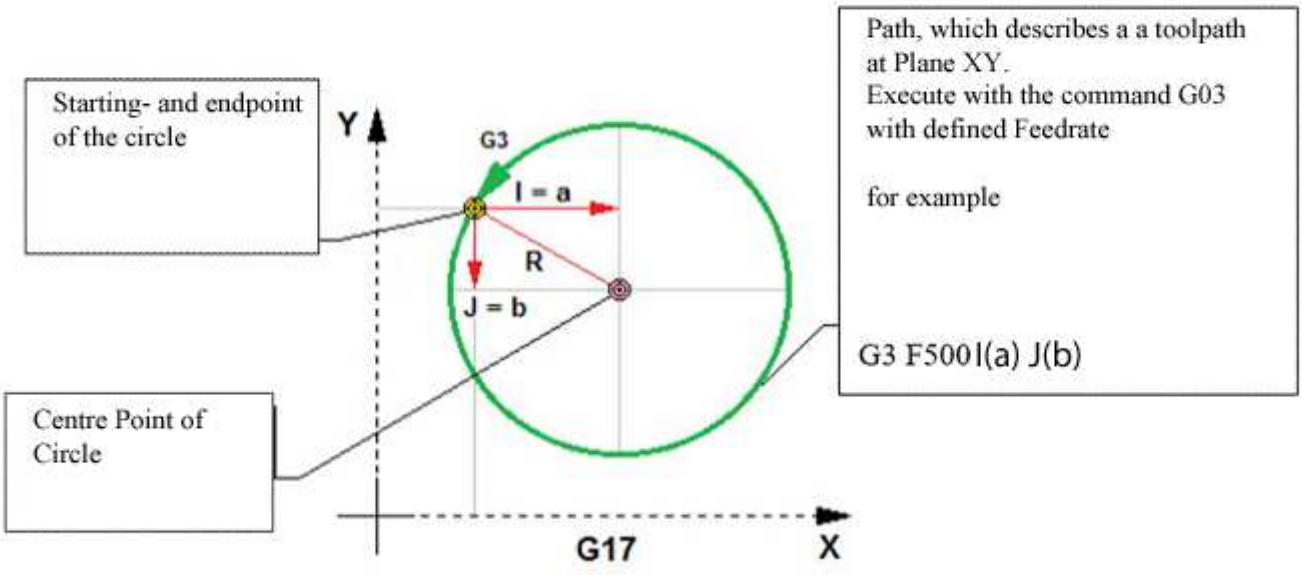
G2 F500 B1 I0 J-100

Das gleiche Kreissegment, welches nun in X0 Y-100 beginnt und in X-100 Y0 endet, soll im Gegen-Uhrzeigersinn gefahren werden. Das Zentrum den Kreissegments befindet sich in X-100 Y0.



The execution of the motion of axis, which describes a full circle, the programmer can program with Parameter I, J, K. depending on the working plane, which is used. The following pictures shows the path, which describe a full cutted circle.





26.5 G4 Delay

The command G4 enables the user, to program a time about which the program should delay. To define the time, the user has two abilities:
To define the time in milliseconds, use the address P.
To define the time in seconds, use the address T.
The precision is 0.001 Seconds .

Example	*description*
G4 P100	*Delay of 100 ms*
G4 T10.5	*Delay of 10.5 seconds*

26.6 G13– clamp respectively release of chuck

The command G13 closes respectively open the Chuck. According as which function (M12 M13) is actually valid.

M12 is the mode for clamping chuck

M13 is the mode for release chuck

Example	DESCRIPTION
G13 M12	If **M12** is active the chuck will clamp
G13 M13	If **M13** is active the chuck will release

26.7 G17, G18, G19 – choosing working Plane and depending tool axis

The G- codes are modal codes. Once commanded G- function remains active till a G- function of same group overwrites the actual function.

EXAMPLE	DESCRIPTON
G17	Defined the Plane XY as working Plane. Simultaneous, Z- axis becomes Tool- axis, in which the Tool correction is added. Momentous only G43 possible.
G18	Defined the Plane XZ as working Plane. Simultaneous, Y- axis becomes Tool- axis, in which the Tool correction is added. Momentous only G43 possible.
G19	Defined the Plane YZ as working Plane. Simultaneous, X- axis becomes Tool- axis, in which the Tool correction is added. Momentous only G43 possible.

27 Special Points at Coordinate- system G28

It is an advantage, if the machine axis are moving to a point after finishing work, which offers the maximum on free scope. Often it is the machine 0 position (MAC). Z- axis is is far away, X and Y also.

That position is reachable with command G28. This is a fix position, which can't be altered. This point is the Machine coordinate 0 position.

The position of the MAC G28 (machine coordinate- system) has to be defined once, while assembly the manufacturing plant. It cant be altered without invention to the kinematic of the machine.

EXAMPLE	DESCRIPTION
G28 X100 Z150	Approach to the origin of Machine coordinate system, across(X100 Z150.). After reaching the coordinate X100 Z150, the controller moves Z on (MAC) 0, following moving (MAC) X0 Y0.
G28 B6	Approach to the origin of Machine coordinate system, across(B6). After that, Z0(MAC) following X0 Y0(MAC)
G28	Approach direct to the origin of Machine coordinate system (MAC) first Z0 following from X0 Y0

Example:

G28 X0 Y0 Z0

- *causes the retraction of each axis to (MAC 0) . First Z. The Tool length correction is ignored.*
- *then X and Y simultaneous.*

G28 Z0

- *causes the retraction of each axis to (MAC 0) . First Z. The Tool length correction is ignored.*
- *then X and Y simultaneous.*

G28 X50 Y-50 Z-10

- *first the controller moves all axis on the programmed coordinate X50 Y-50 Z-10 of the actual coordinate system*
- *The Z- axis is moved to MAC 0*
- *then X and Y simultaneous.*

27.1 G30 motion to the first till sixth Origin, which are definable

G30 works similar to G28, except G28 dependence only to MAC which is fix(always (MAC X0 Y0 Z0). With G30 the controller offers the user the possibility to define 6 additional choosable positions, which are addressable over G30.

*To each origin G54 to G59 exist a second origin **G54 G28** to **G59 G28_6**.*

To define the position, move the machine on the wished position, and define it at menu Material Bases second Offset.

Example: How to define G28_3, so that the user is able to call it "G30 P3"

- *First, move the machine to the position, you want to store*
- *call the menu material basses [MODE] + [8]*
- *choose the table material basses (Offset)*
- *select the offset No. G56 (third offset in table)*
- *with the [PAUSE] button change in Table G56 G28_3*
- *At this position, the user can store the actual position of machine*
  - *With an push on the cosponsoring Key for each axis, the controller is storing the position for this axis.*
  - *Certainly, the value is not able to edited*
- *from now, the position is reachable with line:" G30 P3"*
  - *optional an intermediate position is choosable, which the controller is positioning first. This point is interpreted for the actual Offset coordinate- system, which was active before G30 was programmed.*
- *After that, the controller activated the last coordinate system, which was valid before G30:*

To define and to execute P1 till P6, same procedure as described.

The command G30 works similar to G28, except the origin has to be defined with address P. Optional, across point can be defined.

EXAMPLE	*DESCRIPTION*
G30 P3 X100	*Approach The third Origin, No. 3,(G28_3), across the coordinate X100 which is depending on the actual Origin.. Then Z0 and X0Y0 depending on Origin G28_3*
G30 P4 B6	*Approach The fourth Origin, No. 4,(G28_4), across the coordinate B6 which is depending on the actual Origin.. Then Z0 and X0Y0 depending on Origin G28_4*
G30	*Approach The first Origin, No. 1,(G28) Z0 and X0Y0 depending on Origin G28*

27.2 G50 G92 definition of a programmable coordinate- system respectively limit Spindle speed in RPM

The command G50 respectively G92 working equal, except limit rounds per minute. These commands are able to shift the actual valid coordinate- system. If the user has to program the address Xxxx Yxxx Zxxx Axxx with the relevant value. The controller set the actual position to these coordinates.
The coordinates are shifted temporary. ***No entry in any table will be changed.***
Example: G50 X10 Y10 Z10 A10 or G92 X10 Y10 Z10 A10
To get the original coordinate- system, just call it again.
Example:
N1 G54; original coordinate system
N2 G50 X10 Y10 Z10 A10 or G92 X10 Y10 Z10 A10; coordinate- system G54 is temporary shifted
N3 G54; recall original coordinate system

Additional the command G92 is also able to limit the speed of working spindle. This is able to program the address S.
Example G92 S500

EXAMPLE	*DESCRIPTION*
G50 X10 Y-10 Z10	*Create a temporary coordinate system. This defines the actual position to X10 Y10 Z10*
G92 S400	*Limit the working spindle to 400 rounds per minute*
G92 X10 Y10 Z10	*Create a temporary coordinate system. This defines the actual position to X10 Y10 Z10*

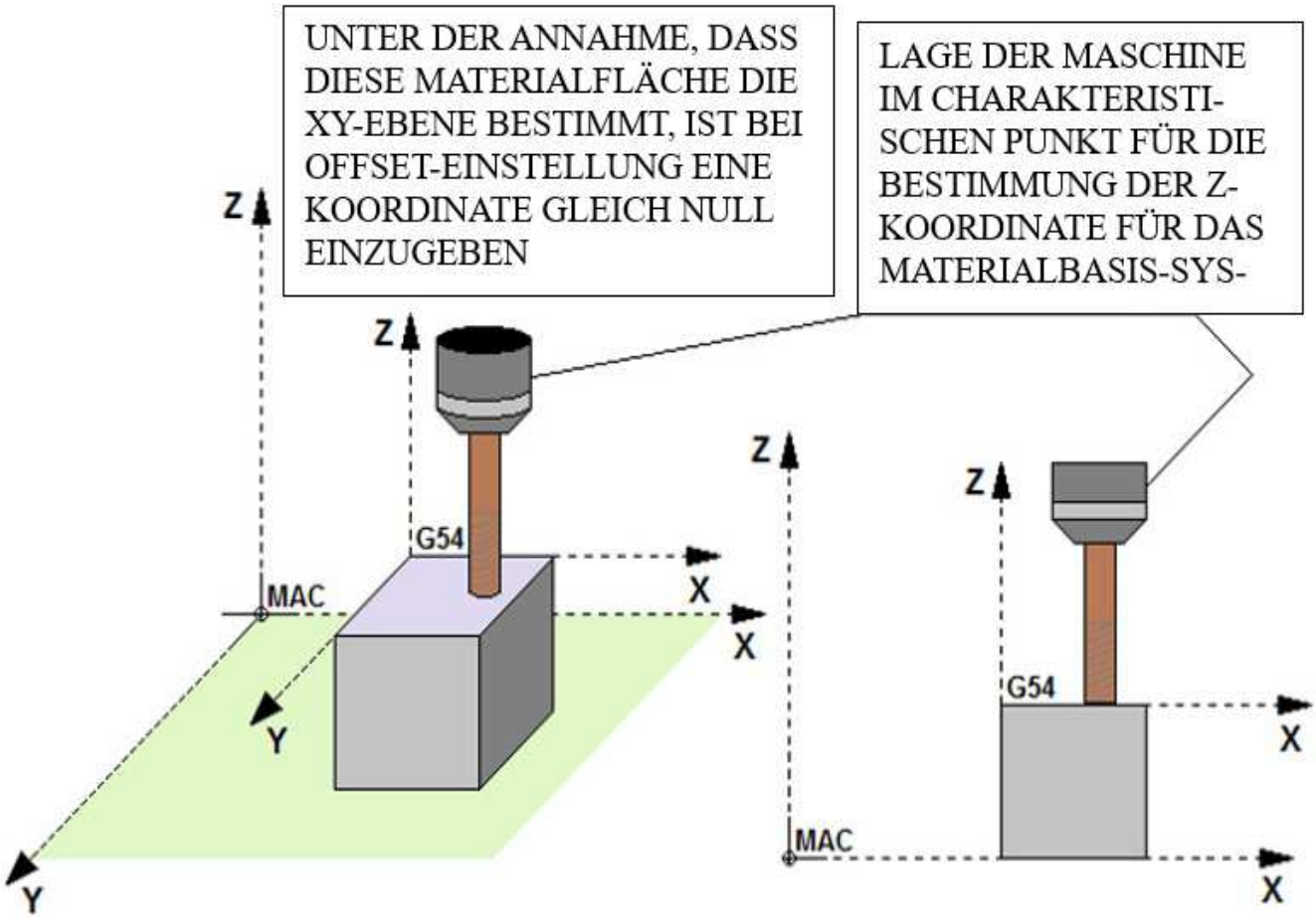
27.3 G54 – G59 Coordinate system and Offset table

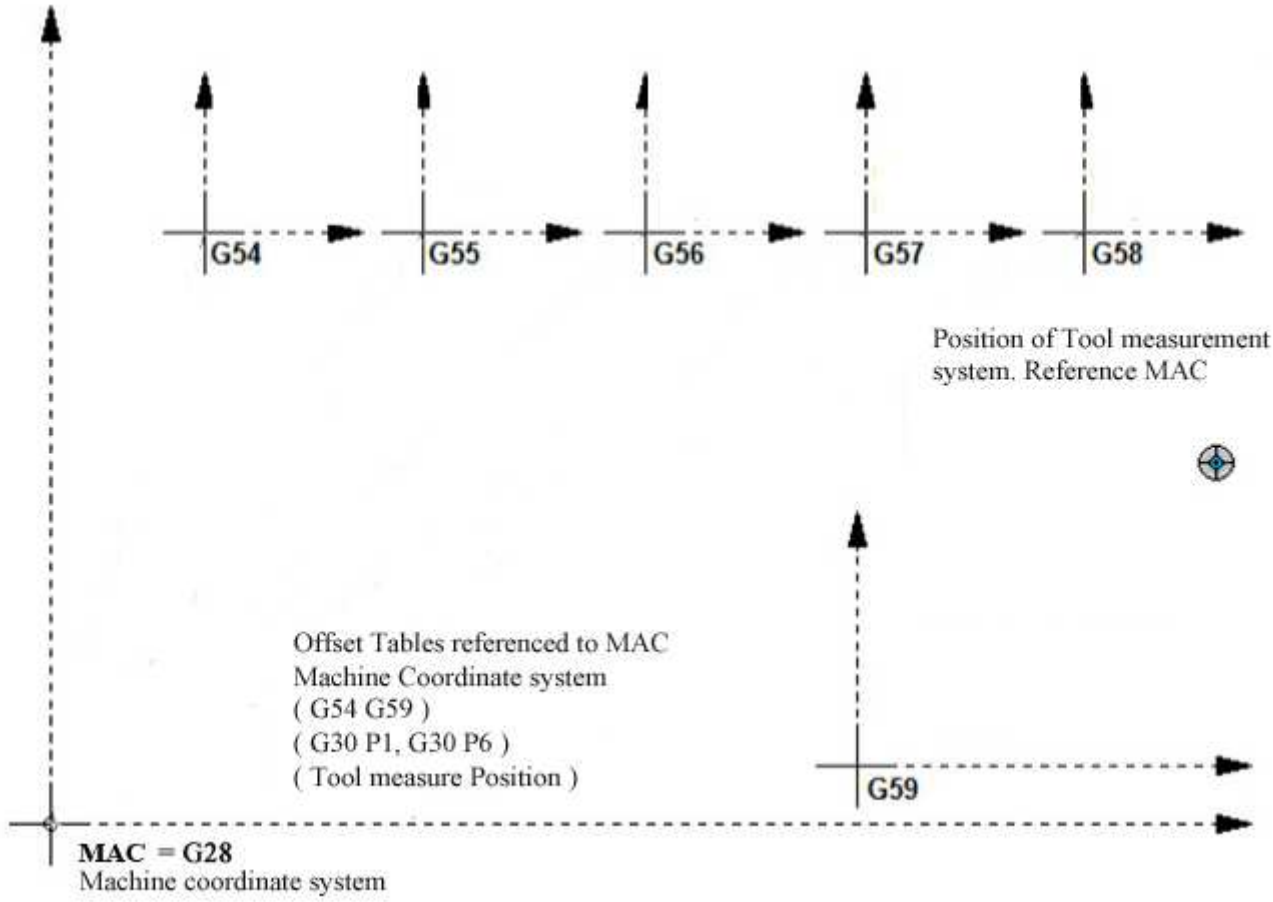
The Controller offers 6 Coordinate- systems, with which the user is able to use. With this entries, the user creates the program Offset.

How to define a coordinate system, lets create G54:

- *First, move the machine to the position, you want to store. It has to be a relevant position to your Origin of coordinate system of the program you want to use.*
- *call the menu material basses [MODE] + [8]*

- *choose the table material basses (Offset)*
- *select the offset in this case No. G54 (first offset in table)*
- *At this position, the user can store the actual position of machine for each axis*
  - *With an push on the cosponsoring Key for each axis, the controller is storing the position for this axis. The controller entered a dialog line at the corresponding axis.*
    - *The controller offers the user the ability to enter an incremental value which is added to the actually machine position to determine the program Origin point. After that push [ENTER] and the position is stored at Offset G54 for these axis. If no incremental value is added, the controller define the actual position as origin at the certain axis.*
    - *Repeat this for all other relevant axis and the Offset is complete defined.*
    - *From now, the User is able to find the position with the command G54*





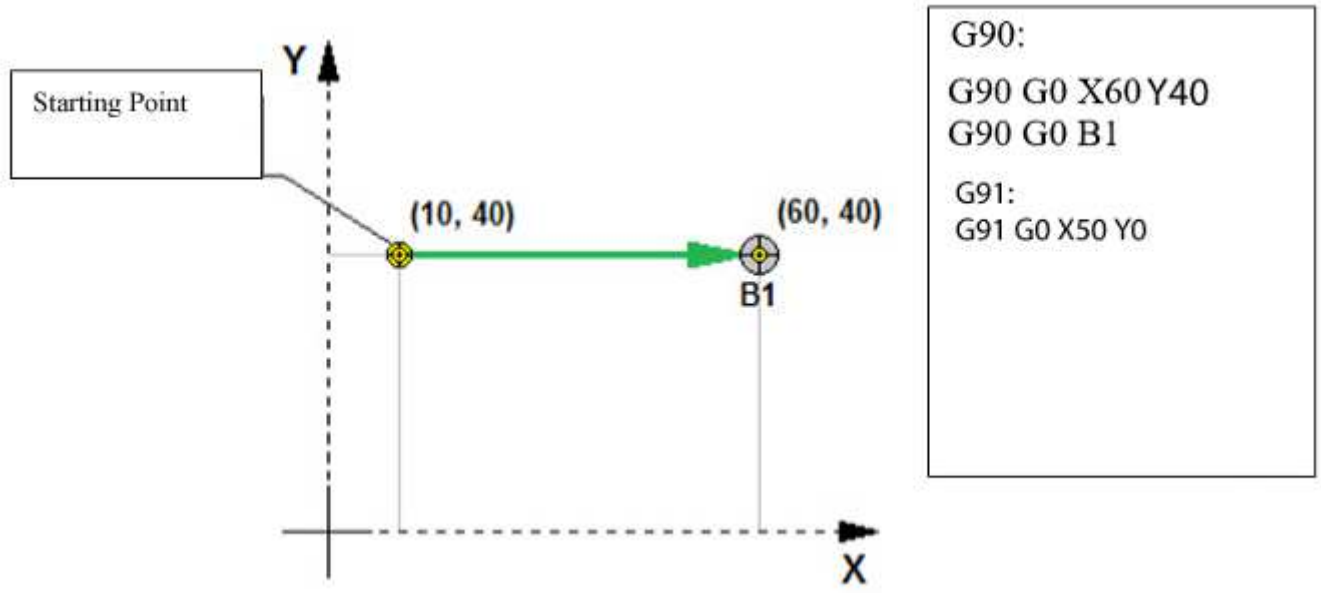
27.4 G90, G91 – absolute and incremental coordinate interpretation

The command G90 respectively G91 are commands, which are setting the coordinate interpretation mode.

- *G90 causes the absolute coordinate interpretation*
  - *the coordinate system is permanent valid. The active Origin remains as long as the function is active.* ***Each position has an relevance to the actually valid coordinate system.***
  - *These function is valid as long as now G91 is commanded.*
- *G91 causes the incremental coordinate interpretation.*
  - ***The Origin of the coordinate system walks with the tool. Each reached position is X0 Y0 Z0 A0***
  - *These function is valid as long as now G90 is commanded.*

EXAMPLE	*DESCRIPTION*
G90	*Choose the absolute coordinate interpretation*
G91	*Choose the incremental coordinate interpretation*

The following picture shows a few Example



28 M- commands, additional commands

The controller enables the input of M- Code commands. These commands adjust additional functions, as spindle on / of, coolant on / of, lubrication on / of and others

the following Table shows the commands, which are supported from controller.

M-code		DESCRIPTION
M0	M00	Absolutely program stop. Create a pause, till start button is pushed once again
M1	M01	Conditional stop. Creates a pause, if the switch M01 is setted. The controller continue the program if start button is pushed once again
M2	M02	Finishing program without return to program start
M3	M03	Start spindle speed clockwise
M4	M04	Start spindle speed counter clockwise
M5	M05	Spindle- Stop
M6	M06	Tool change

M8	M08	Start coolant
M9	M09	Stop coolant
M12		Clamp chuck
M13		Release chuck
M20		Control of the inputs and outputs of the controller
M30		Finishing program with return to program start of main program
M32		Lubrication on
M33		Lubrication off
M97		Invoke a jump address which is stored in actual program: M97 Px (Nx = line no. at the actually Program)
M98		Invoke an external program, which has to be located in same memory and path. M98 Px (X=Programmname)
M99		Finishing subprogram, return to the invoking program

28.1 M6 Tool change

The command M6 initiate the automatically tool change. After this command the display shows a message, which ask the user to change the tool. This request has to be confirm with [ENTER]. Of course, the user has to change the tool.

The command M6 is able, depending on configuration of controller, to initiate the automatically tool measurement system. This function can be executed, after confirmation. Condition is, the controller has to be configured for automatically tool measurement.

28.2 M12 clamp of material at the chuck

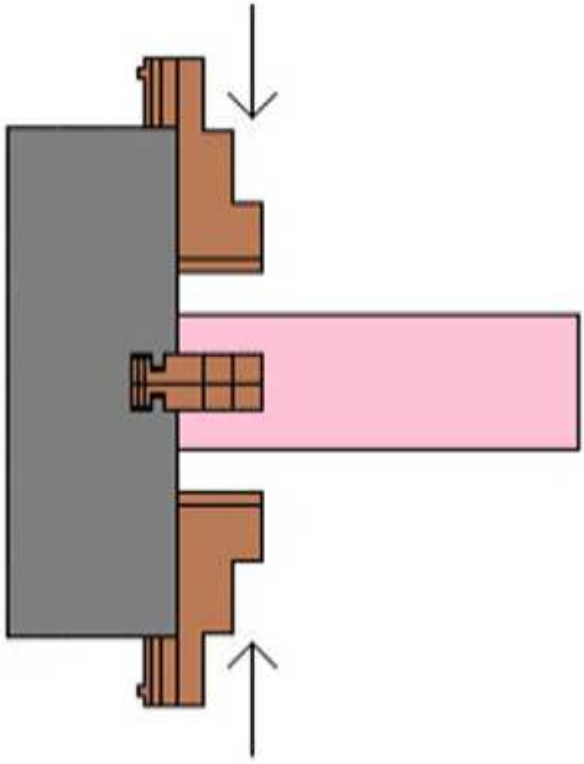
This command controls the chuck.

The chuck is to initiate at the menu, which is controlling if the chuck clamps inside or outside.

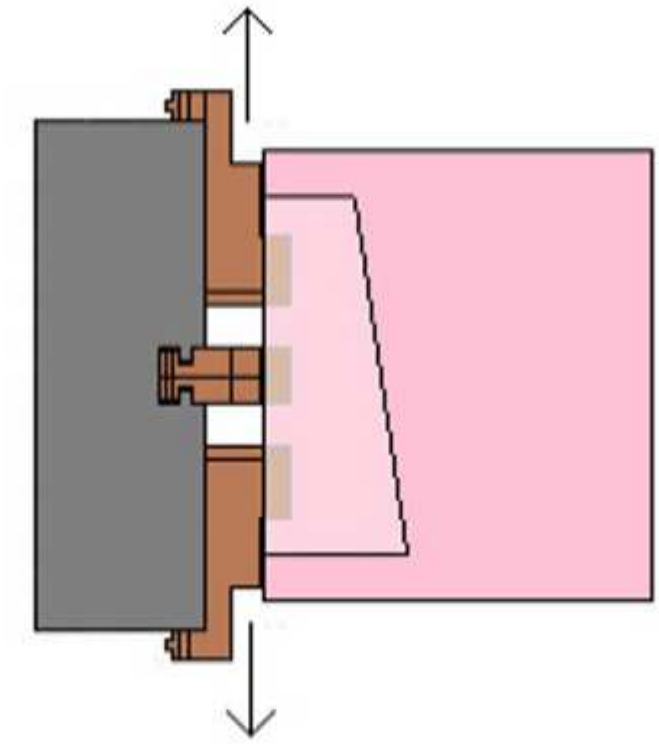
The chuck is clamping respectively release according which command is used. The chuck shall fix the blank as above described Cases.

This command only makes sense in combination with G13

G13 M12 → chuck clamp



clamping of blank through closing the jaws of chuck



clamping of the blank through openning jaws of chuck

EXAMPLE	DESCRIPTION
M12	Clamping material of chuck

28.3 M13 release of material of chuck

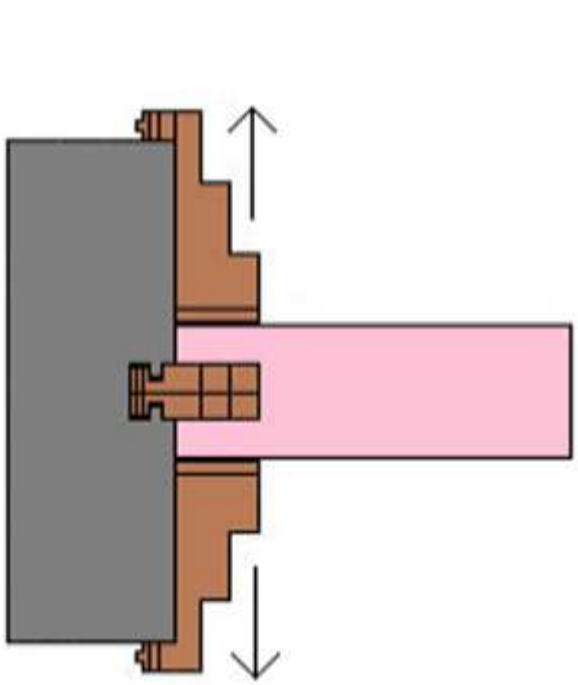
This command controls the chuck.

The chuck is to initiate at the menu, which is controlling if the chuck release inside or outside.

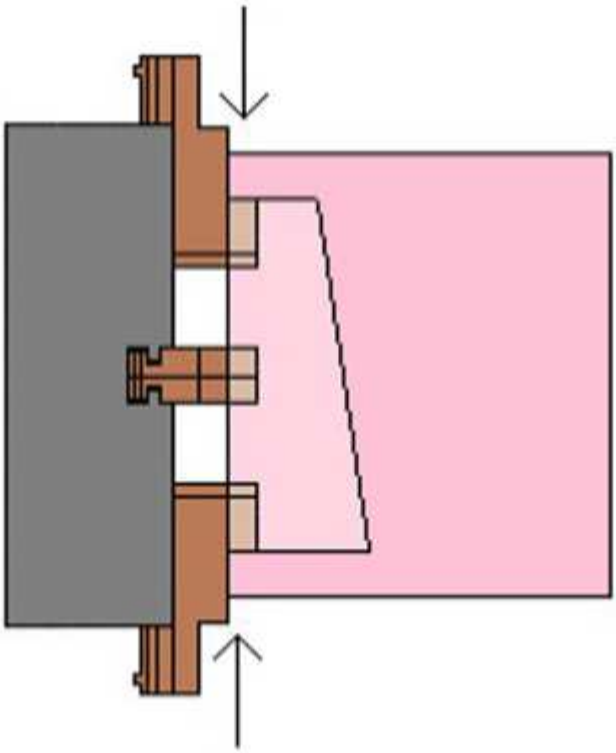
The chuck is release The chuck shall release the blank as below described Cases.

This command only makes sense in combination with G13

G13 M13 → chuck release



release the material through opening the jaws of chuck



Release the material through closing the jaws of chuck

EXAMPLE	DESCRIPTION
M13	Release material of chuck

28.4 M30 finishing program, with shift to the begin

The command M30 is finish the program at automatically mode. Following the prompt is shifted to program start.

28.5 M02 finishing program without shift to the begin

Command M02 or M2 is finishing the program. Which runs automatically. The prompt is not shift to program begin.

The use of M30 and M02 has an historical meaning. The controllers, 40 years ago, didn't have enough ram. So the program was stored on paper tape. If the program, which was stored on it, must be run twice or more, the controller was able to rewind the paper tape. It took time. So that the reason for two end commands.

With M02 M2 the controller didn't rewind the paper tape. Just out span, finished. It was rewind at office.

28.6 M32- lubrication on

M32 lubrication switch on

28.7 M33- lubrication off

M33 lubrication switch off

28.8 M97- invoke a line number at the actual program as transfer target

M97 is a jump command, which is able, to reach a line address at the actual program. The program is continue at this position. If the prompt is reached a M99, the program is continued at the point, which initiated the jump.

Additional, it is possible to command a number of revision (address L). Than the prompt jumps as often as programmed to the begin of the addressed loop, before returning to the the initiated point of program.

Best: The jumping addresses are better written after program end command, as shown beneath. The readability becomes better.

G97 P200(Adresse to jump) L5(number of revisions)

EXAMPLE:

N1G0 G90 G54 Z50

N2 X0 Y0

N3 Z1

N4 M97 P200 L5

N5 G0 Z50

N6 X50 Y50

N7 Z1

N8 M97 P200

N9 G0 Z50

N10 G30 P3

N11 M30; Program end

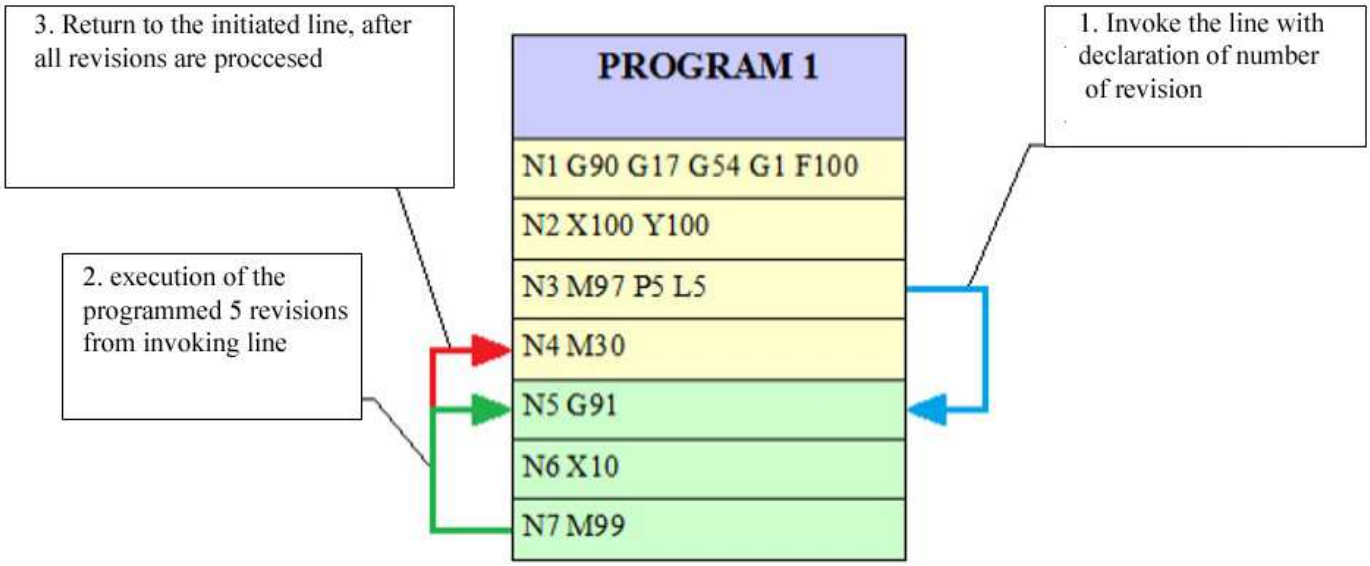
N200 G1 G91 Z-2 F100

N201 X10 F500

N202 X-10

N203 G90

N204 M99



PROGRAM = PROGRAMM

EXAMPLE	*DESCRIPTION*
M97 P10 L6	*Jump to address N10 at the actual program. Executing program from jump address till M99 enclosed 6 revisions. Return at M99 to the initiated jump command*
M97 P67	*Jump to address N10 at the actual program. Executing program once, from jump address till M99. Return at M99 to the initiated jump command*

Note: If an address is programmed, which doesn't exist, the controller is throwing an alarm.

28.9 M98- invoke of an external Subprogram

M98 works similar to M97, except the invocation is calling an external subprogram.

Different to M97 the command M98 calls a program which is stored at the same storage and the same path.

Each subprogram should normally finished with M99.

EXAMPLE:

O0001; Program O0001

N1G0 G90 G54 Z50

N2 X0 Y0

N3 Z1

N4 M98 P2 L5

N5 G0 Z50

N6 X50 Y50

N7 Z1

N8 M98 P2

N9 G0 Z50

N10 G30 P3

N11 M30; Program end

O0002; Program O0002

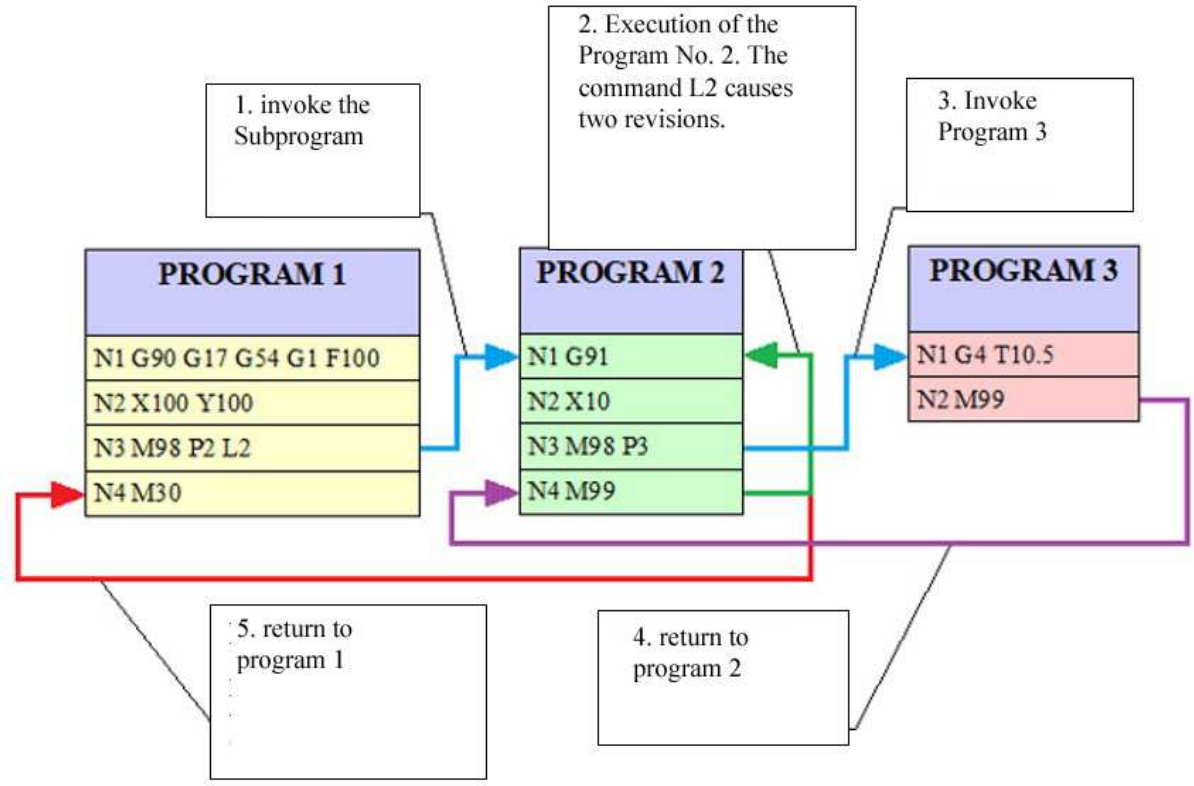
N1 G1 G91 Z-2 F100

N2 X10 F500

N3 X-10

N4 G90

N5 M99



PROGRAM = PROGRAMM

EXAMPLE	*DESCRIPTION*
M98 P4 L3	*Invoke of the subprogram O0004 which is stored in same storage and path. This program will be invoke three times.*

M98 P4	*Invoke of the subprogram O0004 which is stored in same storage and path. This program will be invoke once.*
M98 Pprog.txt L2	*Invoke of the subprogram Pprog.txt. If the program name is written with alphanumerical signs, it is stored at SD Card. This program has to be stored in same storage and path.This program will be invoke twice.*

Note:

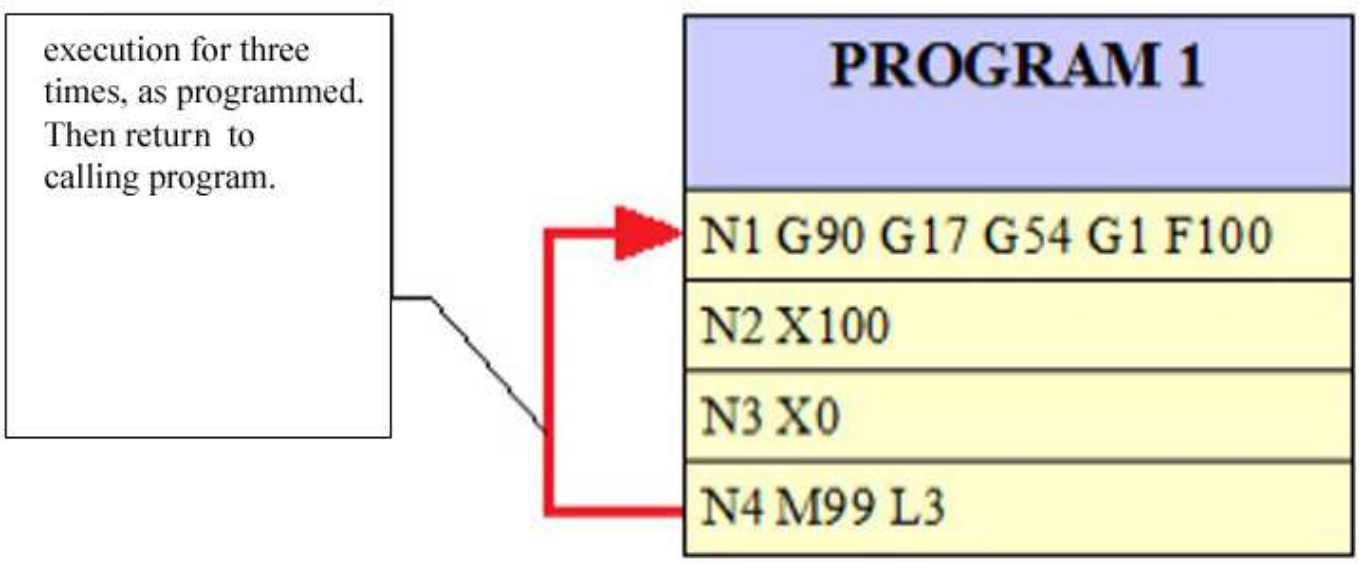
- *If the addressed program, not exist, the controller is throwing an alarm.*
- *If the program not stored in same storage and path, the controller is throwing an alarm.*

28.10 M99 return to the calling address

M99 finishing of an subprogram.

M99 is also the finishing mark for program sequences, which are written in the same program.

If a program should be repeat twice or more, the prompt is shifted to sequence start when it meets the line M99, as often as the program should be repeated.



EXAMPLE	*DESCRIPTION*
M99	*After execution of programmed revisions, the prompt return to the initiated call command, which called this program before.*

29 Programmable inputs and outputs plus 2 integrated relays for output.

Inputs:

- *The controller processes 14 digital inputs. One of them is reserved for emergency stop. Remaining 13 programmable inputs.*

Outputs:

- *The controller processes also 10 digital outputs*
- *Additional 2 relays for output. The relays are able to control a voltage up to 240V and max. 2 Ampere current.*

This functionality enables the user to control the digital inputs, outputs and 2 integrated relays. The controller can be used, to control external relays. Also the realization of protective circuit is possible, for protection of overload.

29.1 operate of the digital inputs and digital outputs and two output- relays

M20 I2 respectively M20 K1 or M20 K-1 are commands to control the outputs respectively to request the inputs.

*M20: with this command the user is able to **switch the outputs, and to request the inputs**, according which address is used after M20.*

The Address I is defining the Input address.

The address K is defining the output address. According as which signed it is the output is switched on or switched off.

- *With **M20 Ix**, the input signal "x" will be requested. The controller continuous not before the input is for one impulse setted.*
- *With an minus as pre sign before the Number of output, the output will become switched off **(M20 K-x)***
- *With positive value, the output is switched on. It is not necessary to write an "+". **(M20 Kx)***

With the line M20 I2, The controller is instructed not to continue before Input I2 is setted. This command synchronized the controller with expected events.

M20 I2

Example, at the input I2 is a Switch witch is called "execution". The controller is working till this line, from than, controller waiting as long as the button execution is not actuated. Only on impulse is necessary to continue the cycle. If this input is switched of after analysis, has no matter.

PROGRAM	DESCRIPTION
M20 I2	Waiting of actuation of button "execution". In this case input 2
G0 X100	Continue the program

This additional functions are given the programmer the possibility, to combine external sensor signals.

With the command "M20 Kx" the digital outputs are switchable. The digital output 1 to 10 are available to switch, additional the relays K11 to K12 are able to switch.

Let us assume, we need to switch three additional pneumatic valves, to process our next program correctly. The three valves are connected to output OUT1, OUT2 and OUT3.

Each of this valves should work about 2.55 seconds. First the first valve, for a period about 2.55 seconds. After that the valve should break. Than the second and third vale should work together. After a additional time about 2.55 seconds again, the valves should become switched off. It could programmed as follows:

PROGRAM	*DESCRIPTION*
M20 K1	*Digital output is switching on,* ***OUT1***
T2.55	*Dwell time about 2.55 seconds*
M20 K-1	*Digital output switch off,* ***OUT1***
M20 K2 K3	*Digital outputs are switching on,* ***OUT2 and OUT3***
T2.55	*Dwell time about 2.55 seconds*
M20 K-2 K-3	*Digital outputs are switching off,* ***OUT2 and OUT3***

30 Setting the Workplace and machine environment

Assumption:

Machine and clamping system are placed and mounted.

- *Workpiece and clamping devices placed and fixed*
- *Position of Program origin is intellectual clear*

machine axis are referenced, so MAC is defined

- *after power up the machine, approach the referencing switches (Chapter 15 – 15.4)*

Program origin definition:

- *Now we have to find and define the Origin of program. This position of the stock, we have to be already able, to set it in relationship with program origin.*
  - *Therefore we have to approach an point of stock or clamping device, which position has an relevance to the program origin in X, Y, Z and if any A.*
  - *we have to ensure, if more than one tool is involved to execute the program, only the machine Z, without tool correction is stored at program origin. That ensures the controller to settle the several tool corrections in the origin.*
- *Afterwards, the user has to choose an a origin- number (G54 to G59) which is not yet defined. This origin enable the user, to find, at any time, the Program position by invoke the origin switch (e.g. G54)*
  - *This origin switch, we are calling and defining at menu* ***Material Bases,*** *as described in* ***chapter 27.3.***
  - *Now the origin for the program is defined, and will be found at any time, with the command: G54 G90*
- *Origin G54 is defined*

create a program:

- *This is to do as in **chapter 21** and chapter **26 – 26.7** described*

*Inside of the program, a tool change is initiated with the command M6. If the automatically tool measurement system is defined, each tool length is measured. The length correction is now calculated to the chosen origin of Program. **See chapter 16.2 and chapter 17***

we wish you success.

31 Positions- Variables

*As already introduced at **chapter 25,** positions variables storing coordinates up to a axis.*

This variables are able to program or to define by table.

To define by table, the user has to initiate the menu [MODE] + [8] the item workpoints.

With the Buttons, as shown in the following table, the user is able to define with the variables by button control.

KEY	FUNCTION
[3], [6]	Shift to an other Positions variable. From B0 to B19
[C] - hold	Reset of the value of positions variable.
[MODE]	Return to pre-menu
[1] - hold	The controller enables the input of the value of X- axis. Through actuate of [ENTER] button, the actually entered value is stored as the actual valid position of these axis at the storage. MODE causes the cancelling of the actual input.
[2] - hold	The controller enables the input of the value of Y- axis. Through actuate of [ENTER] button, the actually entered value is stored as the actual valid position of these axis at the storage. MODE causes the cancelling of the actual input.
[3] - hold	The controller enables the input of the value of Z- axis. Through actuate of [ENTER] button, the actually entered value is stored as the actual valid position of these axis at the storage. MODE causes the cancelling of the actual input.
[4] - hold	The controller enables the input of the value of A- axis. Through actuate of [ENTER] button, the actually entered value is stored as the actual valid position of these axis at the storage. MODE causes the cancelling of the actual input.

Note: the coordinates of certain positions variable are always interpreted over the actually valid coordinate system.

32 Program examples

This chapter describes the kind of program creation. To start a program creation, following requirements has to be completed.

- *The user has a sequential purpose planned.*
- *The controller is configured to the machine correctly*
- *The aggregate are switched correctly to the controller.*

Initialization job description:
The tool spindle is controlled by an inverter, which is controlled by a signal from 0 to 10 voltage. The inverter on the other hand, controls the spindle from 0 to 4000 rpm.
Also, the machine is equipped with a coolant pump, which cools the tool by coolant.

Geometrical and sequential job description:
Recommended, we want to drill two groups of 4 special patterned holes, in which a additional centrum point represented the middle of each group.
This point is only an geometrical fix point. This position won't be drilled.
The position of the different holes are shifted as shown in the following sketch in combination with program2.
The origin X,Y, Z is defined in G54. Both pattern are shifted in X about 200mm
Origin Z lays on the material surface on top
The program1 has a request of input I2, which commands, not as sooner continue the program as the signal I2 is switching to on.
At the end of program 2, a horn has to activate fore one second, to signalized the finishing of pattern.

Program3, the main program is organize the
- *tool and spindle controlling,*
- *coolant controlling*
- *main positioning for archive the mid points of the two pattern*
- *watched the input signals to get the start impulse from I2*
- *calling the first subprogram (program No. 2*

Program 2 is organize the
- *create the pattern*
- *is calling the second subprogram for drilling*
- *controlling the horn*

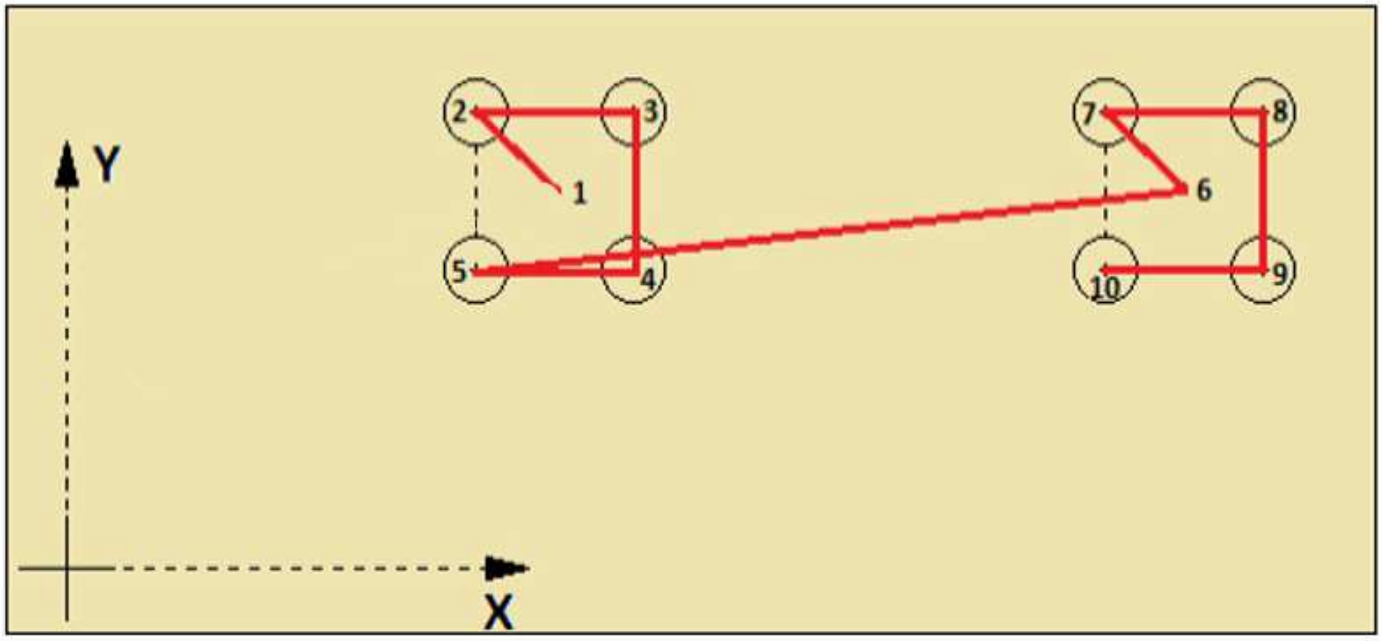
Program 1 is organize the
- *drilling process*

PROGRAM 1	DESCRIPTION
G90	Mode for absolute coordinate
G0 Z0.5	Rapid motion to Z 0.5
G1 Z-20 F100	Manufacturing of one hole with feedrate 100mm/min
G0 Z10	Rapid departure to Z10
M99	Finishing subprogram

PROGRAMM 2	DESCRIPTION
G91	mode for incremental coordinate
G0 X-25 Y25	Rapid motion to the first hole of pattern
M98 P1 L1	Calling subprogram, which is drilling
G91	mode for incremental coordinate
G0 X50	Rapid motion to the second hole of pattern
M98 P1 L1	Calling subprogram, which is drilling
G91	mode for incremental coordinate
G0 Y-50	Rapid motion to the third hole of pattern
M98 P1 L1	Calling subprogram, which is drilling
G91	mode for incremental coordinate
G0 X-50	Rapid motion to the fourth hole of pattern
M98 P1 L1	Calling subprogram, which is drilling
M20 K2	Starting horn
T1.0	Dwell for one second
M20 K-2	Stop horn
M99	Subprogram finishing

PROGRAMM 3	BESCHREIBUNG
G90 G54	Switching to mode for incremental coordinate, switching to origin G54
M3 S600	Starting tooling spindle with 600 rpm clockwise
M8	Starting coolant
G0 Z10 G17	Departure to Z10 and definition of Plane G17
G0 X100 Y100	Move to X100 Y100, in rapid motion, the first midpoint of pattern
M20 I2	Waiting for input I2
M98 P2	Calling subprogram to execute four Holes
G90	mode for absolute coordinate
G0 X300 Y100	Move to X300 Y100, in rapid motion, the second midpoint of pattern
M20 I2	Waiting for input I2
M98 P2	Calling subprogram to execute four Holes
M5	Spindle of
M9	Coolant of
M30	Finishing mainprogram

Die nachstehende Zeichnung stellt den Bewegungsablauf des oben geschilderten Programms wieder.

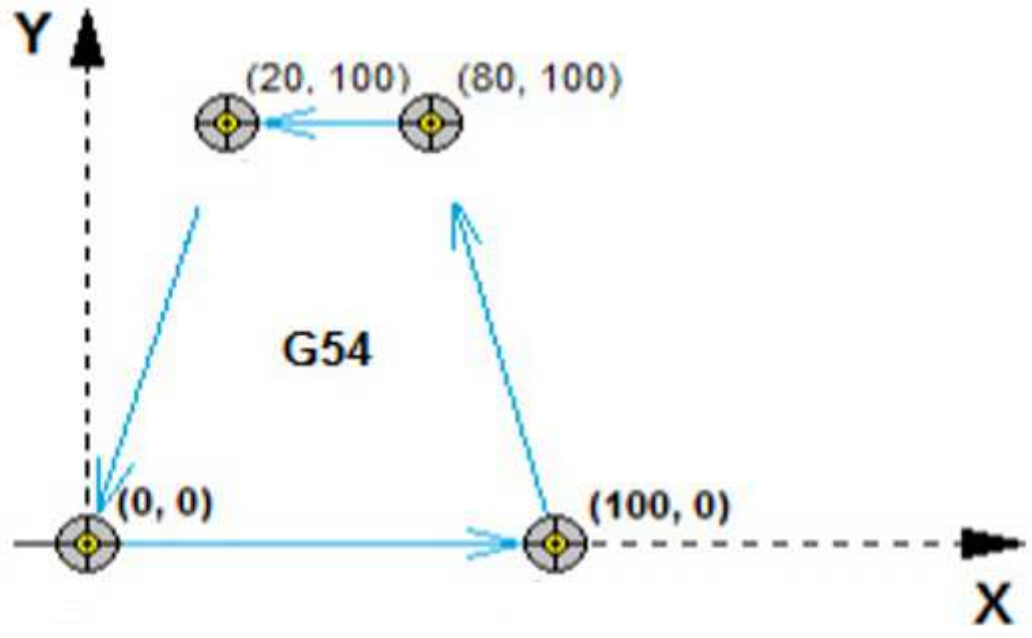


The example above present a modular program. A subprogram is calling from an mainprogram.

- *The subprogram defines all coordinates which are used for each pattern. That means, in this case, no redundance by several calling*
- *the program takes less storage*
- *in case of positions change, only the coordinate from calling program has to be altered once.*

It is no fantastic program, it shall show an additional writing style, of modular organized program writing, with which the user can create a cycle.

33 Drill cycles



Have al look at the sketch above, in which are four hole positions are represented. These holes should have a depth of 15mm. They have to manufactured with an feedrate of 100 mm / min. We are using in this case, a qualified cycle, G81.
This explanation references the following NC- Program.
Program 4 works as follows:

Line 1:

- *The controller gets all informations, which are needed, to work correctly.*
  - *The origin **G54** is called*
  - *Rapid is commanded **(G00 or G0)***
  - *absolutely coordinate interpretation is setted **(G90)***
  - *The plane **G17** is defined, that means working plane X,Y and secondary axis Z.*
    - *in the secondary axis means, all tool length corrections are calculated in this axis.*
  - ***S600** rpm and spindle direction clockwise **M3**, rotation on*
  - *It approaches **Z10** as Z retracting point, if needed*

Line 2:

- *coolant on, (**M8 M08)***

Line 3:

- *approach **X0 Y0***

Line 4:

- *a drilling cycle is defined: G81 R2 Z-15 F100 G98. From now, the cycle is valid and active. It will be executed at each LF (Line Feed). Exception are documented following:*
  - *R2 means Clearance distance. It defines the high at whiche the controller begins to work with feedrate. The axis is the secondary axis. In this case Z*
  - *following the drilling depth is operated to -15 in one cutt. It moves with the programmed feedrate. Also in secondary axis, also Z too*
  - *Is this done, the secondary axis is moved back to clearance distance **R2 = Z2** respectively to retract distance **Z10**.*
    - *The measure to which the controller retract depends on the valid G function **G98 or G99***
      - ***G98:** the tool will be retract to the last programmed value of secondary axis. In this case to Z10*
      - *at **G99** which is deselect G98, the secondary axis will be retract to clearance distance, that means to R2 also Z2*

Lines 5 till Line 7:

- *in this lines, the several positions are approach. G81 is still active and is activate at each position.*

Line 8:

- *in this line, the cycle is cancelled with **G80.** From now the cycle is inactive and wouldn't worc at each position.*

Line 9:

- *The spindle stops **M05***

Line 10:

- *coolant is switching to off **M09 or M9***

Line 11:

- *The axis are retract to MAC (see chapter 27) **G28***

Line 12:

- *this line is finishing the main program **M30***

Programm 4

N1 G0 G54 G90 G17 S600 M3 Z10
N2 M8
N3 X0 Y0
N4 G81 R2 Z-15 F100 G98
N5 X100
N6 X80 Y100
N7 X20
N8 G80 ; Zyklus - Ende
N9 M5
N10 M9
N11 G0 G28 Z0
N12 M30

additional cycles:
G82 = drilling (works as G81) but with dwell at the ground
G82 R2 Z-5 P1000 F100:

- *executed as G81 except the dwell time, addressed with parameter P, defined in milliseconds. In this case, P1000 = dwell one second.*

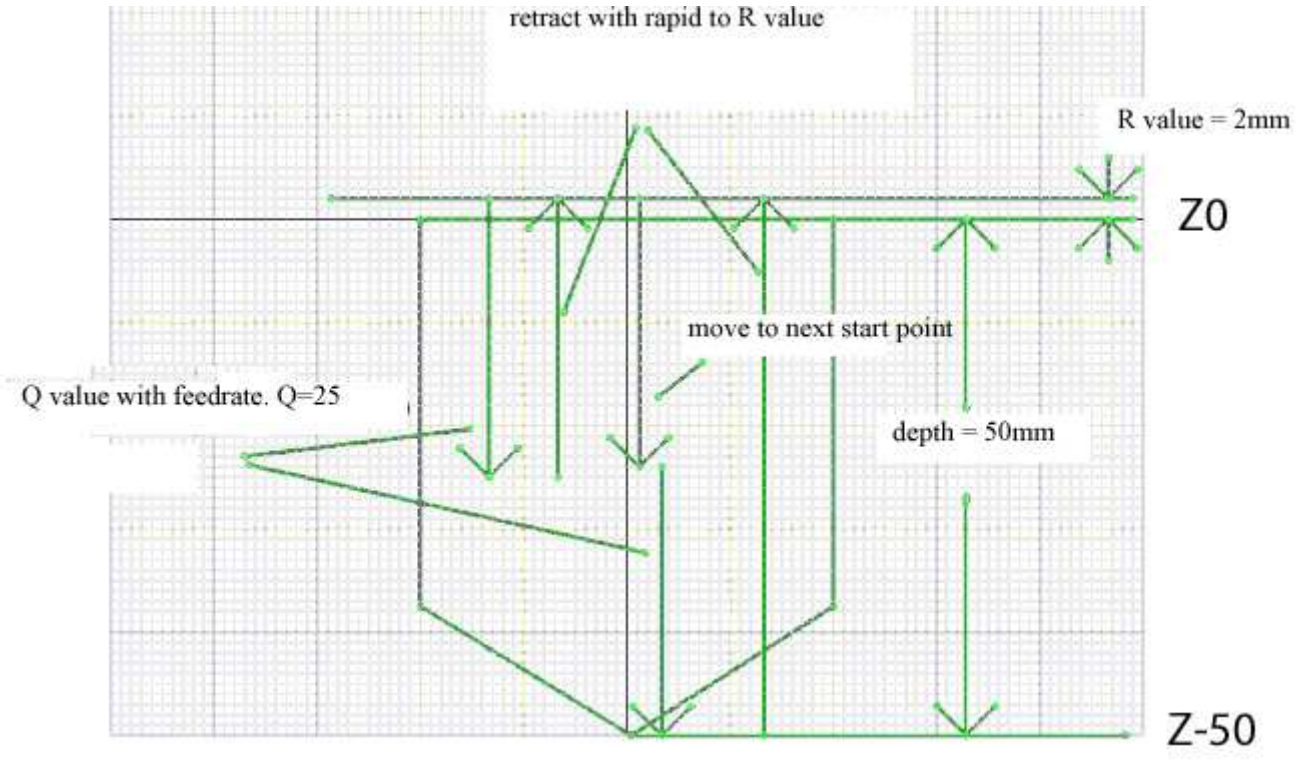
G83 depth hole drilling and G73 peck drilling

common parameters f. G83 and G73
approach increment respectively retreat distance. This entry will be found at [MODE] + [5] Menu general settings item No. 5. a sufficient value will be 0.3mm

G83 Tieflochbohren

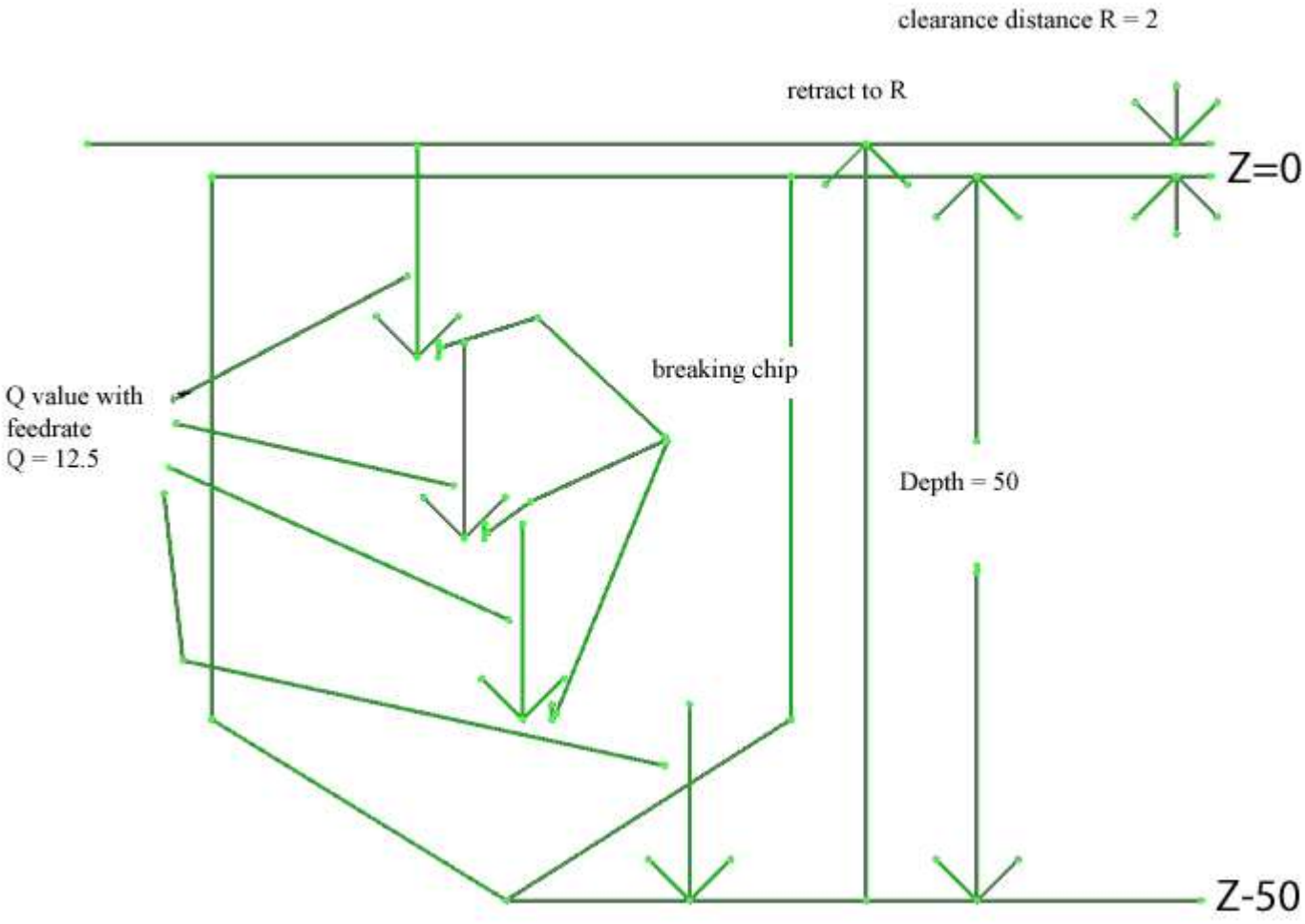
G83 R2 Z-50 Q25:

- *is working as G81, except the deepness increments, which is programmed with parameter Q*
  - *The way from secondary axis among from 2mm to -50mm. That means 2-(-50) = 52 mm.*
    - *Now the value is divided through 25. The resulting Way is not divisible through 25 without any rest. Doesn't matter The drilling depth is divided through the total increment. That means 52 / 25 = 2 rest 2mm. T*
    - *he process is working as follows.*
      - *Start at Z+2mm.*
      - *Drilling till Z-23 with feedrate,*
      - *retract rapid to Z2,*
      - *move to Z-22.7 rapid*
      - *Drilling till Z-48 with feedrate,*
      - *retract rapid to Z2,*
      - *move to Z-47.7 rapid*
      - *Drilling till Z-50 with feedrate.*
      - *retract rapid to Z2.* ***Cycle is finished. The next command can be executed.***


retract with rapid to R value
R value = 2mm
Z0
move to next start point
Q value with feedrate. Q=25
depth = 50mm
Z-50

G73 break chip drilling
G73 R2 Z-50 Q12.5:

- *works similar to G83 except no retraction to R. only a short retract about the amount, which is setted in menu general settings item No. 8. The final retract value depends of G98 respectively G99*



Im Moment fängt der Zyklus bereits ab der Definition an zu arbeiten.
Man kann, ab dem nächsten Update, die Zyklus- Abarbeitung Satzweise unterdrücken, ***dies ist jedoch noch nicht implementiert.***
Beispiel:
Es sollen mehrere in einem Programm zusammengefasste Koordinaten per Zyklus abgearbeitet werden.
Der momentane IST- Stand:
Programm 0001 (Beispiel 1)
N1 G0 G54 G90 G17 S600 M3 Z10
N2 X0 Y0 M8
N3 G81 R2 Z-15 F100 G98
N4 X100
N5 X80 Y100
N6 X20
N7 G80 ; Zyklus – Ende
N8 M5
N9 M9

N10 G0 G28 Z0
N11 M30

In Program1 are programmed the drilling position in main program. That means, should these coordinates manufactured at once with an other tool, the coordinates have to be programmed at once. That means redundant information. The programmer has to watch about the data he is programming at once.
Better the programmer is using an subprogram, in which the position are described one time.

34 Digital inputs

Try to use the digital diagnostic tool chapter 24

at the view of the digital inputs there are 14 pins visible, on which signals could be connected. The inputs are typed NPN (ground controlled) The empty circle shows, that this input has a low signal.
The filed circle shows, the input has a high signal.

35 Analogues inputs

Try to use the digital diagnostic tool chapter 24

at the view of the analogues inputs there are 2 inputs which are showing the voltage level of the device with is connected. Input AIN_1 and AIN_2. The level has to be a value from 0V DC up to 10V DC. The user can observe the actual level.

36 Encoder inputs ENC1, ENC2

Try to use the digital diagnostic tool chapter 24

at the view of the encoder inputs there are 2 encoder inputs, which are showing the several PIN inputs connected. Input ENC1 and ENC2.
The empty circle shows, the high level potential of 5V DC.
The filed circle shows the ground potential.
After connection of the encoder, the user can watch the twinkle of the several bits of the different channels of encoder inputs.

37 keyboard

Try to use the digital diagnostic tool chapter 24

at the view of the keyboard, shows all keys of board. Through pushing of any button, the corresponding signal at the view has to become a fully circle.
If the button isn't actuated, the symbol is readable without any circle.
With this menu, the user is able to proof the keyboard, whether the functionality is in order.

38 digital outputs

Try to use the digital diagnostic tool chapter 24

at the view of the digital outputs, shows 10 digital outputs and 2 relays (R1 and R2) outputs.
*At the 10 digital outputs, a empty circle shows a **not selected** output.*
*At the 10 digital outputs, a fully circle shows a **selected** output*
*At relays outputs, a empty circle shows a **not selected** relays*
*At relays outputs, a fully circle shows a **selected** relays*

39 Analogues outputs

Try to use the digital diagnostic tool chapter 24

at the view of the Analogues outputs, shows the voltage level on at the output. From 0V DC up to 10V DC

40 axes - outputs

Try to use the digital diagnostic tool chapter 24

at the view of the axes outputs, shows the actual condition of the axes X, Y, Z, A.
The user recognise which step frequency in HZ on each axis is setted while moving.
Also a percent display shows the percentage drive of the feedrate.
The display STEP and DIR showing the logical state of the pins STEP+ STEP- and DIR+ and DIR-.
The empty circle shows the logical condition high
The filed circle shows the logical condition low

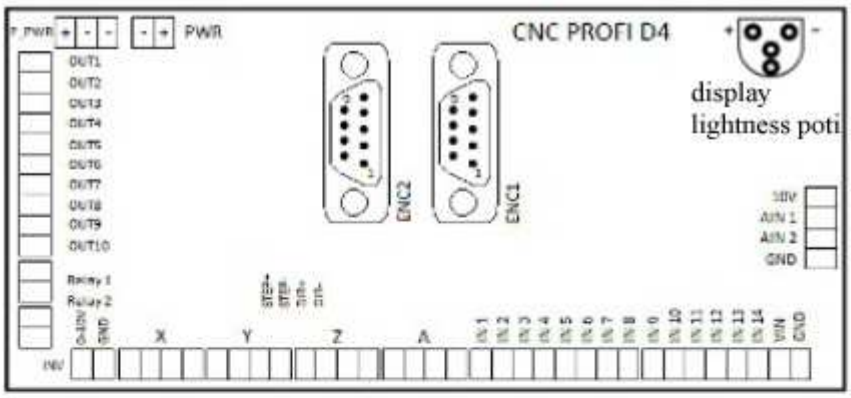
41 Alarm- table and Layout

The following table shows the alarms, which could be invoke, while working with the controller.

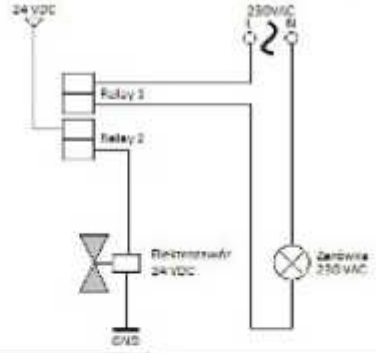
ALARM	REASON	SOLUTION
EMERGENCY STOP	The user has actuated the emergency stop button.	Loosen the emergency stop button. If the button is not actuated and the alarm appears, the configuration of the input ESTOP has to be proofed. Also proof if the button has been damaged.
"mane of axis"LIMIT SWITCH	While running axis, the corresponding axis is driven onto any end switch at one side.	Move from the end switch in opposite direction, till the massage disappear. Or use the automatically leave from end switch. Push [ENTER]. If this alarm appears often, a appropriate range of secure axis movement is to set. If the axis has not reached the end switch, but the alarm is appear, the configuration of the inputs has to be proofed. It is defined at the controller menu input, at which the switch is connected. Please proof also your procedure.
CONTROLLER-ALARM ACHSE X (Y, Z, A)	Message, which is thrown from the axis controlling controller. The cause depends of the certain controller.	Proof the electrical connections and the configuration of the controller input, which is throwing the message. Remove the reson of the alarm
NO OIL PRESSURE	Oil pressure is low.	Possible cause to less oil pressure at the hydraulic system. Fill oil tank. Proof the configuration of the input.
EXTRA ALARM NUMBER 1	The signal extra alarm No.1 is active.	Remove the cause for ALARM at the injput. Proof the electrical connection and the configuration of the input.
EXTRA ALARM NUMBER 2	The signal extra alarm No.2 is active.	Remove the cause for ALARM at the injput. Proof the electrical connection and the configuration of the input.
VORG. SPINDELGESCHW. NICHT ERREICHT	Alarm, which is invoke while automatically switching of gear. If the controller is not able to switch the gear correctly. Cause could be, a range of spindle speed, which lays not in setted interval.	Switch the spindle at once. Proof the spindle speed to the setting parameters. The next trial, use a spindle speed, which lays in the setted speed interval. Proof Parameter max. speed to the actually value of spindle. Proof whether the maximum and minimum value of voltage at the output is in 0V till 10V is corresponding to the input signal of the inverter. Proof whether the resolution of the spindle encoder is setted.

SPINDEL-UMDREHUNGEN NICHT STABIL	ALARM, which is invoke if the regulation needs to long to established the correct spindle speed. The spindle is not able to established a stable spindle speed	Increase Parameter speed stability, till the alarm doesn't invoke. Parameter "Drehzahl-Stabilität" entsprechend vergrößern, dass der Alarm nicht mehr auftritt. Parameter acceleration time and deceleration time sett after spindle possibility. If it doesn't work, value of these parameter increase. Ensure that the signal input of the encoder to count of spindle speed is not confused.
FEHLER DER SPINDEL-GESCHWINDIGKEITS-KONTROLLE	Drop respectively increase of the percentage of spindle speed. The inverter controls a wrong speed. Use of wrong gear data, or gear, while operate, which are responsible for decrease of spindle speed. Damaged 0-10V output. To less value for percentage of spindle speed control. Big trouble with the input 0-10V. While automatically run, an collision happened, which forces the spindle to slow down.	Ensure the inverter, to hold the spindle speed in the environment which the machine are located. Proof, the correct spindle speed is inputed correctly in the gear. Proof the 0-10V output about damage. Proof program, to ensure, no collision is occasion. Proof parameter spindle control thresh, not to less. Recommended 10 to 20 percent. Ensure that signal input A, to count the spindle speed has nor malfunction.
KEIN FREIER PROGRAMMSPEICHER	Value of Program storage is occupied	Delete of several programs, which are no longer needed.
THE SAFTY DOOR HAS BEEN OPENED	Alarm, which appears while the safety door is open and an automatically process if moving a mechanical unit. Then the controller stops the machine.	Proof al electrical connection and configuration of input switches of the housing. Close the housing, delete Alarm by pushing button [C], while automatically mode
ZÜNDSCHLOSS-SPERRE EINGESCHALTET	ALARM invokes if the key switch is not actuated. No adjustment at configuration respectively editing an automatically program is possible.	Find the licensed person, who is hold the key. The alarm is cancelled with button [C]
BAD COMMABD IN LINE Pn.m	ALARM invokes if an logical or geometrical ERROR is	Alarm can be deleted by button [C]. The controller is edited the incorrect

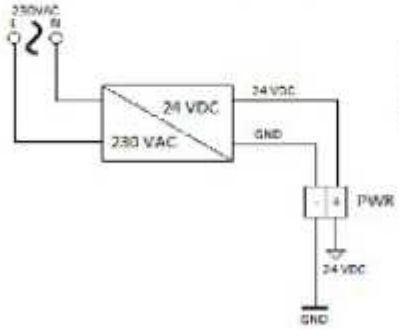
	programmed, in an automatically running program.	*program, and moves to the wrong sentence. Proof the program, if necessary correct it.*
PLÖTZLICHER Ausfall DER SD-KARTE IM SLOT	*Failure of communication of the SD card medium, if the modus SD- card is active.*	*Reset the alarm by pushing [C] button. Alarm should now be deleted.*
FEHLER WÄHREND DES INITIALISIERUNGS-VERSUCHS DER SD-KARTE	*Carde is not served by controller. May be damaged DATA medium.*	*Reset the alarm by pushing [C] button. Alarm should now be deleted. Usage of an other data medium.*
FALSCHES DATEISYSTEM AUF SD-KARTE	*The SD- Card is configured with an unknown file format. FAT 32 is the valid format.*	*Reset the alarm by pushing [C] button. Alarm should now be deleted. Formatting the SD- Card to FAT 32 filesystem.*
FEHLER WÄHREND DES KOMMUNIKATIONS-VERSUCHS MIT SD	*Something went wrong while communication with SD Card. Card is stuck in slot.*	*Reset the alarm by pushing [C] button. Alarm should now be deleted. Usage of an other SD card, or repair the actual card.*
PROBLEM MIT INTERNEM SPEICHER EEPROM	*Intern EEPROM is partly damaged. Hardly communication with EEPROM. Alarm invokes if a kind of control is setted in parameter Control MEM. EEPROM is setted.*	*Reset the alarm by pushing [C] button. Alarm should now be deleted. Change intern EEPROM. Configuration parameter: Control MEM. EEPROM to "NO CONTROL"* ***is not recommended.***
WERKZEUG LOCKER IN SPINDELZANGE	*While spindle is starting to turn, message: tool lose*	*Reset the alarm by pushing [C] button. Alarm should now be deleted. The material has to be fixed in chuck, to ensure a safety manufacturing. After Nach der Inbetriebnahme der Maschine kann der Controller nicht feststellen, ob die Halterung das Material spannt. Deshalb ist bei der Arbeit mit der Drehhalterung nach Einschalten der Maschine das Spannen der Backen des Futters auszulösen.*
FEHLER WÄHREND DER ACHSEN-POSITIONIERUNG	*ERROR while driving axis, an intern error occur, which causes to suffer while positioning the certain axis. No guarantee for an exact positioning.*	*Reset the alarm by pushing [C] button. Alarm should now be deleted. If this alarm appears several times, please contact the service.*



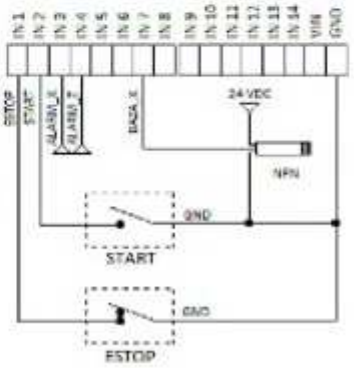
relays outputs



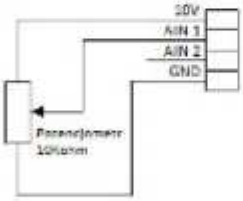
controller supply



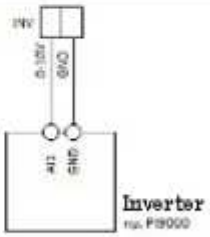
digital inputs



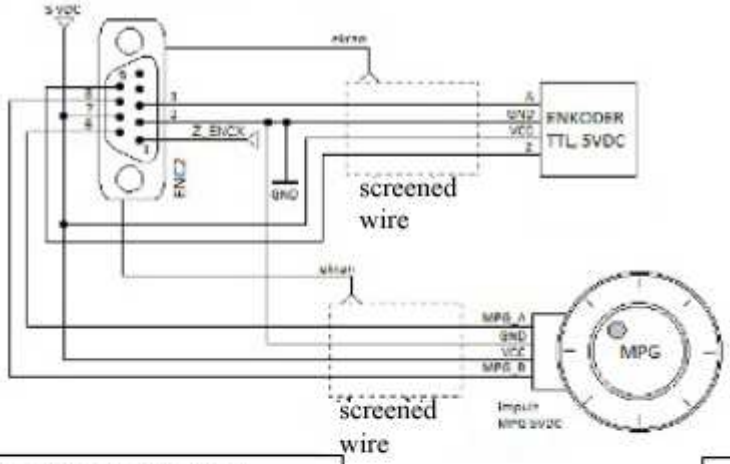
analog output



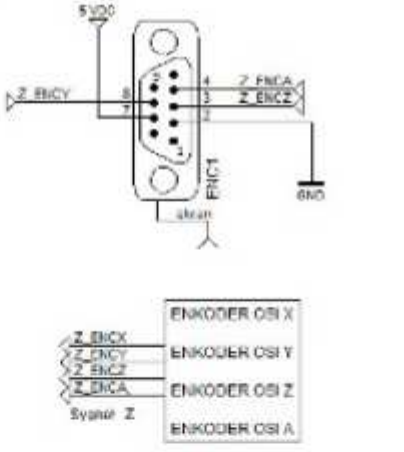
output 0- 10 V



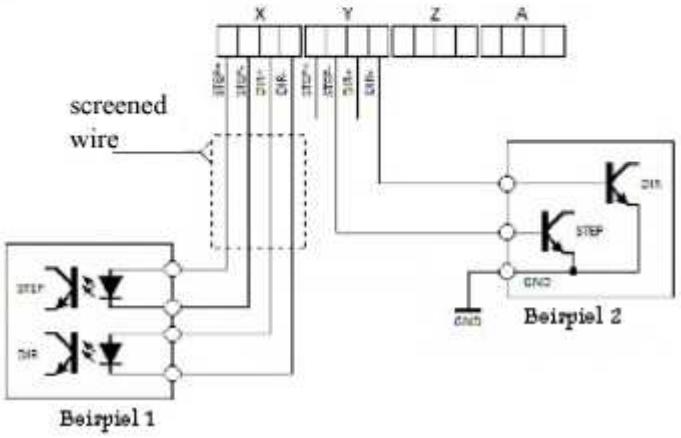
Encoder - input ENC2



Encoder - output ENC1



axis output X,Y,Z and A



digital outputs