

A 3x3 grid of colored squares. The top row has light blue, pink, and light blue squares. The middle row has light green, light green, and light grey squares. The bottom row has light orange, light brown, and light purple squares. A yellow path connects five circles. The path starts at a circle in the top-middle square, goes down to a circle in the middle-right square, then down to a circle in the bottom-right square, then left to a circle in the bottom-middle square, and finally up to a circle in the bottom-left square.

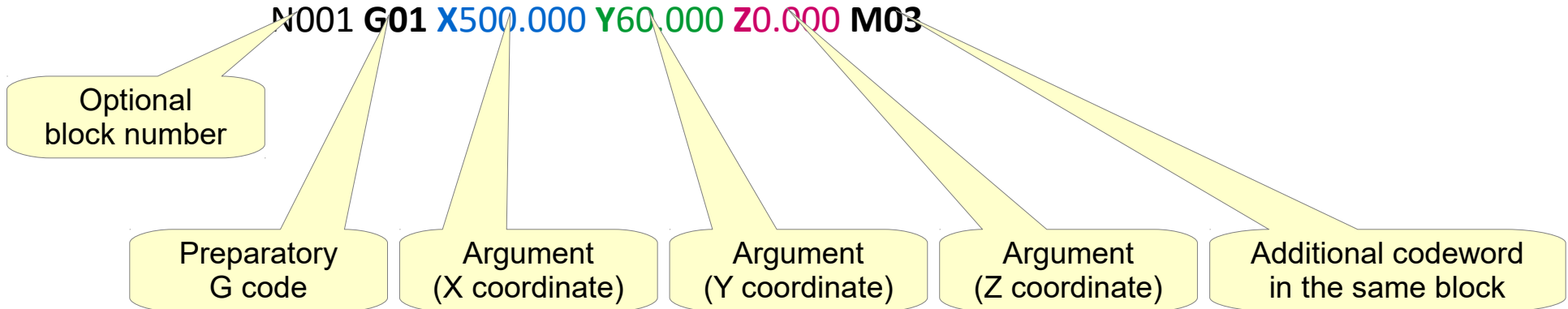
# **Lotta 101**

## **2-3: Introduction to G Code**



# General

- NC-program codes and word are standardized in ISO 840-1973, ISO 841-1974, ISO 1056-1976, ISO 1057-1973.
- Usually a **codeword** signifies the same thing for different machines. Most of the preparatory codes are the same for various machine types
- Coordinate codes express machine specific coordinate information
- A single line of a NC program is called a **block**
- An example code block:





# The Logic of a G code Block

- Normally the NC words are written into a block in the following order:  
N G X Y Z I J K Q R D H F S T M
- But NOTE:
  - The CNC Controller parses and interprets an *entire block at a time*; all codewords are significant
  - The *controller may rearrange execution* order should it be meaningful to do so
  - When a block contains mutually conflicting codewords (those in the same modal group) *the last written stays in effect* (a Fanuc convention!)



# G Code Structure and Reserved Words

- G Code Structure is simple:
  - There is no structure!
  - OK, there is a way to call Subprograms but that's it
  - Basic G Code is a sequence of operations with no branching, no looping, no repetitions of any kind
- There are specific G codes to assist in what are known as "canned cycles" such as peck drilling, boring etc
- G Code Character Set
  - O Program number (only numbers as program identifiers)
  - N Optional block number (seldom used these days)
  - G X Y Z I J K Q R D H F S T M (codeword id's)
  - Digits 0 ... 9
  - Decimal Point (none of this decimal comma stuff)
  - Signs (+ and -)
  - / optional block bypass
  - % tape control (yes – punched paper tape!)
  - TAB
  - LF CR (line feed; one or both together is OK)
  - Blank as codeword separator
  - ( ) ordinary brackets for delimiting comments





# G Code is Modal – the Concept

- Nearly everything a CNC machine does is *modal* on the G code level
- Examples:
  - Motion mode: is the machine set to move using rapid (uncoordinated) traverse, or coordinated tracking motion at feed speed, or perhaps one of the predefined canned work cycles?
  - Dimension mode: Are dimensions given in metric or imperial units?
  - Modal offsets: What coordinate calculation offset definitions might be in effect?
  - Etc etc.
- A **Mode** stays in effect until it is replaced a different **Mode** in the same **Modal Group**



# G Code is Modal – the Actual Modal Groups

- Individual Modes (codewords) in the same Group are mutually exclusive; only one of those modes can be in effect at a time
- Example: Successive traverse and feeding motions:

G00 X-10. Y0.

Z-5.

G01 X10.

Y-10.

X0.

Y0.

G00 Z100.

#	Group	G Codes
1	MOTION	{ <b>G0</b> , <b>G1</b> , <b>G2</b> , <b>G3</b> , G80, G81, G82, G83, G84, G85, G86, G87, G88, G89}
2	Interpolation planes	{ <b>G17</b> , <b>G18</b> , <b>G19</b> }
3	Dimensions	{ <b>G90</b> , <b>G91</b> }
5	Spindle	{G93, G94}
6	Units	{ <b>G20</b> , <b>G21</b> }
7	Diameter comp	{ <b>G40</b> , <b>G41</b> , <b>G42</b> }
8	Length comp	{ <b>G43</b> , <b>G44</b> , <b>G49</b> }
10	Canned cycle return	{ <b>G98</b> , <b>G99</b> }
12	Work Coordinates	{ <b>G54</b> , <b>G55</b> , <b>G56</b> , <b>G57</b> , <b>G58</b> , <b>G59</b> }





# Preparatory Command G

- **G** preparatory commands for motion
- **X, Y, Z** Coordinates along machine axes
- **A, B, C** Coordinates along rotation axes
- **U, V, W** extra linear axis coordinates
- **R** arc radius, chamfering radius
- **I, J, K** arc center coordinates, fillets
- **F** Feed speed
- **S** Spindle speed
- **H** (tool) length offset
- **P, X** Delay
- **P** subprogram number
- **P, Q, R** canned cycle parameters

## ***Indicated Point (IP\_):***

IP\_ == [X][Y][Z], where

- X == "X"nnn.nnn
- Y == "Y"nnn.nnn
- Z == "Z"nnn.nnn
- At least one of the arguments X Y Z must be given.

Fanuc-manuals call the IP\_ ***dimension word***



## Esityksen tuotti



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