
HX – Series (V2.x)

Programming Manual

for Machining Center (MC)

Serial No. : PG-20011120

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TURBO HX (Address)

A	X	N	(Sequence number)
B	Y	O	
C	Z	P	
D		Q	
E	-	R	R ,
F	(Feed Rate)	S	
G	(Preparatory Function)	T	(Tool Function)
H		U	X 가
I	X	V	Y 가
J	Y	W	Z 가
K	Z	X	X
L		Y	Y
M	(Miscellaneous Function)	Z	Z

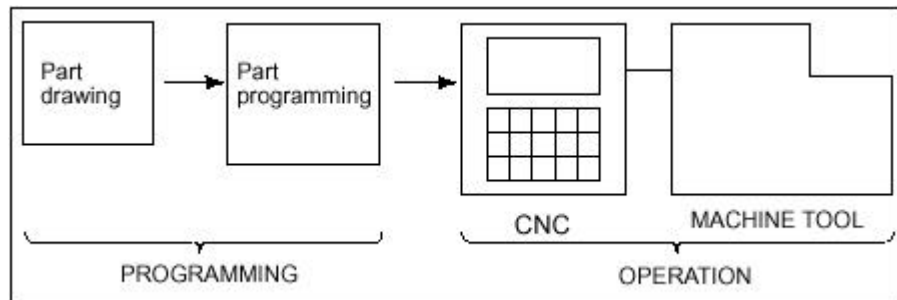
TURBO HX

(	(Comment)	.	()
)	(Comment)	= [EQ]	
[+	
]		-	
*		0 ~ 9	
#		;	
/	Optional block skip	A ~ Z	

G n	G n	G00, G01
Alphabet _	Alphabet _	X_ A_ I_ J_ F_ S_
{ }	{ } 가	{ X_ Z_ / U_ W_ }
[]	가	[G90 / G91]
/		

1 (General)

CNC ()
 CNC , , ,
 CNC , PLC ON/OFF M G
 CNC (ATC : Auto Tool Changer) 가
 (MC) .
 CNC 가
 가



1.1 (Coordinate System)

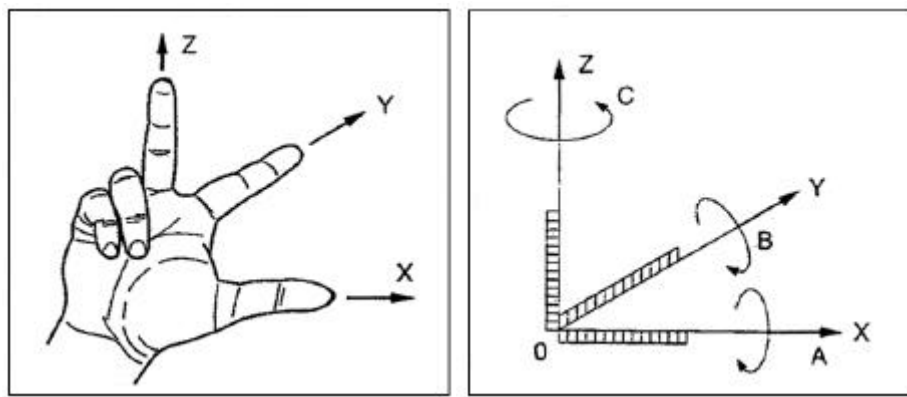
- 1.1.1 (Machine Coordinate System)
- 1.1.2 (Work-piece Coordinate System)
- 1.1.3 (Local Coordinate System)
- 1.1.4 (Relative Coordinate System)
- 1.1.5 (Distant To Go)
- 1.1.6 (Offset & Position in Coordinate System)

1.2 CNC 가 (Machining Conditions)

- 1.2.1 (Cutting Speed) : V [m/min]
- 1.2.2 (Rotation Speed) : N [rpm]
- 1.2.3 (Feed Rate) : F [mm/min, mm/rev]
- 1.2.4 : Q [cm³ / min]
- 1.2.5 가 T [sec]

1.1 (Coordinate System)

가 .
 X, Y, Z 가
 A, B, C (A X , B Y , C Z)
).



- Z
 - 가 X
 - Y Z X X , Z

1.1.1 (Machine Coordinate System)

CNC (Reference Position) 가 ,

(Machine Origin) , 가

(Reference Position,

, 1)

G22/G23

(Stored Stroke Limit), Over Travel,

2,3,4

X0, Y0, Z0

1.1.2 (Work-piece Coordinate System)

가 . 가

NC .

가 NC

가 .

Setting

, G54 ~ G59 가 .

()가 .

ON .

(PI 146) G90() G91()

가 .

G92 X_ Y_ Z_ .

[G90] X0 Y0 Z0 .

1.1.3 (Local Coordinate System)

.

G54~G59

, X_ Y_ Z_

.

가 0 Clear .

1.1.4 (Relative Coordinate System)

,

1.1.5 (Distant To Go)

[AUTO, MDI]

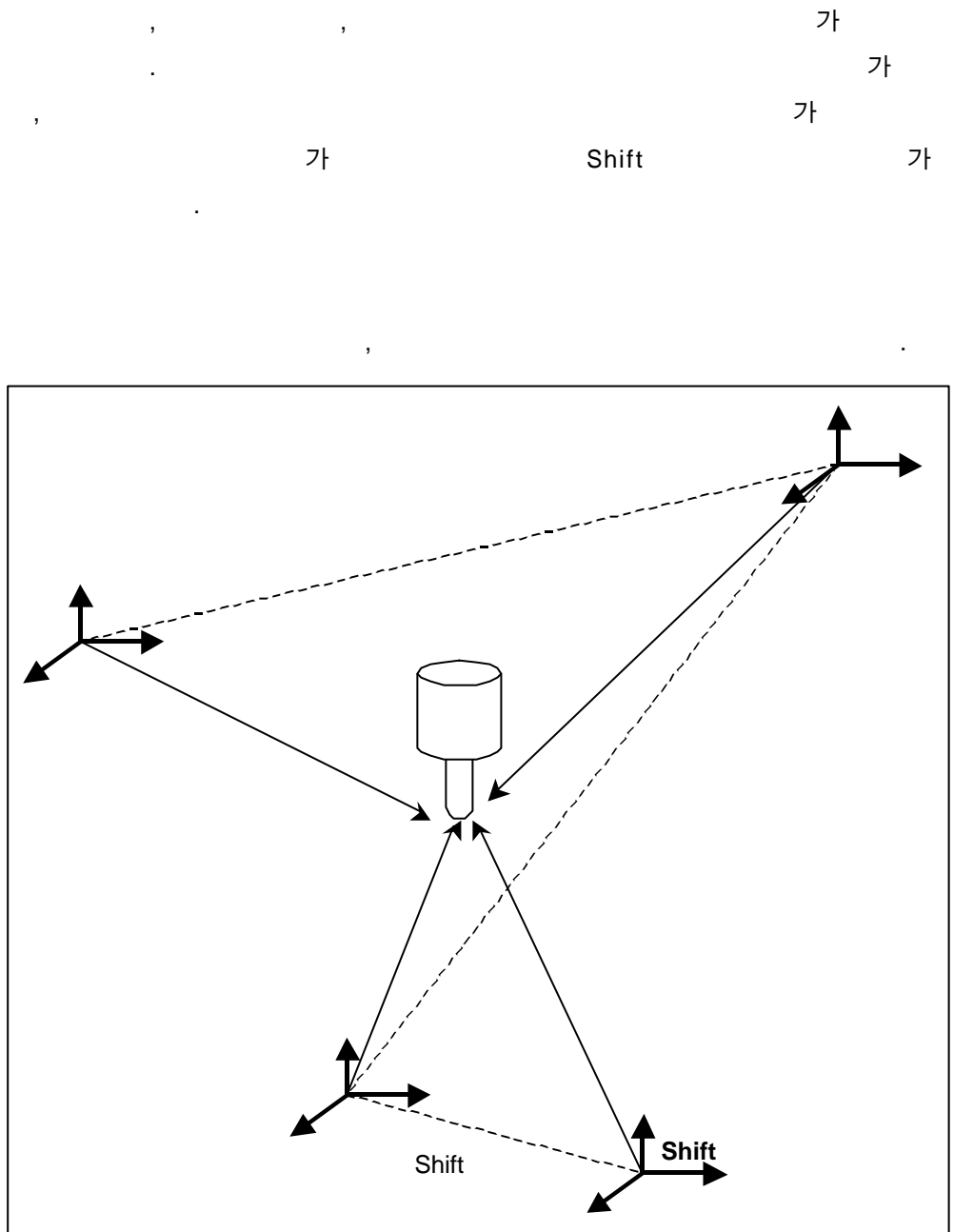
.

Setting 가

.

1.1.6

(Offset & Position in Coordinate Systems)



1.2 CNC 가 (Machining Conditions)

1.2.1 (Cutting Speed) : V [m/min]

V

, 가

m/min

가

$$V = \frac{p \cdot DN}{1000}$$

D: [mm]

N: [rpm]

1.2.2 (Rotation Speed) : N [rpm]

$$N = \frac{1000 \cdot V}{p \cdot D}$$

V: [m/min]

D: [mm]

1.2.3 (Feed Rate) : F [mm/min, mm/rev]

F

(G94)

(G95)

(F) 1

[mm/min] , G94 F200

(f)

1

[mm/rev]

G95 F0.2

$$(F) = (f) \times (Z) \times (N)$$

- F : [mm/min]
- f : [mm/tooth]
- Z : [teeth/rev]
- N : [rpm]

가 [mm/rev]
[mm/min] .

- ,
F [mm/min] = N [rpm] × f [mm/rev]

-
F [mm/min] = N [rpm] × [teeth/rev] × f [mm/teeth]

-
F [mm/min] = N [rpm] ×

1.2.4 : Q [cm³ / min]

-
Q = × ×

d πd² /4 [mm²]

$$Q(Cm^3) = \left(\frac{d}{100}\right) \times (Nrpm) \times \left(\frac{Fmm/rev}{10}\right) = \frac{\times F(mm/min)}{1000}$$

-
Q = × × ×

1.2.5 가 T [sec]

가

가

$$T = \frac{L}{F} \times 60$$

L : 가 [mm]

F : [mm/min]

2 (Program)

가

AUTO

MDI

2.1 (Program Files)

2.2 (Elements of Program)

2.2.1 (Address)

2.2.2 (Data)

2.2.3 (Word)

2.2.4 (Block)

2.3

2.3.1 (Comment)

2.3.2 (Sequence Number)

2.3.3 (Optional Block Skip)

2.3.4 (Program Restart)

2.4 (Main Program & Sub-program)

2.4.1 (Sub-program)

2.4.2 (Multiplex Calls of Sub-program)

2.4.3 (Call & Return of Sub-program)

2.4.4 (Repeat of Main Program)

2.1 (Program Files)

가 “ ”

4 . 9000 9029

“ NC ”

NC

PC

CNC

:
9000 ~ 9029 /Nc/Macro

2.2 (Elements of Program)

CNC 가 . (Block) (Word)
 (Address) (Data) .
 ASCII ~, !, \$, ^, & CNC
 F_82001(
 가 .)

2.2.1 (Address)

A ~ Z 1 가 .

D		G41 D1
H		G43 H1
F		F100.
G		G00
I, J, K		G02 X10. I20.
M		M00
N		N10
O		O1234
S		S1000
T		T1010
X, Y, Z		G00 X10.

%, ;, (,) /가 .

2.2.2 (Data)

12
F_82002(가 .)

F_82004(.)

2.2.3 (Word)

(Address)

(Data)

□ ||

N100

G00

X100.

가 .

□ ||

G00 X100. X200. (X100. X200.)

2.2.4 (Block)

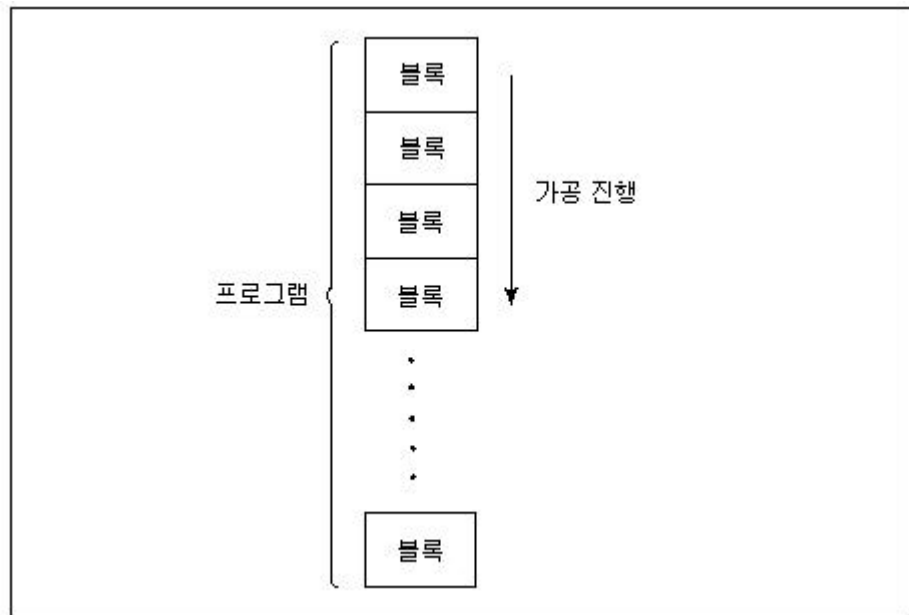
1
300 . 300 (space)
F_82111(300
)

N	G	X .	Y .	Z .	M	S	T	F

2.3

```

O 1234
. O
O , O R
OR . O
M02 M30 M02 M30
F_82016(M02 M30 .)
    
```



2.3.1 (Comment)

%, O, ;, ()가 . %, O, ;
 . ()

2.3.2 (Sequence Number)

N

F_82018(

.)

N__ N 가 N

가 1000

F_82019(가 .)

PI 134(#3124) 0

(1000) 1

2.3.3 (Optional Block Skip)

/

./

F_82017 (가 ON

가 .) /

/ 가 가

10

가 가 /0 ~ /10

, /0 /

2.3.4 (Program Restart)

AUTO RESET 가, 가 가 , 가 가 가

(1)

가 MDI , Feed Cycle Start . EDIT ' F7 UTILITY ' 가 MDI (G54 ~ G59), Feed, G code AUTO 가 가 , Cycle Start . EDIT RESET

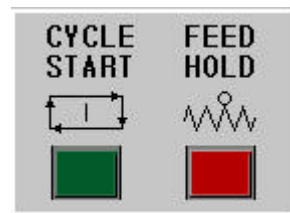
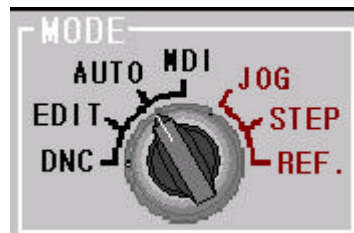
(2)

가 RESET 가 , AUTO RESET 가 , (' PI[133] ') (0), 가 (1), 가 (2) 3 가 가 .

PI [133]	
0 :	<p>가 RESET 가 가 ' ' .</p> <p style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; display: inline-block;">작업물 좌표계 (0/1)</div> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 20px;">0: 유지</div> </p> <p>MDI 가 Feed Cycle Start , AUTO Cycle Start 가 가 .</p>
1 :	<p>가 RESET 가 가</p> <p>Word EDIT AUTO Cycle Start .</p>
2 :	<p>가 가 RESET .</p> <p>Cycle Start .</p>

<p>RESET , Feed 가 .</p>

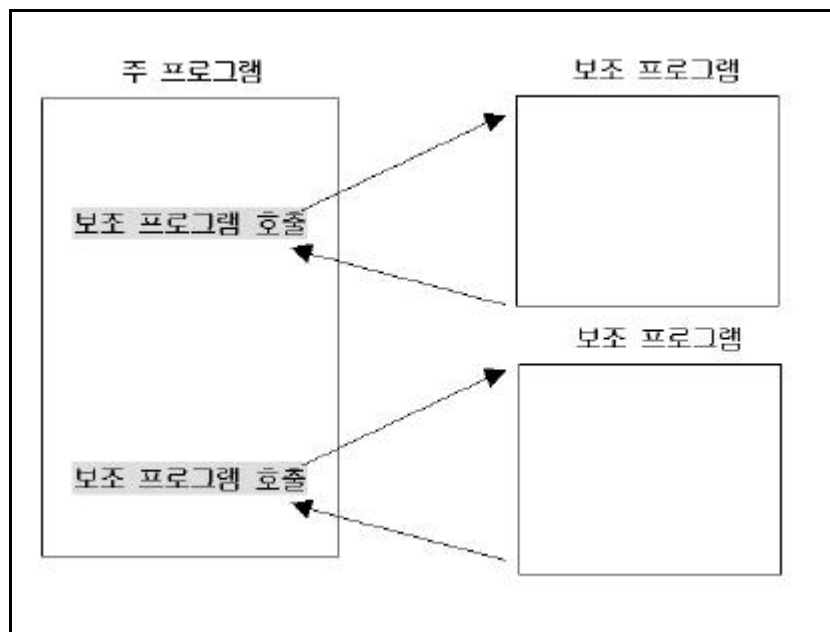
AUTO



2.4

(Main Program & Sub-program)

가



2.4.1

(Sub-program)

가

가

4

```
:  
  
4 가 , 9000 9029
```

2.4.2

(Multiplex Calls of Sub-program)

```
          .                      1  
9        가 . ,                가 9  
F_82022( .) .
```

2.4.3

(Call & Return of Sub-program)

M98 P _ Q _ R _ L _
M99 P _

M98

M99

P _ M98 (_ 4)

M99

Q _

()

R _

(M99 가)

L _

()

F_82109(

.) , 9000~9029

/Nc/ Macro

F_82021(

.)

M99

R_

M99

F_82024(

M99 가

.)

M99

F_82025 (M99

.)

. 1

, F_82023(

.)

MDI

F_82113(MDI

.)

□ □

()

O

G54 G00 X0. Y0. Z0.

X20. Y40.

M98 P10 Q1 R2 L2

X70. Y20.

M98 P10

G91 G28 X0. Y0. M05

M30

()

O 0010

N1 G90 G00 Z5.

G01 Z -10. F20.

Z -25. F100

N2 G00 Z50.

M99

2.4.4

(Repeat of Main Program)

M99 P _ L _

M99

P _

L _

M99

. P _

L _

▣ ||

O

G54 G00 X0. Y0. Z0.

N1 G91 G01 Z5. F500.

X100.

Y100.

X-100.

Y-100.

M99 P1 L3

M30

3 (G Code)

(Preparatory Function) 가 가 . G
 (One Shot) (Modal) . G
 G 가 G 가 . 0 ,
 23 .

	G 가
	G 가

G G
 G 가 F_82030 (G .)
 G 가 G 가
 G
 1 G 가 가
 (G80) .

3.1 G (Table of G Codes)

3.2 G (Initialize of Modal G Codes)

3.1 G (Table of G Codes)

: 초기화 될 때 디폴트가 되는 G 코드를 파라미터에서 설정하는 G 코드

: 초기화 될 때 디폴트가 되는 G 코드

G			
G00		(Rapid Traverse Positioning)	4.1
G01		(Linear Interpolation)	4.3
G02	1	/ CW (Circular/Helical Interpolation CW)	4.4
G03		/ CCW (Circular/Helical Interpolation CCW)	
G04	0	(Dwell)	5.4
G09		(Exact Stop)	5.3.1
G10		(Setting Data)	13.1.3
G10.3	21	가 ON (High Speed Machining Start)	15.1
G11.3		가 OFF (High Speed Machining End)	
G15	17	(Polar Coordinate Command Cancel)	8.3
G16		(Polar Coordinate Command)	
G17	16	XY (Selection of X-Y Plane)	7.4
G18		ZX (Selection of Z-X Plane)	
G19		YZ (Selection of Y-Z Plane)	
G20	6	(Inch)	8.4
G21		(Metric)	
G22	9	ON (Stored Stroke Check ON)	15.5.3
G23		OFF (Stored Stroke Check OFF)	
G27	0	(Reference Position Return Check)	6.4
G28		(Reference Position Return)	6.1
G29		(Return from Reference Position)	6.3
G30		2,3,4 (Return to 2nd,3 rd ,4 th Reference Position)	6.2
G31	23	1 (Skip Function 1)	4.9
G31.1		1 (Multi-step Skip Function 1)	
G31.2		2 (Multi-step Skip Function 2)	
G31.3		3 (Multi-step Skip Function 3)	
G31.4		4 (Multi-step Skip Function 4)	
G33	1	(Constant Lead Thread Cutting)	4.8
G37	0	1 (Automatic Tool Length Measurement 1)	4.10
G37.1		1 (Automatic Tool Length Measurement 1)	
G37.2		2 (Automatic Tool Length Measurement 2)	

G 37.3		3 (Automatic Tool Length Measurement 3)	
G 37.4		4 (Automatic Tool Length Measurement 4)	
G 39		(Tool Diameter Compensation at Corner Arc)	13.2.1
G 40		(Tool Diameter Compensation Cancel)	13.2.1
G 41	7	(Tool Diameter Compensation Left)	13.2.1/13.2.2
G 42		(Tool Diameter Compensation Right)	
G 43	13	+ (Tool Length Compensation +)	13.1.1
G 44		(Tool Length Compensation -)	
G 45	0	(Tool Offset Increase)	13.3
G 46		(Tool Offset Decrease)	
G 47		2 (Tool Offset Double Increase)	
G 48		2 (Tool Offset Double Decrease)	
G 49	13	(Tool Length Compensation Cancel)	13.1.1
G 50	11	(/) , (Scaling Cancel, Mirror Image Cancel)	15.2 / 15.3
G 51		(/) , (Scaling, Mirror Image)	
G 52	0	(Local Coordinate System Setting)	7.3
G 53		(Machine Coordinate System Selection)	7.1.1
G 54	14	1 (Work Coordinate 1 Selection)	7.2.2
G 55		2 (Work Coordinate 2 Selection)	
G 56		3 (Work Coordinate 3 Selection)	
G 57		4 (Work Coordinate 4 Selection)	
G 58		5 (Work Coordinate 5 Selection)	
G 59		6 (Work Coordinate 6 Selection)	
G 60	0	(Single Direction Positioning)	4.2
G 61	15	(Exact Stop Mode)	5.3.2
G 62		(Automatic Corner Override mode)	5.3.5
G 63		(Tapping Mode)	5.3.4
G 64		(Cutting Mode)	5.3.3
G 65	0	(Macro Call)	14.1.1
G 66	12	(Macro Modal Call)	14.1.2/14.1.8
G 67		(Macro Modal Call Cancel)	14.1.2
G 68	18	(Coordinate System Rotation)	15.4
G 69		(Coordinate System Rotation Cancel)	
G 73	10	(High Speed Peck Drilling Cycle)	12.3.4
G 74		(Counter Tapping Cycle)	12.3.6
G 76		(Fine Boring Cycle)	12.3.9
G 80		(Canned Cycle Cancel)	12.2.1
G 81		(Drilling Cycle)	
G 82		(Drilling Dwell Cycle, Counter Boring Cycle)	12.3.2
G 83		(Peck Drilling Cycle)	12.3.3
G 84		(Tapping Cycle)	12.3.5

G 84.2		(Rigid Tap Cycle)	
G 84.3		(Rigid Counter Tap Cycle)	12.3.6
G 85		(Boring Cycle)	12.3.7
G 86		(Boring Stop Cycle)	12.3.8
G 87		(Back Boring Cycle)	12.3.10
G 88		(Manual Boring Cycle)	12.3.11
G 89		(Boring Dwell Cycle)	12.3.12
G 90	3	(Absolute Command)	8.1 / 12.1.3
G 91		(Incremental Command)	8.2 / 12.1.3
G 92	0	(Work Coordinate Setting, Maximum Spindle Speed)	7.2.1 / 9.3
G 94	5	(Feed per Minute)	5.2.1
G 95		(Feed per Revolution)	5.2.2
G 96	2	(Constant Surface Speed Control)	9.1
G 97		(Constant Surface Speed Control Cancel)	9.2
G 98	19	(Return to Initial Point at a Canned Cycle)	12.1.4
G 99		R (Return to R-Point at a Canned Cycle)	
G 107	22	(Cylindrical Interpolation)	4.7
G 112	20	ON (Polar Coordinate Interpolation Mode ON)	4.6
G 113		OFF (Polar Coordinate Interpolation Mode OFF)	

3.2 G (Initialize of Modal G Codes)

(0 ~ 23) 22 ()
 G 가 G
 G 가 .

6 (G20 / G21), 9 (G22 / G23), 16 (G17 / G18 / G19)
 G 가 G RESET
 (G00, G01), (G17, G18, G19), (G20, G21), (G22, G23), (G50, G51), (G68, G69),
 (G90, G91) G .

< >

PI 144 (#3144)	(0 : G00, 1 : G01)
PI 145 (#3145)	(0 : G17, 1 : G18, 2 : G19)
PI 146 (#3146)	/ (0 : G90, 1 : G91)
PI 147 (#3147)	Inch / Metric (0 : G20, 1 : G21)
PI 148 (#3148)	(0 : G22, 1 : G23)
PI 149 (#3149)	(0 : G50, 1 : G51)
PI 150 (#3150)	(0 : G69, 1 : G68)

< ▶ ▶ >

PI 144	0	모달 미송 (0:급속(G00) 1:절삭(G01))
PI 145	0	모달 평면 (0:XY(G17) 1:ZX(G18) 2:YZ(G19))
PI 146	0	모달 절대/중분 (0:절대(G90) 1:중분(G91))
PI 147	0	모달 지령단위 (0:Metric(G21) 1:Inch(G20))
PI 148	0	모달 금지영역 검사 (0:수행(G22) 1:취소(G23))
PI 150	0	모달 좌표계 회전 (0:취소(G69) 1:적용(G68))

< ▶ ▶ >

PI 149	1	스케일 설정 (0:취소(G50) 1:적용(G51))
--------	---	------------------------------

4 (Interpolation Functions)

가

가 가 .

- 4.1 (G00, **Rapid Traverse Positioning**)
- 4.2 (G60, **Single Direction Positioning**)
- 4.3 (G01, **Linear Interpolation**)
 - 4.3.1 (, , Chamfering)
 - 4.3.2 (R, Rounding)
- 4.4 (G02/G03, **Circular Interpolation**)
- 4.5 (G02/G03, **Helical Interpolation**)
- 4.6 (G112/G113, **Polar Coordinate Interpolation**)
- 4.7 (G107, **Cylindrical Interpolation**)
- 4.8 (G33, **Constant Lead Thread Cutting**)
- 4.9 (G31/G31.1/G31.2/G31.3/G31.4, **Skip Function**)
- 4.10 (G37/G37.1/G37.2/G37.3/G37.4)

4.1 (G00, Rapid Traverse Positioning)

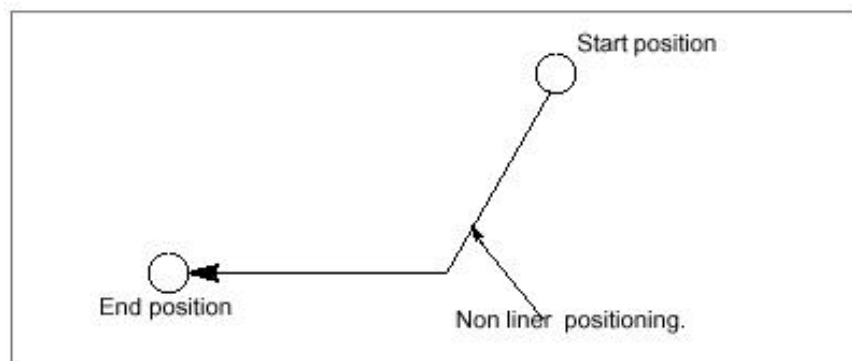
[G90 / G91] G00 X _ Y _ Z _

G90 / G91 / (Absolute / Incremental Command)
 G00 (Positioning Command)
 X _ Y _ Z _ (Position)

X, Y, Z (가 A, B, C 가)
 PM 2759 -2790(#22759 -22790)
 . (In -Position) 가
 . 가
 . (5.1)

PM 2759 -2790 (#22759 -22790)	
PM 2928 -2959 (#22928 -22959)	In Position

가



G00 (1)

□ ||

O

G90 G54 G00 X0. Y0. Z0.

X100. Y50.

Y100.

Z100.

G91 X-100.

Y-100.

Z-100.

M30

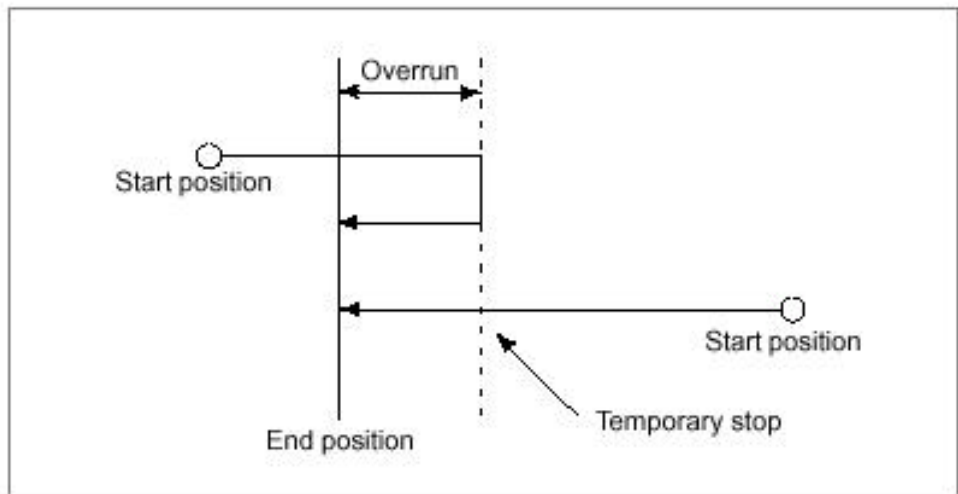
4.2

(G60, Single Direction Positioning)

```
G60 [G00 / G81 - G89] X _ Y _ Z _
```

G60 (Single Direction Positioning)
 G00 / G81~89 / (Positioning/Canned Cycles)
 X _ Y _ Z _ (Position)

G60
 (Overrun)
 . (Overrun) PI 61 -
 69(#3061 - 3069) (: ▶ ▶)
).



Z

(Mirror Image)

□ ||

O

G54 G00 X0. Y0. Z0

G90 G60 X50.

G60 Y50.

G60 Z50.

G91 G60 X-50. Y-50. Z-50.

M30

4.3 (G01, Linear Interpolation)

[G90 / G91] G01 X _ Y _ Z _ F _

G90 / G91 / (Absolute / Incremental Command)
 G01 (Linear Interpolation Command)
 X _ Y _ Z _ (Position)
 F _ (Feed Rate)

가

F _ (G94, mm/min)
 (G95, mm/rev) 가 가

F (5.2)

G01 F
 PM 2871 Feed()

X L_x , Y L_y , Z L_z

$$L = \sqrt{L_x^2 + L_y^2 + L_z^2}$$

$$F_x = \frac{L_x}{L} \times F$$

$$F_y = \frac{L_y}{L} \times F$$

$$F_z = \frac{L_z}{L} \times F$$

G01 (1)

□ ||

○

G54 G00 X0. Y0. Z0.

G90 G01 X-50. F100.

Y-40.

Z -30.

G91 X50. Y40. Z30.

M30

4.3.1 (, , Chamfering)

[,C]
 . [,C] 가 .

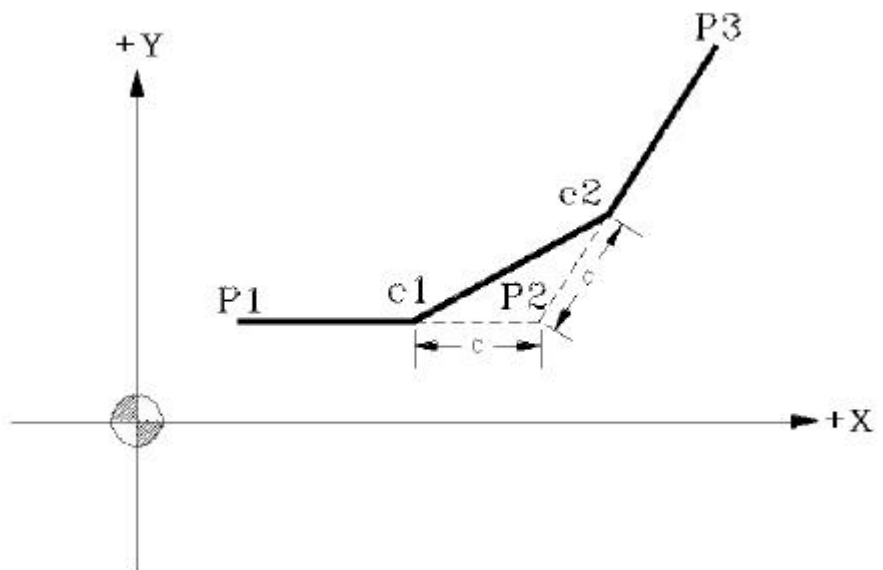
```
G01 X _ Y _ ,C _ F _
```

G01 (Linear Interpolation Command)

X _ Z _ (Position)

,C _ (Chamfering)

< () >



□ □

G00 X10 Y30; (P1)

G01 X30, C5 F300 ; (P1 ▶ P2(c1) ▶ P2(c2))

X50 Y50 (P2(c2) ▶ P3)

```
      :  
      ( )  
      T ) . ( 5 ,  
      P1-P2, P2-P3 [ C, R ] ,
```

4.3.2 (R, Rounding)

[,R]

. [,R]

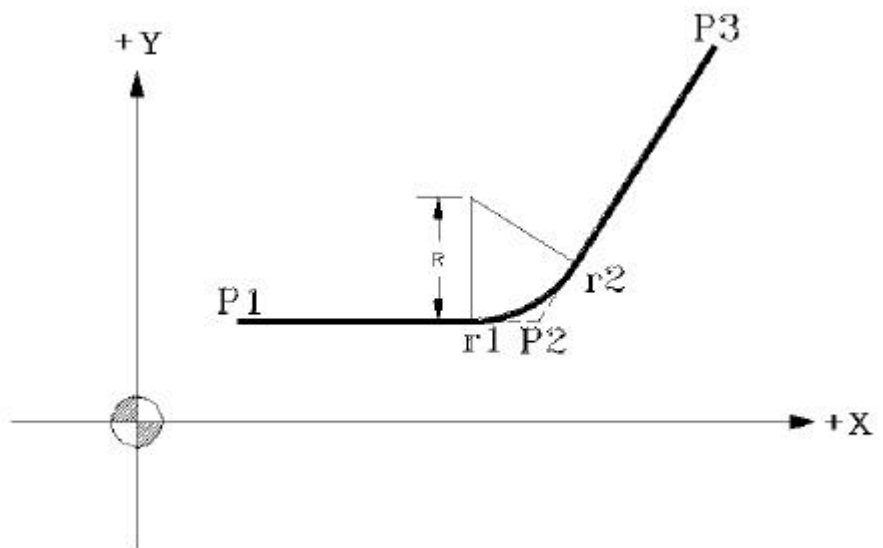
```
G01 X _ Y _ ,R _ F_
```

G01 (Linear Interpolation Command)

X _ Y _ (Position)

,R _ (Rounding)

< >



□ ||

```
G00 X10 Y30 ; ( P1 )
G01 X30, R15 F300 ; ( P1 ▶ P2(r1) ▶ P2(r2) )
X50 Z50 ( P2(r2) ▶ P3 )
```

```
      :  
      ( )  
      T ) .(5 ,  
      P1-P2, P2-P3 [ C, R ] ,
```

4.4 (G02/G03, Circular Interpolation)

[G17]	{G02 / G03}	X _ Y _	{I _ J _ / R _}	F _
[G18]	{G02 / G03}	X _ Z _	{I _ K _ / R _}	F _
[G19]	{G02 / G03}	Y _ Z _	{J _ K _ / R _}	F _

G17 / G18 / G19 (Plane Selection)

G02 / G03 CW / CCW
(CW/CCW Circular Interpolation Command)

X _ Y _ Z _ (Position)

I _ J _ K _ ()

(a Vector component in which the arc center is seen from the start point)

R

R _ (Radius of Arc)

F _ (Feed Rate)

$$X_Y_ / X_Z_ / Y_Z_ \quad I_J_ / I_K_ / J_K_ \quad R_ \\ F_$$

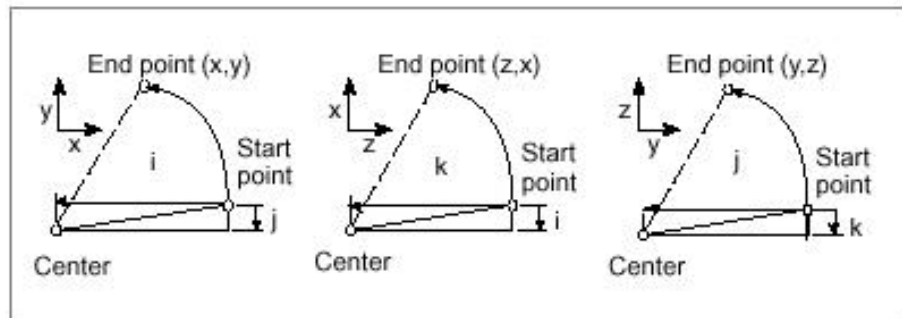
$$F \quad (5.2)$$

$$I_J_ / I_K_ / J_K_ \quad /$$

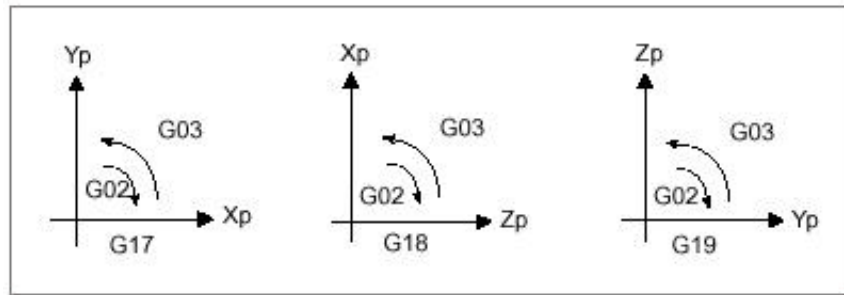
. I0, J0, K0

I _ J _ K _

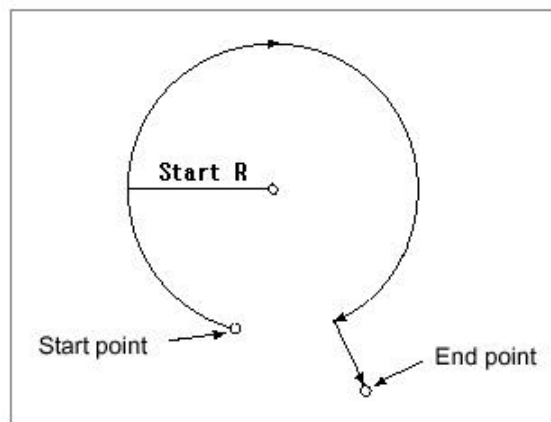
360°



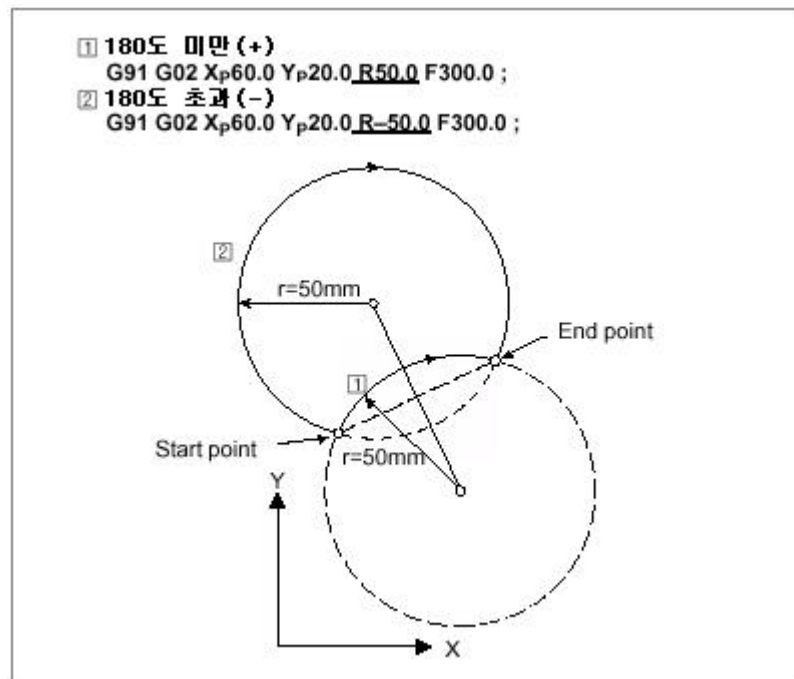
G17 XY , G18 ZX , G19 YZ
 G02 (CCW) G03 (CW)



PI 151(#3151)
 F_82112(가 .)
 PI 151



I _ J _ K _ R _ 가 가
R +, - .
R 가 PI 151
F_82100(.)
I _ J _ K _ R _ I _ J _ K _ R _
. R _ 360 ° .



□ ||

O

G54 G00 X0. Y0. Z0.

(XY)

G90 G17 G02 X50. Y50. I50. F100.

G03 X0. Y0. R -50.

G91 G03 X100. Y100. J100.

G02 X -100. Y -100. R -100.

(ZX)

G90 G18 G02 Z50. X50. K50. F200.

G03 Z0. X0. R -50.

G91 G03 Z100. X100. I100.

G02 Z -100. X -100. R -100.

(YZ)

G90 G19 G02 Y50. Z50. J50. F300.

G03 Y0. Z0. R -50.

G91 G03 Y100. Z100. K100.

G02 Y -100. Z -100. R -100.

()

G17 G02 I50.

G03 J50.

G02 I50. J50.

(I R)

G02 X -100. I30. R50.

M30

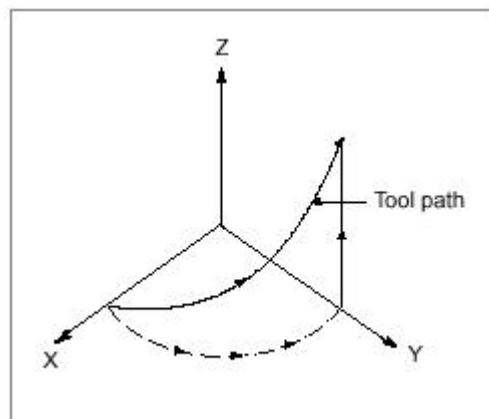
4.5 (G02/G03, Helical Interpolation)

```
[G17] {G02 / G03} X _ Y _ {I _ J _ / R _} Z _ F _
[G18] {G02 / G03} X _ Z _ {I _ K _ / R _} Y _ F _
[G19] {G02 / G03} Y _ Z _ {J _ K _ / R _} X _ F _
```

G17/G18/G19 (Plane Selection)
 G02 / G03 CW / CCW (CW/CCW Circular Interpolation Command)
 X _ Y _ Z _ (Position)
 I _ J _ K _ ()
 (a Vector component in which the arc center is seen from the start point)
 R (Radius of Arc)
 F _ (Feed Rate)

가 . 가

G17	X, Y . Z
G18	Z, X . Y
G19	Y, Z . X



F _

F

. (5.2

)

□ ||

O

G54 G00 X0. Y0. Z0.

(XY)

G90 G17 G02 X50. Y50. I50. Z50. F100.

G03 X0. Y0. Z0. R-50.

G91 G03 X100. Y100. J100. Z100.

G02 X-100. Y-100. Z-100. R-100.

(ZX)

G90 G18 G02 Z50. X50. K50. Y50. F200.

G03 Z0. X0. Y0. R-50.

G91 G03 Z100. X100. I100. Y100.

G02 Z-100. X-100. Y-100. R-100.

(YZ)

G90 G19 G02 Y50. Z50. J50. X50. F300.

G03 Y0. Z0. X0. R-50.

G91 G03 Y100. Z100. X100. K100.

G02 Y-100. Z-100. X-100. R-100.

()

G90 G17 G02 I50. Z50.

G03 J50. Z0.

G02 I100. J100. Z100.

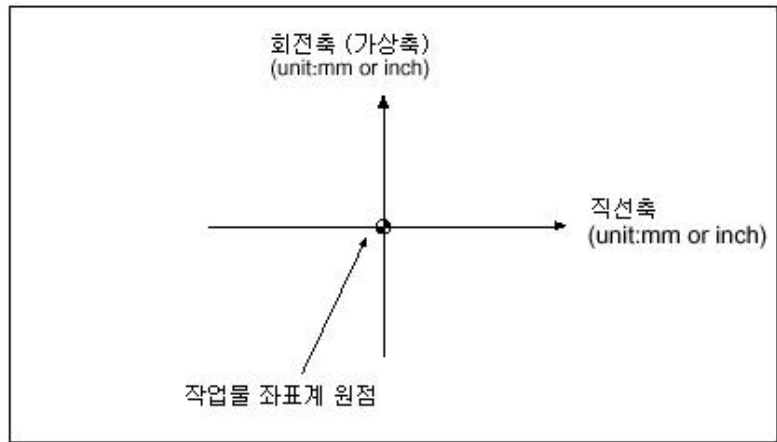
M30

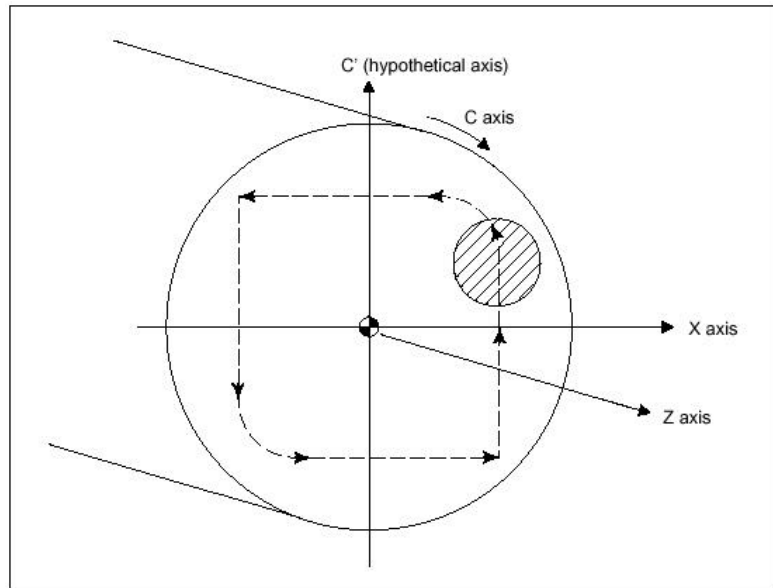
4.6 (G112/G113, Polar Coordinate Interpolation)

```
G112
G01, G02, G03 ...
G113
```

G112 (Start of Polar Coordinate Interpolation)
 G01, G02, G03 ... 가 (Interpolation Commands)
 G113 (End of Polar Coordinate Interpolation)

가 Face Milling Cam Shaft 가 .





G112

가

G113

가

F_82204(

.)

X, Y, Z

A, B, C

XY

X

, Y

I, J, K

I, J

가

PM 4623(#24623)

PM 4624(#24624)

(G94)

F

□ ||

O

G54 G90 G00 X60. C0. Z50.

G112

G42 G01 X20. F100.

C10.

G03 X10. C20. R10.

G01 X-20.

C-10.

G03 X-10. C-20. I10. J0.

G01 X20.

C0.

G40 X60.

G113

M30

4.7 (G107, Cylindrical Interpolation)

```
G107 {A _ / B _ / C _}
G01, G02, G03 ...
G107 {A 0 / B 0 / C 0}
```

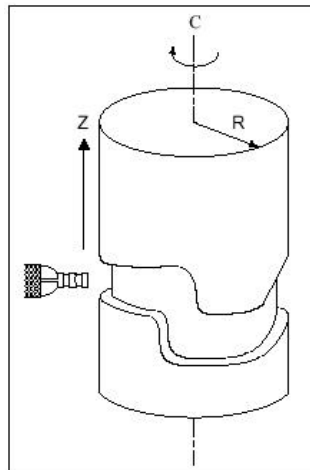
G107 (Cylindrical Interpolation)
 A _ / B _ / C _ (The Axis of Rotation & Radius Setting)
 G01, G02, G03 ... 가 (Interpolation Command)
 A 0 / B 0 / C 0 (Cylindrical Interpolation Cancel)

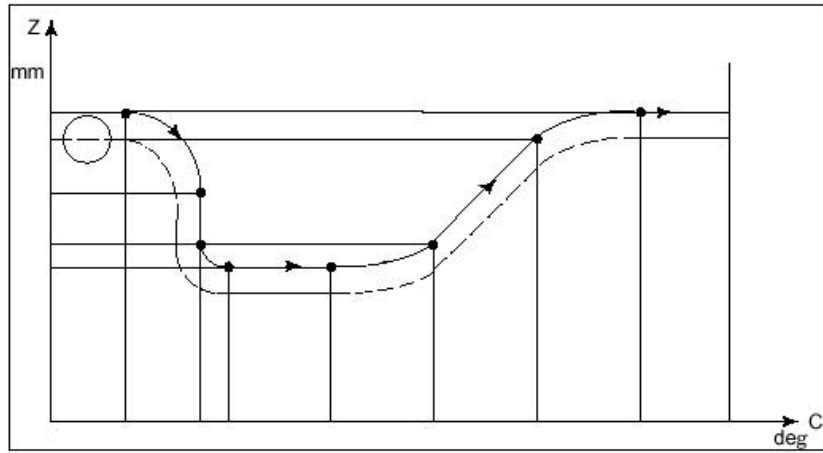
가

가

. G107

0





가 가

F_82208(

.)

```
G107 C30.0 < 30 >
G18 G01 Z10.0 C20. < >
G02 C40. R20. < >
G00 Z20. < >
G107 C0 < >
```

PI 155(#3155)

(G17, G18, G19)

PI 155 (#3155) :	
(Cylindrical Interpolation)	
	X,Y,Z , X
XY (G17)	가 가 가 Y .
ZX(G18)	가 가 Z 가 .
YZ(G19)	

가

가

A X, B Y, C

Z

```

< X >
G17 C_ Y_
G02(G03) C_ Y_ R_
G18 Z_ C_
G02(G03) Z_ C_ R_
    
```

I, J, K

R

가

□ II

```

O
G54 G00 G90 Z100.0 C0
G01 G91 G18 Z0 C0
G107 C57.299
G90 G01 Z120. F250
C30.
G02 Z90. C60. R30.
G01 Z70.
G03 Z60. C70. R10.
G01 C150.
G03 Z70. C190. R75.
G01 Z110. C230.
G02 Z120. C270. R75.
G01 C360.
Z100.
G107 C0
M30
    
```

4.8

(G33, Constant Lead Thread Cutting)

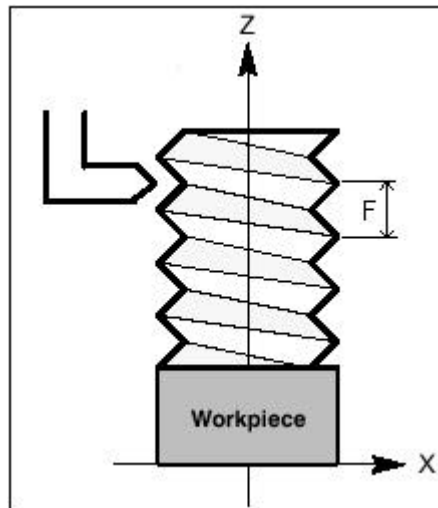
G33 X _ Y _ Z _ F _

G33 (Constant Lead Thread Cutting)

X _ Y _ Z _ (Position)

F _ (Lead of Thread)

가 가 .



가 Feed Hold 가
가 Feed Hold 가

□ ||

O
G90 G54 G00 X0. Y0. Z0.
Z100.
G33 Z0. F5.
M30

4.9 (G31/G31.1/G31.2/G31.3/G31.4, Skip Function)

{G31 / G31.1 / G31.2 / G31.3 / G31.4} X _ Y _ Z _ F _

G31 / G31.1 / G31.2 / G31.3 / G31.4

G

(Skip Function)

X _ Y _ Z _

(Position)

F _

(Feed Rate)

(G01)

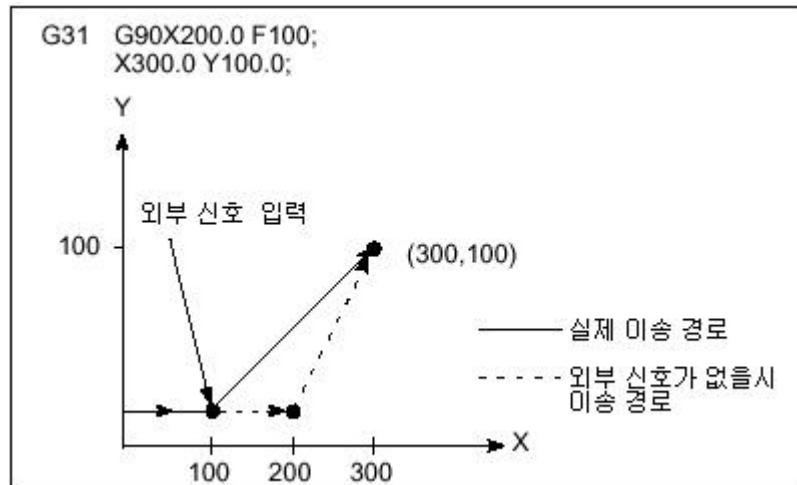
가

가

SN 319 ~ 350

(#6319 ~ 6350)

가



□ ||

O

G90 G54 G00 X0. Y0. Z0.

G31 X100. F500.

(1)

G31.2 Y100.

(2)

G31.3 X0.

(3)

G31.4 Y0.

(4)

M30

4.10

(G37/G37.1/G37.2/G37.3/G37.4)

{G37 / G37.1 / G37.2 / G37.3 / G37.4} {X_ / Y_ / Z_}

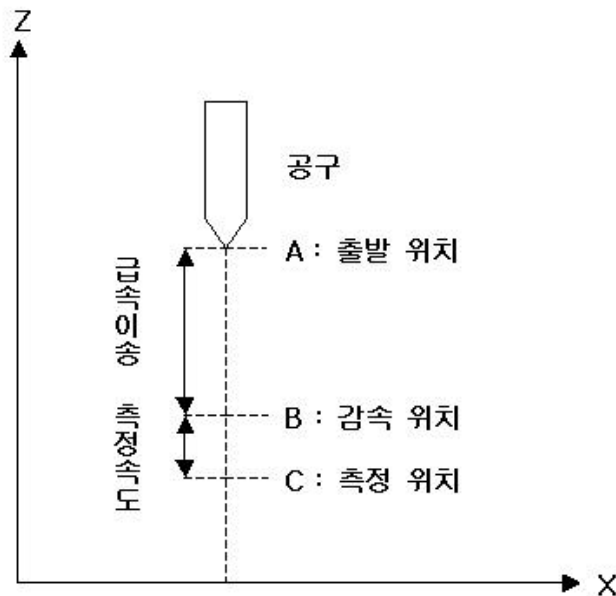
G37	1 (Automatic Tool Length Measurement 1)
G37.1	1 (Automatic Tool Length Measurement 1)
G37.2	2 (Automatic Tool Length Measurement 2)
G37.3	3 (Automatic Tool Length Measurement 3)
G37.4	4 (Automatic Tool Length Measurement 4)
X_ / Y_ / Z_	(Measurement Position)

가

. NC

(SKIP

)가



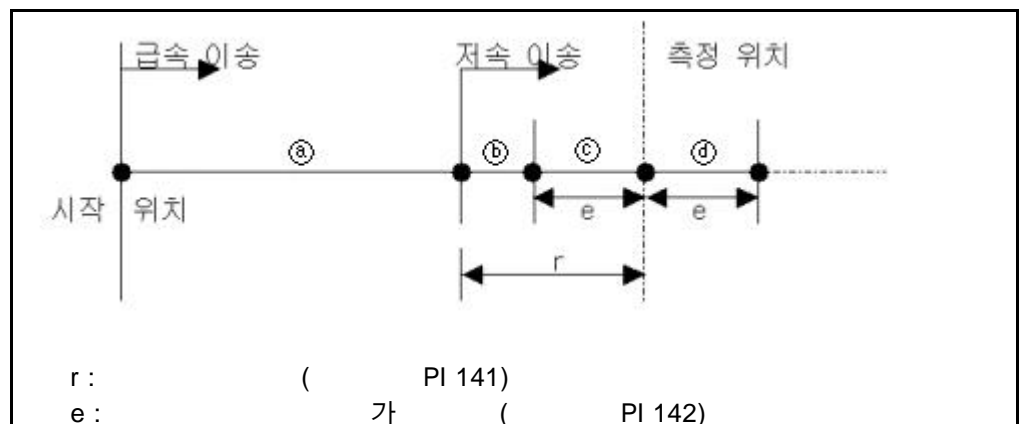
(1) (SKIP)

SKIP 가 HIGH
 . SKIP , 0 ~ 2x(IPO Sampling Time) msec
 , SKIP 가 SN 319~350 (#6319~
 6350) . (-> ->)
 SKIP G , G X,Y,Z

SKIP	G
SKIP1	G37.1(G37)
SKIP2	G37.2
SKIP3	G37.3
SKIP4	G37.4

(2)

, ().
 PI 141(#3141) 가 , PI
 143 (#3143) ().
 가 (SKIP)가 ON



가 F_84022(

.) .

F_84022(

.) .

(3)

, .

$$= + (\text{가 ON} -)$$

5 (Feed Function)

가 가
, (, , ,
) , 가 , (Dwell) .

5.1 (**Rapid Traverse**)

5.2 (**Cutting Feed**)

5.2.1 (G94, Feed per Minute)

5.2.2 (G95, Feed per Revolution)

5.3 (**Cutting Feed Rate Control**)

5.3.1 (G09, Exact Stop)

5.3.2 (G61, Exact Stop Mode)

5.3.3 (G64, Cutting Mode)

5.3.4 (G63, Tapping Mode)

5.3.5 (G62, Automatic Corner Override Mode)

5.3.6

(Internal Circular Cutting Feed Rate Change)

5.4 (G04, **Dwell**)

5.5 가 (**Automatic Acceleration / Deceleration**)

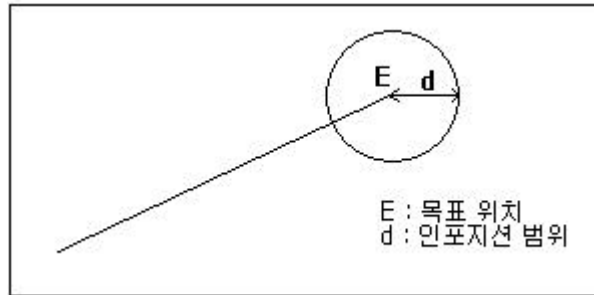
5.1 (Rapid Traverse)

(G00) 가

PM 2759 -2790(#22759 -22790)

가

PM 2928 -2959(#22928 -22959)



가

PM 2791 -2822(#22791 -22822)

0

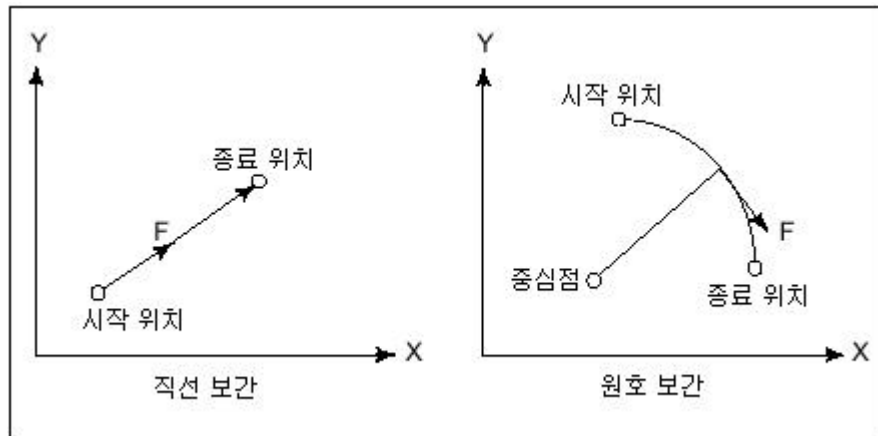
PM 2828(#22828)

. 0

, 1

5.2 (Cutting Feed)

(G01), (G02, G03) F
 가 . (G94)
 (G95) 가 가 .
 가 가



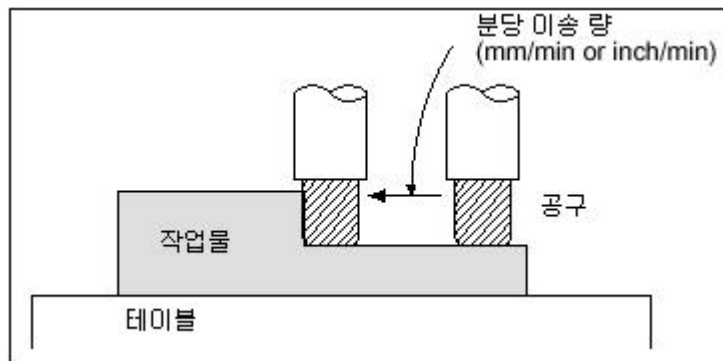
가
 PM 2891 - 2922(#22891 - 22922)
 0
 F 가 F0 PM2871(#22871)
 PM2870(#22870)
 F_84020(
 .)

5.2.1 (G94, Feed per Minute)

G94
F _

G94 (Feed per Minute)
F _ (mm/min inch/min) (Feed Rate)

F 가
(5) G95()가
RESET



□ ||

G54 G00 X0. Y0. Z0.
G94 G01 X100. F500.
M30

5.2.2 (G95, Feed per Revolution)

```

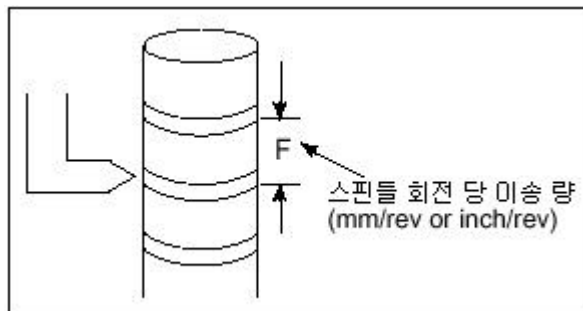
G95
F _
    
```

G95 (Feed per Revolution)
 F _ (mm/rev inch/rev) (Feed Rate)

1

F 가

(5) G94()가



□ ||

```

G54 G00 X0. Y0. Z0.
M03 S100
G95 G01 X100. F5.
M30
    
```

5.3 (Cutting Feed Rate Control)

5.3.1 (G09, Exact Stop)

G09

G09 (Exact Stop)

가

가

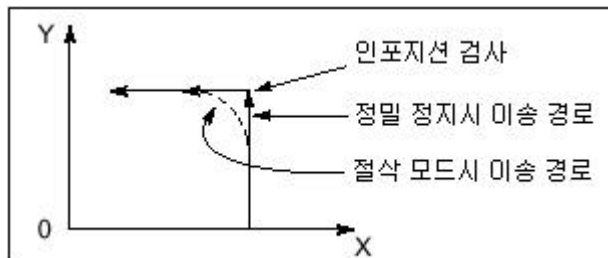
가

```
N1 G00 X50. Y0.  
N2 G01 Y50. F2000.  
N3 X0.
```

Y Y50

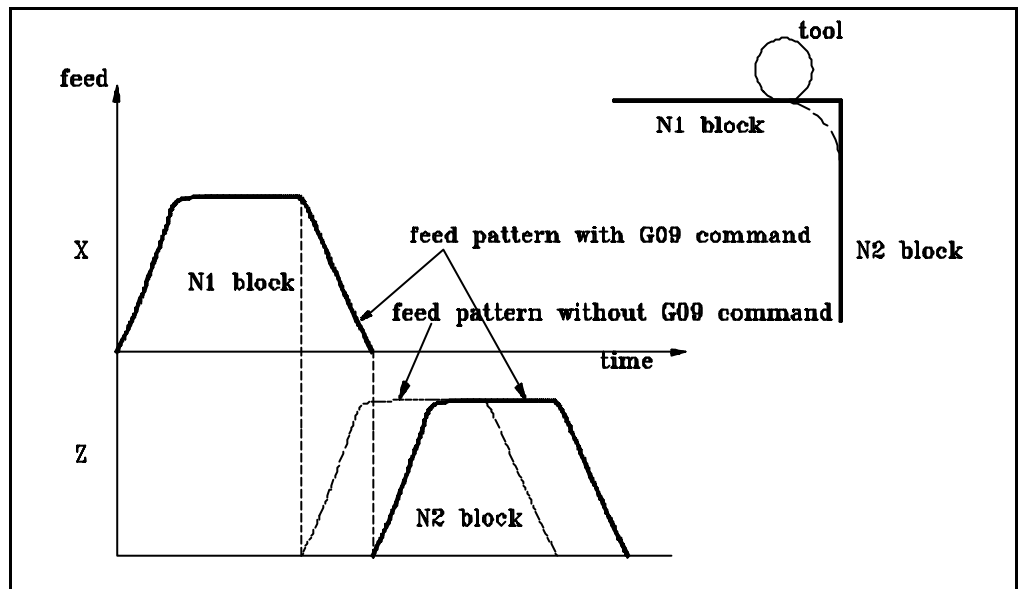
Y

, X 가 . ,



Position , 가 In -
NC 가 (In -Position Check)

In -Position PM 2928~2959(#22928~22959)



09) X Z (G

가 가 가 가



□ ||

G54 G00 X0. Y0. Z0.

G09 G01 X100. F500.

Y100.

X0.

M30

5.3.2

(G61, Exact Stop Mode)

G61

G61

(Exact Stop Mode)

(G61) (G09) (G09) G61 (

15) .

G61 G62(), G63(), G64()

가 .

5.3.1

	G	
(One Shot)	G09	» »
	G61	G62, G63, G64 가 » »
	G64	G61, G63, G64 가 »
	G63	G61, G62, G64 가 G 가 Feed Override 가 100%
	G62	G61, G63, G64 가 feed ()

▶▶ G09 / G61, G64 []
G64

가 가 , 가 , 가

G One Shot Modal 2 가
[: G00, : G60]

G61 G64 [] .

▶▶

G54 G00 X0. Y0. Z0.

G61 G01 X100. F500.

Y100.

G64 X0.

Y0.

M30

5.3.3 (G64, Cutting Mode)

G64

G64 () (Cutting Mode)

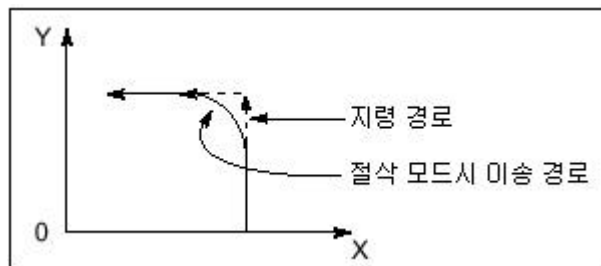
가

가

가

```
N1 G00 X50. Y0.
N2 G01 Y50. F2000.
N3 X0.
```

Y Y50 Y
, X 가 . ,



(15) G61(), G62(), G63()가
RESET



□ □

G54 G00 X0. Y0. Z0.

G64 G01 X100. F500.

Y100.

G61 X0.

Y0.

M30

5.3.4 (G63, Tapping Mode)

G63

G63 (Tapping Mode)

G64()
 가 100% Feed Hold
 . (5.3.3)

(15) G61(), G62(
), G64()가



G54 G00 X0. Y0. Z0.
 G63 G01 X100. F500.
 Y100.
 M30

5.3.5

(G62, Automatic Corner Override Mode)

(1)

(General Automatic Corner Override)

G62

G62

(Automatic Corner Override Mode)

가 가

가

4 가 가

가

2

p

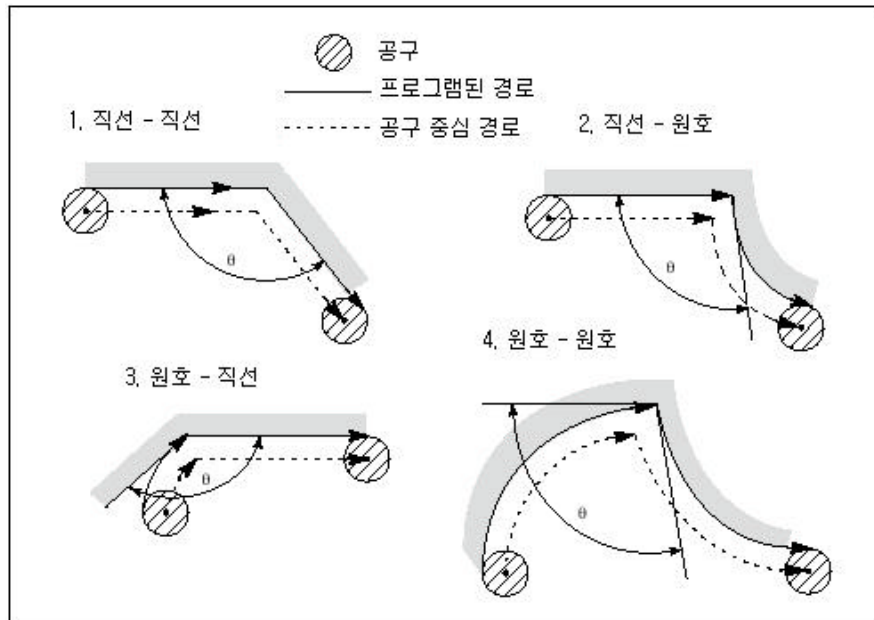
178

p

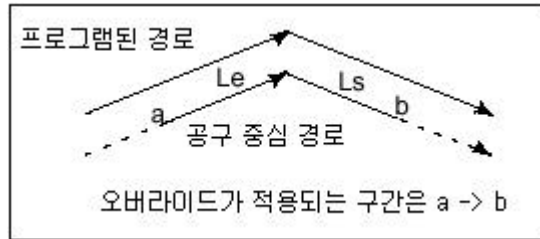
PI 130(#3130)

0 ~ 2

178



가 가
 가 . PI 124(#3124)
 PI 125(#3125)
 0 가 .



PI 126(#3126)
 0 .



(15) G61(), G63(),
 G64()가

□ ||

G54 G00 X0. Y0. Z0.
 G41 D1
 G62 G01 X100. F500.
 G03 X130. Y30. R30.
 G01 X0.
 Y100.
 M30

(2) (Always Automatic Corner Override)

PI 131(#3131) 0
, 1

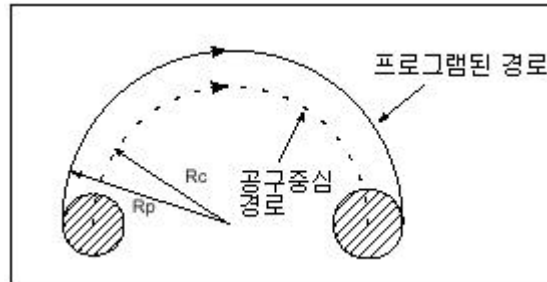
(3) (Automatic Corner Feed Rate)

가 PI 153(#3153)
0
, 0
가

5.3.6

(Internal Circular Cutting Feed Rate Change)

가 가



$$= \frac{R_c}{R_p} \times$$

Rc/Rp 가 0 가 가 PI

132(#3132)

0 Rc/Rp

가

5.4 (G04, Dwell)

G04 {X _ / P _}

G04 (Dwell)
 X_ sec /
 P_ mili-sec (1/1000 sec) /

가 (G95) PI 120(#3120) 1
 X_ P _ 가 . , X_ P _

□ ||

O
 G54 G00 X0. Y0. Z0.
 G94 G01 X10. F500.
 G04 X3 ()
 X20.
 G95 M03 S60. F5.
 Y10.
 #100 = #3120
 #3120 = 1
 G04 P1 ()
 #3120 = #100
 M30

5.5 가 (Automatic Acceleration / Deceleration)

가

가

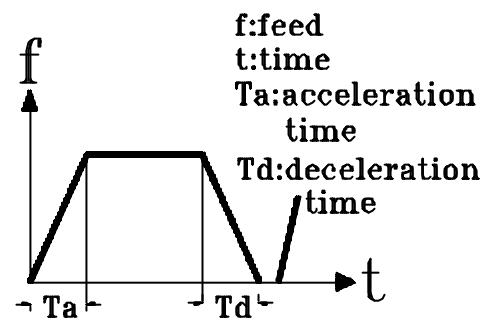
가 /

/ /

(1) 가 /

- ◆ G00
- ◆ Rapid Traverse
- ◆ JOG
- ◆ 가 /

PM 561~592(#20561 ~ 20592)

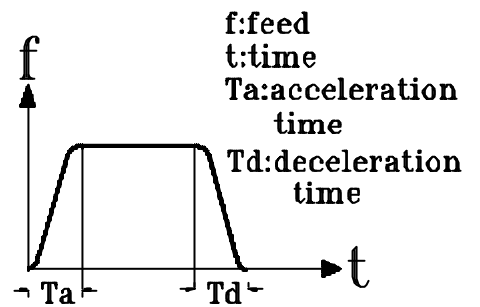


(2) 가 /

- ◆ G01, G02, G03
- ◆ 가

PM 598(#20598)

- ◆ 가
- PM 599(#20599)

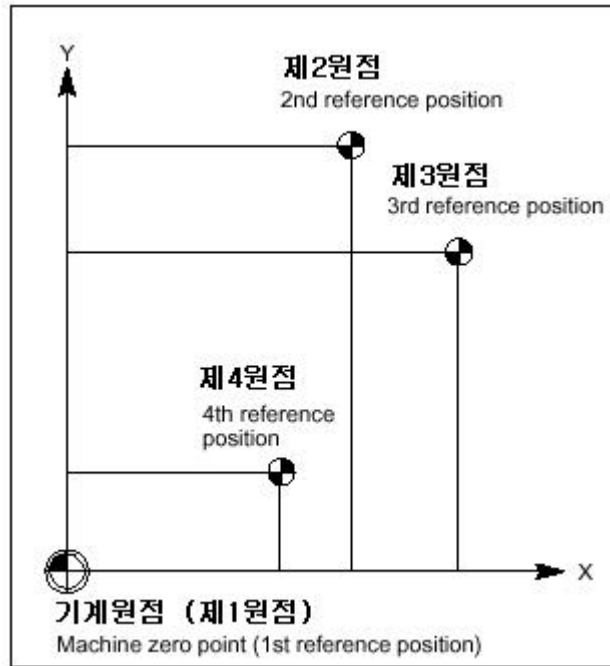


, 가 가 가

가 / 가

6 (Reference Position)

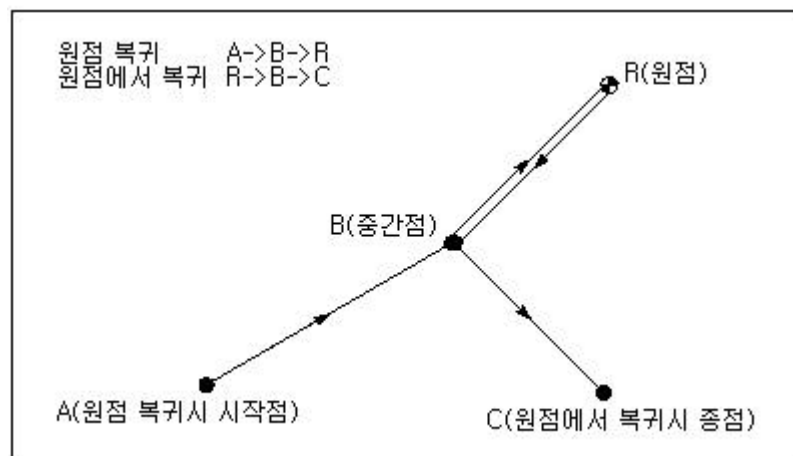
가



(Reference Position

Return)

(Return from the Reference Position)가



(1) ?

:

가

6.1 (G28, **Reference Position Return**)

6.2 2,3,4 (G30, **2nd,3rd,4th Reference Position Return**)

6.3 (G29, **Return from Reference Position**)

6.4 (G27, **Reference Position Return Check**)

6.1 (G28, Reference Position Return)

[G90 / G91] G28 X _ Y _ Z _

G90 / G91 / (Absolute/Incremental Command)

G28 (Reference Position Return)

X _ Y _ Z _

(Position of Intermediate Point)

X _ Y _ Z _

1

:

G29()

□ II 1

O

G91 G28 X0. Y0. Z0. ()

G90 G54 X10. Y20. Z30. (G54 X10. Y20. Z30.

)

□ II 2

O

G91 G28 Z0. (Z)

G28 X0. Y0. (X,Y)

G90 G54 X10. Y20. Z30.

6.2 2,3,4 (G30, 2nd, 3rd, 4th Reference Position Return)

[G90 / G91] G30 { P2 / P3 / P4 } X _ Y _ Z _

G90 / G91 / (Absolute/Incremental Command)

G30 2,3,4 (Reference Position Return)

P2 / P3 / P4 2,3,4
(Reference Position Type Selection)

X _ Y _ Z _
(Position of Intermediate Point)

X _ Y _ Z _

2,3,4

. 2 P2 P2 . 3 P3, 4
P4 .

< >

PM 2097-2128(#22097-22128)	2	()
PM 2129-2160(#22129-22160)	3	()
PM 2161-2192(#22161-22192)	4	()

:

G29()

□ □

O 2,3,4

G90 G54 X0. Y0. Z0. (G54 . X0. Y0. Z0.)

G30 P2 X30. Y50. Z10. (G54 X30. Y50. Z10.

2)

G30 P3 X0. (G54 X0. , X

3)

G30 P4 Y0. (G54 Y0. , Y

4)

M30

6.3 (G29, Return from Reference Position)

```
[G90 / G91] G29 X _ Y _ Z _
```

G90 / G91 / (Absolute/Incremental Command)
 G29 (Return from Reference Position)
 X _ Y _ Z _ (Position)

2,3,4

G28() G30(2,3,4)

```
:
G29
```

||

O
 G90 G54 X0. Y0. Z0. (G54 . X0. Y0. Z0.)
 G28 X30. Y50. Z10. (G54 X30. Y50. Z10.
)
 G29 X0. Y0. Z0. ((G54 X30. Y50.
 Z10.) (G54 X0. Y0.
 Z0 .))
 M30

6.4

(G27, Reference Position Return Check)

[G90 / G91] G27 X _ Y _ Z _

G90 / G91 / (Absolute/Incremental Command)
 G27 (Reference Position Return Check)
 X _ Y _ Z _ (Position)

X _ Y _ Z _ 가
 가 F_82209(
 .)

▶▶

G27

Machine Lock On G27 가
 Check .
 (inch) mm

1μ

Lamp 가 가 .

||

O (X 100, Y 100)

G90 G54 X0. Y0. Z0.

G27 X100. Y100. ()

G27 X10. (F_82209(.))

M30

7 (Coordinate System)

CNC

CNC

3

- (1) (Machine Coordinate System)
- (2) (Work-piece Coordinate System)
- (3) (Local Coordinate System,)

7.1 (Machine Coordinate System)

7.1.1 (G53, Machine Coordinate System Selection)

7.2 (Work -piece Coordinate System)

7.2.1 (G92, Work Coordinate System Setting)

7.2.2 1~6 (G54~G59, Work Coordinate System)

7.2.3 (G54~G59) (Work zero point offset setting)

7.2.4 (Shift) (Work-piece Coordinate Shift)

7.3 () (G52, Local Coordinate System)

7.4 (G17, G18, G19, Plane Selection)

7.1 (Machine Coordinate System)

7.1.1 (G53, Machine Coordinate System Selection)

```
G90 G53 X _ Y _ Z _
```

G90 (Absolute Command)
 G53 (Machine Coordinate System Selection)
 X_ Y_ Z_ (Position)

G53 . G53 One Shot
 G , , G91

가

G28
 1



1 G90 G53 X_ Y_ Z_ One Shot

, G22/G23 Stored Stroke Limit , Over
 Travel, 2, 3, 4 X0, Y0,
 Z0



```
N01 G40 G80 ;  
N02 G53 G90 X-140 Y-120 Z0 ; ( X-140 Y-120 Z0 )  
N03 G92 X0 Y0 Z150 ; ( )  
N04 G30 G91 Z0 ;  
N05 G54 G00 G90 X0 Y0 ;  
    ↓  
N60 M30 ;
```



7.2 (Work-piece Coordinate System)

7.2.1 (G92, Work-piece Coordinate System Setting)

```
G90 G92 X _ Y _ Z _
```

G90 (Absolute Command)

G92 (Work-piece Coordinate System Setting)

X_ Y_ Z_

(Position of Work-piece Coordinate System)

가

CNC

CNC

(1

, 2)

가 ,

G

2

G92

☐ ▶▶

G92

가


```

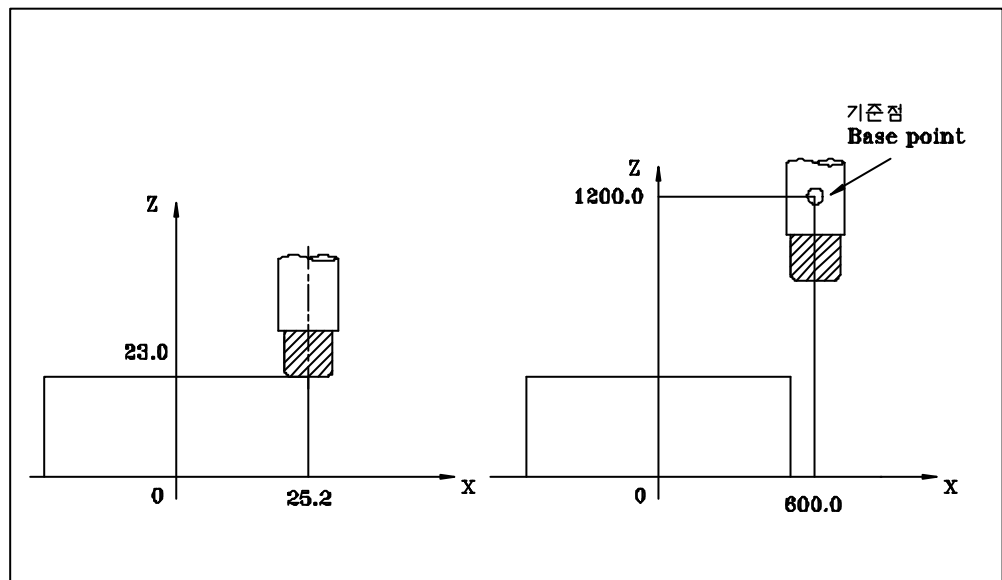
□ II G92      1
N01 G40 G80 ;

N02 G28 G91 X0 Y0 Z0 ;      (
                               [ G91      ] )

N03 □ G92 G90 X140 Y120 Z150 ; (      X0 Y0 Z0
                               X140 Y120 Z150
                               ,
                               [ G90      ]      )

N04 G30 G91 Z0 ;
N05 G00 G90 X0 Y0 ;
      ↓
N60 M30 ;
    
```

□ II 2



```

G92 X25.2 Z23 ;      :
G92 X600 Z1200 ;    :
    
```

7.2.2 1~6 (G54~G59, Work-piece Coordinate System)

G54	X	_	Y	_	Z	_
G55	X	_	Y	_	Z	_
G56	X	_	Y	_	Z	_
G57	X	_	Y	_	Z	_
G58	X	_	Y	_	Z	_
G59	X	_	Y	_	Z	_

G54	1	(Work-piece Coordinate System 1 Selection)
G55	2	(Work-piece Coordinate System 2 Selection)
G56	3	(Work-piece Coordinate System 3 Selection)
G57	4	(Work-piece Coordinate System 4 Selection)
G58	5	(Work-piece Coordinate System 5 Selection)
G59	6	(Work-piece Coordinate System 6 Selection)
X_ Y_ Z_		(Position of Work-piece Coordinate System)



NC 가 ,

G54 ~G59 G92 가 .

(0/1) " 0: " , POWER ON

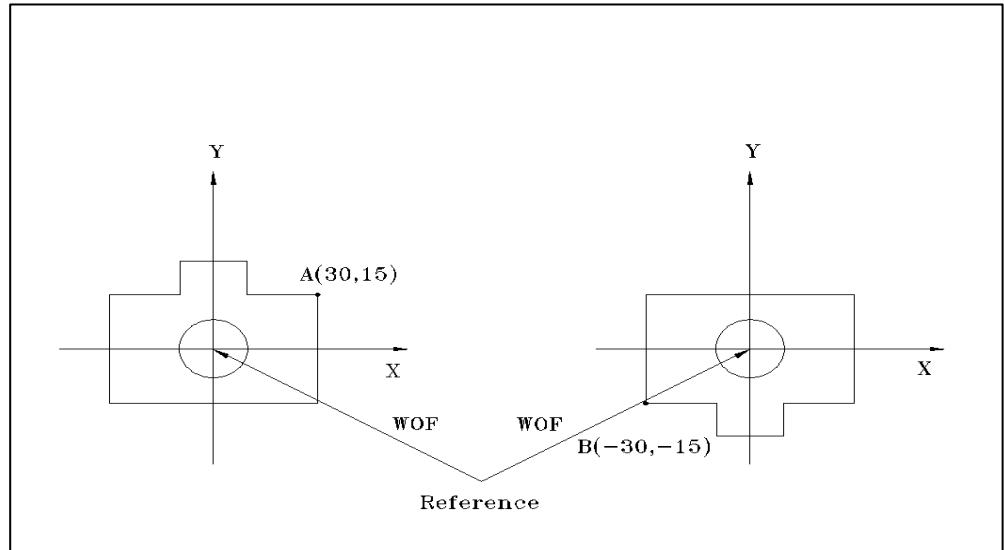
G54~G59, G92 G52 가

RESET POWER ON

가 Clear .

작업물 좌표계 (0/1)	0: 유지
---------------	-------

, Z “ + ” , X , Y “ ” 가 .



□ II 1

□ WOF :

G90 G54 G00 X30 Y15 ; (G54 A)

G55 X-30 Y-15 ; (G55 B)

□ II 2

□

G40 G80 ;

G28 G91 X0 Y0 Z0 ; ([G91])

G54 G00 G90 X0 Y0 Z0 ; (G54 , G54 .)



M30 ;

7.2.3 (G54~G59) (Work zero point offset setting)

(Offset Setting)

X, Y, Z (Offset Setting)

Mode Select Zero Return ⇒ Axis Select Z ⇒ +
Z X, Y

10 ⇒ F2 ⇒ F2

⇒ F2 ⇒ F1

Mode Select JOG ⇒ Spindle Override 100% ⇒ Spindle Start

Mode Select (JOG, X1, X10, X100)

G54 ~ G59

Z

X, Y

"| ±5 "

)가 가

가

Setting

7.2.4

(Shift) (Work-piece Coordinate Shift)

가
Shift

Shift 가 .

“ Shift ” .

< F2 F1 >

좌표계 Shift	
0/1	1: Shift 사용
X	0.000
Y	0.000
Z	10.000

가
Z Shift

Shift 가 가

: Shift

Shift Shift .
Shif 가 Shif
G92 , G54~G59

Shift “ Shift 0/1” 가 1

(-> F2 -> F1)

7.3 () (G52, Local Coordinate System)

```
G52 G90 X _ Y _ Z _
G52 X0 Y0 Z0
```

G90 (Absolute Command)
 G52 (Local Coordinate System Setting)
 G52 (Local Coordinate System Cancel)
 X_ Y_ Z_

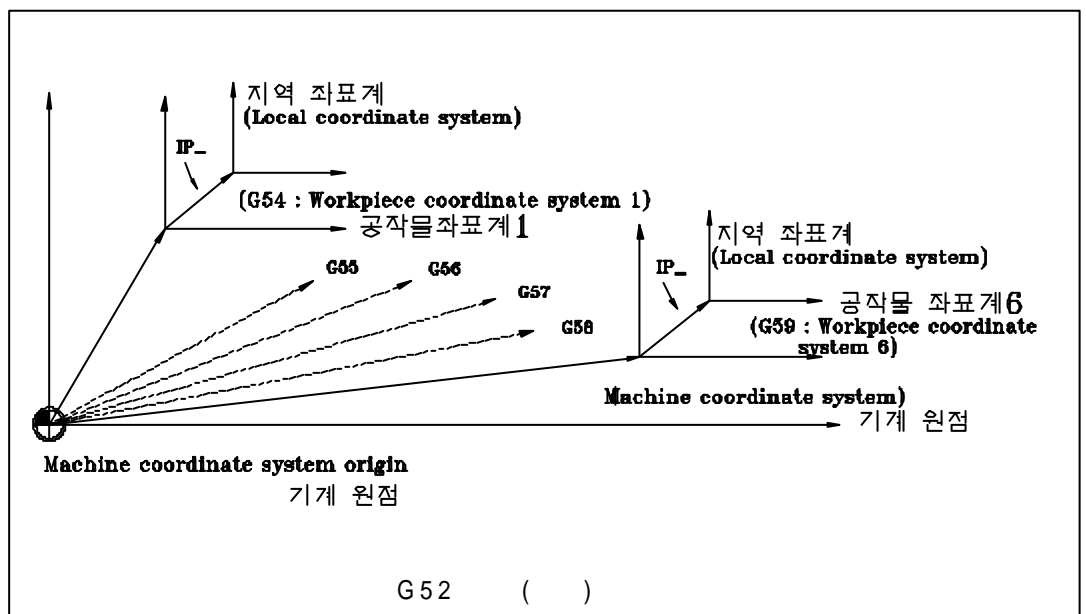
G52 X0 Y0 Z0

G54 ~ G59

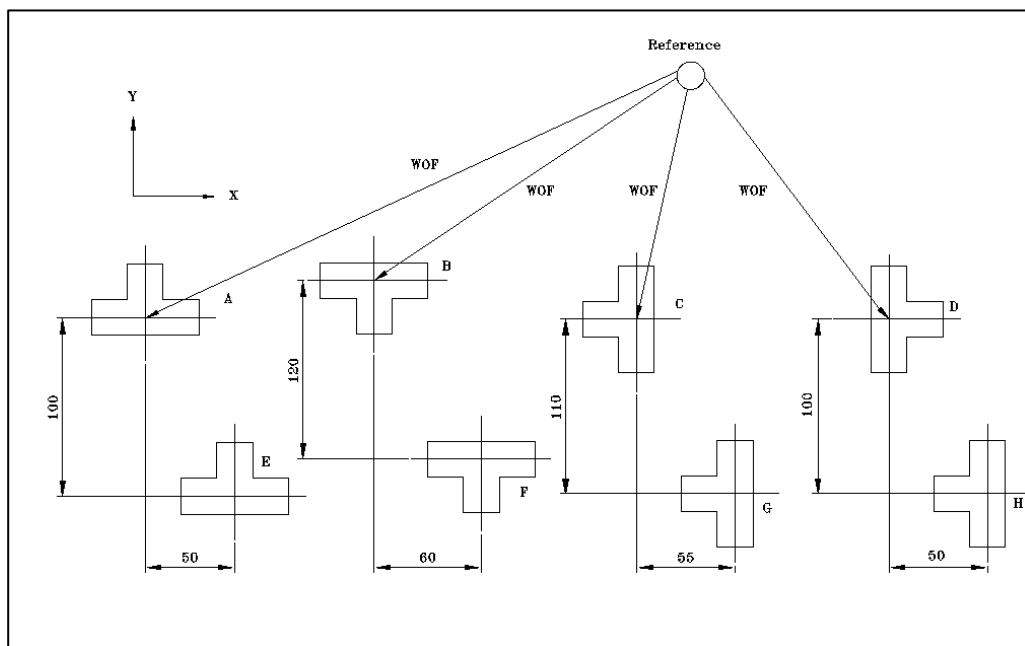
X_ Y_

Z_

가 0 Clear



II ()



II >>

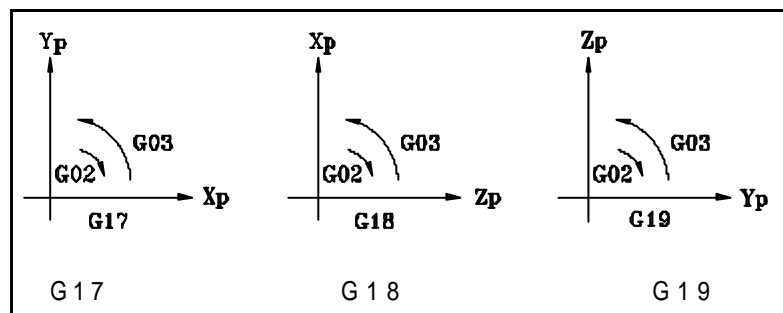
G90 G54 ;	(	A :	1)
G52 X50 Y-100 ;	(	E :	1)
G55 ;	(	B :	2)
G52 X60 Y-120 ;	(	F :	2)
G56 ;	(	C :	3))
G52 X55 Y-110 ;	(	G :	3)
G57 ;	(	D :	4)
G52 X50 Y-100 ;	(	H :	4)

7.4 (G17, G18, G19, Plane Selection)

G17	[G02 / G03]	X _ Y _	[I _ J _ / R _]	F _
G18	[G02 / G03]	X _ Z _	[I _ K _ / R _]	F _
G19	[G02 / G03]	Y _ Z _	[J _ K _ / R _]	F _

G17 X-Y (Selection of X-Y Plane)
 G18 Z-X (Selection of Z-X Plane)
 G19 Y-Z (Selection of Y-Z Plane)
 G02 / G03 CW/CCW (Circular Interpolation CW/CCW)
 X _ Y _ Z _ (Position)
 I _ J _ K _ () (Position of Arc Center)
 R _ (Radius)
 F _ (Feed Rate)

(G02/G03) (G41/G42) 가
 G .



PI 145 (#3145)

8

(Coordinate Value and Dimension)

(Absolute Command), (Incremental Command), (Polar Coordinates Command) .
, Inch/Metric

8.1 (G90, Absolute Command)

8.2 (G91, Incremental Command)

8.3 (G15, G16, Polar Coordinates Command)

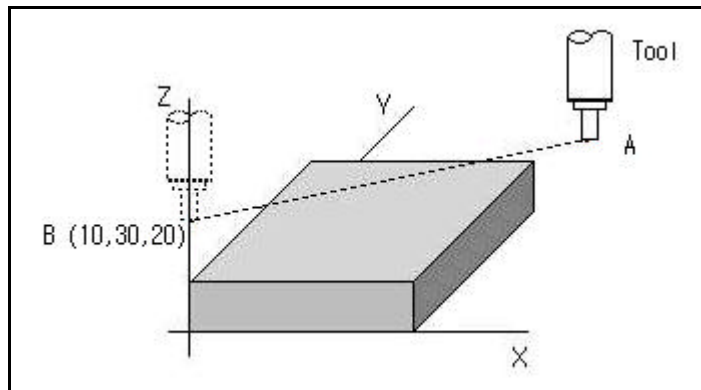
8.4 Inch / Metric (G20, G21, Inch Unit / Metric Unit)

8.1 (G90, Absolute Command)

```
G90 G00 X _ Y _ Z _
```

G90 (Absolute Command)
 G00 () (Rapid Traverse Positioning)
 X _ Y _ Z _ (Position)

|| (G90)



G90 X10. Y30. Z20. (A B)

8.2 (G91, Incremental Command)

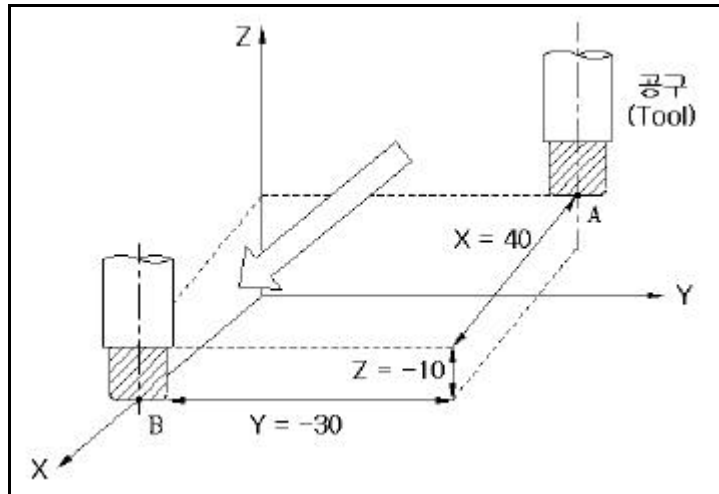
G91 G00 X _ Y _ Z _

G91 (Incremental Command)
 G00 () (Rapid Traverse Positioning)
 X _ Y _ Z _ (Position)

[] ,

, 가 .

II (G91) 1



G91 X40. Y-30. Z-10. (A B)

8.3 (G15, G16, Polar Coordinates Command)

G15
G16 X _ Y _

G15 (Polar Coordinates Command Cancel)

G16 (Polar Coordinates Command)

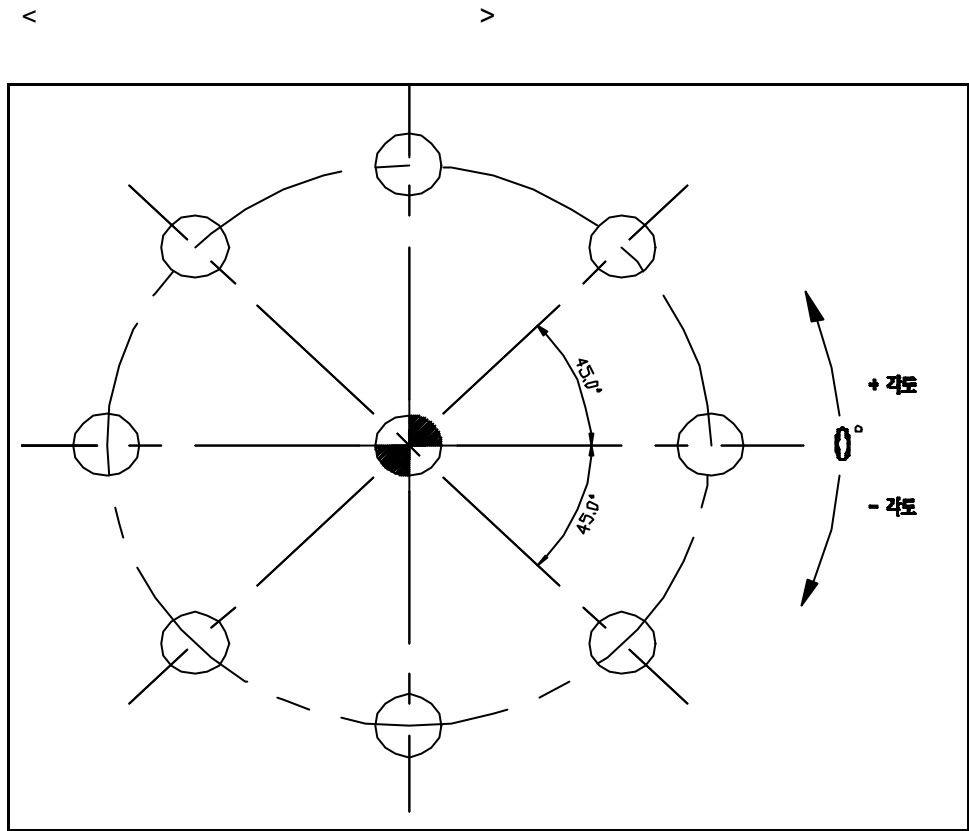
X _ (Radius of Arc)

Y _ (Angle of Rotation)

3 0°

CCW : “ + “ , CW : “ - “

가



▶▶

G_		
G17	X	Y
G18	Z	X
G19	Y	Z

“ + ” X

G90

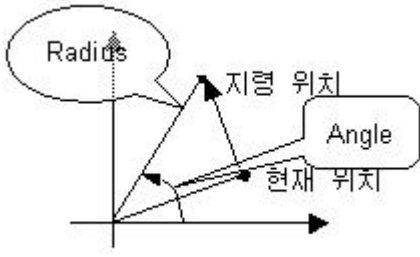
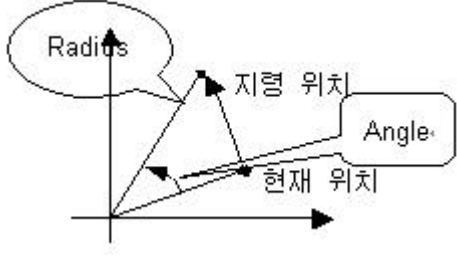
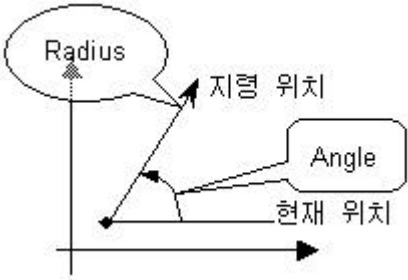
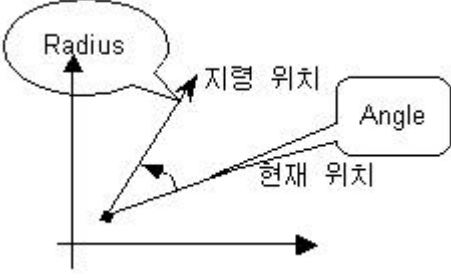
:

G91

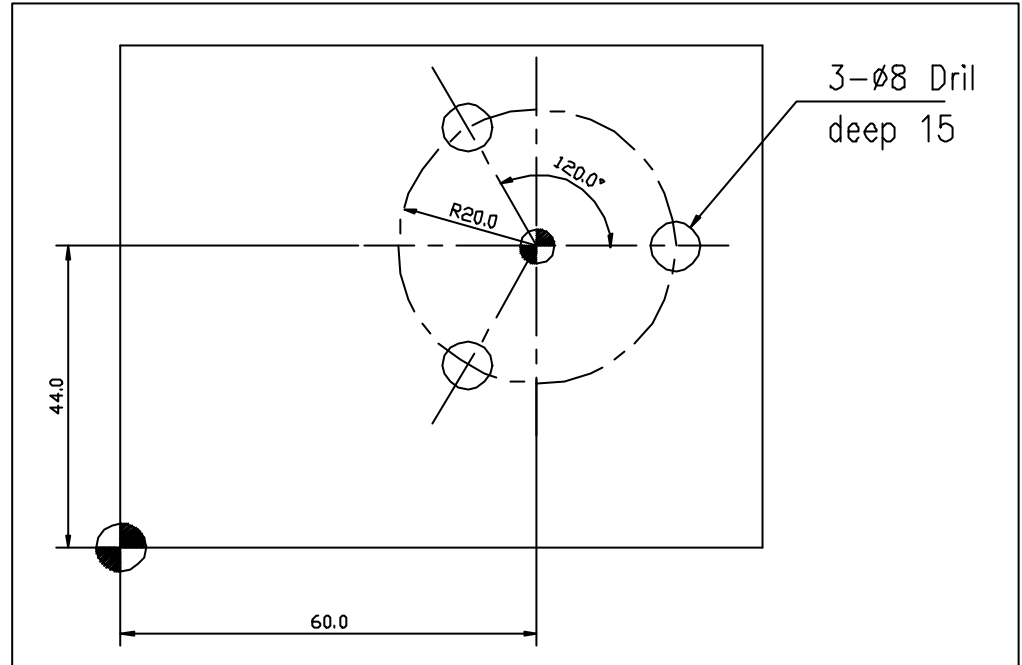
:

가

가

	(G90)	
(G90)	(G91)	
	(G90)	
(G91)	(G91)	

□ II



□ ▶▶

(G90)

N1 G40 G80 ; (,)

N2 G28 G91 X0 Y0 Z0 ; ()

N3 G92 G90 X150 Y150 Z150 ; ()



N50 G52 X60 Y44 ; ()

N51 G16 G17 ; (X Y)

N52 G81 G90 G99 X20 Y0 Z-15 R3 F100 ; (① 가)
(X20 : , Y0 :)

N53 Y120 ; (② 가)

N54 Y240 ; (③ 가)

N55 G15 G00 Z50 M09 ; ()

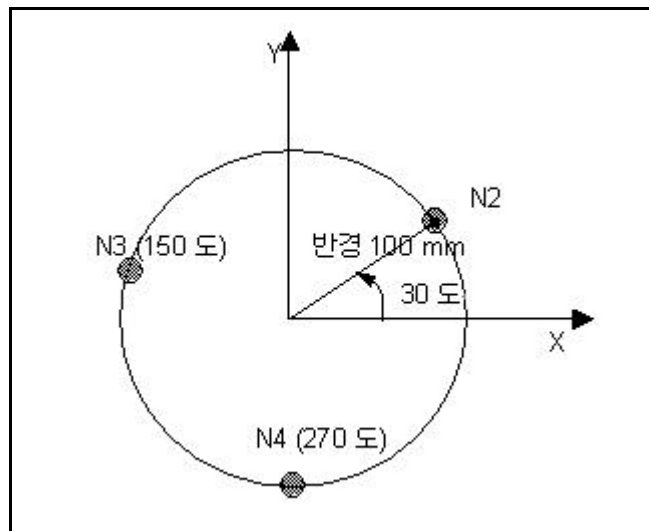


(G91)



N50 G90 X60 Y44 Z10 ; ()
N51 G16 G17 ; (X Y)
N52 G81 G91 G99 X20 Y0 Z-22 R-7 F100 ; (① 가)
N53 Y120 ; (② 가)
N54 Y120 (③ 가)
N55 G15 G00 Z50 M09 ; ()

$\square \gg [\quad , \text{ Bolt Hole cycle : } \quad 30 , \quad 120 , \quad 3 \quad]$
 , (Both radius and angle are absolute)
 N1 G17 G90 G16
 N2 G81 X100. Y30. Z-20. R-5. F200.
 N3 Y150.
 N4 Y270.
 N5 G15 G80



$\square \gg [\quad , \quad]$
 N1 G17 G16
 N2 G81 G90 X100. Y30. Z-20. R-5. F200. ($\quad 100\text{mm}, \quad 30$ point)
 N3 G91 Y120.
 N4 Y120.
 N5 G15 G80

:

- Dwell (G04 X_)
- G10 (G10)
- (G52)
- (G92)
- (G53)
- (G22 X_Y_Z_I_J_K_)
- (G68 X_Y_)
- (G51 X_Y_)
- (G02/G03) 가

8.4 Inch / Metric (G20, G21, Inch Unit / Metric Unit)

<p>G20 G21</p>

G20 Inch
G21 mm

mm inch G
 가 inch mm (Metric)
 inch Metric
 G20 / G21

< >

G		
G20	Inch	0.0001 inch
G21	Metric	0.001 mm

G G 가
 () , G20/G21
 CNC
 mm . NC

PI 147 (#3147)

Inch Metric
 가 Inch Metric

:
G20/G21
G20/G21
PA 0
(Metric/ Inch)
PA 374~405
가 0
Metric
(Inch/Metric)
PA 0
가 1
PA 0

9 (Spindle Function)

9.1 (G96, Constant Surface Speed Control)

9.2 (G97)
(Constant Surface Speed Control Cancel)

9.3 (G92)
(Clamp at Maximum Spindle Speed)

9.1

(G96, Constant Surface Speed Control)

```
G96 S _
```

G96 (Constant Surface Speed Control)

S_ [m / min]

S rpm

M03 M04 0

가 가 ,

가 가

(G96)

(G96)

CNC 가

가 S

가

G97

CNC

C 가

가

가



❶ V [m/min]

$$V = \frac{p \cdot DN}{1000}$$

(D : [mm], N : [rpm])

❷ [Rough Cutting : N rpm]

$$N = \frac{1000 \cdot V}{p \cdot D}$$

(D : [mm], V : [m/min])

9.2

(G97, Constant Surface Speed Control Cancel)

G97 S _

G97

(Constant Surface Speed Control Cancel)

S _

[rpm]

G

rpm

S 5

G97

□ ||

G97 S800

(

800

)

9.3

(G92, Clamp at Maximum Spindle Speed)

G92 S _

G92

(Clamp at Maximum Spindle Speed) [rpm]

rpm

G96()

G92

(G97)

▶▶

G92

PM 3360(#23360)

PM 3361(#23361)

G92

||

G92 S500 (500rpm)

G96 S2000 (2000 mm/min)

M03 (500 rpm)

10

(Tool Function)

T (: , : Offset)
 T0305 , 3 Offset 5

10.1 (Tool Selection Command)

10.1.1 T ()
 (Macro Program Call by T Code)

10.1.2 M ()
 (Macro Program Call by M Code)

10.1 (Tool Selection Command)

T _

T_ (Tool Selection Command)

T 2 가 .
 T 가 . 2
 T 가 . (1)
 (2)
 가 (MTB, Machine Tool Builder)

10.1.1 T () (Macro Program Call by T Code)

ATC T , 9000.NC ~
 9009.NC
 PI 106
 (#3106) 1 .
 T 가 (9000.nc 9009.nc)
 PI 105(#3105) 0
 9000

PI 105(#3105)	T
PI 106(#3106)	T

10.1.2 M () (Macro Program Call by M Code)

T M
 PI 106(#3106) 0 T
 (9020~9029.nc) M
 (M00, M02, M30).
 M

PI 95 ~ 104 (#3095~3104)	M
--------------------------	---

PI 95	21	9020.nc 호출 M Code
PI 96	0	9021.nc 호출 M Code
PI 97	0	9022.nc 호출 M Code
PI 98	0	9023.nc 호출 M Code
PI 99	0	9024.nc 호출 M Code
PI 100	0	9025.nc 호출 M Code
PI 101	0	9026.nc 호출 M Code
PI 102	0	9027.nc 호출 M Code
PI 103	0	9028.nc 호출 M Code
PI 104	0	9029.nc 호출 M Code

11 (M Code)

가

M [M00 M999]
M NC
On/Off

11.1 M (Table of General M Codes)

11.2 M
(Sub-program Call by M Code)

11.1 M (Table of General M Codes)

M (MTB)
 , M
 , M
 (MTB)
 M 10 가
 < M >

M		
M00	Program Stop	M00
M01	Optional Stop	Optional Stop Switch On M00 On
M02	End of Program	RESET M30
M03	[CW]	
M04	[CCW]	
M05		
M06		(ATC)

M08	On	가 . 가 On , Auto 가 Off
M09	Off	.
M30	End of Tape	[가] RESET
M98		.
M99		[]

11.2 M

(Sub-program Call by M Code)

가 M
 M PI 95 ~
 104 (#3095~3104) . M
 9020.nc ~ 9029.nc . local
 (#1 ~ #33) 가 , 가 .

- PI 95~104 (#3095~3104) M

```
G65 P _ < >
```

```
M __ < >
```

G65 (Macro Program Call)
 P _ () (Macro Program Name)
 M __ (PI 95~104) M
 (Macro Program Call M Code, Parameter PI 95~104)

- M FIN, M 가 .(M98, M99)
- M01 ~ M97 10 가 .(9020 ~ 9029)
- G M , T MXX 가
 M .
- M 가

```
M98 P __
```


M__

M98 M (Sub-program Call M Code)

P__ () (Sub-program Name)

M__ M

(Sub-program Call M Code setted at Parameter)

- G M , T M__ 가
M .

12

(Canned Cycles)

가 가

G73 ~ G89

12

G

G80

12.1 (General information about Canned Cycle)

12.1.1 (Action of Canned Cycle)

12.1.2

(G73~G89, Method of Canned Cycle Command)

12.1.3 (G90 / G91)

(Absolute & Incremental Command at the Canned Cycle)

12.1.4 (G98) R (G99) (Return of Initial Point / R Point)

12.2 (Use of Canned Cycle)

12.2.1 (G80, Canned Cycle Cancel)

12.2.2 (Caution of Canned Cycle Command)

12.2.3 가 (Caution of Canned Cycle Command)

12.3 (Explanation of various Canned Cycles)

12.3.1 / (G81, Drilling Cycle / Spot Drilling Cycle)

12.3.2

(G82, Drilling Cycle / Counter Boring Cycle)

12.3.3 (G83, Peck Drilling Cycle)

12.3.4 (G73, High-Speed Peck Drilling Cycle)

12.3.5 (G84, Tapping Cycle) RIGID Tap

(G84.2, RIGID Tapping Cycle)

12.3.6 (G74) RIGID Tap (G84.3)

(Counter Tapping Cycle & Counter Rigid Tap Cycle)

12.3.7 (G85, Boring Cycle)

12.3.8 (G86, Boring Stop Cycle)

12.3.9 (G76, Fine Boring Cycle)

12.3.10 (G87, Back Boring Cycle)

12.3.11 (G88, Manual Boring Cycle)

12.3.12 (G89, Boring Dwell Cycle)

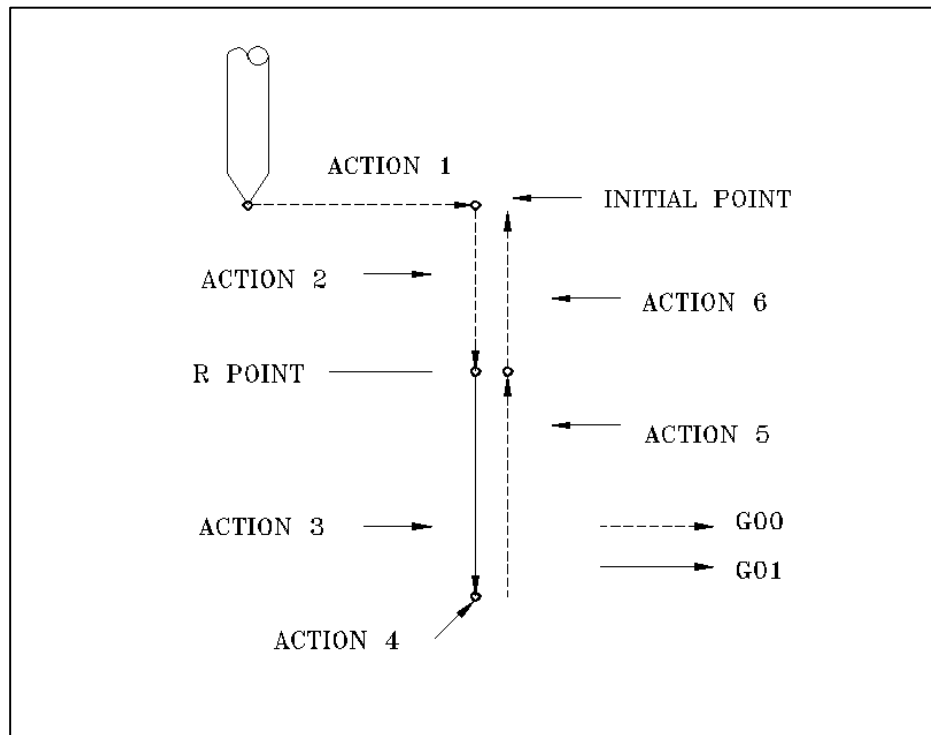
12.4 (Example of Canned Cycle)

12.1 (General Information about Canned Cycle)

12.1.1 (Action of Canned Cycle)

6 가

- 1 (Action 1) X, Y , (Positioning of axes. Axes is selected by plane)
- 2 (Action 2) R (Rapid traverse up to point R)
- 3 (Action 3) 가 (Drilling)
- 4 (Action 4) (Operation at the bottom of a hole)
- 5 (Action 5) R (Retraction to point R)
- 6 (Action 6) (Rapid traverse up to the initial point)



→: (Cutting Feed) - - - - ->: (Rapid Traverse)



(Initial Point)

Z

X, Y

Z

가

,

X

Y

가

12.1.2

(G73~G89, Method of Canned Cycle Command)

{G73~G89} [G90/ G91] [G98/ G99] X_ Y_ Z_ R_ Q_ P_ F_ K_

G17 ~ G18

(Plane selection)

G73 ~ G89

(Canned cycle)

G90 / G91

/ (Absolute/Incremental command)

G98 / G99

/ R

(Return of initial point / Return of R point)

X_ Y_

(Position of hole)

Z_ R_ Q_ P_

(Data of canned cycle)

F_

(Feed rate)

K_

(Count of repeat)

< X - Y (G17) >

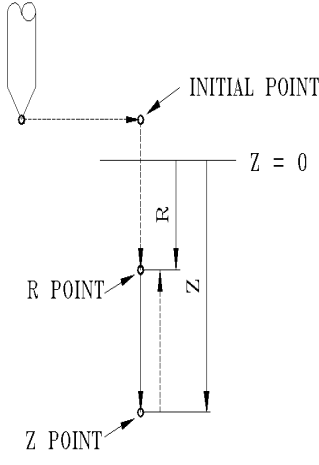
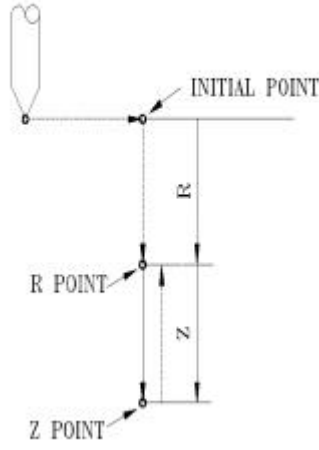
G17 ~ G19	G	, 가
	G	
G90 ~ G91	G	,
G98 ~ G99	G	R
	X, Y	가 G00
	Z	가 G01 Z , R
	R	<12.1.4 (G98) R (G99)>
	Q	G73, G83 G76, G87 Shift
	P	
	F	가
	K	K1 , K K0

12.1.3

(G90/G91, Absolute & Incremental Command at the Canned Cycle)

```

                R           Z
                .
                Z0       .
,Z           R           .
<           >
    
```

G90 []	G91 []
<p>X_Y_Z_ .</p>	<p>X_Y_Z_ . , Z R .</p>
	



5 가

Z

가

G		
G17	X, Y	Z
G18	Z, X	Y
G19	Y, Z	X


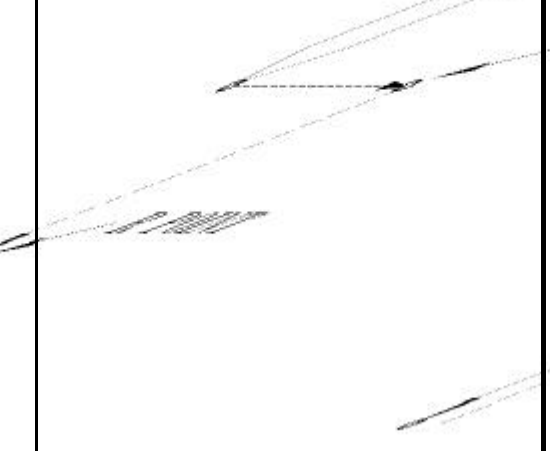
12.1.4

(G98) R

(G99) (Return of Initial Point / R Point)

가 Z G , Z G
 Z G98 , G99
 R
 G99 가 , R R
 가 , R R

< (G98) R (G99) >

G98 []	G99 [R]
R	R
	



G98 ()

: 가 R

G99 (R)

: 가 R , R 가

G90 , R

: Z 0 가 R G00

G91 , R

: 가 R G00

12.2

(Use of Canned Cycles)

MCT G		가		
G80	(Canned Cycle Cancel)			
G81	(Drilling Cycle)			
G82	(Drilling Dwell Cycle, Counter Boring Cycle)		(Dwell)	
G83	(Peck Drilling Cycle)			
G73	(High Speed Peck Drilling Cycle)			
G84	(Tapping Cycle)			
G74	(Counter Tapping Cycle)			
G84.2	(Rigid Tap Cycle)			
G84.3	(Rigid Counter Tap Cycle)			
G85	(Boring Cycle)			
G86	(Boring Stop Cycle)			
G76	(Fine Boring Cycle)		Shift	Shift
G87	(Back Boring Cycle)	Shift	Shift	
G88	(Manual Boring Cycle)		IPR CYCLE_START	
G89	(Boring Dwell Cycle)			

12.2.1

(G80, Canned Cycle Cancel)

G80

G80 [Canned Cycle Cancel]

G80 R , Z R = 0 ,
 Z = 0 가 가
 G01 G00, G01, G02, G03, G33



G00 X_ M03 ;
 G81 X_ Y_ Z_ R_ F_ K_ ; : Z_ , R_ , F_ ,
 . G81 가 K
 Y_ ; : 가 , 가
 G81, Z_ , R_ , F_ 가
 가 Y_ G81
 가 1 .
 G82 X_ P_ K_ ; : 가 X
 G82 가 Z_ , R_ ,
 F_ 가 P_ 가
 K_ .
 G80 X_ Y_ ; : 가
 F_ .
 G85 X_ Z_ R_ P_ ; : 가 F_ Z_ , R_ F_ .
 . P_ .
 X_ Z_ ; : Z_ 가 X_ .
 G89 X_ Y_ ; : Z_ , R_ , P_ G89
 F_ 가
 가 .
 G01 X_ Y_ ; : 가 , 가 (F)

12.2.2

(Caution of Canned Cycle Command)

M
 가 .
 G00 G 가
 , G .
 I_, J_ I_, J_
 가 .
 X_, Y_, Z_, R_
 가
 X_, Y_, Z_, R_ 가 X_가 가
 G04 X_; 가
 가 Q_, P_ 가
 , X_, Y_, Z_ R
 가 (Q_,
 P_) .
 G74, G84, G86
 X_, Y_ G74, G84, G86 가
 R - Z 가
 가
 G04 가 가
 G74, G84 가
 R 가
 G74, G84 가 가
 1 M 가 L(K) 1
 M 가
 G45 ~ G48
 G43, G44, G49
 R 2
 G04P_ 가
 P .

12.2.3

가

(Caution of Canned Cycle Command)

RESET

RESET

가 , 가

G00, G01, G02, G03

G80

G 01

가 .

1 가 3 1, 2, 6

6 가 ,

X, Y

R

R (G99), (G98)

[LED]가

가 , 가

G74, G84
6

3~5

6

G74, G84

100%

12.3 (Explanation of various Canned Cycles)

12.3.1 / (G81, Drilling Cycle / Spot Drilling Cycle)

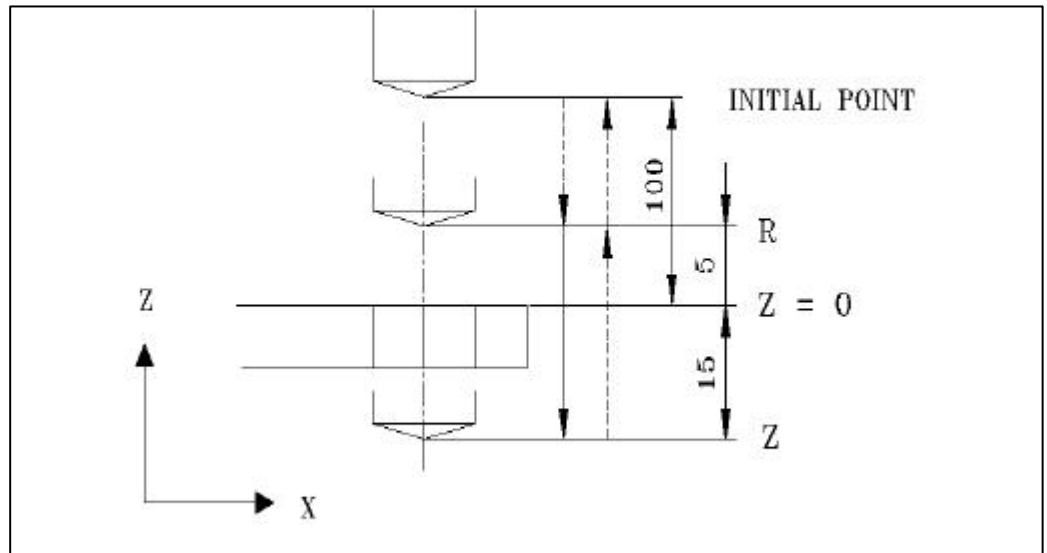
G81 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ F _ K _

G81 /
(Drilling Cycle/Spot Drilling Cycle)

X _ Y _	가	(Position of the hole)
Z _	가	(Depth of the hole)
R _	R	(Position of R point)
F _		(Feed rate)
K _		(Count of repeat)

Drilling, Reaming, Spot boring 가
가 .

📖 G81 G98



(G92 X0 Y0 Z100 ;)

N1 S500 M03 ;

N2 G90 G99 G81 X75 Y50 Z-15 R5 F100 ;


N3 Y-50 ;

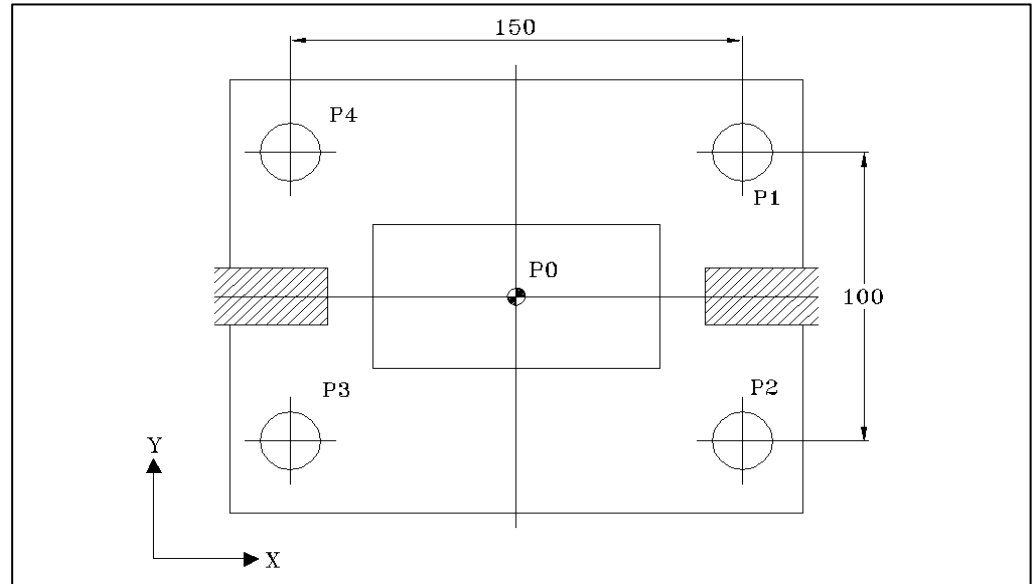
N4 X-75 ;

N5 G98 Y50 ;

N6 G80 G00 X0 Y0 M05 ;

N7 M30 ;

 G81 G99



Y



(G92 X0 Y0 Z100 ;)

N1 S500 M03 ;

N2 G90 G98 G81 X75 Y50 Z-15 R5 F100 ; ()

N3 G99 Y- 50 ; (R)

N4 G98 X- 75 ; ()

N5 Y50 ; ()

N6 G80 G00 X0 Y0 M05 ;

N7 M30 ;

12.3.2

/

(G82, Drilling Cycle / Counter Boring Cycle)

G82 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ P _ F _ K _

G82

/

(Drilling Cycle / Counter Boring Cycle)

X _ Y _

가

(Position of the hole)

Z _

가

(Dept of the hole)

R _

R

(Position of R point)

P _

가

G04

P

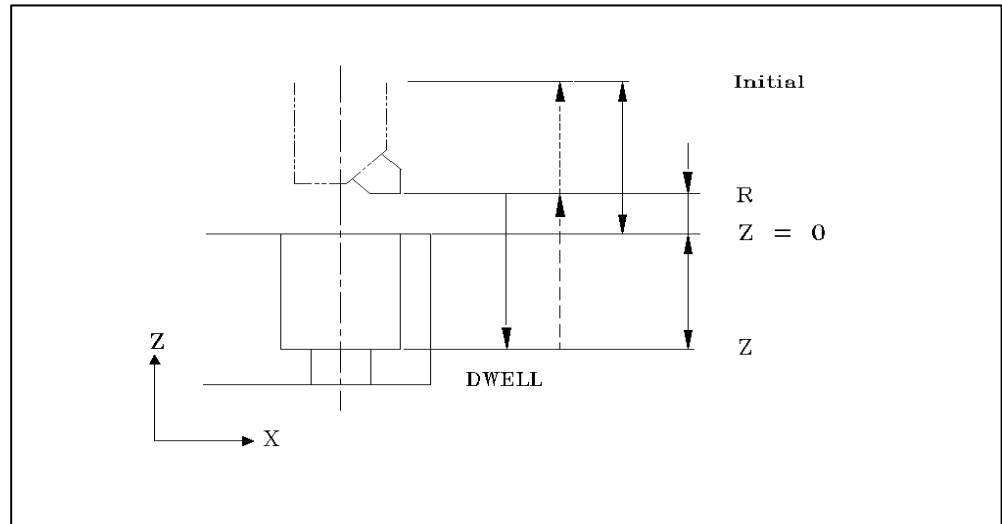
G81

. P500

0.5

Counter Boring, Spot Boring 가

 G82



(G92 X0 Y0 Z100;)

N1 S600 M03 ;

N2 G90 G99 G82 X75 Y50 Z-50 R5 P500 F100 ;

N3 Y-50 ;

N4 X-75 ;

N5 G98 Y50 ;

N6 G80 G00 X0 Y0 M05 ;

N7 M30 ;

12.3.3

(G83, Peck Drilling Cycle)

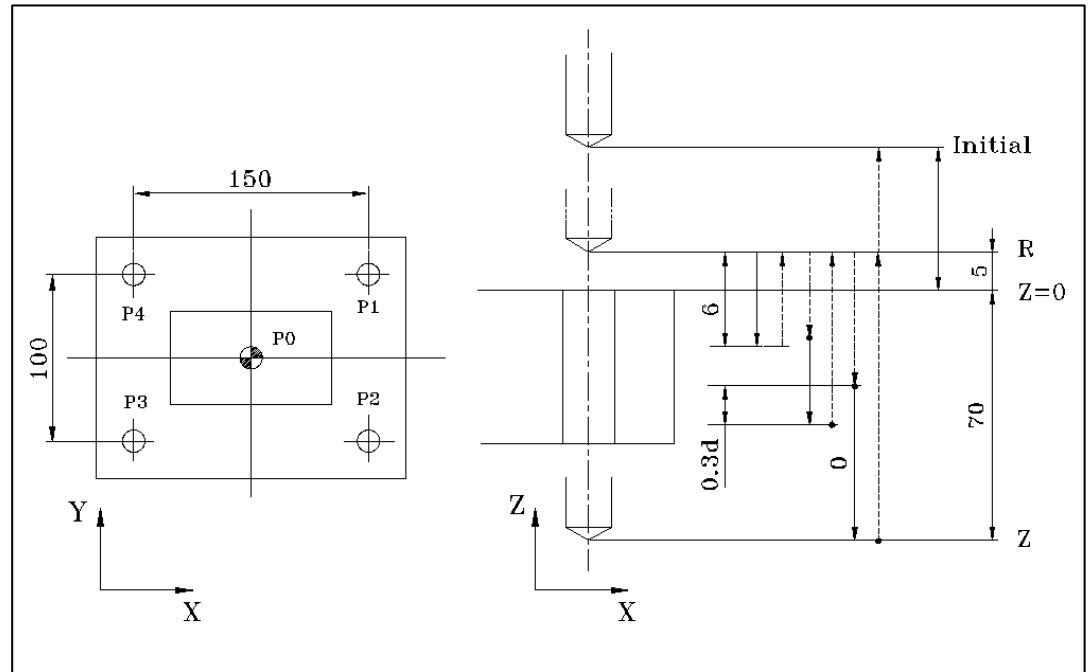
```
G83 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ Q _ F _ K _
```

G83 (Peck Drilling Cycle)
 X _ Y _ 가 (Position of the hole)
 Z _ 가 (Depth of the hole)
 R _ R (Position of R point)
 Q _ + Q
 R Z 가 G81 .

가

. 'Q' 1 'R'
 , 'd'
 'Q' Z 가 . '
 (d)' PI 129(#3129)
 가 가

 G83



(G92 X0 Y0 Z100 ;)

N1 S500 M03 ;

N2 G90 G99 G83 X75 Y50 Z-70 R5 Q6 F100 ;

N3 Y-50 ;

N4 X-75 ;

N5 G98 Y50 ;

N6 G80 G00 X0 Y0 M05 ;

N7 M30 ;

12.3.4

(G73, High-Speed Peck Drilling Cycle)

```
G73 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ Q _ F _ K _
```

G73 (High-Speed Peck Drilling Cycle)

X _ Y _ 가 (Position of the hole)
 Z _ 가 (Depth of the hole)
 R _ R (Position of R point)
 Q _ (Cutting Dept per cycle)
 F _ (Feed rate)
 K _ (Count of Repeat)

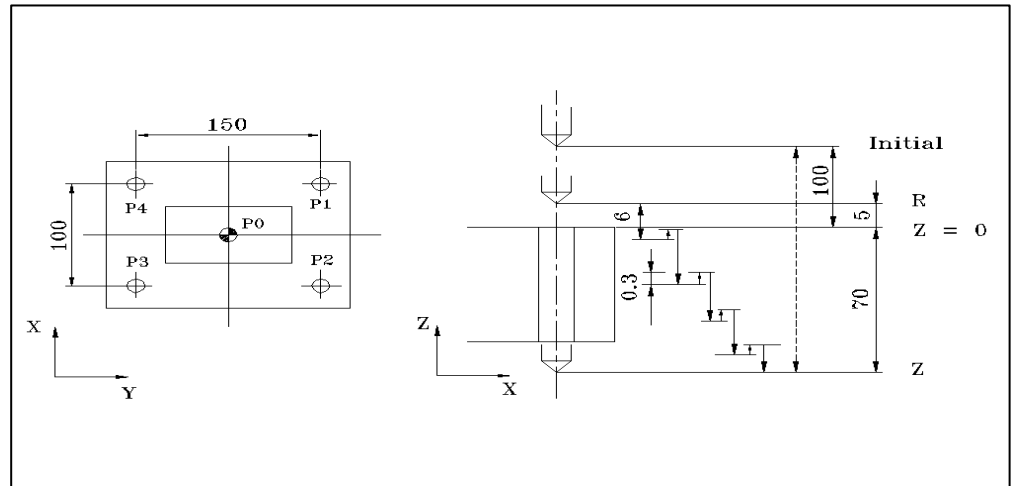
가

Long

' Q ' 1 ' d ' .
 ' Q ' ' d ' .
 Z 가 . ' .
 (d) ' PI 129(#3129) .

(G83) ' R ' , ' d ' 가

 G73



```

(G92 X0 Z100;)
N1 S500 M03 ;
N2 G90 G99 G73 X75 Y50 Z-70 R5 Q6 F100 ;
N3 Y-50 ;
N4 X-75 ;
N5 G98 Y50 ;
N6 G80 G00 X0 Y0 M05 ;
N7 M30 ;

```


12.3.5 (G84) RIGID Tap (G84.2)
(Tapping Cycle & RIGID Tapping Cycle)

G84 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ P _ F _ K _

G84 (Tapping Cycle)

X _ Y _ 가 (Position)
 Z _ 가 (Depth)
 R _ R (Position of R point)
 F _ 가 (Feed rate)
 P _ dwell (Dwell time)
 K _ (Count of repeat)

(M3) Z 가 , (M4) R

G84.2 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ P _ F _ K _

G84.2 RIGID (RIGID Tapping Cycle)

G84.3 RIGID (Counter RIGID Tapping Cycle)

RIGID Tap 가 가 .
 RIGID Tap Z (TAP 가) Tap 가 가
 . RIGID Tap 가 Tap 가
 가 .



가 Feed-Hold Z
가 가 .

가

$$F = n \times f$$

F	가 [mm/min]
n	[rpm]
f	[mm]

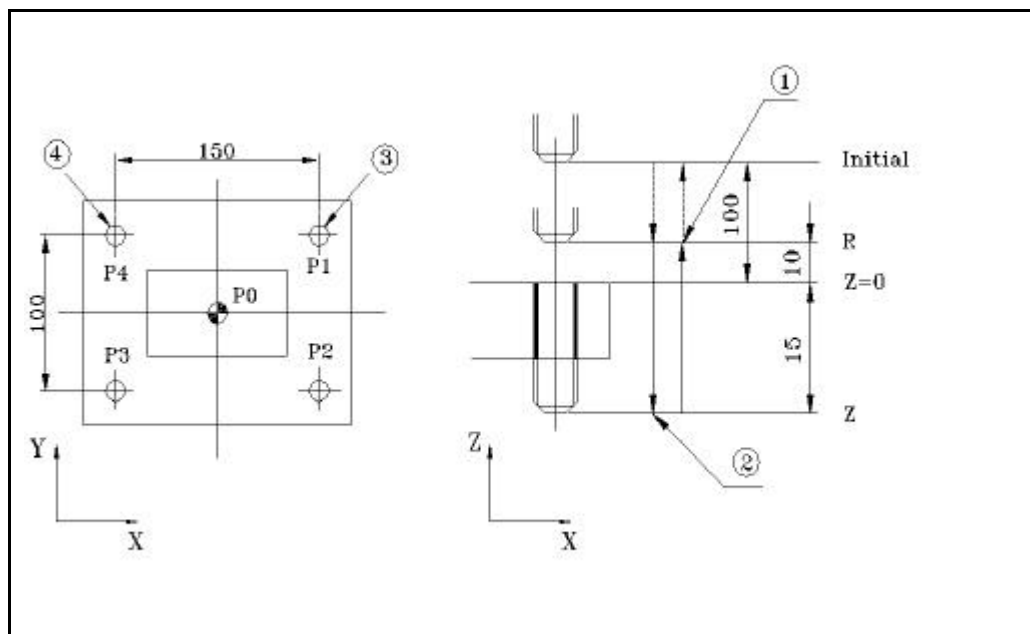


M10 × P1.5 가 가 300 rpm
?



$$F = n \times f \quad F = 300 \times 1.5 = 450 \text{ mm} .$$

 G84



1 : 2 : .

3 : 가 4 : 가

N1 S640 M03;

N2 G90 G99 G84 X75 Y50 Z-15 R10 F640; : Tap 가 R
10mm

N3 Y-50;

N4 X-75;

N5 G98 Y50;

N6 G80 G00 X0 Y0 M05;

N7 M30;

12.3.6 (G74) RIGID Tap (G84.3)
 (Counter Tapping Cycle & Counter Rigid Tap Cycle)

```
G74 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ P _ F _ K _
```

G74 (Counter Tapping Cycle)

X _ Y _ 가 (Position)
 Z _ 가 (Depth)
 R _ R (Position of R point)
 P _ Dwell (Dwell time)
 F _ 가 (Feed rate)
 K _ (Count of repeat)

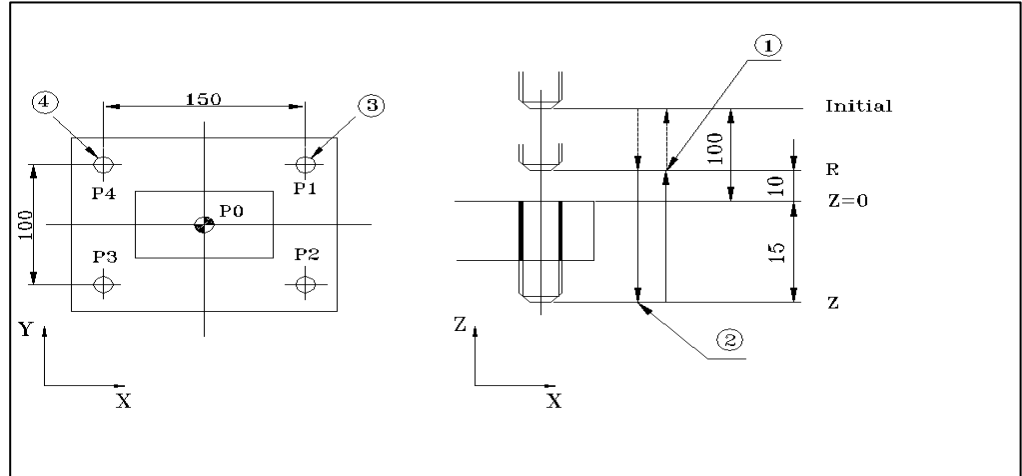
(M4) Z 가 , (M3) R

```
G84.3 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ P _ F _ K _
```

G84.3 RIGID Tap (Counter RIGID Tapping Cycle)

RIGID Tap 가 가 .
 RIGID Tap Z (TAP 가) Tap 가 가
 . RIGID Tap 가 Tap 가
 가

📖 G74



1 : 2 :
 3 : 가 4 : 가

```
( G92 X0 Y0 Z100 ; )
N1 S640 M04 ;
( Tap 가                      R   10mm                      )
N2 G90 G99 G74 X75 Y50 Z-15 R10 F640 ;
N3 Y-50 ;
N4 X-75 ;
N5 G98 Y50 ;
N6 G80 G00 X0 Y0 M05 ;
N7 M30 ;
```

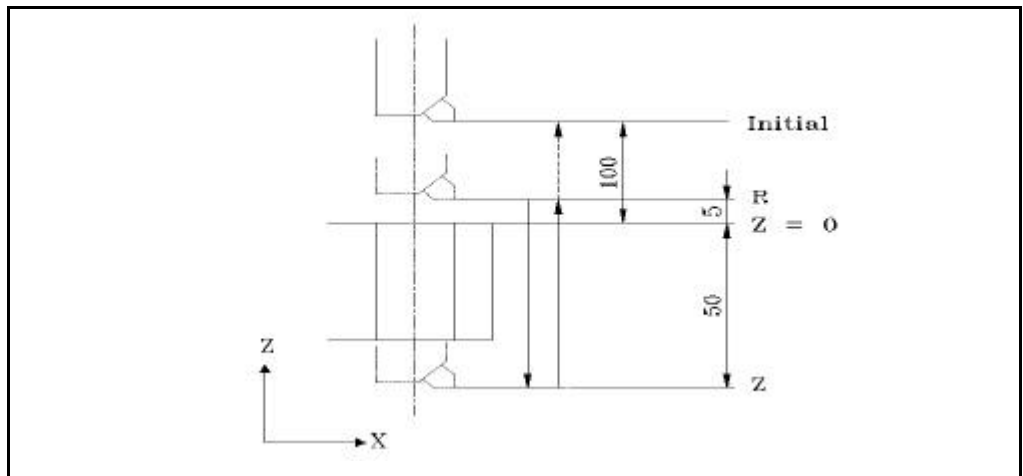
12.3.7 (G85, Boring Cycle)

G85 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ F _ K _

G85 (Boring Cycle)

X_ Y_ 가 (Position)
 Z_ 가 (Depth)
 R_ R (Position of R point)
 F_ (Feed rate)
 K_ (Count of repeat)

(Boring) 가
 가 .

 G85


```
( G92 X0 Y0 Z100; )
```

```
N1 S500 M03 ;
```

```
N2 G90 G99 G85 X75 Y50 Z-50 R5 F100 ;
```

```
N3 Y-50 ;
```

```
N4 X-75 ;
```

```
N5 G98 Y50 ;
```

```
N6 G80 G00 X0 Y0 M05 ;
```

```
N7 M30 ;
```

12.3.8

(G86, Boring Cycle)

G86 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ F _ K _

G86 (Boring Cycle)

X _ Y _ 가 (Position)

Z _ 가 (Depth)

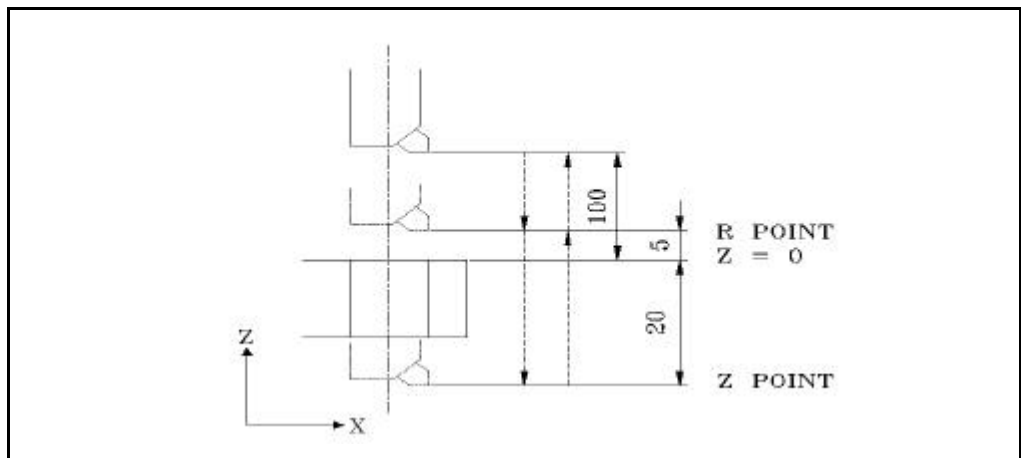
R _ R (Position of R point)

F _ (Feed rate)

K _ (Count of repeat)

가 Z M05

 G86



(G92 X0 Y0 Z100 ;)

N1 S500 M03 ;

N2 G90 G99 G86 X75 Y50 Z-50 R5.0 F100 ;

N3 Y-50 ;

N4 X-75 ;

N5 G98 Y50 ;

N6 G80 G00 X0 Y0 M05 ;

N7 M30 ;

12.3.9

(G76, Fine Boring Cycle)

G76 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ Q _ F _ K _

G76 (Fine Boring Cycle)

X _ Y _ 가 (Position)

Z _ 가 (Depth)

R _ R (Position of R point)

Q _ Shift .
Shift PI 70(#3070), PI 71(#3071)

. Z 가 Z

. I _ J _ Q Shift

F _ (Feed rate)

K _ (Count of repeat)

(Orientation) . Q (I, J)

R .

:

Modal Q G73 G83

12.3.10

(G87, Back Boring Cycle)

G87 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ Q _ F _ K _

G87 (Boring Cycle / Back Boring Cycle)

X _ Y _ 가 (Position)

Z _ 가 (Depth)

R _ R (Position of R point)

Q _ Shift .

Shift PI 70(#3070), PI 71(#3071)

Z 가 Z

F _ (Feed rate)

K _ (Count of repeat)

R Q

R Z

Q

:
Modal Q G73 G83

12.3.11

(G88, Boring Cycle)

G88 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ P _ F _ K _

G88

(Boring Cycle)

X _ Y _

가

(Position)

Z _

가

(Depth)

R _

R

(Position of R point)

P _

가

, G04

F _

(Feed rate)

K _

(Count of repeat)

가

Z

(handle, JOG)

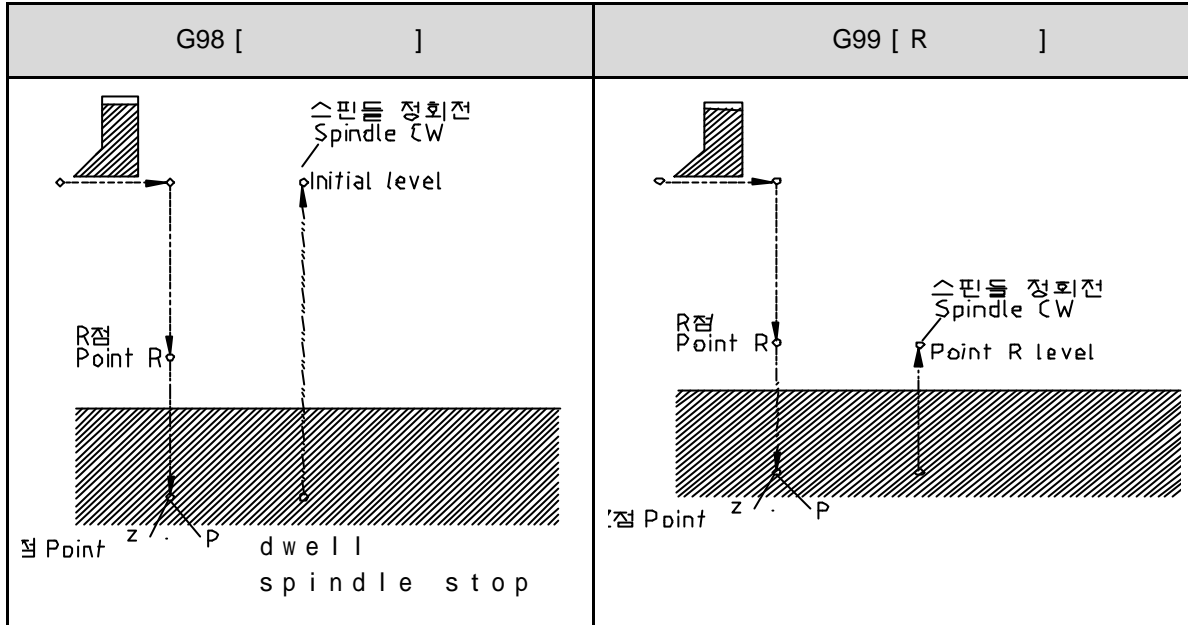
R

G

G

MPG

R



12.3.12

(G89, Boring Dwell Cycle)

G89 [G90 / G91] [G98 / G99] X _ Y _ Z _ R _ P _ F _ K _

G89

(Boring Dwell Cycle)

X _ Y _

가

(Position)

Z _

가

(Depth)

R _

R

(Position of R point)

P _

가

, G04

F _

(Feed rate)

K _

(Count of repeat)

G89

가

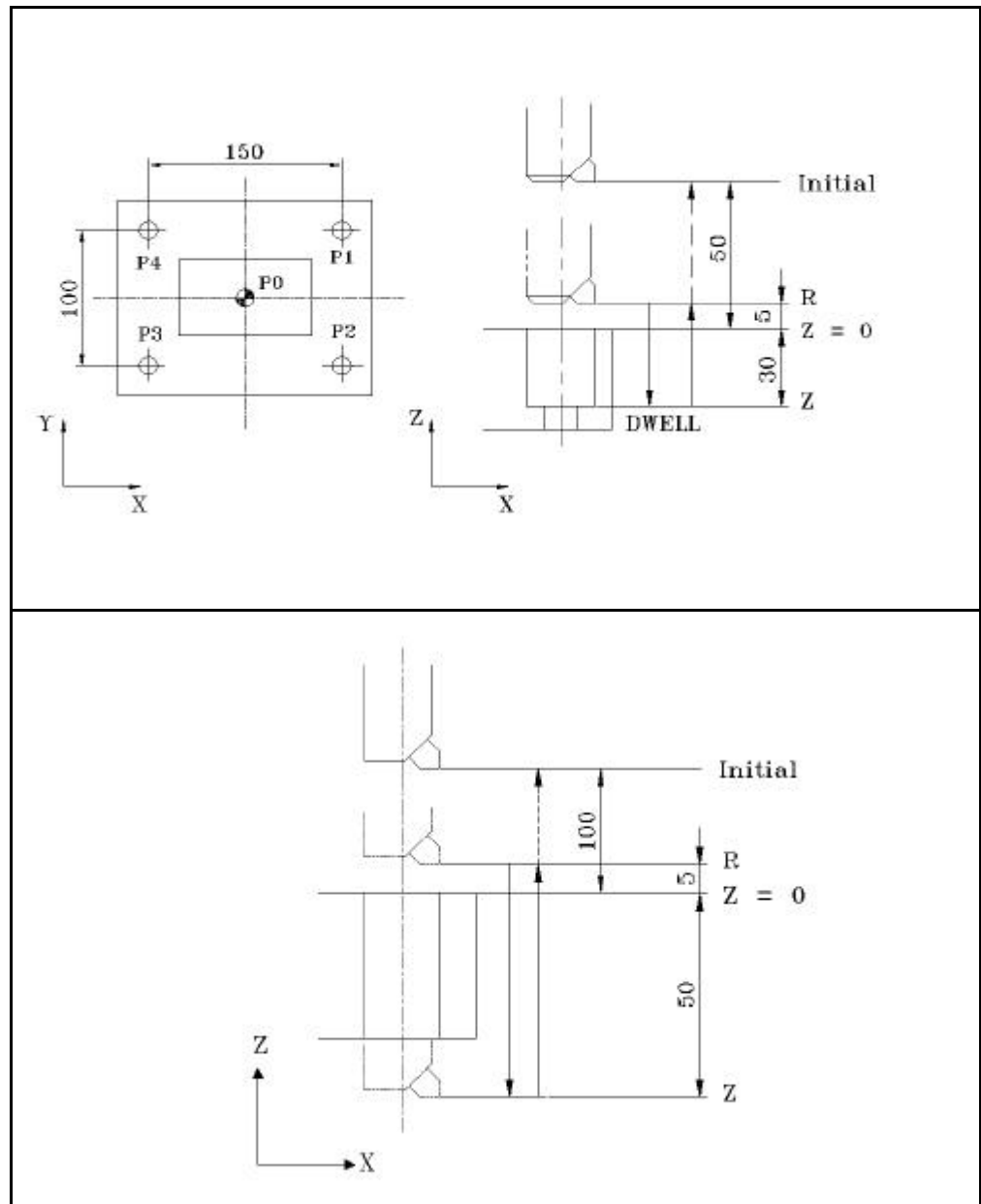
가


G85

, 가

가

📖 G89

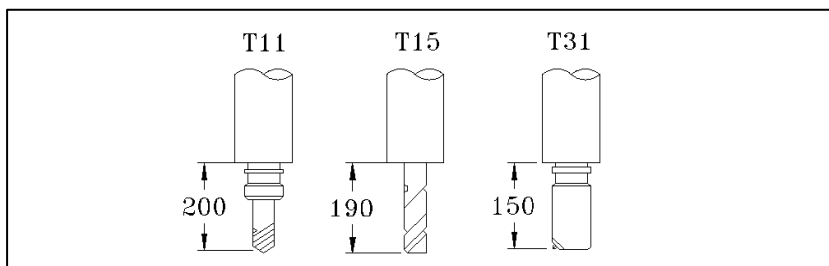
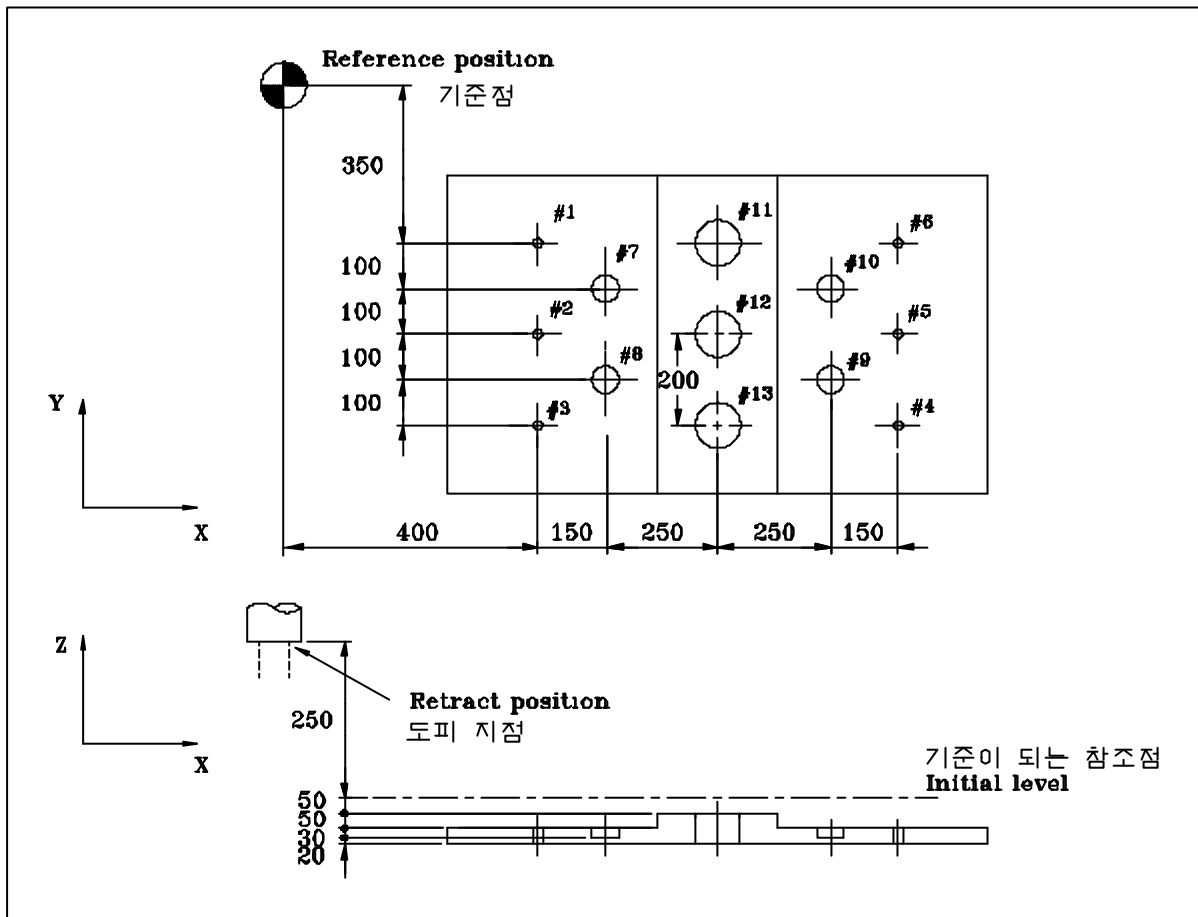




```
( G92 X0 Y0 Z250 ; )  
N1 S600 M03 ;  
N2 G90 G99 G89 X75 Y50 Z-30 R5 P500 F100 ;  
N3 Y-50 ;  
N4 X-75 ;  
N5 G98 Y50 ;  
N6 G80 G00 X0 Y0 M05 ;  
N7 M30
```

12.4

(Example of Canned Cycle)



- # 1 to 6 : Drilling of a 10mm diameter hole
- # 7 to 10 : Drilling of a 20mm diameter hole
- # 11 to 13 : Boring of a 95mm diameter hole(depth 50 mm)

██████████

N01 G92 X0 Y0 Z500 ;
N02 G90 G00 Z250 ;
N03 G43 Z0 H11 ;
N04 S30 M03 ;
N05 G99 G81 X400 R Y-350 Z-153 R-97 F120 ;
N06 Y-550 ;
N07 G98 Y-750;
N08 G99 X1200 ;
N09 Y-150 ;
N10 G98 Y-350 ;
N11 G00 X0 Y0 M05 ;
N12 G49 Z250 T15 M06 ;
N13 G43 Z0 H15 ;
N14 S20 M03 ;
N15 G99 G82 X550 Y-450 Z-130 R-97 P300 F120 ;
N16 G98 Y-650;
N17 G99 X1050 ;
N18 G98 Y-450 ;
N19 G00 X0 Y0 M05 ;
N20 G49 Z250
T31 M06 ;
N21 G43 Z0 H31 ;
N22 S100 M03 ;
N23 G85 G99 X800 Y-350 Z-153 R47 F50 ;
N24 G91 Y-200 K2 ;
N25 G28 X0 Y0 M05 ;
N26 G49 Z500 ;
N27 M02 ;

13 (Tool Compensation)

13.1 (Tool Length Compensation)

13.1.1 (G43, G44, G49, Tool Length Compensation)

13.1.2

13.1.3 (G10, Programmable Data Input)

13.2 (Tool Diameter Compensation)

13.2.1 (G40,G41,G42,G39, Tool Diameter Compensation)

13.2.2 C type (G41,G42, Tool Diameter Compensation)

13.3 (G 45 ~ G 48 , Tool Offset)

13.1

(Tool Length Compensation)

가
가

가
Offset

G43, G44

, H
Z (G17
±

)

가

가

13.1.1

(G43, G44, G49, Tool Length Compensation)

```
{G43 / G44} Z _ H _
G49 Z _
```

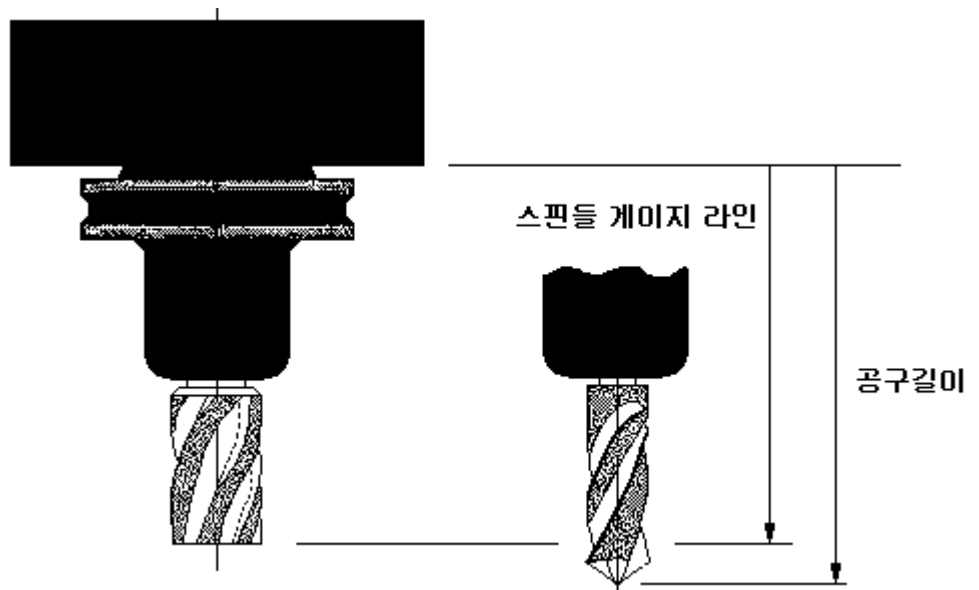
- G43 : + [Tool Length Compensation + Direction]
- G44 : - [Tool Length Compensation - Direction]
- G49 : [Tool Length Compensation Cancel]

Z_ : Z (G17)
가

H_ :

Z H
G43 가 , G44

Z Z G43
+ , G44



□ ▶▶

(G17/G18/G19)

G49 H00

G43, G44, G49 G G 가

H

H00 - H128 00 H00

0 H00

가

Z

G43 H01;

01 () , G49 ;

G49 ,

“ + “

가

Z ,

□ □

: -150.000 mm

H1 : 10.000 mm (= 10mm 가
)

G54 G90 Z100. ; : G54 Z100
 [Z = -50.000]

[Z = 100.000]

G43 G90 G00 Z50. H01 ; : 01 Z 50mm

[

.]

[Z = -90.000(10mm +
)]

[Z = 50.000]

□ □

G90 G49 G00 Z150. ; : Z 150.0

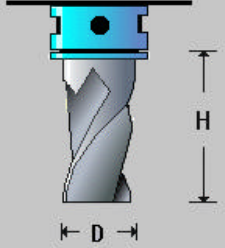
(G90 G43 G00 Z150. H00 ;)

13.1.2

▶▶ F2 ▶▶ F2

MDI

메인PG	aaa	AUTO	공구	0	MLK	DRN	OPS	BDT	SBK	2001-10-20
진행PG	aaa		000000	MM						



← D →

H

공구직경 (D)	공구길이 (H)	공구직경 (D)	공구길이 (H)
D 1	10,000	H 1	20,000
D 2	10,000	H 2	0,000
D 3	0,000	H 3	0,000
D 4	0,000	H 4	0,000
D 5	8,000	H 5	0,000
D 6	16,000	H 6	0,000
D 7	0,000	H 7	0,000
D 8	0,000	H 8	0,000
D 9	0,000	H 9	0,000
D 10	0,000	H 10	0,000
D 11	0,000	H 11	0,000
D 12	0,000	H 12	0,000
D 13	0,000	H 13	0,000
D 14	0,000	H 14	0,000
D 15	0,000	H 15	0,000

상대위치		상대좌표설정	
X	0.000	X	50.000
Y	0.000	Y	100.000
Z	-1192.442	Z	100.000

좌 표 계	입력	설정						메 크 로 스
-------	----	----	--	--	--	--	--	---------

13.1.3

(G10, Programmable Data Input)

[G90 / G91]	G10	L10	P _	R _
[G90 / G91]	G10	L12	P _	R _

G10

L10 H Data [Change of Length Offset value By Program]

L12 D Data [Change of Diameter Offset value By Program]

P_

R_

G90

,

.

G91

,

가

.

,

,

.

G10

가

가

.

 ||

G10 G90 L10 P1 R100 ; : H01 100 .
G10 L12 P1 R20 ; : D1 20 .
G10 G91 L10 P1 R - 0.5 ; : H1 0.5



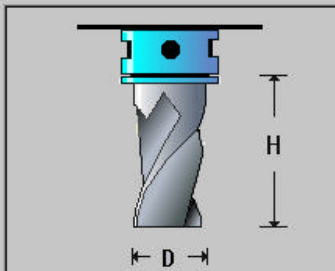
G43 G00 Z50 H02 S1500 M03 ; :

13.2 (Tool Diameter Compensation)

가 가 가
가

< >> F2 >> F2 >

메인PG	aaa	AUTO	공구	0	MLK	DRN	OPS	BDT	SBK	2001-10-18
진행PG	aaa									000000 MM



← D →

H

공구직경 (D)	공구길이 (H)	공구직경 (D)	공구길이 (H)
D 1	10,000	H 1	0,000
D 2	10,000	H 2	0,000
D 3	0,000	H 3	0,000
D 4	0,000	H 4	0,000
D 5	8,000	H 5	0,000
D 6	16,000	H 6	0,000
D 7	0,000	H 7	0,000
D 8	0,000	H 8	0,000
D 9	0,000	H 9	0,000
D 10	0,000	H 10	0,000
D 11	0,000	H 11	0,000
D 12	0,000	H 12	0,000
D 13	0,000	H 13	0,000
D 14	0,000	H 14	0,000
D 15	0,000	H 15	0,000

상대위치		상대좌표설정	
X	360.000	X	50.000
Y	143.999	Y	100.000
Z	-0.001	Z	100.000

좌 표 계
공구
설정
크
로
수

13.2.1

(G40, G41, G42 , G39, Tool Diameter Compensation)

```

G40  [G00 / G01] X _ Y _
G41  [G00 / G01] X _ Y _ D _
G42  [G00 / G01] X _ Y _ D _
G39  {X _ Y _ / I _ J _}

```

G40 (Cutter Compensation Cancel)

G41 (Cutter Compensation Left)

G42 (Cutter Compensation Right)

G39

(Tool Diameter Compensation at Corner Arc)

D _

X _ Y _ / I _ J _

가

가

▶▶ F2 ▶▶ F2

.(

)

PI 72 1

공구직경 (D)		공구반경 (R)	
D 1	10,000	D 1	10,000
D 2	10,000	D 2	10,000
D 3	0,000	D 3	0,000
D 4	0,000	D 4	0,000
D 5	8,000	D 5	8,000

< PI 72 = 0 일 경우 :직경치 > < PI 72 = 1 일 경우 :반경치 >

□ ▶▶

[D]

D []

MDI

D

D 가

00 D00

0

D00

G40

D00

, MDI

RESET

, M02

M30

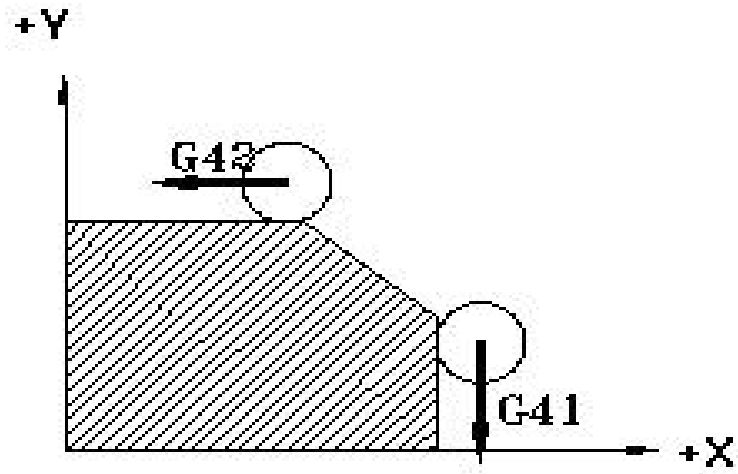
G40

0

G40

G41/G42

G	
G40	
G41	가 . []
G42	가 . []



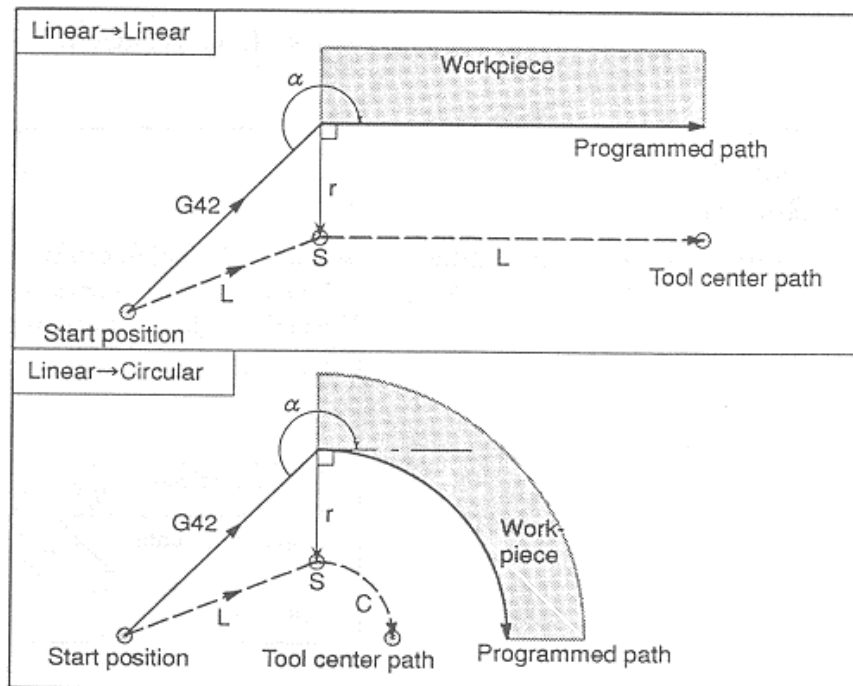
13.2.2 C type (G41, G42, Tool Diameter Compensation)

(1) Start - Up

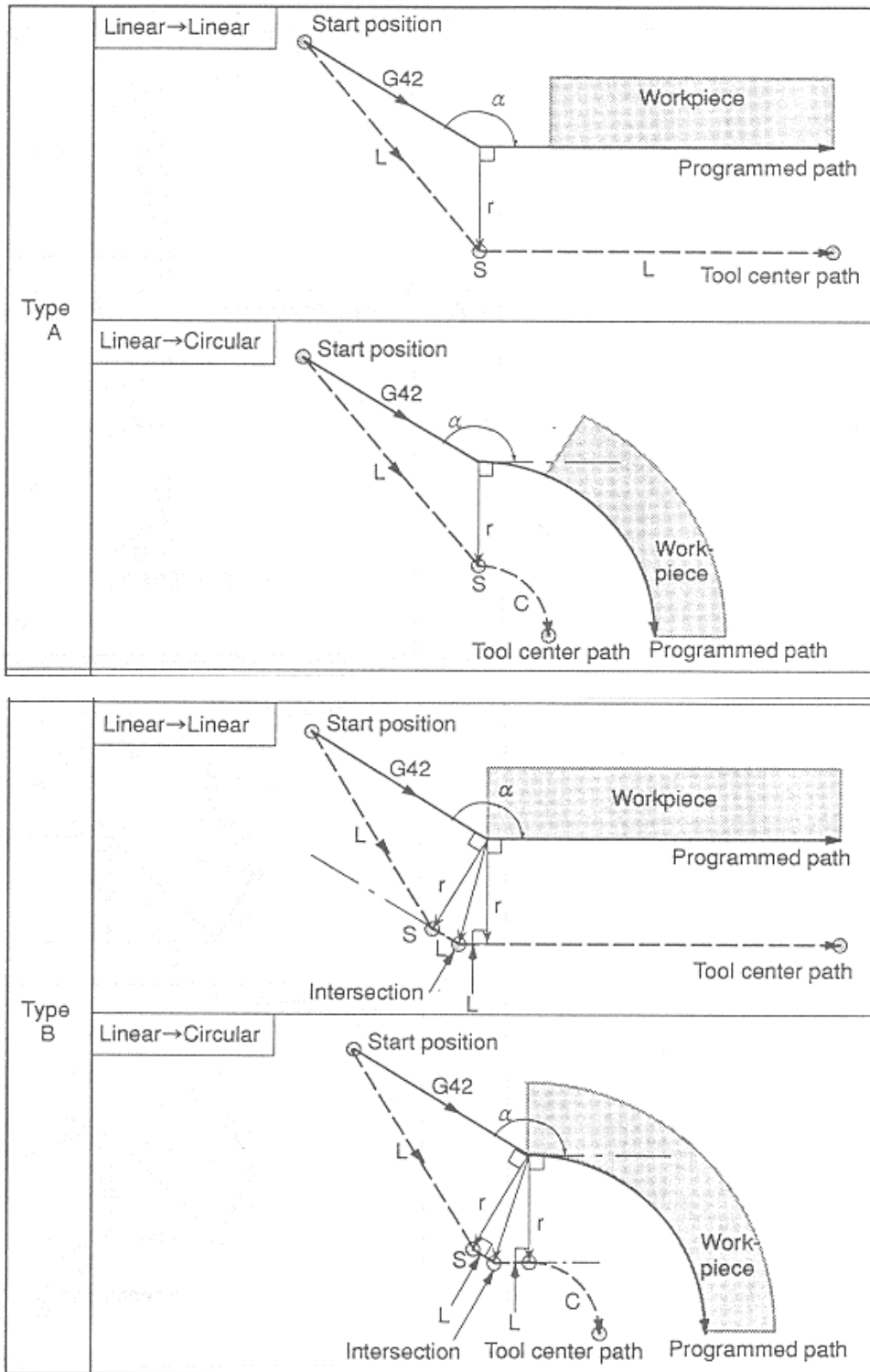
- G41/G42 가 Start Up
- G41 G42 가 Start Up
- Start-Up
- Start-Up [G02/G03]

S	Single Block (.)
SS	Single Block
L	straight line
C	arc
r	

- $\alpha \geq 180^\circ$ (G42)

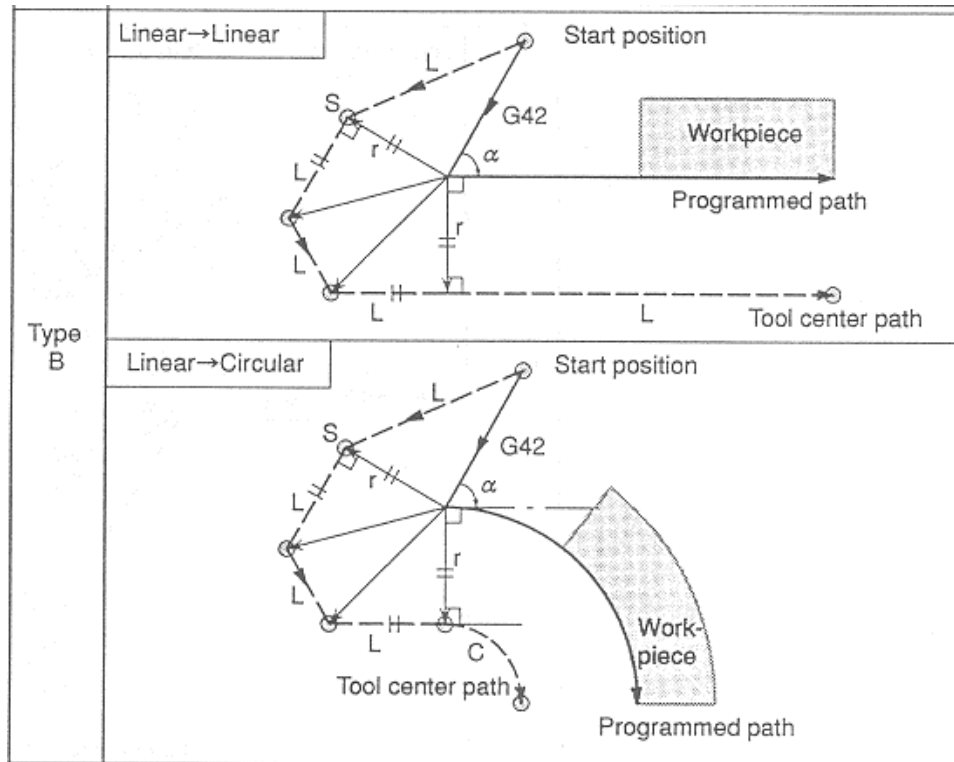
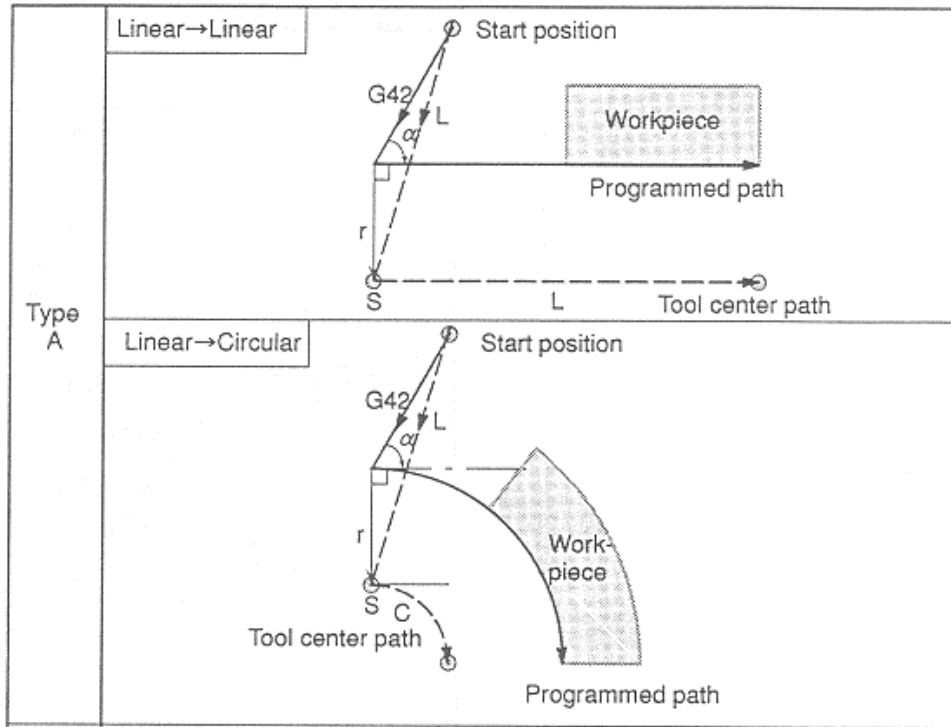


- $90^\circ \leq \alpha \leq 180^\circ$ (G42)
 (PI128(#3128)) A () B ()

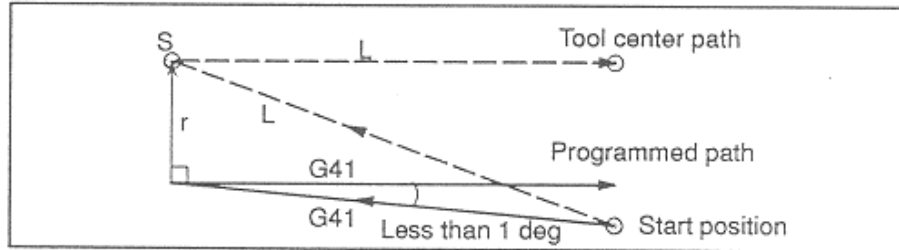


- $\alpha < 90^\circ$ (G42)

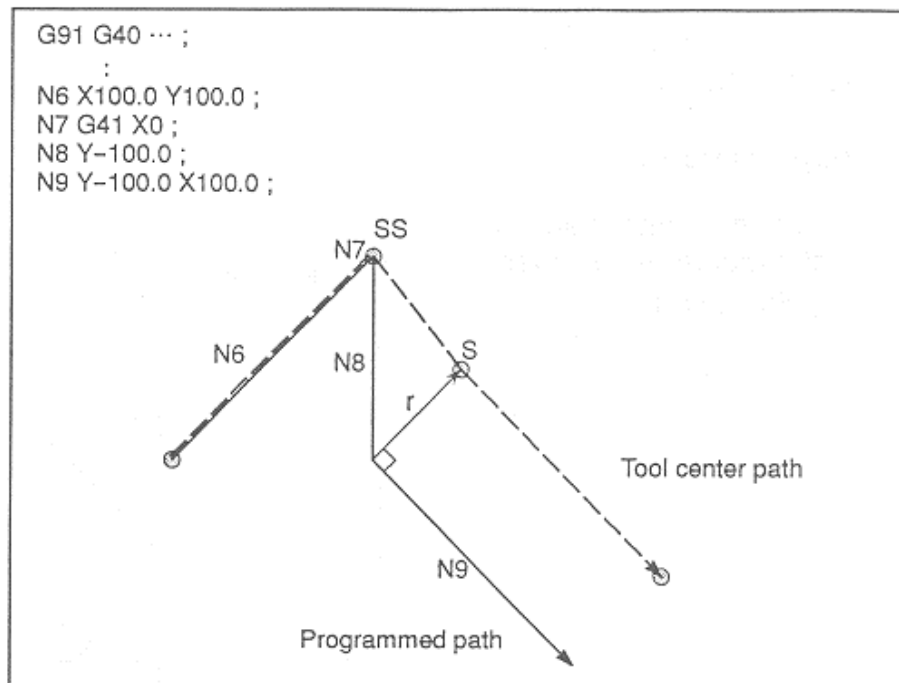
 (PI 128(#3128)) A () B ()



- $1^\circ > \alpha$ (G41)



- (Start-Up)

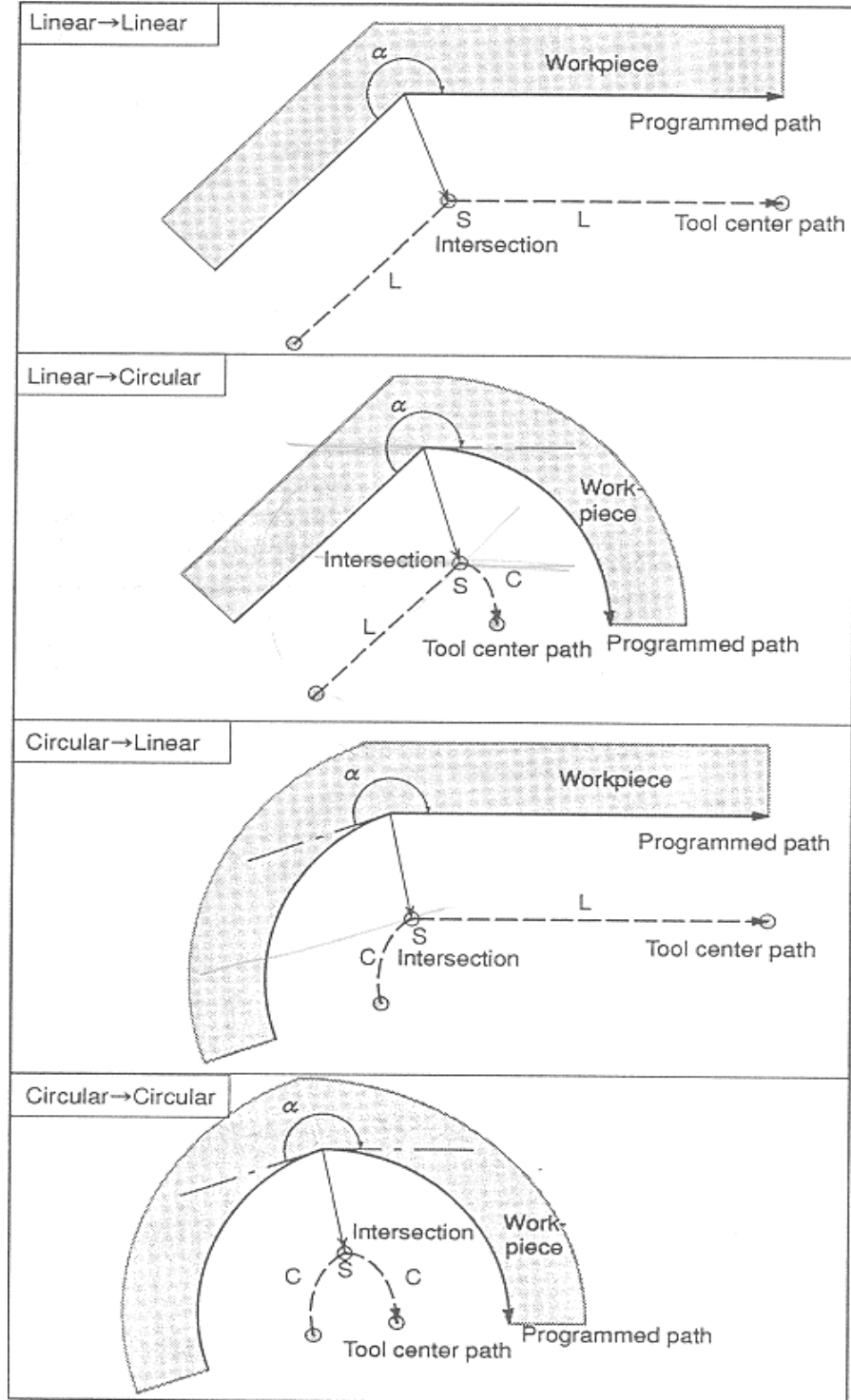


(2) Offset

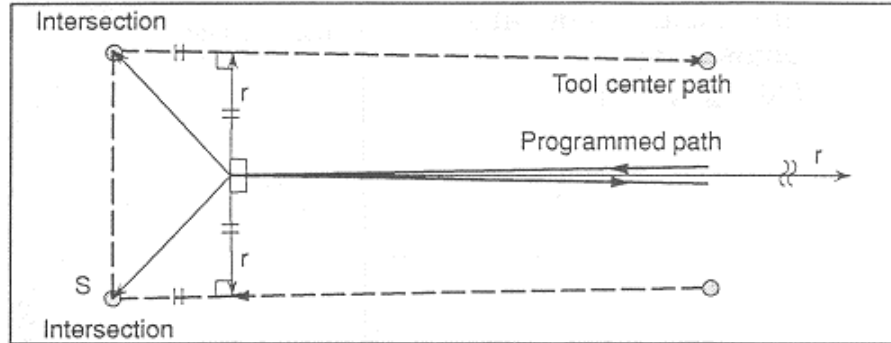
: Start-Up

G40

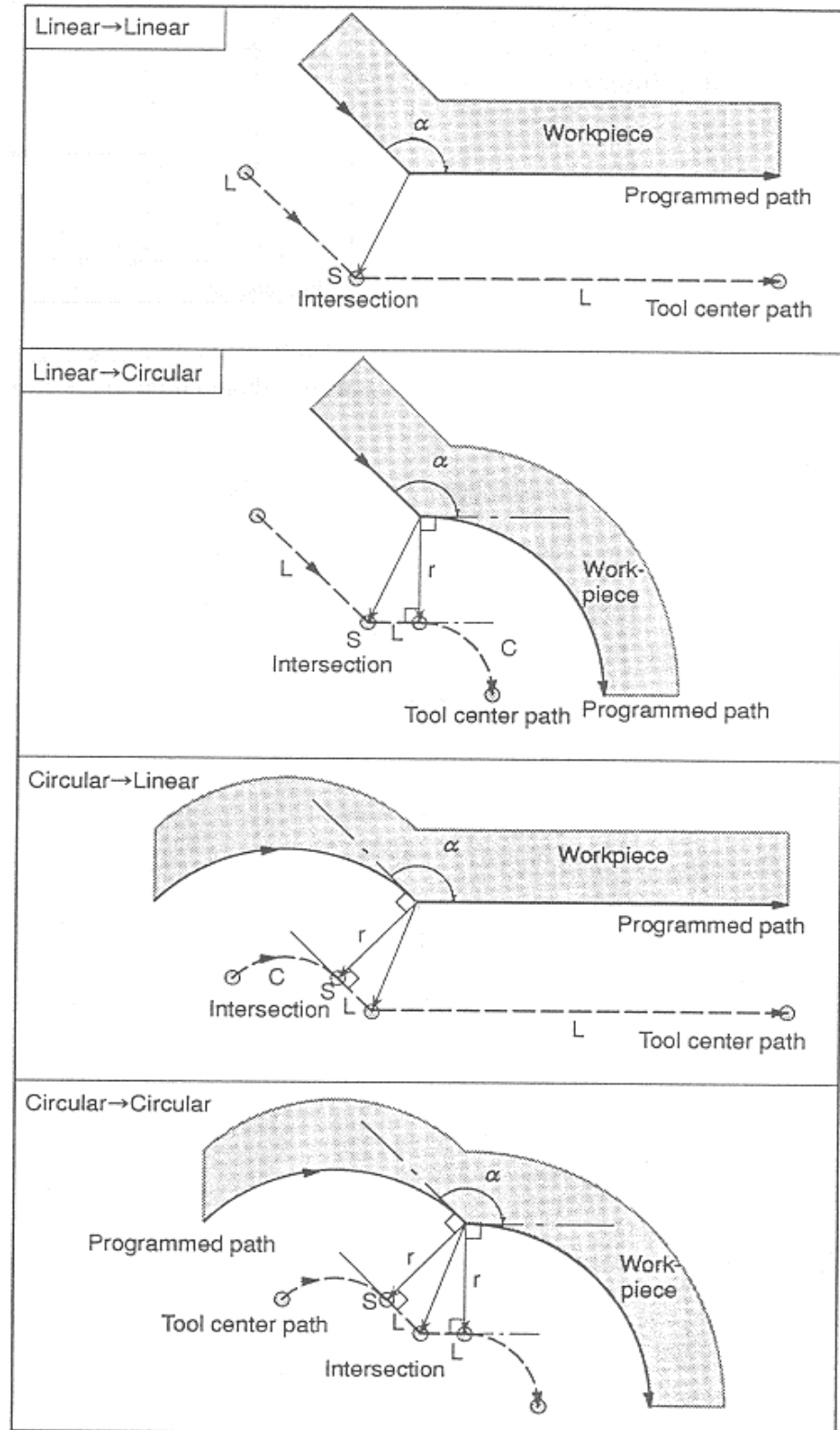
- $180^\circ \leq \alpha$



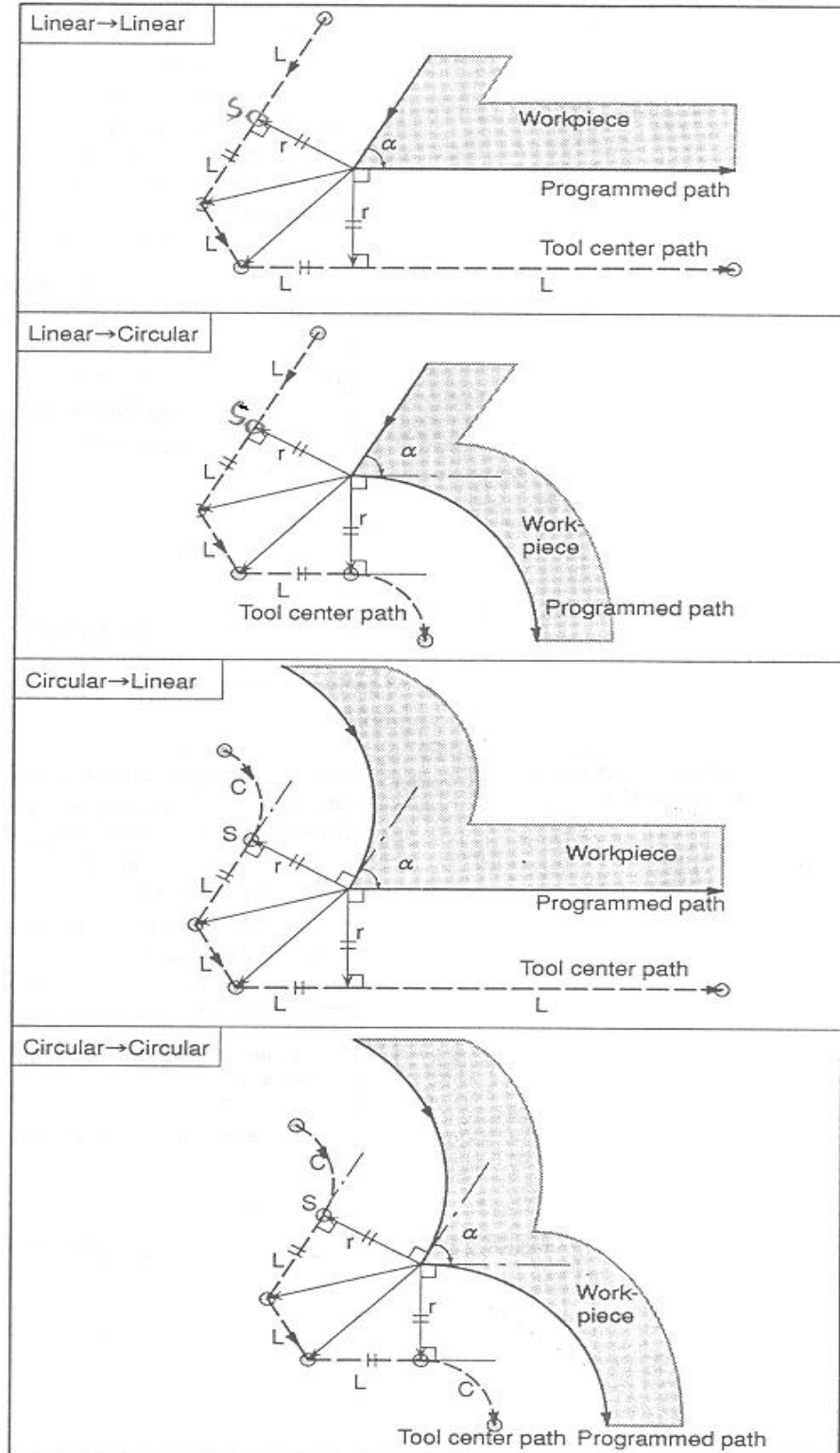
1



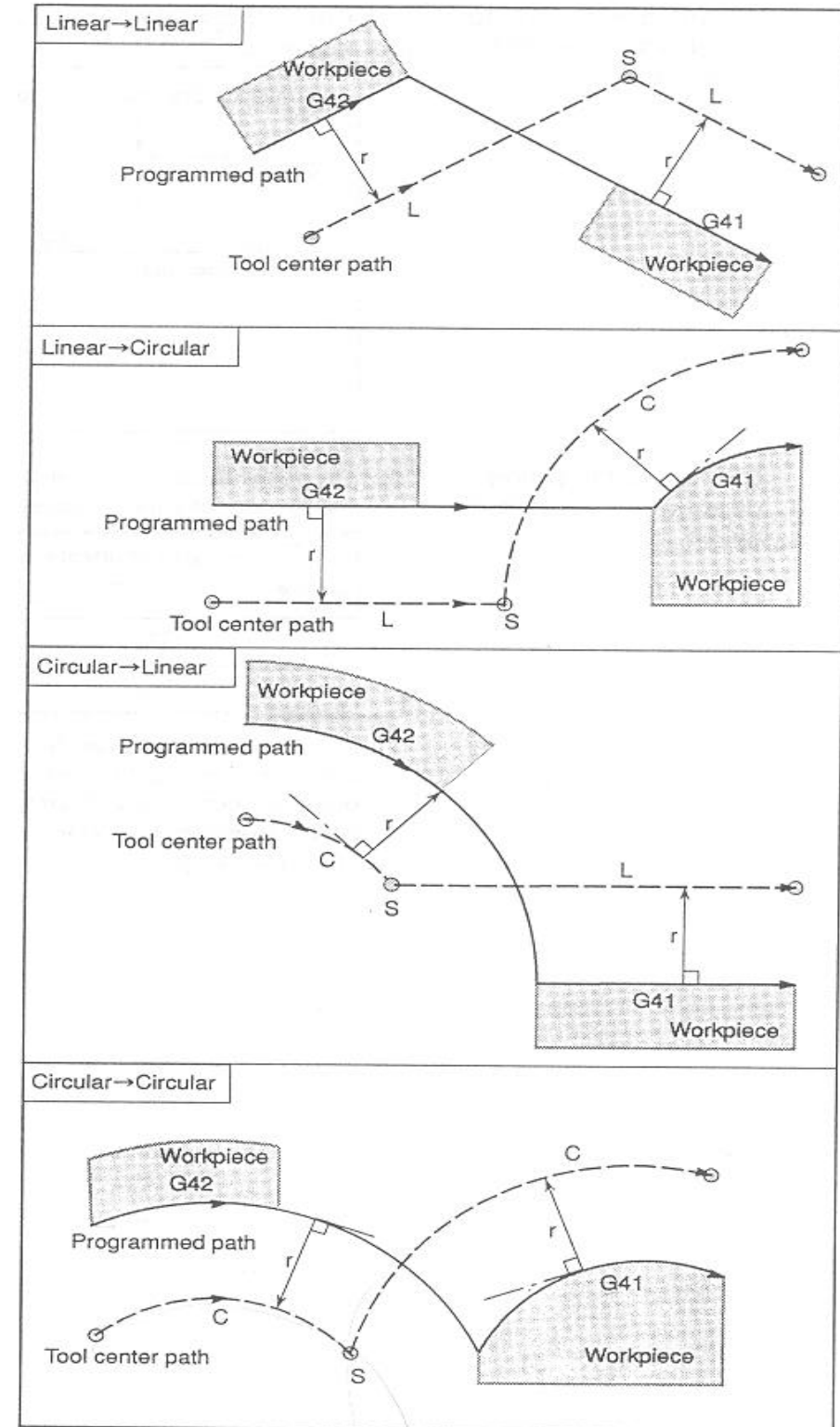
- $90^\circ \leq \alpha < 180^\circ$

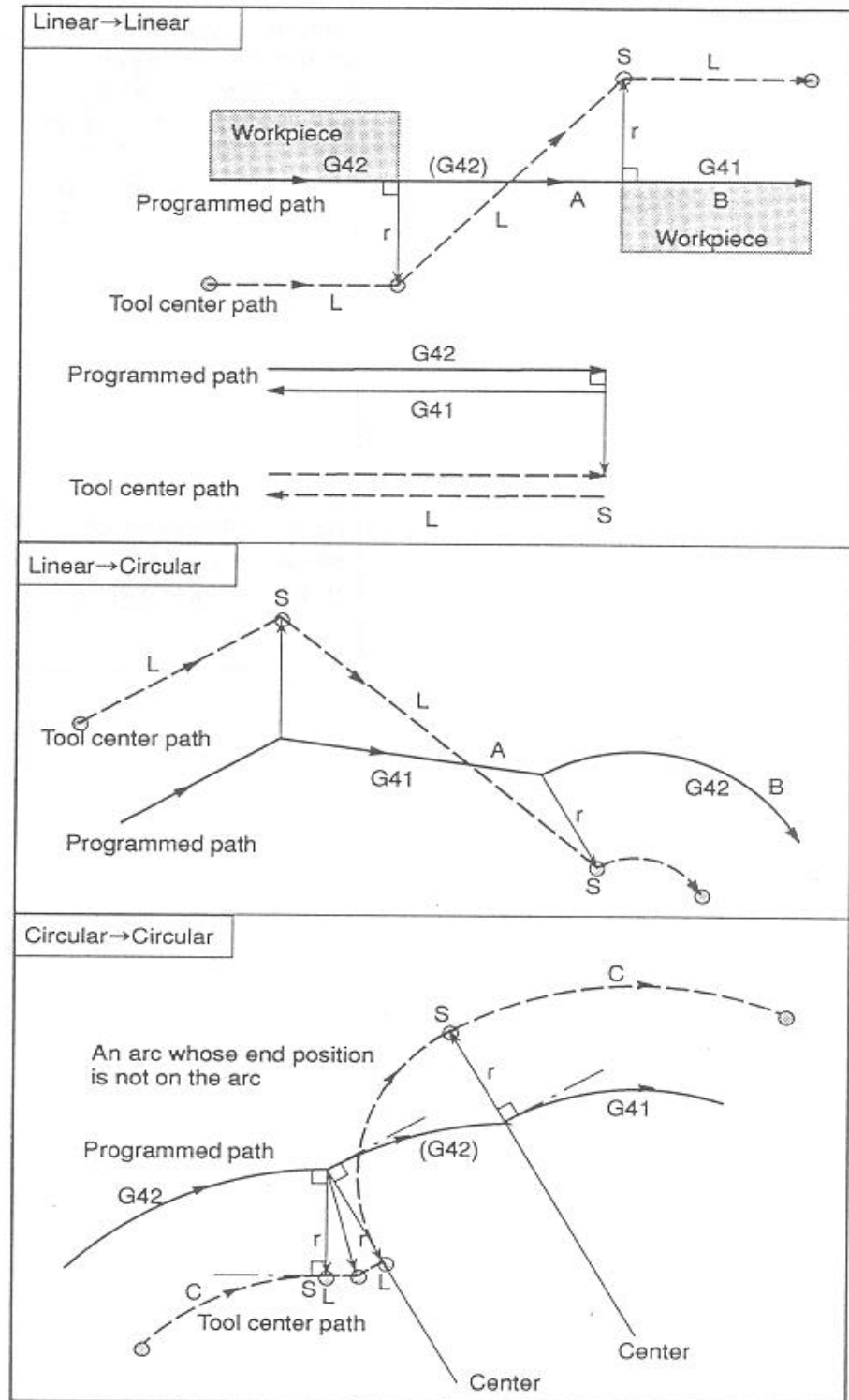


- $\alpha < 90^\circ$

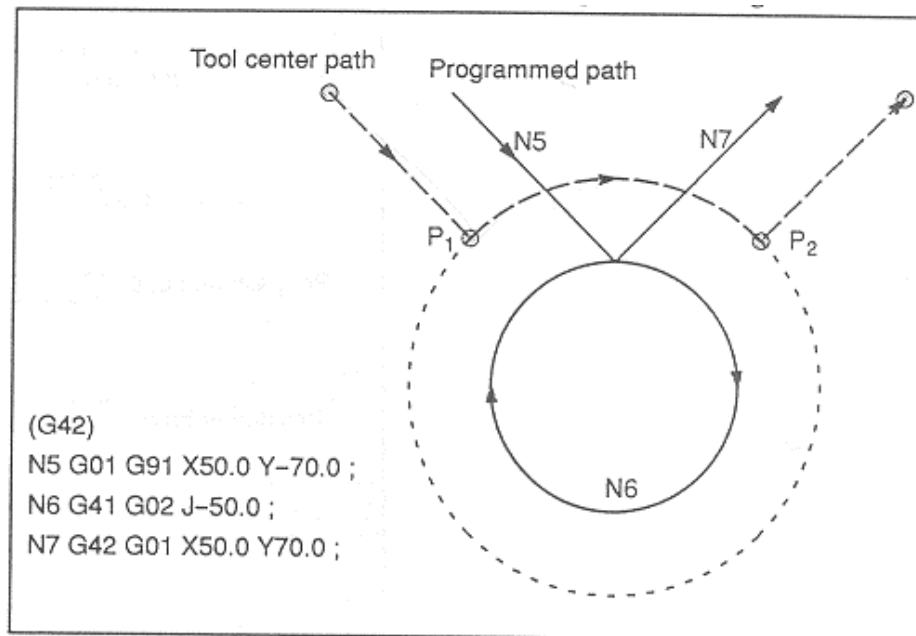


(3) Offset G41/G42가



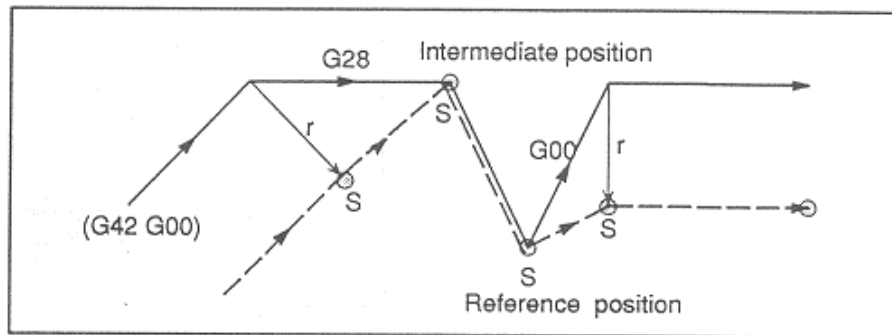


가

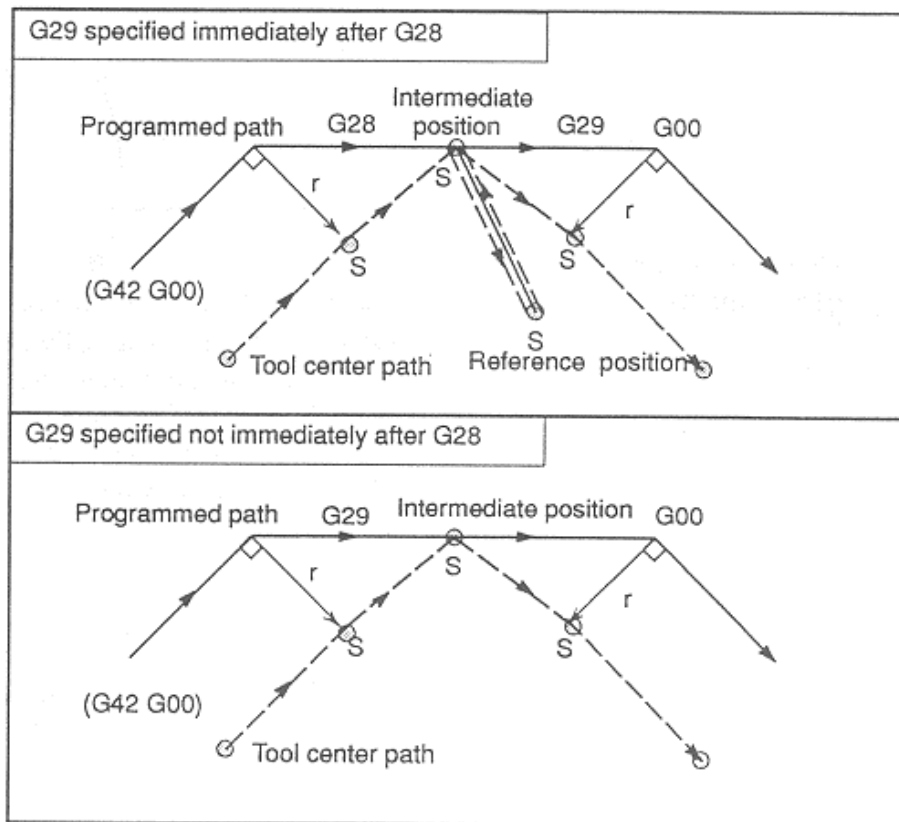


G28, G29, G53
 G92, G54~G59, G52

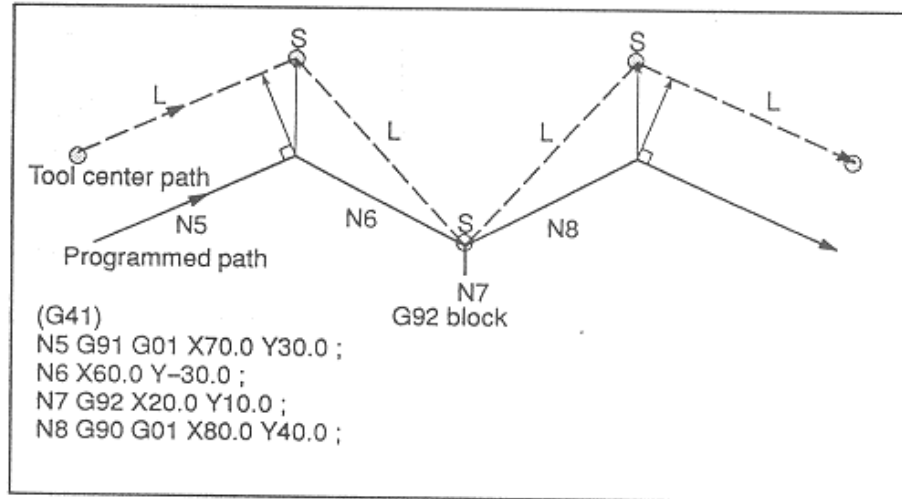
G28

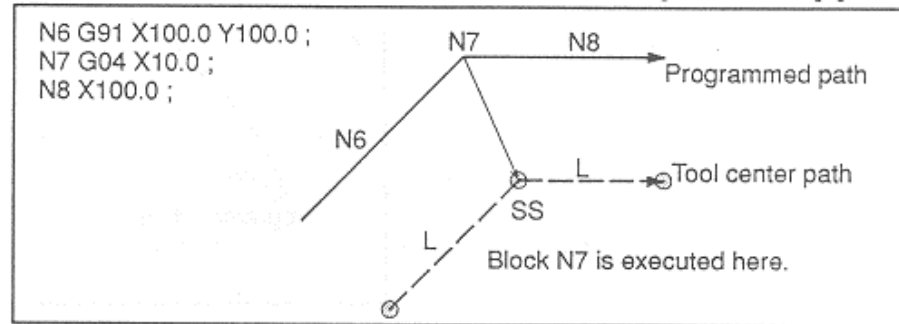


G29, G28



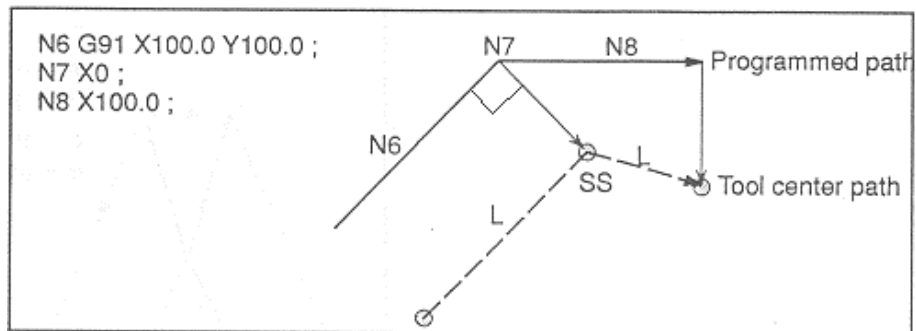
G92





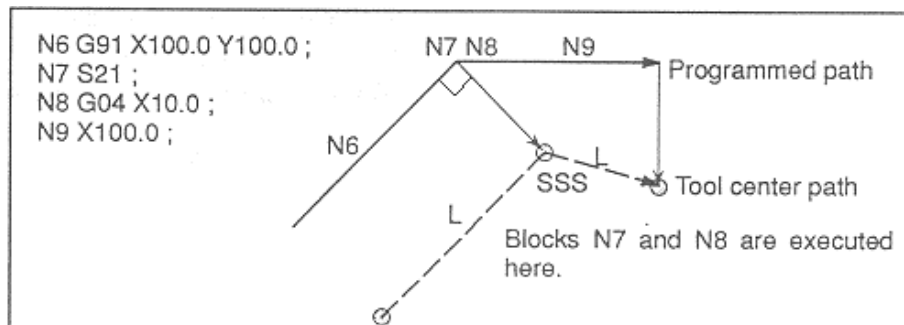
0

(N6 , Single block)



2

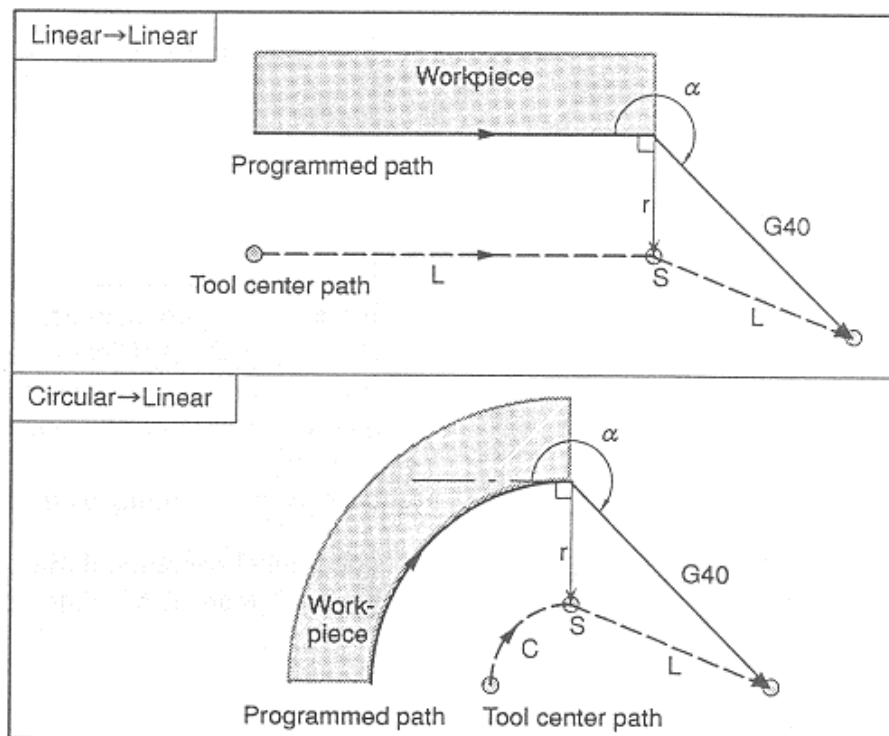
(N6 , Single block)



(4) Offset Cancel

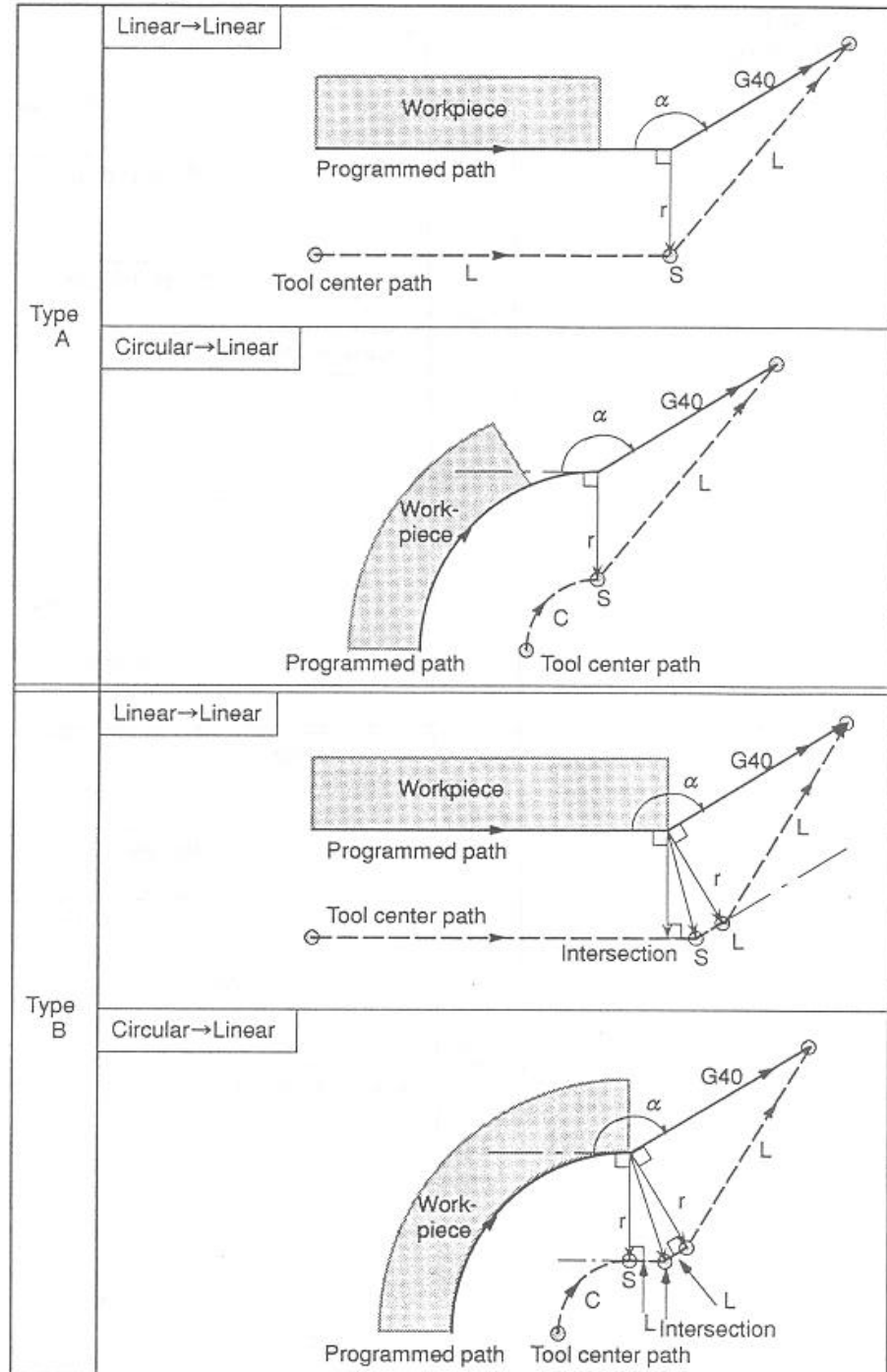
: G40 Offset
 , Offset Cancel .

- $180^\circ \leq \alpha$ (G40)



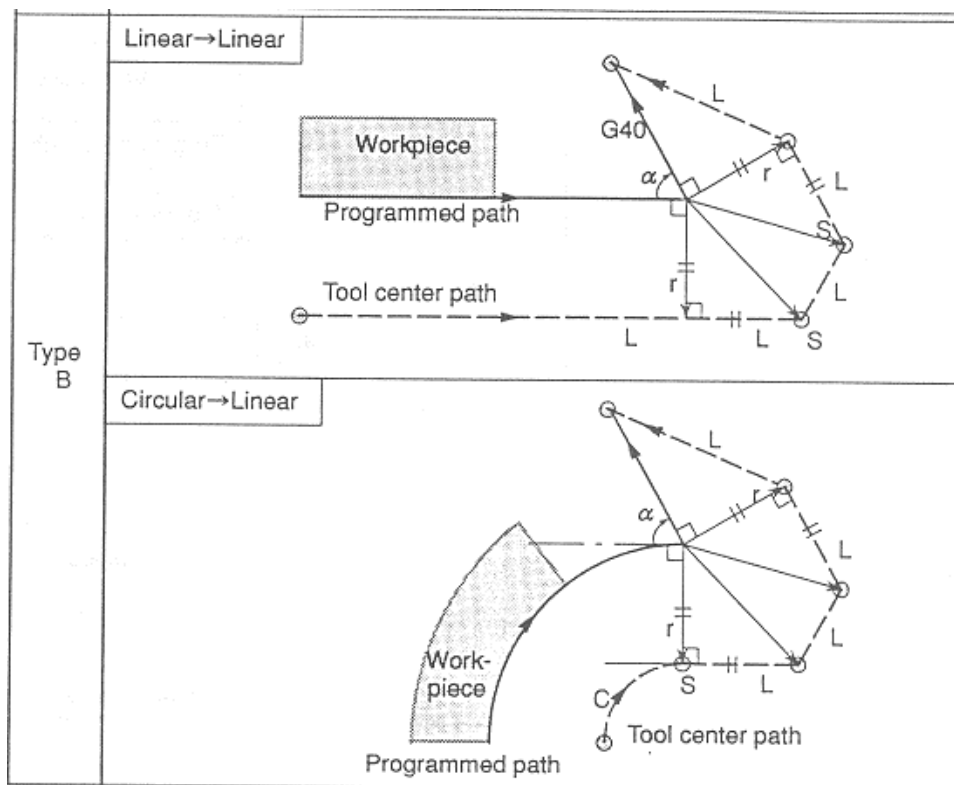
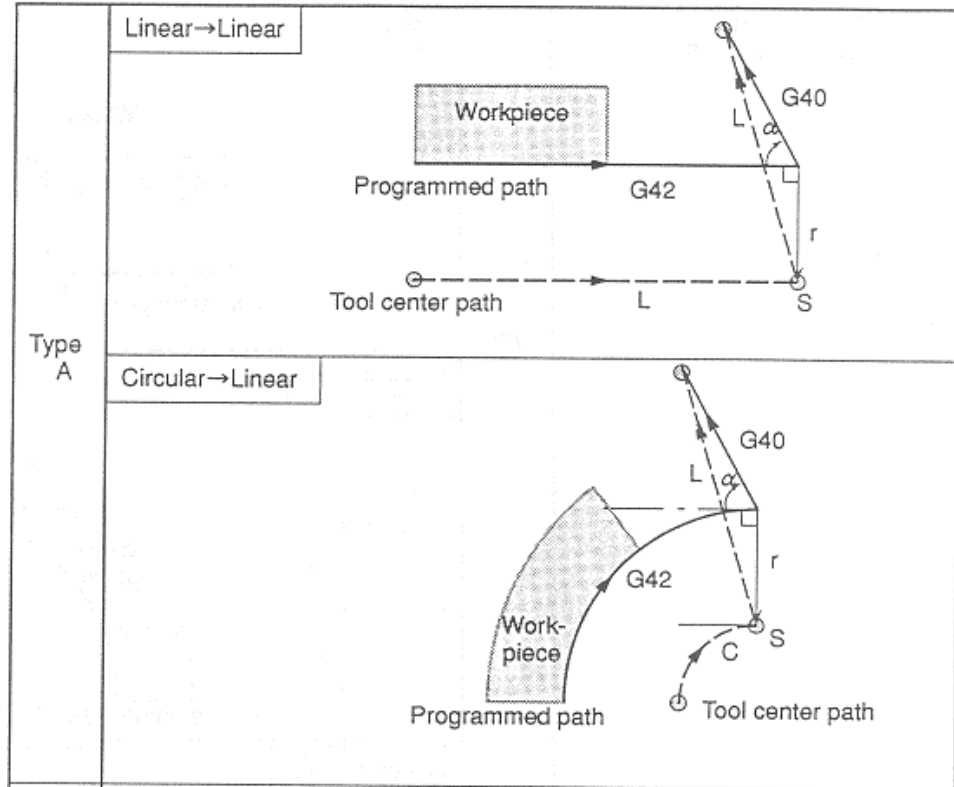
• $90^\circ \leq \alpha < 180^\circ$

(G40)

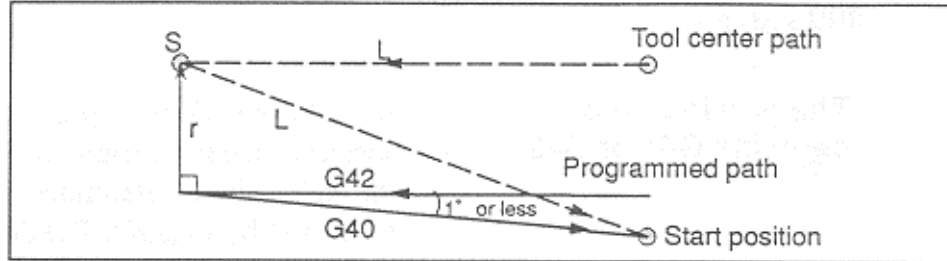


- $\alpha < 90^\circ$

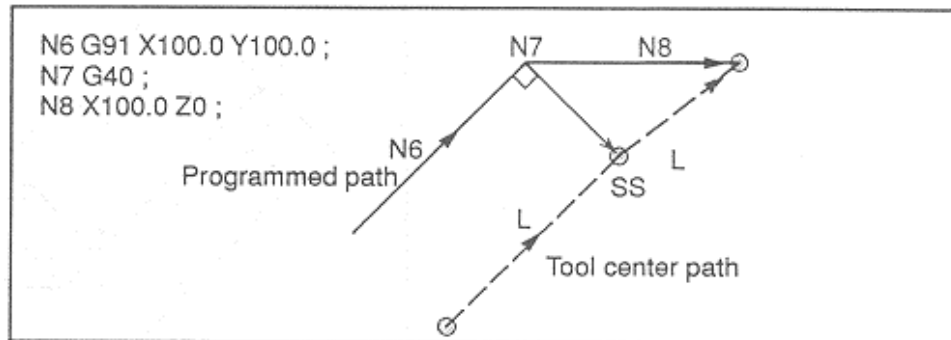
(G40)



- 1 (G40)



- (G40)



(5) I_, J_, K_ G40

G41/G42 offset

I_,J_,K_

G40

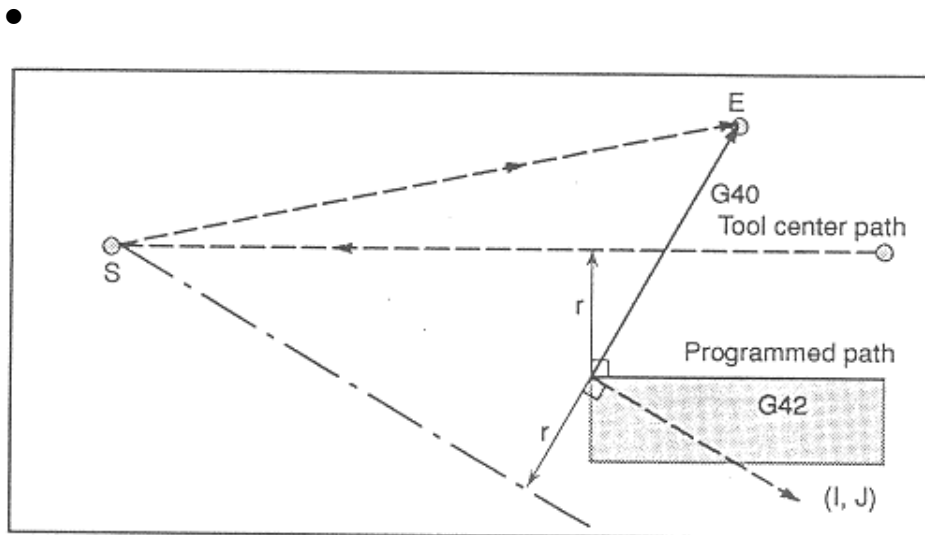
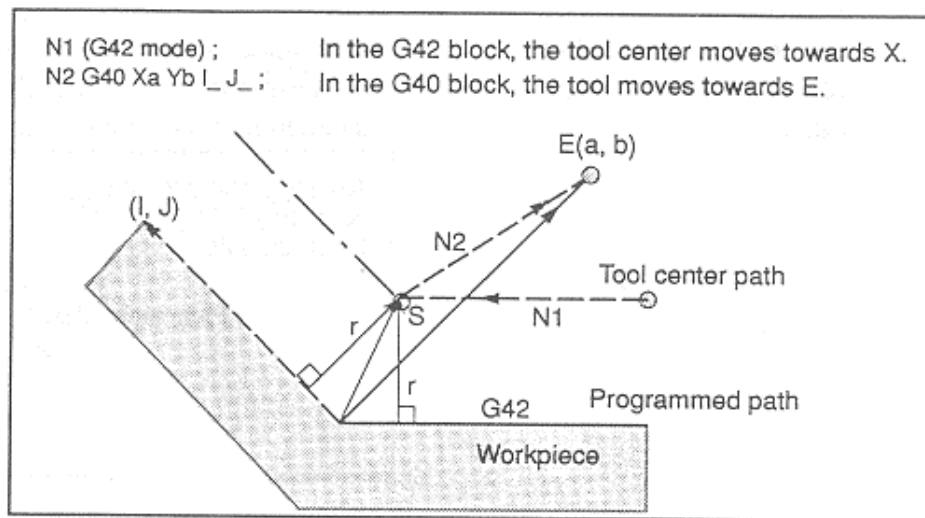
G40

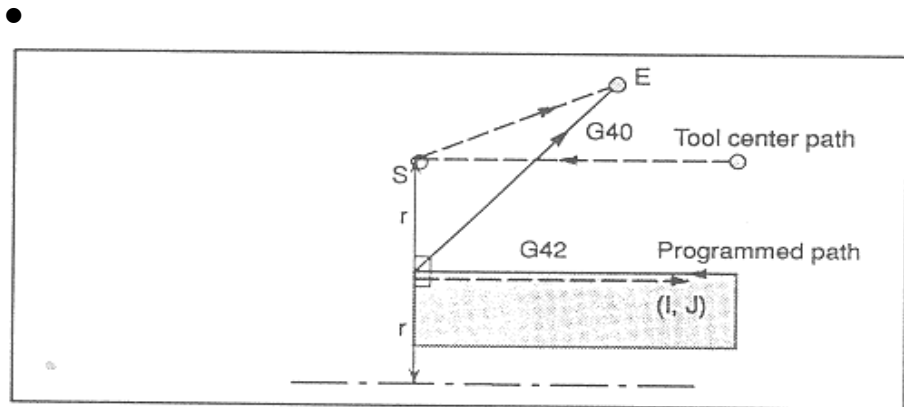
가

. (I,J), (I,K)

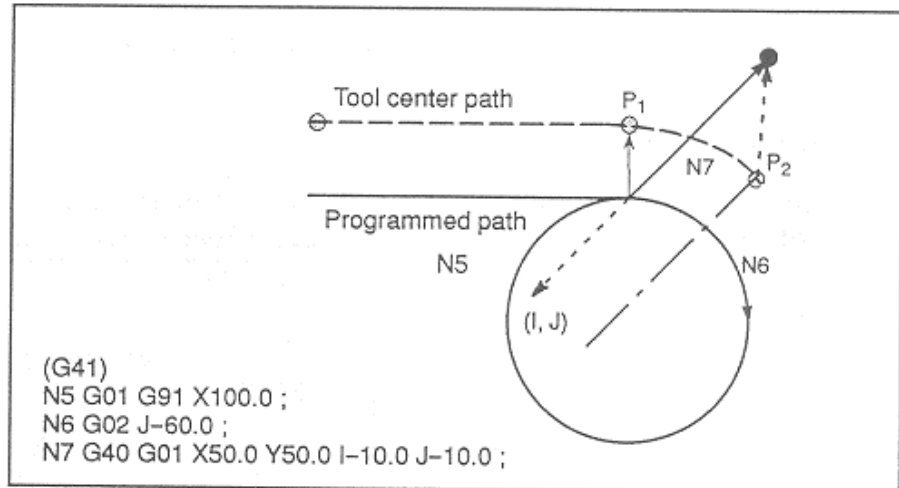
(J,K)

- (I,J)

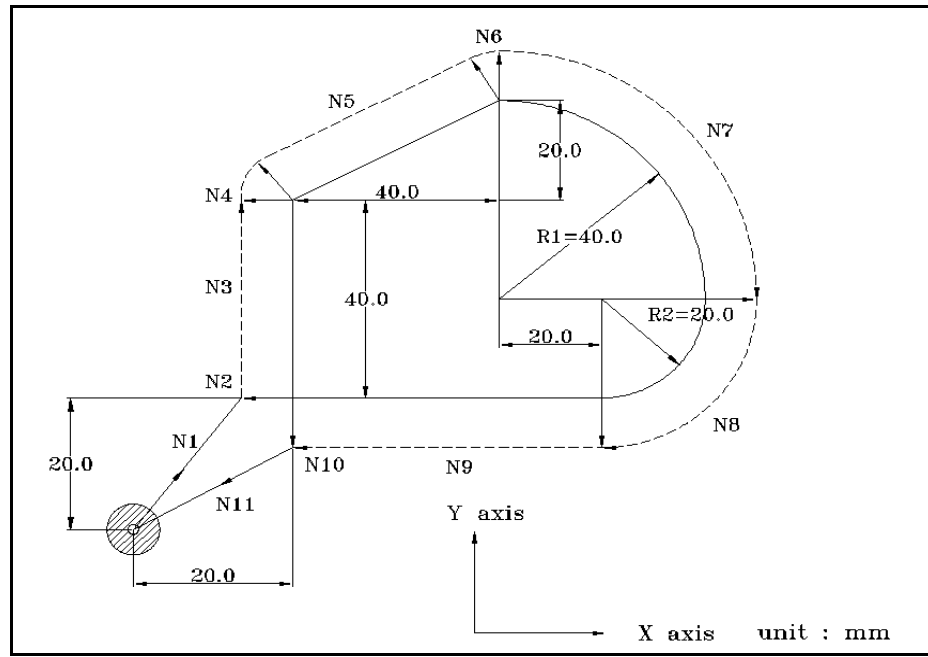




가 P1 P2



II



```

N1 G91 G17 G00 G41 X20. Y20. D08 ; ( D08 )
N2 G01 Z 25. F100 ; ( )
N3 Y40. F250 ;
N4 G39 X40. Y20.; ( )
N5 X40 Y20. ;
N6 G39 X40. Y-20.; ( )
N7 G02 X40. Y 40. R40.0 ;
N8 X 20. Y 20. R20 ;
N9 G01 X 60. ;
N10 G00 Z25. ;
N11 G40 X 20. Y 20.;
N12 M30 ;
    
```

13.3

(G45~G48, Tool Offset)

G45	[G01 / G02 / G03]	X _ Y _ D _
G46	[G02 / G03]	X _ Y _ D _
G47	[G02 / G03]	X _ Y _ D _
G48	[G02 / G03]	X _ Y _ D _

- G45 [Tool Offset Increase]
- G46 [Tool Offset Decrease]
- G47 2 [Tool Offset Double Increase]
- G48 2 [Tool Offset Double Decrease]

D
X, Y G17 X , Y

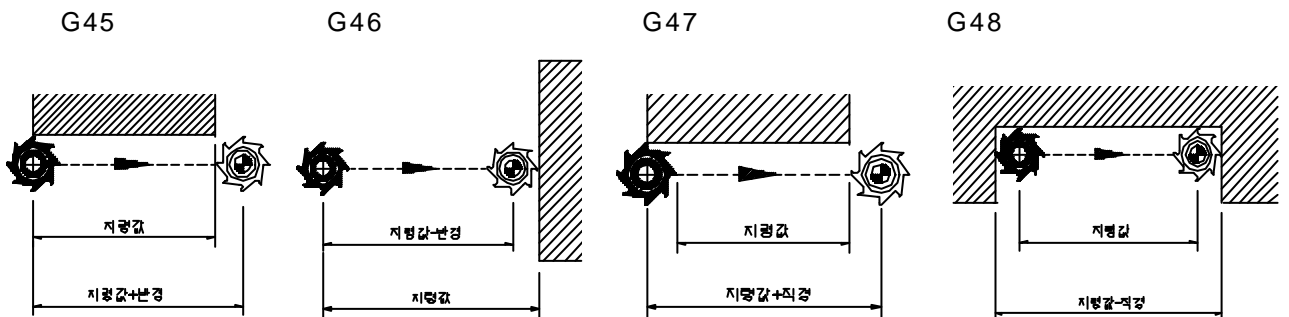
▶▶ F2 ▶▶ F2

MDI

G45 G48

2 , 2

One Shot





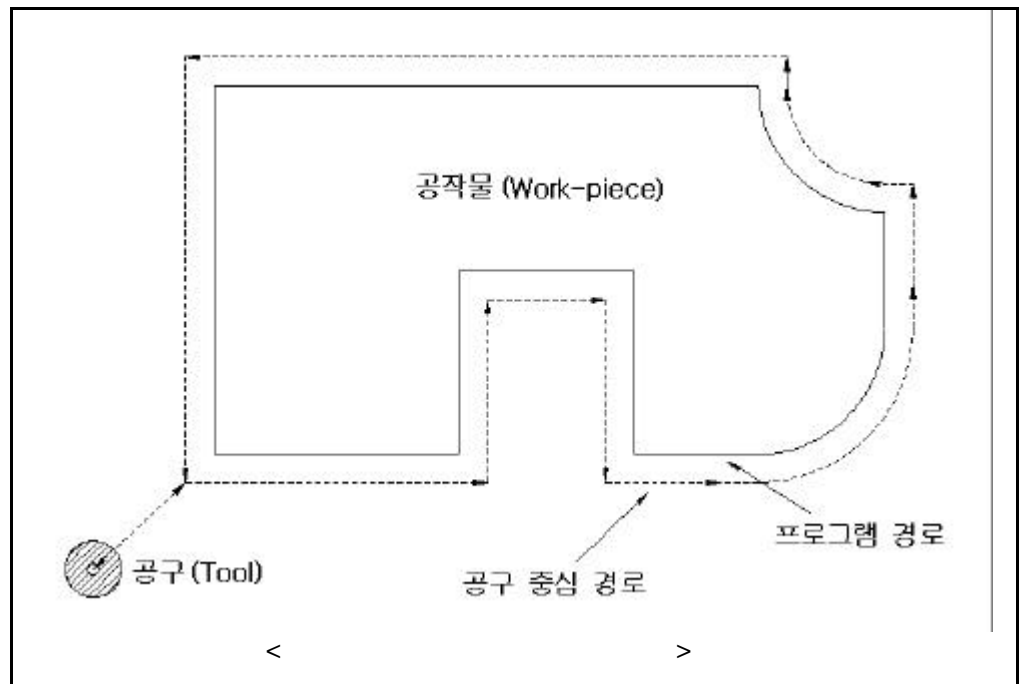
D []
 MDI G02, G03
 I, J, 1/3, 3/4 G45~G48
 G40, G41, G42

가

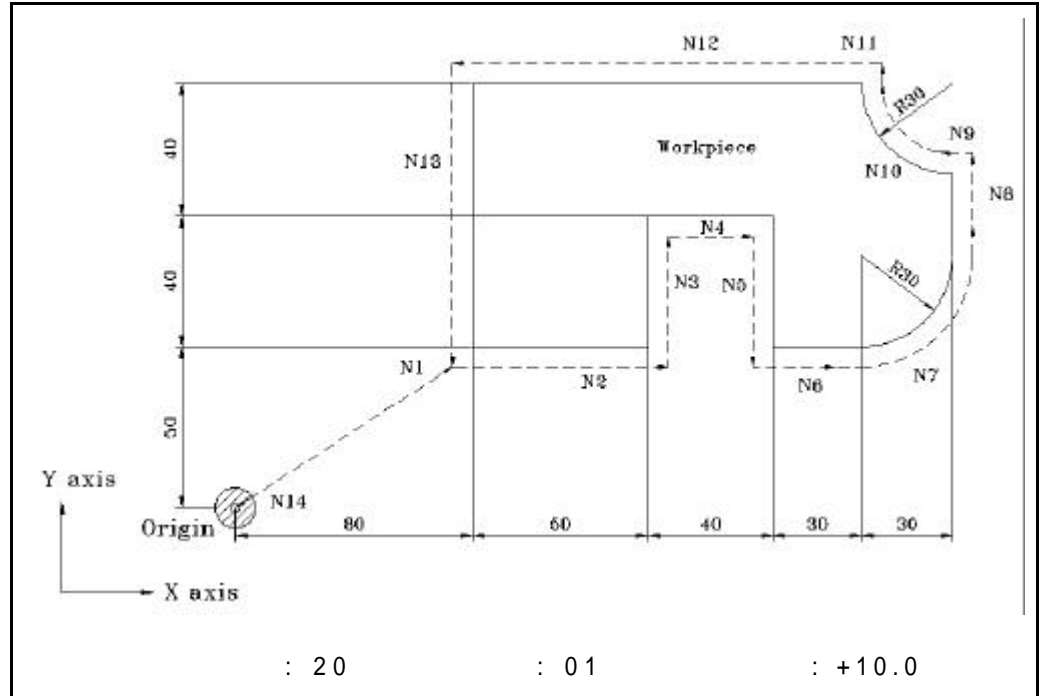
	Metric G21	Inch G20
	0 ~ ± 999.999 mm	0 ~ ± 99.999 inch
	0 ~ ± 999.999 deg	0 ~ ± 999.999 deg

가 , G90

G45 ~ G48



□ □



N1 G91 G46 G00 X80 Y50 D01 ;

N2 G47 G01 X50 F120 ;

N3 Y40;

N4 G48 X40 ;

N5 Y -40 ;

N6 G45 X30 ;

N7 G45 G03 X30 Y30 J30 ;

N8 G45 G01 Y20 ;

N9 G46 X0 ; : 0 , - X
10

N10 G46 G02 X-30 Y30 J30 ;

N11 G45 G01 Y0 ; : 0 , +Y
10

N12 G47 X-120 ;

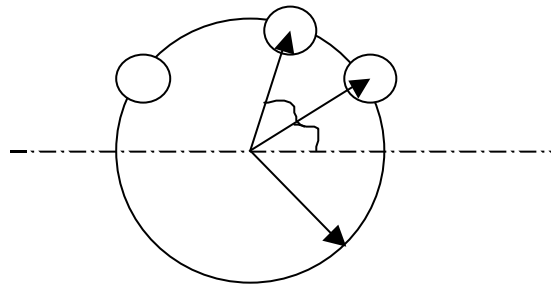
N13 G47 Y-80 ;

N14 G46 G00 X-80 Y-50 ;

14

(CUSTOM MACRO)

가 , 가
 가 가
 (Sub-program)
 , 가
) 가



: - ()
 - ()
 - ()
 -

```
G65 P_p R_ _A_ _B_ K_k;
```

- p : Macro program number
- : radius
- : Start angle
- : Angle between circle
- k : Number of circle

14.1 (Custom Macro Command)

- 14.1.1 (G65)
- 14.1.2 (G66 /G67)
- 14.1.3 G
- 14.1.4 M
- 14.1.5 M
- 14.1.6 T
- 14.1.7 M98 G65
- 14.1.8 (G66)

14.2 (Custom Macro)

- 14.2.1 Format
- 14.2.2
- 14.2.3
- 14.2.4
- 14.2.5
- 14.2.6 CNC

14.3 (Custom Macro)**14.4****14.5**

- 14.5.1 PLANE DRILL
- 14.5.2 가 (1)
- 14.5.3 WHILE - ENDm

14.1 (Custom Macro Command)

14.1.1 (G65)

```
G65 P _ L _ < >
```

G65

P_ (Program Number)

L_

(Custom Macro)

- 가 .
- 가 .
- .
- local , common system
- .
- 4 가 .

(1) |

- G, L, N, P, O 가 .(A_ B_ C_ ... Z_)
- , I, J, K

B_ A_ D_ I_ K_ :

B_ A_ D_ J_ I_ :

● I (G, L, N, P, O)

A	#1
B	#2
C	#3
D	#7
E	#8
F	#9
H	#11
I	#4
J	#5
K	#6
M	#13
Q	#17
R	#18
S	#19
T	#20
U	#21
V	#22
W	#23
X	#24
Y	#25
Z	#26

(2) II

A_B_C_I_J_K_I_J_K_...

- A, B, C , I, J, K 1 가
10 .
- 가
- 가

II

A	#1
B	#2
C	#3
I1	#4
J1	#5
K1	#6
I2	#7
J2	#8
K2	#9
I3	#10
J3	#11
K3	#12
I4	#13
J4	#14
K4	#15
I5	#16
J5	#17
K5	#18
I6	#19
J6	#20
K6	#21
I7	#22
J7	#23
K7	#24
I8	#25
J8	#26
K8	#27
I9	#28
J9	#29
K9	#30
I10	#31
J10	#32
K10	#33

I,J,K

1 ~ 10

(3) I, II

G65 I, II 가
 . I II 가 가
 type I .

```
)
G65 A1.0 B2.0 I3.0 I 4.0 D5.0 P1000;

: #1 = 1.0 (A)
  #2 = 2.0(B)
  #3
  #4 = 3.0(I1)
  #5
  #6
  #7 = 5.0(D) [ #7 4.0(I2) type I D5.0(D =
                #7) ]
```

14.1.2

(G66 /G67)

G66 P _ L _ < >

G67

G66

G67

P _

(Program Number)

L _

(G65)

```

:
G66          G66
G66
(G66) Main   가
G66 G67
가
    
```

□ ||

Drill Cycle : drill cycle

G66 P9082 R(R) Z(Z) X(dwell);

X _ ;

... ;

G67;

O9082()

G00 Z#18;

G01 Z#26;

G04 X#24;

G00 Z - [ROUND[#18] + ROUND[#26]];

M99;

14.1.3 G

(1) 9010.nc ~ 9019.nc G PI
85 ~ PI 94 (#3085~3094)

PI 85	5.3	9010.nc 호출 G Code
PI 86	0.0	9011.nc 호출 G Code
PI 87	0.0	9012.nc 호출 G Code
PI 88	0.0	9013.nc 호출 G Code
PI 89	0.0	9014.nc 호출 G Code
PI 90	0.0	9015.nc 호출 G Code
PI 91	0.0	9016.nc 호출 G Code
PI 92	0.0	9017.nc 호출 G Code
PI 93	0.0	9018.nc 호출 G Code
PI 94	0.0	9019.nc 호출 G Code

N_ G65 P___ < >;
N_ GXX < >; . (G XX
PI 85 ~ PI 94 (#3085 ~
3094) .)

(2) G00 G01 ~ G255 10 G
(9010 ~ 9019) 가 . G 1

: G65, G66, G67 가 .

14.1.1.4 M

(1) 9020.nc ~ 9029.nc M PI
 95 ~ PI 104 (#3095~3104)

PI 95	21	9020.nc 호출 M Code
PI 96	0	9021.nc 호출 M Code
PI 97	0	9022.nc 호출 M Code
PI 98	0	9023.nc 호출 M Code
PI 99	0	9024.nc 호출 M Code
PI 100	0	9025.nc 호출 M Code
PI 101	0	9026.nc 호출 M Code
PI 102	0	9027.nc 호출 M Code
PI 103	0	9028.nc 호출 M Code
PI 104	0	9029.nc 호출 M Code

N_ G65 P___ < >;
 N_ Mxx < >; . (M xx
 PI 95 ~ PI 104(#3095~3104) .)

(2) M FIN, M 가 .(M98, M99)

(3) M01 ~ M97 10 M 가 .
 (M02, M30 가)

- G M , T Mxx 가
 M

- M M (N_)

14.1.5 M

(1) (PI 95~104) M 가
 N_ G_ X_ Y_ M98 P____;
 N_ G_ X_ Y_ Mxx;

: G M , T M Mxx 가

14.1.6 T

(1) PI 105(#3105) T 가
 N_ G_ X_ Y_ M98 P9000;
 N_ G_ X_ Y_ Txx;

14.1.7 M98 G65

(1) G65 가 .
 (2) M98 M , P L
 branch .
 G65 branch .
 (3) M98 O, N, P, L single stop .
 G65 .
 (4) G65 local level , M98 .
 , G65 #i 가 G65
 #i #i .
 M98 #i 가 M98
 #i .
 (5) G66 G65 4 가 . M98 G65, G66
 8 가 .

14.1.8 (G66)

G66 P _ L _ < >

(1)

- 가
.(가)
- 4 가

(2)

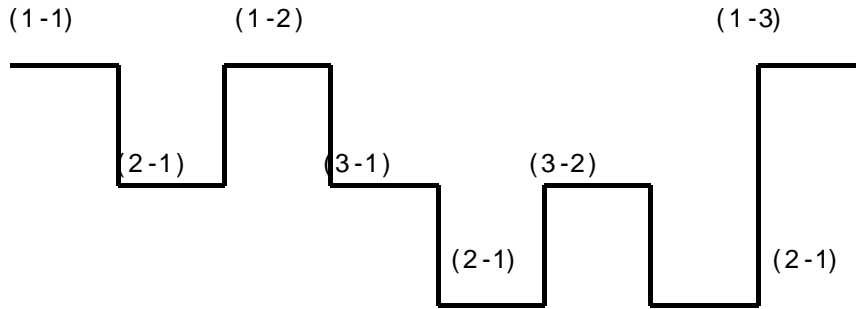
- (motion)
가 . 가
(motion)

- (G66)
) ()
.....
G66 P9100; (,
)
Z1000; (1-1)
G66 P9200
Z15000; (1-2)
G67; P9200 cancelled
G67; P9100 cancelled
Z -25000; (1-3)

O9100;
X5000; (2-1)
M99;

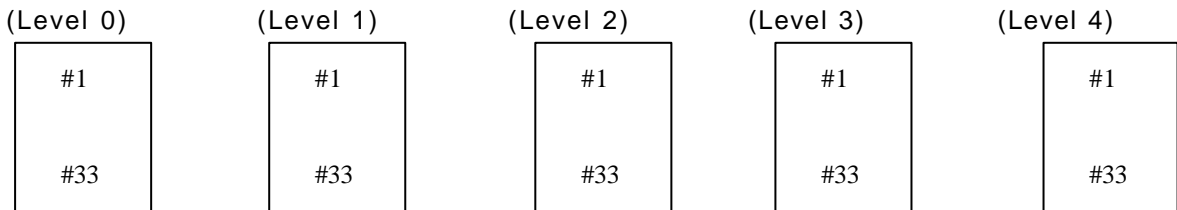
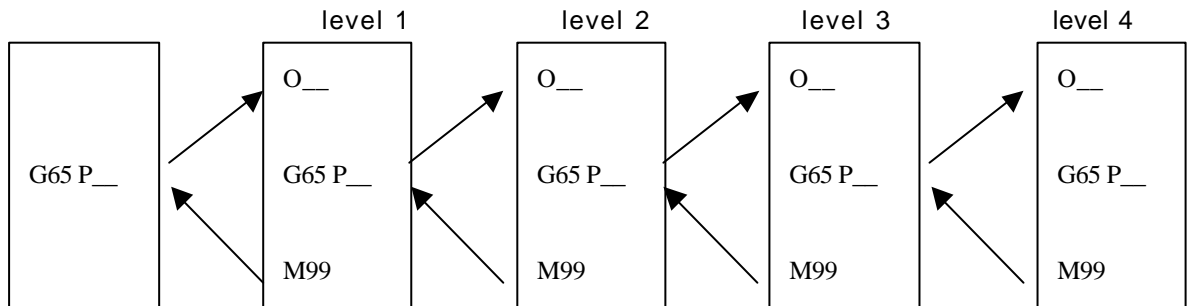
O9200;
Z6000; (3-1)

Z7000; (3-2)
M99;



(3) Level Local

G65, G66 G 가 ,
level 가 (level 0 ~ level 4). local
variable level 1 가 .



- (Level 0) #1 ~ #33 가 .
- G65 (level 1) 가
(store) level 1 #1 ~
#33(level 1) (prepare) .

- 가 (level 2, 3, 4) (level 1, 2, 3)가
 level 가 .
- M99 level 2, 3 (level 0,
1, 2, 3)가 (restore) .

14.2 (Custom Macro)

14.2.1

- O0001 - O8999 가
- O9000 - O9999 (PA 2) , 가
- Custom Macro , 가
- (G65 A_ B_)

14.2.2

-
-

(1)

#i (i= 1, 2, 3, ...)
#[]

(2)

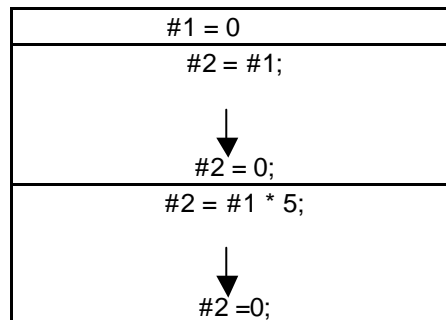
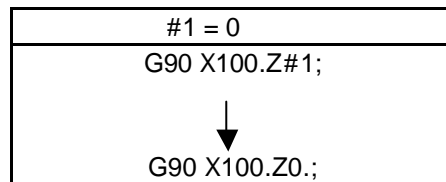
- = #1, -#1 가 .
) F#103 ----- #103= 100 F15
Z-#110 ----- #110 = 250 Z-250 .
- #100 = 105 #105=-500 , "##100"
"#[#100]"
- /, :, O, N .

Optional Block Skip /n n(n= 1, 2, .. 9)

- #140 = 1000 G#140 OVER.
• [] 가 (double)

(3)

- 0



- MDI 가

14.2.3

local , common system

Local	#1 ~ #33	local local #i #i	Local .(/, O, N 가) Local 0
	#34 ~ #99	local	"
Common	#100 ~ #199 #200 ~ #699	Common Main #i () #i common #i .(#[#i]) 가 가	#100 ~ #199 : OFF/ ON 0 clear #200 ~ #699: OFF clear

System	#1600~#1663 :	type	System	가
	#1664~#1727 :	R		
	#1728~#1791 :	X		
	#1792~#1855 :	Y		
	#1856~#1919 :	Z		
	#2112~#2239 :			
	#2240~#2367 :			
	#2377~#2385 : G54	(X, Y, Z...)		
	#2386~#2394 : G55	(X, Y, Z...)		
	#2395~#2403 : G56	(X, Y, Z...)		
	#2404~#2412 : G57	(X, Y, Z...)		
	#2413~#2421 : G58	(X, Y, Z...)		
	#2422~#2430 : G59	(X, Y, Z...)		
	#6718 ~ : G	modal 32		
	#4379 ~ #4382 :	Servo		
#7000 ~#7034:	UI (G115~G118)			
#7500 ~#7534:	UO (F105~F108)			
#8000 ~#8031 :	2			
#8032 ~#8063 :	3			
#8064 ~#8095 :	4			
#4018 : TPG	()			

#4018 : TPG	TPG	TPG	가	가
	(#4018 1 TPG, 0 가)			
	) QT	PLC	F map	
	(9010.nc)	TPG		

- System

(1) system (32bit) : #7000 ~ #7031 , #7032 ~ #7035

- Input Signal

System Variable	Point	Interface input signal	G map
#7000	1	2 ⁰ UI 0 00	G 115.0
#7001	1	2 ¹ UI 0 01	G 115.1
#7002	1	2 ² UI 0 02	G 115.2
#7003	1	2 ³ UI 0 03	G 115.3
#7004	1	2 ⁴ UI 0 04	G 115.4
#7005	1	2 ⁵ UI 0 05	G 115.5
#7006	1	2 ⁶ UI 0 06	G 115.6
#7007	1	2 ⁷ UI 0 07	G 115.7
#7008	1	2 ⁸ UI 0 08	G 115.8
#7009	1	2 ⁹ UI 0 09	G 115.9
#7010	1	2 ¹⁰ UI 0 10	G 115.10
#7011	1	2 ¹¹ UI 0 11	G 115.11
#7012	1	2 ¹² UI 0 12	G 115.12
#7013	1	2 ¹³ UI 0 13	G 115.13
#7014	1	2 ¹⁴ UI 0 14	G 115.14
#7015	1	2 ¹⁵ UI 0 15	G 115.15
#7016	1	2 ¹⁶ UI 0 16	G 115.16
#7017	1	2 ¹⁷ UI 0 17	G 115.17
#7018	1	2 ¹⁸ UI 0 18	G 115.18
#7019	1	2 ¹⁹ UI 0 19	G 115.19
#7020	1	2 ²⁰ UI 0 20	G 115.20
#7021	1	2 ²¹ UI 0 21	G 115.21
#7022	1	2 ²² UI 0 22	G 115.22
#7023	1	2 ²³ UI 0 23	G 115.23
#7024	1	2 ²⁴ UI 0 24	G 115.24
#7025	1	2 ²⁵ UI 0 25	G 115.25
#7026	1	2 ²⁶ UI 0 26	G 115.26
#7027	1	2 ²⁷ UI 0 27	G 115.27
#7028	1	2 ²⁸ UI 0 28	G 115.28
#7029	1	2 ²⁹ UI 0 29	G 115.29
#7030	1	2 ³⁰ UI 0 30	G 115.30
#7031	1	2 ³¹ UI 0 31	G 115.31
#7032	32	UI0 0 UI0 31	G 115
#7033	32	UI1 0 UI1 31	G 116
#7034	32	UI2 0 UI2 31	G 117
#7035	32	UI3 0 UI3 31	G 118

$$\#7032 = \sum_{i=0}^{31} \#[7000 + i] * 2^i$$

Value of variable	Input Signal
1	Contact closed(HIGH)
0	Contact open(LOW)

(2) system (32bit) : #7500 #7531, #7532 ~ #7535

● Output Signal

System Variable	Point	Interface input signal	F map
#7500	1	2 ⁰ UO 000	F105.0
#7501	1	2 ¹ UO 001	F105.1
#7502	1	2 ² UO 002	F105.2
#7503	1	2 ³ UO 003	F105.3
#7504	1	2 ⁴ UO 004	F105.4
#7505	1	2 ⁵ UO 005	F105.5
#7506	1	2 ⁶ UO 006	F105.6
#7507	1	2 ⁷ UO 007	F105.7
#7508	1	2 ⁸ UO 008	F105.8
#7509	1	2 ⁹ UO 009	F105.9
#7510	1	2 ¹⁰ UO 010	F105.10
#7511	1	2 ¹¹ UO 011	F105.11
#7512	1	2 ¹² UO 012	F105.12
#7513	1	2 ¹³ UO 013	F105.13
#7514	1	2 ¹⁴ UO 014	F105.14
#7515	1	2 ¹⁵ UO 015	F105.15
#7516	1	2 ¹⁶ UO 016	F105.16
#7517	1	2 ¹⁷ UO 017	F105.17
#7518	1	2 ¹⁸ UO 018	F105.18
#7519	1	2 ¹⁹ UO 019	F105.19
#7520	1	2 ²⁰ UO 020	F105.20
#7521	1	2 ²¹ UO 021	F105.21
#7522	1	2 ²² UO 022	F105.22
#7523	1	2 ²³ UO 023	F105.23
#7524	1	2 ²⁴ UO 024	F105.24
#7525	1	2 ²⁵ UO 025	F105.25
#7526	1	2 ²⁶ UO 026	F105.26
#7527	1	2 ²⁷ UO 027	F105.27
#7528	1	2 ²⁸ UO 028	F105.28
#7529	1	2 ²⁹ UO 029	F105.29
#7530	1	2 ³⁰ UO 030	F105.30
#7531	1	2 ³¹ UO 031	F105.31
#7532	32	UO0 0 UO0 31	F105
#7533	32	UO1 0 UO1 31	F106
#7534	32	UO2 0 UO2 31	F107
#7535	32	UO3 0 UO3 31	F108

$$\#8032 = \sum_{i=0}^{31} \#[8000 + i] * 2^i$$

, uo[100+i] 가 LOW Vi = 0,
uo[100+i] 가 HIGH Vi = 1,

(3) : #2001 ~ #2901

- Shift

	Shift
X	#2368
Y	#2369
Z	#2370

- 2,3,4

	2	3	4
X	#8000	#8032	#8064
Y	#8001	#8033	#8065
Z	#8002	#8034	#8066

●

-

		offset (Geometric offset)	Wear offset
X	1 ~ 64	#1728 ~ #1791	#1920 ~ #1983
Z	1 ~ 64	#1856 ~ #1919	#2048 ~ #2111
R(Nose)	1 ~ 64	#1664 ~ #1727	
T()	1 ~ 64	#1600 ~ #1663	
Y	1 ~ 64	#1792 ~ #1855	#1984 ~ #2047

●

- : #2112 ~ #2239

D	Variables
1	#2112
2	#2113
..	..
127	#2238
128	#2239

- : #2240~#2367

H	Variables
1	#2240
2	#2241
..	..
127	#2366
128	#2367

X	G54(1)	#2377
	G55(2)	#2386
	G56(3)	#2395
	G57(4)	#2404
	G58(5)	#2413
	G59(6)	#2422
Y	G54(1)	#2378
	G55(2)	#2387
	G56(3)	#2396
	G57(4)	#2405
	G58(5)	#2414
	G59(6)	#2423
Z	G54(1)	#2379
	G55(2)	#2388
	G56(3)	#2397
	G57(4)	#2406
	G58(5)	#2415
	G59(6)	#2424
4 th ~ 9 th	G54(1)	#2380 ~
	G55(2)	#2389~
	G56(3)	#2398~
	G57(4)	#2407~
	G58(5)	#2416~
	G59(6)	#2425~

(4) Single Block : #3083

System #3083 block single
 block .

#3083	Single Block
1	
0	

(5) 가 가 (-)

#6101 : 가 (0 가)

#2431 : 가

(6)

	Modal information
#6718	G group 1
#6719	G group 2
#6720	G group 3
..	..
#6749	G group 32
#4882	D
#4883	H
#4721	F
#6716	No
#4792	S

(7)

System		
#6205		X
#6206		Y
#6207		Z
#6208		4
		(Machine coordinate)
#4083		X
#4084		Y
#4085		Z
#4086		4
#6319	Skip 가	X
#6320	Skip 가	Y
#6321	Skip 가	Z
#6322	Skip 가	4
		G31 skip 가 ON
#4379	X	
#4380	Y	
#4381	Z	
#4382	4	

: G31 skip signal 가
 signal position .

□ ||

G65 P9300 X() Y() Z()

O9300

#1 = #5001;

#2 = #5002;

#3 = #5003;

G00 X#24 Y#25;

G04; (#5201 dwell)

G91 X[Xp - #5021] Y[Yp - #5022] Z[Zp - #5023];

..

X#24 Y#25 Z#26;

X#1 Y#2;

Z#3;

M99

14.2.4

(1) ,
#i = #j

(2) 가
#i = #j + #k
#i = #j - #k
#i = #j OR #k
#i = #j XOR #k

(3)
#i = #j * #k
#i = #j / #k
#i = #j AND #k

(4)
#i = SIN[#j]
#i = COS[#j]
#i = TAN[#j]
#i = ATAN[#j]
#i = SQRT[#j]
#i = ABS[#j]
#i = ROUND[#j]
#i = AND[#j]
#i = OR[#j]
#i = FIX[#j]
#i = FUP[#j]

- ROUND

IF, WHILE

```
#1 = ROUND[1.2345];          #1 = 1.0
IF [#1 LE ROUND[#2]] GOTO 10;  #2 가 3.567      ROUND[#2]
4.0
```

G01 X[ROUND[#1]]; #1 1.4567 X 가 0.001
 G01 X1.456;

) N1 #1 = 1.2345;

N2 #2 = 2.3456;

N3 G91 G01 X#1 F100; (X1.235)

N4 X#2; (X2.346)

N5 X-[#1 + #2]; (1.2345 + 2.3456 = 3.5801

X3.580)

N5 X-[ROUND[#1]+ROUND[#2]]; (1 + 2 = 3 X3.)

(5)

, 가

#i=#j + #k*SIN[#1];

(6) []

[]

[] [] 10 가

#i = SIN[[[#j + #k] * #l + #m] * #n];

14.2.5

(1)

```
IF [ < > ] GOTO n
```

< > : EQ, NE, GT, LT, GE, LE

n : TRUE Sequence n

n [< >] 가

(2)

```
WHILE [ < > ] DOm
(m = 1, 2, 3...)
END m
```

< > DOm END m

< > END m

WHILE [< >] IF 가

DOm ENDm

WHILE [< >] DOm ENDm pair , m ,

)

#120 = 1;

N1 WHILE [#120 LE 10] DO 1;

N2 WHILE [#30 EQ 1] DO 2;

N3 END 2;

#120 = #120 + 1;

N33 END 1;

10


```
( )
DO m      END m
END 1
.
DO 1      ( 가)
DO m      END m      1 1
DO 1
.
DO 1
.
END 1      ( 가)
DO 1
.
END 1
.
END 1      ( 가)
DO 1
.
END 1
.
DO 1
.
END 1      (가 )
DO      3
DO 1
.
DO 2
.
DO 3
.
END 3
.
END 2
.
```

```

END 1
    DO
DO 1
.
DO 2
.
END 1
.
END 2          ( 가 )
    DO
DO 1
.
GOTO 9000
.
END 1
.
N9000          ( 가 )
    DO
GOTO 9000
.
DO 1
.
N9000
.
END 1          ( 가 )

DO 1
.
N9000
.
END 1
.
GOTO 9000     ( 가 )
    DO
. DO

```

```
DO 1
.
G65 ... (가 )
.
G66 ... (가 )
.
G67 (가 )
.
END 1
.
DO 1
.
M98 ... (가 )
.
END 1
```

14.2.6

CNC

	(GOTO, DO, END) (G65, G66, G67, G)
CNC	O, N, P, L (M98, M, T) M99
CNC	single block 가 Nose R Macro - M , G31 가 - 1) R 2) CNC R

14.3 (Custom Macro)

. (9000.NC ~ 9999.NC)
가 .

14.4

(1) MDI

가
가 .

(2) Single Block

single , ,
가 가 .
, (G65, G66, G67), ,
single block 가 가 .

(3) Optional Block Skip

/가 optional block skip

(4) EDIT Mode

(PA 2) 9000 ~ 9999

(5) RESET

RESET clear local (#1~#33) common
(#100~#199)가 0 clear , (PI 74) clear
clear
, , DO clear
main .

(6) restart page

M , T

M , T

M98

(7) Feed Hold

Macro

feed hold

, Macro

(8)

●

#0, #1 ~ #33 (가), #34 ~ #99,

#100~#149, #150~#199,

#500~#699,

System

●

: $\pm 10^{47}$

: $\pm 10^{29}$

● < >

: ± 99999999.999

: ± 0.0000000001

가

●

4

● []

10

●

8

14.5

14.5.1

PLANE DRILL

```
G40 G49 G80 ;
G28 G91 Z0. ;
G28 X0.Y0. ;
G90 G92 X150. Y150. Z200.;
Z50.
G0 X0 Y0

#100 = 15. ; X DRILL NUMBER
#102 = 10. ; X DISTANCE
#103 = 0; ; X COUNT

#111 = 5. ;Y LINE COUNT
#112 = 10. ; Y DISTANCE
#113 = 0; ; Y COUNT

#200 = 0. ; START X POS
#201 = 0.; START Y POS

G90 X[#200] Y[#201]

N10
G90 X[#200] Y[#201 + #112 * #113]
N20
;G81 X_Y_ Z-15. R2. F200.
G90 X[#200 + #102 * #103] Y[#201 + #112 * #113]
G1 Z-10. F100.
G0 Z5.
#103 = #103 + 1;
IF [#103 LT #100-1] GOTO 20
```

```
#103 = 0;  
#113 = #113 + 1;  
IF [#113 LT #111-1] GOTO N10
```

```
G91 G0 Y50.  
X50.
```

```
#102 = #102 + 1;  
G49 G00 Z200. M05;  
M02;
```


14.5.2 가 (1)

(Macro Program)

G40 G49 G80 ;

G28 G91 Z0. ;

G28 X0.Y0. ;

G90 G92 X150. Y150. Z200. ;

Z50.

G0 X0 Y0

#100 = 0. ; ANGLE

#101 = 50.; RADIUS

N20

G1 X[SIN[#100] * #101] Y[COS[#100] * #101]

#100 = #100 + 1;

IF [#100 LE 360.0] GOTO 20

G91 G0 Y50.

X50.

#102 = 1; count

#102 = #102 + 1;

G49 G00 Z200. M05;

M02;

14.5.3 WHILE - END m

(Macro Program CIRCLE DRILL)

G40 G49 G80 ;

G28 G91 Z0. ;

G28 X0.Y0. ;

G90 G92 X150. Y150. Z200.;

G0 Z10.

G0 X0 Y0

G0 X0 Y0

#100 = 0. ; START ANGLE

#101 = 50 ; RADIUS

#102 = 45. ; BETWEEN ANGLE

N150 WHILE [#100 LE [360.-#102]] DO 210

N200 WHILE [#101 GE 10.] DO 220

;G98 G81 X[SIN[#100] * #101] Y[cos[#100] * #101] Z-15. R2. F200.

G0 X[SIN[#100] * #101] Y[cos[#100] * #101]

G1 Z-20. F100.

G0 Z10.

#101 = #101 - 10.; (INCREASE)

END 220

#100 = #100 + #102 ; (RADIUS DECREASE)

#101 = 50. ;RADIUS

END 210

G91 G0 Y50.

X50.

G90 G49 G00 Z200. M05;

M02;

15 (Special Functions)

15.1 가 (High Speed Machining)

- 15.1.1 가
(G10.3, High Speed Machining Mode)
- 15.1.2 가
- 15.1.3 가 (Special Feature of High Speed Machining)
- 15.1.3 가 (Special Feature of High Speed Machining)
- 15.1.4 가
(High Speed Machining Parameter Setting)

15.2 (G50, G51, **Scaling Function**)

- 15.2.1 /
- 15.2.2 /

15.3 (G50, G51, **Mirror Image**)

15.4 (**Coordinate Rotation**)

- 15.4.1 (G68, G69, Coordinate Rotation)
- 15.4.2 (Relationship with other functions)

15.5 (Prohibition Area Setting/Cancel)

- 15.5.1 H/W() Limit (Hardware Limit)
- 15.5.2 S/W() Limit (Software Limit)
- 15.5.3 S/W Limit
(G22, G23, Software Prohibition Area Setting by the Program)

15.6 (Stitch Function)

- 15.6.1 (Stitch Function Mode)
- 15.6.2 (Explanation about Stitch Function)
- 15.6.3 (Stitch Function Parameter Setting)

15.1 가 (High Speed Machining)

15.1.1 가 (G10.3, High Speed Machining Mode)

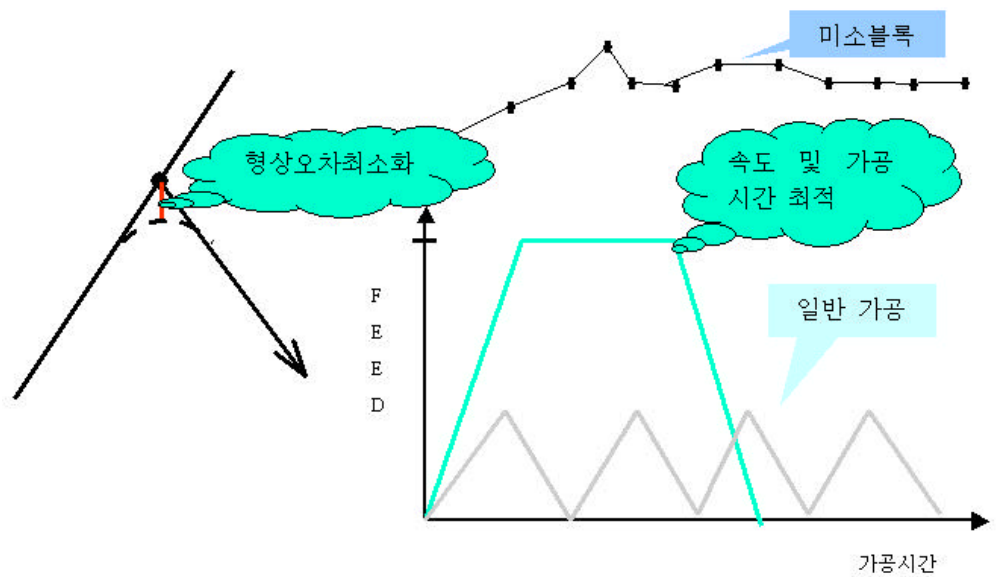
G10.3 G11.3

G10.3	가	[High Speed Machining Mode ON]
G11.3	가	[High Speed Machining Mode OFF]

15.1.2 가

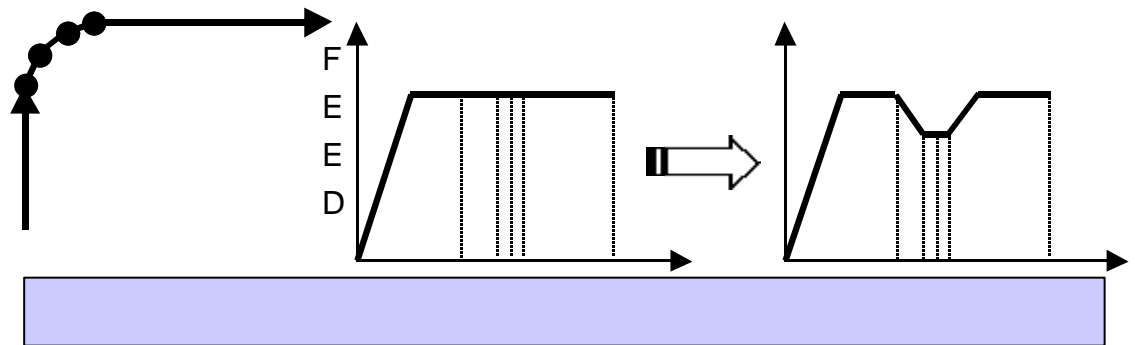
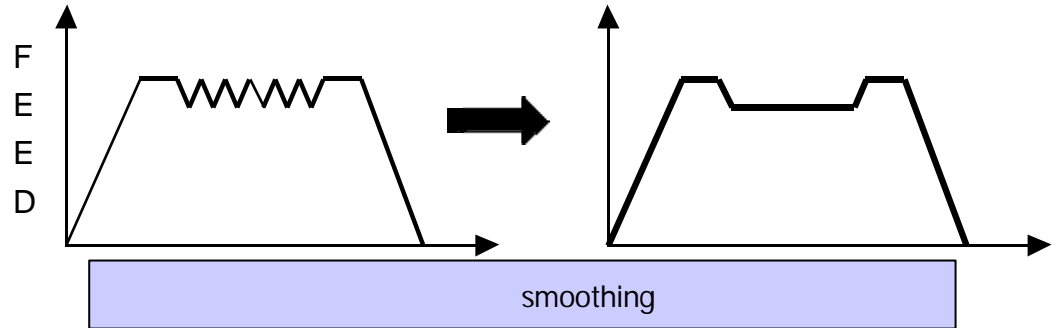
가 , 가
Feed Forward 가

가 가 . 가
가 , 가 가



15.1.3 가 (Special Feature of High Speed Machining)

- 가 Hardware 가 .
- 475 Block Interpreter(Pentium 133MHz) , 1mm
475mm/sec 가 가 가 .
- 100 Block Look Ahead .
- Feed Forward .
- 가 가 .
- .
- 가 smoothing
- 가 (G01) (G02/G03) 가 가 .
- 가 가 .
- 가 가 .
- 가 Feed Override 가 .
- 가 가 .
- smoothing 가 .
- 가 가 가 Feed Hold, .
- Single Block 가 .
- 가 가 .
- 가 interlock 가 .
- 가 TPS .
- 가 Manual ABS On/Off .
- 가 가 .
- Machine Lock 가 가 .



15.1.4 가 (High Speed Machining Parameter Setting)

< ->가 1-> 가 >	
PM 680	0 고속가공 종류 선택(0:Type 1,1:Type 2)
PM 701	50 msec 고속가공 보간전 가감속 시정수
PM 704	0 msec 고속가공 보간후 가감속 시정수(Type2)
PM 710	3000,0 mm/min 고속가공 최고 절삭 속도
PM 711	1,0 mm/min 고속가공 최저 절삭 속도
PM 720	0 mm/min 고속가공 백터오차 허용값
PM 721	0,0010 mm 고속가공 형상오차 허용치(Type 1)
PM 725	0 고속가공 선행 보간 Factor
PM 729	1 R 속도제한기능 사용 여부 (Type2) (0:사용안함 1:사용함)
PM 730	0,000 mm R 속도제한기능 적용 최대 블록 길이 (Type2)
PM 731	0,000 mm R 속도제한기능 기준 반경 (Type2)
PM 732	0,0 mm/min R 속도제한기능 기준 가공속도 (Type2)
PM 735	1 고속가공 가공속도 선택(0:지령속도,1:최대 고속가공속도)
PM 740	1 고속가공중 G00블록의 처리(0:고속가공,1:일반가공)

(1) 가 (PM 680)

: 가 Type1: 가
 가 Type2 : 100 가
 Type1 , Type2

(2) 가 가 (PM 701)

: 가
 1000mm/min . 25~45 .

(3) 가 가 (Type 2) (PM 704)

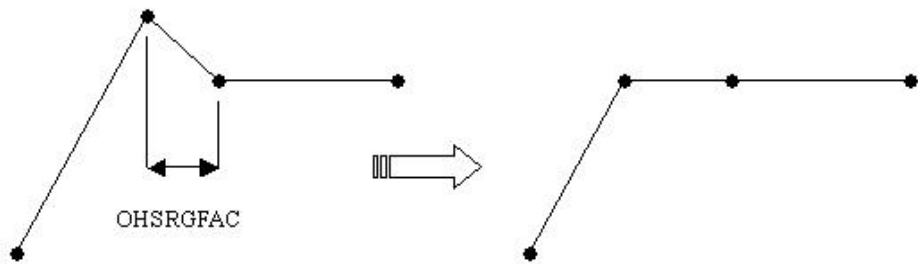
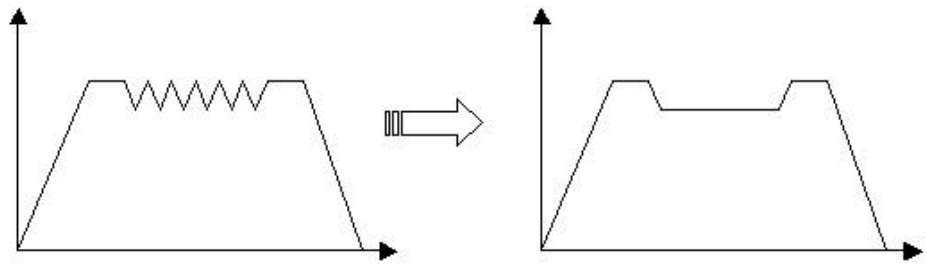
: 가 가 Jerk
 가
 0 .

(4) 가 / 가 (PM 710,711)

: 가 .

(5) 가 (PM 720)
 : , 0

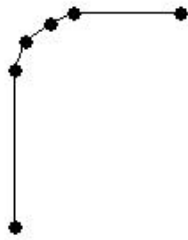
(6) 가 Factor (PM 725)
 : 가 Factor 가
 Type1 가 Type 2 Smoothing
 Sampling 가 Smoothing 가
 , Sampling 3



(7) 가 (R)

: 가

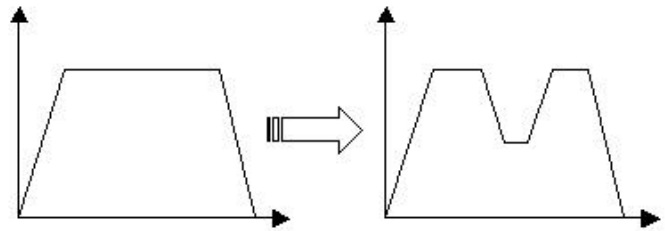
OHSRLMTF



(Type 2) (PM 729)

가

가 OHSRLMTR



(8) 가 (R)

(PM 730)

:

(Type 2)

(9) 가 (G00)

(PM 740)

: 0

가

가

1

가

.

15.2 (G50,G51, Scaling Function)

가

15.2.1 /

G50
G51 X _ Y _ Z _ P _

G50 [Scaling Cancel]

G51 ON [Scaling On]

X_Y_Z_

X_Y_Z_

G51

G90

가

P_

가

1/1000

(2 = P2000, 0.5 = P500)

P

G50

▶▶

P 가

PI 108~116 (#3108~3116)

X, Y, Z 가

G51

G51

가

G50, G51

G

PI 149(#3149)

G

15.2.2

/

G50
G51 X _ Y _ Z _ I _ J _ K _

G50 [Scaling Cancel]

G51 ON [Scaling On]

X_ Y_ Z_ G90 .

X_ Y_ Z_ G51

I_ J_ K_ I = X , J = Y , K = Z

1/1000 .

□ II : G90

G90 G00 X0. Y100. : X0. Y100.

G51 X0. Y0. Z0. I2000. J1000. : X 2 , Y 1

G02 X100. Y0. R100. F500. : X200. Y0.

□ ►►

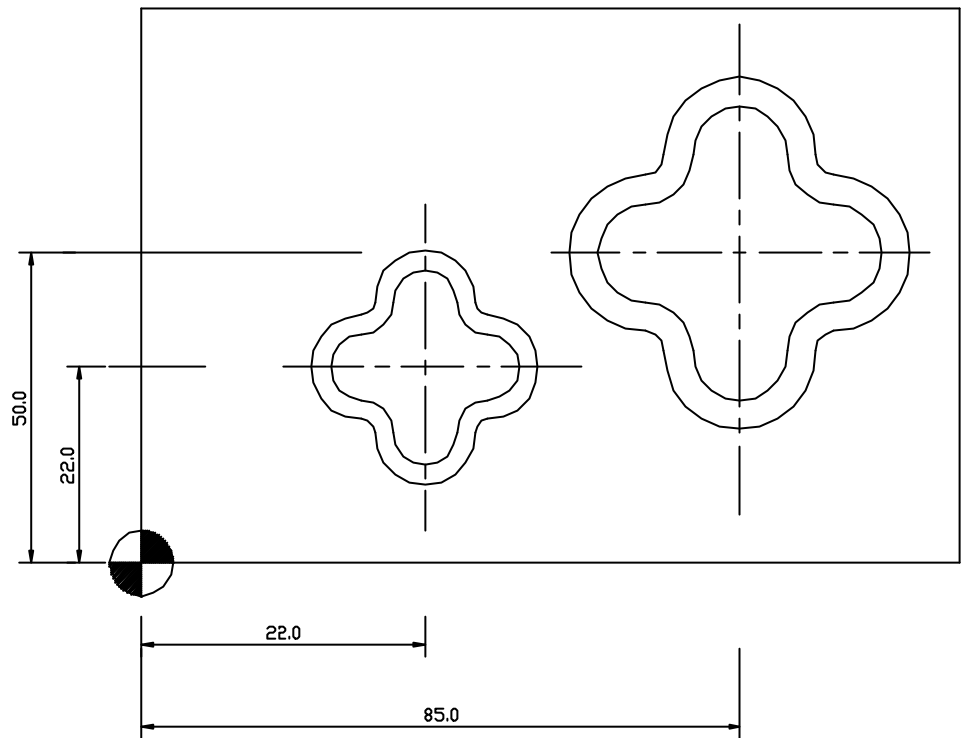
P I, J, K 가 , (Scale Factor)

PI 108~116 (#3108~3116)

X, Y, Z 가 G51 G51 가

G50, G51 G

PI 149(#3149) G



G00 G90 X0. Y0. ;

Z2. ;

G52 X22. Y22. ; ()

G51 X0. Y0. I1000. J1000. ; (1)

M98 P1234 ; ()

Z2. ;

G52 X85. Y50. ; ()

G51 X0. Y0. I1500. J1500. ; (1.5)

M98 P1234 ; ()

G50 ;

G52 X0. Y0. ; ()

```

:
G51 , G50
.
(Canned cycle) Z
- G73/G83 Q (return relief )
- Fine boring (G76)
- Shift of X and Y axes in back boring (G87)
G27, G28, G29, G30, G92 G50
.
5
(center of rotate)
G51 G51
(G91) (G51 )
가 (G90)

```

15.3 (G50,G51, Mirror Image)

G50
G51 X _ Y _ Z _ I -_ J -_ K -_

G50 [Cancel any Mirror Image Command]
G51 [Mirror Image]

X_ Y_ Z_ G90
X_ Y_ Z_ G51

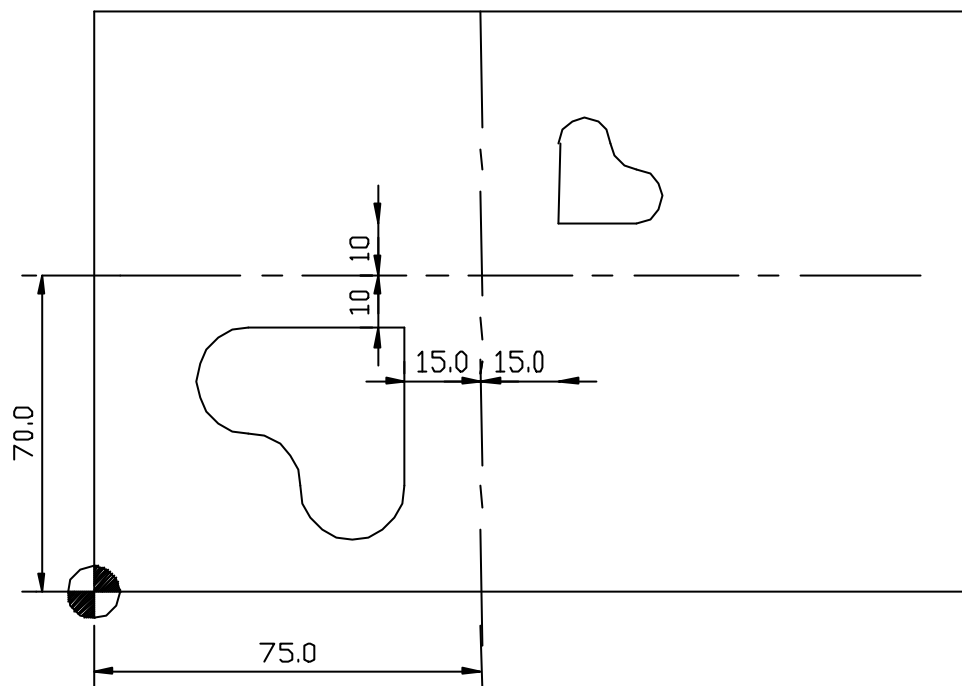
I_ J_ K_ ' - '
I = X , J = Y , K = Z
1/1000

ex) I-1000 : X (1)
J-1500 : Y (1.5)
K-2000 : Z (2)

P_ I_
J_ K_ P_
' - '
(2 = P-2000,
1/2 = P-500)

/ 가 ,
G51 I_ J_ K_(P_) (+)
(-)

□ II



```

G54 G91 XZ0. ;
G54 G90 G00 X0. Y0. ;
G52 G90 X90. Y80. ;           (1           )
G00 X0. Y0. ;
M98 P1234 ;                   (           )
Z2 ;
G52 X60. Y80. ;               (2           )
G51 X0. Y0. I-1500. J-1500. ; (   1.5   )
                                (X,Y       ON)
M98 P1234 ;                   (           )
G50 ;
G52 X60. Y60. ;               (           )
    
```

15.4 (Coordinate Rotation)

15.4.1 (G68, G69, Coordinate Rotation)

```
G17 G68 X _ Y _ R _
G18 G68 Z _ X _ R _
G19 G68 Y _ Z _ R _
G69
```

G68 [Coordinate System Rotation]
 G69 [Coordinate System Rotation Cancel]

G17 X_ Y_ G17
 G18 Z_ X_ G18
 G19 Y_ Z_ G19
 R_

가

가



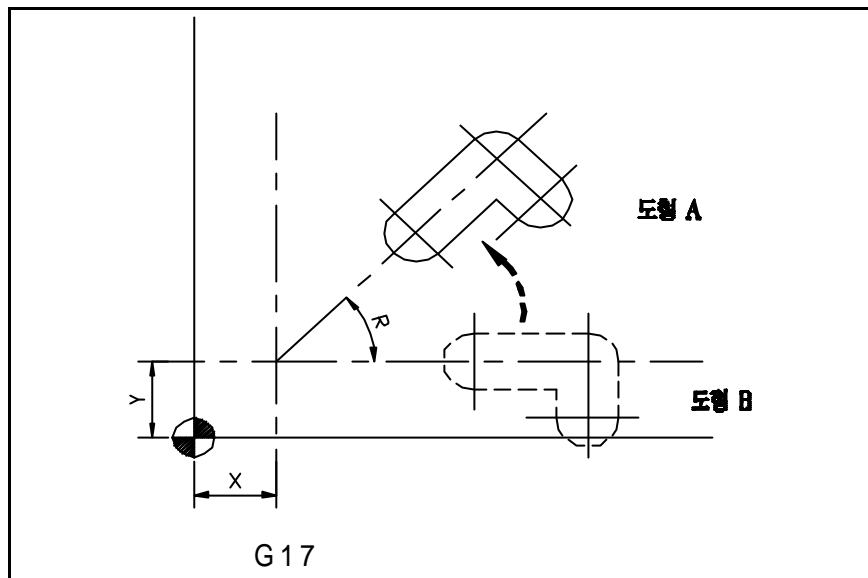
G68 ()가

G68 (G91)
 (G90) G68
 , G68 가

R PI 117(#3117)

가

G69



R : + .

```

:
G68
          PI 150(#3150) 1
R          decimal point가
G68      G00, G01
G27, G28, G29, G30 , G92  G69
    
```

15.4.2 (Relationship with other functions)

(1) C

G68, G69 가 .



```

N1 G92 X0 Y0 G69 G01
N2 G42 G90 X1000. Y1000. F100 D01
N3 G68 R -30.0 ( 30.0 )
N4 G91 X2000.0
N5 G3 Y1000.0 J500.
N6 G1 X-2000.
N7 Y-1000.
N8 G69 G40 G90 X0 Y0 M30
    
```

(2)

(G51)
(a,b) scale . R scale
scale ,



```

G51... ( )
G68... ( ON)
...
G69... ( OFF)
G50... ( )
    
```

:

(G41/G42) (setting)

□ II

(G40)
G51 ... ()
G68... (ON)
.
.
G41.. ()

(3) ()

가 가 .

□ II

G92 X0 Y0 G69 G17
G01 F200 H01
M98 P2100
M98 P2200 L7
G00 G90 X0 Y0
M30

O2200
G68 X0 Y0 G91 R45.0 (O 45 가,
)
G90 M98 P2100
M99

O2100
G90 G1 G42 X0 Y-10.0
X4.142
X7.071 Y-7.071
G40
M99

□ ||

■
N1 G92 X-50 Y-50 G69 G17 ;
N2 G68 X70 Y30 R60 ; (: X 70. Y 30.)
N3 G90 G01 X0 Y0 F200 (G91 X50 Y50) ; (60°)
N4 G91 X100 ;
N5 G01 Y100 ;
N6 X-100 ;
N7 Y-100 ;
N8 G69 G90 X-50 Y-50 M30 ;

15.5 (Prohibition Area Setting/Cancel)

가

가

15.5.1 H/W() Limit (Hardware Limit)

H/W Limit Switch

Over Travel

OP Panel

Mode Select

JOG

Axis Select

O.T Release

15.5.2 S/W() Limit (Software Limit)

Soft Limit

MDI

S/W Limit



Soft Limit 가 가 Soft Limit

X :1, Y :2, Z :4

Soft Limit PM 3378~3409 (#23378~23409)

Soft Limit PM 3410~3473 (#23410~#23473)

/

15.5.3

S/W Limit

(G22, G23, Software Prohibition Area Setting by the Program)

G22 X _ Y _ Z _ I _ J _ K _
G23

G22 [Stored Stroke Check Function On]

G23 [Stored Stroke Check Function Off]

X_ Y_ Z_ A
A 가

I_ J_ K_ B A

I > X , J > Y , K > Z I_ J_ K_
X_ Y_ Z_

G22 가 가 “ G22
Limit Over ” 가
G23 가

☐ ▶▶
G22 G23 G
G23

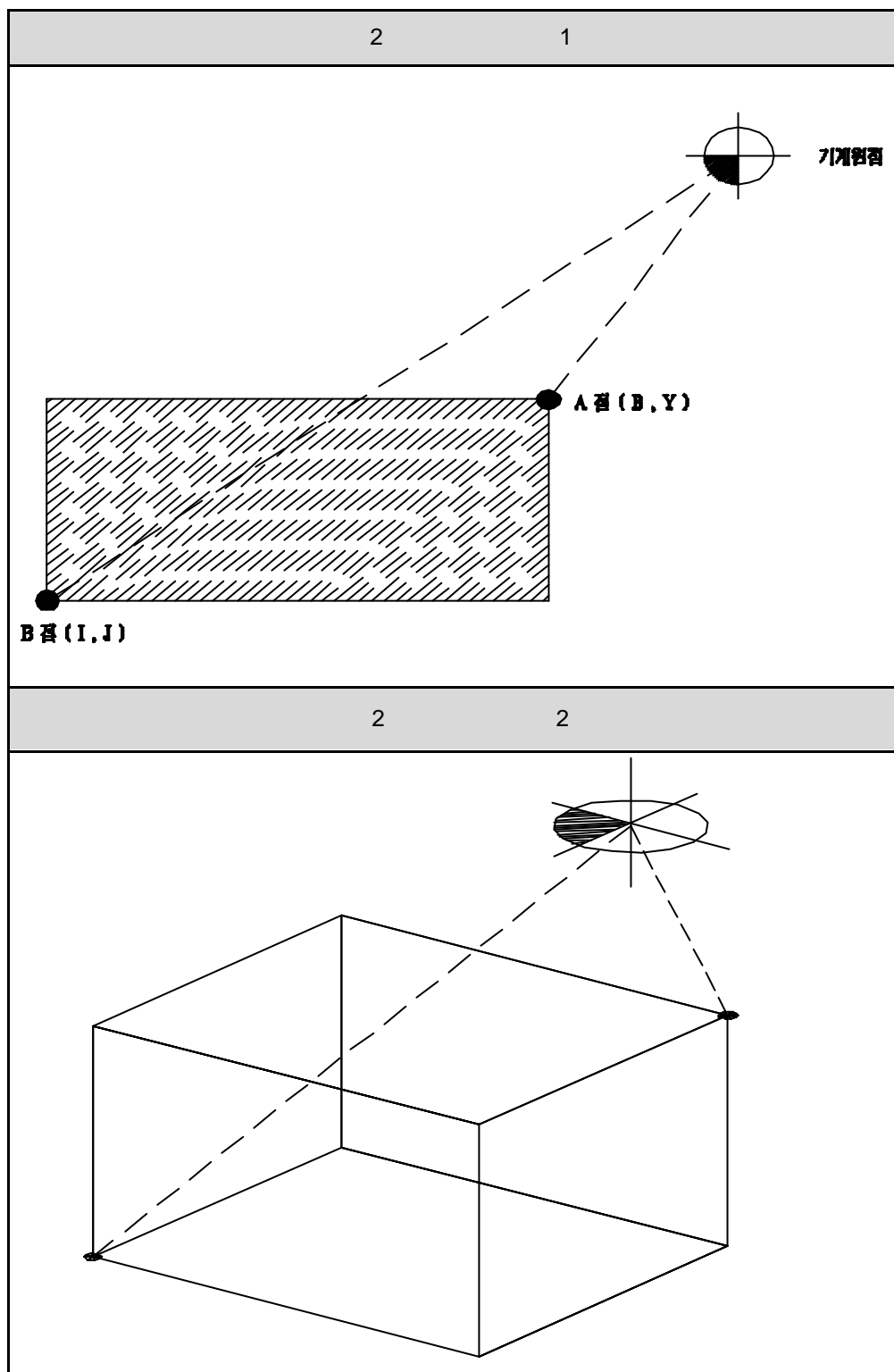
G22 PM 3474 (#23474) 0
. 1 , G22

G22 PM 3475 (#23475)

G94 F500 G01 IP

G95

G94



□ ▶▶

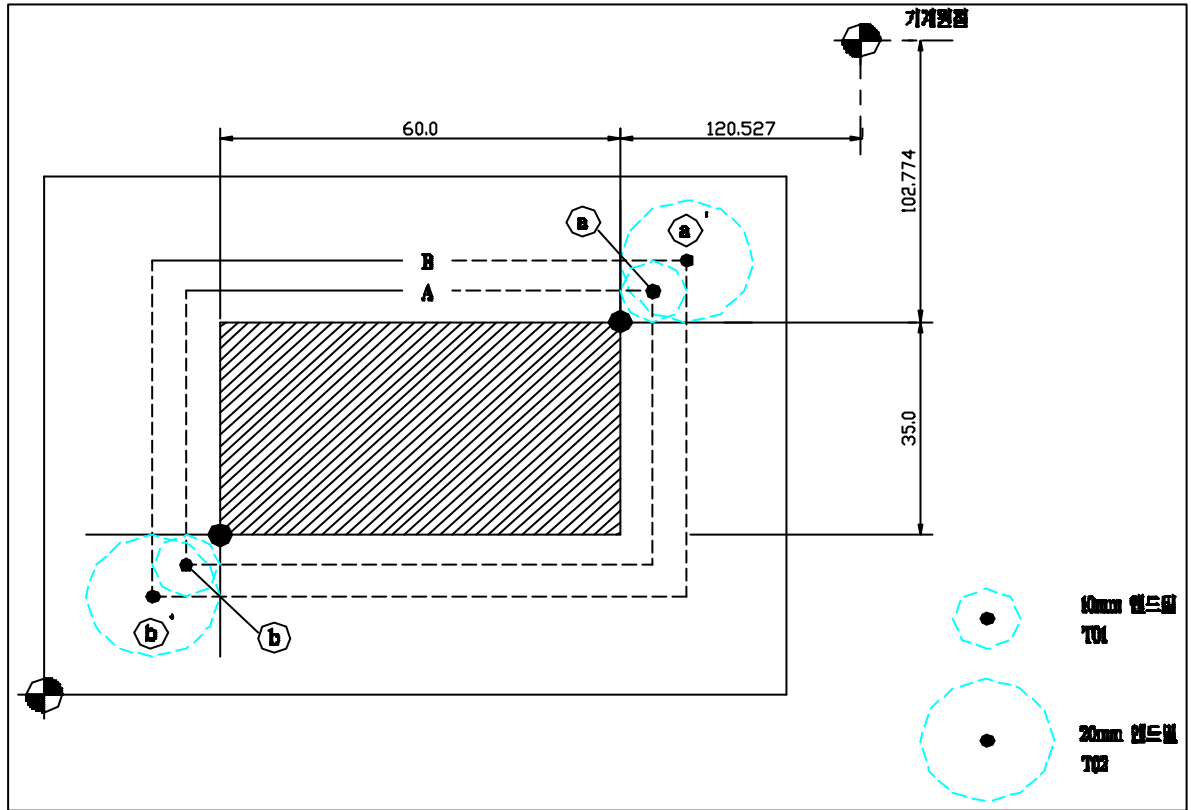
가

가 .

가

가 .

□ II



□ ▶▶

G30 G91 Z0

G22 X-120 Y-100 I-190 J-150 (A a (-120, -100) b (-190, -150))

↓ (가)

G23 ()

↓

G30 G91 Z0

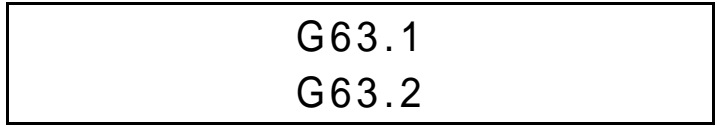
G22 X-110 Y-90 I-200 J-160 (B a' b')

↓ (가)

G23 ()

15.6 (Stitch Function)

15.6.1 (Stitch Function Mode)



G63.1 [Stitch Function Mode ON]
 G63.2 [Stitch Function Mode OFF]

15.6.2 (Explanation about Stitch Function)

가
 가
 가
 8 가

15.6.3 (Stitch Function Parameter Setting)

< -> -> Stitch >

Stitch 제어 기능			
PM 7308	0		급속이송 속도/가감속 시간 가변 제어 사용 여부(0:사용안함,1:사용)
PM 7321	0,000	mm	급속이송 블록의 각 단계의 기준 길이 (#1)
PM 7322	0,000	mm	급속이송 블록의 각 단계의 기준 길이 (#2)
PM 7323	0,000	mm	급속이송 블록의 각 단계의 기준 길이 (#3)
PM 7324	0,000	mm	급속이송 블록의 각 단계의 기준 길이 (#4)
PM 7325	0,000	mm	급속이송 블록의 각 단계의 기준 길이 (#5)
PM 7326	0,000	mm	급속이송 블록의 각 단계의 기준 길이 (#6)
PM 7327	0,000	mm	급속이송 블록의 각 단계의 기준 길이 (#7)

P
 PM 7308 0 가
 가 , 1 가
 가 가 가 가
 OPPG0X(Y)F, OPPG0X(Y)T

(S)			
0	S <	(#1)	Feed(#1) OPPG0X(Y)T(#1)
(#1)	S <	(#2)	Feed (#2) OPPG0X(Y)T(#2)
(#2)	S <	(#3)	Feed (#3) OPPG0X(Y)T(#3)
(#3)	S <	(#4)	Feed (#4) OPPG0X(Y)T(#4)
(#4)	S <	(#5)	Feed (#5) OPPG0X(Y)T(#5)
(#5)	S <	(#6)	Feed (#6) OPPG0X(Y)T(#6)
(#6)	S <	(#7)	Feed (#7) OPPG0X(Y)T(#7)
(#7)	S		Feed (#8) OPPG0X(Y)T(#8)

PM 7328	0.0	mm/min	X축 급송미송 블록의 각 단계의 Feed (#1)
PM 7329	0.0	mm/min	X축 급송미송 블록의 각 단계의 Feed (#2)
PM 7330	0.0	mm/min	X축 급송미송 블록의 각 단계의 Feed (#3)
PM 7331	0.0	mm/min	X축 급송미송 블록의 각 단계의 Feed (#4)
PM 7332	0.0	mm/min	X축 급송미송 블록의 각 단계의 Feed (#5)
PM 7333	0.0	mm/min	X축 급송미송 블록의 각 단계의 Feed (#6)
PM 7334	0.0	mm/min	X축 급송미송 블록의 각 단계의 Feed (#7)
PM 7335	0.0	mm/min	X축 급송미송 블록의 각 단계의 Feed (#8)
PM 7336	0	msec	X축 급속미송 블록의 각 단계의 가감속 시간 (#1)
PM 7340	0	msec	X축 급속미송 블록의 각 단계의 가감속 시간 (#5)
PM 7341	0	msec	X축 급속미송 블록의 각 단계의 가감속 시간 (#6)
PM 7342	0	msec	X축 급속미송 블록의 각 단계의 가감속 시간 (#7)
PM 7343	0	msec	X축 급속미송 블록의 각 단계의 가감속 시간 (#8)
PM 7344	0.0	mm/min	Y축 급송미송 블록의 각 단계의 Feed (#1)
PM 7345	0.0	mm/min	Y축 급송미송 블록의 각 단계의 Feed (#2)
PM 7346	0.0	mm/min	Y축 급송미송 블록의 각 단계의 Feed (#3)
PM 7347	0.0	mm/min	Y축 급송미송 블록의 각 단계의 Feed (#4)
PM 7348	0.0	mm/min	Y축 급송미송 블록의 각 단계의 Feed (#5)
PM 7349	0.0	mm/min	Y축 급송미송 블록의 각 단계의 Feed (#6)
PM 7350	0.0	mm/min	Y축 급송미송 블록의 각 단계의 Feed (#7)
PM 7351	0.0	mm/min	Y축 급송미송 블록의 각 단계의 Feed (#8)
PM 7352	0	msec	Y축 급속미송 블록의 각 단계의 가감속 시간 (#1)
PM 7353	0	msec	Y축 급속미송 블록의 각 단계의 가감속 시간 (#2)
PM 7354	0	msec	Y축 급속미송 블록의 각 단계의 가감속 시간 (#3)
PM 7355	0	msec	Y축 급속미송 블록의 각 단계의 가감속 시간 (#4)
PM 7356	0	msec	Y축 급속미송 블록의 각 단계의 가감속 시간 (#5)
PM 7357	0	msec	Y축 급속미송 블록의 각 단계의 가감속 시간 (#6)
PM 7358	0	msec	Y축 급속미송 블록의 각 단계의 가감속 시간 (#7)
PM 7359	0	msec	Y축 급속미송 블록의 각 단계의 가감속 시간 (#8)
PM 7374	0	msec	X축 미송완료 전 PPF 신호의 출력 시간 설정 (#1)
PM 7375	0	msec	X축 미송완료 전 PPF 신호의 출력 시간 설정 (#2)
PM 7376	0	msec	X축 미송완료 전 PPF 신호의 출력 시간 설정 (#3)
PM 7377	0	msec	X축 미송완료 전 PPF 신호의 출력 시간 설정 (#4)
PM 7378	0	msec	X축 미송완료 전 PPF 신호의 출력 시간 설정 (#5)
PM 7379	0	msec	X축 미송완료 전 PPF 신호의 출력 시간 설정 (#6)
PM 7380	0	msec	X축 미송완료 전 PPF 신호의 출력 시간 설정 (#7)
PM 7381	0	msec	X축 미송완료 전 PPF 신호의 출력 시간 설정 (#8)
PM 7382	0	msec	Y축 미송완료 전 PPF 신호의 출력 시간 설정 (#1)
PM 7383	0	msec	Y축 미송완료 전 PPF 신호의 출력 시간 설정 (#2)
PM 7384	0	msec	Y축 미송완료 전 PPF 신호의 출력 시간 설정 (#3)
PM 7385	0	msec	Y축 미송완료 전 PPF 신호의 출력 시간 설정 (#4)
PM 7386	0	msec	Y축 미송완료 전 PPF 신호의 출력 시간 설정 (#5)
PM 7387	0	msec	Y축 미송완료 전 PPF 신호의 출력 시간 설정 (#6)
PM 7388	0	msec	Y축 미송완료 전 PPF 신호의 출력 시간 설정 (#7)
PM 7389	0	msec	Y축 미송완료 전 PPF 신호의 출력 시간 설정 (#8)
PM 7390	0	msec	C축 미송완료 전 PPF 신호의 출력 시간 설정
PM 7391	0	msec	PPE 신호에 의해 PPF가 LOW 되는 지연 시간 설정
PM 7392	0	msec	PPFS 신호가 HIGH일 때 다음 블록 진행 지연 시간 설정
PM 7393	0	msec	Stitch(자수) 모드에서 위치결정과 PPF 출력사이의 지연 시간 설정
PM 7394	0	msec	Stitch(자수) 모드에서 NPFIN과 다음 블록 시작과의 지연 시간 설정
PM 7395	0	msec	Stitch(자수) 모드에서 PPE신호에 의해 PPF신호를 LOW로 하는 지연 시간 설정
PM 7408	0.000	mm	Stitch(자수) 모드에서 급속미송 블록의 최대 길이

PM 7321 ~ 7327 :
PM 7328 ~ 7335 : X Feed
PM 7336 ~ 7343 : X 가
PM 7344 ~ 7351 : Y Feed
PM 7352 ~ 7359 : Y 가
PM 7374 ~ 7381 : X PPF
PM 7382 ~ 7389 : Y PPF
PM 7391 : PPE PPF 가 LOW
PM 7392 : PPFS 가 HIGH
PM 7393 : () PPF
PM 7394 : () NPFIN
PM 7395 : () PPE PPF LOW

PM 7408 : ()