

Hi4 Function Training

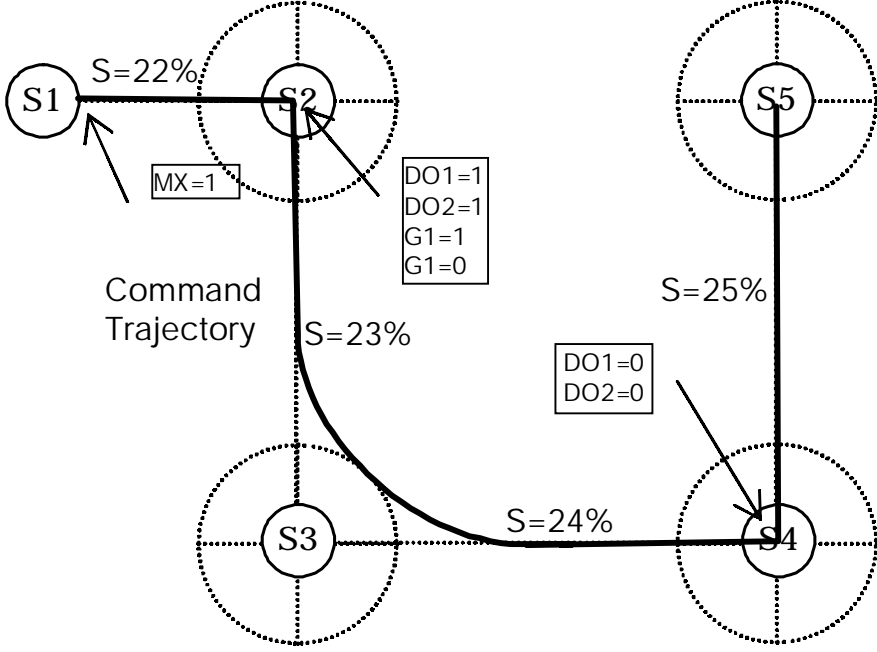
Continuous Path

2003.5. revision 6.13 / 6.30



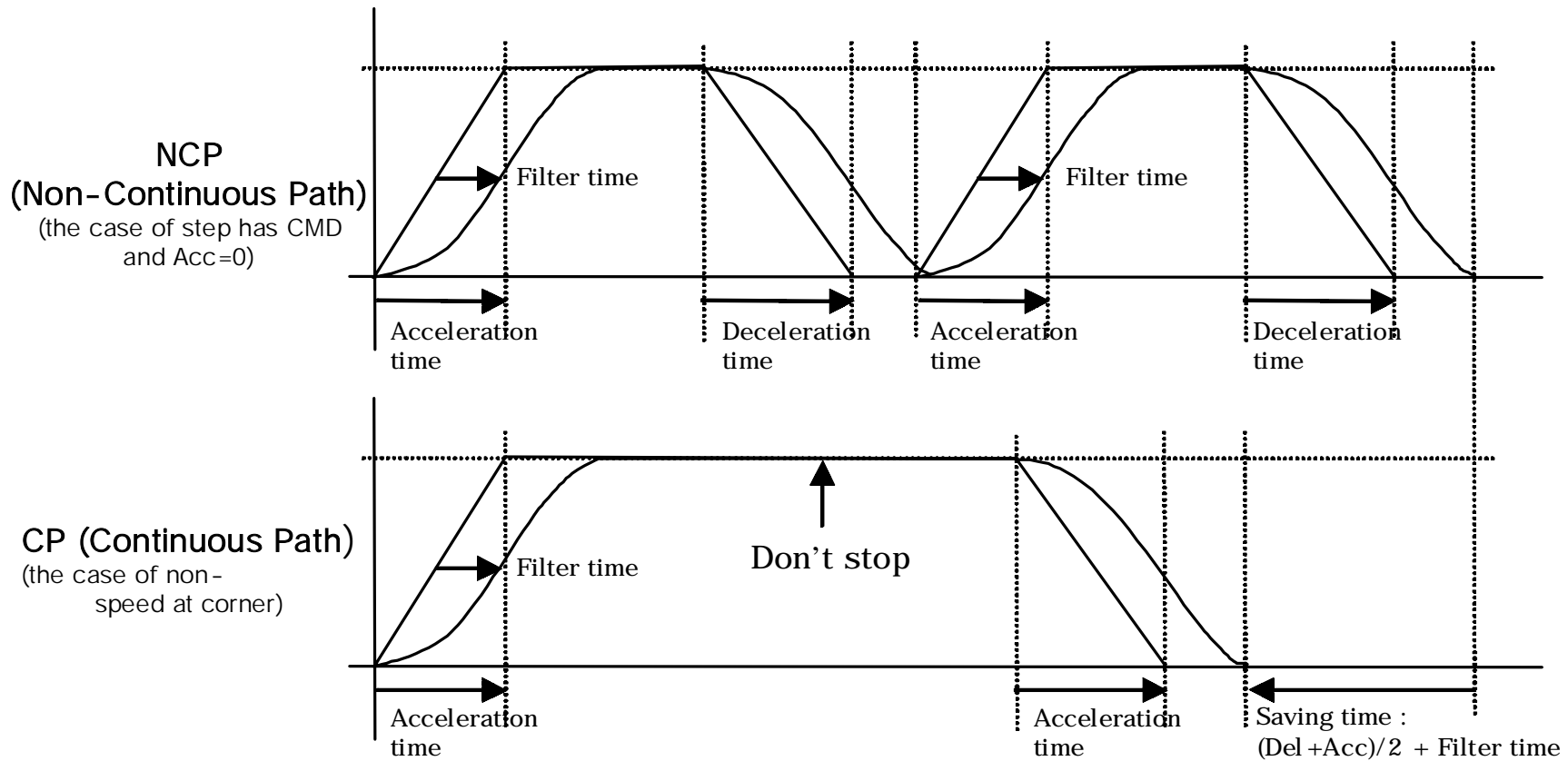
1. The case of "CONTPATH 0" the same as without CONTPATH

```
Robot:HR006-03, 12axis, 5steps  
S1 MOVE L,S=21%,A=1,T=0  
S2 MOVE L,S=22%,A=1,T=0,MX,G1  
DO1=1  
DO2=1  
S3 MOVE L,S=23%,A=1,T=0  
S4 MOVE L,S=24%,A=1,T=0  
DO1=0  
DO2=0  
S5 MOVE L,S=25%,A=1,T=0  
END
```



If a step has function, then robot's motion has acceleration and deceleration, so robot's motion looks like stop at recorded pose, and not good cycle time.

2. Robot motion between steps compare with CP and NCP



3. The case of "CONTPATH 1"

Example 1) programming example

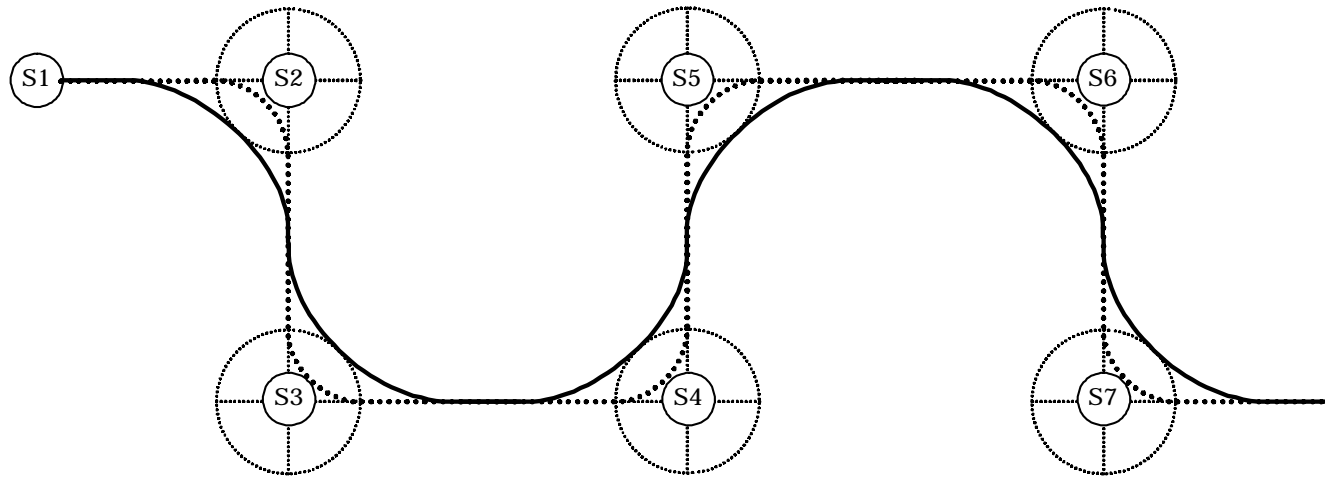
```

CONTPATH 1 'Trajectory is the same as Ex2
CALL 902 'variable initialize
FOR V1%=1 TO 8
S1 MOVE, L, P[V1%],S=90cm/min, A=1, T=0
CALL 901 'signals out base on conditions
NEXT
END
    
```

Example 2) old version for continuous path

```

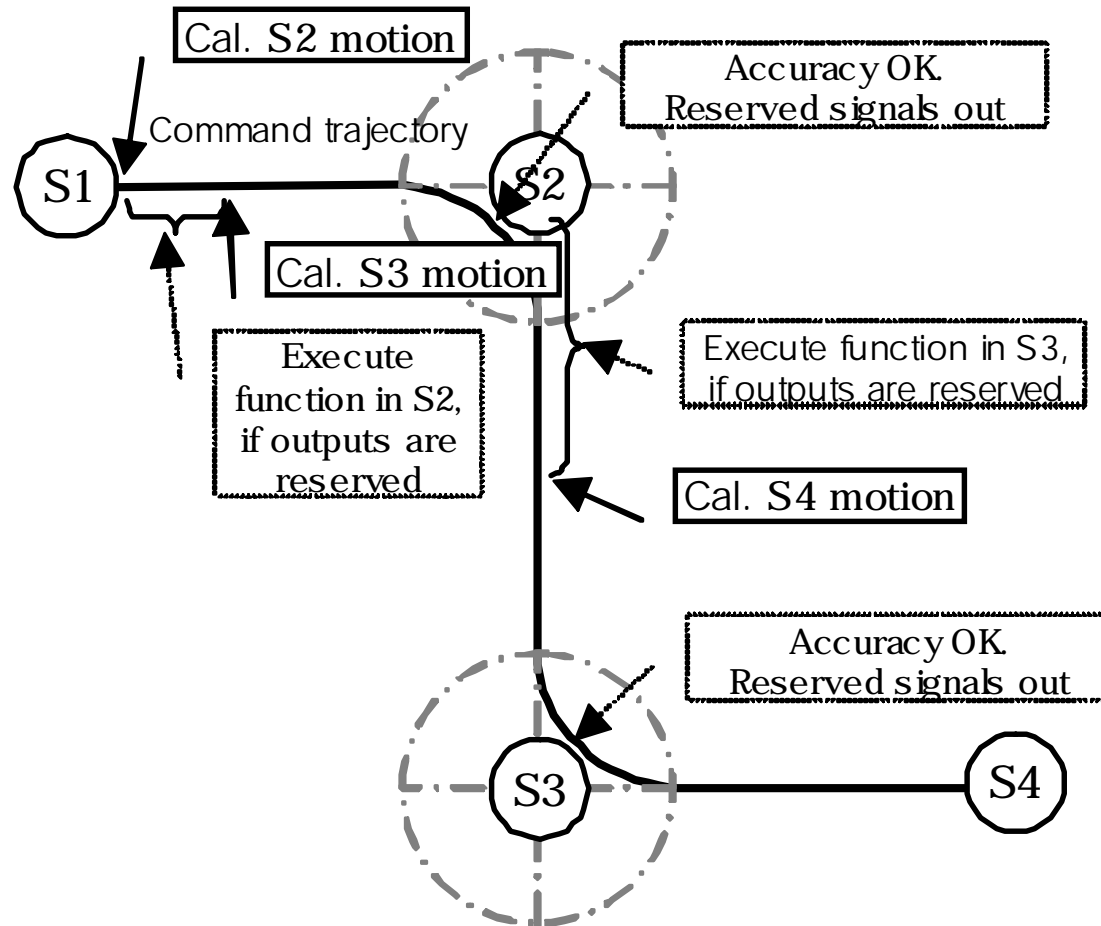
S1 MOVE, L, S=90cm/min, A=1, T=0
S2 MOVE, L, S=90cm/min, A=1, T=0
S3 MOVE, L, S=90cm/min, A=1, T=0
S4 MOVE, L, S=90cm/min, A=1, T=0
S5 MOVE, L, S=90cm/min, A=1, T=0
S6 MOVE, L, S=90cm/min, A=1, T=0
S7 MOVE, L, S=90cm/min, A=1, T=0
S8 MOVE, L, S=90cm/min, A=1, T=0
END
    
```



<< Notice >>

- ① Robot motion of Example 1 are not stop at recorded pose even if step has functions(commands)
- ② The robot motion of example 1 are seam like example 2.

4. Continuous Path



4.1 In CONTPATH non-zero, when robot start moving, all functions of target step are executed.

① Outputs are reserved only.

4.2 Motion arrived within ACC range

① Mark '.', display string to HIST

② Previous reserved signals out

③ Display '.' at HISTory again

4.3 Execution mark (save it to file)

→ These marks remain even if select program/step & reboot

① '.' : Finished execution

② 'r' : Reserved outputs

③ '>' : Start moving or executing

4.4 If press [STEP] key, display PC(Program Count) at last stop, and '.'[SET] can jump to there.

4.5 If step has so many commands, then robot motion can stop.

5. CONTPATH command

CONTPATH <option> : CmdNo=172

If option is 1 or 2, next steps are continuous path (without stop if possible).

option: Arithmetic expression

0: Non-continuous path(with stop) → default value

1: Continuous path, execute commands of target step at moving start, but outputs real out when the robot reach ACC range.

2: Continuous path even if command has any inputs.

This means that inputs are pre-checked at itself executing.

5.1 Display CONTPATH state at middle of the second line in LCD

Nothing : "CONTPATH 0", CP1:"CONTPATH 1", CP2:"CONTPATH 2"

5.2 Clear CONTPATH to zero

[R..][SET], Cycle start (execute the program header except CALL/JUMPP/CALPR), [R..]360[SET]

5.3 The kinds of outputs

DOn(Digital Output), GOn(Group Output), FBn.DOn/FBn.GOn(Field Bus for BD420), AOn(Analog Output), DE(HiNet for co-operation), GE(Group HiNet), PRINT, ENET(Ethernet for error monitoring)

5.4 The kinds of inputs

DIn(Digital Input), GIn(Group Input), FBn.DIn/FBn.GIn(Field Bus for BD420), AIn(Analog Input), DE(HiNet for co-operation), GE(Group HiNet), INPUT

6. Display example for "CONTPATH 1"

```

<< Program:10>>
  Robot:HR006-03, 12축, 총5
  .CONTPATH 1
S1  .MOVE L,S=21%,A=1,T=0
     .V1%=0
     .DO1=1
     .GOTO S2
     DO4=1
S2  >MOVE L,S=22%,A=1,T=0
     rDO7=1
     .V1%=V1%+1
     .CALL 101 'Sub-Program
     .GOTO 10
     DO2=1
S3  MOVE L,S=23%,A=GI1,T=0
S4  MOVE L,S=24%,A=1,T=0
    10 rDO1=0
     rDO2=0
S5  MOVE L,S=25%,A=1,T=0
     END
  
```

```

<< Program:101>>
  Robot:HR006-03, 12축, 총4
  .V2%=0
  .IF V1% THEN 10
S1  MOVE L,S=21%,A=1,T=0
     GOTO S2
     DO4=1
S2  MOVE L,S=22%,A=1,T=0
     DO3=1
    10 .V2%=V2%+1
     .IF V2% THEN 20
     DO2=1
S3  MOVE L,S=23%,A=1,T=0
S4  MOVE L,S=24%,A=1,T=0
    20 rDO5=0
     .END
  
```

```

<< HISTory frame>>
==== .Program Start : 10
  .CONTPATH 1
S1  >MOVE L,S=21%,A=
     .V1%=0
     rDO1=1
     .GOTO S2
S1  .MOVE L,S=21%,A=
     .DO1=1
S2  >MOVE L,S=22%,A=
     rDO7=1
     .V1%=V1%+1
     .CALL 101 'Sub-Pr
==== .Program Start : 101
  .V2%=0
  .IF V1% THEN 10
    10 .V2%=V2%+1
     .IF V2% THEN 20
    20 rDO5=0
     .END
     .GOTO 10
    10 rDO1=0
     rDO2=0
  
```

This is only example for the purpose of understanding of execution mark.

7. Possible CP(Continuous Path) Commands

CMD	CP/ Non-CP	CMD	CP/ Non-CP	CMD	CP/ Non-CP	CMD	CP/ Non-CP
Outputs=...	O(R)	END(Cycle)	X	ENDIF	O	ARCDV	X
Others=...	O	ON	O	FOR	O	WEAVON	X
{ Inputs }	X/X/O	DELAY	X	NEXT	O	WEAVOF	X
PRINT	O(R)	STOP	X	'	O	REFP	X
INPUT	O(W)	WAIT	O(W)	REM	O	LVSON	X
GOTO	O	SETCONT	X//O	ARCON	X	LVSOF	X
GOSUB	O	SELSTN	X	ARCOF	X	RINT	X
RETURN	O	IF	O	ARCCUR	X	RINTA	X
JMPP	O	ELSEIF	O	ARCVOL	X	STOPCND	O
CALL	O	ELSE	O	ARCDC	X	SREQ	O(R)

CMD	CP/ Non-CP	CMD	CP/ Non-CP	CMD	CP/ Non-CP	CMD	CP/ Non-CP
SONL	O(W)	PAL	O	CLR232C	O		
TONL1	O(W)	PALEND	O	CNVYPOS	O		
TONL2	O(W)	PALRST	X/O	WAITCNVY	O(W)		
SREQT	X	CALLPR	O	COWORK	X		
SXYZ	O	SELCRD	O	GUNCHNG	X		
SEA	O	MKUCRD	O				
SPOT	X	ENDLESS	X				
GUNSEA	X	COLDDET	X				
TIERST	O	SOFT	X				
PALPU	O	CNVSYNC	X				

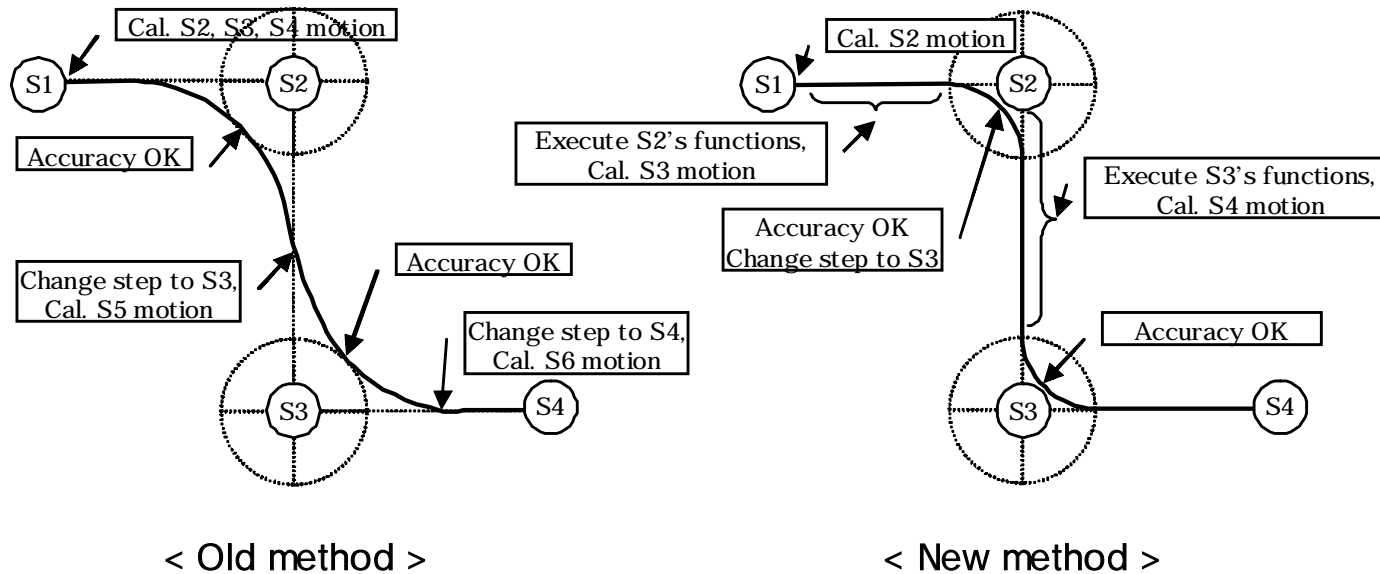
Notice) O:CP(Continuous Path), X:Non-CP, O(R):CP with Reservation), O(W):CP and check condition with moving,
 X / X / O : the case of "CP 0"/ the case of "CP 1"/ the case of "CP 2",

8. The limitation of Continuous Path

8.1 Non-continuous path conditions

- ① Operation for the purpose of non-continuous motion
 - Step FWD running with "CONTI=OFF" in teach pendant
 - Step BWD running
 - "Cycle Type=1Step" in [Condition Set] running
- ② Next step after RINT(M29) : Robot Interrupt Function
- ③ MOVE with UNTIL step
- ④ Include GUN1, GUN2, MX in MOVE command.
- ⑤ The case of "A=0"(accuracy) and its value is also zero
- ⑥ Seam tracking with LVS(Laser Vision Sensor) state
- ⑦ The case of changing tool number
- ⑧ Interpolation between steps : Linear to Circle, Circle to Circle, Circle to Linear

9. Cornering methods



Old method : osculating curve with accuracy circle.

New method : inside curve with accuracy circle.

Notice) Teaching program with old version cannot same trajectory as running with new version because of different cornering method.

10. The Pose of Accuracy=OK

10.1 Detect accuracy range while all moving state

- ① Accuracy range is very long distance, don't over a half distance of steps

10.2 Accuracy=OK detecting pose at command trajectory

