3.9   **MANUAL HANDLE RETRACE**

Overview

In this function, the program can be executed both forward and backward with a manual handle (manual pulse generator) under automatic operation.

Therefore, errors of a program, interference, and so on can be checked easily by working a machine actually.

- Checking mode

In this mode, the program can be executed forward and backward and the program can be checked.

To change to the checking mode, it is necessary to change the mode to the memory mode (MEM mode), and the checking mode signal MMOD<Gn067.2> is set to "1". This function makes the data to execute the program backward when the program is executed forward in the checking mode.

To work a machine synchronizing with a pulse generated by a manual handle in the checking mode, the manual handle check signal MCHK <Gn067.3> is set to "1" in addition to the above-mentioned. As a result, it becomes possible to check the program with a manual handle.

> **NOTE**
> During the checking mode, it is not possible to change the parameter and offset.

- Forward movement with a manual handle

The "forward movement" is that the program is executed forward by turning a manual handle in the positive direction (when the manual handle check signal is set to "1".) or in no relation to rotation of a manual handle (when the manual handle check signal is set to "0".).

When the manual handle check signal is set to "1", the execution speed of the program is proportional to the number of rotations of a manual handle. The program is executed forward rapidly when a manual handle is turned to the positive direction rapidly. And, the program is executed forward slowly when a manual handle is turned to the positive direction slowly. The distance magnification traveled per pulse from manual handle can be switched as same as a usual manual handle feed function.

When the manual handle check signal is set to "0", the execution of the program is controlled as same as an automatic operation.

- Backward movement

The "backward movement " is that the program executed forward once is executed backward by turning a manual handle in the negative direction.

The program can be executed backward only for the block executed forward. And, the number of blocks for it is about 190 blocks. This block number changes by the content of the commanded program.

The program is executed backward rapidly when a manual handle is turned to the negative direction rapidly. And the program is executed backward slowly when a manual handle is turned to the negative direction slowly. The distance traveled per pulse from manual handle can switch magnification as well as a usual manual handle feed.

> **NOTE**
> In the system which exceeds 4 paths and 20 axes, the maximum number of blocks which can move backward becomes about 97 blocks.

Explanation
- Control by the manual handle
Program execution start

The checking mode signal MMOD<Gn067.2> is set to "1" in the memory mode (MEM mode) in order to change the checking mode. Then, the program execution is begun by turning ST signal from "1" to "0".

If the manual handle check signal MCHK <Gn067.3> is set to "1" at this time, the execution of the program is controlled by a manual handle. The program is executed synchronizing with rotation of a manual handle.

When a manual handle check signal MCHK<Gn067.3> is set to "0", it is controlled as usual execution.

When check mode signal MMOD<Gn067.2> is set to "1" during the operation of the program, it is enabled a check mode from the block that next buffering is done.

That is, even if check mode signal set to "1", check mode is not always enabled at once.

When check mode is enabled, check mode confirmation signal MMMOD<Fn091.3> is set to "1".

> **NOTE**
> After the signal MMOD is turned to "0" during the execution of the program, the program cannot be executed forward and backward.

- Control with the manual handle

The value of the parameter No.6410 and the scale factors decide the moving speed of the machine by one pulse generated by a manual handle.

When a manual handle is turned, the actual movement speed of the machine is as follows.

[Feedrate command value] × [Number of the handle pulse per a second]

× [Handle magnification] × ([Parameter setting value]/100) × (8/1000) (mm/min or inch/min)

Example) When feedrate command value is 30mm/min, handle magnification is 100, parameter No.6410 is set to 1 and manual pulse generator is rotated at 100 pulse/rev, the feedrate of axis is decided as follow.

[Feedrate]=30[mm/min] × 100[pulse/s] × 100 × (1/100) × (8/1000)[s]
        =24[mm/min]

When the feedrate exceeds the override 100% feedrate by turning a manual handle rapidly, the feedrate is clamped at the speed of override 100%. That is, if the pulse of the following formula exceeds "1", the feedrate is clamped.

[Number of the handle pulse per a second]

× [Handle magnification] × ([Parameter setting value]/100) × (8/1000)

The rapid traverse feedrate is clamped at 10%. However, the feedrate of the rapid traverse is clamped at 100% when the parameter RPO(No.6400#0) is set to "1".

And if parameter (No.6405) is set to an optional value, it can be clamped to override by nearly optional value.

When the parameter (No.6405) is set to larger value than "100", it is clamped to nearly 100%.

When parameter (No.6405) is set to "0", the setting of parameter RPO(No.6400#0) becomes valid.

The single block signal and the feed hold signal are effective in the checking mode. When the execution of a program is stopped by the single block stop or the feed hold stop, it is necessary to turn ST signal from "1" to "0" in order to restart the program.

In the block with the movement and the block of dwell, the execution speed of the program can be controlled by turning a manual handle. As for the block of neither movement nor dwell such as the block of only address M, S, T, and F, the program advances to the following block even if a manual handle does not turn.

The rotation of the spindle does not synchronize with a pulse of a manual handle. During the checking mode, the spindle rotates at the specified rotation speed. As for the feed per revolution, a program is executed at the feedrate which was converted from the rotation speed of the spindle to the corresponding feed per minute inside CNC.

> **NOTE**
> The manual handle used by this function is always the first. The 2nd and 3rd manual handle cannot be used in this function.

- Forward movement and backward movement with a manual handle

The program is executed forward when a manual handle is turned to the positive direction. And, the program is executed backward when a manual handle is turned to the negative direction.

The program is executed backward as soon as a manual handle is turned to the negative direction in executing the program forward.

When a manual handle keeps being turned in a negative direction, the program is executed backward and the execution stops in the block of O number. Then, if a manual handle is turned to the positive direction, the program is executed forward again.

Even if a manual handle controls the program execution, the program is executed forward in no relation to a pulse generated by a manual handle on setting the manual handle check signal to "0".

- Program end

When the block of M2 or M30 is executed, the manual handle retrace ends. It is not possible to execute the program backward from the block of M2 or M30.

When the execution of the program ends, the checking mode signal and the manual handle check signal must be set to "0".

In 2 path control system, FIN signal must not be set to "1" when the block of M2 or M30 is executed in only one of paths. After the block of M2 or M30 has been executed in both paths, FIN signal is set to "1". (Except for the block of waiting M code is commanded before M2 or M30 in both paths.)

- Notice of the operation

- Dry-run can not operate during the checking mode. Dry-run signal must be set to "0".
- Automatic operation starts immediately with the feedrate commanded by the program, when the checking mode signal or the synchronous operation with handle signal is turned off during executing the program in the checking mode.
- The edit of the program and the change of the parameter and the offset must not be done.

- Backward movement of each code

All modal information of G, T, S-code is memorized in executing the program forward. And, the memorized data of the modal G, T, S-code are used in executing the program backward.

As for M-codes, they are grouped and the modal information is managed by parameter No.6411 to 6490. Therefore, M-code can be executed backward according to the information. As for the modal information of the M-code, a change in each group is memorized in the execution data.

As for the codes except for G, M, S, and T, the same code is output between forward movement and backward movement.

- G-code

If G-code that changes modal information is commanded in backward movement, the modal information of previous block is executed.

Example)

    N1G99;

    N2G01X_F_;

    N3X_Z_;

    N4G98; .... backward movement starts from this block

    N5X_Y_Z_;

If backward movement starts from N4 block, the modal information is changed from G98 to G99 and G99 is executed from N3.

G-code with a movement is traced along the route opposite to forward movement.

G-code that can be command in executing the program backward is as follows.

The other G-codes cannot be command in executing the program backward.

The G-codes in the G-code system B and C also can be used.

Lathe system

G00	G01	G02	G03	G04	G22	G23
G25	G26	G28	G30	G40	G41	G42
G50	G53	G65	G70	G71	G72	G73
G75	G80	G83	G85	G87	G89	G90
G94	G96	G97	G98	G99		

  (G-code system A)

Milling system

G00	G01	G02	G03	G04	G22	G23
G25	G26	G28	G30	G40	G41	G42
G43	G44	G49	G53	G65	G73	G76
G80	G81	G82	G83	G85	G86	G87
G88	G89	G92	G94	G95	G96	G97

NOTE
1 In Small-Holl Pecking Drilling Cycle(G83), backward movement is prohibited.
2 In forward movement of Boring Cycle(G88), the sequence of actions at bottom of holl is shown as follows (dwell -> stop of spindle motor -> hold state). But in backward movement, that is (rotation of spindle -> hold state -> dwell after restart).

- M-code

If there is M-code in the same group is commanded in previous blocks, modal information of the M-code, commanded at the last in previous blocks, is output.

If no M-code is commanded in previous blocks, the M-code set to the first parameter in the same M-code group is output.

If M-code is not set to group M-code in parameter, the same M-code is output in backward movement.

If the parameter RVN(6400#5) is set to "1", the backward movement is prohibited when the M-code, which is not set to group M-code, is commanded in backward movement.

> **NOTE**
>   When setting the parameter RVN, backward
>   movement prohibition is enabled except the
>   M-code which was set in the grouping but
>   backward movement can be enabled for the
>   following M-code exceptionally.
>   1. Subprogram Call by M98/M99.
>   2. Subprogram Call using an M code
>   3. Macro Call using an M code
>   4. Waiting M code
>   5. M0

Example) Output of M-codes that are set to groups by parameters in backward movement
Setting of parameters:
    No.6400#2=1, #3=0 (5 M-codes/group and 16 groups)
    No.6411=100 ⎫
    No.6412=101 ⎪
    No.6413=102 ⎬ Group A
    No.6414=103 ⎪
    No.6415=104 ⎭
    No.6416=200 ⎫
    No.6417=201 ⎪
    No.6418=202 ⎬ Group B
    No.6419=203 ⎪
    No.6420=204 ⎭
Program O10 is executed in forward movement from N1 to N15 and backward movement is executed from N15. In backward movement, the output of M-codes is show as next table.

	Forward movement	Backward movement
O10;		
N1G4X1.;		
N2M101;	M101	M100 (*1)
N3G4X1.;		
N4M204;	M204	M200 (*1)
N5G4X1.;		
N6M104;	M104	M101 (*2)
N7G4X1.;		

	Forward movement	Backward movement
N8M300;	M300	M300 (*3)
N9G4X1.;		
N10M200;	M200	M204 (*2)
N11G4X1.;		
N12M0;	M0	M0 (*3)
N13G4X1.;		
N14M102;	M102	M104 (*2)
N15G4X1.;	Backward movement starts from this block	
M2;		

*1 No M-code in the same group is commanded before this block, so the M-code, which is set in the 1st. parameter of the same group, is output.

*2 M-code in the same group is commanded before this block, so the M-code, which is commanded at the last before this block, is output.

*3 M-code is not set to group M-code, so the same M-code is output.

- S and T-code

A modal value of the previous block is output.

When movement command and S-code or T-code is commanded in the same block, the timing of the output of the S-code and T-code is different. Because, the timing where S-code and T-code are output at the forward movement is different from that at the backward movement. By setting the parameter STO(No.6401#7) to "1", the timing of the output of S and T code at the forward movement is the same as the one at the backward movement.

Example)

T-code output timing at the backward movement

T-code is output as follows when the program proceeds backward after the forward movement to N8 block.

	Forward movement	Backward movement	
		Parameter STO=0	Parameter STO=1
O1000;			
N1G98G00X0Z0;			Default T output
N2G00X-10.T11;	T11 output	Default T output	
N3G00X100.;			T11 output
N4G00X10.Z20.T22;	T22 output	T11 output	No T code output
N5G00X30.Z30.;			
N6G00X-10.Z-20.;			T22 output
N7G00X50.Z40.T33;	T33 output	T22 output	T33 output
N8G04X5.;		(Backward start)	(Backward start)
M30;			

The "Default T" means a T-code status at N1 block in forward movement. If the status is T0, "T0" signal is output as "Default T" in the backward movement.

The timing of T-code output of N7 and N8 in O1000 shown in the example above is as follows.

Forward movement :
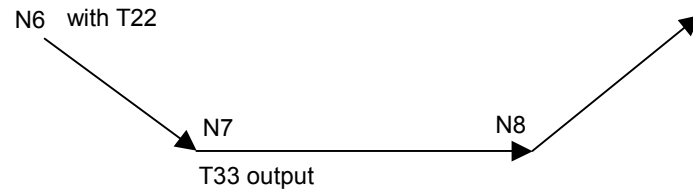
N6   with T22

N7   N8

T33 output

Backward movement (When parameter STO is set to "0") :

N6

N7   N8

T22 output

Backward movement (When parameter STO is set to "1") :

N6

N7   N8

T22 output   T33 output

- Direction change prohibition

The direction change prohibition is a state not changing the direction where the program is executed.

In the state, even if the rotating direction of a manual handle is reversed, the reversed rotation is ignored. A manual handle must be rotate in the same direction as present direction for removing this state.

The direction change prohibition can be confirmed by output signal MNCHG<Fn091.1>.

It becomes the change prohibition state under the following condition.
- While the block with the code waiting for FIN is executing
- After a block has done and until the next block begins to operate
- During thread cutting
- Modal G code of G68.1, G68 and G51.2
- The block with the axis that ends movement earlier in the block with G02 or nonlinear type position (G00) etc.

- Backward movement prohibition

The backward movement prohibition is a state that the program cannot be executed from a certain block backward. In this state, the negative rotation of a manual handle is ignored, and the only positive rotation is effective. The program must be executed forward by rotating a manual handle in the positive direction for removing this state.

The backward movement prohibition can be confirmed by output signal MRVSP<Fn091.2>.

If the following blocks are executed in backward movement, backward movement is prohibited.

- Program number block of main program (except subprogram and macro program)
- Over the maximum number of the blocks for reverse movement
- The block including backward movement prohibition G-code (which is not described in the paragraph "G-code")
- The block which is executed while in modal including backward movement prohibition G-code (which is not described in the paragraph "G-code")

- Status display

In manual handle retrace, the status of manual handle retrace is displayed on clock display of CNC state display line. This status display is displayed during the execution of manual handle retrace. The clock is displayed usually.

When the all condition is filled, "M.H.RTR" is displayed on clock display of CNC state display line. This status is displayed by the color of color number 3 (INPUT KEY, O/N NO. and STATUS are the same color). The screen display is as shown in Fig.3.7(a). When the following conditions are not full, the clock is displayed.

- When parameter CHS(No.6401#2) is set to "0":
  1) Software option of handle manual retrace is enabled.
  2) Status display disable/enable parameter HST(No.6401#6) is set to "1".
  3) Check mode confirmation signal MMMOD<Fn091.3> is set to "1".

- When parameter CHS(No.6401#2) is set to "1":
  1) Software option of handle manual retrace is enabled.
  2) Status display disable/enable parameter HST(No.6401#6) is set to "1".
  3) Cycle start signal STL<Fn000.5> is set to "1".
  4) Check mode signal MMOD<Gn067.2> is set to "1".
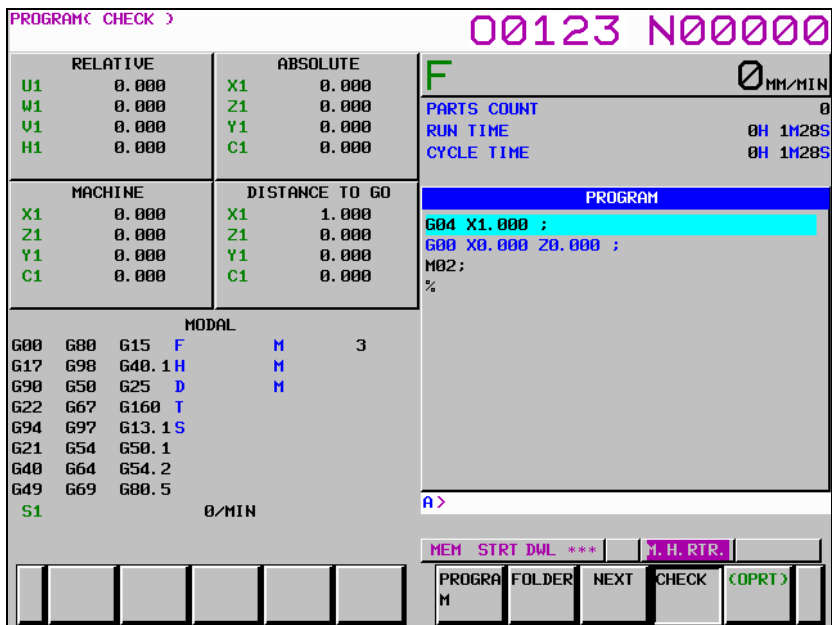 5) Manual handle check signal MCHK<Gn067.3> is set to "1".

Fig. 3.7 (a) "M.H.RTR." status display

Besides, when reverse movement prohibition signal MRVSP<Fn091.2> is set to "1",
the "NO RVRS." is displayed. This status is displayed by blinking/reversing in the color of color number 1 (ALARM is the same color). The screen display is as shown in Fig.3.7(b). When reverse movement prohibition signal MRVSP<Fn091.2> is set to "0", the " M.H.RTR " is displayed again.
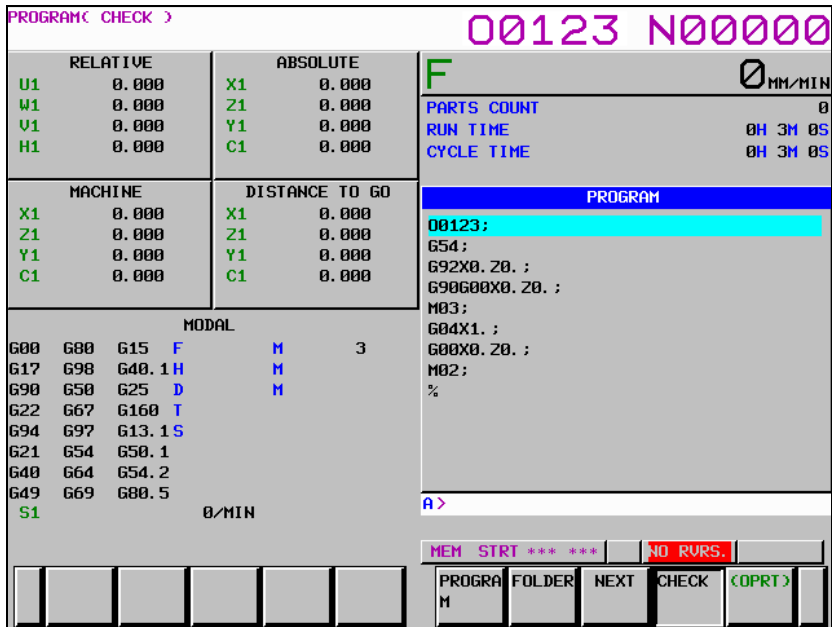

Fig. 3.7 (b) " NO RVRS." status display

Besides, when direction change prohibition signal MNCHG<F0091.1> is set to "1" and the direction of program's execution is changed by manual handle, this status display changes from "M.H.RTR" to "NO.CHAG".

This status is displayed by blinking/reversing in the color of color number 3 (INPUT KEY, O/N NO. and STATUS are the same color) . The screen display is shown as Fig.3.7(c). When the program is executed in the direction as the same as before by manual handle or direction change prohibition signal MNCHG<Fn091.1> is set to "0", the " M.H.RTR " is displayed again.

Moreover, when parameter FWD(No.6400#1) is set to "1" and the program is executed to change direction by manual handle, this status display changes from "M.H.RTR" to "NO.CHAG".

NOTE
> When the improvement of direction change movement in auxiliary function output block is enabled, the state of direction change prohibition signal MNCHG<Fn091.1> is set to "1" and direction change is possible. Therefore please note that the status display of the direction change prohibition is displayed though it is possible to direction change.
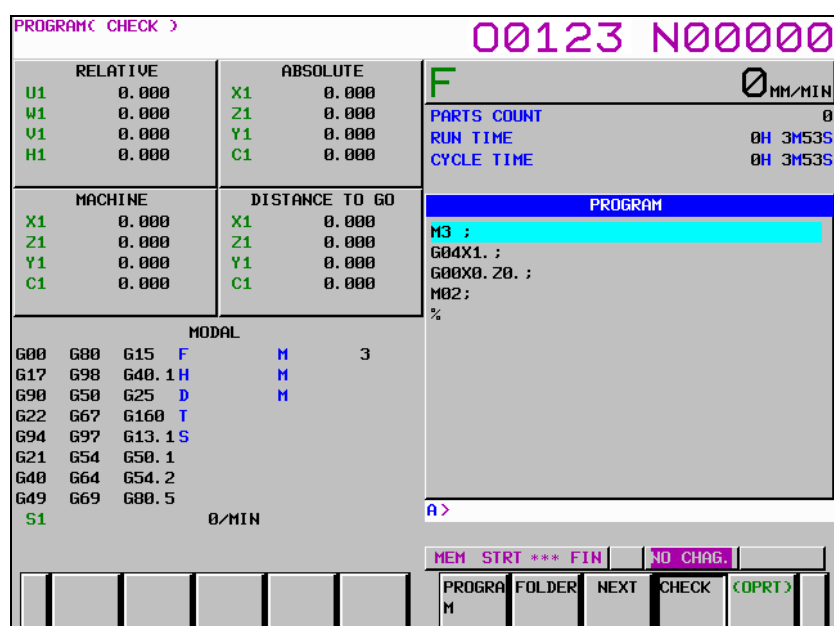
Fig. 3.7 (c) "NO.CHAG." status display

Limitation

- Movement in automatic operation by DNC operation mode(RMT)

In the automatic operation by DNC operation mode(RMT), the backward movement is prohibited though the forward movement is enable.

- Movement in subprogram operation by external subprogram call

In M198 or M-code for subprogram operation by external subprogram call (parameter No.6030), the backward movement is prohibited though the forward movement is enable.

- Movement command and M,S,T-code

When M,S,T-codes and movement commands are in the same block, the timing outputting codes changes between in forward movement and backward movement. Therefore, M, S, T-codes should be commanded in backward movement after confirming that "DEN" signal is set to "1".

Example of executing the following programs with lathe system
```
O0001 ;
M5 S0 F0 ;
G53 X0 Z0 ;................................ (1)
G1 W100 M3 S100 F1. ; ............ (2)
G0 U50. W50. ;.......................... (3)
M2 ;
```
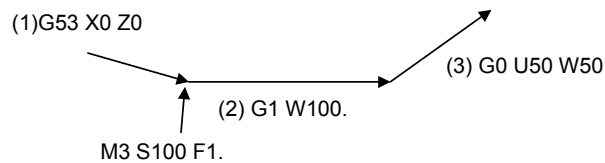[Forward movement]

(1)G53 X0 Z0

(2) G1 W100.

M3 S100 F1.

(3) G0 U50 W50

The block of (2) moves with M3 S100 F1.

[Backward movement]

(1)G53 X0 Z0

(2)G1 W100.

M5 S0 F1.

(3) G0 U50. W50.
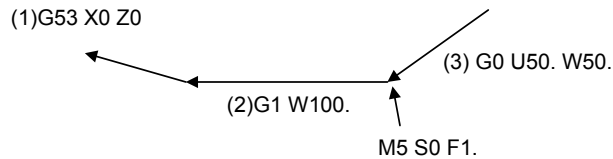
The block of (2) moves with M5 S0 F1.

- Non linear interpolation type positioning

In the non-linear interpolation type positioning, the route is different between forward movement and backward movement.

The route of forward movement

The route of backward
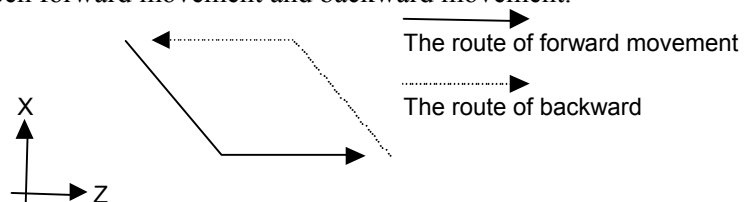
Please use the interpolation type positioning to ward off danger. (Set the parameter LPR (No.1401#1) to "1")

- Threading in forward movement

Threading is always executed at 100% override speed. That is to say, a pulse generated by a manual handle is ignored in executing a threading block. In thread cutting cycle, the pulse is invalid at the time actually cutting thread, but the one are valid in the other movements.

- Macro

In macro statement, the setting, operation, and so on of the macro variable is executed in only first forward movement. That is to say, the setting, operation, and so on of the macro variable is never executed in the block executing them once.

- Axis control by PMC

The movement of axis control by PMC cannot be controlled by this function.

- Check of path unit by multi path system

In the multi path system, the program check of an arbitrary path is possible. In the path not to check, please select the mode excluding the MEM mode. If the parameter HDMPH(No.6400#4) is set to "1", it is possible to execute the check of forward movement, direction change and backward movement.

If waiting M code exist in the program, please set No-wait signal of two path NOWT <Gn063.1>, or No-wait signal of three path NMWT<Gn063.7> to "1".

- Modal display

In the backward movement with manual handle, the modal display is updated according to the operation condition of the program.

- Modal information

In the backward movement with manual handle, the state of modal information is updated according to the operation condition of the program.

- Change in operation mode

When you change to EDIT mode during the checking mode, the backward movement and the re-forward movement cannot be executed in the blocks which have been already executed.

- ON/OFF of Manual Handle Retrace mode

When check mode signal MMOD<Gn067.2> is set to "0" and handle available signal in checking mode MCHK<Gn067.3> is set to "0", the check mode might not be turned off at once.

Basically, in the middle of block, the check mode doesn't switch from ON to OFF or from OFF to ON. After the block is ended, the check mode switches from ON to OFF or from OFF to ON.

- AI contour control

If the checking mode signal MMOD<Gn067.2> is "1", AI contour control mode is canceled. If AI contour control is canceled, forward movement and backward movement can be executed.

Furthermore, if the signal MMOD is set to "1" in AI contour control mode, the checking mode is not effective until AI contour control mode is invalid.

- Multi Spindle

During the backward movement, both TYPE-A and TYPE-B multi spindle control may not be operated exactly.

- Path Table Operation

In path table operation, the backward movement is prohibited. Furthermore, in forward movement, regardless of manual handle, the motion is performed as the command of path table operation.

- Execution of measurement G-code with the speed of override 100%

When the parameter MGO(No.6400#6) is set to "1", a handle pulse is invalid and it is always executed at 100% override. When the parameter MGO(No.6400#6) is set to "0", this function is invalid and a handle pulse is valid.

In the multi path system, this function is not effective in the execution of another path and handle pulse is valid in another path. The measurement G code to which this function is effective is as follows.
1) G31 for skip
2) G31, G31P1, G31P2, G31P3, G31P4, G04, G04Q1, G04Q2, G04Q3 and G04Q4 for multistage skip
3) G31P99 and G31P98 for torque limit skip

When the measurement by G36 and G37 (G37.1 and G37.2.) of automatic tool compensation is executed, a handle pulse is invalid and it is always executed at 100% override regardless of setting the parameter MGO(No.6400#6). At the rapid traverse before measurement, handle pulse is valid.

When the parameter SKF(No.6200#7) is set to "0" and the parameter SFN(No.6207#2) is set to "0", handle pulse at G31 is invalid and it is always executed at 100% override regardless of setting the parameter MGO(No.6400#6).

When the parameter MG4(No.6400#7) is set to "1" and the software option of multistage skip is enabled and the setting of parameter from No.6202 to No.6206 is enabled, the backward movement prohibition is enabled in G04 block for multistage skip.
The G code to which this function is effective is as follows.
1) G04, G04Q1, G04Q2, G04Q03 and G04Q4 for multistage skip

- Relation to another function

This function cannot coexist with the following functions
- Retrace
- Learning control for parts cutting
- Preview repetitive control
- Learning control

Parameter

	#7	#6	#5	#4	#3	#2	#1	#0
6400	MG4	MGO	RVN	HMP	MC8	MC5	FWD	RPO

[Input type]   Parameter input
[Data type]   Bit path

 # 0   RPO   With the manual handle retrace function, the rapid traverse rate is clamped, assuming that:
0:    An override of 10% is used.
1:    An override of 100% is used.

 # 1   FWD   With the manual handle retrace function, program execution can be performed:
0:    In both forward and backward directions.
1:    In the forward direction only. Execution in the backward direction is not permitted.

 # 2   MC5
 # 3   MC8

These parameters set the number of M code groups and the number of M codes per group.
(See explanations of parameters Nos. 6411 to 6490.)

MC5	MC8	M code group setting
0	0	Standard (20 groups of four)
1	0	16 groups of five
0	1	10 groups of eight

When 16 groups of five are used, the meanings of parameters are changed as follows:
Group A   No.6411(1) to No.6415(5)
Group B   No.6416(1) to No.6420(5)
                            :
Group P   No.6486(1) to No.6490(5)
When 10 groups of eight are used, they are changed as follows:
Group A   No.6411(1) to No.6418(8)
Group B   No.6419(1) to No.6426(8)
                            :
Group J   No.6483(1) to No.6490(8)

 # 4   HMP   When inversion or backward movement is inhibited in other paths:
0:    Inversion or backward movement is not inhibited for the currently executed path.
1:    Inversion or backward movement is inhibited also for the currently executed path.

 # 5   RVN   When the manual handle retrace function is used, M codes other than grouped M codes:
0:    Do not disable backward movement.
1:    Disable backward movement.

When this parameter is set to 1, M codes other than grouped M codes disable backward movement in general. Exceptionally, however, the following M codes allow backward movement:
1.   Subprogram call based on M98/M99
2.   Subprogram call based on an M code
3.   Macro call based on an M code
4.   Waiting M code
5.   M0

 # 6   MGO   When the manual handle retrace function is used, handle pulses during execution of a G code related to measurement are:
0:    Valid.
1:    Invalid. A speed with an override of 100% is used for execution at all times.

 # 7   MG4   In the manual handle retrace function, for blocks for which multi-step skip G04 is enabled (when the multi-step skip software option is used, and the settings of parameter Nos. 6202 to 6206 are valid):
0:    Backward movement is not prohibited.
1:    Backward movement is prohibited.

	#7	#6	#5	#4	#3	#2	#1	#0
6401	STO	HST				CHS		

[Input type]   Parameter input
[Data type]   Bit path

 # 2   CHS   In manual handle retrace:
0:    The status is displayed if the following conditions are all satisfied:
   (1)   The manual handle retrace software option is used.
   (2)   Bit 6 (HST) of parameter No. 6401, which specifies whether to enable or disable status display, is set to 1.
   (3)   Check mode output signal MMMOD<Fn091.3> is set to 1.
1:    The status is displayed if the following conditions are all satisfied:
   (1)   The manual handle retrace software option is used.
   (2)   Bit 6 (HST) of parameter No. 6401, which specifies whether to enable or disable status display, is set to 1.
   (3)   Cycle start lamp signal STL<Fn000.5> is set to 1.
   (4)   Check mode input signal MMOD<Gn067.2> is set to 1.
   (5)   Handle input signal MCHK<Gn067.3> is set to 1 in the check mode.

 # 6   HST   When the manual handle retrace function is used, the time display field on the status display line of the CNC screen:
0:    Does not display status.
1:    Displays status.

7   STO   In the manual handle retrace function, the timing for outputting an S code and T code during backward movement is:
0:    Different from the timing during forward movement:
1:    The same as during forward movement.

	#7	#6	#5	#4	#3	#2	#1	#0
6402			MWR					

[Input type]   Parameter input
[Data type]   Bit path

5   MWR   When the manual handle retrace function is used, for a handle operation placed in the wait state by a wait M code during backward movement:
0:    Inversion is prohibited.
1:    Inversion is permitted.

6405	Override value (equivalence) for clamping the rapid traverse rate used with the manual handle retrace function

[Input type]   Parameter input
[Data type]   Word path
[Unit of data]   %
[Valid data range]   0 to 100
This parameter sets an override value (equivalence) for clamping the rapid traverse rate used with the manual handle retrace function. If a value greater than 100 is set in parameter (No.6405), the rapid traverse rate is clamped to an override of 100%. This function is invalid if 0 is set in parameter (No.6405). In this case, the setting of bit 0 (RPO) of parameter No. 6400 is used.

6410	Travel distance per pulse generated from the manual pulse generator

[Input type]   Parameter input
[Data type]   Word path
[Unit of data]   %
[Valid data range]   0 to 100
Set the travel distance per pulse generated from the manual pulse generator in terms of the override value.
The distance traveled by the machine when the manual handle is actually turned can be found by the following expression:
[Specified speed] $\times$ [Handle magnification] $\times$ ([Setting of this parameter]/100) $\times$ (8/60000) (mm or inch)
[Example]
When a specified feedrate is 30mm/min, the manual handle magnification is 100, and parameter No. 6410 is set to 1, the travel distance per pulse generated from the manual pulse generator is calculated as follows:
[Travel distance per pulse]
=30[mm/min] $\times$ 100 $\times$ (1/100) $\times$ (8/60000)[min]= 0.004mm

6411	M code of group A in manual handle retrace (1)
to	
6414	M code of group A in manual handle retrace (4)

6415	M code of group B in manual handle retrace (1)
to	
6418	M code of group B in manual handle retrace (4)

6419	M code of group C in manual handle retrace (1)
to	
6422	M code of group C in manual handle retrace (4)

6423	M code of group D in manual handle retrace (1)
to	
6426	M code of group D in manual handle retrace (4)

6427	M code of group E in manual handle retrace (1)
to	
6430	M code of group E in manual handle retrace (4)

6431	M code of group F in manual handle retrace (1)
to	
6434	M code of group F in manual handle retrace (4)

6435	M code of group G in manual handle retrace (1)
to	
6438	M code of group G in manual handle retrace (4)

6439	M code of group H in manual handle retrace (1)
to	
6442	M code of group H in manual handle retrace (4)

6443	M code of group I in manual handle retrace (1)
to	
6446	M code of group I in manual handle retrace (4)

6447	M code of group J in manual handle retrace (1)
to	
6450	M code of group J in manual handle retrace (4)

6451	M code of group K in manual handle retrace (1)
to	
6454	M code of group K in manual handle retrace (4)

6455	M code of group L in manual handle retrace (1)
to	
6458	M code of group L in manual handle retrace (4)

6459	M code of group M in manual handle retrace (1)
to	
6462	M code of group M in manual handle retrace (4)

6463	M code of group N in manual handle retrace (1)
to	
6466	M code of group N in manual handle retrace (4)

6467	M code of group O in manual handle retrace (1)
to	
6470	M code of group O in manual handle retrace (4)

6471	M code of group P in manual handle retrace (1)
to	
6474	M code of group P in manual handle retrace (4)

6475	M code of group O in manual handle retrace (1)
to	
6478	M code of group Q in manual handle retrace (4)

6479	M code of group R in manual handle retrace (1)
to	
6482	M code of group R in manual handle retrace (4)

6483	M code of group S in manual handle retrace (1)
to	
6486	M code of group S in manual handle retrace (4)

6487	M code of group T in manual handle retrace (1)
to	
6490	M code of group T in manual handle retrace (4)

[Input type]　　　Parameter input
[Data type]　　　2-word path
[Valid data range]　0 to 9999

Set a group of M codes output during backward movement.

For backward movement for an M code, the modal M code in the same group set by the parameter is output.

The first M code in each group is set as the default.

When the number of M codes in a group is 3 or less, set the parameter corresponding to an unused M code to 0.

For backward movement for "M0", "M0" is output regardless of which M code is set for the parameter. "0" set in the parameter is ignored.

For an M code which is not set in any group by any of the above parameters, the M code for forward movement is output.

With these parameters, an M code in the same group can be output in backward movement only when the M code is the first M code in each block. When a block contains two or more M codes, the same M codes as output in forward movement are output as a second M code and up.

> **NOTE**
> The above explanation of M code groups applies to the standard settings. The number of M codes in each group and the number of M code groups vary depending on the settings of bit 2 (MC5) and bit 3 (MC8) of parameter No. 6400.

18060	M code that prohibits backward movement

[Input type] Parameter input
[Data type] Word path
[Valid data range] 1 to 999
When an M code that prohibits backward movement is specified during backward movement, backward movement of blocks before the M code is prohibited. In this case, backward movement prohibition signal MRVSP<Fn091.2> is output.

The M code that prohibits backward movement is not output as an M code. As the M code that prohibits backward movement, set an M code that is not used by auxiliary functions and macros.

18065	M code that prohibits backward movement 1

[Input type] Parameter input
[Data type] Word path
[Valid data range] 1 to 999
When an M code that prohibits backward movement is specified during backward movement, backward movement of blocks before the M code is prohibited. In this case, backward movement prohibition signal MRVSP<Fn091.2> is output.

18066	M code that prohibits backward movement 2

[Input type] Parameter input
[Data type] Word path
[Valid data range] 1 to 999
When an M code that prohibits backward movement is specified during backward movement, backward movement of blocks before the M code is prohibited. In this case, backward movement prohibition signal MRVSP<Fn091.2> is output.

Signal

Checking mode signal MMOD<Gn067.2>

[Classification]   Input signal

[Function]   The status of the manual handle retrace mode is changed.

[Operation]   In case that the automatic operation is executed in the MEM mode when this signal is "1", the mode of the manual handle retrace becomes "ON".

In the MDI operation, the mode becomes "OFF".

Moreover, when this signal is set to "1" in the automatic operation in the MEM mode, the mode will become "ON" from the block executed next.

When this signal is set to "0" in the automatic operation, the mode will become "OFF" from the block executed next.

Handle available signal in checking mode MCHK<Gn067.3>

[Classification]   Input signal

[Function]   Enabling/disabling of the manual handle operation in the manual handle retrace mode is changed.

[Operation]   When this signal is set to "1" in the manual handle retrace mode, the program is executed with the speed corresponding to the rotating speed of a manual steering wheel. Moreover, when the manual handle is rotated to the opposite direction, the program is executed to the opposite direction.

When this signal is set to "0", the program is executed with the speed instructed in the program to the direction of the forward movement as same as a usual automatic operation. When this signal is changed from "1" to "0" during the program, the program is executed as well.

Forward movement prohibition signal FWSTP<Gn531.0>

[Classification]   Input signal

[Function]   The forward movement in the manual handle retrace mode is prohibited.

[Operation]   When this signal is set to "1" in the manual handle retrace mode, the forward movement of the program is prohibited. If this signal is set to "1" during the status of direction change prohibition or the status of the backward movement prohibition, both of the forward movement and the backward movement cannot be done.

Reverse movement prohibition signal MRVM<Gn531.1>

[Classification]   Input signal

[Function]   The backward movement in the manual handle retrace mode is prohibited.

[Operation]   When this signal is set to "1" in the manual handle retrace mode, the backward movement of the program is prohibited. The backward movement is not done and the program stops even if a manual handle is rotated to the opposite direction.

Check mode confirmation signal MMMOD<Fn091.3>

[Classification] Output signal

[Function] This signal indicates the manual handle retrace mode.

[Operation] This signal becomes "1" when the manual handle retrace mode is "ON".

When the manual handle retrace mode is turned off, this signal becomes "0".

Reverse movement signal MRVMD<Fn091.0>

[Classification] Output signal

[Function] This signal indicates that program is being backward movement.

[Operation] This signal becomes "1" in the manual handle retrace mode when the backward movement is executed.

It becomes "0" during the forward movement and the re-forward movement.

Direction change prohibition signal MRNCHG<Fn091.1>

[Classification] Output signal

[Function] This signal indicates that direction change is being prohibited.

[Operation] It becomes "1" when the direction to which the program is executed cannot be changed(The status of the direction change prohibition) in the manual handle retrace mode.

When the backward movement of the program can be done, it becomes "0".

**Reverse movement prohibition signal MRVSP<Fn091.2>**

[Classification] Output signal

[Function] This signal indicates that the backward movement is being prohibited.

[Operation] It becomes "1" when the backward movement can be executed no more (The status of the backward movement prohibition) from a certain block in the manual handle retrace mode.

When the backward movement of the program can be executed, it becomes "0".

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
Gn067					MCHK	MMOD		

	#7	#6	#5	#4	#3	#2	#1	#0
Gn531							MRVM	FWSTP

	#7	#6	#5	#4	#3	#2	#1	#0
Fn091					MMMOD	MRVSP	MNCHG	MRVMD

Notes

1) This function is an option function and available on only T-series.
The following option besides this function is needed.
   - Manual handle feed

2) In manual handle retrace function, when check mode signal MMOD<Gn067.2> is set to "0" and handle available signal in checking mode MCHK<Gn067.3> is set to "0", the check mode might not be turned off at once.
   Basically, in the middle of block, the check mode doesn't switch from ON to OFF or from OFF to ON. After the block is ended, the check mode switches from ON to OFF or from OFF to ON.

3) When the rotate direction of the manual handle is changed, the timing chart of the cycle start lamp signal STL<Fn000.5> and the feed hold lamp signal SPL<Fn000.4> are shown in the figure below.
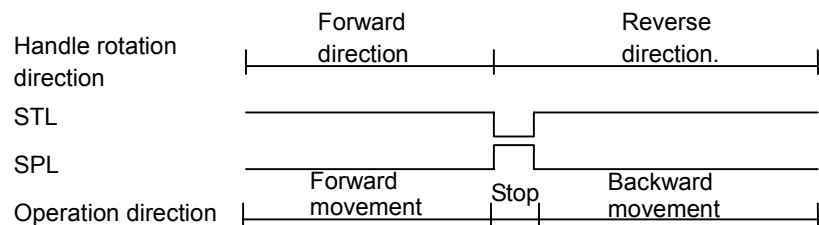
4) When manual handle retrace function is executed at the same time in two or more paths, some gaps might be caused in operation between each paths by repetition of forward movement and backward movement or rotational speed of manual handle. Waiting M codes are used for the synchronized block between each paths.