MR13 Series Digital Controller

Program Function Instruction Manual

Thank you for purchasing the Shimaden M13 series controller.
Please check that the delivered product is the correct item you ordered. Please do not begin operating this product until you have read this instruction manual thoroughly and you understand its contents.
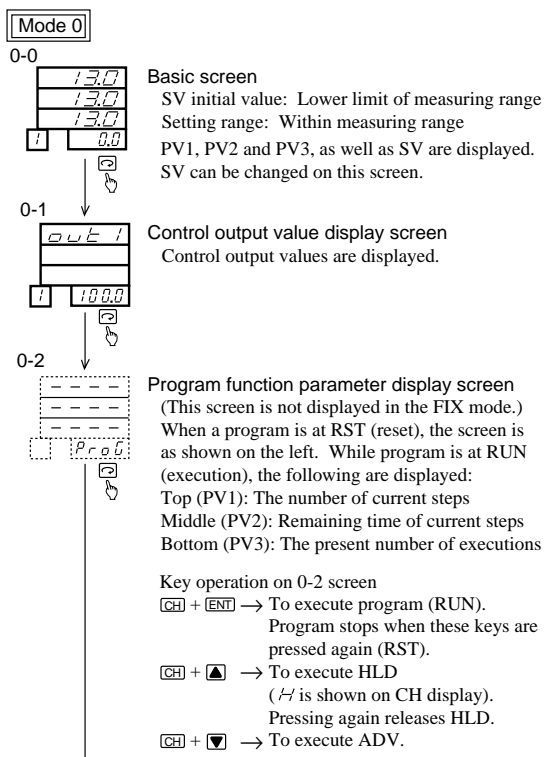
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"Notice"

Please ensure that this instruction manual is given to the final user of this instrument.
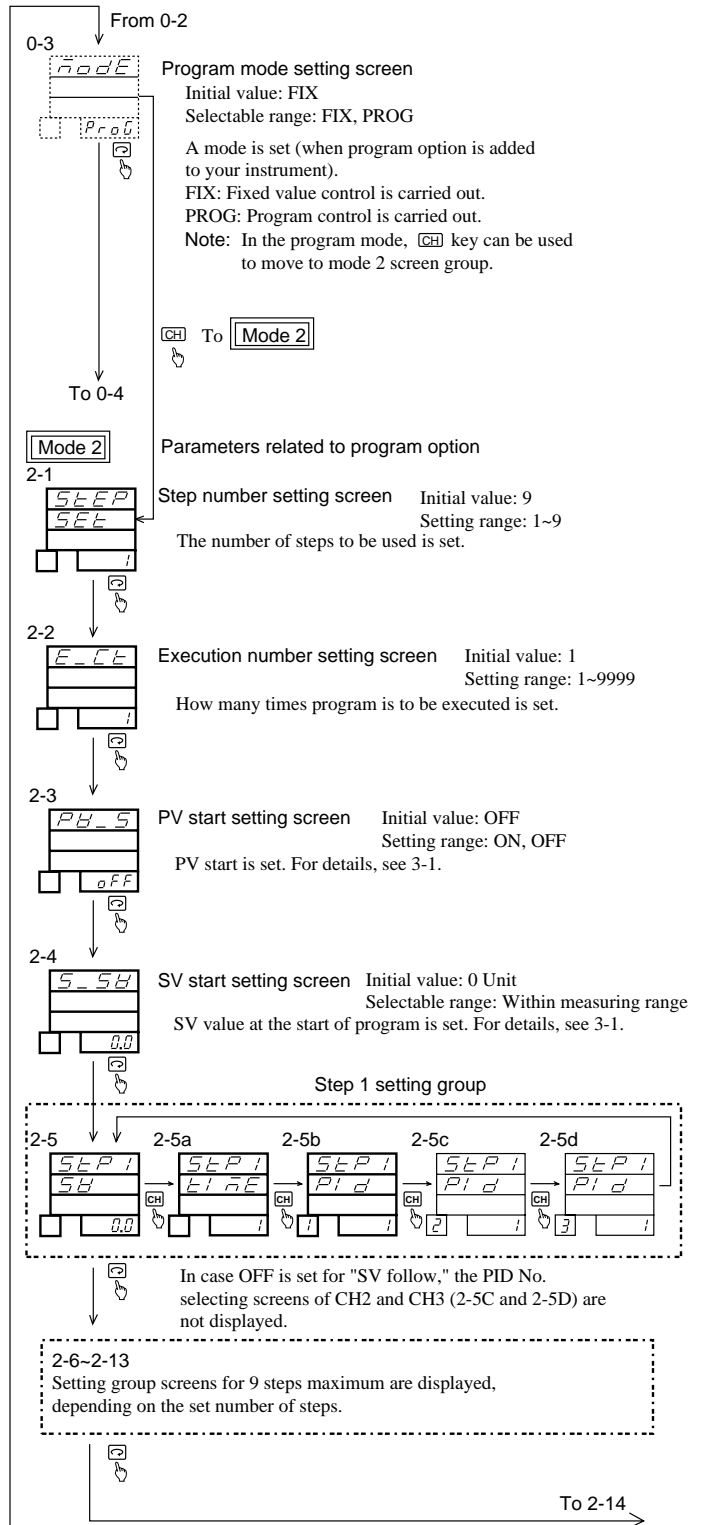
Preface

This instruction manual describes the program function, an optional function of the M13 series digital controller. Concerning the specifications, matters to be attended to during usage and a description of other functions, please refer to the separate instruction manual.
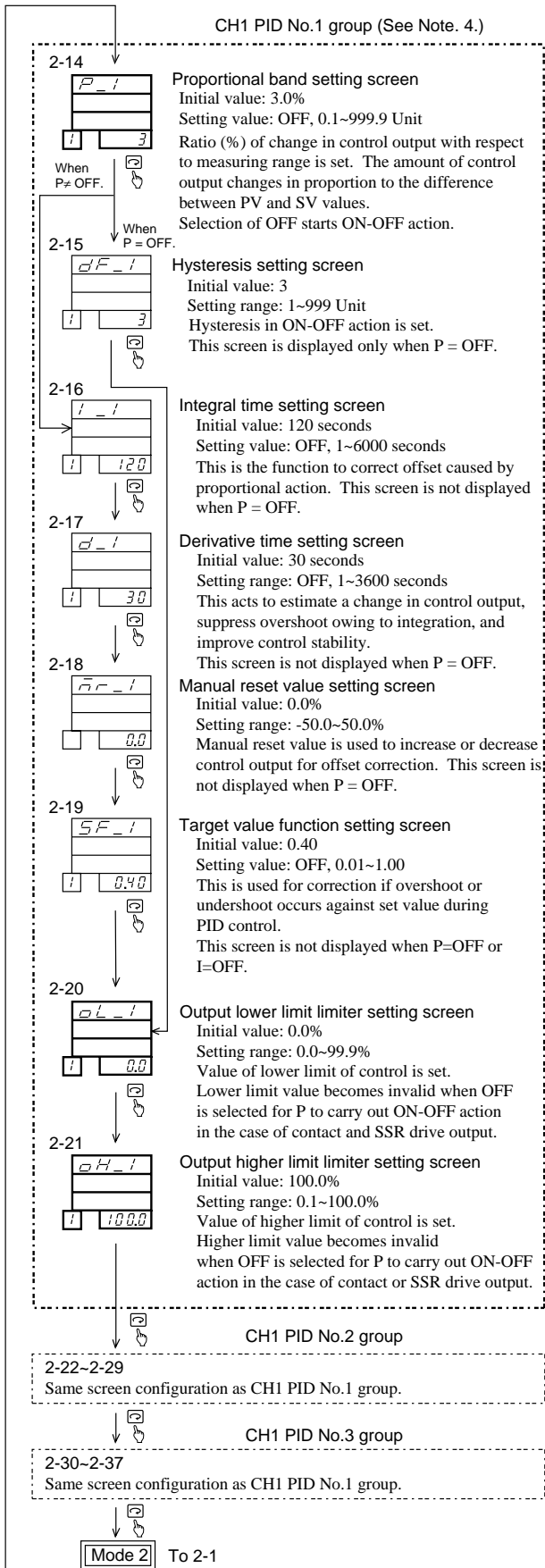
Contents

1. Description of screens and key sequence related to program option

Mode 0

0-0

Basic screen
 SV initial value: Lower limit of measuring range
 Setting range: Within measuring range
 PV1, PV2 and PV3, as well as SV are displayed.
 SV can be changed on this screen.

0-1

Control output value display screen
 Control output values are displayed.

0-2

Program function parameter display screen
 (This screen is not displayed in the FIX mode.)
 When a program is at RST (reset), the screen is as shown on the left. While program is at RUN (execution), the following are displayed:
 Top (PV1): The number of current steps
 Middle (PV2): Remaining time of current steps
 Bottom (PV3): The present number of executions

 Key operation on 0-2 screen
 CH + ENT → To execute program (RUN).
   Program stops when these keys are pressed again (RST).
 CH + ▲ → To execute HLD
   (H is shown on CH display).
   Pressing again releases HLD.
 CH + ▼ → To execute ADV.

To 0-3

From 0-2

0-3

Program mode setting screen
 Initial value: FIX
 Selectable range: FIX, PROG

 A mode is set (when program option is added to your instrument).
 FIX: Fixed value control is carried out.
 PROG: Program control is carried out.
 Note: In the program mode, CH key can be used to move to mode 2 screen group.

CH To Mode 2

To 0-4

Mode 2   Parameters related to program option

2-1

Step number setting screen   Initial value: 9
   Setting range: 1~9
 The number of steps to be used is set.

2-2

Execution number setting screen   Initial value: 1
   Setting range: 1~9999
 How many times program is to be executed is set.

2-3

PV start setting screen   Initial value: OFF
   Setting range: ON, OFF
 PV start is set. For details, see 3-1.

2-4

SV start setting screen   Initial value: 0 Unit
   Selectable range: Within measuring range
 SV value at the start of program is set. For details, see 3-1.

Step 1 setting group

2-5   2-5a   2-5b   2-5c   2-5d

In case OFF is set for "SV follow," the PID No. selecting screens of CH2 and CH3 (2-5C and 2-5D) are not displayed.

2-6~2-13
Setting group screens for 9 steps maximum are displayed, depending on the set number of steps.

To 2-14

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MR13P-1CE
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CH1 PID No.1 group (See Note. 4.)

2-14

P-1 / 1 □ 3

Proportional band setting screen
Initial value: 3.0%
Setting value: OFF, 0.1~999.9 Unit
Ratio (%) of change in control output with respect to measuring range is set. The amount of control output changes in proportion to the difference between PV and SV values.
Selection of OFF starts ON-OFF action.

When P≠ OFF.

When P = OFF.

2-15

dF-1 / 1 □ 3

Hysteresis setting screen
Initial value: 3
Setting range: 1~999 Unit
Hysteresis in ON-OFF action is set.
This screen is displayed only when P = OFF.

2-16

I-1 / 1 □ 120

Integral time setting screen
Initial value: 120 seconds
Setting value: OFF, 1~6000 seconds
This is the function to correct offset caused by proportional action. This screen is not displayed when P = OFF.

2-17

d-1 / 1 □ 30

Derivative time setting screen
Initial value: 30 seconds
Setting range: OFF, 1~3600 seconds
This acts to estimate a change in control output, suppress overshoot owing to integration, and improve control stability.
This screen is not displayed when P = OFF.

2-18

Ar-1 / □ 0.0

Manual reset value setting screen
Initial value: 0.0%
Setting range: -50.0~50.0%
Manual reset value is used to increase or decrease control output for offset correction. This screen is not displayed when P = OFF.

2-19

SF-1 / 1 □ 0.40

Target value function setting screen
Initial value: 0.40
Setting value: OFF, 0.01~1.00
This is used for correction if overshoot or undershoot occurs against set value during PID control.
This screen is not displayed when P=OFF or I=OFF.

2-20

oL-1 / 1 □ 0.0

Output lower limit limiter setting screen
Initial value: 0.0%
Setting range: 0.0~99.9%
Value of lower limit of control is set.
Lower limit value becomes invalid when OFF is selected for P to carry out ON-OFF action in the case of contact and SSR drive output.

2-21

oH-1 / 1 □ 100.0

Output higher limit limiter setting screen
Initial value: 100.0%
Setting range: 0.1~100.0%
Value of higher limit of control is set.
Higher limit value becomes invalid when OFF is selected for P to carry out ON-OFF action in the case of contact or SSR drive output.

CH1 PID No.2 group

2-22~2-29
Same screen configuration as CH1 PID No.1 group.

CH1 PID No.3 group

2-30~2-37
Same screen configuration as CH1 PID No.1 group.

Mode 2 To 2-1

Note 1: The following show the types of screen frames on the respective screens:

Screens always displayed by key operation and some other means.

Screens displayed or skipped depending on other parameter settings.

Screens displayed when appropriate options are added or selected.
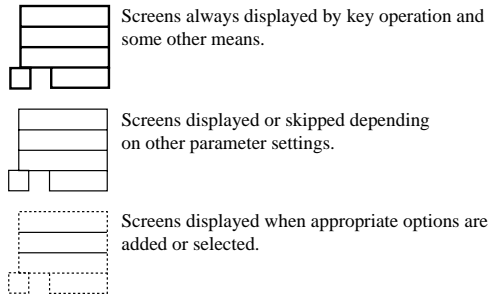
Note 2: When CH display is shaded:
The CH key can be used to change one channel to another and set parameters for each channel. On the 0-3 program mode setting screen, however, the CH key serves to move to the mode 2 screen group.

Note 3: In mode 2 screen group, pressing ▲ key while pressing ⊡ key can change to a previous screen (i.e., opposite to the flow of screens as caused by pressing ⊡ key).

Note 4: In MR13, each channel has 3 PID groups. This instruction manual gives a detailed description of the shaded portions in the following illustration. The other groups have the same screen configuration.
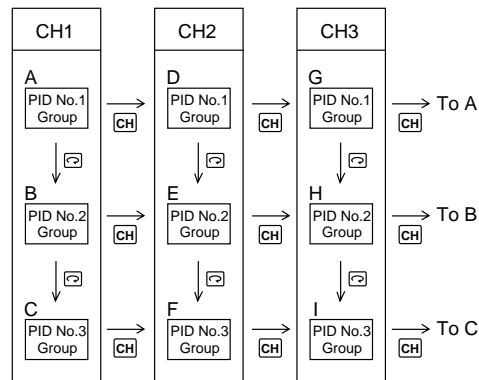
CH1	CH2	CH3	
A PID No.1 Group	D PID No.1 Group	G PID No.1 Group	→ To A
B PID No.2 Group	E PID No.2 Group	H PID No.2 Group	→ To B
C PID No.3 Group	F PID No.3 Group	I PID No.3 Group	→ To C

2. Supplementary description of mode 0 screen group

2-1. 0-2 program function parameter display screen

While program is in execution (RUN), the number of steps, remaining time of current step and the number of executions are displayed. Nevertheless, these are not displayed when program is in suspension (RST).

* While program is in suspension (RST)
  • Control output becomes 0%.
  • Event output turns OFF.
    However, in case event output is used as alarm (event types 1 ~ 6 are assigned and standby action 1 ~ 3 are set), event output turns ON only when sensor break or scaleover occurs.

2-2. Execution of program

• Program is unable to be executed in the case of scaleover of PV1.
• During execution of program, RUN lamp remains lit and the lamp goes out when program stops.
• In case time of step presently in execution is changed, the changed time becomes valid only in the next execution.
• In the following cases, program stops (RST) immediately:
  1. When measuring range, control characteristics or input scaling is changed.
  2. When scaleover occurs.
  3. When setting is changed so as to be the current execution number > the number of executions.
  4. When setting is changed at the last number of execution so as to be the step number currently in execution > the number of executions.
    * When the current execution number is smaller than the number of executions and setting is changed to the current step number > the number of steps, the number of executions is given 1 increment and control is carried out from step 1.
  5. When program control terminates.

2-3. HLD action

• HLD action: The time of step in which HLD is input is temporarily suspended and SV value is fixed.
• HLD action is valid only when program is executed.
• ADV action is unable to be input while HLD is in action.
• While HLD is in action, " $\vdash$ " is shown on the channel display of the 0-2 program function parameter display screen.
• In case HLD is assigned to DI and program is executed (RUN) while DI input is ON, SV of PV start function supercedes.
  Example: Hold is in action with start SV when PV start is OFF.

2-4. ADV action

• ADV action: terminates the step currently in execution and starts the next step.
• ADV action is valid while program is in execution but becomes invalid when HLD is in action.
• Once ADV action is executed, you have to wait about 2 seconds to execute ADV action again.

2-5. AT in program control

• AT is unable to be carried out while ramp is in execution in program control. AT cannot be carried out either if there is no flat portion from step 1 through step 9.
• AT lamp flashes while AT control is actually done in flat portion(s). In other portions the lamp remains lit on standby until all AT completes.
• Occurrence of the following brings AT to a termination:
  1. Scaleover.
  2. Termination of one pattern of program (AT will terminate even if PID operation is not completed because time for one step is too short.)
  3. Completion of operation of all PID Nos.
  4. Suspension of program.

2-6. PID action in program control

In ramp portion, control is carried out in PD action even when I≠ OFF in order to reduce overshoot at the time of moving into flat portion. When SF is less than 0.10, however, control is performed in PID action.
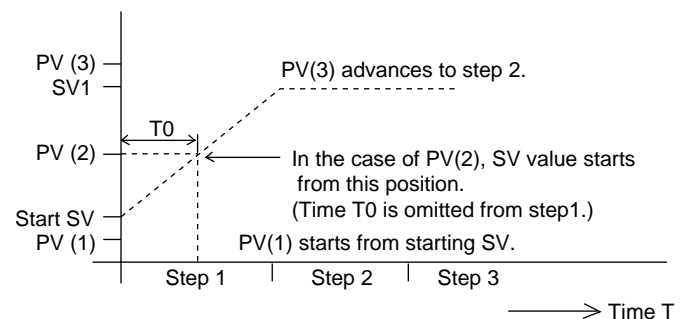
3. Supplementary description of mode 2 screen group

3-1. 2-3 PV start setting screen

When the starting step of program falls on ramp control and starting SV value and PV value are widely apart from each other, action time is wasted. To get rid of such waste of time, starting SV value is set so that the step starts from it as PV start.

When PV start is OFF, step starts always from starting SV value.

The following shows the pattern when RUN is executed in program control.

4. Table for program pattern setting

Step No.	1	2	3	4	5	6	7	8	9
CH1 SV (set value)									
CH2 SV (CH1 SV + CH2 S_FL)									
CH3 SV (CH1 SV + CH3 S_FL)									
Time (minute)									
CH1 PIDNo. (1~3)									
CH2 PIDNo. (1~3)									
CH3 PIDNo. (1~3)									

STEP No. 1~9
PV start ON, OFF
Starting SV value
Number of executions
- MEMO -

		PID No. 1	PID No. 2	PID No. 3
	CH1	P_1= %	P_2= %	P_3= %
		I_1= sec.	I_2= sec.	I_3= sec.
		D_1= sec.	D_2= sec.	D_3= sec.
		DF_1=	DF_2=	DF_3=
		MR_1= %	MR_2= %	MR_3= %
		SF_1=	SF_2=	SF_3=
		OL_1= %	OL_2= %	OL_3= %
		OH_1= %	OH_2= %	OH_3= %
	CH2	P_1= %	P_2= %	P_3= %
		I_1= sec.	I_2= sec.	I_3= sec.
		D_1= sec.	D_2= sec.	D_3= sec.
		DF_1=	DF_2=	DF_3=
		MR_1= %	MR_2= %	MR_3= %
		SF_1=	SF_2=	SF_3=
		OL_1= %	OL_2= %	OL_3= %
		OH_1= %	OH_2= %	OH_3= %
	CH3	P_1= %	P_2= %	P_3= %
		I_1= sec.	I_2= sec.	I_3= sec.
		D_1= sec.	D_2= sec.	D_3= sec.
		DF_1=	DF_2=	DF_3=
		MR_1= %	MR_2= %	MR_3= %
		SF_1=	SF_2=	SF_3=
		OL_1= %	OL_2= %	OL_3= %
		OH_1= %	OH_2= %	OH_3= %