TTM-210

DIGITAL CONTROLLER

TTM-214

TTM-214 TTM-215 TTM-217 TTM-219

DIGITAL CONTROLLER TTM-210

■Features

● **Controllability is improved with the New PID Algorithm**
 ①The time it takes from the control start until it is stabilized has been shortened.
 ②The jump-less control function which controls the occurrence of overshoot after the disturbance has been incorporated.
 ③3-kinds of PID control is selectable.

● **Full multiple input**
 With just one unit, it can accommodate different types of input such as thermocouples (13 types), platinum resistance temperature sensor (2 types), voltage (5 types), current (1 type).

● **Sampling cycle**
 Speed-up to 200mS has been realized.

● **A liquid crystal display has been incorporated for the display**
 ①The indication range has been extended to 5-digit display.
 ②Realization of various indications with 11 segment display.
 ③LED is used for the back-light.

● **PV indication auto-change**
 The Process value (PV) display condition can be set at Lighting, Flashing (high speed), Flashing (low speed), relative to the set value (SV).

● **Compact size**
 The TTM-210 series is made compact with depth of 59.7 mm (for TTM-214), 65 mm (for TTM-215, 217, 219). Moreover, the protrusive portion for the panel side attachment is only 2 mm. (TTM-214: 2.5mm)

● **Loader communication function**
 This function is most appropriate for the set-up work of the parameters.
 Cable: optional (sold separately)
 Software: optional (provided free-of-charge downloadable from our website)

● **Extensive output type**
 Relay contact, SSR drive, open collector, voltage (5 types) and current.

● **Enhanced optional function**
 ①CT input (max. of 2-points), ②Event input (max. of 4-points), ③Event output (max. of 7-points, however, when all 7-points are used, the control output will not be available for use)

● **External standards (TTM-214 only)**
 Conforms to CE markings
 UL, c-UL, UKCA markings have been acquired.
 ※TTM-215/217/219 Pending application

● **Protection structure (TTM-214 only)**
 Corresponds to "IP66".

● **Valve position proportionality control**
 A function has been incorporated enabling the unit to carry out valve position proportionality control without the feedback resistance.

● **Blind function**
 The system can be configured so that only the specific parameters are displayed from the set of parameters.

● **Simplified programmable controlling function**
 A max. of 8-step program control is possible.

● **Simple timer function (3-point stand-alone)**
 A control of "Control start or stop after a lapse of certain time" is possible with a single unit. An independent use as a timer (event output ON/OFF) is possible.

● **Priority screen**
 Indication/Setting is possible without shifting to parameter screen by indicating the necessary parameter screen with operation mode screen. (max. 16 screens)

● **Digital PV filter**
 A filter can be applied with software in response to sudden changes of input value.

● **Manual control**
 Manual output function will enable the application of various instrumentation systems.

● **Communication function (RS485: Dedicated protocol / MODBUS)**
 A communication distance can be extended to a maximum of 500 meters, and up to 31 units can be connected simultaneously.
 With one host computer, a centralized monitoring such as "collection of all data", "changes of various setting value" is possible from a distant location.

● **Soft-start function**
 During the PID control mode, in the READY→RUN mode (or when the power is turned ON), a limit can be applied for a certain period of time to the operation volume.

● **Delay timer (available during ON/OFF control only)**
 During ON/OFF control, the minimum duration time can be set independently for ON & OFF regardless of the control. This function is useful for any equipment which is not suited for frequent ON/OFF switching, or may be used as protection for the freezing equipment.
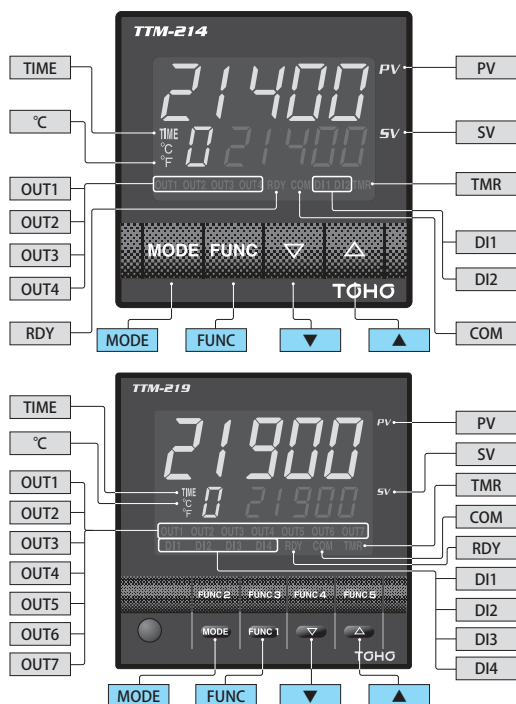
● **Loop error**
 This function monitors the measured value and operation volume, and detects the abnormality in the control loop.

● **Bank automatic switching function**
 This is a function which switches the bank automatically according to the input value (PV, SV). It optimizes the control parameters.
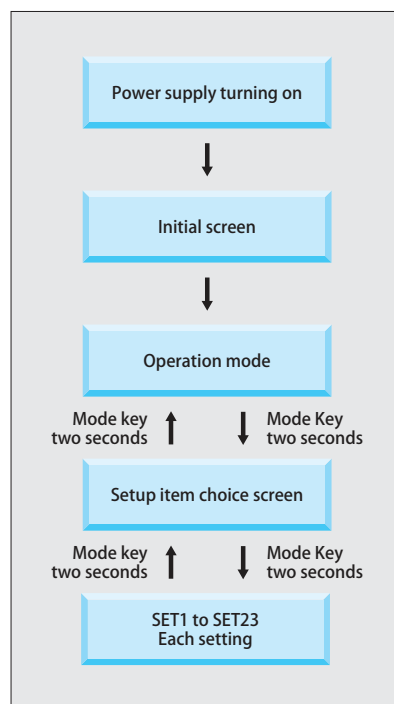
■Front Panel

OUT1	Output1 monitor (appears during output)
OUT2	Output2 monitor (appears during output)
OUT3	Output3 monitor (appears during output)
OUT4	Output4 monitor (appears during output)
OUT5	Output5 monitor (appears during output)
OUT6	Output6 monitor (appears during output)
OUT7	Output7 monitor (appears during output)
RDY	RDY lamp (It appears in the state of Ready)
COM	COM lamp (It blinks during communication)
DI1	DI1 monitor (It appears when DI1 operates)
DI2	DI2 monitor (It appears when DI2 operates)
DI3	DI3 monitor (It appears when DI3 operates)
DI4	DI4 monitor (It appears when DI4 operates)
TMR	TIMER lamp (It appears when timer operates)
TIME	Appears when the setting is at "Timer".
℃／℉	It appears when the setting is at "Temperature".
PV	Measured value indication, Character indication, Timer set-up time indication
SV	Set value indication, Operation quantity indication, Timer remaining time indication
MODE	Mode key It is used when changing a screen.
FUNC	Function key It executes functions that are already set.
▲	Up key It is used when making a setting value increase It is used when changing input setting mode
▼	Down Key It is used when making a setting value decrease It is used when changing parameter screen

※OUT6 is not available for TTM-217.

■Operation flow

Power supply turning on

↓

Initial screen

↓

Operation mode

Mode key two seconds ↑ ↓ Mode Key two seconds

Setup item choice screen

Mode key two seconds ↑ ↓ Mode Key two seconds

SET1 to SET23 Each setting

■Standard specifications

Input type	Thermocouple	K, J, T, E, R, S, B, N, U, L, WRe5-26, PR40-20, PLII (input resistance 1MΩ)
	RTD	Pt100, JPt100 [external resistance below 10Ω (per wire. All three wires must have the same resistance)]
	Current/voltage	4 to 20mA DC (input resistance 250Ω), 0 to 1VDC, 0 to 5VDC, 1 to 5VDC, 0 to 10VDC, 0 to 10mVDC (input resistance 1MΩ or more)
Display (LCD)	PV/character display	LCD display (with LED backlight, luminous color is White) TTM-214/215 5-digits, character height 10mm TTM-217 5-digits, character height 13mm TTM-219 5- digits, character height 20mm
	SV/setting display	LCD display (with LED backlight, luminous color is Green) TTM-214/215 5-digits, character height 8mm TTM-217 5-digits, character height 8mm TTM-219 5- digits, character height 10mm
	Aux. display portion	LCD display (with LED backlight, luminous color is Orange) TTM-214/215 5-digits, character height 7mm TTM-217 5-digits, character height 8mm TTM-219 5- digits, character height 10mm
	Various displays	Orange (OUT1, OUT2, OUT3, OUT4, OUT5, OUT6, OUT7, RDY, COM, DI1, DI2, DI3, DI4, TMR) Item displayed changes depending on their size.
Control	PID (with auto-tuning) (with self-tuning)	Proportional band (P1)		0.1 to 200.0% of set limiter span
		Proportional band OUT2 side (P2)		0.10 to 10.00 times (with respect to the main control proportional band)
		Integral time (I)		0 to 3600 seconds (integral action OFF at "0")
		Differential time (D)		0 to 3600 seconds (differential action OFF at "0")
		Proportion cycle (T1, T2)		0.1 to 120.0 seconds
		Dead band (DB)	Temperature input	−999.9 to 999.9 or −999 to 999 (℃)
			Analog input	−9999 to 9999 (digits) (decimal point position is specified position)
	ON/OFF	Control sensitivity (C1, C2)	Temperature input	0.0 to 999.9 or 0 to 999 (℃)
			Analog input	0 to 9999 (digits) (decimal point position is specified position)
	Output 1/2 OFF point	Position selection setting		SV unit setting High/Middle/Low
		Position setting	Temperature input	−999.9 to 999.9 or −999 to 999 (℃)
			Analog input	−9999 to 9999 (digits) (decimal point position is specified position)
Control output	Relay contact		250VAC 3A (resistance load) 1a contact point Minimum load 5VDC 100mA
	SSR driving voltage		0 to 12VDC (load resistance 600Ω or more)
	Open collector		26.4VDC 100mA
	Current		4 to 20mA DC (load resistance 600Ω or less)
	Voltage		0 to 1VDC (load resistance 500KΩ or more), 0 to 5VDC (load resistance 1KΩ or more), 1 to 5VDC (load resistance 1KΩ or more) 0 to 10VDC (load resistance 1KΩ or more), 0 to 10mV DC (load resistance 500KΩ or more)
Sampling cycle			0.2 seconds
Setting & instruction accuracy (At ambient temp. 23℃ ±10℃)	Thermocouple	K, J, T, E, R, S, B, N	±(0.3% + 1 digit) of the instruction value or ±2℃ whichever is bigger (23℃±10℃) However, ±3℃ between −100℃ to 0℃, ±4℃ between −200 to −100℃. No stipulation below 400℃ in B-thermocouple.
		U, L	±(0.3% + 1 digit) of the instruction value or ±4℃ whichever is bigger (23℃±10℃). ±6℃ below 0℃.
		WRe5-26	±(0.6% + 1 digit) of the instruction value or ±4℃ whichever is bigger (23℃±10℃).
		PR40-20	±9.4℃± 1 digit. No accuracy stipulation below 800℃.
		PL II	±(0.3% + 1 digit) of the instruction value or ±2℃ whichever is bigger
	RTD	Pt100, JPt100	±(0.3% + 1 digit) of the instruction value or ±0.9℃ whichever is bigger (23℃±10℃)
	Current/voltage	0 to 1VDC, 0 to 5VDC 1 to 5VDC, 0 to 10VDC, 4 to 20mA DC	±0.3%±1 digit (23℃±10℃) of the set limiter span
Memory element			EEPROM
Input power supply			100 to 240 VAC (−15%, +10%) 50/60Hz, AC/DC 24V±10% 50/0Hz
Weight			TTM-214: 150gms., TTM-215: 300gms., TTM-217: 300gms., TTM-219: 400gms.
Power consumption			TTM-214: 100 to 240VAC (less than 10VA), AC/DC 24V (less than 4W) TTM-215/217/219: 100 to 240VAC (less than 11VA), AC/DC 24V (less than 6W)
Accessories			Simplified instruction manual and attachment
Standard ambient temp. & humidity range (warranty range such as accuracy)			23℃±10℃, 45 to 75% RH
Usable ambient temp. & humidity range			0 to 50℃, 20 to 85% RH (non-condensing)
Storage ambinet temp. & humidity range			−20℃ to 70℃ (non-freezing, non-condensing), 5 to 85% RH (non-condensing)
Function	Manipulated variable limiter (MLH1, MLL1, MLH2, MLL2)	Upper limit (MLH1, MLH2)	Digital output	MLL1 to 100.0 (%), MLL2 to 100.0 (%)
			Analog output	MLL1 to 110.0 (%), MLL2 to 110.0 (%)
		Lower limit (MLL1, MLL2)	Digital output	0.0 to MLH1 (%), 0.0 to MLH2 (%)
			Analog output	−10.0 to MLH1 (%), −10.0 to MLH2 (%)
	UP/DOWN setting of manipulated variable change ratio limiter			0.0 to 549.9 (%) (Function OFF with 0.0% setting)
	Manipulated variable setting in time of malfunction	Digital output	0.0 to 100.0 (%)	
		Analog output	−10.0 to 110.0 (%)	
	Set limiter (SLL, SLH)	Upper limit (SLH)	Temperature input	(SLL+5.0) to SV setting range upper limit, (SLL+5) to SV setting range upper limit (C℃)
			Analog input	(SLL+50) to SV setting range upper limit (digit)
		Lower limit (SLL)	Temperature input	SV setting range lower limit to (SLH−5.0), SV setting range lower limit to (SLH−5) (℃)
			Analog input	SV setting range lower limit to (SLH−50) (digit)
	Control mode (MD)			Control stop, control start, manual control, timer 1 operation, timer 2 operation, timer 3 operation
	Control types (CNT)	PID type	Type A (normal PID control)	
			Type B (over-shoot suppression function)	
			Type C (external disturbance suppression function)	
		Type B mode	Over-shoot suppession: weak	
			Over-shoot suppession: medium	
			Over-shoot suppression: strong	
		Normal / reverse action setting	Reverse action	
			Normal action	
		Tuning type setting	Primary auto-tuning (Primary PID/during position proportional control)	
			Primary self-tuning (Primary PID/during position proportional control)	
			Secondary auto-tuning (Primary PID/during secondary PID)	
			Secondary self-tuning (Primary PID/during secondary PID)	
			Primary/secondary auto-tuning (Primary PID/during secondary PID)	
	Output gain setting (MV1G, MV2G)			0.0 to 1000.0 (%)
	PV correction 0-point setting (PVS)	Temperature input		−999.9 to 999.9 (℃), −999 to 999 (℃)
		Analog input		−9999 to 9999 (digit)
	PV correction Gain setting (PVG)			0.500 to 2.000 (times)
	PV input filter (PDF)			0.0 to 99.9 (seconds)
	Anti-reset wind up			0.0 to 110.0 (%) (function OFF at 110.0% setting)
	Manual reset (PBB)			0.0 to 100.0 (%) (if there is secondary control, −100.0 to 100.0 (%)) However, when both the primary/secondary control is position proportional control, 0.0 to 100.0 (%).
	Loop malfunction time setting	Primary control loop malfunction time setting		0 to 9999 (seconds)
		Secondary control loop malfunction time setting		0 to 9999 (seconds)

■Standard specifications (Continued)

Function				
	Timer driving mode (TMF)	Three points. 0 min. 00 sec to 99 min. 59 sec.. Frequency of timer repetition: 0 to 99 times (unlimited times at 0) Accuracy: ±(1.5%+0.5 sec.) of the set time. Function: auto-start, manual start, event start, SV start, DI start.		
	Delay timer (FDT)	0 to 99 (min.). Primary/secondary control common.		
	Decimal point shifting (DP)	Indication below decimal point: with/without		
	Manual control	Manual control is possible (balance-less, bump-less)		
	RUN/READY	Switching of RUN/READY is possible		
	Blind function	Any of the parameter screen can be set to non-display mode.		
	Auto-tuning coefficient (ATG)	0.1 to 10.0 (times)		
	Auto-tuning sensitivity (ATC)	Temperature input	0.0 to 999.9 or 0 to 999 (℃)	
		Analog input	0 to 9999 (digit)	
	Function key	Function key can be selected from "digit shifting", "SEt21 operation type setting・・・fixed value operation mode: control mode (MD)/control stop (RdY)/ program mode: program start/stop", "AT start/AT stop", "timer start/rest", "screen backward", "ENT", "bank switching", "MD/MANUAL", "SV/MV screen switching", "fixed operation mode/programmed mode switching", "step forward", "pause", "SET22 recall function (SET22 shortcut function)". Press time setting (0 to 5 sec.)		
	Priority screen	Any of the parameter screen can be indicated on the operation mode screen (max. 16-points)		
	Lock function (LOC)	8 modes [OFF, ALL lock, operation mode lock, lock except operation mode, ALL lock (RUN only), operation mode lock (RUN only), lock except operation mode (RUN only), set lock (RUN only)]		
	Self-diagnostic function	EEPROM data check (Err0), A/D converter action check (Err1), auto-tuning check (Err2), built-in watchdog timer.		
	Ramp function	Action	It sets the SV variance per minute when the SV is changed.	
		Setting range	Temperature input	0.0 to 999.9 (℃ /min.) (ramp function OFF at 0.0)
			Analog input	0 to 9999 (digit/min.) (ramp function OFF at 0)
		Setting unit	Temperature input	0.1℃ /min.
			Analog input	1 digit/min.
	Valve function	Motor stroke time	0.1 to 999.9 (sec.)	
		Motor drive dead band	0.0 to 100.0 (sec.)	
	Default setting mode	Password setting, blind screen temporary recall setting, set value back-up, set value initialization. This mode requires password. Make sure to take note of the password.		
	Bank setting	Parameter can be set from SET 1 to 23 (max. 16-points)		
	Soft-start (primary control)	Output setting	MLL1 to MLH1 (%)	
		Time setting	00:00 to 499.59 (min.: sec.) Function OFF with 00:00 (min.: sec.) setting	
	Programmed operation function	Max. 8-steps. Execution condition 3-kinds (step, soak 1 & 2). Power failue guarantee function.		
	Bank automatic switching function	Max. 8-zones switching. Input type 3-kinds (SV, Ramp SV, PV)		

■Option specifications

Auxiliary Output (Max. 5-points)				
	Relay contact	250VAC 1A (resistance load) 1a contact point Min. load 5VDC 100mA		
	Open collector	26.4VDC 100mA		
	Setting range (Upper and Lower limit)	Temperature input	−1999.9 to 2999.9、−1999 to 2999 (℃)	
		Analog input	−19999 to 29999 (digit)	
	Sensitivity	Temperature input	0.0 to 999.9、0 to 999 (℃)	
		Analog input	0 to 9999 (digit)	
	Delay timer	0 to 9999 (seconds)		
DI Input (Max. 4-points)	Functions	Bank switching, at constant operation mode MD/READY (at closed contact point: READY), at program mode START/STOP (at closed contact point: STOP), AUTO/MANUAL switching (at closed contact point: MANUAL), Reverse Operation / Normal Operation (at closed contact point: NORMAL OPERATION), Auto-Tuning STOP/START (at closed contact point: START), Timer STOP/START (at closed contact point: START), Constant Operation Mode / Program Mode (at closed contact point: Program Mode), step forward at closed setting during program mode, pause. Interlock at open contact point.		
	Input specification	No voltage contact point. Active switching is possible at the time of the input.		
	Minimum input time	200mS		
	When ON electric current	Maximum 10mADC		
	When OFF electric current	Maximum 6VDC		
	Permissible resist. value bet. terminals	When ON: Maximum 333Ω, When OFF: Minimum 500KΩ		
CT input (2 points)	Measurement electric current range	0.0 to 50.0A		
	Setting electric current range	0.0 to 30.0A (Setting resolution 0.1A). However, the function is turning off at 0.0.		
	Setting accuracy	±5% (0.1A or less is outside accuracy)		
	Wire break detection	ON time of control output above 300mS		
	Welding detection	OFF time of control output above 300mS		

Communication		Communication	Loader communication
	Communication standard	RS-485 (1:31)	TTL (1:1)
	Communication terminal	Terminal block	Loader communication dedicated terminal (φ2.5 3-pin mini-jack)
	Protocol	TOHO exclusive protocol/MODBUS (RTU)/MODBUS (ASCII)	TOHO exclusive protocol/MODBUS (RTU)/MODBUS (ASCII)
	Direction of information	Half duplex	Half duplex
	Synchronous system	Asynchronous	Asynchronous
	Transmission code	ASCII	ASCII
	Interface	RS-485 (two lines)	TTIL level
	Transmission speed	2400, 4800, 9600, 19200, 38400bps	2400, 4800, 9600, 19200, 38400bps
	Communication distance	500m	
	Response delay time	0 to 250mS	0 to 250mS
	Communication switching	Write protect/Write enable/Simultaneous temperature rise master/Simultaneous temperature rise slave.	
	Character	Start bit: 1 bit fixed	Start bit: 1 bit fixed
		Stop bit: 1/2 bit	Stop bit: 1/2 bit
		Data length: 7/8 bit * MODBUS: In case of ASCII --- 7 bits fixed In case of RTU --- 8 bits fixed	Data length: 7/8 bit * MODBUS: In case of ASCII --- 7 bits fixed In case of RTU --- 8 bits fixed
		Parity: None/Even number/Odd number	Parity: None/Even number/Odd number
		BCC check: without/with * In case of MODBUS --- BCC Check is invalid	BCC check: without/with * In case of MODBUS --- BCC Check is invalid
		Address: 1 to 99 stations * In case of MODBUS --- 1 to 247 stations	Address: 1 to 99 stations * In case of MODBUS --- 1 to 247 stations

Transfer output			
	Function setting	PV (Process Value) output, SV (Set Value) output, MV1(main manipulated variable) output, MV2 (sub-manipulated variable) output, control SV (Set Value). Reciprocal change is possible.	
	Scaling upper limit setting	Temperature input	Scaling lower limit to 2999.9 (℃), scaling lower limit to 2999 (℃). However, for the thermocouples (R, S, B, WRe5-26 PR40-20), scaling lower limit to 9999 (℃).
		Analog input	Scaling lower limit to 29999 (digit)
	Scaling lower limit setting	Temperature input	−1999.9 to scaling upper limit (℃), −1999 to scaling upper limit
		Analog input	−19999 to scaling upper limit (digit)

■Option Specifications (Continued)

Remote SV Input	Input Type (Current/Voltage Multi-Input)	0 to 1VDC, 0 to 5VDC, 1~5VDC, 0 to 10VDC, 4 to 20mADC	
	Measurement/Range of Setting	−19999 to +29999 (decimal point can be set at any location)	
	Range of Display (Full Scale: Range of FSL2 to FSH2)	0 to 1VDC, 0 to 5VDC, 0 to 10VDC	High Limit: +12% of full scale
			Low Limit: Maximum of −2% of full scale
		1 to 5VDC, 4 to 20mADC	High Limit: +12% of full scale
			Low Limit: −12% of full scale
	Resolution	±0.3% of full scale +1 digit	
	Display scaling Upper limit (FSH2)/Lower limit (FSL2)	Upper limit (FSH2): FSL2 to SV setting range upper limit. Lower limit (FSL2): SV setting range lower limit to FSH2 (digit)	
	Display Resolution Performance	20000 or less	
	PV Correction Zero-Point Setting (PVS2)	−9999 to 9999 (digit)	
	PV Correction Gain Setting (PVG2)	0.500 to 2.000 (Multiple)	
	PV Input Filter (PDF2)	0.0 to 99.9 (seconds)	
	Local/Remote Switch	Local, remote 1 (scaling with SLL1 and SLH1) Remote 2 (scaling with FSL2 and FSH2)	

■Input and scale range

Thermocouple		Measurement/measurement range	Indication resolution
K	℃	−200.0 to 1372.0	1℃／0.1℃
J	℃	−200.0 to 1200.0	1℃／0.1℃
T	℃	−200.0 to 400.0	1℃／0.1℃
E	℃	−200.0 to 1000.0	1℃／0.1℃
R	℃	−50.0 to 1768	1℃
S	℃	−50.0 to 1768	1℃
B	℃	−0.0 to 1800	1℃
N	℃	−200.0 to 1300.0	1℃／0.1℃
U	℃	−200.0 to 400.0	1℃／0.1℃
L	℃	−200.0 to 900.0	1℃／0.1℃
WRe5−26	℃	0 to 2300	1℃
PR40−20	℃	0 to 1880	1℃
PL II	℃	0.0 to 1390.0	1℃／0.1℃

RTD		Measurement/measurement range	Indication resolution
Pt100 (JIS/IEC)	℃	−200.0 to 850.0	1℃／0.1℃
JPt100 (JIS)	℃	−200.0 to 510.0	1℃／0.1℃

Current and voltage	Measurement/measurement range	Indication resolution
0 to 1VDC		
0 to 5VDC		
1 to 5VDC	−19999 to 29999 Indication width is less than 20000.	A decimal point position can be changed arbitrarily.
0 to 10VDC		
0 to 10mVDC		
4 to 20mADC		

■Timer operation mode

Start mode

1	Auto start
2	Manual start
3	SV start
4	DI1 start
5	DI2 start
6	DI3 start
7	DI4 start
8	Event 1 start
9	Event 2 start
10	Event 3 start
11	Event 4 start
12	Event 5 start
13	Event 6 start
14	Event 7 start
15	Step start
16	Soak start

＊Each Start has ON delay/OFF Delay
　ON delay: After time-up control stop or event output OFF
　OFF delay: After time-up control stop or event output ON

■Output connection setting

Main output
Sub-output
Event output
RUN output
RDY output
Timer1 output
Timer1 output at on delay
Timer1 output at off delay
Timer1 output at on + off delay
Timer2 output
Timer2 output at on delay
Timer2 output at off delay
Timer2 output at on + off delay
Timer3 output
Timer3 output at on delay
Timer3 output at off delay
Timer3 output at on + off delay
Transmission output (When OUT1 and OUT2 are Analog output)
End output

■Point of contact output mode

Event function 1

Function	
0	Without
1	Deflection upper and lower limit
2	Deflection upper limit
3	Deflection lower limit
4	Deflection range
5	Absolute value upper and lower limit
6	Absolute value upper limit
7	Absolute value lower limit
8	Absolute value range
Additional function	
0	Without
1	Retain
2	Standby sequence
3	Delay timer
4	Retain + Standby sequence
5	Retain + Delay timer
6	Standby sequence + Delay timer
7	Retain+ Standby sequence + Delay timer
Control linkage function	
0	All mode
1	RUN/MAN mode only
2	RUN mode only

Event function 2 (PV abnormal)

Function	
0	Without
1	With
Additional function	
0	Without
1	Retain
2	Delay timer
3	Retain + Delay timer
Control linkage function	
0	All mode
1	RUN/MAN mode only
2	RUN mode only

Event function 3 (CT abnormal)

Function	
0	Without
1	CT1 abnormal
2	CT2 abnormal
3	CT1 abnormal + CT2 abnormal
Additional function	
0	Without
1	Retain
2	Delay timer
3	Retain + Delay timer
Control linkage function	
0	All mode
1	RUN/MAN mode only
2	RUN mode only

Event function 4 (Loop wire break)

Function	
0	Without
1	With
Additional function	
0	Without
1	Retain

*Event polarity function available

Output functional allotment　(○：Allotment is possible、×：Impossible)

Output types	Control output		Auxiliary output				
	Output1	Output2	Output3	Output4	Output5	Output6	Output7
Main output (Heating)	○	○	○	○	○	○	○
Auxiliary output (Cooling)	○	○	○	○	○	○	○
Transmission	○	○	×	×	×	×	×
Event output	○	○	○	○	○	○	○
RUN, READY output	○	○	○	○	○	○	○
Timer output	○	○	○	○	○	○	○
End output	○	○	○	○	○	○	○

The function allotment setting is possible for each output.
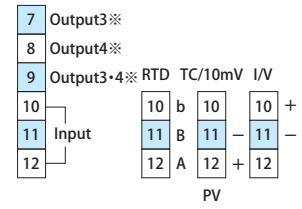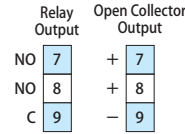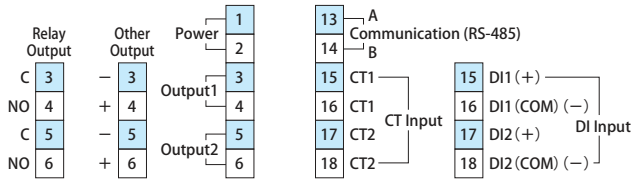　Example) When the output 1, 2 is RR model (relay output is 2-points).
　　　　By setting, they can be switched to "2-point Control Output) or "1-point Control Output, 1-point Event Output".

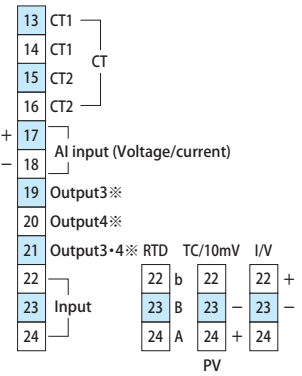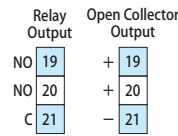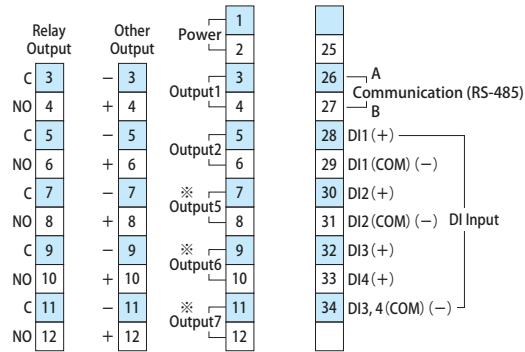＊For the transmission, setting is possible only with the analog output (models K, J, F, G, I, H)

■Wiring

※Please use less than 6mm width terminal
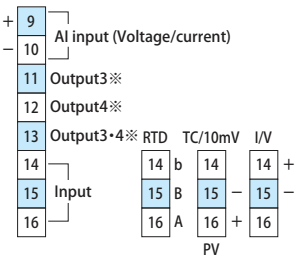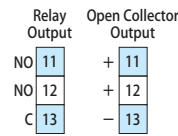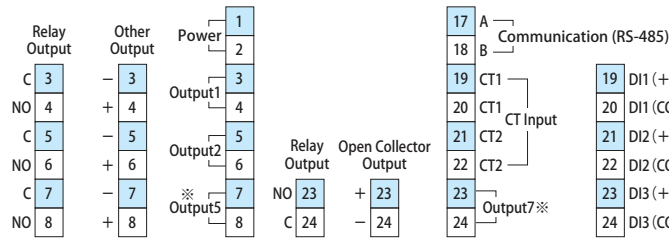
TTM-214

※ Output 3 and 4 (Terminals 7 to 9) are possible to select from either relay output or open collector.

TTM-215、219

※ Output 3 to 7 (Terminals 19 to 21and 7 to 12) are possible to select from either relay output or open collector.
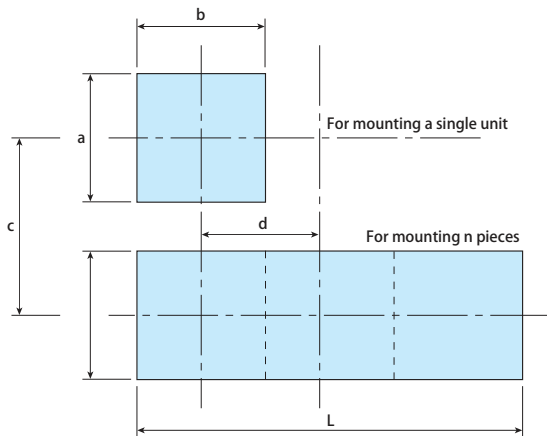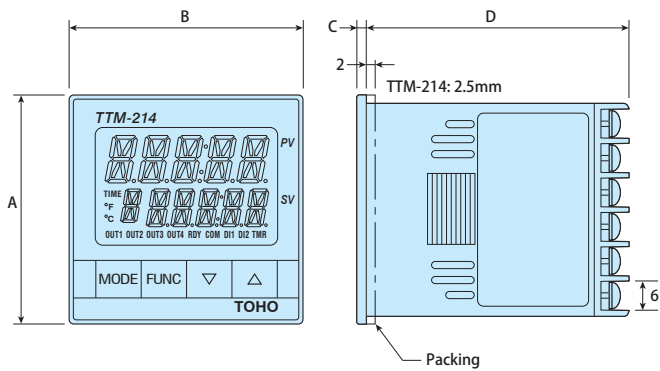
TTM-217

※ Output 3 to 5 and 7 (Terminals 11 to 13, 7 to 8, 23 to 24) are possible to select from either relay output or open collector.

■Terminal explanation

Communication		Please connect A & B terminals correctly. (Please use a converter when it is not RS-485)
Output	Relay contact point	C: Common, No: Normal open
	SSR drive	Please connect directly to INPUT + & − at SSR side.
	Transmission, Open collector	Take note of polarities + & − when making connections.
CT input		Please connect a specified current transformer directly. (CTL-6-P-H)
PV input/ AI input	Thermocouple Current/ voltage	Take note of polarities + & − when making connections.
	RTD	Take note of the terminals A, B & b when making connections.
DI		COM: Common (The polarity can be switched)
AI input		Take note of polarities + & − when making connections.
Power		In case of 24VDC, the polarity assignment shall be terminal no. ①: (+), terminal no. ②: (−)

■Dimensions

TTM-214

TTM-214: 2.5mm

Packing

For mounting a single unit

For mounting n pieces

Model	a		b		c	d	A	B	C	D	L	
TTM-214	45	$+0.6$ -0	45	$+0.6$ -0	60	48	48	48	2.5	59.7	(Bxn−3)	$+0.6$ -0
TTM-215	92	$+0.6$ -0	45	$+0.6$ -0	120	48	96	48	2	65	(Bxn−3)	$+1$ -0
TTM-217	68	$+0.6$ -0	68	$+0.6$ -0	90	72	72	72	2	65	(Bxn−3)	$+1$ -0
TTM-219	92	$+0.6$ -0	92	$+0.6$ -0	120	96	96	96	2	65	(Bxn−3)	$+1$ -0

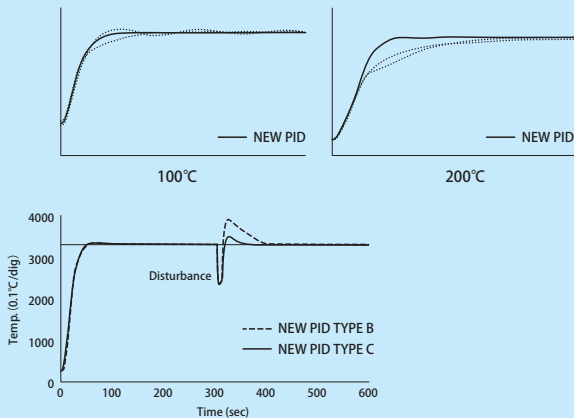# ■Panel Installation

TTM-214	TTM-215、217、219
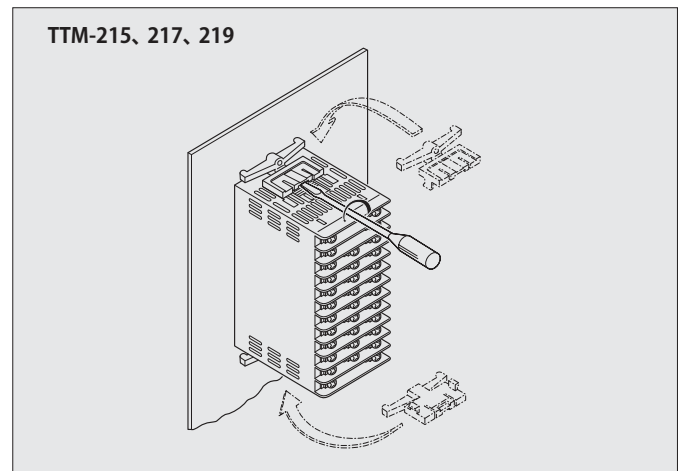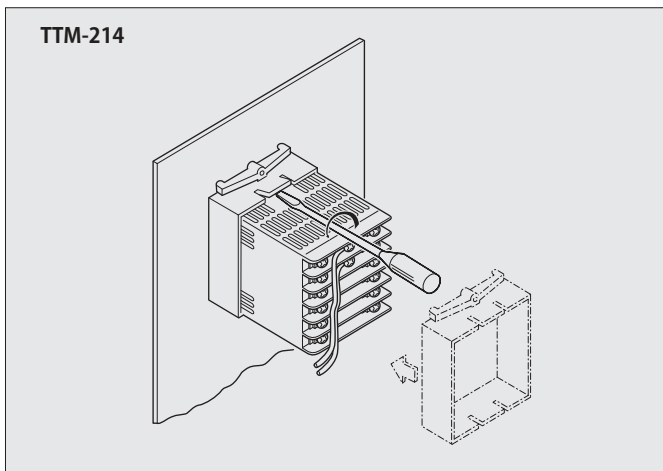
＊How to remove the attachment
Insert the tip of the flat head screwdriver between the controller body and the clip of the attachment, then rotate the screwdriver to suspend the clip, and remove the attachment.
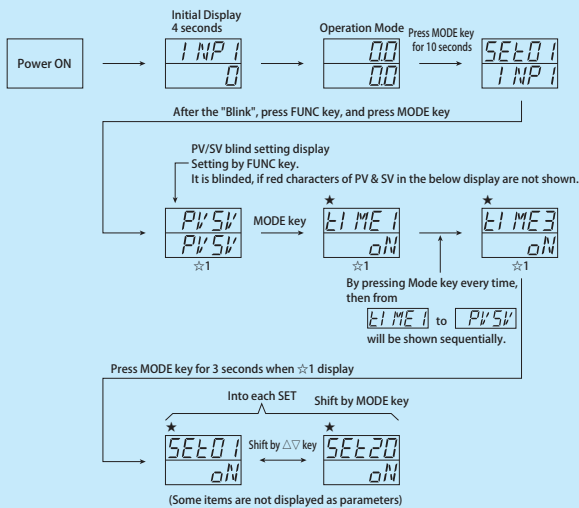
■Advanced Features

●PID control by new algorithm

100℃

200℃

---- NEW PID TYPE B
—— NEW PID TYPE C

●BLIND Function Setting

● Transition to blind setting mode

Content of the above items marked with ★

1. In the blind mode, "on" or "off" will appear below each character (SV indication portion).
2. The change of characters in the blind mode is done by pressing the "FUNC" key.
3. To end the blind setting mode, turn OFF the power first.

By the key operation, screen of your choice will not appear.
Please note that when the SV setting screen is made not to appear also, only the PV will appear during the normal indication mode.

●Auto (RUN) / Manual function

The auto control and the manual control, they can be switched by the front key.
Manual operation is the function that is not concerned with the situation of a deviation, but can set up and output the output for control arbitrarily (manipulation variable).

The system can be operated manually in the time of the system trial run and so on, when to check of final control element (a valve, heater, etc.) of operation is performed, when the sensor breaks down by any chance, or when usual control can't be done.

There is the Balance-less Bump-less function, which holds down sudden change of control output when switching the automatic control and manual control mutually. Furthermore, it stops damage on the peripheral equipment by sudden change and the bad influence to a control system. So, you can operate in comfort.

Balance-less Bump-less
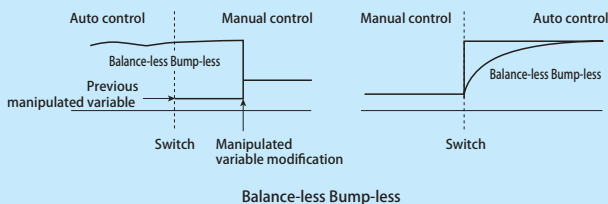
●Timer function

1. In the case of bread baking oven
   ● Put dough in the oven, and push the start key to the timer.
   ● The temperature is controlled by the heater and so on for the timer setup time.
   ● After timer count end control is stopped automatically
     (It is used when making control STOP after the timer count ends.)
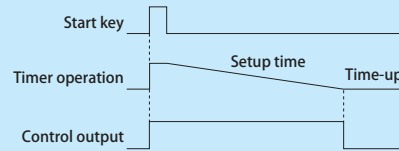
2. In case of packing machine and industrial machine, which control is started after the completing the preparation of the peripheral device
   ● The count of the timer begins from point that turns on the power supply.
   ● The control output stops during timer setting time
   ● The control starts automatically after the timer count ends.
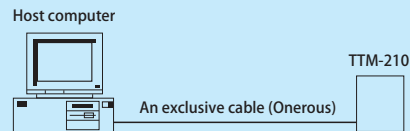   (It is used when making control starts after the timer count ends.)
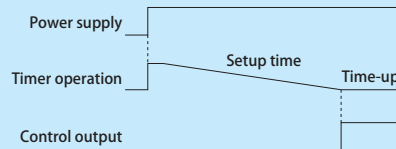
●Communication function

● A connection example with the personal computer
  Centralized supervision with the personal computer is possible with the connection like the chart below.
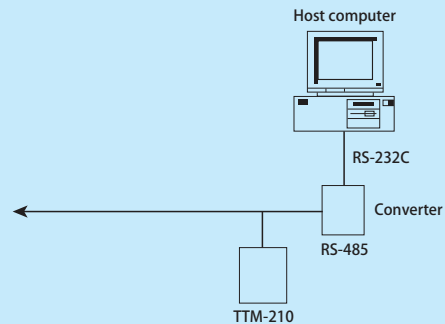
● Loader communication

※Loader cable specification
[Appearance and structure]

USB connector
(Host side)

1800mm

Stereo plug
(TTM-210 side)
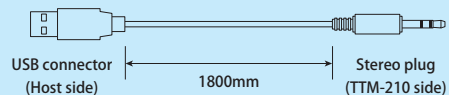
[Standard and performance]

USB I/F standard	USB Specification 2.0 Conforming
DTE (Personal computer side) speed	Up to 38400bps
Connector specification	Personal computer side: USB
	Temperature Controller side : φ2.5mm Stereo plug

[Model]
　　TTM-LOADER

●Digital PV filter

It is the function to realize the CR filter effect on the software by performing primary delay operation to the measured value (PV).

The effect of the filter can be set by the time constant.

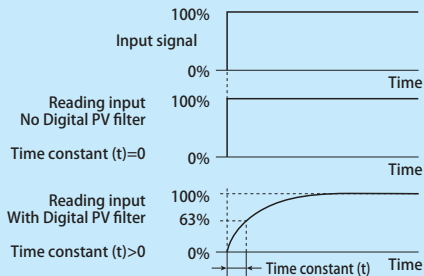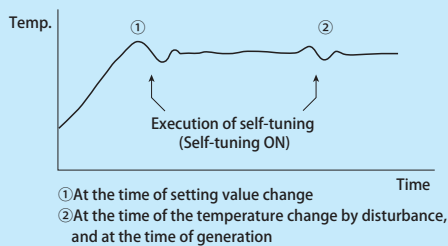(Time constant is the time that the PV value reaches up to about 63% when the input changes on the step.)

```
                    100% ┌──────────────────
      Input signal       │
                     0% ──┘           Time

   Reading input     100% ┌────────────────
   No Digital PV filter    │
   Time constant (t)=0  0% ─┘          Time

   Reading input     100%        ┌────────
   With Digital PV filter   63% ──┤
   Time constant (t)>0   0% ──────┘  Time
                            Time constant (t)
```

The use of Digital PV filter
1) Removal of high frequency noise --- The influence of a noise when an electric noise joining an input is mitigated.
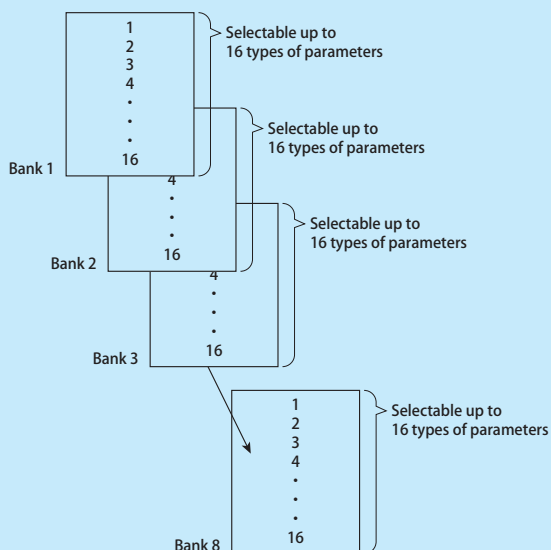2) A response can be delayed against the sudden change of the input.

●Self-tuning PID

```
  Temp.        ①              ②

          Execution of self-tuning
              (Self-tuning ON)
                                  Time
```

①At the time of setting value change
②At the time of the temperature change by disturbance, and at the time of generation

●Bank function

TTM-210 series has a bank function which stores up to 16 types of selected parameters in each of 8 banks.

Different temperature control with one unit can be realized with the presetting of the corresponding parameters in each bank and by simply switching the bank through key operation, DI, or communication without changing the temperature setting and the PID values each time.
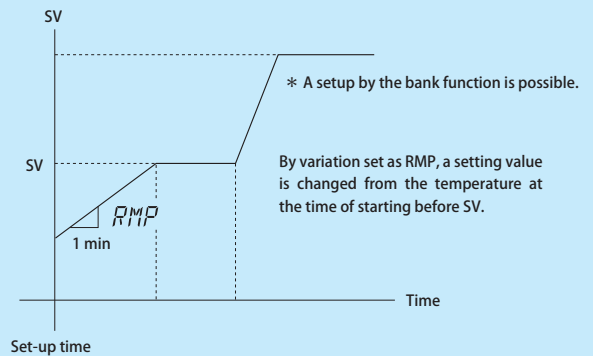
```
  Bank 1   1 2 3 4 ... 16   Selectable up to
                            16 types of parameters
  Bank 2   4 ... 16         Selectable up to
                            16 types of parameters
  Bank 3   4 ... 16         Selectable up to
                            16 types of parameters
  Bank 8   1 2 3 4 ... 16   Selectable up to
                            16 types of parameters
```

●Ramp function

It is a function to give PV value an inclination against the changes of SV value. In the actual action, the "dummy" set value is made to change gradually, and the control is done against the "dummy" set value.

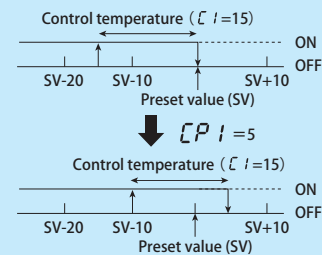The variation per minute of SV is set.

The effect of the ramp function is best exercised when sudden changes of control result is not acceptable due to the characteristics of physical object to be controlled, or, when the changing process (inclination) of the control result of the physical object becomes important.

Please note that this function changes only the SV, therefore, if great effect is expected on the PV, the expected result may not be obtained.

```
  SV │
     │                ＊ A setup by the bank function is possible.
     │           ╱
  SV │       ╱         By variation set as RMP, a setting value
     │   ╱ RMP         is changed from the temperature at
     │  1 min          the time of starting before SV.
     └─────────────── Time
  Set-up time
```

●OFF point position movement of ON/OFF control

When the OFF point position movement is set to 0, the OFF point is the set value position.

```
        Control temperature ( C 1 =15)
                                    ┌─────── ON
        ──────────────────────────┤
        SV-20   SV-10         SV+10   OFF
               Preset value (SV)

                    CP 1 =5
                      ↓
        Control temperature ( C 1 =15)
                              ┌──────────── ON
        ──────────────────────┤
        SV-20   SV-10         SV+10   OFF
               Preset value (SV)
```
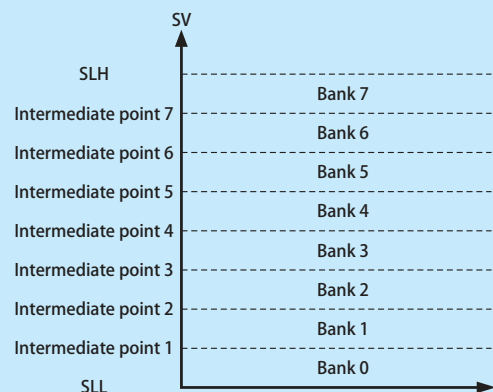
Above is when the OFF point position shift is set at (+5). The actual set value does not vary with above figures, but the position, as ON/OFF, moves (+5) towards the upper side. When the position is moved towards the minus side, the OFF point will move in reverse direction to the positions indicated above.

●Bank auto-switching function

· It is a function in which the bank automatically switches by PV / SV.
By setting the desired value to each bank, an optimized parameter can be created in each temperature range.
Example) PID values during the PID control can be set differently in each bank.

```
        SV ↑
  SLH ───────────────────
                     Bank 7
  Intermediate point 7 ──────
                     Bank 6
  Intermediate point 6 ──────
                     Bank 5
  Intermediate point 5 ──────
                     Bank 4
  Intermediate point 4 ──────
                     Bank 3
  Intermediate point 3 ──────
                     Bank 2
  Intermediate point 2 ──────
                     Bank 1
  Intermediate point 1 ──────
                     Bank 0
  SLL ───────────────────────→
```

● Simultaneous temperature rise function

■ Simultaneous temperature rise

· When simultaneous temperature rise control is exerted by multi-channels using the RS-485 communication function, a master and slave are determined beforehand. This permits reaching the respective goal values at the same time regardless of the characteristic of each channel.

The channel, in which the time from the start of control to the reach to the goal value is the longest, is specified as a master. The other channels are specified as slaves.

· The simultaneous temperature rise function is started at the start of run (including the power ON time) or a change of setting value, and is ended when the master reaches the goal value.
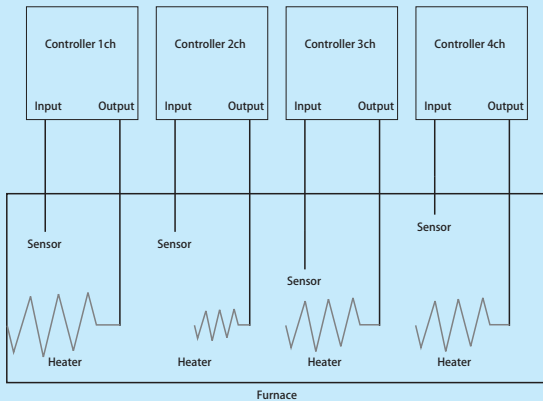
● How to use

1. Perform communication protocol settings to the TOHO protocol.
2. In the communication changeover setting, set the channel, in which the temperature reaches the goal value latest, to the simultaneous temperature rise master, and then set the other channels to the simultaneous temperature rise slaves.
3. Set the main control sensitivity.
   During a simultaneous temperature rise, the slave side exerts ON/OFF control for the current temperature of the master. Accordingly, set the sensitivity to a level that does not cause chattering.

Note: Precautions on use
1. Perform auto tuning for each channel as required.
2. When using the simultaneous temperature rise function, do not perform communication with the outside.

● Heating / Cooling

By allotting main output and secondary output to 2 output points respectively, heating and cooling control would be possible.

With the DB (Dead Band) setting, a range can be set between the heating output and the cooling output.
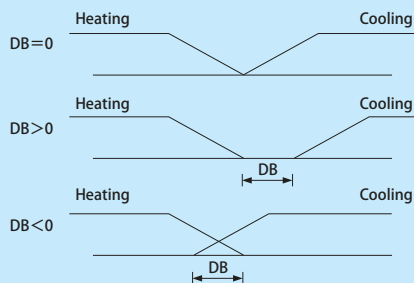
● Position proportional control

■ Position proportional control

· According to the operation amount required for PID control, the valve opening is changed by outputting an open signal or close signal to the valve on the basis of the valve motor stroke time, so that the flow rate is adjusted, thereby controlling the target temperature. The control can be exerted without feedback resistance.

· The valve motor stroke time means the time from the full opening of the valve till its full closing.
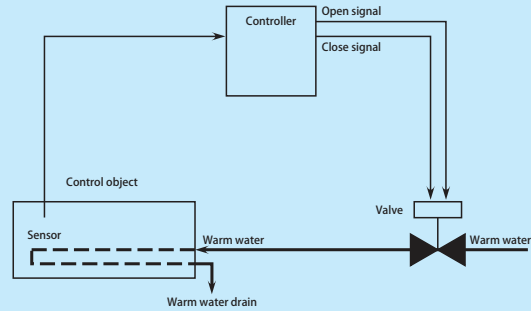
· Valve motor drive dead band

In position proportional control, the open signal or close signal is output so that the operation amount of the regulator may agree with the opening of the valve.

It is necessary to refrain from performing an open/close changeover operation frequently in consideration of the service life of the valve.

A dead band is provided at the open signal/close signal output changeover point.

In this area, both open signal output and close signal output are stopped to reduce frequent open/close changeover operations.
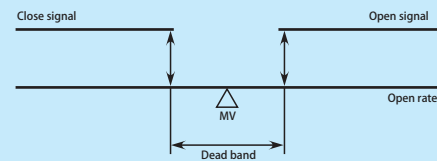
· Initial opening after the end of AT

It is possible to set the operation amount just after the end of auto tuning in order to restrict undershoot just after this end.

Example) Response after the end of AT
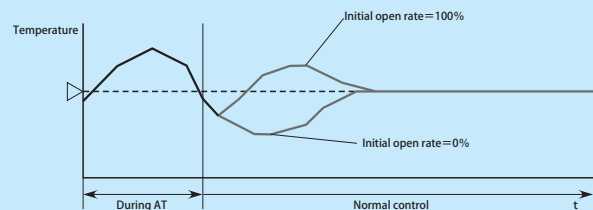
● Remote SV

Signals from external sources become the controller parameters.

· Cascade control using remote SV

Cascade control is where the control signal for a single controller is applied to other controllers, and the controller that receives control signals from an external source convert those signals into parameters for control purposes.
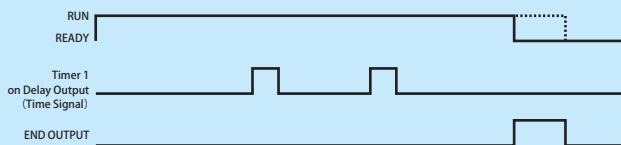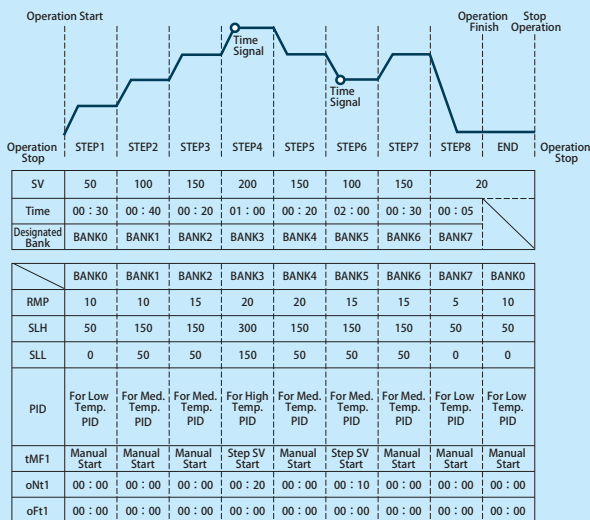
As shown in the illustration above, cascade control can be achieved with the use of two controllers.
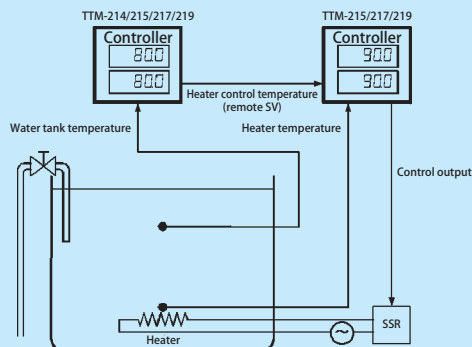
●SIMPLIFIED PROGRAM CONTROL FUNCTION

· Programmed operation with maximum of 8-steps available.
· It's possible to set Time Signal output and End Signal output.
· Maximum of 16 parameters, such as PID, can be changed at the respective steps since it is possible to switch the bank at the respective steps.
· With compensatory function for power failure

Operation Example）

	STEP1	STEP2	STEP3	STEP4	STEP5	STEP6	STEP7	STEP8	END
SV	50	100	150	200	150	100	150		20
Time	00 : 30	00 : 40	00 : 20	01 : 00	00 : 20	02 : 00	00 : 30	00 : 05	
Designated Bank	BANK0	BANK1	BANK2	BANK3	BANK4	BANK5	BANK6	BANK7	

	BANK0	BANK1	BANK2	BANK3	BANK4	BANK5	BANK6	BANK7	BANK0
RMP	10	10	15	20	20	15	15	5	10
SLH	50	150	150	300	150	150	150	50	50
SLL	0	50	50	150	50	50	50	0	0
PID	For Low Temp. PID	For Med. Temp. PID	For Med. Temp. PID	For High Temp. PID	For Med. Temp. PID	For Med. Temp. PID	For Med. Temp. PID	For Low Temp. PID	For Low Temp. PID
tMF1	Manual Start	Manual Start	Manual Start	Step SV Start	Manual Start	Step SV Start	Manual Start	Manual Start	Manual Start
oNt1	00 : 00	00 : 00	00 : 00	00 : 20	00 : 00	00 : 10	00 : 00	00 : 00	00 : 00
oFt1	00 : 00	00 : 00	00 : 00	00 : 00	00 : 00	00 : 00	00 : 00	00 : 00	00 : 00

※ RMP : Ramp function setting
SLH : Upper limit setting for SV limiter
SLL : Lower limit setting for SV limiter
PID : PID constants setting
tMF1 : Timer1 function setting
oNt1 : ON delay time for timer1 } for time signal
oft1 : OFF delay time for timer1

STEP TIME

It's possible to select from step time, soak time 1, soak time 2.
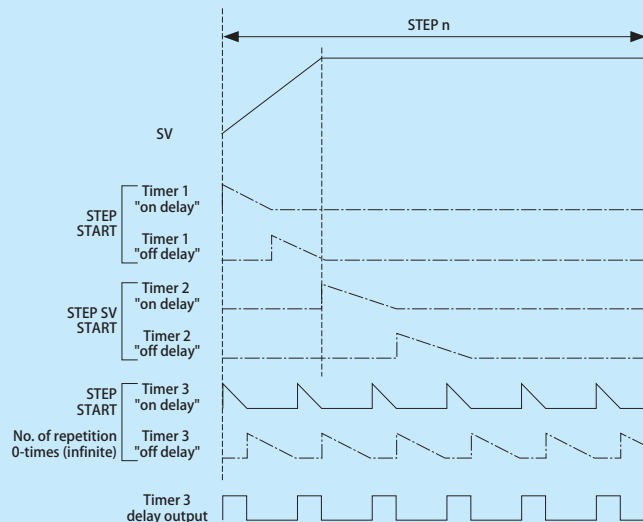　　　Step time: Time of the entire steps
　　　Soak time 1: Time after SV has reached
　　　Soak time 2: Stability time
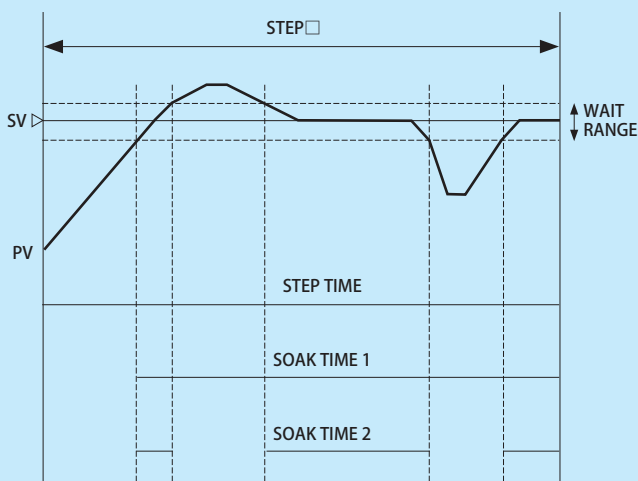
TIME SIGNAL OUTPUT

Time Signal output is possible by using another timer which is different from the simplified program control.
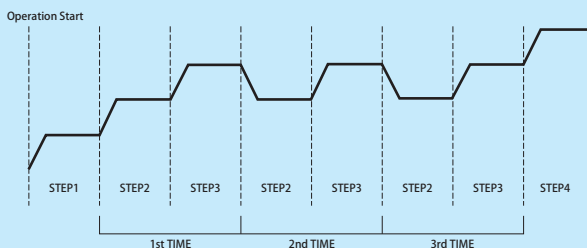
Configuration Sample）

REPEAT OPERATION

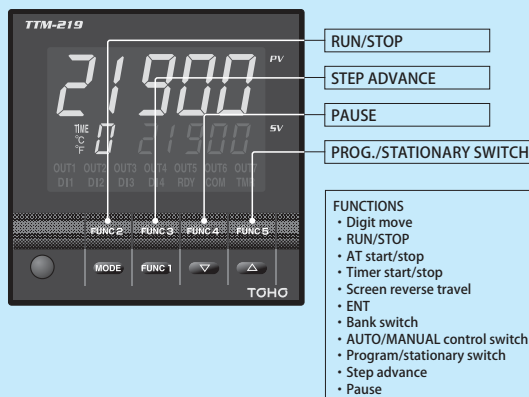It is possible to repeat the operation. Not only full repeat but also partial one are available by setting.

Operation Example）

Repeat Start Step	: STEP 2
Repeat Start Step	: STEP 3
No. of Repeating Times : 3	

OTHERS

Pause and step advance operation can be done by the key operation, the FUNC key and DI.

RUN/STOP
STEP ADVANCE
PAUSE
PROG./STATIONARY SWITCH

FUNCTIONS
· Digit move
· RUN/STOP
· AT start/stop
· Timer start/stop
· Screen reverse travel
· ENT
· Bank switch
· AUTO/MANUAL control switch
· Program/stationary switch
· Step advance
· Pause

■Ordering Information (Model Configurations)

TTM–21 ① – ② ③ – ④ ⑤ ⑥ ⑦ ⑧ ⑨ – ⑩

①	Model		4	48×48			
			5	96×48			
			7	72×72			
			9	96×96			
②	Output 1		N	No		J	Voltage 0 to 5VDC
			R	Relay point of contact		F	Voltage 1 to 5VDC
			P	Voltage for SSR driving		G	Voltage 0 to 10VDC
			A	Open collector		I	Current 4 to 20mADC
			K	Voltage 0 to 1VDC		H	Voltage 0 to 10mVDC
③	Output 2		N	No		J	Voltage 0 to 5VDC
			R	Relay point of contact		F	Voltage 1 to 5VDC
			P	Voltage for SSR driving		G	Voltage 0 to 10VDC
			A	Open collector		I	Current 4 to 20mADC
			K	Voltage 0 to 1VDC		H	Voltage 0 to 10mVDC
④	Output 3、4		A	Open collector	Same for the remote controllers on all models		
			R	Relay point of contact			
⑤	Output 5、6		A	Open collector	Not selectable for 214		
			R	Relay point of contact	217 cannot select output 6		
⑥	Output 7		A	Open collector	Not selectable for 214		
			R	Relay point of contact	Not selectable under TTM-217 when option W (DI3) is reauired.		
⑦	AI input		Y	Remote SV input (voltage/current only) Not selectable for TTM-214			
⑧	Option	214 Selection	ST	CT1, 2			
			SV	CT1, DI2			
			UV	DI1, 2			
		217 Selection	ST	CT1, 2			
			SV	CT1, DI2			
			UV	DI1, 2			
			STW	CT1, 2 DI3 (output 7 not selectable)			
			SVW	CT1, DI2, 3 (output 7 not selectable)			
			UVW	DI1, 2, 3 (output 7 not selectable)			
		215, 219 Selection	ST	CT1, 2			
			SV	CT1, DI2			
			UV	DI1, 2			
			SVW	CT1, DI2, 3, 4			
			UVW	DI1, 2, 3, 4			
			STUV	CT1, 2 DI1, 2			
			STUVW	CT1, 2 DI1, 2, 3, 4			
⑨	Communication		M	Communications (RS-485)			
⑩	Power Supply			100 to 240V (free power)			
			L	24VAC／DC			

＊Parameters up to output 2 must be selected.
＊Specifications apply in accordance with the sequence of selection for output 3 and upwards.
　　　Example: TTM-219-PR-RUVW
　　　　　　P: Output 1: SSR drive voltage
　　　　　　R: Output 2: Relay connection
　　　　　　R: Output 3, 4: Relay connection (does not select output 5 and 6)
　　　　　　UVW: DI1, 2, 3, 4
　　　　　　★Output 3 and 4 must be selected when output 5 and 6 are required.
　　　　　　★Output 3 and 4 and output 5 and 6 must be selected when output 7 is required.
＊Option W only consists of DI3 when TTM-217 has been selected.
　(The option W under 215, 219 selection refers to DI3, 4.)
＊CTL-6-P-H is added when CT is selected. (2pcs are added when 2 CTs are selected.)
＊CT cannot be selected when only analog has been selected for the output.

●Specifications are subject to change without notice.
Note: The color printed in this catalog may be different from actual color.