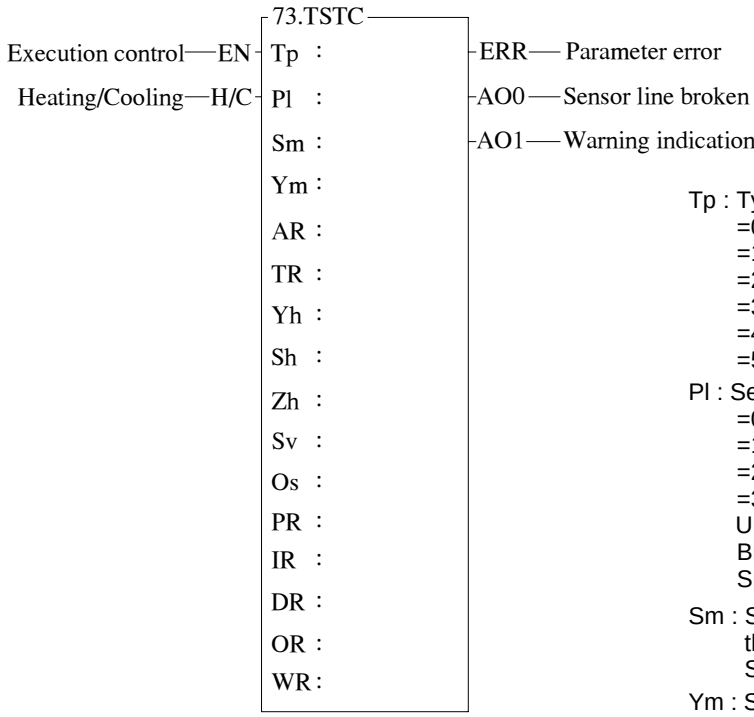
FUN 73 TSTC	Convenient instruction of PID temperature control for FB-2AJ(K)4/FB-2AH(T)4	FUN 73 TSTC



Range / Operand	Y	HR	IR	DR	ROR	K
	Y0 | Y255	R0 | R3839	R3840 | R3903	D0 | D3071	R5000 | R8071	
Tp						0～5
Pl						0～3
Sm						n × 4 n=0～7
Ym	○					
AR			○			
TR		○		○	○*	
Yh	○					
Sh						0～31
Zh						1～32
Sv		○		○	○*	
Os		○		○	○*	
PR		○		○	○*	
IR		○		○	○*	
DR		○		○	○*	
OR		○		○	○*	
WR		○		○	○*	

Tp : Type of sensor
=0, K-type thermocouple
=1, J-type thermocouple
=2, PT-100 RTD
=3, PT-1000 RTD
=4, PT-100 (FB-2AH4-3;Up to 286℃)
=5, PT-1000 (FB-2AT4-3;Up to 286℃)

Pl : Setting of polarity and span
=0, 0 ～10V (Unipolar)
=1, 0 ～5V (Unipolar)
=2, –10 ～10V (Bipolar
=3, –5 ～5V (Bipolar)
Unipolar: U/B jumper set at U position
Bipolar: U/B jumper set at B position
Span : 5V/10V jumper setting

Sm : Starting point of temperature measurement of this module.
Sm=0，4，8……，28

Ym : Starting address of discrete output of this module for multiplexing temperature input; it takes 8 points. When expansion module with discrete output will be installed after the temperature module, the discrete output address of which must be added 8.

AR : Address of analog input for temperature measurement of this module; which is the 3rd analog input. When expansion module with analog input will be installed after the temperature module, the analog address of which must be added 3.

TR : Starting register of the engineering value of temperature measurement, 4 registers in total.

Yh : Starting address of PID ON/OFF output; it takes Zh points.

Sh : Starting point of PID control of this instruction; Sh = 0～31.

Zh : Number of the PID control of this instruction; 1≤Zh≤32 and 1≤Sh+Zh≤32

Sv : Starting register of the setpoint; it takes Zh registers.

Os : Starting register of the in-zone offset; iIt takes Zh registers.

PR : Starting register of the gain (Kc); it takes Zh registers.

IR : Starting register of integral tuning constant (Ti); it takes Zh registers.

DR : Starting register of derivative tuning constant (Td); it takes Zh registers.

OR : Starting register of the PID analog output; it takes Zh registers.

WR : Starting of working register for this instruction. It takes 17 registers and can't be repeated in using.

Temperature instruction proper to FB-2AJ(K)4/ FB-2AH(T)4

FUN 73 TSTC	Convenient instruction of PID temperature control for FB-2AJ(K)4/FB-2AH(T)4	FUN 73 TSTC

Function guide and notifications

- FUN73 Convenient instruction combines the temperature measurement with PID control and it is dedicated for the modules of FB-2AJ(K)4 and FB-2AH(T)4.
- FB-2AJ(K)4/FB-2AH(T)4 multiplexing temperature module occupies 3 points of analog input address and 8 points of discrete output address in physical, more detail as followings:
  - FB-2AJ4 provides 2 points of general purpose analog inputs (1st and 2nd analog input) and 4 points of J-type thermocouple inputs for temperature measurement (With the combination of 3rd analog input and 8 points of discrete output making 4 points of temperature measurement).
  - FB-2AK4 provides 2 points of general purpose analog inputs (1st and 2nd analog input) and 4 points of K-type thermocouple inputs for temperature measurement (With the combination of 3rd analog input and 8 points of discrete output making 4 points of temperature measurement).
  - FB-2AH4 provides 2 points of general purpose analog inputs (1st and 2nd analog input) and 4 points of 3-lines PT-100 RTD inputs for temperature measurement (With the combination of 3rd analog input and 8 points of discrete output making 4 points of temperature measurement).
  - FB-2AT4 provides 2 points of general purpose analog inputs (1st and 2nd analog input) and 4 points of 3-lines PT-1000 RTD inputs for temperature measurement (With the combination of 3rd analog input and 8 points of discrete output making 4 points of temperature measurement).
  - The selection of input span of FB-2AJ(K)4 temperature module can be 5V (500°C) (when jumper setting at the position of 5V) or 10V (1000°C)(when jumper setting at the position of 10V); the input polarity can be set as unipolar (U/B jumper setting at U) or bipolar (U/B jumper setting at B):

    When setting at10V(1000°C) and unipolar,
    the range of measurement is 0°C～750°C/32°F～1382°F (J-type) or
    0°C～900°C/32°F～1652°F (K-type)
    When setting at 5V(500°C) and unipolar,
    the range of measurement is 0°C～420°C/32°F～788°F (J-type) or
    0°C～450°C/32°F～842°F (K-type)
    When setting at 10V(1000°C) and bipolar,
    the range of measurement is –200°C～750°C/–328°F～1382°F (J-type) or
    –200°C～900°C/–328°F～1652°F (K-type)
    When setting at 5V(500°C) and bipolar,
    the range of measurement is –200°C～420°C/–328°F～788°F (J-type) or
    –200°C～450°C/–328°F～842°F (K-type)
  - The selection of input span of FB-2AH(T)4 temperature module can be 5V (when jumper setting at the position of 5V) or 10V (when jumper setting at the position of 10V); the input polarity is fixed for bipolar :

    When setting at 10V,
    the range of measurement of FB-2AH(T)4 ： -49.8°C～146.6°C/–57.6°F～295.9°F (DIN) or
    -48.9°C～143.9°C/–56.0°F～291.0°F (JIS)
    the range of measurement of FB-2AH(T)4-3： -49.1°C～286.2°C/–56.4°F～547.2°F (DIN) or
    -48.2°C～281.0°C/–54.8°F～537.8°F (JIS))
    When setting at 5V,
    the range of measurement of FB-2AH(T)4 ： -12.3°C～83.6°C/9.9°F～182.5°F (DIN) or
    -12.0°C～82.1°C/10.4°F～179.8°F (JIS)
    the range of measurement of FB-2AH(T)4-3： 5.5°C～164.5°C/41.9°F～328.1°F (DIN) or
    5.4°C～161.5°C/41.7°F～322.7°F (JIS)
  - FB-2AJ(K)4/FB-2AH(T)4 multiplexing temperature module occupies 3 points of analog input address and 8 points of discrete output address in physical;
    - when expansion module with analog input will be installed after this kind of module, the analog address of which must be added 3;
    - when expansion module with discrete output will be installed after this kind of module, the discrete output address of which must be added 8.
  - Modules FB-2AJ(K)4/FB-2AH(T)4 can't be used together with module FB-8AD or FB-4AJ(K)××.
  - For the selection of thermocouple, K-type thermocouple is recommended.
  - It is recommended to select 0～5V for the span and polarity of input if it meets the requirement.
  - Connect the "FG" terminal with the shielding of thermocouple if it is with for better measurement.
  - The 〝G㊡〞 terminal must be connected to the safty earth ground of the power system.

FUN 73 TSTC	Convenient instruction of PID temperature control for FB-2AJ(K)4/FB-2AH(T)4	FUN 73 TSTC

- Fun73 instruction employs the multiplexing temperature module〔FB-2AJ(K)4/FB-2AH(T)4〕to get the current value of temperature and let it be as so called Process Variable (PV); after the calculation of software PID expression, it will respond the error with an output signal according to the setting of Set Point (SP),the error's integral and the rate of change of the process variable. Through the closed loop operation, the steady state of the process may be expected.
- Convert the output of PID calculation to be the time proportional on/off (PWM) output, and via transistor output to control the SSR for heating or cooling process; this is a good performance and very low cost solution.
- Through the analog output module (D/A module), the output of PID calculation may control the SCR or proportional valve to get more precise process control.
- Digitized PID expression is as follows:

$$Mn = [Kc \times En] + \sum_{0}^{n} [K_c \times T_i \times T_s \times E_n] - [K_c \times T_d \times (PV_n - PV_{n-1})/T_s]$$

Where,

Mn : Output at time “n”.

Kc : Gain (Range: 1～999；Pb=100(%) / Kc)

Ti : Integral tuning constant (Range:0～999, equivalent to 0.00～9.99 Repeat/Minute)

Td : Derivative tuning constant (Range:0～999, equivalent to 0.00～9.99 Minute)

PVn: Process variable at time “n”

PV n–1: Process variable when loop was last sovled

En : Error at time “n” ; E= SP – PVn

Ts : Solution interval for PID calculation (Valid value are 10, 20, 40, 80 ;the unit is in 0.1Sec)

Temperature instruction proper to FB-2AJ(K)4/ FB-2AH(T)4

FUN 73 TSTC	Convenient instruction of PID temperature control for FB-2AJ(K)4/FB-2AH(T)4	FUN 73 TSTC

Principle of PID parameter adjustment

- As the gain (Kc) adjustment getting larger, the larger the proportional contribution to the output. This can obtain a sensitive and rapid control reaction. However, when the gain is too large, it may cause oscillation. Do the best to adjust "Kc" larger (but not to the extent of making oscillation), which could increase the process reaction and reduce the steady state error.
- Integral item may be used to eliminate the steady state error. The larger the number (Ti, integral tuning constant), the larger the integral contribution to the output. When there is steady state error, adjust the "Ti" larger to decrease the error.
  When the "Ti" = 0, the integral item makes no contribution to the output.
  For exa, if the reset time is 6 minutes, Ti=100/6=17；if the integral time is 5 minutes, Ti=100/5=20.
- Derivative item may be used to make the process smoother and not too over shoot. The larger the number (Td, derivative tuning constant), the larger the derivative contribution to the output. When there is too over shoot, adjust the "Td" larger to decrease the amount of over shoot.
  When the "Td" = 0, the derivative item makes no contribution to the output.
  For exa, if the rate time is 1 minute, then the Td = 100; if the differential time is 2 minute, then the Td = 200.
- Properly adjust the PID parameters can obtain an excellent result for temperature control.
- The default of gain value (Kc) is as follows:

  When the setting of span and polarity of the module is 0～10V, the default of gain (Kc) is 60.

  When the setting of span and polarity of the module is 0～5V, the default of gain (Kc) is 30.

  When the setting of span and polarity of the module is -10～10V, the default of gain (Kc) is 120.

  When the setting of span and polarity of the module is -5～5V, the default of gain (Kc) is 60.
- The default of integral tuning constant is 17, it mens the reset time is 6 minutes (Ti=100/6=17).
- The default of derivative tuning constant is 100, it means the rate time is 1 minutes (Td=100).

User guide to Convenient instruction FUN73

FB-2AJ(K)4 temperature module:

- When execution control "EN"=1, this instruction will perform multiplexing temperature measurement and store the primitive value into R3968(TP0)～R3971(TP3) or R3972(TP4)～3975(TP7),…or R3996(TP28)～R3999(TP31); the value falls in 0～4095(unipolar) or -2048～2047 (bipolar). And then base on the setting of temperature sensor (Tp), input span and polarity (Pl) of the temperature module to scale the primitive values to engineering values and store them to temperature measurement registers (TR+0 as the 1st point, …, TR+3 as the 4th point).

FB-2AH(T)4 temperature module:

- When execution control "EN"=1, this instruction will perform multiplexing temperature measurement and base on the setting of temperature sensor (Tp), input span and polarity (Pl) of the temperature module to scale the primitive values to engineering values and store them to temperature measurement registers (TR+0 as the 1st point, …, TR+3 as the 4th point). Then scale the engineering values by the range of 0～4095 and store them into R3968(TP0)～R3971(TP3) or R3972(TP4)～3975(TP7),…or R3996(TP28)～R3999(TP31); the value falls in 0～4095.
- When the setting of Tp, Pl, Sm comes error, this instruction will not be performed and the output indication "ERR" will be ON.
- When the sensor is K-type thermocouple (it needs FB-2AK4 module):
  1. As the setting of input span and polarity is 0～10V, if the display value is greater than 900°C or 1700°F, it means the line broken of the thermocouple and the output indication "AO0" will be ON.
  2. As the setting of input span and polarity is 0～5V, if the display value is greater than 450°C or 870°F, it means the line broken of the thermocouple and the output indication "AO0" will be ON.
  3. As the setting of input span and polarity is -10～10V, if the display value is greater than 900°C or 1700°F, it means the line broken of the thermocouple and the output indication "AO0" will be ON.
  4. As the setting of input span and polarity is -5～5V, if the display value is greater than 450°C or 870°F, it means the line broken of the thermocouple and the output indication "AO0" will be ON.

FUN 73 TSTC	Convenient instruction of PID temperature control for FB-2AJ(K)4/FB-2AH(T)4	FUN 73 TSTC

- When the sensor is J-type thermocouple (it needs FB-2AJ4 module):
  1. As the setting of input span and polarity is 0～10V, if the display value is greater than 900°C or 1700°F, it means the line broken of the thermocouple and the output indication “AO0” will be ON.
  2. As the setting of input span and polarity is 0～5V, if the display value is greater than 450°C or 870°F, it means the line broken of the thermocouple and the output indication “AO0” will be ON.
  3. As the setting of input span and polarity is -10～10V, if the display value is greater than 900°C or 1700°F, it means the line broken of the thermocouple and the output indication “AO0” will be ON.
  4. As the setting of input span and polarity is -5～5V, if the display value is greater than 450°C or 870°F, it means the line broken of the thermocouple and the output indication “AO0” will be ON.
- When the sensor is RTD type of PT-100 (it needs FB-2AH4) or PT-1000 (it needs FB-2AT4):
  1. As the setting of input span is -10～10V, if the display value is greater than 900.0°C or 900.0°F, it means the line broken of the sensor and the output indication “ALM” will be ON.
  2. As the setting of input span is -5～5V, if the display value is greater than 900.0°C or 900.0°F, it means the line broken of the sensor and the output indication “ALM” will be ON.

Note: When there exists the line broken of the sensor, it can be told from the content of WR+0 working register which tells the input point(s) of line broken.

- Sm: Starting point of temperature measurement of this module. It must be the multiple of 4 , 0≤Sm≤28.
- Ym: Starting address of discrete output of this module for multiplexing temperature input; it takes 8 points of discrete output.
- AR : Address of analog input (3^{rd}) for temperature measurement of this module.
- TR : Starting register of the engineering value of temperature measurement, 4 registers in total. TR+0 stores the 1^{st} temperature,…, TR+3 stores the 4^{th} temperature.
- PID operation will begin after FUN73 has measured the temperature of every point.
- When execution control “EN” = 1, it depends on the input status of H/C for PID operation to make heating (H/C=1) or cooling (H/C=0) control. The current values of measured temperature are through the multiplexing temperature module〔FB-2AJ(K)4/FB-2AH(T)4〕to get ; the set points of desired temperature are stored in the registers starting from Sv. With the calculation of software PID expression, it will respond the error with an output signal according to the setting of setpoint, the error's integral and the rate of change of the process variable. Convert the output of PID calculation to be the time proportional on/off (PWM) output, and via transistor output to control the SSR for heating or cooling process; where there is a good performance and very low cost solution. It may also apply the output of PID calculation (stored in registers starting from OR), by way of D/A analog output module, to control SCR or proportional valve, so as to get more precise process control.
- When Sh, Zh setting error, this instruction will not be executed and the instruction output “ERR” will be ON.
- This instruction compares the current value with the set point to check whether the current temperature falls within deviation range (stored in register starting from Os). If it falls in the deviation range, it will set the in-zone bit of that point to be ON; if not, clear the in-zone bit of that point to be OFF, and make instruction output “AO1” ON.
- In the mean time, this instruction will also check whether highest temperature warning (the register for the set point of highest temperature warning is R4008). When successively scanning for ten times the current values of measured temperature are all higher than or equal to the highest warning set point, the warning bit will set to be ON and instruction output “AO1” will be on. This can avoid the safety problem aroused from temperature out of control, in case the SSR or heating circuit becomes short.
- This instruction can also detect the unable to heat problem resulting from the SSR or heating circuit runs open, or the obsolete heating band. When output of temperature control turns to be large power (set in R4006 register) successively in a certain time (set in R4007 register), and can not make current temperature fall in desired range, the warning bit will set to be ON and instruction output “AO1” will be ON.

Temperature instruction proper to FB-2AJ(K)4/ FB-2AH(T)4

FUN 73 TSTC	Convenient instruction of PID temperature control for FB-2AJ(K)4/FB-2AH(T)4	FUN 73 TSTC

- Yh : Starting address of PID ON/OFF output; it takes Zh points
- Sh : Starting point of PID control of this instruction; where 0 ≤ Sh ≤ 31.
- Zh : Number of the PID control of this instruction;where 1≤Zh≤32 and 1≤Sh+Zh≤32
- Sv : Starting register of the setpoint; it takes Zh registers.
- Os : Starting register of the in-zone offset; it takes Zh registers.
- PR : Starting register of the gain (Kc); it takes Zh registers.
- IR : Starting register of integral tuning constant (Ti); it takes Zh registers
- DR : Starting register of derivative tuning constant (Td); it takes Zh registers.
- OR : Starting register of the PID analog output; it takes Zh registers.
- WR : Starting of working register for this instruction. It takes 17 registers and can't be repeated in using.

  The content of WR+0 register indicates the status of the sensor which is line broken or not.

  Bit definition of WR+0 explained as follows:
  Bit0=1 indicating that the Sm+0 point of sensor is line broken…
  Bit3=1 indicating that the Sm+3 point of sensor is line broken.

  The content of the two registers WR+8 and WR+9 indicating that whether the current temperature falls within the deviation range (stored in registers starting from Os). If it falls in the deviation range, the in-zone bit of that point will be set ON; if not, the in-zone bit of that point will be cleared OFF.

  Bit definition of WR+8 explained as follows:
  Bit0=1, it represents that the temperature of the Sh+0 point is in-zone…
  Bit15=1, it represents that the temperature of the Sh+15 point is in-zone.

  Bit definition of WR+9 explained as follows:
  Bit0=1, it represents that the temperature of the Sh+16 point is in-zone…
  Bit15=1, it represents that the temperature of 32th point is in-zone.

  The content of the two registers WR+10 and WR+11 are the warning bit registers, they indiacte that whether there exists the highest temperature warning or heating circuit opened.

  Bit definition of WR+10 explained as follows:
  Bit0=1, it means that there exists the highest warning or heating circuit opened at the Sh+0 point...
  Bit15=1, it means that there exists the highest warning or heating circuit opened at the Sh+15 point.

  Bit definition of WR+11 explained as follows:

  Bit0=1, it means that there exists the highest warning or heating circuit opened at the Sh+16 point...
  Bit15=1 , it means that there exists the highest warning or heating circuit opened at the 32th point.

  Registers of WR+2～WR+7 and WR+12～WR+16 are used by this instruction.
- This instruction can only be used to perform heating or cooling control of positive temperature while the sensor is the thermocouple.
- Whether the FUN73 is placed in main or sub program and no matter the execution control "EN"=0 or 1, this instruction must be executed at every scan.

Specific registers related to instruction of FUN73

- R4009 : Lower byte=1, temperature in Fahrenheit unit (°F) ;
  =Other values, temperature in Centigrade unit (°C)
- R4014 : Time interval between the measurement points while multiplexing. Which the user can set up. The unit is in mS and the default value is 500; it means it needs 500mS to measure one point of temperature. This means the update rate of the temperature is 2 seconds (500mS×4=2000mS)

When the value of R4014 is 250, it means it needs 250mS to measure one point of temperature;
the update rate of the temperature is 1 second (250mS×4=1000mS).

When the value of R4014 is 1000, it means it needs 1000mS to measure one point of temperature;
the update rate of the temperature is 4 second (1000mS×4=4000mS).

When the value of R4014 is 2000, it means it needs 2000mS to measure one point of temperature;
the update rate of the temperature is 4 second (2000mS×4=8000mS).

FUN 73 TSTC	Convenient instruction of PID temperature control for FB-2AJ(K)4/FB-2AH(T)4	FUN 73 TSTC

- R4015 : Times for the average of measurement, which can be set by the user.
  =0, no average ; every acquired value is the measured value (default)
  =1, average of 2 times; the average on the acquired 2 times of values is the measured value.
  =2, average of 4 times; the average on the acquired 4 times of values is the measured value.
  =3, average of 8 times; the average on the acquired 8 times of values is the measured value.
  =4, average of 16 times; the average on the acquired 16 times of values is the measured value.
- R4016 : The factor for linear scaling to calculate the engineering value of K-type thermocouple while in positive temperature; the default value is 248. The expression for engineering value is as follows:
  Engineering unit temperature value = (Original temperature value ×R4016) /1024 (Unipolar).
  Engineering unit temperature value = (Original temperature value ×2×R4016) /1024 (Bipolar).

  When there is a slight difference in measurement result between the standard meter and the FB-PLC's temperature module, if the user would like to use the value acquired by standard meter for correction, the user can tune the value of R4016 to get a better result in temperature measurement. This register provides fine tuning for positive temperature.
- R4017 : The factor for linear scaling to calculate the engineering value of K-type thermocouple while in negative temperature; the default value is 286. The expression for engineering value is as follows:
  Engineering value = (Primitive temperature value ×R4017) /1024 (–5～5V).
  Engineering value = (Primitive temperature value ×2×R4017) /1024 (–10～10V).

  When there is a slight difference in measurement result between the standard meter and the FB-PLC's temperature module, if the user would like to use the value acquired by standard meter for correction, the user can tune the value of R4017 to get a better result in temperature measurement. This register provides fine tuning for negative temperature.
- R4018 : The factor for linear scaling to calculate the engineering value of J-type thermocouple while in positive temperature; the default value is 240.
  The expression for engineering value is as follows:
  Engineering value = (Primitive temperature value ×R4018) /1024 (Unipolar).
  Engineering value = (Primitive temperature value ×2×R4018) /1024 (Bipolar).

  When there is a slight difference in measurement result between the standard meter and the FB-PLC's temperature module, if the user would like to use the value acquired by standard meter for correction, the user can tune the value of R4018 to get a better result in temperature measurement. This register provides fine tuning for positive temperature.
- R4019 : The factor for linear scaling to calculate the engineering value of J-type thermocouple while in negative temperature; the default value is 280.
  The expression for engineering value is as follows:
  Engineering value = (Primitive temperature value ×R4019) /1024 (–5～5V).
  Engineering value = (Primitive temperature value ×2×R4019) /1024 (–10～10V).

  When there is a slight difference in measurement result between the standard meter and the FB-PLC's temperature module, if the user would like to use the value acquired by standard meter for correction, the user can tune the value of R4019 to get a better result in temperature measurement. This register provides fine tuning for negative temperature.
- R4020 : High Byte of R4020 to tell the alpha value of RTD, =0, α=0.00385 (DIN) =1, α=0.00392 (JIS)
  : Low Byte of R4020 to tell where the registers storing the wire resistance for compensation,
  =1, the wire resistance for compensation for 3-wires RTD input storing in registers Rxxxx
  =2, the wire resistance for compensation for 3-wires RTD input storing in registers Dxxxx
  The starting address of above mentioned registers is storing in R4021 .
  The default of R4020 is 0001H.
- R4021: Storing the starting address of the registers to store the wire resistance for compensation for 3-wires RTD input; the default of R4021 is 8000, it means the starting register to store the wire resistance for compensation is R8000 by default. The unit of the resistance is 0.1Ω. While in long distance measurement and the accuracy will be affected by the wire resistance of the connection between the RTD sensor and temperature module, under such situation, the user has to measure the wire resistance of each loop and input them to the registers mentioned above; otherwise, forget these.
- R4022 : The factor for linear scaling to calculate the engineering value of PT-100 ; the default value is 1024
  The expression for engineering value is as follows:
  Engineering value = (Primitive temperature value ×R4022) /1024
- R4023 : The factor for linear scaling to calculate the engineering value of PT-1000 ; the default is 1024
  The expression for engineering value is as follows:
  Engineering value = (Primitive temperature value ×R4023) /1024
  When it needs to do the calibration between the standard meter and the FB-PLC's temperature module, the user can tune the value of R4022 or R4023 to get a better result of measurement.

Temperature instruction proper to FB-2AJ(K)4/ FB-2AH(T)4

FUN 73 TSTC	Convenient instruction of PID temperature control for FB-2AJ(K)4/FB-2AH(T)4	FUN 73 TSTC

- R4010 : Each bit of R4010Bit15=1 means that to tell the status of the sensor's installation.
  Bit0=1 means that 1st point of temperature sensor is installed.
  Bit1=1 means that 2nd point of temperature sensor is installed.
  ・・
  Bit15=1 means that 16th point of temperature sensor is installed.
  (The default of R4010 is FFFFH)
- R4011: R4011 : Each bit of R4011 to tell the status of the sensor's installation.
  Bit0=1 means that 17th point of temperature sensor is installed.
  Bit1=1 means that 18th point of temperature sensor is installed.
  ・・
  Bit15=1 means that 32nd point of temperature sensor is installed.
  (The default of R4011 is FFFFH)
- When the temperature sensor is installed (the corresponding bit of R4010 or R4011 must be 1), the system will perform the line broken detection to the sensor. If there is line broken happened to the sensor, there will have the warning and the line broken value will be displayed.
- When the temperature sensor is not installed (the corresponding bit of R4010 or R4011 must be 0), the system won't perform the line broken detection to the sensor and there will not have the warning; the temperature value will be displayed as 0.
- Depends on the sensor's installation , the ladder program may control the corresponding bit of R4010 and R4011 to perform or not to perform the line broken detection.
- R4005 : The content of Low Byte to define the solution interval between PID calculation
  =0, perform the PID calculation evey 2 seconds (System default).
  =1, perform the PID calculation evey 4 seconds.
  =2, perform the PID calculation evey 8 seconds.
  ≥3, perform the PID calculation evey 1 second.（R4014 must be 250 to make sense）
  : The content of High Byte to define the cycle time of PID ON/OFF（PWM）output.
  =0，PWM cycle time is 2 seconds (system default)
  =1，PWM cycle time is 4 seconds.
  =2，PWM cycle time is 8 seconds.
  ≥3，PWM cycle time is 1 second.

Note 1 : When changing the value of R4005, the execution control "EN" of FUN73 must be set at 0. The next time when execution control "EN" =1, it will base on the latest set point to perform the PID calculation.

Note 2 : The smaller the cycle time of PWM, the more even can it perform the heating. However, the error caused by the PLC scan time will also become greater. For the best control, it can base on the scan time of PLC to adjust the solution interval of PID calculation and the PWM cycle time.

- R4006 : The setting point of large power output detection for SSR or heating circuit opened, or heating band obsolete. The unit is in % and the setting range falls in 80～100(%); system default is 90(%).
- R4007 : The setting time to detect the continuing duration of large power output while SSR or heating circuit opened, or heating band obsolete. The unit is in second and the setting range falls in 300～65535 (seconds); system default is 600 (seconds).
- R4008 : The setting point of highest temperature warning for SSR, or heating circuit short detection. The unit is in degree and the setting range falls in 50～65535; system default is 350 (degrees).
- R4012 : Each bit of R4012 to tell the need of PID temperature control.
  Bit0=1 means that 1st point needs PID temperature control.
  Bit1=1 means that 2nd point needs PID temperature control.
  ・・
  16th point needs PID temperature control.
  (The default of R4012 is FFFFH)
- R4013 : Each bit of R4013 to tell the need of PID temperature control.
  Bit0=1 means that 17th point needs PID temperature control.
  Bit1=1 means that 18th point needs PID temperature control.
  ・・
  Bit15=1 means that 32nd point needs PID temperature control.
  (The default of R4013 is FFFFH)
- While execution control "EN"=1 and the corresponding bit of PID control of that point is ON (corresponding bit of R4012 or R4013 must be 1), the FUN73 instruction will perform the PID operation and respond to the calculation with the output signal.
- While execution control "EN"=1 and the corresponding bit of PID control of that point is OFF (corresponding bit of R4012 or R4013 must be 0), the FUN73 will not perform the PID operation and the output of that point will be OFF.
- The ladder program may control the corresponding bit of R4012 and R4013 to tell the FUN73 to perform or not to perform the PID control, and it needs only one FUN73 instruction. (The temperature module must be identical in sensor type and the setting of input span and polarity must be the same.)