XMT*-808 SERIES ARTIFICIALINTELLIGENCE INDUSTRIAL CONTROLLER

Operation Instruction

(suitable for accurate controls of temperature, pressure. flow, level, humidity etc.)

CONTENTS

1. SUMMARY

1.1 Main feature

- Advanced operation method leads to easy learning and simple manipulation; the compatibility of operation is available among the instruments differ in the model and function.
- Provide nearly all of the functions contained by most similar industry automatic controller in the world, and the mature technique made it generally used in various kinds of industrial fields.
- Provide various models that can meet different needs either in the functions or price..
- With power supply of 85-264VAC or 24VDC and various installation dimensions for users to choose.
- Adopt digital calibration system for measurement input with measurement input accuracy less then 0.2%F.S. non-linear calibration for common sensors is available in the instrument.
- Adopt advanced XMT808 artificial intelligence control algorithm, no overshoot and with the function of auto tuning and self-adaptation.
- Adopt advanced modular structure, equipped with plentiful output specifications, and can satisfy the needs of various applications. This makes it possible to shorten the date of delivery and convenience the maintenance of the instrument.
- Having passed the ISO 9001 quality verification. Comply with EMC standard, and has the predominant performance of anti-interference.

1.2 Maintenance of instrument

The instrument should be tested once a year for the basically error. With regard to the instrument used in abominable environment for some time, if the error exceeding certain range, then internal instrument should be cleared and dried, and generally doing so will solve the problem. It is not recommended to make error compensation by adjusting parameter “Pb”.

Free repairs and maintenance will be given in 18 months from the delivery. If the damage is caused by misapplication or out of the time limit, appropriate charge is needed.

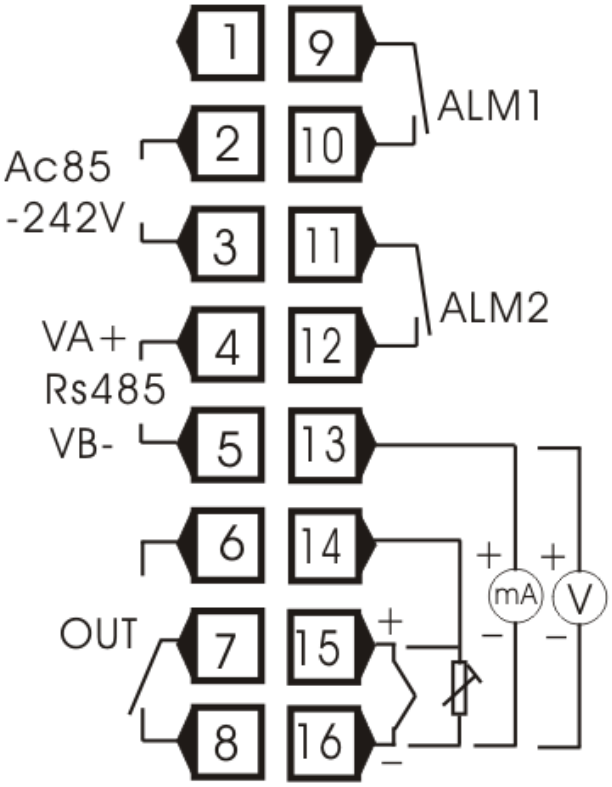
2. TECHNICAL SPECIFICATION

- Input type: (Either of below specifications can be used selectively in the same instrument)
  Thermocouple: K, E, S, R, J, T, B, N
  Resistance temperature detector: Pt100, Cu50
  DC voltage: 0～5V, 1～5V, 0～1V, 0～100mV, 0～20mV, etc.
  DC current (external shunt resist needed): 0～10mA, 1～20mA, 4～20mA, etc.
  Optional: apart from the above-mentioned input type, additional type can be provided upon request. (Graduation index is needed)
- Instrument input range
  K (-50～+1300℃), S (-50～+1700℃), R (-50～+1650℃), T (-200～350℃), E (0～800℃),
  J (0～1000℃), B (0～1800℃), N (0～1300℃)
  Pt100 (-200～+600℃), Cu50 (-50～150℃)
  Linear input: -1999～+9999 defined by user.
- Measurement accuracy
  0.2%F.S: RTD, liner voltage, liner current and input with ice point compensation or Cu50 copper compensation.
  0.2%F.S ±0.2℃: thermocouple input with internal automatic compensation.
- Response time ≤ 0.5s (when FILT=0)

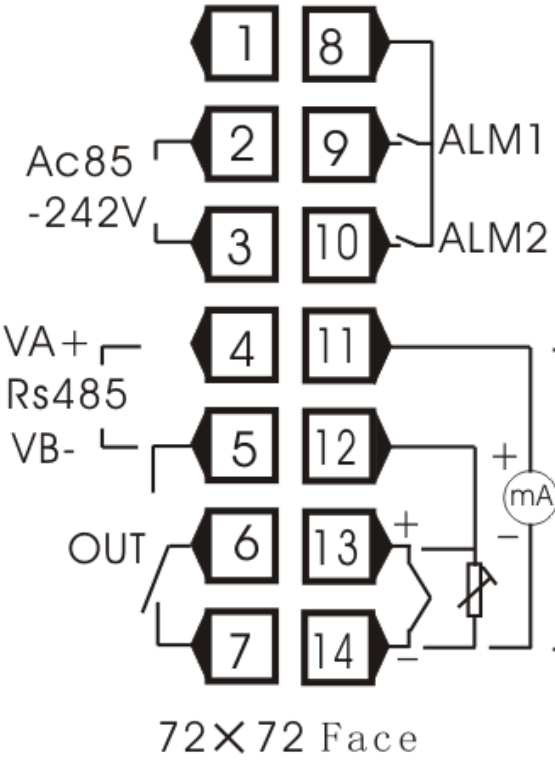
Note: for thermocouple B, the measurement accuracy of ±0.2% FS can be guaranteed when input range is between 600～1800℃, and not guaranteed when input range is between 0～600℃.

- Control mode:
  On-off control mode (dead band adjustable)
  XMT808 artificial intelligence control, including fuzzy logic PID control and advanced control algorithm with the function of parameter auto tuning (MPT).
- Output mode (modular)
  Relay contact discrete output (NO+NC): 264VAC/1A or 30VDC/1A
  BCR no contact discrete output (NO+NC): 85～264VAC/0.2A (continuous), 2A(20mS instantaneous, repeat period ≥5s)
  SSR voltage output: 12VDC/30mA(used to drive SSR)
  Linear current output: 0～10mA, 4～20mA (Output voltage greater then 11V)
  BCR cross zero trigger output: can trigger TRIAC of 5～500A, two parallel-connected BCR or BCR power module.
- Alarm function: upper limit, low limit, positive deviation and negative deviation, selectable using parameters.
- Alarm output: 2 modular output.
- Manual function: AUTO/MAN bump less transfer
- Power supply voltage rating: 85～264VAC/50～60Hz.
- Power consumption: ≤5W
- Ambient temperature: 0～50℃
- Front panel dimension: 48×48mm、48×96mm、96×48mm、96×96mm、72×72mm、80×160mm
- Panel cutout dimension: 45×45mm、44×92mm、92×44mm、92×92mm、68×68mm、76×156mm

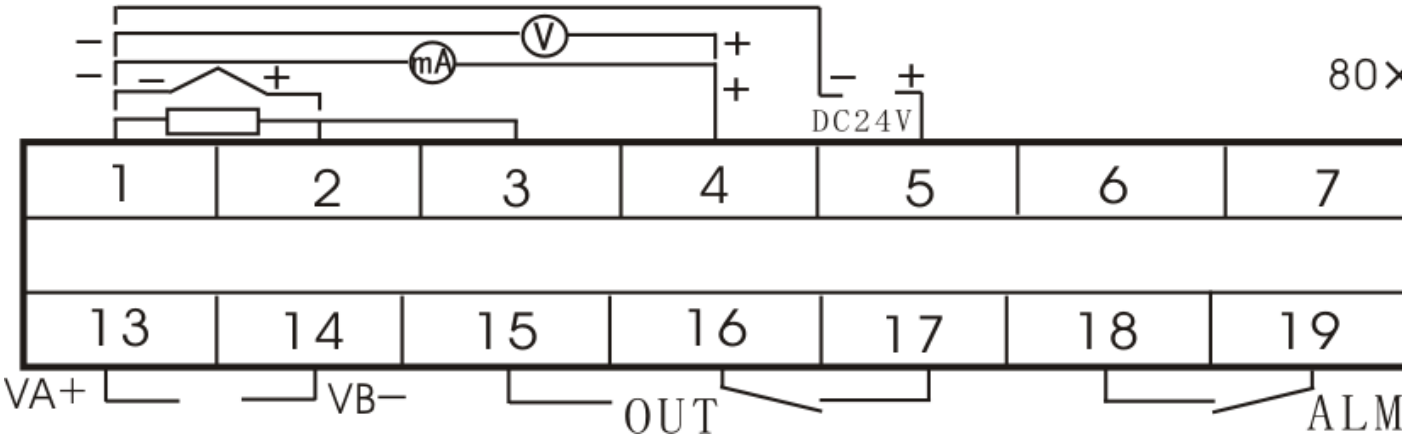
3.INSTRUMENT INSTAL LATION AND WIRING



96×96\ 48×96\ 96×48 Face



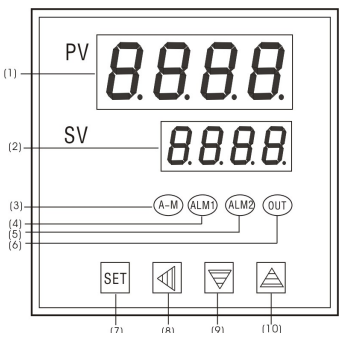
72×72 Face



4. FRONT PANEL AND OPERATION

4.1 Face

(1) PV display
(2) SV display
(3) Manual adjust indicator lamp
(4) First alarm indicator lamp
(5) Second alarm indicator lamp
(6) Output indicator lamp
(7) Display transtor
(8) Data shift key
(9) Data decrease key
(10) Date increase key



4.2 Basal operation description

4.2.1 Data setup

If the parameter lock isn't locked, we can setup most of the data displayed in the lower display window. For example, set point input of XMT-808 is as follows:

Press SET key to change the status to set point input. Now the decimal point of the last one digit (unit's place) of the displayed SV value begins blinking (like curse). Press ▼key to decrease the value, press ▲key to increase the value, and ◀key to move to the digit expected to modify. To complete the set point changing, press SET again.

4.2.2 Man/Auto mode switch

Bumpless switching between **AUTO** and **MAN** can be performed by pressing SET key once. If the instrument works on Manual mode, its output value can be or decreased by pressing ▲ key and ▼key under display status.

4.2.3 Setting parameters

If the instrument is on its basal display status, press SET and hold for about 2 seconds until parameter is displayed. Then the key ◀/▼/▲can be used to modify parameters. Press and hold the ◀key can return to the preceding parameter. Press ◀key (don't release) and then press SET key simultaneously can escape from the parameter setup. The instrument will escape auomatically from the parameter setup operation if no key is pressed within 30 seconds.

Note: refer to the instrument whose parameters are locked by setting parameter "Lock", most of its parameters are inhabited except those defined by field parameter "EP".

4.3 XMT artificial intelligence control and auto turning

XMT artificial intelligence control, which is a new algorithm using fuzzy logical PID control, is adopted in XMT series instrument. The ordinary PID algorithm can give accurate control to processes, with disadvantages of having large overshoot, having a long upset response time. And having difficulty for PID parameters to be determined, and is not suitable for process which are not stable or have a long lag time. Contrarily, fuzzy control algorithm can suitable for processes that have a long lag time and have small overshoot, and it is easy for parameters to be determined, but it has bad control accuracy, and its control curve may have tiny saw-teeth. XMT artificial intelligence algorithm has fuzzy control algorithm and concurrent PID algorithm improved with new derivative integral function added. Which of these two control algorithms is activated is determined by the deviation between measurement value and set point. When the magnitude of the deviation is large, the fuzzy control algorithm is activated to remove PID reset windup, and when the magnitude of the deviation is small, the improved PID algorithm is activated. Therefore, XMT artificial intelligence control has the characteristic of having no overshoot, high control precision and easy parameter tuning and having good control effect for complicate process. Further more, XMT series instrument has the function of self learning, it is able to learn the process character while working. Users are probably unsatisfied with the control effect at the instrument first use after auto tuning, but predominant control result will be obtained after its first use because of the self learning function.

In order to obtain perfect control, the instrument need to get optimum configuration parameter through auto tuning when instrument is used at the first time. **Note:** If the set point value is different, the parameter obtained from auto tuning will not always the same. So if you want execute auto tuning, you must adjus set point to an often-used value first and then press and hold the ◀key for about 2seconds until the "At" system is displayed in the display window if you want to start up auto tuning function (Auto tuning is not allowed to start up again unless you set parameter At to 2 manually if the function has been executed once).During auto tuning, the instrument executes on-off control. After 2-3 times on-off action, the

microprocessor in the instrument will analyze the period, amplitude, waveform of the oscillation generated by the on-off control, and calculate the optimal control parameter value. The instrument begins to perform accurate XMT artificial intelligence control after parameter auto tuning is finished. If you want to escape from auto tuning status, press and hold the ◀key for about 2 seconds until the blinking of "At" system is not displayed in the display window. Generally it will meet you need to perform auto tuning one time only. After the auto tuning is finished. The instrument will set parameter At to 3 (factory set is 1), and now it is not allowed to start up auto tuning by pressing ◀key on front panel. This will avoid repeat auto tuning by mistake.

If the set point value is different, the parameter obtained from auto tuning will not always the same. So if you want to execute auto tuning, you must adjust set point to an often-used value first, and then start up auto tuning function. Parameter T and Hy have influence on the accuracy of auto-tuning. Auto tuning accuracy (deadband), generally, the smaller for these two parameters setting value, the higher for the precision of auto tuning. But Hy parameter value should be large enough to prevent the instrument from error action around set point due to the oscillation of input. There are also some restrictions in application rot parameter "T"(refer to function description for these 2 parameters in the later text).normally, parameters are recommended to be T=0-2, Hy=0.3

On the basis of disturbance caused by on-off control, oscillation period, amplitude and waveform are analyzed to calculate optimum control parameters. The auto tuning for XMT series instrument will gratify for 95% users. Because of the complexity of the automatic process, parameters calculated by auto tuning are probably not the optimal values on some special occasion (mentioned as follows), so manual parameter adjustment is needed.

5. PARAMETER AND SETTING

Code	Description	Setting Range	Engineer Unit	Remarks
ALM1	High limit alarm	-1999～+9999	℃ or 1 defined unit	Linear unit defined by para P-SL and P-SH when linear voltage/resistance input is selected
ALM2	Low limit alarm	-1999～+9999	℃ or 1 defined unit	
Hy-1	Positive deviation alarm	0～9999	0.1℃or 1 defined unit	
Hy-2	Negative deviation alarm	0～9999	0.1℃or 1 defined unit	
Hy	Deadband	0～20℃ or 0～2000		ON/OFF control and alarm only
At	Control mode	0～5 see the following text for details		
I	Hold parameter	0～9999	0.1℃or 1 defined unit	0 disable integral function
P	Rating parameter	1～9999		
d	Lag time	0～2000	sec	
t	Control period/output smooth	0～125	sec	
Sn	Input specification	0～37 see the following text for details		Configure varied resolution
dIP	Decimal point position	0～3 see the following text for details		
P-SL	Input low limit	-1999～+9999	℃or 1 defined unit	
P-SH	Input high limit	-1999～+9999	℃or 1 defined unit	
Pb	Input shift	-1999～+4000	0.1℃or 1 defined unit	

OP-A	Output mode	1～11 see the following text for details		
OUTL	Low limit	0～110	1%	
OUTH	High limit	0～110	1%	
AL-P	Alarm output definition	0～63		
COOL	System function selection	0～127		
Addr	Communication address	0～100		Retransmission low limit current
bAud	Communication baud rate	0～19200		Retransmission high limit current
FILT	PV input filter	0～20		Define digital filter intensity
A-M	A-M status	0. Manual 1. Automatic 2. Manual suppressing		
Lock	Configuration privilege	0～9999		
EP1-EP8	Field parameter definition	nonE-A-M		

5.1 Alarm parameter ALM1, ALM2, Hy-1, Hy-2

These 4 parameters set instrument's alarm function. Alarm signal will be triggered to make instrument's relay contact close (NC contact open), if alarm condition is satisfied. Alarm messages is displayed in turn in SV display window. When the cause of alarm is removed, then the alarm is cleared automatically.

Alarm condition is following:

ALM1: High limit absolute alarm. If the process value is greater then the value specified as "ALM1+Hy", then the alarm is set, and the alarm will be cancelled if the process value is less than the value of "ALM1-Hy".

ALM2: Low limit absolute alarm. If the process value is greater then the value specified as "ALM2+Hy", then the alarm is set, and the alarm will be cancelled if the process value is less than the value of "ALM2-Hy".

Hy-1: Positive alarm. If PV minus SV is greater than the value specified as "Hy-1 +Hy", the alarm is set, and the alarm will be cancelled if the process value is less than the value of "Hy-1 -Hy". It also used as the second high limit alarm in case of on-off control.

Hy-2: Negative deviation alarm. If PV minus SV is greater than the value specified as "Hy-2 +Hy", the alarm is set, and the alarm will be cancelled if the process value is less than the value of "Hy-2 -Hy". It also used as the second high limit alarm in case of on-off control.

orAL: Input over range or under range

Process variable exceeds the configured range (High limit or low limit), caused by error configuration of sensor type, sensor disconnection or short-circuit. In the event of input over range, instrument will stop control automatically and the value specified in advance as the parameter "outL" is output as the manipulated value.

Among which "orAL" don't need to be configured. Generally users don't need the whole 4 alarm. Limit value can be set to those parameters not used to avoid alarm function. Ex, the following configuration: ALM1=9999, ALM2=-1999. When the configuration Hy-1+9999 (999.9℃ for temperature) or Hy-2=9999 (999.9℃ for temperature) is set, even if the difference value is greater than 9999, Hy-1 or Hy-2 alarm will

not be triggered.

The above mentioned 4 alarm can be set as alarm 1 (AL1) or alarm 2 (AL2) action (refer to the description of parameter “bAud”). User can install appropriate output module for alarm 1 or alarm 2, the most common use is relay contact output module, SSR voltage output module or BCR no contact discrete output module can also be used.

5.2 Dead band parameter Hy

Dead band parameter Hy is set to permits protection of position control output from high switching frequencies caused by process input fluctuation. Dead band parameter is used for position control, 4-alarm control as well as the position control at auto tuning

For example: Hy parameter can affect upper absolute alarm as the following, provided upper alarm parameter “ALM1” is set as 800℃, Hy parameter is set as 2.0℃.

- Instrument is in normal status at the beginning, when process value is greater than 802℃(ALM1+Hy), the upper absolute alarm can be triggered.
- Instrument is in upper alarm status at the beginning, when process value is less than 798℃(ALM1-Hy), the alarm can becleared.

As for position control, the larger for Hy parameter value, the longer for output proportion period time and worse for control accuracy, the smaller for Hy parameter, the shorter for output proportion period time, and error action will occur easily due to input fluctuation and make mechanical contactors of relay or contactors shorten their service life.

Hy don’t affect XMT808 artificial intelligence algorithm, but affect the position control at auto tuning, theoretically the smaller for Hy parameter, the batter for auto tuning accuracy, but error action, which caused by process value fluctuation due to noise, should be avoided. Watch process value for some time, if fluctuation is too large, increase input fitter parameter value FILT at first to make the fluctuation smaller than 2-5 unit, then set Hy parameter equal to process fluctuation value.

5.3 Control mode parameter At

At=0 ON OFF control, suitable for the application which don’t need high precision.

At=1 XMT808 artificial intelligence control, it is improved on the basis of PID control and fuzzy control, having more extensive adaptability to the process, and it is possible to get a good control for processes can be started up from front panel on this setting.

At=2 Starting up auto tuning, points for attention have been described in preceding text. The function is the same as starting auto tuning from front panel. After auto tuning is done, once setting parameter At to 2 can start up more auto tuning.

At=3 XMT808 artificial intelligence control, this configuration is automatically set after auto tuning is done. At this setting, starting auto tuning from front panel is inhibited to prevent error operation from starting auto tuning repeatedly.

At=4 Comparing with the control mode of At=3, Parameter P is defined as 10 times as its original value; if set P=5 incase of At=3 and set P=50 incase of At=5, then these 2 setting have then same control effect. In the application of rapidly changed temperature (changes by more than 200℃/second), pressure or flow control, or in the application where inverter is used to control water pressure, if At=3 or At=1 is set, then parameter P has to be a very small value, and sometimes only if parameter P is set to less than 1 can you get satisfied control effect, but if At=4 is set at this time, then parameter P can be enlarged 10 times, and so finer control is obtained.

5.4 XMT808 artificial intelligence parameter I, P, D, T

These parameters are for XMT808 artificial intelligence control algorithm, but not for ON-OFF control mode (if At=0 is set). XMT808 artificial intelligence control, which is a new algorithm using fuzzy logical PID control, is adopted in XMT808 series instrument. The ordinary PID algorithm can give accurate control to processes, with disadvantages of having large overshoot, having a long upset response time, and having difficulty for PID parameters to be determined, and is not suitable for process which are not sable or have a long lag time. Contrarily, fuzzy control algorithm can be suitable for processes that have a long lag time and have small overshoot, and it is easy for parameters to be determined, but it has bad control accuracy, and its control curve may have tiny saw-teeth. XMT808 artificial intelligence algorithm has fuzzy control algorithm and concurrent PID algorithm improved with new derivative integral function added. Which of these two control algorithms is activated is determined by the deviation between measurement value and set point. When the magnitude of the deviation is large, the fuzzy control algorithm is activated to remove PID reset windup, and when the magnitude of the deviation is small, the improved PID algorithm is activated. Therefore, XMT808 artificial intelligence control has the characteristic of having no overshoot, high control precision and parameter tuning and having good control effect for complicate process.

The following text is a description for the definition of MPt parameters and temperature control is taken as an example because it has a great difficulty and a wide-range application. XMT808 artificial intelligence algorithm is suitable for various controlled processes such as pressure, flow-rate, level, temperature and so on.

5.4.1 I hold parameter

I is defined as measurement variation after output is changed by 5% (0.5mA if OP-A=1) and when controlled process is basically stabilized. “5” indicates that output variation is 5 (5% or 0.5mA). “I” parameter is called “P” for short in the latter text. Generally I parameter of the same system will changes with measurement value, and so I parameter should be configured with process value around operating point.

Take temperature control of electric furnace as an example, operating point is 700℃. To find out optimum I parameter, assuming that when out remains 50%, the temperature of electric furnace will finally be stabilized at 700℃ or so, and when output changes to 55%, the temperature will final be at 750 or so.

Then I (optimum parameter)=750-700=50℃. I parameter mainly determines the degree of integral function, similar as integral time of PID control. The smaller I parameter is, the greater integral function is, and the larger I parameter is, the smaller integral function is (integral time is increased). But if M=0, then integral function an artificial intelligence control function will be removed and the instrument is turned to be an PD adjustment that used as a secondary controller during cascade control.

5.4.2 P rate parameter

P is in reverse proportion to measurement variations caused by output changes by 100% in one second. It is defined as the following: if At=1 or 3, then P=1000/measurement variations each second, the unit is 0.1℃ or 1 defined unit(for linear input).

Ex., instrument use 100% power to heat and there is no heat loss, if temperature in crease 1℃ each second, then P=1000/10=100. If At=5, then P parameter will be configured by increasing 10 times. Ex., P should be set to 1000 in the a.m. example.

P is used to control proportional and derivative function in direct proportion, decreasing P parameter will decrease proportional and derivative function. P parameter dose not affect integral function.

5.4.3 t lag time parameter

Parameter t is applied as one of the important parameters of XMT808 artificial intelligence control algorithm. “t” is defined as follows: time needed for a electric furnace from the beginning of elevating temperature to get to 63.5% against the final speed of temperature elevating, provided there is no heat loss.

The unit of parameter “t” is second.

For industrial control, hysteresis effect of the controlled process is an important factor impairing control effect. The longer is system lag time, the more difficult to get ideal control effect. Lag time parameter “d” is a new introduced important parameter for XMT808 artificial intelligence algorithm. XMT808 series instrument can use parameter “d” to do fuzzy calculation, and therefore overshoot and hunting do not easily occurs and the control have the best responsibility at the time.

Parameter “d” gives effect on proportional, integral and derivative function. Decreasing parameter “d” will strengthen proportional and integral function and weaken derivative function, with the extent of strengthening greater than that of weakening. And therefore as a whole decreasing “d” will strengthen feedback function. If d≤T, derivative function of system will be eliminated.

5.4.4 T output period

Parameter T can be set between 0.5 to 125 seconds. It represent the calculate speed of the instrument. When T increased, proportion function will be increased and derivative function will be decreased. If T≥5s, derivative function is absolutely eliminated, then the system is a proportional or proportional-integral system. The change of this parameter will nearly have no influence to the system if T is less than 1/5 of its original value.

The following principle is for adjusting parameter “T”.

- In case of time proportional output mode, if SSR (Solid state relay) or PBR is used as executive bodies, then control period can be set smaller (generally 0.5 through 2 seconds) to improve control precision. If relay contact output is used, then parameter “T” should be set to be larger than or equal 4 seconds generally, because a small value set will decrease service life of mechanical contacts. A large value set will increase service life of relay, but will decrease control precision, so select a value to satisfy both sides.
- In ease of liner current output, decreasing parameter T will speed up output responsibility and improve control precision, but will lead to frequently changed output current and arising there from frequent movement of executive bodies (ex. Control value). Now increasing parameter Ctl appropriately will make value move smoothly.

5.4.5 I, P,D, T setup

You can also modify, by your experience and referring the above mentioned parameters such as M, P, t and T on the basis of parameter values after auto tuning. You can accumulate experience more easily to use these parameters than to use deterministic PID parameters because of these parameters dePbribe system characteristic, XMT808 artificial intelligence algorithm includes many control modes such as proportional(P). Proportional-integral (P&I), proportional-derivative and XMT808 artificial intelligence control to satisfy varied regiment.

Parameter setting process is as follows:

1. Executing parameter auto tuning at first. And pay attention to some notes for attention for this operation (there have been some descriptions in preceding text, including setting dead band parameter HY correctly to prevent on-off control from error action due to input fluctuation, adjusting digital filter parameter FILT if necessary to prevent measurement from great fluctuation due to input noise and setting the set point for auto tuning correctly at the most commonly used value or at the highest temperature value for use). The ongoing auto tuning process normally needs a time from several minutes to several hours. (you had better write down the time taken). After auto tuning, observe for about one half of the time taken by auto tuning to see the control precision is satisfied. If only according to notes for attention demanded by auto tuning, In 90% cases, the operation will get satisfied control effect.
2. If not satisfied with the control effect, you can make a further adjustment by stepwise trial on the basis

of original parameter. Each time modify parameters M, P and t separately by making it change to twofold or one half, ex., you can change parameter I from the original value "1000" to new value "500" or "2000".

3. Therefore, after auto tuning, if the control has a fluctuation (measurement fluctuate around set point), then you can increase I. If the control has a dead difference (the difference can not be removed even after slating for a long time), then you can decrease I. Sometimes, adjusting parameter "I" only can not solve the problem, you can adjust parameter "P" again (increase twice as much or decrease one half).
4. Too large parameter "P" and too small parameter "I" will result in system fluctuation or overshoot (the former has a short period, the latter has a long period), conversely, too small parameter "P" and too large parameter "I" will result in dead difference.
5. If parameter P is too small and parameter I is normal, then a long period overshoot will be resulted. If the control can not be satisfying yet after adjusting parameter I and P for many times, then you can adjust parameter t (increase to twice as much or decrease to one half). As regard to parameter T, if only taking service life of executive bodies (ex., value and AC contactor) into consideration, the smaller the setting, the higher precision the control has.

5.4.6 Technical summaries:

- Take temperature control as an example, parameter I represent the system performance of heat preservation, P represents system heating capability, t represents the lag time of system, and T is used to balance control effect (fast response and high precision) and to stabilize output (increase service life of execution bodies).
- Decreasing parameter I will strengthen integral function in direct proportion, increasing parameter P will strengthen proportional and derivative function simultaneously in direct proportion, deceasing parameter "t" will strengthen proportional function while weaken derivative function, but proportional strengthening function is greater than derivative weakening function, and therefore decreasing parameter "t" will strengthen proportional-derivative function as a whole, and also strengthen integral function in the same proportion as strengthening proportional-derivative function do. Parameter T is used to balance proportional function and derivative function. The sampler T is set, the stronger derivative function is and the weaker proportional function is, but proportional-derivative function as a whole keep unchanged.
- Tuning parameter I to zero can remove integral function. Under one of these two condition of T $\geqslant$5 (seconds) or T=D (if parameter T is tuned to tuned to greater than t, then the instrument will automatically take T as t), derivation will be removed, and increasing of T will prolong output period while weaken derivative function. Generally, tuning T to 2 to 4 seconds will get very stable output.
- XMT808 artificial intelligence algorithm has several great improvements, comparing to PID algorithm, which include.

1 Fuzzy regulation is used for control at the status great deviation.

2 Except proportional, integral and derivative function, it has integral control for derivative function, and this is greatly helpful for the prevention of integral wind-up.

3 The deviation caused by set point change and measurement is processed by different ways, in order to prevent overshoot.

4 Its' proportional, derivative and integral function is twice stronger than traditional PID control. Its' control precision and system response speed is increased. It also has the function to prevent overshoot.

5 It has characteristic of self-adaptive control, i.e., an expert system is added with PID control to simulate process control, when the real control is not the same as the ideal result, adaptive system begins sub control, the result of which is added with PID output This makes good control be remained even if parameters MPT is with a fairly big error.

5.5 Input specification parameter Sn

XMT808 series instrument is available with varied input function. Different input type such as thermocouple, RTD and linear voltage can be selected in the same instrument through parameter setting. Automatic non-linear calibration of nogh precision for thermocouple and RTD is available in the instrument, with measurement input accuracy less than 0.2%F.S. Special instrument, which uses special input specification such as EA2, BA1, BA2 and G index and evolution, can be customized according to the index table supplied by user. The following stable shows input specifition corresponding to the set value of parameter Sn.

Sn	Input spec.	Sn	Input spec.	Sn	Input spec.
0	K	1	S	2	R
3	T	4	E	5	J
6	B	7	N	8-19	Spare
20	Cu50	21	Pt100	22-25	Spare for special RTD
26	0-80Ωresistance input	27	0-400Oresistance input	28	0-20mV Voltage input
29	0-100mV Voltage input	30	0-60mV Voltage input	31	0-1V Voltage input 0-500mV Voltage input
32	0.2-1V Voltage input 100-500mV input	33	1-5V voltage input	34	0-5V Voltage input
35	-20-+20mV input 0-10V voltage input	36	-100-+100Vinput 2-10V voltage input	37	-5-+5V Voltage input 0-50V Voltage input

5.6 Decimal point setting parameter dIP

5.6.1 In case of linear input, parameter dIP is used to define decimal point place according to users' habit.

dIP=0, display pattern is 0000, decimal point not displayed.

dIP=1, display pattern is 000.0, decimal point is at ten's place.

dIP=2, display pattern is 00.00, decimal point is at hundred's place.

dIP=3, display pattern is 0.000, decimal point is at thousand's place.

Adjustment of this parameter affects display only, and gives no effect on measurement input accuracy and control precision.

5.6.2 In case of thermocouple of RTD input, dIP is used to define temperature display resolution.

dIP=0, temperature display resolution is 1℃.

dIP=1, temperature display resolution is 0.1℃.

Adjustment of this parameter only affects the display, and gives no effect on control or retransmission output because the internal temperature measurement resolution is fixed at 0.1℃, then temperature will be displayed at the resolution of 0.1℃ for input below 1000℃ and 1℃ for input over 1000℃.

5.7 P-SH and P-SL: Scale definition parameter for linear input/retransmission output

Linear input includes signals of various specifications such as mV, 5V, 1-5V, 0-10mA and 4-20mA, display range of which is from –1999-+9999 (decimal point can be defined by "dIP".

When selecting instrument, its is recommended to select voltage-input type to substitute current input type. Ex., select the instrument of 0-1V or 0.2-1V voltage-input type for current input signals, by converting current signal to corresponding voltage signal through 1000 or 500 resistance. Or select the instrument of 0-5V, 1-5V voltage input type for current input signals, by converting current signals to

corresponding voltage signal though 5000 or 2500 resistance.

Parameter “P-SH” and “P-SL” are used to define the display span for linear input, and to set the engineering unit for measurement.

For example, a pressure transmitter is used to convert pressure signal (temperature, flow and humidity signals also possible) to stand 1-5V input (4-20mA can be obtained through an external wired 2500 resistance). Among which, 1V corresponding to pressure o and 5V corresponding to pressure 1Mpa, and the display resolution of 0.001Mpa is expected. Each parameter can be set as the following:

Sn=33(Select 1-5V DC Voltage input)

dIP=3 (Set decimal point, and the display pattern is “0.000”)

P-SL=0.000 (define the pressure display value corresponding to low input limit 1V)

P-SH=1.000 (define the pressure display value corresponding to high input limit 5V)

5.8 Input shift parameter Pb

Parameter Pb is used to make input shift to compensate the error produced by sensor or input signal itself.

For thermocouple input, parameter Pb is used to correct reference junction compensation error.

The instrument itself will not produce error after a long time used, because the technology of digital calibration is used in the instrument to substitute potentiometer of bad stability, and function of automatic zero modulation will guarantee no zero drift produced in the instrument.

Parameter “Pb” is used to make input shift to compensate the error produced by measurement. For example, provided input signal keep unchanged, if when parameter “Pb” is set to 0.0℃, the temperature measurement of the instrument is 500.0℃, then when parameter “Pb” is set to 10.0℃, the temperature measurement display will be 510.0℃.

Instruments are all calibrated before delivering, and so the default value of parameter “Pb” is zero. Only adjust this parameter when recalibration of measurement is necessary.

5.9 Output definition parameter “OP-A”, “outL”, and “outH”

Parameter OP-A is used to define the mode of main output signal, and parameter “outL” and “outH” is used to define output lower limit and upper limit. Note: setting of parameter “OP-A” must conform to the module type installed as main output.

OP-A=0, the mode of main output is time-proportional output (for XMT808 artificial intelligence control) of on-off mode (for on-off control). If output modules such as SSR voltage output, relay contact discrete output, BCR cross zero trigger output, and BCR n0-contact diPbrete output are installed as main output, then “OP-A=0” should set.

OP-A=1, any specification DC current output, continuous output mode. Linear current output module should be installed to main output.

OP-A=2, Actuation is time proportional output of on-off mode.

outL, Restrain minimum value of adjust output. When the function of sectional power restriction is executed, it is the output upper limit if output value is lower than the value of lower limit alarm. If bi-directional adjustment software is installed, then instrument is turned to be duo directional output system, when outL＜0, it represents the maximum output of refrigeration output.

outH, Restrain maximum value of adjust output.

5.10 Alarm output definition parameter “AL-P”

Parameter “AL-P” may be configured in the range of 0 to 63, and used to define which alarm type of “ALM1”, “ALM2”, “Hy-1” and “Hy-2” is output to AL1 or AL2. Its function is determined by the

following formula:

AL-P=A×1+B×2+C×4+D×8+E×16

If A=0, then AL1 is activated when upper alarm occurs;

If A=1, then AL2 is activated when upper alarm occurs;

If B=0, then AL1 is activated when lower alarm occurs;

If B=1, then AL2 is activated when lower alarm occurs;

If C=0, then AL1 is activated when positive deviation alarm occurs;

If C=1, then AL2 is activated when positive deviation alarm occurs;

If D=0, then AL1 is activated when negative deviation alarm occurs;

If D=1, then AL2 is activated when negative deviation alarm occurs;

If E=0, then alarm types, such as "ALM1" and "ALM2" will be displayed alternatively in the lower display window when alarm occurs. This makes it easier to find out alarm occurs.

If E=1, then alarm types, will not be displayed in the lower display window (except for "orAL"). Generally this setting is given when alarm output is used for control purpose.

For example: If it is needed that AL1 is activated when upper alarm or positive deviation alarm occurs, AL2 is activated when lower alarm or negative deviation alarm occurs, and alarm type is displayed in the lower display window when alarm occurs, then we reach a conclusion: A=0, B=1, C=0, D=1, E=0 and parameter "AL-P" should be configured to:

AL-P=0×1+1×2+0×4+1×8+0×16=10

5.11 Function parameter "COOL"

Parameter "COOL" is used to select some system functions

COOL=A×1+B×2+C×4+D×8+E×16

A=0, reverse action control mode. When this mode is selected, an increase in PV results in decrease in the control output. Ex, heating control.

A=1, direct action control mode. When this mode is selected, an increase in PV results an increase in the control output. Ex, cooling control.

B=0, without the function of alarm suppressing at on or set point changing.

B=1, having the function of alarm suppressing at power on or set point changing. Refers to the dePbription in the latter text.

C=0, auxiliary function module of the instrument works as communication interface.

C=1, auxiliary function module of the instrument works as linear current output.

D=0, inhibits remote set point input.

D=1, allows remote set point input.

E=0, without the function of sectional power restriction.

E=1, with the function of sectional power restriction.

For example: if it is expected that the instrument service as reverse action control, have the function of alarm suppressing at power on, have a communication interface which auxiliary module 4 works as, and is not allowed to receive remote set point input. Then we get A=0, B=1, C=0, D=0, E=0, and so parameter "COOL" should be set as follows:

COOL=0×1+1×2+0×4+0×8+0×16=2

5.12 Communication interface related parameters Addr and bAud (concurrently scale definition of retransmission linear current).

When RS232C or RS485 communication interface is installed as auxiliary function, parameter "Addr"

and “bAud” is used to define the communication address and baud rate respectively for communication modules in the instrument. Communication baud rate can be configured in the ranged of 300 to 19200bit/s, and the address of the instrument can be configured in range of 0-100. Instruments should have different address configured when they are installed in the same communication line.

The data character format for communication interface is: 8 data bits, and no parity bit. CRC calibration is used for data check, its correcting capability is thousands times beyond even-odd check. This makes communication data correct and reliable. XMT808 series instruments can make up distributed control system together with computer. Demonstration software, which has detail description about distributed control system, is available for your ordering. When trouble occurs on computer, communication interface, and line, the instrument itself can still work as usual to maintain the control of process.

If linear current output module is installed in the instrument as auxiliary function module, then parameter “Addr” and “bAud” is used to define the scale of liner current for the corresponding retransmission output. And parameter “Addr” is used to define output low limit and parameter “bAud” is used to define output high limit. The unit is 0.1mA. For example, if a 4-20mA retransmission output need to be defined, then you can set like below: Addr=40, bAud=200.

5.13 Input digital filter parameter “FILT”

These is one intermediate-value filter system and one second order integral digital filter system in XMT808 series instrument, among which intermediate value filter takes intermediate value among three continuous values, and second order digital filter has same effect as resistance-capacity integral filter. If measurement input fluctuates due noise, then digital filter can be used to smooth the input. Parameter “FILT” may be configured in the range of 0 to 20, among which, 0 means no filter, 1 means intermediate-value filter and 2-20 means that intermediate-value filter and second order integral filter can be selected simultaneously.

The multiples of second integral filter is the square parameter “FILT”, and can be up to hundreds times. When a large value is set, the measurement input is stabilized but the responsibility at the time is deteriorated. Generally if great interference exist, then you can increase parameter “FILT” gradually to make momentary fluctuation of measurement input less than 2 to 5 values. If the instrument is being tested at laboratory, then parameter “FILT” should be sit to 0 or 1 to short the time responsibility.

5.14 System A-M parameter A-M

This parameter is only suitable for XMT808-808 and XMT808-808P series instrument, furthermore the functions defined are different in these two types of instruments.

1. For XMT808 type, parameter A-M is used to define auto/man be working status as below.

   A-M=0, manual control state

   A-M=1, automatic control state

   A-M=2, automatic control state, in this state manual operation is prohibited. When the manual function is not required, it can avoid entering manual state due to operator’s false operating.

As auto/man transfer can be carried out directly from the keypad, it is not needed to adjust parameter A-M to perform auto/man transfer. However, when a computer is used to control the instrument via RS232C or RS485 communication interface, the transfer of auto/man status can be carry out by adjusting parameter A-M from computer.

2. For XMT808 type, parameter A-M is define the event handling mode when program is A-M.

Abrupt actions affecting control execution of program are called event, as the outcomes of events are always probably unpredicted, the aim of event handing is turn those unpredicted things into predicted

results.

A-M=A×1+B×4

Among which: A is used to select 3 kinds of outage/start event handing modes; B is used to select 4 kinds of A-M/modify event-handing modes.

There are three outage-handing function for XMT808 series instrument. The setting functions of A in parameter A-M is below:

A=0 Anyway, the program will jump to 29th segment to begin the program A-M and clear event output status at the same time. This mode is suitable for the application of an extremely high process demand, in which power failure is not allowed at any time. User may do trouble handling in NO 29 segment, for example, switch on the event output to trigger alarm.

A=1 If these is no deviation alarm after power on, it will continue the program A-M from the original break point, and the event output state remains. Otherwise, the program will jump to the 29th segment to begin the program A-M and clear event output status at the same time. This mode is suitable for the application of a fairly high process demand.

A=2 After power on, it will continue the program A-M from the original break point, and the event output state remains. This mode is suitable for the application in which power failure dose not affect the production.

A-M/modify event handling

XMT808 series instrument supply the following modes for user to select to deal with the problems of A-M/modify event by setting parameter B:

B=0, series instrument is have control and output when it is hold.

B=1, series instrument is OUTL output when it is hold.

5.15 Privilege for parameter set Lock

If parameter Loc is set to other values than 808, then only field parameters the range of 0 to 8 and parameter Loc itself can be set. When parameter Loc is set to 808, user can set al parameters. Parameter Loc provides several operation privileges. When user has completed setting some important parameters such as input and output, parameter Loc can be set to other values than 808 in order to avoid field operators' accidental modification of some important operation parameters. See the following:

For XMT808 series instrument

Loc=0, modification field parameters and set point is allowed.

Loc=1, allowed to display and view field parameters, and to set point. But the modification of field parameters (except parameter Loc itself) is not allowed.

Loc=2, allowed to display and view field parameters, but the modification of field parameters and set point (except parameter Loc itself) is not allowed.

Loc=808, configuration of all parameters and set point is allowed.

5.16 Field parameter definition: EP1-EP8

When configuration of the instrument is completed, most parameters will not need to be field operators. Furthermore, field operators may not understand many parameters, and may probably set parameters incorrectly by mistake and make the instrument unable to work.

Intelligent instruments are generally equipped with parameter lock function, but ordinary lock function always all parameters. Sometimes it is needed for field operators to modify or adjust some parameters such as I0, P, t, and upper alarm ALM1, and to modify some program such as the temperature and time value of a certain segment for XMT808-808P series instrument.

EP1-EP8 define 1-8 field parameters for operators' use in parameter table. Their parameter values are

parameters except parameter EP itself like ALM1, ALM2, etc, for XMT808-808P series instrument it should include setting values of program like C01, t01, etc. when Loc is set to 0, 1, 2, and so on, only parameters or setting values of program defined can be displayed, other parameters can not be displayed and modified. This function can speed up the parameter modification and prevent important parameters (like input, output parameters) form modifying falsely.

Parameters from EP1 to EP8 can define 8 field parameters at most, if the number of field parameters is less than 8 (sometimes even none), it is necessary t define useful parameters from EP1 to EP8 in order, the first (parameter which are not used is defined as none, For example, two parameters of ALM1 and ALM2 are need to be modified by field operators, the parameter EP can be set as following:

Loc=0, EP1=ALM1, EP2=ALM2, EP3=nonE.

Sometimes field parameters are not needed after we finish adjusting the instrument, we can set EP1 parameter an nonE.

6. Additional remarks of instrument function

6.1 Time proportional output (when OP-A=0)

In case of time proportional output mode, the output value can change by adjusting, during a fixed base period, the ratio of relay on-off time (or the ratio of the time during which SSR high voltage output or low voltage output is activated).

Time proportional output can be regarded as a square wave, the base period of which equals to control period T, and the output value of which direct proportional to the on-off ratio of the square wave. The on-off ratio may be configured to be in the range of 0% to 100%. For special applications, the range of time proportional output can be clamped by tuning parameters “OUTL” and “OUTH”. Fox example, if the output need to be clamped to between 20% and 60%, then “OUTL=20, OUTH=60” may just be set. Normally in case of time proportional output, if “OUTL=0, OUTH=100” is set, then there will be no output limit.

6.2 Position proportional output （when OP-A= 1 ）

XMT808 series instrument can directly control the A-M of valve motor without using servo amplifier. For this control mode, it is needed to install 2 discrete module (relay contact discrete module of BCR no control discrete module can be used) in main output and alarm 1 socket to control respectively forward A-M/reverse A-M of the motor. Because AL1 is used for the reverse A-M of the motor.

6.3 Remote set point input

If remote set point input is allowed, then the set point can be given by a 1-5V voltage signal inputted from wiring terminal of the instrument The scale of the remote set point is determined by parameter “P-SL” and “P-SH”.

If the voltage signal inputted from remote is less than 1V, then remote set point input is automatically inhibited, and local set point input is allowed. In the application of remote set point input, the measurement input of the instrument should not be 1-5V or 0-5V. If the measurement input is 1-5V or 0-5V (0-10mA or 4-20mA), then you can set the specification of main input of the instrument to be 0-1V or 0.2-1V (or 0-100mV), and then externally connect suitable resistance for voltage or current dividing. With the function of remoter set point input, XMT808 series instrument can make up cascade control system to fulfil complicated tasks, and can also use external voltage input to switch target set point, if a second set point is defined by setting “P-SL=P-SH=The second set point”, through a 1-5V voltage input.

6.4 Alarm suppressing at power on

The function of alarm suppressing at power on: instrument alarm often occurs immediately after power on or set point changing. Take electrical furnace temperature control (heating control) as an example. The actual temperature is far below target set point at power on. If lower alarm or negative deviation alarm is configured, then the alarm condition may be satisfied at power on. But in fact the control system may not have problem. Contrarily in case of cooling control (direct action control), upper alarm may occur at power on. XMT808 series instrument provides the function of alarm suppressing after power on or set point changing. Even if alarm condition is satisfied after power on or set point changing, alarm will not occurs.

If an alarm condition is satisfied again after it is cleared, then the alarm function is started up. The effect of alarm suppressing after power on depends on the selection of direct/reverse action. In case of reverse action control (heating control), lower alarm and negative deviation alarm are suppressed after power on. In case of direct action control (cooling control), upper alarm and positive deviation alarm are suppressed after power on. The corresponding deviation alarm is suppressed after set point changing.

6.5 Sectional power restriction

With regards to some high temperature electric resistance furnace whose heating materials is silicon-molybdenum bar or tungsten filament, the resistance of there heater in cold condition is much lower than that in hot condition, so the furnace current will exceed its rated current greatly in cold condition. If the instrument works in automatic control mode, full power output in cold condition will lead to power switch trip and shorten the heating materials service life to a large extent.

The function of sectional power restriction will be executed if E=1 is set while setting parameter COOL. Then the instrument output lower limit will be fixed on 0, while outL is the output upper limit when output is lower than the value of lower limit alarm, if output is higher than the lower limit alarm value outH is the upper limit. In this way, the instrument can work with 2 optional powers according to the measurement in order to restrict the oversized current in cold condition. Lower limit alarm function will be canceled in sectional power restriction.

For example: If it is needed that output power should be restrict to 20% when the furnace temperature is lower than 600℃ and the 100% upper limit is allowed when the temperature is more than 600℃. Parameters is as follows:

ALM2=600, outL=20, outH=100, E=1(see parameter COOL for details).

6.6 Communicate with computer

The operation and the function of the instrument can be executed by using computer sustained with XMT808 BUS communication protocol when RS485 communication module (with photoelectric isolation) is installed. Besides various application software developed by users, we also provide XMT808 DCS for communication, it will A-M under the operating system of Windows95/98/NT. By using this software, XMT808 series instrument with the number of 1-200 can be centralized monitored and controlled, while automatic record and print is available.

An RS232/RS485 converter is needed when using RS485 communication interface for communication. Then you can connect 64 (maximum number) instruments with the computer and computer control is now available. If more than 100 instruments are needed for a system, each computer interface can be connected with 100 instruments with the help of RS485 repeaters and computer LAN consists of 2 or more computers will be bring into use if it is necessary. Different address should be given to each instrument. Communicator protocol is free for users who want to develop the configuration

software of their own. Here are the instrument communication parameters: 8 data bit, 1 or 2 stop bit, no parity bit, 16 bits summation check.

7. Further description about general work mode of XMT808 Series instruments

7.1 ON-OFF control instrument (simple temperature controller)

ON-OFF control instrument is widely used in the application of simple temperature control, such as plastic machine, industrial boiler, dehydrator, food manufacturing machine, packing machine and so on, which don't need high precision of temperature control. It is also widely used for alarm task.

You can select the simple type instrument of XMT808-808 to perform ON=OFF control by installing one relay contact output module in the main output (midule1) socket. When ON-OFF control instrument is used for temperature control, generally, it uses its internal relay to control external intermediate relay, and this external intermediate relay controls an A.C contactor controls the power on and power off of heater to control temperature. Input temperature sensors are mainly thermocouples, such as K, E and so on. Pt100 is also in used sometimes.

Dead band of ON-OFF control can be set by parameter Hy. When XMT808 series instruments are used for ON-OFF control, is should be set as below: At=0, OP-A=0.

Besides setting input specification parameters properly, you also need to set alarm parameters such as ALM1, ALM2, Hy-1 and Hy-2 to limit value (the default factory set) to avoid unnecessary alarms. Parameters for XMT808 artificial intelligence control, such as I0, P, t and T, have no function in this occasion. After input related parameters are properly set, it is suggested to set parameter Loc and EP1 as below:

Loc=1: inhibit the modification of field parameters, inhibit the display and modification of other parameters.

EP1=nonE: field parameters are not defined.

Because of the simple function of ON-OFF control instrument, generally, there is no need to set parameters. So all parameters are locked to avoid troubles made by unintentional modification.

Because of low accuracy of ON-OFF control mode, it is suggested to use XMT808 artificial intelligence control mode for better effect, if the condition is allowed.

7.2 3-point (upper, lower alarm) control instrument

Typical 3-point control (upper-lower alarm type, also named as control plus upper alarm type) is also widely used. XMT808 series instrument performs 3-point control by installing a relay contact output module in main output socket and alarm 1 socket respectively. Comparing to 2-point control instrument, a relay output is added as upper alarm function for 3-point control instrument. To make the instrument have upper, lower alarm function, the parameters should be set as below: At=0, OP-A=2, COOL.A=0, AL-P=30, Loc=0, EP1=ALM1, EP2=nonE.

Refer to descriptions for the above mentioned parameters in the preceding text. The set of At=0, OP-A=2 and COOL=0 configure main output to be ON-OFF control, relay output and reverse action control. This means that main output relay is activated when measurement value is less than set point (SV), and so main output of the instrument functions as lower alarm control, with set point set to be lower alarm value (Note: if COOL is set 1, then main output functions as upper alarm control). The set of AL-P=30 means that alarm 1 output is activated when upper alarm occurs, and that alarm 2 output, with no module installed is activated when the other alarms occur. It also means that no alarm code is shown in the lower display

window when alarm occurs.

Setting set point (SV) can set lower alarm value, and setting parameter ALM1 can set upper alarm value. Because the set of parameter ALM1 is needed at field LocK=0, and EP1=ALM1 should be set, i.e., ALM1 can be modified as field parameter, and other parameters are locked with display and modification inhibited.

XMT808 series instrument has plentiful control and alarm modes; this 3-point control instrument can also be set to have the function of high, high-high alarm or low, low-low alarm according to the need.

7.3 Temperature transmitter/Program generator

XMT808 series instrument can retransmit its analog input signal into linear current output of any range, and can be used as an instrument with the display and temperature retransmission function. You can set various thermocouple/RTE input, and any temperature retransmission range and current output specification, with the retransmission accuracy less than 0.1mA in the range of 0-20mA (i.e., less that 0.5%F.S). Related parameters are as below:

If C=1 is set for parameter COOL, and a linear current output module (isolated of non-isolated modules can be selected) is installed in the auxiliary function socket, then linear current retransmission output function is available in the instrument (but communication function cannot be added any more). The parameters concerned are shown below:

Sn: select thermocouple/RTD input specification

P-SL: set low limit of retransmission output, the unit is ℃.

P-SH: set high limit of retransmission output, the unit is ℃.

Addr: set the current output value of the instrument when analog input signal is less than or equal to the parameter value set as P-SL, the unit is 0.1mA.

bAud: set the current output value of the instrument when analog input signal is more than or equal to the parameter value set as P-SH, the unit is 0.1mA.

For example, if the instrument is expected to have retransmission function for thermocouple of K type, with the temperature range of 0～400℃, output range of 4～20mA, then each parameter can be set as below: Sn=0, P-SL=0, P-SH=400, Addr=40, bAud=200.

Transmitter defined as above will output 4mA when temperature is below or equal to 0℃, 20mA when temperature is over or equal to 400℃, and a continuously changes between 0～400℃.

If At=0 (ON-OFF control mode) and OP-A=1, (linear current output) is set , then the main output of the instrument can also be used as retransmission output, with the current output defined by parameter outL and outH. In this occasion, the instrument will not have control function but have alarm function and the function of communication with computer.

As regards to XMT808-808P, if main OUT is defined as retransmission output, its output represents the set point and the instrument is now used as Program Generator.

7.4 Temperature (pressure, flow of level) controller with high precision

2-point and 3-point control instrument, mentioned in the preceding text, can only perform the temperature control without high precision. The first advantage of XMT808 series instrument is using advance XMT808 artificial intelligence algorithm to perform unprecedented control with high precision. Its advance auto tuning (AT) function makes manual parameter setting unnecessary for user. The accurate control function can be performed with XMT808 series instrument. Among which, XMT808 has auto/man bumpless switching function and auto tuning function with limited output amplitude, and should be selected for the application of linear voltage output, especially for the application where control valve is used. XMT808 has program control function, suitable for the application where set point need to be

changed automatically with time.

To perform control with high precision, the following modes are often used as main output modes of XMT808 series instrument.

SSR voltage output: (time proportion output) equipped main output (OUT) with module G, to drive external solid's state relay.

Single-phase/three-phase BRC zero cross signal output: (time proportion of period proportion output) equipped main output (OUT) with module K, can drive external BRC directly.

Linear current output: equipped main output (OUT) with module X. 0-10mA, 4-20mA, 0-20mA, etc. output signal. Need to externally connect executive bodies, such as BCR voltage regulator and control valve.

BCR no contact discrete output (time proportion, control AC signals only): equipped main output (OUT) with module L. Used to control AC contractor through an intermediate relay (or control small AC contractor directly).

Relay contact discrete output: used to control AC contractor through an intermediate relay.

To use the instrument, besides correctly setting input related parameters, user need to understand the use of output related parameters, user need to understand the use of output related parameters (OP-A, outL, outH), be familiar with control modes and the operation of auto tuning (parameter At), and understand the use of control parameters(I, P,D, T).