SET64rs Series Programmable Temperature Controller 64 steps

SET64rs   SET64rs-4

SET64rs controller is a new controller. Many new techniques are introduced into the controller. Various sensors and transducers can be used with the controller.

The set value (SV) can be changed as the time elapses according to a predetermined program pattern, and 64 steps patterns can be programmed.

The controller has re-transmission output function or communication function. Remote control function can be performed by linking the controller to computer or PLC.

★64 steps pattern meets the different industrial requirements.

★The controller has a good compatibility of input signals.

★ Preset 9 group PID parameters in order to adapt to different work conditions (High Temperature/Low Temperature/Constant Temperature/Heating/Cooling)

★ Three kinds of parameter set method: panel keys, control configuration software and special download software.

★Pause, skip, cycle, branch and power down protection functions can be realized by simple and effective instructions.

★The controller has many power-on patterns and power down memory functions.

★It has an extraction、small signal removal function.

★It has a delay startup function.

★It has an alarm hold function.

★It has an auto/manual undisturbed switch function.

★It adopts a combine control method using the classical PID and intelligent control.

★It has RS485 communication function. Option.

★It has re-transmission function. Option.

1 Introduction

1.1 Specification

Power Supply: AC85~260V(DC85～360V)

Precision: within 0.2%FS±1 digit

Indication: Two rows, four digits

Sample rate: 5 times per second

Feed output: DC24V/25mA

Control Output: Standard: SSR driving output. Options: Relay Contact, DC output (0-10mA/4-20mA/0-20mA/ 0-5V/1-5V/0-10V)

Output rated: (a) Relay contact:
AC220V/3A、DC24V/5A (resistive load)
(b) DC output: less 500Ω load

Cmmunication: Optoelectronic isolated and master-slave asynchronous serial interface RS-485, 1200~9600bps baud rate

SSR driving: 25mA/12V

SET63 series mode1 and Outline Dimensions

Model Code	LED dimensions		Penal Dimensions (mm)	Cutout Dimensions (mm)
	Top Line	Bottom Line		
SET64rs	0. 36″（Red）	0. 36″（Green）	48×96×112	44×92, upright
SET64rs-4	0. 56″（Red）	0. 36″（Green）	96×48×112	92×44, horizontal
SET64rs-6	0. 80″（Red）	0. 56″（Green）	96×96×112	92×92, square
SET64rs-8	0. 80″（Red）	0. 39″（Green）	160×80×80	152×76, horizontal

1.2 Model codes

SET64rs □ — □ — □

2nd output:Default: None
RS485：isolated RS485 interface
mA：re-transmission current（0-10mA/4-20mA/0-20mA）
5V：re-transmission voltage（0-5V/1-5V）
10V：re-transmission voltage（0-10V）

Main output
J: Relay contact output
SSR：SSR driving output (voltage pulse output)
mA：analog current output（0-10mA/4-20mA/0-20mA）
5V：analog voltage output（0-5V/1-5V）
10V：analog voltage output（0-10V）

Outline dimensions code
3:48×96mm (upright) In stock.
4:96×48mm (horizontal) 5-9weeks w/ min 5units.
6:96×96mm (square) 5-9weeks w/ min 5 units.
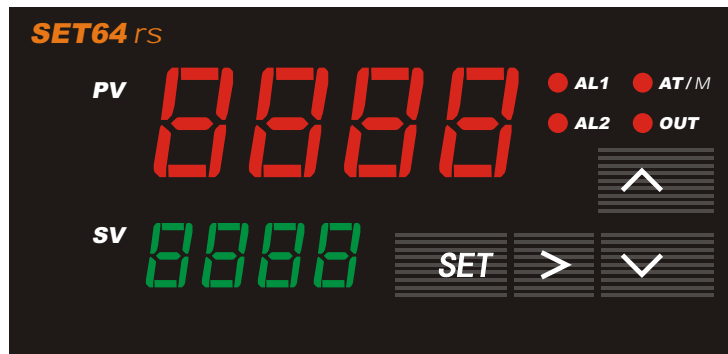8:160×80mm (horizontal) 5-9weeks w/ min 5 units.

Caution: Re-transmission function is optional only when master output is SSR

2 Operation manual

2.1 Name of parts

2.1.1 Panel

SET64rs series digital controller has the same setting method and part names, therefore, we introduce its setting method with examples of SET64rs.

PV display unit: display PV

SV display unit: display setting value/output/ step no. /residual time of current step (change the display by pressing the set key)

AL1：Relay J1 output lamp

AL2：Relay J2 output lamp

AT/ M: auto-tuning/manual lamp, the lamp flashes during auto-tuning and lights during manual mode.

OUT: control output indication lamp. It lights during control output is turned on.

ⓈⒺⓉkey:①register function; ②Manual mode is changed to auto mode when the key is pressed.

⊙key: ①Shift function; ②SV display content change; ③auto-manual switch by pressing it for 3 seconds; ④manual output value is registered by pressing it.

⊘Key: ①decrease function; ②previous parameter select.

⊙Key: ①increase function; ②next parameter select;③pause function (Changing to the pause state by pressing it when the steps number or residual time displaying on the SV display screen, the SV value is constant in pause mode).

2.1.2 Instrument work mode
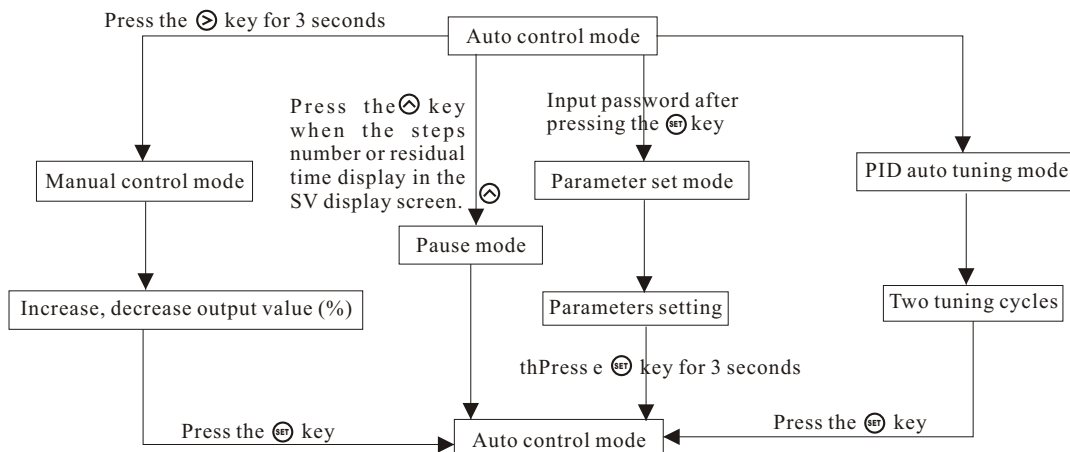
Five work modes are as follows:
(a) Parameter setting mode   (b) Auto control mode   (c) Manual control   mode
(d) PID auto tuning mode   (e) Pause mode

2.1.3 Change between the modes

Press the ⊙ key for 3 seconds

Auto control mode

Press the ⊙ key when the steps number or residual time display in the SV display screen.

Input password after pressing the ⓈⒺⓉ key

Manual control mode

Parameter set mode

PID auto tuning mode

Pause mode

Increase, decrease output value (%)

Parameters setting

Two tuning cycles

thPress e ⓈⒺⓉ key for 3 seconds

Press the ⓈⒺⓉ key

Auto control mode

Press the ⓈⒺⓉ key

Note:
   (a) In the auto control mode, the SV, the output value, the current step number and the runtime can be displayed in turns by pressing the ⊗key. The display means that the right three digitals is the output value when its format is "oXX.X". The display means that the right two digitals is the current step number when its format is "S-XX", for example S-64. The work mode is changed to pause mode (the SV value doesn't change) by pressing the ⊙key when the step number or residual time display in the SV indication screen.
   (b) The work mode is changed from auto mode to manual mode by pressing the ⊘key for 3 seconds. AT/M lamp lights and indicates that the operation has been done. Manual output value can be modified by pressing the ⊙ key or the ⊙key, and it is valid by pressing the ⊗key. Manual mode is changed to auto control mode by pressing the ⊛ key for 3 seconds.

2. 1. 4 Display unit
   PV display unit: Display the measured value of input signal in auto mode and parameter symbol in setting mode.
      One of the three situations is possible when "EEEE" displays in PV display unit
   (a) Setting code of input signal type is not same as actual input signal type.
   (b) Input signal value is beyond the high or low limit.
   (c) Connection between the instrument and sensor (or transducer) is broke.
      SV display unit: Display next parameter symbol in parameter select mode or parameter value in parameter value modification and examination mode.
      Display SV/output/current step number/runtime in auto mode (the content of SV display unit is changed in turns by pressing the ⊗ key).
      Display the output value (%) in manual mode.
      Display the SV in AT mode.

2.1.5 Function of the keys: Functions of every key in all modes are listed in the following table.

Mode \ Key name	Auto mode	Setting mode	Manual mode	AT
⊛	To setting mode	To auto mode by pressing the key for 3 seconds.	Quit manual mode	To auto mode
⊗	SV, output (%), current step number and runtime are sequentially displayed by pressing the key; Manual mode is switched by pressing the key for 3 seconds.	Select the set digital (shift)	utput the manual value	
⊙	Decrease the SV when MODL=SV	Select previous parameter or decrease the value of the digital after selecting parameter	Decrease output (%)	
⊙	SV can be increased using the key when MODL=SV, the switch between pause and run can be realized by pressing the key in other patterns.	Select next parameter and increase the value of the digital after selecting parameter	Increase output (%)	Pause/R un

2.1.6 Indication lamp

State	Relay J1 alarm	Relay J2 alarm	manual mode	AT mode
AL1	light			
AL2		light		
AT/M			light	
AT/M				flash

2 Wiring (subject to the terminal blocks attached to the controller)
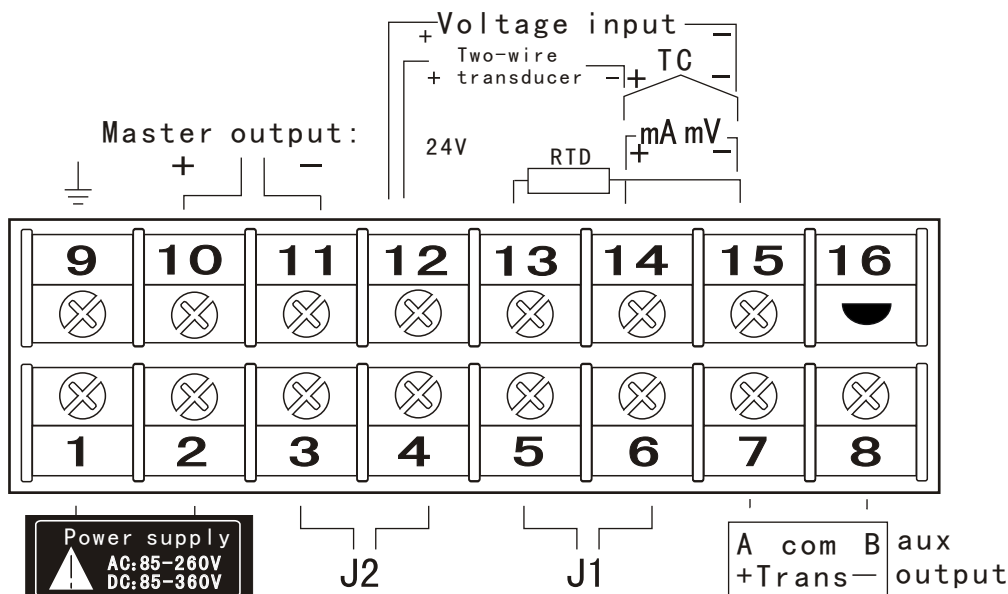
Main output:	2nd output:
SSR driving voltage	Analog current （0-10mA/4-20mA/0-20mA）
Relay output	Analog voltage (0-5V/1-5V)
Analog current （0-10mA/4-20mA/0-20mA）	Analog voltage (0-10V)
Analog voltage (0-5V/1-5V)	RS485 interface
Analog voltage (0-10V)	

Note:
(a) Every of the two terminates of the power supply can be connected to the positive pole or negative pole for the DC power supply.
(b) The ground terminate should ⏚ be connected to Earth when interference around the instrument is intense or the instrument works together with other instruments.
(c) The corresponding compensating wiring should be used when the sensor is a thermocouple.
(d) Three low-resistance (<5 Ω) and identical wirings should be used when sensor is a RTD
(e) Input signal wirings should keep distance from power wirings and motor cables and avoid the interference.
(f) The interference filter should be installed and be connected to Earth, and distance from filter to instrument power terminate should be as small as possible.
(g) Voltage input signal should be connected to No.14 and No.15 terminates and the position of shorting bar should be adjusted as the following scheme


The position of shorting bar when transducer power is supplied by the instrument

The position of shorting bar when the voltage input signal is applied

3 Parameter setting

SET 64rs series instrument has five parameter groups: function parameter group, work parameter group, PID parameter group, ramp/soak parameter group and control parameter group. The five passwords (0089/0036/0037/2000/0001) are corresponding to parameter groups respectively. You can set the parameter groups using the passwords as the following scheme.
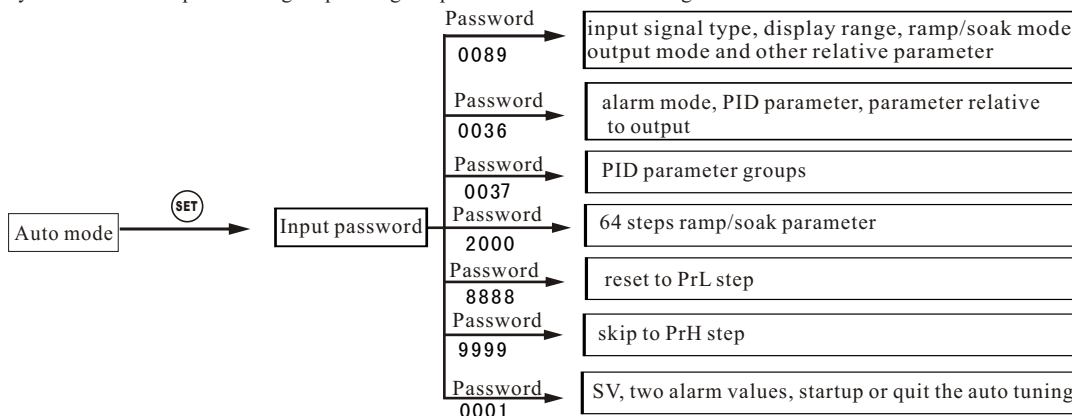

3.1 Function parameter group
3.1.1 Introduction (password is 0089)

	Symbol	Description	Address	Range	Factory set value
IntY	Inty	Input signal type	2000H	See the section 3.1.3	Pt100
PvL	PvL	Display low limit	2001H	−1999～9999	0. 0
PvH	PvH	Display high limit	2002H	−1999～9999	500. 0
dot	dot	Decimal point position	2003H	0: No digital below decimal point 1: 1 digital below decimal point 2: 2 digital below decimal point 3: 3 digital below decimal point	1
rd	rd	Direct/reverse action	2004H	0: reverse action 1: direct action	0
obtY	obty	Re-transmission output type	2005H	0-10/4-20/0-20mA	0-20
obL	obL	Re-transmission low limit	2006H	−1999～9999	0000
obH	obH	Re-transmission high limit	2007H	−1999～9999	500. 0
oAtY	oAty	Output type	2008H	0-10mA；4-20mA；0-20mA 3~100 is proportioning cycle, its unit is second	0-20
EL	EL	Extraction	2009H	On: extraction OFF: no extraction	OFF
SS	SS	Small signal removal	200AH	0-100%	0
rES	rES	Delay startup	200BH	0-120S	0
uP	uP	Power fail process	200CH	0； 1；	1
ModL	ModL	Work mode	200DH	SV；S-SV；M-SV S-PV；M-PV	SV
PrL	PrL	First step	200EH	1-63	1
PrH	PrH	Last step	200FH	2-64	63
corF	corf	Celsius/Fahrenheit	2012H	C: Celsius F: Fahrenheit	C
Id	Id	Communication address	2010H	1-64	5
bAud	bAud	Communication baud rate	2011H	1200/2400/4800/9600	9600
End	End	End code		No option	

3.1.2 Parameter setting is as the following flowchart:
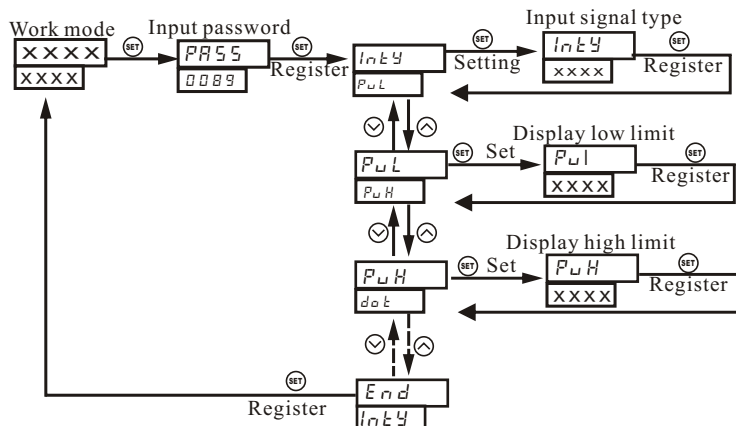
Crucial points：

(a) Change to setting mode by pressing the (SET) key.

(b) Input password and set the parameters by pressing ⊘ the key, the ⊙ key and the ⊗key.

(c) Register by pressing the (SET) key.

(d) Select the parameter pressing the⊗ key and the⊙ key.

3.1.3 Parameter description

(a) Inty: input type

Set the input signal code according to the following table.

input signal cde	input signal cde	dispiay scope	resolution	precision	input impedance
t	T TC	0~400 ℃	1℃	0.2%	100K
r	R TC	0~1600℃	1℃	0.2%	100K
J	J TC	0~1200 ℃	1℃	0.2%	100K
Ĥ r E	Wre3-Wre25 tc	0 ~2300℃	1℃	0.2%	100K
b	B TC	350~1800℃	1℃	0.2%	100K
5	S TC	0 ~1600℃	1℃	0.2%	100K
Ĥ	K TC	0 ~1300 ℃	1℃	0.2%	100K
E	E TC	0~900 ℃	1℃	0.2%	100K
Pt 100	Pt100 RTD	−199.9~600℃	0.1℃	0.2%	(0.2mA)
C u50	Cu50 RTD	−50.0~150.0℃	0.1℃	0.2%	(0.2mA)
r 375	0~375 remote pressure	Low and high limit of scope can be set from −1999 to 9999	Display scope is continuous from −1999 to 9999 using 16 bit A/D sample	0.2%	(0.2mA)
0-75	0 ~75mv current divider			0.1%	100K
0-30	0~ 30 mv			0.1%	100K
0-5u	0~5v standard signal			0.1%	100K
1-5u	1~5v standard signal			0.1%	100K
10u	0~10v standard signal			0.1%	100K
0-10	0~10mA standard signal			0.1%	20 Ω
0-20	0~20mA standard signal			0.1%	20 Ω
4-20	4~20MA standard signal			0.1%	20 Ω

Note 1: 16 bit A/D device is adopted and the display value continuous changes from -1999 to 9999.

(b) PvH/PvL: display high/low limit

PvH is a display value when input signal is maximum, and PvL is a display value when input signal is minimum.

(c) rd: direct/reverse action

The reverse action is applied in heating control. If select reverse action (rd=0), output decreases when PV increases and error increases.

The direct action is applied in cooling control. If select direct action (rd=1), output decreases when PV decreases and error decreases.

(d) obty: re-transmission output type

Re-transmission output type can be selected one of the followings: 0-10mA、4-20mA、0-20mA. The Instrument can output PV as a unified analog signal. If the output is 0-5V, 1-5V and 0-10V, a resistance (250Ω or 500Ω) should be connected to corresponding terminates.

(e) EL: extraction function

When input signal is pressure difference (flow measure) and the transducer has no extraction function, this parameter should be set ON. Otherwise should be set OFF.

(f) SS: small signal removal

When input signal is pressure difference (flow measure) and small signal removal function is required, SS parameter can be set no zero value. For example, input signal is 4-20mA, set SS to 3 and get [4+（20-4）X3%]=4.48mA, so when input signal is between 4~4.48mA, the input signal is treated with 4mA.

(g) rES: delay startup

In some applications, maximum PID control output (100%) is not permitted. If maximum output (%) is computed soon after reset, this parameter can be set to delay the maximum output. For example, when rES is 80 s and 100% output is computed soon after reset, the output is delayed. The output achieves 100% in 80s after reset.

(h) uP: Power down protection

0: After reset, start the program from step PrL.

1: after reset, start the program from the executed step before power down.

(i) ModL: work mode

S-SV: Quit current step according to the setting time (no matter how much the error between PV and SV). Its unit is second.

M-SV: Quit current step according to the setting time (no matter how much the error between PV and SV). Its unit is minute.

S-PV: Quit current step according to SV, and start next step when PV reaches the current step SV. Its unit is second.

M-PV: Quit current step according to SV, start next step when PV reaches the current step SV. Its unit is minute.

SV: constant SV mode. In this mode the SV in 0001 parameter group is object value, the mode is also called single constant SV mode. In this mode the PID auto tuning function is valid, and P, I and D in 0036 parameter group is valid, all parameters in 0037 parameter group are invalid.

(j) PrL/PrH: first step and last step

When the application program skips to the step, whose number is less than the PrL value or more than the Prh value, the program will stop automatically.

3.2 Work parameter group

3.2.1 Work parameter list (password is 0036)

Symbol		Description	Address	Range	Factory set value
ALIY	ALIy	First alarm type	1000H	00 ~ 06 ; 11 ~ 16	01
ALIC	ALIC	First alarm hysteresis	1001H	0 ~ 9999	0. 0
AL2Y	AL2y	Second alarm type	1002H	00 ~ 06 ; 11 ~ 16	02
AL2C	AL2C	Second alarm hysteresis	1003H	0 ~ 9999	0. 0
P	P	Proportional band	1004H	0. 1~ 300. 0	20. 0
I	I	Integral time	1005H	0 ~ 2000	100
d	d	Derivative time	1000H	0 ~ 999	020
Ct	Ct	PID proportion cycle	1007H	0 ~ 100S	001
SF	SF	Anti-reset windup	1008H	0 ~ 9999 ℃	50
Pd	Pd	Derivative amplitude limit	1009H	0. 10~ 0. 9	0. 5
bb	bb	Range of PID action	100AH	0 ~ 9999 ℃	1000
outL	outL	Output low limit	100BH	0 ~ 100. 0 %	0. 0
outH	outH	Output high limit	100CH	0 ~ 100. 0 %	100. 0
nout	nout	Output value when input is abnormal	100DH	0 ~ 100 %	20
PSb	Psb	PV bias	100EH	−1999 ~ 9999	0. 0
FILt	FILt	Digital filter	100FH	0 ~ 3	1
End	End	End code		No option	

3.2.2 Work parameter description

(a) AL1y/AL2y: Alarm type. Event output is defined when it is set to 00 (programming call), and alarm output is defined when it is set to 01~06, 11~16. Alarm hold action is valid when its is set to 1X and invalid when 0X.The 6 alarm types are as following figures.

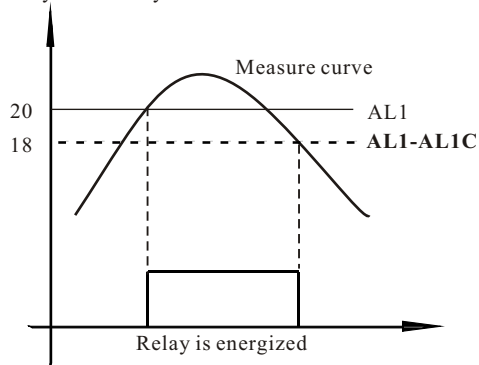High alarm (SV=100 AL1=20 AL1C=2)
AL1y=01orAL1y=11

Fig. 1

Low alarm (SV=100 AL1=20 AL1C=2)
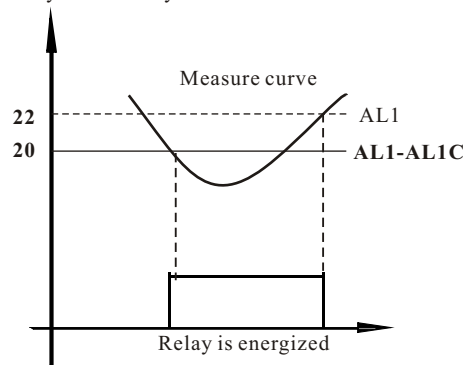AL1y=02 or AL1y=12

Fig. 2

Deviation high alarm (SV=100 AL1=20 AL1C=2)
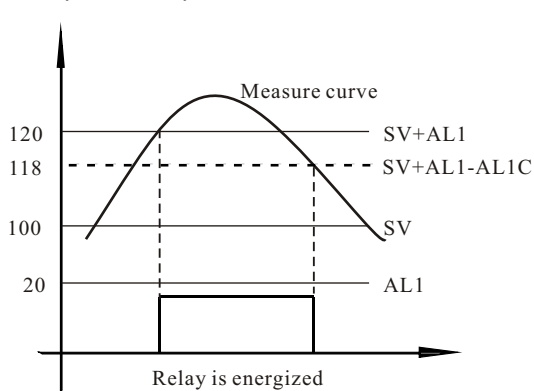AL1y=03 or AL1y=13

Fig. 3

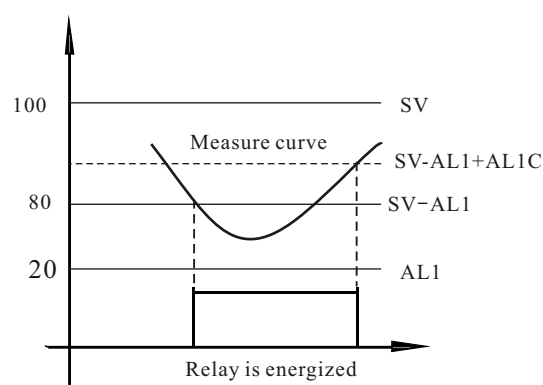Deviation low alarm (SV=100 AL1=20 AL1C=2)
AL1y=04 or AL1y=14

Fig. 4

Band alarm (SV=100 AL1=20 AL1C=2)
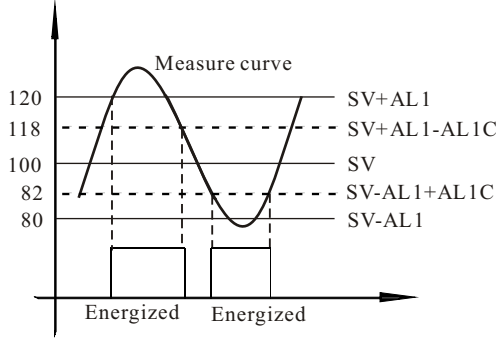AL1y=05 or AL1y=15

Fig. 5

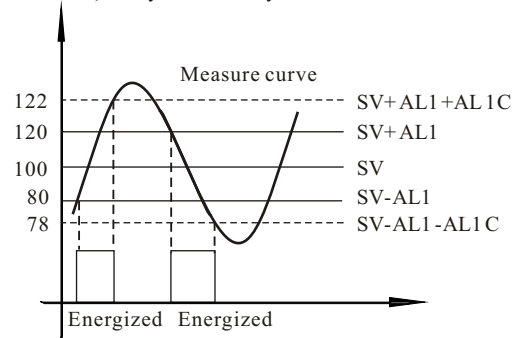Deviation high/low alarm (SV=100 AL1=20
AL1C=2) AL1y=06 or AL1y=16

Fig. 6

(b) Description of the PID parameter

P: Proportional band
  Control output rate (%) is set for measuring range. For wide proportional band, change of control output is small to deviation.

I: integral time
  The integral function compensates the offset created by proportional action. Effect of compensation is weaker for longer integral time and is intensified by shortening time. Too short integral time causes integrating hunting and may result in wary operation.

d: derivative time
  The derivative function improves stability of control by reducing overshooting of integration from expected change of the control output. Effect of compensation is weaker for shorter derivative time and is intensified for longer time. Too longer derivative time may result in oscillating operation.

SF:Anti-reset windup
  The SF introduces the integral action separation, overshooting and undershooting are restricted by the action.

Pd: Derivative amplitude limit
  The parameter is against the output jump from PV interference, there is the strongest effect when Pd=0.9 and the weakest when Pd=0.1.

bb: range of PID action
  If PV is in the range of SV±bb, output is computed with PID action, otherwise with ON-OFF action.

(c) outL/outH: output low/high limit
  Analog current output is often limited by the octuator. For example, input current of an electric control valve is 0~10mA and opening limit is 10%~90%, we should set outL to 10 and set outH to 90.

(d) nout: Output value when abnormal input
  Instrument outputs the setting value when input is abnormal.

(e) Filt: Digital filter
  When it is set to 0, the PV digital filter is turned off. When it is set to 1, 2 or 3, the digital filter action is weaker, medium or stronger, respectively.

3.3 PID parameter group

3.3.1 Parameter list (password is 0037)

Symbol		Description	Address	Range	Factory set value
$P\ l$	P1	1st P	4000H	0. 1 ～ 300. 0	20. 0
$l\ l$	I1	1st I	4001H	0～2000	100
$d\ l$	d1	1st D	4002H	0～1000	20
……	……	……	……	……	……
$P9$	P9	9th P	4018H	0. 1～300. 0	20. 0
$l9$	I9	9th I	4019H	0～2000	100
$d9$	d9	9th D	401AH	0～1000	20
End	End	Quit			

3.3.2 PID parameters description

  10 sets of PID (PID in 0036 group is the 0th) are used for different steps to improve precision of different situation (high temperature\low temperature\rise in temperature\drop in temperature). The 0th PID is used when MODL=SV

3.4 ramp/soak parameter

3.4.1 parameter list（password is 2000）

Symbol		Description		Address	Range	Factory set value
$C-0l$	C-01	PID number of 1st step		3000H	1～9	1
$t-0l$	t-01	Run time of 1st step		3001H	−1999～9999	0（Pause)
$Su0l$	Su01	SV of 1st step		3002H	−1999～9999	0
……	……	……	……	……	……	……
$C-64$	C-64	PID number of 64th step		30BDH	1～9	1
$t-64$	t-64	Run time of 64th step		30BEH	−1999～9999	0（Pause
$Su64$	Su64	SV of 64th step		30BFH	−1999～9999	0
End	End	Quit				

3.4.2 Ramp/soak parameter description

tX：
  0< tX ≤9999（S）PV should change from Svn to Svn+1 in tX seconds
  tX=0 Pause and continue by pressing the increase key

-1~-64 Skip to |tX |, CX, SvX is invalid. For example, t64=-10 means that 10th step starts when 64th step is over.

tX=-1011, The event that relay J1 is energized is output when AL1Y=00;

tX=-1010, The event that relay J1 is deenergized is output when AL1Y=00;

tX=-1021, The event that relay J2 is energized is output when AL1Y=00;

tX=-1020, The event that relay J2 is deenergized is output when AL1Y=00;

SvX: -1999~9999，SV of x step

CX: PID group Number (0~8) of the Xth step.

3.4.3 Program method

There are three methods that can be used to program.

(a) Panel program

Write and modify the program by panel keys.

This method doesn't require PC and is adaptive to small program or a little modification.

(b) PC program

Program is loaded to controller in term of parameter using PC. One instruction is loaded one time and the instruction can be read and \ verified. W/R method is described in detail in 《communication protocol》

This is the most flexible method, and it can be applied directly or expanded to new method.

(c) Factory-special application software

All programs can be written to the controller using software "SET64rs Downloader" , and the programs can be read and verified.

This method has many advantages: program is stored, copied, modified, printed and saved simply; the format of the program is fixed, and the program is easily read.

The second and third method is supported by the communication function. If these methods are used, please select the term "RS485" in ordering list.

3.4.4 Program basic format

Instruction of SET64rs program is composite of the four parts.

t-01   Sv01   C-01;   comment

t-02   Sv02   C-02;   comment

SV changes from Sv01 to Sv02 in time t-01, and rate of grade is (Sv02- Sv01)/t-01. The SV will change according to rate of grade.

The optimal PID group should be selected according to the state of controlled device.

3.4.5 Note

(a) Factory default setting status of all steps is pause status, so program should be started from P001 and go on in sequence. Txx of the idle step should be set to appropriate value or skip to noidle step.

(b) Default pattern is pause pattern when instruction is invalid. The instruction should be verified if there is abnormal pause pattern.

3.4.6 Program example

SET63X Program example: temperature PV curve of certain device
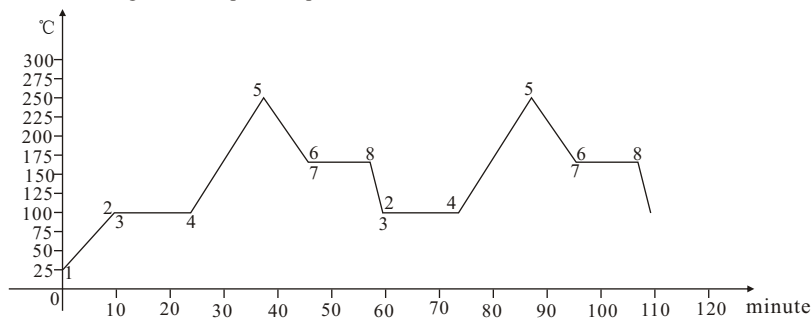
t-01=10 Sv01=25 C-01=0; Temperature rises from 25℃(Sv01) to 100℃(Sv02) in 10 minutes. Rate of grade is 7.5℃/m; Appropriate PID group is selected (for example 1 st group P1, I1, D1).

t-02=13 Sv02=100 C-02=1; Maintain constant temperature in 13 minutes; Appropriate PID group is selected (for example 2nd group).

T-03=-1011 Sv03=100 C-03=1; Relay J1 is energed, SV and PID group is constant and relay work mode is 00.

t-04=15 Sv04=100 C-04=0; Temperature rises from 100℃ to 250℃ in 15 minutes. Rate of grade is 10℃/m; Appropriate PID group is selected (for example 1st group).

t-05=8 Sv05=250 C-05=2; Tmperature descend from 250℃ to 170℃ in 8 minutes. Rate of grade is 10℃/m; Appropriate PID group is selected (for example 3rd group)

t-06=0 Sv06=170 C-06=1; Change to pause pattern and maintain constant temperature 170℃, Appropriate PID group is selected (for example 2nd group).

T-07=-1010 Sv07=170 C-07=1; Relay J1 is deenergized

t-08=3 Sv08=170 C-08=2; Start the 6th step and temperature descends to 100℃ in 3 minutes. Rate of grade is 23℃/m; Appropriate PID group is selected (for example 3rd group).

t-09=-2 Sv09=100 C-09=1; Skip to 02 step and maintain constant temperature 100℃ in 13 minutes; Appropriate PID group is selected (for example 2nd group).

So 2-8 steps are completed.

3.5 control parameter group

3.5.1 Parameter list (password is 0001)

Symbol		Description	Address	Range	Factory set value
5ᵤ	SV	Set value	0000H	−1999～9999	50.0
ЯL I	AL1	First alarm set value	0001H	−1999～9999	60.0
ЯL2	AL2	Second alarm set value	0002H	−1999～9999	40. 0
Яt	At	Auto tuning ON/OFF	0003H	0～1	0
End	End	End mark		No option	

3.5.2 Parameters description

AT: Auto tuning ON/OFF

Auto tuning is valid when MODL=SV.

When set AT to 1 and register it by pressing the ⊙key, and the AT program starts. The AT lamp flashes in AT mode (the AT action is

stopped by pressing the ⊛ key in AT mode).

When the AT is over, parameter P, I and D of 0036 group should be optimal, P, I, D of 0037 group don't change.

3.6 Reset of program and end of set

In ramp/soak control mode, input the password "8888" and press the ⊛ key to register it, the program skip to step "PRL" and start the step

Input the password "9999" and press the ⊛ key to register, the program skip to step "PRH".

3.7 Summarize

On the basis of above three parameter groups, the key operation is as following:

(a) In ramp/soak control mode, the symbol "PASS" is displayed by pressing the ⊛ key, input the password and change to corresponding parameter groups setting mode.

(b) When input password and confirm it, two parameter symbols display in two rows, the valid parameter is in upper row and flashes. The next parameter is in lower row. Select previous or next parameter by pressing the ⊗ key or the ⊘ key.

(c) When one parameter symbol flashes, the parameter can be examined and modified by pressing the ⊛ key. The parameter symbol is in upper row, parameter value is in lower row. The value can be modified using the ⊘ key and the ⊘/⊗ key.

(d) When modification of one parameter is completed, press the ⊛ key and register it. The parameter symbol is in the upper row, select previous or next parameter using the ⊗ key or ⊘ key.

(e) Repeat above operation and examine every parameter value.

Note: (a) In parameter set mode the parameter value can be registered by pressing the ⊛ key for 3 seconds and the set mode is over. If there is no operation in 60 seconds, set mode is over and the current setting value is invalid.

(b) If the parameter is modified, suggest that reset the controller and assure that the modified parameter is valid.

4．Special Function

4.1 Alarm hold

If the alarm hold function is valid, no matter there is alarm, the alarm don't output soon after reset. When there is alarm after no alarm, the alarm output. Alarm hold action can be set to be valid in ALIy and AL2y.

4.2 AT/MT undisturbed switch

The output isn't changed when work mode changes to manual mode from auto mode (For example, if the output is 45% before the mode switch, the output is still 45% when transferring to manual mode). Before transferring to auto mode, manual operation makes the PV close to the SV. This is against oscillation of the PV, and this action can make the switch more stable.

4.3 PID auto tuning

The parameters P, I and D are crucial to the control precision, the appropriate value of these parameter is relative to controlled device, so it is difficult to give a group of value for all situation. For ease use, SET63X introduces ON/OFF auto tuning function and obtains the appropriate parameter values automatically. Auto mode starts if auto tuning is completed.

SV of auto tuning should be close to the objective value.

Because ON/OFF action is applied in auto tuning mode, it is possible that the PV is oscillated in the auto tuning process, so auto tuning should be used carefully when the PV large oscillation is not permitted.

In auto tuning process abnormal interference, for example, load, transducer or operator is broke, is not permitted.

The run time of auto tuning depends on the controlled system, it can be completed in several minutes or in several hours. The auto tuning can be canceled by pressing the ⊛ key, and the parameter value doesn't change.

4.4 Adjustment of PID parameter

When the satisfactory control precision can't be obtained using parameter value form auto tuning, these parameter should be modified manually.

4.4.1 Adjustment of proportional band (P).

P is the most important parameter for control precision. System overshoot, transition time and steady-state error depend on the parameter crucially. The narrower the proportional band is, the more sensitive the output is, the quicker the response speed is. Too narrow proportional band causes ON-OFF like action with oscillation. The wider the proportional band is, the more steady the PV is. Too wide proportional band causes slow response speed.

4.4.2 Adjustment of integral time (I).

Integral function compensates offset created by proportional action. It is inverse proportional to the integral action. Too small integral time causes unstable response of PV.

4.4.3 Adjustment of derivative time (D).

Derivative action predicts the error and adjusts the output in advance. It improves the stability of control. Effect of compensation is weaker for shorter derivative time and is intensified for longer time.

To sum up of the above, the selection of these parameters should be compromise between speed and stability.

4.5 Communication protocol

For SET64rs series controller, the MODBUS_RTU is adopted. The controller communicates with the PC using RS485 transmission standard. Communication drive software of the controller is embedded in the configuration software KINGACT, MCGS, century star and etc. If user develops the drive software by himself, the detail communication protocol and test software is in CD attached with the controller.

Communication speed: 1200bps, 2400bps, 4800bps, 9600bps

Stop bit: 1

Data bit: 8

Parity bit: without

Function code 03: read

Function code 01: read the status (SV、A/M、R/D、setting、abnormal、AL2、AL1、AT) (the code is only for reading the status)

Function 05: change control pattern (set A/M to 0 or 1, set AT to 0) (the code is only for changing control pattern) detail is in protocol attached with controller.

5 Maintenance and guarantee

5.1 Maintenance

No special maintenance is required, carry the controller to factory and calibrate it when necessary.

5.2 Storage

The controller should be stored in dry, ventilate, non-corrosive environment with packing box.

5.3 Guarantee

Guarantee period is one year from sale date. Material fee should be taken because of the fault of unmerited use or beyond the guaranteed period.