User's Manual

AUTO TUNE PID CONTROLLER LC5248L-AT

SPECIFICATION

INPUT

Input Type	Thermocouple, RTD (Pt100), Current, Voltage
Display Range	Refer Table-1.1
Accuracy	± (0.25% of Full Span ± 1 count) for T/C and RTD input. ± (0.1% of Full Span ± 1 count) for Linear input.
ADC Resolution	16 bits
Display Resolution	0.1°C / 1 Count
Sampling Rate	4 Samples/Sec
CJC Error	±3.0 °C Max
Sensor open Detection	All inputs except 0-5V
Sensor Burnout current	0.25uA
RTD excitation current	0.166mA (Approx)
Allowable wiring resistance for RTD	Maximum 15 ohms/wire (Resistance between three wires should be equal)
NMRR	> 40 dB
CMRR	> 120 dB
Temp-co	< 100ppm/°C
Input Impedance	> 1MΩ (Voltage Input) 250Ω (Current Input)
Max Voltage	20VDC

DISPLAY

PV Display	4-Digit, 7-Segment, Red, Character height of 0.40"
SV Display	4-Digit, 7-Segment, Green, Character height of 0.31"
Status Indication	Individual RED Led's for Relay/SSR Status

OUTPUT TYPE

Relay output

No. Of output	2 Relays Relay-1 • For PID or ON-OFF Controlling. • Used as Alarm-1 Output if Output Type is SSR Relay-2 • Alarm-2 Output
Type	Single Change over, Two Terminals (C, NO)
Rating	5A @ 230VAC / 30VDC

SSR output

Output signal On-condition	11VDC or more
Off-condition	2VDC or less
Resolution	10 ms

POWER SUPPLY

Standard	85-265VAC/ 100-300VDC
Optional	18-36VDC
Power consumption	<5 VA

ENVIRONMENTAL CONDITION

Humidity	30% to 95% RH (Non-Condensing)
Instrument Warm-up Time	Approx. 15 minutes
Ambient Temperature	0 to 55°C
Storage Temperature	0 to 80°C

PHYSICAL

Front Bezel	48 x 48 mm
Panel Cutout	45 x 45 mm
Depth Behind The Panel	77mm
Weight	120g Approx.
Enclosure Material	ABS
Enclosure Protection	IP20
Terminal Cable Size	2.5 mm^2

Table-1.1

Input type	**Temperature Range °C**
PT100 (0.1°C)	-199.9 to 850.0
PT100 (1°C)	-200 to 850
E	-200 to 1000
J	-200 to 1200
K	-200 to 1372
T	-200 to 400
B	450 to 1800
R	0 to 1768
S	0 to 1768
***4-20mA/1-5VDC , *0-20mA/0-5VDC 0-10VDC**	-1999 to 9999 (Field Scalable)

*Use external 250ohms, 0.1% for current Input

ORDERING CODE

Model	Input		Power Supply		Output	
LC5248L-AT	1	**E**	U1	85-265VAC / 100-300VDC	**1**	Relay1 + Relay2
	2	**J**	U2	18-36VDC	**2**	SSR + Relay1
	3	**K**			**3**	SSR + Relay1 + Relay2
	4	**T**				
	5	**B**				
	6	**R**				
	7	**S**				
	9	**PT-100**				
	C	**1 to 5V**				
	D	**0 to 5V**				
	E	**4-20 mA**				
	F	**0-20mA**				
	G	**0to10V**				

SAFETY/WARNING PRECAUSTIONS

To ensure that the device can be operated safely and all functions can be used, please read these instructions carefully.
Installation and Start-up must be carried out by qualified personnel only. The relevant county-specific regulations must also be observed.
Before start-up it is particularly important to ensure:

- Terminal wiring: check that all cables are correctly connected according to the connection diagram
- All wiring must confirm to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for voltage, current and temperature rating of the system.
- Unused control terminals should not be used as jumper points as they may be internally connected, which may cause damage to the unit.

WARRANTY

Warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification.
Masibus is not liable for special, indirect or consequential damages or for loss of profit or for expenses sustained as a result of a device malfunction, incorrect application or adjustment

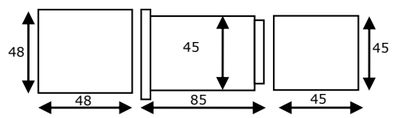
Masibus' total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

MECHANICAL INSTALLATION

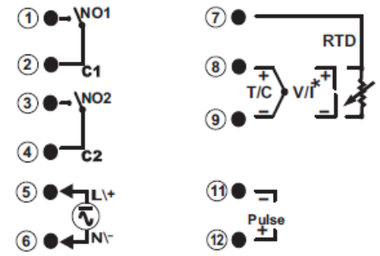
For installing the controller

1. Prepare the panel cut-out with proper dimensions as shown.
2. Remove the clamp from the controller.
3. Push the controller into the panel cut-out. Secure the controller in its place by pushing the clamp on the rear side.

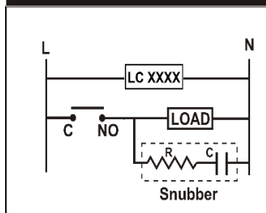
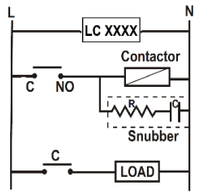
OVERALL DIMENSIONS (In mm)



TERMINAL CONNECTION



Load connection

For load current less than 0.5A	For bigger loads, use interposing relay / contactor
	

Electrical precautions during use

Electrical noise generated by switching of inductive loads can create momentary disruption, erratic display, latch up, data loss or permanent damage to the instrument. Use of snubber circuits across loads as shown above, is recommended.

PARAMETER SETTINGS

Following parameters can view or change during run time.

Press ⏬ key to show percentage power (0.0 to 100.0%).

- For Thermocouple input type, Press ⏫ key to show ambient temperature
- During manual mode, ⏬ and ⏫ key will use to modify the percentage power.
- Function of A/M key is decided by parameter selection in F.Key. If A-M, Press A/M to toggle between AUTO & MANUAL mode. If r-S, Press A/M to toggle between RUN & STOP the controlling action.
- 99.9 shows on lower display indicates 99.9% output power in manual mode.
- Following parameters can view using 🔄 and change using ⏬ or ⏫ Keys.

Display	Name	Description	Default Value	Shows only if
C1.SP (C1.SP)	Control Set Point 1	Range Depending on PV sensor type selected	100	-
A1.SP (A1.SP)	Alarm Set Point 1	Range Depending on PV sensor type selected	100	Output Type is SSR
A2.SP (A2.SP)	Alarm Set Point 2	Range Depending on PV sensor type selected	100	-

Press ⏬ and ⏫ keys simultaneously will ask to enter password.
On entering correct pass word, unit will show mode.
tUnE ConF CAL mode.

tUnE Mode

NOTE: This Menu appear for COP (Control Output Type) other than ONOF (ON-OFF)

A.TUN (A.tUn)	Auto Tune	Start / Stop Auto Tuning Process **yes** / **no**	NO	Control Type(COP) is PI or PID
PB (Pb)	Proportional Band	0 to 9999 or 0.0 to 999.9	10.0	Control Type(COP) is P or PI or PID
TI (tI)	Integral Time	0 to 1000	60	Control Type(COP) is PI or PID
TD (td)	Derivative Time	0 to 180	0	Control Type(COP) is PID
CT (Ct)	Cycle Time	For, SSR o/p: (1 – 60 sec) Relay o/p: (10 – 300 sec)	10	
O.DIR (o.dir)	Output Direction	REVERSE/Direct	0 (REV)	Control Type(COP) is P or PI or PID
MR (mr)	Manual Reset	It is used to shift PB and for critical Controlling situations. (Applicable only if Control O/P is "P") -(PB/2) to +(PB/2)	0	Control Type(COP) is P

ConF Mode

INPT (inPt)	INPUT Type	tC E / tC J / tC P / tC t / tC b / tC r / tC S / rtd.1 / rtd / 0-5u / 1-5u / 0-10	TC E	
ZERO (2Ero)	Zero	Can be set to any value within the Input Range & less the SPAN Value.	-200	If TC E
SPAN (SPAn)	Span	Can be set to any value within the Input Range & greater the ZERO Value.	1000	If TC E
DP (dP)	Decimal Point	Set position of Decimal Point on Display. 0/ 0.0/ 0.00/ 0.000	0	Input Type is Linear
***FLTR** (FLtr)	Filter	Enable or Disable Filter for PV Input(0 to 6)	3	
OFST (OFSt)	Offset	Offset to be added in PV value -1000 to 1000	0	
TSP1 (tSP1)	Type of Set Point	L-ON (Lower ON) H-ON (Higher ON)	L-ON	Control Type(COP) is ON-OFF.
OPES (oPES)	OPEN Sensor Status	Set Control O/P when Input OPEN condition. DOWN /UP	UP	
RD1 (rd1)	Relay Delay	For Relay-1 1 to 99 sec	1 sec	Control Type(COP) is ON-OFF.
HY-1 (HY-1)	Hysteresis –	Hysteresis Value (in °C) for Relay-1 during ON-OFF type Control.	1	Control Type(COP) is ON-OFF.
DISP (d.SP)	Display Set Point	Set which Set Point to shown in SV display in RUN mode	**C1.sp**	Output Type is SSR then A1.SP will

		while device is in Auto Mode [I .SP / A2 .SP / A I .SP		appear.
BRHT (brHt)	Brightness	10 to 100	100	
OT (ot)	Output Type	Output Type rELY / SSr (Factory Settable)	Relay	
COP (CoP)	Control Output Type	Select Controlling Type for Output P / P ı / P id / onoF	PID Type	ON-OFF option will not appear if OT(Output Type) is SSR
CO.LO (Co .Lo)	Control Output Low Limit in %	Control Output Low Limit in % 0.0 to 100.0 %	0.0	
CO.HI (Co .H ı)	Control Output High Limit in %	Control Output High Limit in %. 0.0 to 100.0 %	100.0	
A1TP (A ItP)	Alarm Type – 1	Refer ALARM Type 0 to 15	Pv.A.L	Output Type is SSR
A2TP (A2tP)	Alarm Type – 2	Refer ALARM Type 0 to 15	Pv.A.L	
A1HY (A IHY)	Alarm 1 Hysteresis	Set Hysteresis(in °C) for Alarm-1	1	Output Type is SSR
A2HY (A2HY)	Alarm 2 Hysteresis	Set Hysteresis(in °C) for Alarm-2	1	
A1LC (A ILC)	Alarm 1 Logic	Set Logic for Alarm-1 norñ / FLSF For Fail-Safe Logic Alarm will work completely opposite to Normal behavior	Normal	Output Type is SSR
A2LC (A2LC)	Alarm 2 Logic	Set Logic for Alarm-2 norñ / FLSF	Normal	
A1DY (A IdY)	Alarm 1 Delay	1 to 99 sec	1	Output Type is SSR
A2DY (A2 .dY)	Alarm 2 Delay	1 to 99 sec	1	
A.CJC (A .CJC)	Auto Cold Junction Compensation	nO / YES	YES	Input Type is TC
F.CJC (F .CJC)	Fix cold junction Compensation	0 to 60.0 °C	0.0	Input Type is TC & A.CJC is NO
F.KEY (F .KEY)	Function for A/M key	A-ñ(Auto-Manual) / r-S(Run-Stop) / NonE	NONE	
PASS (PASS)	Password	0 to 99	1	
VERS (vErS)	Version	Shows the Version of the Current Firmware	-	

CAL Mode

AMB (Añb)	Ambient	Ambient Adjustment	-	Input is TC
CALZ (CALZ)	Calibration Zero	Calibration Zero for PV Input (SV Display : PV)		
CALS (CALS)	Calibration Span	Calibration Span for PV Input (SV Display : PV)		

*The value of FLTR will determine the ability of filtering noise. When a large value is set, the measurement input is stabilized but the response speed is slow. Generally, if great interference exists, then you can increase parameter "FLTR" gradually. When the meter of the instrument is being examined at laboratory, "FLTR" should be set to 0 or 1 to short the response time.

CONTROL FUNCTION

ON/OFF Control ON/OFF Controller is the simplest form of temperature control device. The output from the device is either on or off, with no middle state. An on-off controller will switch the output only when the temperature crosses the set point. For heating control, the output is on when the temperature is below the set point, and off above set point.

Since the temperature crosses the set point to change the output stage, the process temperature will be cycling continually, going from below set point to above, and back below. In cases where this cycling occurs rapidly, and to prevent contactors and valves from getting damaged, an on-off differential, or "hysteresis," is added to the controller operations. On-Off hysteresis prevents the output from "chattering" or making fast, continual switches if the cycling above and below the set point occurs very rapidly.

High type (H-ON): For High type of set value, once process value reaches up to set point + Hysteresis value, relay will be ON after few seconds (as per relay delay) and it will be ON until process value goes down to Set point.

Low type (L-ON): For Low type of set value, once process value reaches down to set point – Hysteresis value relay will be ON after nearly few seconds (as per relay delay) and it will be ON until process value goes up toward Set point

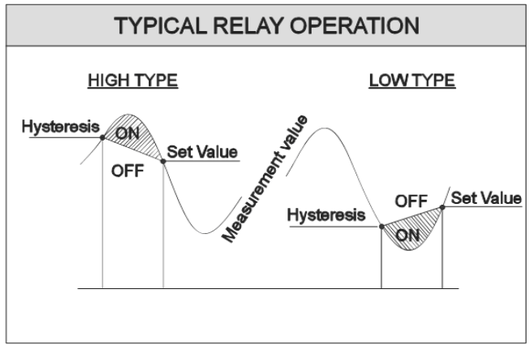
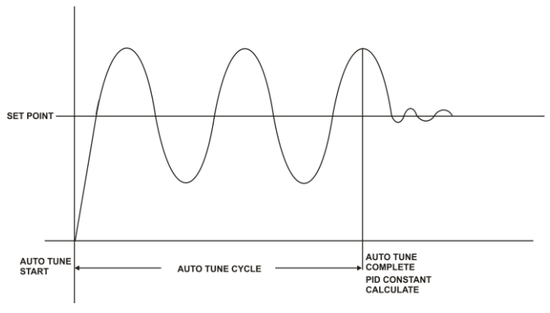


Figure 1.1: Typical Relay operation

PID Control

AUTO TUNE FUNCTION:



Auto Tuning:
The Auto tuning process is performed at set point. Temperature will oscillate around the set point during tuning process. Set a set point to a lower value if overshooting around the normal process value is likely to cause damage. To start the auto tuning process, set the desired set point, select the parameter A.TUN in TUNE menu and set it to YES. During Auto tuning lower display (SV) will flash "AT" message.
After auto tune procedure is completed, the message will be removed and controller will revert back to the PID control by using the new calculated PID values. The PID values obtained are stored in the nonvolatile memory.

Control Parameter:-

Proportional BAND:
Proportional action is the action which the control output varies in proportion to the deviation between the setting value and the processing temperature. If the proportional band is narrowed, even if the output changes by a slight variation of the processing temperature, better control results can be obtained as the offset decreases. However, if when the proportional band is narrowed too much, even slight disturbances may cause variation in the processing temperature, and control action changes to ON/OFF action and the so called hunting phenomenon occurs. Therefore, when the processing temperature comes to a balanced position near the setting value and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

Integral Time:

Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the setting point is quickened. However, the cycle of oscillation is also quickened and the control becomes unstable.

Derivative Time:

Derivative action is used to restore the change in the processing temperature according to the rate of change. It reduces the amplitude of overshoot and undershoots width. If the derivative time is shortened, restoring value becomes small, and if the derivative time is made longer, an excessive returning phenomenon may occur and the control system may be oscillated.

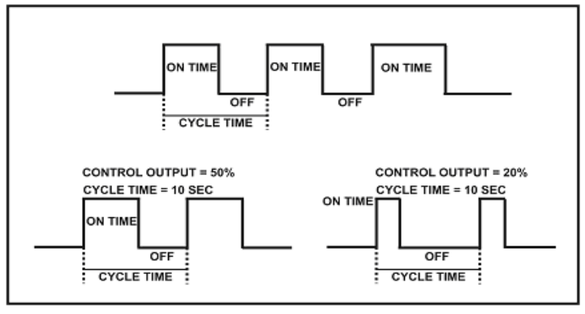
Manual Reset:

Virtually no process requires precisely 50% output on single output controls or 0% output on two output controls. Because of this many older control designs incorporated an adjustment called manual reset (also called offset on some controls). This adjustment allows the user to redefine the output requirement at the set point. A proportioning control without manual reset or Integral time (defined above) will settle out somewhere within the proportioning band but likely not on the set point.
Some controls use manual reset (as a digital user programmable value), this allows the user to preprogram the approximate output requirement at the set point to allow for quicker settling at set point when Automatic reset (Integral time) set to zero. Range for the manual reset is -50.0% to +50.0% of proportional band for LC5296-AT & -100 to 100 °C for LC5248-AT.

Cycle Time:

The Cycle time for output is the time where the output is on for percentage of that time and off for a percentage of that time, creating a portioning effect. The cycle time is only used where PI, PD or PID control action is used. The shorter the cycle time, the higher the proportionate resolution is, and better is the control.

For Relay output: Set to 10 to 300 seconds or more
For SSR output: Set to 1 to 60 seconds or more



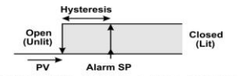
ALARM OUTPUT

Alarm Types

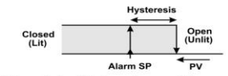
Various alarm operations are shown in the reference figure.

ALARM TYPE NO	Display message	ALARM TYPE	Note
0	**none**	None	NO operation available
1	**Pv.d.H**	Deviation High alarm	Ref figure 3
2	**Pv.d.l**	Deviation Low alarm	Ref figure 4
3	**Pv.d.r**	Deviation High & Low range alarm	Ref figure 5
4	**Pv.d.b**	Deviation High & Low Band alarm	Ref figure 6
5	**Pv.a.H**	Absolute value High alarm	Ref figure 1
6	**Pv.A.L**	Absolute value Low alarm	Ref figure 2
7	**SP.A.H**	Absolute value set point high alarm	Ref figure 7
8	**SP.A.L**	Absolute value set point low alarm	Ref figure 8
9	**P.S.d.H**	Deviation High alarm with standby	Same as figure 3
10	**P.S.d.L**	Deviation Low alarm with standby	Same as figure 4
11	**P.S.d.r**	Deviation High & Low range alarm with standby	Same as figure 5
12	**P.S.d.b**	Deviation High & Low limit alarm with standby	Same as figure 6
13	**P.S.A.H**	Absolute value High alarm with standby	Same as figure 1
14	**P.S.A.L**	Absolute value Low alarm with standby	Same as figure 2
15	**PV.-E.**	PV error (OPEN/OVER/UNDER)	Note 1

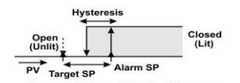
NOTE-1: The fault diagnosis output turns on in case of input burnout (PV) failure.



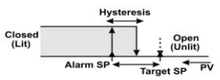
Absolute Value High Alarm
Figure: 1



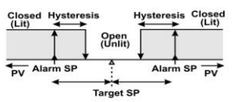
Absolute Value Low Alarm
Figure: 2



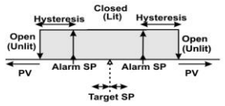
Deviation High Alarm
Figure: 3



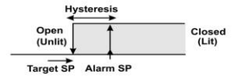
Deviation Low Alarm
Figure: 4



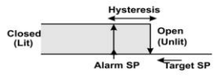
Deviation High/Low Range Alarm
Figure: 5



Deviation High/Low Band Alarm
Figure: 6



Absolute Value
Set Point High Alarm
Figure: 7



Absolute Value
Set Point Low Alarm
Figure: 8

NOTE:-

- LIT = LED on, UNLIT = LED off
- Up arrow indicate Alarm will ON from this value.
- Down arrow indicate Alarm will OFF from this value.

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