



AUTO TUNE PID CONTROLLER

SPECIFICATION			
Input type	Temp. Range°C	Input type	Temp. Range°C
PT100	-200 to 850*	T	-200 to 400*
E	-199.9 to 1000*	B	450 to 1820
J	-199.9 to 1200*	R	0 to 1768
K	-199.9 to 1372*	S	0 to 1768
1-5VDC /0-5VDC /0-10V		-1999 to 9999 (Field Scalable)	
4-20mA /0-20mA ,Ext. 250ohms			

Table-1

*0.1 °C possible for range -199.9 to 999.9

PV Input		
Input Type	Thermocouple (E, J, K, T, B, R, S), RTD (Pt100), Current, Voltage	
Display Range	Refer Table-1	
Accuracy T/C and RTD Linear input	± (0.25% of Full Span + 1 degree) ± (0.1% of Full Span + 1 count)	
ADC Resolution	16 bits	
Display Resolution	0.1 / 1 °C	
Sampling Rate	5 Samples/Sec	
CJC Error	±2.0 °C Max	
Sensor open Detection	All inputs except 0-5V, 0-10V	
Sensor Burnout current	0.25uA	
RTD excitation current	0.16mA (Approx)	
NMRR	> 40 dB	
CMRR	> 120 dB	
Temp-co	< 100ppm/°C	
Input Impedance	> 1MΩ (Voltage Input) 250Ω (Current Input)	
Max Voltage	20VDC	
Display & Keys	TC5396	TC5348
Process Value	0.8", 7 segment, White LED, 4 digits	0.4", 7 segment, White LED, 4 digits
Set Value	0.4", 7 segment, Green LED, 4 digits	0.28", 7 segment, Green LED, 4 digits
Manipulated Value	10 segment bar Orange LED	-
Keys	Enter, A/M, Increase, Decrease	
Status LEDs	For Relay, Communication,	For Relay,

	A/M,Auto tune,	Communication, Manual, SSR
Output		
Control Type		
Control Type	On/Off, P, PI, Auto tune PID, Valve Position Control (without Feedback)	
Manual Offset	±50% of P band	
Proportional Band	0.1 to 200.0 %	
Integral Time	0(off) to 1000 Sec	
Derivative Time	0(off) to 250 Sec	
Cycle Time For SSR For Relay	1 to 60 Sec 1 to 300 Sec (Hyst in on/off mode)	
Output Type	TC5396	TC5348
Relay-1	10A@30VAC/28VDC	5A@230VAC/30VDC
Relay-2	5A@230VAC/30VDC	5A@230VAC/30VDC
Relay-3,4	5A@230VAC/30VDC	NA
SSR	Optional (In lieu of RL1)	Yes*(std.)
*If SSR is selected as a Control o/p then RL1 will function as an Alarm o/p		
Relay Output (RL1)		
Function	Control	
Type	Single Change over (C, NO, NC)	
Relay Output (RL2)		
Model	TC5396	TC5348
Function	Alarm	
Type (Single Change over)	C, NO, NC	C, NO
Relay Output (RL3, RL4) For TC5396		
Function	Alarm	
Type	Single change over (C, NO)	
SSR Output		
Function	Control	
Rating	11V DC@20mA	
Analog Output 1-AO1 (Option)		
Function	Control, Retransmission	
Current	0-20mA/ 4-20mA @500Ω Max	
Voltage	0-5V/ 1-5V/ 0-10V @3 KΩ Min	
Output accuracy	±0.25% of span	
Analog Output 2-AO2 (Option)		
Function	Retransmission	
Current	0-20mA/ 4-20mA @500Ω Max	
Voltage	0-5V/ 1-5V/ 0-10V @3 KΩ Min	
Output accuracy	±0.25% of span	
Communication Output-RS485 (Option)		
Function	Read/Write all Parameters	
Protocol	Modbus RTU	
Baud Rate	9600, 19200, 38400	
Parity & Stop Bit	Parity - None, Even, Odd Stop Bit -1,2	
TPS (TC5396)	24V DC (±10%) @26mA (Current limited)	
Power Supply		
Standard	85-265VAC/ 100-300VDC	

Optional	20-36VDC
Power consumption	<10 VA (Approx)

Isolation (Withstanding voltage)

Between primary terminals* and secondary terminals**:
At least 1500 V AC for 1 minute

Between primary terminals* and grounding terminal: At least 1500 V AC for 1 minute

Between grounding terminal and secondary terminals**:
At least 1500 V AC for 1 minute

Between secondary terminals**: At least 500 V AC for 1 minute

* Primary terminals indicate power terminals and relay output terminals.

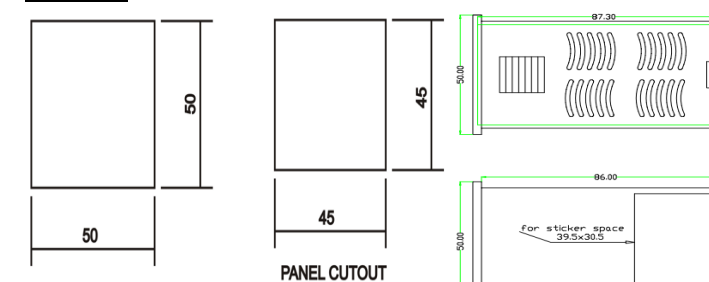
** Secondary terminals indicate analog I/O signal and Communication O/P.

Insulation resistance: 20MΩ or more at 500 V DC

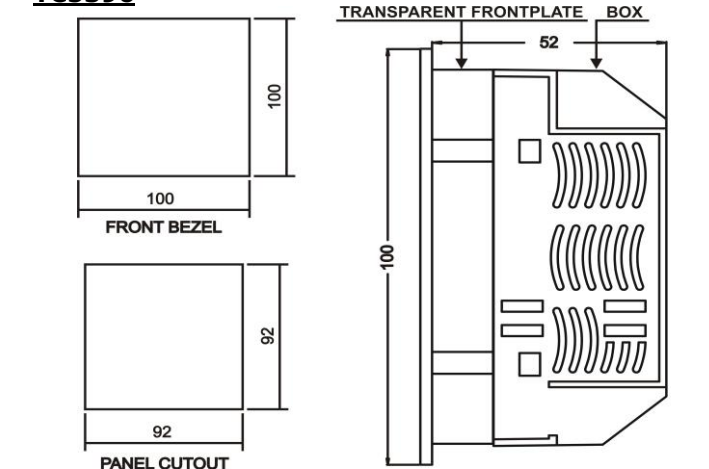
Environmental		
TEMPCO	Input to PV Display < 100ppm. Display to Retransmission and Control output < 100ppm	
Humidity	30% to 95% RH (Non-Condensing)	
Ambient Temp.	0 to 55°C	
Storage Temp.	0 to 80°C	
Physical	TC5396	TC5348
Mounting Type	Panel	
Size H x W x D mm	100 x 100 x 55	50 x 50 x 98
Front Bezel mm	100 x 100	50 x 50
Panel Cutout mm	92 mm x 92	45 x 45
Depth Behind the Panel	52 mm	95 mm
Weight	300g Approx.	110g Approx.
Enclosure Material	Front: Polycarbonate, Base: ABS	
Enclosure Protection	IP 20	
Terminal & Cable Size	Barrier type terminal, cable 2.5 mm ²	

MOUNTING DETAILS

TC5348



TC5396



All Dimensions are in mm

SAFETY/WARNING PRECAUTIONS

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:

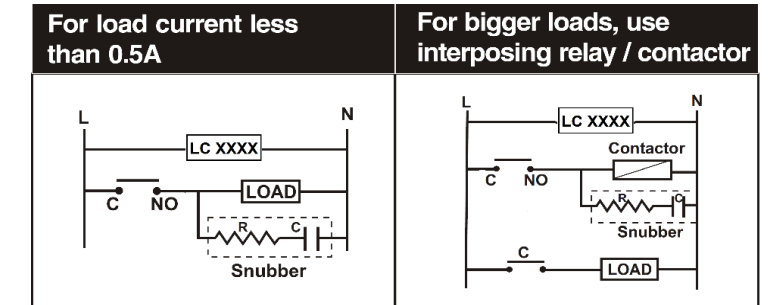
- Terminal wiring: check that all cables are correctly connected according to the connection diagram.
- All wiring must confirm to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for voltage, current and temperature rating of the system.
- Unused control 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 because 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.

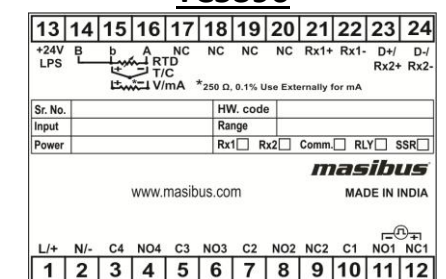
LOAD CONNECTION

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

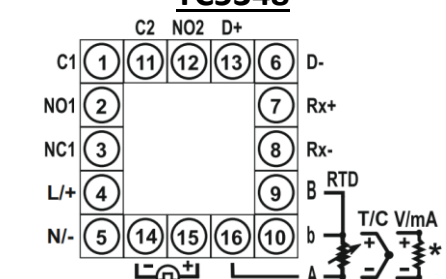


TERMINAL CONNECTION

TC5396



TC5348



*250 Ω, 0.1% Use Externally for mA

Terminal details			
Terminal	TC5 396	TC5 348	Descriptions
L/+	1	4	Power Supply Input
N/-	2	5	
C4	3	-	
NO4	4	-	For Relay-4 potential free Contacts
C3	5	-	
NO3	6	-	
C2	7	11	For Relay-2 potential free Contacts. Reverse Relay if output type is Motor position control without slide wire feedback
NO2	8	12	
NC2	9	-	
C1	10	1	For Relay-1 potential free Contacts PID/ On-Off Control o/p.Alarm-1 o/p if output type is Linear. Forward Relay if output type is Motor position control without slide wire feedback. Terminal 11,12:- SSR Pulse o/p.
NO1	11	2	
NC1	12	3	
+24V LPS	13	-	+24VDC Loop power supply. Terminal 16 is ground Reference.
B	14	9	For RTD Input Only
b/TC+/V +	15	10	For Thermocouple, RTD & Linear Input
A/TC-/V-/LPS-*	16	16	
NC	17-20	-	Not connected
Rx1+	21	7	For Rx-1 output
Rx1-	22	8	Linear type Control Output
D+/Rx2+	23	13	For Rx-2 output
D-/ Rx2-	24	6	Modbus-RTU Communication Output
SSR+	-	15	SSR Pulse o/p.
SSR-	-	14	

FRONT KEYS DESCRIPTION

Symbol		Function
TC5396	TC5348	
		Increment the Value of any Parameter. Shows ambient value for T/C Input in RUN mode. In Manual Mode this key is used to Increment the %Power.
		Decrement the Value of any Parameter. Shows %Power value if Device is in Auto Mode in RUN mode. In Manual Mode this key is used to Decrement the %Power.
		In RUN mode, shows custom display parameters selected from Level-6 menu. In Sub Menu it can be used to get to the next Parameter. It is also used to save the parameters to non-volatile memory, when user setting a proper data by Increment and decrement key for parameter configuration.
		It works as escape key, if unit is not in RUN mode. In RUN mode, if pressed for at least 2 sec, It is used to switch between Auto to Manual mode and Manual to Auto mode if function key is A/M. Shows remaining soak time when pressed if function key is selected SOK.T.
PV		Display process value. Display parameter name when user set parameter. Display error message when an error occurs.
SV		Display set value. Display parameter value of parameter in process value field when user set parameter. Display control output value when in manual mode.
MV	-	Display control output value in form of Bar scaled in 10 segments bar orange led
RL1	1	ON when Relay1 is energized & OFF otherwise.
RL2	2	ON when Relay2 is energized & OFF otherwise.

RL3	3	ON when Relay3 for TC5396 is energized, SSR For TC5348 is ON & OFF otherwise.
RL4	-	ON when Relay4 is energized & OFF otherwise.
MAN	M	ON when unit is in Manual mode. OFF when unit in Auto Mode.
AT	-	Blink when Auto tune Process is on
Tx	T	ON when device is transmitting some Data (RS-485).
Rx	R	ON when device is receiving some Data (RS-485).

CONTROL FUNCTION

ON/OFF Control (For L-ON Mode): The relay is 'ON' up to the set temperature and cuts 'OFF' above the set temperature. As the temperature of the system drops, the relay is switched 'ON' at a temperature slightly lower than the set point.

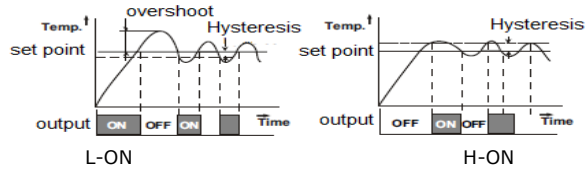


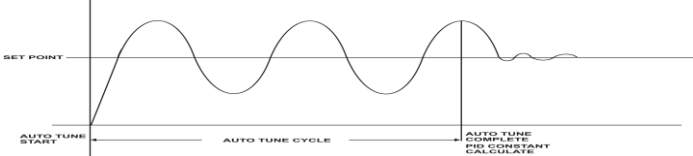
Figure 1.1: Typical Relay operation

HYSTERESIS: The difference between the temperatures at which relay switches 'ON' and at which the relay switches 'OFF' is the hysteresis or dead band.

PID Control

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.

AUTO TUNE FUNCTION:

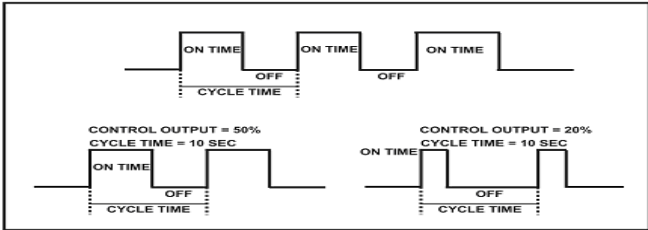


Manual Reset: After some time, the process temperature settles at some point and there is a difference between the set temperature & the controlled temperature. This difference can be removed by setting the manual reset value equal & opposite to the offset. Range for the manual reset is -50.0% to +50.0% of proportional band.

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 1 to 300 seconds or more

For SSR output: Set to 1 to 60 seconds or more



USER GUIDE

PV offset for input correction: PV offset is used for normal operation. This function can be used for adjustment to compensate for differences in measurement reading.

Settable Digital Filter: In certain application the process value is too unstable to be read. To improve this, a programmable low pass filter incorporated in the controller can be used. This is a first order IIR filter with time constant.

Settable manual reset to prevent overshoot: 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 will settle out somewhere within the proportioning band but likely not on the set point.

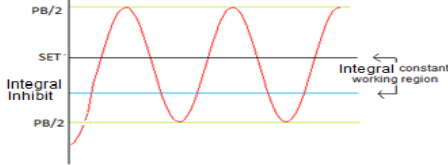
Some controls use manual reset (as a digital user programmable value),this allows the user to pre-program the approximate output requirement at the set point to allow for quicker settling at set point when Automatic reset (Integral time) set to zero.

For PI and PID control, set MR to prevent overshoot

Range for the manual reset is -50% to +50% of Proportional band.

Integral Inhibit: The Value of Integral Inhibit is in a percentage of PB. To accurate control a process at some defined set point we use PID control. But some of the processes, overshoot can occur during controlling. To overcome this type of issue we can use Integral Inhibit parameter in such type of process to control overshoot.

By use of integral inhibit "I" term (Integral constant) function is limited in specific region of Proportional band (PB).



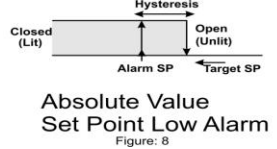
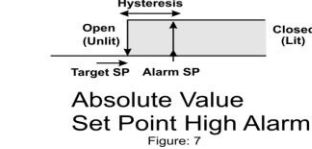
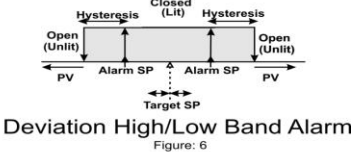
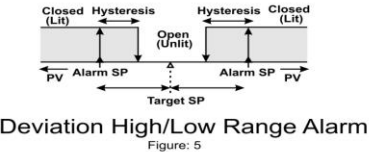
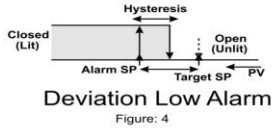
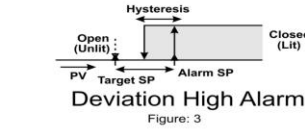
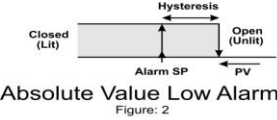
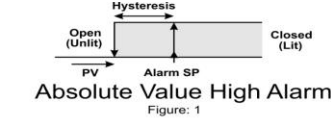
ALARM TYPES

Various alarm operations are shown in the reference figure.

	Display message	ALARM TYPE		Display message	ALARM TYPE
1	none	None	9	SPAL	Absolute value set point low alarm
2	PvdH	Deviation High alarm	10	PSdH	Deviation High alarm with standby
3	PvdL	Deviation Low alarm	11	PSdL	Deviation Low alarm with standby
4	Pvdr	Deviation High & Low range alarm	12	PSdr	Deviation High & Low range alarm with standby
5	Pvdb	Deviation High & Low Band alarm	13	PSdb	Deviation High & Low limit alarm with standby
6	PvaH	Absolute value High alarm	14	PSAH	Absolute value High alarm with standby
7	PvAL	Absolute value Low alarm	15	PSAL	Absolute value Low alarm with standby
8	SPAH	Absolute value set point high alarm	16	PV-E	PV error (OPEN/OVER/UNDER)
17	E-Sk	End Of Segment			

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

NOTE-2: End Of Segment output turns on in case of Soak completed.



NOTE: -

LIT = LED on, UNLIT = LED off

Up arrow indicate Alarm will ON from this value.

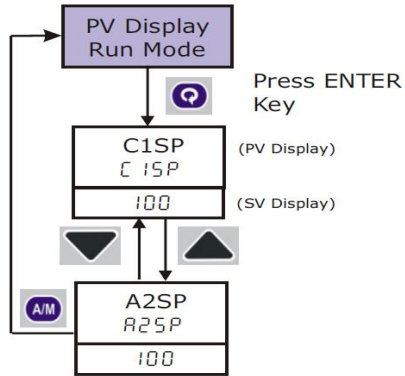
Down arrow indicate Alarm will OFF from this value.

Standby operation:

For alarm types, 9 to 14, the relay action happens only after the PV has crossed the SP after power on.

Example: How to change SET POINT:-

C1SP and A2SP will be shown in operator mode if they are selected in one of the SELECT Display Parameter from [LEVEL-6](#) Menu. Here "SELECT display 1"(DS1) is set for "1"(C1SP) and "SELECT display 2"(DS2)is set for 2 (A2SP).



NOTE: ALL other parameters can EDIT according to the above steps.

For operation manual please visit www.masibus.com

Specifications are subject to change without notice due to Continuous improvements.

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