

TEMPERATURE CONTROLLER

Catalogue Number : TCS4T2A0 & TCS4T300



TCS4T2A0
TCS4T300

FEATURES

- Compact Size, Lower depth of 65mm
- Wide auxiliary supply voltage range 90 -270V AC/DC.
- Configurable Output : Relay or 12V, 50mA SSR drive.
- Universal Input Capability: Thermocouple & PT100.
- IP-65 Front panel Protection.
- Sensor Break, Over Range & Under range detection, SSR short circuit.
- Auxiliary output for Alarm indication.
- Indication for Relay output, Autotune.
- Confirms to CE and EMC directive.

CAUTION

- Installation should be done by skilled person only, avoid incorrect connections
- When extending the thermocouple lead wires, always use thermocouple compensation wires for wiring
- For RTD sensor, use a wiring material with a small lead resistance (5Ω max per line) & no resistance differentials among 3 wires
- Product should be cleaned with a clean soft cloth & Do not use isopropyl alcohol or any other cleaning agent to avoid blockage of ventilating parts
- Use of contactors is recommended if load exceeds the contact rating Please see Inductive load category
- When replacing the sensor, please turn OFF the power

TECHNICAL SPECIFICATIONS

Supply Characteristics	
Rated Supply voltage (Un)	90V to 270V AC/DC
Supply frequency	47/ 63 Hz
Typical Power Consumption	6VA @240VAC
Functional Characteristics	
Sensor Inputs (IEC) (mV input is applicable for TCS4T300)	1) Thermocouple (J, K, T, R & S) 2) RTD (Pt-100, 3-wire, 2-wire) For 2 wire RTD short terminal number 9-10 3) mV input : -5 to 56mV
Sensor Measurement Range	J-type °C -199 to 750 °F -326 to 1382
	K-type °C -199 to 1350 °F -306 to 2462
	T-type °C -199 to 400 °F -326 to 752
	R & S-type °C 0 to 1750 °F 32 to 3182
	RTD (PT-100) °C -200 to 850 °F -328 to 1562
Resolution	For J,K,T & PT100 : 0.1/1°C For R & S : 1°C Fixed -5 to 60 mV: 0.01/0.1/1°C
Measurement Accuracy	TC: ±0.5% of PV or ±2°C (Higher one) ±1 digit. R & S: ±0.5% of PV or ±2°C (Higher one) ±1 digit. RTD: ±0.5% of PV or ±3°C (Higher one) ±1 digit. mV: ±0.1% of FS
Signal Sampling Time	50 mS
Key De-bouncing time	30 mS
Error Indications	• Sensor open/Break error
	• Over range error
	• Under range error
	• Error in auto tune
	• SSR short circuit detection

NOTE

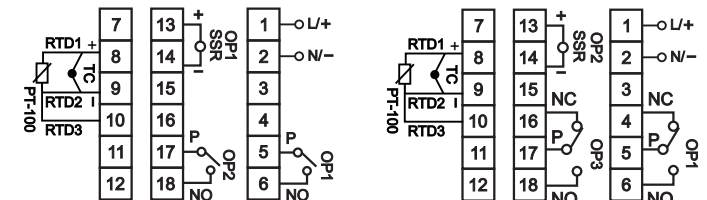
- 20 Min Warm-up time for all Thermocouple sensor
- Accuracy ±10°C over the temperature range & under influence of electromagnetic environment .
- Product innovation being a continuous process, we reserve the right to alter specifications without any prior notice
- Ensure that the input sensor connected at the terminals and the input type set in the product configuration are the same.
- To allow the heat to escape, do not block the area around the product. Do not block the ventilation holes around the product.
- To avoid inductive noise, do not wire power lines together with or parallel along with sensor cables

Environmental Parameters	
Operating Temperature	0 °C to 60 °C
Storage Temperature	-20 °C to 75 °C
Humidity	85% RH (Without condensation)
Altitude	2000 meters (Max)
Pollution Degree	2
Over voltage category	II
Mechanical Parameters	
Degree of protection	Front fascia -IP 65 , Enclosure - IP 30 & Terminals- IP 20
Housing	UL94-00
Mounting	Panel Mounting
Dimensions (L X W X D)	48 x 48 x 65 in mm
Weight (Unpacked)	95 gm Approx. (TCS4T2A0 & TCS4T300)

Output Characteristics		
MODEL	TCS4T2A0	TCS4T300
Output 1 Relay/SSR	SPST, 10A @250VAC/ 24V DC OR SSR 12Vdc, 50mA	SPDT, 10A @ 250VAC/ 24V DC
Output 2	SPST, 5A @250VAC/ 24VDC	SSR* 12Vdc, 50mA
Output 3	Not Applicable	SPDT, 5A @ 250VAC/ 24V DC
Contact arrangement	Relay 1 : 1 C/O (5,6) Relay 2 : 1 C/O (17,18)	Relay 1 : 1 C/O (4,5,6) Relay 2 : 1 C/O (16,17,18)
Contact Material	AgNi	
Mechanical Life	1 × 10 ⁷ Operations	
Electrical Life	1 × 10 ⁵ Operations	
SSR O/P Voltage	12VDC, 50mA (Max)	

* Note- If all 3 o/p are configured, then SSR current rating will be 12Vdc, 25mA & if 2 o/p is configured the it will be 12Vdc, 50mA for cat_id TCS4T300

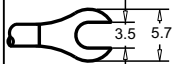
CONNECTION DIAGRAM



TCS4T2A0

TCS4T300

TERMINAL TORQUE AND CAPACITY

Tightening Torque	0.5 Nm(4.5 LB.in) Terminal Screw - M3
	1 x 2.5 mm ² Wire with Lug AWG: 1 X 22 to 12

ELECTROMAGNETIC COMPATIBILITY

Product Standard IEC 61326

EMI/ EMC TEST

Harmonic Current Emissions	IEC 61000-3-2 Class A
Voltage Flicker and Fluctuations	IEC 61000-3-3 Class A
ESD	IEC 61000-4-2 Level 3
Radiated Susceptibility	IEC 61000-4-3 Level 3
Electrical Fast Transients	IEC 61000-4-4 Level 4
Surge	IEC 61000-4-5 Level 3
Conducted Susceptibility	IEC 61000-4-6 Level 3
Power Frequency Magnetic Field	IEC 61000-4-8
Voltage Dips & Interruptions (AC)	IEC 61000-4-11
Voltage Dips & Interruptions (DC)	IEC 61000-4-29
Conducted Emission	CISPR 11 Class A
Radiated Emission	CISPR 11 Class A

SAFETY DATA

Dielectric strength(Input & Output)	IEC 60255-5 Level 2kV
Impulse Voltage between input and output	IEC 60255-5 Level 4kV
Insulation Resistance	UL 508, >100MΩ
Leakage Current	UL 508, <3.5mA
Single Fault test	IEC 61010-1

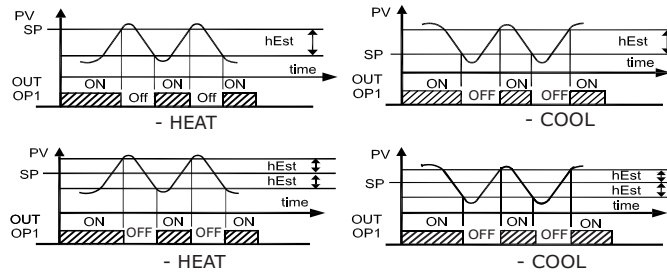
ENVIRONMENTAL DATA

Cold Heat	IEC 60068-2-1
Dry Heat	IEC 60068-2-2
Vibration	IEC 60068-2-6
Repetitive Shock	IEC60068-2-27
Non-repetitive Shock	IEC60068-2-27

USER GUIDE

CONTROL ACTION:=>

1) ON/OFF Control: Parameters regarding ON/OFF control are placed under DN (Down) in Input menu .This type of control can be set by programming parameter " " = for ON-OFF action with symmetric hysteresis OR for ON-OFF action with asymmetric hysteresis. It drives the output programmed as COP ,depending on the measured temperature value, on set point, function mode () and on the hysteresis ().In case of reverse action i.e. HEAT being set on par. "F " menu, the controller activates the output when the process value "PV" goes below [-]. It deactivates the output when the PV goes above " + " in case of symmetric ON-OFF control and above " " in case of Asymmetric ON-OFF control. Similarly in case of direct action i.e. COOL being set on par. " ", the controller activates the output when the process value "PV" goes above ' + ' & deactivates the output when "PV" goes below ' - ' in case of symmetric ON-OFF control & " " in case of Asymmetric ON-OFF control.



2) PID Control: Parameters regarding PID control are placed under DN (Down) key in Input menu .This type of control can be set by programming parameter "con"= PID. A PID controller depending upon the effective setpoint "SP", function "fun" and on the instrument's PID algorithm the control output is calculated.

The PID control algorithm foresees the setting of following parameter:
 Pb: Proportional band
 Int: integral Time
 Der: derivative Time
 Ct : Cycle time

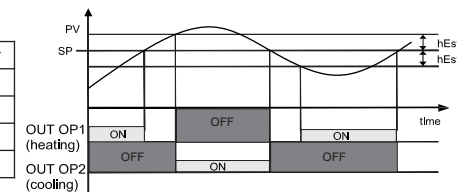
3)Double acting PID Control: The double action PID control is used to control processes where there is an element which causes a positive increase in temperature (ex.Heating) and an element which causes a decrease in temperature (cooling). This type of control is selected by setting outputs/Function as HEAT & COOL. The effective set Point "SP" and the instruments algorithm decides the controller output of Double Action PID control. The cycle times "hct" (Heat cycle time: for output acting on heater) and "cct" (cool cycle time: for output acting on cooler) should have low value with frequent intervention of control outputs, so that good stability of process variable can be achieved, in case of fast processes. It is recommended to use solid state relays to drive actuators. The Double Action PID control algorithm needs the programming of following parameters:

Pb: Proportional band
 Int: integral Time
 Der: derivative Time
 hCt: Heat cycle time
 cct: Cool cycle time
 rS: Manual reset (If Int=0)
 coEF: Coefficient Relation between power heating and cooling element. Range between 0.1 to 10.
 coEF > 1: Represents that the cooling element is stronger than heating element.
 coEF = 1: Represents that the heating and cooling element are equally strong.
 coEF < 1: Represents that the heating element is stronger than cooling element.

4) Neutral Zone ON/OFF Control (nr): Parameters regarding to neutral zone ON/OFF control are listed in the input group. This type of control can be set when two outputs configured by parameter OP1 as heater and OP2 as cooler and the parameters "cont" = nrzn. The neutral zone control is used to control processes in which there is an element which causes a positive increase in temperature (eg. Heater, Humidifier etc.) and an element which causes decrease in temperature (e.g. Cooler, de-humidifier, etc.) Depending on measurements of effective set point "SP" and on hysteresis "hEST", the control functions works on programmed outputs. The controller activates the output configured as heater when process value goes below [SP-hEst] and deactivates it once the PV reaches SP. Further it activates the output configured on cooler when process value goes above [SP+hEst]. The cooler output is deactivated when PV reaches SP again.

Note: This type of control is applicable for double acting cat ids only.

Condition	Heater	Cooler
PV < [SP-hEST]	ON	OFF
PV=SP	OFF	OFF
PV >[SP+hEST]	OFF	ON
PV = SP	OFF	OFF



cmdc Menu : Compressor duty cycle is used to protect compressor short cycling. It is a time based activation of the compressor. The activation of compressor can be avoided till the time set on parameter "cmdc",thus providing the delay. Time programmed on cmdc is counted starting from last output deactivation and then even if the regulator requires to switch on the corresponding output, the activation is delayed till the time set on "cmdc" elapses.

Note : This menu is visible only when control type is Neutral zone

Auto tuning: Parameters regarding Auto tuning are placed under UP key in regulator (reg) menu.

This Auto tuning can be set by programming parameter "TUNE"= for Auto tune action with " " if using heater or " " if using cooler. It drives the output programmed as [in STATUS], depending on the setting:

"TEP" - Tune at every Power ON.

"T1P" - Tune at first power ON.

"TMN" - Tune manually.

"TSP" - Tune at every set point change.

The condition needs to satisfy for to start Auto tune For Ag1 & Ag2:

If " / " is " " ; PV<[SP - |SP/3|]

PV < [SP - |SP/5|] if soft start is configured

If " / " is " " ; PV>[SP + |SP/3|]

PV>[SP + |SP/5|] If Soft start is configured

If the PV condition is not satisfied at start of auto tune, display will shows " " message and device works according to previous set program of PID.

Rate () & Offset (): Product can be re-calibrated according to application needs, by using par. " " and " ". If " " = 1.00, then using par " ", it is possible to set positive or negative offset that is simply added to the value read by the probe. If the offset set is not to be constant for all measurements, it is possible to operate the calibration on any of two points.

In this case, in order to decide which values to program on par.

" " and " ", the following formulae must be applied:

$$\frac{y_2 - y_1}{x_2 - x_1} = \text{rate} * x_2$$

$$y = x * \text{rate} + \text{offset}$$

Where, y1 = Measured temperature 1

x1 = temperature displayed by instrument

y2 = Measured temperature 2

x2 = temperature displayed by instrument.

The instrument thus visualizes the temperature as:

$$y = x * \text{rate} + \text{offset}$$

where y = displayed value and x = measured value.

Offset is placed under DN (Down) in Input menu & rate is placed under enter key in advance "Adv" menu option.

Soft Start: All parameters referring to the soft start functioning are contained in the group "rEg". The soft start functioning allows limitation of output power when instrument is switched on for a limited period of time. Following parameters are needed:

"SSt" - Soft start time in hh: mm

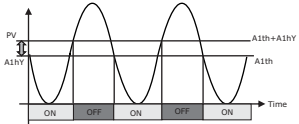
"SSth" - Soft start threshold & "StP" - Soft start power

Soft start functionality will abort when sst or ssth whichever earlier is met.

ALARMS

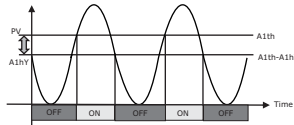
1. Absolute low ("AbLO" on display): Alarm is activated if PV goes below A1th and is deactivated if PV goes above (A1th+A1hy).

Menu	Sub menu	Option
AL1/AL2	A1tY	AbLo



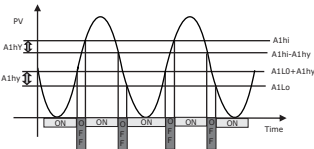
2. Absolute high ("AbhI" on display): Alarm is activated if PV goes above A1th and is deactivated if PV goes below (A1th-A1hy).

Menu	Sub menu	Option
AL1/AL2	A1tY	Abhi



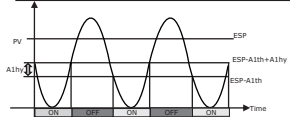
3. Absolute band ("AbbA" on display): Alarm is activated if PV goes above A1hi or below A1Lo. It is deactivated if it goes below (A1hi-A1hy) or above (A1Lo+A1hy).

Menu	Sub menu	Options
AL1/AL2	A1tY	AbbA



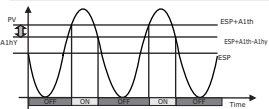
4. Deviation low ("dELo" on display): Alarm is activated if PV goes below (Effective Set Point(ESP) - A1th) and is deactivated when it goes above (Effective Set Point (ESP)-A1th + A1hy).

Menu	Sub menu	Options
AL1/AL2	A1tY	dELo



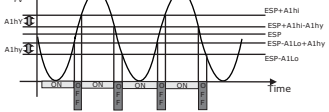
5. Deviation high ("dEHi" on display): Alarm is activated when PV goes above Effective Set Point(ESP) +A1th) and is deactivated When it goes below (Effective Set Point(ESP) + A1th-A1hy).

Menu	Sub menu	Option
AL1/AL2	A1tY	dEHi



6. Deviation band ("dEbA" on display): Alarm is activated when PV goes above (Effective Set Point(ESP) + A1hi) or below (Effective Set Point(ESP) - A1Lo) and is deactivated when PV goes below (Effective Set Point (ESP)+ A1hi - A1hy) or above (Effective Set Point(ESP) - A1Lo + A1hy).

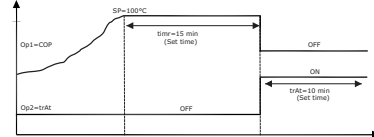
Menu	Sub menu	Option
AL1/AL2	A1tY	dEbA



Alarm Functions : (Applicable only for TCS4T300)

Sr	Value	Details	Application
1	0	Normal Activation: When alarm condition occurs. Deactivation: When the alarm condition disappears.	Normal
2	1	Acknowledged Activation: When alarm condition occurs. Deactivation: 1. When the alarm condition disappears. 2. When Configurable key programmed for alarm acknowledgment and press in alarm condition.	To ignore the alarm condition
3	2	Delayed Activation: delayed by time set in A1dL parameter after occurrence of the alarm condition. Deactivation: When the alarm condition disappears. Note: During the delay if the alarm condition disappears, alarm will not be generated.	To delay the alarm generation, some times alarm can be generated for shorter time due to some disturbance in system.
4	4	Latched Activation: When alarm condition occurs. Deactivation: When Configurable key programmed for alarm acknowledgment and press once alarm generated. Note: Alarm will not get automatically deactivated once generated.	To record or draw attention of alarm generation condition every time. Since no automatic of alarm.

Timer: 1) When PV value reach or cross to SP then the timer will start, during this process Op1=cop will be in controlling action.
2) OP2 and OP3 can be assign to Timer alarm (Only for TCS4T300)
3) Timer functionality works in both PID & in ON-OFF mode. For e.g: When OP1 reaches to SP=100°C then the timer will start, Timer will be on for timr=15 minutes then after completing timer time Op1 will be continues OFF and "ovEr" will displays on lower display. If alarm is configure to timer then alarm will be ON as the timer time is elapsed.



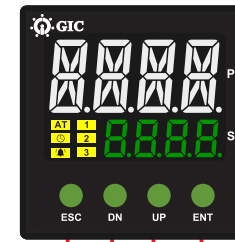
Output in case of measurement error: In case of measurement error (over range/under range/sensor break), the instrument supplies the power as programmed on parameters "oPP". In case of PID control, the power output is as a percentage of cycle time. In case of ON/OFF control, the Cycle time is automatically considered as 20s ("e.g. In event of probe error with ON/OFF control and "oPP = 50" the control output will be activated for 10s and deactivated for 10s till measurement error remains.)
If No Error

Controller	Output Power
PID	As per % of cycle time
On/Off	20 Secs

If Error

Controller	Output Power
Any	As per programmed in opp

TCS4T2A0 Menu flow



Press ENT key 2 Sec Main menu

Display value	Parameter Description	Default value	Range
Inp	Input menu	Refer INP menu flow	
REG	Regulator menu	Refer REG menu flow	
Pwd	Password	Dis	DIS/EN EN : 0 to 9950
F.rSt	Factory reset	No	NO/YES (If yes, DNE will display & product will be factory reset)
AdV	Advance menu	No	NO/YES

Press ESC key for 2 Sec

Display value	Parameter Description	Default value	Range
Sp1	Set Point 1	- - -	SPLL to SPHL
Sp2	Set Point 2	- - -	SPLL to SPHL
Sp3	Set Point 3	- - -	SPLL to SPHL
ESP	Effective Set Point	SPI	SP1,SP2,SP3

Note : SP1, SP2 & SP3 range will be updated as per Select sensor SPLL & SPHL.

Press DN key for 2 Sec Input menu (INP)

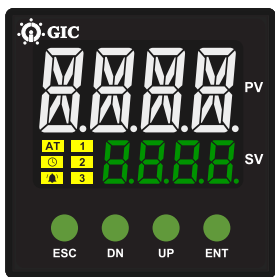
Display value	Parameter Description	Default value	Range
SEnS	Sensor	J	J/K/T/R/S/PT1
cop	Controller Output	RLY	RLY/SSR
CONT	Control action	PID	PID/ONFS/ONFA
FUn1	Function 1	HEAT	HEAT/COOL/OFF
Unit	Unit	C	°C/°F
DP	Decimal Point	1	1/0.1
FUn2	Function 2	OFF	HEAT/COOL/OFF/ALM
OfSt	Offset	0	-1999 to 9999

Note : Below Alarm menu will be visible if FUN2=ALM

ALM	Alarm	1	ABLO/ABHI/ABBA/DELO/DEHI/DEBA
ALo	Alarm Low	0	-1999 to AHI
AHI	Alarm High	100	ALO to 9999
ALTh	Alarm threshold	0	-1999 to 9999
ALHy	Alarm Hysteresis	0	0 to 9999

Press UP key for 2 Sec Regulator menu (REG)

Display value	Parameter Description	Default value	Range
TuNE	Auto tune	Toff	TOFF/TMN/T1P/TSP/TEP
ALGo	Controlling Algorithm	Aq1	AG1/AG2/AG3
Pb	Proportional Band	64	1 to 9999
int	Integral time	1380	0 to 9999 S
DER	Integral time	345	0 to 9999 S
cyt	Cycle time	15	1 to 130 S
CCT	Cool cycle time	15	1 to 130 S
RS	Manual reset	0.0	Double Acting: -100.0 to 100.0 Single Acting: 0.0 to 100.0
RS menu will be visible if Int=0			
TImEr	Timer time	OFF	OFF to 9999 m
SPLL	Set point low limit	-199	Low value of Selected sensor to High value of Selected sensor
SPHL	Set point high limit	750	Low value of Selected sensor to High value of Selected sensor
rATE	RATE	1.000	0.001 to 2.000
DUR	Display update rate	1	1 to 100
DISP	Lower Display Configurable	SP	SP,COP,Timer, Unit,CJC
Hyst menu will be visible if CONT= ONFS or ONFA			
HYST	Hysteresis	0	0 to 9999



Press ENT key 2 Sec

Main menu

Display value	Parameter Description	Default value	Range
Op1	Output 1	HEAt	HEAT/COOL/OFF
Op2	Output 2	OFF	HEAT/COOL/AL1/AL2/SENB/LBRK/TRAL/OFF
Op3	Output 3	OFF	HEAT/COOL/AL1/AL2/SENB/LBRK/TRAL/OFF
Inp	Input menu	Refer INP menu flow	
REG	Regulator menu	Refer REG menu flow	
Pwd	Password	Dis	DIS/EN
FrSt	Factory reset	No	NO/YES <small>(If yes, DNE will display & product will be factory reset)</small>
AdV	Advance menu	No	NO/YES

Press ESC key for 2 Sec

Display value	Parameter Description	Default value	Range
Sp1	Set Point 1	- - -	SPLL to SPHL
Sp2	Set Point 2	- - -	SPLL to SPHL
Sp3	Set Point 3	- - -	SPLL to SPHL
ESP	Effective Set Point	SPI	SP1,SP2,SP3

Note : SP1, SP2 & SP3 range will be updated as per Select sensor SPLL & SPHL.

Press UP key for 2 Sec

Regulator menu (REG)

Display value	Parameter Description	Default value	Range
TUNE	Auto tune	Toff	TOFF/TMN/T1P/TSP/TEP
ALGo	Controlling Algorithm	Aq1	AG1/AG2/AG3
Pb	Proportional Band	64	1 to 9999
int	Integral time	180	0 to 9999 S
DER	Derivative time	345	1 to 9999
cyT	Cycle time	15	1 to 130 S
cCr	Cool cycle time	15	1 to 130 S
RS	Manual reset	0.0	Double Acting: -100.0 to 100.0 Single Acting: 0.0 to 100.0
TIMR	Timer time	OFF	OFF to 9999 m
SPLL	Set point low limit	.199	Low value of Selected sensor to High value of Selected sensor
SPHL	Set point high limit	750	Low value of Selected sensor to High value of Selected sensor
RATE	Rate	1.000	0.001 to 2.000
DUR	Display update rate	1	1 to 100
DISP	Lower Display Configurable	SP	SP,COP,Timr, Unit,CJC
Hyst menu will be visible if CONT= ONFS or ONFA			
HYST	Hysteresis	0	0 to 9999

Press DN key for 2 Sec
Input menu (INP)

Display value	Parameter Description	Default value	Range
SEnS	Sensor	J	J/K/T/R/S/PT1/-5.60
ISCL	Analog input low	.5	-1999 to 9999
ISCH	Analog input high	60	-1999 to 9999
AIRL	Analog input range low	.5.00	-5.00 to AIRH
AIRH	Analog input range High	60.00	AIRL to 60.00
CONT	Control action	PID	PID/ONFS/ONFA/NRZA
Unir	Unit	C	°C/°F
DP	Decimal Point	1	J,K,T,PT100 : 0.1/1°C R & S : 1°C Fixed mV: 0.01/0.1/1°C
OfSt	Offset	0	-1999 to 9999

Alarm 1, Timer Alarm & Loop break menu

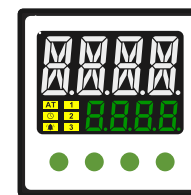
Display value	Parameter Description	Default value	Range
AlTy	Alarm 1 type	ABLO	ABLO/ABHI/ABBA/DELO/DEHI/DEBA
AISP	Alarm 1 SP	EFSP	SP1/SP2/SP3/EFPS
AlLo	Alarm 1 Low	0	-1999 to A1HI
AlHI	Alarm 1 High	100	A1LO to 9999
AITH	Alarm 1 threshold	0	-1999 to 9999
AlHY	Alarm 1 hysteresis	0	0 to 9999
AIFN	Alarm 1 function	off	OFF/ACK/LTCH/DELY
AIDY	Alarm1 delay	off	Off to 9999 Sec
LBRK & TRAL menu will be visible if it is selected in OP menu			
LBRK	Loop break time	off	Off to 9999 Sec
TRAT	Timer Alarm time	off	Off to 9999 Sec

Note: Menu for Alarm 2 are same as Alarm 1

Advance menu (Applicable for TCS4T2A0 & TCS4T300)

Display value	Parameter Description	Default value	Range
CJC	Cold junction compensation	EN	EN/DIS
CMDC	Compressor duty cycle	0	0 to 9999 Sec
COEF	Cool coefficient	0.1	0.1 to 10.0
OPE	Output Power error	0.0	0.0 to 100.0 %
IUR	Input update rate	1	1 to 100
ACRF	Accept reject filter	DSBL	DSBL/ENBL
ACRN	Accept reject count	5	3 to 20
Soft start function is applicable for TCS4T300			
SST	Soft start time	off	Off, 1 to 999 Min
SSP	Soft start power	00.0	-100 to 100
SST	Soft start threshold	0	-1999 to 9999

FRONT FACIA

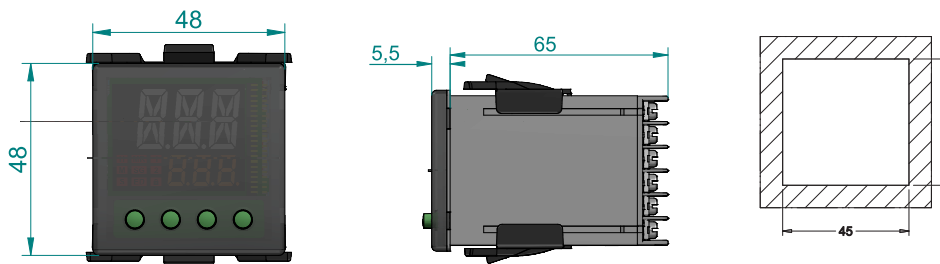


Front Keys Description

Sr. no	Display/Indicatio	Description
1	ESC (Escape key)	To exit from main menu. To return to home screen. To abort changed value or parameter. Press 2 sec to display SP menu.
2	DN (Down key)	Press once to display the effective set value. To decrement the value.
3	UP (Up key)	Press once to display the set value. To increment the value.
4	ENT (Enter key)	Press 2 sec to enter into the main menu. To save & move to next parameter. To acknowledge alarm condition.

Sr.no	Display/Indicatio	Description
1	PV	To display the Process Value
2	SV	To display the Set Value
3	OP/[1]	To indicate the LED for Output 1
4	OP/[2]	To indicate the LED for Output 2
5	OP/[3]	To indicate the LED for Output 3
6	AT	To indicate the LED for Auto tuning process
7	[Timer icon]	To indicate that Timer functionality is in process
8	[Warning icon]	Not applicable

MOUNTING DIMENSION (mm)



RECOMMENDED PANEL CUTOUT
45 mmX 45 mm +0.5 mm

E-WASTE REGULATORY NOTICE



Kindly treat, recycle or dispose of this equipment in an environmentally sound manner after End of Life, as per WEEE (Waste Electrical and Electronic Equipment) regulations or as per local norms; or hand it over to General Industrial Controls Pvt. Ltd, through website <https://www.gicindia.com/get-in-touch/>

TEMPERATURE CONTROLLER



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⚠ CAUTION:

1. Always follow instructions stated in this product booklet.
2. Before installation, check to ensure that specifications agree with intended application.
3. Installation must be done by skilled technician.
4. Automation and controlled devices must be properly “installed” so that they are protected against any risk of involuntary actuations.
5. Suitable dampers should be provided in event of excessive vibrations.
6. Do not route sensor wires along with power cables.

1.0 CATALOG DESCRIPTION:

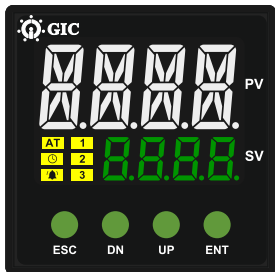
CAT ID	Action	Analog I/P	O/P 1 & O/P 2	O/P 3	Analog O/P	Modbus	CT
TCS4U4A0	Dual	YES	RELAY	RELAY	YES	NA	YES
TCS4U50C	Dual	YES	RELAY	SSR	YES	YES	NA
TCS4U40C	Dual	YES	RELAY	RELAY	YES	YES	NA
TCS4U5A0	Dual	YES	RELAY	SSR	YES	NA	YES

2.0 FEATURES:

1. 4 digit Dual bright display for better understanding
2. Compact Size, Lower depth of 85mm
3. Universal Inputs like Thermocouple, RTD, mV, Voltage & Current
TC: J, K, T, R, S, C, E, B, N & RTD: Pt100
Analog input: -5 to 60mV, 0 to 10V DC, 0 to 20 mA DC
4. Memory card support to transfer the program from one device to other device.
5. Universal Output (Relay, SSR or Analog output)
Short circuit error for Load protection while using SSR
o/p (SSR current capacity 50mA)
6. Controlling : Auto tune & ON/OFF control
7. 3 Different algorithms to control Fast & slow changing system
8. High speed control capability (i.e. Signal sampling time $\approx 50\text{ms}$)
9. Compressor Protection : Feature to protect Compressor from continuous output ON-OFF during controlling
10. 8 Profile Ramp-Soak function
11. Different Alarm Function : Output can be set as alarm

12. Configurable lower display : User selectable lower display for quick monitoring of parameters
13. RS485 Modbus communication (Applicable for TCS4U50C, TCS4U40C)
14. CT functionality : Which is used to monitor the current flowing to the load & trigger alarm (Applicable for TCS4U4A0, TCS4U5A0)
15. Wide auxiliary supply voltage range 90 -270V AC/DC
Confirms the CE, EMC directive & IP65 frontal certified



3.0 FRONT FASCIA:



Shortcut keys: 'ESC', 'DN', 'UP'

Press for >2 sec to view configured parameter

FRONT FASCIA DESCRIPTION:

1. PV : Displays the "Process Value".
2. SV : Displays the "Set Value".
3. OP1 : To indicate the LED Output 1
4. OP2 : To indicate the LED Output 2
5. OP3 : To indicate the LED Output 3
6. AT : To indicate the LED for Auto tuning process
7.  : To indicate that Timer functionality is in process
8.  : To indicate the Alarm status

Front Keys Description		
1	ESC (Escape key)	To exit from main menu. To return to home screen. To abort changed value or parameter. Press 2 sec to display SP menu.
2	DN (Down key)	Press once to display the effective set value. To decrement the value.
3	UP (Up key)	Press once to display the set value. To increment the value.
4	ENT (Enter key)	Press 2 sec to enter into the main menu. To save & move to next parameter. To acknowledge alarm condition.

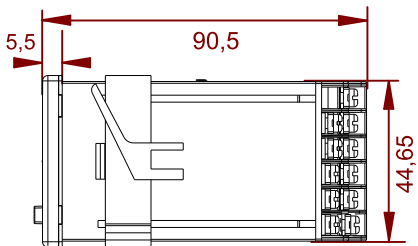
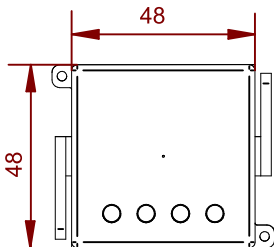
4.0 PRODUCT DESCRIPTION:

Temperature controller is a single loop, single/dual acting Microprocessor based controller with ON-OFF, PID, and Auto tuning functionality. The product has up to 8 programmable set points and provides four different outputs.

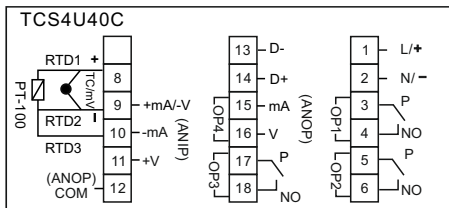
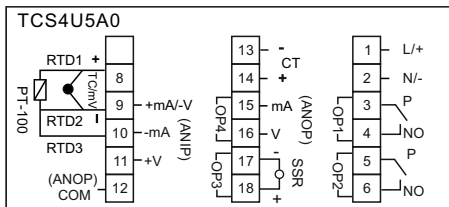
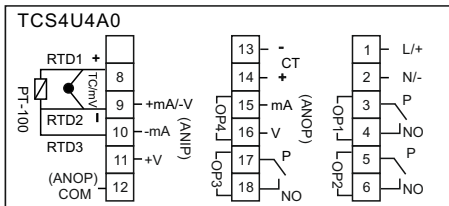
Four Input sensor accepted

1. Thermocouples
2. RTD: PT-100 (Three wire compensation)
3. Standard mV signals: -5 to 60 mV
4. Voltage 0-10V, Current 0-20mA

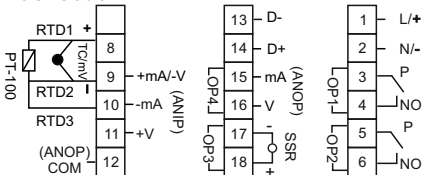
5.0 DIMENSIONS: (in mm):



6.0 CONNECTION DIAGRAMS:



TCS4U50C



Function	Terminal Name	Terminal Number
Supply	L/+ & N/-	1 & 2
Output 1	P & NO	3 & 4
Output 2	P & NO	5 & 6
Output 3 *TCS4U40C, TCS4U4A0	P & NO	17 & 18
Output 3 *TCS4U50C, TCS4U5A0	SSR+ & SSR-	17 & 18
Output 4 (ANOP) Analog O/P Volt	+V & COM	16 & 12
Output 4 (ANOP) Analog O/P mA	mA & COM	15 & 12
Modbus *TCS4U40C, TCS4U50C	D- & D+	13 & 14
CT *TCS4U4A0, TCS4U5A0	CT- & CT+	13 & 14
Analog Input Volt (ANIP)	-V & +V	9 & 11
Analog Input mA (ANIP)	+mA & -mA	9 & 10
TC & mV input	TC+/mV+ & TC-/mV-	8 & 9
RTD Input (PT 100)	+RTD 1 & -RTD 2,3	8 & 9,10

7.0 TECHNICAL SPECIFICATIONS:

Supply Voltage

90-270 VAC/DC, 50-60 Hz

Power Consumption

6 VA

Temperature Sensors

Thermocouple J, K, T, R, S, C, E, B, N
RTD (PT100, 3 wire compensation),
mV signals (-5 to 60 mV)

Analog I/P

Voltage 0-10V
Current 0-20mA

Measurement Range

Sensor Type	Range in °C	Range in °F
Sensor J	-199 to 750	-326 to 1382
Sensor K	-199 to 1350	-326 to 2462
Sensor T	-199 to 400	-326 to 752
Sensor E	-200 to 750	328 to 1382
Sensor S	0 to 1750	32 to 3182
Sensor B	218 to 1820	424 to 3308
Sensor R	0 to 1750	32 to 3182
Sensor C	0 to 2300	32 to 4172
Sensor N	-200 to 1300	-328 to 2372
Sensor Pt100	-200 to 850	-328 to 1562

Measurement Accuracy

0.5 % of full scale of Pt100, for j, K +/-1% & for other thermocouple it is +/- 3%, For Tc and mV signals +/- 0.2% at 25°C (For DC Analog Input)

Resolution

S, B, R : 1°C

J, E, K, PT100: 0.1°C for Tc and mV signals

mV: 0.001°C

Output Configuration

Output	Rating
Output 1 Relay	SPST, 5A @250VAC/ 24VDC
Output 2 Relay	SPST, 5A @250VAC/ 24VDC
Output 3 Relay for TCS4U40C, TCS4U4A0	SPST, 5A @250VAC/ 24VDC
Output 3 Relay for TCS4U50C, TCS4U5A0	SSR 12DC, 50mA
Output 4 Voltage/Current Analog Output (ANOP)	0-20mA, 4-20mA :Terminal 15(+mA) & 12(ANOP COM) 0-5V, 0-10V : Terminal 16(+V) & 12(ANOP COM)
Contact Material	AgNi
Mechanical Life	1 × 10 ⁷ Operations
Electrical Life	1 × 10 ⁵ Operations
SSR O/P Voltage	12VDC, 50mA (Max)

Display

4- Digit 11 upper & 7 lower Segment LED Display with LED indication.

Display update Rate

10 mS

Weight (Unpacked)

280 g

Humidity

85% Rh Non-condensing

Max. Operating Altitude

2000 m

Operating Temperature Range

0°C to 60 °C

Storage Temperature Range

-20°C to 75 °C

Pollution Degree

2

IP Protection

Front fascia - IP 65, Housing - IP 30, Terminal - IP 20

Dimensions (W X H X D)

48 X 48 x 90.5 (in mm)

Mounting

Panel mounting

Terminal Capacity

1x2.5mm²

Torque

0.5 N.m (4.4lb.in) to 0.7N.m (6.2lb.in)

Certifications

CE, RoHS

Environmental :

Cold Heat
IEC 60068-2-1
Dry Heat
IEC 60068-2-2
Vibration
IEC 60068-2-6, 5 g

9.0 MEASUREMENT :

Parameters for this are included in the group "InP". Inputs accepted are Thermocouples, mV signals, Current, Voltage & RTD .For proper functionality, it is recommended to switch off and on the instrument, whenever these are modified. The parameters related to input are 'unit' - unit of measurement (°C , °F) and 'dP' - decimal point representation. In case of analog input, the input voltage/ input current gets divided over the range set in the parameters 'IScL' lower limit and 'ISch' upper limit. Instrument can be re-calibrated according to application needs, by using parameters "oFSt" and "RAte". If "RAte" = 1.000, then using parameters "oFSt", it is possible to set positive or negative offset that is simply added to the value read by the probe.

If the offset is not constant for all the measurements, it is possible to operate the calibration on any of two points. In this case, in order to decide which values to program on parameters "oFSt" and "RAtE", the following formulae must be applied:

$$\text{"RAtE"} = (y2-y1)/(x2-x1)$$

$$\text{"oFSt"} = y2 - \text{rate} * x2$$

Where,

y1 = Measured temperature 1

x1 = temperature displayed by instrument

y2 = Measured temperature 2

x2 = temperature displayed by instrument

The instrument thus visualizes the temperature as :

$$y = x * \text{"RAtE"} + \text{"oFSt"}$$

where y = displayed value and x = measured value

8.1 Output in case of measurement error:

In case of measurement error (over range/under range/sensor break), the instrument supplies the power as programmed on parameters "O.P.E.R". In case of PID control, the power output is as a percentage of cycle time parameter "Cyt". Output in case of measurement error will work only in PID control action.

In case of double acting system value for O.P.E.R is from -100 to +100. Negative value i.e. (-100 to 0) will act for cool output in percentage & positive value i.e (0 to 100) will act for heat output in percentage.

Value of O.P.E.R will be shown on lower display during sensor break (S.ERR) only. if system is set to single acting, for HEAT, Output percentage value on lower display will shown in positive & for COOL Output percentage value on lower display will shown in negative whichever is set by user.

10.0 DISPLAY:

Using parameters "**diSP**", located in the group "**MISC**", it is possible to configure the lower display to visualize different parameters on lower display given in below table.

Menu	Sub menu	Sub menu	Options
MISC	Conf No/Yes	Disp	1.EFSP 2.SP 3.Cop 4.hrmt 5.Ct_i* 6.StS 7.timr 8.Unit 9.CJC
For * : Ct_i visible only for TCS4U4A0 & TCS4U5A0			

Note:1)If we select Unit-->C/F

i.e (C:Celsius, F:Fahrenheit) then C or F will displays on lower display.

2)If timr option is selected then set timer time will displayed on lower display & if timer is started then timer value wil display in reverse counting in min.

If diSP

= EFSP then, Effective set point number will display

= SP then, Effective set point value will display

= Cop then, Control poutput percentage value will display

When diSP: timr, then only timer time will be displayed.

11.0 ACTIVE SET POINT SELECTION:

This instrument allows pre-programming of,
up to 8 different set points

("SP1", "SP2", "SP3", "Sp4" "SP8")

(for all the cat_id's)

and then selection of which one must be active.

The effective set point can be selected:

-by parameter "EFsP" in the group of parameters "SP".

-By key "DN" on single press.

The maximum number of set points is determined by
parameter "NSP" located in the group of parameters "SP".

12.0 CONTROL ACTIONS:

In automatic control, the controller can provide different control actions depending on the parameter "cont" in "rEg" group. The different control actions are explained as below:

Menu	Sub menu	Options
REg	CoNt	onFS (On Off Symmetric) onFA (On Off Asymmetric) nrZn (Neutral Zone) PID (PID Control)

12.1 ON/OFF Control:

All the parameters regarding ON/OFF control are listed in group "rEg". This type of control can be set by programming parameters "CoNt"= **onFS** for ON-OFF action with symmetric hysteresis OR **onFA** for ON-OFF action with asymmetrical hysteresis.

The action can be explained as follows,

In case of reverse action i.e. hEAt being set on parameters in "oP" menu (oP1/oP2/oP3), the controller activates the output when the process value "PV" goes below [SP-hySt]. It deactivates the output when the PV goes above "SP+hySt" in case of symmetric ON-OFF control and above "SP" in case of Asymmetric ON-OFF control.

Menu	Sub menu	Options
oP	oP1/oP2/oP3	hEAt

Symmetric On Off Control (hEAt) :

Condition	Action
$PV < [SP-hySt]$	Controller Output is activated
$PV > [SP+hySt]$	Controller Output is deactivated

Asymmetric On Off Control:

Condition	Action
$PV < [SP-hySt]$	Controller Output is activated
$PV > [SP]$	Controller Output is deactivated

Similarly in case of direct action i.e.Cool being set on parameters."oP"menu (oP1/oP2/oP3), the controller activates the output when the process value "PV" goes above (SP+hySt) and deactivates the output when "PV" goes below "SP-hySt" in case of symmetric ON-OFF control and"SP" Asymmetric ON-OFF control.

DIRECT ACTING:

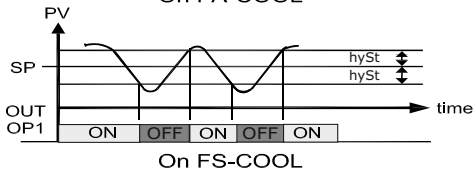
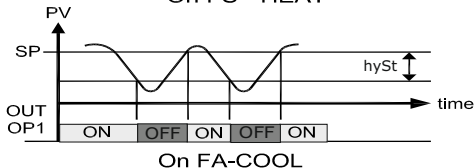
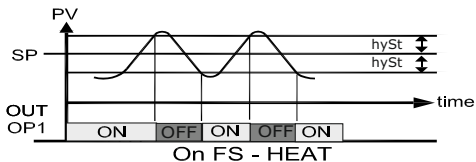
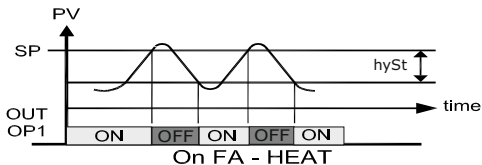
Menu	Sub menu	Options
oP	oP1/oP2/oP3	Cool

Symmetric On Off Control (cool):

Condition	Action
$PV < [SP-hySt]$	Controller Output is deactivated
$PV > [SP+hySt]$	Controller Output is activated

Asymmetric On Off Control:

Condition	Action
$PV < [SP-hySt]$	Controller Output is deactivated
$PV > [SP]$	Controller Output is activated



12.2 Neutral Zone ON/OFF Control (nrZn):

12.2.1 Action:

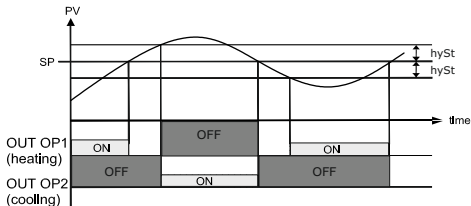
All the parameters referring to neutral zone ON/OFF control are listed in the group "Reg & oP". This type of control can be set when any two outputs, configured by parameter "oP" (configures as Op1 = Heat as heater and OP2 = Cool as cooler) and the parameters "cont" = nrZn.

The neutral zone control is used to control processes in which there is an element which causes a positive increase in temperature (eg. Heater, Humidifier etc.) and an element which causes decrease in temperature (e.g. Cooler, de-humidifier, etc.) Depending on measurements of effective set point "SP" and on hysteresis "hySt", the control functions works on programmed outputs. The controller activates the output configured as heater when process value goes below $[SP-hySt]$ and deactivates it once the PV reaches SP. Further it activates the output configured on cooler when process value goes above $[SP+hySt]$. The cooler output is deactivated when PV reaches SP again.

Note: This type of control is applicable for double acting setting

Menu	Sub menu	Options
Reg	cont	nrZn
OP	oP1/oP2/oP3	hEAAt/CooL

Condition	Heater	Cooler
$PV < [SP-hySt]$	ON	OFF
$PV = SP$	OFF	OFF
$PV > [SP+hySt]$	OFF	ON
$PV = SP$	OFF	OFF



12.2.2 CMdC Menu :

Compressor duty cycle "CMdC" is used to protect compressor short cycling. It is a time based activation of the compressor. The activation of compressor can be avoided till the time set on parameter "CMdC". "thus" providing the delay. Time programmed on "CMdC" is counted starting from last output deactivation and then even if the regulator requires to switch on the corresponding output, the activation is delayed till the time set on "CMdC" elapses.

Note :

This menu is visible only when control type is selected as nrZn(Neutral zone)

Menu	Sub menu	setting
Adv	CMdC	0 to 9999 sec

12.3 PID Control

12.3.0 Single Acting PID Control:

All the parameters referring to PID control are listed in the group "rEg". The single action PID control can be obtained by programming below parameters
 "cont" = PId and oP1/oP2/oP3 = "HEAt or Cool"
 Depending upon the effective set point "sP" and

the instrument's PID algorithm the control output is calculated. The single action PID control algorithm foresees the setting following parameters:

"Pb" - Proportional Band.

"Int" - Integral Time

"dEr" - derivative time

"RS" - Manual Reset (if "Int=0" only)

"cyt" - Cycle time

Menu	Sub menu	Options
rEg	cont	Pid
OP	OP1/OP2/OP3 (atleast one)	hEAt/cool

12.3.1 Double Acting PID Control :

All the parameters referring to PID control are listed in the group "rEg". The double action PID control is used to control processes where there is an element which causes a positive increase in temperature (ex.Heating) and an element which causes a decrease in temperature (cooling). This type of control is selected by setting "cont" as Pid setting. Out of 3 outputs any 2 output are configured for HEAT and COOL. For eg: oP1=hEAt & oP2 = Cool, oP3 = hEAt & oP1 = Cool same as any oP can be selected as Heat or Cool.

The effective set Point "SP" and the instruments algorithm decides the controller output of Double Action PID control.

The cycle times "hct" (Heat cycle time: for output acting on heater) and "cct" (cool cycle time: for output acting on cooler) should have low value with frequent intervention of control outputs, so that good stability of process variable can be achieved, in case of fast processes.

It is recommended to use solid state relays to drive actuators. The Double Action PID control algorithm needs the programming of following parameters:

- "Pb" - Proportional Band
- "Int" - Integral Time
- "dEr" - derivative time
- "hct" - Heat cycle time
- "cct" - cool cycle time
- "RS" - Manual Reset (if "Int=0 only)
- "coEF"- Coefficient Relation between power heating and cooling element. Range between 0.1 to 10.
 - "coEF" > 1: represents that the cooling element is stronger than heating element.
 - "coEF" = 1: represents that the heating and cooling element are equally strong.
 - "coEF" < 1: represents that the heating element is stronger than cooling element.

Menu	Sub menu	Options
rEg	cont	PId
OP	OP1/OP2/OP3 (atleast two)	HEAt or Cool

13.0 AUTO TUNING:

Auto tuning is a process by which the controller automatically calculates the values of P_b , I_{nt} , dE_r & ct suitable for the process. In this process, the controller carries out several operations on the process plant to determine these values.

Steps for Auto-tuning are as follows:

1. Program and select desired Set Point.
2. Program parameters "cont"=PID.
3. For single action PID control, program parameters "oP1/oP2/oP3" as "hEAt" if using heater or "cool" if using cooler.
4. In case of Double action PID control, set "hEAt & Cool" on the any two outputs to act on heater and cooler.

Menu	Sub menu	Options
rEg	cont	PId
OP	OP1/OP2/OP3 (two for double acting) OP1/OP2/OP3 (one for single acting)	hEAt & Cool
rEg	tUNE	t1P, tEP, tMn, tSP

Note:

Double acting device can be used as single acting device.

6. Program parameters. "tUNE" as:
 - "tEP"- Tune at Every power ON. If auto-tuning is desired, each time the instrument is switched ON.
 - "t1P"- Tune at first power ON. If auto-tuning is desired, the next time the instrument is switched ON. Once the tuning is finished, the parameters. "tUNE" is swapped automatically to "OFF".
 - "tMn"- Tune manually. If auto-tuning is to be started manually by pressing the DN or UP key programmed as "stAt"
 - "tSP"- Tune at every set point change or at the end of soft start. This activates auto-tuning at every change of set point or at the end of soft-start cycle.
7. Switch OFF the instrument power and then switch it ON to start tuning if "tUNE" is set as "tEP" or "t1P" or by pressing DN or UP key programmed as "stAt". Flashing AT symbol indicates the activation of Auto-tuning function. To start the auto tune following condition needs to satisfy:
 - For Single Acting mode, if "oP1/oP2/oP3" is "hEAt" OR
 - For dual acting mode if first stage is heating.
 - Conditions...
 - $PV < [SP - |SP/5|]$ if soft start is configured OR
 - $PV < [SP - |SP/3|]$ if soft start is not configured.
 - and $SP - PV > = 10$

For Single acting mode, if "oP1/oP2/oP3" is "cool" or
For Double acting mode if first stage is cooling.

Conditions :

PV > [SP + [SP/5]] If Soft start is configured

OR

PV > [SP + [SP/3]] If Soft start is not configured
and $PV - SP \geq 10$

If the above conditions are not satisfied at the start of auto tune, the display will show "E.At" message and the instrument will take the control conditions according to previously programmed PID. To make 'E.At' disappear, Press "ENTER" key. If autotune is not completed in 2 hours, the instrument shows 'NoAt' on display. The cycle in progress is automatically get stopped in case of sensor error.

After correct PID parameters are tuned, the calculated values are stored in instrument memory.

14.0 RAMP AND SOAK

1. The Temperature controller has provision for 8 ramps and 8 soaks corresponding to SP1, SP2.....SP8.
2. All parameters related to Ramp-Soak functions are grouped in menu 'MISC'.
3. Three strategies have been adopted that determine the state of ramp and soak in case of power resumption after failure.

Note:-

At the end of the Ramp & Soak profile the controller switches 'OFF' controller outputs. To repeat the Ramp & Soak profile reset the device. This can be done by assigning 'rSET' to the DN or UP key in the 'ConF' menu. If the Ramp & Soak profile is not desired, set RMSK parameter in MISC menu to 'OFF'.

14.1 Power Down Resumption Mode (Prmd):

a. cont: The device keeps in memory the last set value before the power failure. After resumption, it starts from the same value and continues the profile. In case of soak stage once the power is resumed, the stage continues for the remaining time.

Power failure in	Action
Ramp stage	After power resumption, device will continue from the last virtual sp value. Assume 3 set points, SP1 = 50, SP2 = 80 and SP3 = 100. If the virtual set point is 65, and power failure occurs. After power resumption, device will start from last virtual set point with the respective ramp rate, irrespective of the PV value.

Power failure in	Action
Soak stage	<p>After resumption device will continue for remaining soak time. Eg: Assume 3 set points, SP1 = 50, SP2 = 80 and SP3 = 100. If the device is in second Soak Stage and configured soak time is 50 minutes. If power failure occurs after 10 minutes, then after power resumption, device will continue with soak stage of 40 minutes and move towards the next SP with new ramp rate, irrespective of the PV</p>

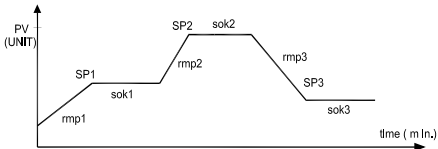
b. rbck: The device starts from present PV value and continues with the profile. In case of power failure in soak stage, once the power is resumed and if PV is not equal to the target SP of the given soak stage, then starting from PV the SP ramps up to the target SP value with the slope of previous ramp. Once target SP is reached, device move to soak stage which continues for the remaining time.

Power failure in	Action
Ramp stage	<p>SP1=50C,SP2=60C,SP3=70C Ramp1=5C/min Ramp2=10C/min Ramp3=15C/min If device was in between 60C and 70C, if power fails then after power resumption device will check for PV. If PV(40C) is less than current Ramping stage set point i.e (SP2=60C) then device will start from 40C with ramp rate of second stage(Ramp2=10C/min).</p>

Power failure in	Action
Soak stage	<p>Device will compare SP with PV if not equal then device will ramp back from current PV with ramp rate of last set point till the soak stage reached then continue for remaining soaking period.</p> <p>Eg: Assume three set points SP1=50, SP2=60, SP3=70 If device was in between 60 and 70 if power fails then after power resumption device will compare PV with SP value. Consider PV is 40 which is not equal to last set point SP which was 60 then device will ramp back from 40 with ramp rate of second stage and reach till 60. After reaching 60 device will enter into soaking stage for remaining time.</p>

c. rsEt: On power failure, the entire ramp and soak profile is reset. At the end of the profile irrespective of 'Prmd ' the device switches OFF all the control outputs.

Power failure in	Action
Ramp stage/ Soak stage	<p>Profile is reset and device will start from beginning.</p> <p>Eg: Assume three set points SP1=50, SP2=60, SP3=70 If device was in between 60 and 70 if power fails then after power resumption device will start form 50 which is first set point irrespective of PV value in both stages.</p>



14.2 Holdback (hbck):

14.2.0 Holdback In Ramp:

While in ramp mode if the difference between SP and PV value goes beyond Holdback value, the SP ramping stops and it is held on the given value as long as $PV < (SP - hbck)$ (hEAT) OR $PV > (SP + hbck)$ (cool) range

14.2.1 Holdback In Soak:

While in Soak mode if the difference between SP and PV value goes beyond Holdback value, the soak timing is stopped and it is resumed when PV comes back within $(SP - hbck)$ (hEAT) and $(SP + hbck)$ (cool) range.

15.0 SOFT START:

All parameters referring to the soft start functioning are contained in the group "rEg". The soft start functioning allows limitation of output power when instrument is switched on for a limited period of time. Following parameters are needed:

"SSt" - Soft start time in hh: mm

"SSth" - Soft start threshold

"StP" - Soft start power

Soft start functionality will abort when sst or ssth whichever earlier is met.

16.0 Dwell Timer:

Single acting:

- 1) When PV value reach or cross to SP then the Dwell Timer will start, during this process oP1/oP2/oP3 = hEAT or Cool will be in controlling action.
- 2) Remaining output can be assign to timer alarm.
- 3) Timer functionality will work in both PID & ON-OFF mode.

for example

Setting : SP = 100

TIMR = 15min

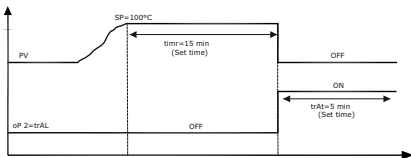
oP1 = hEAT

oP2 = trAL

tRAAt = 5min

PV = 25

When PV reaches to SP=100°C then the timer will start, Dwell Timer will be ON for 15 minutes then after completing timer time oP1 will be continues OFF then oP2 will get ON for 5min.



Note: 1) When ever the Set Timer time is completed then "OVER" message will display on lower display.

Dual acting:

- 1) When PV value is greater than SP & with the help of cooler PV reaches or cross SP+1 then the Dwell Timer will start,
- 2) When PV value is less than SP & with the help of heater PV reaches or cross SP-1 then the Dwell Timer will start
- 3) During this process Heater & Cooler will be in controlling action.
- 2) Remaining output can be assign to timer alarm.
- 3) Timer functionality will work in both PID & Neutral zone mode.

for example

Setting : SP = 100

TIMR = 15min

oP1 = hEAT

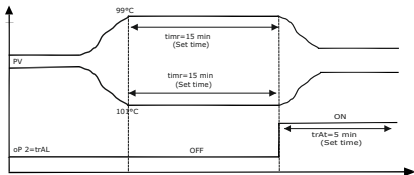
oP2 = trAL

oP3 = Cool

tRAAt = 5min

PV = 25

When PV reaches to SP=100°C then the timer will start, Dwell Timer will be ON for 15 minutes then after completing timer time oP1 will be continues OFF then oP2 will get ON for 5min.



Note: 1) When ever the Set Timer time is completed then "OVER" message will display on lower display.

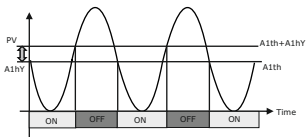
17.0 ALARMS :

17.1 Alarm Types:

1. Absolute low ("AbLO" on display):

Alarm is activated if PV goes below $A1th$ and is deactivated if PV goes above $(A1th+A1hY)$.

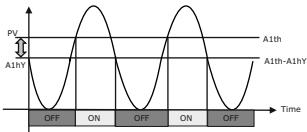
Menu	Sub menu	Option
AL1/AL2	A1tY	AbLo



2. Absolute high ("AbhI" on display):

Alarm is activated if PV goes above $A1th$ and is deactivated if PV goes below $(A1th-A1hY)$.

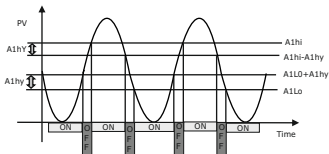
Menu	Sub menu	Option
AL1/AL2	A1tY	Abhi



3. Absolute band ("AbbA" on display):

Alarm is activated if PV goes above A1hi or below A1Lo. It is deactivated if it goes below (A1hi-A1hy) or above (A1Lo+A1hy).

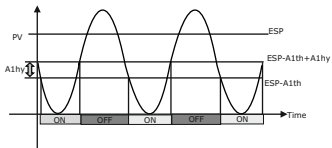
Menu	Sub menu	Options
AL1/AL2	A1tY	AbbA



4. Deviation low ("dELo" on display):

Alarm is activated if PV goes below (Effective Set Point(ESP) - A1th) and is deactivated when it goes above (Effective Set Point (ESP)-A1th + A1hy).

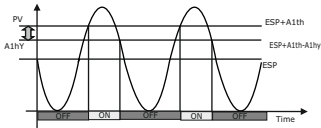
Menu	Sub menu	Options
AL1/AL2	A1tY	dELo



5. Deviation high ("dEhi" on display):

Alarm is activated when PV goes above Effective Set Point(ESP) +A1th) and is deactivated When it goes below (Effective Set Point(ESP) + A1th-A1hy).

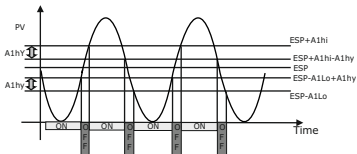
Menu	Sub menu	Option
AL1/AL2	A1tY	dEhi



6. Deviation band ("dEbA" on display):

Alarm is activated when PV goes above (Effective Set Point(ESP) + A1hi) or below (Effective Set Point(ESP) - A1Lo) and is deactivated when PV goes below (Effective Set Point (ESP)+ A1hi - A1hy) or above (Effective Set Point(ESP) - A1Lo + A1hy).

Menu	Sub menu	Option
AL1/AL2	A1tY	dEbA



ALARM FUNCTIONALITY

Menu	Sub Menu	Options	Details	Dependencies	Functions
AL1 OR AL2	A1tY	AbLO	Absolute Low Activation : $PV < A1th$ Deactivation : $PV > A1th + A1hY$	PV,A1th,A1hY	To alert user when PV falls below predefined value.(A1th)
		AbhI	Absolute High Activation : $PV > A1th$ Deactivation: $PV < A1th - A1hY$	PV, A1th, A1hY	To alert user when PV exceeds predefined value.(A1th).
		AbbA	Absolute band Activation : $PV > A1hi$ or $PV < A1Lo$ Deactivation: $PV < A1hi - A1hY$ or $PV > A1Lo + A1hY$	PV, A1hi, A1Lo, A1hY	To alert user when PV, 1. falls below predefined value. (A1Lo) OR 2.exceeds predefined value.(A1hi).
		dELo	Deviation Low Activation : $PV < (SP - A1th)$ Deactivation: $PV > (SP - A1th) + A1hY$	PV, SP, A1th, A1hY	To alert user when PV falls below the SP by the value set in A1th
		dEhI	Deviation High Activation : $PV > (SP + A1th)$ Deactivation: $PV < (SP + A1th) - A1hY$	PV, SP, A1th, A1hY	To alert user when PV exceeds the SP by the value set in A1th.
		dEbA	Deviation Band Activation : $PV < (SP - A1Lo)$ or $PV > (SP + A1hi)$ Deactivation: $PV > (SP - A1Lo) + A1hY$ or $PV < (SP + A1th) - A1hY$	PV, SP, A1Lo, A1hi, A1hY	To alert user when, 1. PV falls below the SP by the value set in A1Lo. 2. PV exceeds the SP by the value set in A1hi.

Menu	Sub menu	Options
AL1/AL2	A1tY	AbLo AbhI AbbA dELo dEhI dEbA

17.2 Alarm Functions :

Sr	Function	Details	Application
1	INSt	<p>Instant Activation: When alarm condition occurs. Deactivation: When the alarm condition disappears.</p>	Normal
2	Ack	<p>Acknowledged Activation: When alarm condition occurs. Deactivation: 1. When the alarm condition disappears. 2. When Configurable key programmed for alarm acknowledgment and press in alarm condition.</p>	To ignore the alarm condition
3	LtCh	<p>Latched Activation: When alarm condition occurs. Deactivation: When Configurable key programmed for alarm acknowledgment and press once alarm generated. Note: Alarm will not get automatically deactivated once generated.</p>	To record or draw attention of alarm generation condition every time. Since no automatic of alarm.
4	dELy	<p>Delayed Activation: delayed by time set in A1dL parameter after occurrence of the alarm condition. Deactivation: When the alarm condition disappears. Note: During the delay if the alarm condition disappears, alarm will not be generated.</p>	To delay the alarm generation, some times alarm can be generated for shorter time due to some disturbance in system.

18.0 CT Current Monitoring

(Applicable only for TCS4U4A0 & TCS4U5A0)

1. The Temperature controller has provision of current monitoring which is connected through CT (Current transformer) input.
2. All parameters related to Current monitoring functions are grouped in menu 'MISC'.
3. Three alarm types are provided for Current Monitoring.
I. CtLo (CT low), II. CtHI (CT High), III. CtbA (CT Band)
4. CT has scaling parameter also Power on delay, Latch & ON delay functionality.
5. Device has a range for current monitoring from 0.0Amp to 108.0Amp.
6. For the current monitoring use 1000:1 CT

18.1 Power ON Delay (PdLy) :

After Power On, if Alarm ON condition is occurred then Alarm relay will not get ON until the PdLy time complete. PdLy time is in mm:ss.

Menu	Sub menu	Option
MISC	CTAL = Lo/hI/bA	PdLy

18.2 ON Delay (tdLy) :

Every time when alarm ON condition occurred then Alarm relay will ON after completion of tdLy Time. tdLy time is in mm:ss.

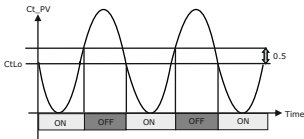
Menu	Sub menu	Option
MISC	CTAL = Lo/hI/bA	tdLy

18.3 CT Alarm Types:

1. CT low ("CtLo" on display):

Alarm is activated if Current value (Ct_PV) goes below CtLo and is deactivated if Ct_PV goes above (CtLo+0.5).

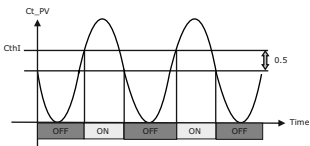
Menu	Sub menu	Option
MISC	CTAL	Lo



2. CT high ("CthI" on display):

Alarm is activated if Current value (Ct_PV) goes above CthI and is deactivated if Ct_PV goes below (CthI-0.5).

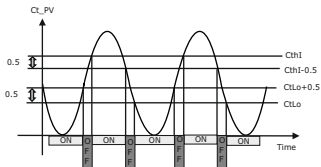
Menu	Sub menu	Option
MISC	CTAL	HI



3. CT band ("CtbA" on display):

Alarm is activated if Current value (Ct_PV) goes above CthI or below CtLo. It is deactivated if it goes below (Cthi-0.5) or above (CtLo+0.5).

Menu	Sub menu	Options
MISC	CTAL	bA



19.0 PROGRAMMING:

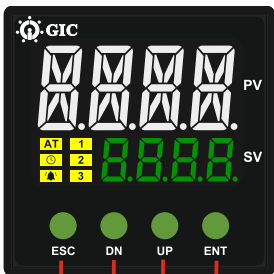
Follow given procedure to program the device:

- 1.** Press key 'E' to enter menus. If password "Enabled", then 'PV' display shows "codE", which is blinking and 'SV' display shows "0".
- 2.** Enter code as "69" using 'UP' key.
Press key 'E' to enter into menu. If wrong code is entered, then the device exits from programming mode. If correct code is entered, the device enters into the set of menus.
- 3.** Using 'UP' or 'DN' key we can move to desired set of parameter.
- 4.** Press key 'E', to enter the group of parameters related to the main menu. Here, the 'PV' display shows the menu and 'SV' shows the value programmed on it.
- 5.** To change this value, press key 'E'. Using 'UP' or 'DN' key, select the value to be entered. Press key 'E' to confirm the value or key 'C' to maintain the previous value.
- 6.** Whenever the value of the menu is being edited, the 'PV' display blinks. Here, 'UP' and 'DN' key change the value on 'SV' display. When the display is not blinking, we can move to next menu using 'UP' or 'DN' key.
To exit from the menu press key 'C'
- 7.** Key 'C' acts as "EXIT" key when in programming mode. While on main screen, when 'PV' display shows temperature and 'SV' display shows user configured value, it performs the function as configured on it in the "key" parameter of "conF" menu.

20.0 SEVEN SEGMENT DISPLAY:

A	B	C	D	E	F	G	H
<i>A</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>E</i>	<i>F</i>	<i>g</i>	<i>h</i>
I	J	K	L	M	N	O	P
<i>i</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>ñ</i>	<i>n</i>	<i>o</i>	<i>P</i>
Q	R	S	T	U	V	W	X
<i>q</i>	<i>r</i>	<i>S</i>	<i>t</i>	<i>U</i>	<i>v</i>	<i>W</i>	<i>X</i>
Y	Z						
<i>y</i>	<i>Z</i>						

21.0 KEY DESCRIPTION & MENU:



Main menu

Press UP key for 2 Sec
(Regulator menu REG) *Default

Press DN key for 2 Sec
Input menu (IN_{VP}) *Default

Press ESC key for 2 Sec
for SP menu (SP)

Main menu

Display value	Parameter Description	Table reference
INP	Input	(A)
OP	Output	(B)
SP	Set point	(C)
REG	Regulator	(D)
AL1	Alarm 1	(E)
AL2	Alarm 2	(E)
ANOP	Analog output	(F)
MISC	Miscellaneous	(G)
Modb	Modbus	(H)
FRSt	Factory reset	(I)
PWd	Password	(J)
Adv	Advance menu	
AL1 menu is visible if OP1/OP2/OP3 is selected as AL1 AL2 menu is visible if OP1/OP2/OP3 is selected as AL2 ANOP menu Visible if output 4 is not equal to OFF Modb menu applicable only for TCS4U50C,TCS4U40C		

(A) Input menu (IMP)

Display value	Parameter Description	Default value	Range
SENS	Sensor	J	J, H, S, r, t, c, b, E, n, Pt 1, 0-20, 0-10, \bar{n}_u
Unit	Unit	C	C, F
DP	Decimal Point	1	1, 0.1, 0.01, 0.001
ISCL	Analog input low	0	-1999 to 9999
ISCH	Analog input high	20	-1999 to 9999
AIRL	Analog input range low	0.00	For 0-20 : 0.00 to AIRH For 0-10 : 0.00 to AIRH For \bar{n}_u : -5.00 to AIRH
AIRH	Analog input range High	20.00	For 0-20 : AIRL to 20.00 For 0-10 : AIRL to 10.00 For \bar{n}_u : AIRL to 60.00
RATE	Rate	1.000	0.001 to 2.000
OFST	Offset	0	-1999 to 9999

For Analog input - ISCL, ISCH, AIRL, AIRH will be visible & Unit will not applicable.

For TC & RTD DP= 1 & 0.1 is only applicable

(B) Output menu (oP)

Display value	Parameter Description	Default value	Range
oP1	Output 1	<i>HEAt</i>	<i>HEAt,COOL,OFF,AL1,AL2,SEn.b,Ct,LbrH,trAL</i>
oP2	Output 2	<i>OFF</i>	<i>HEAt,COOL,OFF,AL1,AL2,SEn.b,Ct,LbrH,trAL</i>
oP3	Output 3	<i>OFF</i>	<i>HEAt,COOL,OFF,AL1,AL2,SEn.b,Ct,LbrH,trAL</i>
oP4	Output 4	<i>OFF</i>	<i>OFF,0-20,4-20,0-5,0-10</i>
<i>A1CF</i>	Alarm 1 Output configuration	<i>no</i>	<i>no , nc</i>
<i>A2CF</i>	Alarm 2 Output configuration	<i>no</i>	<i>no , nc</i>
<i>o.P.Er</i>	Output in case of error	<i>0.0</i>	0.0% to 100.0% -100.0 to 100.0 in case of double acting
<i>tMR</i>	Timer	<i>OFF</i>	<i>OFF</i> to 9999 min
<i>tRALt</i>	Timer Alarm time	<i>OFF</i>	<i>0n</i> to 9999 min
<i>LBRt</i>	Loop break time	<i>OFF</i>	<i>OFF</i> to 9999 sec
<p>A1CF visible if OP1/OP2/OP3 is assigned as AL1 A2CF visible if OP1/OP2/OP3 is assigned as AL2 LBRT visible if OP1/OP2/OP3 is assigned as LBRK TRAT visible if OP1/OP2/OP3 is assigned as TRAL & Timer is not equal to OFF CT visible only in TCS4U4A0 & TCS4U5A0 cat ids.</p>			

(C) SP menu (SP)

Display value	Parameter Description	Default value	Range
NSP	Number of set point	1	1 to 8
SP1	Set Point 1	----	SPLL to SPHL
SP2	Set Point 2	----	SPLL to SPHL
SP3	Set Point 3	----	SPLL to SPHL
SP4	Set Point 4	---	SPLL to SPHL
SP5	Set Point 5	---	SPLL to SPHL
SP6	Set Point 6	---	SPLL to SPHL
SP7	Set Point 7	---	SPLL to SPHL
SP8	Set Point 8	----	SPLL to SPHL
EFSP	Effective Set Point	SP1	SP1 to SP8
SPLL	Set point low level	-199	-1999 to SPHL
SPHL	Set point high level	750	SPLL to 9999

Note : SP range will be updated as per selected sensor's SPLL & SPHL.

(D) Regulator menu (REG)

Display value	Parameter Description	Default value	Range
CONT	Control Action	PID	PI d, ONFS, ONFA, nr2n
TUNE	Auto tune method	OFF	OFF, tEP, tIP, tIn, tSP
ALGO	Controlling Algorithm	A91	A91, A92, A93
Pb	Proportional Band	10	1 to 9999
INT	Integral time	120	0 to 9999 sec
DER	Derivative time	30	1 to 9999 sec
Hct	Cycle time	10	1 to 130 sec
cct	Cool Cycle time	10	1 to 130 sec Visible only in double acting mode
RS	Manual reset	0.0	- 100 to 100% 0.0 to 100.0% for single acting
dUR	Display update rate	1	1 to 100
if CONT= ONFS or ONFA or NrZN then above all parameter will hide, only HYST will be visible			
HYST	Hysteresis	0	0 to 9999

(E) Alarm 1 menu (AL 1)

Display value	Parameter Description	Default value	Range
A1TY	Alarm 1 type	AbLO	AbLO, AbH, AbbA, dELO, dEH, dEbA
A1SP	Alarm 1 SP	EFSP	Sp1 to Number of SP, EFSP
A1LO	Alarm 1 Low	0	- 1999 to A1HI
A1HI	Alarm 1 High	100	A1LO to 9999
A1TH	Alarm 1 threshold	0	- 1999 to 9999
A1HY	Alarm 1 hysteresis	0	0 to 9999
A1FN	Alarm 1 function	Inst	Inst, ALH, LbCH, dELY
A1dy	Alarm1 delay	OFF	OFF to 9999 Sec
<p>A1SP visible only if Alarm type DELO/DEHI/DEBA A1LO & A1HI visible only if Alarm type ABBA/DEBA & A1TH will hide A1TH will visible if Alarm type ABLO/ABHI/DELO/DEHI A1dy will visible if A1FN = dely</p>			

Note: Menu for Alarm 2 are same as Alarm 1

(F) Analog output menu (ANOP)

Display value	Parameter Description	Default value	Range
MANL	Analog output manual	OFF	off, on
PtAG	Analog output Percentage	0.0	0.0 to 100.0 Visible if MANL = on
SErr	Sensor error	h 19h	h 19h/LoL'
RotY	Analog output	tEiP	tEiP/ESP/COP
PVLo	Process value low	0	- 1999 to 9999
PVHi	Process value high	100	- 1999 to 9999
CoLo	Cop value low	0.0	- 199.9 to 999.9 Visible if RotY = COP
CoHi	Cop value high	100.0	- 199.9 to 999.9 Visible if RotY = COP

(G) Miscellaneous menu (MISC)

Display value	Parameter Description	Default value	Range
HRMT	Hour meter	OFF	OFF, HOUR, DAY
HCTH	Counter threshold	OFF	OFF to 9999 Visible if HRMT other than OFF
SST	Soft start time	OFF	OFF to 9999 min
SSP	Soft start power	0.0	-100.0 to 100.0 in Dual acting 0 to 100 in Single acting
SSTH	Soft start threshold	0	-1999 to 9999
CONF	Down Key, UP key & Display configuration	no	If yes, Down key, UP key, Lower display configuration (for menu see table G.1)
RMSO	Ramp soak	OFF	OFF to 8 (for menu see table G.2)
CTAL	CT Alarm	OFF	OFF, ctLO, ctHI, ctbA (for CT menu see table G.3)

(G.1) Configuration (CONF)

Display value	Parameter Description	Default value	Range
down	Down Key configuration	rEG	Hrīt, l nP, St_At, bl īr, rSEt rEG, noFC
UP	Up Key configuration	l nP	Hrīt, l nP, St_At, bl īr, rSEt rEG, noFC
diSP	Lower display configuration	SP	ESP, SP, COP, Hrīt, Ct_ l, StS, bl īr, Unl t, CJC
Up to set number of ramp & soak same parameter will appear as shown in Ramp1 & Soak 1			

(G.2) RAMP (RAMP) & SOAK menu (SOAK)

Display value	Parameter Description	Default value	Range
PrMd	Power down mode	cont	Cont, rbcH, rSEt
RMP 1	Ramp 1	0.01	0.01 to 99.99 min
SoK 1	Soak 1	0.01	0.01 to 99.99 hh:mm
Up to set number of ramp & soak same parameter will appear as shown in Ramp1 & Soak 1			
hbcK	Hold Back	OFF	OFF to 9999

(G.3) CT Menu for TCS4U4A0, TCS4U5A0

Display value	Parameter Description	Default value	Range
15CL	Display scale low	0_1	0.1 to 15CH
CLLo	CT input low	0_1	0.1 to CLHi - 0.1
15CH	Display scale high	100_0	15CL to 999.9
CLHi	CT input high	100_0	CLLo + 0.1 to 100.0
Ltch	latch	OFF	On / OFF
PdLY	Power on delay	3_00	0.00 to 59.59 min
tDLy	Reset time delay	0.00	0.00 to 59.59 min
LO	Alarm low limit	0.1	0.1 to 15CH For CLAL = LO 0.1 to HI - 0.1 For CLAL = bA
HI	Alarm high limit	30	0.1 to 15CH For CLAL = HI LO + 0.1 to 15CH For CLAL = bA

(H) Modbus menu (Modb)
Applicable for TCS4U50C,TCS4U40C

Display value	Parameter Description	Default value	Range
Addr	Device ID	1	1 to 247
baud	Baud rate	96	48, 96, 192, 384, 576, 1152
ParE	Parity	nonE	Even, Odd, nonE
bits	Number of bits	8	8/9
StPb	No. of stop bits	1	1/2

(I) Factory Reset

Parameter	Description
rSEt	To reset device and load default setting. Please press the enter key. If "Yes" - Device will get reset to factory default If "No" - will get back to menu.

(J) Password menu (PwD)

Display value	Parameter Description	Default value	Range
StAt	status	d5bL	EnbL / d5bL
SEt	Set password value	107	1 to 9950
LoCK	Lock	īA in	īA in / PArA

If *LoCK* = *īA in* then below menu will display

Display value	Parameter Description	Default	Range
INP	Input	UnLH	rERd, LoCH, UnLH
oP	Out put		
SP	Set point		
REG	Regulator		
AL1	Alarm 1		
AL2	Alarm 2		
ANOP	Analog output		
MISC	Miscellaneous		
Modb	Modbus		
FRSE	Factory reset		

rERd : User can only read setting can not modify

LoCH : Menu will hidden

UnLH : User can read or modify the setting

If $LocH = PAR$ then below menu will display

Display value	Parameter Description	Default	Range
SP1	Set point 1	UnLH	rERd, LOCH, UnLH
SP2	Set point 2		
SP3	Set point 3		
SP4	Set point 4		
SP5	Set point 5		
SP6	Set point 6		
SP7	Set point 7		
SP8	Set point 8		
tUnE	Tune		
t _{irr}	Dwell Timer		

Main Menu: modb (Modbus)

1	Addr	Device Id Range: 1 to 247 default: 1
2	bAUd	Baud rate: Range: 1. 48 : 4800 baud rate 2. 96 : 9600 baud rate 3. 192 : 19200 baud rate 4. 384 : 38400 baud rate 5. 576 : 57600 baud rate 6. 1152 : 115200 baud rate default: 96
3	PART	Parity: Range: 1.EvEn: Even parity 2.odd: odd parity 3.None:None parity default: None
4	bItS	No. of bits Range: 8 to 9 default: 8
5	StPb	No. of stop bits Range: 1 to 2 default: 1

22.0 MODBUS : For TCS4U50C & TCS4U40C

Advance Temperature Controller has adopted widely used MODBUS RTU protocol. The MODBUS RTU communication functions implemented: Function 3 – Read Holding Register (read); Function 4 - Read Input Register
Function 6 - Preset Single Register (write);
Function 16 - Preset Multiple Register (write).

These functions allow the supervisory program to read and modify any data of the controller.

The communication is based on messages sent by the master station (host) to the slave stations (Temperature Controller) and vice versa.

Every a message contains four fields:

- a) Slave address (from 1 to 247)
- b) Function code: contains 3,4,6 or 16 for specified functions.
- c) Information field: contains data like word addresses and word values as required by Function in use.
- d) Control word: a cyclic redundancy check (CRC) performed with particular rules for CRC.

3.1 Function 3 - Read n Word

The request has the following frame:

Filed Name	Byte Position
Slave MODBUS ID	Byte 0
Function Code(3)	Byte 1
First word Address MSB	Byte 2
First word Address LSB	Byte 3
Number of words MSB	Byte 4
Number of wordsLSB	Byte 5
CRC LSB	Byte 6
CRC MSB	Byte 7

The normal reply(as opposed to exception reply) has the following frame:

Filed Name	Byte Position
Slave MODBUS ID	Byte 0
Function Code(3)	Byte 1
NB Number of Read bytes	Byte 2
Value of first word MSB	Byte 3
Value of first word LSB	Byte 4
Following Words	Byte 5
CRC Error Check LSB	Byte NB+2
CRC Error Check MSB	Byte NB+3

3.2 Function 4 - Read n Word

The request has the following frame:

Filed Name	Byte Position
Slave MODBUS ID	Byte 0
Function Code(4)	Byte 1
First word Address MSB	Byte 2
First word Address LSB	Byte 3
Number of words MSB	Byte 4
Number of wordsLSB	Byte 5
CRC LSB	Byte 6
CRC MSB	Byte 7

The normal reply(as opposed to exception reply) has the following frame:

Filed Name	Byte Position
Slave MODBUS ID	Byte 0
Function Code(4)	Byte 1
NB Number of Read bytes	Byte 2
Value of first word MSB	Byte 3
Value of first word LSB	Byte 4
Following Words	Byte 5
CRC Error Check LSB	Byte NB+2
CRC Error Check MSB	Byte NB+3

3.3 Function 6 - One word write. The request has the following frame:

Filed Name	Byte Position
Slave MODBUS ID	Byte 0
Function Code(6)	Byte 1
Word Address MSB	Byte 2
Word Address LSB	Byte 3
Value of first word MSB	Byte 4
Value of first word LSB	Byte 5
CRC Error Check LSB	Byte 6
CRC Error Check MSB	Byte 7

3.4 The exception reply

An exception reply is given when the request is formally correct, but cannot be satisfied standing particular situations; the reply contains a code indicating the cause of the missing regular reply. The frame is:

Filed Name	Byte Position
Slave MODBUS ID	Byte 0
Function Code(3)	Byte 1
First Word Address MSB	Byte 2
First Word Address LSB	Byte 3

Number of Word MSB	Byte 4
Number of Word LSB	Byte 5
CRC Error Check LSB	Byte 6
CRC Error Check MSB	Byte 7

3.5 Function 16 - Preset Multiple Register, "N" word Write.

The request has the following frame:

Filed Name	Byte Position
Slave MODBUS ID	Byte 0
Function Code(0X10)	Byte 1
Start register no,(high byte)	Byte 2
Start register no,(Low byte)	Byte 3
No. of register to write(High byte)	Byte 4
No. of register to write(Low byte)	Byte 5
No. of data bytes	Byte 6
Data 0 MSB	Byte 7
Data 0 LSB	Byte 8
Data 1 MSB	Byte 9

Data 1 LSB	Byte 10
Data 2 MSB	Byte 11
Data 2 LSB	Byte 12
CRC bytes of 1 to 6 (LSB)	Byte 13
CRC bytes of 1 to 6 (MSB)	Byte 14

Note: Number of data bytes that follows
 3 registers X 2 Bytes each = 6

The normal reply(as opposed to exception reply)
 has the following frame:

Filed Name	Byte Position
Slave MODBUS ID	Byte 0
Function Code(0X10)	Byte 1
Start register no,(high byte)	Byte 2
Start register no,(Low byte)	Byte 3
No. of register written(High byte)	Byte 4
No. of register written(Low byte)	Byte 5
CRC bytes of 1 to 6 (LSB)	Byte 6
CRC bytes of 1 to 6 (MSB)	Byte 7

- 1) Illegal Function code -1
- 2) Illegal data address -2
- 3) Illegal data value field -3
- 4) Slave device busy -6

Address 0 used for broadcasting messages
 has not been implemented.

23. MODBUS QUERIES:

1.Variable - PV

Description: Process Variable

Data type: Float

Range: -1999 to 9999

Decimal dependence: Yes

READ/WRITE: Read

Address (in DEC) : 203

2. Variable - coP

Description: Control Output

Data type: Signed short

Range: -100.0 to 100.0

Decimal dependence: No

READ/WRITE: Read

Address (in DEC): 205

3. Variable - AL1

Description: Alarm 1 Status

Data type: Unsigned short

Range: OFF- 0000 0000, ON- 0000 0001

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 215

4. Variable - AL2

Description: Alarm 2 Status

Data type: Unsigned short

Range: OFF- 0000 0000, ON- 0000 0001

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 216

5. Variable - sEnb

Description: Sensor break alarm status

Data type: Unsigned short

Range: OFF-0000 0000, ON- 0000 0001

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 217

6. Variable - LbRK

Description: Loop break alarm status

Data type: Unsigned short

Range: OFF- 0000 0000, ON- 0000 0001

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 218

7. Variable - hRMt

Description: Hour Meter Day

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 1501

8. Variable - hRMt

Description: Hour Meter Hour

Data type: Unsigned short

Range: 0 to 23

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 1502

9. Variable - hRMt

Description: Hour Meter Minute

Data type: Unsigned short

Range: 0 to 59

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 1503

10. Variable - hRmT

Description: Hour Meter Second

Data type: Unsigned short

Range: 0 to 59

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 1504

11. Variable - cvEr

Description: Code Version

Data type: Unsigned short

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 201

12. Variable - rFLg

Description: Ramp Soak Flg status

Range: NO RAMP SOAK ON: 0

RAMP1 STAGE: 1

SOAK1 STAGE: 2

RAMP2 STAGE: 3

SOAK2 STAGE: 4

RAMP3 STAGE: 5

SOAK3 STAGE: 6

RAMP4 STAGE: 7

SOAK4 STAGE: 8

RAMP5 STAGE: 9

SOAK5 STAGE: 10

RAMP6 STAGE: 11

SOAK6 STAGE: 12

RAMP7 STAGE: 13

SOAK7 STAGE: 14

RAMP8 STAGE: 15

SOAK8 STAGE: 16

RAMP SOAK END: 17

Data type: Unsigned short

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 219

13. Variable - Soak Time

Description: Elapsed Soak Time

Data type: Unsigned Long

Range: 0 to 359940

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 220

14. Variable - Aout

Description: Value Transmitted on Analog output

Data type: Float

Range: -3.00 to 24.00 or -1.00 to 11.50

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 209

15. Variable - MvEr

Description: Model Number

Data type: Unsigned short

Range: 6 (TCS4U50C) , 7 (TCS4U40C)

Decimal dependence: NA

READ/WRITE: Read, Address (in DEC): 801

16. Variable - CJC

Description: CJC Value

Data type: Float

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 207

17. Variable - Output 2 Status (ON/OFF)

Description: This is for indication of OP2

Data type: Unsigned short

Range: 0 : OFF - 1 : ON

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 213

18. Variable - Output 3 Status (ON/OFF)

Description: This is for indication of OP3

Data type: Unsigned short

Range:0 : OFF - 1 : ON

Decimal dependence: NA

READ/WRITE: Read

Address (in DEC): 214

SP

1. Variable - SPLL

Description: Set point low

Data type: Signed short

Range: -1999 to setpoint as selected by EFSP

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 811

2. Variable - SPHL

Description: Set point high

Data type: Signed short

Range: Setpoint as selected by EFSP to 9999

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 812

3. Variable - nSP

Description: Number of set point

Data type: Unsigned short

Range: 1 to 8

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 802

4. Variable - EFSP

Description: Effective set point

Data type: Unsigned short

Range: 1 to nsP

Decimal dependence: NA

READ/WRITE: Read/Write

Decimal dependence: NA

Address (in DEC): 813

5. Variable - SP1

Description: Set point 1
Data type: Signed short
Range: spLL to sphL
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC): 803

6. Variable - SP2

Description: Set point 2
Data type: Signed short
Range: spLL to sphL
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC): 804

7. Variable - SP3

Description: Set point 3
Data type: Signed short
Range: spLL to sphL
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC): 805

8. Variable - SP4

Description: Set point 4
Data type: Signed short
Range: spLL to sphL
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC): 806

9. Variable - SP5

Description: Set point 5
Data type: Signed short
Range: spLL to sphL, READ/WRITE: Read/Write
Decimal dependence: dP, Address (in DEC): 807

10. Variable - SP6

Description: Set point 6
Data type: Signed short
Range: spLL to sphL
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC): 808

11. Variable - SP7

Description: Set point 7
Data type: Signed short
Range: spLL to sphL
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC): 809

12. Variable - SP8

Description: Set point 8
Data type: Signed short
Range: spLL to sphL
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC): 810

InP

1. Variable - SEns

Description: Sensor select
Data type: Unsigned short
Range: 0 :- J thermocouple 7 :- E thermocouple
 1 :- K thermocouple 8 :- N thermocouple
 2 :- S thermocouple 9 :- PT-100
 3 :- R thermocouple 10 :- 0-20mA
 4 :- T thermocouple 11 :- 0-10V
 5 :- C thermocouple 12 :- -5 to 60mV
 6 :- B thermocouple

Decimal dependence: NA
READ/WRITE: Read/Write, Address (in DEC): 814

2. Variable - IScl

Description: Analog input low

Data type: Signed short

Range: -1999 to 9999

Decimal dependence: dP

READ/WRITE: Read/Write, Address (in DEC): 817

3. Variable - ISch

Description: Analog input high

Data type: Signed short

Range: -1999 to 9999

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 818

4. Variable - AIRL

Description: Analog input range low

Data type: Float

Range: $0-20/0-10 = 0$ to AIRH, $mV=-5$ to AIRH

Decimal dependence: 2

READ/WRITE: Read/Write

Address (in DEC): 819

5. Variable - AIRH

Description: Analog input range high

Data type: Float

Range: $0-20 =$ AIRL to 20, $0-10 =$ AIRL to 10
 $mV=$ AIRL to 60

Decimal dependence: 2

READ/WRITE: Read/Write

Address (in DEC): 821

6. Variable - rAtE

Description: Measurement Rate

Data type: Float

Range: 0.001 to 2.000
Decimal dependence: 3
READ/WRITE: Read/Write
Address (in DEC): 824

7. Variable - oFSt

Description: Measurement Offset
Data type: Signed short
Range: -1999 to 9999
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC) : 823

8. Variable - o.P.ER

Description: Output power in case of error
Data type: Float
Range: -100.0 to 100.0
Decimal dependence: 1
READ/WRITE: Read/Write
Address (in DEC): 832

9. Variable - dP

Description: Decimal point
Data type: Unsigned short
Range: 0 to 3
Decimal dependence: 0
READ/WRITE: Read/Write
Address (in DEC) : 816

10. Variable - unIt

Description: Unit of measurement
Data type: Unsigned short
Range: 0 - C, 1 - F
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 815

11. Variable - PvLo

Description: Process value/Set point low value for analog output according to value defined on OP1.

Data type: Signed short

Range: -1999 to 9999

Decimal dependence: dP, READ/WRITE: Read/Write

Address (in DEC): 862

12. Variable - Pvhi

Description: Process value/Set point high value for analog output according to value defined on OP1

Data type: Signed short

Range: -1999 to 9999

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 863

13. Variable - CoLo

Description: Control output low value

Data type: Signed short

Range: -100.0 to 100.0

Decimal dependence: 1

READ/WRITE: Read/Write

Address (in DEC): 864

14. Variable - CohI

Description: Control output high value

Data type: Signed short

Range: -100.0 to 100.0

Decimal dependence: 1

READ/WRITE: Read/Write

Address (in DEC): 866

oP - Output

1. Variable - A1cF

Description: Alarm 1 output configure

Data type: Unsigned short

Range: 0: NO, 1: NC

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 830

2. Variable - A2cF

Description: Alarm 2 output configure

Data type: Unsigned short

Range: 0: NO, 1: NC

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 831

3. Variable - oP1

Description: Output1 act on

Data type: Unsigned short

Range: 0: HEAt, 1: Cool, 2: oFF 3: AL1, 4: AL2,
5: SENB, 6: LBRK, 7: TRAL

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 826

4. Variable - oP2

Description: Output2 act on

Data type: Unsigned short

Range: 0: HEAt, 1: Cool, 2: oFF 3: AL1, 4: AL2,
5: SENB, 6: LBRK, 7: TRAL

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 827

5. Variable - oP3

Description: Output3 act on

Data type: Unsigned short

Range: 0: HEAT, 1: Cool, 2: oFF 3: AL1, 4: AL2,
5: SENB, 6: LBRK, 7: TRAL

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 828

6. Variable - oP4

Description: Output3 act on

Data type: Unsigned short

Range: 0: 0-20, 1: 4-20, 2: 0-5 3: 0-10, 4: oFF

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 829

7. Variable - brkt

Description: Loop Break time

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 836

8. Variable - Timr

Description: Dwell timer time

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 834

9. Variable - trAt

Description: Dwell timer alarm time

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 835

10. Variable - AOTY

Description: Analog Output Type
Data type: Unsigned short
Range: 0: COP, 1: TEMP, 2: EFSP
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 861

Analog Output

1. Variable - MANL

Description: Manual status
Data type: Unsigned short
Range: 0: oFF, 1: oN
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 859

2. Variable - S.ERR

Description: Sensor Error Status
Data type: Unsigned short
Range: 0: SERR High, 1: SERR Low
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 860

3. Variable - PtAg

Description: Analog Output Percentage
Data type: Unsigned short
Range: 0.0 to 100.0
Decimal dependence: 1
READ/WRITE: Read/Write
Address (in DEC): 868

Alarm 1

1. Variable - A1tY

Description: Alarm 1 type

Data type: Unsigned short

Range: 0: AbLo, 1: AbHI, 2: AbbA, 3: dELo, 4: dEHI,
5: dEbA

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 925

2. Variable - A1Fn

Description: Alarm 1 Function

Data type: Unsigned short

Range: 0: OFF, 1: ACK, 2: LATCH, 4: DELAY

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 931

3. Variable - A1Lo

Description: Alarm 1 Low

Data type: Signed short

Range: -1999 to A1th

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 927

4. Variable - A1SP

Description: Alarm 1 SP

Data type: Unsigned short

Range: 0: ESP, 1: SP1, 2: SP2.....8: SP8

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 926

5. Variable - A1th

Description: Alarm 1 Threshold

Data type: Signed short

Range: A1Lo to A1hi

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 929

6. Variable - A1hi

Description: Alarm 1 High

Data type: Signed short

Range: A1th to 9999

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 928

7. Variable - A1hY

Description: Alarm 1 hysteresis

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 930

8. Variable - A1dL

Description: Alarm 1 delay

Data type: Unsigned short

Range: OFF to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 932

Alarm 2

1. Variable - A2tY

Description: Alarm 2 type

Data type: Unsigned short

Range: 0: AbLo, 1: AbHi, 2: AbbA, 3: dELo

4: dEHi, 5: dEbA

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 933

2. Variable - A2Fn

Description: Alarm 2 Function

Data type: Unsigned short

Range: 0: OFF, 1: ACK, 2: LATCH, 4: DELAY

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 939

3. Variable - A2Lo

Description: Alarm 2 Low

Data type: Signed short

Range: -1999 to A2th

Decimal dependence: DP

READ/WRITE: Read/Write

Address (in DEC): 935

4. Variable - A2SP

Description: Alarm 2 SP

Data type: Unsigned short

Range: 0: ESP, 1: SP1, 2: SP2.....8: SP8

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 934

5. Variable - A2th

Description: Alarm 2 Threshold

Data type: Signed short

Range: A2Lo to A2hi

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 937

6. Variable - A2hi

Description: Alarm 2 High

Data type: Signed short

Range: A2th to 9999

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 936

7. Variable - A2hY

Description: Alarm 2 hysteresis

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: dP

READ/WRITE: Read/Write

Address (in DEC): 938

8. Variable - A2dL

Description: Alarm 2 delay

Data type: Unsigned short

Range: OFF to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 940

1. Variable - Cont

Description: Control type

Data type: Unsigned short

Range: 0: PID, 1: onFS, 2: onFA, 3: nrZn

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 838

2. Variable - hEst

Description: On Off Hysterisis

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 839

3. Variable - AUto

Description: Autotune

Data type: Unsigned short

Range: 0: oFF , 1: TEP, 2: T1P, 3:TMN, 4: TSP

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 840

4. Variable - Algo

Description: Algo Type

Data type: Unsigned short

Range: 0: AG1 , 1: AG2, 2: AG3

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 841

5. Variable - Pb

Description: Proportional Band

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 842

6. Variable - Int

Description: Integral time

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 843

7. Variable - dEr

Description: Derivative time

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 844

8. Variable - rs

Description: Manual reset

Data type: Signed short

Range: -100 to 100

Decimal dependence: 1

READ/WRITE: Read/Write

Address (in DEC): 857

9. Variable - hct

Description: Heater output cycle time

Data type: Unsigned short

Range: 1 to 130

Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 845

10. Variable - cct

Description: Cooler output cycle time
Data type: Unsigned short
Range: 1 to 130
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 846

11. Variable - coEF

Description: Coefficient
Data type: Unsigned short
Range: 0.1 to 10.0
Decimal dependence: 1
READ/WRITE: Read/Write
Address (in DEC): 851

12. Variable - cdtY

Description: Compressor On delay time
Data type: Signed short
Range: 0 to 9999
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 850

13. Variable - Prmd

Description: Power down resume mode
Data type: Unsigned short
Range: 0:Cont, 1: rbcK, 2: rSEt
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 877

14. Variable - DUR

Description: Display Update Rate

Data type: Unsigned short

Range: 0 to 100

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 847

15. Variable - CJC

Description: CJC status

Data type: Unsigned short

Range: 0 : Enable, 1 : Disable

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 848

16. Variable - IUR

Description: Input Update Rate

Data type: Unsigned short

Range: 0 to 100

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 849

17. Variable - RmSo

Description: Number of Ramp Soak stage

Data type: Unsigned short

Range: 0: oFF, 1 to 8

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 876

18. Variable - rmP1

Description: Ramp 1
Data type: Unsigned short
Range: 0 to 99.99
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 879

19. Variable - rmP2

Description: Ramp 2
Data type: Unsigned short
Range: 0 to 99.99
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 881

20. Variable - rmP3

Description: Ramp 3
Data type: Unsigned short
Range: 0 to 99.99
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 883

21. Variable - rmP4

Description: Ramp 4
Data type: Unsigned short
Range: 0 to 99.99
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 885

22. Variable - rmP5

Description: Ramp 5
Data type: Unsigned short
Range: 0 to 99.99

Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 887

23. Variable - rmP6

Description: Ramp 6
Data type: Unsigned short
Range: 0 to 99.99
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 889

24. Variable - rmP7

Description: Ramp 7
Data type: Unsigned short
Range: 0 to 99.99
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 891

25. Variable - rmP8

Description: Ramp 8
Data type: Unsigned short
Range: 0 to 99.99
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 893

26. Variable - soK1

Description: Soak 1
Data type: Unsigned short
Range: 0 to 99.59(hour:min)
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 895

27. Variable - soK2

Description: Soak 2
Data type: Unsigned short
Range: 0 to 99.59(hour:min)
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 897

28. Variable - soK3

Description: Soak 3
Data type: Unsigned short
Range: 0 to 99.59(hour:min)
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 899

29. Variable - soK4

Description: Soak 4
Data type: Unsigned short
Range: 0 to 99.59(hour:min)
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 901

30. Variable - soK5

Description: Soak 5
Data type: Unsigned short
Range: 0 to 99.59(hour:min)
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 903

31. Variable - soK6

Description: Soak 6
Data type: Unsigned short
Range: 0 to 99.59(hour:min)
Decimal dependence: 2

READ/WRITE: Read/Write
Address (in DEC): 905

32. Variable - soK7

Description: Soak 7
Data type: Unsigned short
Range: 0 to 99.59(hour:min)
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 907

33. Variable - soK8

Description: Soak 8
Data type: Unsigned short
Range: 0 to 99.59(hour:min)
Decimal dependence: 2
READ/WRITE: Read/Write
Address (in DEC): 909

34. Variable - hbck

Description: Ramp Hold back
Data type: Unsigned short
Range: 0 to 9999
Decimal dependence: dP
READ/WRITE: Read/Write
Address (in DEC): 878

35. Variable - SSP

Description: Soft start Power
Data type: Unsigned short
Range: -100.0 to 100.0
Decimal dependence: 1
READ/WRITE: Read/Write
Address (in DEC): 854

36. Variable -SSTH

Description: Soft start threshold

Data type: Signed short

Range: -1999 to 9999

Decimal dependence: dp

READ/WRITE: Read/Write

Address (in DEC): 856

37. Variable - SST

Description: Soft start time

Data type: Unsigned short

Range: 0 to 9999 min

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 853

Conf

1. Variable -DOWN Key

Description: Configure Key

Data type: Unsigned short

Range: 0: HRMT, 1: INP, 2: ST.AT, 3: TIMR,

4: REST, 5: REG, 6: NOFC

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 872

2. Variable -UP Key

Description: Configure Key

Data type: Unsigned short

Range: 0: HRMT, 1: INP, 2: ST.AT, 3: TIMR,

4: REST, 5: REG, 6: NOFC

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 873

3. Variable - diSP

Description: Configure Lower Display

Data type: Unsigned short

Range: 0: ESP, 1:SP, 2:COP, 3:HRMT,
4:RMPSOK Status, 5: TIMER, 6: UNIT, 7: CJC

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 875

Hour Meter

1. Variable - HrMt

Description: Hour Meter Unit

Data type: Unsigned short

Range: 0: oFF, 1:Hour, 2: Day

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 870

2. Variable - HctH

Description: Hour Meter Threshold

Data type: Unsigned short

Range: 0 to 9999

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 871

Password

1. Variable - PWD

Description: Password status
Data type: Unsigned short
Range: 0: Disable, 1: Enable
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 922

2. Variable - Set

Description: Password value
Data type: Unsigned short
Range: 1 to 9950
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 923

3. Variable - Lock

Description: Lock menu
Data type: Unsigned short
Range: 0: Main menu, 1 : sub-parameter menu
Decimal dependence: NA
READ/WRITE: Read/Write
Address (in DEC): 924

Password Status of Main Menu

1. Variable - Inp

Description: Input status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 964

2. Variable - OP

Description: Output status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 965

3. Variable - SP

Description: Set point status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 966

4. Variable - rEg

Description: Regulator status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 967

5. Variable - AL1

Description: Alarm 1 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 968

6. Variable - AL2

Description: Alarm 2 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 969

7. Variable - ANOP

Description: Analog output status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 970

8. Variable - MISC

Description: Miscellaneous status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 971

9. Variable - Modb

Description: Modbus status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 972

10. Variable - F.RST

Description: Factory reset status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 969

Password Status of Sub-Menu

1. Variable - SP1

Description: Set point 1 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 974

2. Variable - SP2

Description: Set point 2 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 975

3. Variable - SP3

Description: Set point 3 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 976

4. Variable - SP4

Description: Set point 4 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 977

5. Variable - SP5

Description: Set point 1 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 978

6. Variable - SP6

Description: Set point 2 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 979

7. Variable - SP7

Description: Set point 7 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 980

8. Variable - SP8

Description: Set point 8 status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 981

9. Variable - Tune

Description: Autotune status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 982

10. Variable - TIMR

Description: Timer status

Data type: Unsigned short

Range: 0: Unlock, 1: Read, 2: Lock

Decimal dependence: NA

READ/WRITE: Read/Write

Address (in DEC): 983

24. Error Occurred in Device:

Error	Error Details	Reason	Action
SEnS	Sensor break error	Sensor is interrupted	Verify connection . between sensor and device & then verify the correct functioning of the sensor
oURg	Over Range error	PV Value is above sensor limit	
UnrG	Under Range error	PV Value is under sensor limit	
ERtE	Auto Tune error	Auto tuning cannot be started because process value is too high or too low	Press error key to make error disappear
noRtE	Auto tuning time out	Auto tuning is not finished within 2 hrs	
FRI L	Fail error	An attempt is made to change the auto tuning parameters during auto tuning	
cbrh	Loop break interrupted	Loop control interrupted	Configure exit key to off & make control output off
Err I	Memory error	Possibly EEPROM error	Press enter to make error disappear
SSr	SSR error	Possible SSR terminals are short	Check SSR terminals if error does not disappear after Enter key pressed

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PASSWORD = 107