TCS - TCE

Temperature Controllers

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☺ Whenever this symbol appears it indicates a note or useful hint

1. Installation and Basic Operation

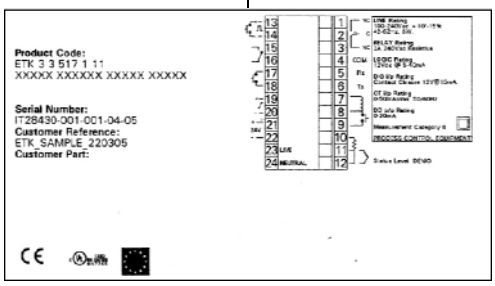
1.1. What Instrument Do I Have?

The controller may have been ordered to a hardware code only or pre-configured using an optional 'Quick code'.

The label, fitted to the side of the sleeve, shows the ordering code that the controller was supplied to.

The last two sets of five digits show the Quick Code.

If the Quick Code shows *****/***** the controller was supplied with default parameters and it will need to be configured when it is first switched on. This is described in section 3 of this User Guide.



For special features not covered in this User Guide, a detailed Engineering Manual, Part No HA029065, and other related handbooks can be downloaded from www.eroelectronic.com

1.2. Unpacking and storage

The following items are included in the box:

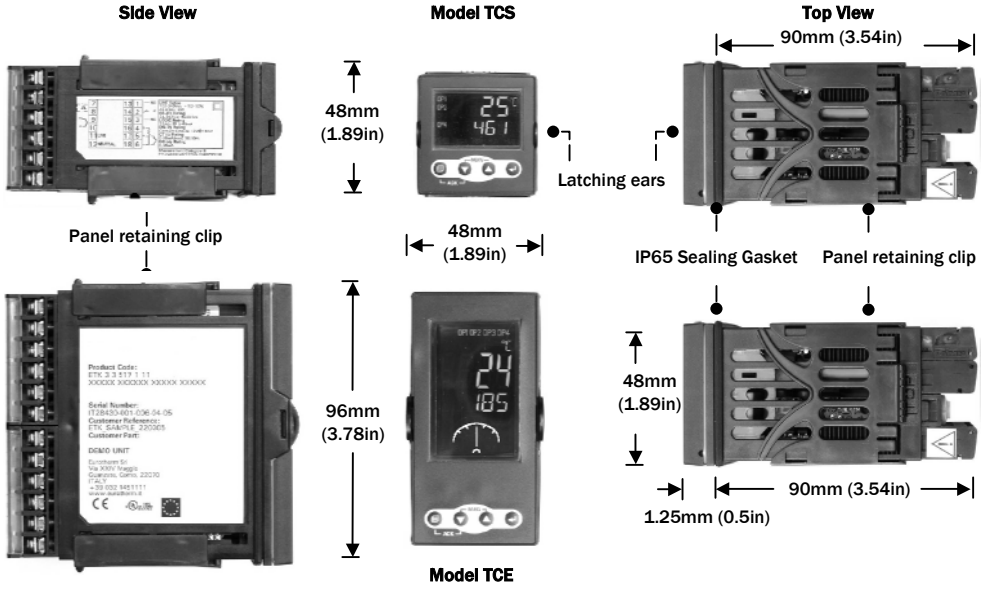
- Controller mounted in its sleeve
- Two panel retaining clips
- An IP65 sealing gasket mounted on the sleeve
- Component packet containing a snubber for each relay output and a 2.49Ω resistor for current inputs (see section 2)
- This User Guide

If on receipt, the packaging or the instrument is damaged, do not install the product but contact your supplier.

If the instrument is to be stored before use, protect from humidity and dust in an ambient temperature range of -10ºC to +70ºC.

1.3. Dimensions

General views of the controllers are shown below together with overall dimensions.



1.4. Step 1: Installation

This controller is intended for permanent installation, for indoor use only, and enclosed in an electrical panel

Select a location which is subject to minimum vibrations and the ambient temperature is within 0 and 55ºC (32 - 131ºF)

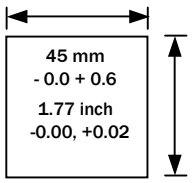
The controller can be mounted on a panel up to 15mm thick

To ensure IP65 and NEMA 4 front sealing against dust and water, mount on a non-textured surface.

1.4.1. Panel Mounting the Controller

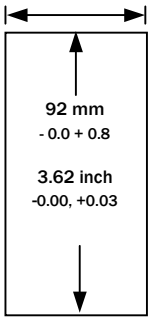
1. Prepare a cut-out in the mounting panel to the size shown. If a number of controllers are to be mounted in the same panel observe the minimum spacing shown.
2. Fit the IP65 sealing gasket behind the front bezel of the controller
3. Insert the controller through the cut-out
4. Spring the panel retaining clips into place. Secure the controller in position by holding it level and pushing both retaining clips forward.
5. Peel off the protective cover from the display

1.4.2. Panel Cut-out Sizes



Model TCS

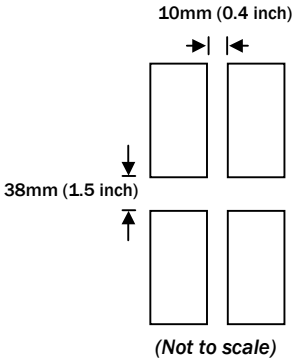
45 mm - 0.0 + 0.6
1.77 inch -0.00, +0.02



Model TCE

1.4.3. Recommended Minimum Spacing of Controllers.

Applies to all Model sizes



(Not to scale)

1.4.4. To Remove the Controller from its Sleeve

The controller can be unplugged from its sleeve by easing the latching ears outwards and pulling it forward out of the sleeve. When plugging it back into its sleeve, ensure that the latching ears click back into place to maintain the IP65 sealing.

1.5. Ordering Code (TCS and TCE)

The following tables define the hardware fitted:-

Model	Function		Power Supply		Option 1 (OP1)		Option 2 (OP2)		Option 3 (OP3)*		Option 4 (OP 4)	
TCS	3	PID On/Off	3	100-240Vac	0	Not fitted	0	Not fitted	0	Not fitted	0	Not fitted
TCE	5	Motorised Valve	5	20 - 29V ac/dc	1	Relay (form A)	1	Relay (form A)	1	Relay (form A)	1	Relay (form C)
					5	Logic I/O *	6	Logic I/O (SSR) *				
					7	Linear output (0-20mA) *	7	Linear output *	7	Linear output isolated		

(*) These outputs are not electrically isolated from the measurement input

CT+Logic IP		Comms		Language	
0	Not fitted	0	Not fitted	E	English
1	CT + Logic IP	1	RS232 + 2nd Logic IP	I	Italian
		2	RS485 + 2nd Logic IP	G	German
				F	French
				S	Spanish

Available OP1, OP2 option combinations TCS:- 0-0; 0-1; 0-2; 1-0; 1-1; 1-2 respectively.

Available OP1, OP2, OP3 option combinations TCE:- 1-1-0; 1-1-1; 5-0-0; 5-6-0; 5-1-1; 5-6-1; 5-6-7; 5-1-7; 5-7-7; 1-1-7; 7-1-7; 7-7-7 respectively.

OP 4 options are only available on model TCE

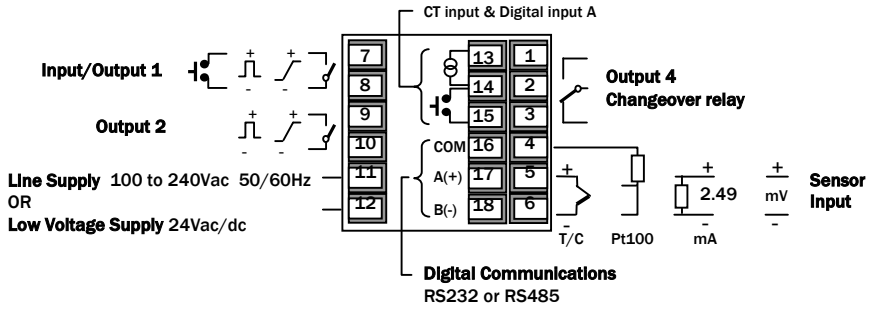
2. Step 2: Wiring

2.1. Terminal Layout TCS Controller

Warning

Ensure that you have the correct supply for your controller

Check order code of the controller supplied



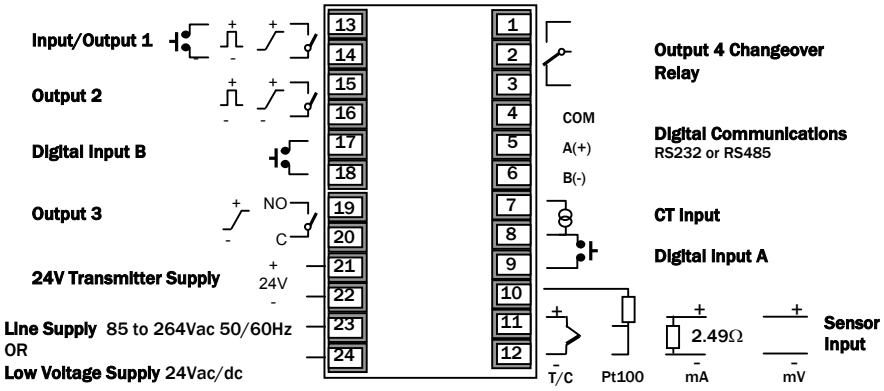
Key to symbols used in the wiring diagrams					
⎍	Logic (SSR drive)		Relay (form C)		Current transformer input
⎎	mA analogue output		Contact input		Relay (form A)

2.2. Terminal Layout TCE Controllers

Warning

Ensure that you have the correct supply for your controller

Check order code of the controller supplied



2.3. Wire Sizes

The screw terminals accept wire sizes from 0.5 to 1.5 mm (16 to 22AWG). Hinged covers prevent hands or metal making accidental contact with live wires. The rear terminal screws should be tightened to 0.4Nm (3.5lb in).

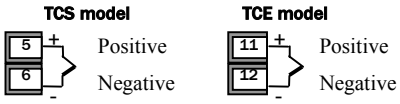
2.4. Precautions

- Do not run input wires together with power cables
- When shielded cable is used, it should be grounded at one point only
- Any external components (such as zener barriers) connected between sensor and input terminals may cause errors in measurement due to excessive and/or un-balanced line resistance, or leakage currents.
- Not isolated from the logic outputs & digital inputs
- Pay attention to line resistance; a high line resistance may cause measurement errors

2.5. Sensor Input (Measuring Input)

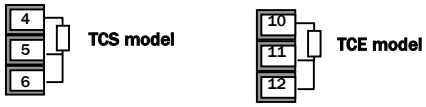
Includes thermocouple, platinum resistance thermometer, mA, mV and volts.

2.5.1. Thermocouple Input



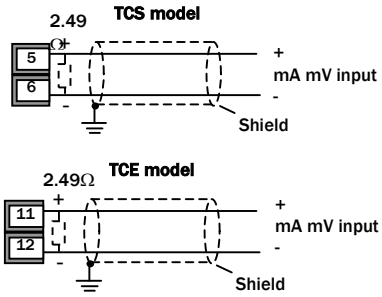
- Use the correct compensating cable preferably shielded.

2.5.2. RTD Input

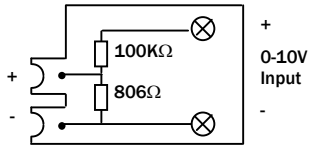


- The resistance of the three wires must be the same.
- The line resistance may cause errors if it exceeds 22Ω.

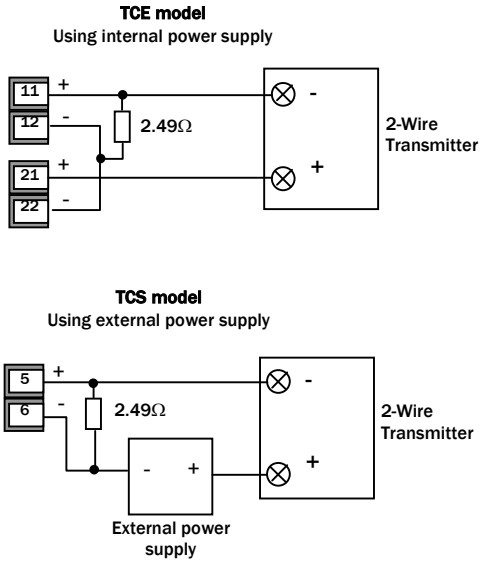
2.5.3. Linear mA, mV or Voltage Inputs



- For a mA input connect the 2.49Ω burden resistor supplied between the V+ and V- terminals as shown
- For a 0-10Vdc input an external input adapter is required (not supplied). Part number: SUB21/IV10



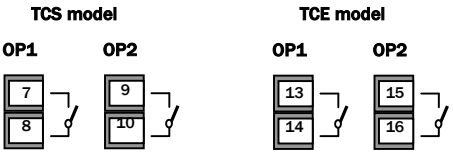
2.5.4. Two-Wire Transmitter Inputs



2.6. Options 1 and 2

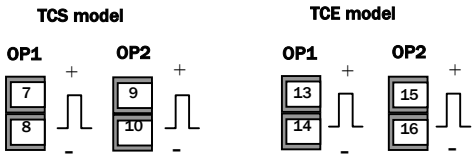
Option 1 may be configured as input or output. Outputs can be logic (SSR drive), or relay, or mAdc. Input is contact closure.

2.6.1. Relay Output (Form A, normally open)



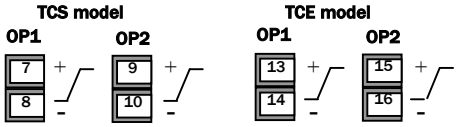
- Isolated output 240Vac CATII
- Contact rating: 2A 264Vac resistive
  100mA 12Vdc minimum
- Output functions: Heating, or cooling, or alarm , or motorised valve open or closed

2.6.2. Logic (SSR drive) Output



- Not isolated from the sensor input
- Output ON state: 12Vdc at 44mA max
- Output OFF state: <300mV, <100µA
- Output functions: Heating, or cooling, or alarm, or motorised valve open or closed
- **The output switching rate must be set to prevent damage to the output device in use. See parameter 1.PLS or 2.PLS in the level 2 parameter section 4.2.1**

2.6.3. DC Output



- Not isolated from the sensor input
- Software configurable: 0-20mA or 4-20mA.
- Max load resistance: 500Ω
- Cal. accuracy: ±(<1% of reading + <100μA)
- Output functions: Heating, or cooling, or retransmission.

2.6.4. Logic Contact Closure Input (I/O1 only)

- Not isolated from the sensor input
- Switching: 12Vdc at 40mA max
- Contact open > 500Ω. Contact closed < 150Ω
- Input functions: Please refer to the list in the Quick Start codes.

2.7. Option 3

Option 3 is available only in the model TCE. It will be either a relay or a mA output.

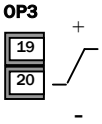
2.7.1. Relay Output (Form A, normally open)

OP3

- Isolated output 240Vac CATII
- Contact rating: 2A 264Vac resistive.
  100mA 12Vdc minimum
- Output functions: Heating, or cooling, or alarm.

2.7.2. DC Output

OP3



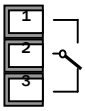
- Isolated output 240Vac CATII
- Software configurable: 0-20mA or 4-20mA
- Max load resistance: 500Ω
- Cal. accuracy: ±(<0.25% of reading + <50µA)
- Output functions: Heating, or cooling, or retransmission.

2.8. Option 4

This is always a changeover relay output.

2.8.1. Relay Output (Form C)

OP4



- Isolated output 240Vac CATII
- Contact rating: 2A 264Vac resistive
  100mA 12Vdc minimum
- Output functions: Heating, or cooling, or alarm.

* General Notes about Relays and Inductive Loads

High voltage transients may occur when switching inductive loads such as some contactors or solenoid valves. Through the internal contacts, these transients may introduce disturbances which could affect the performance of the instrument.

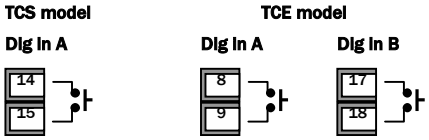
For this type of load it is recommended that a 'snubber' is connected across the normally open contact of the relay switching the load. The snubber recommended consists of a series connected resistor/capacitor (typically 15nF/100Ω). A snubber will also prolong the life of the relay contacts.

WARNING
When the relay contact is open, or it is connected to a high impedance load, it passes a current (typically 0.6mA at 110Vac and 1.2mA at 240Vac). You must ensure that this current will not hold on low power electrical loads. If the load is of this type the snubber should not be connected.

2.9. Digital Inputs A & B

Digital input A is an optional input in all Model sizes.

Digital input B is always fitted in the Model TCE.

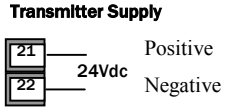


- Not isolated from the sensor input
- Switching: 12Vdc at 40mA max
- Contact open > 500Ω. Contact closed < 150Ω
- Input functions: Please refer to the list in the quick codes.

2.10. Transmitter Power Supply

The Transmitter Supply is not available in the Model TCS.

It is fitted as standard in the Model TCE.



- Isolated output 240Vac CATII
- Output: 24Vdc, +/- 10%. 28mA max.

2.11. Current Transformer

The current transformer input is an optional input in all model sizes.

It can be connected to monitor the rms current in an electrical load and to provide load diagnostics. The following fault conditions can be detected: SSR (solid state relay) short circuit, heater or SSR open circuit and partial load failure. These faults are displayed as alarm messages on the controller front panel.

TCS model

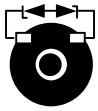
CT Input

TCE model

CT Input

Note: C is common to both the CT input and Digital input A. They are, therefore, not isolated from each other.

- CT input current: 0-50mA rms (sine wave, calibrated) 50/60Hz
- A burden resistor, value 10Ω, is fitted inside the controller.
- It is recommended that the current transformer is fitted with a voltage limiting device to prevent high voltage transients if the controller is unplugged. For example, two back to back zener diodes. The zener voltage should be between 3 and 10V, rated at 50mA.



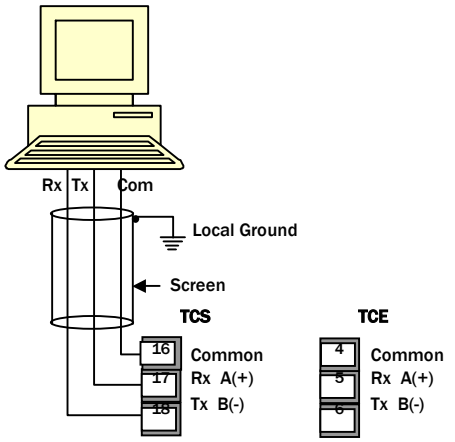
- CT input resolution: 0.1A for scale up to 10A, 1A for scale 11 to 100A
- CT input accuracy: ±4% of reading.

2.12. Digital Communications Optional

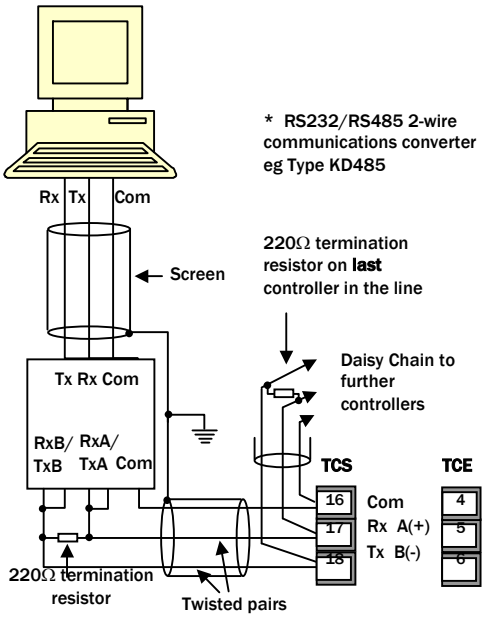
Digital communications uses the Modbus protocol. The interface may be ordered as RS232 or RS485 (2-wire).

- Isolated output 240Vac CATII

RS232 Connections



RS485 Connections



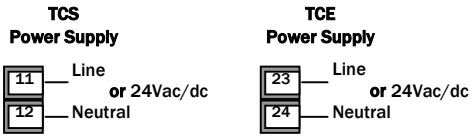
2.13. Controller Power Supply

1. Before connecting the controller to the power line, make sure that the line voltage corresponds to the description on the identification label.
2. Use copper conductors only.
3. The power supply input is not fuse protected. This should be provided externally.

   Recommended external fuse ratings are as follows:-

   For 24 V ac/dc, fuse type: T rated 2A 250V

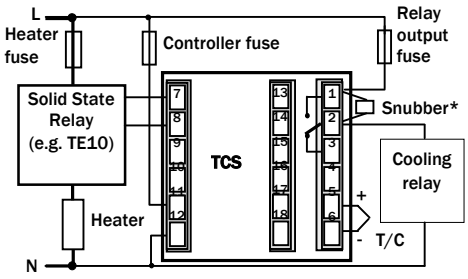
   For 100-240Vac, fuse type: T rated 2A 250V.
4. For 24V the polarity is not important.



- High voltage supply: 100 to 240Vac, -15%, +10%, 50/60 Hz
- Low voltage supply: 24Vac/dc, -15%, +10%

2.14. Example Wiring Diagram

This example shows a heat/cool temperature controller where the heater control uses a SSR and the cooling control uses a relay.



Safety requirements for permanently connected equipment state:

- A switch or circuit breaker shall be included in the building installation
- It shall be in close proximity to the equipment and within easy reach of the operator
- It shall be marked as the disconnecting device for the equipment.

Note: a single switch or circuit breaker can drive more than one instrument.

3. Switch On

The way in which the controller starts up depends on factors described below in sections 3.1, 3.2 and 3.3.

3.1. New Controller

If the controller is new AND has not previously been configured it will start up showing the 'Quick Configuration' codes. This is a built in tool which enables you to configure the input type and range, the output functions and the display format.

⚠ **Incorrect configuration can result in damage to the process and/or personal injury and must be carried out by a competent person authorised to do so. It is the responsibility of the person commissioning the controller to ensure the configuration is correct**

The quick code consists of two 'SETS' of five characters. The upper section of the display shows the set selected, the lower section shows the five digits which make up the set.

Adjust the quick codes as follows:-.

1. Press any button. The first character will change to a flashing '-'.
2. Press ⊙ or ⊙ to change the flashing character to the required code shown in the quick code tables – see next page. Note: An **X** indicates that the option is not fitted.
3. Press ⊙ to scroll to the next character.

☺ You cannot scroll to the next character until the current character is configured.

☺ To return to the first character press ⊙

4. When all five characters have been configured the display will go to Set 2.
5. When the last digit has been entered press ⊙ again, the display will show 

.
6. Press ⊙ or ⊙ to 

. The controller will then automatically go to the operator level, section 3.3

SET 1

J C H C 0

Input type		Range		Option 1		Option 2		Option 4
Thermocouple		**Full range**		X	Unconfigured			**Note (1)** O/P Relay only
B	Type B	C	°C	H	PID Heating (logic, relay(1), or 4-20mA or motor valve open			
J	Type J	F	°F	C	PID Cooling (logic, relay(1), or 4-20mA or motor valve close			
K	Type K	**Centigrade**		J	ON/OFF Heating (logic, or relay(1)), or PID 0-20mA heating			
L	Type L	0	0-100	K	ON/OFF Cooling (logic, or relay(1)), or PID 0-20mA cooling			
N	Type N	1	0-200	**Alarm(2): energised in alarm**		**Alarm(2): de-energised in alarm**		
R	Type R	2	0-400	0	High alarm	5	High alarm	**Note (2)** OP1 = alarm 1 OP2 = alarm 2 OP3 = alarm 3 OP4 = alarm 4
S	Type S	3	0-500	1	Low alarm	6	Low alarm	
T	Type T	4	0-800	2	Deviation high	7	Deviation high	
C	Custom	5	0-1000	3	Deviation low	8	Deviation low	
RTD		6	0-1200	4	Deviation band	9	Deviation band	
p	Pt100	7	0-1400	**DC Retransmission (not O/P4)**				
Linear		8	0-1600	D	4-20mA Setpoint	N	0-20mA Setpoint	
M	0-80mV	9	0-1800	E	4-20mA Temperature	Y	0-20mA Temperature	
2	0-20mA	**Fahrenheit**		F	4-20mA output	Z	0-20mA output	
4	4-20mA	G	32-212	**Logic input functions (input/Output 1 only)**				
		H	32-392	W	Alarm acknowledge	V	Recipe 2/1 select	
		J	32-752	M	Manual select	A	Remote UP button	
		K	32-1112	R	Timer/program run	B	Remote DOWN button	
		L	32-1472	L	Keylock	G	Timer/Prog Run/Reset	
		M	32-1832	P	Setpoint 2 select	I	Timer/Program Hold	
R	32-2912	N	32-2192	T	Timer/program Reset	Q	Standby select	
T	32-3272	P	32-2552	U	Remote SP enable			

SET 2

1 W R D T

Input CT Scaling	
X	Unconfigured
1	10 Amps
2	25 Amps
5	50 Amps
6	100 Amps

Note (2)
OP1 = alarm 1
OP2 = alarm 2
OP3 = alarm 3
OP4 = alarm 4

Digital Input A	
X	Unconfigured
W	Alarm acknowledge
M	Manual select
R	Timer/Program Run
L	Keylock
P	Setpoint 2 select
T	Timer/Program reset
U	Remote SP enable
V	Recipe 2/1 select
A	Remote UP button
B	Remote DOWN button
G	Timer/Prog Run/Reset
I	Timer/Program Hold
Q	Standby select

Digital Input B TCE only

Option 3 TCE only			
X	Unconfigured		
H	PID heating or motor valve open		
C	PID cooling or motor valve close		
J	ON/OFF heating		
K	ON/OFF cooling		
Alarm Outputs(2)	Energised in alarm		De-energised in alarm
0	High alarm	5	High alarm
1	Low alarm	6	Low alarm
2	Dev High	7	Dev High
3	Dev Low	8	Dev Low
4	Dev Band	9	Dev Band

Lower Display	
T	Setpoint (std)
P	Output
R	Time remaining
E	Elapsed time
1	Alarm setpoint
A	Load Amps
D	Dwell/Ramp Time/Target
N	None
C	Setpoint with Output meter (3)
M	Setpoint with Ammeter (3)

Note (3) TCE only

DC outputs

Retransmission	
D	4-20 Setpoint
E	4-20 Measured Temperature
F	4-20mA output
N	0-20 Setpoint
Y	0-20 Measured Temperature
Z	0-20mA output

Control	
H	4-20mA heating
C	4-20mA cooling
J	0-20mA heating
K	0-20mA cooling

3.2. To Re-Enter Quick Code Configuration Mode

If you need to re-enter the 'Quick Configuration' mode this can always be done as follows:-

1. Power down the controller
2. Hold ⧉ button down and power up the controller again. Keep the button pressed until Set 1 is displayed.
3. The quick codes may then be set as described previously

☺ Parameters may also be configured using a deeper level of access. This is described in the TCS/TCE Engineering Handbook Part No. HA029065 which may be downloaded from www.dynisco.com

☺ If the controller is started with the ⧉ button held down, as described above, and the quick codes are shown with dots (e.g. J.C.X.X.X), this indicates that the controller has been re-configured in a deeper level of access and, therefore, the quick codes may not be valid.

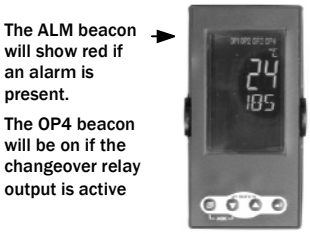
3.3. Pre-Configured Controller or Subsequent Starts

A brief start up sequence consists of a self test during which the software version number is shown followed briefly by the quick codes.

It will then proceed to **Operator Level 1**..

You will see the display shown below. It is called the HOME display.

TCE example

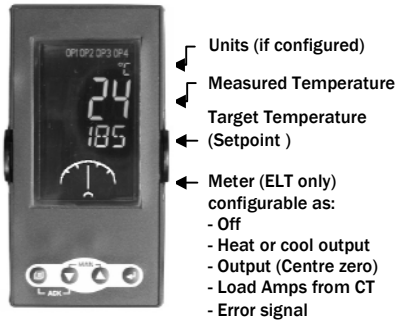


☺ If the quick codes do not appear during this start up, it means that the controller has been configured in a deeper level of access, see note in section 3.2. The quick codes may then not be valid and are therefore not shown.

3.4. Front Panel Layout

Beacons:-

ALM (flashing or steady) Alarm active (Red)
OP1 Lit when output 1 is ON (normally heating)
OP2 Lit when output 2 is ON (normally cooling)
OP3 Lit when output 3 is ON (TCE only)
OP4 Lit when the changeover relay output is ON
SPX Alternative setpoint in use (SP2)
REM Remote setpoint or communications active
RUN Timer/programmer running
RUN (flashing) Timer/programmer in hold
MAN Manual mode selected



Units (if configured)
Measured Temperature
Target Temperature (Setpoint)
Meter (ELT only) configurable as:
- Off
- Heat or cool output
- Output (Centre zero)
- Load Amps from CT
- Error signal

Operator Buttons:-

From any view - press to return to the HOME display.

Press to select a new parameter. If held down it will continuously scroll through parameters**.**

Press to change a selection or to decrease a value.

Press to change a selection or to increase a value.

3.4.1. To Set The Temperature (Setpoint)

In the HOME display:-

Press to raise the setpoint

Press to lower the setpoint

The new setpoint is entered when the button is released and is indicated by a brief flash of the display.

3.4.2. Auto, Manual and Off Mode

The controller can be put into Auto, Manual or Off mode

Auto mode is the normal operation where the output is adjusted automatically by the controller in response to changes in the measured temperature.

In Auto mode all the alarms and the special functions (auto tuning, soft start, timer and programmer) are operative

Manual mode means that the controller output power is manually set by the operator. The input sensor is still connected and reading the temperature but the control loop is 'open'. In Manual mode the Band and deviation alarm are masked, the auto-tuning timer and programmer functions are disabled.

In manual mode the MAN beacon will be lit. The power output can be continuously increased or decreased using the ⊙ or ⊙ buttons.

⚠ **Manual mode must be used with care. The power level must not be set and left at a value that can damage the process or cause over-heating. The use of a separate 'over-temperature' controller is recommended.**

Off mode means that the heating and cooling outputs are turned off. The process alarm and analogue retransmission outputs will, however, still be active while Band and deviation alarm will be OFF.

3.4.3. To Select Auto, Manual or OFF Mode

Press and hold ♦ and · (MAN) together for more than 1 second.

This must be done in the HOME display.

1. 'Auto' is shown in the upper display. After 5 seconds the lower display will scroll the longer description of this parameter. ie 'loop mode – auto manual off'

2. Press · to select 'mAn' or twice to select 'OFF'. This is shown in the upper display.

3. When the desired Mode is selected, do not push any other button. After 2 seconds the controller will return to the HOME display.

4. If **OFF** has been selected, OFF will be shown in the lower display and the heating and cooling outputs will be off

5. If manual mode has been selected, the **MAN** beacon will light. The upper display shows the measured value and the lower display the demanded output power.

☺ The transfer from Auto to manual mode is 'bumpless'. This means the output will remain at the current value at the point of transfer. Similarly when transferring from Manual to Auto mode, the current value will be used. This will then slowly change to the value demanded automatically by the controller.

6. To manually change the power output, press · or ♦ to lower or raise the output. The output power is continuously updated when these buttons are pressed

7. To return to Auto mode, press · and ♦ together. Then press ♦ to select 'Auto'.

3.4.4. Level 1 Operator Parameters

Operator level 1 is designed for day to day operation so that the access to these parameters is not protected by a pass code.

Press ↵ to step through the list of parameters. The mnemonic of the parameter is shown in the lower display.

After five seconds a scrolling text description of the parameter appears.
The value of the parameter is shown in the upper display. Press ⊙ or ♦ to adjust this value. If no key is pressed for 30 seconds the controller returns to the HOME display
The parameters that appear depend upon the functions configured. They are:-

Mnemonic	Scrolling text and Description	Availability	
WRK.OP	**WORKING OUTPUT** The active output value	Read only. Shown when the controller is in AUTO or OFF mode.	
WRK.SP	**WORKING SETPOINT** The current setpoint value	Read only. Shown when the controller is in MAN or OFF mode.	
SP.SEL	**SETPOINT SELECT** Select setpoint 1 or 2 (SP1 or SP2).	Alterable.	
A.TUNE	**AUTOTUNE** automatically sets the control parameters to match the process characteristics.	Off On	Disable Enable
REC.NO	**CURRENT RECIPE NUMBER** Select the recipe to recall (1 to 5)	Alterable. If a recipe is selected which has not been previously loaded 'Fail' will be shown	
T. ELAP	**ELAPSED TIME** Timer time passed	Read only	
T.REMN	**TIME REMAINING** Timer time remaining.	Alterable. 0:00 to 99.59 hh:mm or mm:ss	
LK.AMP	**Leakage Current** Current measured in OFF state	Read only. Shown when the CT current measurement is configured.	
LD.AMP	**Load Current** Current measured in ON state	Read only. Shown when the CT current measurement is configured.	

4. Operator Level 2

Level 2 provides access to additional parameters. It is protected by a security code.

4.1. To Enter Level 2

1. From any display press and hold
2. After a few seconds the display will show:-

3. Release .
   (If no button is pressed for 45 seconds the display returns to the HOME display)
4. Press or to choose Lev 2 (Level 2) →

5. After 2 seconds you will see →

6. Press or to enter the pass code. Default = '2' →

7. If an incorrect code is entered the controller reverts to Level 1.

4.2. To Return to Level 1

1. Press and hold
2. Press to select LEv 1

The controller will return to the level 1 HOME display. Note: A pass code is not required when going from a higher level to a lower level.

4.2.1. Level 2 Operator Parameters

Press to step through the list of parameters. The mnemonic of the parameter is shown in the lower display. After five seconds a scrolling text description of the parameter appears.

The value of the parameter is shown in the upper display. Press or to adjust this value. If no key is pressed for 30 seconds the controller returns to the HOME display

Backscroll is achieved when you are in this list by pressing while holding down .

The following table shows a list of parameters available in Level 2. The order in which they appear depends on the options available.

☺ Press ⓘ at any time to return immediately to the HOME screen.

☺ Hold ↵ down to continuously scroll through the above list

Mnemonic	Scrolling Display and description	Range	
WKG.SP	**WORKING SETPOINT** is the current target setpoint and appears when the controller is in Manual. It may be derived from SP1 or SP2, or, if the controller is ramping (see SP.RAT), it is the current ramp value.	SP.HI to SP.LO	
WRK.OP	**WORKING OUTPUT** is the output from the controller expressed as a percentage of full output. It appears when the controller is in Auto. In a motorised valve controller (option VC or VP) this is the 'inferred' position of the valve For a time proportioning output, 50% = relay or logic output on or off for equal lengths of time. For an On/Off output 0 to <1% = output off, >1 to 100% = output on	0 to 100% heat only -100 (max cooling) to 100% (max heating	
A.TUNE	**AUTO-TUNE ENABLE** automatically sets the control parameters to match the process characteristics.	Off	Disable
		On	Enable
SP.SEL	**SETPOINT SELECT** Choose setpoint 1 or setpoint 2 as the working setpoint	SP1	Setpoint 1
		SP2	Setpoint 2
SP1	**SETPOINT 1** to set the value of control setpoint 1	Alterable: from SP.HI to SP.LO	

<table>
<tr><th>Mnemonic</th><th colspan="4">Scrolling Display and description</th><th>Range</th></tr>
<tr><td>SP2</td><td colspan="4">SETPOINT 2 to set the value of control setpoint 2</td><td>Alterable: from SP.HI to SP.LO</td></tr>
<tr><td colspan="6">The next four parameters apply to Alarms only. If an alarm is not configured the parameters do not appear</td></tr>
<tr><td rowspan="4">A1.— - to
A4.—</td><td colspan="4">ALARM 1 (2, 3 or 4) SETPOINT sets the threshold value at which an alarm is detected. Up to four alarms are available and are only shown if configured.
— = the mnemonic for the alarm type which may be:-</td><td rowspan="4">Range high to range low</td></tr>
<tr><td>Lo</td><td>Full Scale Low</td><td>Bnd</td><td>Deviation Band</td></tr>
<tr><td>Hi</td><td>Full Scale High</td><td>dLo</td><td>Deviation Low</td></tr>
<tr><td></td><td></td><td>dHi</td><td>Deviation High</td></tr>
<tr><td colspan="6">The next two parameters allow current settings to be stored and selected</td></tr>
<tr><td>REC.NO</td><td colspan="4">CURRENT RECIPE NUMBER the most frequently used parameters can be stored in up to 5 recipes. This parameter selects the recipe to use.</td><td>none or 1 to 5 or
FaiL if no recipe set stored</td></tr>
<tr><td>STORE</td><td colspan="4">RECIPE TO SAVE the most frequently used parameter s can be stored in up to 5 recipes. This parameter allows you to store the current values in recipe numbers 1, 2, 3, 4, or 5. none does not store values.</td><td>none or 1 to 5
done when stored</td></tr>
</table>

Mnemonic	Scrolling Display and description	Range
The following parameters set up the control characteristics		
PB	**PROPORTIONAL BAND** sets an output which is proportional to the size of the error signal. Units may be % or display units.	0.1 to 3000 display units Default 20
TI	**INTEGRAL TIME** removes steady state control offsets by ramping the output up or down in proportion to the amplitude and duration of the error signal.	Off to 9999 seconds Default 360
TD	**DERIVATIVE TIME** determines how strongly the controller will react to the rate of change in the process value. It is used to prevent overshoot and undershoot and to restore the PV rapidly if there is a sudden change in demand.	Off to 9999 seconds Default 60 for PID control Default 0 for valve position control
MR	**MANUAL RESET** applies to a PD only controller i.e. the integral term is turned off. Set this to a value of power output (from +100% heat, to -100% cool which removes any steady state error between SP and PV.	-100 to 100% Default 0
R2G	**RELATIVE COOL GAIN** adjusts the cooling proportional band relative to the heating proportional band. Particularly necessary if the rate of heating and rate of cooling are very different. (Heat/Cool only)	0.1 to 10.0 Default 1.0
HYST.H	**HEATING HYSTERESIS** sets the difference in PV units between output 1 turning off and turning on. Only shown if channel 1 control action is On/Off.	0.1 to 200.0 display units Default 1.0
HYST.C	**COOLING HYSTERESIS** sets the difference in PV units between output 2 turning off and turning on. Only shown if channel 2 control action is On/Off.	0.1 to 200.0 display units Default 1.0

Mnemonic	Scrolling Display and description	Range	
D.BAND	**CHANNEL 2 DEADBAND** adjusts a zone between heating and cooling outputs when neither output is on. Off = no deadband. 100 = heating and cooling off.	OFF or 0.1 to 100.0% of the cooling proportional band	
MTR.T	**MOTOR TRAVEL TIME.** This parameter only applies if the controller is a motorised valve positioner. Set this value to the time that it takes for the motor to travel from its fully closed to its fully open position. Note: In motorised valve control only the PB and TI parameters are active – see below. The TD parameter has no effect on the control.	0.0 to 999.9 seconds	
The next nine parameters are only shown if the timer is configured			
SS.SP	**SOFT START SETPOINT** sets the threshold below which the power is limited – applies to timer type Soft Start only	Between SP.HI and SP.LO	
SS.PWR	**SOFT START POWER LIMIT** Sets the power limit during start up – applies to timer type Soft Start only	-100 to 100%	
DWELL	**SET TIME DURATION** This parameter only appears if 'TM.CFG' is set to Dwell, Delayed Start or Soft Start type. It can be adjusted while the timer is running.	0:00 to 99.59 hh:mm: or mm:ss	
T.ELAP	**ELAPSED TIME** Time from when RUN was initiated – applies to all timer types.	0:00 to 99.59 hh:mm: or mm:ss	
T.REMN	**TIME REMAINING** Time remaining to reach the set time – applies to all timer types.	0:00 to 99.59 hh:mm: or mm:ss	
TM.CFG	**TIMER CONFIGURATION** configures the timer type - Dwell, Delay, Soft Start or none (only when in Reset) The programmer is an orderable option. ProG is only shown if the programmer option has been ordered. For programmer parameters see Programmer Addendum Part No. HA029085.	none	None
		Dwel	Dwell
		DeLy	Delayed switch on
		sfst	Soft start

Mnemonic	Scrolling Display and description	Range	
		Prog	Programmer
TM.RES	**TIMER RESOLUTION** selects hours or minutes (only when in Reset) – applies to all timer types.	Hour min	Hours Minutes
END.T	**TIMER END TYPE** The action of the timer when it has timed out can be selected from Dwell (control continues at the setpoint), Off (control outputs turn off), SP2 (control at setpoint 2). Can be changed while the timer is running – applies to Dwell types only.	OFF	Control OP goes to zero
		Dwel	Control continues at SP1
		SP2	Go to SP2
THRES	**TIMER START THRESHOLD** The timer will not run until the PV becomes in range of the value set by this parameter. This value can be changed when the timer is running – applies to Dwell and Programmer timer types only.	OFF or 1 to 9999	
1. (2, 3 or 4) PLS.	**OUTPUT 1 (2, 3 or 4) MINIMUM PULSE TIME** Sets the minimum on and off time for the control output. ⚠ Ensure this parameter is set to a value that is suitable for the output switching device in use. For example, if a logic output is used to switch a small relay, set the value to 5.0 seconds or greater to prevent damage to the device due to rapid switching.	Relay outputs 0.1 to 150.0 seconds – default 5.0. Logic outputs Auto to 150.0 -Default Auto = 55ms 1. (2, 3 or 4) PLS.	
PV.OFS	**PV OFFSET** To set a simple offset to the process variable. See section 8.3 for further details	-1999 to 3000	

Mnemonic	Scrolling Display and description	Range
FILT.T	**FILTER TIME** To set the value of the input filter time constant. The value can be increased to reduce the effect of excessive noise being applied to the controller from external sources. If the value is set too high the slower the controller will respond to changes in the process value	OFF to 100 seconds Default 1.6 seconds
SP.HI	**SETPOINT HIGH LIMIT** allows a high limit to be applied to SP1 and SP2	As quickcode SET1
SP.LO	**SETPOINT LOW LIMIT** allows a low limit to be applied to SP1 and SP2	
SP.RAT	**SETPOINT RATE LIMIT** sets the rate of change of setpoint. Limits the rate of heating or cooling.	OFF to 3000 display units per minute
OP.HI	**OUTPUT HIGH** limits the maximum heating power applied to the process or a minimum cooling output.	+100% to OP.LO
OP.LO	**OUTPUT LOW** Limits the minimum heating power applied to the process or a minimum cooling output.	+100% to OP.HI
SAFE	**SAFE OUTPUT POWER** The output power if the loop is in inhibit	Default 0% Range +100%
The next five parameters apply to current transformer input only. If the CT option is not configured the parameters do not appear		
LD.AMP	**LOAD CURRENT** is the measured load current when the power demand is on	CT Range
LK.AMP	**LEAK CURRENT** is the measured leakage current when the power demand is off.	CT Range
LD.ALM	**LOAD CURRENT THRESHOLD** sets a low alarm trip point for the load current as measured by the CT. This detects partial load failure.	CT Range
LK.ALM	**LEAK CURRENT THRESHOLD** sets a high alarm trip point for the leakage current measured by the CT.	CT Range

Mnemonic	Scrolling Display and description	Range
HC.ALM	**OVERCURRENT THRESHOLD** sets a high alarm trip point to show over current as measured by the CT	CT Range
The next two parameters apply to Digital Communications		
ADDR	**ADDRESS** - communications address of the controller, if digital communications has been supplied. 1 to 254	1 to 254
BAUD	**BAUD RATE** Digital communications baud rate	9600, 19.2K, 4800, 2400, 1200

4.3. Alarms

Up to four process alarms may be configured using the Quick Start Codes section 3.1. Each alarm can be configured for:-

Full Scale Low	The alarm is shown if the process value falls below a set threshold
Full Scale High	The alarm is shown if the process value rises above a set threshold
Deviation Low	The alarm is shown if the process value deviates below the setpoint by a set threshold
Deviation High	The alarm is shown if the process value deviates above the setpoint by a set threshold
Deviation Band	The alarm is shown if the process value deviates above and below the setpoint by a set threshold

If an alarm is not configured it is not shown in the list of level 2 parameters, section 4.2.1.

Additional alarm messages may be shown such as CONTROL LOOP BROKEN. This occurs if the controller does not detect a change in process value following a change in output demand after a suitable delay time. Another alarm message may be INPUT SENSOR BROKEN (SBr). This occurs if the sensor becomes open circuit; the output level will adopt a 'SAFE' value which can be set up in Operator Level 2, see section 4.3.

4.3.1. Alarm Indication

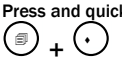
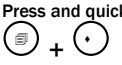
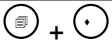
If an alarm occurs, the red ALM beacon will flash. A scrolling text message will describe the source of the alarm. Any output attached to the alarm will operate. An alarm relay can be configured using the Quick Start Codes to be energised or de-energised in the alarm condition. It is normal to configure the relay to be de-energised in alarm so that an alarm is indicated if power to the controller fails.

Press  and  (ACK) together to acknowledge the alarm

If the alarm is still present the ALM beacon will light continuously otherwise it will go OFF.
By default alarms are configured as non-latching, de-energised in alarm. If you require latched alarms, please refer to the engineering handbook.

4.4. Timer Operation

An internal timer can be configured to operate in one of three different modes. The mode is configured in Level 2 by the **'TM.CFG'** (timer configuration) parameter. Each Timing Mode is described in the pages that follow.

Operation	Action	Indication
To Run the timer	Press and quickly release 	Beacon – RUN = On Scrolling text display:- TIMER RUNNING
To Hold the timer	Press and quickly release 	Beacon – RUN = Flashing Scrolling text display:- TIMER HOLD
To Reset the timer	Press and hold  for more than 1 second	Beacon – RUN = Off If the timer is a Dwell Type and configured to turn power off at the end of the timing period OFF will be displayed
	Timer has timed out (END state)	Beacon – RUN = Off SPX = On if End Type = SP2 Scrolling display:- TIMER END. Note:- The timer can be re-run from the end state without the need to reset it.

The timer can also be RUN, HELD or RESET by the parameter 'T.STAT' (Timer status). It can also be controlled via digital inputs (if configured).

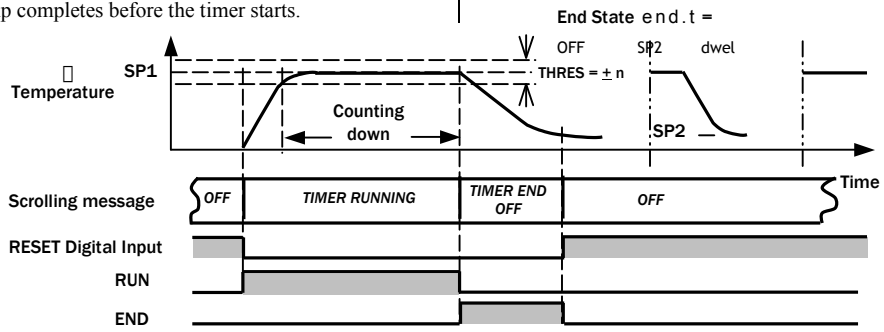
4.4.1. Dwell Timer

A dwell timer ('**TI.CFG' = 'DwEll'**) is used to control a process at a fixed temperature for a defined period.

At power up the instrument will start in the same mode (Auto or OFF) or with the same setpoint (SP1 or SP2) it have prior to the power shutdown.

In reset the controller behaviour depends on the configuration of the '**END.T'** parameter.
In run the instrument will select the SP1 as operative set point and the control will start. Timing starts when the temperature is within the threshold '**THRES'** and the setpoint. If the threshold is set to OFF the timing starts immediately. If setpoint ramping is enabled, then the ramp completes before the timer starts.

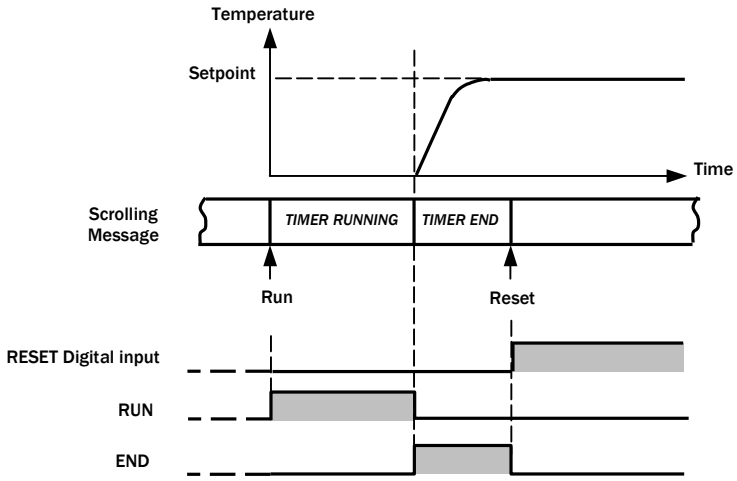
In the END state the behaviour is determined by the parameter '**END.T'** (End type):
OFF: The heating and cooling is turned OFF (resets to Off)
Dwell: Controls at setpoint1 (resets to Setpoint 1)
SP2 Controls at setpoint 2 (resets to Setpoint 1)
Note: The dwell period can be reduced or increased while the timer is running.



4.4.2. Delayed Timer

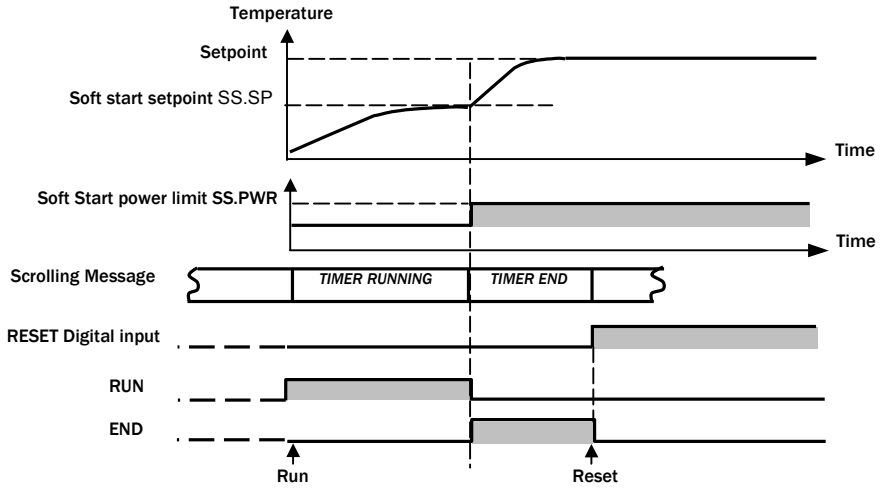
'TI.CFG' = 'DELY'. The timer is used to switch on the output power after a set time. The timer starts immediately on power-up, or when run. The controller remains in standby with heating and

cooling off, until the time has elapsed. After the time has elapsed, the instrument controls at the target setpoint.



4.4.3. Soft Start Timer

'**TI.CFG' = 'SS.St'.** A Soft Start timer starts automatically on power up. It applies a power limit ('**SS.PWR')** until the temperature reaches a threshold value ('**SS.SP')** or the timer times-out after the dwell period ('**DwEll')**. It is typically use to dry-out heaters in Hot Runner control systems



5. General Specifications

Case: Polycarbonate black colour;

Self-extinguishing degree: V2 according to UL 94.

Front protection - designed and tested for IP 65 (*) and NEMA 4X (*) for indoor locations (when panel gasket is installed).

(*) Tests were performed in accordance with CEI 70-1 and NEMA 250-1991 STD.

Installation: panel mounting.

Rear terminal block: 18 screw terminals with connections diagram and safety rear cover.

Dimensions: DIN 43700 48 x 48 mm, depth 90 mm.

Weight: 250 g.

Power supply:

- 100V to 240V AC 50/60Hz (-15% to + 10% of the nominal value).

- 24 V AC/DC ($\pm$ 10 % of the nominal value).

Power consumption: 5 VA max.

I**nsulation resistance**: > 100 MΩ according to IEC 1010-1.

Dielectric strength: 1500 V rms according to IEC 1010-1.

Display updating time: 500 ms.

Sampling time: 250 ms

Accuracy: $\pm$ 0,25% of reading @ 25 °C ambient temperature.

Common mode rejection: > 120 dB @ 50/60 Hz.

Normal mode rejection: > 60 dB @ 50/60 Hz.

Operative temperature: from 0 to 55 °C (+32 to 131 °F).

Storage temperature: -10 to +70 °C (-14 to 158 °F)

Humidity: from 20 % to 85% RH, non condensing.

5.1. Inputs

A) THERMOCOUPLE

Type : B - L -J -K -N -R -S -T. °C/°F selectable.
External resistance: 100 Ω max, maximum error 0,1% of span.
Cold junction: automatic compensation from 0 to 55°C.
Cold junction accuracy : > 30 to 1
Input impedance: > 1 MΩ
Calibration : according to IEC 584-1 and DIN 43710 - 1977.

STANDARD RANGES TABLE

TC	Range (°C)			Range (°F)		
J	-210	1200	°C	-238	2192	°F
K	-200	1372	°C	-238	2498	°F
L	-200	900	°C	-238	1652	°F
R	-50	1700	°C	-58	3124	°F
B	0	1820	°C	-32	3308	°F
N	-200	1300	°C	-238	2372	°F
T	-200	400	°	-238	752	°F
			C			
S	-50	1768	°C	-58	3214	°F

B) RTD

Type: PT100, 3-wire connection
Bulb current: 0.2 mA
Line resistance compensation: no error up to 22Ω /wire.
Standard range: from –200 to 850 °C (–238 to 1562 °F)

C) LINEAR INPUTS

Read-out: programmable from -1999 to +9999.
Decimal point: programmable in any position

STANDARD RANGE TABLE

Minimum	Maximum	unit	Impedance
0	60	mV	> 1MΩ
12	60	mV	> 1MΩ
0	10	mV	> 100 kΩ
2	10	mV	> 100 kΩ
0	20	mA	< 3 Ω
4	20	mA	< 3 Ω

D) LOGIC INPUT

Type: contact closure
Contact open : > 500 Ω
Contact closed : < 200 Ω

6. Safety Requirements

Safety and EMC Information

This controller is intended for industrial temperature and process control applications when it will meet the requirements of the European Directives on Safety and EMC. Use in other applications, or failure to observe the installation instructions of this handbook may impair safety or EMC. The installer must ensure the safety and EMC of any particular installation.

Safety

This controller complies with the European Low Voltage Directive 73/23/EEC, by the application of the safety standard EN 61010.

Electromagnetic compatibility

This controller conforms with the essential protection requirements of the EMC Directive 89/336/EEC, by the application of a Technical Construction File. This instrument satisfies the general requirements of the industrial environment defined in EN 61326. The EMC

Booklet (part number HA025464) gives further installation information.

Installation requirements for EMC

To ensure compliance with the European EMC directive certain installation precautions are necessary as follows:

- For general guidance refer to EMC Installation Guide, HA025464. This may be downloaded from www.dynisco.com.
- When using relay outputs it may be necessary to fit a filter suitable for suppressing the emissions. The filter requirements will depend on the type of load. For typical applications we recommend Schaffner FN321 or FN612.
- If the unit is used in table top equipment which is plugged into a standard power socket, then it is likely that compliance to the commercial and light industrial emissions standard is required. In this case to meet the conducted emissions requirement, a suitable mains filter should be installed. We recommend Schaffner types FN321 and FN612.

General notes

The information contained in this manual is subject to change without notice. While every effort has been made to ensure the accuracy of the information, your supplier shall not be held liable for errors contained herein.

Service and repair

This controller has no user serviceable parts. Contact your supplier for repair.

Caution: Charged capacitors

Before removing an instrument from its sleeve, disconnect the supply and wait at least two minutes to allow capacitors to discharge.

Failure to observe these precautions may cause damage to components of the instrument or some discomfort to the user.

Electrostatic discharge precautions

When the controller is removed from its sleeve, some of the exposed electronic components are vulnerable to damage by electrostatic discharge from someone handling

the controller. To avoid this, before handling the unplugged controller discharge yourself to ground.

Cleaning

Do not use water or water based products to clean labels or they will become illegible. Isopropyl alcohol may be used to clean labels. A mild soap solution may be used to clean other exterior surfaces of the product.

Safety Symbols

Various symbols may be used on the controller. They have the following meaning:

Caution, (refer to accompanying documents)

Equipment protected throughout by DOUBLE INSULATION

☺ Helpful hints

Personnel

Installation must only be carried out by suitably qualified personnel.

Enclosure of Live Parts

To prevent hands or metal tools touching parts that may be electrically live, the controller must be enclosed in an enclosure

Caution: Live sensors

The controller is designed to operate if the temperature sensor is connected directly to one cable of the power line. However, you must ensure that service personnel do not touch connections to these inputs and to all other inputs/outputs not isolated from the measuring input while they are live. With a live sensor, all cables, connectors and switches for connecting the sensor must be mains rated for use in 240Vac CATII.

Wiring

It is important to connect the controller in accordance with the wiring data given in this guide. Take particular care not to connect AC supplies to the low voltage sensor input or other low level inputs and outputs. Only use copper conductors for connections (except thermocouple inputs) and ensure that the wiring of installations comply with all local wiring regulations. For example in the UK use the latest version of the IEE wiring regulations, (BS7671). In the USA use NEC Class 1 wiring methods.

Power Isolation

The installation must include a power isolating switch or circuit breaker. This device should be in close proximity to the controller, within easy reach of the operator and marked as the disconnecting device for the instrument.

Overcurrent protection

The power supply to the system should be fused appropriately to protect the cabling to the units.

Voltage rating

The maximum continuous voltage applied between any of the following terminals must not exceed 240Vac:

- relay output to logic, dc or sensor connections;
- any connection to ground.

The controller must not be wired to a three phase supply with an unearthed star connection. Under fault conditions such a supply could rise above 240Vac with respect to ground and the product would not be safe.

Conductive pollution

Electrically conductive pollution must be excluded from the cabinet in which the controller is mounted. For example, carbon dust is a form of electrically conductive pollution. To secure a suitable atmosphere in conditions of conductive pollution, fit an air filter to the air intake of the cabinet. Where condensation is likely, for example at low temperatures, include a thermostatically controlled heater in the cabinet.
This product has been designed to conform to BSEN61010 installation category II, pollution degree 2. These are defined as follows:-

Installation Category II (CAT II)

The rated impulse voltage for equipment on nominal 230V supply is 2500V.

Pollution Degree 2

Normally only non conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.

Grounding of the temperature sensor shield

In some installations it is common practice to replace the temperature sensor while the controller is still powered up. Under these conditions, as additional protection against electric shock, we recommend that the shield of the temperature sensor is grounded. Do not rely on grounding through the framework of the machine.

Over-temperature protection

When designing any control system it is essential to consider what will happen if any part of the system should fail. In temperature control applications the primary danger is that the heating will remain constantly on. Apart from spoiling the product, this could damage any process machinery being controlled, or even cause a fire.
Reasons why the heating might remain constantly on include:

- the temperature sensor becoming detached from the process
- thermocouple wiring becoming short circuit;
- the controller failing with its heating output constantly on
- an external valve or contactor sticking in the heating condition
- the controller setpoint set too high.

Where damage or injury is possible, we recommend fitting a separate over-temperature protection unit, with an independent temperature sensor, which will isolate the heating circuit.

Please note that the alarm relays within the controller will not give protection under all failure conditions.

Routing of wires

To minimise the pick-up of electrical noise, the low voltage DC connections and the sensor input wiring should be routed away from high-current power cables. Where it is impractical to do this, use shielded cables with the shield grounded at both ends. In general keep cable lengths to a minimum.