

Thermo Fisher Scientific Literature

Yokogawa UT150 to Eurotherm 3216c Controller Conversion Procedure

LT71X28 • Revision D • January, 2021

UT150 to 3216c Controller Change

Caution: The unit must be turned off and disconnected from the power supply or follow Lockout/Tagout procedures as necessary to prevent electrical shock.

To replace the UT150 controller with the 3216c controller remove the wires from the UT150 controller terminals and reconnected to the appropriate terminals on the 3216c Controller. The terminal conversion is listed below.

UT150 Terminals #	3216c Terminals #	Function	Notes
7	V+	TC +	Thermocouple
8	V-	TC -	
9	L	L1 Line Voltage	AC Input
10	N	L2 Neutral	
14	1A	SSR Control Output +	Solid State Relay
15	1B	SSR Control Output -	
12	AC	Alarm Relay N/C	
13	AB	Alarm Relay Common	
3	HF	RS485 +	RS485 Communication
4	HE	RS485 -	
5	HD	RS485 Common	

Table1: *Wiring changes*

Use new jumper wire provided in the service kit for new controller to connect L and AB terminals. After the controller is wired, put the clips supplied with the controller on the top and bottom then slide them forward until controller is tightly secured into unit. A 'Factory' code used to configure all the functions essential for temperature controlling process. This includes input sensor type, measurement range, control options and alarms.

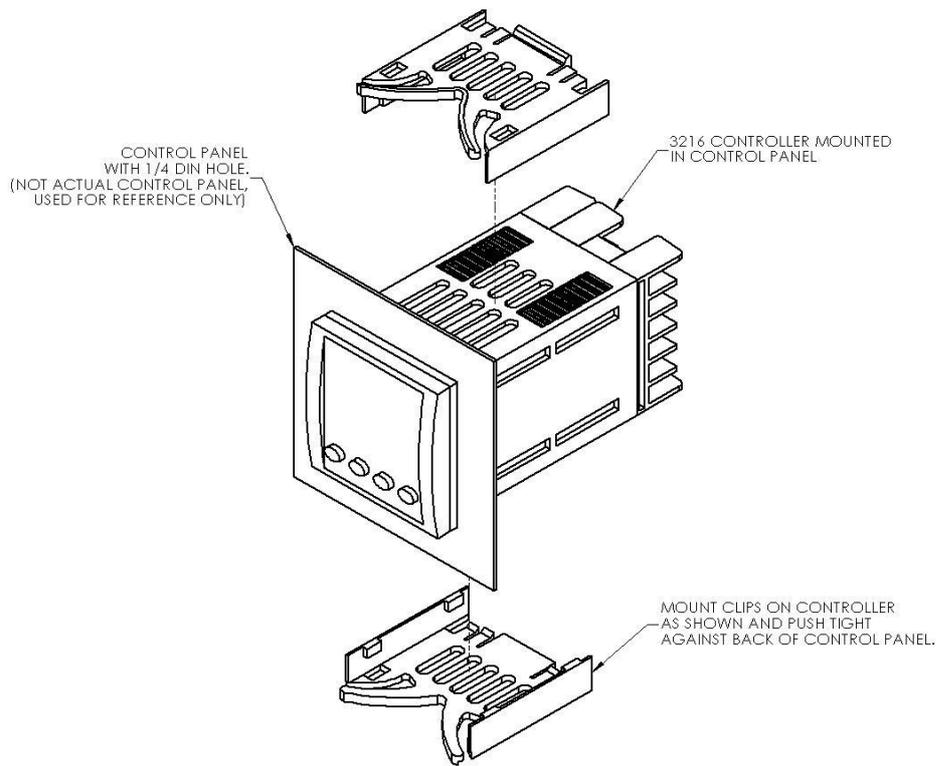


Figure 1
Controller Installation View

1x8 segment Programmable Model w/OTP

Eurotherm 3216 Controller

The Eurotherm 3216c and 3216p temperature controllers sense the furnace's chamber air temperature (the PV or process value) and provides the heat needed to reach the required set point.

There are two choices of controls used in the various furnaces models: The 3216c controller is a basic single setpoint and Timer (1-program 8-segment or Dwell timer or Delay timer). The 3216p controller offers single setpoint and 5-program 16-segment, this controller can store up to 5-different programs and each program can contain 16 segments.

This chapter provides brief instructions on various controller operations which include:

- Setting target temperature
- Setting the ramp rate
- Changing display units
- Auto tuning the controller
- Setting over – temperature protection (OTP)
- Temperature offset procedure
- Timer operation (3216c controller only)
- 5x16 programmer operation (3216p controller only)



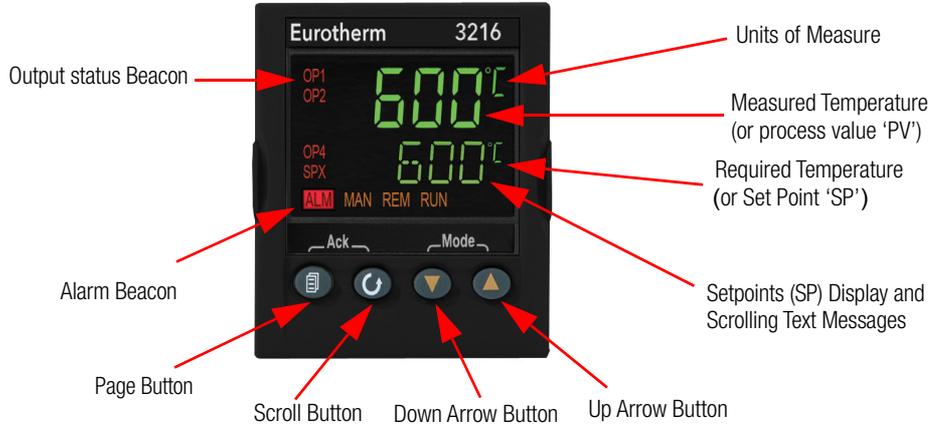
CAUTION : Before operating the controller, read this chapter carefully. Wrong procedures can change the unit characteristics and design parameters, which can hamper performance and make the equipment dangerous to use.

The furnace temperature controller is configured and tuned at the factory to function well for most applications. Occasionally, it may be advisable to configure the temperature controller differently to suit a particular working environment or process.

Operator Interface & HOME Display

When the controller is turned ON, it will perform a brief self-test and then display the HOME Display page. The measured value (process value) is found in the upper display and the set point is found in the lower display.

The description of interface beacons and buttons are shown in “Beacon Display and Description” & “Operator Buttons” respectively.



Beacon Display and Description

OP1 (Output 1)	Illuminates when the output to heater
OP4 (Output 4)	Illuminates when the output is ON (Over-temperature alarm).
SPX	Alternative set point in use (SP2)
ALM	Alarm active (Red)
REM	Remote set point or communication active
RUN	Timer running for 3216c or Program running for 3216p
RUN (flashing)	Timer hold for 3216c or Program hold for 3216p

Operator Buttons



Press to select a new list of parameters and from any display - press PAGE to return to the HOME Page



Press to select new parameter from the page header. If held down it will continuously scroll through parameters.



Hold down SCROLL and press UP ARROW to scroll back parameters.



Press to decrease or change the state of a value.



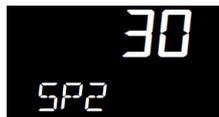
Press to increase or change the state of a value.

Single Set Point Operation

3216 controller has capability to select set point-1 and set point-2. User can setup two different set points to select the desired set point, SP.SEL function can be used.

To set the desired temperature set point, complete the following steps:

1. Press the SCROLL  button until SP1 or SP2 is displayed.



2. Press UP  or DOWN  button until the desired setpoint is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and is indicated by a brief flash of the display.
3. Press PAGE  button to return to the HOME display.

Alternate Set Point Selection (SP2)

1. Press the SCROLL  button from HOME display until SP.SEL is displayed.
2. Press UP  or DOWN  button to select SP1 or SP2.



If SP2 is selected, then SPX beacon will appear on the HOME display indicating the action of alternate set point in use.



Set Point Ramp Rate

The ramp rate SP.RAT is designed to reduce the heating rate that the furnace normally exhibits. When SP.RAT is 'OFF', the furnace will operate at its maximum heating capability. But if ramp rate feature is used, then the chamber is heated at any rate slower than the maximum capability of the unit. To fine tune ramp rates, you may need to test the furnace using loads that you intend to use in furnace application or with loads having similar mass and thermal properties.

NOTE If ramp rate exceed the capability of the furnace unit, it will run the max 100% output of heater capacity. If ramp rate value set less than 100%, furnace unit heater output is reduced and furnace unit chamber gets heated slowly.

Complete the following steps to set the ramp rate units:

1. The ramp rate units can be set in seconds, minutes or hours.
2. Press the SCROLL  button until RAMPU is displayed.
3. Press UP  or DOWN  button until the desired ramp rate unit is indicated on the display.



4. The new ramp rate unit is applied when the button is released and is indicated by a brief flash of the display.
5. Press PAGE  button to return to HOME display.

Complete the following steps to change the ramp rate of SSP.

6. Press the SCROLL  button until SP.RAT is displayed.



7. Press UP  or DOWN  button until the desired ramp rate is indicated on the display. The unit of ramp rate depends on the type of ramp unit RAMPU selected.



8. The new ramp rate is applied when the button is released and is indicated by a brief flash of the display.
9. Press PAGE  button to return to HOME display.

View or Change the Display Units

To change the temperature scale in 3216 controller to operate on °F instead of the factory setting of °C, or to change from °F to °C, follow these steps.

1. Press the SCROLL  button until "UNITS" is shown in the lower display. The current unit is shown in the upper display.



2. Press UP  or DOWN  button to change the display unit.
- a. (°C): Degrees Celsius



- b. (°F): Degrees Fahrenheit



- c. (°K): Kelvin



- d. (NONE): No units displayed



- e. (PERC): Percent



NOTE Do not use nonE & PErc, they are used to measure other applications types other than temperature.

Auto Tuning

In Auto Tuning the characteristics (PID parameters) of the controller are matched to the characteristics of the product load in order to obtain good control.

Good control means:

- Stable control of the set point
- No overshoot or undershoot
- Quick response to deviations from the set point
- Removal of fluctuations

The 3216 controller uses a one-shot tuner which automatically sets the initial values of the parameters listed in Table 2 “Parameter Description and Accessibility in 3216c” and Table 3 “Parameter Description and Accessibility in 3216p”.

Thermofisher recommends that you tune the furnace to your specific application to obtain the best results.

Steps to Auto Tune the Controller

1. Load the chamber with materials that have the same mass and thermal characteristics as a typical product load.
2. Set the temperature as per requirement; refer to section “Single Set Point Operation” on setting SP1 or SP2.
3. Press SCROLL  button to scroll through the list of parameters until A.TUNE is displayed.



4. To enable the auto-tune, set the A.TUNE parameter to ON by using DOWN  or UP  button.
5. Press the PAGE  button to return to the HOME display. The display will flash TUNE to indicate that tuning is in progress.



The auto tune is completed when the regular display of the measured temperature is shown and the process is allowed to control at the target set point using the new control terms.

NOTE

- If the process temperature or load changes significantly another auto tune session may be necessary to optimize the chamber performance.
- If the controller is auto tuning and sensor break occurs, the auto tune will abort. Auto tune must be re-started when the sensor break condition is no longer present.
- If an Auto tune cannot be performed an error message, Etun will be flashed in the display.
- Auto tune will not work when controller is running program or Timer.

Parameter List

Parameters are available under different levels of security and are defined as Operator Level 1 (LEv1) & Operator Level 2 (LEv2). This section describes various parameters used in each operator levels.

Operator Level 1

Operator level 1 is designed for day to day operation of the controller and parameters are not protected by a security code. From HOME display, press SCROLL  button to scroll through the list of parameters in Level 1.

The parameter mnemonic and its scrolling description are shown in the lower display. The value of the parameter is shown in the upper display. After 5 seconds, a description of the parameter will scroll once along the display and then revert back to the mnemonic. The scrolling text can be interrupted at any time by a single press of any of the buttons, but will not scroll again until the parameter is returned to.

Operator Level 2

Operator Level 2 provides access to additional parameters and this access is protected by a security code. The Level 2 access should typically be granted to a specially trained person, since changing parameters can have major impact on the temperature performance of the furnace. After entering Level 2, press SCROLL  button to scroll through the list of parameters. Like Level 1, the mnemonic of the parameter is shown in the lower display, followed once by a scrolling help message showing a longer description of the parameter. The value of the parameter is shown in the upper display.

Press DOWN  or UP  button to adjust this value. If no button is pressed for about 30 seconds, the display returns to 'HOME Display'.

Back scroll is achieved when you are in the list by pressing UP  button while holding DOWN  and SCROLL  button.

To Enter Level 2

1. From any display press and hold PAGE  button.
2. After a few seconds the display will show 'LEv 1 GOTO'.



3. Release SCROLL  button. (If no button is pressed for about 45 seconds the display returns to the HOME Display).
4. Press the UP  or DOWN  button to choose LEv2 (Level 2).



5. Press UP  or DOWN  button to enter the password. The default code is '25'.



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

To Return to Level 1

1. Press and hold PAGE  button to show the current operator level.
2. Press UP  or DOWN  button to select LEv 1.

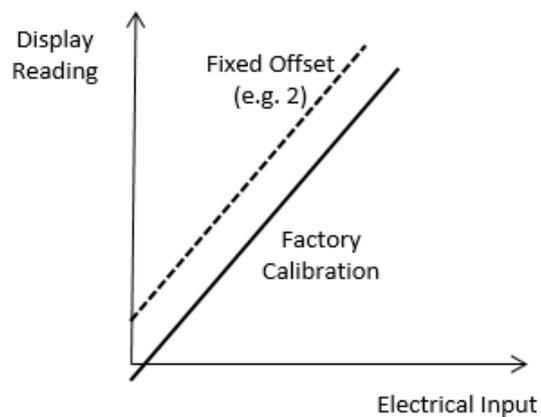


When Level 1 is selected the display reverts to the HOME display. A passcode is not required when moving from a higher level to a lower level.

Offset Procedure

All ranges of the controller have been calibrated against traceable reference standards. This means that if the input type is changed it is not necessary to calibrate the controller. There may be occasions, however, when you wish to apply an offset to the standard calibration to take account of known errors within the process, for example, a known sensor error or a known error due to the positioning of the sensor. In these instances it is not advisable to change the reference (factory) calibration, but to apply a user defined offset.

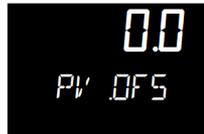
PV Offset applies a single offset to the temperature or process value over the full display range of the controller and can be adjusted in Level 2. It has the effect of moving the curve up or down about a central point as shown in the example below:-



To Apply an Offset

Connect the input of the controller to the source device which you wish to calibrate to. Set the source to the desired calibration value. The controller will display the current measurement of the value. If the display is correct, the controller is correctly calibrated and no further action is necessary. If you wish to offset the reading:

1. Enter Level 2; refer to section “To Enter Level 2” for steps to enter Level 2.
2. Press SCROLL  button to scroll through the parameter list until ‘PV.OFS’ displayed.



3. Press UP  button or DOWN  button to set the required offset value.

Alarms & Diagnostics

Alarms are used to alert an operator when a pre-set level has been exceeded. They are indicated by a scrolling message on the display and the red ALM beacon.

Alarm Indication & Acknowledgment

Alarm Indication & Acknowledgement should go before Sensor Break.

- If an alarm occurs the red ALM beacon will flash, a scrolling message will give the source of the alarm and the alarm (relay) output will operate. A typical default message will show the source of the alarm followed by the type of alarm. For example, ‘ALARM 1 FULL SCALE HIGH’. If more than one alarm is present further messages are flashed in turn in the main display. The alarm indication will continue while the alarm condition is present and is not acknowledged.
- ALM beacon on continuously = alarm has been acknowledged.



- Press PAGE  button and SCROLL  button together to acknowledge an Alarm. If the alarm is still present the ALM beacon lights continuously.

The action which takes place depends on the type of alarm configured:

Sensor Break & Loop Break Protection

Sensor Break Protection - The controller provides sensor break protection in the event the thermocouple opens. If an open thermocouple condition occurs, the digital display will blink "S.br", a red alarm beacon will be illuminated and the power to the heating element will be shut off.

Loop Break alarm is displayed 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. Since the time of response will vary from process to process the Loop Break Time parameter 'LBT' allows a time to be set before a loop break alarm is initiated. In these circumstances the output power will drive to high or low limit. For a PID controller, if the PV has not moved by $0.5 \times P_b$ in the loop break time the loop is in break.

The loop break time is set by the AutoTune, a typical value is $12 \times T_d$. The loop break alarm may be disabled by setting its time to Off.

Over – Temperature Protection (OTP)

The over-temperature protection will be in effect during any alarm condition when the temperature of the furnace has deviated beyond the limit. The Deviation High alarm is triggered when the measured temperature becomes higher than the set point by the amount of the threshold/deviation. Thermofisher recommend a value of 50°C above your working temperature to provide protection for your workload.

In certain units, full scale high alarm 'Hi' is also present. Full scale high alarm will be detected if the PV value exceeds the full alarm trip level.

To Configure Deviation High Alarm

1. Press SCROLL  button until "A1.DHi" appears on the display.



2. Press UP  or DOWN  button to select the OTP value you desire. We recommend a value of 50.

Program/Timer Segment Types

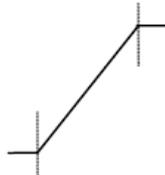
Programmer where each segment consists of a controlled rate ramp to a target set point followed by a dwell at that set point. These values can be set by the user.

- a. Target set point

Target set point will ramp from the current value of the measured temperature to the target set point value based on ramp rate.

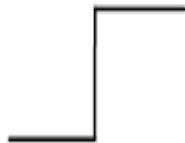
b. Ramp Rate

A Ramp segment provides a controlled change of set point from an original to a target set point. The duration of the ramp is determined by the rate of change specified. The segment is specified by the target set point and the desired ramp rate. The ramp rate parameter is presented in engineering units (°C, °F, Eng.) per real time units (Seconds, Minutes or Hours). If the units are changed, all ramp rates are re-calculated to the new units.



c. Step

The set point changes instantaneously from its current value of the measured temperature to a new value at the beginning of a segment. Step can be achieved by turning off Ramp rate. A Step segment has a minimum duration of 1 second.



d. Dwell

The set point remains constant for a specified period at the specified target. The operating set point of a dwell is inherited from the previous segment.



Remaining Time

Time remaining before the dwell segment completes.

NOTE For all modes except the setpoint programmer, the time remaining may be edited while the program is running, in this case the program duration is modified immediately. This is useful for extending or shortening the duration of a batch.



Elapsed Time

The time elapsed since the Program/Timer was activated.



1-Program 8-Segment Controller Operation

An internal timer in 3216c controller can be configured to operate in four different modes:

- Dwell at temperature. This may be used in combination with the set point ramp limit to provide a simple ramp/dwell temperature sequence.
- Delayed switch on timer. This may be used to implement a switch on delay, and often eradicates the need for a separate timer device.
- Soft Start timer. Starts automatically on power up. It applies a power limit until the temperature reaches a threshold value or the timer times-out after the dwell period. It is typically used to dry-out heaters in Hot Runner control systems.
- 8-Segment programmable controller (4 ramps & 4 soaks).

The 8-segment programmable 3216c controller consists of microprocessor based three-mode PID (Proportional, Integral and Derivative) and appropriate output switching devices to control the furnace. The programmable controller can be used as a single set point controller or as a programmable controller. The 8-segment digital model enables eight segments of programming. The controller is capable of varying temperature or process value with time through programming. A program is stored as a series of segments and can be run once.

Some of the commonly used parameters in operator Level 1 and Level 2 of 3216c controller are:

Table 2 Parameter Description and Accessibility in 3216c

No.	Parameter	Description	Level	Access	Value	Page No.
1	T.STAT	Timer Status	Level 1 + 2	Read/Write	rES	15
2	T.REMN	Timer Remaining	Level 1 + 2	Read Only		12
3	T.ELAP	Elapsed Time	Level 1 + 2	Read Only		13
4	A1.DHI	Deviation High Alarm Set Point	Level 1	Read/Write	50	11
5	A2.HI	High Temperature Alarm Set Point	Level 2	Read Only	*	11
6	SP.SEL	Set point Select	Level 1 + 2	Read/Write	SP1	3
7	SP1	Set point 1	Level 1 + 2	Read/Write	25	4
8	SP2	Set point 2	Level 1 + 2	Read/Write	25	4
9	RAMPU	Set point Ramp Units	Level 1 + 2	Read/Write	Mins	4
10	SP.RAT	Set point Rate Limit	Level 1 + 2	Read/Write	Off	5
11	A.TUNE	Auto Tune Enable	Level 1 + 2	Read/Write	Off	6
12	UNITS	Display Units	Level 1 + 2	Read/Write	Deg C	6
13	TM.CFG	Timer Configuration	Level 1 + 2	Read/Write	Prog(10)	8
14	SS.SP	Soft Start Setpoint	Level 1 + 2	Read Only		15
15	SS.PWR	Soft Start Power Limit	Level 1 + 2	Read Only		15
16	T.T	Requested Time Duration	Level 1 + 2	Read Only		15
17	THRES	Timer Start Threshold	Level 1 + 2	Read/Write	1	17
18	END.T	Timer End Type	Level 1 + 2	Read/Write	Dwell	17
19	Timer.TimeRes	Timer resolution	Level 1	Read Only	Mins	11
20			Level 2	Read/Write		11
21	TSP.1 to TSP.4	Target Set point 1 to Target Set point 4	Level 2	Read/Write	550	18
22	RMP.1 to RMP.4	Ramp Rate 1 to Ramp Rate 4	Level 2	Read/Write	OFF	18
23	DWEL.1 to DWEL.4	Dwell Time 1 to Dwell Time 4	Level 2	Read/Write	1 hour	19
24	PB#	Proportional Band	Level 2	Read/Write	-	-
25	TI#	Integral Time	Level 2	Read/Write	-	-
26	TD#	Derivative Time	Level 2	Read/Write	-	-
27	LBT	Loop Break Time	Level 2	Read/Write	30 mins	11
28	PV.OFS	PV Offset	Level 2	Read/Write	0	10
29	ADDR	Comms Address	Level 2	Read/Write	1	23
30	BAUD	BAUD RATE	Level 2	Read/Write	9600	23
31	IN.TYP	Input Type	Level 2	Read Only	*	-
32	ID	Customer ID	Level 2	Read Only	*	-

#After Controller replacement perform Auto Tune for optimize the PID parameters for better unit performance.

★	Model	1100°C	1200°C	1500°C
	High Temperature Alarm Set Point	1125°C	1225°C	1525°C
	Customer ID	301 Without COMMS 302 With COMMS	305 Without COMMS 306 With COMMS	309 Without COMMS
	Input Type	K-Type	Platinel ii	R-Type

Soft Start Timer

The timer is used to start a process at reduced power and/or reduced setpoint. It may be used where it is required to dry out a heater before applying full power, such as hot runner applications.

It is initiated by any one of the following:

- Switching on power;
- Pressing  and  together;
- Setting the parameter T.STAT to run;
- A command through serial communications;
- A logic input suitable configured.

When the timer status = run, the control output is limited to a reduced start up power until parameter SS.SP is exceeded. If the PV is already greater than SS.SP the reduced power limit is not applied and the timer times out.

When the timer status = reset, the control output is controlling at a level limited by the output high and low limits.

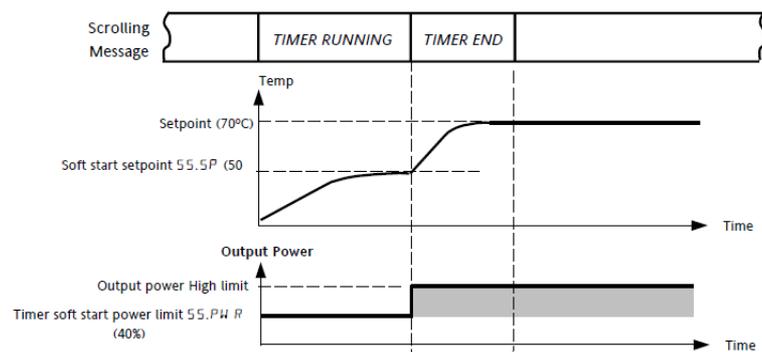
Soft Start Setpoint

A soft start timer is provided to control start-up of sensitive heaters. If these heaters are stressed by applying 100% power from cold they could be damaged. The soft start facility introduces a power limit until either the safe operating temperature (SS.SP) is reached or a time duration has elapsed (TIME).

The SS.SP is the threshold for the soft-start timer. If the PV is below this value at power up then the soft start timer is started.

Soft Start Power Limit

The soft start function limits the power delivered to the heater until it has warmed up. The SS.PWR is the power limit applied until the PV reaches the SS.SP or the timer has elapsed.



Delayed Switch On Timer

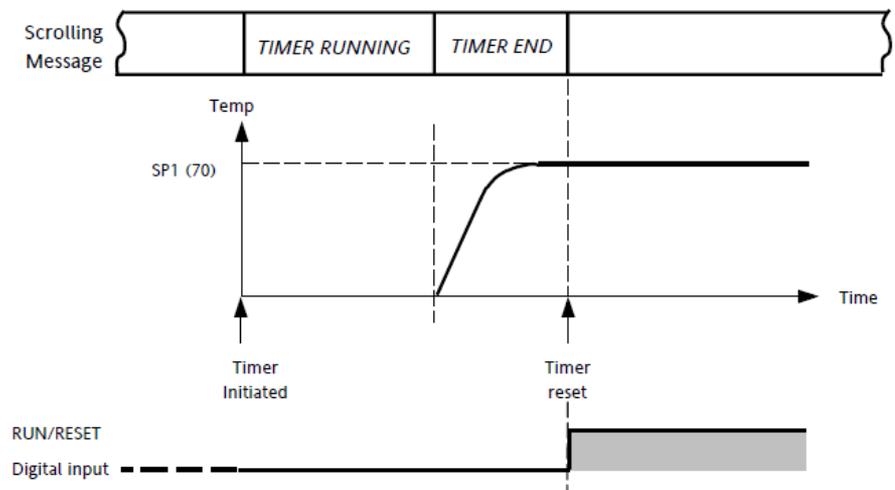
The timer is used to switch on the controller output power after a fixed length of time. It could be used to turn on a process at a particular time.

It is initiated by any of the following:

- Switching on power;
- Momentarily pressing  and  together;
- Setting the parameter T.STAT to run;
- A command through serial communications;
- A logic input suitably configured.

When the timer status = run, the control output is off.

When the timer status = reset, the control output is controlling.



Timer Start Threshold

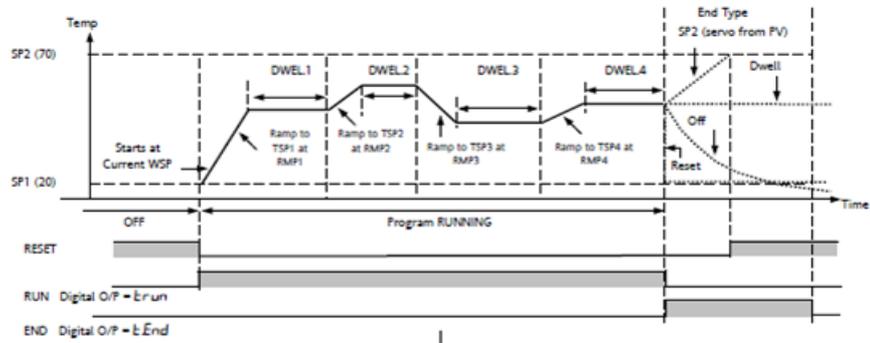
A single threshold value is available to provide a holdback on the entry to the dwell part of the ramp/dwell pair. It holds back the dwell until the PV has reached the band defined by +/- threshold around the PV. The timer starts timing when the temperature is within this threshold of the setpoint. This provides a guaranteed soak temperature. The threshold can be set to Off (0) in which the threshold is ignored and the timing starts immediately. Note that if a ramp rate is set, the ramp completes before timing starts.

To set the threshold value, press SCROLL (G) button until 'THRES' is displayed. ("THRES" can be accessed from Level 1 and Level 2). Press UP (▲) or DOWN (▼) button to adjust the value (In the example given below, the dwell periods will not start until the PV is within 5 units of the set point).



Timer as 8-Segment Programmer

A sample program profile of 3216c is shown in the diagram below. It is an 8 segment programmer consisting of four ramp/dwell pairs. Each ramp consists of a controlled rate of change of set point to a target level. Each ramp is followed by a dwell at that level. The ramp rate, target level and dwell time are set by the user.



End Type parameter

The action which occurs at the end of program or in reset depends on the configuration of the 'END.T' parameter. The 'END.T' can be:

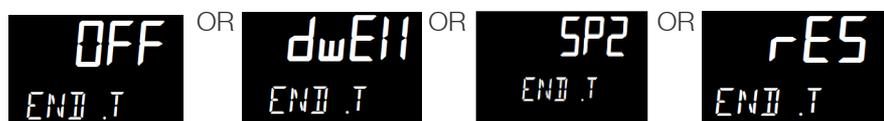
OFF : The heating is turned OFF,

dwEll : Controls at last program setpoint,

SP2 : Controls at setpoint 2 (When the timer completes the target setpoint will switch to setpoint 2. The setpoint 2 may be a lower or a higher temperature.),

rES : Reset on completion and reverts to SP1 or SP2, based on the Setpoint selection.

SCROLL (G) through parameters in level 2 and set the required 'END.T' by pressing (▲) or (▼).



To Configure the Programmer

1. Enter level 2 to configure the timer as a programmer. Press SCROLL  button to scroll through the list of parameters until **'TM.CFG'** is displayed. Now, press DOWN  or UP  button to select **'PROG'**.



2. To set the resolution, press SCROLL  button to select **'TM.RES'**. Press DOWN  or UP  button to set 'Hour' or 'min' (In this example, the ramp rate and dwell period are set in hours).



3. Now set the threshold by pressing SCROLL  button to select **'THRES'**. Press UP  or DOWN  button to adjust the value (In this example, the dwell periods will not start until the PV is within 5 units of the set point).



4. Now, set the action when the programmer times out. Press SCROLL  button to select **'END.T'** is displayed. Press UP  or DOWN  button to select 'Off' or 'SP2' or 'Dwell' (This example uses 'dwell' where the controller will continue to control indefinitely at the last set point. OFF will turn the output power off and SP2 will control at set point 2).



5. To set the first target set point, press SCROLL  button to select **'TSP.1'**. Press UP  or DOWN  button to adjust the value (In this example the set point will ramp from the current value of the PV to the first target 45°C).



6. To set the first ramp rate, press SCROLL  button to select **'RMP.1'**. Press UP  or DOWN  button to adjust the value to 8. (In this example the set point will ramp to 45 at 8.0 units per hour).



7. To set the first Dwell, press SCROLL  button to select '**DWEL.1**'. Press UP  or DOWN  button to adjust the value to 2:11. (In this example the set point will dwell at 45 for 2 hours 11 minutes).



8. Now repeat the above three steps (5, 6 & 7) to set remaining all segments.

To Operate the Programmer

Operation	Action	Indication
To Run a program	Press and quickly release  + 	Beacon RUN = On Scrolling display - TIMER RUNNING
To Hold a program	Press and quickly release  + 	Beacon RUN = Flashing Scrolling display - TIMER HOLD
To Reset a program	Press and hold  +  for more than 1 second	Beacon RUN = Off If End Type = Off then OFF will be displayed at the end of the program
	Program ended	Beacon RUN = Off SPX On if End Type = SP2 Scrolling display – TIMER END

Programs can also be operated from the '**T.STAT**' parameter found in the level 1 parameter list.

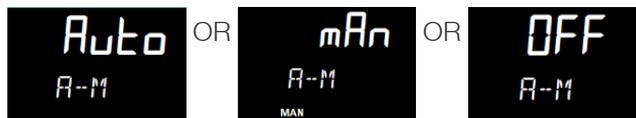


NOTE

- The program ramp rate is designed to reduce the heating rate or cooling rate that the furnace normally exhibits. When not using this feature, the furnace will operate at its maximum heating and cooling capability.
- When the program ramp has ended or has been reset, the furnace will continue to maintain set point temperature. It will not cool to ambient temperature unless the set point is set to ambient temperature by the program or by the operator.
- When a step change is required, the ramp rate should be set to 'OFF'.
- Where ramp/dwell pairs are not required, the ramp rate should be set to 'OFF' and the target set point, TSP, the same as the preceding segment.
- TIMER END- when the end type is SP2, Timer END does not occur until the ramp is complete or SP2 is achieved. It is more usual to use a DWELL (default) or RESET end type.
- The program will start from the measured temperature. On recovery from power failure, the program will automatically run at the last ramp rate from the current measured temperature.

AUTO/MAN/OFF: (Auto/Manual/OFF Mode)

Operation	Action	Indication
To change Auto to Manual model	Press and hold  +  for more than 3 seconds	Controller display Shows Auto mode as A-M.



1. AUTO: When the controller is in the automatic mode the output automatically adjusts to keep the temperature or process value at the setpoint. Auto mode is also referred to as "closed loop" as the controller will use thermocouple temperature as feedback to control the furnace temperature.
2. MAN: Manual mode means that the controller output power can be adjusted directly by the user. The input sensor is still connected and reading the PV but the control loop is 'open'. In manual mode the MAN beacon will be lit, Band and deviation alarm are masked, the auto-tuning timer and programmer functions are disabled. The power output can be continuously increased or decreased using the up or down buttons.

3. OFF: 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.

NOTE

Thermofisher shall does not recommend to use controller in MANUAL mode or OFF mode, as Manual mode can damage the unit or cause over-heating without care or proper operation. If controller set as MANUAL mode operation, the end user must use a separate 'over-temperature' controller for safe operation of the unit.

Communication Option

The factory installed optional RS 485 Digital Communications Port allows controller to be connected to a PC for remote monitoring and control of the furnace. The equipment with communication option (COM) is equipped with two DB9 serial ports (1 Male port & 1 Female port). These ports are intended for connection to the PC or a Laptop & making a communication chain of furnace with communication option (COM) Capability. The RS 485 communication allows multiple devices (up to 30) to communicate at half-duplex on a single pair of wires, plus a ground wire.

NOTE The RS 485 pin should match with your DB9 to USB or 232 adapters for the communication option to work.

Furnace DB9-Pinout	RS 485 Output	DB-9 Male	DB-9 Female
Pin 2	A / D-		
Pin 3	B / D+		
Pin 5	Ground		

Adapters - RS 485 to RS 232/USB

The communication option requires an RS 485 to USB Adapter or RS 485 to RS 232 Adapter to for the furnace to communicate with the PC or Laptop. The RS 485 to USB or RS 485 to RS 232 adapter with terminal block is recommended for free wire connections. RS 485 adapter is suggested as pin connections vary with different adapter manufacturers and may not work properly if they don't match with the above DB9 pinout of the furnace.

NOTE Please ensure the adapter is compatible with the operating system of your PC/Laptop. Some adapter needs driver softwares & port access privileges on your PC/Laptop for proper functioning. Please contact your local IT for assistance.

RS 485 Pinout & Connections

The furnace is provided with a communication cable for connecting the furnace to the RS 485 adapter. The communication cable consists of DB9 connector at both ends. Use the accessory Cable # 7233 for serial communication.

NOTE 7233

Twenty five feet RS 485 cable and RS 232 converter for connection of furnace/control console RS 485 port to personal computer serial port.

Host Computer & Software

The host computer can communicate with furnaces with communication option (COM). A data logging & control software is required for data logging & control of the furnace using the RS 485 communication. Thermofisher Scientific does not providing any software - please refer to specialized software suppliers like SpecView or Eurotherm. These softwares can communicate with either a single Furnace or a network of Furnaces with the communication option.

Controller Parameters for Communication

Table 4 Controller Parameters for Communication

Parameter	Value
Comms Module Identity	Comms (67)
Communications Protocol	Modbus
Communication Interface	RS 485
Baud Rate	9600_baud (0)
Parity	none
Comms Address	1

If your connection is not working properly, check the following conditions:

- A. Verify complete and tight cable connections between the furnace and the PC.
- B. Verify that power has been supplied to the unit and temperature controller before starting the software program.
- c. Verify DB-9 pin connections as shown in wiring diagram, interchange 2 & 3 connections if communication is not working.
- d. Verify the configuration values in the controller, listed in the Table 4, "Controller Parameters for Communication".