

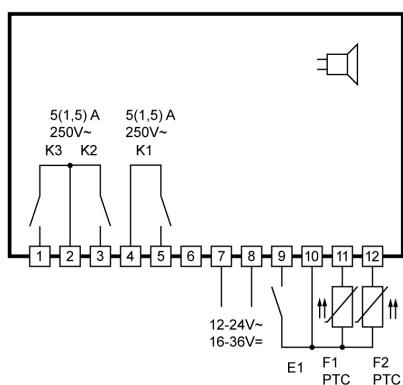
## ST70-36.13

Controller for cooling applications

Order number 900381.002



## Wiring diagram



## Product description

The cooling controller ST70-36.13 is a controller with a timed defrost function. It has two analogue inputs for PTC resistance sensor and three relays. All parameters are freely adjustable and pre-set ex works on a practice-oriented basis. An external defrost process can be started at the digital switching input.

It is an easy-handling controller that has proven itself in various standard applications for many years.

**Sensor:** PTC

**Range:** -55...99°C

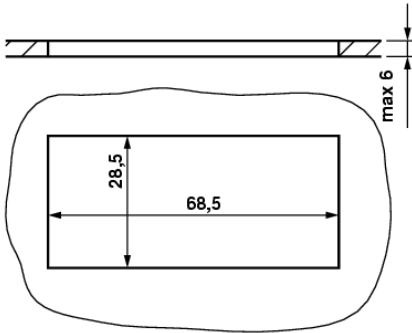
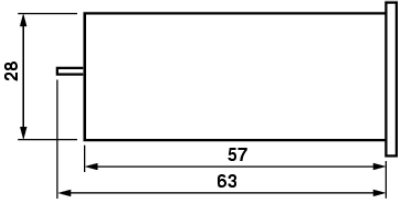
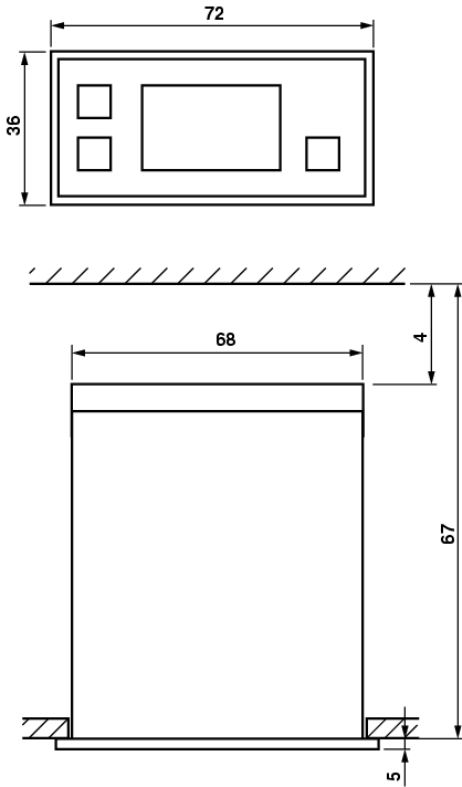
**Front size:** 72mm x 36mm

**Panel cut-out:** 68,5mm x 28,5mm

**Tightness:** front IP50

**Connector:** screw terminal

ST 70 ...



## SOFTWARE .11, 13, 14

### Adjustment options



#### **Key UP**

Pressing this key you can increase the parameter or parameter value or scroll the parameter list.



#### **Key DOWN**

Pressing this key you can decrease the parameter or parameter value or scroll the parameter list. At alarm the buzzer function can be switched off with this key.



#### **Key SET**

While SET key is pressed, the setpoint is indicated.  
In addition, the SET key is used for setting parameters.

### First control level:

#### **Parameter setting of the control setpoint**

If none of the keys is pressed, the display indicates the actual value of the temperature. Pressing the SET key, the setpoint shows on the display.

If the setpoint is to be changed, the SET key is to be kept pressed while adjusting the setpoint with the keys UP and DOWN.

Please note that the setpoint can only be changed within the set setpoint limits. The display flashes if these limits are exceeded.

Parameter	Function description	Adjustment range	Standard setting	Custom setting
S1	Setpoint	r1...r2	0.0°C	

### Second control level:

#### Setting of control parameters

Simultaneously pressing the UP and DOWN key for at least 4 seconds opens a parameter list containing control parameters (the complete list of all parameters is to be found on the third control level).

With the UP and DOWN key the parameters r0 (ST 70-36.11) and dA (ST70-36.13 and .14) can be selected.

Pressing the SET key will give you the value of the respective parameter. Pressing also the UP or DOWN key at the same time the value can be adjusted.

Return to the initial position takes place automatically, if no key is pressed for 45 seconds, or by simultaneously pressing the UP and DOWN key for approx. 4 seconds.

### Third control level (all parameters):

#### Setting of control parameters

Access to the third control level is granted when selecting parameter PA on the second control level. Parameter PA is to be set at '-19'. Then the key UP and DOWN have to be simultaneously pressed for approx. 4 seconds which will give access to the third control level. With the keys UP and DOWN you can scroll the list in both directions. Pressing the SET key will give you the value of the respective parameter. By pressing the UP or DOWN key at the same time the value can be adjusted.

Return to the initial position takes place automatically, if no key is pressed for 45 seconds, or by simultaneously pressing the UP and DOWN key for approx. 4 seconds.

#### Parameters for controller specifications

Parameter	Function	Adjustment range	Standard setting	Customer setting
/0	Sensor type  right now only the hardware for sensor KTY81-121 is available	1: KTY81-121 (PTC)	1	
/1	Calibration temperature sensor	-5.5 ... 9.9 K	0.0K	
/2	Software filter	0: no filter 1: 0.4 sec. 2: 1.4 sec. 3: 3.0 sec. 4: 8.0 sec. 5: 19.8 sec. 6: 48.0 sec.	3	

## Parameters for cooling control

Parameter	Function	Adjustment range	Standard setting	Customer setting
r0	Hysteresis for the compressor	1...15 K	2 K	
r1	Setpoint limitation (minimum)	-55°C...r2	-50°C	
r2	Setpoint limitation (maximum)	r1...+99°C	50°C	
r3	Key lock	0: Front keys not locked 1: Front keys locked		
r4	Display mode	0: without decimal place 1: with decimal place	0	
r5	Temperature scale	0: Fahrenheit 1: Celsius	1	
r6	Key acknowledgement	0: inactive 1: activated	1	

## Parameters for compressor protection

Parameter	Function	Adjustment range	Standard setting	Customer setting
c0	Start protection of the compressor after "cooling on"	0...15 min.	0 min.	
c1	Start protection after compressor start	0...15 min.	5 min.	
c2	Start protection after compressor stop	0...15 min.	3 min.	
c3	Function in the case of error of sensor F1	0: compressor off 1: compressor on	0	
c4	Switching delay of compressor relay	0: no delay 1: 3 sec. delay	0	

## Parameters for defrosting

Parameter	Function	Adjustment range	Standard setting	Customer setting
d0	Defrosting interval	0...99 h	8 h	
d1*	Defrosting mode	0: electrical 1: with hot gas	0	
d2*	Defrosting temperature	-55...+99°C	10°C	
d3	Defrosting time limit	1...99 min.	30 min.	
d4	Function after "cooling on"	0: immediate cooling, no defrost 1: first defrosting, then cooling	0	
d5	Defrost delay after "cooling on"	0...31 min.	0 min.	
d6	Indication of the refrigerating chamber temperature during defrosting	0: actual temperature 1: temperature determined just before the start of defrosting	1	
d7*	Drainage time	0...15 min	2 min.	
d8	Alarm suppression time after defrosting	0...15 hrs.	1 hrs.	
d9*	Execution of defrost demand	0: dependent execution 1: immediate execution	0	
dA*	Indication of the evaporator temperature	N/A		
dB*	Time base defrost cycle	0: standard time basis 1: reduced time basis	0	

## Parameters for alarm and error conditions

Parameter	Function	Adjustment range	Standard setting	Customer setting
<b>A0</b>	Hysteresis for alarm contact	1...15 K	2 K	
<b>A1</b>	Minimum limit value (deactivated with A1=0, if boundary alarm)	-99...+99 K/°C	-10 K	
<b>A2</b>	Maximum limit value (deactivated like A1)	-99...+99 K/°C	10 K	
<b>A3</b>	Alarm suppression time after "cooling on"	0...15 hrs.	2 hrs.	
<b>A4**</b>	Effect of external alarm input	0: regulation remains active 1: regulation deactivated	0	
<b>A5</b>	Alarm mode	0: Boundary alarm, relative 1: Boundary alarm, absolute 2: Range alarm, relative 3: Range alarm, absolute	0	
<b>A6</b>	Special function at boundary alarm	0: no special function 1: flashing display 2: buzzer 3: flashing display and buzzer 4: like 3, buzzer can be cancelled 5: like 4, cancelled buzzer restarts after 10 min. 6: like 4, cancelled buzzer restarts after 30 min	4	
<b>A7**</b>	Switching sense for the external alarm input (230V~)	0: alarm with 230V~ 1: alarm without 230V~	1	

## Parameters for the ventilator

Parameter	Function	Adjustment range	Standard setting	Customer setting
<b>F0*</b>	Ventilator control	0: dependent on temperature 1: continuous on	0	
<b>F1*</b>	Ventilator setpoint	-55...+99°C	-1°C	
<b>F2*</b>	Switching hysteresis ventilator	2...15 K	2 K	
<b>F3*</b>	Behaviour at compressor stop	0: ventilator independent of compressor 1: ventilator off together with compressor	1	
<b>F4*</b>	Behaviour at defrosting	0: ventilator independent of defrosting 1: ventilator off together with defrosting	1	
<b>F5*</b>	Ventilator delay time after defrosting	0...15 Min.	2 Min.	
<b>F6*</b>	Ventilator control	0: absolute control 1: dynamic control	0	
<b>Pro</b>	Software version	---		

\* Parameter only available at type ST 70-36.13 and .14

\*\* Parameter only effective at type ST 70-36.14

## Parameter description:

### **/0: Sensor type**

This parameter permits selection of the sensor type, if the needed hardware prerequisites are available. Right now only hardware for sensor type KTY81-121 (PTC) is available.

### **/1: Calibration of the sensor**

This parameter allows the correction of actual value deviations caused for example by sensor tolerances or extremely long sensor lines. The regulation measure value is increased or decreased by the here adjusted value.

### **/2: Software filter**

With several measuring values, it is possible to obtain an average value. This parameter can determine by how many measured values an average value is to be formed. If a sensor with a very fast reaction to external influences is used, an average value ensures a calm signal process.

### **r0: Hysteresis of the compressor contact**

Parameter r0 sets the temperature margin between switching off and switching on of the compressor. A small hysteresis permits a more exact regulation, however also leads to more frequent switching of the compressor. The hysteresis is set one-sided above the setpoint

### **r1: Setpoint limitation (minimum)**

### **r2: Setpoint limitation (maximum)**

These parameters limit the adjustment range of the setpoint S1, in order to avoid that the end user sets inadmissible values for the plant.

The entire adjustment range corresponds to the maximum operating range of a PTC sensor.

### **r3: Key lock**

The key lock mode allows the deactivation of the front keys. If locked, the setpoint cannot be changed with the keys. Trying to change the setpoint the display shows "---".

### **r4: Display mode**

The value can be indicated in integrals or with decimals in 0.1°K. In general, all parameter indications are presented in 0.1°K.

### **r5: Temperature scale**

Indication can be switched between Fahrenheit and Celsius. At conversion, the parameters and setpoints maintain their numerical value and adjustment range. (Example: A controller with the desired value of 32°C is switched to Fahrenheit. The new desired value is then interpreted as 32°F, which corresponds to a temperature of 0°C).

### **r6: Activation of key acknowledgement**

This parameter permits to switch on/off the key confirmation by internal buzzer.

### **c0: Start protection of the compressor after "cooling on"**

After cooling is switched on (e.g. by switching on the mains voltage) the start of the compressor is delayed until the start protection time is over. This secures e.g. that several cooling units do not start at the same time and load the electricity supply net.

### **c1: Start protection of the compressor after compressor start**

This time protection starts when the compressor is switched on. After switching the compressor off, a renewed switching on is impossible until this protection time runs out. This prevents from too frequent switching-on of the compressor and thus increases its life span.

## **c2: Start protection of the compressor after compressor stop**

This time protection starts when the compressor is switched off. After switching the compressor off, a renewed switching on is impossible until this protection time runs out.

## **c3: Function in the case of error of refrigerating chamber sensor**

Here is determined whether the compressor keeps running or not in the case of an error of the refrigerating chamber feeler F1. When deep-freezing, the compressor should normally continue running, in order to prevent de-frosting of the goods. At the normal cooling range above 0 °C, a continuation, however, could lead to frost damages.

## **d0: Defrosting interval**

After each defrosting interval a defrosting process is started. With the beginning of the defrosting process, the defrosting interval starts anew, which results in periodic defrosting in firm intervals. Defrosting can also be started by pressing the key "manual defrosting" (UP key) for at least 3 seconds. This automatically restarts the defrosting interval.

## **d1: Defrosting mode**

This parameter determines whether defrosting is effected by an electrical heating coil (d1=0) or by means of hot gas (d1=1).

## **d2: Defrosting temperature**

The defrosting process is terminated when the evaporator has reached the adjusted temperature. (Always provide good thermal contact between evaporator sensors and lamellas). In case that defrosting takes too long, the time limit set in "d3" will come into effect.

## **d3: Defrosting time limit**

Here the maximal defrosting time can be adjusted. According to this time frame, defrosting is terminated even if the evaporator is not warm enough to be ice-free.

## **d4: Function after "cooling on"**

After "cooling on" cooling can start immediately and defrosting starts after the defrost interval or defrosting can start immediately and then the defrost interval is started. For deep-freezing applications the immediate defrosting is recommended since a defrost cycle might be skipped in case of a power failure and therefore the evaporator might be iced up.

## **d5: Defrost delay after "cooling on"**

After "mains on" the defrosting starts after the here adjusted delay (only effective if d4=1). Among other things this is to prevent energy peaks.

## **d6: Indication of the refrigerating chamber temperature during defrosting**

It is to be assumed that the refrigerating chamber temperature slightly rises during the defrosting process. d6=0 indicates the actual refrigerating chamber temperature during the defrosting process. d6=1 indicates the temperature determined just before the start of defrosting until the setpoint of the refrigerating chamber is reached again after the defrosting process is completed. Thus, an irritation of the operator during defrosting can be avoided. In the case of emergency, the display flashes and the actual temperature of the refrigerating chamber is indicated.

## **d7: Drainage time**

Completed defrosting is immediately followed by a drainage period, in order to let the evaporator drip off. During drainage time, the exits compressor and ventilator are switched off.

## **d8: Alarm suppression time after defrosting**

A temperature alarm caused by the warming up of the refrigerating chamber during defrosting will be suppressed for this time period after defrosting has finished.



### **d9: Execution of defrost demand**

With d9 = 0 the defrost demand will be prevented as long as the locking conditions of parameters c0, c1 and c2 apply. With d9 = 1 defrosting starts independently of these parameters.

### **db: Time base defrost cycle**

This parameter changes the time base for the defrosting cycle. With parameter set to "1" hours become minutes and minute become seconds. This allows a quick control and monitoring of the refrigeration plant during installation and maintenance. For regular operation of the plant it is necessary to switch back to standard time basis

### **A0: Hysteresis for alarm contact**

The hysteresis of the alarm contact is asymmetrically, set downward at the maximum alarm value upward at the minimum alarm value.

### **A1: Minimum limit value**

### **A2: Maximum limit value**

The limit values serve for monitoring of the refrigerating chamber temperature. Alarm is released when exceeding maximum limit value or when falling below the minimum limit value.

The buzzer can be turned off with the DOWN key, the display continues flashing until the alarm is turned off.

### **A3: Alarm suppression time after "cooling on"**

After switching cooling on, an alarm is suppressed for the adjusted time, i.e. the refrigerant plant can get to work temperature without releasing alarm.

### **A4: Effect of external alarm input**

This parameter determines if the regulation is active or inactive in case of an external alarm.

### **A5: Function alarm exit**

The alarm exit evaluates an upper and a lower limit value, whereas a selection is possible as to whether the alarm is active if the temperature lies within these two limits, or whether the alarm is released if the temperature lies beyond them.

### **A6: Special function at boundary alarm**

Here can be selected whether, in the case of a boundary alarm, the indication is to flash and/or the buzzer is to start.

### **A7: Switching sense of the external alarm input**

The parameter determines if an alarm is triggered with or without 230V~ on the external alarm input.

### **F0: Ventilator control**

At setting "0" the control is dependent of temperature with the ventilator setpoint F1 or according to the setting F6=1 (dynamic control).

At setting "1" the ventilator is permanently on assumed that it is not stopped by the setting F3=1 (off at compressor stop) or F4=1 (off at defrosting).

### **F1: Ventilator setpoint**

As soon as the evaporator temperature falls below the ventilator setpoint (with hysteresis) the ventilator is switched on and vice versa. Above the setpoint the ventilator is off.

### **F2: Switching hysteresis ventilator**

The hysteresis is set one-sided and below the ventilator setpoint.

### F3: Behaviour at compressor stop

With F3=0 the ventilator operation is independent of the compressor (standard refrigeration range above 0°C).

With F3=1 the fan is switched off if the compressor is switched off.

### F4: Behaviour at defrosting

With F4=0 the ventilator continues to run during defrost (standard refrigeration range above 0°C).

With F4=1 the ventilator is stopped during defrost (deep-frying range).

### F5: Ventilator delay time after defrosting

Following drainage time d7, start of the ventilator can be delayed until the evaporator has sufficiently cold air again. If the ventilator started immediately, the warm air resulting from the defrosting process would probably be blown into the refrigerating chamber

### F6: Ventilator control

With F6=0 the ventilator is controlled depending on ventilator setpoint F1

With F6=1 the ventilator control is dynamic.

In this case the absolute setpoint adjusted with F1 is no more effective but the ventilator setpoint depends directly on actual value of the refrigerating chamber. The ventilator setpoint results of the refrigerating chamber temperature minus the relative evaluated temperature set in F1.

Example: settings F1 = 5, F2 = 2, F6 = 1

The ventilator setpoint is always 5K below the refrigerating chamber temperature. If the refrigerating chamber temperature is 10°C the ventilator will switch off if the evaporator temperature is above 5°C and the ventilator will switch on if the evaporator temperature falls below 3°C. If the refrigerating chamber temperature is 9°C the ventilator will switch off if the evaporator temperature is above 4°C and the ventilator will switch on if the evaporator temperature falls below 2°C.

This variant makes it possible to switch the ventilators delayed dependent on temperature at each temperature start (start-up relief) or to switch them off delayed after compressor stop (usage of the refrigerating capacity of the evaporator).

### Status messages

Message	Cause	Error elimination
E0	Sensor error F1, open or short circuit	Check sensor
E1	Sensor error F2, open or short circuit	Check sensor
E2	Error in parameter memory	
E3	External alarm	

## Technical data of ST70-36.13

### Input

**E1:** External potential-free switching contact

### Measuring input

**F1:** Resistance thermometer PTC

**F2:** Resistance thermometer PTC

Measuring range: -55...+99°C

Measuring accuracy: 1K, without sensor

### Outputs:

**K1:** Relay, normally-open contact, 5A 250V, compressor

**K2:** Relay, normally-open contact, 5A 250V, defrosting

**K3:** Relay, normally-open contact, 5A 250V, ventilator

### Display

One 3-digit LED Display, height 13 mm, colour red

### Power supply

12...24 V AC (50/60 Hz) or 16...36V DC

### Connectors

screw terminal

### Ambient conditions:

Storage temperature: -20°C...70 °C

Operating temperature: 0...55 °C

Relative humidity: max. 75 %, without dew.

### Weight

148g

### Enclosure

Front IP50, IP63 at request IP63

### Installation data

Front size: 72 x 36 mm

Panel cut-out: 68.5 x 28.5 mm

Installation depth: ca. 70 mm with connector

Mounting: by fixing strap