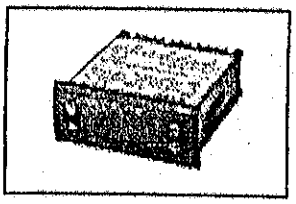
Cooling & Heating Controllers

ACT Series

The ACT control is designed for close temperature control (cooling and heating) and also incorporates a defrost facility for small/medium sized fridges,freezers or display counters. Ideally suited for applications such as florists' cabinets, fruit storage, dough retarders and provers, air-conditioning or beer cellars.

Part Number	Supply	Range	Probe	Output	Price £
Panel mount					
ACT122T1R3BS	12v	-50/+150°C	c/w 2x PTC	4x Rly & Buzzer	

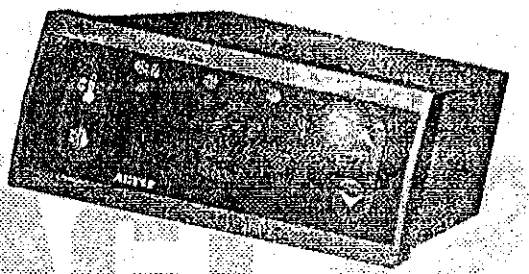


Specifications
Available in 12Vac/dc supply
Relay Output
SPDT 5A 240Vac
Parameters include
Tamperproof settings,
Evaporator fan control
during defrost, Compressor
staggered start, Anti-cycle timer
Heating & Cooling Operation

ACT12

NEW

ACT12	Heating/Cooling Controller, range -50°..+150°C
2T1	Thermostat and defrost PTC1000 probe inputs
R3	4 relays: compressor, heater, defrost, fans,
B	Alarm buzzer

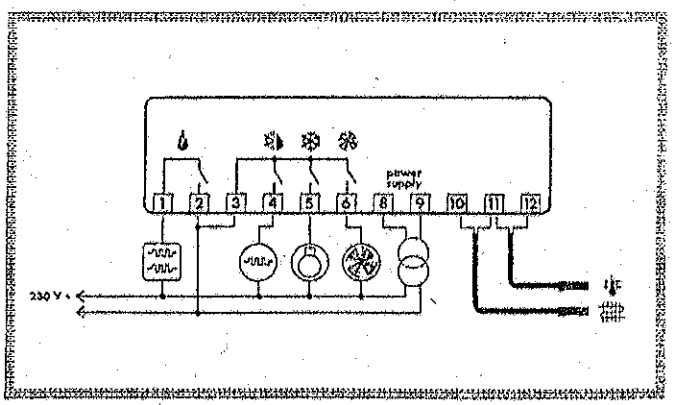


Refrigerated Transport Defrost Unit

Thermostatic control with automatic Heating/Cooling selection • Timed or on demand defrost start • Hot Gas, Electric or Off cycle defrost • Evaporator fan control • Alarm on buzzer.

Applications: refrigerated environments that may be in climatic conditions where the external temperature falls below the cooling setpoint.

For more details, consult our general catalogue or local dealer.



ACT 12 2..: Instructions for installation and use

ACT 12 is a compact controller for temperature conditioning (cooling and heating) and also incorporates a defrost facility for small and medium-sized fridges, freezers or display counters. It integrates the following functions:

- COOLING THERMOSTAT
- HEATING THERMOSTAT WITH DEAD BAND
- DEFROST CONTROL AND OPTIMISATIONS
- REMOTE DEFROST CONTROL
- FAN CONTROL
- MULTI SOURCE ALARM CONTROL
- THERMAL MASS SIMULATION
- SERIAL COMMUNICATION WITH PC OR REMOTE DISPLAY

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1. INSTALLATION

1.1 The instrument is inserted into the panel through a 71x29 mm hole and secured via the suitable brackets, exerting correct strength. If the rubber IP54 gasket is used this must be placed between the panel and the instrument front, checking carefully that there are no gaps.

1.2 For proper functioning the instrument needs an ambient temperature between -10°...+50°C and 15%...80% rH.
To reduce the effects of electro-magnetic interference, place the cables carrying signals (probes and serial connections) and the controller as away as possible from power lines.

1.3 Probes, power supply and outputs/inputs must be wired strictly following the diagram indicated on the enclosure. If present, the probe screen must not be connected to any other leads; for power supply the suitable transformer (mod. TRxxx) must be used.

1.4 Probe 1 measures "air temperature" and is used for thermostat function; probe 2 measures the evaporator temperature and must be secured to it in a place where the maximum formation of frost occurs.

1.5 The remote defrost input needs an external activation voltage between 10...16 Vac; 10 mA. When the circuit is shorted, defrost is started.

Caution:
If the relays switch large loads frequently, we suggest you contact us to obtain information about the relay contact life.
Where delicate or valuable products have to be maintained in special conditions, we recommend not to use the same instrument for both control and limit functions.

2. DISPLAYS

In some cases, owing to the structure of the cabinet or air stratification, the probes can not measure the desired temperature. If necessary, through the parameters **oS1**, **oS2** and **oS3** the temperatures t1 and t2 measured by the probes can be adjusted in order to obtain the desired values for computing: thermostat **T1=t1+oS1**; defrost **T2=t2+oS2**; display **T3=t1+oS3**.
Ex.: setpoint= -20; oS1= -2; oS3= +6, temperature t1 will be controlled at -18° and the display will show -12°.

2.1 At the power up, the display shows "--" for 5 sec. during which the unit carries out a self-check; then the temperature T3 appears.

2.2 To display the instantaneous temperatures T1, T2 or T3 press [DOWN], [DEFR.] or [ALT] respectively.

2.3 The optional remote display CDCREMOTO repeats the indications of the controller to which it is connected, except during the alarms which are indicated with "---". When a fault in communication occurs, the remote unit shows "..-.." (only the line in the center).

2.4 Through the serial communication it is possible to switch off the controller; this stand-by status is signalled by permanent "---". Also, if the local settings are remotely inhibited, when attempting to perform any changes, the display shows "Inh".

* When writing [KEY]+[KEY] it's meant that keys are pressed sequentially and kept pressed.

3. COOLING THERMOSTAT FUNCTION

At power-up if cooler start is needed, it's delayed by the sum of **coF** and **crS**; this latter is used in those applications where it is necessary to avoid several simultaneous compressor starts which may cause line overload. For ex.: **coF**= 03, **crS**= 05; after power-up, at least 03 min. and 05 sec. must elapse before the cooler starts.
coF and **con** are, respectively, the cooler minimum off and on time. The relay which controls the cooler, after switching off/on or on/off, will remain in that status for at least the pre-programmed time. When you have to maintain a very small hysteresis **hyS**, we recommend to program a suitable value for **coF** and **con** to ensure a long life to relay/contactor and compressor.
The temperature control is based on the comparison between temperature T1 and setpoint, of which value is displayed by pressing [THERM.]. To change it, keep [THERM.] pressed and by pushing key [UP] or [DOWN], select the desired value within the limits **SPL** and **SPh**.

The cooler on switching temperature is achieved by adding hyS to the setpoint. Ex.: setpoint=-20°C; hyS=04, the relay is off with T1=-20° and on with T1=-16°C.
When a failure or overrange of probe 1 occurs, the display shows "PF1" and the cooler run isn't controlled according to setpoint but determined by cdc which represents the cooler duty cycle, i.e. (on time)/(10 minute cycle). For ex.: 04= 4 min. on time, 6 min. off time.
The cdc value has to be set taking into consideration the normal cooler duty cycle. This function allows to avoid damage to the goods when the actual temp. can't be measured as a result of probe failure.

4. HEATING THERMOSTAT FUNCTION

ACT 12 allows keeping the preservation temperature within a programmable hunting band. In other words, in addition to the cooling function described in Par.3, it's possible to enable a heating function that, in the event that temperature T1 drops lower than a given value, automatically switches on the output controlling the heater.

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Access to heating parameter set is obtained by pressing [ALT]+[THERM.] for 4 seconds. They are:

HEn	enable (01), inhibit (00) heating
Hdb	heating dead band (-1.. -20°)
Hhy	heating hysteresis (-1.. -10°)

The parameter is chosen through [UP] or [DOWN]. The current value is displayed by pressing [THERM.], to change it press [THERM.] + [UP] or [DOWN].
Exit from the alternative set occurs automatically after 10 sec. since the last pressure on the keys.
If enabled (HEn=01), the heating thermostat starts to work when temperature T1 falls below the threshold given by cooling setpoint + Hdb differential.
Ex.: setpoint=+8°C; Hdb=-3°K; Hhy=-2°K. Heater is off for T1>=+3°C and on for T1<=+1°C.
Between the heater off switching and the next start, a minimum 30 sec. pause elapses. The output status is signalled by a blinking dot.
The heating is excluded in case of probe 1 failure (PF1).

5. DEFROST START

The moment when defrost must be started can be chosen according to:

5.1 REGULAR INTERVAL: this counting system, which is selected with doP=con, provides constant time between defrosts, determined by drE.

5.2 FROST ACCUMULATION: in this case, doP=Acc, the built-in timer counts only when a frost growth condition occurs (i.e. fin temperature lower than 0°C and below the dew point) until reaching the drE time. This optimisation system is particularly effective when the evaporator works at around 0°C; the defrost frequency is function to the thermal load and the climatic condition (external air temp. and humidity). If setpoint is much lower than 0°C, the frequency mainly depends on the cooler on times. Ex. if the cooler cycle is 5 min. run and 5 min. stop and drE=04h, defrost will take place every 8h approx.

5.3 REMOTE START: it allows to start a defrost remotely regardless of the time elapsed. This function permits to carry out defrosts not homogeneously spread in time or according to a given program. The activation of the remote start ANTICIPATES a defrost of which start is however determined by drE. In other words, when drE=12, if within 12 hours since the last defrost the controller does not receive the start signal, defrost will however take place. This function overlap avoids that a fault in the remote control or in the connection excludes any defrost.

5.4 MANUAL DEFROST: it is possible to manually start or abort defrost by pushing [DEFR.]+[MAN.].

Warning! The timers used for the functions described in Par.5.1 and 5.2, are cleared when the heater output is on. The timer counts are only re-started after the output has been switched off.

6. DEFROST FUNCTION

Regardless of the defrost start cause, the parameters which control it are: dLI determines the evaporator temp. which terminates the heating phase; dto, if greater than 0, provides a time-out for the heating phase. If set at 0, the evaporator heating only ends when temperature dLI is reached (time-out is excluded) or when the remote contact is opened.
After the heating phase, the dripping time drP, by delaying the cooler re-start, allows a homogeneous heat spread all over the evaporator and the drain of the drops of water.
During defrost the display is controlled according to the parameter dIS, if 00 the temperature continues to be displayed. If dIS= -01, then the display shows "dEF" since defrost start as long as the temperature T1 is higher than setpoint+hyst. By programming a value between 1 and 30 min., after the defrost "dEF" is still displayed until the time programmed has elapsed unless the above condition is reached before.
The ice melting method, determines the activation of the outputs and is chosen among the following:

6.1 AIR BLOWING: dty=FAn, this method is applicable where the setpoint is higher than 0°C and no heating element is used. In this case the evaporator fans are kept on, cooler and defrost outputs are off.

6.2 ELECTRIC HEATER: dty=ELE, when defrost starts, the cooler is switched off and the defrost output on.

6.3 HOT GAS: dty=GAS, this method uses the hot gas coming out of the compressor to heat the evaporator therefore defrost and cooler outputs are on.

After a power failure the defrost timer re-starts the counting from the point where it was interrupted, with ±30 min. approximation. Nevertheless, the start is delayed by an amount of time which is determined by the crS value expressed in minutes. This function is used in those applications where it's necessary to avoid simultaneous defrost start of several plants.

For ex. crS=02; if a power failure occure after 04h51 of timer counting and returns after 5 min., the timer is reloaded with 04h28.
The defrost LED is lit when the corresponding output is On; it blinks during defrost through "air blowing" and dripping time.
When probe 2 is faulty, any new defrost is inhibited.

7. FAN CONTROL

To obtain the best temperature and humidity regulations within the refrigerator, it's important to suitably control the fans during the cooling/heating process. With parameter Fct the fans can be controlled in three different ways. With -01, the fans work continuously; if 00 the fans are stopped simultaneously with the cooler/heater. By setting a value between 1 and 10 min., after the cooler/heater stops, the fans continue to run for the programmed amount of minutes. The fans are switched on simultaneously with the cooler/heater.
During and immediately after defrost, the fans are controlled by the parameters Fid and FrS.

7.1 FAN STOP: Fid=00, at the start and all through defrost the fans are off; they are switched on again, after compressor re-start, when the evaporator reaches the FrS temperature.

7.2 PARTIAL VENTILATION: Fid=01; in this case the fans are active as long as the evaporator has a temperature lower then FrS.

7.3 CONTINUOUS VENTILATION: Fid=02; all through defrost the fans are on (even with dty=ELE or GAS).

8. ALARM FUNCTION AND PROBE FAILURE

A check on the correct refrigeration plant function can be performed by monitoring temperature T1, T2 or T3, selectable via AIn parameter. ALo and AHi determine, respectively, the lower and higher temperature alarm threshold.
AdL allows the control of the alarm function: with -01 the temperature alarm is excluded, while, if this parameter is 00, the alarm is on immediately when the condition is detected. If AdL is programmed between 01 and 120 min. the temperature must constantly remain over the alarm threshold for the chosen time, before the signalling takes place.
When the alarm is entered, "ALM" blinks on the display and the buzzer is switched on. The signallings remain, even when the alarm condition is over, until the alarm is "acknowledged" by pressing any key. Now, if the temperature is within the alarm limits, any alarm indication disappears. Otherwise the current temperature is displayed alternating with "ALM" and, for 1 min. every 30, the buzzer beeps; all this happens as long as the alarm condition persists.
As a result of probe failure or overrange, the display shows "PF1" or "PF2", the alarm output is switched on immediately, regardless of the set delay. Also in this case the condition must be acknowledged by pressing any key.
During defrost and dripping, the high alarm monitoring is inhibited.

9. THERMAL MASS SIMULATION

This function has the purpose to simulate the behaviour of a thermal mass inside the refrigerator. It allows to hide rapid fluctuations of the displayed temperature, resulting for example from door opening or defrost, but also to reduce hunting due to temperature control.
By setting a value for SIM parameter between 01 and 200 you define the mass to simulate; if set to 00 the display shows the instantaneous temperature T3=(t1+oS3. The greater the programmed value, the greater the resulting slow down will be (ex. 100 approx. simulates a 0.5 l bottle of water).

10. PROBE RE CALIBRATION

Should it be necessary to recalibrate the unit, for instance in consequence of probe replacement, then act in the following way: get an accurate reference thermometer or calibrator; make sure that the offset oSx of the probe to be re-calibrated is 00; switch off then on the unit. During the self check (5 sec. from power-up), press [DEFR.]+[THERM.]+[DOWN]. When the re-calibration function is active choose the desired calibration section by means of [UP] or [DOWN]: 0A1 and 0A2 allow 0°C calibration, i.e. a constant offset across the whole range of the respective probe. SA1 and SA2 allow high temperature calibration to rectify a span error. After selecting the desired parameter, press [THERM.]+[UP] or [DOWN] to match the read-out value with the one of the reference instrument (make sure the temperature is stable).
Exit from the recalibration occurs after 10 sec. of no key activation. Therefore, to avoid exit, keep [THERM.] pressed as long as you need.

11. SETUP

ACT 12 configuration is achieved by programming the control parameters, access to it is obtained by pressing [DOWN]+[THERM.]+[UP] for 4 sec. Scroll through the parameters by pressing [UP] or [DOWN] until you select the desired parameter. Check its value by means of [THERM.] and change it via [THERM.]+[UP] or [DOWN]. Exit from the SETUP occurs after 10 sec. of no key activation. To help yourselves during programming, refer to the table annexed.

12. AUXILIARY FUNCTIONS

ACT 12 can be fitted with RS485 serial port, in order to take part as a peripheral in a data communication network managed by a master PC supervisor. The data base puts all measurement and control data on line as well as the output status. Adr is the unit identification number within the network.

Through serial communication it's also possible to change all control parameters (setpoint and setup), start defrost cycle, put the controller in stand-by or inhibit the instrument keyboard in order to avoid unauthorised access to the programming function.
The stand-by, emphasised by permanent "--", turns off all the outputs, but temperature measurement and serial communication are however active.
ACT 12 can be also put in or exit from stand-by manually, by pressing [DEFR]+[UP]+[DOWN] during self-check following the power-up.

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TECHNICAL DATA

Dimensions	35x77x77 mm
Operating temp.	-10°C ...+50°C
Range	-50° ...+150°
Resolution	01°
Sensor type	PTC 1000
Relay rating	ref. to data on unit
Probe connections	connectors/terminal blocks
Relays and supply	screw terminal 2mm^2
Power supply	12 Vac/dc; 3VA
Front protection	IP54

WARRANTY
LAE electronic Srl warrant that their products are free of any defects in workmanship and materials for a period of 1 (one) year from date of production shown on the enclosure. LAE electronic Srl shall only repair or replace those products of which defects are due to LAE electronic Srl and recognised by their technicians.
LAE electronic Srl are not liable for damages resulting from malfunctions of the products.
Defects due to exceptional operating conditions, misapplication and/or tampering will void the warranty.
All transport charges for returning the product to the manufacturer, after prior authorisation by LAE electronic Srl, and for the return to the purchaser are always for the account of the purchaser.

Par. N	Mnemonic and description	Minimum and Maximum limit	Factory setting	Current value
1	SPL cooler minimum set	-50 ... ... +150°	-30°	
2	SPh cooler maximum set	SPL ... ... +150°	+20°	
3	hyS cooler hysteresis	+01 ... ... +20°	+02°	
4	coF cooler min. off time	00 ... ... 10 min.	00 min.	
5	con cooler min. on time	00 ... ... 10 min.	00 min.	
6	cdc cooler duty cycle	00 ... ... 10(0)%	05(0)%	
7	crS cooler re-start	00 ... ... 120 sec.	00 sec.	
8	drE defrost repetition time	01 ... ... 99 hours	06 hours	
9	dLI defrost limit temperature	+01 ... ... +70°	+10°	
10	dto defrost time out	00 ... ... 120 min.	30 min.	
11	drP dripping time	00 ... ... 10 min.	03 min.	
12	dIS display in defrost	-01 ... 0 ... ... 30 min.	10 min.	
13	dty defrost type	FAn; ELE; GAS	ELE(ctrical)	
14	doP defrost optimisation	Con; Aco	con(tinuous)	
15	Fct evaporator fan control	-01 ... 00 ... ... 10 min.	01 min.	
16	FrS fan re-start after defrost	-50 ... ... +150°	-10°	
17	Fid ventilation in defrost	00=off; 01=Te<FrS; 02=always on	00	
18	ALo low alarm threshold	-50 ... ... +150°	-32°	
19	Ahi high alarm threshold	ALo ... ... +150°	+22°	
20	AdL temperature alarm delay	-01 ...00 ... 120 min.	10 min.	
21	AIn alarm input selection	01, 02, 03	01	
22	oS1 thermostat probe offset	-20 ... ... +20°	00°	
23	oS2 evaporator probe offset	-20 ... ... +20°	00°	
24	oS3 displayed probe offset	-20 ... ... +20°	00°	
25	SIM thermal mass simulation	00 200	00	
26	Adr peripheral number	000 255	01	