

LDU15

Thank you for having chosen an LAE electronic product. Before installing the instrument, please read this instruction booklet carefully in order to ensure maximum performance and safety.

1. INSTALLATION

1.1 The LDU15, size 77x35x77 mm (WxHxD), is inserted into the panel through a hole measuring 71x29 mm and is fixed by pressing gently into the relative clamps. The rubber gasket should be inserted between the instrument frame and the panel, checking that it adheres perfectly in order to prevent infiltration.

1.2 The instrument should work with room temperatures between -10°.. +50°C and relative humidity between 15%.. 80% inclusive. Supply voltage, switched powers and connection set-up should scrupulously comply with the indications given on the container. To reduce the effects of electromagnetic disturbance, keep the sensor and signal cables well separate from the power wires.

1.3 The sensor T1 measures the air temperature and activates in the thermostat control cycle; it should be placed inside the appliance in a point that truly represents the temperature of the stored product.

CAUTION: should the relays have to changeover a heavy load frequently, it is advisable to contact the manufacturer for indications on the lifetime of the contacts.

Whenever products must be kept within very severe specifications or the products have considerable value, the use of a second instrument is recommended, which activates upon or warns of any malfunction.

2. CONFIGURATION

The controller is adapted to the controlled system by suitably programming the configuration parameters, that is, through the setup. The instrument is dispatched with a general setup and correctness of the parameters must therefore be checked before use. The setup is accessed by pressing the buttons **◀** + **SET** + **▶** in succession and keeping them pressed simultaneously for 3 seconds. The available parameters appear in table 1 as shown below.

Press the button **▶** to pass from one parameter to the next and the button **◀** to go back. Press **SET** to display the value correlated to the parameter and press **SET** and **▶** or **◀** simultaneously to change it. Exit from setup is by pressing **AUX** or is automatic after 30 seconds of not using the keypad. Setpoint **SP** display and adjustment is also possible during normal operation of the controller by pressing the **SET** and **◀** or **▶** buttons. The range in any case remains within the limits **SPL** and **SPH**.

SCL	1°C/2°C/°F	Readout scale
SPL	-25.0.. SPH [°]	Minimum temperature set point
SPH	SPL.. +25.0 [°]	Maximum temperature set point
SP	SPL.. SPH [°]	Effective temperature set point
HYS	+0.1.. +10.0 [°]	Thermostat hysteresis
CRT	0.. 30 [min]	Compressor rest time
CDC	0.. 10	Compressor regulation with sensor T1 failure
DFR	0.. 24	Defrosting frequency /24h
DTO	1.. 120 [min]	Defrosting duration
DDY	1.. 60 [min]	Defrosting display control
ATL	-12.0.. 0 [°]	Low alarm differential
ATH	0.. +12.0 [°]	High alarm differential
ATD	0.. 120 [min]	Temperature alarm delay
ACC	0.. 52 [weeks]	Condenser periodic cleaning
OAU	NON/SBY/MAN/DEF/ALR	Auxiliary output mode of operation
BAU	NON/SBY/MAN	Auxiliary button mode of operation
OS1	-12.5.. +12.5 [°]	Sensor T1 correction
SIM	0.. 100	Display slowdown
ADR	1.. 255	Peripheral address

TABLE 1

3. DISPLAYS

Upon switching on, just the central line (autotest) appears on the display for approximately three seconds and the subsequent indications depend on the operating status of the controller. Table 2 gives the indications associated with the various states.

The temperature measured by the sensor T1 is handled by the microprocessor so that it is displayed in the most representative way. In other words, the parameter **SCL** is used to select the display in °C with 0.1/1° auto-range (SCL=1°C), in °C with 1° fixed resolution

(SCL=2°C) or in Fahrenheit (SCL=°F). The measured temperature may be corrected with a fixed offset by assigning a value other than 0 to the parameter **OS1**. Furthermore, prior to display, the temperature is treated by an algorithm that allows the simulation of a thermal mass directly proportional to the **SIM** value. The result is a reduction in the fluctuation of the displayed value. The LDU15 also features a minimum and maximum temperature recording. By pressing button **◀**, the display will show the minimum stored temperature; by pressing button **▶**, the display will show the maximum stored temperature. In order to reset the recordings, first get the logged value displayed by pressing button **◀** or **▶**, then press **SET** simultaneously while the value is displayed. The status of the compressor and auxiliary outputs is shown through the respective dots on the display.

-	autotest (3 seconds)	HI	high temperature alarm
2.5	sensor T1 temperature	LO	low temperature alarm
DF	defrosting in progress	E1	sensor T1 failure
OFF	standby	CLN	Condenser cleaning

TABLE 2

CAUTION: upon changing the display scale SCL, it is **ABSOLUTELY** necessary to reconfigure the parameters related to the absolute (SPL, SPH, SP) and differential (HYS, ATL, ATH, OS1) temperatures.

4. THERMOSTAT CONTROL

4.1 Thermostat control is based on comparing the temperature T1, the set point **SP** and the hysteresis **HYS**.

Example: SP= 2.0; HYS= 1.5, relay Off with T1= +2.0° and On with T1= +3.5°.

The compressor only switches On again if the minimum Off time **CRT** since the previous switchover has elapsed. Whenever a very small hysteresis **HYS** must be maintained, we advise assigning a suitable value to CRT in order to reduce the number of starts/hour.

4.2 If sensor T1 fails, the output is controlled for a fixed time established with **CDC**; this determines the activation time of the output within 10-minute cycles.

Example: CDC=06, 6 minutes On, 4 minutes Off.

5. DEFROSTING

Defrosting starts automatically when the internal timer reaches the necessary time to obtain the defrosting frequency set with **DFR**. For example, with DFR=4 defrosting occurs once every 6 hours. With DFR=0 the timed defrosting function is cut out. When the controller is put on a standby, the timer count is frozen.

Defrosting may also be induced manually by pressing the buttons **◀** and **▶** simultaneously.

The internal timer is set to zero when the instrument is switched on, at each subsequent defrost start and, if in the standby mode, whenever standby lasts for at least the time set in **DTO**.

Defrosting occurs upon stopping the compressor and, if **OUA=DEF**, upon activating the defrost heater through the auxiliary relay for the time **DTO**. During defrosting **DF** appears on the display and remains there after the end of defrosting for the time set in **DDY**.

6. ALARMS

With LDU15 correct operation of the thermostat, sensor and the periodic warning of condenser cleaning can be checked. The alarm warnings are given on the display with explicit indications (table 2) intermittent buzzer sounding and with **OAU=ALR**, also on the auxiliary relay, which will remain on as long as the alarm condition continues (not for condenser cleaning).

The alarm warning is removed from the display and the buzzer muted upon pressing any button for two seconds. Then, if the alarm persists, the buzzer and the display warning will be periodically activated for 20 seconds every 60 minutes, until the alarm ends. Operation of the various sections is given in detail below.

6.1 The parameters **ATL** and **ATH** define two differential temperatures that, referred to the set point, determine the temperature alarm thresholds. **ATL** establishes the alarm differential for temperatures below set point, **ATH** the alarm differential for temperatures above set point + hysteresis. Putting one or both differentials to 0 cuts out the corresponding alarm.

Example: SP= 2.0, HYS= 1.5, ATL= -5.0, ATH= 5.0; the alarm thresholds are fixed at -3.0° and +8.5°.

The alarm warning may be immediate or delayed by the time **ATD** whenever this is greater than 0. The high temperature alarm is bypassed during defrosting.



6.2 Assigning a value greater than 0 to the parameter **ACC** enables the indication for periodic cleaning of the condenser. In other words, when the count of compressor hours of operation reaches the equivalent in weeks set with ACC, an indication for cleaning appears on the display (see table 2).

Example: with ACC=16 there is a warning once every $16 \times 7(\text{weeks}) \times 24(\text{hours}) = 2688$ hours of **compressor operation**, in other words, assuming for this an operation with 5 minutes On and 5 minutes Off - after approx. 32 weeks.


The time counter may only be cleared after the programmed time has been reached. Therefore proceed as follows: press the buttons **◀** and **AUX** in sequence and hold them simultaneously.

7. TEMPERATURE STORAGE


The LDU15 features a system for permanent storage of the minimum and maximum temperature logged during operation. This system is a valid help to achieve compliance with the HACCP directive in its part relating to a correct preservation of foodstuffs. Temperature is measured by probe T1 which should therefore be placed in a point where the temperature of the preserved product may always be measured correctly. The logging is however subject to some simple rules that filter the data and give a rational interpretation. As a matter of fact, the logging is suspended during the periods in which the refrigerator is put on a standby. In addition, the new minimum or maximum temperature measured must exceed the previous limit for longer than 1 minute before the new value is stored. In this way, it will be possible to avoid idle loggings that don't reflect the actual product temperature, because of, for example, the door being left open, or other temporary short term temperature huntings.

We therefore advise you to put the product into the refrigerator and now start a new logging cycle by clearing previous values (see par. 3). It will now suffice that at regular intervals, you check the minimum and maximum logged values by means of buttons  and  in order to know if the product has been kept within the limits established by the criteria of a correct preservation.


8. AUXILIARY FUNCTIONS

The LDU15 controller comprises a button and an auxiliary relay with functions that may be suitably combined through the parameters **OAU** and **BAU**. The parameter **OAU** assigns one of the following functions to the auxiliary output: alarm warning (ALR), defrost heater control (DEF), manual control (MAN), auxiliary loads (SBY), cut-out (NON). The parameter **BAU** determines the function associated with the button : direct control of the auxiliary relay (MAN), instrument on/off (SBY), no function (NON). A few examples of use are given below:

*Example 1, **OAU=BAU=MAN**: each time the button  is pressed there is a changeover of the auxiliary load (e.g. interior lights).*

*Example 2, **OAU=BAU=SBY**: pressing  for approx. 3 seconds changes the status of both the controller (on/standby) and the auxiliary load (e.g. evaporator fans).*

*Example 3, **OAU=ALR** and **BAU=NON**: the auxiliary relay is activated during an alarm condition; the  button is only used to exit from the setup and to reset the condenser cleaning timer.*

*Example 4, **OAU=DEF** and **BAU=SBY**: the auxiliary relay is activated during defrost, pressing  for approx. 3 seconds changes the status of the controller (on/standby).*

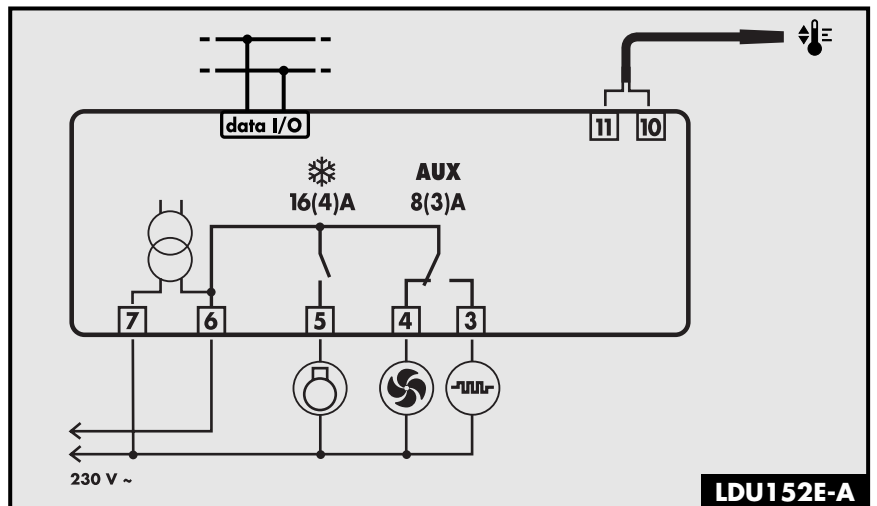
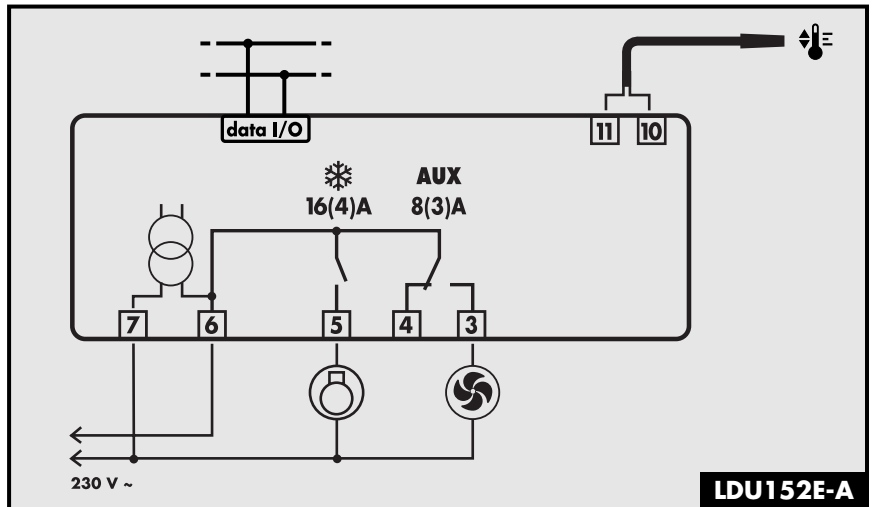
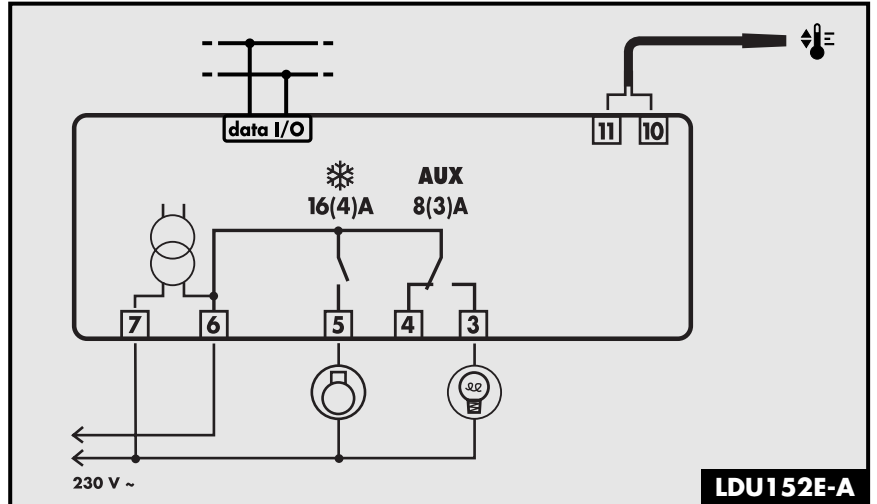
The controller is provided with a serial port for connection to a PC or a programmer. In the first case it is important to assign to the parameter **ADR** a different value for each linked unit (peripheral address); with automatic programming, ADR should remain on 1.

WARRANTY

LAE electronic Srl guarantees its products against defects due to faulty materials or workmanship for one (1) year from the date of manufacture shown on the container. The Company shall only repair or replace products which are shown to be defective to the satisfaction of its own technical services. The Company shall not be under any liability and gives no warranty in the event of defects due to exceptional conditions of use, misuse or tampering.

All carriage expenses for returning the product to the manufacturer, after having obtained the latter's permission, and for any return to the buyer shall be paid by the buyer.

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