

# AD2-28 INSTRUCTIONS FOR USE

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

## DESCRIPTION



Fig.1 - Front panel

- Info / Setpoint button.
- Manual defrost / Decrease button.

## INSTALLATION

- The AD2-28 controller, size 107x95x47 mm (WxHxD), is to be secured to a DIN rail in such a position as to ensure that no liquid infiltrates causing serious damage and compromising safety.
- Make sure that electrical connections comply with the paragraph "wiring diagrams". To reduce the effects of electromagnetic disturbance, keep the sensor and signal cables well separate from the power wires.
- Place the probe T1 inside the room in a point that truly represents the temperature of the stored product.
- Place the probe T2 on the evaporator where there is the maximum formation of frost.
- The function of probe T3 is determined by the parameter T3. With T3=DSP the probe measures the temperature to be displayed. With T3=CND the probe measures the condenser temperature, it must therefore be placed between the fins of the condensing unit. With T3=2EU the probe measures the temperature of the second evaporator and it must therefore be placed where there is the maximum formation of frost. With T3=NON, the third probe is disabled.

## OPERATION

### DISPLAY

During normal operation, the display shows either the temperature measured or one of the following indications:

|     |                                  |                |                               |
|-----|----------------------------------|----------------|-------------------------------|
| dEF | Defrost in progress              | hP             | Condenser high pressure alarm |
| oFF | Controller in stand-by           | h <sub>1</sub> | Room high temperature alarm   |
| cL  | Condenser clean warning          | L <sub>0</sub> | Room low temperature alarm    |
| dO  | Door open alarm                  | E <sub>1</sub> | Probe T1 failure              |
| hC  | Condenser high temperature alarm | E <sub>2</sub> | Probe T2 failure              |
|     |                                  | E <sub>3</sub> | Probe T3 failure              |

### INFO MENU

The information available in this menu is:

|                |                             |                 |                                      |
|----------------|-----------------------------|-----------------|--------------------------------------|
| t <sub>1</sub> | Instant probe 1 temperature | t <sub>h1</sub> | Maximum probe 1 temperature recorded |
| t <sub>2</sub> | Instant probe 2 temperature | t <sub>h0</sub> | Minimum probe 1 temperature recorded |
| t <sub>3</sub> | Instant probe 3 temperature | cnd**           | Compressor working weeks             |
|                |                             | loc             | Keypad state lock                    |

\*: displayed only if enabled (see §Configuration Parameters) \*\*: displayed only if ACC > 0

### Access to menu and information displayed.

- Press and immediately release button [I].
- With button [V] or [A] select the data to be displayed.
- Press button [I] to display value.
- To exit from the menu, press button [X] or wait for 10 seconds.

### Reset of THI, TLO, CND recordings

- With button [V] or [A] select the data to be reset.
- Display the value with button [I].
- While keeping button [I] pressed, use button [X].

### STAND-BY

Button [SB], when pressed for 3 seconds, allows the controller to be put on a standby or output control to be resumed (with SB=YES only).

### KEYPAD LOCK

The keypad lock avoids undesired, potentially dangerous operations, which might be attempted when the controller is operating in a public place. In the INFO menu, set parameter LOC=YES to inhibit all functions of the buttons. To resume normal operation of keypad, adjust setting so that LOC=NO.

### SELECTION OF SECOND PARAMETER GROUP

It's possible to select control parameters between two different pre-programmed groups, in order for the fundamental control parameters to be adapted quickly to changing needs. Changeover from Group I to Group II (and vice versa) may take place MANUALLY by pressing button [M] for 2 seconds (with IISM=MAN), or AUTOMATICALLY when heavy duty conditions are detected (with IISM=HDD), or when IISM=D12 and the AUXILIARY INPUT DI2 is activated (the activation of DI2 selects Group II). If IISM=NON, switchover to Group II is inhibited. The activation of Group II is signalled by the lighting up of the relevant LED on the controller display.

### DEFROST

- Automatic defrost.** Defrost starts automatically as soon as the time set with parameter DFT has elapsed.
- Timed defrost.** With DFM=TIM defrosts take place at regular intervals when the timer reaches the value of DFT. For example, with DFM=TIM and DFT=06, a defrost will take place every 6 hours.
- Optimized defrost.** With DFM=FRO the timer is only increased when the conditions occur for frost to form on the evaporator, until the time set with parameter DFT is reached. If the evaporator works at 0°C, defrost frequency depends on the thermal load and climatic conditions. With setpoints much lower than 0°C, defrost frequency mainly depends on the refrigerator operating time.
- Synchronised defrost.** With DI2=DSY and when more units (models AD2-28x3xxx only) are linked to each other as per Fig. 3, synchronised defrosts of all linked controllers will take place. The first controller which will start defrost, will also get all other controllers synchronised.
- Defrost time count backup.** At the power-up, if DFB=YES, the defrost timer resumes the time count from where it was left off before the power interruption. Vice versa, with DFB=NO, the time count re-starts from 0. In stand-by, the accumulated time count is frozen.

**Manual or remote defrost start.** It's possible to manually start a defrost, by pressing button [M] for 2 seconds, or defrost may be started remotely, if DI2=RDS, through the making of the auxiliary contact DI2.

**Defrost type.** Once defrost has started, Compressor and Defrost outputs are controlled according to parameter DTY. If FID=YES, the evaporator fans are active during defrost.

**Defrost termination.** The actual defrost duration is influenced by a series of parameters.

- Time termination:** T2=NO and T3 different from 2EU: the evaporator temperature is not monitored and defrost will last as long as time DTO.
- Temperature monitoring of one evaporator:** T2=YES and T3 different from 2EU. In this case, if the sensor T2 measures the temperature DLI before the time DTO elapses, defrost will be terminated in advance.
- Temperature monitoring of two evaporators:** T2=YES, T3=2EU, OAU=2EU. This function is for the control of two independent evaporators and it switches off the individual heating of the evaporator which gets to temperature DLI first, waiting for the second evaporator to get to that temperature before the time DTO elapses.

**Resuming thermostatic cycle.** When defrost is over, if DRN is greater than 0, all outputs will remain off for DRN minutes, in order for the ice to melt completely and the resulting water to drain. Moreover, if probe T2 is active (T2=YES), the fans will re-start when the evaporator gets to a temperature lower than FDD; Vice versa, if probe T2 is not active (T2=NO) or after defrost has come to an end, such condition does not occur by end of the time FTO, after FTO minutes have elapsed the fans will be switched on anyway.

**Caution:** if DFM=NON or C-H=HEA all defrost functions are inhibited; if DFT=0, automatic defrost functions are excluded. During a high pressure alarm, defrost is suspended. During defrost, high temperature alarm is bypassed.

## CONFIGURATION PARAMETERS

- To get access to the parameter configuration menu, press button [M] + [I] for 5 seconds.
- With button [V] or [A] select the parameter to be modified.
- Press button [I] to display the value.
- By keeping button [I] pressed, use button [V] or [A] to set the desired value.
- When button [I] is released, the newly programmed value is stored and the following parameter is displayed.
- To exit from the setup, press button [X] or wait for 30 seconds.

## INDICATIONS

- Thermostat output
- Fan output
- Defrost output
- Activation of 2nd parameter set
- Alarm
- Manual activation / Increase button.
- Exit / Stand-by button.

| PAR | RANGE                    | DESCRIPTION  |
|-----|--------------------------|--|
| SCL | 1°C;<br>2°C;<br>°F       | Readout scale.<br>1°C (with INP=SN4 only): measuring range -50/-9.9 ... 19.9/80°C<br>2°C: measuring range -50 ... 120°C<br>°F: measuring range -55 ... 240°F<br><b>Caution:</b> upon changing the SCL value, it is then <b>absolutely necessary</b> to re-configure the parameters relevant to the absolute and relative temperatures (SPL, SPH, SP, ALA, AHA, etc.).  |
| SPL | -50...SPH                | Minimum limit for SP setting.  |
| SPH | SPL...120°               | Maximum limit for SP setting.  |
| SP  | SPL...SPH                | Setpoint (value to be maintained in the room).   |
| C-H | REF; HEA                 | Refrigerating (REF) or Heating (HEA) control mode.   |
| HYS | 1...10°                  | OFF/ON thermostat differential.<br><br>Refrigerating control (C-H=REF)<br><br>Heating control (C-H=HEA)  |
| CRT | 0...30min                | Compressor rest time. The output is switched on again after CRT minutes have elapsed since the previous switchover. We recommend to set CRT=03 with HYS<2.0°.  |
| CT1 | 0...30min                | Thermostat output run when probe T1 is faulty. With CT1=0 the output will always remain OFF.   |
| CT2 | 0...30min                | Thermostat output stop when probe T1 is faulty. With CT2=0 and CT1>0 the output will always be ON.<br><b>Example:</b> CT1=4, CT2= 6: In case of probe T1 failure, the compressor will cycle 4 minutes ON and 6 minutes OFF.  |
| CSD | 0...30min                | Compressor stop delay after the door has been opened (active only if DS=YES).  |
| DFM | NON;<br>TIM;<br>FRO      | Defrost start mode<br>NON: defrost function is disabled (the following parameter will be FID).<br>TIM: regular time defrost.<br>FRO: the defrost time count is only increased when the conditions occur for frost to form on the evaporator (optimised time increase).   |
| DFT | 0...99 hours             | Time interval among defrosts. When this time has elapsed since the last defrost, a new defrost cycle is started.   |
| DFB | NO/YES                   | Defrost timer backup. With DFB=YES, after a power interruption, the timer resumes the count from where it was left off with ±30 min. approximation. With DFB=NO, after a power interruption, the defrost timer will re-start to count from zero.   |
| DLI | -50...120°               | Defrost end temperature.   |
| DTO | 1...120min               | Maximum defrost duration.  |
| DTY | OFF;<br>ELE;<br>GAS      | Defrost type<br>OFF: off cycle defrost (Compressor and Heater OFF).<br>ELE: electric defrost (Compressor OFF and Heater ON).<br>GAS: hot gas defrost (Compressor and Heater ON).   |
| DPD | 0...240sec               | Evaporator pump down. At the beginning of defrost, defrost outputs (determined by DTY) are OFF for DPD seconds.  |
| DRN | 0...30min                | Pause after defrost (evaporator drain down time).  |
| DDM | RT;<br>LT;<br>SP;<br>DEF | Defrost display mode. During defrost the display will show:<br>RT: the real temperature;<br>LT: the last temperature before defrost;<br>SP: the current setpoint value;<br>DEF: "dEF".   |
| DDY | 0...60min                | Display delay. The display shows the information selected with parameter DDM during defrost and for DDY minutes after defrost termination.   |
| FID | NO/YES                   | Fans active during defrost.  |
| FDD | -50...120°               | Evaporator fan re-start temperature after defrost.   |
| FTO | 0...120min               | Maximum evaporator fan stop after defrost.   |
| FCM | NON;<br>TMP;<br>TIM      | Fan mode during thermostatic control.<br>NON: The fans remain ON all the time;<br>TMP: Temperature-based control. The fans are ON when the compressor is ON. When the compressor is turned OFF, the fans remain ON as long as the temperature difference Te-Ta is greater than FDT. The fans are turned ON again with FDH differential. (Te = Evaporator temperature, Ta = Air temperature);<br>TIM: Timed-based control. The fans are ON when the compressor is ON. When the compressor is OFF, the fans switch ON and OFF according to parameters FT1, FT2, FT3 (See Fig.2). |
| FDT | -120...0°                | Evaporator-Air temperature difference for the fans to turn OFF after the compressor has stopped.   |
| FDH | 1...120°                 | Temperature differential for fan re-start.<br><b>Example:</b> FDT = -1, FDH=3. In this case, after the compressor has stopped, the fans are OFF when Te > Ta - 1 (FDT), whereas the fans are ON when Te < Ta - 4 (FDT-FDH).  |
| FT1 | 0...180sec               | Fan stop delay after compressor stop. See Fig. 2   |
| FT2 | 0...30min                | Timed fan stop. With FT2=0 the fans remain on all the time.  |
| FT3 | 0...30min                | Timed fan run. With FT3=0, and FT2 > 0, the fans remain off all the time.  |
| ATM | NON;<br>ABS;<br>REL      | Alarm threshold management.<br>NON: all temperature alarms are inhibited (the following parameter will be ADO).<br>ABS: the values programmed in ALA and AHA represent the real alarm thresholds.<br>REL: the values programmed in ALR and AHR are alarm differentials referred to SP and SP+HYS.<br><br>Temperature alarm with relative thresholds, refrigerating control (ATM=REL, C-H=REF).<br><br>Temperature alarm with absolute thresholds, heating control (ATM=REL, C-H=HEA).  |
| ALA | -50... 120°              | Low temperature alarm threshold.   |
| AHA | -50... 120°              | High temperature alarm threshold.  |
| ALR | -12... 0°                | Low temperature alarm differential. With ALR=0 the low temperature alarm is excluded.  |
| AHR | 0... 12°                 | High temperature alarm differential. With AHR=0 the high temperature alarm is excluded.  |
| ATI | T1; T2; T3               | Probe used for temperature alarm detection.  |
| ATD | 0... 120min              | Delay before alarm temperature warning.  |
| ADO | 0... 30min               | Delay before door open alarm warning.  |
| AHM | NON;<br>ALR;<br>STP;     | Operation in case of high condenser alarm<br>NON: high condenser alarm inhibited.<br>ALR: in case of alarm, "HC" flashes in the display and the buzzer is switched on.<br>STP: in addition to the alarm symbols displayed, the compressor is stopped and defrosts are suspended.   |

|      |   |   |
|------|---|---|
| AHT  | -50...120°  | Condensation temperature alarm (referred to T3 probe).  |
| ACC  | 0...52 weeks  | Condenser periodic cleaning. When the compressor operation time, expressed in weeks, matches the ACC value programmed, "CL" flashes in the display. With ACC=0 the condenser cleaning warning is disabled and CND disappears from Info Menu.  |
| IISM | NON;<br>MAN;<br>HDD;<br>DI2                         | Switchover mode to second parameter set<br>NON: inhibition to use the second parameter group (the following parameter will be SB).<br>MAN: button [M] switches the two parameter groups over.<br>HDD: automatic switchover to the second parameter group, when heavy duty conditions are detected.<br>DI2: switchover to the second parameter group when the auxiliary DI2 input makes.   |
| IISL | -50... IISH   | Minimum limit for IISP setting.   |
| IISH | IISL... 120°  | Maximum limit for IISP setting.   |
| IISP | IISL... IISH  | Setpoint in mode 2.   |
| IIHY | 1... 10°  | OFF/ON differential in mode 2.  |
| IIFC | NON;TMP;<br>TIM                                     | Fan control in mode 2. See FCM.   |
| HDS  | 1...5   | Controller sensitivity for the automatic switchover from Group I to Group II (1=minimum, 5=maximum).  |
| IIDF | 0...99 hours  | Time interval among defrosts in mode 2.   |
| SB   | NO/YES  | Stand-by button [SB] enabling.  |
| DS   | NO/YES  | Door switch input enabling (closed when door is closed).  |
| DI2  | NON;<br>HPS;<br>IISM;<br>RDS;<br>DSY                | DI2 digital input operation<br>NON: digital input 2 not active.<br>HPS: when contact opens a condensing unit high pressure alarm occurs.<br>IISM: when contact makes the controller will use group 2 parameters.<br>RDS: when contact makes a defrost is started (remote control).<br>DSY: defrost synchronisation. The defrosts, linked as per Fig. 3, will all start and end defrost together. The first controller in defrost will get defrost of all the others started. The last controller ending defrost will get defrost of all the others stopped. |
| LSM  | NON;<br>MAN;<br>DOR                                 | Light control mode<br>NON: light output not controlled.<br>MAN: light output controlled through button [M] (if OAx=LGT).<br>DOR: light output switched on when door is opened (if OAx=LGT).   |
| OA1  | NON;<br>O-1;<br>LGT;<br>2CU;<br>2EU;<br>AL0;<br>AL1 | AUX 1 output operation<br>NON: output disabled (always off).<br>O-1: the relay contacts follow the on/standby state of controller.<br>LGT: output enabled for light control.<br>2CU: output programmed for the control of an auxiliary compressor.<br>2EU: output enabled for the control of the electrical defrost of a second evaporator.<br>AL0: contacts open when an alarm condition occurs.<br>AL1: contacts make when an alarm condition occurs.   |
| OA2  | See OA1   | AUX2 output operation. See OA1.   |
| 2CD  | 0...120 sec   | Auxiliary compressor start delay. If OAx=2CU the auxiliary output is switched on with a delay of 2CD seconds after the main compressor has cut-in. Both compressors are turned off at the same time.  |
| INP  | SN4; ST1  | Temperature sensor selection. With INP=SN4, the probes must be the LAE models SN4.; with INP = ST1, the probes must be the LAE models ST1...  |
| OS1  | -12.5, 12.5°C                                       | Probe T1 offset.  |
| T2   | NO/YES  | Probe T2 enabling (evaporator).   |
| OS2  | -12.5, 12.5°C                                       | Probe T2 offset.  |
| T3   | NON;<br>DSP;<br>CND;<br>2EU                         | Auxiliary probe T3 operation<br>NON: probe T3 not fitted.<br>DSP: temperature T3 to be displayed.<br>CND: condenser temperature measurement.<br>2EU: second evaporator temperature measurement.   |
| OS3  | -12.5, 12.5°C                                       | Probe 3 offset.   |
| TLD  | 1...30 min  | Delay for minimum temperature (TLO) and maximum temperature (THI) logging.  |
| SIM  | 0...100   | Display slowdown.   |
| ADR  | 1...255   | AD2-28 address for PC communication.  |

## WIRING DIAGRAMS

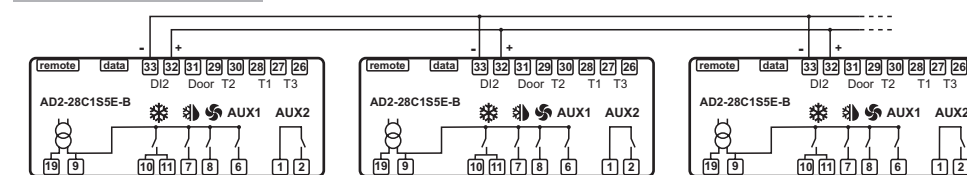
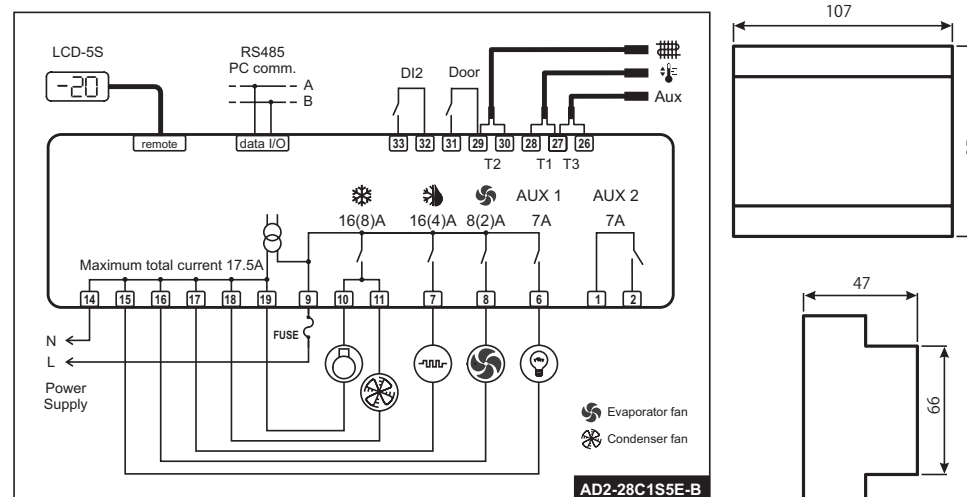


Fig.3 Connection for synchronising defrost start and termination



## TECHNICAL DATA

**Power supply**  
AD2-28...D 12Vac/dc ±10%, 3W  
AD2-28...E 230Vac ±10%, 50/60Hz, 3W  
AD2-28...U 115Vac ±10%, 50/60Hz, 3W

### Relay output max loads (240Vac)

|                   | AD2-28...S/T...-.             | AD2-28...Q/R...-.             |
|-------------------|-------------------------------|-------------------------------|
| Compressor        | 16A resistive<br>8 FLA 48 RLA | 12A resistive<br>8 FLA 48 RLA |
| Evap. Fan         | 8A resistive<br>2 FLA 12 RLA  | 8A resistive<br>2 FLA 12 RLA  |
| Defrost           | 16A resistive                 | 12A resistive                 |
| Auxiliary loads 1 | 7A resistive                  | 7A resistive                  |
| Auxiliary loads 2 | 7A resistive                  | 7A resistive                  |

### Input

NTC 10KQ@25°C LAE Part No. SN4...  
PTC 1000Q@25°C LAE Part No. ST1...

### Measurement Range

-50...120°C, -55...240°F  
-50/-9.9 ... 19.9/80°C (NTC10K only)

### Measurement accuracy

<0.5°C within the measurement range

### Operating conditions

-10 ... +50°C; 15%...80% r.H.

### CE - UL (Approvals and Reference norms)

EN60730-1; EN60730-2-9; EN55022 (Class B);  
EN50082-1  
SA32385, UL 60730-1A

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