

## BD1-28 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 BD1-28 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>i</sub>	Room high temperature alarm
cL	Condenser clean warning	L <sub>o</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>Lo</sub>	Minimum probe 1 temperature recorded
t <sub>3</sub>	Instant probe 3 temperature	cnd**	Compressor working weeks
		L <sub>oc</sub>	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 **I** 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 **I** or **A** select the data to be reset.
  - Display the value with button **I**.
  - While keeping button **I** pressed, use button **X**.

#### SETPOINT : display and modification

- Press button **I** for at least half second, to display the setpoint value.
- By keeping button **I** pressed, use button **I** or **A** to set the desired value (adjustment is within the minimum **SPL** and the maximum **SPH** limit).
- When button **I** is released, the new value is stored.

#### STAND-BY

Button **I**, 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 ECO conditions are detected (with **IISM=ECO**), or when **IISM=DI**, **DxO=IISM** and the digital input is activated (the activation of Dlx selects Group II, x=1,2,3). 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 matched. 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 **D3O=DSY** and when more units are linked to each other, 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 **I** for 2 seconds, or defrost may be started remotely, if **DxO=RDS**, through the activation of the auxiliary contact Dlx.

**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**, **A0x=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 **I** + **I** for 5 seconds.
- With button **I** or **A** select the parameter to be modified.
- Press button **I** to display the value.
- By keeping button **I** pressed, use button **I** 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.

PAR	RANGE	DESCRIPTION
SPL	-50...SPH	Minimum limit for SP setting.
SPH	SPL...110°	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.
HY0	1...10°	Thermostat OFF -> ON differential.
HY1	0...10°	Thermostat ON -> OFF differential.
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 HY0<2.0°.
CT1	0...30min	Compressor/Heater output run when probe T1 is faulty. With CT1=0 the output will always remain OFF.
CT2	0...30min	Compressor/Heater output stop when probe T1 is faulty. With CT2=0 and CT1>0 the output will always be ON. <i>Example:</i> CT1=4, CT2= 6: In case of probe T1 failure, the compressor will cycle 4 minutes ON and 6 minutes OFF.
DFM	NON; TIM; FRO	Defrost start mode <b>NON</b> : defrost function is disabled ( <i>the following parameter will be</i> FCM). <b>TIM</b> : regular time defrost. <b>FRO</b> : 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...110°	Defrost end temperature.
DTO	1...120min	Maximum defrost duration.
DTY	OFF; ELE; GAS	Defrost type <b>OFF</b> : off cycle defrost (Compressor and Heater OFF). <b>ELE</b> : electric defrost (Compressor OFF and Heater ON). <b>GAS</b> : hot gas defrost (Compressor and Heater ON).
DSO	OFF; LO; HI	Defrost start optimisation <b>OFF</b> : no optimisation. <b>LO</b> : defrost waits until the compressor cut-out. <b>HI</b> : defrost waits until the compressor cut-in.
SOD	0...30 min	Start optimisation delay.
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; LT; SP; DEF	Defrost display mode. During defrost the display will show: <b>RT</b> : the real temperature; <b>LT</b> : the last temperature before defrost; <b>SP</b> : the current setpoint value; <b>DEF</b> : "dDEF".
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...110°	Evaporator fan re-start temperature after defrost.
FTO	0...120min	Maximum evaporator fan stop after defrost.
FCM	NON; TMP; TIM	Fan mode during thermostatic control. <b>NON</b> : The fans remain ON all the time; <b>TMP</b> : 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); <b>TIM</b> : 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	-12...0°	Evaporator-Air temperature difference for the fans to turn OFF after the compressor has stopped.
FDH	1...12°	Temperature differential for fan re-start. <i>Example:</i> 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/heater 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; ABS; REL	Alarm threshold management. <b>NON</b> : all temperature alarms are inhibited ( <i>the following parameter will be</i> ACC). <b>ABS</b> : the values programmed in ALA and AHA represent the real alarm thresholds. <b>REL</b> : the alarm threshold is obtained by the sum of setpoint, thermostat differential and ALR/AHR.
ALA	-50... 110°	Low temperature alarm threshold.
AHA	-50... 110°	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.
ACC	0...52 weeks	Condenser periodic cleaning. When the compressor operation time, expressed in weeks, matches the <b>ACC</b> value programmed, "CL" flashes in the display. With ACC=0 the condenser cleaning warning is disabled and CND disappears from Info Menu.
IISM	NON; MAN; ECO; DI	Switchover mode to second parameter set <b>NON</b> : inhibition to use the second parameter group ( <i>the following parameter will be</i> SB). <b>MAN</b> : button <b>M</b> switches the two parameter groups over. <b>ECO</b> : automatic switchover to the second parameter group, when ECO conditions are detected. <b>DI</b> : switchover to the second parameter group when Dlx input is on.
IISL	-50... IISH	Minimum limit for IISP setting.
IISH	IISL... 110°	Maximum limit for IISP setting.
IISP	IISL... IISH	Setpoint in mode 2.
IIH0	1... 10°	Thermostat OFF->ON differential in mode 2.
IIH1	0... 10°	Thermostat ON->OFF differential in mode 2.
IDF	0...99 hours	Time interval among defrosts in mode 2.
IIFC	NON;TMP; TIM	Fan control in mode 2. See FCM.
ECS	1...5	Controller sensitivity for the automatic switchover from Group I to Group II (1=minimum, 5=maximum).

EPT	0...240 min	Eco pull-down time. Only with IISM=ECO. Group I parameters are used in regulation for at least EPT minutes. See Fig.3
SB	NO/YES	Stand-by button <b>I</b> enabling.
DSM	NON; ALR; STP	Door switch input mode: <b>NON</b> : door switch inhibited <b>ALR</b> : when Dlx=DOR and the digital input is on, an alarm is generated after ADO minutes <b>STP</b> : when Dlx=DOR and the digital input is on, in addition to the alarm, the fans are immediately stopped and the compressor is stopped after CSD minutes.
DAD	0...30 min	Delay before door open alarm warning.
CSD	0...30 min	Compressor/heater stop delay after door has been opened.
D1O	NON; DOR; ALR; IISM; RDS	D11 digital input operation <b>NON</b> : digital input 1 not active. <b>DOR</b> : door input. <b>ALR</b> : when the input is on, an alarm is generated (if AHM=STP, the compressor is stopped and the defrosts are suspended). <b>IISM</b> : when the input is on, the controller will use group 2 parameters. <b>RDS</b> : when the input is on, a defrost is started (remote control).
D1A	OPN; CLS.	D11 digital input activation. <b>OPN</b> : on open <b>CLS</b> : on close
D2O	See D1O	D12 digital input operation. See D1O.
D2A	OPN; CLS.	D12 digital input activation. <b>OPN</b> : on open <b>CLS</b> : on close
D3O	NON; DOR; ALR; IISM; RDS; DSY.	D13 digital input operation <b>NON ... RDS</b> : See D1O. <b>DSY</b> : defrost synchronization. The controllers 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.
D3A	OPN; CLS.	D13 digital input activation. <b>OPN</b> : on open <b>CLS</b> : on close
LSM	NON; MAN; ECO; DI1; DI2; DI3.	Light control mode <b>NON</b> : light output not controlled. <b>MAN</b> : light ouput controlled through button <b>M</b> (if OAx=LGT). <b>ECO</b> : lights activated/deactivated following the ECO state. <b>Dlx</b> : lights activated/deactivated following the Dlx state.
LSA	OPN; CLS	Light activation (only with LSM=ECO or LSM=Dlx). <b>OPN</b> : lights on with Dlx open or ECO mode deactivated. <b>CLS</b> : lights on with Dlx closed or ECO mode activated.
OA1	NON; LGT; 0-1; 2CU; 2EU; ALO; ALC	AUX 1 output operation <b>NON</b> : output disabled (always off). <b>LGT</b> : output enabled for light control. <b>0-1</b> : the relay contacts follow the on/standby state of controller. <b>2CU</b> : output programmed for the control of an auxiliary compressor. <b>2EU</b> : output enabled for the control of the electrical defrost of a second evaporator. <b>ALO</b> : contacts open when an alarm condition occurs. <b>ALC</b> : 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.
OS1	-12.5..12.5°	Probe T1 offset.
T2	NO/YES	Probe T2 enabling (evaporator).
OS2	-12.5..12.5°	Probe T2 offset.
T3	NON; DSP; CND; 2EU	Auxiliary probe T3 operation <b>NON</b> : probe T3 not fitted. <b>DSP</b> : temperature T3 to be displayed. <b>CND</b> : condenser temperature measurement. <b>2EU</b> : second evaporator temperature measurement.
OS3	-12.5..12.5°	Probe T3 offset.
AHM	NON; ALR; STP;	Operation in case of high condenser alarm <b>NON</b> : high condenser alarm inhibited. <b>ALR</b> : in case of alarm, "HC" flashes in the display and the buzzer is switched on. <b>STP</b> : in addition to the alarm symbols displayed, the compressor is stopped and defrosts are suspended.
AHT	-50...110°	Condensation temperature alarm (referred to T3 probe).
TLD	1...30 min	Delay for minimum temperature (TLO) and maximum temperature (THI) logging.
TDS	T1; 1-2; T3	Selects the temperature probe to be displayed. <b>T1</b> : probe T1 <b>1-2</b> : the AVG-weighted average between T1 and T2 <b>T3</b> : probe T3
AVG	0...100%	The relative weight of T2 on T1 (if TDS = 1-2) Example 1: T1 = -5°, T2 = -20°, AVG = 100%. The displayed temperature will be -20° (T1 has no effect) Example 2: T1 = -5°, T2 = -20°, AVG = 60%. The displayed temperature will be -14.
SCL	1°C; 2°C; °F	Readout scale. <b>1°C</b> : measuring range -50...110°C (0.1°C resolution within -9.9 + 19.9°C interval, 1°C outside) <b>2°C</b> : measuring range -50 ... 110°C <b>°F</b> : measuring range -55 ... 180°F
SIM	0...100	Display slowdown.
ADR	1...255	BD1-28 address for PC communication.

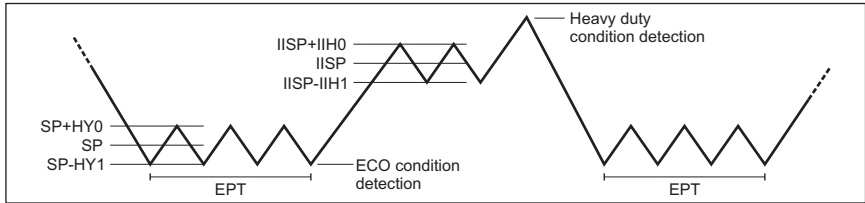


Fig.3 EPT parameter

### TECHNICAL DATA

**Power supply**  
BD1-28...W 100-240Vac ±10%, 50/60Hz, 3W

#### Relay output max loads (240Vac)

	BD1-28..S/T...:	BD1-28..Q/R...:
Compressor	16A resistive 12 FLA 48 RLA	12A resistive 12 FLA 48 RLA
Evap. Fan	16A resistive 4 FLA 12 RLA	8A resistive 4 FLA 12 RLA
Defrost	16A resistive 4 FLA 12 LRA	16A resistive 4 FLA 12 LRA
Auxiliary loads 1	7A resistive	7A resistive
Auxiliary loads 2	7A resistive	7A resistive

**Input**  
NTC 10KΩ@25°C LAE Part No. SN4...

#### Measurement Range

-50...110°C, -58...180°F  
-50 / -9.9 ... 19.9 / 110°C

#### Measurement accuracy

<0.5°C within the measurement range

#### Operating conditions

-10 ... +50°C; 15%...80% r.H.

#### CE (Approvals and Reference norms)

EN60730-1; EN60730-2-9; EN55022 (Class B); EN50082-1

### WIRING DIAGRAMS

