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.

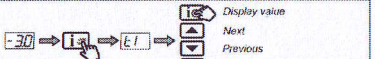
1. INSTALLATION

- The BD1-28 controller, size 107x65x47 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

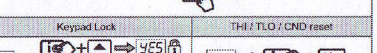
2. DISPLAY INFO

	Alarm	hi	Room high temperature alarm
	Thermostat output	Lo	Room low temperature alarm
	Fan output	hc	Condenser high temperature
	Defrost output	hP	Condenser high pressure
II°	Activation of 2nd set	cL	Condenser clean warning
oFF	Controller in stand-by	E1	Probe T1 failure
dEF	Defrost in progress	E2	Probe T2 failure
do	Door open alarm	E3	Probe T3 failure

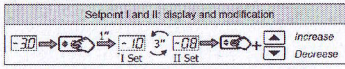
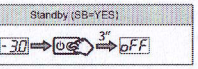
= Click = Click and Hold

Info items		Navigation	
t1	Instant probe 1 temperature		Display value Next Previous Exit
t2*	Instant probe 2 temperature		
t3*	Instant probe 3 temperature		
th1	Max probe 1 temperature		
tL1	Min probe 1 temperature		
cnd**	Compressor working weeks		
Loc	Keypad state lock		

*: only if enabled **: only if ACC > 0

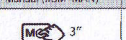
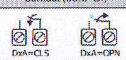
Keypad Lock	THI / TLO / CND reset
	

3. OPERATION

Setpoint I and II: display and modification	Standby (SB=YES)
 Increase / Decrease	

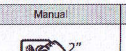
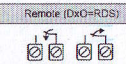
I Set II Set

3.1 SELECTION OF SECOND PARAMETER GROUP

Manual (IISM=MAN)	Automatic (IISM=ECO)	Contact (IISM=DI)
	ECO *(See Fig. 3)*	

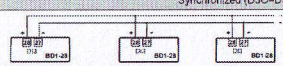
DxA=CLS DxA=OPN

3.2 DEFROST START

Manual	Timed (DFM=TIM)	Optimized (DFM=FRO)	Remote (DxO=RDS)
	DFT hours	T2 < 0°C for DFT hours	

DxA=CLS DxA=OPN

Synchronized (D3O=DSY)



Start and end are synchronized among connected BD1-28

3.3 DEFROST TERMINATION

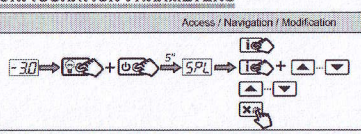
Time limit	1 Evaporator monitor before time limit	2 Evaporators monitor before time limit
DTO minutes	DTO minutes or T2 ≥ DLI	DTO minutes or T2 and T3 ≥ DLI

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.*

4. CONFIGURATION PARAMETERS

Access / Navigation / Modification



Visualize value
Increase or decrease value
Next or previous parameter
Exit

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. *Example*: 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 **NON** : defrost function is disabled *(the following parameter will be FCM)*. **TIM** : regular time defrost. **FRO** : the defrost time count is only increased when the conditions occur for frost to form on the evaporator (optimised time increase). 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.
DFT	0...99 hours	Time interval among defrosts. When this time has elapsed since the last defrost, a new defrost cycle is started. For example, with **DFM**=TIM and **DFT**=06, a defrost will take place every 6 hours.
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. **OFF**: off cycle defrost (Compressor and Heater OFF). **ELE**: electric defrost (Compressor OFF and Heater ON) **GAS**: hot gas defrost (Compressor and Heater ON).
DSO	OFF; LO; HI	Defrost start optimisation **OFF** : no optimisation. **LO** : defrost waits until the compressor cut-out. **HI** : 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: **RT**: the real temperature; **LT** : the last temperature before defrost; **SP** : the current setpoint value; **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...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. **NON** : The fans remain ON all the time; **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); **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 parameteres 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. *Example*: 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.
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. **NON** : all temperature alarms are inhibited *(the following parameter will be ACC)*. **ABS** : the values programmed in ALA and AHA represent the real alarm thresholds. **REL** : 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 **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; MAN; ECO; DI	Switchover mode to second parameter set **NON** : inhibition to use the second parameter group *(the following parameter will be SB)*. **MAN** : button M switches the two parameter groups over **ECO** : automatic switchover to the second parameter group, when ECO conditions are detected. **DI** : switchover to the second parameter group when DIx 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.
IIDF	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 enabling.
DSM	NON; ALR; STP	Door switch input mode. **NON** : door switch inhibited **ALR** : when DIx=DOR and the digital input is on, an alarm is generated after ADO minutes **STP** : when DIx=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 NO	Compressor/heater stop delay after door has been opened. If CSD=NO compressor/heater never stops due to the door opening.
D1O	NON; DOR; ALR; IISM; RDS	DI1 digital input operation **NON** : digital input 1 not active. **DOR** : door input. **ALR** : when the input is on, an alarm is generated (if AHM=STP, the compressor is stopped and the defrosts are suspended). **IISM** : when the input is on, the controller will use group 2 parameters. **RDS** : when the input is on, a defrost is started (remote control).

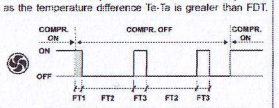


Fig.2 Time-optimised fan control (FCM=TIM)

D1A	OPN; CLS.	DI1 digital input activation. **OPN** : on open **CLS** : on close
D2O	See D1O	DI2 digital input operation. See D1O.
D2A	OPN; CLS.	DI2 digital input activation. See D1A.
D3O	NON; ...; RDS; DSY.	DI3 digital input operation **NON** ... **RDS** : See D1O. **DSY** : 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.	DI3 digital input activation. See D1A.
LSM	NON; MAN; ECO; DI1; DI2; DI3.	Light control mode **NON** : light output not controlled **MAN** : light output controlled through button M (if OAx=LGT). **ECO** : lights activated/deactivated following the ECO state. **DIx** : lights activated/deactivated following the DIx state.
LSA	OPN; CLS	Light activation (only with LSM=ECO or LSM=DIx) **OPN** : lights on with DIx open or ECO mode deactivated **CLS** : lights on with DIx closed or ECO mode activated.
OA1	NON; LGT; 0-1; 2CU; 2EU; ALO; ALC	AUX 1 output operation **NON** : output disabled (always off). **LGT** : output enabled for light control. **0-1** : the relay contacts follow the on/standby state of controller. **2CU** : output programmed for the control of an auxiliary compressor. **2EU** : output enabled for the control of the electrical defrost of a second evaporator. **ALO** : contacts open when an alarm condition occurs. **ALC** : 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 **NON** : probe T3 not fitted **DSP** : temperature T3 to be displayed. **CND** : condenser temperature measurement. **2EU** : second evaporator temperature measurement.
OS3	-12.5...12.5°	Probe 3 offset.
AHM	NON; ALR; STP;	Operation in case of high condenser alarm **NON** : high condenser alarm inhibited **ALR** : in case of alarm, "HC" flashes in the display and the buzzer is switched on. **STP** : 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; T1-2; T3	Selects the temperature probe to be displayed. **T1** : probe T1 **1-2** : the AVG weighted average between T1 and T2 **T3** : 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. **1°C** : measuring range -50 ...110°C (0.1°C resolution within -9.9 ÷ 19.9°C interval, 1°C outside) **2°C** : measuring range -50 ... 110°C **°F** : measuring range -55 ... 160°F
SIM	0...100	Display slowdown.
ADR	1...255	BD1-28 address for PC communication.

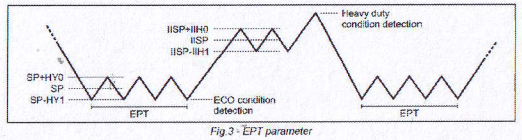
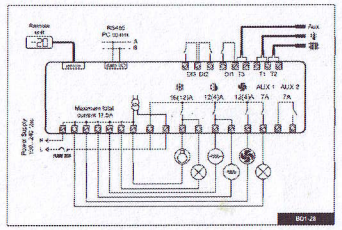


Fig.3 - EPT parameter

5. WIRING DIAGRAMS



6. 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	12A resistive 4 FLA 12 RLA
Defrost	16A resistive 4 FLA 12 LRA	12A 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% rH

CE (Approvals and Reference norms)
EN60730-1; EN60730-2-9; EN55022 (Class B); EN50082-1
RoHS 2011/65/UE

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