# CD5 SERIES 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

• Insert the controller through a hole measuring 71x29 mm.
• Make sure that electrical connections comply with the paragraph "wiring diagrams".
  To reduce the effects of electromagnetic disturbance, keep the sensor and signal cables wellseparate 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.

## 2. DISPLAY INFO

| | | | |
|---|---|---|---|
| ⚠ | Alarm | hi | Room high temperature alarm |
| ❄ | Compressor output | Lo | Room low temperature alarm |
| ✖ | Fan output | hc | Condenser high temperature |
| ❄❄ | Defrost output | ALr | Digital input alarm |
| 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 |

*In case of alarm, press any key to mute the buzzer sound.*

👆 = Tap    ✊ = Hold
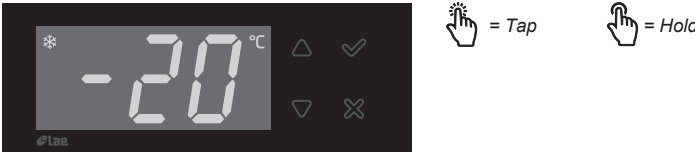
## 3. OPERATION

### SETTING

| Setpoint: display and modification | | | Standby (SB=YES) | | Light ON/OFF |
|---|---|---|---|---|---|
| | | 👆 Confirm | | | |
| 1" | 1" | ▲ Increase | 3" | 1" blink | 3" |
| -30 → ▲ or ▼ → SP → -10 Set | | ▼ Decrease | -30 → ✊✖ → - | | 👆 → L-0 / L-1 |
| | | ✊✖ Discard | | | |

| Info items | | Navigation | |
|---|---|---|---|
| t1 | Instant probe 1 temperature | | 👆 Display value |
| t2⁽¹⁾ | Instant probe 2 temperature | 1" 1" | ▲ Next |
| t3⁽¹⁾ | Instant probe 3 temperature | -30 → ✊✔ → inF → t1 | ▼ Previous |
| Loc | Keypad state lock | | ✊✖ Exit |
| PSd | Configuration menu password | | |

*1) only if enabled.*

| Keypad Lock | |
|---|---|
| Loc → ✊✔ → ▲ YES🔒 / ▼ no🔓 | 👆✔ Confirm / ✊✖ Discard |

| Configuration menu access | |
|---|---|
| | 👆 Confirm |
| | ▲ Increase |
| PSd → ✊✔ → 000 | ▼ Decrease |
| | ✊✖ Discard |

### DEFROST START

| Manual | Timed (DFM=TIM) | Optimized (DFM=FRO) |
|---|---|---|
| 3" ✊▲ + ✊▼ | ⏱ DFT hours | ⏱+🌡 T2 < 0°C for DFT hours |

### DEFROST TERMINATION

| Time limit | Survey of 1 evaporator before time limit | Remote start (DRS=RDS) |
|---|---|---|
| ⏱ DTO minutes | ⏱+🌡 DTO minutes or T2 ≥ DLI | 19 20 |

**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. Then, after the FTO time has elapsed, the evaporator fans will restart. Differently, if T2=YES and this probe measures the FDD temperature before FTO elapses, then the fans re-start immediately.
*Caution: if **DFM**=NON all defrost functions are inhibited; if **DFT**=0, automatic defrost functions are excluded. During defrost, high temperature alarm is bypassed.*

## 4. CONFIGURATION PARAMETERS

### 4.1 FIRST CONFIGURATION

At the first power-up, "SEt" is displayed, to indicate that the controller needs a first configuration.
Tap ✔, PS will be displayed. Once again tap ✔, then select the profile desired among the options available via ▲ or ▼. After selecting the option of choice, tap ✔ again. The display will now show SCL (readout scale). If need be, by tapping ▼, you return to the selection of the profile.
Tap ✔, then select the readout scale desired via ▲ or ▼. In closing tap ✔ again.
The controller is now ready to be used.

| First configuration |
|---|
| SEt → ✊✔ → PS → ✊✔ → CtM ▲…▼ → ✊✔ → SCL → ✊✔ → ▲…▼ → ✊✔ → C01 / F1 |
| → ▼ → HEA |

## 5. PARAMETER SETTING

To obtain a customised configuration of the parameters, get access to the SETUP menu from the INFO menu with password 123.

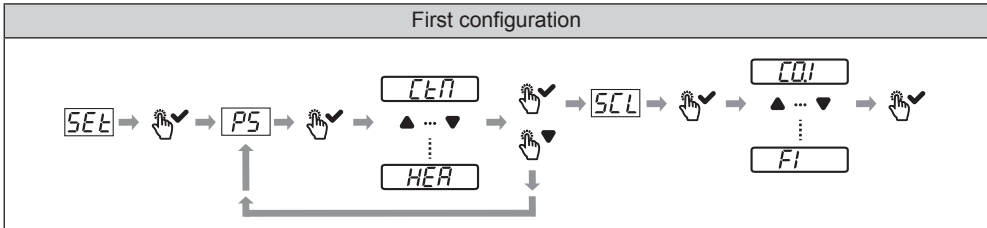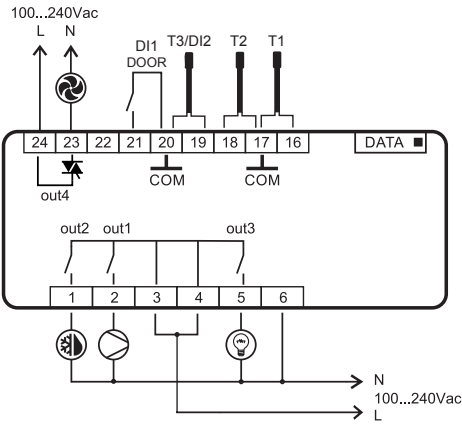| PARAMETERS PROFILES | | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **Description** | **Profiles** | | | | **Dim.** |
| | | Ctm | Ctp | Fr | HeA | |
| SCL | Readout scale | C0.1 | C0.1 | C1 | C1 | |
| SPL | Minimum temperature setpoint | 2.0 | 2.0 | -22.0 | 50.0 | °C |
| SPH | Maximum temperature setpoint | 12.0 | 12.0 | -15.0 | 90.0 | °C |
| SP | Setpoint | 5.0 | 5.0 | -18.0 | 70.0 | °C |
| CH0 | Thermostat OFF -> ON (ref. to SP) | 2.0 | 2.0 | 2.0 | 3.0 | °K |
| CH1 | Thermostat ON -> OFF (ref. to SP) | 1.0 | 1.0 | 1.0 | 2.0 | °K |
| CRT | C/H minimum OFF time | 3 | 3 | 3 | 3 | min |
| CMT | C/H minimum ON time | 1 | 1 | 1 | 1 | min |
| CT1 | C/H output ON when probe T1 is faulty | 2 | 2 | 5 | 0 | min |
| CT2 | C/H output OFF when probe T1 is faulty | 5 | 5 | 5 | 0 | min |
| DFM | Defrost Start Mode | TIM | TIM | TIM | NON | |
| DFT | Time based defrost | 8 | 8 | 6 | - | hrs |
| DDS | Minimum Time Between Defrost | 4 | 4 | 2 | - | hrs |
| DAR | Defrost time optimization | YES | YES | YES | - | |
| DTY | Defrost type | OFF | OFF | ELE | - | |
| DPD | Delay for pressure equalization for hot gas | 0 | 0 | 0 | - | sec |
| DLI | Defrost end temperature | 4.0 | 4.0 | 6.0 | - | °C |
| DTO | Maximum defrost duration | 20 | 20 | 30 | - | min |
| DRN | Drain down time | 0 | 0 | 3 | - | min |
| DDM | Display defrost mode | DEF | DEF | DEF | - | |
| DDY | Display delay | 3 | 3 | 5 | - | min |
| FID | Fans active during defrost | YES | YES | NO | - | |
| FDD | Fan re-start temperature after defrost | -1.0 | -1.0 | -1.0 | - | °C |
| FST | Fan stop temperature | 12.0 | 12.0 | 12.0 | - | °C |
| FTO | Maximum fan stop for FDD/FET | 3 | 3 | 3 | - | min |
| FCM | Fan mode during thermostatic control | NON | NON | NON | NON | |
| FET | Target evaporator temperature | -3 | -3 | -28 | 0 | °C |
| FT1 | Fan stop delay after compressor stop | 30 | 30 | 30 | 60 | sec |
| FT2 | Timed fan stop | 2 | 2 | 2 | 2 | min |
| FT3 | Timed fan run | 2 | 2 | 2 | 2 | min |
| FMS | Fan Minimum Stop | 30 | 30 | 30 | 30 | sec |

| PARAMETERS PROFILES | | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **Description** | **Profiles** | | | | **Dim.** |
| | | Ctm | Ctp | Fr | HeA | |
| ATM | Alarm threshold management | NON | NON | NON | NON | |
| ALA | Low temperature alarm threshold | - | - | - | - | °C |
| AHA | High temperature alarm threshold | - | - | - | - | °C |
| ALR | Low temperature alarm differential | - | - | - | - | °K |
| AHR | High temperature alarm differential | - | - | - | - | °K |
| ATI | Probe used for temperature alarm detection | - | - | - | - | |
| ATD | Temperature alarm delay | - | - | - | - | min |
| AHM | Operation in case of high condenser alarm | - | - | - | - | |
| AHT | Condensation temperature alarm | - | - | - | - | °C |
| SB | Stand-by button enabling | YES | YES | YES | YES | |
| DSM | Door switch input mode | STP | STP | STP | STP | |
| DAD | Door alarm delay | 3 | 3 | 3 | 3 | min |
| CSD | Compressor stop delay | 5 | 5 | 5 | 0 | min |
| DOT | Door stop timeout (0=inhibited) | 60 | 60 | 60 | 0 | min |
| D1O | DI1 digital input operation | DOR | DOR | DOR | DOR | |
| D1A | DI1 digital input activation | OPN | OPN | OPN | OPN | |
| D2O | DI2 digital input operation | NON | NON | NON | NON | |
| D2A | DI2 digital input activation | OPN | OPN | OPN | OPN | |
| LSM | Light control mode | MAN | MAN | NON | MAN | |
| OA1 | RL1 output operation | CMP | CMP | CMP | HTR | |
| OA2 | RL2 output operation | DEF | DEF | DEF | NON | |
| OA3 | RL3 output operation | LGT | LGT | DFH | LGT | |
| OA4 | RL4 output operation | FAN | FAN | FAN | FAN | |
| OS1 | Probe T1 offset | 0.0 | 0.0 | 0.0 | 0.0 | °K |
| T2 | Probe T2 enable | NO | YES | YES | NO | |
| OS2 | Probe T2 offset | 0.0 | 0.0 | 0.0 | 0.0 | °K |
| T3 | Auxiliary probe T3 operation | NON | NON | NON | NON | |
| OS3 | Probe T3 offset | 0.0 | 0.0 | 0.0 | 0.0 | °K |
| TDS | Selects the temperature probe to be displayed | T1 | T1 | T1 | T1 | |
| AVG | The relative weight of T2 on T1 | 0 | 0 | 0 | 0 | % |
| SIM | Display slowdown | 10 | 10 | 10 | 10 | |
| ADR | Address for PC communication | 1 | 1 | 1 | 1 | |
| PRT | Modbus protocol selection | ASC | ASC | ASC | ASC | |
| PS | Preset parameters | Ctm | Ctp | Fr | HeA | |

## 6. WIRING DIAGRAM



100...240Vac
L  N
DI1  T3/DI2  T2  T1
DOOR

| 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | DATA ■ |
out4
COM  COM

out2  out1  out3

| 1 | 2 | 3 | 4 | 5 | 6 |

N
100...240Vac
L

## 7. TECHNICAL DATA

**Power supply**
CD5                100-240Vac ±10%, 50/60Hz, 3W

**Relay output max loads**

| Model<br>Output | CD5-01WR |
|---|---|
| OUT1 | 15FLA; 90LRA - 15A resistive |
| OUT2 | 10A resistive |
| OUT3 | 10A resistive |
| OUT4 | 1A (30A/1mS) |

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

**Measurement Range**
-50...110°C; -50 / -9.9...19.9 °C / 110°C
-58...180°F

**Measurement accuracy**
<0.5°C on the whole measurement range

**Operating conditions**
-10 … +50°C; 15%...80% r.H.
Pollution degree 2

**Reference Norms**
- EN/UL60335
- IEC/EN 60079-15
- EN61000-6-1
- EN61000-6-3

0L0030R00-EN

| PAR | RANGE | DESCRIPTION |
|---|---|---|
| SCL | C0.1;<br>C1;<br>F1 | Readout scale.<br>**C0.1**: measuring range -50 … 110°C (0.1°C resolution within -9.9 ÷ 19.9 °C interval, 1°C outside)<br>**C1**: measuring range -50 … 110°C<br>**F1**: measuring range -55 … 180°F |
| 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). |
| CH0 | 1...10° | Thermostat OFF -> ON refer to SP (See fig.1). |
| CH1 | 1...10° | Thermostat ON -> OFF refer to SP (See fig.1). |
| CRT | 0...30min | CMP / HTR minimum OFF time. The output is switched on *at least* after CRT minutes have elapsed since the previous switchover. |
| CMT | 0...30min | CMP / HTR minimum ON time. |
| CT1 | 0...30min | CMP / HTR output run when probe T1 is faulty. With CT1=0 the output will always remain OFF. |
| CT2 | 0...30min | CMP / HTR output stop when probe T1 is faulty. With CT2=0 and CT1>0 the output will always be ON.<br>*Example:* CT1=4, CT2= 6: In case of probe T1 failure, the CMP / HTR will cycle 4 minutes ON and 6 minutes OFF. |
| DFM | NON;<br>TIM;<br>FRO | Defrost start mode<br>**NON**: defrost function is disabled.<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). If the evaporator works around 0°C, defrost frequency depends on the climatic conditions. With setpoints much lower than 0°C, defrost frequency mainly depends on the compressor 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. |
| DDS | 0...99 hours | Minimum time between defrosts. |
| DAR | NO/YES | Defrost time optimisation. If during temperature control the evaporator temperature is higher than DLI, this condition is considered as a defrost and thus the timer is re-started to count for the next defrost. |
| DTY | OFF;<br>ELE;<br>GAS | Defrost type.<br>**OFF**: off cycle defrost (Compressor and Defrost OFF).<br>**ELE**: electric defrost (Compressor OFF and Defrost ON).<br>**GAS**: hot gas defrost (Compressor and Defrost ON). |
| DPD | 0...240sec | Delay for pressure equalization for hot gas defrost. At the beginning of defrost, compressor and defrost are OFF for DPD seconds. |
| DLI | -50...110° | Defrost end temperature. |
| DTO | 1...120min | Maximum defrost duration. |
| DRN | 0...30min | Compressor, defrost and fan outputs are OFF after defrost for the evaporator drain down. |
| DDM | RT;<br>LT;<br>SP;<br>DEF | Defrost display mode. During defrost the display will show:<br>**RT**: the actual 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...110° | Evaporator fan re-start temperature after defrost. |
| FTO | 0...120min | Maximum evaporator fan stop for FDD/FET. |
| FST | -50...110° | Fan stop temperature |
| FCM | NON;<br>TIM;<br>TMP | Fan mode during thermostatic control.<br>**NON**: The fans remain ON all the time;<br>**TIM**: Timed control: the fans are ON when the compressor is ON. When the compressor switches OFF, the fans are time controlled by parameter FT1,FT2, FT3 (See fig. 2).<br>**TMP**: Temperature based control: as TIM with the difference that the fans are ON only after evaporator temperature has dropped below FET degrees (See fig. 2). |
| FET | -50...110° | Target evaporator temperature:<br>In case of timed control (FCM = TMP) |
| FT1 | 0...180sec | Fan stop delay after compressor 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. |
| FMS | 0...240sec | Fan Minimum Stop |
| ATM | NON;<br>ABS;<br>REL | Alarm threshold management.<br>**NON**: temperature alarms are inhibited.<br>**ABS**: it considers the absolute thresholds ALA and AHA only.<br>**REL**: it considers the relative thresholds ALR and AHR only. |
| ALA | -50...110° | Low temperature alarm threshold. |
| AHA | -50...110° | High temperature alarm threshold. |
| ALR | -12...0° | Low temperature alarm differential linked to the setpoint. With ALR=0 the low temperature alarm is excluded. |
| AHR | 0...12° | High temperature alarm differential linked to the setpoint. 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. |
| AHM | NON;<br>ALR;<br>STP; | Operation in case of high temperature condenser alarm<br>**NON**: high condenser alarm inhibited.<br>**ALR**: in case of alarm, "HC" flashes on 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...110° | Condenser unit temperature alarm (referred to T3 probe). |
| SB | NO/YES | Stand-by button ✕ enabling. |
| DSM | NON;<br>ALR;<br>STP | Door switch input mode:<br>**NON**: door switch inhibited<br>**ALR**: when DIx=DOR and the digital input is on, an alarm is generated after DAD minutes<br>**STP**: when DIx=DOR and the digital input is on, the fan are immediately stopped, the compressor will be stopped after CSD minutes and the warning indication will be generated after DAD minutes. |
| DAD | 0...30 min | Delay before door open alarm warning. |
| CSD | 0...30 min<br>NO | Compressor stop delay after door has been opened. If CSD=NO compressor never stops due to the door opening. |

| PAR | RANGE | DESCRIPTION |
|---|---|---|
| DOT | 0...200 min | Door stop timeout. If the door switch remains open for longer than DOT minutes, it will then be ignored. With DOT=0, this function is disabled. |
| D1O | NON;<br>DOR;<br>ALR;<br>RDS | DI1 digital input operation<br>**NON**: digital input not active.<br>**DOR**: door input.<br>**ALR**: when the input is on, an alarm is generated (if AHM=STP, the compressor is stopped and the defrosts are suspended).<br>**RDS**: remote defrost start. |
| D1A | OPN;<br>CLS | DI1 digital input activation<br>**OPN**: on open<br>**CLS**: on close |
| D2O | NON;<br>DOR;<br>ALR;<br>RDS;<br>T3 | DI2 digital input operation<br>**NON**: digital input not active.<br>**DOR**: door input.<br>**ALR**: when the input is on, an alarm is generated (if AHM=STP, the compressor is stopped and the defrosts are suspended).<br>**RDS**: remote defrost start.<br>**T3**: Auxiliary probe enable. |
| D2A | OPN; CLS. | DI2 digital input activation. See D1A. |
| LSM | NON;<br>MAN;<br>DOR | Light control mode<br>**NON**: light output not present.<br>**MAN**: light ouput controlled through button ✔<br>**DOR**: lights ON/OFF following the door state (DIx=DOR). |
| OA1 | NON;<br>CMP;<br>HTR;<br>DEF;<br>FAN;<br>LGT;<br>DFH;<br>ALO;<br>ALC | OUT1 output operation<br>**NON**: output disabled (always off).<br>**CMP**: compressor / condenser fan.<br>**HTR**: heater.<br>**DEF**: defrost.<br>**FAN**: evaporator fan.<br>**LGT**: output enabled for light control.<br>**DFH**: door frame heater.<br>**ALO**: contacts open when an alarm condition occurs.<br>**ALC**: contacts make when an alarm condition occurs. |
| OA2 | See **OA1** | OUT2 output operation. See OA1. |
| OA3 | See **OA1** | OUT3 output operation. See OA1. |
| OA4 | See **OA1** | OUT4 output operation. See OA1. |
| 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;<br>AU;<br>CND | Auxiliary probe T3 operation<br>**NON**: probe T3 not fitted.<br>**AU**: auxiliary probe.<br>**CND**: condenser temperature measurement. |
| OS3 | -12.5...12.5° | Probe 3 offset. |
| TDS | T1;<br>1-2;<br>T3 | Selects the temperature probe to be displayed.<br>**T1**: probe T1.<br>**1-2**: the AVG-weighted average between T1 and T2.<br>**T3**: probe T3. |
| AVG | 0...100% | The relative weight of T2 on T1 (if TDS = 1-2)<br>Example 1: T1 = -5°, T2 = -20°, AVG = 100%. The displayed temperature will be -20° (T1 has no effect).<br>Example 2: T1 = -5°, T2 = -20°, AVG = 60%. The displayed temperature will be -14. |
| SIM | 0...100 | Display slowdown. |
| ADR | 1...255 | CD5-xx address for PC communication. |
| PRT | ASC;<br>RTU | ASCII and RTU Modbus protocol selection. |
| PS | Ctm;<br>Ctp;<br>Fr;<br>HeA | Ctm: storage cabinet with timed defrost (without evaporator temperature probe).<br>Ctp: storage cabinet with timed or temperature terminated defrost (with evaporator temperature).<br>Fr: freezer.<br>HeA: heated box. |
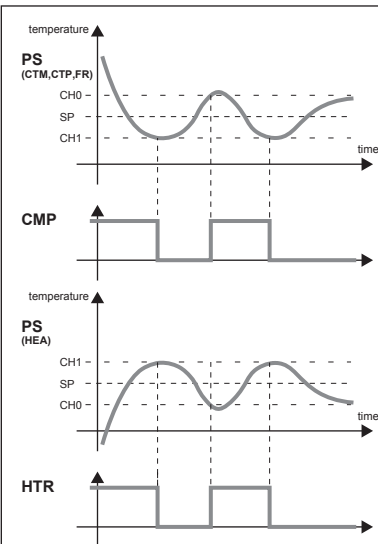


Fig. 1: Thermostat mode control
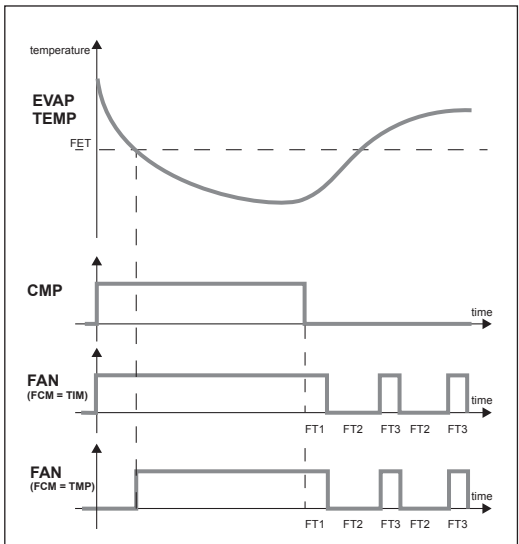


Fig. 2: Evaporator fan output when FCM = TIM and when FCM = TMP