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**

- **PARAMETER INF** selects the input used for control.
- **INF=1-P**: Input 1-P (0/4..20mA) is used to control pressure. In the setup the parameters relating to the variable to be controlled (SPL, SPH, SP1..) are expressed in bar. In normal mode, the display shows the pressure measured in bar, or the corresponding temperature in °C, calculated according to the refrigerant gas used (see REF). Input 2-T is disabled.
- **INF=2-T**: Input 2-T (NTC10K) is used for temperature control. In the setup the parameters relating to the variable to be controlled (SPL, SPH, SP1..) are expressed in °C. In normal mode the display shows the temperature measured in °C, or the corresponding pressure calculated in bar. Input 1-P is disabled.

**OPERATION**

**DISPLAY**

- **Parameter INF** selects the input used for control.
- **INF=1-P**: Input 1-P (0/4..20mA) is used to control pressure. In the setup the parameters relating to the variable to be controlled (SPL, SPH, SP1..) are expressed in bar. In normal mode, the display shows the pressure measured in bar, or the corresponding temperature in °C, calculated according to the refrigerant gas used (see REF). Input 2-T is disabled.
- **INF=2-T**: Input 2-T (NTC10K) is used for temperature control. In the setup the parameters relating to the variable to be controlled (SPL, SPH, SP1..) are expressed in °C. In normal mode the display shows the temperature measured in °C, or the corresponding pressure calculated in bar. Input 1-P is disabled.

**TECHNICAL DATA**

- **Power supply**
  - MS27..E: 230Vac±10%, 50/60Hz, 3W
  - MS27..U: 115Vac±10%, 50/60Hz, 3W
- **Relay outputs**
  - OUT1…OUT4: 5(1)A
- **Pressure input**
  - type: NTC10K (LAE SN4…)
  - range: -10…+50°C; 15…80% r.H.
  - resolution: 0.1bar
- **Pressure display**
  - range: -1.0…45.0bar
  - type: 0/4…20mA
- **Alarm display**
  - 7(2)A

**INFO MENU**

To have access to the info menu, press button **SP+PB**. The available info is:

- **SPL**: Output 1.4 state / hours of operation
- **SPH**: Min input value measured.
- **SP**: Max input value measured.
- **LL**: Keydpad state (lock)
- **OC1**: High pressure alarm
- **OC2**: Low pressure alarm
- **OC3**: Over range or probe failure
- **OC4**: Low compressor oil alarm
- **OC**: Periodic maintenance warning
- **INP**: Controller in stand-by
- **SB**: Low refrigerant level alarm

**SETPOINT**

- **Display of pressure setpoint values**
  - Press button **SB** for at least half second, to display the setpoint value.
  - When the second setpoint has been enabled (see D1, D2), before its value appears, the display shows "2SP".
  - By keeping button **SB** pressed, use button **SP** or **SPH** to set the desired value (adjustment is within the minimum SPL and the maximum SPH limit).
  - When button **SB** is released, the new value is stored.

**ALARM MENU**

The last nine alarms can be displayed in the alarm menu, from the most recent AL1, to the least recent AL9.

- **Access to menu and information displayed**
  - With button **SB** or **SP** select the data to be displayed;
  - Press button **SP** to display the value.
  - To exit from the menu, press button **SB** or wait for 10 seconds

**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=1** to inhibit all functions of the buttons. To resume normal operation of keypad, adjust setting so that **LOC=0**.
CONTROL

OUTPUT CONFIGURATION

Outputs are configured with parameters OC1, OC2, OC3, OC4. Parameter OCx controls the operation of output OUTx: OCx=1...100 indicates the power in percentage over the total power, of the compressor connected to OUTx. With OCx=1, OUTx is connected to a stage, which is active when the relay is closed. With OCx=2, output OUTx is associated to a stage, which is active when the relay is open. With OCx=0, output OUTx is not used for control. Warning: the output associated to the compressor motor must always be wired before the terminals where the outputs belonging to the other stages are. Example: in a system with two compressors of different power (the first with 60% of total power, the second with 40%), each compressor having a stage, the configuration of outputs is as follows: OC1 = 60, OUT1 is connected to the motor of compressor 1 of power equal to 60% of total power. OC2 = 1, OUT2 is connected to the stage of compressor 1, the stage is active when the relay is closed. OC3 = 40, OUT3 is connected to the motor of compressor 2 of power equal to 40% of total power. OC4 = 1, OUT4 is connected to the stage of compressor 2.

CONTROL ALGORITHM

Parameter CM provides the control algorithm.

- CM=ROT: rotation of outputs of equal power. This algorithm minimises the number of starts/stops per hour of each load. When the system calls for more power, the lower value measured alarm threshold.
- CM=LON: load on/off for longer will be activated. When demand for power decreases, the output which has been on for longer will be switched off. When an output remains active for more than LRT minutes, the controller looks for an inactive output fulfilling the requirements to be activated (less hours of operation, minimum time off elapsed...) and the rotation of the two outputs will take place. In this way, an equal sharing of the total operation time among all loads will be achieved (see Fig. 2). Note: the compressor control algorithm assumes that compressors have got an equal power. In this case, parameter OCx is used only to define if output OUTx either controls a compressor or a stage. So, if the value is positive, it will have no effect on OCx, regardless of what you program. Example: in a system consisting of four compressors, each will have a power equal to 25% of the total value, regardless of the value programmed in CM.
- CM=SEQ: sequential activation of the enabled outputs. The outputs are switched on/off with fixed sequence, from output 1 to output 4 (see Fig. 3).
- CM=PO: optimisation of the available power. The controller combines the outputs in a way as to obtain a fine control, both in case of calls for more power and less power. Example: OC1=10, OC2=23, OC3=30, OC4=65. If a capacity of 90% is required, outputs OUT1, OUT3, OUT4 (10+30+50) are switched on. If a capacity of 50% is required, outputs OUT2 and OUT3 (20+30) are switched on (see Fig. 4).

CONFIGURATION PARAMETERS

- To get access to the parameter configuration menu, press button CD+ or @ for 5 seconds;
- with button CD+ or @ select the parameter to be modified;
- press button CD+ to display the value;
- by keeping button CD+ pressed, use button CD+ or @ to set the desired value;
- when button CD+ is released, the newly programmed value is stored and the following parameter is displayed;
- to exit from the setup, press button CD+ or @ for 30 seconds.

Note: re-programming some parameters causes a complete re-configuration of the controller operation. So please put the controller on stand-by, if you have to modify the parameters relating to the output configuration or the selection of the control algorithm.

In the parameter description, we refer to 'pressure control'. In case of temperature based control, please replace the word 'pressure' with 'temperature' and 'bar' with '°C'.

PAR | RANGE | DESCRIPTION
--- | --- | ---
INF | 1-P, 2-T | Input selection for control
1-P: input 1-P is used for pressure control; input 2-T is disabled.
2-T: input 2-T is used for temperature control; input 1-P is disabled.

MPI | 0MA, 4MA | Min. current input range.
0MA: input 0...20mA, 4MA: input 4...20mA

RLO | -1.0...RHI bar | Min. scale range.
RHI bar: takes the minimum value measured by the transmitter (corresponding to 0/4mA).

RHI | RLO...45.0bar | Max. scale range.
RHI takes the maximum value measured by the transmitter (corresponding to 20/30mA).

OS1 | -12.0...12.0bar | Probe offset

REF | 404,507,114,134 | Refrigerant used. It allows Pressure - Temperature conversion.
404=R404A, 507=R507, 114=R22, 134=R134A

SPL | RLO...3PH | Minimum limit for SP and 2SP setting

SPH | SPL...RHI | Maximum limit for SP and 2SP setting

SP | SPL...3PH | Main setpoint, indicates the pressure to be maintained.

2SP | SPL...3PH | Alternate Setpoint.
Pressure reference is 2SP if D1 (D2) = 2SP and the corresponding input is active.

DBH | 0.0...10.0bar | Neutral zone.
The state of outputs remains unchanged as long as pressure is within the band SP+DBH and SP-DBH.

LON | 0...250s | Load start delay.
Pressure must remain higher than SP+DBH for LON seconds before the next load is switched on.

LOF | 0...250s | Load stop delay.
Pressure must remain lower than SP-DBL for LOF seconds before the next load is switched off.

SON | 0...250s | Stage start delay.
Pressure must remain higher than SP+DBH for SON seconds before the next stage is switched on.

SOF | 0...250s | Stage stop delay.
Pressure must remain lower than SP-DBL for SOF seconds before the next stage is switched off.

PB | 0...20.0bar | Proportional band (PWM output control, see Fig. 5).
Zone above setpoint in which the PWM output is activated proportionally.
Example: pressure = SP, PWM=0%, pressure=SP+PB, PWM=50%, pressure=SP+PB, PWM=100%.

IT | 0...250s | Integral action time (control of PWM output, see Fig. 5).
The greater the IT value, the more stable control takes place.

CM | ROT, SEN, PO | Selection of control algorithm.
ROT: rotation of equal power outputs.
SEN: sequential activation of outputs.
PO: optimisation of available power.

OPERATION EXAMPLES

OC1=2...100
Control of output 1, 2, 3, 4.
1...100: power (percentage of total) of the load connected to output OUTx (x=1, 2, 3, 4).
0: output OUTx not used.
-1: output OUTx connected to a stage, which is activated when the contact is closed.
0: output OUTx connected to a stage, which is activated when the contact is open.

MSL | 0...300min | Minimum time off of loads.
Minimum time which must elapse between when the load is switched off and when it's switched on again.

LRT | 0..120min | Time of forced rotation of loads (only with CM=ROT).
This parameter: if greater than 0, provides the operation time of a load after which the controller takes into account the possibility of rotation of two outputs.

DPU | 0..120min | Start delay.
Delay between the time when the controller is switched on when the outputs are activated, in order for the compressor crankcases to warm up.

SCD | 0..100% | Down Scaling.
It indicates the maximum per cent power usable during an alarm with enabled down scaling action.

ALA | RLO...RHI | Low value measured alarm threshold.

AD | 0...120min | High/Low alarm delay.

D1M | NDN, SBY, NON | Function of digital input D1, D2.
NDN: input disabled.
SBY: when input D1 (D2) is active, the control is put on a stand-by.
NON: when input D1 (D2) is inactive, the control setpoint is 2SP.

D2C | OPN, CLS | Activation of digital input D1, D2.
OPN: active input is open; CLS: active input is closed

DxM | DNF, HP, OIL, LL, ALR | Function of digital input D3, D4, D5.
DNF, HP: input disabled.
OIL, LL: high pressure alarm; HP: high pressure alarm.
ALR: low compressor oil level; LL: low refrigerant level alarm; ALR: generic alarm.

Dx6 | OPN, CLS | Activation of digital input D3, D4, D5 (see D2C).

DxG | 0...120min | Activation delay of alarm D3, D4, D5.
The digital input must remain in the activation condition for this time before the alarm is detected.

Dx6 | DNF, HP, OIL, LL, ALR | Reaction following alarm D3, D4, D5.
DNF: alarm display.
SAR: in addition to the alarm displayed, a down scaling (SCD) is activated and control is stopped. When the alarm is over, the controller resumes output control automatically (automatic reset).
SMR: in addition to alarm displayed, all loads are switched off and control is stopped. When the alarm is over, control is resumed but only after the alarm has been acknowledged by pressing button @ (manual reset).

MTC | 0...600 | (x100hours)
The operation hours of any load achieve this value, a maintenance warning will flash on display. To eliminate the warning, after performing maintenance, reset the hour counters as described in paragraph "Info menu".

SB | NOYES | Stand-by button enabling.

TLD | 1...300min | Delay for min / max input loggin.

SN | NOYES | Alarm buzzer enabling.

ADR | 1...255 | MS27 address for PC communication.