6.00 PARAMETER LIST

#	MEANING	SETTING
SEt	Main Set Point	Range between «LoS» & «HiS»
HYS	Thermostat differential (Hysteresis)	Range 0 .. 10 °C
LoS	Minimum value for SET POINT parameter	Range –50 .. HiS (100) °C
HiS	Maximum value for SET POINT parameter	Range (-30) LoS .. +154 °C
OFS	Offset 1, temperature calibration for probe 1	Range –9 .. +9 °C (-8..+7°F)
OF2	Offset 2, temperature calibration for probe 2	Range –9 .. +9 °C (-8..+7°F)
AcY	Anticycling time output	Range 0 .. 254 (see "tis")
LoA	Low limit point of temperature alarm	Range –50 .. HiA (100) °C
HiA	High limit point of temperature alarm	Range (-30) LoA .. +155 °C
Alr	Alarm mode of operation	0: disabled; 1: enables Hit; 2: enables Lot; 3: enables Hit & Lot
Adi	Alarm delay at Power ON	Range 0 .. 99 min
Ald	Alarm delay on running time	Range 0 .. 99 min
dPt	Defrost pause time	Range 1 .. 254 (see "tis")
ddt	Max. defrost duration time	Range 0 .. 99 (see "tis")
dEt	Defrost end temperature	Range –35 .. + 50 °C
dEo	Defrost end optimization	Range 0 .. 99 min
Odd	Operating mode during defrost	0: compressors 1& 2 OFF; 1: compr. 1 ON, the 2nd OFF; 2: compr. 1 OFF, the 2nd ON; 3: compressors 1 & 2 ON.
add	After defrosting delay to switch on the compressor	Range 0 .. 99 min
dud	Display up-date temperature after defrost end	Range 0 .. 99 min
Fod	Fan operation mode	0: in parallel with compressor; 1: fan always ON; 2,3: stop during defrost (see text); 4: on during defrost (see text)
FSd	Fan delay at power-on and after defrost end	Range 0 .. 99 min
FSt	Fan start set point temperature	Range –35 .. + 50 °C
unt	Temperature displayed unit	0 = Celsius, 1 = Fahrenheit
utd	Display update time delay	Range 0 .. 60 sec
tiS	Time scale of defrost and anticycling	0: dPt [h], ddt [m], acy [s]; 1: dPt [m], ddt [s], acy [s]; 2: dPt [h], ddt [m], acy [m]; 3: dPt [h], ddt [s], acy [m].
dio	Digital input operation mode (optional)	0: disabled; 1: open door alarm; 2: instrument off; 3: defrost start/stop by pulse; 4: Energy saving (St2 <-> Set); 5: defrost end by pulse.
did	Digital input delay (optional)	Range 0 .. 254 sec
CPF	Compressor operating mode for probe failure case (main output)	0: always OFF; 1: always ON; 2: ON/OFF by time Con/Cof.
Con	Compressor "ON" time during probe failure	Range 0 .. 99 min
CoF	Compressor "OFF" time during probe failure	Range 0 .. 99 min
St2	Secondary set point (optional)	Range –50 .. +155 °C

7.00 SPECIFICATIONS

DISPLAY: 3 digit, 13.2 mm, high intensity red;
INPUTS: two PTC sensor;
MEASURING RANGE: -50 … +150 °C / -50 … +302 °F;
ACCURACY AT 25°C: ±0.5 °C + 1 digit;
RESOLUTION: 1 °C / 2 °F;
OUTPUTS: up to four relays -
 - 1 spdt 250Vac 8A max resistive (0.5hp),
 - 1 spdt relay 250Vac 16A max resistive (1hp),
 - 2 spst 250Vac 5A max resistive (¼hp);
POWER SUPPLY: 12 Vac/dc ±10%, or 230 Vac ±10% 50/60Hz, or 115 Vac ±10% 50/60Hz, or 9 ..24 Vac/dc (switching conf.);
ENVIRONMENTAL CONDITIONS:
- operating temperature: –5 … +50 °C;
- storage temperature: –20 … +70 °C;
- relative humidity: 30 … 90 % non condensing;
- no shocks or vibrations;
MECHANICAL DATA:
- plastic housing self extinguishing type UL94V0;
- connections through terminal block for 2.5mm^2 gauge wire;
- protection degree: IP64 for the frontal panel (enclosure IP31).

Typical terminal connections (See the label close to the terminals for the right power supply diagram connection).

BL43-2651-16A-DI
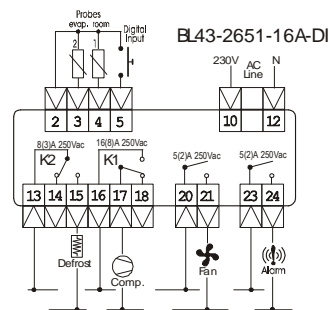
8.00 ANOMALIES SIGNALING

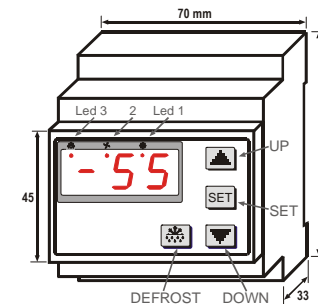| MSG	CAUSE	OUTPUT
HIt blinking	Measured temperature is higher than HiA (max. temp alarm).	The alarm relay will switch-on. The other outputs don't change.
LOt blinking	Measured temperature is lower than LoA (min. temp alarm).	The alarm relay will switch-on. The other outputs don't change.
dOP	Open door alarm (optiona, only with dio=1).	Switch off the fan relay. The other outputs don't change.
PF1	The probe input line 1 is open or short circuited (cold room).	The alarm relay will switch-on. Compressor operation is according to CPF.
PF2	The probe input line 2 is open or short circuited (evaporator probe).	The alarm relay will switch-on. Other outputs don't change. It assumes a temp. -55°C for the 2nd probe.

FRONTAL PANEL LAYOUT AND FUNCTIONS

Installation and operating instructions

BL 4x Series

Electronic refrigeration controller with one or two inputs

Rev.: 29-09-2005 Cod.: 00990267

Up: 1) To increase the value of the selected parameter; **2)** To scroll the parameters in SET mode; **3)** During defrost action, to update the probe 1 temperature and to display the temperature of probe 2; **4)** To scroll the parameters in SET mode.

Down: 1) To decrease the value of the selected parameter; **2)** To scroll the parameters in SET mode; **3)** To switch-off the optional internal alarm buzzer or the alarm relay.

Set: To access the parameter menu to view and change the values. It is also the "Enter" key to confirm the new values.

Defrost: Used to start/stop a manual defrost.

1.00   GENERAL DESCRIPTION AND INSTALLATION NOTICE

The **BL** models of the ***BLUE LINE SERIES*** are controllers specifically designed to manage refrigerating units operating at positive or negative temperatures. Higher models of the series can also perform defrost cycles and fan control. Can be available controllers with OFF cycle defrost (with compressor switching OFF), or controller with HOT–GAS defrost. The defrost end may be based on fixed time or by the evaporator temperature. The devices can offer up to three relay outputs for compressor, fan and defrost control. It is available, on request, with a built-in transformer to feed it from the main line. The access to the operating parameters can be prevented by a combination of keys.
The installation must be done only by specialized personnel in according to the rules in force in the country where the controllers are used. The instrument is conceived for controlling and regulation working not for safety function. It must be installed in a place protected from extreme vibrations, impact, water, corrosive gases, and where temperature and moisture do not exceed the maximum rating levels indicated in the specifications. The same directions are valid for the probe installation.

1.10 THE THERMOSTAT PROBE
The probe must be installed in a place protected from direct air flow particularly far from fans and doors, so a better average temperature of the room will be measured. The probe is not waterproof, it should be placed with its head upward, so that drops would not penetrate into the bulb and damage the sensor. Maintain the length of the electrical wires as short as possible in order to keep the noise picked by them at low level, otherwise a shielded wire will be needed, where the shield will be connected to the ground.

1.20 ELECTRICAL WIRING
We recommend to protect the power supply of the controller from electrical noise, spikes, and especially from voltage surges and drops. This can be easily done following these recommendations:
-separate the power supply of the loads (compressor, heaters, fans, etc) from the power supply of the controller. This can alleviate   problems related to voltage dips that can arise during the switch-on of the loads, that may interfere with the controller's microprocessor causing unexpected resets.
-the cables of the probes and the ones of the controller supply or the loads must be separated and not close, to reduce spikes and noise on the sensor. This improves the stability of the reading and it also makes the commutation of the device more accurate.

1.30 CRITICAL ENVIRONMENT
For applications in heavy industrial environment these rules should be followed.
- After having identified the source of noise spikes, it is recommended to apply a line filter to the source in question of the type specifically designed to solve EMC (Electromagnetic compatibility) related problems. Sometimes it may be sufficient an RC type filter, also called «snubber» , connected in parallel to the external relay coils, or circuit breakers.
- An independent power supply should be used to power the device in extreme conditions.

1.40 MOUNTING
The controller is a Omega Rail Din 4 mounting. Leave enough room to avoid compression or excessive bending of the cables.

2.00 HOW THE DEVICE WORKS (overview)

Usually the instrument **BL 42/43** works with two PTC probes; the second sensor generally is located near the evaporator area and it is used to control the defrost function. The main probe is located in the cold room in a place where it can sense the average temperature. This probe makes as the main process variable that activates the compressor output.

2.10 Compressor control:

Compressor START temperature: temp Probe1 $\geq$ SEt + HyS;
Compressor STOP temperature: temp Probe1 < SEt.
To avoid damages to the compressor it is possible to set an anticycling time against OFF – ON cycles (see "acy" parameter).

2.20 Fan Control (model BL 43):

The fan can be driven in different modes depending on your needs (see par. Fod). The fan operation also depends from the temperature value of the probe #2 (evaporator probe).
Fan START temperature: temp Probe2 < FSt.
Fan STOP temperature: temp Probe2 $\geq$ FSt + 2 °C.
Furthermore, to avoid the circulation of hot air at start up or after defrost it is possible to set the Fsd parameter to delay the fan.

2.30 Defrost control:

The **BL 42/43** models are provided with the second probe for the evaporator to manage defrost cycles by temperature. They also have an additional relay output to drive an heater to perform this function.

The defrost action will be ended when the evaporator temperature rises the value of the dEt parameter.
Anyway, the defrost cycles finish by the time set in ddt.

Furthermore, it is possible perform a defrost optimization (see Fig. 1) in order to melt all the ice from the evaporator without excessive heating.

Note: during a defrost cycle the displayed temperature is not updated (it is updated only if there will an alarm condition).

Fig. 1 - Defrost End Optimization
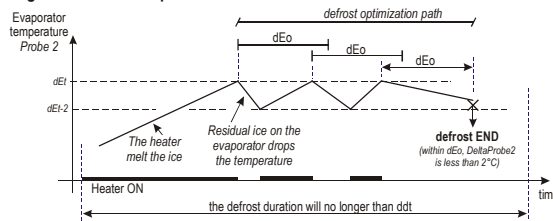
2.40 Alarm management and fault tolerance:

All the BL controllers show on display the signals of the alarm conditions (see table). You can set and enable the min. and max. temperature (see parameter Alr) alarm set points. This alarm set point must be intended as absolute value, not related to the main Set Point. To prevent alarm signaling, it is possible set alarm delays at start-up and during running time (see parameters Adi and Ald).
Note: if alarm is on, press the "▼" key to switch off the optional internal buzzer or relay.
In case of probe failure the BL controllers display a message (PF1 or PF2). When there is a main probe (#1) failure the compressor can be managed by an emergency routine, to try to keep the temperature close to the desired Set Point (see parameters CPF, Con and Cof).

3.00 DISPLAY FUNCTIONS

The display has tree digits available, of the seven segment type. During normal working it shows the value of the temperature, while in an alarm condition it shows the proper indication as described in the «anomalies signaling» table (8.00).
The three leds have the following functions: led n°3, on the left, blinks during the setting operations or on the defrost optimization time and it lights on during the defrost; led n°2 lights when the fan runs; led n°1, on the right, lights when compressor runs. On the controllers with the optional digital input feature, the led 3 blink when the external contact is closed (only if dio=1 or dio=4).

4.00 HOW TO DISPLAY AND ADJUST THE MAIN SET POINT

1) Press "SET" and hold it for 3s, SEt is displayed;
2) Press "SET" to view the Set Point value, adjust it by using "▲" or "▼";
3) Press "SET" to confirm the data, after few seconds the controller will leave the set mode and the data will be stored in the memory.
WARNING: the instrument must not be reset before leaving the set mode, otherwise the new setting will be lost.
Note: it is only possible to choose values for the set point inside the «Los» and «His» range.

4.10 HOW TO DISPLAY THE EVAPORATOR TEMPERATURE

Press "▲": the evaporator temperature (probe 2) will appear on the display.

4.20 HOW TO ACTIVATE MANUALLY A DEFROST CYCLE

Press and hold for 5s the "Defrost" key, the led 3 will lights on and the controller's outputs will follow the parameters "Odd" and "Fod".

4.30 HOW TO ADJUST OPERATING PARAMETERS

1) Press "SET" and hold it for 10s, the code of the first variable "HyS" will appear;
2) Press "▲" or "▼" to scroll all the parameter codes;
3) While a code is displayed press "SET" to view its content, adjust it by pressing "▲" or "▼";
4) Press "SET" to confirm the data, after 10s the controller will leave the set mode and the data will be stored in the memory.
WARNING: the instrument must not be reset before leaving the set mode, otherwise the new setting will be lost.
Note: The controller leave programming mode if no push-button is pressed for at least 10 seconds.
The new values for time parameters will be active only after the start of the following time cycle.

4.40 KEYBOARD LOCKING

Press and hold "SET" + "▼" for 10s, in order to lock and unlock the keyboard.
Code displayed for one second: "Pof": Locked;   "Pon": Unlocked.
When the keyboard is locked it is possible change only the "Set" value.

5.0 GENERAL PARAMETERS DESCRIPTION

SEt - main Set Point: it's the required temperature in the cold room.

HYS - main differential (hysteresis): the value that controls the compressor operation, moving the value of the set point in such a way that the system does not oscillate.

LoS - low limit of set point: a limit below which it is not possible to move the set point value.

HiS - high limit of set point: a limit above which it is not possible to move the set point value.

OFS - offset for main temperature probe: it is the variation temperature added or subtracted to the temperature measured by the probe 1 to compensate for any deviation from the real value.

OF2 - offset for evaporator probe: it is the variation temperature added or subtracted to the temperature measured by the probe 2 to compensate for any deviation from the real value.

AcY - anticycling delay time of K1: it is the minimum time between two successive compressor output maneuvers (off – on cycle). When the compressor is switched-off, the controller wait at least "AcY" minutes to switch on the relay again. It is also the delay for the first activation of the compressor relay at the start-up.

LoA - low operation point of alarm temperature: a limit below which the system goes in alarm and simultaneously the display shows «LoT».

HiA - high operation point of alarm temperature: a limit above which the system goes in alarm and simultaneously the display shows «Hit».

Alr - alarm mode of operation: the high and low temperature alarms can be enabled or disabled as required by the installer. The available options are: 0 = all alarms disabled; 1 = only high temperature alarm enabled; 2 = only low temperature alarm enabled; 3 = high and low temperature alarms enabled.

Adi - alarm delay initialization: delay between the power-up of the instrument and the arming of the alarms. *At the start-up an alarm will be showed not before Adi+Ald time.*

Ald - alarm delay during running time: it is the elapsed time between the trigger of an alarm and the effective displayed state.

dPt - defrost period time: it is the period of time of defrost cycles (the time elapsed between two consecutive switching on of the defrost action) . *When a manual defrost is called, the time counter is reset.*

ddt - defrost duration time: it is the time duration of a single defrost action. Usually during this time the compressor is switched-off *(Odd=0)* to allow a deicing process. If ddt = 0 the defrost function is disabled.

dEt - defrost end temperature: it is the temperature, measured by the evaporator probe (if probe 2 is connected), to define the defrost action end. Anyway, the defrost will be ended by time (see ddt), even if the evaporator temperature doesn't reach the programmed value.

dEo - defrost end optimization: after reaching the dEt temperature, the controller starts regulation cycles in such a way to keep the evaporator temperature near the dEt value (defrost optimization phase) in order to improve the de-iceing process. We can avoid an excessive warming of the evaporator area. If dEo=0 the function is disabled.

Odd - compressor behavior during defrost: you can select the operation mode according your needs.
0: compressor 1 & 2 OFF during defrost (standard); 1: compressor 1 ON, compressor 2 OFF during defrost (hot gas defrosting); 2: compressor 1 OFF, compressor 2 ON during defrost; 3: compressors 1 & 2 ON during defrost (used in hot gas defrosting with a 2nd compressor delayed respect to the 1st one).
Note: the standard BL family have only the first compressor → only odd=0 or odd=1 have meaning.

add - compressor start delay after defrost: it is also known as "dripping time". After a defrost cycle, the compressor will be maintained stopped to assure dripping of possible water still present in the evaporator. During defrost dripping time, the fan may be turned off with a proper FSd time.

dud - delay up-date display: it allows to delay the updating of the displayed temperature after a defrost cycle. Remember that during a defrost cycle the displayed temperature is not updated.

Fod - fan operating mode: the operator can select the behavior of the fan according to his needs (if fan is armed as per Fst). 0) Fan runs in parallel with the compressor; 1) The fan is always ON; 2) The fan is OFF during defrost, otherwise is always ON; 3) The fan is OFF during defrost, otherwise is in parallel to the compressor; 4) The fan is ON during defrost, otherwise is in parallel to the compressor.

FSd - fan delay at start-up and after defrost: it is the delay time at start-up and after a defrost cycle to avoid any hot air circulation in the cold room. This time starts from the end of the defrost action.

FSt - fan start set point: it is the value of the temperature that determines the arming of the fan. The fan is turned ON only when the temperature of the evaporator probe (probe #2) drops below this set point value. *Note:* for security reasons both parameters FSt and FSd interacts. So, the fan is armed when the temperature is lower than FSt and triggered after the delay time set in FSd, afterwards the behavior follows the Fod parameter.

unt - displayed unit: it switches the temperature unit between Celsius and Fahrenheit (internal calculations are made in Celsius and then converted to Fahrenheit – there are rounding errors).

utd – update time delay: it sets the time delay between two display refreshes (the min update time of the display is 5 sec.). *The switching over of the relay is related only to the acy not to utd values..*

tiS - scale times: it switches the scale times of the dPt from hours to minutes, ddt from minutes to seconds, acy from seconds to minutes and vice versa.

dio - digital input operation mode *(optional)*: on instruments with this option included, this parameter can set different ways of working for the digital input. Modes: 0) Digital input disabled; 1) If the cold room's door is open more than "did" time, the instrument gives an alarm indication (dOP in the display) and switch-off the fan relay; 2) when the external contact will be closed, the controller will swith-off the display and all the outputs; 3) Allows the activation of the defrost remotely, you can start and finish a defrost cycle by a pulse (close and then open) of an external contact; 4) It is possible to modify the SET point value by an external contact. When the contact will close, SET2 will become the active set point, instead of SET; 5) it allows to stop the defrost action by a pulse of the contact.

did - digital input delay *(optional)*: it is the time elapsed between the activation of the digital input and the effective action.

CPF - compressor behavior with probe failure: In case of probe failure, the thermostat output works according to the setting of this parameter, until the defect is removed.
There are the following possibilities: 0 = the compressor output is always OFF; 1 = the compressor output is always ON ; 2 = the outputs are turned ON and OFF by an "emergency routine"; according to the settings of parameters "Con" and "COF".

Con - compressor ON time: it is the time of compressor "ON" in case of probe failure, if parameter CPF = 2.

CoF - compressor OFF time: it is the time of compressor "OFF" in case of probe failure, if parameter CPF = 2.

St2 - secondary set point *(optional)*: it is the temperature value required for the Energy Saving Mode (see dio param.).