AERMEC
La prima per il clima

Preliminary

USAGE MANUAL

Carel electrical regulation for water-based modular chillers
with two-stage centrifugal compressor

Tw110

C E

AERMEC
COMPANY QUALITY SYSTEM

S
ICIM

ISO 9001 - Cert. n° 0128/4

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TABLE OF CONTENTS

Characteristics of the regulation

The regulation of the unit TW110 is made by using a PCO1 card (one for each compressor of the system) and a touchscreen display for each unit.

The use of the unit TW110 offers two different plant engineering solutions, each producing distinctive characteristics in the management of the machine. The possible configurations are:
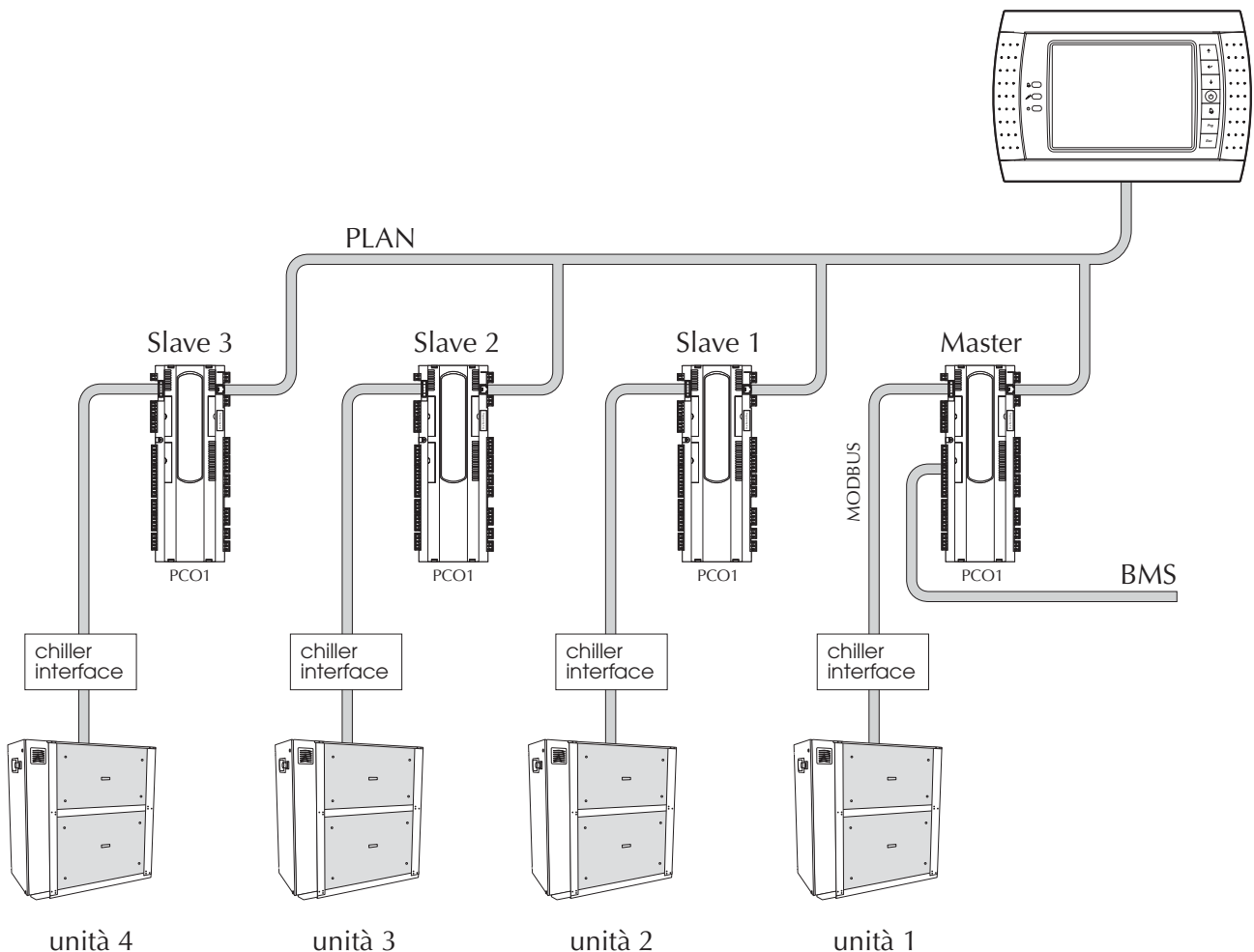• a single unit TW110 installed in the system
• more than one unit (maximum four) installed in a single system, and connected to each other via the network

In the first case, the electronic regulation of the unit will consist of an electric control card PCO1, connected to a touchscreen colour display, via which the user can monitor/modify the working of the unit.

If more than one unit is installed, and these are connected to each other, the system will be managed according to the logic expressed in the diagram below. The display to pilot the units will be connected to the PCO1 cards of the machines, and these will be organised on the basis of a master/slave hierarchy; in this mode, each card will be connected to loads, transducers and alarms relating to the compressor it controls, but only the master card will control the main functions of the unit. For further information relating to the network connection for more than one unit, refer to the specific section of this manual.

PLAN

Slave 3	Slave 2	Slave 1	Master

MODBUS

| PCO1 | PCO1 | PCO1 | PCO1 | BMS |

chiller interface	chiller interface	chiller interface	chiller interface

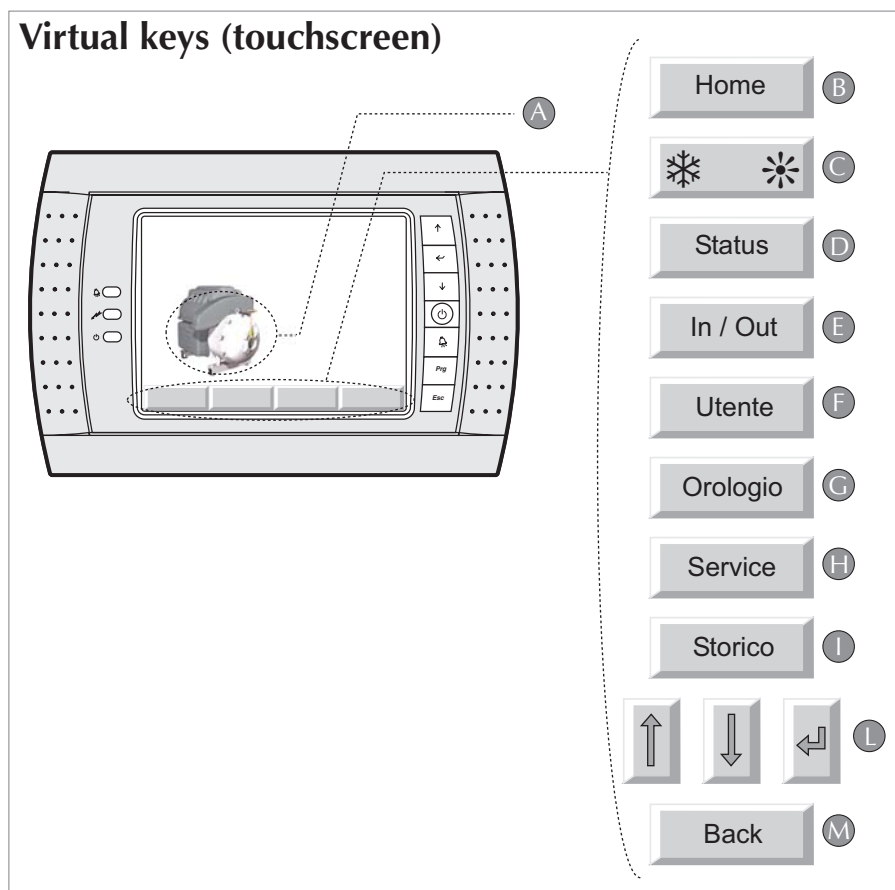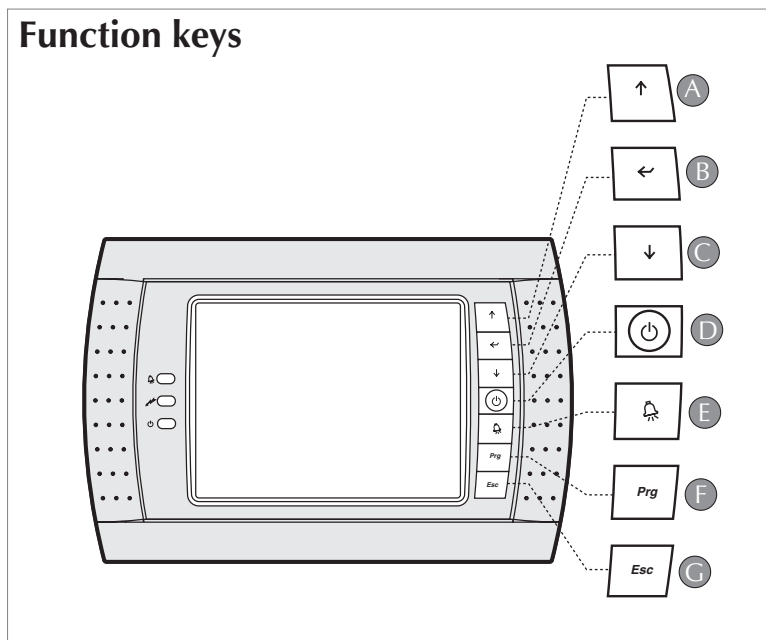| unità 4 | unità 3 | unità 2 | unità 1 |

User interface

The user interface consists of a touchscreen colour graphic display; all the functions of the unit are visualised and modified via this interface.

The user utilises the display by means of two types of command - the first via the keys on the right-hand side (figure below), and the second via the graphic keys visualised in the various screens (that can be used by pressing directly on the screen, thanks to the touchscreen function).

Function keys

Virtual keys (touchscreen)

Function keys

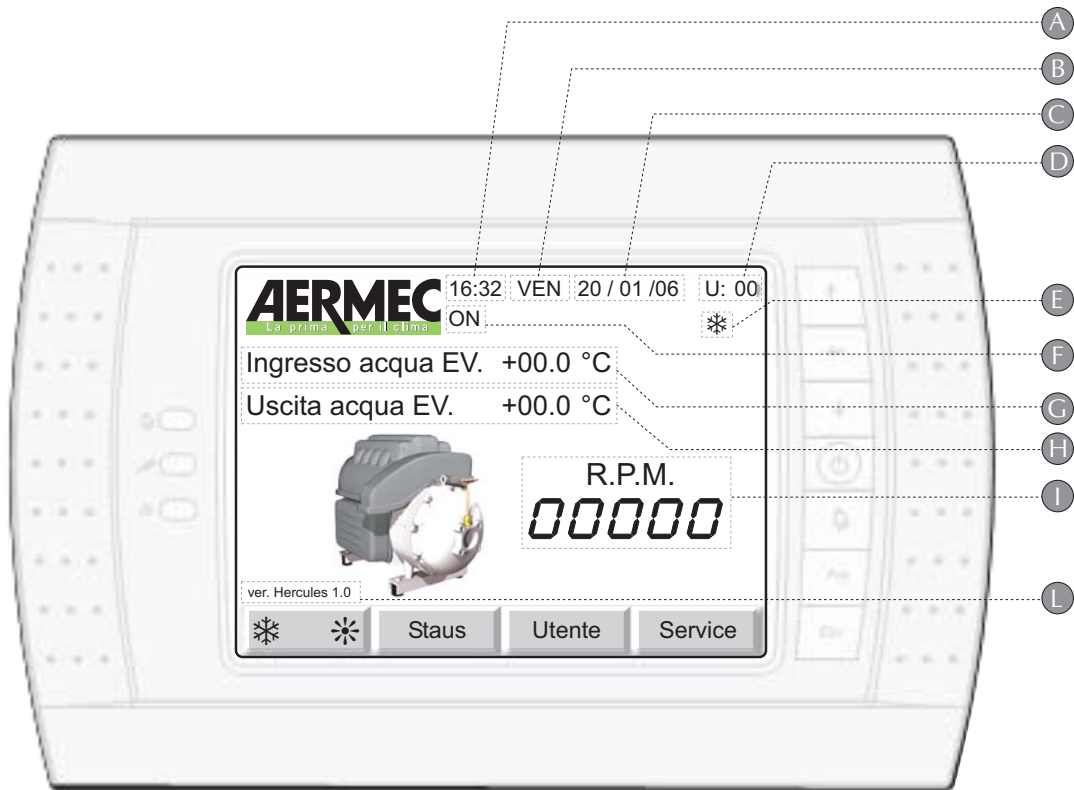| KEY	Function	USE	Notes
D	ON / OFF	Switches the unit on/off	This command is always given priority with regard to the remote or supervisor command. If the system is multicompressor, by pressing this key on the MASTER unit you switch the entire system on or off; if you press it on a SLAVE unit, you switch the single circuit on or off.
E	ALARM	Visualises/resets the alarms	Pressed once, it visualises the alarms activated and switches off the alarm buzzer. In alarm visualisation mode, if you press the key a second time you reset the alarm(s) currently indicated; if no alarm has been generated, the pressing of this key will produce the message NO ALARM ACTIVATED. The sequence of the alarms is given by pressing the arrow keys UP and DOWN.
A - C	Arrow keys	Scroll through data UP/DOWN	These keys scroll through the masks of a menu; you can pass from the last to the first, and vice versa. If the cursor is in a numerical field, the keys increase or decrease the value on which the cursor is positioned. If the cursor is positioned on a field of choice, by pressing the arrow keys UP/DOWN, you can visualise the available options (e.g. YES/NO).
B	ENTER	Confirmation key	In the value setting masks, by pressing the key once, the cursor moves onto the first introduction field; by pressing again, you confirm the value set and move the cursor onto the next field. From the last field, the cursor is then hidden.
F	PRG	Activates FACTORY menu	Pressing this key, you access the FACTORY menu (after inserting the password) that allows you to visualise the parameter settings of the manufacturer.
G	ESC	Changes control card	If the system is multicompressor, the display visualises the parameters and information of one electric control card (PCO1) at a time; by pressing this key, the display visualises the data from the next card (with the following increase logic: MASTER, SLAVE1, SLAVE2, SLAVE3, SLAVE4).

Virtual keys (touchscreen)

KEY	Function	USE	Notes
A	Compressor status	Activates compressor menu	On the STATUS mask, there is the virtual key (with a picture of the compressor); when pressed, you access the compressor menu.
B	Home	Returns to the main menu	By pressing this key, the visualisation returns to the main mask, where the water inlet and outlet temperatures are shown, plus the machine status, the time and day of the week, which PCO1 card is being controlled, and other specific information.
C	Operating mode	Type of operation	This key allows you to set the COLD/HOT operation.
D	STATUS	Activates the STATUS menu	Selects the STATUS mask in which there is a summary of the main working parameters of the unit, with clear graphic representations and access to the IN/OUT menu.
E	IN/OUT	Activates the IN/OUT menu	Selects the INPUT/OUTPUT menu to visualise analogical inputs and outputs, and the status of the digital inputs and outputs of the PCO1 electric control card selected.
F	User	Activates the USER menu	Selects the USER menu, with the settings of the user setpoint and access to the clock menu.
G	Clock	Activates the CLOCK menu	Selects the CLOCK menu and time band programming.
H	SERVICE	Activates the SERVICE menu	By pressing this key, you access the SERVICE menu (after inserting the password) that contains the settings of the maintenance parameters, and you can also access the ALARM LOG menu.
I	LOG	Activates the ALARM LOG menu	This key allows you to access the ALARM LOG menu, where the recent anomalies are stored.
L	ARROWS	UP, DOWN, ENTER	These keys have the same function as the function keys A-C, B (arrow UP, arrow DOWN, ENTER key).
M	BACK	BACK	This key allows you to return to the visualisation of the previous menu.

Parameters visualised in the default mask

Once the unit has been started up, a default mask is visualised, showing some fundamental parameters. These parameters allow the user a quick overall view of the working of the unit, or units (in the case of multicompressor systems). The parameters visualised during this initial phase are:
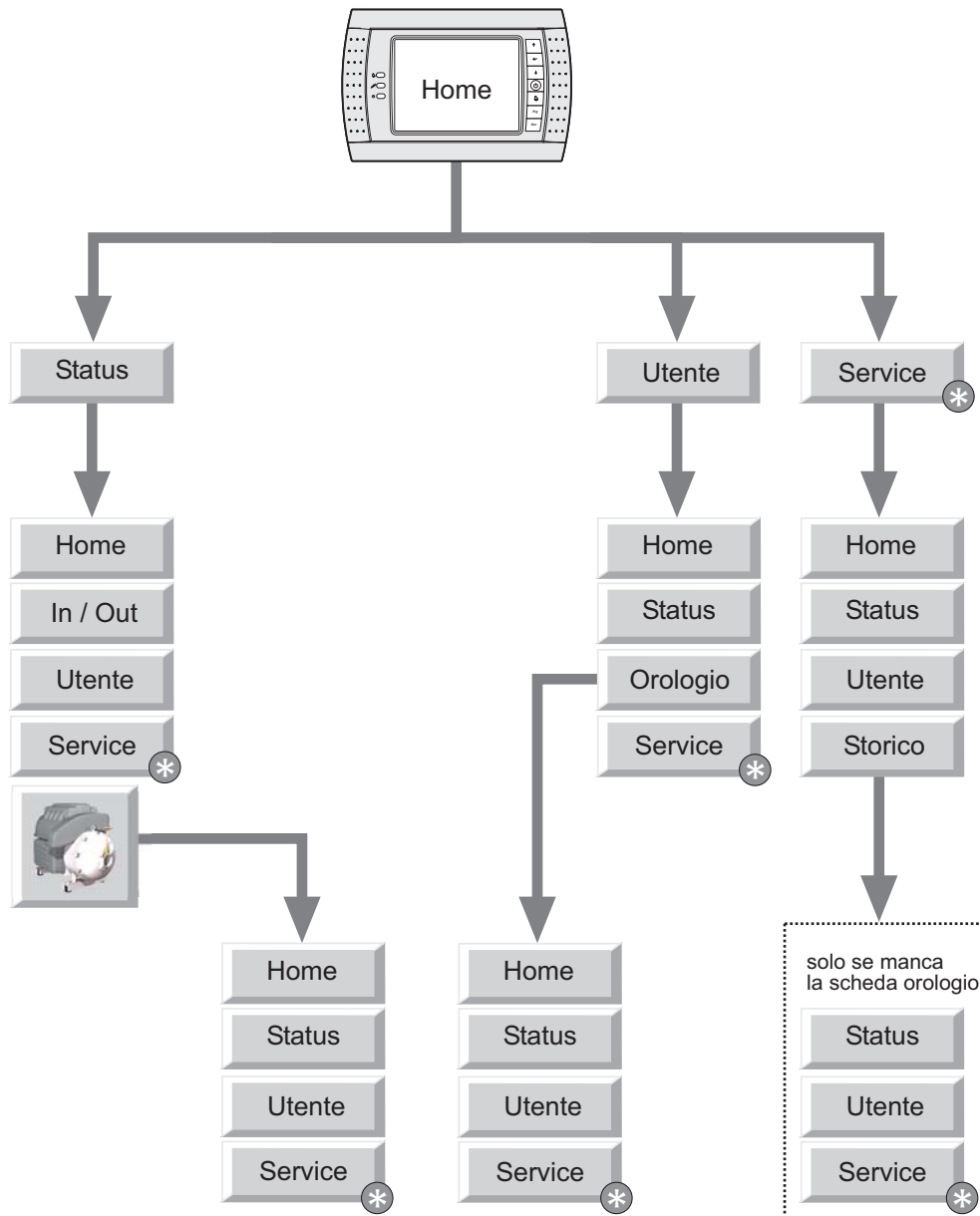
Parameter	Function	Notes
A	TIME	Time set for the system.
B	DAY	Day set for the system.
C	DATE	Date set for the system.
D	PCO1 address	Indicates on which PCO1 card you are working (only for the multicompressors).
E	Working mode	Indicates the working mode selected.
F	Working status of the unit	ON = machine switched on OFF BY KEYB = machine switched off via keyboard command OFF BY DIG IN = machine switched off via remote contact OFF BY SUPERV = machine switched off by supervisor OFF BY TIME Z = machine switched off via timer OFF BY ALARM = machine switched off by alarm
G	WATER INLET temperature	Indicates the EVAPORATOR WATER INLET temperature (CONDENSER in the case of water-water unit, hot working mode).
H	WATER OUTLET temperature	Indicates the EVAPORATOR WATER OUTLET temperature (CONDENSER in the case of water-water unit, hot working mode).
I	Compressor r.p.m.	Indicates the number of rotations per minute of the centrifugal compressor.
L	Software version	Indicates the version of the software installed on the PCO1 electric control card selected.

Organisation of the menus and the windows

All the information and parameters visualised or modified by the user are organised according to a different series of menus, each including specific information relating to a particular aspect of the unit. The hierarchy with which these menus have been implemented allows for the quick management of all the information regarding the moment-by-moment working of the machine.

The layout below gives an example of the menu structure, showing the hierarchy (remember that not all the menus can be activated by mere selection: some are, in fact, protected by a password, to avoid the manipulation of sensitive parameters by unauthorised personnel).

```
                          ┌─────────┐
                          │  Home   │
                          └────┬────┘
        ┌──────────────────────┼───────────────┬───────────┐
        ▼                      ▼                ▼
    ┌────────┐            ┌────────┐        ┌──────────┐
    │ Status │            │ Utente │        │ Service ✱│
    └───┬────┘            └───┬────┘        └────┬─────┘
        ▼                     ▼                  ▼
    ┌────────┐            ┌────────┐        ┌────────┐
    │ Home   │            │ Home   │        │ Home   │
    ├────────┤            ├────────┤        ├────────┤
    │ In / Out│           │ Status │        │ Status │
    ├────────┤            ├────────┤        ├────────┤
    │ Utente │            │Orologio│        │ Utente │
    ├────────┤            ├────────┤        ├────────┤
    │Service✱│            │Service✱│        │ Storico│
    └────────┘            └────────┘        └────┬───┘
```

solo se manca la scheda orologio

Home	Home	Status
Status	Status	Utente
Utente	Utente	Service ✱
Service ✱	Service ✱	

✱ = remember that the SERVICE menu is protected by a password

Menu parameters [Utente]

Display visualisation

```
AERMEC                    USER    Pag 1
La prima per il clima  Setpoint acqua
❄ Setpoint                07.0 °C        ⇧
❄ Secondo Setpoint        11.0 °C
☀ Setpoint                50.0 °C        ↵
☀ Secondo Setpoint        45.0 °C

              Setpoint recupero di calore
Setpoint recuperatore     50.0 °C        ⇩
Diff. recuperatore        05.0 °C

  Home    |   Staus   | Orologio |  Service
```

Parameters	Notes
❄ Setpoint	Setting of cold setpoint
❄ Second Setpoint	Setting of second cold setpoint (only if the double setpoint function of the SERVICE menu is activated)
☀ Setpoint	Setting of hot setpoint
☀ Second Setpoint	Setting of second hot setpoint (only if the double setpoint function of the SERVICE menu is activated)
Recuperator Setpoint	Setting of setpoint to start the proportional band for the recovery thermostat
Recuperator differential	Differential for the proportional band of the recovery thermostat

Display visualisation

```
AERMEC                    USER    Pag 2
La prima per il clima  Comandi attuali

Setpoint utilizzato       07.0 °C        ⇧

              Comandi da seriale         ↵

Serial limit              100 %          ⇩
Serial Demand    [◦◦●]    000 %

  Home    |   Staus   | Orologio |  Service
```

Parameters	Notes
Setpoint used	Setpoint currently used, selected from those possible (hot, cold, double hot, double cold, multifunction input, serial)
Serial Limit	Limit of the power, owing to serial or multifunction input request
Serial Demand	Power request from serial (visible only if the multichiller function is enabled). The green traffic light symbol indicates that the communication is active, and the % figure of requested power is valid; red indicates that the communication is not present, so the machine remains idle, waiting for a reliable figure

Display visualisation

```
AERMEC                    USER    Pag 3
La prima per il clima  Ingresso multifunzione  ●
Ingresso                +000.0 °C        ⇧
❄ Setpoint              +00.0  °C
☀ Setpoint              +00.0  °C        ↵
  Limit                 000    %
  Demand                000    %
❄ Compensation          +00.0  °C        ⇩
☀ Compensation          +00.0  °C

  Home    |   Staus   | Orologio |  Service
```

Parameters	Notes
Multifunction input	Status of multifunction entry from digital input ID14
Inlet	Input value in the size selected
❄ Setpoint	Cold setpoint from multifunction input
☀ Setpoint	Hot setpoint from multifunction input
Limit	Limit of maximum power from multifunction input
Demand	Power requested from multifunction input
❄ Compensation	Compensation of cold set from multifunction input
☀ Compensation	Compensation of hot set from multifunction input

Menu parameters | Orologio

Display visualisation

AERMEC	OROLOGIO Pag 1
La prima per il clima	

ORA   16:43
DATA   20/01/06
GIORNO   Venerdì

FASCE ORARIE   ●off

Home	Staus	Utente	Service

Parameters	Notes
TIME	Time of the system
DATE	Date of the system
DAY	Day of the week
Time bands	Enablement of the working with time bands for switching on and off

---

Display visualisation

AERMEC	OROLOGIO Pag 2
La prima per il clima	

Giorno Non inizializzato

START1   STOP1   START2   STOP2
00:00   00:00   00:00   00:00

    ON   ON

Home	Staus	Utente	Service

Parameters	Notes
DAY	Day of the week in which to set the time bands
START1	Switch-on time for the chiller
STOP1	Switch-off time for the chiller
START2	Second switch-on time for the chiller
STOP2	Second switch-off time for the chiller

N.B: the wording TIMER ERROR may appear if the start and stop times are not coherent (START1<=STOP1<=START2<=STOP2)

Display visualisation

AERMEC	
La prima per il clima	

STOP

SCHEDA OROLOGIO
NON INSTALLATA

Back

Parameters	Notes
	This screen appears if the clock card is not installed (or is faulty) on the PCO1 electric control card; the clock card should be installed in the "Clock Card" slot

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Display visualisation

AERMEC	
La prima per il clima	

STOP

ACCESSO SOLO DA
SCHEDA MASTER

Back

Parameters	Notes
	This screen appears only if you try to access the clock menu from a slave card (PLAN address different from 1)

Menu parameters

Status

Display visualisation

AP	00.0 bar
Tman	+000.0 °C
Tco	+00 °C
Subc.	000 °C

RPM 0000.0
KW in 000.0 KW
Amp 000 A

TUAH +00.0 °C
TIAH +00.0 °C

BP	00.0 bar
Tasp	+00.0 °C
Tev	+00 °C
Superh	+00 °C

TIA +00.0 °C
TUA +00.0 °C

| Home | In / Out | Utente | Service |
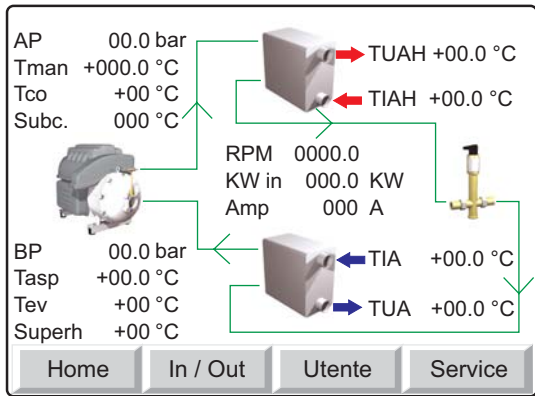
Parameters	Notes
AP	High pressure (in delivery)
Tman	Compressor delivery temperature
Tco	Condensing temperature
Subc.	Under-cooling
BP	Low pressure (suction)
Tasp	Compressor suction temperature
Tev	Evaporation temperature
Superh	Overheating
RPM	Rotations per minute of the compressor
KW in	Input power to the compressor
Amp	Input current to the compressor
TUAH	Water outlet temperature from condenser
TIAH	Water inlet temperature from condenser
TIA	Water inlet temperature in evaporator
TUA	Water outlet temperature from evaporator

Menu parameters   In / Out

Display visualisation	
AERMEC *La prima per il clima*	Richiesta potenza
Power demand	000.0 °C
	000.0 %
Err. Proporzionale	+000 %
Err. Integrale	+000 %
Lim safety	000 %
Home	Staus	Utente	Service

Parameters	Notes
Power demand	Power requested by thermostat, in kW
	Power requested by thermostat, in %
Proportional error	Proportional error of the thermostat
Integral error	Integral error of the thermostat
Safety limit	Limit of maximum power activated, limits the request of the thermostat to the value shown

Display visualisation	
AERMEC *La prima per il clima*	Carichi
MPOE OFF RA OFF	
RS OFF	
MV/MPOC OFF	
VSL OFF	
VECO OFF	
VSBS OFF	
Interlock OFF	
Home	Staus	Utente	Service

Parameters	Notes
MPOE	Status of evaporator pump relay output
RS	Status of evaporator antifreeze resistance relay output
MV/MPOC	Status of condenser pump relay output
VSL	Status of liquid solenoid valve relay output
VECO	Status of economiser valve relay output
VSBS	Status of bypass start valve relay output
Interlock	Status of interlock contact relay output for compresssor (contact open = compressor stop)
RA	Status of alarm summary relay output

Menu parameters

Display visualisation

```
AERMEC                          COMPRESSORE-DATI
La prima per il clima
Rpm attuali      00000   3ph Vac    000  V      ⇑
Rpm richiesti    00000   3ph Amp    000  A
Rpm max          00000   Motor Pow  000.0 KW
Rpm min          00000   IGV        000.0 %     ⏎
Cavity Temp.    +000.0 °C
Inverter Temp.  +000.0 °C
SCR Temp.       +000.0 °C  Solenoide 1  OFF      ⇓
AP Turbo          00.0   bar  Solenoide 2  OFF
   Home        Staus       Utente      Service
```

Parameters	Notes
Current rpm	Current rotations/minute of the compressor
Rpm requested	Rotations/minute requested by the thermostat
Maximum rpm	Maximum rotations/min possible, under current working conditions
Minimum rpm	Minimum rotations/min possible, under current working conditions
Cavity temperature	Winding temperature compressor motor
Inverter temperature	Temperature of compressor inverter
SCR temperature	Temperature of rectifier diodes
AP Turbo	Compressor condensation pressure (upstream from the single-direction delivery valve)
3ph Vac	Three-phase voltage at compressor input
3ph Amp	Input current to the compressor
Motor Power	Electrical input power to compressor
IGV	Percentage (0~110%) of IGV valve opening
Solenoid 1	Status of cooling solenoid for compressor inverter (1 stage)
Solenoid 2	Status of second cooling solenoid for compressor inverter (2-stage)

Display visualisation

```
AERMEC                          COMPRESSORE-STATO
La prima per il clima           ERRORE
Lockedout    OFF    MaxFlow         OFF    ⇑
Resetting    OFF    MinIgv          OFF
Rampingup    OFF    InterlockOpen   OFF
HalfCloseVane OFF   Faultwaiting    OFF    ⏎
NormalState  OFF    Temperaturestop OFF
Loadingup    OFF                           ⇓
   Home        Staus       Utente      Service
```

Parameters	Notes
Compressor command modes	ERROR: error in the selection of the command mode CALIBRATION MODE: in internal calibration MANUAL MODE: control via monitoring program ANALOG MODE: control via 0-10V MODBUS MODE: control via modbus CHILLER MODE: control via probes
Lockedout	The compressor is in a serious alarm condition; it is necessary to disconnect and reconnect the voltage to unblock it. WARNING: do not carry out this operation without checking the reason for the serious block
Resetting	The compressor is in the initialisation phase, following a firing
Rampingup	The compressor is carrying out the initial rotation increase phase in start-up
HalfCloseVana	The IGV valve is 50% open
NormalState	The compressor is in a normal condition
Loadingup	The compressor is in the rotation increase phase
MaxFlow	The IGV valve is completely open
MinIgv	
InterlockOpen	
Faultwaiting	
Temperaturestop	

Parameters	Notes
Invertertemp	Pre-alarm excess temperature inverter
Dischargetemp	Pre-alarm excess temperature delivery
Suctionpres	Pre-alarm low pressure
Dischargepres	Pre-alarm high pressure
Phasecurrent	Pre-alarm excessive current absorption
Cavitytemp	Pre-alarm excess temperature motor winding
Leavingwater	Pre-alarm antifreeze
CP ratio	Pre-alarm compression ratio
SCRtemp	Pre-alarm excessively high temperature SCR diodes
Preal. Bearing	Pre-alarm code magnetic bearings
Preal. Motor	Pre-alarm code compressor motor

Menu parameters   Storico

Display visualisation

AERMEC
La prima per il clima

STORICO ALLARMI Pag 1

N° 000

Nessun allarme		00:00	00/00/00
Volt	000	Amp	000
RPM	00000	IGV	000.0 %
TIA	+00.0 °C	TGP	+000.0 °C
TUA	+00.0 °C	Set	+00.0 °C
AP	00.0 bar	Diff.	00.0 °C
BP	00.0 bar	Set AG	+00.0 °C

[◄◄]   [►►]   Back

Parameters	Notes
Alarm Log	The alarm log allows you to view the last 100 alarms activated. For each alarm, a series of parameters is stored, with the values present at the time of the alarm. The alarm log cannot be reset, and the storage is circular, so each new alarm registered overwrites the oldest of the 100 stored
n°	Progressive number of the alarm (from 0 to 100)
No alarm 00:00 00/00/00	Code and description of the alarm, followed by time and date when the alarm occurred
Volt	Three-phase voltage applied to the compresssor
RPM	Rotations per minute of the compresssor
TIA	Evaporator water inlet temperature
TUA	Evaporator water outlet temperature
AP	High pressure
BP	Low pressure
Amp	Input current to the compressor
IGV	Percentage of opening of the IGV capacity control valve
TGP	Force gas temperature
Set	Setpoint used in the production of evaporator outlet water
Diff.	Differential used by the setpoint
SetAG	Antifreeze set
	Load next alarm
[►►]	Load previous alarm
[◄◄]	

Display visualisation

AERMEC
La prima per il clima

STOP

STORICO NON DISPONIBILE

| ❄ | ☀ | Staus | Utente | Service |

| Parameters	Notes
	This window appears if the alarm log is not available, due to the absence of the clock card

Alarm management

The electric control card of the unit TW110 monitors the moment-by-moment working of the machine, and if an irregular situation arises, an alarm is activated. The alarms are visualised at different levels; the first signal is indicated by a LED located on the left-hand side of the display. This LED, usually switched off, switches on when an alarm condition arises. To pass to the visualisation of the code and the relative description, it is necessary to press the alarm key (identified by the bell; ref. page 5) positioned on the left-hand side of the display. At this point, a window will appear on the screen, showing the code and description of the current alarm. There is also a virtual key with which you can reset the error and re-equip the unit.

Remember that, before resetting the alarm, it is necessary to resolve the cause of the error. Bear in mind also that every alarm blocks the working of the unit, which cannot restart until the error has been reset.
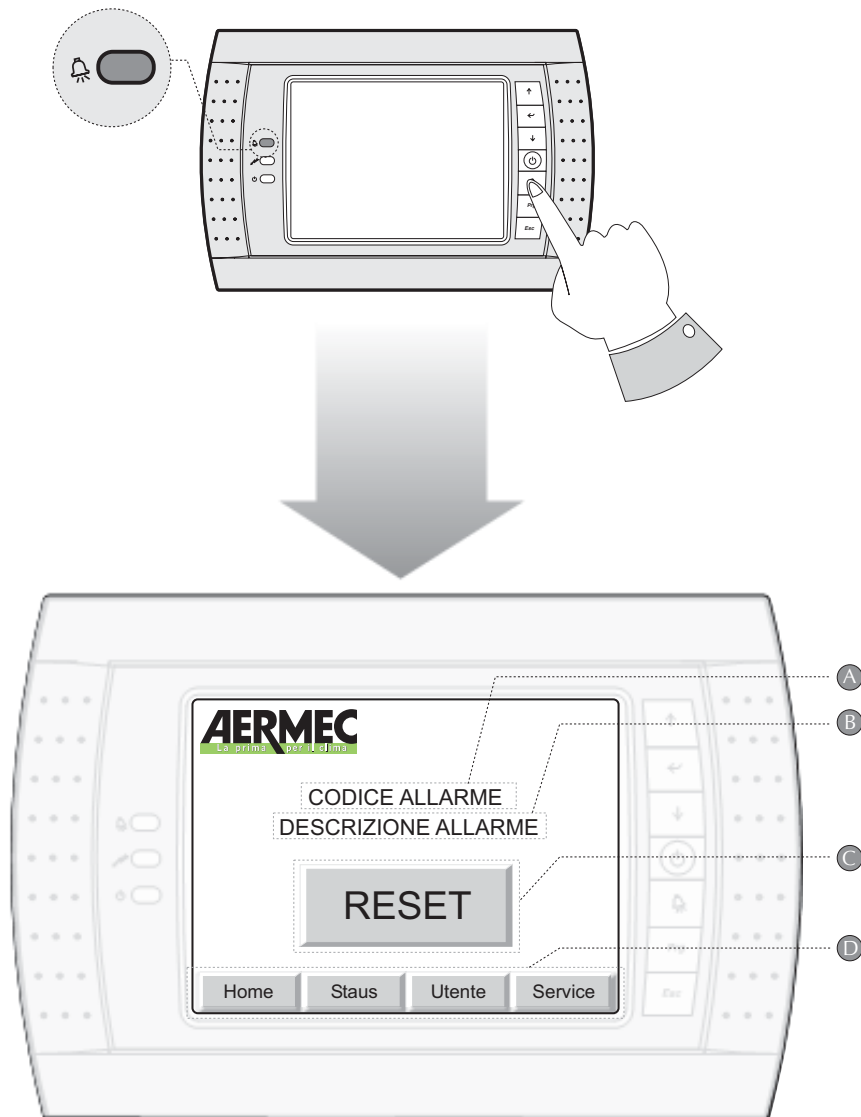
Parameters	Function
A	Alarm code
B	Alarm description
C	Virtual key to reset the error and re-equip the unit
D	Navigation keys

Alarm codes

Code	Description
001	Automatic re-equip alarm
002	Voltage or phase monitoring alarm
003	Antifreeze alarm
004	Compressor thermal alarm
005	Flow switch alarm
006	Pressure differential alarm
007	Pressure switch alarm (high pressure)
008	Transducer alarm (high pressure)
009	Pressure switch alarm (low pressure)
010	Transducer alarm (low pressure)
011	Force gas high temperature alarm
012	Fan heating alarm
013	Condenser pump heating alarm
014	Evaporator pump heating alarm
015	Evaporator pump maintenance alarm
016	Condenser pump maintenance alarm
017	Compressor maintenance alarm
018	Probe alarm: probe B1 faulty or not connected
019	Probe alarm: probe B2 faulty or not connected
020	Probe alarm: probe B3 faulty or not connected
021	Probe alarm: probe B4 faulty or not connected
022	Probe alarm: probe B5 faulty or not connected
023	Probe alarm: probe B6 faulty or not connected
024	Probe alarm: probe B7 faulty or not connected
025	Probe alarm: probe B8 faulty or not connected
026	Condenser water filter alarm
027	Alarm: low pressure
028	Alarm: unit 1 not connected
029	Alarm: unit 2 not connected
030	Alarm: unit 3 not connected
031	Alarm: unit 4 not connected
032	Compressor inverter temperature alarm
033	Delivery temperature alarm
034	Compressor suction pressure alarm
035	Compressor delivery pressure alarm
036	Power supply current alarm
037	Compressor internal temperature alarm
038	Alarm: TURBOCOR LEAVING WATER
039	Alarm: TURBOCOR COMPRESSOR RATIO
040	BEARING MOTOR alarm
041	Alarm: TURBOCOR SCR TEMPERATURE
042	SYSTEM LOCK OUT alarm
043	Alarm: CALIBRATION FAILED
044	Alarm: START CHECK FAILED
045	Alarm: TURBOCOR AXIAL DISPLACEMENT
046	Alarm: TURBOCOR AXIAL STATIC LOAD
047	Alarm: TURBOCOR FRONT RADIAL DISPLACEMENT X

Code	Description
048	Alarm: TURBOCOR FRONT RADIAL DISPLACEMENT Y
049	Alarm: TURBOCOR FRONT RADIAL STATIC LOAD X
050	Alarm: TURBOCOR FRONT RADIAL STATIC LOAD Y
051	Alarm: TURBOCOR BACK RADIAL DISPLACEMENT X
052	Alarm: TURBOCOR BACK RADIAL DISPLACEMENT Y
053	Alarm: TURBOCOR BACK RADIAL STATIC LOAD
054	Alarm: TURBOCOR BACK RADIAL STATIC LOAD Y
055	Alarm: TURBOCOR SINGLE PHASE OVERCURRENT
056	Alarm: TURBOCOR DC BUS HIGH VOLTAGE
057	Alarm: TURBOCOR HIGH CURRENT MOTOR (LW)
058	Alarm: TURBOCOR HIGH CURRENT MOTOR (LE)
059	Alarm: TURBOCOR IGBT INVERTER ERROR SIGNAL
060	Alarm: TURBOCOR HIGH CURRENT START-UP
061	Alarm: TURBOCOR BEARING ERROR
062	Alarm: TURBOCOR BEARING WARNING
063	Alarm: TURBOCOR OUTPUT VOLTAGE ON THE MOTOR GENERATES NO CURRENT
064	Alarm: TURBOCOR AVC DATA MISSING
065	Alarm: TURBOCOR MOTOR BACK EMF LOW
066	Alarm: TURBOCOR EEPROM CHECKSUM ERROR
067	Alarm: TURBOCOR COMPRESSOR IS RUNNING IN GENERATOR MODE
068	Alarm: TURBOCOR SCR PHASE LOSS
069	Alarm: communication error
070	Alarm: waiting for reduction differential pressures