

Manuale centralina per compressori *User's manual* *Control unit for compressors*

SERIE / SERIES

- ETIV



Research and Development

Compilatore/*Prepared by:* Giunti Mattia

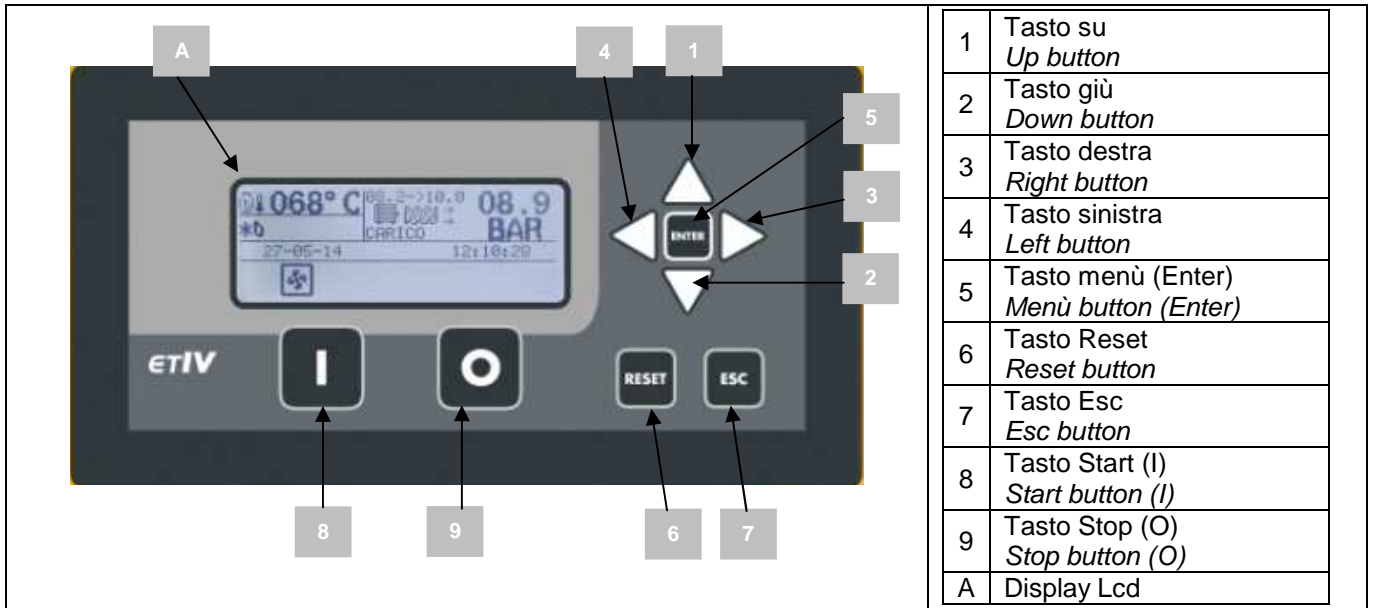
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Main technical features:

Power supply:	24V _{AC} ± 20% 50/60 Hz
Power Consumption:	8VA _{max}
Operating temperature:	-10°C ÷ +60°C with max 90% UR (non condensing).
Storage temperature:	-20□ ÷ +70□
Inputs:	1 analog input pressure switch Resolution 12 bit. 2 Temperature sensor inputs Resolution 10 bit.. 9 digital inputs with 1 common (9-way connector).
Relay outputs:	10: NO relay outputs max 4A (9 outputs with 1 common+ 1 separate output "10-way connector").
Analog outputs:	1: analog output 4-20mA resolution 10 bit (i.e. for inverter).
Communication:	1 serial RS485 (Half duplex max 115200baud prot. MODBUS RTU).
Container:	ABS self extinguishing.
Maximum dimensions:	24x13x5cm
Container protection rating:	Front panel IP64, the inner side should be assembled in a watertight compartment.
Container fastening:	4 plastic brackets with self-tapping screws.
Connectors:	Removable, screw locking system pitch 5mm.
User Interface	Graphic Display 192x64 backlit display area (98x34mm). 9-key keyboard with metallic dome. Buzzer for acoustic warnings.
Hardware Features:	Flash memory for firmware equal to 128Kbyte. Eeprom memory for parameters equal to 1024byte. Real time clock calendar (dd/mm/yyyy hh:mm:ss) powered by a CR2032 battery (replaceable).
Set-up:	Connector for further expansion (e.g. modules for I/O, serial, USB, Memory, Can, etc.).

Description of general operation

DNAir2 is a device designed to control the operation of rotary screw air compressors.

This controller based on a microcontroller is able to check/verify the entire production cycle of compressed air without the aid of other external devices.

It features a user-friendly and clear interface and maximum versatility that make it suitable for various types of compressors.

Preset for installing expansion boards to meet even unpredicted requirements.

In addition to controlling the production cycle of the air, the board is capable of controlling a dryer and the condensate drain

Compressor Functioning

Start-up procedure:

Press the START (I) button. If no alarms are on, the start-up cycle activates:

-Start-up stand-by: the controller waits for the following conditions to be met until starting the compressor:

-If the machine was switched off or a previous stoppage was executed, the control unit waits 15 seconds before starting the compressor.

-The control unit waits for the pressure to go below the value set in the "**Load pressure**" set before starting the compressor.

(On display appears "**STAND-BY**")

-Star compressor start-up: the line and star remote control switch is powered for a time set in the parameter "**Star/triang. time**" (on display appears "**VACUUM**")

-Switching from star to triangle: the line remote control switch remains energized while the star remote control switch is disabled; this phase lasts for a fixed time of 20msec. (on display appears "**VACUUM**")

-Compressor operational start-up: the line relay is maintained active and also the delta relay is activated; this phase lasts for the time set in the parameter "**Load delay**". (on display appears "**VACUUM**")

-Compressor load phase : the load solenoid valve relay is energized. This phase lasts as long as the pressure measured reaches the value set in the parameter "**Vacuum pressure**". (on display appears "**LOAD**")

-Compressor vacuum phase: the load solenoid valve relay is deactivated; this phase lasts as long as set in the parameter "**Vacuum time**". After this, the cycle re-starts from the **Start-up stand-by** phase (on display appears "**VACUUM**")

Stoppage procedure:

Press the STOP button (O) to activate the shutdown procedure. The load solenoid valve is deactivated and the vacuum cycle starts for a period of time set in the parameter "**Shutdown time**" (on display appears "**VACUUM**" followed by "**STATE-OFF**")

Remote Pressure

Enable the remote pressure control via the parameter "Enable remote" to activate the digital input of remote pressure. In this configuration, the controller will monitor the remote input as external pressure switch, and also controls that it acts within the set range (set load, set vacuum). If the pressure set is exceeded due to remote pressure control failure, the controller will take over the control of the cycle of the compressor operating with the internal values set, thus generating the alarm "**Remote press. failure**".

If the anomaly is solved and the remote pressure control is triggered before the controller vacuum set, the pressure control is taken over by the remote pressure input, (at this point the alarm can be reset).

ON/OFF remote

Using the "remote ON/OFF" input, the compressor can be activated remotely, by pressing the Start (I) key. If no alarms are on, the remote control is enabled. The remote command has less priority over the Start (I) and Stop (O) keys on the panel.

Compressor Functioning with an Inverter

Start-up procedure:

Press the START (I) button. If no alarms are on, the start-up cycle activates:

- Start-up stand-by:** the controller waits for the following conditions to be met until starting the compressor:
 - If the machine was switched off or a previous stoppage was executed, the control unit waits 15 seconds before starting the compressor.
 - The controller waits for the pressure to drop below the set value in the parameter "**Oper.Press. - Operation Delta/2**" before starting the compressor.
(on display appears "**STAND-BY**")
- **Compressor start-up:** the line remote control switch is powered
- Compressor operational start-up:** the line relay is maintained active and also the delta relay is activated; this phase lasts for the time set in the parameter "**Load delay**". (on display appears "**VACUUM**")
 - Compressor load phase :** the load solenoid valve relay is energized. This phase lasts as long as the pressure measured reaches the value set in the parameter "**Oper. Press. +Operation Delta/2**". (on display appears "**LOAD**")
- Compressor vacuum phase:** the load solenoid valve relay is deactivated; this phase lasts as long as set in the parameter "**Vacuum time**". After this, the cycle re-starts from the **Start-up stand-by** phase (on display appears "**VACUUM**").

In this phase, the control unit executes a control algorithm to keep the pressure as close as possible to the working pressure by adapting the speed of the motor based on air consumption.

Dryer Functioning

For machines supplied with a dryer, the control unit can control the drying cycle.

Using the "Dryer ON" parameter, if its functioning is enabled, which can be continuous or linked to compressor motor functioning, by setting the parameter "Functioning mode".

The dryer motor is activated if the temperature is over the total of the temperatures defined in the parameters "Temperature OFF" and "Thermal drift" and deactivated if lower than the parameter "Temperature OFF".

If the temperature remains outside the aforementioned limits for a time over that set in the parameter "Alarms delay", an alarm is triggered (see the section ALARMS and WARNINGS)

To avoid damaging the motor due to over-frequent start-ups you can moderate re-starts for the time defined in the parameter "Minimum time". (for further details see DRYER MENU section).

Condensate Drainage Functioning

For machines requiring the condensate drainage function using the parameter "Condensate drainage ON", the function can be enabled and defined by setting the parameter "Functioning mode".

The drainage solenoid valve stays on for the time set in the "Interval" parameter and remains deactivated for the time defined in the parameter "Opening time" (see the CONDENSATE DRAINAGE MENU paragraph).

Compressor Rotation

The rotation of the compressors can be carried out between maximum 4 compressors, this rotation takes place without the need for a MASTER control unit while each compressor has its own ID; this allows you to perform the rotation of the compressor, even if one of them has problems or is turned off, in this case, the rotation is done anyway with the remaining compressors. Once the operation is enabled, the ID is entered and the rotation time is set, the system works as follows. The first time the tank is empty; all compressors start until reaching the set vacuum pressure and then, on the basis of the value of load pressure set, starts first the compressor with the

highest load set. When the rotation time set elapses, the controller changes its vacuum and load pressures to the first ID available.

Example of 3 coupled compressors:

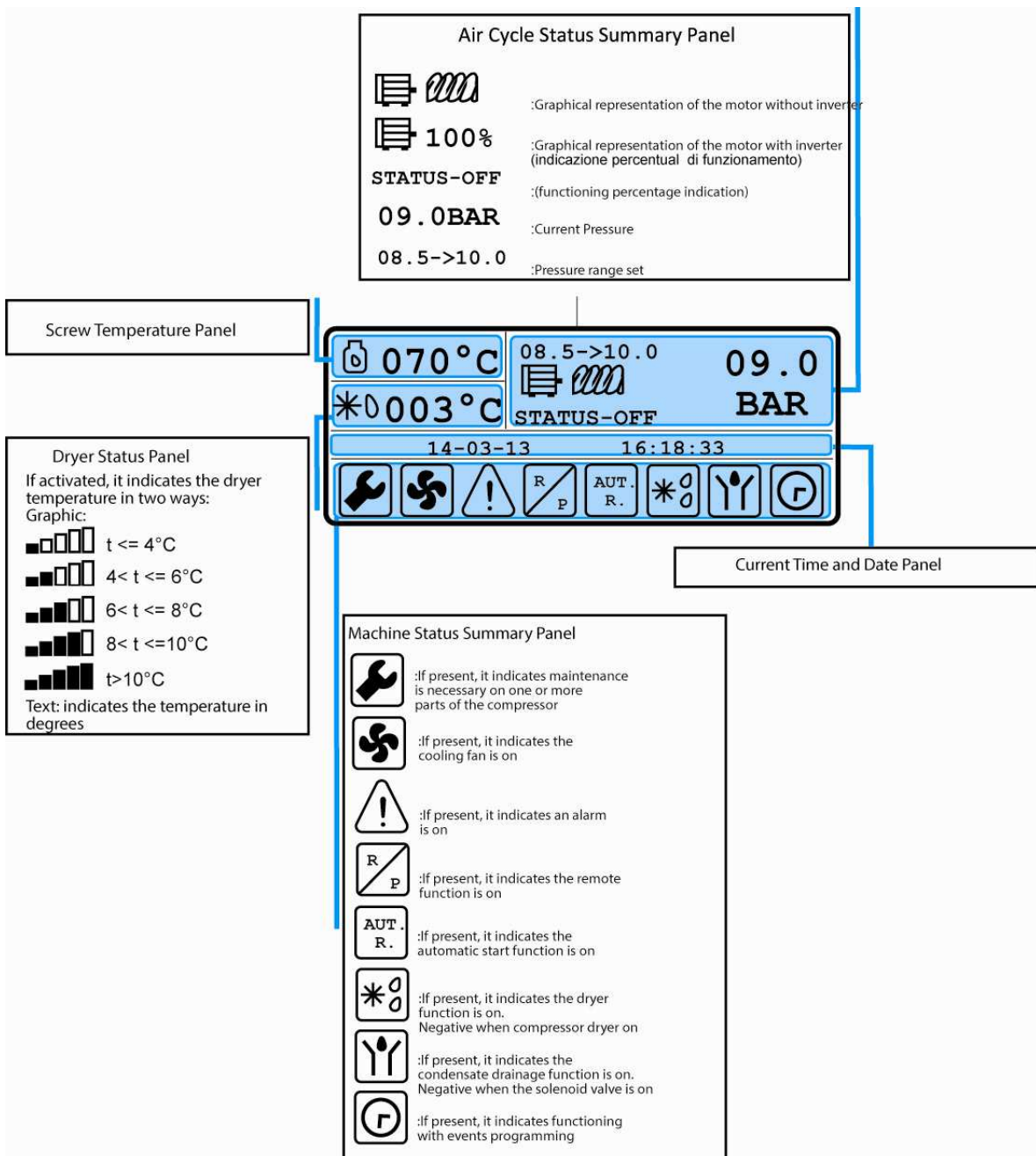
When the rotation time set elapses, the compressor with ID01 switches its set pressures to the compressor with ID02; the latter switches its set pressures to the compressor with ID03, and the compressor ID03 switches its set pressures to the compressor with ID01 and closes the cycle.

Each time the pressures are switched, the hour meter of the previous compressor is reset.

NOTE: The system works only with ON/OFF type compressor, not with inverter.

Main Screen

The main screen summarises the current status of the machine



Current Air Cycle Status (1):

- a) STAND-BY: state active but with the motor turned off.
 - b) STATE-OFF: the motor is OFF and the load solenoid valve is disabled.
 - c) VACUUM: the motor is on but the load solenoid valve is disabled.
 - d) LOAD: the motor is on and the load solenoid valve is enabled.
 - e) REMOTE-OFF: Remote program enabled in stand-by for the start-up remote command.
- TIME-OFF: Start-up program enabled, in stand-by for start time.

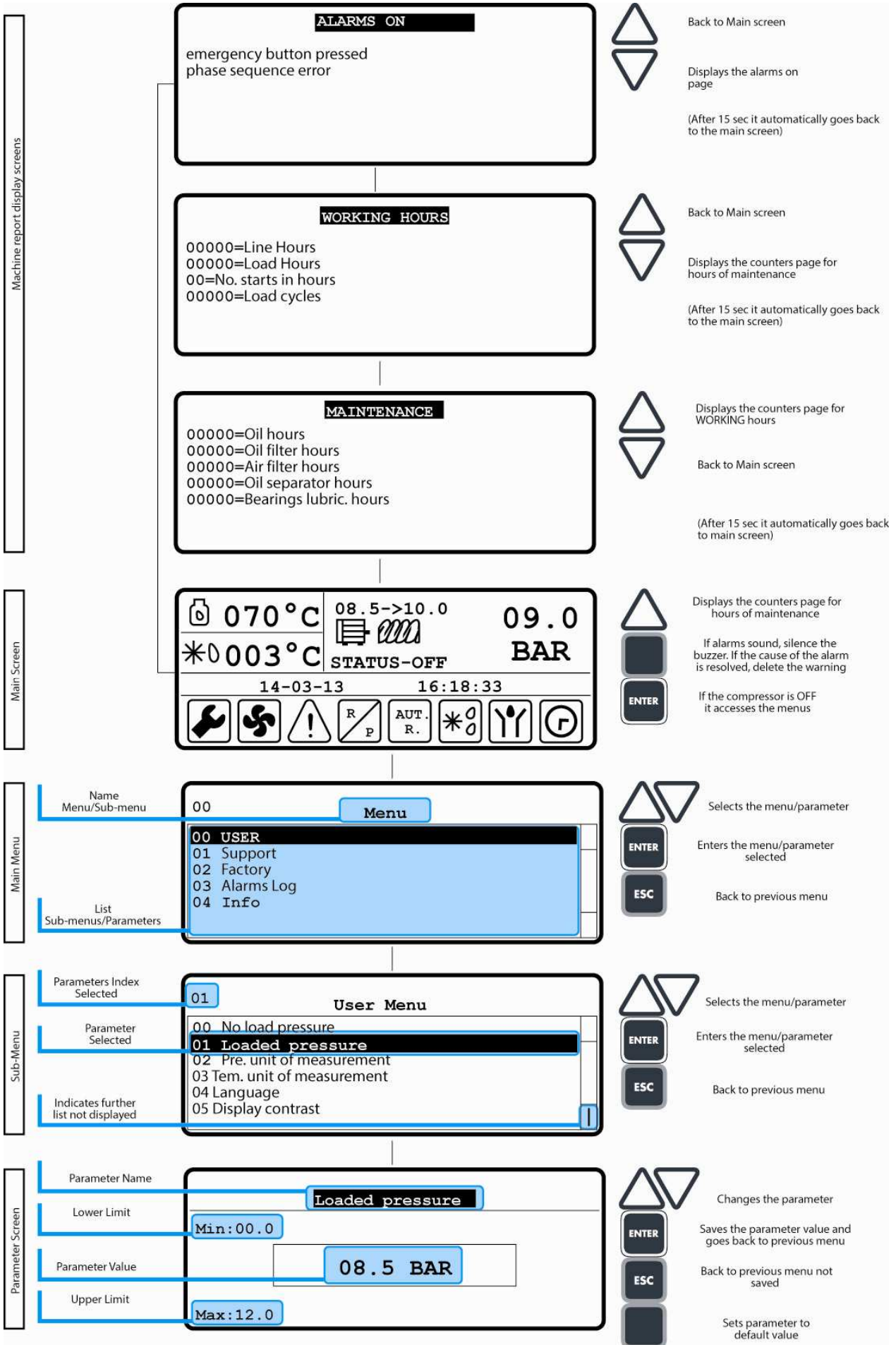
Menus and Parameters

The menus are structured as vertical drop-down menus; the title is on top and is followed by the list of parameters or sub-menus available. If the menu contains more items than the LCD display can show, two arrows (Up and Down) appear on the right to indicate that more items are present?

Use the "Arrow up" and "Arrow down" keys to find the parameter or sub-menu and highlight it to then open it by pressing the "Enter" key; go back by pressing the "Esc" key.

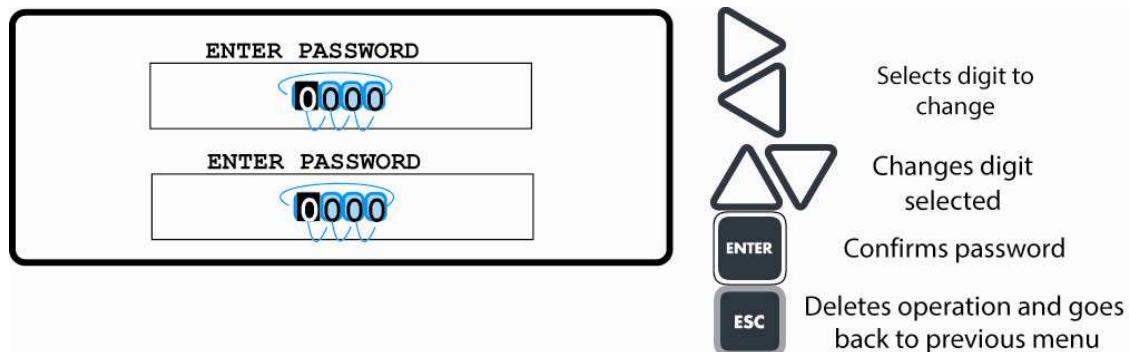
If you go to a parameter screen you can change its value using the "Arrow up" and "Arrow down" keys or you can make this value the default value using the "Reset" key. By pressing the "Enter" key, you exit the menu, saving the parameter value. Press the "Esc" key to return to the previous menu only.

Some menus contain exceptions in relation to parameter entries, which will be dealt with individually in the following paragraphs.



Password

Certain menus are password protected. A password is requested if you try to access the reserved areas. Removal of menu protection persists until you go back to the main screen.



Main Menu

User: Menu containing the User parameters (see USER MENU paragraph).

Customer service: Menu containing the Support parameters (see SUPPORT MENU paragraph). Password protected **2954**.

Factory: Menu containing the Factory parameters (see FACTORY MENU paragraph). Password protected

Alarms Log: List of last 50 alarms. Press "ENTER" on the alarm displayed to view the date, the time, the pressure and the temperature of oil at the moment in which the alarm was triggered. You can delete the entire alarm log by holding down the "RESET" button; to complete the operation successfully you must enter the factory password.

Info: The system displays information regarding the version of the software, the type of machine and the info email.

User Menu

No load pressure: It defines the pressure at which the compressor should stop; the maximum settable value is defined in the parameter "Maximum pressure" in the factory menu.

Load pressure: It defines the residual pressure required to restart the compressor; maximum value settable blocked at 0.1 bar below the value set in the parameter "No load pressure".

Pre. unit of measurement: Defines the pressure unit of measurement.

Tem. unit of measurement: Defines the temperature unit of measurement.

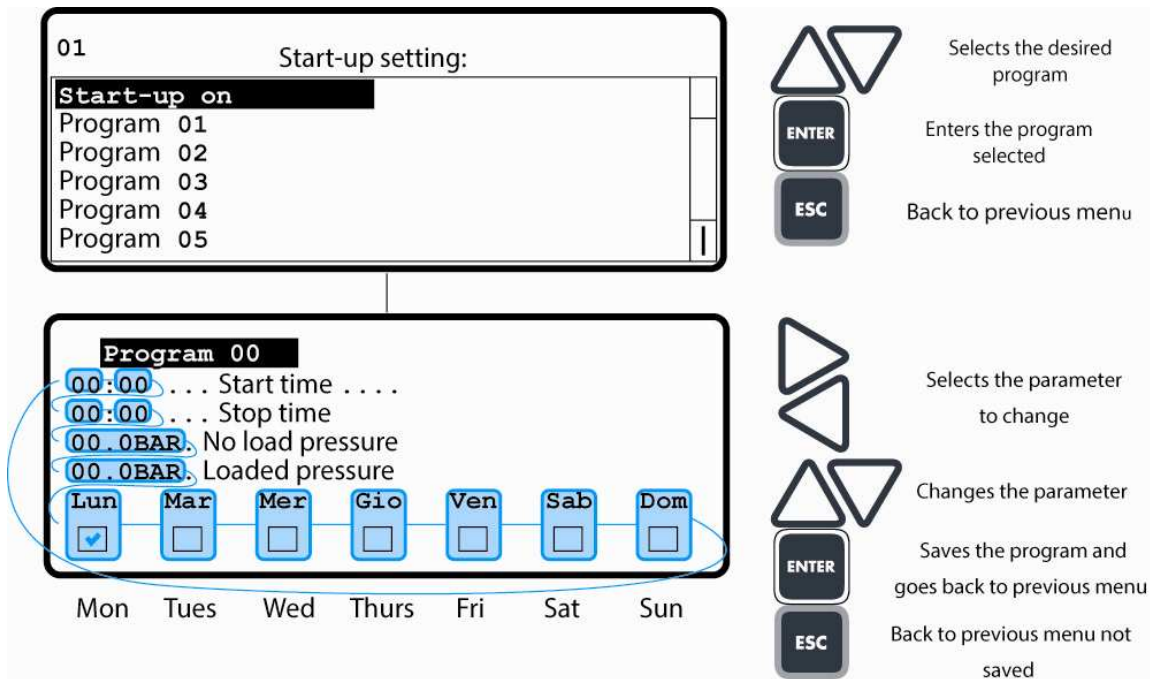
Language: Set the menu language.

Display contrast: Defines the LCD display contrast.

Display lighting: Defines the LCD display backlit brightness.

Time/Date setting: Sets the date and time. Data is entered according to specific steps; the system prompts the user to enter/confirm the year, the month, the day, the hours, the minutes and the seconds. Once the entire procedure is completed, the parameters will be saved.

Start-up setting: Sub-menu where you can define 10 programs (0-9) per week for compressor start-up and stoppage. The settable parameters are the start time, stoppage time, no load pressure, loaded pressure and the day of the week.



Support Menu

Oil hours: Indicates the number of hours left before having to change the oil; the parameter can have negative values to avoid performing any maintenance on the relative parameter. The value can be changed.

Oil filter hours: Indicates the number of hours left before having to change the oil filter; the parameter can have negative values to avoid performing any maintenance on the relative parameter. The value can be changed.

Air filter hours: Indicates the number of hours left before having to change the air filter; the parameter can have negative values to avoid performing any maintenance on the relative parameter. The value can be changed.

Oil separator hours: Indicates the number of hours left before having to change the oil separator filter; the parameter can have negative values to avoid performing any maintenance on the relative parameter. The value can be changed.

Bearings lubric. hours: Indicates the hours remaining before the main electric motor bearing needs to be lubricated; the parameter can have negative values to avoid performing any maintenance on the relative parameter. The value can be changed.

Fan temperature: Defines the working temperature of the cooling fan. The threshold set has a hysteresis that can be changed by 10°C, the value can be changed. If the operating temperature is set at 80°C, the fan will activate at 80°C and stop at 70°C (screw unit supply temperature).

No load time: Defines the motor stoppage time from the moment the load solenoid valve was deactivated because the desired pressure was reached.

Stop time: Defines the delay of compressor shutdown from the moment in which stop is requested via the key START/STOP. The solenoid valve is turned off immediately.

Automatic Start: If the compressor is on, it starts automatically after a power outage. The first start should be activated by pressing the START (I) key on the panel.

Max start-up hours: Defines the maximum number of start-ups of the main electric motor within the arc of one hour. If surpassed, the compressor will stay on (loaded or with no load depending on the pressure) until the hour is up as calculated from first start-up and then returning to normal functioning. If set to zero, this function is disabled.

Remote enabling: Remote command enabling.

Fan extra time: It defines the time within which the fan remains active after the temperature returns within the safety limits.

Load SV cycles: Indicates how many times the compressor was passed during the load phase; this parameter can be changed.

Fan temperature hysteresis: Defines the delta temperature within which the main cooling fan must work.

Screw oil days: It is a meter set by default to 30 days; if the compressor has never run a load cycle within this time, the alarm "SCREW OIL" is triggered and blocks the compressor; the alarm can be reset via the RESET button.

The parameter can be set to 0 days to disable the hour meter.

Diagnosis: Using the diagnostic menu, you can control the various inputs and outputs of the control unit:

Input: the status of 9 digital inputs can be controlled

Output: using the right and left keys, you can move on the relay output you want to command, while using the up and down buttons to activate the output

AN1: Indicates pressure in bar with centesimal precision

AN2: Indicates the temperature in °C Screw probe

AN3: Indicates the temperature in °C Dryer probe

INV: Indicates the inverter output automatically switches 4-20mA

Keeping the **key I** pressed, you can run a motor start-up test.

Pressing the **key O**, you can upload the default parameters (there are 32 sets of parameters present, factory password is requested).

Press **RESET** to calibrate the pressure transducer (the Factory password is required)

Output configuration: Sub-menu that allows you to associate the outputs CN4-8 and CN4-9 with a function, choosing from: "Pre-alarm", "Control ON", "Compressor ON", "Motor running" and "Compress. No Load/Loaded".

The diagram illustrates the 'Output Configuration' menu with two examples of settings for CN4-8 and CN4-9. The first example shows 'Emergency pressed' for CN4-8 and 'Control ON' for CN4-9. The second example shows 'Motor running' for CN4-8 and 'Control ON' for CN4-9. To the right of each menu view, navigation instructions are provided: a right arrow to select the output to change, left and right arrows to change configuration, an ENTER button to save and return to the previous menu, and an ESC button to return to the previous menu without saving.

Compressor rotation control: Submenu for multiband compressor operation setup and activation (see COMPRESSOR ROTATION CONTROL).

Drier: Sub-menu for dryer configuration (see DRYER MENU paragraph).

Condensate drain: Sub-menu for dryer configuration (see CONDENSATE DRAIN MENU paragraph).

Inverter: Sub-menu for inverter configuration (see INVERTER MENU paragraph).

Cust. service Password change: Submenu that enables the user to change the Customer service password; the system prompts you to enter the new code twice.

Dryer Menu

Dryer ON: Dryer Enabling.

Minimum time: Defines the minimum maintenance time of the deactivated dryer. It serves to protect the dryer compressor from over-frequent start-ups.

Temperature OFF: Defines the value of the temperature at which the dryer compressor is deactivated.

Temp. differential: Defines the positive differential between the OFF temperature and the re-activation temperature.

Temperature offset: Defines the difference between the temperature measured and the temperature displayed.

Manual mode: Defines the functioning mode of the dryer:

Automatic: the compressor starts and stops based on the main motor of the compressor functioning.

Continuous: the dryer starts as soon as the compressor is switched on and will only stop when it is switched off.

Alarm delay: Defines the delay with which the dryer alarms are displayed.

Type of alarm: Defines the effects of the alarm on the compressor:

Alarm : blocks the compressor.

Warning: warning without blocking the compressor.

Extra run: Defines the time in which the dryer must continue to work, also after the compressor motor has stopped, if the functioning mode is set to automatic.

Dryer filters hours: Indicates the number of hours left before having to change the filters; the parameter can have negative values to avoid performing any maintenance on the relative parameter. The value can be changed.

Condensate Drainage Menu

Condensate drain on: Condensate drain enabling.

Period: Defines the time in which the condensate drainage solenoid valve remains closed.

Opening time: Defines the time in which the condensate drainage solenoid valve must stay open.

Manual mode: Defines the functioning mode of condensate drain:

Automatic: condensate drain is activated only when the compressor is on and in load mode.

Continuous: condensate drain is always on.

Compressor rotation Menu

Enable rotation: Enable compressor rotation

Id: Defines the identification number of the compressor from 1 to 4

Rotation hours: Parameter used to set the hours of rotation; these hours are calculated based on the hours of compressor line

in which rotation must take place.

This parameter indicates the time elapsed after which the compressor passes the set pressures to the next compressor.

In the WORKING HOURS display menu is present the HOURS OF ROTATION meter that shows the number of hours

from the last rotation.

Enable Inverter:

Inverter enabling. % Min functioning:

% Min operation: Defines the minimum percentage of operation of the inverter; the maximum is always 100%

Inverter Integral: Defines the integral part on the PID calculation of the inverter percentage.

Inverter Proportional: Defines the proportional part on the PID calculation of the inverter percentage.

Inverter Differential: Defines the differential part on the PID calculation of the inverter percentage.

Pressure at 100%: the pressure at which the inverter can work up to 100%

Minimum % pressure: the pressure at which the inverter must work at the % Min functioning percentage set.

Alarms and Reports

All alarms triggered are displayed on the home page in the "Alarms and Warnings Field", in "Machinery State Summary Report" (see the Home Page section) and acoustically by a buzzer.

The sound alarm can be silenced immediately by pressing the "RESET" key, while the alarm indication on the LCD display will disappear only if the cause that generated it was cancelled.

The last 100 alarms can be found in the "Alarm log" (see Main menu paragraph) where you can check their chronological order, the pressure and temperature in the instant in which they occurred.

The possible alarms are as follows:

Alarm! Minimum temp.: Having reached the oil minimum temperature, the alarm BLOCKS the compressor. To restart the compressor, you need to wait for the temperature to go below the programmed value.

Alarm! Maximum temp.: Having reached the oil maximum temperature, the alarm BLOCKS the compressor. To re-start the compressor, you need to wait for the temperature to go below the programmed value.

Warning! Pre-alarm temp.: Having reached the oil pre-alarm temperature, the alarm DOES NOT BLOCK the compressor.

Alarm! Temp. sen. faulty: When an anomaly occurs on the oil temperature sensor (sensor short-circuits or open), the alarm BLOCKS the compressor. To restart the compressor, you need to replace the probe.

Alarm! Motor thermal switch: When the main motor thermal switch activates, the alarm BLOCKS the compressor. To restart the compressor, wait for the motor to cool down.

Alarm! Fan thermal switch: When the fan thermal switch activates, the alarm BLOCKS the compressor. To restart the compressor, wait for the fan to cool down.

Alarm! Max. press. alarm: Having reached the maximum permitted pressure, the alarm BLOCKS the compressor. To re-start the compressor, you have to bring pressure under the maximum pressure programmed.

Alarm! Press. sen. faulty: When a pressure sensor anomaly occurs (sensor broken or disconnected), the alarm BLOCKS the compressor. To restart the compressor, you need to reset the probe.

Alarm! Rotation direction err.: When a wrong sequence of the main motor phases occurs, the alarm BLOCKS the compressor. To restart, you need to check the phases sequence is right.

Alarm! Emergency pressed: Having pressed the emergency button, the alarm BLOCKS the compressor. To restart, you need to reset the emergency button.

Alarm! Air filter: When an air filter anomaly occurs, the alarm BLOCKS the compressor.

Alarm! Oil separator filter: When an oil separator filter anomaly occurs, the alarm BLOCKS the compressor.

Alarm! Inverter faulty: When an inverter anomaly occurs, the alarm BLOCKS the compressor. To restart the compressor, you need to reset the inverter.

(NOTE: there is an alarm only if the inverter is enabled)

Warning! Remote press. alarm: When the remote command and the loaded/no load pressures set on the control unit are inconsistent, the alarm DOES NOT BLOCK the compressor. The compressor continues to work with the pressures programmed on the control unit. The alarm stops only when the remote command starts working correctly again.

(NOTE: there is an alarm only if remote is enabled)

Warning! High dew point: The dryer temperature remains over the total of the temperatures defined in the parameters "Temperature OFF" and Temperature Differential "" +20° C for the time defined in the parameter "Alarms delay".

(NOTE: there is an alarm only if the dryer is enabled)

Alarm! Ice alarm: The dryer temperature is below the value set in the "Temperature OFF" parameter, for a time set in the "Alarm Delay" parameter

(NOTA: there is an alarm only if the dryer is enabled)

Alarm! Dryer sen. faulty: When an anomaly occurs on the dryer temperature sensor (sensor short-circuited or open), if the parameter "Alarm type" is set as the "alarm"(see Dryer menu paragraph), the alarm BLOCKS the compressor, otherwise the compressor continues to work. To restart the compressor, you need to replace the probe.

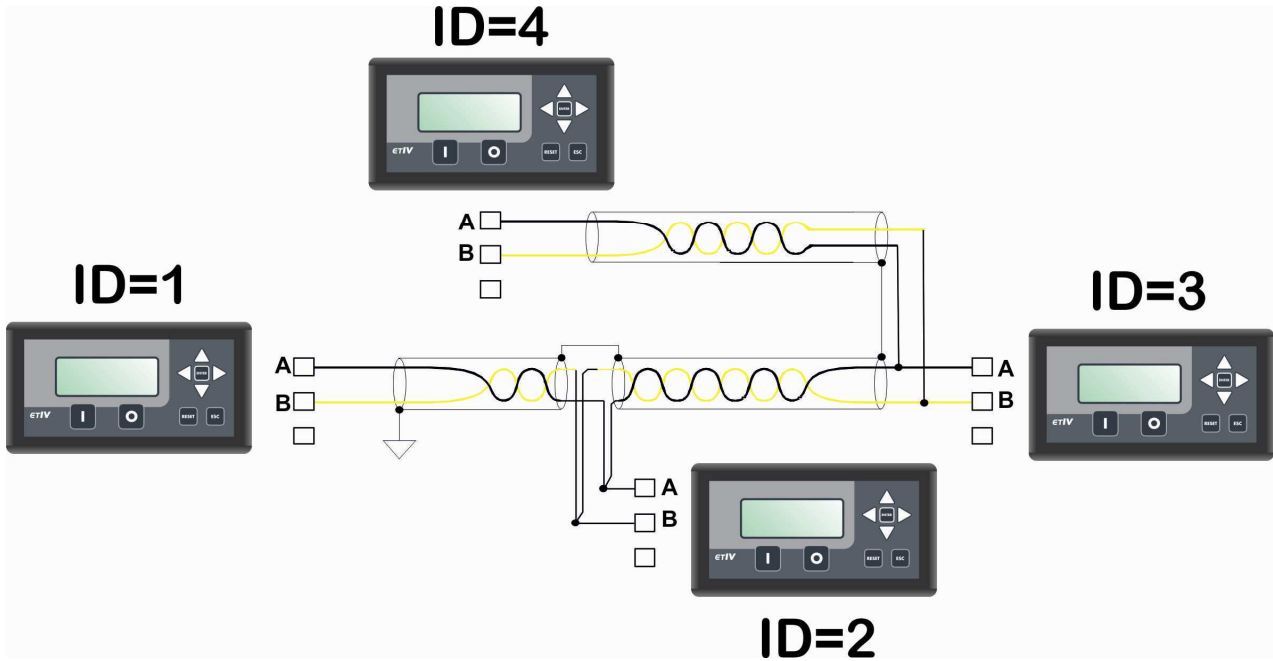
(NOTE: there is an alarm only if the dryer is enabled)

RS485 connection for multiband compressor

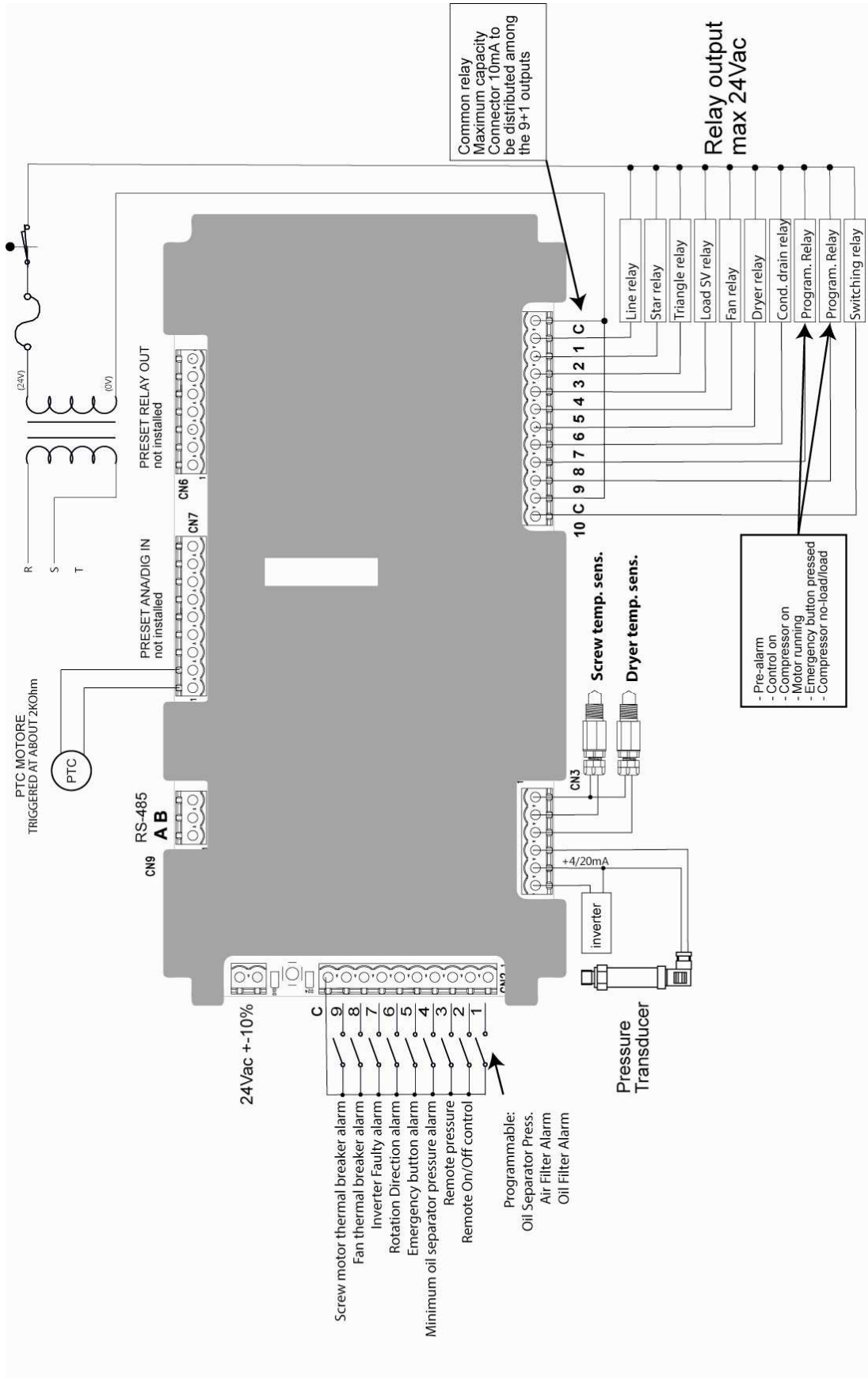
Communication distance before the first and the last device must not exceed 1200 metres.

The RS485 output can connect up to 4 controllers

We advise you to use a shielded twisted-pair cable. To avoid close loops, the shield should be connected to a single point within the entire network, as shown in the figure.



Wiring diagram



R 0

N	DESCRIZIONE MODIFICA	DESCRIPTION OF MODIFICATION	Data/Date
0	Creazione (tutte le pagine)	<i>Created on (all pages)</i>	27/08/2015

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