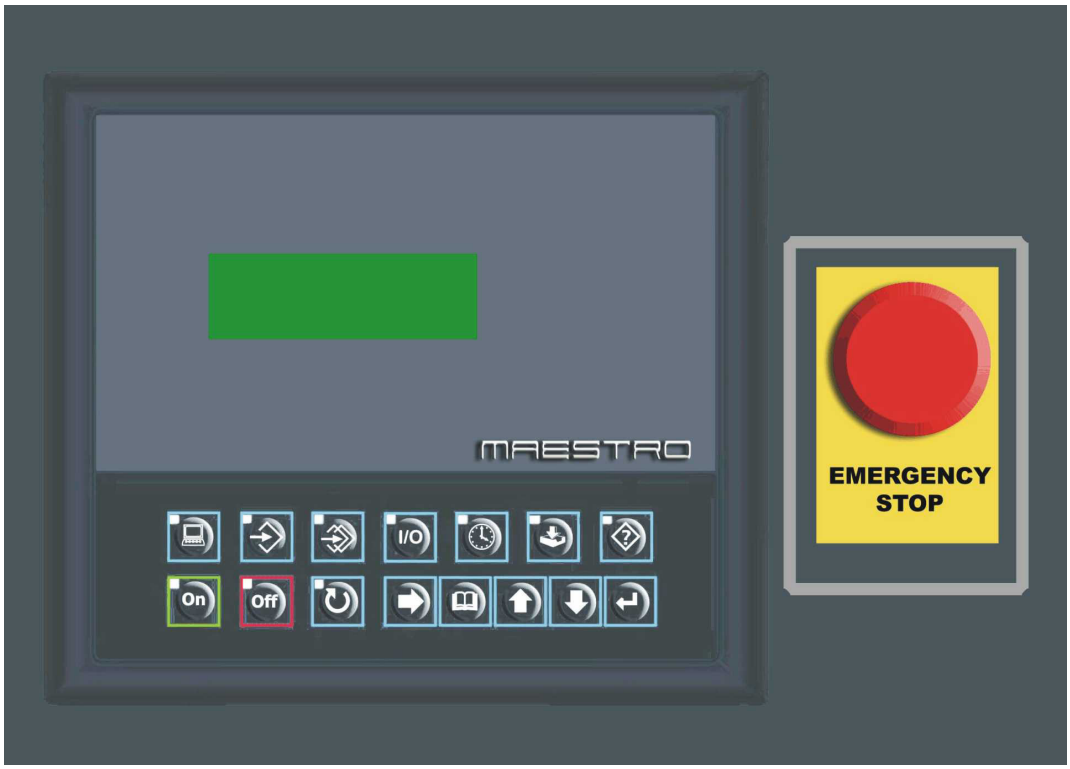
AIR COMPRESSORS



MAESTRO

USER'S MANUAL

TIP00G-105

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Product Code:
Hardware: AC40F34300 Video display
AC40F34081 Acquisition Card
Software: TSS2-X0204

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Maestro is a programmable control device of the compressor that can adapt its operation to the specific requirements of the air network it is connected to. It provides several levels of programming, special systems for checking/analysing both operation and failures. The advanced levels of programming and analysis are protected by digital codes so as to prevent any possible unintentional tampering. The Maestro**'s** memory saves the settings made and the operational data over a period of time even if the compressor is not connected to the mains supply or in case of voltage drops. Setting a weekly start/stop schedule is possible combined with the connection management of other compressors so as to keep any multiple installations under control as efficiently as possible.

INTRODUCTION

The controller family called "Maestro" is made up of

- Maestro Base
- Maestro

The selection of the type used strictly relates to the compressor family the controller should be installed.
In fact, the Basic version manages a lower number of probes and functions than the complete version.
The two versions have the same hardware device. A specific selector inside the video monitor activates the various functions.

In general, "Maestro" is a control device with two separate and distinct units:

- ❑ Monitor: it interfaces with the user. The compressor management operating program is located in the monitor.
- ❑ Acquisition and Control Card: it acquires data and controls the devices regulating the compressor

The Display

It shows the machine operation status such as pressures and temperatures, etc. It also displays any failure that might cause the machine to malfunction.

The Keyboard

It allows the user to interact with the compressor while permitting its activation and programming. The keyboard is divided into two separate sections, i.e.:

- Rapid Menu Access Keys
- Control and Function Keys

Menu Access Keys

They allow rapid access to the required menus during configuration. A short description of their functions follows.

Monitor Menu
It displays pressure values, operating temperatures, and operation hours of the compressor.

Basic Programming Menu
The user can set the basic parameters for the compressor operation.

Advanced Programming Menu
It permits configuration of the advanced operation parameters.
Access is password-protected

Check Menu
Menu to be used only by the Technical Service. It allows the machine operation to be checked.

Clock Menu
Maestro is provided with a clock that enables turning on/off the compressor at preset times.

Event Menu
It allows access to the saved data regarding the alarms given during the compressor operation. In this way, identification of the reason for failure is possible. As many as 20 events can be stored.

Menu for Configuration Restoring
It enables some parameters to be returned to the menus accessible to the original configuration.
Furthermore, the Mattei staff can clear the historical archive.

Information Menu
The installed software version is installed as well as some general information.
Accessing the time band-programming menu is possible.

Control and Function Keys

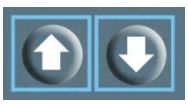
They provide control and changes in the programming mode. A short description of their functions is here below:

ON button
It activates the compressor operation.

OFF button
It deactivates the compressor operation.

Reset button
If pressed once, it shows the failure source.
If pressed twice, it clears the alarm.

Tabulation button
It allows the cursor to be moved when modifying the clock parameters as well when programming the time band.



UP and DOWN buttons
They allow surfing within the entries of the different menus and either increase or decrease values during configurations.

ENTER button
It opens and closes the memory during programming.

Mattei rotary compressors are set at the factory to deliver compressed air at the nominal pressure setting. There are three separate operation modes:

- Continuous mode,
- Automatic mode,
- Modulation mode.

To these modes, the OPTIMA can be added if an inverter has been installed in the machine.

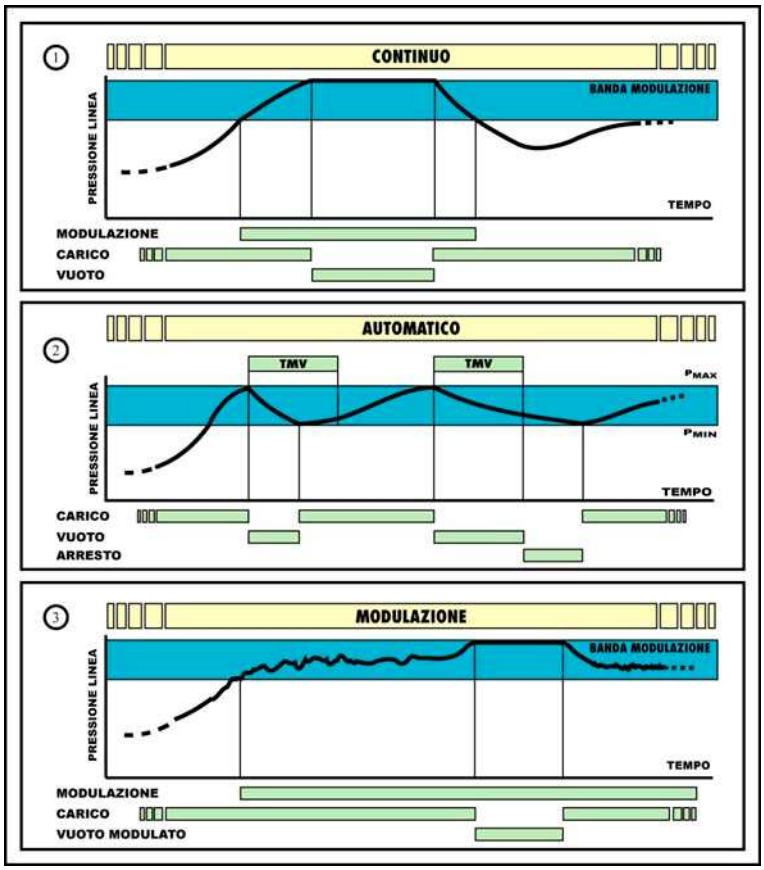


Diagram 10

Diagram 10 describes the said modes in graph form that are the same both in the “Maestro” and the “Maestro Base” configurations, while that which changes is the pressure check. This check is done with a probe if a “Maestro” controller is installed and a pressure switch in the case of the “Maestro Base” controller.

CONTINUOUS Mode

When this mode is activated, the compressor delivers air to a well-defined pressure band. The maximum and minimum values are preset at optimal levels by Mattei although they can be customised as required using the programming functions available in the menu [BASIC PROGRAMM.]). Should pressure reach the maximum value (P_{max}), then the compressor is put into idle operation with the suction valve closed and decompressed to reduce the electrical input. As soon as a request for air from the net lowers the pressure value to the minimum (P_{min}), the compressor is reloaded and starts delivering air again. The compressor can then be stopped at any moment by pushing the stop button. The stop procedure includes an idling stage of a preset time during which the compressor is decompressed.

AUTOMATIC Mode

A further function to the preceding one is added to this mode. When the request for air is low or nil, the compressor can be stopped automatically. The cycle is as follows. When the online pressure reaches the P_{max} value, the compressor is "set to idle"; two things can happen:

1. If there is no request for air, it idles for a certain TMV period (Time of Idling), and stops when this time expires. It will start again as soon as the line pressure lowers to the P_{min} value;

2. If, on the other hand, the line pressure lowers to the P_{min} value before the TMV time has elapsed, the compressor is "reloaded".

A characteristic typical to MATTEI rotary compressors can be added to the above operation modes, i.e. the MODULATION mode.
In fact, when duly regulating the "servo valve" of the compressor, the compressor can be made to start moduling before reaching the P_{max} value.

MODULATION Mode

All MATTEI compressors have their own automatic pressure regulation system according to the delivery pressure. The compressor inside pressure (partly) depends on the line pressure, and, as a consequence, on the air request, when this lowers or is missing, both the line and the inside pressure rise. The maximum pressure value at which the compressor idle time operates can be set on Mattei rotating equipment (by setting a specific valve). For values slightly lower than the maximum one, the suction valve is only "partially" closed, by modulating the machine capacity on the line requirements. The maximum pressure and the slightly higher values define either a range or a band that is called MODULATION BAND.
The modulation exploits this capacity as Maestro ignores the Pmax and Pmin set values by operating the compressor uninterruptedly unless stopped by the operator.

NOTE:

The modulation band amplitude is typically 0,3 bar. Let us assume, for example, that the maximum idling pressure be set at 7.3 bar (by means of the SERVOVALVE): this means that for any pressure value lower than 7 bar (7.3 - 0.3 = 7), the compressor delivers 100% of its capacity. For those values ranging between 7 and 7.3 bar (i.e. the values representing the modulation band) the compressor delivers a capacity lower than the nominal one and adequate to the one requested by the line.

OPTIMA mode

Maestro can control an inverter that, being connected to the compressor motor, allows for its operation at variable speeds. As a result, the free air delivery of the compressor may vary according to the rotational speed of the electric motor.
The management mode is based on reaching and maintaining a pressure within a pressure band identified by P_{min} and P_{max}.

Control logic

The inverter (frequency converter) is an electronic device capable of modulating the voltage and frequency of the compressor mains supply.
According to MAESTRO commands and the parameters set by the user, the inverter drives the motor, consequently changing the rotational speed.

As a result of this and through monitoring of the line pressure, the compressor free air delivery can change according to the speed of the electric motor.
The management mode is based on reaching and maintaining a pressure within a pressure band identified by P_{min}

Operation

Like for all standard compressors the user sets the **P_{min}** and **P_{max}** values (the minimum difference between the two cannot be lower than 0,1 bar) thus defining the required pressures interval.

MAESTRO automatically calculates the maximum speed value associated with the **P_{max}** value set (the minimum speed value is set by the manufacturer and it cannot be changed).
During operation, according to the line pressure value, MAESTRO varies the working speed on a variable number of steps, by adjusting the air delivery to the real needs

	NOTE: OPTIMA is originally set for the INVERTER mode (see sect. 5, sect. 6.04, selection MAESTRO 1.1.03, and MAESTRO manual supplied along with these instructions)

During starting the compressor accelerates until reaching the **$P >= P_{max}$** condition as quickly as possible.
The pressure starts increasing. When **$P < P_{max}$**, meaning that the air production is higher than the actual need, the rotational speed of the motor decreases thus reducing the free air delivery instantaneously and reducing the energy consumption at the same time.

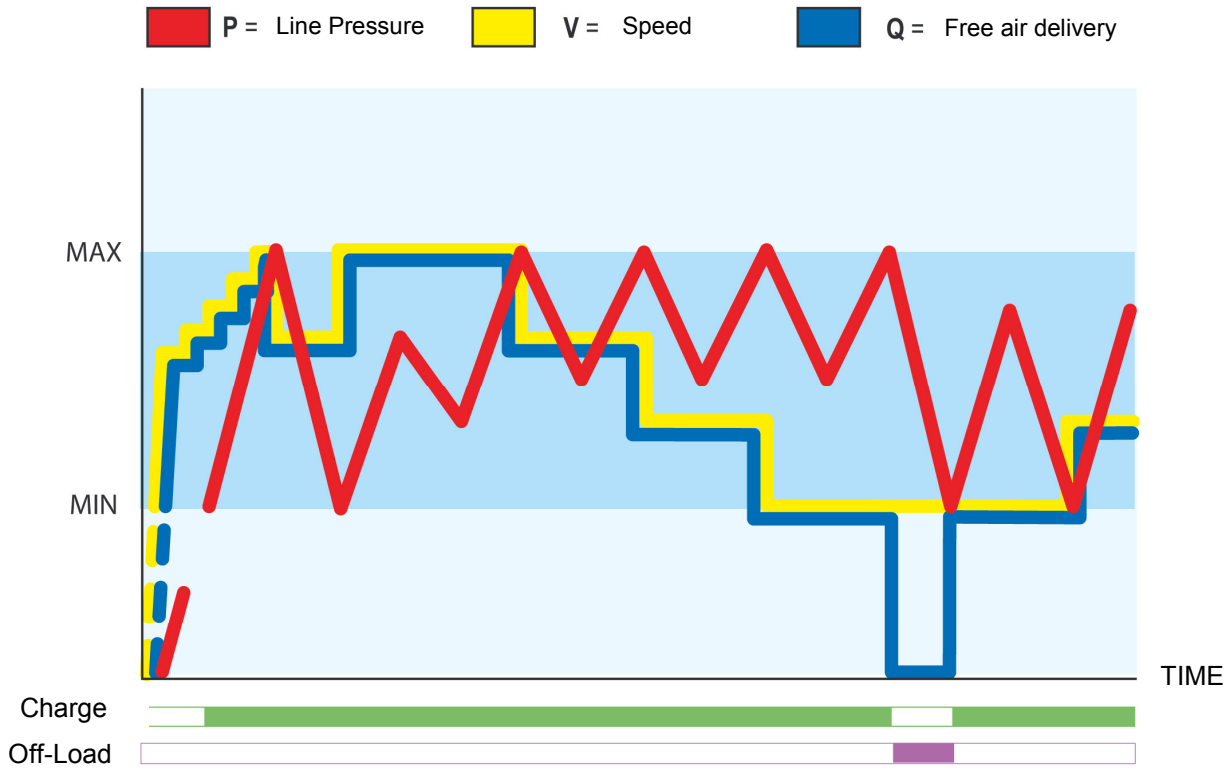
The speed decreases progressively as long as the **$P > P_{max}$**. condition is stable.

In case the pressure continues to rise even if the minimum speed has been reached, the compressor goes off-load to further reduce the energy consumption.
At the same time the timer **TMV** (Off-Load Time) is activated.

Once the time set has elapsed (and in case the oil temperature exceeds the preset value, a condition required to avoid condensates (see sect. 5.11, parameter 2.4.04) the compressor stops.
Following the compressor stopping (or off-load) the line pressure starts decreasing.

Once the **$P < P_{min}$**, condition has been reached OPTIMA goes back to load (or it starts again in case the limit time for **TMV** has elapsed) and starts increasing its rotational speed so as to operate again within the range of preset pressures.
When the line pressure measured is between **P_{min}** and **P_{max}** the rotational speed of the compressor keeps constant.
Generally the compressor accelerates when, following an increase of the line air consumption, the **$P < P_{min}$** condition occurs and in the opposite way it decelerates when the **$P > P_{max}$**.condition occurs, following a reduction in the consumption.

If $P < P_{min}$ the compressor is enabled to run with $V = V_{min}$.
The rotational speed will increase up to $V = V_{max}$ until reaching the $P = P_{max}$.condition
When $P = P_{max}$ the inverter reduces the rotational speed so as to adjust the compressor free air delivery to the air demand.



Graph 1

If the line pressure still tends to rise over P_{max}, even in the $V = V_{min}$ condition, the compressor is set off-load ($V_{off\text{-}load}$ = changeable; see Sect. 5.11, parameter 2.4.03).

There are two possibilities :

1. $P > P_{min}$ and $t \geq TMV$: the compressor stops (if $T_{oil} > T_{\text{oil consent to stop}}$ > default = 60°C).
2. $P < P_{min}$ and $t < TMV$: the compressor goes back to load

Note: The condition $T_{oil} > T_{\text{oil consent to stop}}$ has been set so as to avoid that condensate forms in the compressor.
The $T_{\text{oil consent to stop}}$ is set for each kind of machine during the test or, in case of special installation with a different thermal operating conditions than the standard machine.

Thanks to the use of the inverter which reduces the peaks of current circulating through the motor during the starting phases, the **TMV** (off-load time) can substantially be reduced if compared with the value used in the other operating modes.
In any case, to allow a complete exhaust of the pressure in the chamber the interval must not be reduced too much.

	**Note** The minimum limit value for the Off-Load Operation is **TMV ≥ 30 sec.**

	**Note** The reference speeds given by the inverter are expressed in Hertz and any modification must be carried out by trained personnel.

The controller relies on several menus to monitor and program the compressor.
The final user can easily access some of them, while others are protected by a password and are for the sole use of the technical service staff. Changing some of the data residing in these latter menus can cause malfunctioning of the compressor.
The menus are divided into submenus and are identified by numbers with the exception of the [Monitor].

- The first number identifies the reference menu number
- The second number identifies the submenus belonging to the variable.
- The third number identifies the variable inside the belonging submenu.

Attention: The numbering of pages of the menus depends on the functions activated. Below, a complete description of menus is given through which monitoring and controlling the compressor is possible.

Monitor Menu

In this menu, data on the compressor operation are shown such as pressures and temperatures. The various pages displayed are described below.

```
Loc Auto  Stop
====================
Total Hours: 00000h
Line      : 000.0Bar
```

This displays the compressor operating hours and the line pressure of the equipment to which it is connected.
If the controller has been configured as "**Maestro Basic**", the line pressure is not displayed. This display can be accessed only selecting the control mode "**Pressure Probe**" in the [**Basic Programming**] menu.
Note: If no operation is done on the keyboard, this page is automatically displayed after some 60 seconds.

```
Loc Auto  Stop
====================
Separator:000.0Bar
Chamber   :000.0Bar
```

The pressures below are displayed:

- Separator
- Chamber

Note: In the "**Basic Maestro**" mode, this page is not displayed.

```
Loc Auto  Stop
====================
Air Temp.: 000.0°c
Oil Temp.: 000.0°c
```

The temperatures below are displayed:

- Output Air
- Compressor Oil

```
Loc Auto  Stop
====================
Running Hours:00000h
Load Hours: 00000h
```

The Running Hours and the loading hours of the compressor are displayed.
The first ones show how many hours the compressor has actually worked; the second ones show how many hours the compressor has worked under load.

```
Loc Auto  Stop
====================
Start 05/04 14:34:48
Stop  05/04 17:00:00
```

It shows the last start and stop of the compressor.
This page is displayed only if the clock is on the board.

The following pages are displayed only if the operation modes related to them are activated.

```
Loc Opt    Stop
====================
Inv. Speed:    off
```

If the operation mode [Optima] is selected, the page showing the rotation speed of the motor connected to the inverter is displayed. When the machine is not running, the sign "**off**" is shown.

```
Loc Opt    Stop
====================
Inv. Speed: 1100 rpm
 -                   +
```

During operation, the speed as ***rpm*** is shown together with a scrolling band also showing the speed.

```
Loc Auto   Stop
====================
Dew Point Time
             000.0°c
```

If the compressor has a drier, the "Dew Point Time" appears.
If the temperature drops under 0 °C " **> 000.0°C"** is shown.

```
ID: 00000000001
    01234567890
MK: Pss
cd: avc
```

This is active only if the card is configured as "Master". This page does not allow for the displaying of the condition of the compressor net.

Mk	
P	Maestro Master
S	Basic Maestro Base Master
p	Maestro Slave
s	Maestro Base Slave
cd	
A	Alarm
B	Block
T	Time-out
s	Stand-By: Stop
v	Idle
c	Load

A code indicating the condition of the compressors connected is shown under each ID (address) to identify the type and the configuration of the individual controller:

Mk: shows the model and its relevant configuration.
Cd : shows the machine state of the individual compressor within the network.

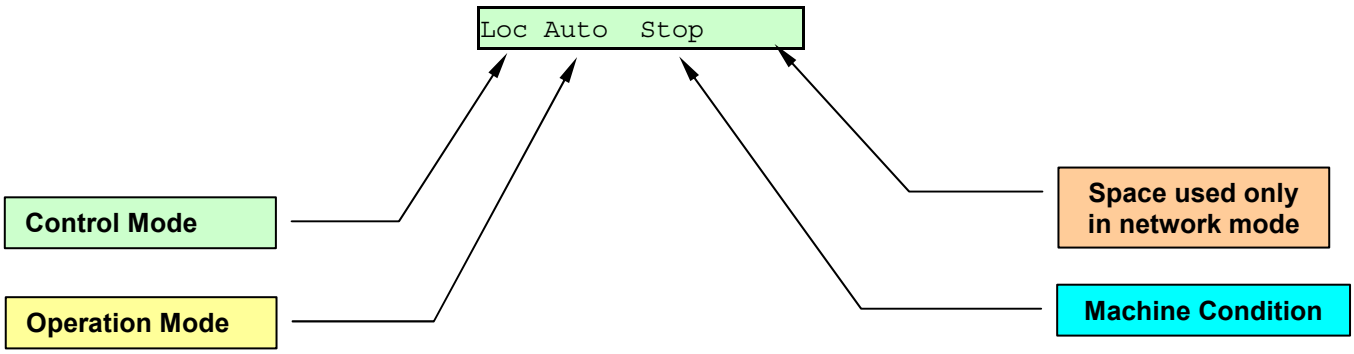
The table sums up all of the displayed indications.

In the example given, the network composed of 3 compressors, 2 of which provided with the "Basic Maestro" controller and 2 with the "Maestro" controller. The first compressor (Master) is in stand-by, the second one idles, and the third one is under load.

```
Loc Auto* Stop
====================
Total Hours: 00000h
Line      : 000.0Bar
```

When the symbol " * " is displayed, it shows that an external condition exists that prevents the compressor from starting.
When the above symbol appears with the compressor running, it does not stop it, but prevents it subsequent start.
This function is active in the complete version only.

In the first line of the preceding pages, the selected operation type is shown as well as the active machine status of the compressor.



The first label indicates the type of control. Based on the selection, the following initials appear:

Loc	Local
Mst	Maestro Master
Slv	Maestro Slave
Pls	Slave of Plus

The second label indicates the type of operation. Based on the selection, the following initials appear:

Auto	Automatic
Cont	Continuous
Mod	Modulation
Opt	Optima

Note: The two labels are linked to the selections made in the "***Basic Programming***" menu.

The third item refers to the machine status. The visible machine status is:

Stop	Machine still and not activated to operation
Stdby	Machine still and enabled waiting to be starter.
Load	Loaded machine running
Idle	Idling Machine
[ALL]	Machine in alarm

Basic Programming Menu

Note
The writing in bold refer to the factory presetting

This menu contains the basic configuration parameters for the compressor operation. Final user can access to these parameters, changing some of them is not possible with the compressor activated. Below is a description of the menu individual entries.

```
1.1>Configuration
1.2 Settings
1.3 Maintenance
1.4 Network
```

The parameters in this menu are subdivided according to the function they carry out.

Configuration

In this area the control procedures of the compressor can be set.

```
1.1.01
====================
Language Selection
   Italian
```

Maestro can interface with 5 languages

- **Italian**
- English
- French
- German
- Spanish

```
1.1.02
====================
Control Mode
   Local
```

It allows for the selection of the compressor control type. The selection options are:

- **Local**
- Master
- Slave Maestro
- Slave Plus

This parameter cannot be modified if the compressor is activated.
If an entry different from “Local” is selected, entries 1.1.03 and 1.1.04 are not displayed.

```
1.1.03
====================
     Automatic
       Mode
```

Maestro can run according to different modes:

- **Automatic**
- Continuous
- Modulation

This parameter cannot be modified if the compressor is activated.
This page is not shown when the inverter is activated for the optima mode in the menu [**Advanced Programming**]

```
1.1.04
====================
Pressure Probe
Pressure Control
```

Maestro can control the compressor by using a pressure probe or by a mechanic pressure switch.
The settings are as follows:

- **Pressure probe** in the Maestro version
- **Pressure Switch** in the Basic Maestro

This parameter cannot be modified if the compressor is activated.
This page is not shown when the inverter is activated for the optima mode in the menu [**Advanced Programming**]

Settings

This menu allows for the setting of operating pressures and scheduling.

```
1.2.01
====================
Maximum Pressure
   007.7Bar
```

This is the maximum pressure value over which line pressure should not rise.
If the entry “pressure control” is set on ***pressure switch***, this indication is not shown.

```
1.2.02
====================
Minimum Pressure
   006.5Bar
```

This is the minimum pressure value under which the line pressure should not go.
If the entry “pressure control” is set on ***pressure switch***, this indication is not shown.

```
1.2.03
====================
Idling Time
   120 Sec
```

This is the operating idling time before the compressor stops after reaching the maximum pressure.
Attention: Not valid in the “ Continuous “ and “ Modulation” mode.

Maintenance

This menu allows for the setting of the compressor maintenance intervals.

```
1.3.01
====================
Maintenance
Oil Change:   5000h
```

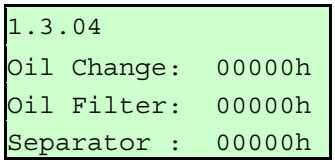
Setting an interval schedule that alerts the user on the need for the compressor oil changing is possible. Once this time has elapsed, a message appears that indicates the need for it to be changed.

```
1.3.02
====================
Maintenance
Oil Filter:   5000h
```

Setting an interval schedule that alerts the user on the need for the compressor oil filter changing is possible.
Once this time has elapsed, a message appears that indicates the need for it to be changed.

```
1.3.03
====================
Maintenance
Separator :  10000h
```

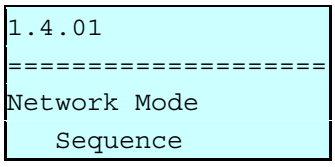
Setting an interval schedule that alerts the user on the need for the separator filter changing is possible. Once this time has elapsed, a message appears that indicates the need for it to be changed



.
This page allows the service staff to know how many hours are still required until the next maintenance.
The hours counted by the maintenance hour counter are shown.

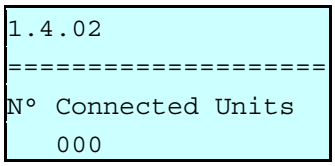
Network

Accessible only if the "Control Mode" is set on "***Maestro Master***". It allows several compressors to be controlled.
This menu is accessible only if the compressor is not running and is deactivated.

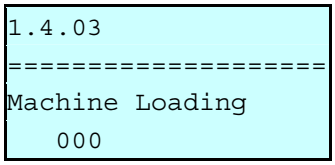


This entry sets the compressor operating mode when a network for multiple operations is realized.
The operating modes are:

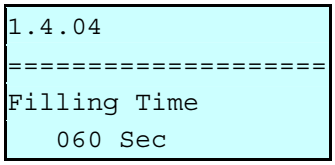
- **Sequence**
- Drop-down
- Equalization of working hours



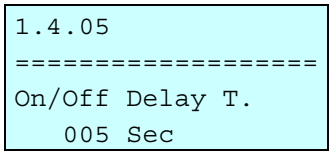
It allows the number of "Slave" compressors the network is composed of to be indicated to the controller
Nine (9) units is the maximum number of slave compressors that can be connected



A function valid only in "Drop-down" mode to set the compressor with which to fill the line when this is activated.
Usually, the basic compressor has the address "**000**" but setting a different one is possible.



To prevent unnecessary starting of compressors at the line filling stage, it is possible to start one compressor for a lapse of time sufficient to accomplish such operation. Once this time has elapsed, the [***Master***] will start the [***Slave***] compressors based on the programmed operating requirement.
This function is valid only when the network is activated for the first time during the day.



To prevent the compressors starting too soon one after the other, the network, it is possible to set the starting time between one compressor and the other.
This time also protects the user's electrical protection by preventing the simultaneous insertion of very high voltages.

Note: The menu **1.4.03 is** available only if the "***Drop-down***" mode has been selected.

Clock Menu

Maestro is provided with an inner clock that makes it possible to start and stop the compressor without the operator's intervention.
This function is not activated automatically. To display both the date and the system time, press the relevant key.

```
********************
*  Tue 11/02/2003  *
*     17:50:25     *
********************
```

The first page shows the date and the time.

Once the clock has appeared, press key menu to access the configuration submenus for the weekly schedules.
Note: If the compressor is activated, the following pages will not be shown.

```
4.1>Regulation
4.2 Time Bands
```

- **Regulation**: this activates/deactivates the weekly schedule
- **Time Bands**: this sets the start and stop times.

```
4.1.01
====================
Weekly Schedule
-> None
```

The weekly schedule can be activated in two different modes:

- ❑ **None**
- ❑ 5 days
- ❑ 7 days

```
Mon-Fri (5 days)
ON1>00:00 OFF1>00:00
ON2>00:00 OFF2>00:00
ON3>00:00 OFF3>00:00
```

In the **5**-day mode, the compressor can be started and stopped with 3 different time bands valid throughout the working week (from Monday to Friday).
When scheduling the ON OFF times for one day, these will be valid for every week.

```
Mon           (7days)
ON1>00:00 OFF1>00:00
ON2>00:00 OFF2>00:00
ON3>00:00 OFF3>00:00
```

In the **7**-day mode, the compressor can be started and stopped with 3 different time bands for each day of the week.
The time bands should be set for every day.

Warning !!!
Changing the settings related to the weekly schedule is allowed only if the machine has been deactivated.

Warning !!!
Setting the summer time should be done manually if necessary and according to the installation places.

Activation of the Weekly Schedule

When the weekly schedule is active, the relevant led comes on.

Once the required programming mode has been set as well as are the start and stop schedules, press **On** to activate the compressor**.**
When the operation is activated, the led the key **On** flashes.

To cut off the compressor from the weekly scheduling, press **off**.
To completely cut off the weekly scheduling bring entry "**Regulation"** in menu [**Clock**] back to "***None***".

Temporary Exclusion of Weekly Scheduling

Keep the key of the menu [Clock] pressed at least for 5 seconds. The related warning led will start flashing thus informing the operator that the weekly scheduling has been deactivated.
This operation brings the compressor back to the manual mode. To start the machine, press key **On.**

To restore programming, stop the compressor. When the compressor has stopped, keep key "Clock" press for over 5 seconds. When restoring is complete, the led turns on without flashing.

Clock Setting

Note: The system DOES NOT foresee the possibility of controlling summer time. Hence, the time should be changed manually.
Apply the following procedure to execute this operation:

```
********************
*  Tue 11/02/2003  *
*     17:50:25     *
********************
```

Press the key of the clock menu and a screen will appear that shows both the date and the current time.

Press the memory opening key

```
********************
*  Tue 11/02/2003  *
*     17:50:25     *
********************
```

The underlining symbol will appear under the weekday “Tue”.
(For example)

Press the tab key until the underscoring sign has moved under the value to be changed (e.g. the hour)

```
********************
*  Tue 11/02/2003  *
*     17:50:25     *
********************
```

Change the hour as required using keys **Up** or **Down**

```
********************
*  Tue 11/02/2003  *
*     18:50:25     *
********************
```

Press key “Enter” again to confirm the change. The underscoring sign will disappear.
Press key “Monitor” to return to the main display.

Setting the Weekly Scheduling

To do the weekly scheduling, first select the required operating mode: 5 or 7 days. In the first case, bands set are valid from Monday to Friday; in the second case, setting daily bands with different times on each day of the week is possible.
Apply the following procedure to execute this operation:

```
********************
*  Tue 11/02/2003  *
*     17:50:25     *
********************
```

Press the key of the clock menu and a screen will appear that shows both the date and the current time.

Press key “Menu”

```
4.1>Regulation
4.2 Time Bands
```

The page for the mode selection and the setting the time bands appears.
Let us assume, for example, that the compressor use is required for 5 days at the same on and off schedules.
Select entry [**01 > Regulation**]

Press key “Enter”

```
4.1.01
====================
Weekly Scheduling
-> None
```

The currently valid option is displayed. Press key “Enter” to open the memory. Change the option to 5 days and press key “Enter” again

Press key “Menu” to return to the menu entry menu 4.0

```
4.1>Regulation
4.2 Time Bands
```

Select entry [**02 > Time Bands**]

Press key “Enter”

```
Mon-Fri (5 days)
ON1>00:00 OFF1>00:00
ON2>00:00 OFF2>00:00
ON3>00:00 OFF3>00:00
```

The setting page of the two available bands is displayed. This page includes the reset times.
Apply the following procedure to change the time.

Press key “Enter”

```
Mon-Fri (5 days)
ON1>00:00 OFF1>00:00
ON2>00:00 OFF2>00:00
ON3>00:00 OFF3>00:00
```

The underscore sign appears under the starting time of the first band.

To change the values, press keys “Up” or “ Down”

```
Mon-Fri (5 days)
ON1>00:00 OFF1>00:00
ON2>00:00 OFF2>00:00
ON3>00:00 OFF3>00:00
```

Keep key “Up” pressed to defer the starting time

Press key “Tabulation” to switch from the starting time to the stop time of the first band.

```
Mon-Fri (5 days)
ON1>00:00 OFF1>00:00
ON2>00:00 OFF2>00:00
ON3>00:00 OFF3>00:00
```

Press key “Enter” to close the memory if no other changes are required. Press key “Tabulation” again to switch to the changing of the ON time of the second band.

Press key “Menu” to return to the entry menu 4.0

Press key “Monitor”

Special Settings of the Weekly Scheduling

Different programming from those set by Mattei could be necessary. One of the variants could include the need for the compressor to run uninterruptedly during the day or to start the compressor on Monday and stop it on Wednesday.
Below are two programming examples for these events:

Daily Example

```
Mon-Fri (5 days)
ON1>07:30 OFF1>22:50
ON2>00:00 OFF2>00:00
ON3>00:00 OFF3>00:00
```

Let us assume that the machine should start at 7:30 a.m. and stop at 22:50 without stops in between. Then, the setting will be:

On1 = 7:30
Off1 = 22:50

As the other bands will be left on 00:00 setting, Maestro will not consider them valid, hence they are excluded from operation.

Weekly Example

```
Mon           (7 days)
ON1>08:00 OFF1>23:59
ON2>00:00 OFF2>00:00
ON3>00:00 OFF3>00:00
```

```
Tue           (7 days)
ON1>00:00 OFF1>12:00
ON2>13:00 OFF2>17:00
ON3>00:00 OFF3>00:00
```

```
Wed           (7 days)
ON1>08:00 OFF1>12:00
ON2>13:00 OFF2>17:00
ON3>00:00 OFF3>00:00
```

Let us assume now that the compressor should be used with different modes during the week, i.e. the compressor should not be stopped for one night when the uninterrupted pressure use is required and during the rest of the week it should be used at different times every day.

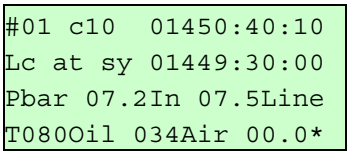
In the given example, the assumption has been made to turn on the compressor at 8:00 a.m. on Monday and to turn it off at 12:00 noon on Tuesday.
Then to start it again at 13:00 and to stop it at 17:00 still on Tuesday.
Then to turn it on again at 8:00 a.m. and to stop it at 12:00 noon on Wednesday for a first time band and for a second band from 13:00 until 17:00.

Between Monday and Tuesday the compressor is idle from 23:59 to be loaded again at 00:00.

Events Menu

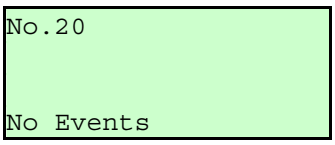
```
#01 c10  01450:40:10
Lc at sy 01449:30:00
Pbar 07.2In 07.5Line
T080Oil 034Air 00.0*
```

As many as 20 failure events are stored. Once the memory is full, the software cancels the oldest event while replacing it with the latest one.
The parameters allowing for the identification of the failure occurred are saved in the pages.



The following is saved in a page:

- The event sequential number.
- The failure code.
- Working hours, minutes, and seconds when the failure occurred.
- The test procedure.
- The operation mode.
- The machine condition.
- The hour, minutes, and seconds related to the test start of the compressor.
- The chamber pressure (only for Maestro).
- The line pressure.
- The oil temperature.
- The output air temperature.
- The dew point temperature (Only activated dryer).



If no events are saved, the following message appears:
"**No Events**"

If one or more probes are not be connected to the controller, the following indication appears "---".
To identify the test procedure, the operating mode, and the compressor condition at the moment of the failure, the following decoding table will help.

Test Procedure	
Lc	Local
Ms	Master
Sv	Slave
Pl	Slave Plus

Operating Mode	
Au	Automatic
Co	Continuous
Md	Modulation
Op	Optima

Compressor Condition	
Of	Stop
Un	Unloaded
Lo	Loaded
Sy	Stand-By

Table 1

Reserved Menus

The menus

- Advanced Programming
- Test
- Function Reset

These are for Mattei's staff use only. Hence, their access is password-protected.

Setting a Parameter

As an example, let us assume that the compressor maximum operating pressure value should be changed.
Select menu [Basic `Programming`] with the rapid access key or by selecting from the menu list.

```
1.1>Configuration
1.2 Settings
1.3 Maintenance
1.4 Network
```

The symbol “>” (Cursor) indicates the selected menu entry.

Select the required menu entry to be changed with arrow-key Up and Down.

```
1.1 Configuration
1.2>Settings
1.3 Maintenance
1.4 Network
```

The maximum pressure is in the submenu “Settings”. Select the relevant submenu.

Press key “Enter” to open the memory and change the value after selecting the submenu indicated by the cursor symbol.

```
1.2.01
====================
Maximum Pressure
   007.7Bar
```

The screen appears with the first variable contained in the submenu, which in this case is the maximum pressure. Using the arrow-keys, it is possible to move to the other variables.

When the entry to be changed has been selected, it is indicated by the cursor symbol next to the value to be changed. Press key “Enter” to open the memory and change the value

```
1.2.01
====================
Maximum Pressure
-> 007.7Bar
```

The underscoring sign under the last character of the subject value indicates that the memory is open.

Use the arrows to either increase or decrease the value of the variable being changed

```
1.2.01
====================
Maximum Pressure
-> 008.0Bar
```

Press key “*Enter*” again to confirm the change when the required one has been reached.

```
1.2.01
====================
Maximum Pressure
   008.0Bar
```

The underscoring sign disappears when the entry has been changed.

Should no further changes be required in this menu, press key “Basic Programming” again to return to the starting menu.

```
1.1 Configuration
1.2>Settings
1.3 Maintenance
1.4 Network
```

When all the required changes have been made, press the menu access key [Monitor] to return to the main menu or press the key corresponding to the menu to be accessed.

Attention: Please remember that some menus and some menu entries are not active if the compressor is on.
The inactivity of the entries is noted as the underlining sign does not appear under the parameter to be changed.

	WARNING ==================== NOT available	*Warning !!!* *If access is attempted into either menus or submenus that are not available for any reason, will a page informing of this impossibility appear.*

Operation Failures

Failures can be divided as follows:

- Failures with an intervention signal (alarms)
- Failures causing the immediate stop of the compressor (blocks).

The board signals a failure by flashing the reset key led together with a buzzer signal

```
Loc Auto   [All]
====================
Total Hours: 00000h
Line       : 000.0Bar
```

The indication [**All**] that is displayed also informs the user that there is a failure.

To display the kind of failure occurred; press the “Reset” key once. A page appears that contains the information on the failure and specifically:

```
cod:02          03400h
Motor High Temper.
Oil Temper. : 080.0c
Chamber     : 007.0Bar
```

- The event code
- The working time at which the failure occurred
- The detailed description of the failure
- The oil temperature at the moment of failure
- The Chamber pressure at the moment of failure

All the information is stored in the incorporated historical archive together with other information previously shown, and in which as many as 20 failures can be stored.
When the failure number exceeds the allowed limit, the system clears the least recent failure to insert the latest one.

Press key ““***Reset***” a second time to reset the compressor operation.

Note: In the versions “Plus” provided with a dryer, the failures “Ice Alarm” and “High Dew Point” behave differently according to that which is set in the [Advanced Programming] menu (2.5.02) by your service engineer.
Should this option be set on “Alarm”, the above-mentioned signals are reset automatically when values return within the standard ones.
On the other hand, if it is set on “Block”, an operator should reset the failures.

Warning !!!
If the failure cause cannot be solved, the compressor will not start as the failure results to be still active and displays the intervention request again.

Below is a description of the different alarms and blocks that might occur during the normal operation of the compressor.

Signal	Action	Code	Type	Cause
Emergency Stop	Block	**00**	Digital	The emergency button on the electrical panel has been pressed.
Separator Pressure	Alarm	**01**	Analog	The pressure difference between the chamber and the separator has exceeded the set value.
Motor High Temperature	Block	**02**	Digital	Main electrical motor overload (Temperature exceeding the set limit).
Comp. High Temp. (D)	Block	**03**	Digital	Very high oil temperature in the chamber (Temperature exceeding the set limit).
Separator High Temp.	Block	**04**	Analog	Very high air temperature in the separator (Temperature exceeding the set limit).
Oil Filter Clogged	Block	**05**	Digital	It shows that the oil filter should be replaced as it is clogged.
Oil High Temperature	Block	**06**	Analog	Very high oil temperature in the compressor (Temperature exceeding the set limit).
Air High Temperature	Block	**07**	Analog	Very high delivery air temperature (Temperature exceeding the set limit).
Oil Level	Block	**08**	Digital	Low oil level in the chamber (The amount of oil is lower than what is required for correct operation).
Step Rotation	Block	**09**	Digital	“Basic Maestro” : It shows a wrong connection of the supply steps. “Maestro”: prevents from starting.
Wrong Ventilation	Block	**10**	Digital	The access door to the compressor has been opened or the thermorelay protecting the motor fan has triggered (if installed).
Air Filter	Alarm	**11**	Digital	It shows if the air filter is clogged. This alarm is available if the machine comes with the specific sensor.
Oil Change	Alarm	**12**	Service	It shows that oil replacement is required as the number of hours forecast for replacement has been reached.
Oil Filter	Alarm	**13**	Service	It shows that oil filter replacement is required as the number of hours forecast for replacement has been reached.
Separator Filter	Alarm	**14**	Service	It shows that separator filter replacement is required as the number of hours forecast for replacement has been reached.
Blackout	Alarm	**15**	----	It shows that voltage supplied to the compressor has dropped.
Ice Alarm	Alarm	**16**	Analog	It shows the excessive cooling of the dryer, if connected. This signal is managed as a block.
	Block	**17**	Analog	It shows the excessive cooling of the dryer, if connected. This signal is managed as an Alarm.
Start of problem	Block	**18**	Analog	Failure occurred in the starting sequence that has prevented the same from starting.
Clock Fault	Block	**19**	Analogue	Wrong connection of the clock module.
Timeout Slave	Alarm	**20**	Software	It shows that in the operating mode “net”, the compressor set, as slave cannot communicate with the “Master” controller.
Chamber Probe Fault	Block	**21**	Analog	It shows a failure in the pressure probe mounted in the compressor chamber. It also shows an interruption in the connection.
Separator Probe Fault	Block	**22**	Analog	It shows a failure in the pressure probe mounted in the compressor separator. It also shows an interruption in the connection.
Line Probe Fault	Block	**23**	Analog	It shows a failure in the pressure probe mounted in the radiator. It also shows an interruption in the connection.
General Failure	Alarm	**24**	Digital	It shows a generic device not foreseen in the normal system operation. It does not stop the compressor.
	Block	**25**	Digital	It shows a generic device not foreseen in the normal system operation. It stops the compressor.
Inverter Failure	Block	**26**	Digital	It shows the abnormal operation of the inverter connected to and managed by it.
High Dew Point	Alarm	**27**	Analog	It shows a non-cooling of the dryer, if connected. This signal is managed as a block.
	Block	**28**	Analog	It shows a non-cooling of the dryer, if connected. This signal is managed as an Alarm.
Dryer Failure	Alarm	**29**	Digital	It shows a fault in the dryer. Its intervention does not stop the compressor.
	Block	**30**	Digital	It shows a fault in the dryer. Its intervention does not stop the compressor.

Table 1

The Maestro Hour Counters are divided into two:

1. Operation hour counters
2. Service hour counters

The first informs the user how many hours the compressor has worked, while the second warns the user that the preset operation time has elapsed and that a Maintenance intervention should be carried out.

Operation Hour Counter

Maestro provides the user with 3 types of hour counters with different operation modes.
The counters that the user can access are:

- Activation Hour Counter
- Run Hour Counter
- Load Hour Counter

Activation Hour Counter

The "activation" hour counter shows how many hours the compressor has been activated, i.e. enabled for operation. This hour counter also considers the periods when the compressor is off, as it is not operating in the working cycle.

Remember that the compressor activation is signalled by the green led coming on with the "**On**" key.

Run Hour Counter

The "Run" hour counter shows for how many hours the compressor has been running. This hour counter is connected to the Machine Maintenance hour counters.

Load Hour Counter

The "Load" hour counter shows how many hours the compressor has been running under load.

Scheduled Maintenance Intervals

The Maintenance Hour Counters inform the users that Maintenance should be carried out on the compressor to ensure its correct operation.
In the [**Basic Programming**] menu it is possible to set the interval at which to carry out the Maintenance of a specific part of the compressor.

The [**Hidden**] menu, to which only the Mattei staff can access, houses the hour counters necessary for the compressor Maintenance. These counters inform the user when the value set has been reached in the [**Basic Programming**].
Once the user has been informed of the required Maintenance, press the "Reset" key to initialize the relevant counter and clear the Maintenance indication.

The [**Basic Programming**] menu [**1.3 Service**] houses the hour counters necessary for the programmed machine Maintenance:

- Replacement of the compressor oil (Menu entry 1.3.01)
- Replacement of the compressor oil filter (Menu entry 1.3.02)
- Replacement of the separator filters (Menu entry 1.3.03)

A (Menu entry1.3.04) page is also present that indicates how many hours the timers have already accrued thus informing the Service engineer of the hours still missing until the next Maintenance.

	*Warning !!!* *The Maestro hour counters reach a maximum limit of **65535** hours after which the counting starts from **00000** again.*

Maestro offers different advanced functions to meet the need of connecting to other devices and signals that are most requested by customers. Below is a brief description of the additional devise functions.

Realizing a compressor network

The “Maestro” controller offers several ways to manage the compressor:

- Cascade
- Sequence
- Equalization of working hours

These operating modes allow customers to adapt the net operation to their working requirements.
Please note that, generally speaking, the “Cascade” mode is used if the network is made up of machines providing different air delivery, while the “Sequence” mode is recommended for those networks with machines of the same capacity.
Should a balance be necessary between the operating hours, then the ”equalization” mode is recommended.

Cascade Mode (LIFO – Last In First Out)

In the **CASCADE** mode, the first compressor that starts is also the last one to idle and stop. Let us assume that a certain number of compressors should be started and that the line pressure Pmax should be set on 7,0 bar and its minimum value Pmin on 6,0 bar. The management program will start the “loading” compressor for a lapse defined as “Loading Time” (TR. When this loading period has elapsed, the compressor No. 2 will be started and so on until the last compressor has been started. When the line pressure reaches the Pmax value, compressor No. 4 (the last) will be excluded from the line. If pressure is still ≥ than Pmax, compressor No.3 will be excluded and so on until pressure is lower than the Pmax value.
In brief, if pressure remains within the range established by Pmin and Pmax, neither starts or stops are made; as soon as pressure leaves this range, Maestro will restore pressure into the limits hence starting or stopping the available compressors.

Start sequence **1⇒2⇒3⇒4**
Stop sequence **1⇐2⇐3⇐4**

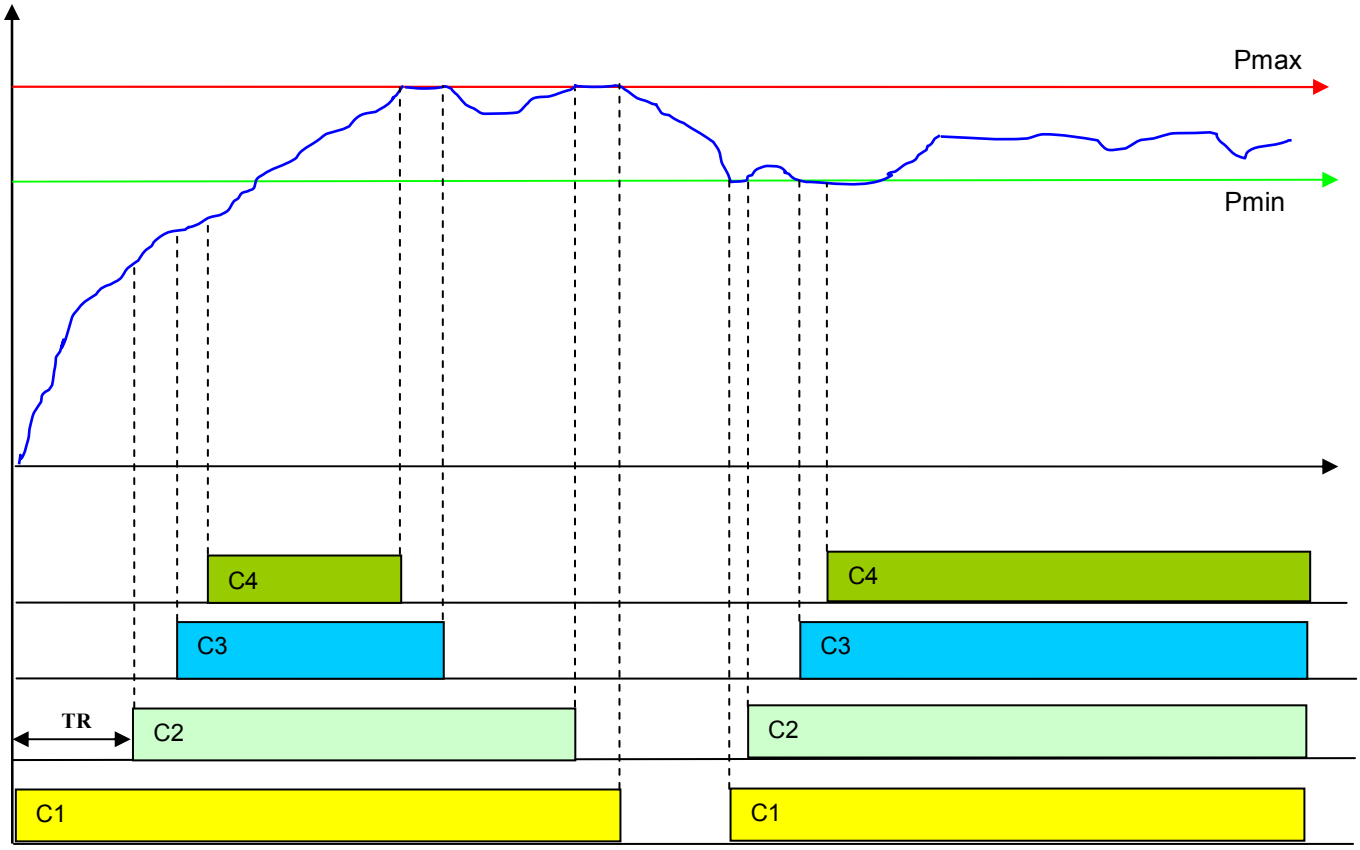
Selecting a compressor among those making up the network, as the line loading will only be possible in this operating mode.

Assuming that compressor No. 3 has been selected to be loaded, when the network is activated compressor No. 3 will start first until the expiry of the loading time.
When this time has elapsed (TR), if line pressure is ≥ than Pmin, then no further starts will be done; on the contrary, compressor No. 1 and then No. 2 and, lastly, No. 4 will be started.

Start sequence **3⇒1⇒2⇒4**
Stop sequence **1⇐2⇐3⇐4**

From this moment on, the start and stop sequence becomes the standard one, i.e.

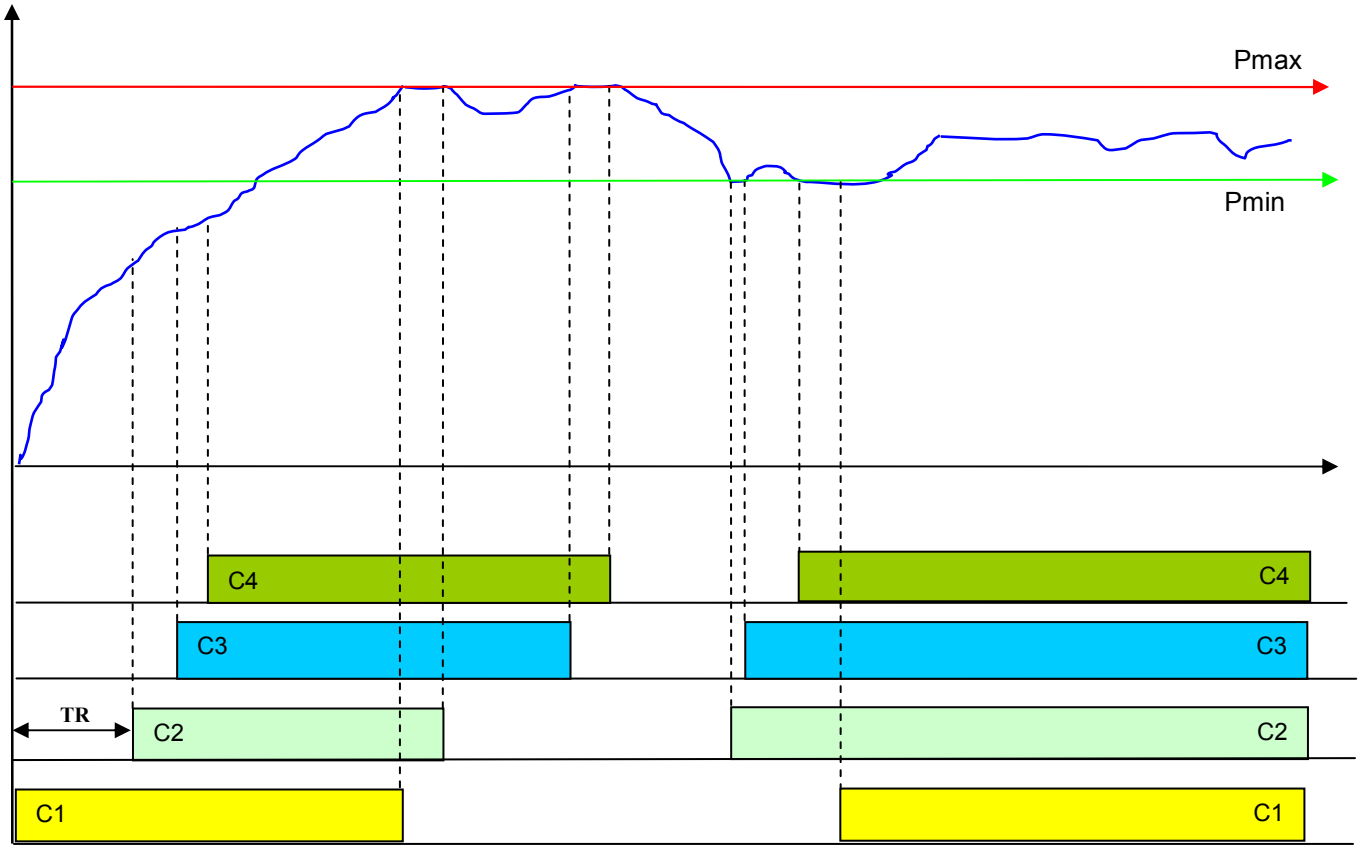
Start sequence **1⇒2⇒3⇒4**
Stop sequence **1⇐2⇐3⇐4**



Sequence Mode (FIFO – First in First out)

In the **SEQUENCE** mode, the first compressor to be started will also be the first one to go idle and then stopped until the full accomplishment of the cycle. When line pressure again requires that a compressor be put into operation, the compressor to be started will be the one following the first one that started in the previous sequence (e.g. the first start sequence of compressors was **1⇒2⇒3⇒4;** in the following start sequence, the order will be the following **2⇒3⇒4⇒1.**

During operation, if a request for air exists on the line that is a higher that the one delivered by the system (need for another compressor to be started), the “Master” controller will verify whether any IDLE compressor is present in the network, in which case it will put it under **LOAD** again.
If several compressors are idle, then the last compressor to become idle will be put under load again, and so in reverse.
Performing this operation will prevent starting a compressor that is still hence permitting a considerable saving of energy.



Equalization Mode

In the **WORKING HOURS EQUALIZATION** mode, Maestro automatically equalizes the operation hours of the compressors that make up the network.
The operation foresees that compressors with a lower number of operation hours under load are activated. Once the working hours equalization has been reached, select the network operation on SEQUENCE.
In this operating mode, like the sequence mode, if there are several idle compressors, when pressure lowers the last compressor that has to become idle will be put under load again.

Inserting an Optima Machine into the Network

It could be useful to insert one or more Optima machine models in the network. This implies a different net configuration than the one of a net made up only of a machine running at a fixed speed.

If a variable speed machine is inserted, all information from this machine should be managed so as to guarantee a correct operation of the entire net.
Some restrictions exist in using Optima compressors within a network that vary according to the selected operating mode.

One of the restrictions refers to the maximum number that can be inserted in the network. Below is a reference table.

Network Operation Mode	Max. No. Of Optima
Sequence	1
Cascade	10
Equalization	10

These machines are normally inserted in a cascade operation, and as the last compressor to accomplish the “Fine” regulation of the line pressure.
If the network accommodates an Optima compressor, then the Master waits for it to have gained the maximum deliverable speed before starting the next compressor. Vice versa, before excluding it, it waits for it to have reached the minimum speed.

Attention: In all operation modes, the “Pmin” and “Pmax” parameters should be set exactly like the ones set on the “Master” compressor.

Sequence Mode

This mode allows for the insertion of only one Optima compressor in the network as it is an operating mode that, as already mentioned above, assumes that compressors be of a similar capacity. The operation is similar to the one described for the standard machines with the exception that before starting the next compressor in the start chain, the machine speed is to be adjusted only when it has reached the maximum available speed. The same applies for the stop stage of the machines.

Cascade Mode

In this mode there are no special restrictions to be applied. In fact, it is possible to realize networks that are made up of Optima compressors only, which is usually placed as the last compressor.
Its scope within a network is to stabilize the delivery supplied on line, while inserting standard machines as machines able to provide a first stable delivery supply, while Optima can modify its speed based on possible line consumption surges.

Equalization Mode

In this mode like in the preceding one, there are no restrictions in the use of Optima compressors. However, it should be remembered that this mode could balance the hours of use of the compressors. In all operating modes described above, when an “Optima” compressor is activated before activating the next compressor, a check is made to ensure that it has reached the maximum available speed. The same logic also applies in an exclusion stage of such compressor.

Remote Activation

Usually the compressor is activated by the key “**On**” and deactivated by the key “**Off**” on the keyboard. However, it is possible to enable the compressor by a digital contact coming from a different room where the compressor is located.
To use such an option, a pulse contact should be realized that lasts over 5 seconds to activate-deactivate the compressor.

Note: The circuit should be of a pulse-driven type and **NOT** a permanently open or close contact.

Remote Signalling

Sometimes it is necessary to “distance” some pieces of information relevant to the compressor. The possibility exists to display remotely the following signals of the machine conditions:

- Enabled compressor
- Running Compressor
- Loaded Compressor
- Blocked Compressor

These signalling are obtained by means of digital contacts voltage-free.
To obtain the correct system operation, observe the following parameters:

- Maximum applicable voltage **230 Vac 48 Vdc**
- Maximum applicable load **8 A**

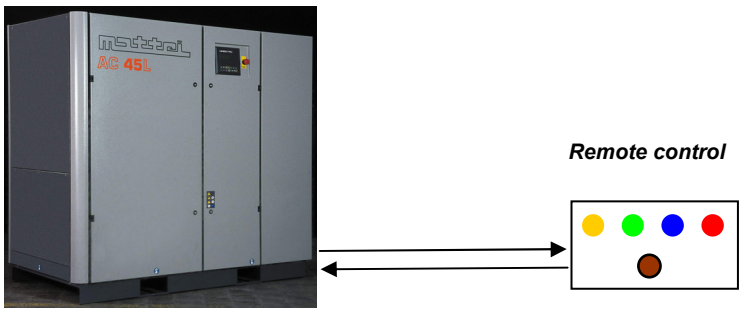


Photo16

Connecting a mechanical pressure switch or a higher control device

A mechanical pressure switch controls maestro, in its “Basic” version, while pressure probes with a 4 ÷ 20 mA reference signal control the standard version.
If necessary, the control can be set on “Pressure Switch”. In this case, once activated and if the digital contact is closed, the compressor is started otherwise is remains on stand-by.

This mode is also used to connect a superior control device such as Multicomp and Multicomp II.

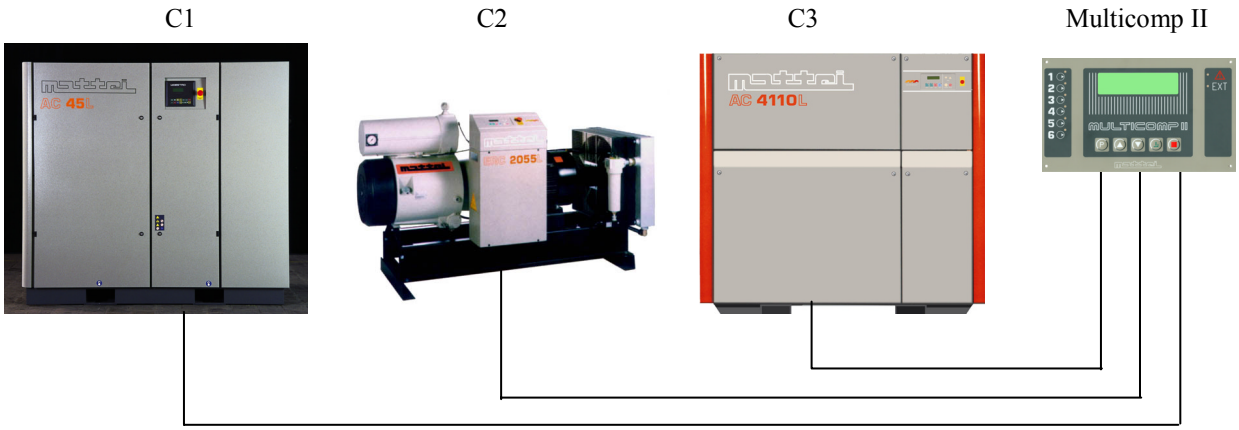


Diagram18

```
1.1.04
====================
Pressure Control
   Pressure Switch
```

Enter menu [Basic Programming] with the machine deactivated and select the submenu [1.1 Configuration]. Select page 1.1.04.
Change the selection to “Pressure Switch” if not already selected.
Connect the cables to the terminal board while referring to the electrical diagram supplied with the machine.

After having made all electrical connections, connect and activate the compressor. From this moment on, the start and stop operation of the compressor will only depend on the logical condition of the external digital contact.

Supervision of the Equipment

When a network with two or more compressors is formed, it may be necessary to monitor the network with specific supervision program that manages its operation and stores both data and alarms relating to the operation.

To make this operation possible, equip all compressors in the network with a serial network communication board (code AC40C23502) and connect as per diagram 14.

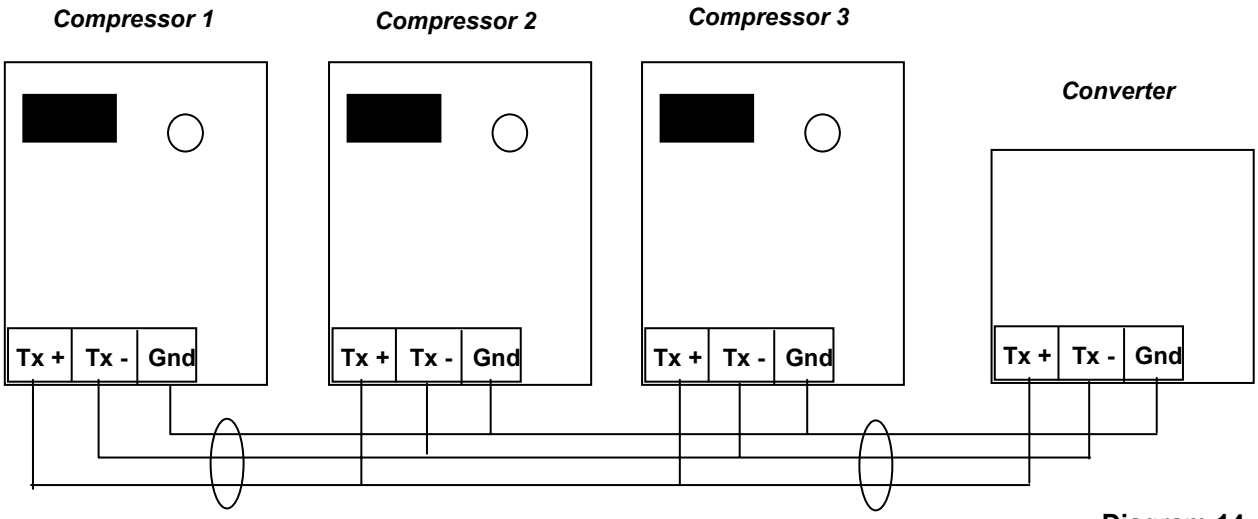


Diagram 14

Two separate networks are created: the first one for the communication between compressors, the second one for the communication of the individual compressors with the supervision software (code **TSP2-X0003**).

Fig.15

Maestro is provided with a built-in auto-diagnostic system to prevent possible unsignalled malfunctioning. However, some failures exist that do not originate from the abnormal compressor operation, but from events beyond the controller's jurisdiction.

These failures are:

Problem	Cause	Remedy
Maestro does not turn on	No supply voltage	Check the mains voltage. Check the 24VAC on the transformer are present.
	Safety fuses burnt	Replace fuses
	Defective connection in the terminal board	Check connections in the terminal board
	Defective door opening safety relay	Replace relay
Maestro turns on but nothing is displayed	Missing Program	Load program (Mattei staff only)
	Defective Screen	Replace the screen
When "On" is pressed, the compressor does not start	The chamber pressure exceeds the start threshold.	
	The line pressure is higher than the Pmin value	Wait for pressures to decrease
	The compressor is connected in the network mode	The start is subject to the selected sequence hence it is necessary to wait for the compressor call.
	A block is active	Check and correct the failure
Maestro gives either wrong or incorrect indications	Defective connections of the connecting Flats to the acquisition card	Check the correct connection of the 2 Flat cables between screen and acquisition card. Check the connections comply with the electrical diagram of the machine.
Incorrect pressure values	Defective pressure probes	Replace the pressure probe
	Working field different from the one set in the controller	Set the correct working field in the "Hidden" menu (Mattei staff only)
	0 is quoted in pressure values (e.g. 0,1 bar)	Modify by acting on the probe offset in the hidden menu (Mattei staff only)
	Probes incorrectly connected	Check the probe connections
Incorrect temperature values	Defective probes	Replace probes
	Wrong probes	Check that PT 1000 are present
	Wrong or interrupted connections	Check the probe connections
	Inaccurate values	Modify with the probe offset in the hidden menu (Mattei staff only)

REMARKS