

*ELECTRONIC PRESSURE REGULATOR*

***EPR 100 A***

***EPR 100 D***

***MATRIX***



***MATRIX***

*Pneumatic Division*



## EPR 100 - Electronic pressure regulator

The *Matrix EPR 100* is an electronic pressure regulator equipped with a latest-generation, 8 bit microcontroller. It can process signals and commands, carry out complex functions and communicate with other control systems via an *RS-232* serial line. The functional design, ease of use, and integration in advanced systems are characteristics which qualify the *EPR 100* as an active component of pneumatic systems. Appropriate programming adapts it quickly to a specific circuit.

The controlling signal, which may be analog or digital (via *RS-232* or keypad), is processed by the microcontroller. The information is then converted into a proportional pressure signal by high speed solenoid valves. These valves are controlled in frequency by a technique known as PWM (Pulse Width Modulation).

An integrated pressure sensor monitors the pressure of the controlled circuit and the value is compared with the pressure level required to activate the system, so that any variation in the pressure can be compensated. This closed loop system has a reaction time of less than 5 ms.

The maximum flow rate that *EPR 100* can produce, and the high speed make its use possible in applications until now controlled by more elaborate systems.

When interfacing a driven pressure regulator (power stage), it changes the functional characteristics into those of a proportional servovalve, with extremely fast intervention times and high precision even under near maximum flow rate conditions.

As the unit is compact, very hard wearing and insensible to shocks and accelerations, it is ideal for use in severe industrial environments.

The *EPR 100* is available in two basic versions:

**EPR 100 A** with current analog control or via *RS-232* serial line.

**EPR 100 D** with *RS-232*, keypad or analog control; with visual display of pressure readings.

## Applications

- Regulation at pressure driver stage (driving of servo regulators).
- Power control for industrial machinery (actuators, suspensions, welding equipment, clamping devices, laser applications, energizing, braking at pneumatic control, painting, packaging and manufacturing machines, moulding machines, batching machines, smoothing machines, cleaning machines, textile looms, test stands, robotics, suspensions control, antislipping systems, etc.)
- Remote controls.
- Processing, precision and calibration equipment.

## **Advantages**

- Integration with analog or digital control systems (PC, PLC, etc.).
- Display of measured pressure data and keypad control (EPR 100 D).
- High flexibility with programmable configuration.
- High speed in response times.
- High precision, repeatability and reliability.
- Compact and strong manufacture, ease of use and high security.
- Low power absorption.

## Technical characteristics EPR 100 A

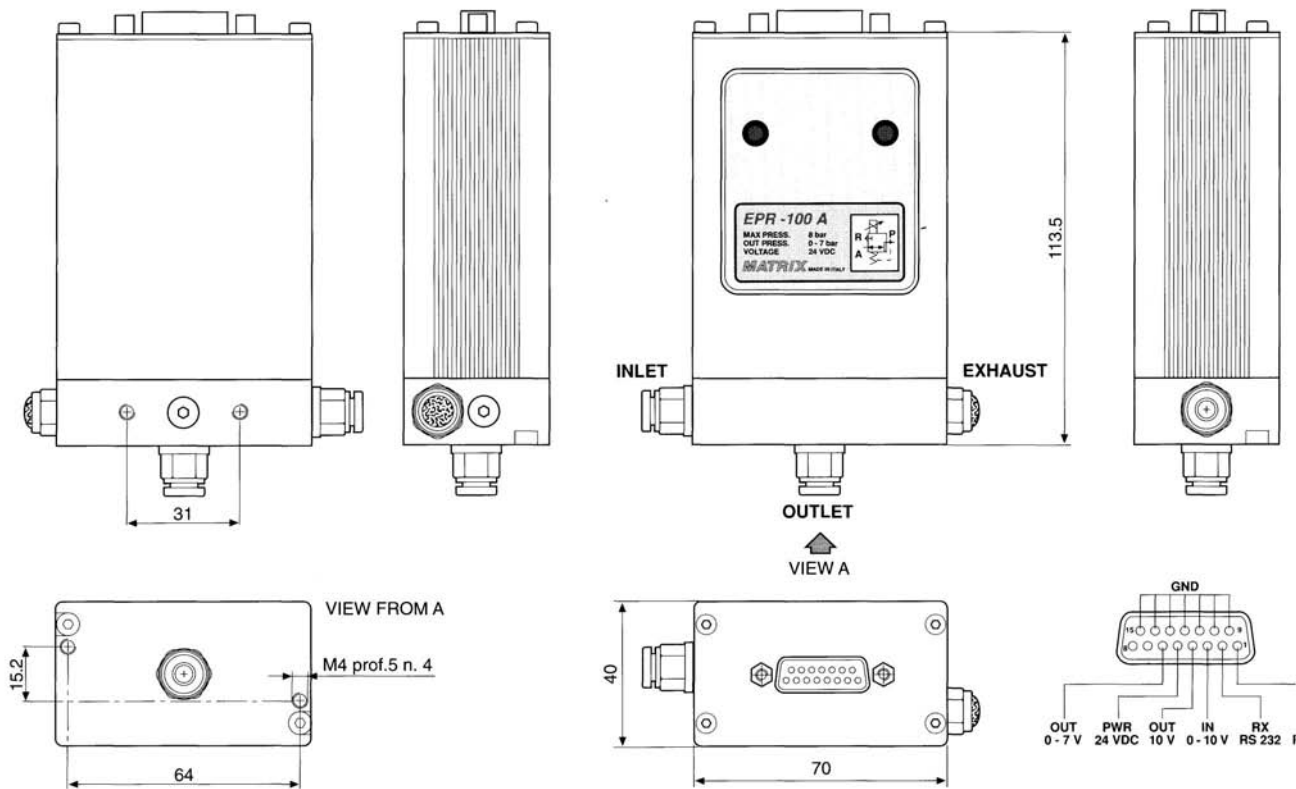
• Dimensions	120 x 70 x 40 mm
• Weight	400 g
• Protection ratio	IP 60 (IP 65 on request)
• Pneumatic connections	G 1/8
• Operating temperature	- 10 - + 50° C
• Handled fluid	filtered, not lubricated and dry air
• Filtration ratio	20 µm
• Feeding voltage	24 Vdc ± 10%
• Max. absorbed power	2 W
• Control	0 - 5v / 0 - 10 v / RS-232
• Max. flow rate	60 dm <sup>3</sup> / min (ANR) @ 6 bar
• Inlet pressure	1 - 8 bar
• Outlet pressure	0 - 7 bar
• Reaction time	< 5 ms
• Response time (*)	60 ms (1) - 100 ms (2)
• Sensibility	< 1 % F.S.
• Linearity	< 1 % F.S.
• Hysteresis	< 1 % F.S.
• Repeatability	< 1 % F.S.

---

(\*) Volume 30 cm<sup>3</sup> • @ Pal = 8 bar • (1) from 2 to 4 bar (rise time) • (2) from 4 to 2 bar (fall time)



## EPR 100 A



**Technical characteristics EPR 100 D**

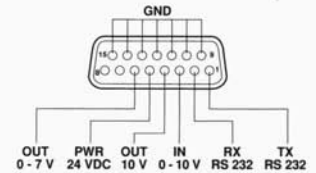
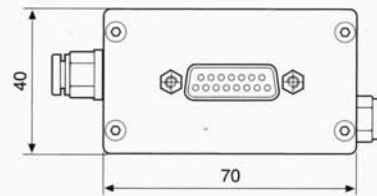
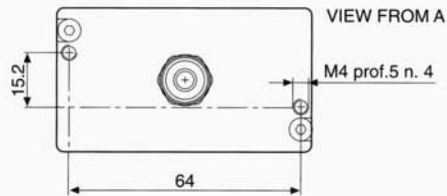
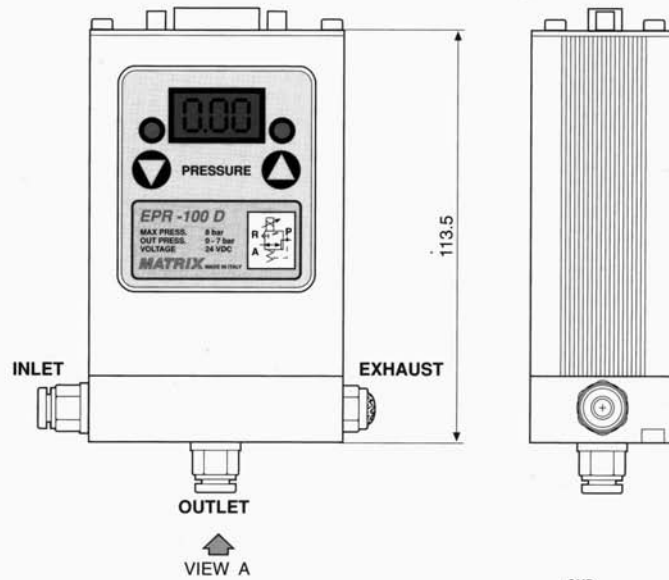
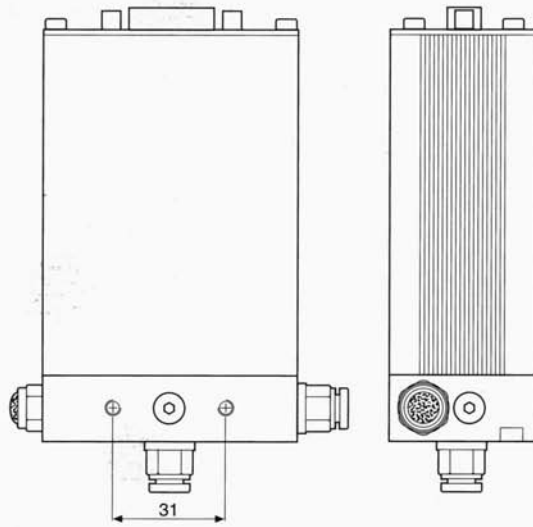
• Dimensions	120 x 70 x 40 mm
• Weight	400 g
• Protection ratio	IP 60 (IP 65 on request)
• Pneumatic connections	G 1/8
• Operating temperature	- 10 - + 50° C
• Handled fluid	filtered, not lubricated and dry air
• Filtration ratio	20 µm
• Feeding voltage	24 Vdc ± 10%
• Max. absorbed power	2 W
• Control	0 - 5v / 0 - 10 v / RS-232 / Manual
• Max. flow rate	60 dm <sup>3</sup> / min. (ANR) @ 6 bar
• Inlet pressure	1 - 8 bar
• Outlet pressure	0 - 7 bar
• Reaction time	< 5 ms
• Response time (*)	60 ms (1) - 100 ms (2)
• Sensibility	< 1 % F.S.
• Linearity	< 1 % F.S.
• Hysteresis	< 1 % F.S.
• Repeatability	< 1 % F.S.

---

(\*) Volume 30 cm<sup>3</sup> • @ Pal = 8 bar • (1) from 2 to 4 bar (rise time) • (2) from 4 to 2 bar (fall time)

---

## EPR 100 D



**EPR 100 A - EPR 100 D****Contents****1 Assembly Instructions**

- 1.1 Pipe fitting and mechanical assembly
- 1.2 Pneumatic connections
- 1.3 Electrical connections

**2 Set-up**

- 2.1 Set-up via keypad
- 2.2 Set-up via RS-232 serial line

**3 Operating Instructions**

- 3.1 0 to 10 V voltage check
- 3.2 0 to 5 V voltage check
- 3.3 4 to 20 mA current check (available on request)
- 3.4 Keypad check
- 3.5 RS 232 serial line check

**4 Maintenance and controls****5 Connection cable to the unit**

# 1 • Assembly Instructions

## 1.1 - Pipe fitting and mechanical assembly

Do not use solid or liquid dope when fitting pipes (G 1/8 threaded connections) as these may damage the unit. The unit can be assembled in any position, although the electrical connections should be kept uppermost. The unit should be kept in a clean and well-ventilated position, following the indications about temperature and filtering given in the technical characteristics section. Four M4 threaded holes are provided for screwing the unit down.

## 1.2 - Pneumatic connections

Before connecting the EPR 100 to the pneumatic circuit, check the filtration level (20  $\mu\text{m}$ ) and make sure the pipes are free of impurities (metal shavings, water, condensation, etc.). The line filters should be checked periodically (condensation removal, cleaning or replacement of filter parts, etc.). Lubricating devices must not be placed ahead of the unit.

The feeding line should have a minimum internal diameter of  $\text{Ø } 2 \text{ mm}$ . The feeding pressure must always be greater than the set pressure. The use of an unsuitable silencer on the exhaust may cause variations in the unit's reaction time.

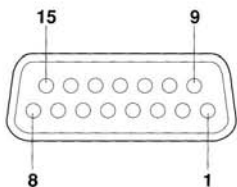
- 1 Inlet (pressure = 1 to 8 bar)
- 2 Outlet (pressure = 0 to 7 bar)
- 3 Exhaust

## 1.3 Electrical connections

A 15 D pole metal-shell connector must be used for the unit's electrical connection. The power supply should be grounded, and the unit should not be plugged in until all connections have been made. The technical characteristics indicated below must be scrupulously respected, both for the power supply (24 Vdc  $\pm$ 10%), recommended stable, and for the connection diagram.

The unit has an IP 60 protection ratio: it must not come into contact with water or corrosive substances as these may damage the internal electrical and pneumatic components. A model with an IP 65 protection ratio is available on request.

CONNECTION DIAGRAM

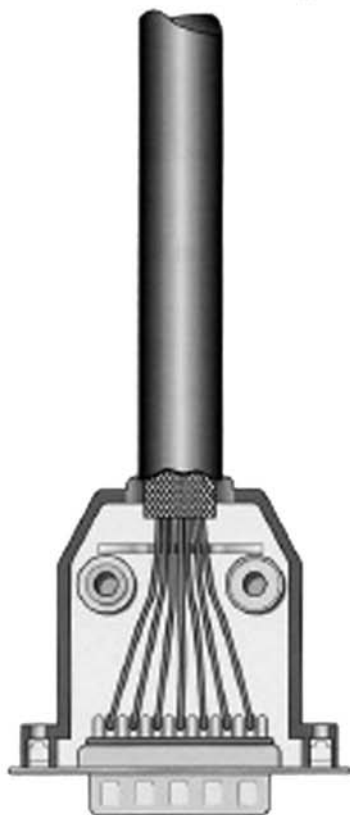


- 1 TX RS-232
- 2 RX RS-232
- 3 In for power control 0 to 5 V / 0 to 10 V
- 4 Out 10 Vdc for potentiometer 10 K $\Omega$
- 5 Power supply 24 Vdc
- 6 Out in power supply 0 to 7 V (1 bar = 1 V)
- 7 not connected
- 8 not connected
- 9 GND
- 10 GND
- 11 GND
- 12 GND
- 13 GND
- 14 GND
- 15 GND



- 1 - TX RS232 - (Brown)
- 2 - RX RS232 - (Green)
- 3 - IN 0-10 V 0-5V - (Orange)
- 4 - OUT 10V - (Violet)
- 5 - PRW 24V - (Red)
- 6 - OUT 0-7V - (Blue)
- 11- GND - (Black)
- T -  $\perp$
- 7 - SCHIELDING
- 8 - IN 4-20 mA - (Grey)

## 5 • Connection cable to the unit











The electronic pressure regulators EPR 100 A and EPR 100 D are in conformity with the norms EN 500082 - 2 • EN 55011 class B. In order to maintain and guarantee this conformity, the connection cable to the unit must be shielded as indicated in the figure.

Note: During assembly make sure that the shielding of the cable is in contact with the shell.

The shell must be made of conductive material.

## 2 • Set-up

### 2.1 Set-up via keypad ( for EPR 100 D only )

The set-up is accessed by holding down the  +  keys together when the unit is switched on. The parameters which can be configured are indicated by a letter on the left side of the display. The default value assigned to each parameter is indicated by a number on the right side of the display. Press the left key  to move from one parameter to the next. Press the right key  to change the value shown. To exit Set-up saving the values, and return to normal working, press the  +  keys together. The values entered are stored permanently and can only be changed by repeating the procedure described above: switch the unit off, press down the  +  keys and switch the unit back on again.



The parameters which can be configured, shown on the display, are:

**b n**

**Precision**

Defines the unit's precision.

The parameter n can have the following values:

0	precision	± 0 bit	
1	precision	± 1 bit	( ± 0.03 bar )
2	precision	± 2 bits	( ± 0.06 bar )
3	precision	± 3 bits	( ± 0.09 bar )
4	precision	± 4 bits	( ± 0.12 bar )
5	precision	± 5 bits	( ± 0.15 bar )
6	precision	± 6 bits	( ± 0.18 bar )

**c n**

**Unit of measure of the pressure**

Defines the unit of measure of the pressure shown on the display.

The parameter n can have the following values:

0	displayed in	bars
1	displayed in	PSI
2	displayed in	kPa

**d n                      Inlet type**

Defines the inlet of the pressure request command.

The parameter n can have the following values:

- 0    pressure set via 0 to 10 V voltage
- 1    pressure set via 0 to 5 V voltage
- 2    pressure set via inlet in 4 to 20 mA current
- 3    pressure set via keypad
- 4    pressure set via RS-232 serial line

**E n                      Pressure regulation threshold**

Defines the unit's behaviour under pressure variations: a high threshold (e.g. E 8) means very damped, a low threshold (e.g. E 1) means only slightly damped.

The parameter n can have the following values:

- 1    pressure threshold P = 0.12 bar
- 2    pressure threshold P = 0.25 bar
- 3    pressure threshold P = 0.37 bar
- 4    pressure threshold P = 0.50 bar
- 5    pressure threshold P = 0.62 bar
- 6    pressure threshold P = 0.75 bar
- 7    pressure threshold P = 0.87 bar
- 8    pressure threshold P = 1.00 bar

## LOADING VALVE PROTECTION

This control can be connected (or disconnected) through the L parameter, during set-up.

With:

L = 0 control disconnected

L = 1 valve protection process occurring after 20 sec. ca

L = 2 valve protection process occurring after 40 sec. ca

L = 3 valve protection process occurring after 60 sec. ca

Once the control connected, if the pressure is not sufficient, the regulator blocks the valve, and the two red leds blink alternatively.

After about 20sec., the regulator opens the loading valve for 2.5 sec., checking if the output pressure increases. In case of an increase in pressure, the regulator restarts its normal functioning, otherwise it waits for 20 seconds. The regulator can restart its normal functioning, if the pressure set up during the 20-second wait is lower or equal to the feeding pressure.

## Parameters available only with MW Skillair/New Deal regulators

### **Fn Inlet pressure**

Defines the pressure to Regulator Metal Work  
The parameter **n** can have the following values:

- 0 inlet pressure 4-6 bar
- 1 inlet pressure 6-8 bar

### **Hn Regulator Metal Work type**

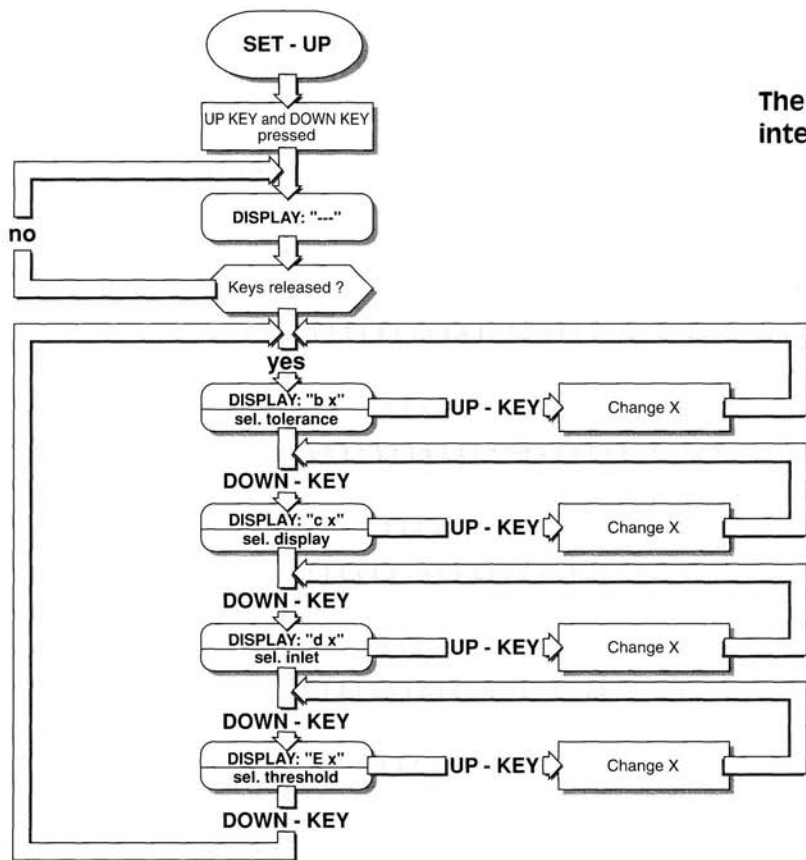
Defines the pressure Regulator Metal Work type  
The parameter **n** can have the following values:

- 0 Pressure Regulator Metal Work REG 400
- 1 Pressure Regulator Metal Work REG 300



**The parameters defined by the maker are:**

- b = 2 precision  $\pm 1$  bit ( $\pm 0.03$  bar )
- c = 0 unit of measure in bars
- d = 0 pressure set via power supply 0 to 10 V
- \*E = 2 pressure regulation threshold 0.25 bar
- F = 1 inlet pressure > 6 bar
- H = 0 Regulator type REG 400
- L = intervention valves protection after about 20 seconds

\*for regulators 300/400 E = 3 (0.37 bar)



The flowchart shows all possible interventions in the set-up:

To exit Set-up, save the values and return to normal working, press the  +  keys together

## 2.2 • Set-up via RS-232 serial line

The communication protocol is 2400 bps, N, 8, 1 (no parity, 8 data bits, 1 stop bit) and ASCII commands are used. The ASCII format means commands can be sent using an appropriately configured normal terminal program. The spaces shown in the command examples have only been included to increase legibility. Do not include spaces when typing in the commands.

All the commands have the format “ESC c nnn”, where c stands for a specific command (e.g. E) and nnn is a number up to 3 digits which stands for the command parameter (e.g.1). For example “ESC E 1”.

The unit ignores all characters received from the send line which are not recognized as commands. The unit can be set up via the RS-232 serial line by giving the following commands:

ESC d 4	RS-232 serial inlet type
ESC R	general reset

The set-up commands are then given, after which normal working is resumed by sending a pressure request command and the type of inlet for the command:

ESC P 000	pressure set to 0
ESC d n	inlet type (e.g. ESC d 0 - pressure set to 0 to 10 V )

## The commands are:

<b>ESC b n</b>	<b>Precision</b>
( 1B - 62 - 3x )	

Defines the unit's precision.

The parameter n can have the following values:

0	precision	±	0	bit	
1	precision	±	1	bit	( ± 0.03 bar )
2	precision	±	2	bits	( ± 0.06 bar )
3	precision	±	3	bits	( ± 0.09 bar )
4	precision	±	4	bits	( ± 0.12 bar )
5	precision	±	5	bits	( ± 0.15 bar )
6	precision	±	6	bits	( ± 0.18 bar )

If the command is accepted, the display shows “ **b --**”

<b>ESC c n</b>	<b>Unit of measure of the pressure</b>
( 1B - 63 - 3x )	

Defines the unit of measure of the pressure shown on the display.

The parameter n can have the following values:

0	displayed in bars
1	displayed in PSI
2	displayed in kPa

If the command is accepted, the display shows “ **c --**”



**ESC E n**  
( 1B - 45 - 3x )

**Pressure regulation threshold**

Defines the unit's behaviour under pressure variations: a high threshold (e.g. E 8) means very damped, a low threshold (e.g. E 1) means only slightly damped.

The parameter n can have the following values:

- |   |                    |              |
|---|--------------------|--------------|
| 1 | pressure threshold | P = 0.12 bar |
| 2 | pressure threshold | P = 0.25 bar |
| 3 | pressure threshold | P = 0.37 bar |
| 4 | pressure threshold | P = 0.50 bar |
| 5 | pressure threshold | P = 0.62 bar |
| 6 | pressure threshold | P = 0.75 bar |
| 7 | pressure threshold | P = 0.87 bar |
| 8 | pressure threshold | P = 1.00 bar |

If the command is accepted, the display shows “E --”

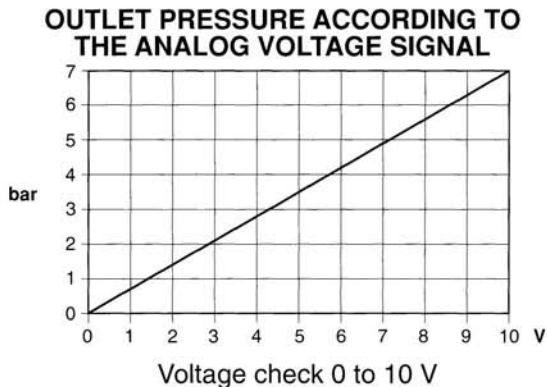
### 3 • Operating instructions

#### 3.1 - 0 To 10 V [ d = 0 ] Voltage check

When the unit is switched on, it starts to regulate the pressure according to the voltage. The righthand red LED indicates that the unit is ON. The lefthand LED can be either red or green: red indicates that the unit is energizing one of the solenoid valves, i. e. it is correcting the pressure on the line; green indicates that the requested pressure level has been reached.

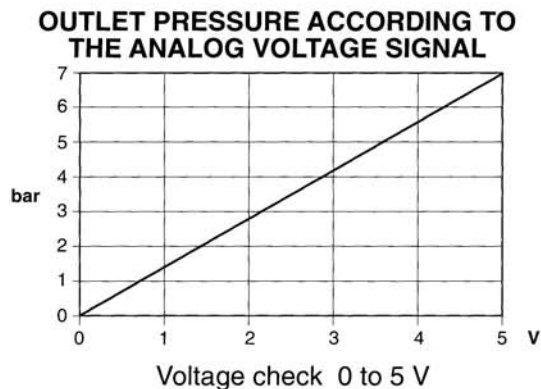
The solenoid valves are energized until the pressure level indicated by the relative command is reached. If the power on LED does not light up after the unit has been switched on, check that electricity is present and that the wires are connected correctly. If the LED still does not light up, call for technical assistance.

During normal operation, the unit can receive and transmit information along an RS-232 serial line. The instructions are given in Section 3.5.



### 3.2 - 0 to 5 V [d = 1] Voltage check

When the unit is switched on, it starts to regulate the pressure according to the voltage. The righthand red LED indicates that the unit is ON. The lefthand LED can be either red or green: red indicates that the unit is energizing one of the solenoid valves, i. e. it is correcting the pressure on the line; green indicates that the requested pressure level has been reached.

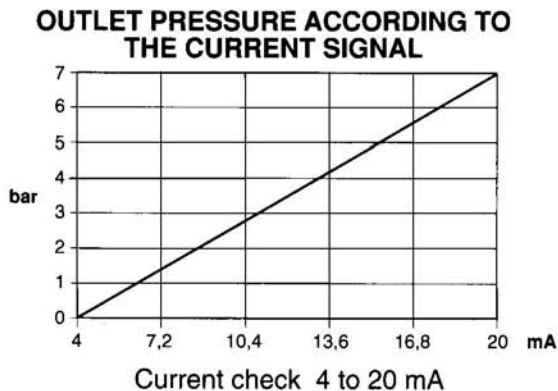


The solenoid valves are energized until the pressure level indicated by the relative command is reached. If the power on LED does not light up after the unit has been switched on, check that electricity is present and that the wires are connected correctly. If the LED still does not light up, call for technical assistance.

During normal operation, the unit can receive and transmit information along an RS-232 serial line. The instructions are given in Section 3.5.

## 3.3 - 4 to 20 mA [d = 2] Current check (available on request)



When the unit is switched on, it starts to regulate the pressure according to the current. The righthand red LED indicates that the unit is ON. The lefthand LED can be either red or green: red indicates that the unit is energizing one of the solenoid valves, i. e. it is correcting the pressure on the line; green indicates that the requested pressure level has been reached.



The solenoid valves are energized until the pressure level indicated by the relative command is reached. If the power on LED does not light up after the unit has been switched on, check that electricity is present and that the wires are connected correctly. If the LED still does not light up, call for technical assistance.

During normal operation, the unit can receive and transmit information along an RS-232 serial line. The instructions are given in Section 3.5.

### 3.4 - Keypad check [ d = 3 ] ( only for EPR 100 D )

When the unit is switched on, it starts to regulate the pressure according to the command given from the keypad. The lefthand key  reduces the pressure, whereas the righthand key  increases it. The display shows the regulated pressure, using the unit of measure indicated during set-up (parameter c). By pressing any key, the display changes to show the pressure level for three seconds (the point of the third figure of the display lit up - e.g. 3.50). After three seconds the regulated pressure is shown again. When the unit is switched off, the value assigned to the pressure is maintained.

During normal operation, the unit can receive and transmit information along an RS-232 serial line. The instructions are given in section 3.5.

### 3.5 - RS-232 Serial line check [ d = 4 ]

The communication protocol is 2400 bps, N,8,1 ( no parity, 8 data bits, 1 stop bit ) and ASCII commands are used. The ASCII format means commands can be sent using a normal, appropriately configured terminal program.

The unit ignores all characters received from the serial line which are not recognized as commands. All the commands have the format "*ESC c nnn*", where *c* stands for a specific command ( e.g. P ), and *nnn* is a 3-figure number which stands for the command parameter (e.g. 143). For example "*ESC P 143*".

As the unit has a reception buffer, when the instruction buffer is full, the unit sends the command DC3 ( hex ⇒ 13 ), to indicate that it cannot momentarily receive any more data. When it is ready to start receiving data again, it sends the command DC1 ( hex ⇒ 11 ). Any data sent between a DC3 command and a DC1 command are ignored.

When the unit is switched on, it waits for the set-up commands from the RS-232 send line, showing the await command message [---] on the display.

## The commands are:

<b>ESC d n</b> ( 1B - 64 - 3x )	<b>Inlet type</b>
------------------------------------	-------------------

Defines the inlet of the pressure request command.  
The parameter n can have the following values:

- |   |                                      |                   |
|---|--------------------------------------|-------------------|
| 0 | pressure set via                     | 0 to 10 V voltage |
| 1 | pressure set via                     | 0 to 5 V voltage  |
| 2 | pressure set via inlet in 4 to 20 mA |                   |
| 3 | pressure set via keypad              |                   |
| 4 | pressure set via RS-232 serial line  |                   |

<b>ESC P nnn</b> ( 1B - 50 . 3x - 3x -3x )	<b>Defined pressure</b>
---	-------------------------

Defines the requested pressure level.

The parameter nnn can vary from 000 to 255, where 000 is the minimum pressure and 255 is the maximum pressure.

You can use this command to leave set-up and define a new pressure level.

This command is only available when checking the unit via RS-232 serial line ( d = 4 ).

**ESC p**  
( 1B - 70 )

**Regulated pressure request**

Asks the unit for the regulated pressure value.  
The reply to this command is:

**ESC p nnn**  
( 1B - 70 - 3x - 3x - 3x )

**ESC i**  
( 1B - 69 )

**Set-up request**

Asks the unit to display the current set-up (defined parameters).  
The reply to this command is:

**ESC i P nnn b n c n d n E n**  
( 1B - 69 - 50 - 3x - 3x - 3x - 62 - 3x - 63 - 3x - 64 - 3x - 45 - 3x )



**ESC s**  
( 1B - 73 )

### Working state request

Asks the unit for the working state.  
The reply to this command is:

**ESC s n**  
( 1B - 73 - 3x )

where n can have the following values:

0	⇒	Waiting	Regulated pressure reached, regulator waiting
1	⇒	Working	Regulated pressure not yet reached, unit being piloted
2	⇒	Error	Line error in command reception

When n = 2, the unit does not accept any more commands until the appropriate command for activating the pressure regulator (ESC G) is received.

**ESC R**  
( 1B - 52 )

### General reset

The unit is completely reset, which involves:

- stopping any solenoid valve energizing activity;
- emptying the command reception buffer;
- displaying the await command message [---].

This command is recognized by the line and when it is received, all pending commands are removed, and the command is carried out immediately.

After receiving this command, the unit either waits for new instructions (set-up commands) if the pressure command inlet is the RS-232 serial line ( d = 4 ), or a start-up command for pressure regulation (ESC G).

**ESC G**  
( 1B - 47 )

### Pressure regulation start-up

Resumes normal working after the unit has received a general reset command (ESC R), or after a line error has occurred in command reception.

## 4 • Maintenance and controls

The filtering elements for the unit's inlet (1) and outlet (2) should be checked and cleaned periodically, and replaced if necessary.

In case of malfunctioning, call for technical assistance. Do not carry out maintenance on the unit yourself.

The information contained in this document is subject to change without prior notice.

No part of this document may be reproduced or transmitted in any form or by any means, without written authorisation from MATRIX S.p.A.

© MATRIX S.p.A. - Pneumatic Division. All rights reserved



**MATRIX S.p.A.** - Pneumatic Division

Corso Vercelli n. 330

10015 Ivrea (To) - ITALY

Tel. + 39 • 125 - 61.54.42

Fax + 39 • 125 - 61.53.77

e-mail: [matrix@matrix.to.it](mailto:matrix@matrix.to.it) • <http://www.matrix.to.it>

*Cod.820.104 M Rev. 00*

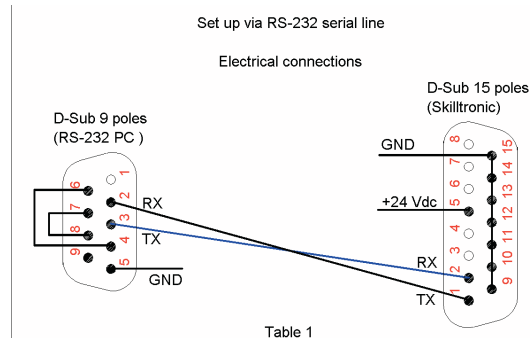
# ePressure Regulator

## Preface

ePressure is a software product designed to connect your PC to Skilltronic, via RS-232 connection. ePressure lets you remotely change parameter or control your Skilltronic A/D.

### PC Requirements:

- Windows 2000 Service Pack 3; Windows 98; Windows 98 Second Edition; Windows ME; Windows Server 2003; Windows XP Service Pack 2.
- [Windows Installer 3.0](#) (except for Windows 98/ME, which requires [Windows Installer 2.0](#) or later). [Windows Installer 3.1](#) or later is recommended. [NET Framework](#).
- [IE 5.01](#) or later.
- Disk Space Requirements: 280 MB (x86), 610 MB (x64).
- RS-232 serial communications port and special communication cable. For electrical connection see table 1.



## Installing ePressure software

Follow the steps below to install ePressure software.

1. Install dotNet Framework with double click on icon [dotnetfx.exe](#). The installation wizard appears next and guides you through the rest of installation process. Follow the instructions in the wizard.
2. Install ePressure software with double click on icon [e-Pressure\\_Regulator.msi](#).

## Running ePressure

Connect your PC to Skilltronic by the special cable.

Connect your Skilltronic to electrical power supply and pneumatic supply.

To start ePressure, select Start > Programs > Metal Work S.p.A. > e-Pressure Regulator > ePressure Regulator. Select the COM port number in the options menu for establish a communication link from your PC to your Skilltronic. Select the language in the options menu, in this case, you must restart the software.

Press the START button to run the communication. ePressure will show you the configuration parameters stored in Skilltronic memory.

## Change parameters and control pressure

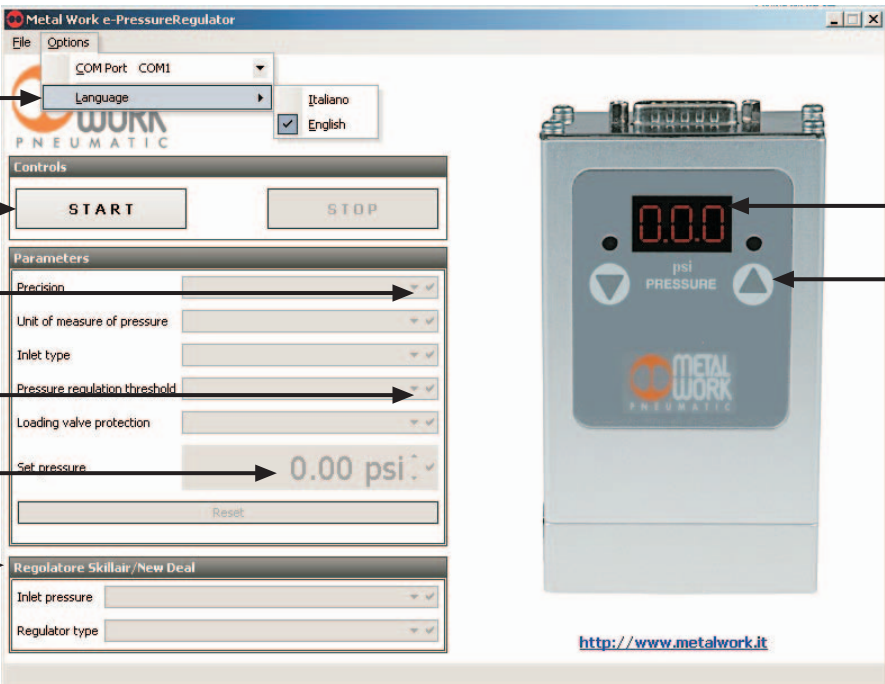
ePressure allows you to change all parameters and set pressure. For enable this service, you must select first Inlet type > RS-232 in the Inlet type menu and send it to Skilltronic.

Now the windows of parameters and the set pressure are enabled.

Refer to Skilltronic manual for more detailed of parameter function.

## Control Pressure

The pressure can be set by pressing Set Pressure buttons or directly in the Set Pressure window, the Read pressure display shows you the real pressure in the device.



**Set COM port**  
**Set Language**

**Start / stop program**

**Set Parameter**

**Enter Parameter**

**Set pressure**

**Skillair/New Deal parameter**

**Read pressure**

**Set pressure**

<http://www.metalwork.it>