





FIO2

Field Installation Manual

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<u>Index</u>

1.	Intro	oduction	3	
2.	2. Installation of the single components			
2	.1	Q-kit	4	
	2.1.1	REFLUX-REVAL	5	
	2.1.2	NORVAL	6	
	2.1.3		8	
Z	.2	P-Kit	9	
2	.3	FIO2 ECU Electronic Control Unit	12	
	2.3.1	Wall mounting Pipe/pole mounting	12 12	
	2.3.3	Protection box mounting	13	
2	.4	Pneumatic pressure + temperature connections of FIO2 ECU	14	
	2.4.1	KIT HP-HP	15	
	2.4.2	KIT HP-LP	2	
	2.4.3	KIT LP-LP	1	
~	2.4.4		2	
2	.5 251	RTUBOX / LOOSE DAIMers	ර 2	
	2.5.1	Box	3	
3.	Elec	ctrical connections	6	
	3.1.1	Removing the cover of the wiring compartment	6	
	3.1.2	Diagram of connections	7	
	3.1.3	Field connections of FIO2 ECU to other components:	8	
	3.1.4	Connections RTUBox to 115-230 Vac, 24 Vac and solar panel:	10 12	
	3.1.6	Connections loose barriers to FIO2 ECU:	13	
	3.1.7	Connections P&CD-external antenna:	14	
4.	Star	rtup of the electrical devices and preliminary tests	15	
4	.1	ECU Startup	15	
4	.2	FIOBox	15	
4	.3	Test of solenoid valves	16	
4	.4	Serial communications configuration	18	
4	.5	Serial communications test	18	
5.	Bas	ic configurations on ECU	19	
5	5.1	Setting of Q-kit (limits 0% and 100% of regulator)	19	
	5.1.1	Preparation of FIO2 menu and password entering	19	
	5.1.2	Setting the full scale of the regulator (100%).	20	
	5.1.3 5.1.4	Setting the zero of the regulator (0%). Save of the settings	21 22	
F	; 2	Setting of Ca curve on the EIO2	22	
U.	5.2.1	Setting the zero of the regulator with Low Trim Scale (<0%).	25	
6.	Star	rt-up of the line		
7	Mai	ntenance of the line	27	
· ·	imali		ZI	

FIO2 Field Installation Manual – Ed.1. Rev.A

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Field Installation Manual

1. Introduction

This document is a FIELD INSTALLATION MANUAL FOR THE EXPLANATION OF THE OPERATIONS TO BE PERFORMED ON FIELD AND REMOTELY FOR THE INSTALLATION AND COMMISSIONING OF THE FIO2 SYSTEM.

ALL THE OPERATIONS TO DO HAVE BEEN PRESENTED IN SEQUENTIAL ORDER, SO THIS GUIDE CAN BE ASSUMED AS A PROCEDURE FOR INSTALLATION AND COMMISSIONING OF THE WHOLE FIO2 SYSTEM (SEE GREEN COLOR INDICATIONS).

It describes the phases of:

- -installation of the single components
- -pneumatic connection and electric wiring
- -startup of the equipment and preliminary verifications.
- -manual configuration of unit on field FIO2.1 ECU (Electronic Control Unit).
- -basic configurations with terminal (TSG Local).
- -complete configuration with terminal (TSG Local) or remotely with TSG.

This manual does not replace the manuals of the single equipments. It has been realized in order to provide to the installer a consultation tool for the connection among them of all the equipment that are included on the system FIO2. When the information provided in this manual are not sufficient, please refer to the manuals of the single equipment:

- FIO2 UM User manual FIO2 ECU (Electronic Control Unit)
- FIO RTU-SOLAR UM User manual RTUBox in safe area
- FIO2.0_ProtocolloModbus_(PR_12_02)_REV_ Modbus protocol for remote connection
- FIO2_SMS_Protocol Pubblic FIO2 SMS protocol





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2. Installation of the single components

PROCEDURE STEP 1:

- Before starting the operations, close upstream and downstream ball or butterfly valves and discharge all the pressure in the line.
- Installation of Q-kit, P-kit, FIO2 ECU and RTUBox. Refer to the following instructions.

Note: if one of these units is not used, don't consider the corresponding chapter.

2.1 *Q-kit*

The Q-kit is installed if the indirect flow measurement (IFM) is required.

It consists of a device for the acquisition of the displacement % of the pressure regulator from the closing position. It is necessary for the calculation of the flow rate with the indirect method.

It is composed on a resistive transducer coupled to a moving component of pressure regulator for the reading of the position (stroke indicator of Reflux, Reval and Dixi or main diaphragm of Norval).

The transducer is wrapped on an aluminum cover in order to ensure the protection against atmospheric events.

The coupling to moving parts is guaranteed by the magnet located at the end of the rod. It is supplied preassembled (see picture on the right).

In case of new regulator, the Q-kit will be already assembled in factory.







FIO2

Field Installation Manual

For a field upgrade on existing regulator, use the following instructions:

2.1.1 REFLUX-REVAL

- Pict 1- Disassemble the upper cover of the regulator
- Pict 2- Replace the upper flange with the flange supplied in the Q-kit. Use the new o-rings supplied on the kit.
- Pict 3- Replace the stroke indicator rod with the longer one supplied in the Q-kit.



- Pict 4- Put the upper cover on the lower cover paying attention that the base of the stroke indicator rod is correctly inserted into the groove.
- Pict 5- Position correctly the upper cover and fix the screws in order to close the head
- Pict 6- Screw on the upper flange the intermediate collector with the swivel exagon. Fix strongly using the 10 mm Allen key.



- Pict 7- Put the o-ring on the extremity of the displacement transducer and assemble it on the swivel exagon. Pay attention that the stroke indicator rod has to enter inside the cavity with the magnet of the displacement transducer.
- Pict 8- Fix using two exagonal wrenches on the point indicates on the picture.





2.1.2 NORVAL

For Norval application two models has been provided: shorter rod for head 375 and 375 TR; longer rod for head 495 and 630.



Unscrew the setting screw; unscrew the cab; remove the main spring with the spring-guide; remove the top cover; remove the bottom flange of the body.

- Pict 1- Unscrew the nut that holds the stem on the diaphragm. With one hand in the bottom of the regulator catch the stem and put it out.
- Pict 2- Put the diaphragm kit out of the regulator and unscrew the big nut.
- Pict 3- Remove the lower spring-guide from the plate.



- Pict 4- Put the plastic spacer on the plate for the position feedback.
- Pict 5- Insert the metallic plate for the alignment of the spacer. Take care for the right positioning.
- Pict 6- Put the belleville washer if present.



- Pict 7- Put the lower spring-guide.
- Pict 8- Screw the big nut, taking care that the spring-guide has to remain free even if the nut is fixed.
- Pict 9- Lock the big nut.





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Field Installation Manual

Pict 10-Insert from the bottom of the body the stem and join it on the diaphragm kit with the nut.

Pict 11-Before fixing the nut definitely, align all the holes of the lower cover with the holes of the diaphragm.

Pict 12-Lock the screw with three keys in order to avoid the rotation of the diaphragm .



Pict 13-Fix the screws and close the bottom flange of the regulator.

Pict 14-Assemble the top cover.

Pict 15-Insert the spring and the spring-guide.



Pict 16-Screw the cap completely and screw the setting screw.

Pict 17-The setting screw has to push the spring-guide below the 1/2" female thread.

Pict 18-The cap has two 1/2" female threads. Screw a 1/2" plug in the hole closer to the antipumping valve.



Pict 19-In the other hole in the opposite side of the cap screw the $\frac{1}{2}$ " elbow.

Pict 20-Unscrew the antipumping valve.

Pict 21-Screw the antipumping valve on the elbow





- Pict 22-Screw on the 1/2" female threadolet of the cover the intermediate collector with the swivel exagon. Fix strongly using the 10 mm Allen key.
- Pict 23-Insert the transducer, taking care to insert the rod inside the cover as much vertical as possible, in order to have the best measurement accuracy and prevent frictions. Fix using two exagonal wrenches



Note: The Norval regulators assembled in factory ordered with Q-kit already built-in, will be provided with 2x 1/2" female threadolet directly on the top cover. In that case the antipumping valve position won't be modified and the cap will be the standard one. The transducer will be assembled on the second threadolet.

2.1.3 DIXI

- Remove the stroke indicator
- Screw the intermediate collector with the swivel exagon.
- Fix strongly using the 10 mm Allen key.
- Put the o-ring on the extremity of the displacement transducer and assemble it on the swivel exagon. Take care to insert the rod inside the head as much vertical as possible, in order to have the best measurement accuracy and prevent frictions
- Fix using two exagonal wrenches on the point indicates on the picture.





Field Installation Manual

2.2 P-kit

The pilot P-kit is installed if the pressure modulation is required. It is able to change remotely the setting of the pilot. In case of new regulator, the P-kit will be already assembled in factory.

Are available two different models:

- 204/A/2CS/ FIO with two solenoid valves (UP and DOWN) for high, medium, low pressure (pict.1 and pict. 2).
- 201/E/FIO with electric motor for low pressure (pic.3).









For a field upgrade of existing regulator, use the following instructions:

- Remove the traditional pilot.
- Pict 1- Replace the traditional pilot with the new P-kit. Since there are several models of pilot, the bracketing systems varies according to the applications Fix the bracket of the new pilot on the regulator

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- Pict 2- Prepare and connect the feeding tube to the pilot system.
- Pict 3- Prepare and connect the tube of control pressure

REFLUX / REVAL:



APERFLUX / APERVAL:



DIXI:

The P-kit for Dixi has the same tubing connections of Reval but, considering the weight of the pilot, has a specific bracket for the fixing on the head (standard pilot has not the bracket)

Example:

REFLUX + 204/A/2CS FIO

REVAL + 201/E/FIO

DIXI + 204/A/2CS FIO





- Pict 4- Connect the sensing line on the pilot
- Pict 5- Connect the sensing line on the multiple take-off (don't insert needle valve through this line)
- Pict 6- For REFLUX / REVAL / DIXI: Connect the discharge tube on the upper head.
- Pict 7- For APERFLUX / APERVAL / NORVAL : Connect the discharge tube on the pilot
- Pict 8- Connect the discharge tube on downstream (don't insert needle valve through this line). Only for REFLUX / REVAL / DIXI: the discharge tube of the head can be connected in the same multiple take-off of the sensing line. APERFLUX, APERVAL AND NORVAL: the discharge tube must be ALWAYS separated from the sensing line.



IMPORTANT: In the downstream side keep always a free vent valve for the preliminary settings before opening the downstream valve to the net.



2.3 FIO2 ECU Electronic Control Unit

2.3.1 Wall mounting

This installation has the limitation that the length of the pressure/temperature sensors cables (3 meters) can not be changed. So the position on the wall of the FIO2 ECU has to be selected considering that the furthest sensor is within the radius of 3 meters.

In alternative, if the distance is more than 3 meters, is possible to cover the distance sensor/pressure point using a tubing (10 mm) from the pressure point to the sensor.

In the fittings-kit are available the fittings for the connection to pressure sensor in both cases (direct connection or connection with the pneumatic extensions). If necessary, the cables of solenoid valves and displacement transducers can be extended. In the box of FIO2 ECU are included four little brackets for the fixing on the wall with the screws.



2.3.2 Pipe/pole mounting

This installation is more flexible. Is possible to install the FIO2 ECU directly on the pipe line close to the regulator in order to minimize the distance from the sensor points.

The pole installation is suggested in case of two lines application. In this case the pole can be install between the two lines. For every FIO2 ECU is provided a kit with the plate for pipe/pole mounting.





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Page 12/15



Pict 1- Fix the two brackets with the nuts. For pipeline fixing "1a". For pole fixing "1b".

Pict 2- Cut a piece of stainless steel band. The length has to be measured as the circumference of the pipeline + 150 mm (6 inch)



- Pict 3- Pass one side of the stainless steel band in the endless-head
- Pict 4- Pass the opposite side of the band on the slits of the bracket.
- Pict 5- Pass the band around the pipe and then insert it inside the endless-head, screwing the endless screw
- Pict 6- Adjust the bracket in the proper position and then fix it definitively



2.3.3 Protection box mounting

FIO2 ECU housing is not protected from ultra-violet ray. In case of direct sun exposure is suggested to install the unit inside a protection box. The installation procedure is same as wall mounting. For installation of protection box see the supplier instruction.



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2.4 Pneumatic pressure + temperature connections of FIO2 ECU

The fittings kit included on the FIO2 system can be different according with the pressure sensor range and the $\frac{1}{2}^n$ thread (ISO or NPT).

HP: pressure range =99 bar ; LP: pressure range <=23 bar.

The transducer with pressure range =99 barg has a different swivel fitting, suitable for high pressure applications. Also the isolation valves change according to the pressure range.

If Pd=99 barg, pressure take-off is separated from the termowell.

If Pd<=23 barg, pressure connection and thermowell are jointed in one component.





Inside the kit there is all the necessary to satisfy different ways to connect the pressure transducer:



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Page 14/15



2.4.1 KIT HP-HP

- Remove gauge indicator and isolation valve 1-
- Install the multiple take-off 2-
- 3-Install on the top the existing isolation valve and the gauge indicator



For Pu1, Pu2 (if present) and Pd:

- For distance < 3 meters, install the insolation value on $\frac{1}{4}$ " Install the plug on 1/8" thread. 4-
- 5-
- Install the swivel fitting on the isolation valve 6-
- 7-Install and fix the sensor (take care that the internal o-ring has to be in right position)
- For distance >3 meters, install the compression fitting on $\frac{1}{4}$ " Install the plug on $\frac{1}{8}$ " thread. 4-
- 5-
- Make the extension tube for covering the distance exceeding 6the 3 meters from the FIO2 ECU
- Install on the isolation valve the compression fitting female in 7one side and the swivel fitting on the other side
- 8-Install and fix the sensor (take care that the internal o-ring has to be in right position)







2.4.2 KIT HP-LP

- 1- Remove gauge indicator and isolation valve
- 2- Install the multiple take-off on Pu1 and Pu2 (if present)
- 3- Install the mano-thermometric device
- 4- Install on the top the existing isolation valve and the gauge indicator



For Pu1 and Pu2 (if present)

- 5- For distance <3 meters, install the insolation value on $\frac{1}{4}$ " thread
- 6- Install the plug on 1/8" thread.
- 7- Install the swivel fitting on the isolation valve
- 8- Install and fix the sensor (take care that the internal o-ring has to be in right position)
- 5- For distance >3 meters, install the compression fitting on ¼" thread
- 6- Install the plug on 1/8" thread.
- 7- Make the extension tube for covering the distance exceeding the 3 meters from the FIO2 ECU
- 8- Install on the isolation valve the compression fitting female in one side and the swivel fitting in the other side
- 9- Install and fix the sensor (take care that the internal o-ring has to be in right position)





- For Pd:
- 9- For distance <3 meters, if the gauge indicator is necessary, modify the mano-thermometric device in order to add the ½" female thread for gauge indicator connection. See the instruction below (from pos.1 to pos.2)
- 10- Install and fix the sensor (take care that the internal o-ring has to be in right position
- 11- Insert the temperature sensor on the top of the manothermometric device. Fix the cable with the cable gland for temperature (not too strong, the risk is to cut the cable)
- 10- For distance >3 meters, modify the mano-thermometric device in order to add the ½" female thread for gauge indicator connection. See the instruction below (from pos.2 to pos.3)
- 11- Make the extension tube for covering the distance exceeding the 3 meters from the FIO2 ECU
- 12- Install on the isolation valve the compression fitting female in one side and the swivel fitting in the other side
- 13- Install and fix the sensor (take care that the internal o-ring has to be in right position)

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2.4.3 KIT LP-LP

- 1- Remove gauge indicator and isolation valve
- 2- Install the multiple take-off on Pu1 and Pu2 (if present)
- 3- Install the mano-thermometric device
- 4- Install on the top the existing isolation valve and the gauge indicator



For Pu1 and Pu2 (if present)

- 5- For distance <3 meters, install the insolation value on $\ensuremath{\mathcal{U}}^{"}$ thread
- 6- Install the plug on 1/8" thread.
- 7- Install the swivel fitting on the isolation valve
- 8- Install and fix the sensor (take care that the internal o-ring has to be in right position)
- 5- For distance >3 meters, install the compression fitting on $\ensuremath{\mathcal{Y}}^{"}$ thread
- 6- Install the plug on 1/8" thread.
- 7- Make the extension tube for covering the distance exceeding the 3 meters from the FIO2 ECU
- 8- Install on the isolation valve the compression fitting female in one side and the swivel fitting in the other side
- Install and fix the sensor (take care that the internal o-ring has to be in right position)







- For Pd:
- For distance <3 meters, if the gauge indicator is necessary, modify the mano-thermometric device in order to add the ½" 9female thread for gauge indicator connection. See the instruction below (from pos.1 to pos.2)
- 10- Install and fix the sensor (take care that the internal o-ring has to be in right position
- 11- Insert the temperature sensor on the top of the manothermometric device. Fix the cable with the cable gland for temperature (not too strong, the risk is to cut the cable)
- 10- For distance >3 meters, modify the mano-thermometric device in order to add the ½" female thread for gauge indicator connection. See paragraph 2.5.4, from pos.2 to pos.3.
- 11- Make the extension tube for covering the distance exceeding the 3 meters from the FIO2 ECU
- 12- Install on the isolation valve the compression fitting female in one side and the swivel fitting in the other side 13- Install and fix the sensor (take care that the internal o-ring
- has to be in right position)





2.4.4 For all the versions



Modification of mano-thermometric device for application with gauge indicator:



Modification of mano-thermometric device for application with gauge indicator and tube extension:





2.5 RTUBox / Loose barriers

The FIO2 ECU has these optional functionalities to the external safe area:

- can be supplied with external source
- can be connected with serial port to external units (local software, RTU for SCADA, ...)
- can export the flow rate (pulses retransmission) to external unit (flow computer, odorizing system, ...)

If one or more of these functions are requested, is mandatory to separate the hazardus area from the safe area through these optional barriers. Use only these models in order to comply the ATEX prescriptions:

- Power: electrical supply of FIO2 ECU STHAL 9143/10-156-160-10s
- Serial: serial connection STHAL 9185/11-45-10s
- Pulse: retransmission of measured flow rate STHAL 9170

For energy consumption reasons the external electrical source is mandatory in case of serial communication and/or pulse retransmission.

2.5.1 Loose barriers

Only the requested barriers are provided.

Usually are installed directly inside the customer box in safe area in a standard din rail. The barriers must be supplied with 24 Vdc.





2.5.2 Box

There are many different models according to the energy source available (115-230 Vac, 24 Vdc, Solar panel).

The boxes includes all the necessary components for the interface hazardus area / safe area.

2.5.2.1 Box version 115-230VAC

It includes:

- -Thermal-magnetic switch for circuit protection
- -Surge protection device
- -Service socket
- -Power supply unit (115-230Vac to 24 Vdc)
- -Terminal strip and cable glands for hazardus area cables
- -Terminal strip and cable glands for safe area cables
- -Power supply barrier Ex-i (for FIO2 ECU supply)
- -Serial barrier Ex-i (repeater of RS485 to RS485/RS232) (optional)
- -Pulse barrier Ex-I (repeater of pulses) (optional)



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2.5.2.2 Box version 24 VDC

It includes:

- -Thermal-magnetic switch for circuit protection
- -Surge protection device
- -Terminal strip and cable glands for hazardus area cables
- -Terminal strip and cable glands for safe area cables
- -Power supply barrier Ex-i (for FIO2 ECU supply)
- -Serial barrier Ex-i (repeater of RS485 to RS485/RS232) (optional)
- -Pulse barrier Ex-I (repeater of pulses) (optional)







FIO2 Field Installation Manual

2.5.2.4 Wall mounting for all versions

- Pict 1- Mark the positions on the corners of the box (see picture 1)
- Pict 2- Insert the brass supports on the four holes
- Pict 3- Beat, using an hammer and a parallel pin, in the center of the support in order to move the internal plate to the bottom position
- Pict 4- Fix the support with the screw in vertical position or \ldots
- Pict 5- fix the support with the screw in horizontal position
- Pict 6- Fix the box on the wall with screws anchor and close with the black covers
- Pict 7- In alternative can be mounted on a pole with a specific fixing kit.







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3. Electrical connections

PROCEDURE STEP 2:

Once all the equipment have been installed, is possible to connect them together electrically. -Realize all the electrical connection between FIO2 ECU, RTUBox/barriers, source 115-230 Vac, 24 Vdc or solar panel, external antenna (optional), flow meter (optional), digital input (optional), solenoid valves. Refer to the following instructions. The line has to remain vented during this step.

Note: if one of these units is not provided, don't consider the corresponding chapter.

3.1.1 Removing the cover of the wiring compartment

Open the transparent front door by pressing the button positioned on the bottom of the device.

The removal of the plastic cover placed on the wiring compartment allows accessing the connection terminals as described in the following figure:



The Pu1, Pd and T sensors are always present and the terminals are not accessible by removing only the cover described in the previous paragraph.

FIO 2.0 is provided with cable glands to assure the device IP tightness, provided that cables with a maximum diameter of 7 mm are connected.

The arrangement of the cable glands is shown in the following picture:





anual

CAUTION: The cable gland related to Displace2 is shared with a second optional input BF; where the digital inputs 5 and 6 come from the field through a cable other than the one of the digital inputs from 1 to 4, it is necessary to use the cable gland related to BF/HF out. WARNING: take care to tighten the caps of the cable glands after having performed the wiring to assure the IP tightness of the device. The tightening of the caps of the cable glands can be done without the aid of special equipment because they feature an automatic locking mechanism.

3.1.2 Diagram of connections

With reference to Errore. L'origine riferimento non è stata trovata., here below the diagram with the available connections is shown.



Diagram of connections

3.1.3 Field connections of FIO2 ECU to other components:



P-kit needs the connection kit from solenoid valve to FIO2 ECU (n°2 cables lengh 1-3-5 meters). For turbine meter use shielded cable 2x0,75 mmq (LF/HF)

* All the shields MUST ALWAYS be connected to FIO2 ECU side (see FIO2 ECU manual)



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3.1.3.1 Displacement transducer

Respect the colour of the wires (brown-yellow-blue).



3.1.3.2 Solenoid valves

Check the connector for the polarity. + (positive) = UP/DOWN; - (negative) = COM.

The shield of the cable has to be jointed with the negative wire in FIO2 ECU side. Cover with thermo-shrinking sheathing .

Do not connect the shield to the opposite terminal of the cable and insulate it.



3.1.3.3 Pulse input from flow meter

For HF pulse respect the polarity. + (positive) = COUNT2HF; - (negative) = COM. For BF there is no polarity. The cable has to respect the ATEX restrictions. Is suggested a shielded cable blue 2x0,75 (for example ÖLFLEX® EB CY or similar). The shield of the cable has to be jointed with the negative wire in FIO2 ECU side. Cover with thermo-shrinking sheathing . Do not connect the shield to the opposite terminal of the cable and insulate it.

3.1.3.4 Digital input

The digital input available are 6. Collect as much as possible in one cable the digital inputs. There is no polarity. Connect one wire on DIG1 to DIG6 terminal. Collect all the other wire in COM. The shield of the cable has to be jointed with the wire connected in COM terminal in FIO2 ECU side. Cover with thermo-shrinking sheathing.

Do not connect the shield to the opposite terminal of the cable and insulate it.

See the example below. Obviously the digital can be used also for other purposes. The only prescription is that the digital must be a free contact.





Can be used for monitoring of:

-filters clogging

-monitors intervention

- -safety valves intervention
- -entrance gate intrusion alarm
- -gas presence detector
- -flood or flame detector



3.1.4 Connections RTUBox to 115-230 Vac, 24 Vdc and solar panel:

The terminal board of the power supply inside the box is in the lower right corner. No specific ATEX prescriptions for cable. Cable and protection devices must be selected according to standard normative of the country.



3.1.4.1 Connections RTUBox to 115-230 Vac:

-Be sure to remove the external supply.

-Move to OFF the automatic switch internally the box.

-Connect the cable respecting the Line, Neutral and Earth wires.



3.1.4.2 Connections RTUBox to 24 Vdc:

-Be sure to remove the external supply.

-Move to OFF the automatic switch internally the box.

-Connect the cable respecting the + positive and – negative.





3.1.4.3 Connections RTUBox to Solar panel:

-Move to OFF the automatic switch internally the box.

-Disconnect the fuse of the battery.

-Insert the positive terminal of the battery.

-Connect the cable from the panel respecting the + positive and - negative.



3.1.5 Connections RTUBox to FIO2 ECU and to external devices:

For connection to FIO2 ECU, the cable has to respect the ATEX restrictions.Is suggested a shielded cable blue 2x0,75 (for example ÖLFLEX® EB CY or similar).

Do not connect the shield to the opposite terminal of the cable and insulate it.

Use separate cables for every signal!

FIO2		FIO RTU / SOLAR			
	Terminal	RTU 115-230VAC	RTU 24VDC	SOLAR	
	+ Positive	J1	J5	J1	
EXT.POWER	 Negative 	J2	J6	J2	
SUPPLY	Shield	Do not connect	Do not connect	Do not connect	
	+ Positive	J5	J9	J5	
PULSE	 Negative 	J6	J10	J6	
(DOUT-N)	Shield	Do not connect	Do not connect	Do not connect	
	A+	J3	J7	J3	
SERIAL RS485	В-	J4	J8	J4	
(RSA)	Shield	Do not connect	Do not connect	Do not connect	

For connections to external area, there are no specific ATEX prescriptions for cable. Cable and protection devices must be selected according to standard normative of the country.

External device		FIO RTU / SOLAR		
Tipo	Signal	RTU 115-230VAC	RTU 24VDC	SOLAR
	TXD	J9	J13	J9
SERIAL	RXD	J8	J12	J8
R5232	GND	J7	J11	J7
	+	J10	J14	J10
PULSE	-	J11	J15	J11



Before connect the external supply of the barrier to the FIO2 ECU, verify the voltage on terminals 10-11. The correct value is 13 Vdc. If is not this value, adjust it with the trim in the front of the barrier to 13 Vdc.

3.1.6 Connections loose barriers to FIO2 ECU:

For connection to FIO2 ECU, the cable has to respect the ATEX restrictions. Is suggested a shielded cable blue 2x0,75 (for example ÖLFLEX® EB CY or similar).

Do not connect the shield to the opposite terminal of the cable and insulate it.

Use separate cables for every signal!

For connections to external area, there are no specific ATEX prescriptions for cable. Cable and protection devices must be selected according to standard normative of the country.



IMPORTANT: Before connect the external supply of the barrier to the FIO2 ECU, verify the voltage on terminals 10-11. The correct value is 13 Vdc. If is not this value, adjust it with the trim in the front of the barrier to 13 Vdc.



FIO2 **Field Installation Manual**

Zone 2

Ê-]⊤×D

A-R×D





3.1.7 Connections P&CD–external antenna:

In case of problems with GSM network coverage, it is possible to replace the pre-assembled rod aerial (only for versions with GSM modem) with a remote antenna.

To replace the antenna unscrew it and replace it with the wished one.

The connection is of SMA type.







FIO2

4. Startup of the electrical devices and preliminary tests

PROCEDURE STEP 3:

After all the pneumatic and electric connections has been realized, is possible to startup the electrical devices.

- Switch on FIO2 ECU and RTU Box if present. Refer to the following instructions.

- In order to avoid malfunctioning, verify the connections between FIO2 ECU, solenoid valves and serial connections. Refer to the following instructions.

The line has to remain vented during this step.

4.1 ECU Startup

Unscrew the screws related to the cover of the electronic card.

Remove the front panel on which the keyboard is installed while paying attention not to damage the flat type connection that connects the keyboard to the display card.

Remove the brown separating plate positioned between the terminal compartment and the compartment

containing the electronic card (see figure below).

Unlock the opening of the SIM door and introduce the new SIM .

Close the door and lock it with the special locking lever.

Fix the connector of the battery, in particular:

The 2-way connector is dedicated to the connection of the Lithium battery.

The 3-way connector is dedicated to the connection of the rechargeable battery.



4.2 FIOBox

Switch-on the automatic switch in order to energize the barriers.

On the display of FIO2 ECU, the external supply indicator has to move from



If it doesn't work, check the polarity and measure the voltage on the ext. supply wires after disconnection from FIO2 ECU terminals. The value has to be around 13 Vdc. Connect the wires to the terminals and check that the voltage decreases to 5-6 Vdc.

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4.3 Test of solenoid valves

After the connection of the solenoid valves, and before activate the pressure modulation, is suggested the test manually the UP/DOWN solenoid valve, in order to debug mistakes.

The manual activation is in Station/ Maintenance menu:



Page 16/27







Pressing the button "F1", "F2" or "F3", considering that is the first modification that you are going to do, FIO2 asks the introduction of the password (the default is "1").





-Pressing "F2" the UP solenoid valve has to activate -Pressing "F3" the DOWN solenoid valve has to activate



4.4 Serial communications configuration

All the FIO2 ECU coming from the factory have the Modbus Address set to 0 (default).

For this modification it is necessary to reach the Menu "Settings \ System Settings \ Modbus Adr." and modify the address from 0 to 10. For the navigation through ECU menus see 5.1.

The user can change the address of the equipment.

4.5 Serial communications test

To test the serial connection just performs with the software TSGLocal a serial connection:

- 1- Connect the cable with adapter RS485/USB on the connector of Serial A of FIO2 ECU
- 2- If the RTUBox with the serial barrier is present, verify the serial connection downstream the barrier, using the RS232 or RS485 channel.

For the connection with TSGLocal is important to know the COM port used from the serial/USB converter. Check in the "Peripheral management" page of the computer.



5. Basic configurations on ECU

PROCEDURE STEP 4:

After the electrical devices and connections have been verified, the first configuration has to be done on ECU.

- In case of indirect measurement of the flow rate, set the full scale (100%) and the zero (0%) of the regulator. Refer to the following instructions.

Note: if one of these units is not provided, don't consider the corresponding chapter.

5.1 Setting of Q-kit (limits 0% and 100% of regulator)

The indirect measurement of the flow rate is based on the correlation between the position % of a specific regulator and the inlet and outlet pressures. The position is measured through the displacement transducer. It has a measurement range greater than the stroke of the regulator. So it is necessary for the FIO2 to know exactly the position of complete opening and complete closing of the regulator (see example on the right) on order to calculate by interpolation the intermediate position % during the working operation.

The numbers on the example can be totally different from the real case.



5.1.1 Preparation of FIO2 menu and password entering

Press two times the "ESC" button. FIO2 display switches on. Press "F3" to activate the back-light if necessary.



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Page 19/27





Press the button "F1" or "F2". Considering that is the first modification that you are going to do, the FIO2 asks the introduction of the password (the default is "1").



5.1.2 Setting the full scale of the regulator (100%).

Is preferable to carry out initially the 100% and that the 0%, but the procedure can also be inverted. The suggestion is because normally the opening to 100% of the regulator is realized before the complete pressurization.

If the regulator is fail to open, you don't need to do any operation.

If is Fail to Close, widely open it by pressing the push valve upstream the pilot system.

Follow this procedure:

-check the connection of the push valve: the secondary inlet has

to be connected upstream the slam shut valve or the inlet ball valve

-close the slam shut valve or the inlet ball valve

-open a discharge valve downstream the regulator

in order to keep to the atmosphere the downstream volume

-press the push valve. The regulator opens widely

-keep the push valve pressed until the 100% on $\ensuremath{\mathsf{FIO2}}$ is done.









Verify that the position value in count is stable, than press "F2".

5.1.3 Setting the zero of the regulator (0%).

- 1- Pressurize the regulator.
- 2- Perform all the required settings (Slam shut valve, monitor).
- 3- Adjust, with the setting spring, the required outlet pressure value, flowing with a ½" ball valve on downstream side open at 45° discharging in atmosphere
- 4- Set the Zero on FIO2 with the following procedure

We suggest to perform the zero setting with this small flow rate in order to be sure that the regulator is not working under lock-up pressure. In fact, in lock-up pressure case, the zero would correspond to the position of the seat while it is penetrating in the rubber (see example on the right, case A). The error that could be made in the indirect flow measurement in case "A" would be with no doubt greater than the error generated when considering the zero in a condition of lamination very close to the rubber surface (see example on the right, case B).







5.1.4 Save of the settings.

The <u>first</u> opening and closing calibration of FIO2 must been done for both limits (100% and 0%). After the setting procedure, is necessary to save the new data pressing "F3". In case of mistakes, press "F4" in order to esc from the calibration menu without saving.

Following adjustments can be done separately.





5.2 Setting of Cg curve on the FIO2

The formula for the calculation of flow rate with the indirect method needs, as input, the Cg value at that specific opening position.

The Cg value can be determinate through the Cg curve (Cg vs opening) starting from the opening position.

Every type and size of regulator has his specific Cg curve, also the accessories modifies it. In order to determine the correct Cg value correlated to the opening position, FIO2 needs to have stored the proper regulator Cg curve.

The download on the FIO2 of the Cg curve is carried out with the software Fio2Modbus.

Open Fio2Modbus and connect to FIO 2.0

- 1. Press basic setup
- 2. Select Indirect
- 3. Set Line 1

4. Select Pu1 for calculation

- 5. Set Line 1
- 6. Press LOAD (Cg curve)

Repeat the sequence for Line 2 if present.



FIO2 Field Installation Manual - Ed.1. Rev.A

Page 23/27

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7. Make the below choices:

Regulator type: Reflux, Reval, Norval, ecc.. X" - DN XX Silencer: YES / NO Accessory: None / SB /

Enable second line: YES / NO

Press copy config. if second Line is identical to the first Line. Otherwise

configure the different second Line as it is.

8. Press OK

nsti 🛒	Load Cg coeff.vi	
00	Reg. Type Reg. Size Silencer? Accessory NO None	
2	Enable second line? NO Copy config.	
	Reg. Type 2 Reg. Size 2 Silencer? 2 Accessory 2 2 1"- DN 25 NO None	
	ок	
	24,38	49

Page 24/27



5.2.1 Setting the zero of the regulator with Low Trim Scale (<0%).

After this procedure, in order to improve the accuracy of the indirect flow measurement, is possible to repeat the low setting entering a known flow rate value on FIO2 as Low trim. FIO2 will calculate the corresponding opening value and redefine the Zero of the regulator. The flow rate that can be entered must be, in any case, very low and must be a corrected value in Smc/h.

From the Calibration Menu, press Enter, type the measured flow rate in Smc/h (in this example 55), press Enter again, press "F1" and press "F3" (Save).



The known flow rate value can be obtained in 2 ways:

-flow meter installed upstream or downstream the station

-discharge the natural gas through the vent valve downstream the regulator. On the vent valve has to be install a restrictor hole of defined diameter. Using a calculation sheet is possible, at specific conditions of diameter hole, pressure, type of gas, to obtain the corresponding flowrate.



FIO2 Field Installation Manual

6. Start-up of the line

At the end of the configuration of flow rate measurement parameters:

- Release the spring of the P-kit completely free
- Pressurize the upstream line opening slowly the upstream ball or butterfly valve. Leave the downstream valve closed.
- Open the SSV if present
- Screw the setting screw of P-kit keeping a small flow rate from the downstream side to the atmosphere through the vent valve.
- Increase the downstream pressure and adjust all the pneumatic settings of the other devices (SSV, relieve valve, accelerator, monitor) following the standard procedures
- Set the spring of P-kit at the minimum pneumatic setting agreed with the customer.
 20../A/2CS FIO: screw CLOCKW ISE the setting screw (pict 1).
 201/E/F IO: remove the lower part (electric motor) (pict 2) and screw ANTICLOCKW ISE the setting screw (pict 3).
- Lock the minimum setting:
 20../A/2CS FIO: lock the nut of the setting screw (pict 4).
 201/E/F IO: approach the two limit screws up to resistance is felt (pict 5 and pict 6). Then increase again ANTICLOCKW ISE the setting screw e then go back to the minimum pressure in order to verify the position of the limit screws. In case adjust them again and repeat the sequence.
- Activate the FIO2 modulation (OPC). See the "HMI User Manual" and "TSG Local User Manual" for instruction.







FIO₂ **Field Installation Manual**

7. Maintenance of the line

In case of maintenance (single line or two lines alternatively), it is suggested to follow this procedure: Stop the pressure modulation of FIO2 and empty the tank:

- switching to IDLE mode through HMI or TSG Local and then emptying the tank activating manually the decrement
- solenoid valve or unscrewing a compression fitting of the tank or pressing the emergency button and then pressing the F1 button

From this moment the line is in mechanical configuration, so proceed following the standard procedures.

After the maintenance operation, is possible to restart the pressure modulation of FIO2:

- switching to REMOTE mode through HMI or TSG Local solenoid valve (close before the compression fitting of the tank if necessary)
- or pressing the F2 button if the emergency button has been pressed

See the "HMI User Manual" and "TSG Local User Manual" for instruction.