

ASCON spa
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ISO 9001

ASCOMB

**Ascomb
Oxygen System
Indicator
Series ASCOMB OXI**

INSTRUCTION MANUAL

INSTRUCTION MANUAL
M.I.U. OXI - 1 / 05.04
Cod. J30 - 154 - 1AOXI - ING



ASCON spa

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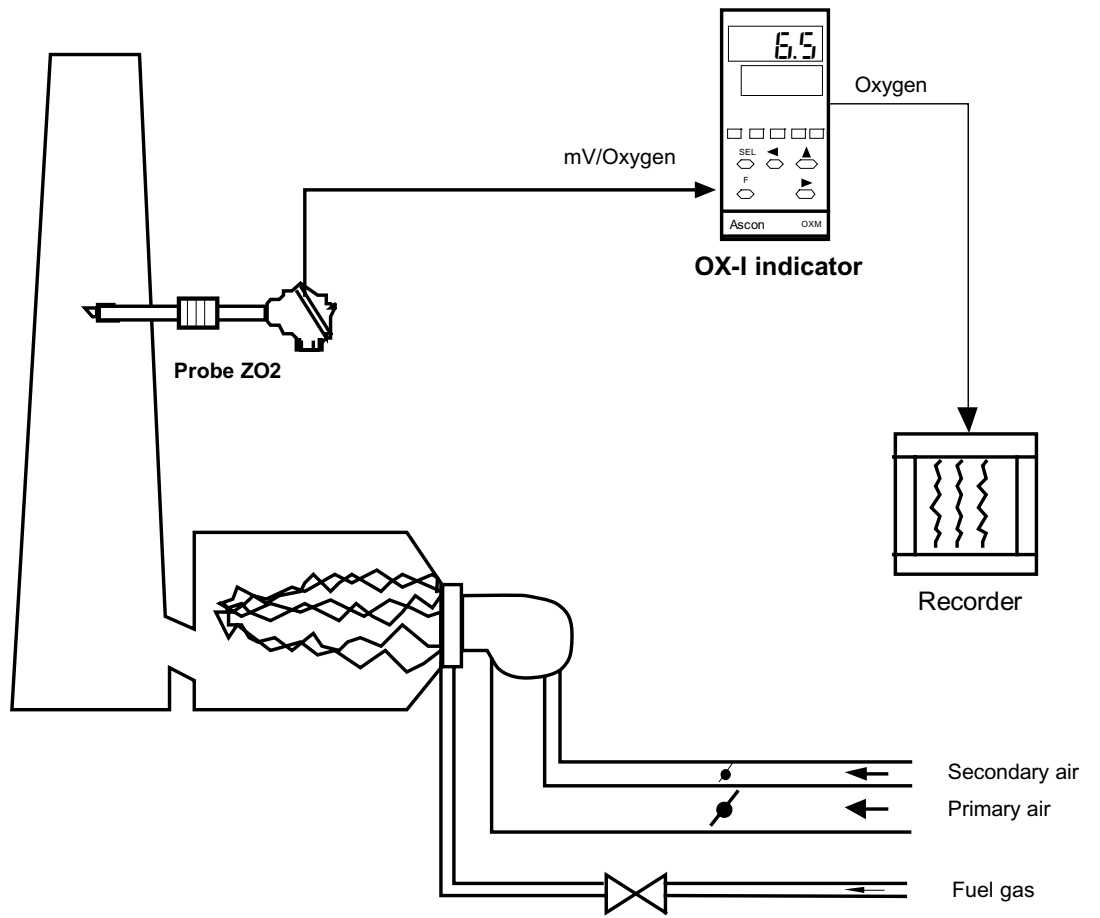
1. DESCRIPTION OF THE ASCOMB SYSTEM

ASCOMB is a compact and low cost system for the indicating of the oxygen content in flue gases. The system is based on an in-situ zirconium oxide probe that ensures a continuous, fast response and accurate readout. The probe is generally positioned at the exit of the combustion chamber or at the base of the stack. **A reference air circuit is not required** since one side of the zirconium oxide sensor is in contact with the oxygen present in the fuel gases and the other side is in contact with the ambient air present inside the probe head. Since the mV signal generated by the sensor is also influenced by the temperature, the probe is provided with a built-in heater with an external power supply unit suitable to maintain the sensor at a known and constant temperature.

ASCOMB therefore represents the ideal solution for small and medium size boilers. The mV signal provided by the probe is accepted and linearized by the OXI Indicator. The OXI Indicator can also accept, instead of the probe mV signal, a linearized 4...20 mA input from a transmitter.

- The Indicator is also equipped with the following analogue inputs:
 - O₂ in the flue gases (in the 0.0...20.9% range)
- The Indicator is equipped with two alarms AL1 and AL2 with relay outputs. AL1 and AL2 operate on the *Oxygen Concentration* variable on all the scale with a fixed Hysteresis of 0.5% full scale. The parameter code tde1 permits the introduction of a time delay in the activation of the alarms from 0 (excluded) to 120 seconds. The alarms may be independently configured as follows:
 - Excluded
 - Independent active High
 - Independent active Low
- The Indicator is provided with one analogue output with galvanic separation (4...20 mA or 0...10 V) for the retransmission of %O₂ variable.
- The indicator is equipped with 2 logic inputs (IL1, IL2) which permit to remotely carry out some functions by means of external contacts. The first logic input is used to put the Indicator in the "Hold" mode during the start-up phase, the second logic input is used to signal a malfunction status ("Fail") of the probe or of the plant.
- In order to fit the indicator for the ZO2 probe, a simple calibration tool is provided. The calibration procedure can be bypassed by manually inserting (for the given parameters) the coefficients present on the ZO2 probe body. 2 calibration procedures are foreseen, one in free air (20.9% O₂), the second at a known O₂ percentage value in the range 0.3... 3.0 %O₂.
- The Indicator is optionally equipped with serial communication for connection to a computer or to a supervision system.
- The indicator, while is functioning in operator mode, has only the X display active; the W display is active during the parameters setting phase.
- The operator through the SEL key can turn OFF the display on which is shown the %O₂ value; the alarm indicators remain active to warn the operator that the instrument is in blind condition, but is functioning.

1.1 APPLICATION EXAMPLE



2. MODEL IDENTIFICATION AND CONFIGURATION

Configuration is one of the start-up operations necessary to adapt the inputs and the outputs of the Indicator to the characteristics and requirements of the plant.



If the instrument is already configured, it is strongly recommended to check that the programmed functions and parameters are suitable for the actual needs of the plant.

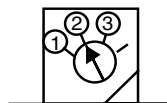
The first important operation to be done is the identification of the model number. The model number identifies the hardware of the instrument and its options. If the hardware for some functions is not provided, it will not be possible to obtain relevant functions during the configuration phase. **The identification of the model no. shall be done during the ordering phase.**

The identification of the model number is obtained from the following table:

2.1 Model identification

Indicator :	OX - I			
	A	B	C	D
Power supply				0
100 ...240 Vac, 50/60 Hz	3			
16...28 Vac, 50/60 Hz and 20...30 Vdc	5			
Serial communication (optional)				
Not provided		0		
RS 485 ModBus RTU		3		
Retransmission output Y1				
In current 4...20 mA ⁽¹⁾			1	
In voltage 0...10 V ⁽¹⁾			2	

Note: It is possible to modify the Y1 retransmission output from 4..20 mA to 0...10 V by means of a small switch located inside the Indicator. This switch can be reached by withdrawing the instrument from its housing after loosening the front screw located under the front flap.



- ① 4...20 mA continuous output Standard
- ② 0... 10 mV mA continuous output
- ③ Not used

2.2 Configuration

The software configuration of the Indicator can be done at any time by the operator or by entering two series of numerical codes called **Con.1** and **Con.2**. Configuration can also be performed through the serial communication line SCI (optional).

In the first configuration section (**Con.1**), the following functions can be selected:

- %O₂ input
- Retransmission output

In the second configuration section (**Con.2**), the method of operation of the AL1 and AL2 alarms can be selected.

Configuration:

Con.1

	0		0
--	---	--	---

Input from the O ₂ probe	E	F	G	H
Direct in mV from the ZO ₂ probe	0			
From transmitter 4...20 mA linearized	2			
Retransmission output				
Not provided			0	
Retransmission of % O ₂ level			1	

Configuration:

Con.2

0	0		
---	---	--	--

Method of operation of the alarms	I	L
	AL1	AL2
Bypassed	0	0
Independent	Active high	1
	Active low	2

An example of the composition of code number: **OX-I 3310/ 0000-0012**

The model number of the instrument is indicated on a nameplate located on the front flap. The complete identification (model and configuration) is shown on a nameplate on one side of the instrument housing.

The configuration code can be displayed, while the instrument is in operation, by means of the mnemonic code **CONF** available on the main menu of the instrument (for more details refer to the programming sheet).



If, when instrument is switched on, X and W displays show the numbers 9999, it means that the Indicator is **not configured** and all its functions are inhibited.

2.3 Linear input scaling

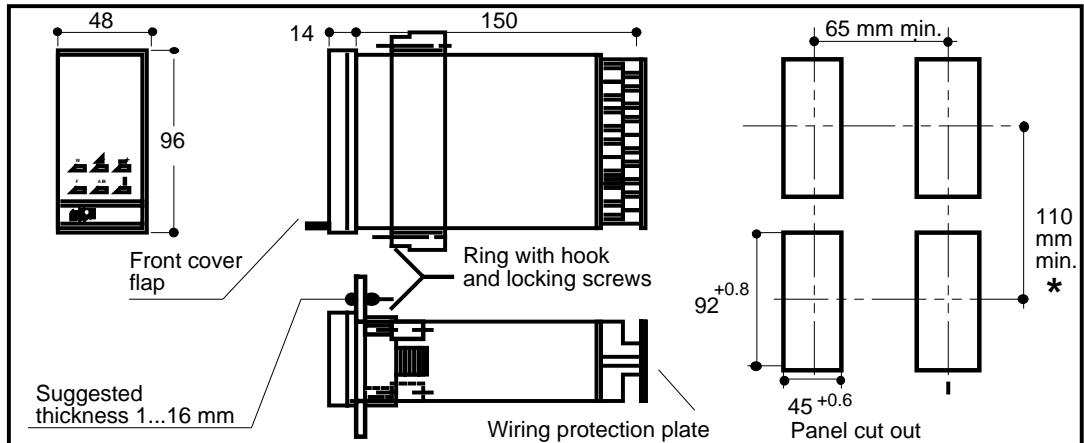
If the oxygen input is configured as linear 4...20 mA input (code **E = 2**), codes **U_{in}** and **RL** do not appear in the main menu. Two different parameters will be shown in the configuration sequence; these two parameters are necessary to configure the desired range.

Parameter	Description	Range	SCI code
1.O.lo	Start of oxygen scale	0.0...1.0.Hi%	"IOL"
1.O.Hi	End of oxygen scale	1.0.lo...20.9%	"IOH"

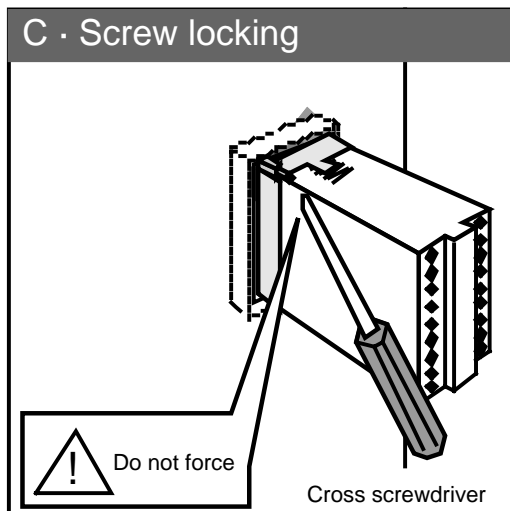
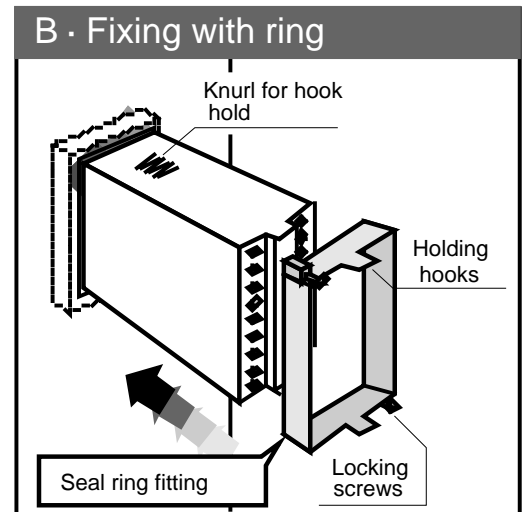
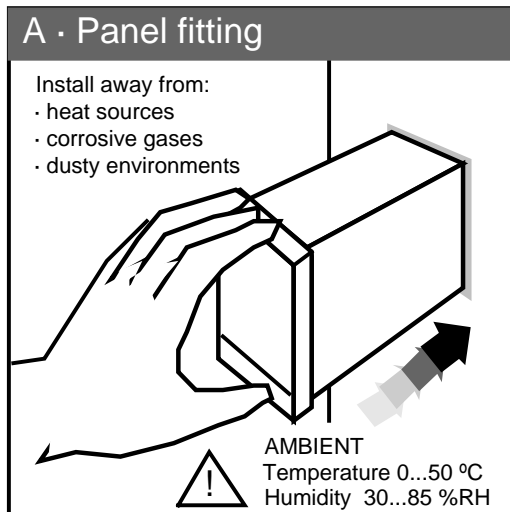
Zero and full scale values of linearized 4...20 mA input signals can be adjusted by means of the two parameters **1.O.lo** and **1.O.Hi**.

3. DIMENSIONS AND INSTALLATION

Overall dimensions (in compliance with DIN 43700)



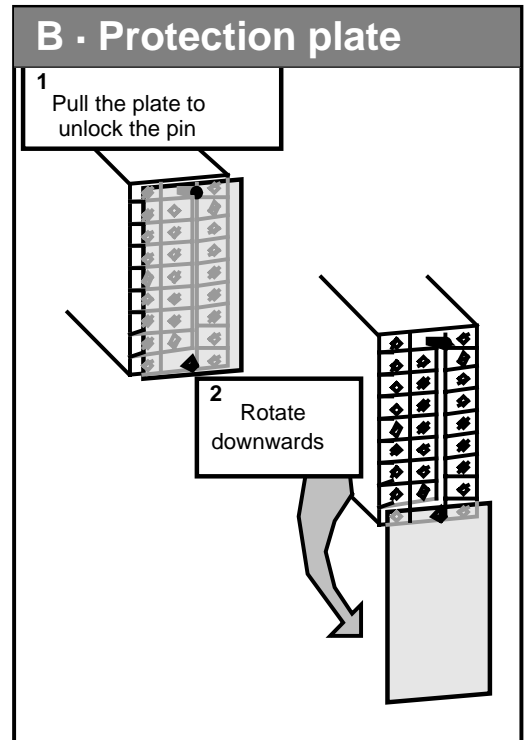
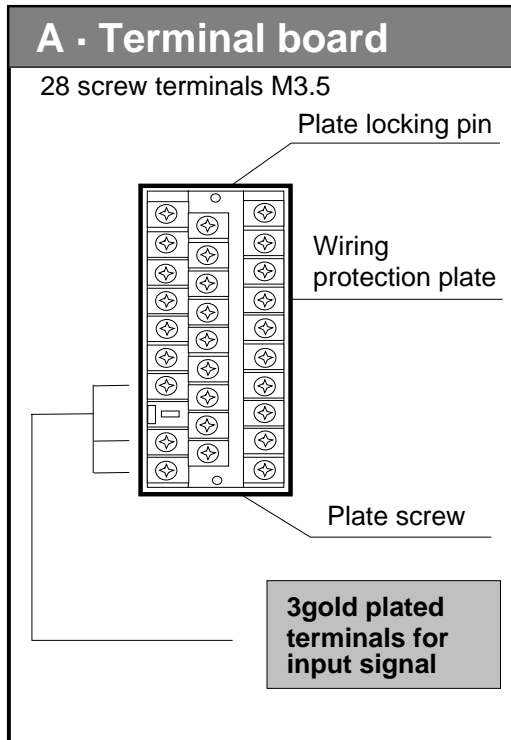
Panel installation



* 150 mm with IP65 front protection

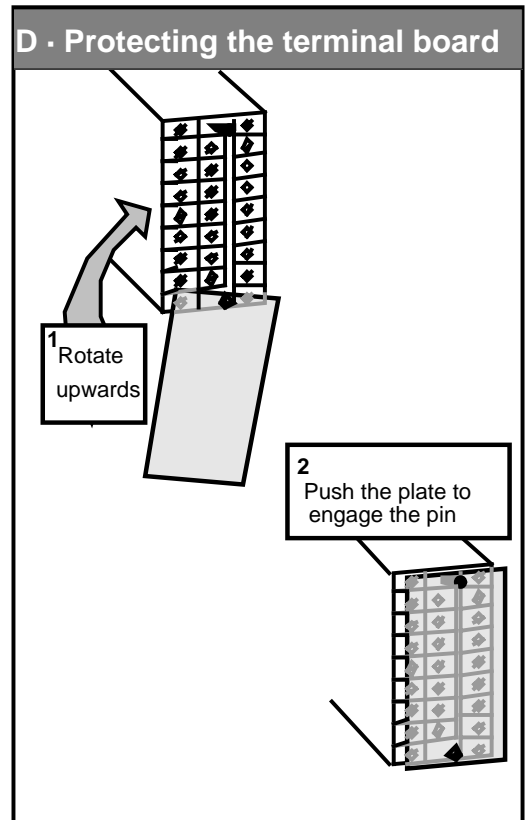
4. ELECTRICAL CONNECTIONS

Please carefully read the recommendations and study the drawings before proceeding with the Indicator installation.

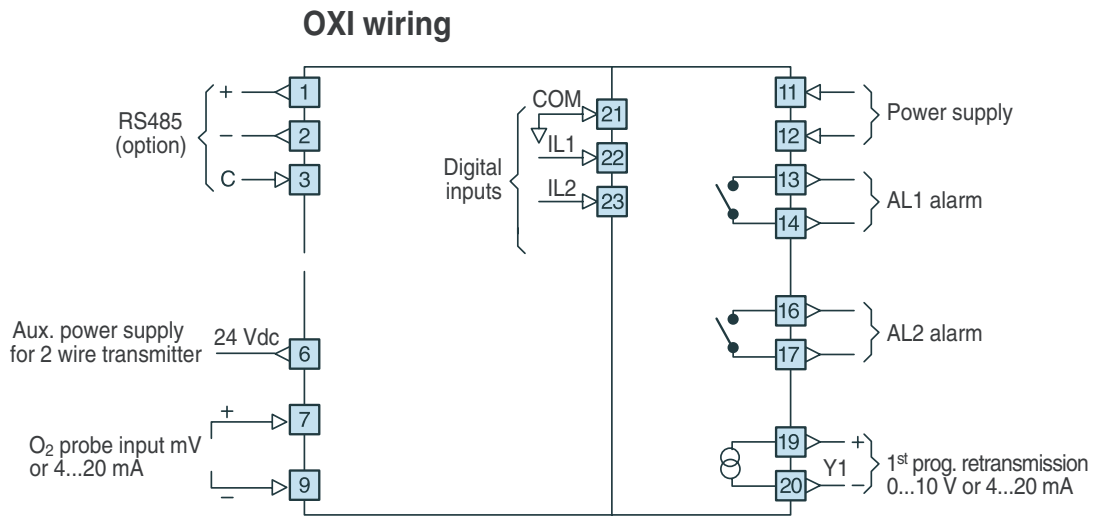


C - Wire connections

With eyelet terminals	Cable section	Max N° Wires	
<p>6.9 mm max.</p>	0.25..2.5 mm ² (AWG 22..14)	2	
<p>6.9 mm max.</p>			<p>7 mm</p>
<p>6 - 7 mm</p>			
Preferential			



5. WIRINGS



All the instrument output relay contacts are internally connected, in parallel, with one 2.2 nF / 2 kV capacitor and one 300 V varistor.

6. BUTTONS AND INDICATORS FUNCTIONS

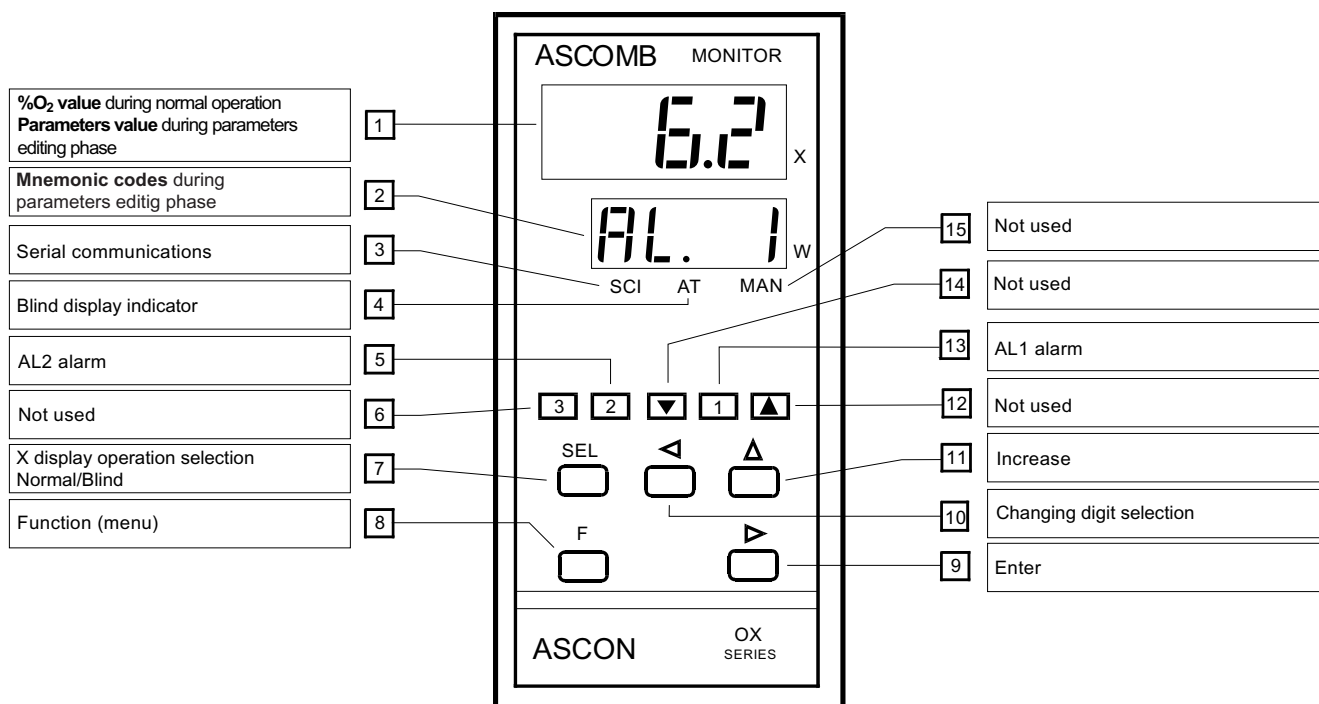


Fig. 5

6.1 Signalizations and operational status

The signalizations located on the front of the instrument are used to inform the operator of the operational status of the Indicator's functions.

- **AT (4), 3 (6), ▽ (14) and MAN (15)** indicators are permanently unlit as they represent some unused functions.
- **SCI Signalization (3)**. This signalization is lighted when the serial communications are enabled, during the programming phase, through the parameter **5C I** located in the third parameter group. Signalization is switched off when the serial communications are disabled. Signalization flashes when the Indicator *receives and recognizes* a message in transit on the serial line.

6.2 Keys

The five keys on the instrument allow to enter functions and parameters, to configure, to program, to calibrate and to modify parameters.

- The **SEL (7)** key enables/disables the indications that appear on the display **X**.
- The **F (8)** (Function) key provides the access to the main menu of the functions to be programmed or activated. Within the parameters groups allows to skip from the current group to the next one. Pressing the F key before any other selection, the Indicator shows the **U In** function that gives the value (in mV) generated by the ZO₂ probe. The resolution of the indication is 1/100 mV within the range -9.99...99.9 mV and 1/10 mV outside the indicated range.
- The **▶ (9)** (Confirm) key is used for the confirmation of the selected function, the access to the parameters and the change from one parameter to the next one in the same group.
- The **◀ (10)** (Shift) key is working only in the parameters editing phase. This key is used to select the display digit to be modified. The digit that can be modified flashes. By actuating the **◀** key the flashing digit is shifted to the next left digit.

- The **Δ (11)** (Increase) key is working only in the parameter entering phase. This key is used to increase the number shown by the display digit selected to be modified (flashing digit).

6.3 Displays

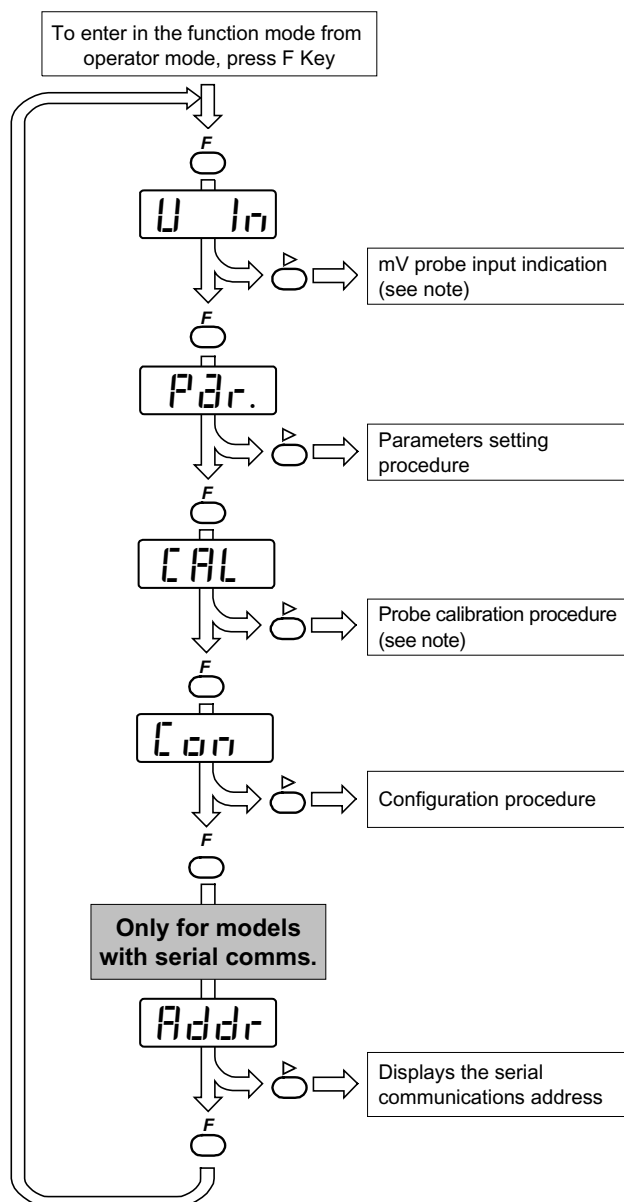
- The display **X (1)** is normally dedicated to the indication of the concentration of oxygen in the range 0.0...20.9%. If the percentage of oxygen goes outside the 0.0...20.9 by $\pm 5\%$ scale, the display will show :
Lower out of range: 4 orizontal segments in the lower part of the display area;
Upper out of range: 4 orizontal segments in the higher part of the display area.
During the parameter editing phase, the upper display **(1)** shows the value of the selected parameter.
If the **IL2** logic input is activated (closed contact) the upper display **(1)** shows "F3 , 1".
- The display **W** is dedicated to parameters indication.
The other three digits of the display show the variable value.
When the **IL1** logic input is activated (closed contact) the display shows "H0 Id"
When the **IL2** logic input is activated (closed contact) the display is totally unlit.

6.4 Alarms signalizations

- The **1 (13)** LED signalization is lighted when the AL1 alarm threshold is actuated (high or low depending upon configuration). When the LED is lighted the AL1 output contact is closed.
- The **2 (5)** LED signalization is lighted when AL2 alarm threshold is actuated (high or low depending upon configuration). When the LED is lighted the AL2 output contact is closed.

7. PARAMETERS

All the instrument's parameters are organized into groups of homogeneous functions. In order to reach all the parameters of the instrument a simple, but efficacious, selection menu has been realized. By the actuation of the " F " key the name of function group will be displayed, the "Enter ►" key allows to reach the parameters groups, the probe calibration procedure, etc. (see the flow chart previously shown).



Note:

If the instrument is configured for a linear 4...20 mA input for the O₂ probe measurement (code E=2), the codes U In and CAL do not appear in the menu.

7.1 Arrangement of groups and parameters

Parameter Code	Description	Range	S.C.I. Code	Note	GRUOP
Al 1	Set point alarm 1	0...20.9%	"SA1"	1,2	1st
Al 2	Set point alarm 2	0...20.9%	"SA2"	1,3	
t.de1	Delay operation of alarms	0...120 s	"DEL"	4	
O2.lo	Lower oxygen limit for retransmission	0.0...O2.Hi%	"O2L"	1,5	2nd
O2.Hi	Upper oxygen limit for retransmission	O2.lo...20.9%	"O2H"	1,5	
t.Fi1	Time constant of input filter	0...30 s	"FIL"		3rd
C.C1	1st calibration constant (U1)	-9.99...10.00mV	"CC1"	6	
C.C2	2nd calibration constant (T)	-200...200°K	"CC2"	6	
S.C.I.	Serial communication enabling index	0 = OFF 1 = ON		7	
Addr	Address	0...247	"ADR"	7	
S.C.b.r	Baud rate	0...4	"BDR"	7	
S.C.Pa	Parity	0...4	"PAR"	7	

Notes:

- 1) If in the configuration the %O₂ input is linear (E = 2) the scale range is limited from 1.O.lo to 1.O.Hi.
- 2) If not present in the configuration alarm AL 1 is deactivated (I = 0).
- 3) If not present in the configuration alarm AL 2 is deactivated (L = 0).
- 4) If not present in the configuration both alarms are deactivated (I & L = 0).
- 5) If not present in the configuration then not selected for **Y1** is the retransmission of oxygen level (**G=0**).
- 6) If not present in the configuration the input **X** is linear (**E = 2**)
- 7) If not present in the configuration the instrument will not provide for serial communication.

7.2 Programming table

See "Programming table" enclosed in this manual.

8. **PASSWORD**

In order to inhibit unauthorized or undesirable operations, the OX series Indicators are provided with two access protection passwords to reach the different levels of configuration and parameter editing. All the instrument's parameters are organized into groups of homogeneous functions. The instrument has three important groups of functions selectable from a main menu, these groups are:

1. Configuration
2. Operating parameters
3. Calibration of the probe.

In order to reach the *configuration* procedure, when the instrument requires the password with the "PASS" signalization on the display, the code **3333** has to be entered. Subsequently, the configuration codes **[on1]** and **[on2]** will be available for configuration operations (see programming sheet).

The *operating parameters* of the instrument are divided into three groups and are not protected by any password, they are therefore always accessible.

In order to reach the *calibration* procedure of the ZO_2 probe, when the instrument requires the password (PASS), the code **1111** has to be entered (see chapter 10 of this manual for subsequent operations).

9. CALIBRATION PROCEDURE FOR THE ZO₂ PROBE

The scope of this procedure is to automatically compute the two constant calibration coefficients, CC1 and CC2, of the probe and to enter them into the Indicator under the corresponding CC1 and CC2 codes located in the third group of parameters. Selecting the item [CAL] from the main menu, and giving 1111 at the P355 display, is possible to start the calibration procedure that consists of 3 different steps:

1. The display **W** shows the [CAL] code.

Send the reference gas (instrument air with 20.9% of O₂).

The upper display will show the deviation between the actual mV probe output and the mV value of the previous calibration stored in the instrument and valid for 20,9% of O₂.

Press the ► (enter) key, to bring to "zero" the mV deviation value.

If after some seconds the upper display indication is still different from "ZERO", the operation shall be repeated, otherwise proceed by pressing the "F" key;

2. The display shows [SPAN].

Enter the reference value of the O₂ % used for the second step of the calibration (calibration of Span).

The Span gas O₂ % value can be selected in the range from 0.30...3.00%.

Proceed by pressing ► (enter) or the "F" key

3. The display **W** shows the "[CAL]" code. Send the calibration span gas at the selected concentration of O₂ (the same O₂ % entered as reference value [SPAN]) at the correct flow rate and pressure. The upper display will show the deviation between the working temperature of the heated probe and the theoretical temperature value of the previous calibration stored in the instrument . The displayed temperature deviation is expressed in °K.

Press the ► (enter) key to bring to "zero" the temperature deviation value.

If after some seconds the upper display indication is still different from "ZERO", the operation shall be repeated, otherwise terminate the procedure by pressing the "F" key.



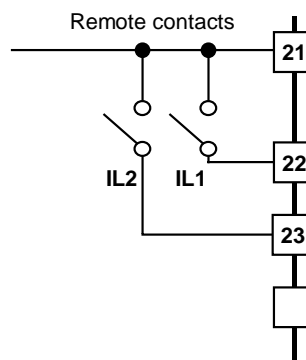
During the start-up phase or when the ZO₂ probe is replaced, this procedure can be avoided by manually entering the two [CC1] and [CC2] constants (marked on the probe head) into the instrument.

10. LOGIC INPUTS FUNCTIONS

To switch over the two tables of the fuel constants and to put the Ascomb Indicator into the Hold or Fail state, it is necessary to use the logic inputs by connecting the instrument.

The permanent closing of contacts at the logic inputs IL1 or IL2 or IL3, forces the following changes:

- **IL1** when activated (closed contact):
 - disables the alarms
 - disables the cyclical display of the variables through the W key.
 - the message "Hold" appears on the display **W**, while the X display shows the O₂ value;
 - The serial communications answer "Hold" to the variable requests.
- **IL2** when activated (closed contact) :
 - disables the alarms
 - sets the retransmission outputs at Start of range.
 - disables the cyclical display of the variables through the W key.
 - the message "Fail" appears on the upper display and the lower display is switched off;
 - the serial communications answer "Fail" to the variable requests;



The release of the logic inputs (opening of the contacts) returns the Indicator to operate in the same conditions existing before contact closure.

Note: In case of a simultaneous closing of IL1 and IL2, the IL2 signal will prevail and the instrument will be switched in the "FAIL" mode.

11. SERIAL COMMUNICATION

Optionally, on the Indicator can be installed a serial communications port with electrical interface RS485 (OXI-33xx).

To connect a Host Computer equipped with RS232 ports, install a protocol converter, contact Ascon for further details.

With serial communication it is possible to effect almost any operational configuration.

In order to allow the serial communication with the OXI indicator it is necessary to set up four dedicated parameters SCI , $Addr$, $SCbr$, $SCPa$ located in the third group of parameters protected with the password 1111.

- SCI is the serial communications activation code . With $SCI = 0$, the Indicator answers all the supervisor questions and answers "NOP" to any assignment and command from the supervisor. With $SCI = 1$, the Indicator answers all the questions, and responds to any assignment and command from the supervisor.
- $Addr$ represents the Indicator address, which may be inputted from 0...63 with Ascon protocol, from 1 to 247 with ModBus – Jbus protocol, and **must be different from any other instrument connected to the line!**
- $SCbr$ represents the data transfer speed in bits per second and **must be inputted in an identical mode to all the other elements connected to the line** from 0 to 4 with the following significance:

$SCbr$	Baud Rate
0	9600 (*)
1	4800
2	2400
3	1200
4	600

(*) with Modbus – Jbus protocol only.

- $SCPa$ represents parity check for the messages transferred in the line and **must be inputted in an identical mode to all the other elements connected to the line** from 0 to 4 with the following meaning:

$SCPa$	N° of characters	Parity	Protocol
0	8	Excluded	Ascon
1	7	Odd	Ascon
2	7	Even	Ascon
3		absent	ModBus
4		absent	JBus

To give the operator the opportunity to easily identify, when necessary, the source/destination of the messages, the address codes in the communication protocol are converted into ASCII characters, as indicated in the table below.

11.1 The Data Base

The ASCON instrument variables available for serial communication through the MODBUS protocol are contained in two distinct sections: the bit zone and the word zone.

11.2 The BIT Zone

The bit zone is made up of 16 addressable bits containing information on the functioning status of the instruments. With some instruments, certain bits are not used; the status request for these bits with the 01 and 02 functions is permitted but returns a fixed value of 0; these bits are indicated in the tables by the presence of an hyphen "-". The assignment of the bit status with the 05 and 15 functions is only allowed on addresses in which this is possible, which condition is indicated by "R/W".

11.3 The Word Zone

The word zone is made up of 126 addressable that contain control variables and the instrument parameters. With some instruments certain words are not used; the request for the values of these words with the 03 and 04 functions is permitted but returns a fixed value of 0; these words are indicated in the table by the presence of a hyphen "-". The assignment of the word value with the 06 and 16 functions is only allowed on addresses in which this is possible, which condition is indicated by "R/W".

The variables and parameters are coded as integer numbers with a plus or minus sign (two's complement notation) without taking into account the decimal point in the representation. Assignment is only allowed within the values assigned to each parameter, any attempt to assign a value outside of those permitted within the field, will cause the instrument to respond with an error message and a an exception code = 3, and the assignment will not be carried out.

11.4 ModBus Address

11.4.1 Bit Zone

Adress		Variable	Type
ModBus	JBus		
0	1	Alarm status Y1 (0 = OFF, 1 = ON)	R
1	2	Alarm status Y2 (0 = OFF, 1 = ON)	R
2	3	Out of range (0 = Normal operation, 1 = Safety)	R
3	4	Status of logical input IL1 (0 = OFF, 1 = ON)	R
4	5	Status of logical input IL1 (0 = OFF, 1 = ON)	R
5	6	Status of logical input IL3 (0 = OFF, 1 = ON)	R
6	7	-	
7	8	-	
8	9	-	
9	10	-	
10...15	11...16	-	

Read Status

Function 07 (Read Status) returns an eight bit status with the following meanings:

Bit	Adress	Variable
1 (LSB)	1	Alarm status Y1 (0 = OFF, 1 = ON)
2	2	Alarm status Y2 (0 = OFF, 1 = ON)
3	3	Out of range (0 = Normal operation, 1 = Safety)
4	4	Status of logical input IL1 (0 = OFF, 1 = ON)
5	5	Status of logical input IL2 (0 = OFF, 1 = ON)
6	6	Status of logical input IL3 (0 = OFF, 1 = ON)
7	7	-
8 (MSB)	8	-

11.4.2 Word Zone – Parameters Page

Adress		Variable	Parameter code	Type
ModBus	JBus			
0	1	Oxygen concentration measure (X)		R
1...8	2...9	-		
7	8	AL 1 alarm setpoint	AL.2	R/W
8	9	AL2 alarm setpoint	AL.3	R/W
9	10	Alarms intervention delay	t.del	R/W
10...13	11...14	-		
14	15	Oxygen temperature low range limit	O2l	R/W
15	16	Oxygen temperature high range limit	O2h	R/W
16...23	17...24	-		
24	25	Input filter time constant	t.FiL	R/W
25...34	26...35	-		
35	36	1st calibration constant	C.C1	R/W
36	37	2nd calibration constant	C.C2	R/W
37	38	Address	Addr	R/W
38	39	Baud Rate	ScBr	R/W
39	40	Parity	ScPa	R/W
40...49	41...50			

11.4.3 Word Zone Configuration Page

Adress		Variable	Parameter code	Type
ModBus	JBus			
100	101	1st part of Configuration code	Con.1	R/W
101	102	2 nd part of Configuration code	Con.2	R/W
102	103	Oxygen low range	I.O.lo	R/W
103	104	Oxygen High range	I.O.Hi	R/W
110...119	111...120	-		
120	121	Factory code (600 = Ascon)		R
121	122	Product code ("OX")		R
122	123	Product code ("M")		R
123	124	1st part of Software release code		R
124	125	2ndt part of Software release code		R
125	126	-		

12. TECHNICAL DATA

• Accuracy	0.2% ±1 digit on the main input signal
• Main input	mV directly from ZO ₂ 4...20 mA from linear transmitter
• Auxiliary Inputs	2 logic inputs
• Auxiliary Outputs AL1 - AL2	N.O. relay contacts, 5A /250 Vac
• Output Y1 Retransmission	4...20 mA or 0...10V (galvanically isolated from the input)
• Output Y2 retransmission (opt.)	4...20 mA or 0...10V (galvanically isolated from the input)
• Serial communication	RS485 ModBus - JBUS
• Protection of parameters	with password software
• Noise immunity	Level 4, in accordance with IEC 801-4
• Data storage	Non volatile memory
• Power supply A.T.	100...240Vac, -15...+10%, 48...63Hz
• Power supply B.T.	24Vac, -15...+10%, 48...63Hz or 24Vdc ± 15%
• Power consumption:	4VA approx.
• Two wire transmitter power supply	24 Vdc ±10% for one transmitter
• Electro Magnetic Compatibility	in accordance with EN 50081-2 and EN 50082-2
• Isolation group	C in accordance with VDE 0110
• Climatic category	KWF in accordance with DIN 40040
• Ambient temperature	0...50°C
• Ambient humidity	35...85 RH%
• Front protection:	IP 54 standard (IP 65, with F10-170-2A101 mask)
• Housing protection	IP 30
• Terminal protection	IP 20
• Housing material	UL 94V1
• Weight	480 gr. approx.
• Dimensions	48 x 96mm, depth 150mm in accordance with DIN 43700

Warranty

The equipment is guaranteed free from manufacturing defects for 1 year after installation, for a maximum of 18 month after delivery.

Faults caused by use other than that described in the operating instructions are excluded from the guarantee.

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