ASCON TECNOLOGIC

The Ascomb System
A complete monitoring system for combustion parameters
Series ASCOMB OXM

INSTRUCTION MANUAL
M.I.U. OXM – 4a/12.06
Cod. J30 - 154 - 1AOXM - ING

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GENERAL INDEX

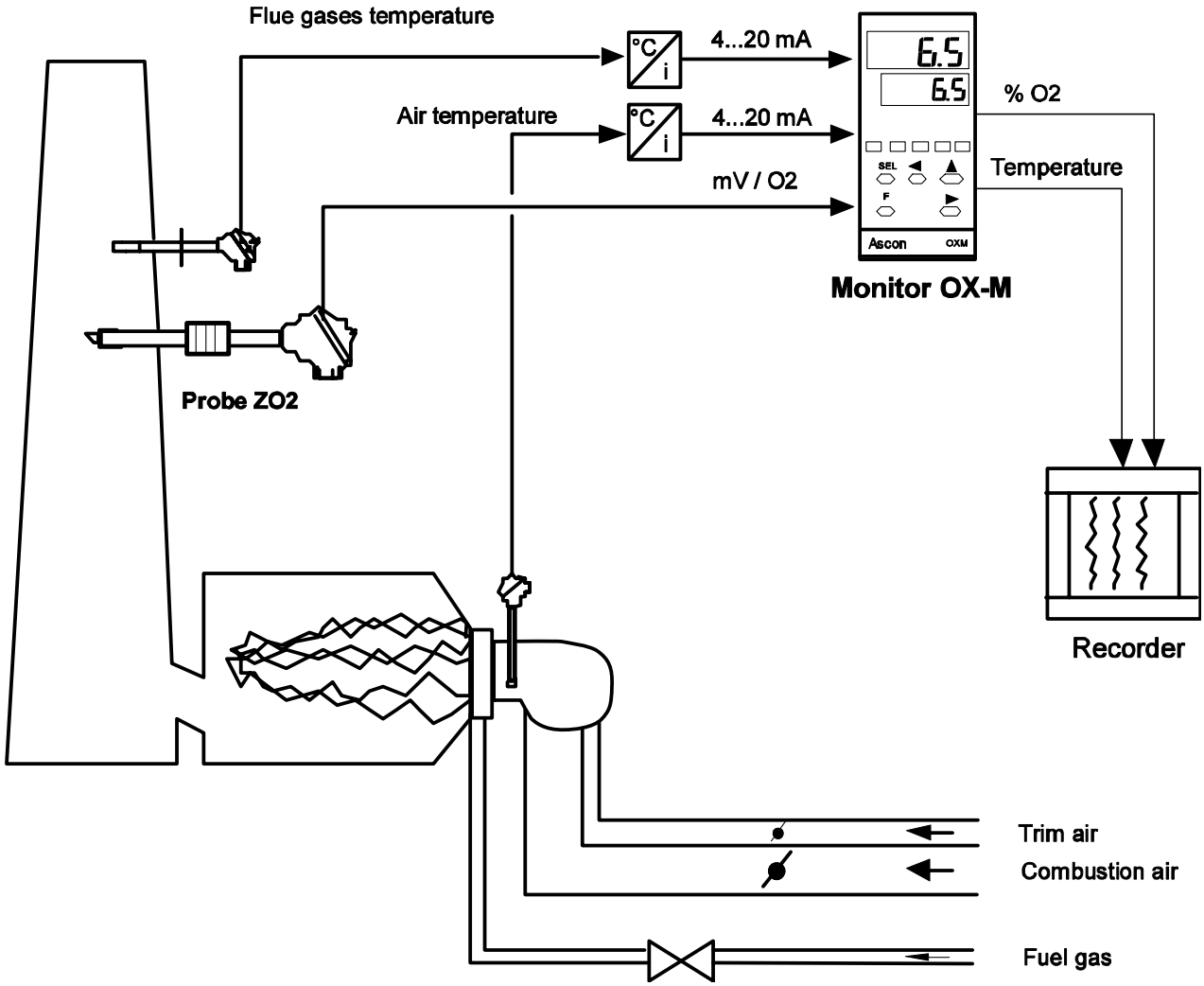
1. DESCRIPTION OF THE ASCOMB SYSTEM

ASCOMB is a compact and low cost system for monitoring the oxygen content in flue gases. The system is based on an in-situ zirconium oxide probe that ensures a continuous, fast 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 atmosphere 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, is the ideal solution for small and medium size boilers. The mV signal provided by the probe is accepted and linearized by the OX-M Monitor. Instead of the probe mV signal, the OX-M Monitor can also accept a linearized or non-linearized 4...20 mA input from a transmitter.
It is also possible to read the probe measure in mV.
Two additional inputs allow the acquisition (through transmitters) of the sensor signals coming from the flue gases and the combustion air temperature (atmosphere). It is also possible to acquire directly a signal representing the difference between the two temperatures (Δt flue gas/air). In this case, the second input port may be disabled.

- The Monitor also comes with the following analogue inputs:
  - O_2 in the flue gases (in the 0.0...20.9% range)
  - Flue gas temperature or flue gas/air Δ temperature
  - Combustion air temperature

  and the following computed variables:
  - λ excess air in the combustion (in the 1.000...2.000 range)
  - CO_2 in the flue gases (in the 0.0...25.0% range)
  - η% efficiency of combustion (in the 0.0...100.0% range)
- The Monitor is fitted 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 Monitor is provided with two analogue outputs (one is optional) with galvanic separation (4...20 mA or 0...10 V) that can be used for the retransmission of two variables selected between: $\%O_2$, $\%CO_2$, % η efficiency, λ excess air, temperature of the flue gases (or Δt flue gas/air) and combustion air temperature.
- The monitor is fitted with 3 logic inputs (IL1, IL2, IL3) which allow some functions to be carried out remotely by means of external contacts. The first logic input is used to put the Monitor 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, and the third logic input allows switching from the first (primary) group of fuel constants to the second (emergency) one (for example from natural gas to oil). In many cases, the plant employing the ASCOMB system can use two different fuels. Usually, the first fuel is used for normal operations and the second one is used when there is a lack of the main fuel. In order to enable a quick changeover, without the need to manually re-enter the fuel constants, the instrument can be configured with two a… E groups of constants. The first, a1…E1, is the main fuel group. The second, a2…E2, is used for emergency fuel. Switching from the primary to the secondary fuel constants is signalled by the “Δ“ LED flashing on in the display
- In order to fit the monitor to the ZO2 probe, a simple calibration tool is provided. The calibration procedure can be bypassed 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% O_2), the second at a known O_2 percentage value in the range 0.3… 3.0 $\%O_2$.
- The Monitor is optionally equipped with serial communication, for connection to a computer or supervision system.

1.1 APPLICATION EXAMPLE



2. MODEL IDENTIFICATION AND CONFIGURATION

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

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

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

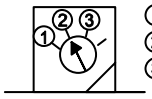
2.1 Model identification

Monitor : **OX - M** [ ][ ][ ][ ]

	A	B	C	D
Power supply				
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		**3**		
Retransmission output Y1				
In current 4...20 mA (1)			**1**	
In voltage 0...10 V (1)			**2**	
Retransmission output Y2 (optional)				
Not provided				**0**
In current 4...20 mA (2)				**1**
In voltage 0...10 V (2)				**2**

Note:

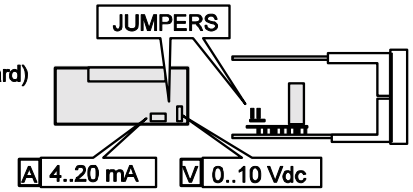
1) It is possible to modify the Y1 retransmission output from 4..20 mA to 0...10 V by means of a small switch located inside the Monitor. This switch can be reached by withdrawing the instrument from its case after loosening the front screw located under the front flap.



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

2) It is possible to modify the Y2 retransmission output from 4…20 mA to 0...10 Vdc by relocating a jumper located inside the Monitor. This jumper can be reached by withdrawing the instrument from its case after loosening the front screw located under the front flap. For the location of the jumper, see the figure below:

Changing from 4...20 mA (standard) to 0...10 V, locating jumper inside the monitor



2.2 Configuration

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

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

- $\%O_2$ input
- Air temperature input
- Retransmission outputs

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

Configuration : Con.1 | | | | |

	E	F	G	H
Input from the O_2 probe				
Direct in mV from the ZO2 probe	**0**			
From transmitter 4...20 mA linearized	**2**			
Air temperature input				
Not used		**0**		
In current 4...20 mA		**1**		
Retransmission output				
Not provided			**0**	**0**
Retransmission of % O_2 level			**1**	**1**
Retransmission of estimated % CO_2			**2**	**2**
Retransmission of gas temperature or Δt			**3**	**3**
Retransmission of estimated gas-air Δt (1)			**4**	**4**
Retransmission of estimated efficiency $\eta\%$			**5**	**5**
Retransmission of excess air index λ			**6**	**6**

Note 1) Available only when the combustion air temperature input is used.

Configuration : Con.2 | 0 | 0 | | |

				I	L
Method of operation of the alarms		-	-	**AL1**	**AL2**
Bypassed				**0**	**0**
Independent O2	Active high			**1**	**1**
	Active low			**2**	**2**
Independent Gas Temp.	Active high			**3**	**3**
	Active low			**4**	**4**
Independent Efficiency	Active high			**5**	**5**
	Active low			**6**	**6**
Independent % CO_2	Active high			**7**	**7**
	Active low			**8**	**8**

An example of the code number composition: **OX-M 3311/ 0115-0012**

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 case.

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).

The Monitor is normally delivered already configured and ready for use.

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

2.3 Linear input scaling

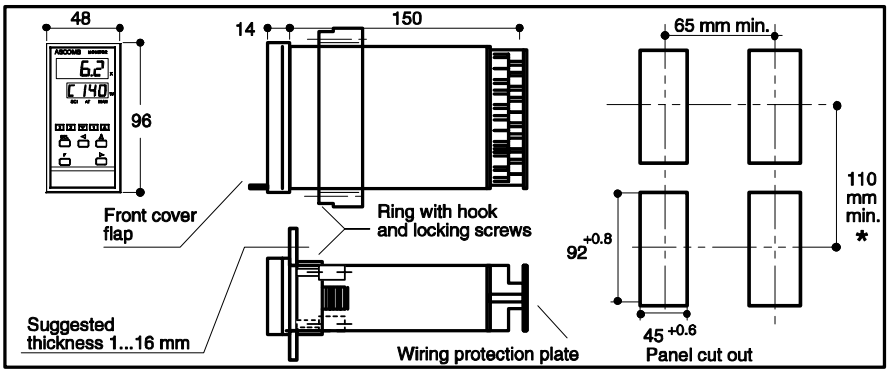
If the oxygen input is configured as linear 4…20 mA input (code **E** = 2), codes U In and CAL do not appear in the main menu. Two different parameters will be shown in the configuration sequence. These two parameters are necessary to configure the desired range.

Parameter	Description	Range	SCI code
I.O. Io	Start of oxygen scale	0.0... I.O.H ,%	"IOL"
I.O.H ,	End of oxygen scale	I.O. Io...20.9%	"IOH"

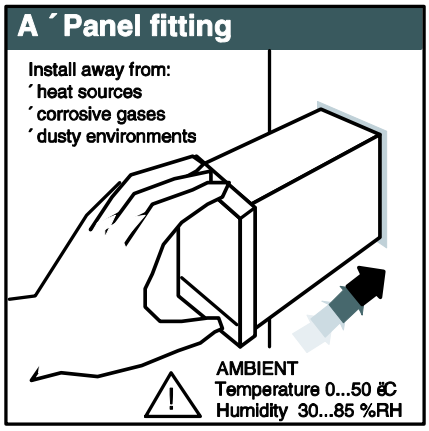
Zero and full scale values of linearized 4...20 mA input signals can be adjusted by means of the two parameters I.O. Io and I.O.H ,.

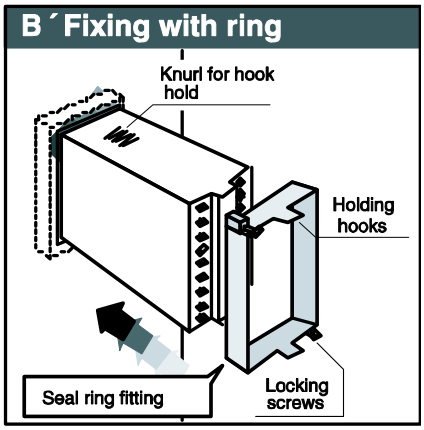
3. DIMENSIONS AND INSTALLATION

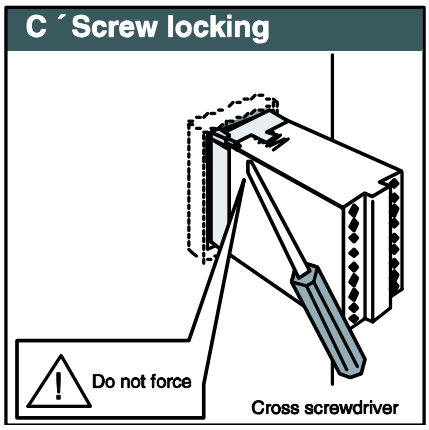
Overall dimensions (in compliance with DIN 43700)



Panel installation







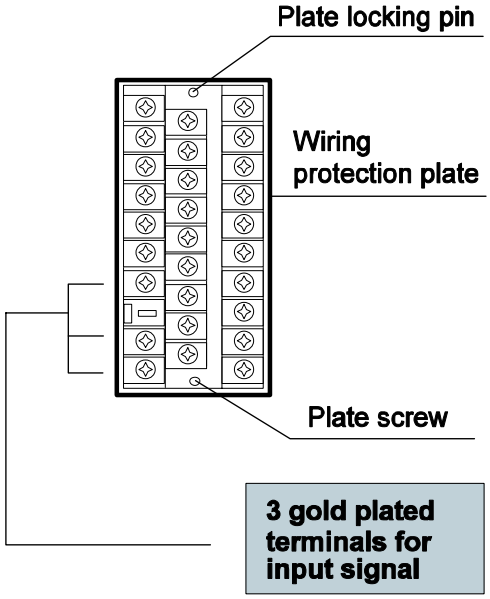
* 150 mm with IP65 front protection

4. ELECTRICAL CONNECTIONS

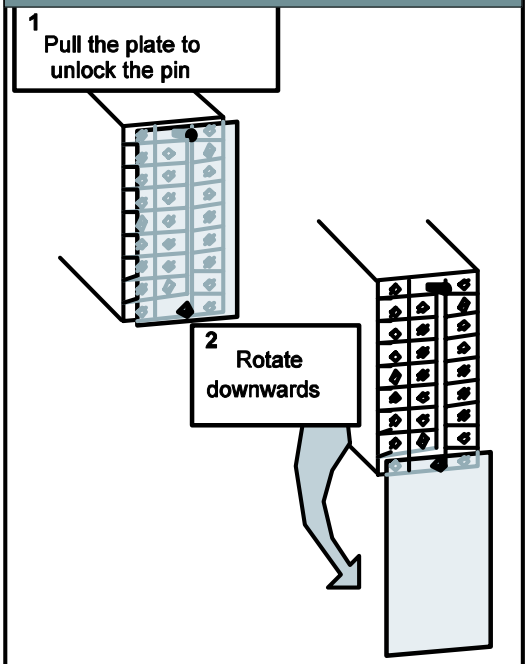
Please read the recommendations carefully and study the drawings before installing the Monitor.

A · Terminal board

28 screw terminals M3.5



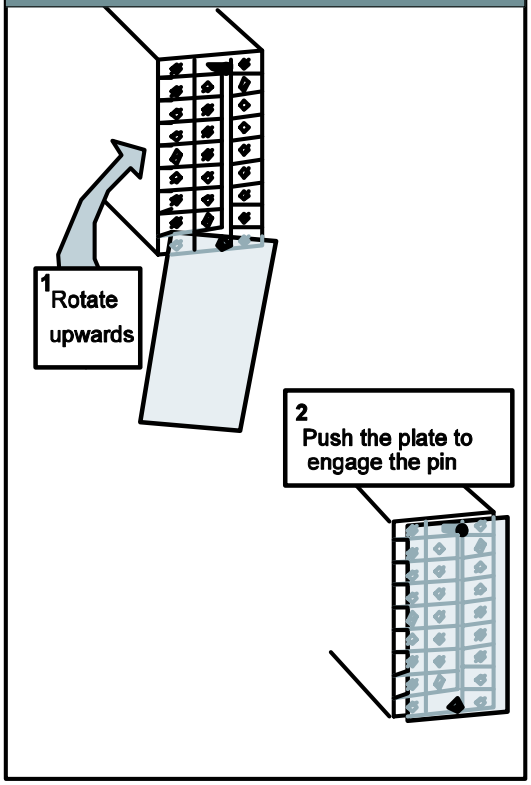
B · Protection plate

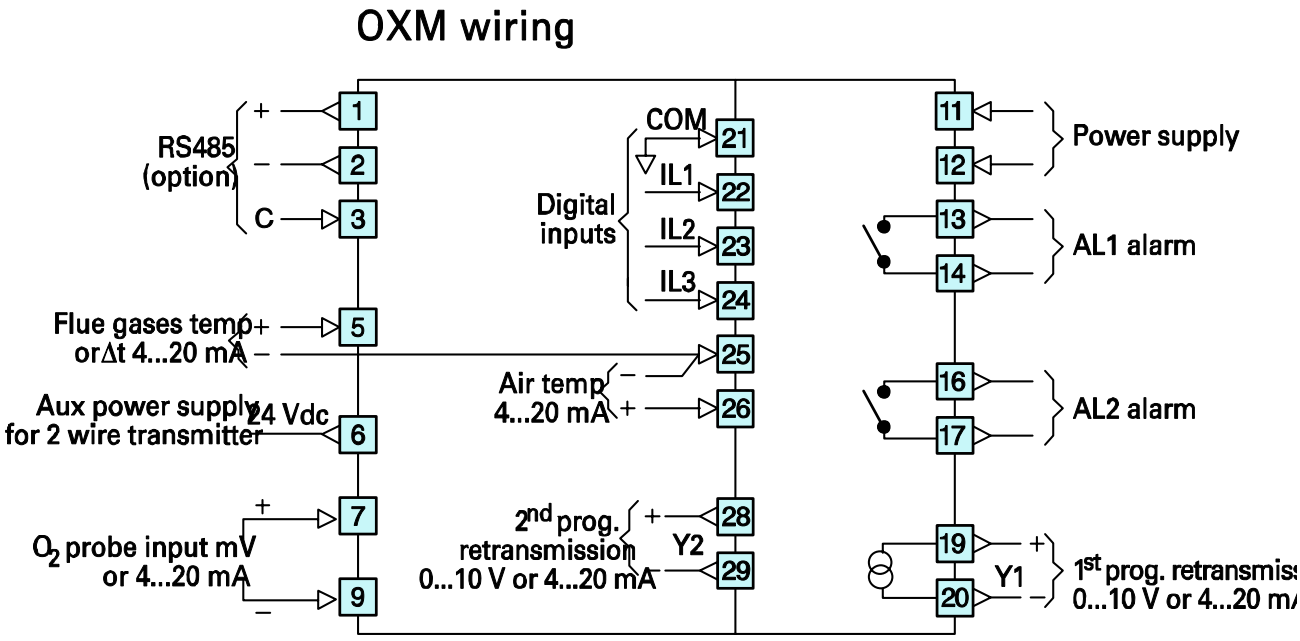


C · Wire connections

	Cable section	Max N° Wires	
With eyelet terminals 6.9 mm max.	0.25..2.5 mm2 (AWG 22..14)	2	
With fork terminals 6.9 mm max.		1	7 mm
With tinned wire 6 - 7 mm		2	
Preferential			

D · Protecting the terminal board





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

6. BUTTON AND INDICATOR FUNCTIONS

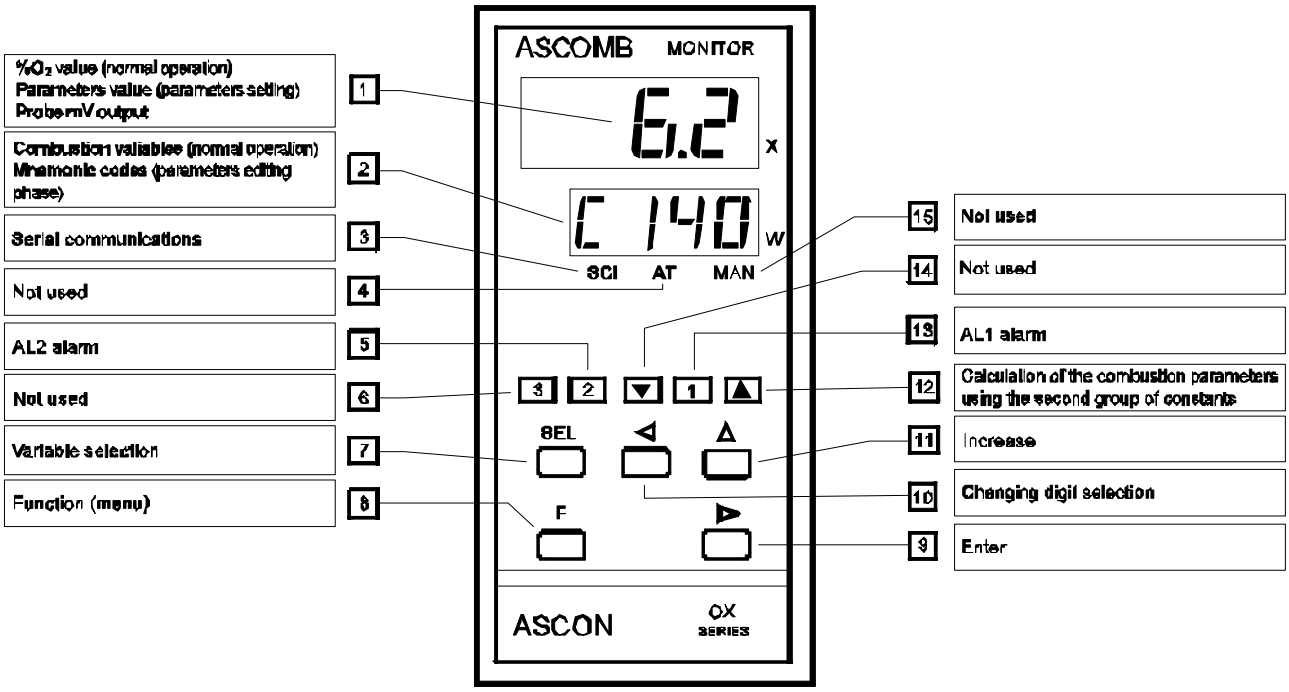


Fig. 5

6.1 Pilot lights and operational status

The pilot lights located on the front of the instrument are used to inform the operator of the operational status of the Monitor's functions.

- The pilot lights **AT (4)**, **3 (6), ∇ (14)** and **MAN (15)** are permanently unlit as they represent unused functions.
- **SCI** Pilot Light **(3).** This pilot light lights up when the serial communications are enabled, during the programming phase, through the parameter SCI located in the third parameter group. The pilot light is switched off when the serial communications are disabled. The pilot light flashes when the Monitor *receives and recognizes* a message in transit on the serial line.
- (Δ) Pilot Light (12). This red pilot light flashes to indicate that the Monitor is computing the value of $\%CO_2$, efficiency η% and excess air λ, by using the fuel constants of the emergency (or secondary) fuel (a2…E2) group of fuel constants, in accordance with the presence of an external signal (closed contact) connected to the logic input IL3. In order to return to normal operating conditions (computing performed with the first group of constants a1…E1), it is sufficient to release (open contact) the logic input IL3.

6.2 Keys

The five keys on the instrument allow functions and parameters to be entered, and parameters to be configured, programmed, calibrated and modified.

- The ***SEL* (7*)*** key selects the indicators that appear on the display **W** (**2**). The variables that can be selected and viewed by repeatedly pressing the key are:

L Combustion excess air **λ**, range 1.00...2.00.
E Efficiency of combustion **η%,** range 0.0...99.9%.
C Carbon dioxide **CO_2%,** range 0.0...25.0%.
t Flue gas temperature (or flue gases/air ΔT), in accordance with the entered range In.lo and In.Hi.
A Air temperature (if the relevant input is provided), in accordance with the entered range (t.a.lo and t.a.Hi)

Once selected, the required indicators are permanently displayed on the display **W (2)** until a further selection is made.

- The ***F* (8)** (Function) key provides access to the main menu of the functions to be programmed or activated. Within the parameter groups, it allows users to skip from the current group to the next one. By pressing the F key before any other selection is made, the Monitor shows the U In function that gives the value (in mV) generated by the ZO_2 probe. The indicator resolution 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 to confirm the selected function, access to the parameters and the change from one parameter to the next one in the same group.
- The ◅ **(10)** (Shift) key only works during the parameters editing phase. This key is used to select the display digit to be modified. The digit to be modified flashes. By pressing the ◅ key, the flashing digit moves to the next digit on the left.
- The △ **(11)** (Increase) key only works during the parameter entering phase. This key is used to increase the selected digit (flashing digit).

6.3 Displays

- The **X (1)** display normally indicates the concentration of oxygen in the range 0.0...20.9%. If the percentage of oxygen exceeds the 0.0...20.9 ±5% range, the display will show :
  Lower out of range: 4 horizontal segments in the lower part of the display area;
  Upper out of range: 4 horizontal segments in the upper part of the display area.
  During the parameter editing phase, the upper display **(1)** shows the value of the parameter selected.
  If the **IL2** logic input is activated (closed contact), the upper display **(1)** shows "Fai .
- The display **W (2)** indicates the selected variable. The first digit from the left shows the mnemonic code of the indicated variable, as follows:

L Combustion excess air **λ**.
E Combustion efficiency **η%**.
C Carbon dioxide **CO_2%.**

t Flue gas temperature or flue gas/air Δ T.

A Combustion Air temperature (if the relevant input is provided)

The other three digits of the display show the variable value.

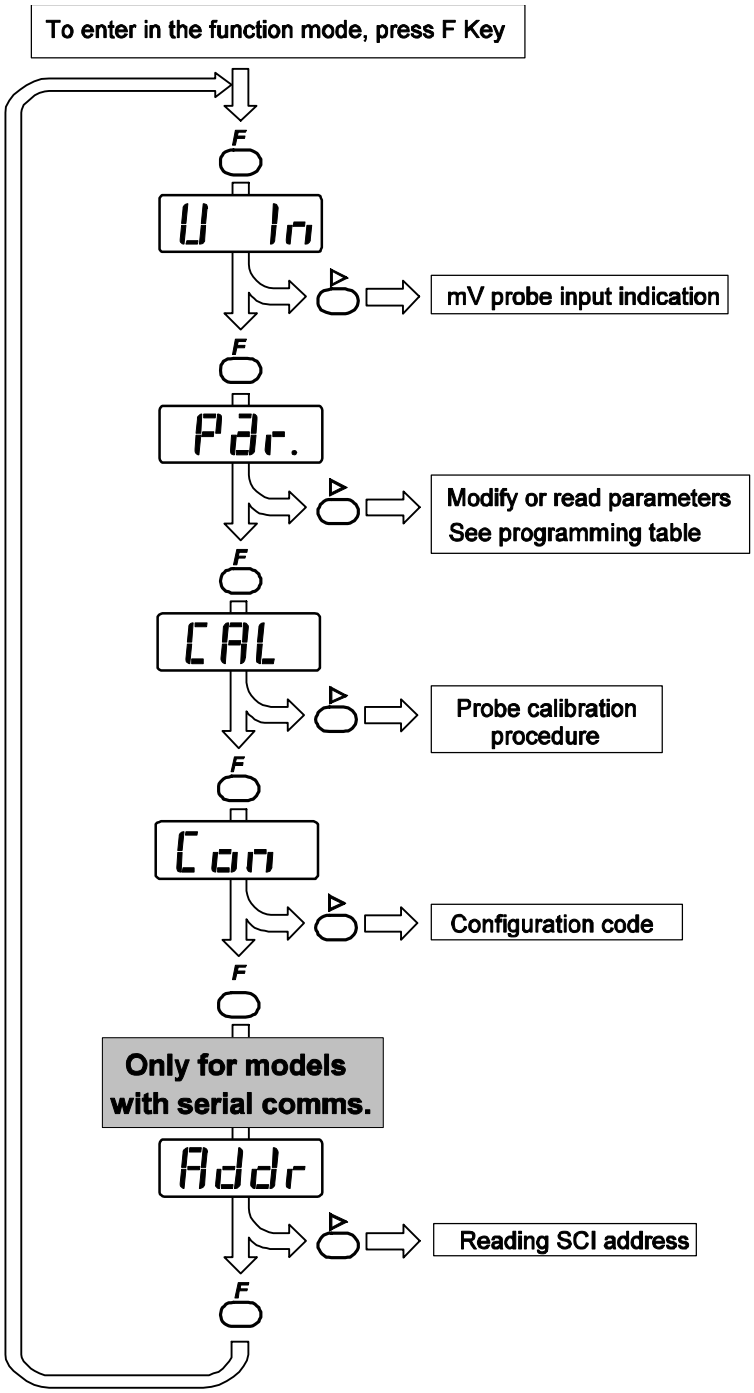
When the **IL1** logic input is activated (closed contact), the display shows "Ho Id"
When the **IL2** logic input is activated (closed contact), the display is totally unlit.

6.4 Alarm pilot lights

- The **1 (13)** LED pilot light lights up when the AL1 alarm threshold is activated (high or low depending upon configuration). When the LED lights up, the AL1 output contact is closed.
- The **2 (5)** LED pilot light lights up when the AL2 alarm threshold is activated (high or low depending upon configuration). When the LED lights up, the AL2 output contact is closed.
- The red indicator Δ (12) flashes while the Monitor is using the fuel constants of the second group a2...E2 to calculate the %CO_2, efficiency η% and air excess λ. To switch to the second constants group, simply close the IL3 digital input contacts. When the IL3 contacts are open, the Monitor uses the first group of constants (a1 ... E1) for the calculation.

7. PARAMETERS

All the instrument's parameters are organized into groups of homogeneous functions. A simple but effective selection menu has been created to access all the parameters of the instrument. By activating the
" ***F*** " key, the name of the function group is displayed. The "Enter ▷ key allows the parameter groups, the probe calibration procedure, etc., to be accessed (see the flow chart shown above).



Note:
If the instrument is configured for a linear 4…20 mA input for the O_2 probe measurement (code E=2), the codes U In and CAL do not appear in the menu.

7.1 Arrangement of groups and parameters

Paramete Code	Description	Range	S.C.I. Code	Note	GROUP
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	
tdEL	Delay operation of alarms	0...120 s	"DEL"	4	
In.Lo	Lower limit of gas temperature scale or ΔT	0... In.H °C	"INL"		2nd
In.H	Upper limit of gas temperature scale or ΔT	In. Lo...600°C	"INH"		
t.a.Lo	Lower limit of air temperature scale	-50...t.a.H °C	"TAL"	5	
t.aH	Upper limit of air temperature scale	t.a. Lo...150°C	"TAH"	5	
O2.Lo	Lower oxygen limit for retransmission	0.0...O2.H %	"O2L"	1,6	
O2.H	Upper oxygen limit for retransmission	O2. Lo...20.9%	"O2H"	1,6	
CO.Lo	Lower carbon dioxide limit for retransmission	0.0...CO.H %	"COL"	7	
CO.H	Upper carbon dioxide limit for retransmission	CO. Lo...25.0%	"COH"	7	
°C.Lo	Lower gas temperature or Δ T limit for retransmission	In Lo..°C.H °C	"TEL"	8	
°C.H	Upper gas temperature or Δ T limit for retransmission	°C Lo... In.H °C	"TEH"	8	
EF.Lo	Lower combustion efficiency limit for retransmission	0.0...EF.H %	"EFL"	9	
EF.H	Upper combustion efficiency limit for retransmission	EF. Lo...100.0%	"EFH"	9	
λ.Lo	Lower excess air limit for retransmission	1.000... λ.H	"LAL"	10	
λH	Upper excess air limit for retransmission	λ. Lo...2.000	"LAH"	10	
t.F 1	Time constant of input filter	0...30 s	"FIL"		3rd
A 1	1st fuel constant group 1 (γot/γoa)	1.000...1.500	"KA1"		
b 1	2nd fuel constant group 1 (γot/γoa*(1-w))	0.800...1.000	"KB1"		
C 1	3rd fuel constant group 1 (CO_2max.)	10.00...30.00%	"KC1"		
d 1	4th fuel constant group 1 (D)	0.00...20.00	"KD1"		
E 1	5th fuel constant group 1 (E)	0.100...1.000	"KE1"		
A 2	1st fuel constant group 2 (γot/γoa)	1.000...1.500	"KA2"		
b 2	2nd fuel constant group 2 (γot/γoa*(1-w))	0.800...1.000	"KB2"		
C 2	3rd fuel constant group 2 (CO_2max.)	10.00...30.00%	"KC2"		
d 2	4th fuel constant group 2 (D)	0.00...20.00	"KD2"		
E 2	5th fuel constant group 2 (E)	0.100...1.000	"KE2"		
CC 1	1st calibration constant (U1)	-9.99...10.00mV	"CC1"	11	
CC2	2nd calibration constant (T)	-200...200°K	"CC2"	11	
S.C. I.	Serial communication enabling index	0 = OFF 1 = ON		12	
Addr	Address	0...247	"ADR"	12	
S.C.b.r	Baud rate	1...4	"BDR"	12	
S.C.Pa	Parity	0...2	"PAR"	12	

Notes:

1) If at the time of configuration the $\%O_2$ input is linear (E = 2), the scale range is limited from 1.0. Lo to 1.0.H.
2) Whenever not present in the configuration, alarm AL 1 is deactivated (I = 0).
3) Whenever not present in the configuration, alarm AL 2 is deactivated (L = 0).
4) Whenever not present in the configuration, both alarms are deactivated (I & L = 0).
5) Whenever not present in the configuration, the Air Temperature input is deactivated (F = 0).

6) Whenever not present in the configuration, then the retransmission of oxygen level (**G=0**) is not selected for **Y1** or **Y2**.
7) Whenever not present in the configuration, then the retransmission of the estimated level of carbon dioxide (**G** & **H** <> 1) is not selected for **Y1** or **Y2**.
8) Whenever not present in the configuration, then the retransmission of the Gas Temperature or Delta Temperature (**G** & **H** <> 3 or 4) is not selected for **Y1** or **Y2**.
9) Whenever not present in the configuration, then the retransmission of the estimated value of the combustion efficiency (**G** & **H** <> 5) is not selected for **Y1** or **Y2**.
10) Whenever not present in the configuration, then the retransmission of the estimated level of excess air (**G** & **H** <> 6) is not selected for **Y1** or **Y2**.
11) Whenever not present in the configuration, the input **X** is linear (**E** = 2)
12) Whenever not present in the configuration, the instrument will not provide for serial communication.

7.1.1 Characteristic constants of fuel

Each type of fuel is characterized by a number of specific constants. These constants are:

- **A** Flue gas volume and combustion air volume ratio (per unit of fuel), relevant to the stoichiometric combustion (Wet).
- **b** Flue gas volume and combustion air volume ratio (per unit of fuel), relevant to the stoichiometric combustion (Dry).
- **C** Maximum % volume content of CO_2 in the flue gas (Dry) for stoichiometric combustion.
- **d** % loss due to latent heat (*Humidity Losses).*
- **E** Combustion factor relevant to the composition of the fuel.

The above-listed constants are used by the Ascomb System to compute, by the use of suitable formulae, the CO_2%, λ, η% variables, starting from the O_2 concentration measurement.
The following table gives some of the most used fuel constants:

Fuel	A	b	C	d	E
Natural Gas	1.105	0.895	11.7	11	0.38
Propane	1.084	0.916	13.8	7.7	0.42
LPG	1.091	0.912	14	7.4	0.43
Oil	1.068	0.936	15.1	6.1	0.56
LFO	1.067	0.94	15.6	6.0	0.56
HFO	1.065	0.944	15.8	5.8	0.58
Coal	1.03	0.98	19.1	2.7	0.67
Wood	1.2	0.99	20.1	12.5	0.58

Note: The parameter “d” is set to zero by default, thus the efficiency value is calculated based on wet flue gas, without taking account of losses due to the latent heat of water vapour condensation.

7.2 Programming table

See “Programming table” enclosed in this manual.

8. PASSWORD

In order to prevent unauthorized or undesirable operations, the OX series Monitors are provided with two access protection passwords to access 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, which may be selected from a main menu. These groups are:

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

In order to access the *configuration* procedure, when the instrument requests the password (i.e. the "PASS" pilot light appears on the display), the code 3333 must be entered. Subsequently, the configuration codes Con1 and Con2 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. Therefore, these are always accessible.

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

9. CALIBRATION PROCEDURE FOR THE ZO2 PROBE

The purpose of this procedure is to automatically compute the probe's two constant calibration coefficients, CC1 and CC2, and to enter them into the Monitor under the corresponding CC1 and CC2 codes located in the third group of parameters. Selecting the item **CAL.** from the main menu, and entering **1111** in the PASS display, it is possible to start the calibration procedure, which consists of 3 different stages:

1. The display **W** shows the CAL.1 code.
Send the reference gas (instrument air with 20,9% of O_2).
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 O_2.
Press the ▷ (enter) key, to set the mV deviation value to "zero".
If after a few seconds the upper display indicator is still not equal to "ZERO", the operation shall be repeated. Otherwise, proceed by pressing the "F" key;

2. The display shows O2 C.
Enter the reference value of the O_2 % used for the second step of the calibration (calibration of Span).
The Span gas O_2 % 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.2" code. Send the calibration span gas at the selected concentration of O_2 (the same O_2 % entered as reference value O2 C) 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 set the temperature deviation value to "zero".
If after a few seconds the upper display indicator is still not equal to "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 entering the two CC1 and CC2 constants (marked on the probe head) manually into the instrument.

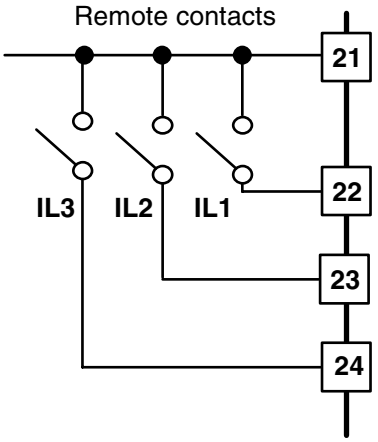
10. LOGIC INPUT FUNCTIONS

To switch over the two tables of the fuel constants and to put the Ascomb Monitor 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)
  - it disables the alarms
  - it disables the cyclical display of the variables through the W key
  - the message "Ho Id" appears on the display **W**, while the X display shows the O_2 value;
  - the serial communications output "Ho Id" upon variable requests.

- **IL2:** when activated (closed contact)
  - it disables the alarms
  - it sets the retransmission outputs to the Start of range.
  - it 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 output "FAIL" upon variable requests;

- **IL3:** when activated (closed contact)
  - the computation of **CO_2%, λ** and **η%**, is switched from the main fuel constants d1...E1 to those of the secondary fuel d2...E2.



By releasing the logic inputs (opening the contacts), the Monitor starts to operate in the conditions existing before contact closure.

Note: In event of IL1 and IL2 closing simultaneously, the IL2 signal will prevail and the instrument will be switched to the “FAIL” mode.

11. TROUBLESHOOTING

Due to the high number of inputs applied to the Monitor, a simplified table is given below, showing all the possible faults which may occur concerning the various inputs, outputs and indicators on the display.

Fault condition	Effect on Indicators and Outputs										
	O2%		λ		CO2%		η%		Indic.	Indic.	Retransm
	Indic.	Retransm	Indic.	Retransm	Indic.	Retransm	Indic.	Retransm	Gas T.	Air T.	Temp.
Open circuit to Lambda probe	Under Range	0%	Under Range	0%	Under Range	0%	Under Range	0%	OK	OK	OK
Level > 300mV on Lambda probe input	Under Range	0%	Under Range	0%	Under Range	0%	Under Range	0%	OK	OK	OK
Oxygen level > 21.9% (> 105% scale)	Over Range	0%	Under Range	0%	Under Range	0%	Under Range	0%	OK	OK	OK
Flue gases temperature input, open or short circuited	OK	OK	OK	OK	OK	OK	Under Range	0%	Under Range	OK	0%
Flue gases temperature input, under scale	OK	OK	OK	OK	OK	OK	Under Range	0%	Under Range	OK	0%
Flue gases temperature input, over scale	OK	OK	OK	OK	OK	OK	Under Range	0%	Over Range	OK	100%
Air temperature input, open or short circuited	OK	OK	OK	OK	OK	OK	Under Range	0%	OK	Under Range (1)	0% (1), (2)
Air temperature input under scale	OK	OK	OK	OK	OK	OK	Under Range	0%	OK	Under Range (1)	0% (1), (2)
Air temperature input over scale	OK	OK	OK	OK	OK	OK	Under Range	0%	OK	Over Range (1)	100% (1), (2)

Note:

1) If the Air Temperature input is excluded, any of its fault conditions will have no affect.
2) A fault on the Air Temperature input will only influence the retransmission of ΔT.

12. SERIAL COMMUNICATION

A serial communications port may optionally be installed on the Monitor, with the electrical interface RS485 (OXM-33xx).

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

It is possible to effect almost any operational configuration through the serial communication.
In order to allow serial communication with the OXM monitor, it is necessary to set up four specific 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 Monitor answers all the supervisor questions and answers "NOP" to any assignment and command from the supervisor. With SCI = 1, the Monitor answers all questions, and responds to any assignment and command from the supervisor.
- Addr represents the Monitor address, which may be inputted from 0…63 with Ascon protocol or 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, identically 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 the parity check for the messages transferred in the line, and **must be inputted, identically 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.

12.1 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.

12.2 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 a hyphen "-". Assigning the bit status using the 05 and 15 functions is only allowed on addresses in which this is possible. This condition is indicated by "R/W".

12.3 The Word Zone

The word zone is made up of 126 addressable words containing 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 "-". Assigning the word value using the 06 and 16 functions is only allowed on addresses in which this is possible. This condition s indicated by "R/W".

The variables and parameters are coded as integer numbers with a plus or minus sign (complement notation in pairs) 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 those permitted within the field will cause the instrument to return an error message with exception code = 3, and the assignment will not be carried out.

12.4 ModBus Address

12.4.1 Bit Zone

Address			
ModBus	**JBus**	**Variable**	**Type**
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	Address	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	

12.4.2 Word Zone – Parameters Page

Address				
ModBus	**JBus**	**Variable**	**Parameter code**	**Type**
0	1	Oxygen concentration measure (X)		R
1	2	Air excess measure (L)		R
2	3	Combustion efficiency (E)		R
3	4	CO2 percentage (C)		R
4	5	Flow gases temperature (TF)		R
5	6	Air temperature (TA)		R
6	7	Tf –Ta (DT)		R
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	11	Flow gases temperature low range limit	In.Lo	R/W
11	12	Flow gases temperature high range limit	In.Hi	R/W
12	13	Air temperature low range limit	t.a.Lo	R/W
13	14	Air temperature high range limit	t.a.Hi	R/W
14	15	Oxygen temperature low range limit	O2l	R/W
15	16	Oxygen temperature high range limit	O2h	R/W
16	17	CO_2 retransmission low range limit	CO.Lo	R/W
17	18	CO_2 retransmission high range limit	CO.Hi	R/W
18	19	Flow gases temperature retransmission low range limit	°C.Li	R/W
19	20	Flow gases temperature retransmission high range limit	°C.Hi	R/W
20	21	Efficiency retransmission low range limit	EF.Lo	R/W
21	22	Efficiency retransmission high range limit	EF.Hi	R/W
22	23	Air excess retransmission low range limit	La.Lo	R/W
23	24	Air excess retransmission high range limit	La.Hi	R/W
24	25	Input filter time constant	t.FiL	R/W
25	26	1st fuel constant, group 1	A1	R/W
26	27	2nd fuel constant, group 1	B1	R/W
27	28	3rd fuel constant, group 1	C1	R/W
28	29	4th fuel constant, group 1	D1	R/W
29	30	5th fuel constant, group 1	E1	R/W
30	31	1st fuel constant, group 2	A2	R/W
31	32	2nd fuel constant, group 2	B2	R/W
32	33	3rd fuel constant, group 2	C2	R/W
33	34	4th fuel constant, group 2	D2	R/W
34	35	5th fuel constant, group 2	E2	R/W
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			

12.4.3 Word Zone Configuration Page

Address				
ModBus	**JBus**	**Variable**	**Parameter code**	**Type**
100	101	1st part of the Configuration code	Con.1	R/W
101	102	2nd part of the 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
104	105			
105	106			
106	107			
107	108			
108	109			
109	110			
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 the Software release code		R
124	125	2ndt part of the Software release code		R
125	126			

13. 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
• **Air temperature input**	4...20 mA from linear transmitter
• **Flow gases temperature input**	4...20 mA from linear transmitter
• **Auxiliary Inputs**	3 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
• **Protection of parameters**	with password software
• **Noise immunity**	Level 4, in accordance with IEC 801-4
• **Data storage**	with non-volatile memory
• **Power supply A.T.**	100...240Vac, 48…63Hz, -15% + 10%
• **Power supply B.T.**	24Vac, 48…63Hz, -15% +10% 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
• **Atmosphere temperature**	0....50^{o}C
• **Atmosphere 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 g approx.
• **Dimensions**	48 x 96mm, depth 150mm in accordance with DIN 43700

WARRANTY

We warrant that the products will be free from defects in material and workmanship for 18 months from the date of delivery.

Products and components that are subject to wear due to conditions of use, service life, and misuse are not covered by this warranty.

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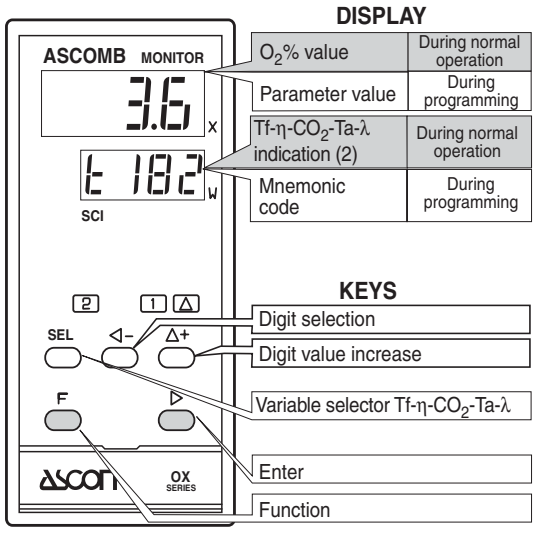
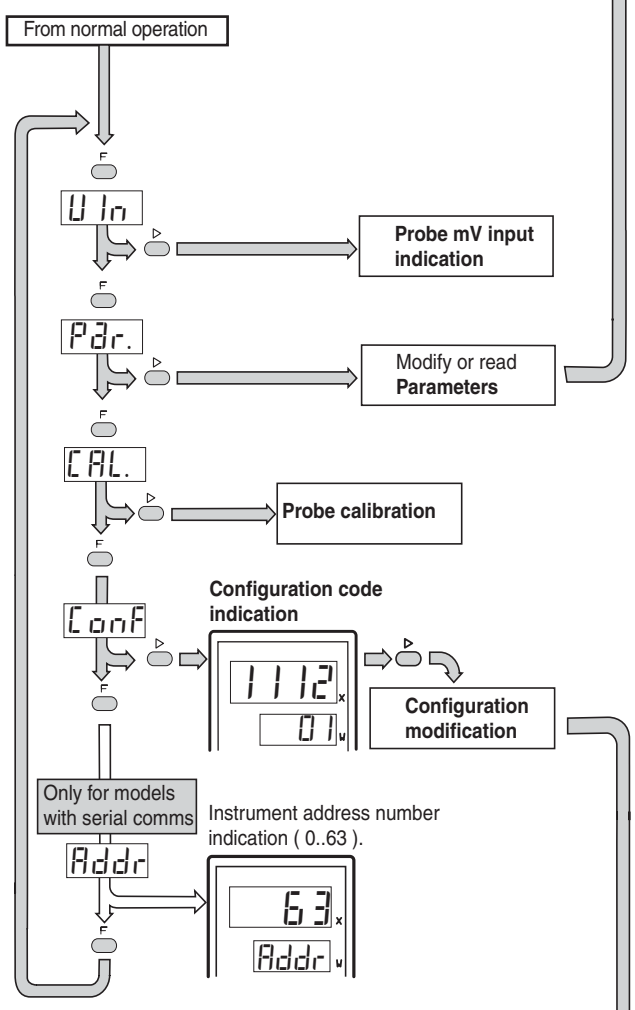
7.2 • PROGRAMMING INSTRUCTIONS • OXM SERIES MONITOR

FUNCTION MENU



To enter in the function menu, press F



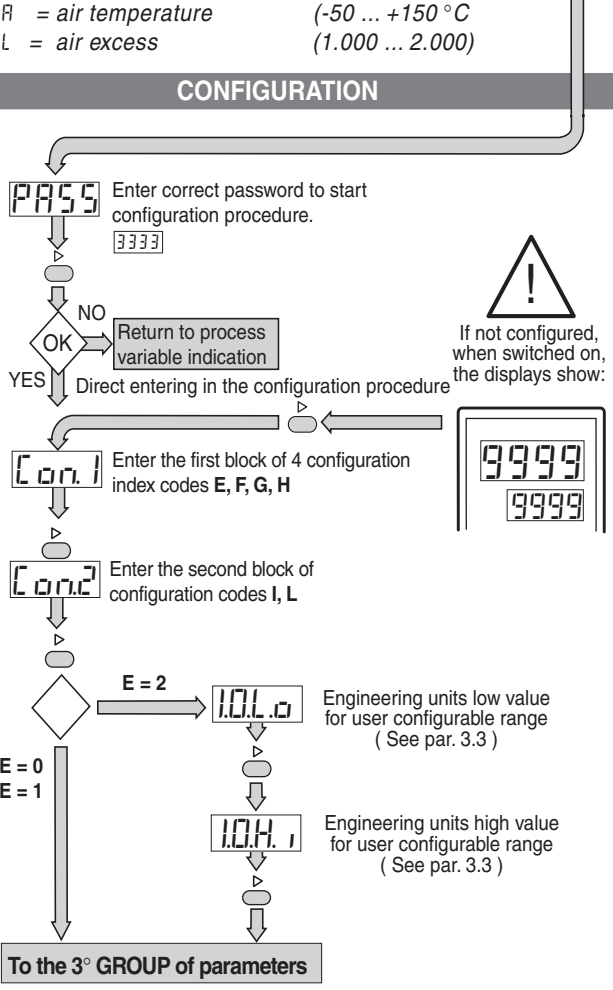
Notes:

1 *If F or ▷ are not pressed within 10 seconds the displays return to the previous indication.*

2 *Mnemonic codes:*

E	= combustion efficency	(0.0 ... 99.9%)
C	= carbon dioxide	(0.0 ... 25.0%)
t	= flue gases temperature	(0 ... 600 °C)
A	= air temperature	(-50 ... +150 °C
L	= air excess	(1.000 ... 2.000)

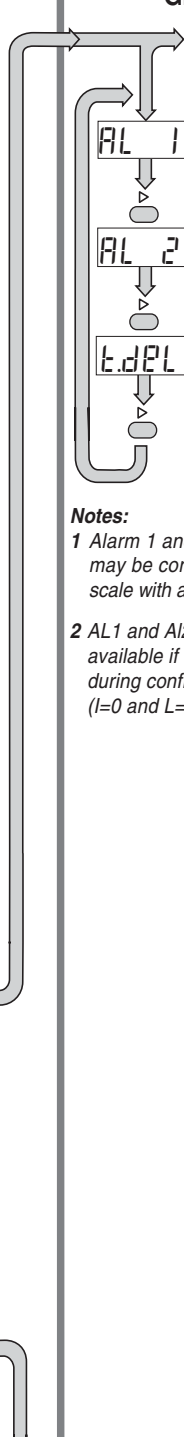
CONFIGURATION



The indication of the configuration code is permanent, no automatic return to the previous indication is foreseen. After the configuration procedure, the group 3 parameters can be directly reached to modify, if necessary, input filter value, etc..

PARAMETERS

GROUP 1

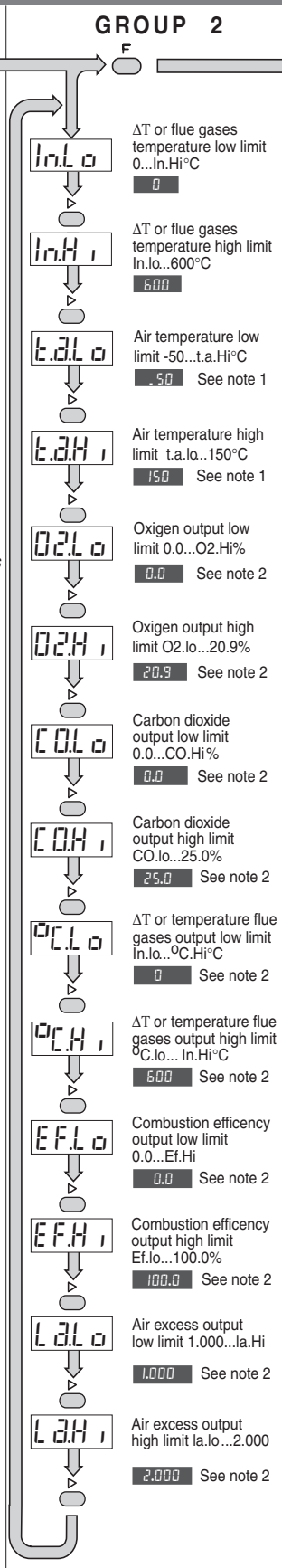


Notes:

1 *Alarm 1 and alarm 2 set points may be configured over the full scale with a fixed 0.5% hysteresis*

2 *AL1 and Al2 parameters are not available if they are disabled during configuration (I=0 and L=0)*

GROUP 2

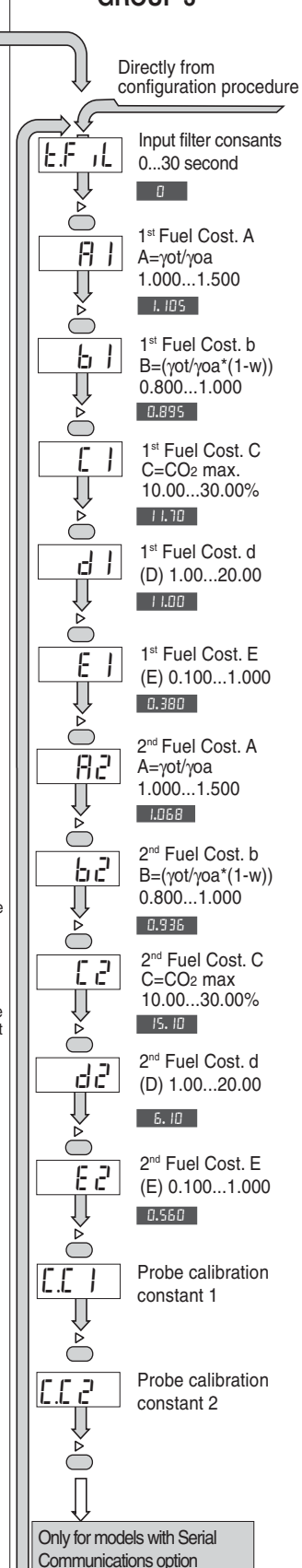


Notes:

1 *The ta.lo and ta.Hi are not available if they are disabled during the configuration (F=0)*

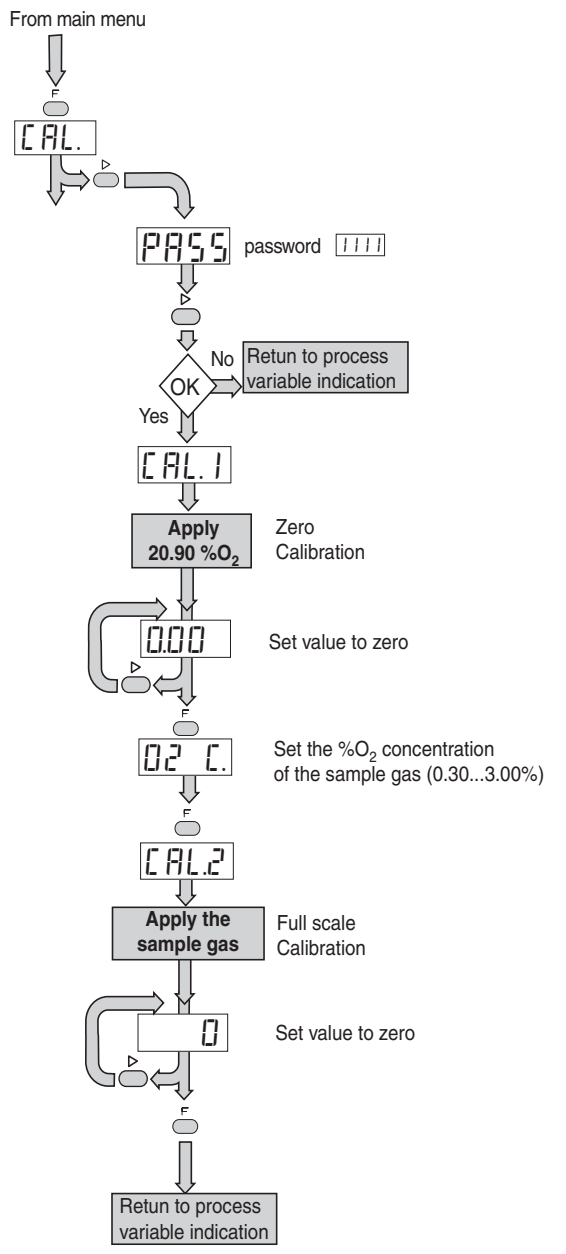
2 *The %O2 - %CO2 - Flue gases T. Ait T. - η - λ retransmission parameters are not available if they are disabled during the configuration (G=0 and H=0)*

GROUP 3



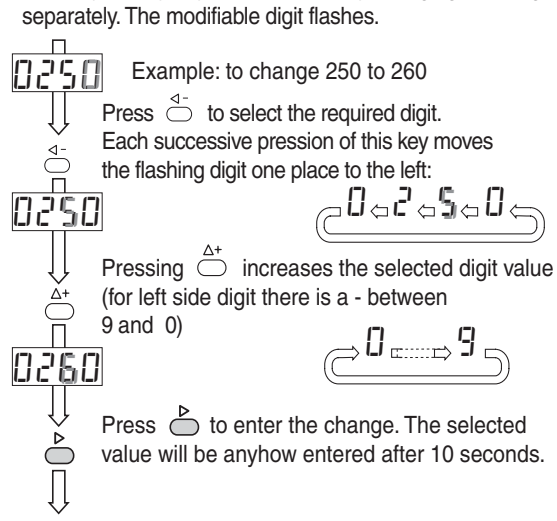
Note: ■ ***factory set parameters***

PROBE CALIBRATION



MODIFICATION OF A NUMERIC VALUE

You may modify any numeric value by changing each digit separately. The modifiable digit flashes.



CONFIGURATION CODE