USER MANUAL

Oil flow computer

CDN 12 – 2EA1Z

CE

Pipe European
Model

C 72364-01 rev. 1 dated 12.08.02

Meci s.a.s

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SECTION I CONTENTS

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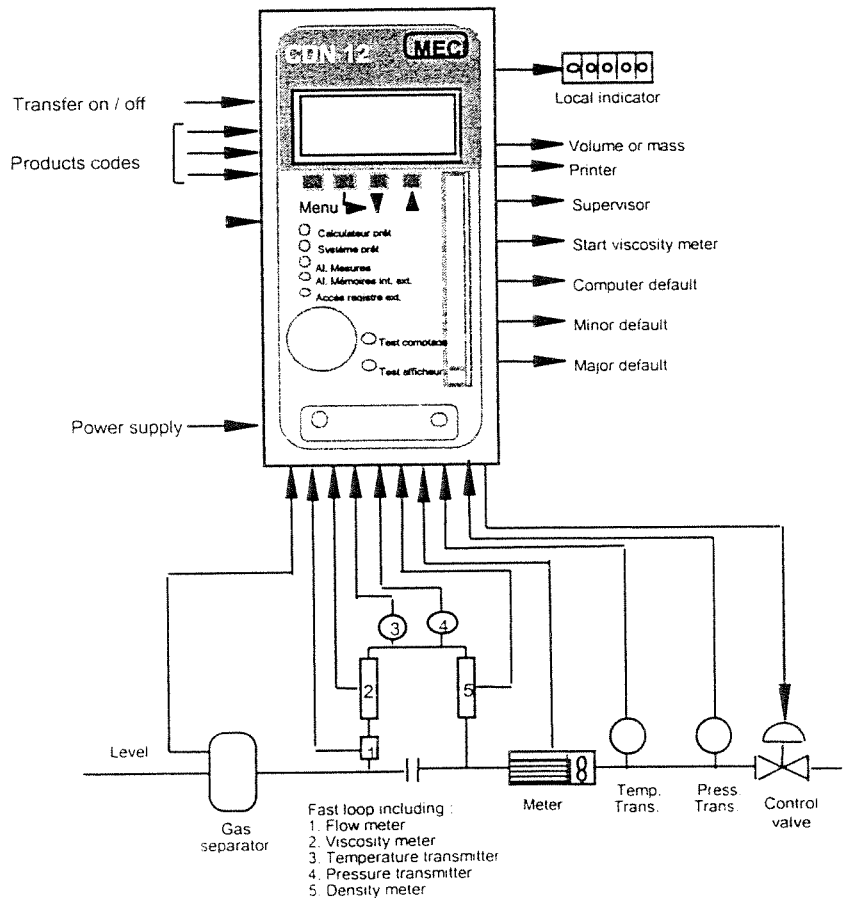
SECTION I

EQUIPMENT DESCRIPTION

1. APPLICATION

The CDN 12 flow computer is a metering and storage system designed for metering on pipeline.



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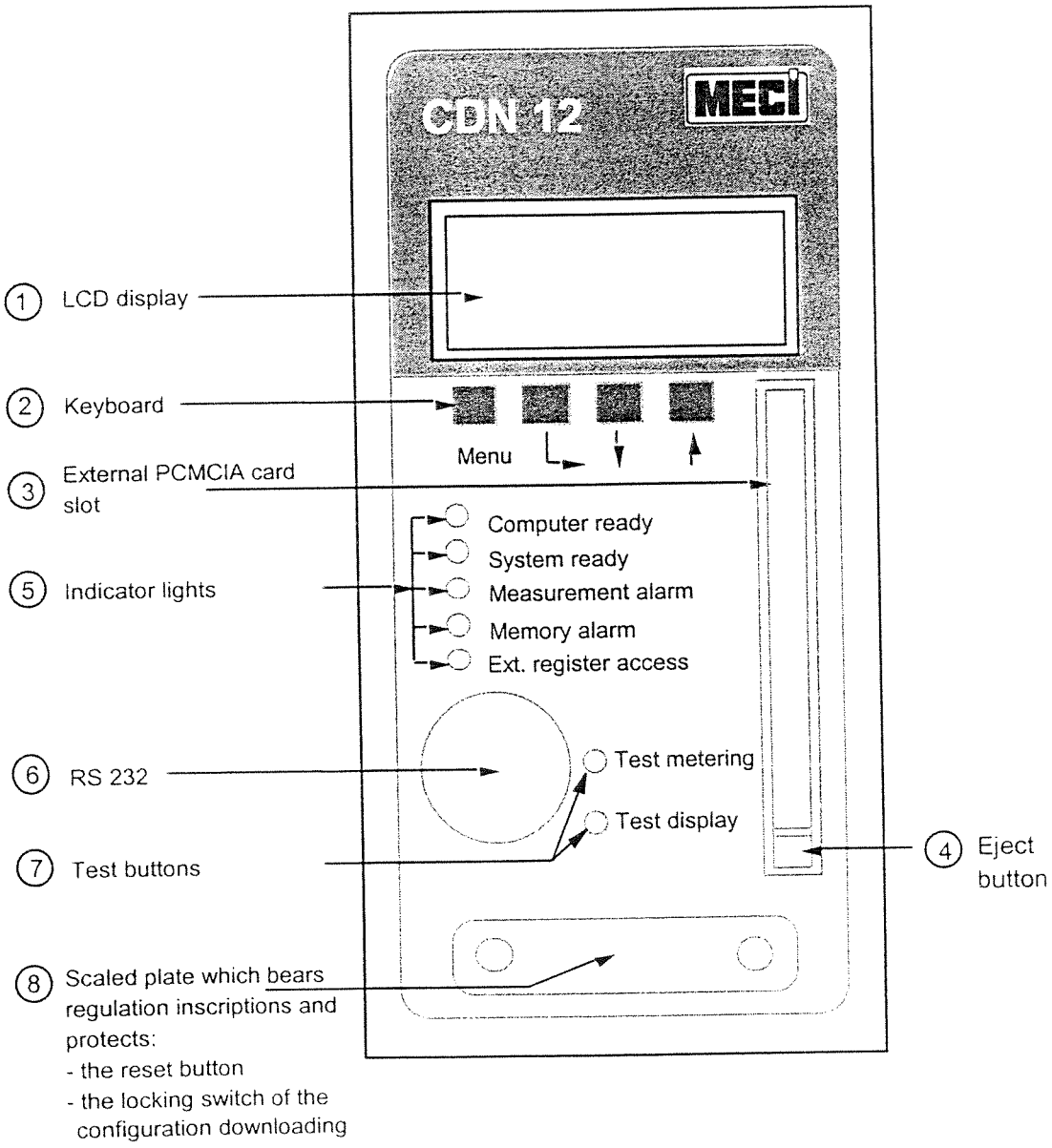
2. EQUIPMENT DESCRIPTION

2.1 FRONT PANEL

2.1.1 FRONT PANEL EQUIPMENT



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2.1.2 FRONT PANEL ELEMENT CHARACTERISTICS

(1) LCD display

An alphanumeric display of 2 lines of 12 characters allows the operator to visualize the data of the various menus.

(2) Keyboard

4 keys allow the operator to access to the different menus available in the CDN 12.

(3) External PCMCIA card slot

It receives the external PCMCIA card, which stores the different metering data safety.

(4) Eject button

It enables to remove the external PCMCIA card.

(5) Indicator lights

Computer ready	:	green, indicates that the computer is ready for use.
System ready	:	green, indicates that the system is ready for use (computer + peripheral).
Measurement alarm	:	red, indicates transducer faults (line break, alarm, etc.).
Memory alarm	:	red, indicates internal ad external memory card faults.
Ext. register access	:	yellow, indicates the access to the external memory card. It also indicates a fault on this memory.

(6) RS 232

PC connection which permits the computer configuration, maintenance and operation.

(7) Test buttons

Test metering:

Push-button which creates a fault enabling testing of disparity between the metering acquisition channels.

Test display:

Push-button which creates a fault enabling testing of the display controls.

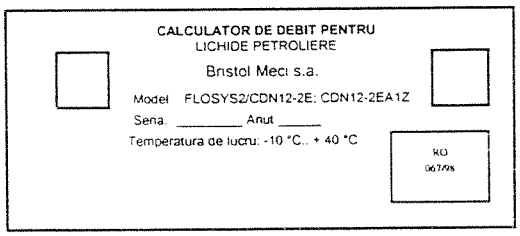
(8) Sealed plate

The plate has 2 functions:

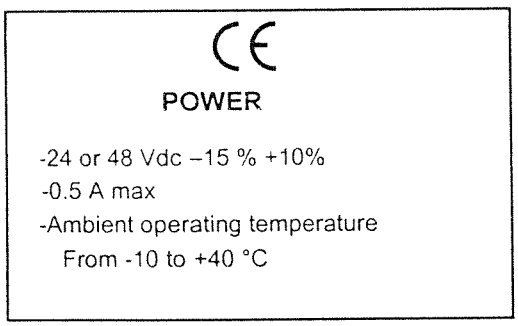
- Identification plate : it bears regulation inscriptions.
- Protective plate : after having been removed, the protective plate gives access to the following components:
  - front panel dismounting screw
  - reset button of the CDN 12
  - locking switch of the configuration downloading

The plate is fastened with two screws provided with standard washers with lead seals ensuring the computer regulation seals.

2.1.3 IDENTIFICATION LABEL OF THE CDN 12



2.1.4 IDENTIFICATION LABEL OF THE CDN 12's CASING



IFP / SOFRESID PATENT

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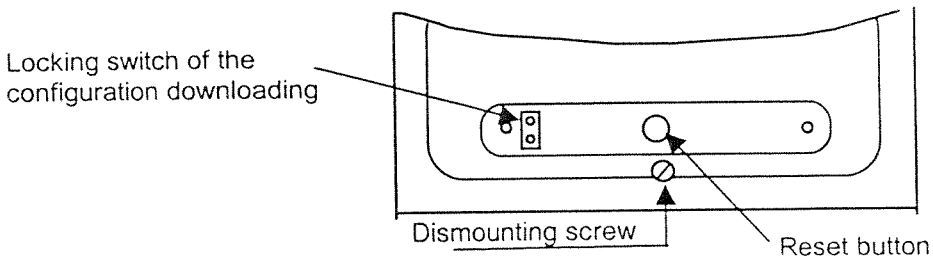
2.1.5 FUNCTION OF THE PROTECTED COMPONENTS

These components are accessible after opening the protective cover.



Locking switch of the configuration downloading:

- In up position: Configuration downloading inhibited.
  We will use further in the manual: "configuration locking switch ON".

- In down position: Configuration downloading enabled.
  We will use further in the manual: "configuration locking switch OFF".

Reset button:

Pressing this button resets the computer.

2.2 INTERNAL STRUCTURE

The CDN 12 is made up of 4 cards:

- CPU
- Power supply
- Extension board
- LCD display

2.2.1 CPU CARD

2.2.1.1 Architecture

This is made up of :

- Micro computer 68302, 16 MHz (32 internal biTs)
- EPROM 512 ko
- NOVRAM 256 ko
- 2 Mo flash memory (internal)
- 3 serial ports RS 232
  - configuration terminal (output on the CDN 12 front panel)
  - printer
  - unused
- 1 serial port RS 485 (supervisor)
- 2 galvanic isolated digital inputs
- 8 digital outputs open collector

2.2.1.2 External additional equipment

- 2 Mo flash memory (removable)

2.2.1.3 View of the CPU card (component side)

See appendix 1.

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2.2.2 POWER SUPPLY CARD

2.2.2.1 Architecture

It is made up of:

- 3 voltage converters
- 2 metering inputs
- 2 galvanic isolated analog inputs 4-20 mA - A/D converter 16 bits
- 1 digital link RS 485 local indicator

2.2.2.2 View of the power supply card

See appendix 2.

2.2.3 EXTENSION BOARD

2.2.3.1 Architecture

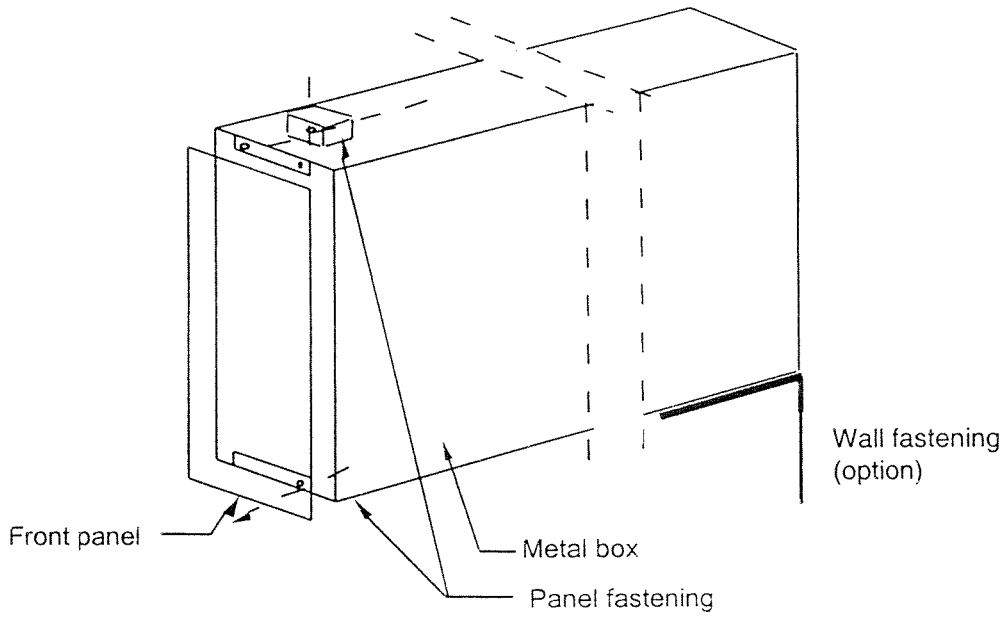
It is made up of:

- 4 galvanic isolated digital inputs
- 3 galvanic isolated analog inputs 4-20 mA - A/D converter 16 bits
- 2 analog outputs 4-20 mA - D/A converter 12 bits
- 1 frequency input for density meter.

2.2.3.2 View of the extension board

See appendix 3.

2.3 CASING



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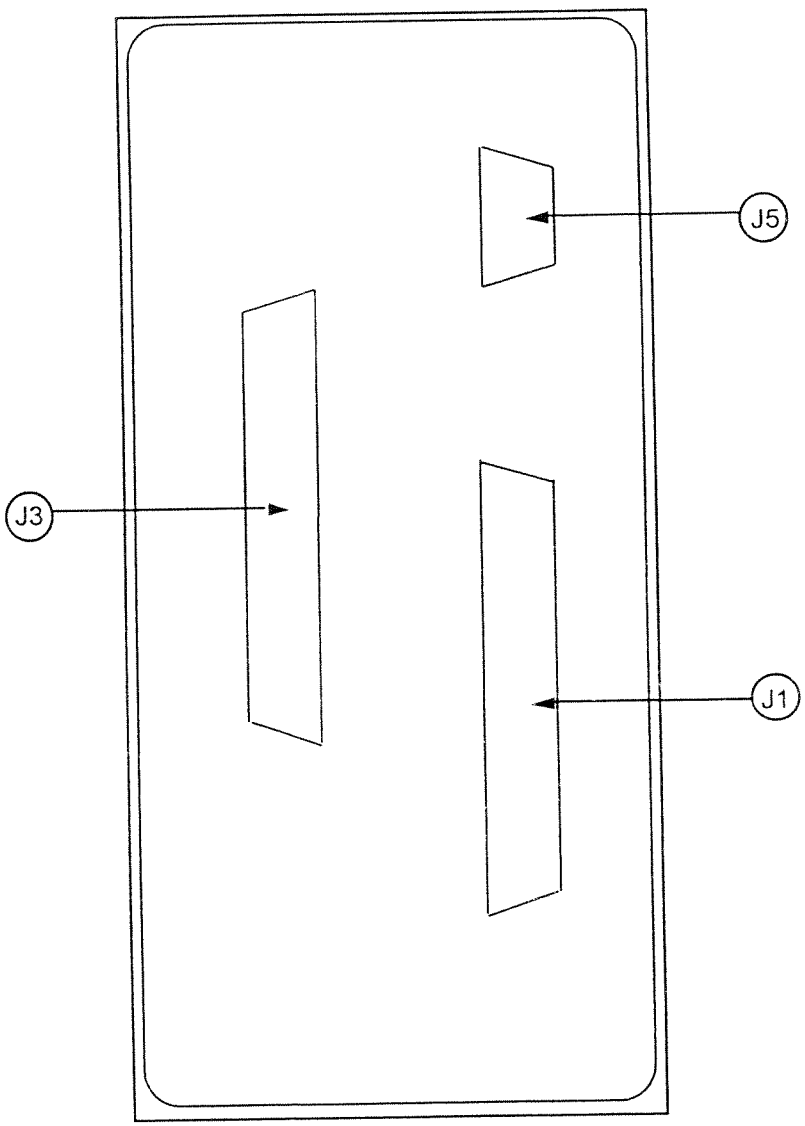
2.4 REAR PANEL



3 FIXED CONNECTORS
D-SUB or Canon

(J5) D-SUB connector, 9 male pins (power supply card)
(J1) D-SUB connector, 37 female pins (power supply card)
(J3) D-SUB connector, 37 male pins (CPU card)

3. CHARACTERISTICS

3.1 GENERAL CHARACTERISTICS

- Computer power supply	:	24 or 48 VDC
- Metering input power supply	:	output 12 VDC available
- Power consumption	:	10W - from 24 to 48 VDC
- Back-up display function (on power cut-off)	:	visualization on the indicator with a run time of 15 min.
- Back-up data storage function (on power cut-off)	:	internal values saved by batteries (5 years)
- Operating temperature	:	-10 to +40°C
- Mounting	:	- wall - panel
- Connections	:	D-SUB connectors
- Size (width, height, depth)	:	72 mm x 144 mm x 300 mm
- Weight	:	about 2 kg
- Humidity	:	0 to 95% without condensation
- Housing protection degree	:	IP20

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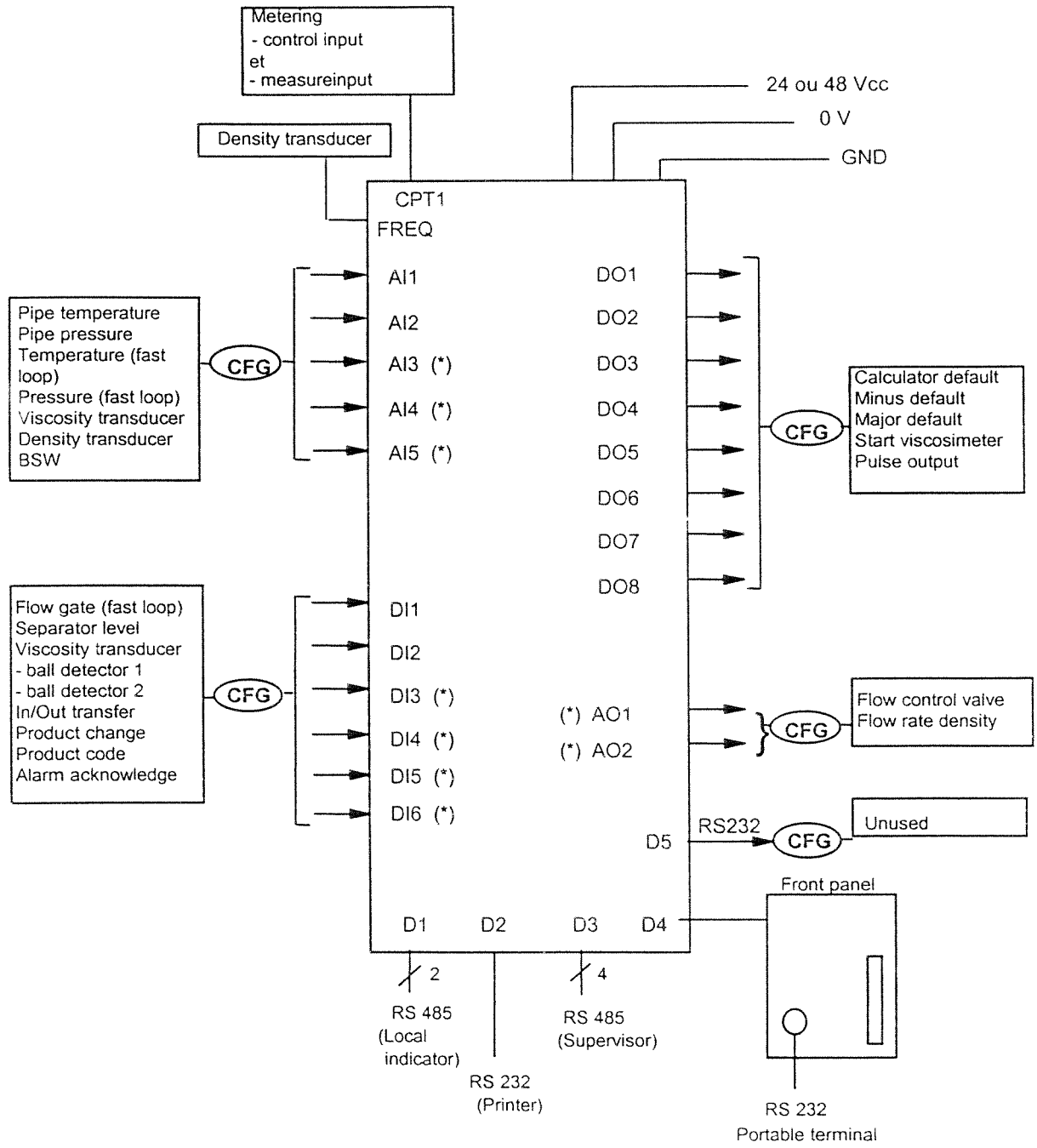
3.2 INPUTS / OUTPUTS

3.2.1 DIAGRAM OF INPUTS / OUTPUTS



CFG: Configuration
(*) : Only available on the additional board

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a) Metering inputs

The metering is set to the metering input CPT1.
CDN 12 has one control input and one measure input.

b) Analog inputs (EANA1 to EANA5)

By configuration, the operator can assign to the 5 analog inputs the previous measurements:

- Pipe pressure
- Pipe temperature
- Densitometer pressure
- Densitometer temperature
- Viscosity
- BSW
- Density

c) Analog outputs (SANA1, SANA2)

3 assignments available by configuration:

- Valve control
- Density copy
- Flow rate copy

d) Digital inputs (ETOR1 to ETOR6)

The previous assignments is available by configuration:

- Flow rate (fast loop)
- Separator level
- Viscosimeter ball detector 1
- Viscosimeter ball detector 2
- In/Out of transfer
- Product code bit 0
- Product code bit 1
- Product code bit2
- Alarm acknowledge

e) Digital outputs (STOR1 to STOR8)

By configuration, you can choose:

- Calculator default
- Major default
- Minus default
- Start viscosimeter
- Pulse output

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f) **Frequency input**

This input is used by a density transducer.

g) **Numerical links**

- 1 RS 485 used by local indicator (D1)
- 1 RS 232 used by printer (D2)
- 1 RS 485 used by supervisor (D3)
- 1 RS 232 used by portable terminal (D4)
- 1 RS 232 not used

3.2.2 POWER SUPPLY SOURCE

The CDN 12 draws its power from external 24 or 48 volt DC sources.

Consumption: 10 W from 24 Vdc to 48 Vdc.

3.2.3 METERING

Pulses are filtered widthways and in height. The system ensures a hardware and software filtering which eliminates disturb pulses.

Characteristics

- Maximum frequency : 500 Hz with 50 % of cyclic ratio
- Minimum duration of state : 100 µs
- Logic state ON : 12 V maxi
- Logic state OFF : 0 V
- Level calibration : by resistors mounted on support

Output 12 Vdc / 60 mA available.

3.2.4 ANALOG INPUTS

These inputs are galvanically isolated.

Characteristics

- Resolution : 16 bits
- Accuracy : 0.03 % within temperature range-10 / +40 °C
- Min. current : 0 mA
- Max. current : 24 mA
- Input impedance : 100 Ω

3.2.5 ANALOG OUTPUTS

Analog copy:
This output generates a standardized 4-20 mA current copy of the measurement of flow rate or density (as selected by the configuration).

Valve control:
This output generates a standardized 4-20 mA current to control a proportional valve adjuster.

Characteristics

- Resolution : 12 bits
- Accuracy : 0.2 % (4-20 mA within the temperature range)
- Max. load resistance : 1 HΩ
- Min. current : 0 mA
- Max. current : 23 mA

3.2.6 DIGITAL INPUT

Flow rate loop
Contact provided by a flow rate sensor located in the analysis loop or the start-up switch of the feed pump of this loop.

- Digital input supplied ⇒ Flow in loop
- Digital input no supplied ⇒ No flow

Low level
This as a contact provided by a level sensor located in the lower part of the degassed or condenser vessel.

This information detects the presence of a gas pocket or excess gaseous phase.

- Digital input supplied ⇒ Level correct
- Digital input no supplied ⇒ Level too low

Viscosity transducer ball detector 1 and 2
It is the measurement of product viscosity in the analysis loop by the time of the ball falling.

The time measurement is done by the ball's passage in front of 2 detectors. The begin and the end of the measurement is defined by a digital input.
An digital output is used to start the measurement.

The coefficients of scale setting an set by configuration and define the measurement by:
- a linear coefficient (mm^2/s^2)
- an offset (mm^2/s)

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In/Out transfer
In autonomous mode, a product change is detected when the digital input is supplied.

Product code
3 digital inputs are assigned to the product code. So the CDN 12 is able to define the product in the pipe.

Product code			Product in pipe
ETOR X bit 2	ETOR X bit 1	ETOR X Bit 0	
NS	NS	NS	No product
NS	NS	S	Product code 1
NS	S	NS	Product code 2
NS	S	S	Product code 3
S	NS	NS	Product code 4
S	NS	S	Product code 5
S	S	NS	Product code 6
S	S	S	Product code 7

NS : No supplied
S : Supplied

Alarm acknowledge
This digital input allows operator acknowledge the alarms.

Digital input characteristics

	Typical	Maximum
Supply voltage	24 Vdc	40 Vdc
Supply current	2.8 mA	5 mA

3.2.7 DIGITAL OUTPUT

Calculator default
Digital output ON (command) ⇒ CDN 12 out of default
OFF (stand by) ⇒ CDN 12 in default

Major default / Minus default
Like calculator default.

Viscosity transducer start
A viscosity measurement is validated when the digital output flips from OFF to ON.

Pulse output
The pulse output is already active when the configurated output is the meter volume (pulses x K0m x k3m).

For the others parameters, the pulse output is only active in transfer.
The step value is configurated and it can be different of the main indicator (the width of the pulse is fixed by configuration).

3.2.8 DENSITY TRANSDUCER INPUT

This input is used to measuring the density of the product flowing trough the analysis loop.

The density transducer provides a modulated current in the supply loop, whose frequency (of the order of the kHz) is directly proportional to the density of the fluid passing through it.

Characteristics of density transducer input

-	Frequency range	:	25 to 5000 Hz
-	Input impedance	:	47 kΩ
-	Accuracy	:	25 ppm (writhing the temperature range)
-	Measurement resolution	:	2.5 ms
-	Input levels	:	min: 100 mV peak max: 5 V

3.2.9 NUMERICAL LINKS

a) Supervisor link

- RS 485 asynchronous 4 wire type galvanically isolated
- Modbus protocol – RTU mode. The CDN 12 is a modbus slave of supervisor.
- Speed from 1200 to 19200 bauds (configurable)
- 8 data bits, no parity, 1 stop bit
- Address type: word or byte

b) Printer link

- RS 232 galvanically isolated
- Speed from 1200 to 19200 bauds (configurable)
- 8 data bits, no parity, 1 stop bit

c) Portable terminal link

- RS 232 galvanically isolated
- Speed from 9600 bauds
- 8 data bits, no parity, 1 stop bit

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3.2.10 LOCAL INDICATOR LINK

The CDN 12 calculator can be associated with a local indicator.

Exchanges with the local indicator are effected with raster of type Modbus RTU mode. The indicator is a modbus slave of the CDN 12.

Characteristics of the asynchronous RS 485 2 wires

- Speed from 2400 to 4800 bauds (configurable)
- 8 data bits, no parity, 1 stop bit
- Galvanically isolated

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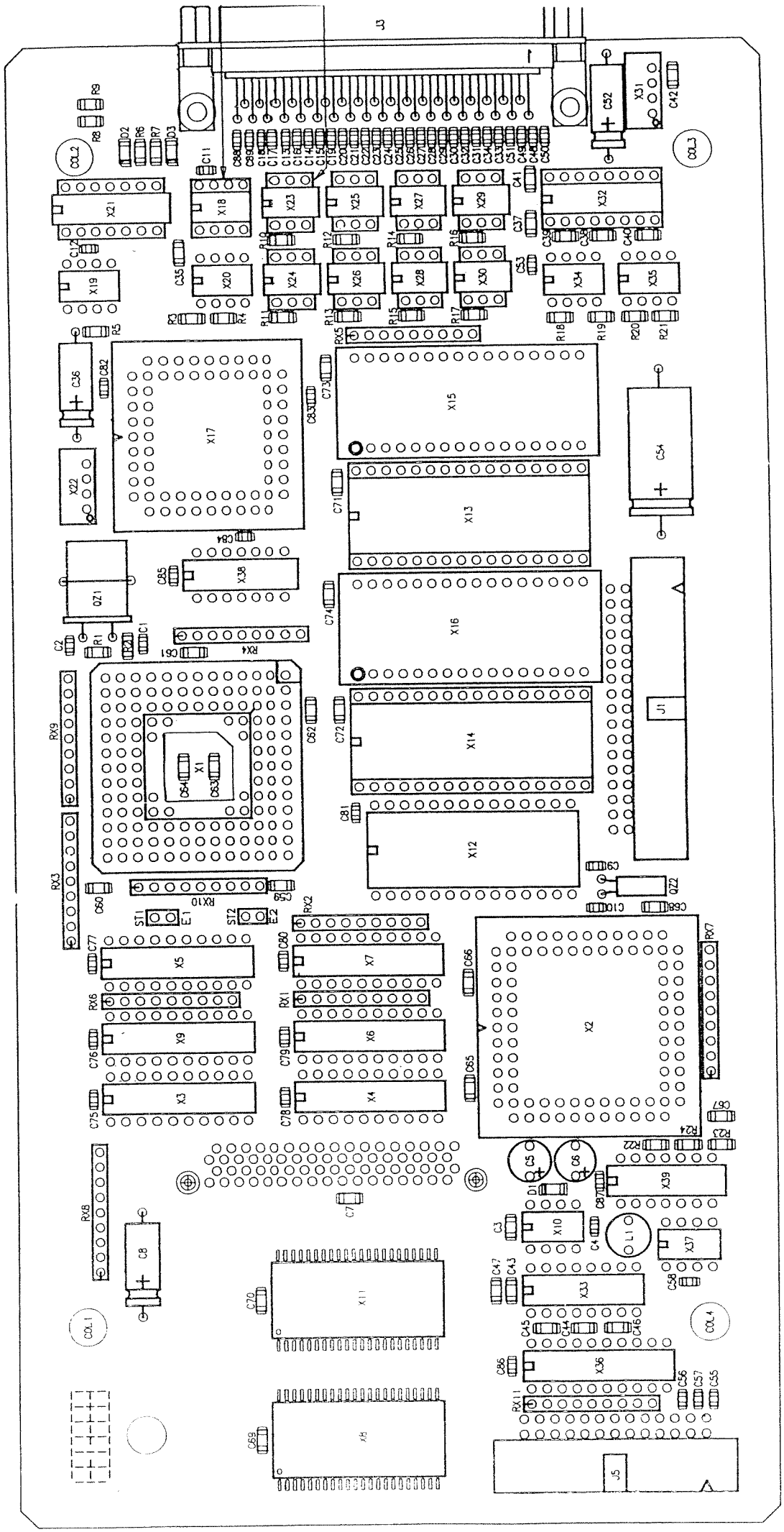
APPENDIX 1

CPU CARD

CPU CARD


J3
J1
J5
X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
X11
X12
X13
X14
X15
X16
X17
X18
X19
X20
X21
X22
X23
X24
X25
X26
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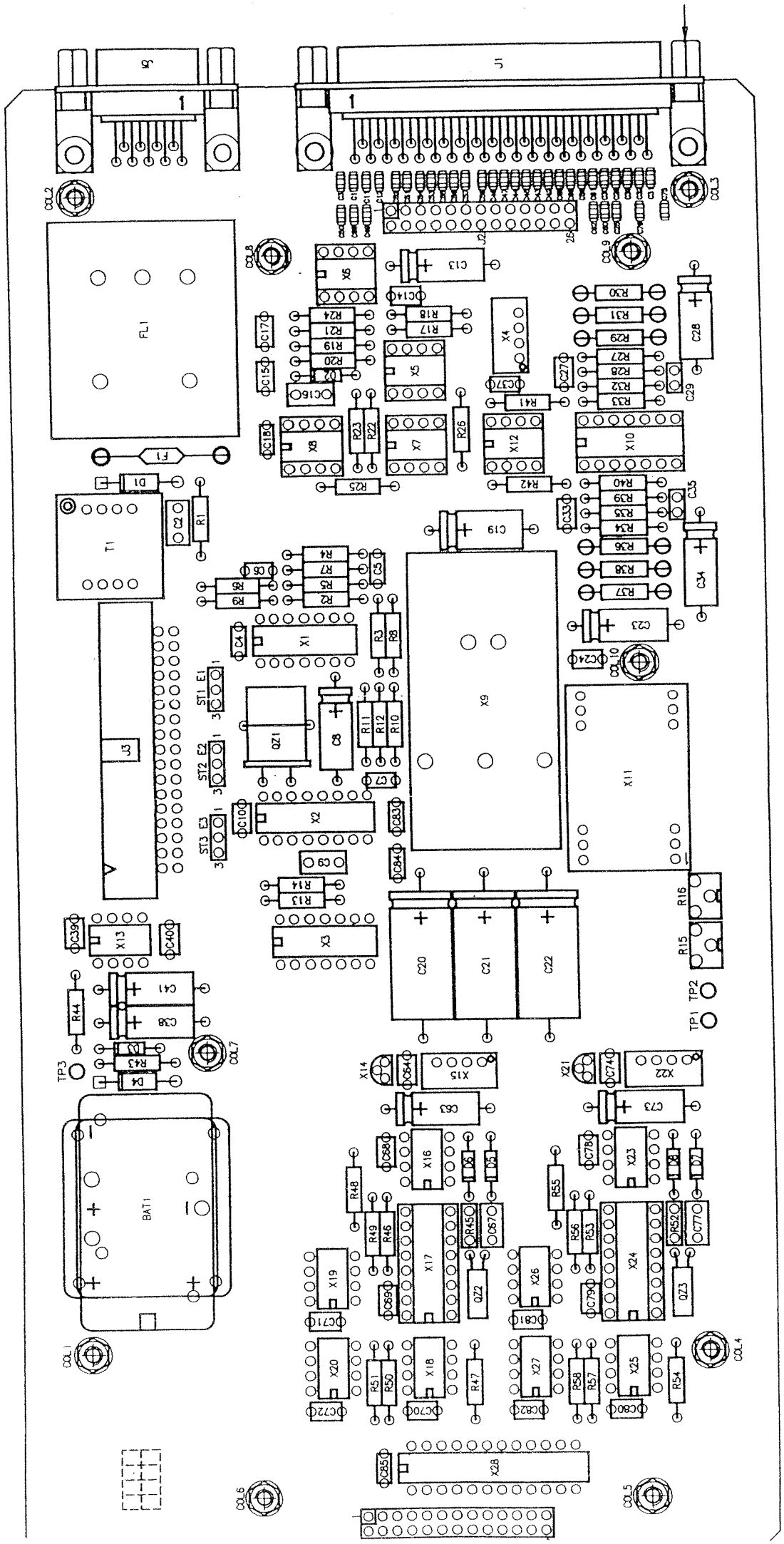
X28
X29
X30
X31
X32
X33
X34
X35
X36
X37
X38
X39
C52
C54
QZ1
QZ2
L1
COL1
COL2
COL3
COL4

APPENDIX 2

POWER SUPPLY CARD

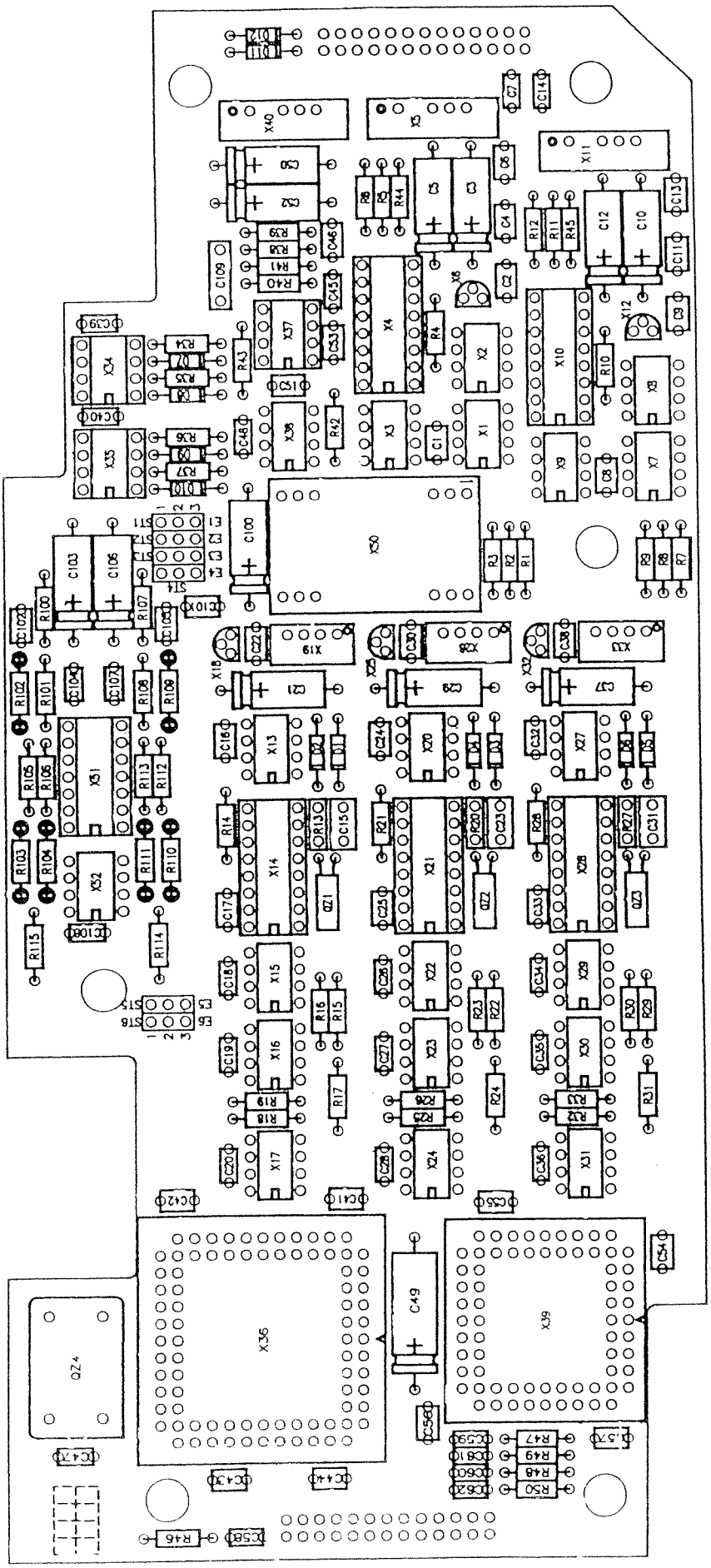
POWER SUPPLY CARD



APPENDIX 3

EXTENSION BOARD

EXTENSION BOARD



SECTION II CONTENTS

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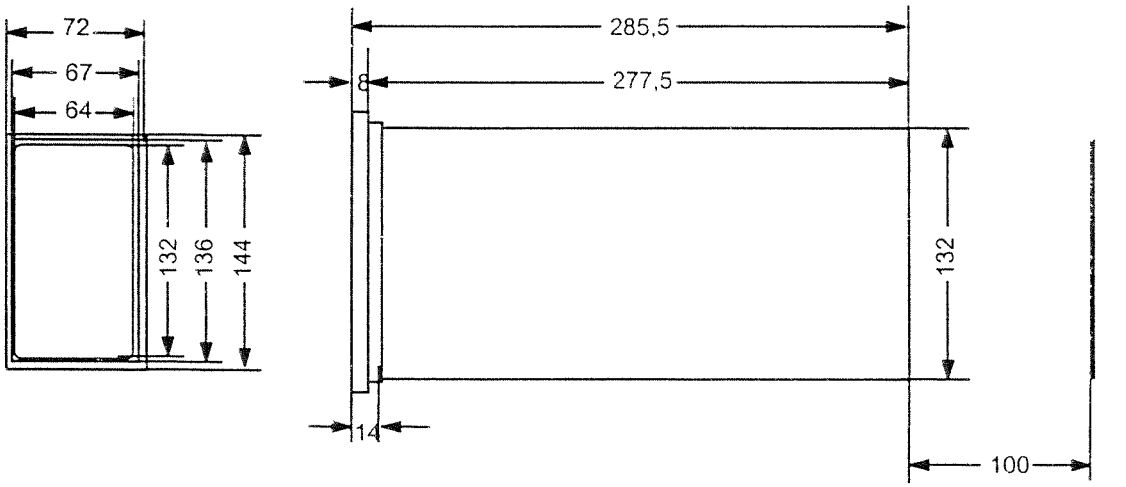
SECTION II

INSTALLATION - STARTING

1. INSTALLATION

1.1 MOUNTING

1.1.1 DIMENSIONS



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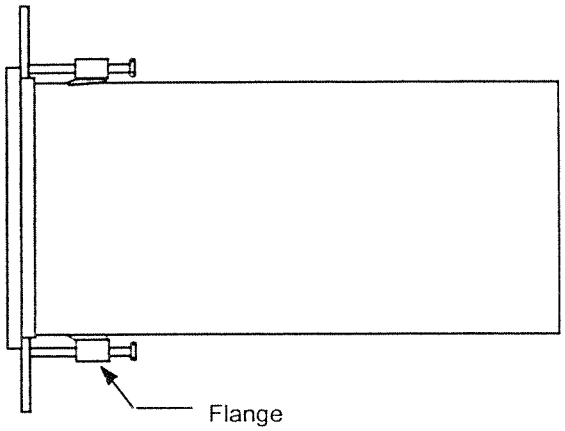
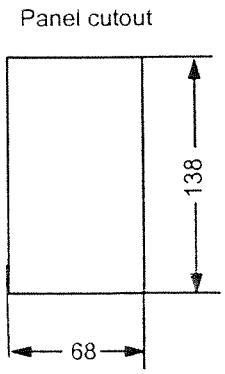
1.1.2 PANEL MOUNTING

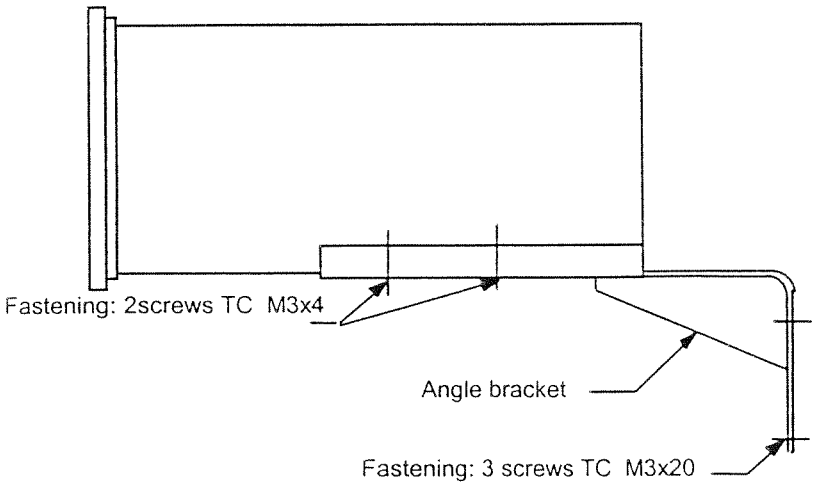
Cutout drawing:

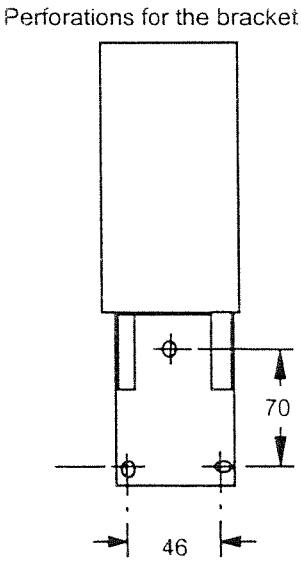




1.1.3 WALL MOUNTING

Angle bracket drawing:





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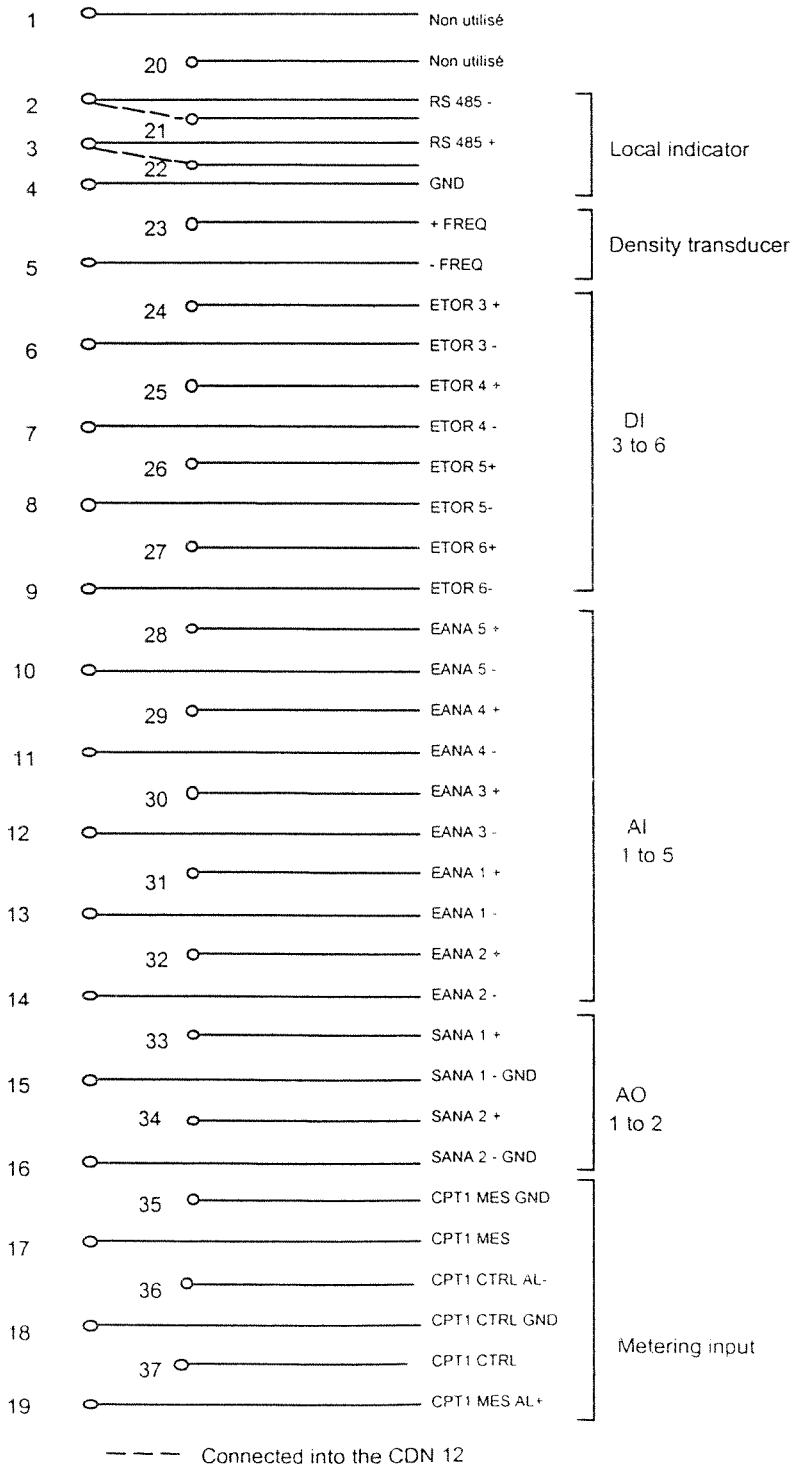
1.2 CONNECTION

All connector spacers and the box are connected to the ground.

Wiring diagram:

POWER SUPPLY CARD

J1 (CDN 12 rear panel)



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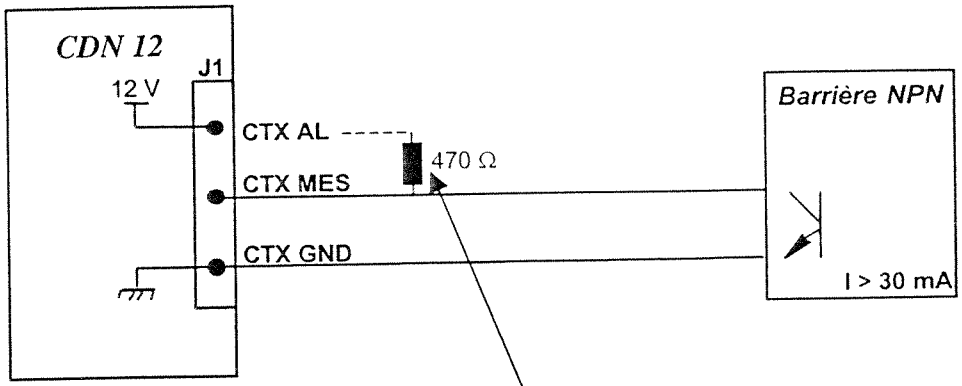
WARNING: **Since April 2000,** the new calculators are not equiped with a line adaptation resistance on the metering inputs (the user must do the adaptation).

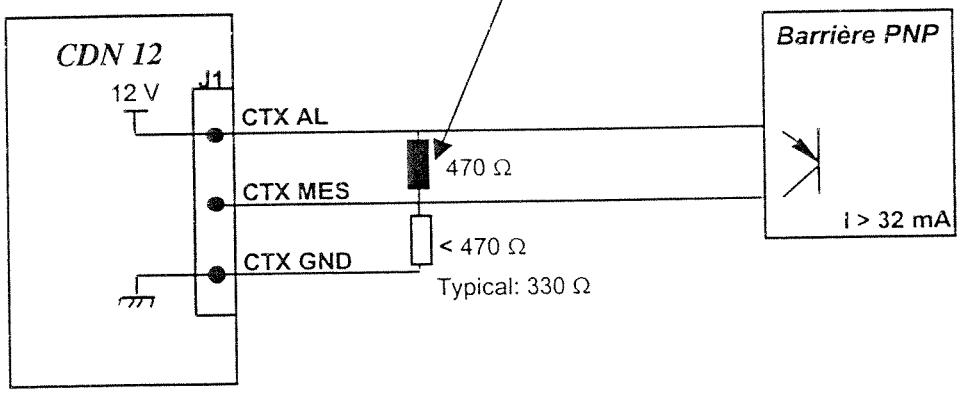
Examples of connection of metering inputs CT1

1st example:

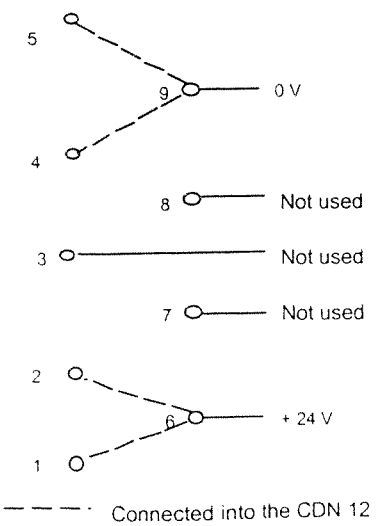


Line adaptation example

2nd example:



J5 (CDN 12 rear panel)



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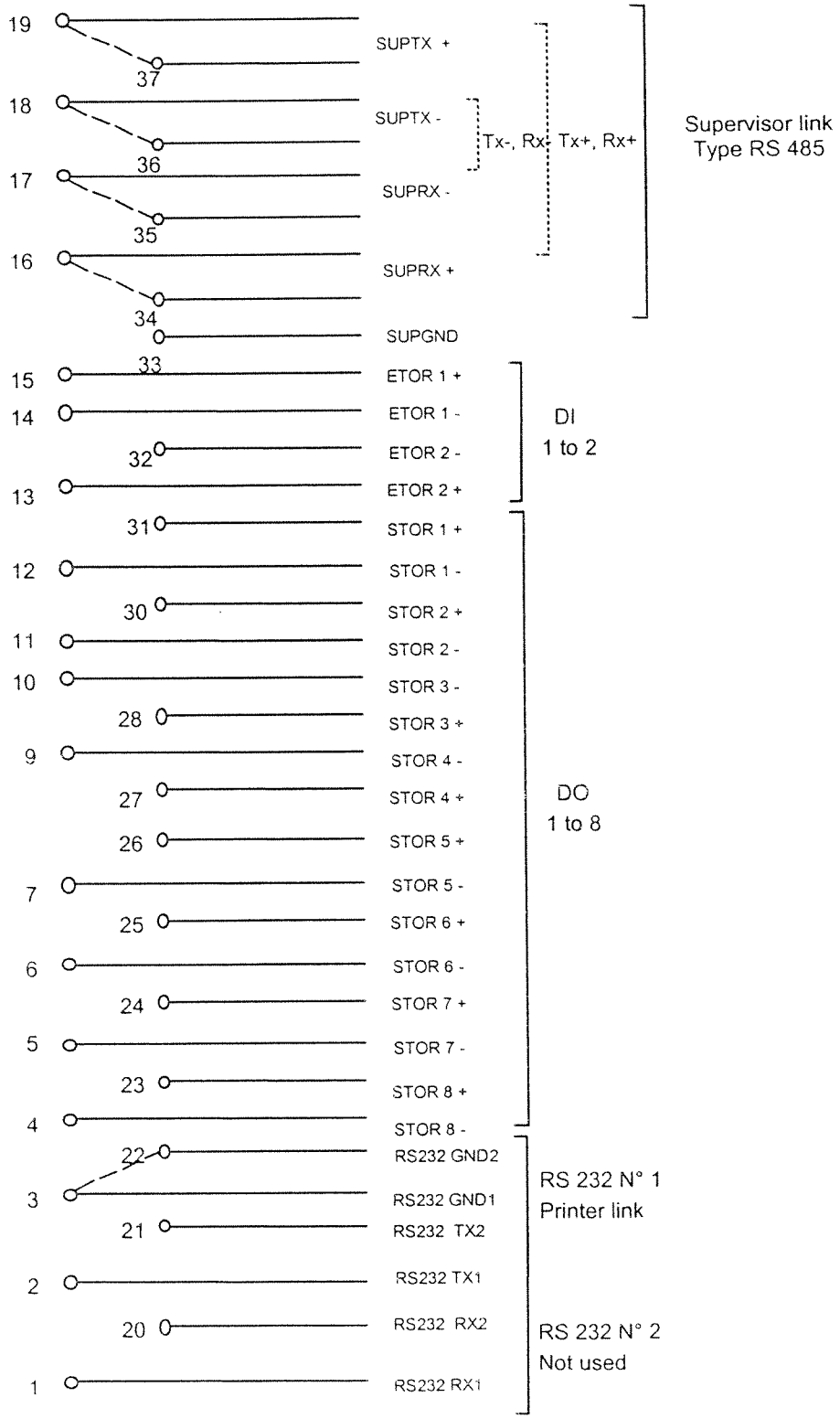
CPU CARD

J3 (CDN 12 rear panel)



— — — — Connected into the CDN 12

---------- No connected into the CDN 12

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1.3 COMPUTER DISASSEMBLY

PROCEDURE:

- Power off the equipment
- Disconnect the terminals
- Remove the equipment
- Remove the 2 screws located on the top of the front panel

  Remove the lead seal on the right of the identification plate
- Tilt the identification plate down to access to the protected components
- Remove the screw located behind the identification plate
- Gently pull out the front panel
- Disconnect the cable connecting the front panel to the CPU card by removing the connector on the CPU card

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2. CDN 12 STARTING

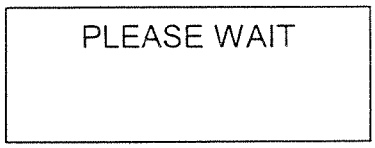
The operator powers up the CDN 12 within the following context:

- Configuration locking switch ON:
  . No configuration downloading is possible

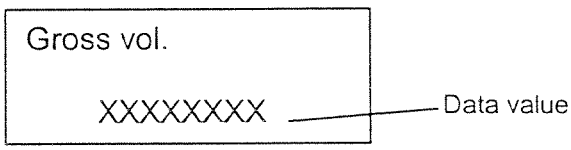
or

- Configuration locking switch OFF:
  . Configuration downloading is possible

<PLEASE WAIT> message appears while the CDN 12 performs initializations and tests.



Then the first datum of main display is displayed.



If an alarm is active, the unit flashes.

The <computer ready> LED is illuminated.

The <system ready> LED:
- flashes if the configuration locking switch is OFF
- is illuminated if the configuration locking switch is ON.

Then make sure that the CDN 12 is on time and analog inputs/outputs have been calibrated.

INITIAL SETUP PROCEDURE WHEN STARTING

- **Make sure that the CDN 12 is on time.**
- **Calibrate analog inputs/outputs.**
- **Format the internal memory card.**
- **Format the external memory card if used.**

These functions are available in the maintenance Terminal.

Note: *At power-up, if the CDN 12 displays the "EXIT" message, refer to the Maintenance Manual.*

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SECTION III CONTENTS

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SECTION III

OPERATION

1. USER INTERFACE

1.1 GENERAL

A LCD display of 2 lines of 12 characters and a four key keyboard allow the operator to visualize the various data of the CDN 12 (measured and calculated data, configuration parameters, daily and hourly cumulative totals and alarms etc.).

These datas are filled in 13 menus according to their nature:

- ACKNOWLEDGE ALARM
- MEASURES (measured parameters, average and instantaneous values)
- CORRECTION FACTORS
- TOTALIZERS (reset and general totalizers)
- CONTROL LOOP (valve parameters)
- CURRENT TRANSFER
- REQUEST MEMORIZED
- IDENTIFI.
- UNITS
- INSTALLATION CONFIGURATION
- METROLOGY CONFIGURATION
- CHECKING ALARMS
- CHECKING LED (allow to check the operation of the LEDS of the front panel)

In addition to the 13 menus in operation, the CDN 12 presents a main display:

- of gross volume reset totalizer
- of net volume reset totalizer or mass reset totalizer
- of CDN 12 state

1.2 KEY FUNCTION

Key MENU

It enables:
- to quit the main display to display the title of the first menu
- to return to the title of the selected menu or sub-menu
- to go from the title of a sub-menu to the title of the corresponding menu
- to go from the title of a menu to the main display

Key ⇨

It enables:
- to select the displayed menu or sub-menu
- to return to the main display when visualizing a datum in a menu or sub-menu

Key ⇩

It enables:
- to scroll down through the titles of menus or sub-menus
- to move from one datum to the next inside a menu or sub-menu (display of the datum title and then the datum value)
- to look up the different data of the main display

Key ⇧

It enables:
- to scroll up through the titles of menus or sub-menus
- to move from one datum to the next inside a same menu or sub-menu (display of the datum title only)

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1.3 MAIN DISPLAY

1.3.1 PRESENTATION

This mode of display is obtained in the 4 following cases:

a) At power up of the CDN 12.

b) The title of a menu is displayed: pressing the **Menu** key permits to return to the main display.

c) A datum in a menu or sub-menu is displayed: pressing the ↵ key permits to return to the main display.

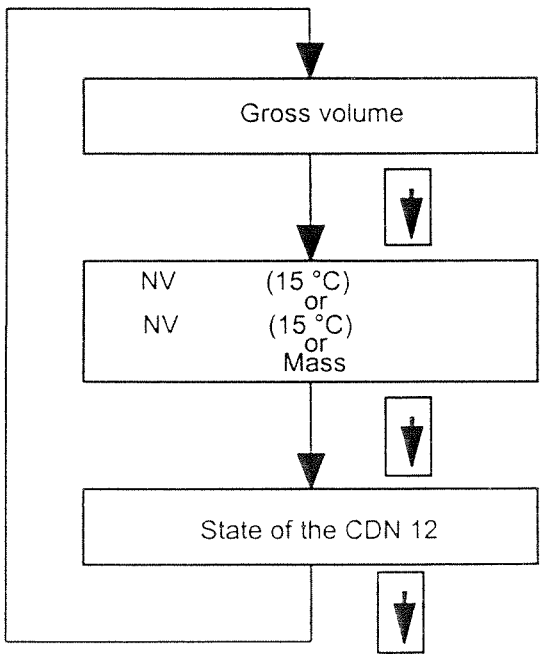
d) The title of a menu, a sub-menu, a datum or the value of a datum is displayed if no keyboard key is pressed for 3 minutes. The CDN 12 automatically returns to main display, the latest datum selected in this mode is visualized.

This mode of display permits to visualize the following data:

- Gross volume
- Net volume or mass
- State of the computer

1.3.2 GENERAL STRUCTURE OF MAIN DISPLAY

↓ means pressing this key



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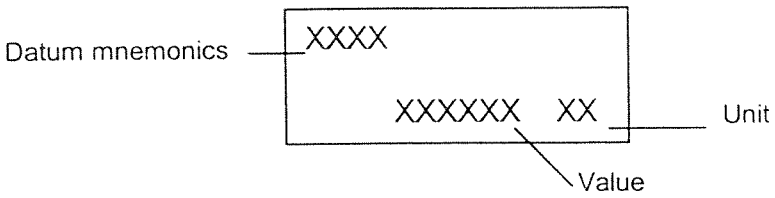
1.3.3 DATA VISUALIZATION OF MAIN DISPLAY

a) Data are displayed in the following form:



When the gross volume is in alarm:

- the gross volume display in or with default replaces the main display. For showing the problem to the operator, the unit flashes

When the net volume or mass totalizer are stopped by an alarm:

- the unit of this totalizer is flash because this data can't be calculated

b) The CDN 12 states are displayed in the following form:

OUT OF TRANSFER

or

ON TRANSFER

or

FLOW IN TRANSFER

or

FLOW OUT TRANSFER

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1.4 MENUS AND SUB-MENUS

1.4.1 PRESENTATION

When the CDN 12 presents its main display, pressing the **Menu** key enables to visualize the title of the first menu. The operator can visualize the titles of the different menus and sub-menus using keyboard keys.

1.4.2 GENERAL STRUCTURE OF THE DISPLAY OF MENU TITLES

Symbolization used in the flow chart (see next page):

Menu	Pressing the menu key
↳	Pressing the enter key
⇩	Pressing the down key
⇧	Pressing the up key

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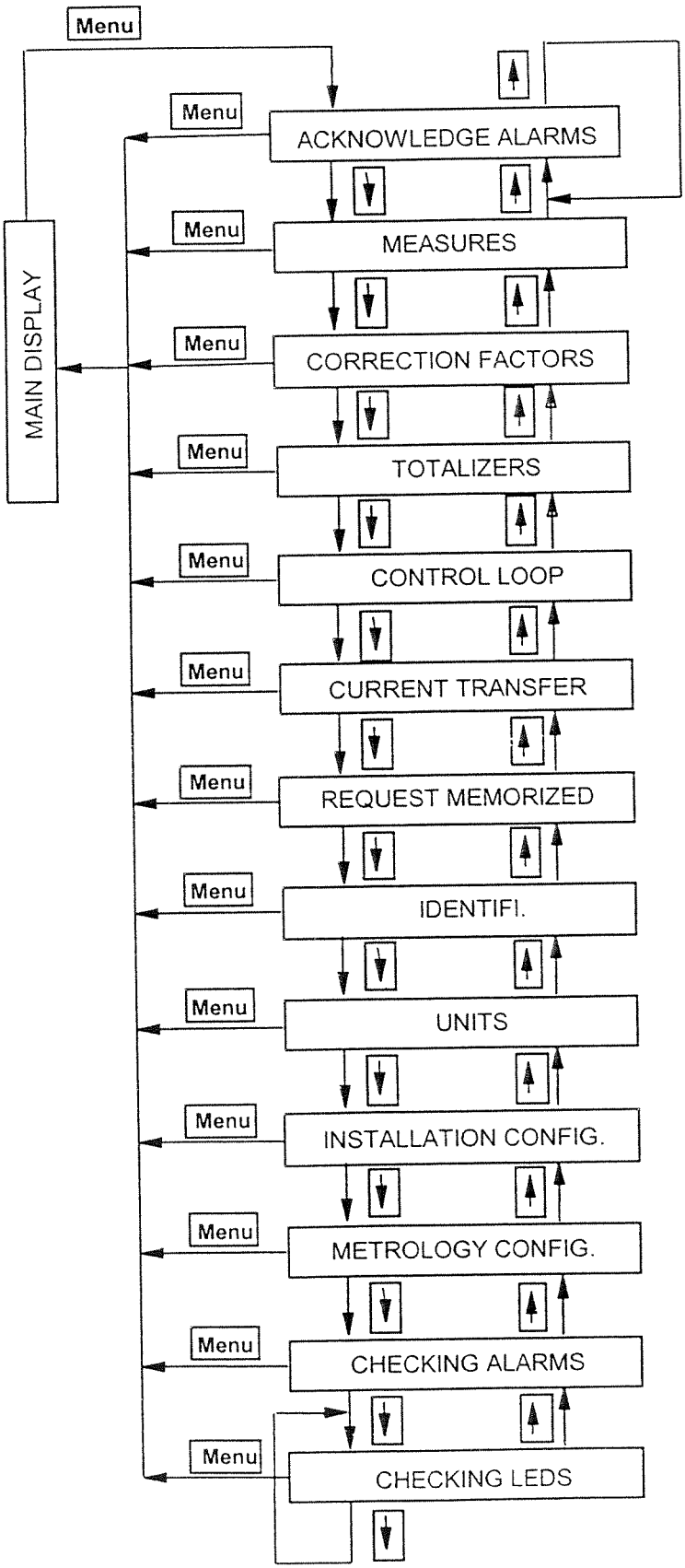
Menu
Menu
ACKNOWLEDGE ALARMS
Menu
MEASURES
MAIN DISPLAY
Menu
CORRECTION FACTORS
Menu
TOTALIZERS
Menu
CONTROL LOOP
Menu
CURRENT TRANSFER
Menu
REQUEST MEMORIZED
Menu
IDENTIFI.
Menu
UNITS
Menu
INSTALLATION CONFIG.
Menu
METROLOGY CONFIG.
Menu
CHECKING ALARMS
Menu
CHECKING LEDS

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1.4.3 GENERAL STRUCTURE OF DATA DISPLAY OF A MENU OR SUB-MENU

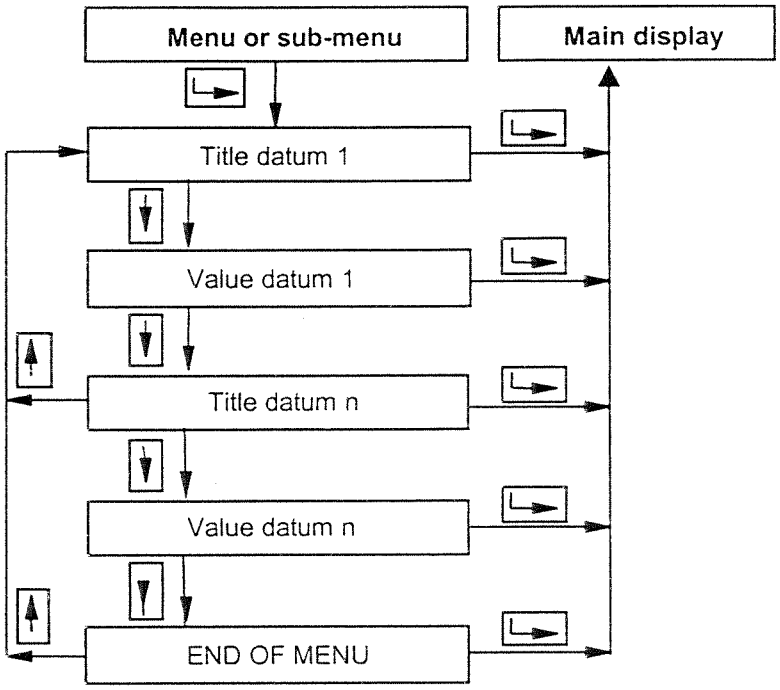
When the CDN 12 display the title of a menu or sub-menu, pressing the ↳ key allows to visualize the first datum of the menu or sub-menu. The operator can the visualize the different data of this menu or sub-menu using keyboard keys (see the flow chart below).

Symbolization used in the flow chart:

↳ Pressing the enter key

⇩ Pressing the down key

⇧ Pressing the up key



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1.4.4 VISUALIZATION OF DATA OF A MENU OR SUB-MENU

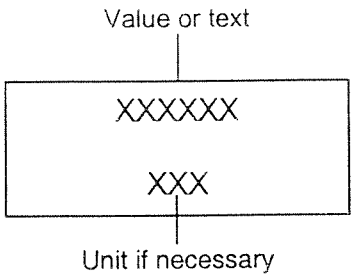
2 displays to visualize a datum:

- 1st display: datum title

- 2nd display: datum value

The title is displayed on one or two lines in clear language.

The datum is displayed in the following form:



1.5 CONTENTS OF MENU

1.5.1 « ACKNOWLEDGE ALARMS » MENU

This menu is present only if an alarm is detected by the CDN 12.

Only title datum's are displayed.

Alarms acknowledge method (CDN 12 in autonomous mode)

1. Display the title datum of the alarm
2. Push [↵]

If default is always here, CDN 12 display "Ack." under title datum.

This title datum disappears when alarm will not be present

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Table of alarm messages:

Name	Message in 12 caracters											
Memory checksum	M	E	M	O	R	Y		C	H	E	C	K
Program checksum	P	R	O	G	.		C	H	E	C	K	
Power supply		P	O	W	E	R		F	A	I	L	
Watch dog			W	A	T	C	H		D	O	G	
Storage medium - Absent, incompatible or protected	P	C	M	C	I	A		A	B	S	.	
Internal storage	M	E	M	O	R	Y		F	A	I	L	
External storage	P	C	M	C	I	A		F	A	I	L	
Storage unbalanced (external key)	D	I	S	C	R	E	P		M	E	M	.
Risk of overwriting internal legal data	M	E	M	O	R	Y		E	R	A	S	.
Risk of overwriting external legal data	P	C	M	C	I	A		E	R	A	S	.
End of capacity internal medium	M	E	M	O	R	Y		F	U	L	L	
End of capacity external medium	P	C	M	C	I	A		F	U	L	L	
Metering	P	U	L	S		D	I	S	C	R	E	P
Phase	P	H	A	S		D	I	S	C	R	E	P
Leakage					L	E	A	K				
Display	L	C	D		D	I	S	P	L	A	Y	
Technological pipe temperature	P	I	P	E		T	.	T	E	C	H	.
Technological densimeter temperature	D	E	N	S	.	T	.	T	E	C	H	.
Pipe temperature range	P	I	P	E		T	.	U	S	E	R	
Densimeter temperature range	D	E	N	S	.	T	.	U	S	E	R	
Temperature discrepancy		T	.		D	I	S	C	R	E	P	.
Technological pipe pressure	P	I	P	E		P	.	T	E	C	H	.
Technological densimeter pressure	D	E	N	S	.	P	.	T	E	C	H	.
Pipe pressure range	P	I	P	E		P	.	U	S	E	R	
Densimeter pressure range	D	E	N	S	.	P	.	U	S	E	R	
VP deviation	V	A	P	.	P	.	D	E	V	I	A	T
Technological density	D	E	N	S	I	T	Y		T	E	C	H
Density range	D	E	N	S	I	T	Y		U	S	E	R
Under flow rate		U	N	D	E	R		F	L	O	W	
Excess flow rate		O	V	E	R		F	L	O	W		
Technological viscosity	V	I	S	C	O		T	E	C	H	.	
Technological BSW		B	S	W		T	E	C	H	.		
Viscosity range		V	I	S	C	O		U	S	E	R	
BSW range			B	S	W			U	S	E	R	
Calculate viscosity	V	I	S	C	O		C	A	L	C	U	L
Low level	S	E	P	A	R		L	E	V	E	L	
Densimeter flow rate		D	E	N	S	.		F	L	O	W	
File full	M	E	M	.	R	E	C	.	F	U	L	L
Product unknown	P	R	O	D	.		E	R	R	O	R	
VCF calculation		V	C	F		C	A	L	C	U	L	
Absent preset	P	R	E	S	E	T		E	M	P	T	Y
Local indicator	I	N	D	.			P	O	S	T	E	
Printer				P	R	I	N	T	E	R		

1.5.2 « MEASURES » MENU

Title display		
1st line	2nd line	Units
Gross	flowrate	m^3/h
Measured	pipe temp.	°C
Average	pipe temp.	°C
Measured	dens. temp.	°C
Measured	pipe pres.	bar
Average	pipe pres.	bar
Measured	dens. pres.	bar
Measured	density	kg/m^3
Base cond.	density	kg/m^3
Average B.C.	density	kg/m^3
Cinematic	viscosity	mm^2/s
Dynamic	viscosity	mPa.s
Vapour	pressure	bar
BSW		%
Mass	flowrate	t/h
Net	flowrate	m^3/h

1.5.3 « CORRECTION FACTORS » MENU

This menu hasn't units.

Title display	
1st line	2nd line
Vcf	
c_f	
Coef. K1m	
Coef. K2m	

1.5.4 « TOTALIZERS » MENU

Title display		
1st line	2nd line	Units
Gross vol.	reset tot.	m^3
Gross vol. al	reset tot.	m^3
Net vol.	reset tot.	m^3
Net vol. al	reset tot.	m^3
Mass	reset tot.	t
Mass al	reset tot.	t
Scrap vol.	reset tot.	m^3
Pulses disc.	totalizer	imp
Gross vol.	general tot.	m^3
Gross vol. al	general tot.	m^3
Net vol.	general tot.	m^3
Net vol. al	general tot.	m^3
Mass	general tot.	t
Mass al	general tot.	t
Scrap vol.	general tot.	m^3

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1.5.5 « CONTROL LOOP » menu

Title display		
1st line	2nd line	Units
Gross	flowrate	m^3/h
Set point		%
Set point		m^3/h
Output		%
Control loop	state	
Gain		
Integral		S

1.5.6 « CURRENT TRANSFER » menu

Title display		
1st line	2nd line	Units
Network	number	
Station	number	
Installation	identifi.	
Order	number	
Transfer	identifi.	
Product	name	
Flowmeter	Identifi.	
Coef. vol.	1/K	L/pulses
Dens. meter	identifi.	
Gross vol.	general tot.	m^3
Gross vol.	reset tot.	m^3
Gross vol. al	general tot.	m^3
Gross vol. al	reset tot.	m^3
Net vol.	general tot.	m^3
Net vol.	reset tot.	m^3
Net vol. al	general tot.	m^3
Net vol. al	reset tot.	m^3
Mass	general tot.	t
Mass	reset tot.	t
Mass al	general tot.	t
Mass al	reset tot.	t
Average B.C.	density	kg/ m^3
Average	temp.	°C
Average	pres.	bar

1.5.7 « IDENTIFI. » menu

Title display		
1st line	2nd line	Units
Soft	release	
Hard	identifi.	
PCMCIA	code	
Date		d/m/y
Hour		h :min :s
Free	records	records

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1.5.8 « REQUEST MEMORIZED » menu

A press on the key ↵ :

- Make a record
- Print a report (if printer is set)
- do a come back on the main display

1.5.9 « UNITS » menu

Title display		
1st line	2nd line	Units
Pressure		bar
K factor		pulses/ m^3
Coef. vol.	1/K	l/pulses
Temperature		°C
Gross vol.		m^3
Net vol.		m^3
Mass		t
Mass (*)	conventional	t
Density		kg/ m^3
Gross	flowrate	m^3/h
Mass	flowrate	t/h
Cinematic	viscosity	mm^2/s
Dynamic	viscosity	mPa.s

(*) According to the configuration

1.5.10 « INSTALLATION CONFIG. » menu

Affichage de l'intitulé		
1ère ligne	2ème ligne	Unités
Config.	release	
Config.	date	d/m/y
Network	number	
Station	number	
Installation	identifi.	
Multiproduct		
Product	name	
Quantity	of products	
Product name	number 1	
Product name	number 2	
Product name	number 3	
Product name	number 4	
Product name	number 5	
Product name	number 6	
Product name	number 7	
Supervisor	mode	
Broadcast	period	s
With	remote ind.	
Remot ind.	info type	
Product	type	
LPG	type	
Transfer	transfer type	
Start of	storage	h:min

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Title display		
1st line	2nd line	Units
Duration of	storage	h
Valve	presence	
Valve	assignment	AO
Valve	prop. action	
Valve	int. action	s
Flowrate	setpoint	
Output	acting	
Open	security	%
With	preset	
Preset	input	
Type of	preset	
Jetty	constant	
Low	flowrate	m^3/h
Dens. flow	detection	
Pumping	min. flowrate	m^3/h
Leak	threshold	m^3
Neutralizat.	volume	m^3
Display on	2nd line	
Vap. pres. al.	threshold	bar
Min. time	ball f. visco	s
Max time	ball f. visco	s
Time out	ball f. visco	s
Scale factor	ball f. visco	mm^2/s^2
Offset	ball f. visco	mm^2/s
Flow dens.	assignment	DI
Separ. level	assignment	DI
Bal 1 f.visco	assignment	DI
Bal 2 f.visco	assignment	DI
I/O transfer	assignment	DI
Prod. removal	assignment	DI
Prod. code 1	assignment	DI
Prod. code 2	assignment	DI
Prod. code 3	assignment	DI
Alarms ack.	assignment	DI
System def.	assignment	DO
Major def.	assignment	DO
Minor def.	assignment	DO
Start visco	assignment	DO
Pulse output	assignment	DO
Pulse output	info type	
Pulse output	weight	
Pulse	width	ms
Ana. output	info type	
Ana. output	assignment	AO
Supervisor	bauds rate	bauds
Remote ind.	bauds rate	bauds
PCMCIA	validation	
File name		
Printer	validation	
Printer	bauds rate	bauds
RS 232-2	bauds rate	bauds

1.5.11 « METROLOGY CONFIG. » menu

Affichage de l'intitulé		
1ère ligne	2ème ligne	Unités
Measuring	system	interrupt.
Flowmeter	identifi.	
K factor	Product	pulses/m^3
Coef. 1/K	product 1	L/pulses
K factor	product 2	pulses/m^3
Coef. 1/K	product 2	L/pulses
K factor	product 3	pulses/m^3
Coef. 1/K	product 3	L/pulses
K factor	product 4	pulses/m^3
Coef. 1/K	product 4	L/pulses
K factor	product 5	pulses/m^3
Coef. 1/K	product 5	L/pulses
K factor	product 6	pulses/m^3
Coef. 1/K	product 6	L/pulses
K factor	product 7	pulses/m^3
Coef. 1/K	product 7	L/pulses
Flowmeter	M factor	
Ctsm	factor	$°C^{-1}$
Flowmeter	cal. temp.	°C
Cpsm	factor	bar^{-1}
Flowmeter	cal. pres.	bar
Min	flowrate	m^3/h
Max	flowrate	m^3/h
Min delivery	gross vol.	m^3
Error max	OIML R117	%
Pulses	discrepancy	pulses
Phases	discrepancy	pulses
Quantity of	decimals tot.	
Min us. ran.	pipe temp	°C
Max us. ran.	pipe temp.	°C
Min tech. ran.	pipe temp.	°C
Max tech. ran	pipe temp.	°C
Pipe temp.	assignment	AI
Min us. ran.	dens temp	°C
Max us. ran.	dens temp.	°C
Min tech. ran.	dens temp.	°C
Max tech. ran	dens temp.	°C
Dens. temp.	assignment	AI
Temperature	²discrepancy	°C
Min us. ran.	pipe pres.	bar
Max us. ran.	pipe pres.	bar
Min tech. ran.	pipe pres.	bar
Max tech. ran	pipe pres.	bar
Pipe temp.	assignment	AI
Min us. ran.	dens pres	bar
Max us. ran.	dens pres.	bar
Min tech. ran.	dens pres.	bar
Max tech. ran	dens pres.	bar
Dens. temp.	assignment	AI

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If the density measurement is an analog input:
- in line conditions:

Title display		
1st line	**2nd line**	**Units**
Min us. ran	density	kg/m^3
Max us. ran.	density	kg/m^3
Min tech. ran	density	kg/m^3
Max tech. ran	density	kg/m^3
Density	assignment	AI

- in base conditions:

Title display		
1st line	**2nd line**	**Units**
Min us. ran	base density	kg/m^3
Max us. ran.	base density	kg/m^3
Min tech. ran	base density	kg/m^3
Max tech. ran	base density	kg/m^3
Base density	assignment	AI

Title display

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1st line	2nd line	Units
Dens. meter	identifi.	
Type of	densimeter	
Minimum	density	kg/m^3
Maximum	density	kg/m^3
Fixed B.C.	density	kg/m^3
Supervisory	B.C. dens.	
B.C. dens.	by table	
Prod1	B.C. dens.	kg/m^3
Prod2	B.C. dens.	kg/m^3
Prod3	B.C. dens.	kg/m^3
Prod4	B.C. dens.	kg/m^3
Prod5	B.C. dens.	kg/m^3
Prod6	B.C. dens.	kg/m^3
Prod.7	B.C. dens.	kg/m^3
Dens. meter	K0 factor	
Dens. meter	K1 factor	
Dens. meter	K2 factor	
Dens. meter	K18 factor	
Dens. meter	K19 factor	
Dens. meter	cal. temp.	°C
Dens. meter	K20A cal. temp.	
Dens. meter	K20B cal. temp.	
Dens. meter	K21A cal. temp.	
Dens. meter	K21B cal. temp.	
Fixed	viscosity	mm²/s
Supervisory	viscosity	
Viscosity	by table	
Prod1	viscosity	mm²/s
Prod2	viscosity	mm²/s
Prod3	viscosity	mm²/s
Prod4	viscosity	mm²/s
Prod5	viscosity	mm²/s
Prod6	viscosity	mm²/s
Prod.7	viscosity	mm²/s
ASTM visco	A fact. prod1	
ASTM visco	B fact. prod1	
ASTM visco	C fact. prod1	
ASTM visco	A fact. prod2	
ASTM visco	B fact. prod2	
ASTM visco	C fact. prod2	
ASTM visco	A fact. prod3	
ASTM visco	B fact. prod3	
ASTM visco	C fact. prod3	
ASTM visco	A fact. prod4	
ASTM visco	B fact. prod4	
ASTM visco	C fact. prod4	
ASTM visco	A fact. prod5	
ASTM visco	B fact. prod5	
ASTM visco	C fact. prod5	
ASTM visco	A fact. prod6	
ASTM visco	B fact. prod6	
ASTM visco	C fact. prod6	
ASTM visco	A fact. prod7	
ASTM visco	B fact. prod7	
ASTM visco	C fact. prod7	
Linear	method	

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Title display		
1st line	2nd line	Units
Flow MF a	product 1	
Flow MF b	product 1	
Flow MF c	product 1	
Flow MF d	product 1	
Flow MF e	product 1	
Flow MF f	product 1	
Flow MF g	product 1	
Flow MF a	product 2	
Flow MF b	product 2	
Flow MF c	product 2	
Flow MF d	product 2	
Flow MF e	product 2	
Flow MF f	product 2	
Flow MF g	product 2	
Flow MF a	product 3	
Flow MF b	product 3	
Flow MF c	product 3	
Flow MF d	product 3	
Flow MF e	product 3	
Flow MF f	product 3	
Flow MF g	product 3	
Flow MF a	product 4	
Flow MF b	product 4	
Flow MF c	product 4	
Flow MF d	product 4	
Flow MF e	product 4	
Flow MF f	product 4	
Flow MF g	product 4	
Flow MF a	product 5	
Flow MF b	product 5	
Flow MF c	product 5	
Flow MF d	product 5	
Flow MF e	product 5	
Flow MF f	product 5	
Flow MF g	product 5	
Flow MF a	product 6	
Flow MF b	product 6	
Flow MF c	product 6	
Flow MF d	product 6	
Flow MF e	product 6	
Flow MF f	product 6	
Flow MF g	product 6	
Flow MF a	product 7	
Flow MF b	product 7	
Flow MF c	product 7	
Flow MF d	product 7	
Flow MF e	product 7	
Flow MF f	product 7	
Flow MF g	product 7	
Min us. ran	viscosity	mm²/s
Max us. ran	viscosity	mm²/s
Viscosity	type	
Min tech. ran	viscosity	mm²/s
Max tech. ran.	viscosity	mm²/s

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Affichage de l'intitulé		
1ère ligne	2ème ligne	Unités
Visco	assignment	AI
Min user	range BSW	%
Max user	range BSW	%
Min tech. ran.	BSW	%
Max tech. ran	BSW	%
BSW	assignment	AI
Measuring	system	interrupt.

1.5.12 « CHECKING ALARMS » menu

This menu is only available if all the alarms are acknowledged and CDN 12 is out of transfer.

In this menu, you can display all alarms titles.

1.5.13 « CEHCKING LEDS » menu

Tests functioning of the leds on front panel and in display.

To start test, press [↵].

To stop test, press [Menu] (ofter one cycle).

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SECTION IV CONTENTS

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SECTION IV

FUNCTIONS AND SUPERVISOR INTERFACE

1. OPERATION OF THE CDN 12

1.1 FUNCTION MODES

The CDN 12 functions in two main modes:

Supervisor mode
The system receives orders from the modbus link.

Autonomous mode
Orders come from the digital inputs.
The mode choice is done by configuration.

1.2 TYPE DE TRANSFERT

The CDN 12 supports the following types of transfer:

Declared, the system recognizes 4 states:
- Out of transfer (CDN 12 initial state)
- Flow out transfer
- On transfer
- Flow in transfer

Permanent, in this mode, only 2 states are supported:
- On transfer (CDN 12 initial state)
- Flow in transfer

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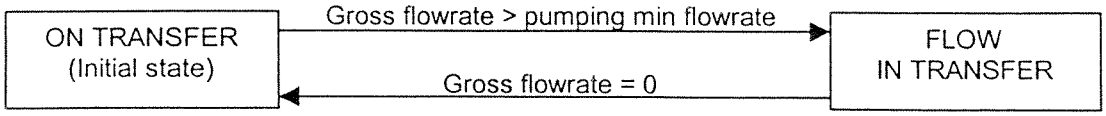
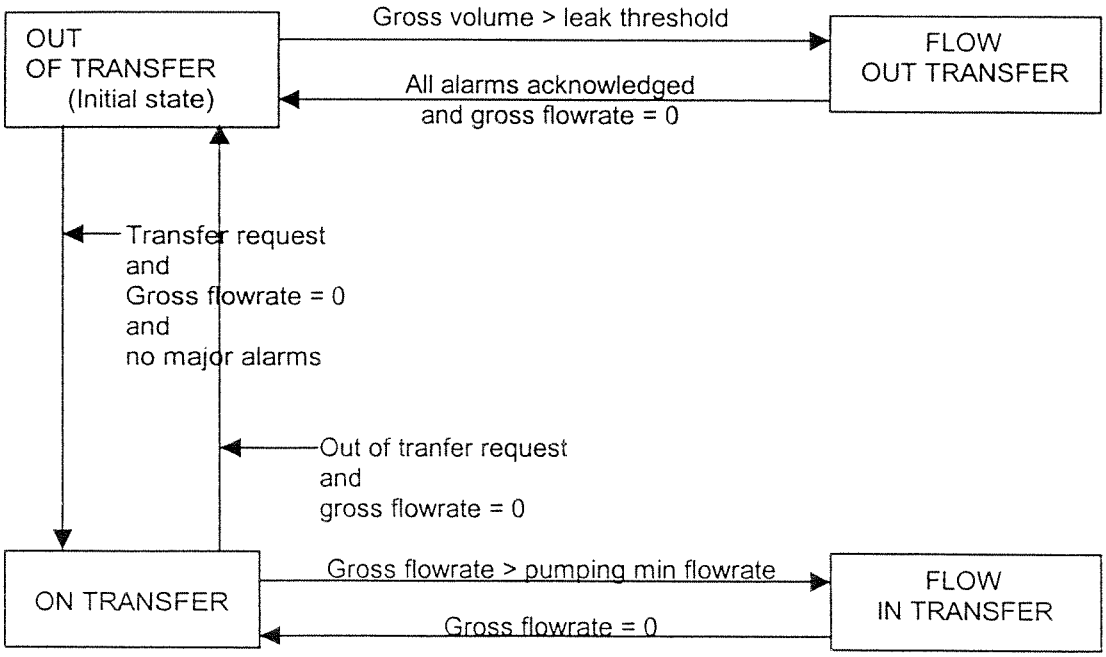
1.3 CDN 12 WORKING STATE

1.3.1 SWAPPING RULES BETWEEN STATES

Permanent transfer mode



Declared transfer mode



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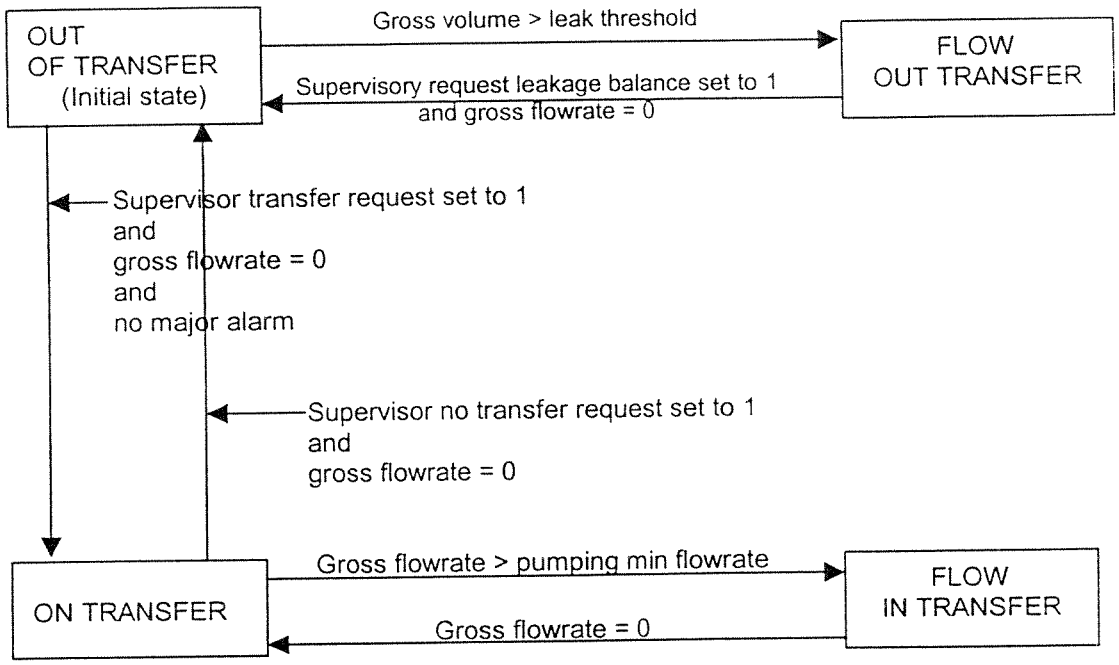
Supervisory mode



1.3.2 INDUCED ACTIONS BY STATE CHANGE

Permanent transfer mode

Previous state	Current state	Actions
ON TRANSFER	FLOW IN TRANSFER	Start of pumping record.
FLOW IN TRANSFER	ON TRANSFER	End of pumping record.

The general totalizer release, the reset of the reset totalizer and the alarm reset are done at "start of storage".
(this value is set by configuration)

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Declared transfer mode

- Autonomous mode

Previous state	Current state	Actions
ON TRANFER	OUT OF TRANSFER	End of transfer record.
FLOW OUT TRANSFER	OUT OF TRANSFER	Alarms reset. End of leak record.
OUT OF TRANSFER	FLOW OUT TRANSFER	Leak alarm record
OUT OF TRANFER	ON TRANSFER	In multi-product, product code is tested. If it's unknown, CDN 12 doesn't swap ON TRANSFERT state. General totalizers release alarms reset. Start of transfer record
ON TRANSFER	FLOW IN TRANSFER	Start of pumping record.
FLOW IN TRANSFER	ON TRANSFER	End of pumping record.

- Supervisory mode

Previous state	Current state	Actions
ON TRANSFER	OUT OF TRANSFER	End of transfer record.
FLOW OUT TRANSFER	OUT OF TRANSFER	Alarms reset. End of leak record.
OUT OF TRANFER	FLOW OUT TRANSFER	Leak alarm record.
OUT OF TRANSFER	ON TRANSFER	The supervisor can modify some CDN 12 parameters: - date and time - transfer number - product name Some parameters can block the transfer way. So supervisory must set: - the base conditions density - the cinematic viscosity - the index of product family - the preset value - BSW After, the CDN 12: - reset the reset totalizers - release general totalizers - reset the alarms - start of transfer record
ON TRANSFER	FLOW IN TRANSFER	Start of pumping record.
FLOW IN TRANSFER	ON TRANSFER	End of pumping record.

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1.4 WEIGHTING PERIOD

This configuration obligatory in the case of permanent transfer can be useful during long declared transfer.
By configuration, the user must set:

- The start of storage
  It's the start of the weighting period (hh:min).
- The duration of storage
  When this time is elapsed, an "end of period" record is made by the CDN 12.

The day adjustment of weighting period:
Example:
Start of storage: 8:00
Duration of storage: 5

The day is divided on 5 periods:
1st period : 8:00 to 13:00
2nd period : 13:00 to 18:00
3rd period : 18:00 to 23:00
4th period : 23:00 to 4:00
5th period : 4:00 to 8:00

The 5th period has only 4 hours.
If time is the start of storage, CDN 12:
- release the general totalizers
- reset the reset totalizers

1.5 INTERRUPTABLE / NO-INTERRUPTABLE MEASURING SYSTEM

The measuring system is interruptable or no-interruptable according to liquid flow and it can be or not interrupt easily and fastly (OIML R117 – pg. 11).
When be control valve is drived by CDN 12, it is never closed on a no-interruptable measuring system.

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2. UNITS AND SYMBOLES

Symboles	*Désignation*	*Unités*
Vgross	Measure conditions volume	m^3
CCF	volume correction factor	
VCF	Liquid temperature correction factor	
c_f	Liquid pressure correction factor	
Vnet	Base conditions volume	m^3
T	Instantaneous temperature	°C
P	Instantaneous pressure	bar
Pe	Vapour pressure	bar
M	Mass	t
ρ	Density	kg/m^3
ρ15	Base conditions density	kg/m^3
Qgross	Gross flowrate	m^3/h
Qnet	Net flowrate	m^3/h
Qmass	Mass flowrate	t/h
N	Meter pulse number	pulses
KF	Meter volumetric coefficient	$pulses/m^3$
K0M	Volumetric coefficient	l/pulses
K1M	Meter temperature and pressure correction	
K2M	Meter flow rate and viscosity correction factor	
K3M	Coefficient of displacement	
Bsw	Basic sediment water	%
ν	Cinematic viscosity	mm^2/s
η	Dynamic viscosity	mpa/s

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3. METER MANAGEMENT

1.1 GENERAL

Volume acquisition at operating conditions is made by pulses emitted by meter.
For the meter, the user set (by the configurator) the next values:
- Minimum flowrate
- Maximum flowrate

This values are used to:
- Set "UNDER FLOW" alarm
- Set "OVER FLOW" alarm

On stepping over the threshold, CDN 12:
- Set a metering alarm
- Make a record
- Print a report
- Stops the incrementation of the gross volume totalizer
- Start the incrementation of the gross volume totalizer in default
- Stops all calculations except gross volume

Like OIML R117, CDN 12 manages parameters:
- Minimum delivery (m^3)
  The smallest liquid volume metrologicaly available on the measuring system.
- Error maximum (%)
  The operator must reports to the OIML R117 which fix this error according to the application.
- Pulses discrepancy (pulses)
  This discrepancy is controlled on a weighting period on each meter.
  It is calculated by CDN 12 like minimum delivery and error maximum.
  In threshold step over, a "PULS DISCREP" alarm is set.

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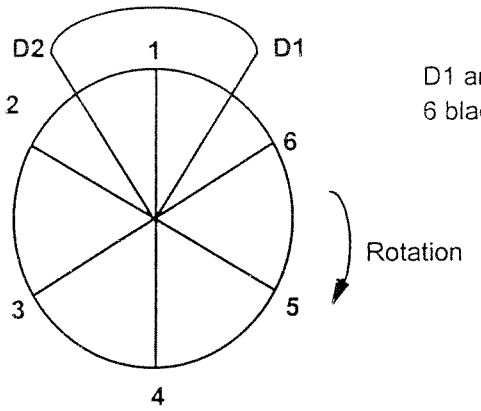
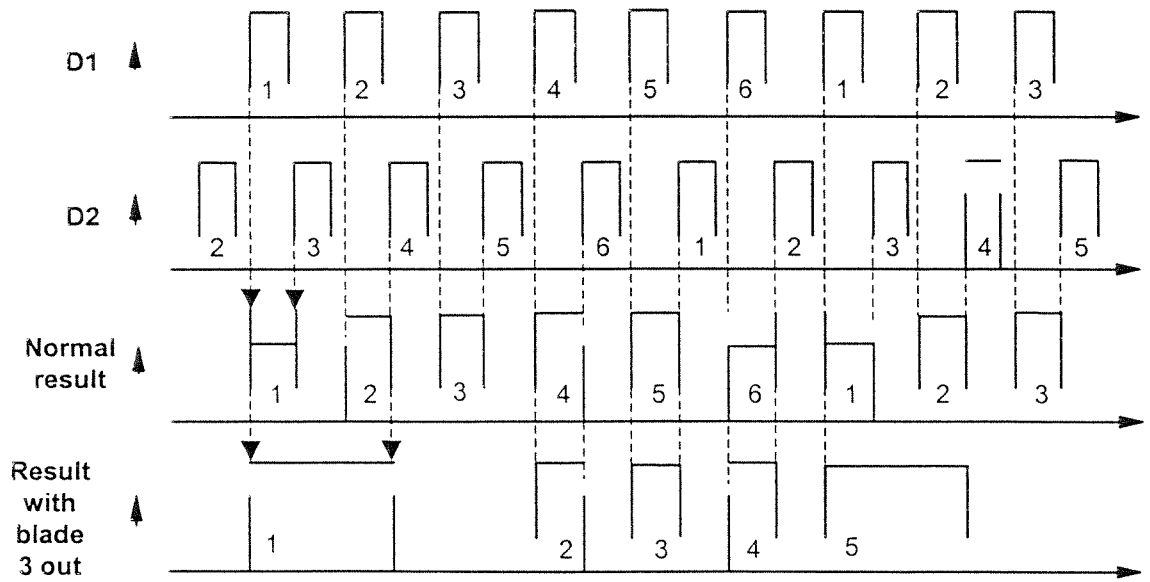
3.2 METER WORKING

Phasis discrepancy
This discrepancy is controlled during a weighting period.
If the pulses sequences are out of phase, the disphasis control is made by a third pulses sequence build by the others.So the phasis control can detect a lack of blade meter.
In threshold step over, a "PHAS DISCREP" alarm is set.

Principle :



D1 and D2 sensors
6 blades (1 to 6)



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3.3 METHOD OF LINEARIZATION

Application of coefficient K2m corrects the effects of flow rate and viscosity on the meter.
As a function of the configuration variable (LINEAR), the correction coefficient K2m can be calculated in three different ways:

1. Correction by equation using log flow rate / visco:

$$K2m \quad \sum_{i=0}^{i=6} a(i) \cdot \log^{i} (Q / v)$$

The 7 coefficients a(i) (a..g) are entered during configuration.

2. Correction by equation using log frequency / visco:

$$K2m \quad \sum_{i=0}^{i=6} a(i) \cdot \log^{i} (f / v)$$

The 7 coefficients a(i) (a..g) are entered during configuration.

3. Correction by table coefficients:

Correction by table of coefficients consists in establishing, for each product, a table of flow rate coefficient of correction doublets, which is equivalent to reducing the linearization curve to a sequence of straight-line segments, enabling a linear interpolation to be effected between two flow rate points.
The 7 coefficient/flow rate couples are entered during configuration.

4. CALCULATIONS

The next calculations are done every record:
- Gross volume
- Net volume
- Mass or conventional mass
- Measured density
- Base conditions density

The next calculations are done all the two seconds
- Gross flowrate
- Mass flowrate

The base conditions are:
- Temperature 15 °C at the absolute pressure 1 bar for crude, refined and lube
- Temperature 15 °C at vapour pressure for liquefied gas

4.1 VOLUME CORRECTION FACTOR

$$CCF = VCF \times c\_f$$

CCF : Volume correction factor
VCF : Liquid temperature correction factor
c_f : Liquid pressure correction factor

4.2 LIQUID TEMPERATURE CORRECTION FACTOR

4.2.1 CASE OF CRUDE, REFINED AND LUBE

Calculation of VCF for crude, refined and lube products is descended from API 2540 tables and are the subject of Norm ISO 91.1.

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4.2.2 CASE OF LIQUEFIED GAS (LG)

Case of Butane, Propane and Propylen
Calculation for LG product is descended from the Norm NF M08 017.

Case of other LG types
Calculation of VCF, for others LG types, is made:

$$VCF = 1 + A0 + A1\,(T-15) + A2\,(T-15)^2 + A3\,(T-15)^3 + A4\,(T-15)^4$$

with:

T : Measured temperature (°C)

All the coefficients Ax are set by the configuration.

4.2.3 CASE OF OTHER TYPES OF PRODUCTS

VCF calculation, for others types, is made:

$$VCF = 1 + A0 + A1\,(T-15) + A2\,(T-15)^2 + A3\,(T-15)^3 + A4\,(T-15)^4$$

with:

T : Measured temperature (°C)

All the coefficients Ax are set by the configuration.

4.3 LIQUID PRESSURE CORRECTION FACTOR

4.3.1 CASE OF CRUDE, REFINED AND LUBE

Calculation of c_f for crude, refined and lube is descended from the norm ISO 9770 (NF M08 011).

4.3.2 CASE OF LIQUEFIED GAS (LG)

Calculation of c_f for LG is descended from the Norm NF M 08 009 et NF M 08 010.

4.3.3 CASE OF OTHER TYPES OF PRODUCTS

Calculation of c_f is fixed at 1.0.

4.4 GROSS VOLUME

Vgross = N x 1/KF x K1m x K2m x K3m

with:

Vgross	:	Gross volume (m^3)
N	:	Number of pulses per record
KF	:	Meter volumetric coefficient (pulses/m^3)
K1m	:	Temperature and pressure meter correction coefficient = (1 + Ct_m (T – to)) x 1 + Cp_m (P – po)) Ct_m: Ctsm factor Cp_m: Cpsm factor To and Po : Temperature and pressure flowmeter calibration
K2m	:	Meter flowrate and viscosity correction factor
K3m	:	Coefficient of displacement

4.5 NET VOLUME

Vnet = Vgross x CCF X Csw

with:

Vnet	:	Net volume (m^3)
Vgross	:	Gross volume (m^3)
CCF	:	Volume correction factor
Csw	:	(100 – Bsw) x 100

4.6 MASS WITHOUT CORRECTION

Mass = Vnet x ρ_{15} / 1000

with:

Mass	:	In tonnes
Vnet	:	Net volume (m^3)
ρ_{15}	:	Base conditions density (kg/ m^3)

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4.7 CONVENTIONAL MASS

$$\text{Conventional mass} = V_{net} \times (\rho_{15} - 1.1) / 1000$$

with :

Conventional mass : Mass in air

4.8 DENSITY

It can be measured by a densitometer

- **SOLARTRON type**

$$\rho = (K0 + K1 \times T + K2 \times T^2) \times (1 + K18 \times (t\text{-}to)) + K19 \times (t\text{-}to)$$

with:

ρ	:	Density (kg/ m^3)
K0, K1, K2, K18, K19	:	Calibration parameters of solartron
T	:	Period (us)
t	:	Densitometer temperature (°C)
to	:	Calibration densitometer temperature (°C) (ex.:20 °C)

All the densitometer haven't pressure compensation, so we must multiply the previous density by:

$$((1 + K20 \times P) + K21 \times P)$$
$$K20 = K20A + K20B \times P$$
$$K21 = K21A + K21B \times P$$

with:

K20A . . . K21B	:	Calibration parameters of solartron
P	:	Densitometer pressure (bar)

- **PAAR type**

$$\rho = \frac{A (T)^2 - B}{(T0)^2}$$

with:

ρ	:	Density (kg/ m^3)
A	:	$A0 + A0\ a_1 (t - t0) + A0\ a_2 (t - t0)^2$
B	:	$B0 + B0\ b_1 (t - t0)$
A0, a_1, a_2, B0, b_1	:	Calibration parameters of Paar
T	:	Period (ms)
T0	:	Calibration period of densitometer for distillated water at 20 °C
t0	:	Calibration temperature of densitometer (°C) (ex.: 20 °C)

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4.9 BASE DENSITY

It can be:
- By analog input
- Fixed
- By table
- By supervisory
- Calculated

$$\rho_{15} = (\rho / Vcf) \times c\_f$$

with:

ρ_{15}	:	Base conditions density (kg/ m^3)
ρ	:	Density (kg/ m^3)
c_f	:	Liquid pressure correction factor
VCF	:	Liquid temperature correction factor

4.10 GROSS FLOWRATE

This calculation is done all the 2 seconds.
If the flowrate by 2 seconds cycle is lowest to make a sure calculation, this calculation is done the next cycle.
For very low flowrate, CDN 12 accept 5 cycles (5 x 2 seconds) to done calculations.

$$Qgross = N \times 1/KF \times K3m \times 1800$$

with:

Qgross	:	Gross flowrate (m^3/h)
N	:	Number of pulses every 2 seconds
KF	:	Meter volumetric coefficient (pulses/ m^3)
K3m	:	Coefficient of displacement

4.11 NET FLOWRATE

This calculation is done all the 2 seconds.
If the flowrate by 2 seconds cycle is lowest to make a sure calculation, this calculation is done the next cycle.
for very low flowrate, CDN 12 accept 5 cycles (5 x 2 seconds) to done calculations.

$$Qnet = Qgross \times Vcf \times c\_f \times Csw$$

avec :

Qgross	:	Gross flowrate (m^3/h)
Vcf	:	Liquid temperature correction factor
c_f	:	Liquid pressure correction factor
Csw	:	(100 – Bsw) x 100

4.12 MASS FLOWRATE

$$Qmass = Qgross \times \rho_{15} \times c\_f \times VCF / 1000$$

with:

Qmass	:	Mass flowrate (t/h)
ρ_{15}	:	Base conditions density (kg/ m^3)
c_f	:	Liquid pressure correction factor
VCF	:	Liquid temperature correction factor

4.13 CINEMATIC VISCOSITY

It can be:
- Declared
- By supervisory
- By table
- Calculated by ASTM formula
- By ball fall viscosimeter
- By 4-20 mA viscosimeter

Calculated by ASTM formula

It is calculated according to ASTM-D-341-89:

$$\log (\log (\nu + C)) = A - B \cdot \log (273{,}15 + T)$$

with:

ν	:	Product cinematic viscosity (mm^2/s)
T	:	Instantaneous temperature of product (°C)
A, B, C	:	Product ASTM coefficient

Calculated by ball fall viscosimeter

This calculation is done every 10 seconds, at the start of transfer.

$$\nu = \textbf{temps chute de bille x coefficient de mise à l'échelle + offset}$$

with:

ν	:	Cinematic viscosity (mm^2/s)
Ball fall time	:	Time measurement between the 2 ball sensors (s)
Scale factor	:	Constructor coefficient (mm^2/s^2)
Offset	:	Constructor coefficient (m^2/s)

4.14 DYNAMIC VISCOSITY

$$\nu = \eta / \rho$$

with:

ν	:	Cinematic viscosity (mm^2/s)
η	:	Dynamic viscosity (mPa.s)
ρ	:	Density (kg/m^3)

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4.15 VAPOUR PRESSURE FOR LG

Case of Butane, Propane and Propylene

The vapour pressure calculation is done by Antoine formula:

VP (abs) = e (A - (B / (C + T)))

For these types of LG, A, B, C coefficients are fixed in CDN 12.

Butane	:	A = 9.638292158	B = 2321.283296	C = 256.64
Propane	:	A = 8.8258658	B = 1897.664764	C = 262.79
Propylene	:	A = 9.0823	B = 1807.53	C = 247.00

Case of others

The vapour pressure calculation is always done by Antoine formula:

VP (abs) = e (A – (B / (C + T)))

In this case, A, B, C coefficients are set by the configuration.

5. ALARMS

CDN 12 has 2 alarms types which are connected to a digital outputs.

Major alarms ⇒ Major default digital output
Minor alarms ⇒ Minor default digital output

CDN 12 manages calculator default which are connected to a digital output:
Calculator default ⇒ System default digital output

5.1 ALARMS DETECTION SEQUENCE

When a default is detected, CDN 12 set to 1 the default bit in Modbus table.

- Neutralizable alarm:
  the alarm starting is temporized the alarm appears if the default persists over neutralization volume.
- Not neutralizable alarm:
  the alarm starting is instantaneous.

5.2 ALARMS MANAGEMENT

When the alarm is set, CDN 12 start the next sequence:

- set to 1 the alarm bit in Modbus table
- set the digital output major default, minor default or calculator default
- manages the led associated
- informs "Acknowledge alarms" menu
- makes a record
- print a report if printer is validated

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5.3 ALARMS ACKNOWLEDGE SEQUENCE

When the user acknowledges an alarm, a « Ack » message appears under the title of the alarm in the « Acknowledge alarms » menu.

After an acknowledge request:

1er case	:	the default persists	⇒	alarm message is already here
2ème case	:	the default has disappearing	⇒	alarm message disappears too

5.4 MAJOR ALARMS

When a major alarm is detected, CDN 12 can't swap into « ON TRANSFER » state.

Listing of major alarm

1. Memory checksum
2. Program checksum
3. Power fail
4. Watch-dog
5. Pulses discrepancy
6. Phases discrepancy
7. LCD display
8. Pipe temperature technological
9. Pipe temperature user
10. Densitometer temperature technological
11. Densitometer temperature user
12. Pipe pressure technological
13. Pipe pressure user
14. Vapour pressure deviation
15. Density technological
16. Density user
17. Under flow
18. Over flow
19. Separator level
20. Preset empty

Comments:

(15) Density technological
Its alarm is set if Freq- or Freq+ input is broken.

(19) Separator level
Its alarm is set if the digital input associated.
So the user is informed of the gas pocket presence or gas phases more important.

5.5 MINUS ALARMS

1. PCMCIA absent
2. Memory fail
3. PCMCIA fail
4. Memories discrepancy
5. Memory erase
6. PCMCIA erase
7. Memory full
8. PCMCIA full
9. Leak
10. Temperature discrepancy
11. Densitometer pressure technological
12. Densitometer pressure user
13. Technological viscosity
14. User viscosity
15. Technological BSW
16. User BSW
17. Viscosity calculation
18. Densitometer flow
19. Product error
20. Memory record full
21. Vcf calculation
22. Local indicator
23. Printer

Comments :

(1) PCMCIA absent
The external PCMCIA memory is not connected to the CDN 12.

(2) Memory fail
The internal memory is failed.

(3) PCMCIA fail
The external memory is failed. It must be changed.

(4) Memories discrepancy
CDN 12 doesn't identify the external PCMCIA memory.
The storage key of the external memory isn't the CDN 12 key waited:
- this PCMCIA card has been formatted by an other CDN 12
- this PCMCIA card isn't the last formatted card by the CDN 12

Reading access mode : no consequences
Writing access mode : if the default persists, CDN 12 believe that the user had changed the PCMCIA card. So it formats this new card, writes a new key and the configuration on it.

(6) PCMCIA erase
The PCMCIA card is full to 95 %. You must introduce a new card else the CDN 12 is gang to erase the first track of the old card

(17) Viscosity calculation
ASTM calculation method : the value is out of the user range

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(19) Product error
In multi-products mode:
1) The product number isn't valid according to the configuration.
2) With LGP, the base conditions density isn't compatible with selected product:
. Propane 502 < MV15 < 520
. Butane 559 < MV15 < 600
. Propylene 520 < MV15 < 540

(20) Memory record full
CDN 12 stores every record in a FIFO. Then every record are send to the memory.
If there are any problem in the memories cards, all the records are stored in the FIFO.
When the FIFO is full, the alarm is set and CDN 12 erases the oldest record.
This alarm is acknowledged if the problem of the memory is disappeared the next record.

(21) Vcf calculation
this alarm is set on step over the threshold of API table.

5.6 NEUTRALIZABLE ALARMS

1. Pipe temperature technological
2. Densitometer temperature technological
3. Pipe temperature user
4. Densitometer temperature user
5. Temperature discrepancy
6. Pipe pressure technological
7. Densitometer pressure technological
8. Pipe pressure user
9. Densitometer pressure user
10. Under flow
11. Over flow
12. Technological BSW
13. User

Others alarms become neutralizable according to the configuration:

- with LPG, "Separator level" alarm becomes neutralizable
- with densitometer (density transducer), "Density technological" and "Density user" become neutralizables
- with viscosity in analog input, "Technological" and "User viscosity" become neutralizables

5.7 CALCULATOR DEFAULT

1. Memory checksum
2. Program checksum
3. Power fail
4. Watch dog
5. PCMCIA absent
6. PCMCIA fail
7. Memory fail
8. Memories discrepancy

6. FRONT PANEL LIGHTS

The CDN 12 front panel has 5 lights:
- Computer ready
- System ready
- Measurement alarm
- Memory alarm
- Ext. register access

6.1 COMPUTER READY LED

This green light is normally illuminated. The light is faded to signal:
- a power fail
- a watch dog
- a RAM problem
- a PROM problem

6.2 SYSTEM READY LED

This green light:
- **Blinks** : front panel switch is unlocked. The user can send the configuration.
- **Stay illuminated** : front panel switch is locked. The user can't send the configuration.

The light is normally illuminated. It is faded to signal:
- a power fail
- a watch dog
- a RAM default
- a PROM default
- a display default
- a FIFO saturation
- a PCMCIA saturation (full to 95 %)
- a leak alarm
- a pulses discrepancy
- a phases discrepancy
- a technological alarms
- a user alarms
- a pipe temperature and densitometer temperature discrepancy
- a vapour pressure deviation
- an under flow or an over flow alarm
- a viscosity calculation alarm
- a Vcf calculation alarm
- a separator level alarm
- a densitometer flow alarm

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6.3 MEASUREMENT ALARM LED

This red light is normally faded. It is illuminated to signal:

- a pulses discrepancy
- a phases discrepancy
- a technological alarms
- a user alarms
- a pipe temperature and densitometer temperature discrepancy
- a vapour pressure deviation
- an under or over flow alarm
- a viscosity calculation alarm
- a Vcf calculation alarm
- a separator level alarm
- a densitometer flow alarm

6.4 MEMORY ALARM LED

This red light is normally faded. It is illumidated to signal:

- PCMCIA card absent
- memory fail
- MCMCIA fail
- PCMCIA key is not valid
- memory record full (FIFO)
- PCMCIA is full to 95 %

6.5 EXT. REGISTER ACCESS LED

This yellow light is normally faded. It is illuminated to signal a PCMCIA card access or:

- PCMCIA absent
- PCMCIA fail
- PCMCIA key is not valid
- PCMCIA is full to 95 %

7. RECORDS

The stores records on the external and internal memory.
The external memory is a PCMCIA card, which is connected to the front panel of the CDN 12.
The free records number on the PCMCIA card can be read on the Modbus table or in the "identifi." menu of CDN 12.

7.1 STORED DATAS SECURITY

Datas are stored very safely. Before each external or internal memory access, CDN 12 does the next tests:

- CDN 12 validates record after memories cards contents and RAM memory comparison.
- If the record is validated, CDN 12 calculates and writes the checksum at the record end. This allows the exploitation software to validate the stored datas.
  When the exploitation software reads the records, it calculates checksum and compares it with the checksum record.

7.2 RECORD COMPONENTS

Each record is composed of:

- Network number
- Station number
- Installation identifier
- Order number
- Date
- Hour
- Transfer identifier
- Recording cause
- Products family
- Product name
- Meter tag
- K factor
- Densitometer tag
- Reset and general totalizers
- Average base conditions density
- Density mode
- Average temperature
- Average pressure
- Mass mode

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7.3 STORING PERIOD

The records are done:
- On operator request
- On a swapping of state
- At the end of weighting period
- at the start and at the end of an alarm
- After a configuration sending
- When the operator sets time if the current time and the new time are altered more than 6 minutes

7.4 RECORD READING

The stored datas are accessible to:
- Operator terminal
- Supervisory

The recovery is done by order number or by date (the order has priority).
See chapters "Operator terminal and supervisory" for user mode.

7.5 EXTERNAL MEMORY CARD

CDN 12 knows only an external memory card: the latest formatted card.

When a blank card is in the front panel of the CDN 12, the calculator makes a protection key. This key is stored on the memory card and the RAM CDN 12. It cannot possibly external memory card has the same key.

When the external memory card key isn't the same stored in the RAM of CDN 12, an "discrepancy memories" alarm is set.

Reading mode	:	No consequences
Writing mode	:	If the default persists, CDN 12 thinks that there is an external memory card change and is formatting the new card. Then it is storing a new key and the configuration.

7.6 CAPACITY

The full capacity is 2 Mo (7680 records).

CDN 12 signalizes the end of a memory card by a led. The led illumination is made when it is the last sector of the last track.

Nevertheless, the records made after an alarm start are stored in the FIFO and saved on the memory at the alarm end.

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8. TOTALIZERS

8.1 GENERAL TOTALIZERS

This totalizers are never reset.

There are 7 totalizers:

- Gross volume
- Gross volume in alarm
- Net volume
- Net volume in alarm
- Mass
- Mass in alarm
- Scrap volume

General totalizers updating process:
General totalizer = Reset totalizer + General totalizer

This updating take place:

- on swapping "Out of transfer" to "On transfer"
- at the start of storage (defined by configuration)

8.2 RESET TOTALIZERS

There are 7 totalizers, the same than the general totalizers.

They are reset:
- on swapping "Out of transfer" to "On transfer"
- at the start of storage (defined by configuration)

8.3 RESET TOTALIZER IN ALARM

If one of the measurement has a default, the CDN 12:
- Stops the calculations in the reset totalizer
- Starts the calculations in the reset totalizers in alarm with :
  . the average value of the measurement in default for temperature and pressure
  . the latest good value for other measurements

If one of the associated measurements has a default, or the metering itself is not good (the corrections and/or the conversion aren't available) the CDN 12:
- Stops the calculations in the gross volume reset totalizers
- Starts the calculations in the reset totalizer in alarm
- Stops all the calculations except gross volume

Alarms listing for:

- Calculation in the reset totalizers in alarm:
  . pulses discrepancy
  . phases
  . over flow
  . under flow
  . BSW user
  . If there is a temperature and/or pressure correction and there is a temperature and/or pressure user alarm during the transfer
  . pipe temperature user or densitometer temperature user
  . pipe pressure user or densitometer pressure user
  . densitometer flow
  . density technological
  . density user
  . Vcf calculation

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9. PULSES OUTPUT

This output can be affected to:

- meter volume (pulses x K0m x K3m)
- gross volume (meter volume x K1m x K2m)
- net volume (gross volume x Vcf x c.f)
- mass

It can be affected to one of the eight digital output.

Its weight can be defined by configuration: 1 litre, 10 litres, 100 litres or 1000 litres (1 m^3).

The high state is configurated at 1 to 999 ms. The high state time is the same than low state time. This time value must be attached to the flowrate

Example :

Affectation : weight

Gross volume : 10

When 10 litres are totalized, CDN 12 send 1 pulse to the digital output.

10. VALVE CONTROL

Supervisory mode

When the valve state switchs:

- At manual to automatic mode : the supervisory can write the "Flowrate setpoint" value, the "Integral action", the "Proportional action" and set to 1 the "Auto or manu valve control" field in the supervisory computer parameters ASCII table (Modbus).
  So, CDN 12 makes itself the valve control.

- At automatic to manual mode : the supervisory can write the "Regulator output" value and set to 0 the "Auto or manu valve control" field in the supervisory computer parameters ASCII table (Modbus).
  So, CDN 12 sets its output to the value of the "Regulator output".

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11. DIALOGUE WITH THE SUPERVISORY

The dialogue between the CDN 12 system and the supervisor is based on RTU mode Modbus protocol. The CDN 12 is a slave on the bus.

Among the commonly known Modbus functions, the CDN 12 system makes use of the following:

- Function 1 or 2 : read N bits
- Function 2 or 4 : read N words
- Function 5 : write 1 bit
- Function 6 : write 1 word
- Function 15 : write N bits
- Function 16 : write N words

The interface data between the CDN 12 and the supervision are structured in fifteen tables each having its own individual role, storage format, direction of transfer and synchronisation.

11.1 LIST OF TABLES OF EXCHANGES WITH SUPERVISOR MODBUS

Details of these tables are given in an appendix.

The notion of a table for reading or writing is defined as seen by the supervisor.

The list of tables of exchanges is as follows:

- The configuration zone contains a picture of the configuration of the CDN 12 system in text mode. Access to this table of words is read only and it is only updated during configuration by portable terminal.

- The buffer zone for recordings read contains an image in text format of the data read in the flash memory on demand by the supervisor. Access to this table of words is read only. It is updated by the file management module when it receives a request to read back a recording.

- The ASCII current data zone contains an image in text format of the status of the physical parameters of the current metering (volume, flow, temperature) and of information relating to the current transaction. Updating of this read-only list of words is effected by several agencies in the course of the calculations which they perform.

- The current numerical data zone contains the same data as its ASCII opposite number, is up dated in the same way.

- The records for balancing zone contains an image in text format of the data measured during the last transaction. Access to this table of words is read only. It is updated by the system sequencer each time that a event appears (alarm, start or end of transfer, leakage, ...). This is the table of which an image will be copied to the report in the flash memory.

- The supervisor parameters zone contains all the parameters valid for at least one of the system commands. This table of words is updated by the supervisor. It is read by the command processing program module during execution of a command. It is therefore essential that the supervisor should leave these data items unchanged throughout execution of the command.

- The alarm bits zone brings together all the alarm indicators in the system. Each bit in this table represents a cause for an alarm. These items are read-only data and are placed by the fault management system after the faults appear. Resetting to zero is effected on condition that the corresponding fault bit has disappeared.

- The fault bits zone brings together all the fault indicators in the system. Each bit in this table represents a fault. These items are read-only data and are placed or reset to zero by the fault management system after the faults appear. The supervisor is unable to exert any influence on these data items. The structure of this table is identical to that of the alarms.

- The current bits zone "CDN 12 state" contains functioning indicators of the sequencer and acknowledgements of transaction journal read requests. Access to this table of words is read only. Updating is performed by the sequencer and the file manager. Acknowledgement bits are always updated after those of the result variables that they indicate.

- The alarm acknowledgement zone enables an alarm to be deleted. An alarm bit can only be deleted if the fault has disappeared. The acknowledgement bit is reset to zero immediately after processing. The structure of this table is identical to those for alarms and faults.

- The "Supervisor commands" current bits zone brings together all the command bits sent by the supervisor. When the supervisor wants to send an order to the CDN 12 system, it places the necessary parameters in the parameter zone, then places the appropriate command bit in this table. A command bit is always reset to zero by the processing module which takes it over.

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11.2 READING A RECORDING IN ONE OF THE FLASH MEMORIES

To find a recording, the supervisor must provide an order number (NORD) or a date (DATE) in the supervisor parameter zone. If the order number is absent, the first recording on that day will be addressed. Similarly, if the date is absent, only the order number will be taken into account.

Next, the supervisor must set the supervisor current order bit to <Internal memory read request> or <External memory read request> according to whether reading of the internal or the external flash is required.

If the CDN 12 finds the recording, it places it in the recordings read buffer zone (see Modbus tables), then sets the CDN 12 current state bit to<Recording ready> (ENPRET). In case of a problem, the CDN 12 sets the CDN 12 current state bit to <Recording unknown or erroneous>.

The sequence can be summarized as follows:

SUPERVISORY	CDN 12
Writing of 2 words (NORD & DATE)	Writes the words
Writing of 1 bit (DEMENR = 1)	Writes the bit
Do Read 2 bits (ENPRET & ENINCONNU) While ENPRET = 0 et ENINCONNU = 0	Record search If record is present Writing an record in the Modbus table ENPRET = 1 Else ENINCONNU = 1
If ENPRET = 1 Reading of n words (Modbus table)	
Writing of bit (DEMENR = 0)	Writes the bit Reset ENPRET & ENINCONNU

- IF NORD = 0 : the first recording of that day (DATE) is addressed
- IF DATE = 0 : only the order no. (NORD) is taken into account

11.3 SETTING THE TIME ON THE CDN 12

The time and/or date can be set at any moment. The supervisor must write the date and/or time in the supervisor parameter zone of the CDN 12 and then set the supervisor current order bit to <Request date/time change>.

Two recording will result from this action if the gap between current how and new hour exceeds 6 minutes. The first "Modify date/time before" with the time and/or date before the reset, the second "Modify date/time after" with the reset time and/or date which has been taken into account.

A date/time reset can also be effected during a declared transfer. The supervisor must send the reset time and/or date to the supervisor parameters when the CDN 12 is in "no transfer - no leakage" state, after which the reset will be effected on the change to transfer state.

A date/time reset can also be effected in the same way during permanent transfer when a change of product takes place.

Note:
- *As for all the supervisor parameters, once the parameter has been taken into account, it is deleted.*
- *It is possible to set the time on the CDN 12 by the portable terminal.*

11.4 PARAMETERS BY DIALOGUE

During declared transfer, density and viscosity can be given to the CDN 12 by writing these values into the supervisor parameter zone when the CDN 12 is in no transfer - no leakage state. These values will be taken into account when the CDN 12 changes to transfer state.

Similarly, in permanent transfer and multi-product mode, density and viscosity can be communicated to the CDN 12 at a change of product. To do this, the supervisor must write the parameter(s) in question into the supervisor parameter zone and then set to 1 the supervisor order current bit <Change product>.

If the value transmitted is out of range, it is set to zero and a alarm appears.

In declared transfer modes, in end of transfer this alarm will be acknowledged. In permanent transfer mode, the supervisor must send a correct value and the acknowledgement bit.

Note: *As for all the supervisor parameters, once the parameter has been taken into account, it is deleted.*

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11.5 RECORDING REQUEST

A recording containing the current parameters can be requested at any time.
To do this, the supervisor has to set the supervisor order current bit <Request recording> to 1.

11.6 PARAMETERS DESIGNATING A TRANSFER OR A PRODUCT

In declared transfer, the name of the product, the transfer number and product family index must be written into the supervisor parameter zone during the no transfer - no leakage state. These parameters will be taken into account at the change to transfer state.

In permanent transfer, the product name and product family index can be written into the supervisor parameter zone at any time. They will be taken into account when the supervisor order current bit <Change product> is set to 1 by the supervisor.

11.7 CDN 12 / SUPERVISOR EXCHANGE DURING A RECORDING

During a recording, the CDN 12 signals to the supervisor, by the CDN 12 current state bit <Data ready>, that a recording has just been created. This bit remains in place for 10 seconds or until the supervisor replies with the supervisor order current bit <Data read>.

12. LOCAL INDICATOR

12.1 INTRODUCTION

The CDN 12 system is installed in an equipment room, so that the user is unable to read the information shown on the built-in display unit. For this reason, provision has been made for control of a local indicator.

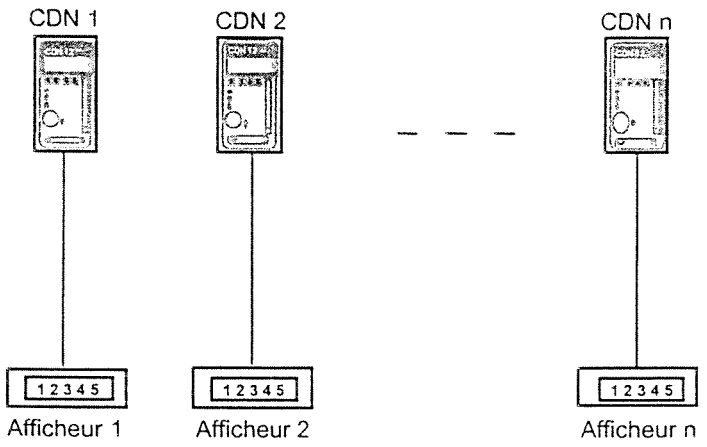
The link protocol is of type Modbus RTU mode: the CDN 12 is master and the indicator the slave.

A configuration parameter enables use of the local indicator to be validated, or not:

By configuration, one of the following three meters can be displayed:

- The current gross volume meter
- The current net volume meter
- The current mass meter

The local indicator functions in point to point mode with the CDN 12:



In this case, address of indicator is station number (configurable)

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12.2 COMPONENTS OF THE SYSTEM

The local indicator consists of two boards:

- Display board
- Power supply and CPU board

12.2.1 DISPLAY BOARD

The display is composed to 5 + 1 digits and 3 decimal points managed in multiplex mode.

A supplementary digit displays the number of the arm in service.

There is also a red LED to indicate an alarm.

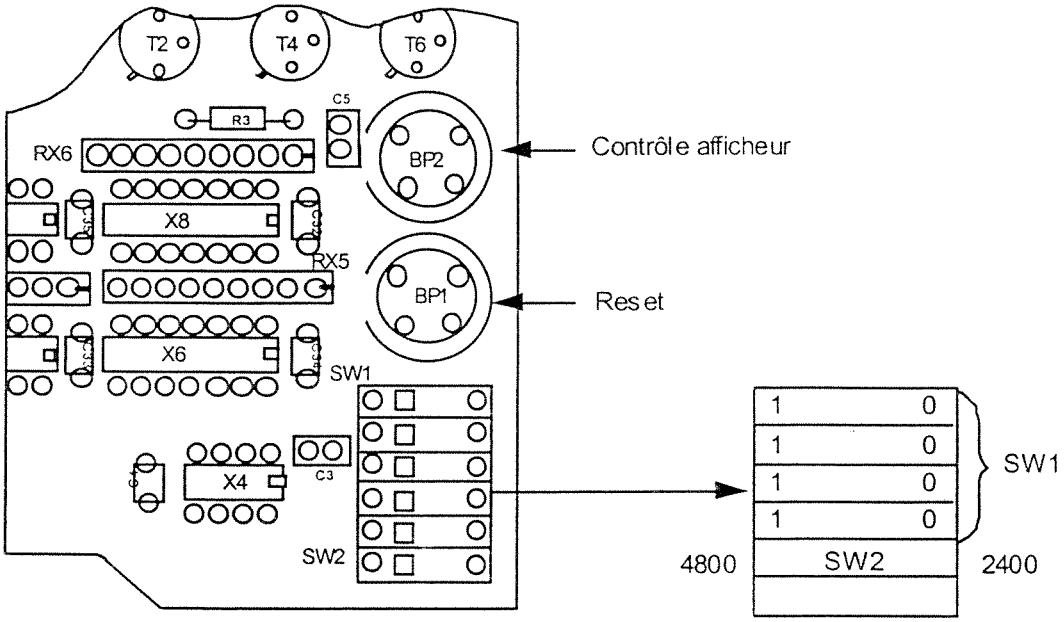
A view of the component side of the display board is shown in an appendix.

12.2.2 POWER SUPPLY AND CPU BOARD

This is made up of:

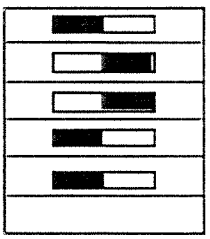
- 1 microcontroller, 68302, 16 MHz (16 bits)
- EPROM 64 ko
- NOVRAM 64 Ko
- 1 RS 485 serial link
- 1 reset push-button (BP1) to reinitialize the microcontroller
- 1 display test push-button (BP2) to check the display
- 6-bit configuration switches arranged as follows:

  . 4 bits (SW1) : network address coding, display by rack or by arm
  . 1 bit (SW2) : transmission speed (4800 or 2400 bauds)
  . 1 bit : unused



Example of configuration

- Adress n° 9
- 4800 bauds



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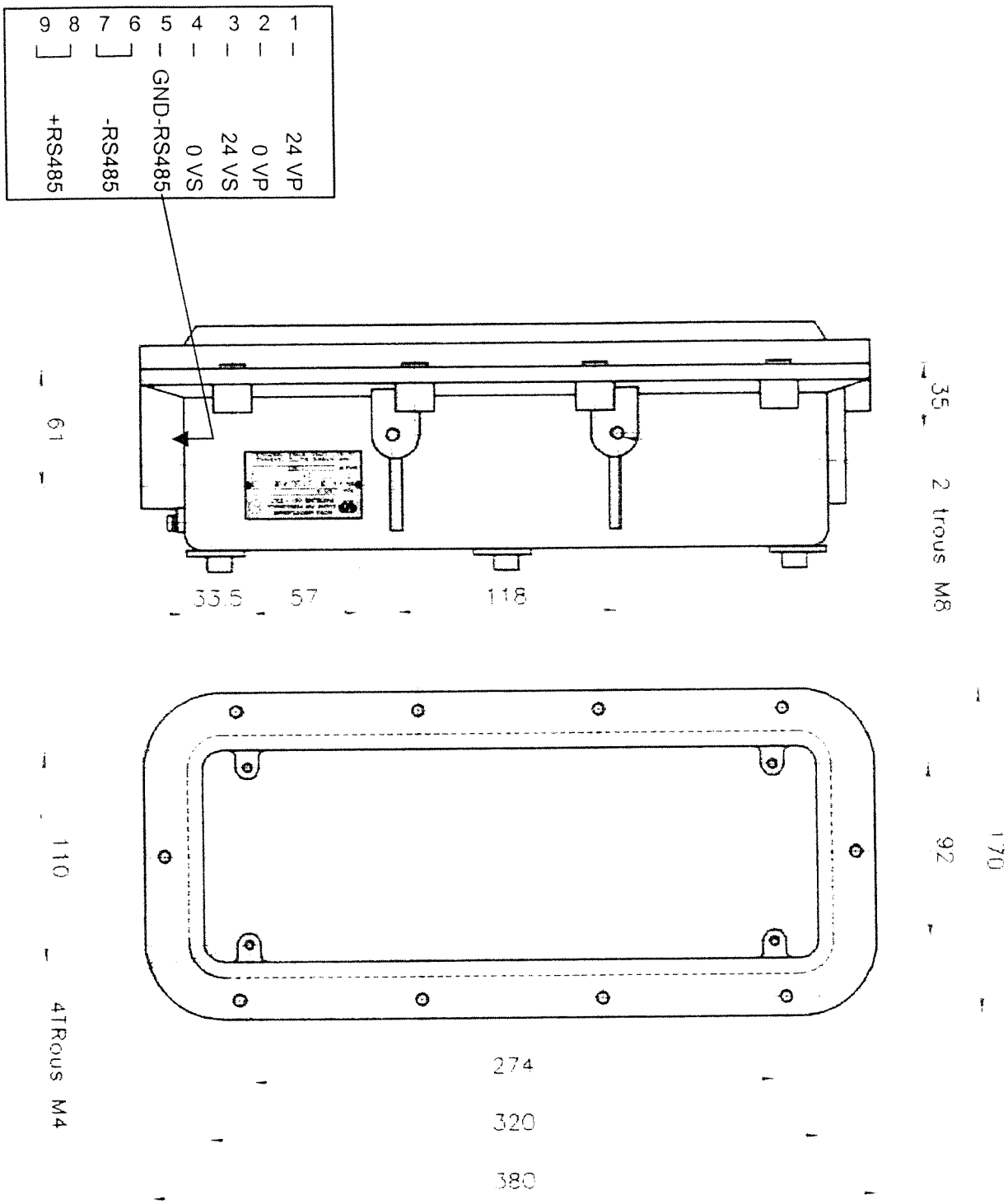
12.2.3 CONNEXION DIAGRAMM



12.3 CARACTERISTICS

- Casing : ADF EEx d IIBT 6
- Dimensions : 170 mm x 380 mm x 140 mm
- Glands : 2
- Power supply : 24 or 48 V DC
- Temperature : -20 to +60 °C

12.4 FUNCTIONING OF THE LOCAL INDICATOR

12.4.1 FUNCTIONING

Except during transfer, the local indicator is switched off. When changing over to transfer, the metering electronics send a "wake-up" signal to the local indicator. The latter starts a series of tests, then displays in real time the volumes transmitted by the metering electronics. At the end of a transfer, the metering electronics send a "switch-off" command to the local indicator.

In case of an alarm, the metering electronics place in the volume message a special semaphore requesting the local indicator to go into blink mode to indicate to the driver that conditions are abnormal.

12.4.2 SECURITY AND TEST

Security of the local indicator is provided by:

- Protected transmission protocol (Modbus, RTU mode)
- Back-up power supply
- Re-reading of display control commands

Transmission is protected by:

- Verification of the receiver address
- Coherence of the code transmitted
- CRC 16 of the message
- Acknowledgement by return

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Security of the power supply consists in the provision of two power supply lines, one normal and one protected. In case of absence or disappearance of the protected supply, the local indicator goes on alarm and returns an error code. In case of loss of the main supply, the local indicator returns an error code and continues operation for 15 minutes.

Display security is assured at two levels:

- Visual check by the driver during the "wake-up" phase of the successive display of 8, blanks and 0
- An internal check: at each display segment command, the command current is verified by return

Two test devices are installed in the local indicator:

- In accordance with regulations, an internal device can generate a typical hardware-type display fault
- The local indicator possesses an address coding system; re-starting the indicator with address 0 activates a continuous sequence of auto-tests (8, blank, 0)

13. PRESET

13.1 DEFINITION

This function is used to define the quantity to load during a pumping.

This quantity can be defined in net volume (15 °C m^3) or in mass (tonnes). If the preset is reached CDN 12 closes the control valve.

This working mode is only available in declared transfer mode.

13.2 WORKING SEQUENCE

CDN 12 must be in normal state when the sequence is initialized:

- CDN 12 display: OUT OF TRANSFER
- The preset quantity (t or en m^3) is send to the CDN 12 which writes it in the Modbus table "Supervisory computers para meter zone ASCII"
- The "ON TRANSFER" order is send to the CDN 12
- CDN 12 wakes up and test local indicator
- Local indicator blinks during 10 seconds in displaying the preset
- CDN 12 display: ON TRANSFER
- CDN 12 opens the control valve to the open security (in %)
- CDN 12 display: FLOW IN TRANSFER
- When it detects a flowrate, CDN 12 opens the valve control in order to reach the flowrate set point
- When the loading quantity = preset – jetty constant (defined in kg or litre by the configuration), CDN 12 swaps in low flowrate (defined in m^3/h by configuration). This jetty constant is used to reduce the valve opening to avoid an fastest closing. So CDN 12 can adjust the loading quantity.

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- The loading quantity is equal than the preset.
  CDN 12 : . closes the control valve (to the closing set point see § valve) with an anticipation time in order to adjust the loading quantity in taking the valve response time into consideration
  . points out that the preset is reached in setting the bit "PREDE-ATTE" to 1 in the Modbus table

- CDN 12 display: ON TRANSFER

- The "OUT OF TRANSFER" request is send to CDN 12

- CDN 12 display: OUT OF TRANSFER

13.3 PROBLEMS

The preset value is absent in the Modbus table when the operator send the "ON TRANSFER" order.

CDN 12:
- sets the "PRESET ABS" alarm
- cancels "ON TRANSFER" request

Solution: Acknowledge the alarm and restart sequence

The local indicator doesn't response:
CDN 12 set the "IND. POSTE" alarm to 1

Solution : Acknowledge the alarm and the sequence restarts

SECTION V CONTENTS

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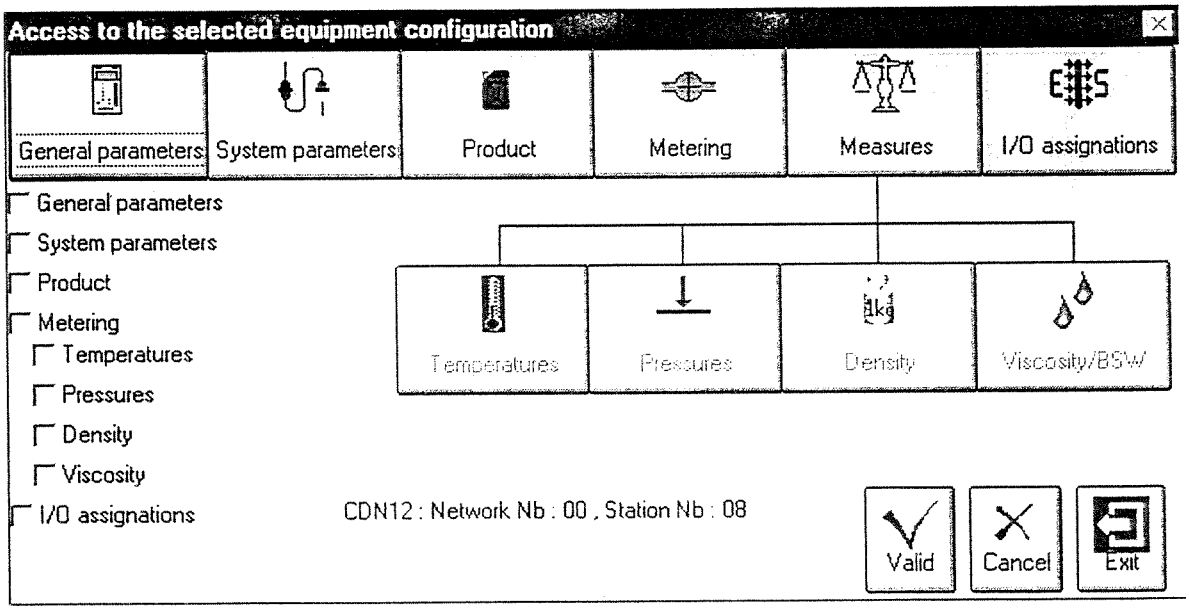
SECTION V

CONFIGURATION SOFTWARE

1. CONFIGURATION PARAMETERS

1.1 PRESENTATION OF WINDOW PARAMETERS CONFIGURATION

If you click on the "Modify..." button of the "Configurator, equipment choice" window the next screen appears:



The screen is made of 10 icons:

- General parameters
- System parameters
- Product
- Metering
- Measures
- I / O assignations
- Temperatures
- Pressures
- Density
- Viscosity / BSW

To open an icon, you must click on it.

Progress in icon:
When the user clicks on an icon, the associated check button is checked.
The "temperatures", "pressures", "density" and "viscosity / BSW" icons become available when the user clicks on "Measures" icon.

Partial modification of the configuration :
The operator can modify only some parameters. He must click on the associated icon.

1.2 GLOSSARY

Some parameters appear more times in this manual. They are defined one time for all the section.

Min technological range and Max technological range :
These parameters define the range of the transducer. If the input value steps over the threshold, an alarm "Technological ..." is set.

Min using range and Max using range or XX Min and XX Max:
Its define the working range initialised by the operator. If the input value steps over the threshold, an alarm "User ..." is set.

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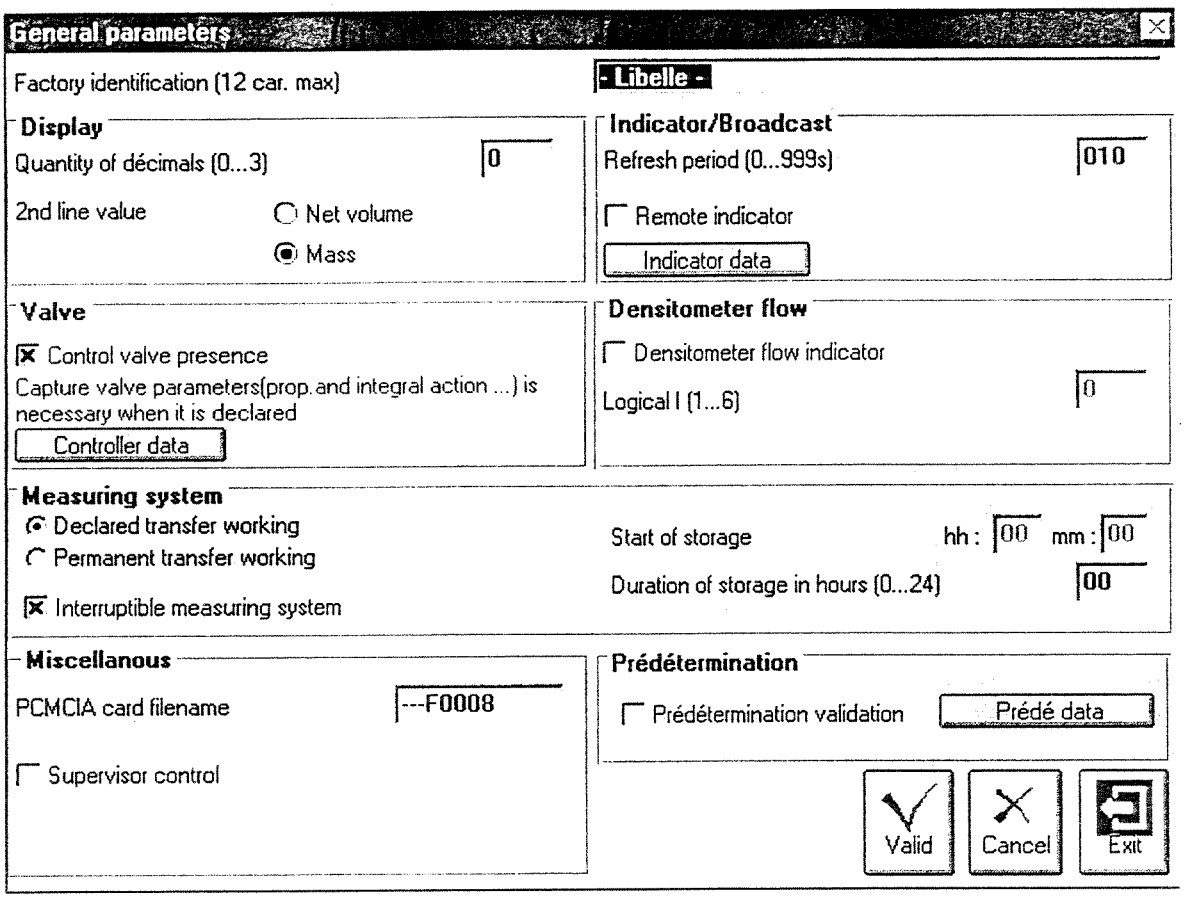
2. GENERAL PARAMETERS



Factory identification:
This identifier allows the station identification. It appears in:
- the records
- the configuration report
- the "Config. Installation" menu

Display:
The user selects the second value displayed of the permanent menu.
Two choices are available:
- Net volume
- Mass

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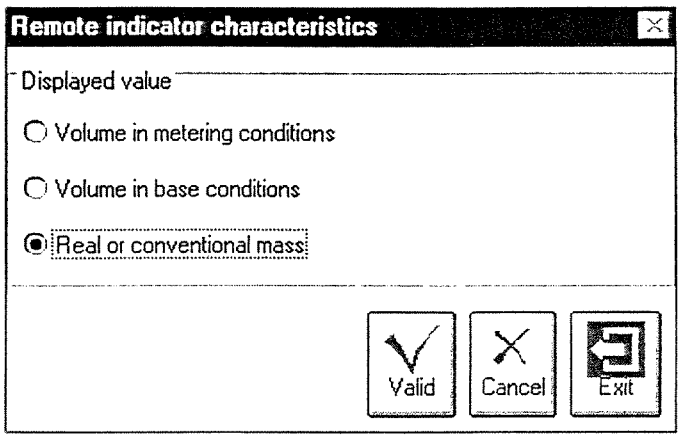
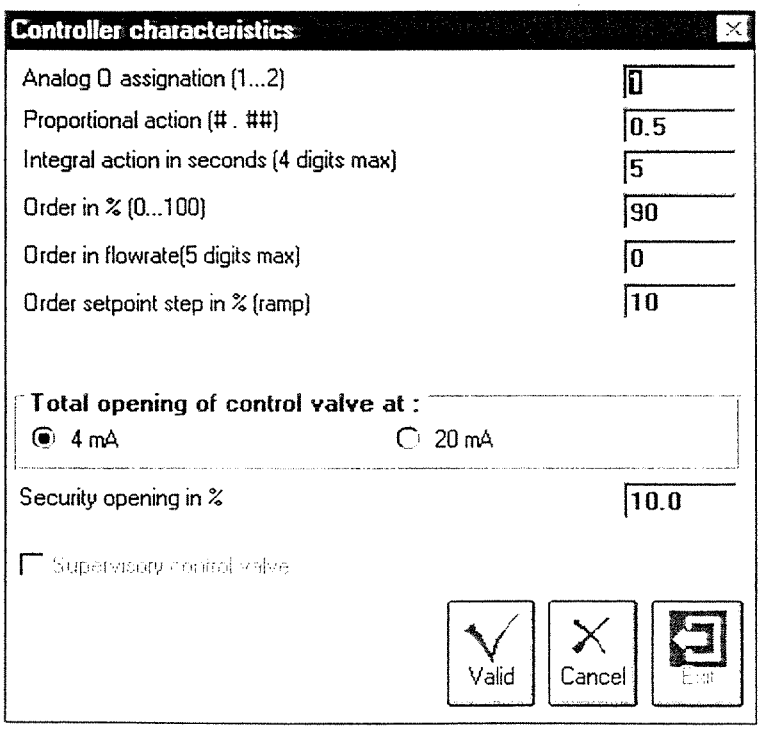
Indicator / Broadcast:
When "Remote indicator" is checked, the next screen appears:



The user selects one of the three previous definitions. Later on, this choice can be modified in clicking on the "Indicator data" button of the "General parameters" screen.

The refresh period of the remote indicator can be fixed at 1 to 999 seconds by 1second step.

Valve:
When the user validates a valve, the next screen appears:



The user can declare the "security opening" in %.

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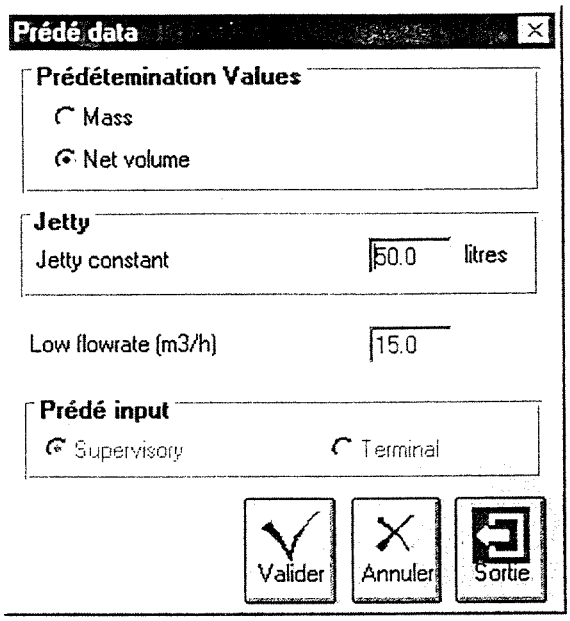
Preset:
The associated screen of the Preset is:



The "jetty constant" is declared in litres or in kg and the" low flow rate" associated in m3/h.

Densitometer flow:
The user:
- validates the densitometer installation
- affects one digital input :
  - to a flow detector put in the analysis ring
    if the input is closed, there is a flow rate in the ring
    if the input is opened, there isn't a flow rate in the ring
  - to a start detector of the supply pomp of the ring

Measuring system:
The user specifies the transfer type used:
- Permanent transfer: this function mode is used if the flow rate is continued.
- Declared transfer: used for wagons or ships loading.

The measuring system can be:
- interruptible
- or no interruptible

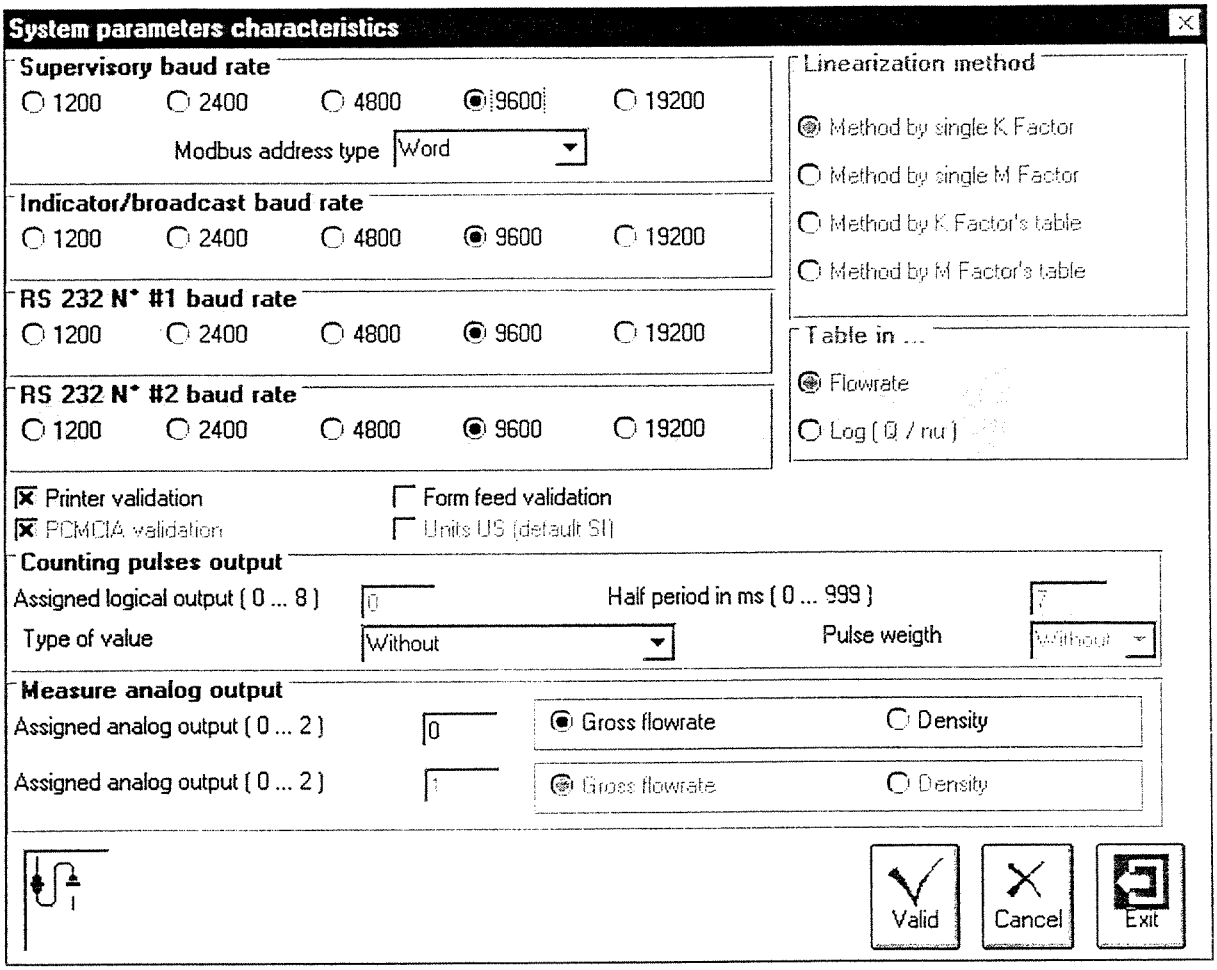
The data "Start of storage" and "Duration of storage in hours" manage the weighting periods (see section IV)

Miscellaneous:
Pcmcia card name:
The user attributes a name to the records file in the PCMCIA card.

Supervisor control:
The user checks this option if the supervisor manages the CDN12 working sequence.

3. SYSTEM PARAMETERS CHARACTERISTICS

These parameters of this view are configurable in system mode.



In case of this CDN12 model, the next parameters are not configurable:

- Linearization method
- Table in ...
- Pcmcia validation
- Units US

Printer validation:
In this case CDN12 drives a printer.

Supervisory baud rate:
This numerical link is an RS485.
The modbus address type can be byte or word.

RS 232 N°#1 baud rate:
This numerical link is the printer link.

RS 232 N°#2 baud rate:

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Not used for this model.

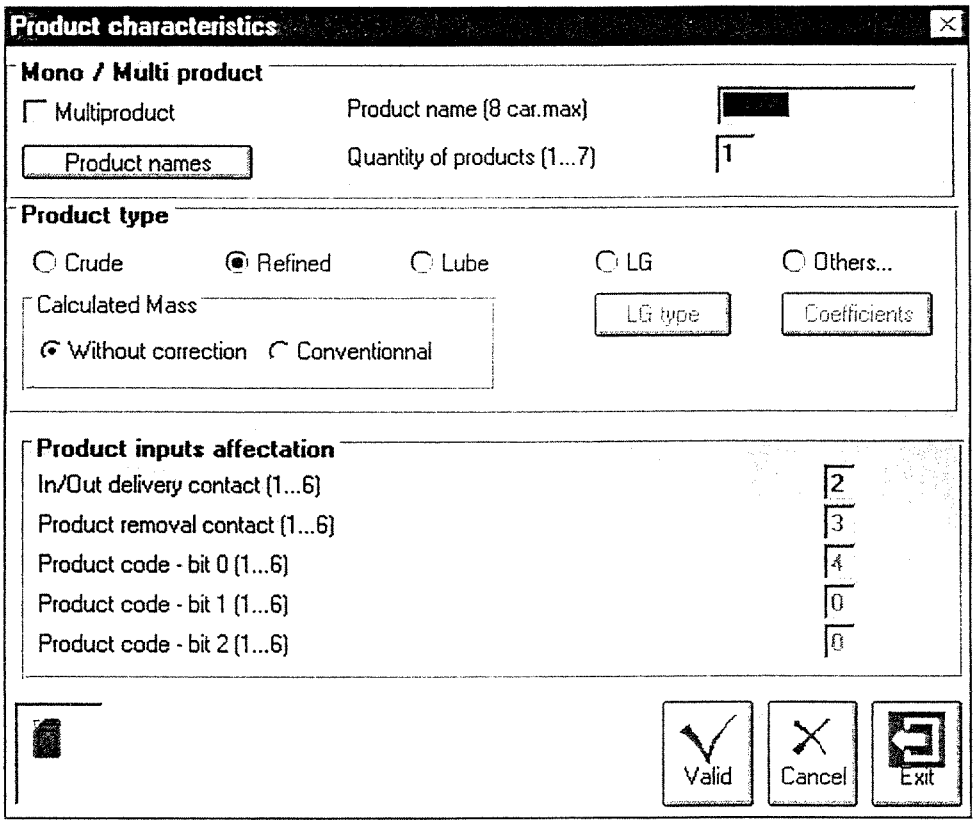
Indicator / broadcast baud rate:
This numerical link is an RS485.

Counting pulses output:
The next choice is available for pulse output:
- Meter volume : Pulses * K0m * K3m
- Gross volume : Pulses * K0m * K3m * K1m * K2m
- Net volume
- Mass

The weight pulse is configurable too:
- x 1 : 1 pulse per litre or kg
- x 10 : 1 pulse per 10 litres or 10 kg
- x 100 : 1 pulse per 100 litres or 100 kg
- x 1000 : 1 pulse per 1000 litres or 1000 kg

Half period in ms (0...999):
The user must verify the compatibility with the external totalizer.
See section IV

4. PRODUCT CHARACTERISTICS



Calculated Mass:
For LG, the calculated mass is fixed "without correction".
For others products, the user choices what he wants.
This type of mass is displayed in the "Units" sub menu.

Multi product:
This parameter is checked to signal there are many products in this pipe.
The number and the name must be informed by the user.

Product type:
Case of crude, refined or lube:
For this type, the operator must inform the product name.

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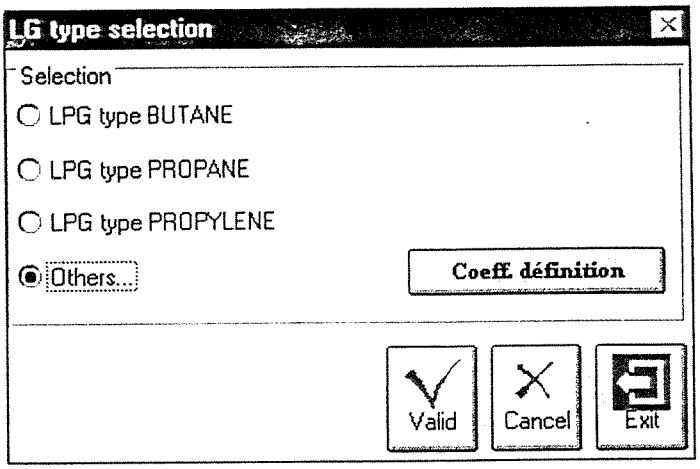
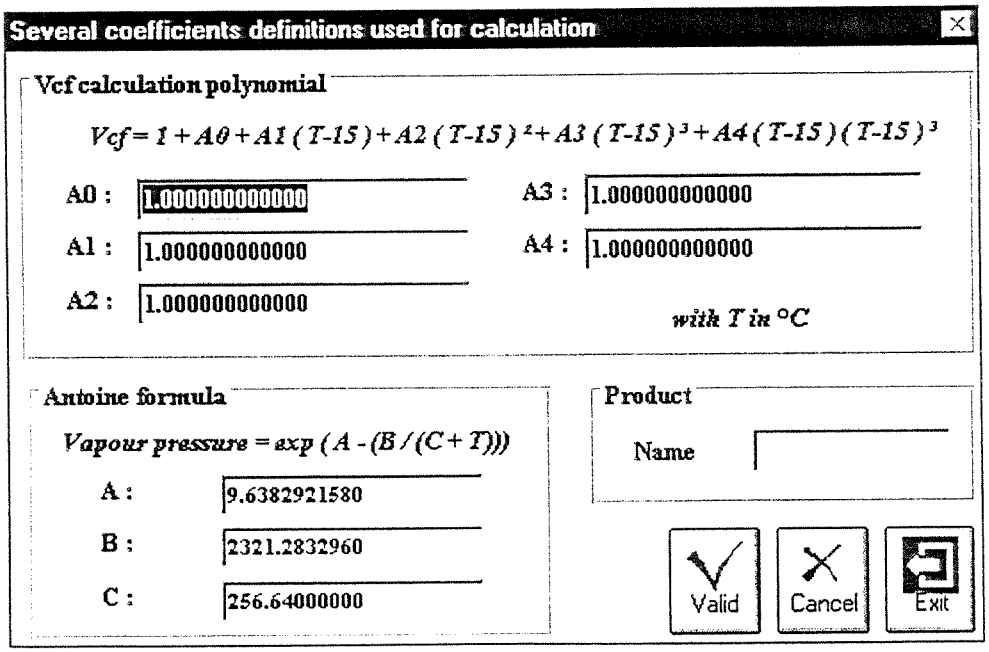
Case of LG:
If the user push the "LG type" button, the next screen appears:



For LPG type Butane, Propane or propylene:
The product name, the Vcf calculation method and the Antoine formula coefficients are not configurable.

For others LG :
The next view is displayed :



The user can inform the Vcf polynomial coefficients, the Antoine Formula coefficients and the product name.

Case of others:
When this button is checked, the next view appears too.
Only Vcf calculation polynomial coefficients are configurable.

Product inputs affectation :
In autonomous mode,

- One digital input is affected to In / Out delivery contact.
- In system mode and multi products,
  One digital input is affected to product removal contact
  Three digital input are affected to product code. So Cdn12 can know the product in the pipe.

Product code			Product in pipe
Bit 2	Bit 1	Bit 0	
0	0	0	Interdit
0	0	1	Code n°1
0	1	0	Code n°2
0	1	1	Code n°3
1	0	0	Code n°4
1	0	1	Code n°5
1	1	0	Code n°6
1	1	1	Code n°7

Bit X to 0 : Opened contact on the digital input
Bit X to 1 : Closed contact on the digital input

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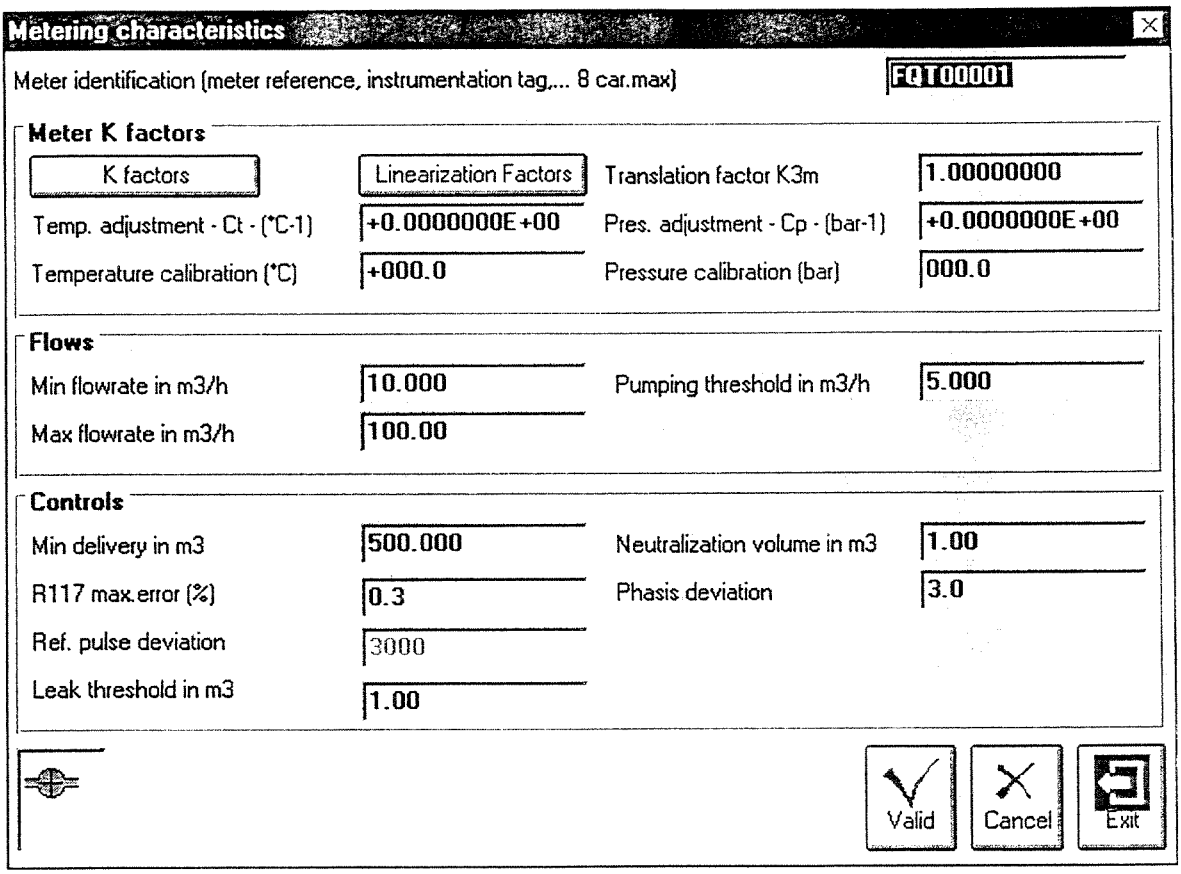
5. METERING CHARACTERISTICS



Meter identification:
It is a label to identify the metering used.

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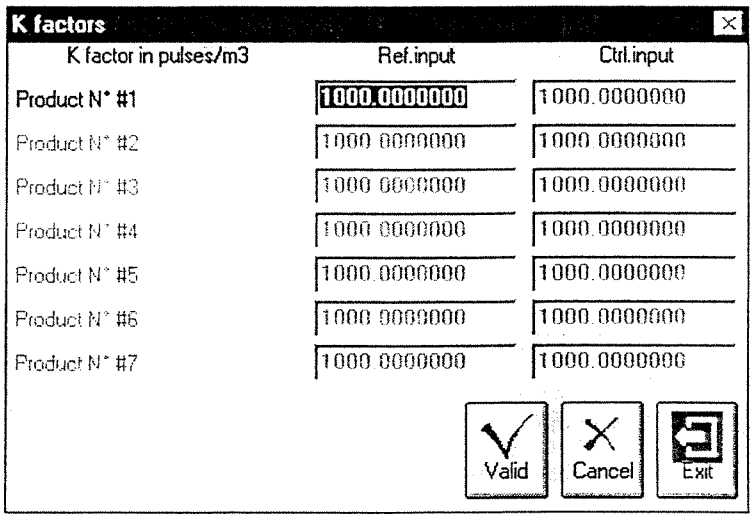
Meter factors:

K factors :

It is the volumetric meter coefficient.
For multi product, the meter is adjusted with each product. So, there is a K factors for each product.

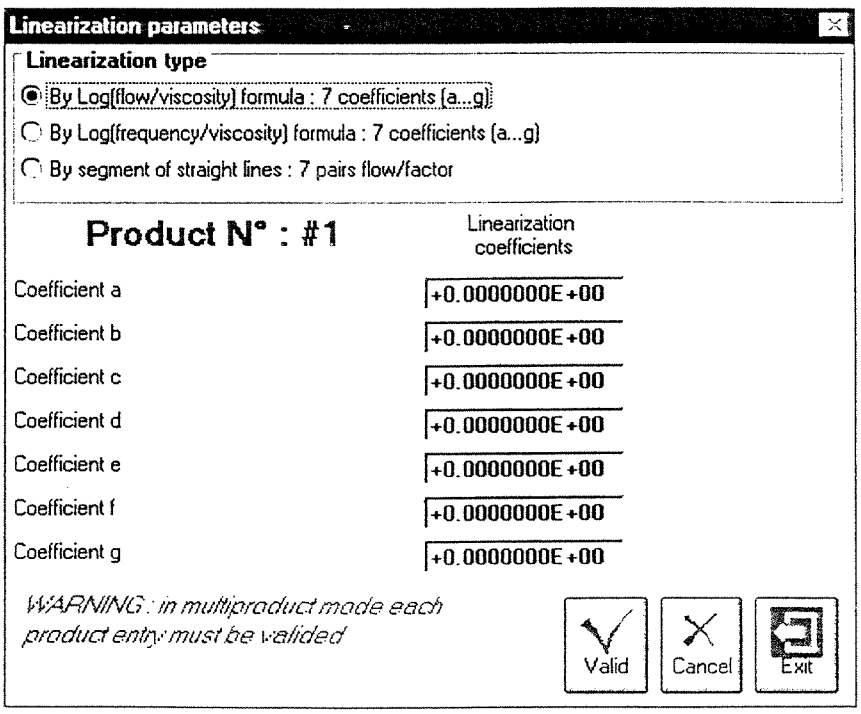
The K factor is set for the reference input and copied in the control input.
These coefficients are introduced at the first adjustment and they are not modified later.



Linearization factors:

It allows to correct the flow rate and the viscosity effects on the meter.

It is possible to introduce 7 linearization coefficients defined when the meter is adjusted for each product type.



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Ct ,Cp:
They are the meter expansion coefficients in function of temperature (Ct) and pressure (Cp).

Temperature and pressure calibration:
These parameters indicate the temperature and the pressure used for calibration.
To complete the "Flows" and "Controls" see the section IV.

Min flow rate, Max flow rate, Min delivery, R117 max error, ref. Pulse deviation, phases deviation : « Cdn12 working state ».

Pumping threshold, leak threshold : "Meter management".

Neutralization volume : "Alarms acknowledge"

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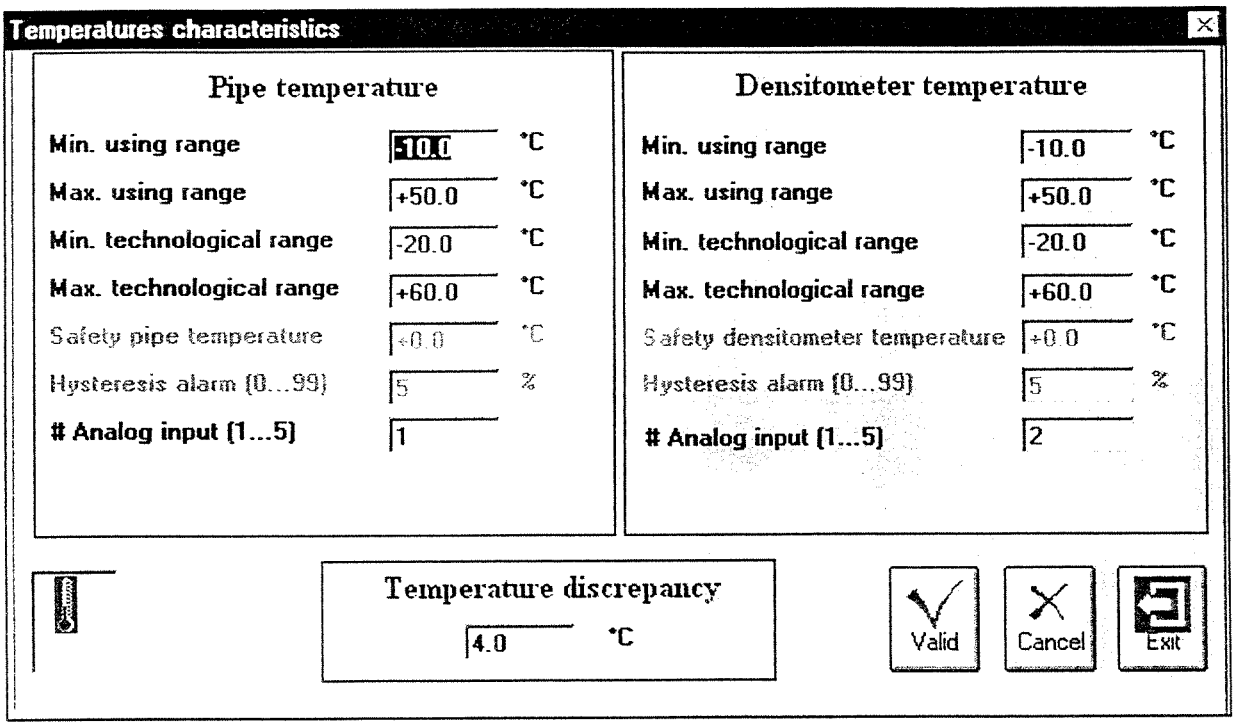
6. TEMPERATURE CHARACTERISTICS



The following propositions are not available for this model:
- Safety pipe temperature
- Safety densitometer temperature
- Hysteresis alarm

Temperature discrepancy:
It is the discrepancy allowed between pipe temperature and densitometer temperature. If this threshold is over stepped, an "temperature discrepancy" alarm is set.

-30°C < User range < +310°C
-50°C < Technological range < +400°C
0°C < Temperature discrepancy < 9.9°C

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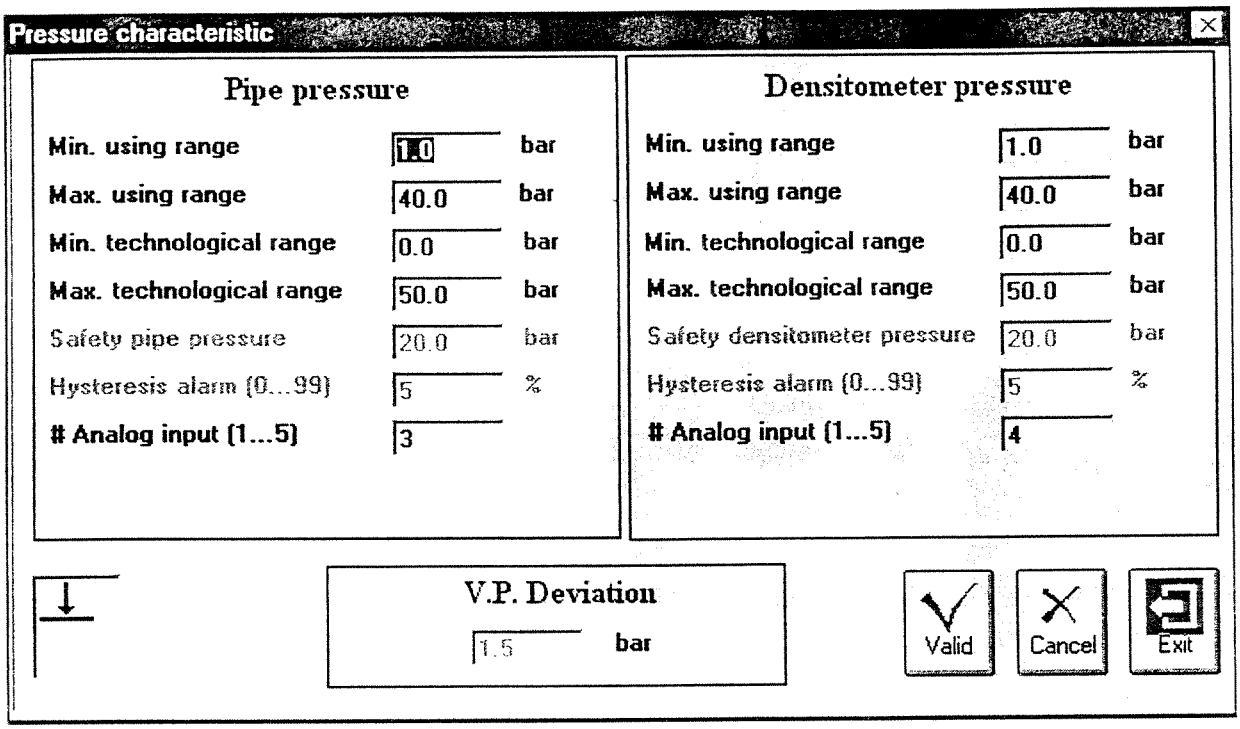
7. PRESSURE CHARACTERISTICS



The following propositions are not available for this model:

- Safety pipe pressure
- Safety densitometer pressure
- Hysteresis alarm

V.P. Deviation:
It's only used for LG products.

It is the discrepancy allowed between pipe pressure and vapour pressure. If this threshold is over stepped, an "Vap.P.deviat " alarm is set.

0 bar < User range < 600 bar
0 bar < Technological range < 900 bar
0 bar < Vapour pressure discrepancy < 9.9 bar

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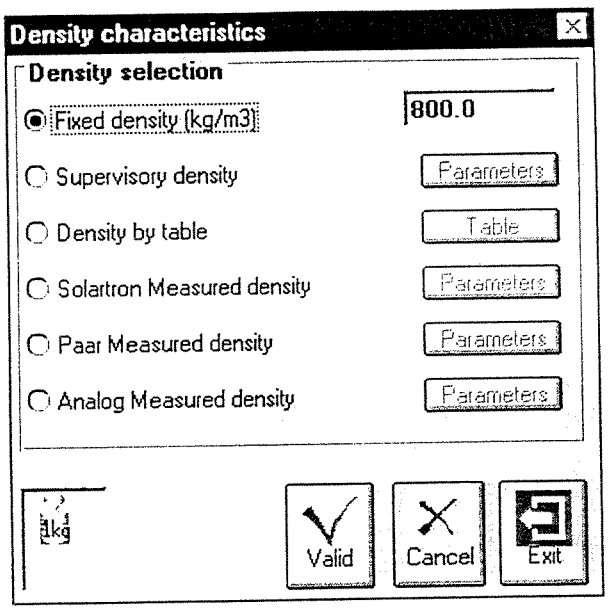
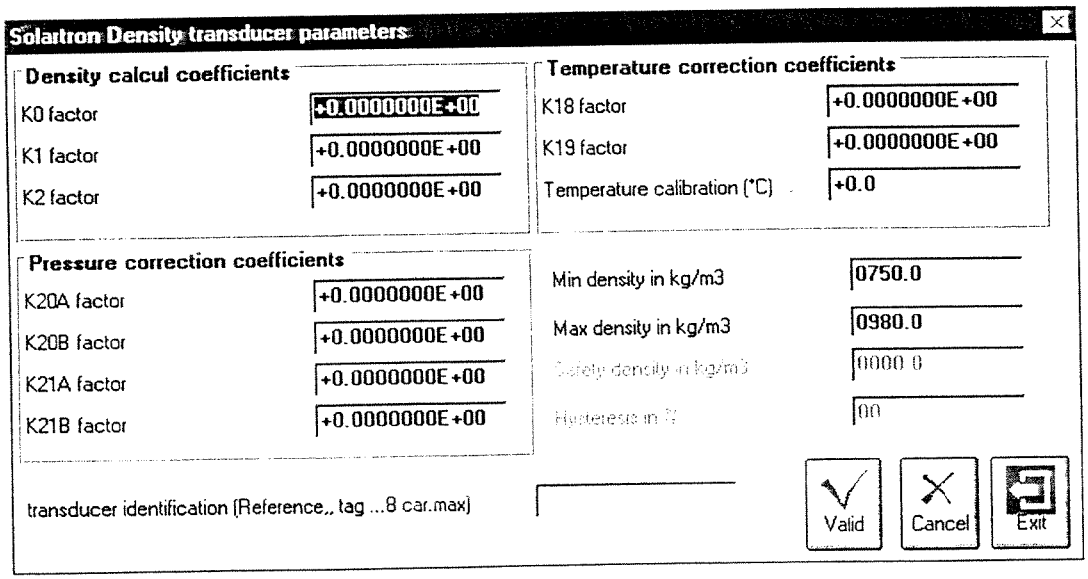
8. DENSITY CHARACTERISTICS



➢ **Solartron measured density**



K1, K2, K3, K18, K19
K20A, K20B, K21A, K21B : Calibration coefficients of Solartron.

Transducer identification : It is an identifier for the densitometer.

The following propositions are not available for this model:
- Safety density
- Hysteresis

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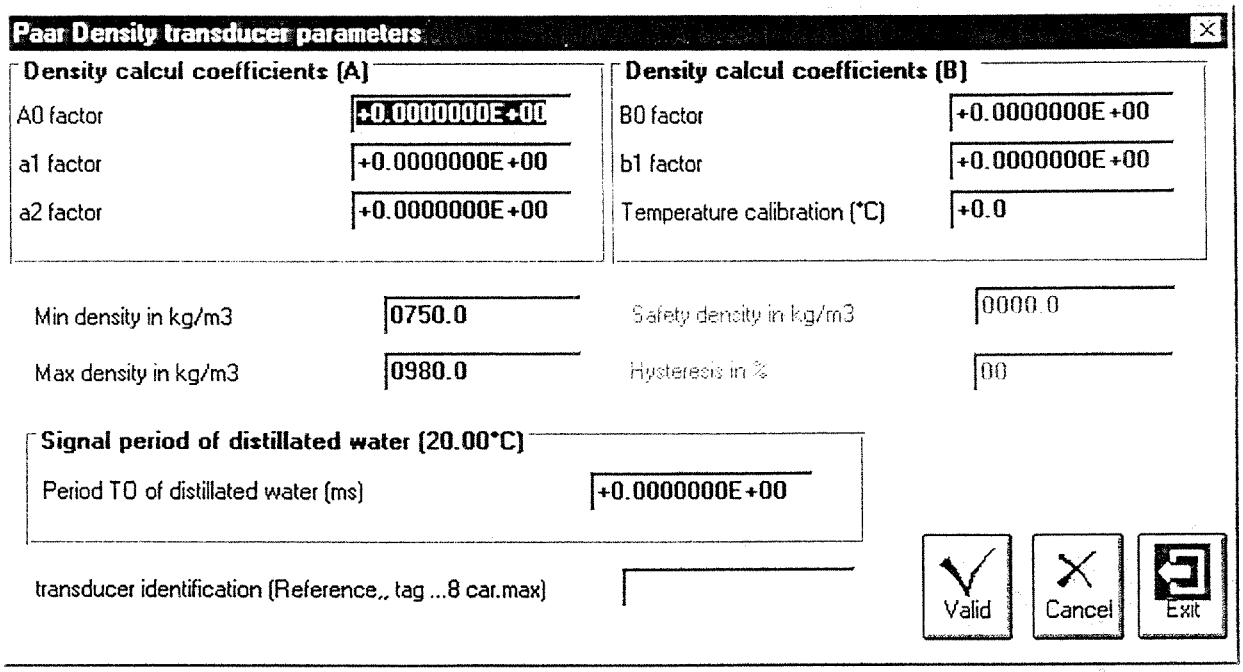
➢ Paar measured density



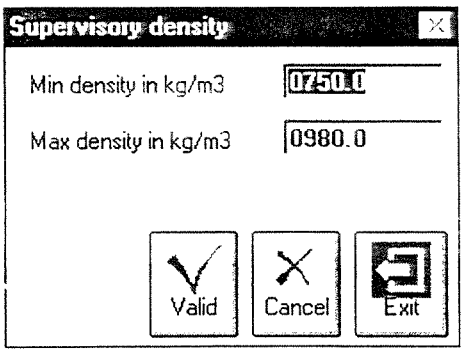
A0, a1, a2, B0, b1 : Calibration coefficients of Paar.

Transducer identification: It is an identifier for the densitometer.

The following propositions are not available for this model:
- Safety density
- Hysteresis

➢ Supervisory density

This choice is only available in supervisory mode.



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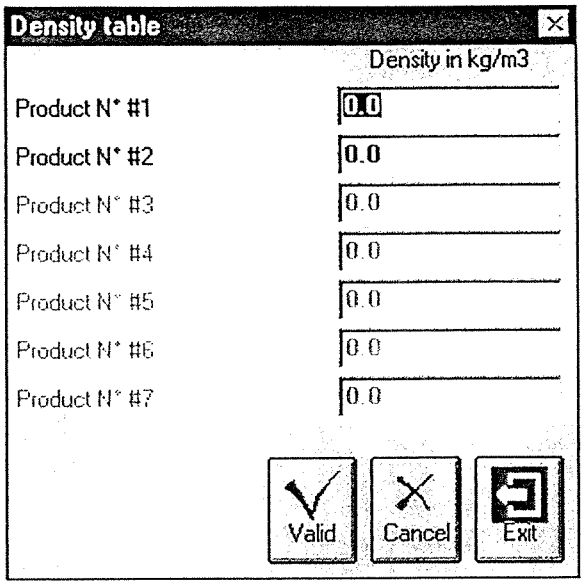
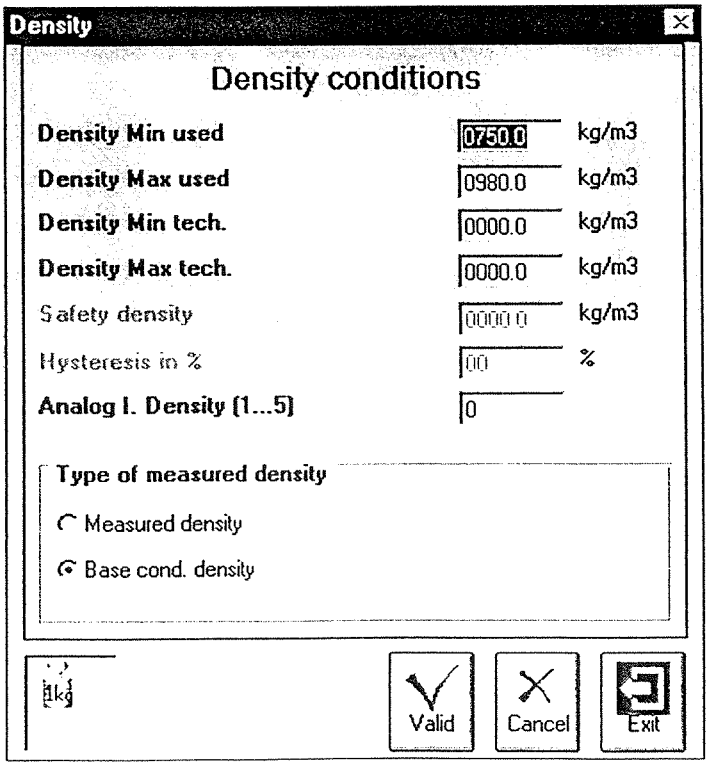
➢ **Density by table**

This choice is only available in multi products mode.



The user informs the base conditions density.

➢ **Analog measured density**



The following propositions are not available for this model:
- Safety density
- Hysteresis

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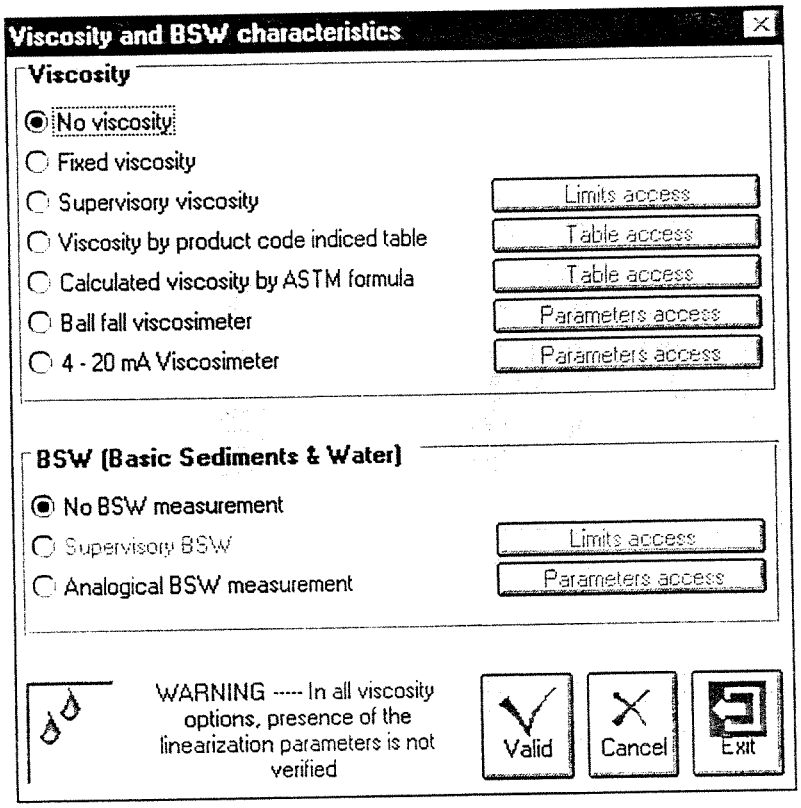
9. VISCOSITY AND BSW CHARACTERISTICS

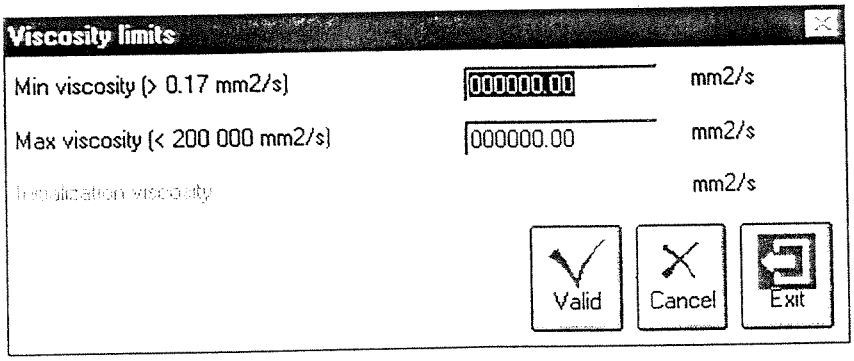


➢ **No viscosity**

➢ **Fixed viscosity**

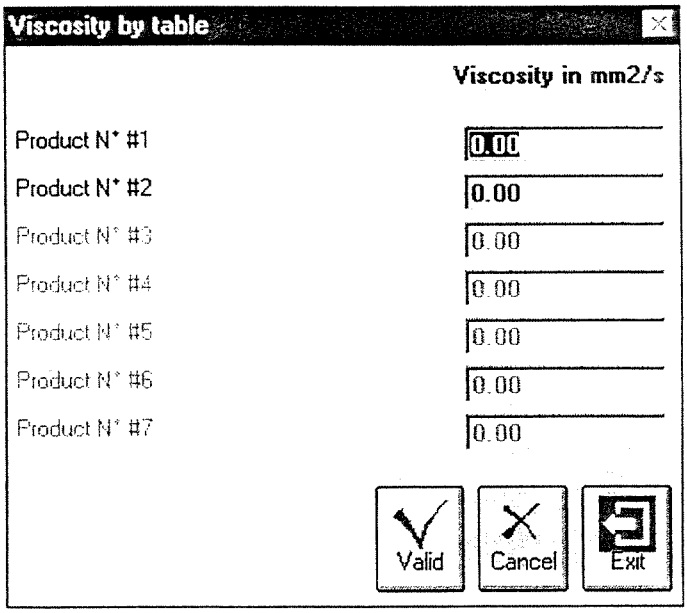
This value is in mm²/s

➢ **Supervisory viscosity**

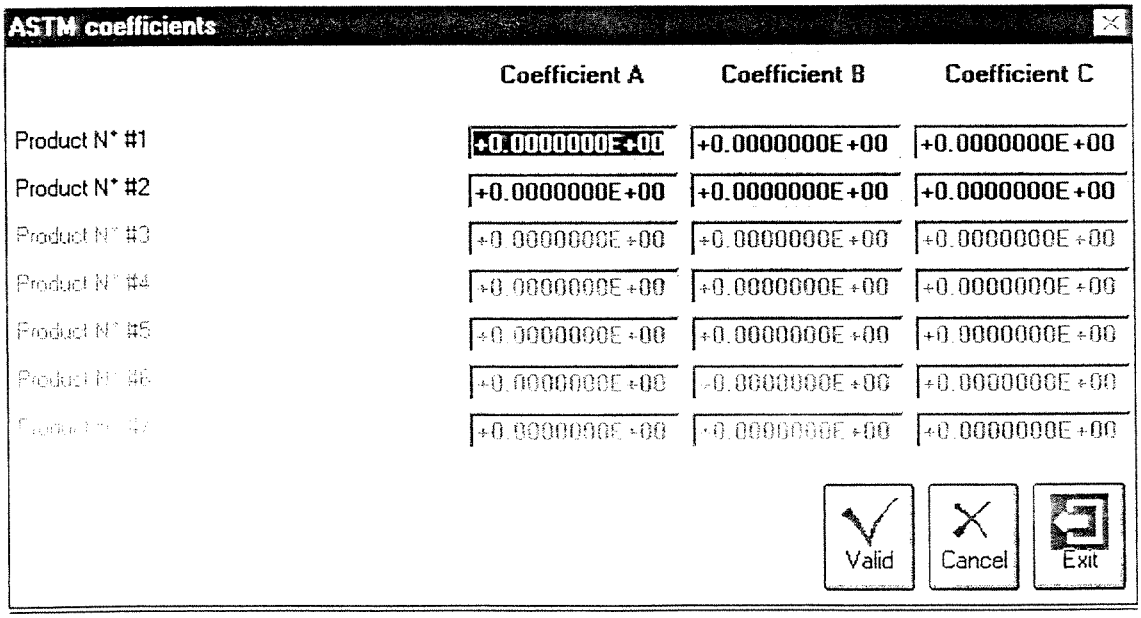


➢ **Viscosity by product code indiced table**

Only available in multi products



➢ **Calculated viscosity by ASTM formula**



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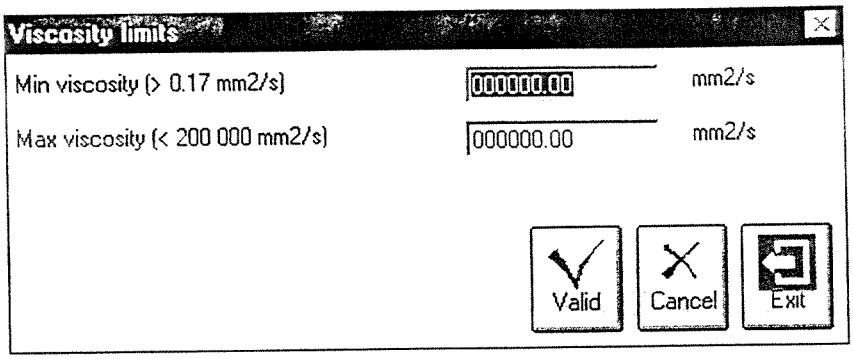
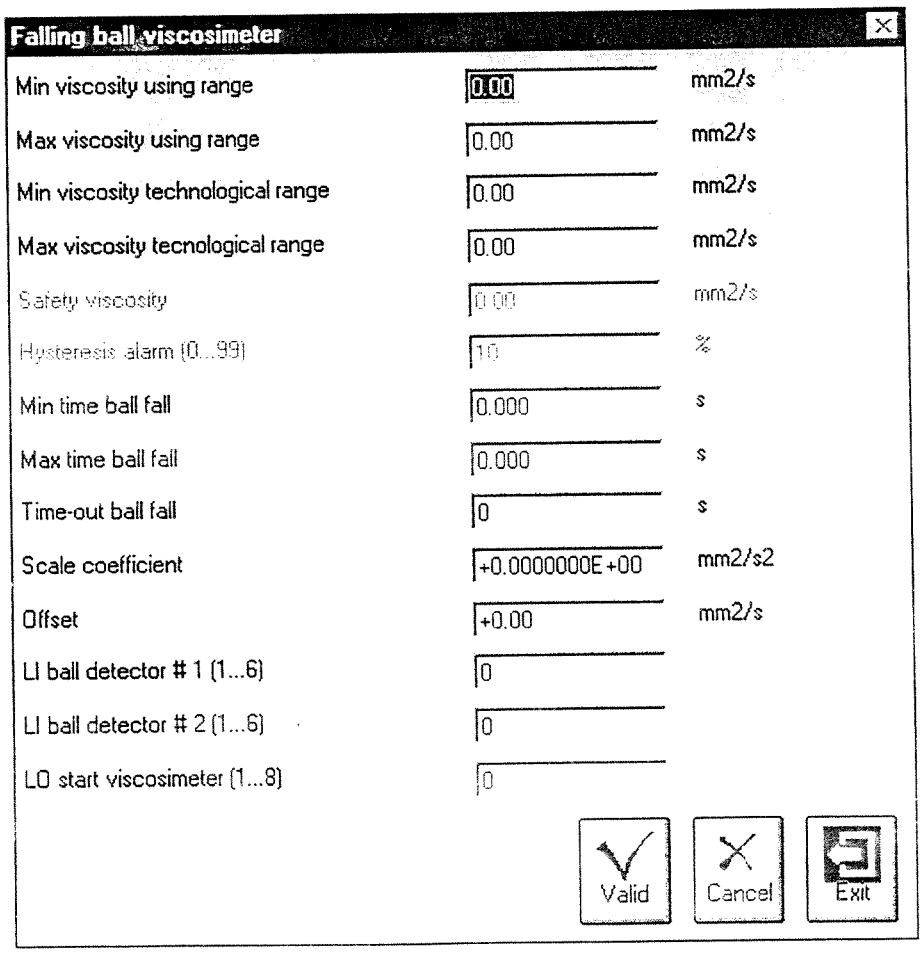
Once the coefficients A, B, C are set, the user must inform the viscosity limits.



➢ **Ball fall viscosimeter**



The following propositions are not available for this model:

- Safety viscosity
- Hysteresis

Min time ball fall and Max time ball fall
These parameters are supplied by the constructor.
If the measured time is out of range, a "Viscosity user" alarm is set.

Time-out ball fall
If the ball is not detected by the sensor 2 in this time, a "Viscosity calculation" alarm is set.

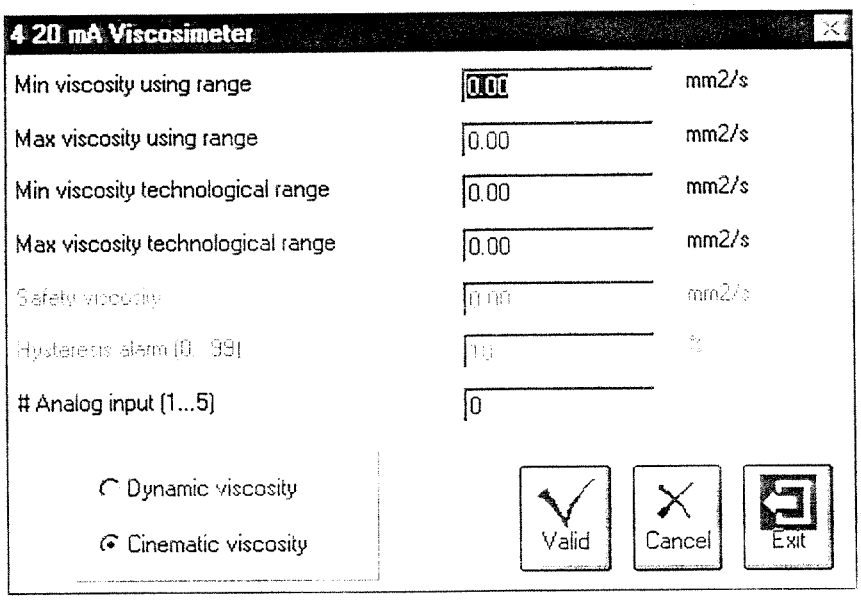
Scale coefficient
This parameter is supplied by constructor.

Ball detector #1 and Ball detector #2
Two digital inputs are affected to the sensors.

Start viscosimeter
One digital output is set when the ball is detected by the sensor 1.

➢ **4 – 20 mA viscosimeter**

These measures are done during "flow on transfer" state.
It is made every 2 seconds.



The following propositions are not available for this model:
- Safety viscosity
- Hysteresis

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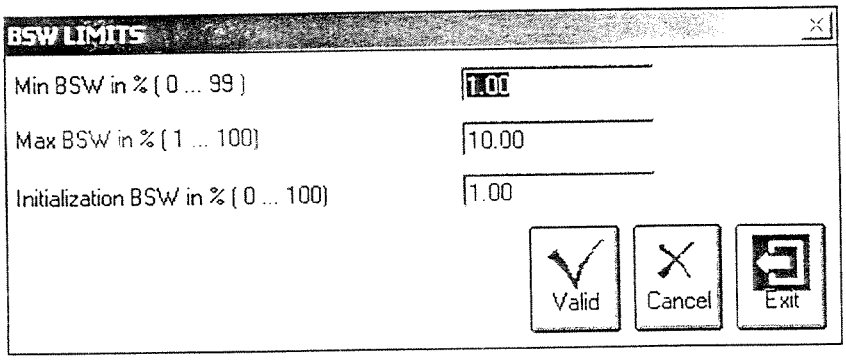
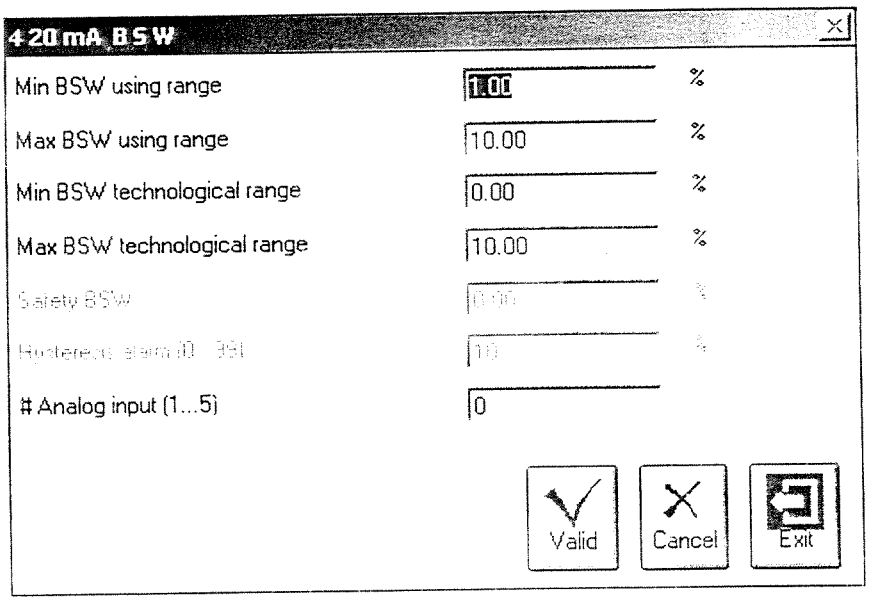
➢ BSW (Basic sediments & Water)

Supervisory BSW



4-20 mA BSW

These measures are done during "flow on transfer" state. It is made every 2 seconds.



The following propositions are not available for this model:

- Safety BSW
- Hysteresis

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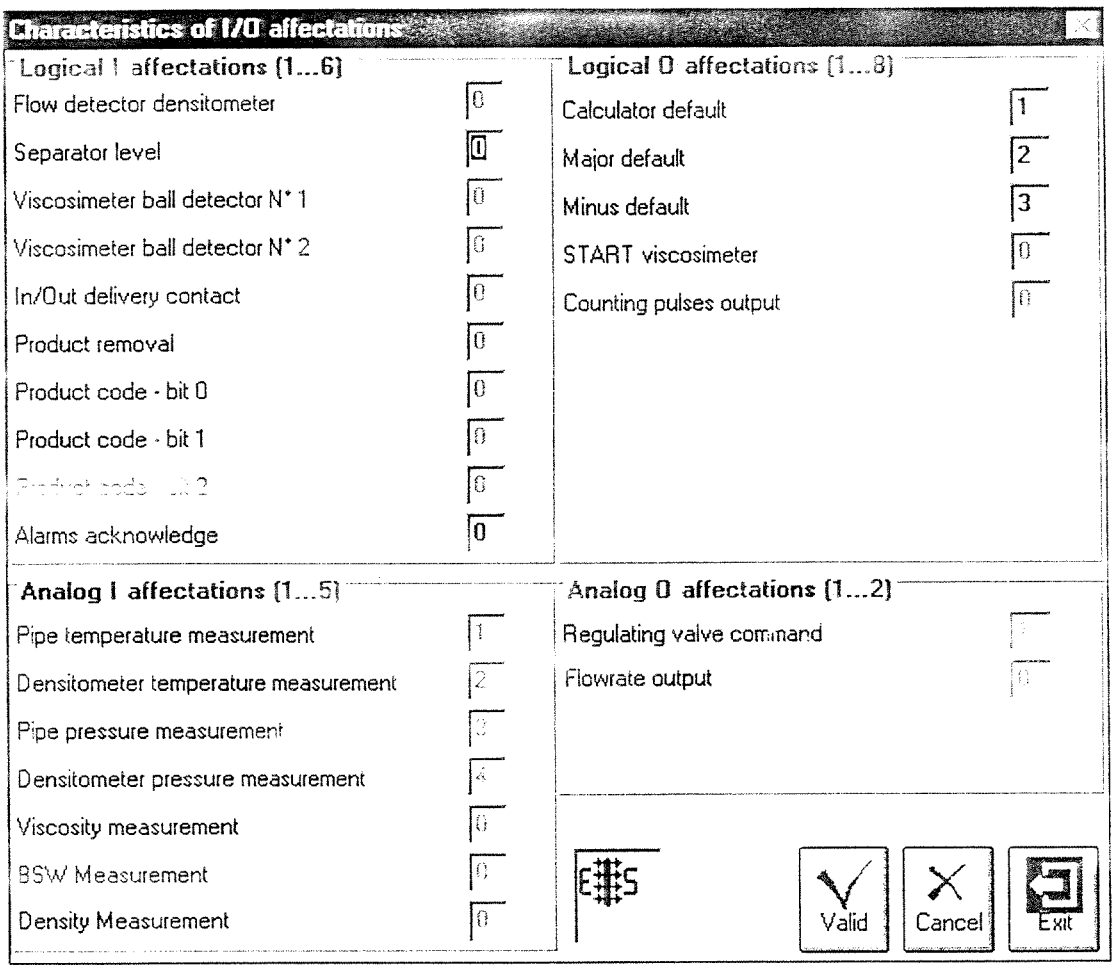
10. CHARACTERISTICS OF I / O AFFECTATIONS



➢ Logical affectation

Only two logical inputs are configurable is this view:
- separator level
- alarms acknowledge

Parameters	Associated screen
Flow detector densitometer	General parameters
Viscosimeter ball detector N°1	Measures – Viscosity – Ball fall viscosimeter
Viscosimeter ball detector N°2	Measures – Viscosity – Ball fall viscosimeter
In / Out delivery contact	Product
Product removal	Product
Product code bit 0	Product
Product code bit 1	Product
Product code bit 2	Product

Separator level

It is a associated contact with a level detector set in the low part of the condensor . It's information is provided if there is a gas pocket in the pipe.

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Alarms acknowledge
This input is used to acknowledge all the alarms.

➢ Logical O affectation

Three parameters are configurable in this screen
- Calculator default
- Major default
- Minus default

The next parameters are affected to the logical output in others screens:

Parameters	Associated screen
Start viscosimeter	Measures : Viscosity : Ball fall viscosimeter
Counting pulses output	System parameters

➢ Analogical I affectation

It is a global view of the analogical Inputs.

Parameters	Associated screen
Pipe temperature measurement	Measures : Temperature
Densitometer temperature measurement	Measures : Temperature
Pipe pressure measurement	Measures : Pressure
Densitometer pressure measurement	Measures : Pressure
Viscosity measurement	Measures : Viscosity : 4 –20 mA viscosimeter
BSW measurement	Measures : BSW : 4-20mA BSW meter
Density measurement	Measures : Density

➢ Analogical O affectation

It is a global view of the analogical Outputs.

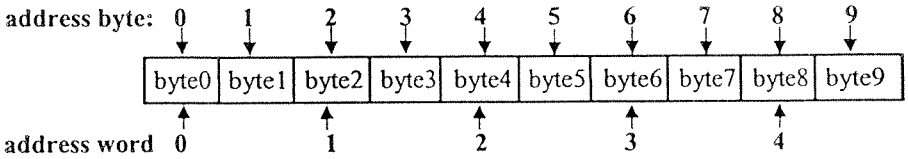
Parameters	Associated screen
Regulating valve command	General parameters : Controller data
Flow rate output	System parameters

INFORMATION ON THE MODBUS TABLE in *RTU format*

1. ACCESS TO DATA

Data can be accessed using an address byte (used by BRISTOL MECI in CIT12A)
or an address word (used by most supervisory computers)
The choice is made during the configuration of CDN12 with the CONFIGURATION program.

Example:



In the following tables can be found

Column 1: The address byte expressed in decimal
Column 2: The address byte expressed in hexadecimal
Column 3: The address word expressed en decimal

2. THE DATA STRUCTURE

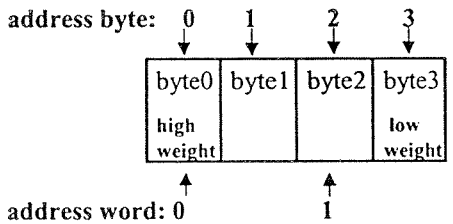
The majority of the data is available in two forms :

in ASCII format
in digital format.

The digital format used the following forms:

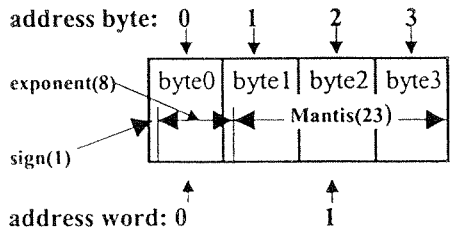
LONG: (*values:* -2147483648 à +2147483647)

A integer number stored as 4 bytes (or two words)



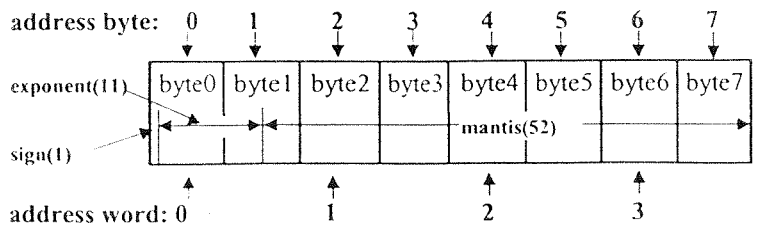
SINGLE: (*between:* 1.5e-45 .... 3.4e38 in + and - precision to 7/8 decimal places)

A real floating point number (IEEE) stored as 4 bytes (or 2 words)



DOUBLE: (*between:* 5.0e-324 .... 1.7e308 4e38 in + and - precision to 15/16 decimal places)

A real floating point number (IEEE) stored as 8 bytes (or 4 words)



3. COMMUNICATION WITH THE SUPERVISOR

The CDN12 computer is slaved to the bus
Amongst the available functions of the MODBUS protocol the CDN12 computer uses the following functions:

Function 1: Reading n bits R/W **"coils"** or **"coil status"**
Function 2: Reading n bits R **"discrete inputs"**
Function 3: Reading words R/W **"Holding register "**
Function 4: Reading words R **"Input register "**
Function 5: Writing 1 bit of type **"coils"**
Function 6: Writing 1 word of type **"Holding register "**
Function 15: Writing n bits of type **"coils"**
Function 16: Writing n words of type **"Holding register "**

The MODBUS tables present are:

Configuration zone **ASCII** (page 3), ***reading (function=4) writing only through the configuration program***
Holding register zone **ASCII** (page 7), ***read only (function=4)***
Current data zone **ASCII** (page 8), ***read only (function=4)***
Current data zone **digital** (page 9), ***read only (function=4)***
Particular data zone **ASCII** (page 10), ***read only (function=4)***
Particular data zone **digital** (page 10), ***read only (function=4)***
Balance recording zone **ASCII** (page 11), ***read only (function=4)***
Supervisory computers parameters zone **ASCII** (page 12), ***reading (function=3) and writing (function=6,16)***
Alarm bit zone (page 13), ***read only (function=2)***
Default bit zone (page14), ***read only (function=2)***
Current state of CDN12 bits zone (page 14), ***read only (function=2)***
Clearing alarm bits zone (page 15), ***reading (function=1) and writing (function=5,15)***
Status of supervisor bits zone (page 15), ***reading (function=1) and writing (function=5,15)***

CONFIGURATION ZONE ASCII

Reading (function=4) — *Writing only through the configuration program*

Address byte deci	hexa	word deci	Mnemonic	Designation	Format	bytes	Units SI	US
0000	0000	0000	NORES	network number	##	2	none	
0002	0002	0001	NOSTA	Station number in network	##	2	none	
0004	0004	0002	LIBEL	Factory identification	30 x #	30	none	
0034	0022	0017	MULTIP	Multiproduct "O" or "N"	#	1	none	
			null for even			1		
0036	0024	0018	NOPRO	Product name (if MULTIP = "N")	########	8	none	
0044	002C	0022	NBPRO	Number of product families	#	1	none	
			null for even			1		
0046	002E	0023	TNOPRO	Table of names of product families	7 x ########	56	none	
0102	0066	0051	*null*	*Spare*		40		
0142	008E	0071	NOMFIC	Name of file	########.CPT	12	none	
0154	009A	0077	GESFI	Mode of management of file "T"	#	1	none	
			null for even			1		
0156	009C	0078	MODSUP	Supervisory system ("O" or "N")	#	1	none	
			null for even			1		
0158	009E	0079	PRAF	Period of refreshment of display	###	3	s	
			null for even			1		
0162	00A2	0081	AFFI	Remote indicator	#	1	none	
			null for even			1		
0164	00A4	0082	VALAF	Value on remote indicator ('B', 'C' or 'M')	#	1	none	
			null for even			1		
0166	00A6	0083	PROD	Type de product ("B", "R", "L" or "G")	#	1	none	
			null for even			1		
0168	00A8	0084	TYGPL	Type of GPL (if PROD = "G")	#	1	none	
			null for even			1		
0170	00AA	0085	TTRAN	Type of transfer	#	1	none	
			null for even			1		
0172	00AC	0086	TTDEB	Start of segment	##:##	5	hh:mm	
			null for even			1		
0178	00B2	0089	TTDUR	Duration of storage	##	2	hh	
0180	00B4	0090	TBANC	Type of banc ("I" or "N")	#	1	none	
			null for even			1		
0182	00B6	0091	VANNE	'O': valve 'M': density 'D': flow 'N': SA not use	#	1	none	
			null for even			1		
0184	00B8	0092	SANA_I	Allocation of analogue output valve	#	1	none	
			null for even			1		
0186	00BA	0093	PVANNE	Proportional action	####	4	none	
0190	00BE	0095	INTEGRAL	Integral action	####	4	s	
0194	00C2	0097	CONSIG	Instruction for flow rate in %	###	3	none	
			null for even			1		
0198	00C6	0099	CONSIGD	Instruction for flow rate	#####	5	m^3/h	
			null for even			1		
0204	00CC	0102	SACTION	Action	#	1	none	
			null for even			1		
0206	00CE	0103	DEBB	Densitometer flow indicator	#	1	none	
			null for even			1		
0208	00D0	0104	IDCOMP	Meter identity	########	8	none	
0216	00D8	0108	K0M_REF	Table of K factors reference	7 x 5#.7#	98	$pulses/m^3$	
0314	013A	0157	K0M-CTRL	Table of K factors control	7 x 5#.7#	98	$pulses/m^3$	
0412	019C	0206	K3M	Translation factor	#.########	10	none	
0422	01A6	0211	CT	Temperature adjustment	+/-#.7#E+/-##	14	°C-1	
0436	01B4	0218	T0M	Temperature calibration	+/-###.#	6	°C	
0442	01BA	0221	CP	Pressure adjustment	+/-#.7#E+/-##	14	bar-1	
0456	01C8	0228	P0M	Pressure calibration	###.#	5	bar	
			null for even			1		
0462	01CE	0231	DEBMIN	Minimum flow rate	####.###	8	m^3/h	
0470	01D6	0235	DEBMAX	Maximum flow rate	####.###	8	m^3/h	
0478	01DE	0239	DEBPOM	Pumping threshold	####.###	8	m^3/h	
0486	01E6	0243	LIVMIN	Minimum delivery	####.###	8	m^3	
0494	01EE	0247	ECIMP_REF	Pulse deviation reference channel	###.#	5	pulses	
			null for even			1		
0500	01F4	0250	ECIMP_CTRL	Pulse deviation control channel	###.#	5	pulses	
			null for even			1		
0506	01FA	0253	EPHASE	Phase deviation	###.#	5	pulses	
			null for even			1		

Address_byte deci	Address_byte hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
0512	0200	0256	VFUITE	Leak threshold	###.##	6	m^3
0518	0206	0259	VNEUTR	Neutralization volume	###.##	6	m^3
0524	020C	0262	NBDEC	Number of decimals displayed	#	1	none
			null for even			1	
0526	020E	0263	AFF2	Value on second line of display ("V", "M")	#	1	none
			null for even			1	
0528	0210	0264	TUPMIN	Minimum pipe temperature using range	+/-###.#	6	°C
0534	0216	0267	TUPMAX	Maximum pipe temperature using range	+/-###.#	6	°C
0540	021C	0270	TTPMIN	Minimum pipe temperature technological range	+/-###.#	6	°C
0546	0222	0273	TTPMAX	Maximum pipe temperature technological range	+/-###.#	6	°C
0552	0228	0276	*null*	*spare*		8	
0560	0230	0280	EANA_T1	Allocation of analogue input pipe temperature	#	1	none
			null for even			1	
0562	0232	0281	TUDMIN	Minimum densitometer temperature using range	+/-###.#	6	°C
0568	0238	0284	TUDMAX	Maximum densitometer temperature using range	+/-###.#	6	°C
0574	023E	0287	TTDMIN	Minimum densitometer temperature technological range	+/-###.#	6	°C
0580	0244	0290	TTDMAX	Maximum densitometer temperature technological range	+/-###.#	6	°C
0586	024A	0293	*null*	*spare*		8	
0594	0252	0297	EANA_T2	Allocation of analogue input densitometer temperature	#	1	none
			null for even			1	
0596	0254	0298	DELTT	Temperature discrepancy	#.#	3	°C
			null for even			1	
0600	0258	0300	PUPMIN	Minimum pipe pressure using range	###.#	5	bar
			null for even			1	
0606	025E	0303	PUPMAX	Maximum pipe pressure using range	###.#	5	bar
			null for even			1	
0612	0264	0306	PTPMIN	Minimum pipe pressure technological range	###.#	5	bar
			null for even			1	
0618	026A	0309	PTPMAX	Maximum pipe pressure technological range	###.#	5	bar
			null for even			1	
0624	0270	0312	*null*	*spare*		8	
0632	0278	0316	EANA_P1	Allocation of analogue input pipe pressure	#	1	none
			null for even			1	
0634	027A	0317	PUDMIN	Minimum pressure densitometer using range	###.#	5	bar
			null for even			1	
0640	0280	0320	PUDMAX	Maximum pressure densitometer using range	###.#	5	bar
			null for even			1	
0646	0286	0323	PTDMIN	Minimum pressure densitometer technological range	###.#	5	bar
			null for even			1	
0652	028C	0326	PTDMAX	Maximum pressure densitometer technological range	###.#	5	bar
			null for even			1	
0658	0292	0329	*null*	*Spare*		8	
0666	029A	0333	EANA_P2	Allocation of analogue input densitometer pressure	#	1	none
			null for even			1	
0668	029C	0334	DEFTV	VP discrepancy	#.#	3	bar
			null for even			1	
0672	02A0	0336	IDTMV	Transducer identification	########	8	none
0680	02A8	0340	MVMIN	Minimum density	####.#	6	kg/m^3
0686	02AE	0343	MVMAX	Maximum density	####.#	6	kg/m^3
0692	02B4	0346	*null*	*spare*		8	
0700	02BC	0350	MVFIX	Fixed density	####.#	6	kg/m^3
0706	02C2	0353	MVDI	Density by dialogue ("O", "N")	#	1	none
			null for even			1	
0708	02C4	0354	*null*	*spare*		6	
0714	02CA	0357	MVTAB	Density by table ("O", "N")	#	1	none
			null for even			1	
0716	02CC	0358	TABMV	Table of densities	7 x ####.#	42	kg/m^3
0758	02F6	0379	K0_MV	Coefficient for calculation of density	+/-#.7#E+/-##	14	none
0772	0304	0386	K1_MV	Coefficient for calculation of density	+/-#.7#E+/-##	14	none
0786	0312	0393	K2_MV	Coefficient for calculation of density	+/-#.7#E+/-##	14	none
0800	0320	0400	K18_MV	Transducer temperature correction coefficient	+/-#.7#E+/-##	14	none
0814	032E	0407	K19_MV	Transducer temperature correction coefficient	+/-#.7#E+/-##	14	none
0828	033C	0414	T0D	Calibration temperature	#+/-###.#	6	°C
0834	0342	0417	K20A_MV	Transducer pressure correction coefficient	+/-#.7#E+/-##	14	none
0848	0350	0424	K20B_MV	Transducer pressure correction coefficient	+/-#.7#E+/-##	14	none
0862	035E	0431	K21A_MV	Transducer pressure correction coefficient	+/-#.7#E+/-##	14	none
0876	036C	0438	K21B_MV	Transducer pressure correction coefficient	+/-#.7#E+/-##	14	none
0890	037A	0445	NUFIX	Fixed viscosity	######.##	9	mm^2/s
			null for even			1	

Address byte deci	hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
0900	0384	0450	NUDI	Viscosity by dialogue ("O", "N")	#	1	none
			null for even			1	
0902	0386	0451	*null*	*spare*		10	
0912	0390	0456	NUTAB	Viscosity by table ("O", "N")	#	1	none
			null for even			1	
0914	0392	0457	TABNU	Table of viscosity	7x ######.##	70	mm^2/s
0984	03D8	0492	A_NU	Table of ASTM coefficients	7x+/-#.7#E+/-##	98	none
1082	043A	0541	B_NU	Table of ASTM coefficients	7x+/-#.7#E+/-##	98	none
1180	049C	0590	C_NU	Table of ASTM coefficients	7x+/-#.7#E+/-##	98	none
1278	04FE	0639	LINEAR	Type of correction ("Q", "F" or "K")	#	1	
			null for even			1	
1280	0500	0640	a_DNU	Table of correction coefficients viscosity (•1)	7x+/-#.7#E+/-##	98	none
1378	0562	0689	b_DNU	Table of correction coefficients viscosity	7x+/-#.7#E+/-##	98	none
1476	05C4	0738	c_DNU	Table of correction coefficients viscosity	7x+/-#.7#E+/-##	98	none
1574	0626	0787	d_DNU	Table of correction coefficients viscosity	7x+/-#.7#E+/-##	98	none
1672	0688	0836	e_DNU	Table of correction coefficients viscosity	7x+/-#.7#E+/-##	98	none
1770	06EA	0885	f_DNU	Table of correction coefficients viscosity	7x+/-#.7#E+/-##	98	none
1868	074C	0934	g_DNU	Table of correction coefficients viscosity	7x+/-#.7#E+/-##	98	none
1966	07AE	0983	NUUMIN	Minimum viscosity using range	######.##	9	mm^2/s
			null for even			1	
1976	07B8	0988	NUUMAX	Maximum viscosity using range	######.##	9	mm^2/s
			null for even			1	
1986	07C2	0993	TYPVIS	Type of viscosity ("D", "C")	#	1	none
			null for even			1	
1988	07C4	0994	*null*	*spare*		12	
2000	07D0	1000	EANA_V1	Allocate analog input for viscosity	#	1	none
			null for even			1	
2002	07D2	1001	*null*	*spare*		12	
2014	07DE	1007	NUTMIN	Minimum viscosity technological range (4 - 20 mA)	######.##	9	mm^2/s or %
			null for even			1	
2024	07E8	1012	NUTMAX	Maximum viscosity technological range (4 - 20 mA)	######.##	9	mm^2/s or %
			null for even			1	
2034	07F2	1017	BSWUMIN	Minimum BSW using range	######.##	9	%
			null for even			1	
2044	07FC	1022	BSWUMAX	Maximum BSW using range	######.##	9	%
			null for even			1	
2054	0806	1027	BSWTMIN	Minimum BSW technological range	######.##	9	%
			null for even			1	
2064	0810	1032	BSWTMAX	Maximum BSW technological range	######.##	9	%
			null for even			1	
2074	081A	1037	*null*	*spare*		12	
2086	0826	1043	EANA_V2	Allocate analog input for BSW	#	1	none
			null for even			1	
2088	0828	1044	VTMIN	Minimum time ball fall	##.###	6	s
2094	082E	1047	VTMAX	Maximum time ball fall	##.###	6	s
2100	0834	1050	VTTO	Time - out ball fall	##	2	s
2102	0836	1051	COEFVI2	Scaling coefficient , viscosity by falling ball	+/-#.7#E+/-##	14	$mm^2/s/ms$
2116	0844	1058	OFFVI2	Offset viscosity by falling ball	+/-######.##	10	mm^2/s
2126	084E	1063	ETOR_QB	Digital input channel no. Densitometer flow rate	#	1	none
			null for even			1	
2128	0850	1064	ETOR_SEP	Digital input channel no. separator level	#	1	none
			null for even			1	
2130	0852	1065	ETOR_DNU1	Digital input channel no. Viscometer ball sensor 1	#	1	none
			null for even			1	
2132	0854	1066	ETOR_DNU2	Digital input channel no. Viscometer ball sensor 2	#	1	none
			null for even			1	
2134	0856	1067	ETOR_EH	Digital input channel no. Contact NO/TRANSFER	#	1	none
			null for even			1	
2136	0858	1068	ETOR_CP	Digital input channel no. Change product	#	1	none
			null for even			1	
2138	085A	1069	ETOR_CP1	Digital input channel no. product code – low weight bit	#	1	none
			null for even			1	
2140	085C	1070	ETOR_CP2	Digital input channel no. product code	#	1	none
			null for even			1	
2142	085E	1071	ETOR_CP3	Digital input channel no. product code – High	#	1	none
			null for even			1	
2144	0860	1072	STOR_DC	Digital output channel no. calculator default	#	1	none
			null for even			1	

Address byte		word					
deci	hexa	deci	Mnemonic	Designation	Format	bytes	Unit
2146	0862	1073	STOR_DMA	Digital output channel no. major default	#	1	none
			null for even			1	
2148	0864	1074	STOR_DMI	Digital output channel no. minor default	#	1	none
			null for even			1	
2150	0866	1075	STOR_STNU	Digital output channel no. start viscometer	#	1	none
			null for even			1	
2152	0868	1076	STOR_RI	Digital output pulse output	#	1	none
			null for even			1	
2154	086A	1077	VSANA_DM	Analog output flow rate (D) or density (M)	#	1	none
2155	086B		SANA_RI	Allocation of analogue output pulse	#	1	none
2156	086C	1078	DEMI_PR	Pulse width	###	3	ms
			null for even			1	
2160	0870	1080	VITSUP	Transmission speed supervisor link	#####	5	bauds
			null for even			1	
2166	0876	1083	VITAFF	Transmission speed publication/display link	#####	5	bauds
			null for even			1	
2172	087C	1086	*null*	*spare*		2	
2174	087E	1087	V_232_1	Transmission speed 232 link No 1	#####	5	bauds
			null for even			1	
2180	0884	1090	V_232_2	Transmission speed 232 link No 2	#####	5	bauds
			null for even			1	
2186	088A	1093	V_IMP	Validate printing CTRDU on RS232 No 1 'N' :no 'O' : yes no from feed 'P' : with from feed	#	1	none
			null for even			1	
2188	088C	1094	V_PCMCIA	Validate use of PCMCIA card ("O", "N")	#	1	none
			null for even			1	
2190	088E	1095	*null*	*spare*		8	
2198	0896	1099	*reserve1*		############	14	
2212	08A4	1106	*reserve2*		############	14	
2226	18B2	1113	*reserve3*		########	8	
2234	08BA	1117	C_JETEE	"Constante de jetée" in kg or in liters	####	4	kg or liter
2238	08BE	1119	T_PREDE	Source prede 'S' :supervisor 'T' terminal	#	1	
			null for even			1	
2240	08C0	1120	*reserve3_1*		##	2	
2242	08C2	1121	VANNE_MIN	security open	##.#	4	%
2246	08C6	1123	PETIT_DEBIT	in small flow rate	####	4	m^3/h or t/h
2250	08CA	1125	*réserve6*		########	8	
2258	08D2	1129	*réserve7*		########	8	
2266	08DA	1133	TYP_MASSE	Type masse 'M' :none correction 'C' : conventionnelle	#	1	
			null for even			1	
2268	08DC	1134	*réserve8*		##	2	
2270	08DE	1135	ADRESS_SUP	Type of address supervisor mot :'M', octet :'O'	#X	2	'M' or 'O' + 'X
2272	08E0	1136	V_PREDE	Validate "prédétermination" 'O' or 'N'	#	1	
2273	08E1		TYP_PREDE	"Prédétermination " in masse 'M' in volume 'V'	#	1	
2274	08E2	1137	AFF_IMP	Affectation imp (#1)	#	1	
2275	08E3		POIDS_IMP	pulse weight (#2)	#	1	
2276	08E4	1138	*réserve11*		##	2	
2278	08E6	1139	NOVER	Version number	###	3	
			null for even			1	
2282	08EA	1141	DATVER	Version date config	##########	10	
2292	08F4	1146	MODELE	Type of configuration	########	8	
2300	08FC	1150	*checksum*		##	2	
2302	08FE	1151		System reservations		2	
2304	0900	1152	*null*	*spare*		1024	

Note: viscosity in mm^2/s

NOTE 1 : for correction of flow rate ("Q") or frequency ("F") each element in the table corresponds to a coefficient +/-#.#######E+/-

for K factor correction ("K") each element in the table contains the flow rate value #### in m^3/h and the coefficient K #.#####

Separated by 3 spaces

#1 : '1' : nb pulses * K0M * K3M '2' : gross volume '3' : net volume '4' : mass

#2 : '1' : in liter or kg '2' : en decaliter '3' : en hectoliter '4' : in m^3 or tone

HOLDING REGISTER ZONE ASCII

read only (function=4)

Address byte deci	hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
3328	0D00	1664	NORES	Network number	##	2	without
3330	0D02	1665	NOSTA	Station number	##	2	without
3332	0D04	1666	LIBEL	Personalization label	30#	30	without
3362	0D22	1681	NORD	Order number	########	8	without
3370	0D2A	1685	DATE	Storage date	##/##/####	10	jj/mm/aaaa
3380	0D34	1690	HEURE	Storage hour	##:##	5	hh:mm
			null for even			1	
3386	0D3A	1693	NOTRAN	Transfer number	########	8	without
3394	0D42	1697	CAUSE	Cause of storage	20#	20	without
3414	0D56	1707	FAM_PRO	Product family reference	########	8	without
3422	0D5E	1711	PROD	Product name	########	8	without
3430	0D66	1715	IDCOMP	Meter identify	########	8	without
3438	0D6E	1719	ID_K0M	Volumetric coefficient	4#.8#	13	L/pulse
			null for even			1	
3452	0D7C	1726	IDTMV	Densitometer identifier	########	8	without
3460	0D84	1730	INDDB	Gross volume general totalizer	8#.3#	12	m^3
3472	0D90	1736	VOLB	Gross volume reset totalizer (position of . in function of NBDEC)	#######.#	9	m^3
			null for even			1	
3482	0D9A	1741	VOLBAL	Gross volume in alarm reset totalizer (position of . in function of NBDEC)	#######.#	9	m^3
			null for even			1	
3492	0DA4	1746	VOLCAL	Gross volume in alarm reset totalizer (position of . in function of NBDEC)	#######.#	9	m^3
			null for even			1	
3502	0DAE	1751	INDDC	Net volume general totalizer	8#.3#	12	m^3
3514	0DBA	1757	VOLC	Net volume reset totalizer (position of . in function of NBDEC)	#######.#	9	m^3
			null for even			1	
3524	0DC4	1762	INDM	Mass general totalizer	8#.3#	12	t
3536	0DD0	1768	MASSE	Mass reset totalizer (position of . in function of NBDEC)	#######.#	9	t
			null for even			1	
3546	0DDA	1773	MV15M	Average base conditions density	####.#	6	kg/m^3
3552	0DE0	1776	TYTMV	Density type	##	2	without
3554	ODE2	1778	MASSEAL	Mass in alarm reset totalizer (position of . in function of NBDEC	#######.#	9	t
			null for even			1	
3564	0DEC	1782	TEMPM	Average temperature	+/-###.##	7	°C
			null for even			1	
3572	0DF4	1786	PRESM	Average pressure	###.#	5	bar
			null for even			1	
3578	0DFA	1789	TYP_MASSE	Type of mass (M): without (C): conventional	#	1	
			null for even			1	

CURRENT DATA ZONE ASCII

read only (function=4)

Address byte deci	hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
3840	0F00	1920	COMCB	Gross volume reset totalizer	########.#	9	m^3
			null for even			1	
3850	0F0A	1925	COMCBEA	Gross volume in alarm reset totalizer	########.#	9	m^3
			null for even			1	
3860	0F14	1930	COMCC	Net volume reset totalizer	########.#	9	m^3
			null for even			1	
3870	0F1E	1935	COMCCEA	Net volume in alarm reset totalizer	########.#	9	m^3
			null for even			1	
3880	0F28	1940	COMCM	Mass reset totalizer	########.#	9	m^3
			null for even			1	
3890	0F32	1945	COMCMEA	Mass in alarm reset totalizer	########.#	9	m^3
			null for even			1	
3900	0F3C	1950	VR	Scrap volume reset totalizer	########.#	9	m^3
			null for even			1	
3910	0F46	1955	DEBIT	Instantaneous gross flow rate	####	4	m^3/h
3914	0F4A	1957	DEBITC	Instantaneous net flow rate	####	4	m^3/h
3918	0F4E	1959	DEBITM	Instantaneous mass flow rate	####	4	m^3/h
3922	0F52	1961	TEMPI	Pipe temperature	+/- ###.##	7	°C
			null for even			1	
3930	0F5A	1965	TEMPI	Densitometer temperature	+/- ###.##	7	°C
			null for even			1	
3938	0F62	1969	TEMPM	Average weighted temperature	+/- ###.##	7	°C
			null for even			1	
3946	0F6A	1973	PREPI	Pipe pressure	###.#	5	bar
			null for even			1	
3952	0F70	1976	PREDI	Densitometer pressure	###.#	5	bar
			null for even			1	
3958	0F76	1979	PREPM	Average weighted pressure	###.#	5	bar
			null for even			1	
3964	0F7C	1982	MVTI	Instantaneous density	####.#	6	kg/m^3
3970	0F82	1985	MV15I	Base conditions density	####.#	6	kg/m^3
3976	0F88	1988	MV15M	Average weighted base conditions density	####.#	6	kg/m^3
3982	0F8E	1991	SORTIEV	Valve output	###	3	%
			null for even			1	
3986	0F92	1993	GREG	Regulator setpoint	######	6	% or m^3/h
3992	0F98	1996	INTEGRAL	Integral action	####	4	none
3996	0F9C	1998	P_VANNE	Proportional action	####	4	none
4000	0FA0	2000	ECART	Pulse discrepancy	#########	9	pulses
			null for even			1	
4010	0FAA	2005	VISCO_C	Cinematic viscosity	######.##	9	m^3/s
			null for even			1	
4020	0FB4	2010	VISCO_D	Dynamic viscosity	########.##	9	mPa.s
			null for even			1	
4030	0FBE	2015	TVI	Vapour pressure	##.#	5	bar
			null for even			1	
4036	0FC4	2018	ID_K0M	Volumetric coefficient	4#.8#	13	L/pulse
			null for even			1	
4050	0FD2	2025	ID_K2M	Meter flow rate correction	#.#####	7	none
			null for even			1	
4058	0FDA	2029	BSW	Basic sediment water	###.##		%
			null for even			1	
4064	0FE0	2032	PREDE	Preset volume or mass	10#	10	m^3 or t
4074	0FEA	2037	NORD	Order number	########	8	none
4082	0FF2	2041	NOTRAN	Transfer number	########	8	none
4090	0FFA	2045	ENRG_DISP	Free records on PCMCIA card	######	6	none
4096	1000	2048	PROD	Product name	########	8	none
4104	1008	2052	FREE			248	

CURRENT DATA ZONE DIGITAL

Address byte deci	hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
4352	1100	2176	COMCB	Gross volume reset totaliser	DOUBLE	8	m^3
4360	1108	2180	COMCBEA	Gross volume in alarm reset totalizer	DOUBLE	8	m^3
4368	1110	2184	COMCC	Net volume reset totalizer	DOUBLE	8	m^3
4376	1118	2188	COMCCEA	Net volume in alarm reset totalizer	DOUBLE	8	m^3
4384	1120	2192	COMCM	Mass reset totalizer	DOUBLE	8	m^3
4392	1128	2196	COMCMEA	Mass in alarm reset totalizer	DOUBLE	8	m^3
4400	1130	2200	VR	Scrap volume reset totalizer	DOUBLE	8	m^3
4408	1138	2204	DEBIT	Instantaneous gross flow rate	SINGLE	4	m^3/h
4412	113C	2206	DEBITC	Instantaneous net flow rate	SINGLE	4	m^3/h
4416	1140	2208	DEBITM	Instantaneous mass flow rate	SINGLE	4	m^3/h
4420	1144	2210	TEMPI	Pipe temperature	SINGLE	4	°C
4424	1148	2212	TEMDI	Densitometer temperature	SINGLE	4	°C
4428	114C	2214	TEMPM	Average weighted temperature	SINGLE	4	°C
4432	1150	2216	PREPI	Pipe pressure	SINGLE	4	bar
4436	1154	2218	PREDI	Densitometer pressure	SINGLE	4	bar
4440	1158	2220	PREPM	Average weithted pressure[2]	SINGLE	4	bar
4444	115C	2222	MTVI	Instantaneous density	SINGLE	4	kg/ m^3
4448	1160	2224	MV15I	Base conditions density	SINGLE	4	kg/ m^3
4452	1164	2226	MV15M	Average weithted base conditions density	SINGLE	4	kg/ m^3
4456	1168	2228	SORTIEV	Valve output	SINGLE	4	%
4460	116C	2230	CREG	Regulator setpoint	SINGLE	4	% or m^3/h
4464	1170	2232	INTEGRAL	Integral action	SINGLE	4	none
4468	1174	2234	P_VANNE	Proportional action	SINGLE	4	none
4472	1178	2236	ECART	Pulse discrepancy	SINGLE	4	pulses
4476	117C	2238	VISCO_C	Cinematic viscosity	SINGLE	4	mm^2/s
4480	1180	2240	VISCO_D	Dynamic viscosity	SINGLE	4	mPa.s
4484	1184	2242	TVI	Vapour pressure	SINGLE	4	bar
4488	1188	2244	ID_K0M	Volumetric coefficient	SINGLE	4	l/pulse
4492	118C	2246	ID_K2M	Meter flow rate correction	SINGLE	4	none
4496	1190	2248	BSW	Basic sediment water	SINGLE	4	%
4500	1194	2250	PREDE	Preset volume or mass	SINGLE	4	m^3 or t
4504	1198	2252	NORD	Order number	LONG	4	none
4508	119C	2254	NOTRAN	Transfer number	LONG	4	none
4512	11A0	2256	ENRG_DISP	Free records on PCMCIA card	LONG	4	none
4516	11A4	2258	PROD	Product name	########	8	none
2524	11AC	2262	FREE			84	

PARTICULAR DATA ZONE ASCII

read only (function=4)

Address byte deci	Address byte hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
4608	1200	2304	VERS	Software version	########	8	without
4616	1208	2308	INDB	Gross volume general totalizer	8#.###	12	m^3
4628	1214	2314	INDC	Net volume general totalizer	8#.###	12	m^3
4640	1220	2320	INDM	Mass general totalizer	8#.###	12	t
4652	122C	2326	N_ORDRE	Order balance No.	########	8	none
4660	1234	2330	*null*	*spare*		2	
4662	1236	2331	INDBAL	Gross volume in alarm general totalizer	8#.###	12	m^3
4674	1242	2337	INDCAL	Net volume in alarm general totalizer	8#.###	12	m^3
4686	124E	2343	INDMAL	Mass in alarm general totalizer	8#.###	12	t
4698	125A	2349	INDR	Scrap volume general totalizer	8#.###	12	m^3
4710	1266	2355	DATE_REC	Current date of CDN 12	##/##/####	10	jj/mm/aaaa
4720	1270	2360	HEURE_REC	Current time of CDN 12	##:##:##	8	hh:mm:ss
4728	1278	2364	IDENTMAT	Hardware identification	12#	12	none
4740	1284	2370	CODEPCMCIA	PCMCIA code	####	4	none
4744	1288	2372	FREE			120	

PARTICULAR DATA ZONE DIGITAL

Address byte deci	Address byte hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
4864	1300	2432	VERS	Software version	########	8	Without
4872	1308	2436	INDB	Gross volume general totalizer	DOUBLE	8	m^3
4880	1310	2440	INDC	Net volume general totalizer	DOUBLE	8	m^3
4888	1318	2444	INDM	Mass general totalizer	DOUBLE	8	t
4896	1320	2448	N_ORDRE	Order balance Nb	LONG	4	without
4900	1324	2450	*null*	*spare*		4	
4904	1328	2452	INDBAL	Gross volume in alarm general totalizer	DOUBLE	8	m^3
4912	1330	2456	INDCAL	Net volume in alarm general totalizer	DOUBLE	8	m^3
4920	1338	2460	INDMAL	Mass in alarm general totalizer	DOUBLE	8	t
4928	1340	2464	INDR	Scrap volume general totalizer	DOUBLE	8	m^3
4936	1348	2468	FREE			184	

BALANCE RECORD ZONE ASCII

read only (function=4)

Address byte deci	Address byte hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
5120	1400	2560	NORES	Network number	##	2	without
5122	1402	2561	NOSTA	Station number	##	2	without
5124	1404	2562	LIBEL	Personalization label	30#	30	without
5154	1422	2577	NORD	Order number	########	8	without
5162	142A	2581	DATE	Storage date	##/##/####	10	jj/mm/aaaa
5172	1434	2586	HEURE	Storage hour	##:##	5	hh:mm
			null for even			1	
5178	143A	2589	NOTRAN	Transfer number	########	8	without
5186	1442	2593	CAUSE	Cause of storage	20#	20	without
5206	1456	2603	FAM_PRO	Product family reference	########	8	without
5214	145E	2607	PROD	Product name	########	8	without
5222	1466	2611	IDCOMP	Meter identify	########	8	without
5230	146E	2615	ID_KOM	Volumetric coefficient	4#.8#	13	L/pulse
			null for even			1	
5244	147C	2622	IDTMV	Densitometer identify	########	8	without
5252	1484	2626	INDDB	Gross volume general totalizer	8#.3#	12	m^3
5264	1490	2632	VOLB	Gross volume reset totalizer (position of . in function of NBDEC)	########.#	9	m^3
			null for even			1	
5274	149A	2637	VOLBAL	Gross volume in alarm reset totalizer (position of . in function of NBDEC)	########.#	9	m^3
			null for even			1	
5284	14A4	2642	VOLCAL	Net volume in alarm reset totalizer (position of . in function of NBDEC)	########.#	9	m^3
			null for even			1	
5294	14AE	2647	INDDC	Net volume general totalizer	8#.3#	12	m^3
5306	14BA	2653	VOLC	Net volume reset totalizer (position of . in function of NBDEC)	########.#	9	m^3
			null for even			1	
5316	14C4	2658	INDM	Mass general totalizer	8#.3#	12	t
5328	14D0	2664	MASSE	Mass reset totalizer (position of . in function of NBDEC)	########.#	9	t
			null for even			1	
5338	14DA	2669	MV15M	Average basis conditions density	####.#	6	kg/ m^3
5344	14E0	2672	TYTMV	Density type	##	2	without
5346	14E2	2673	MASSEAL	Mass in alarm reset totalizer (position of . in function of NBDEC)	########.#	9	t
			null for even			1	
5356	14EC	2678	TEMPM	Average temperature	+/-###.##	7	°C
			null for even			1	
5364	14F4	2682	PRESM	Average pressure	###.#	5	bar
			null for even			1	
5370	14FA	2685	TYP_MASSE	Type of mass (M): without (C): conventional	#	1	
			null for even			1	

SUPERVISORY COMPUTERS PARAMETERS ZONE ASCII

reading (function=3) and writing (function=6,16)

Address byte deci	hexa	word deci	Mnemonic	Designation	Format	bytes	Unit
5632	1600	2816	NORD	Order number (find recording)	########	8	without-
5640	1608	2820	DATE	Date (find recording)	##/##/####	10	jj/mm/aaaa
5650	1612	2825	DATE_REC	Date (clock reset)	##/##/####	10	jj/mm/aaaa
5660	161C	2830	HEURE_REC	Time (clock reset)	##:##:##	8	hh/mm/ss
5668	1624	2834	NOTRAN	Transfer number	########	8	without
5676	162C	2838	IN_PROD	Index of product family	#	1	without
			null for even			1	
5678	162E	2839	NOM_PRO	Product name	########	8	without
5686	1636	2843	MV15	Base conditions density of product	####.#	6	kg/m^3
5692	163C	2846	VISCO	Cinematic viscosity	######.##	9	cSt
			null for even			1	
5702	1646	2851	BSW	Basic sediment water	###.##	6	%
5708	164C	2854	CD	Flow rate setpoint	#####	5	m^3/h
			null for even			1	
5714	1652	2857	SR	Regulator output	###	3	%
			null for even			1	
5718	1656	2859	VAM	Auto or manu valve control	#	1	without
			null for even			1	
5720	1658	2860	INTEGRALE	Integral action	####	4	second
5722	165A	2861	PREDE_M	"Prédétermination" in masse	##########	10	t
5724	165C	2862	GAIN	Proportionnal action	####	4	without
5728	1660	2864	PREDE_M	Mass preset	10#	10	t
5738	166A	2869	PREDE_V	Volume preset	10#	10	m^3
5748	1674	2874	FREE			140	

ALARM BIT ZONE

read only (function=2)

Address byte deci	hexa		Mnemonic	Designation	Format	bytes	Unit
5888	1700		TAB_AL	Memory checksum	#	1	none
5889	1701			Program checksum	#	1	none
5890	1702			Power supply	#	1	none
5891	1703			Watch - dog	#	1	none
5892	1704			Storage medium - Absent, incompatible or protected	#	1	none
5893	1705			Internal storage	#	1	none
5894	1706			External storage	#	1	none
5895	1707			Storage unbalanced (external key)	#	1	none
5896	1708			Risk of overwriting internal legal data	#	1	none
5897	1709			Risk of overwriting external legal data	#	1	none
5898	170A			End of capacity internal medium	#	1	none
5899	170B			End of capacity external medium	#	1	none
5900	170C			Metering	#	1	none
5901	170D			Phase	#	1	none
5902	170E			Leakage	#	1	none
5903	170F			Display	#	1	none
5904	1710			Technological pipe temperature	#	1	none
5905	1711			Technological densitometer temperature	#	1	none
5906	1712			Pipe temperature range	#	1	none
5907	1713			Densitometer temperature range	#	1	none
5908	1714			Temperature discrepancy	#	1	none
5909	1715			Technological pipe pressure	#	1	none
5910	1716			Technological densitometer pressure	#	1	none
5911	1717			Pipe pressure range	#	1	none
5912	1718			Densitometer pressure range	#	1	none
5913	1719			VP discrepancy	#	1	none
5914	171A			Technological density	#	1	none
5915	171B			Density range	#	1	none
5916	171C			Under flow rate	#	1	none
5917	171D			Excess flow rate	#	1	none
5918	171E			Technological viscosity	#	1	none
5919	171F			Technological BSW	#	1	none
5920	1720			Viscosity range	#	1	none
5921	1721			BSW range	#	1	none
5922	1722			Calculate viscosity	#	1	none
5923	1723			Low level	#	1	none
5924	1724			Densitometer flow rate	#	1	none
5925	1725			File full	#	1	none
5926	1726			Product unknown	#	1	none
5927	1727			Calculate VCF not in table	#	1	none
5928	1728			no "prédétermination"	#	1	none
5929	1729			no Indicator of post	#	1	none
5930	172A			FREE		213	

DEFAULT BIT ZONE

read only (function=2)

Address byte deci	hexa		Mnemonic	Designation	Format	bytes	Unit
6144	1800		TAB_DF	Memory checksum	#	1	none
6145	1801			Program checksum	#	1	none
6146	1802			Power supply	#	1	none
6147	1803			Watch - dog	#	1	none
6148	1804			Storage medium - Absent, incompatible or protected	#	1	none
6149	1805			Internal storage	#	1	none
6150	1806			External storage	#	1	none
6151	1807			Storage unbalanced (external key)	#	1	none
6152	1808			Risk of overwriting internal legal data	#	1	none
6153	1809			Risk of overwriting external legal data	#	1	none
6154	180A			End of capacity internal medium	#	1	none
6155	180B			End of capacity external medium	#	1	none
6156	180C			Metering	#	1	none
6157	180D			Phase	#	1	none
6158	180E			Leakage	#	1	none
6159	180F			Display	#	1	none
6160	1810			Technological pipe temperature	#	1	none
6161	1811			Technological densitometer temperature	#	1	none
6162	1812			Pipe temperature range	#	1	none
6163	1813			Densitometer temperature range	#	1	none
6164	1814			Temperature discrepancy	#	1	none
6165	1815			Technological pipe pressure	#	1	none
6166	1816			Technological densitometer pressure	#	1	none
6167	1817			Pipe pressure range	#	1	none
6168	1818			Densitometer pressure range	#	1	none
6169	1819			VP discrepancy	#	1	none
6170	181A			Technological density	#	1	none
6171	181B			Density range	#	1	none
6172	181C			Under flow rate	#	1	none
6173	181D			Excess flow rate	#	1	none
6174	181E			Technological viscosity	#	1	none
6175	181F			Technological BSW	#	1	none
6176	1820			Viscosity range	#	1	none
6177	1821			BSW range	#	1	none
6178	1822			Calculate viscosity	#	1	none
6179	1823			Low level	#	1	none
6180	1824			Densitometer flow rate	#	1	none
6181	1825			File full	#	1	none
6182	1826			Product unknown	#	1	none
6183	1827			Calculate VCF no in table	#	1	none
6184	1828			no "prédétermination"	#	1	none
6185	1829			no Indicator of post	#	1	none
6186	182A			FREE		213	

CURRENT STATE of CDN12 BITS ZONE

read only (function=2)

Address byte deci	hexa		Mnemonic	Designation	Format	bytes	Unit
6400	1900		ENPRET	Recording ready	#	1	none
6401	1901		ENINCONNU	Recording unknown or erroneous	#	1	none
6402	1902		*null*	*spare*		14	none
6416	1910		HT_SF	No transfer no leakage	#	1	none
6417	1911		HT_EF	No transfer leakage	#	1	none
6418	1912		ET_HP	Transfer not pumping	#	1	none
6419	1913		ET_EP	Transfer pumping	#	1	none
6420	1914		DPRETE	Data ready (balance)	#	1	none
6421	1915		EREG	Control state (0 = M / 1 = A)	#	1	none
6422	1916		ALA_MAJ	Alarm major	#	1	none
6423	1917		ALA_MIN	Alarm major	#	1	none
6424	1918		CON_FAC	Connection by front panel	#	1	none
6425	1919		PREDE_ATTE	"Prédétermination" finish	#	1	none
6426	191A		LIBRE			230	

CLEARING ALARM BITS ZONE

reading (function=1) and writing (function=5,15)

Address byte deci	hexa		Mnemonic	Designation	Format	bytes	Unit
6656	1A00		TAB_ACQ	Memory checksum	#	1	none
6657	1A01			Program checksum	#	1	none
6658	1A02			Power supply	#	1	none
6659	1A03			Watch - dog	#	1	none
6660	1A04			Storage medium - Absent, incompatible or protected	#	1	none
6661	1A05			Internal storage	#	1	none
6662	1A06			Internal storage	#	1	none
6663	1A07			Storage unbalanced (external key)	#	1	none
6664	1A08			Risk of overwriting internal legal data	#	1	none
6665	1A09			Risk of overwriting external legal data	#	1	none
6666	1A0A			End of capacity internal medium	#	1	none
6667	1A0B			End of capacity external medium	#	1	none
6668	1A0C			Metering	#	1	none
6669	1A0D			Phase	#	1	none
6670	1A0E			Leakage	#	1	none
6671	1A0F			Display	#	1	none
6672	1A10			Technological pipe temperature	#	1	none
6673	1A11			Technological densitometer temperature	#	1	none
6674	1A12			Pipe temperature range	#	1	none
6675	1A13			Densitometer temperature range	#	1	none
6676	1A14			Temperature discrepancy	#	1	none
6677	1A15			Technological pipe pressure	#	1	none
6678	1A16			Technological densitometer pressure	#	1	none
6679	1A17			Pipe pressure range	#	1	none
6680	1A18			Densitometer pressure range	#	1	none
6681	1A19			VP discrepancy	#	1	none
6682	1A1A			Technological density	#	1	none
6683	1A1B			Density range	#	1	none
6684	1A1C			Under flow rate	#	1	none
6685	1A1D			Excess flow rate	#	1	none
6686	1A1E			Technological viscosity	#	1	none
6687	1A1F			Technological BSW	#	1	none
6688	1A20			Viscosity range	#	1	none
6689	1A21			BSW range	#	1	none
6690	1A22			Calculate viscosity	#	1	none
6691	1A23			Low level	#	1	none
6692	1A24			Densitometer flow rate	#	1	none
6693	1A25			File full	#	1	none
6694	1A26			Product unknown	#	1	none
6695	1A27			Calculate VCF no in table	#	1	none
6696	1A28			no " prédétermination"	#	1	none
6697	1A29			no Indicator of post	#	1	none
6698	1A2A			FREE		213	

STATUS of SUPERVISOR BITS ZONE

reading (function=1) and writing (function=5,15)

Address byte deci	hexa		Mnemonic	Designation	Format	bytes	Unit
6912	1B00		DEMENRINT	Internal memory read request	#	1	without
6913	1B01		DEMENREXT	External memory read request	#	1	without
6927	1B02		*null*	*spare*		14	without
6928	1B10		DSFUITE	Leakage balance request	#	1	without
6929	1B11		DDET	Tranfer request	#	1	without
6930	1B12		DDHT	No transfer request	#	1	without
6931	1B13		DDENRG	Recording request (operator)	#	1	without
6932	1B14		DSOLDE	Data read (balance)	#	1	without
6933	1B15		DDCDH	Change date / hour request	#	1	without
6934	1B16		FINLEC	End of reading (balance or reading)	#	1	without
6935	1B17		CHA_PRO	Product change	#	1	without
6936	1B18		CHA_PARAM	Parameters change	#	1	without
6936	1B18		FREE			231	

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