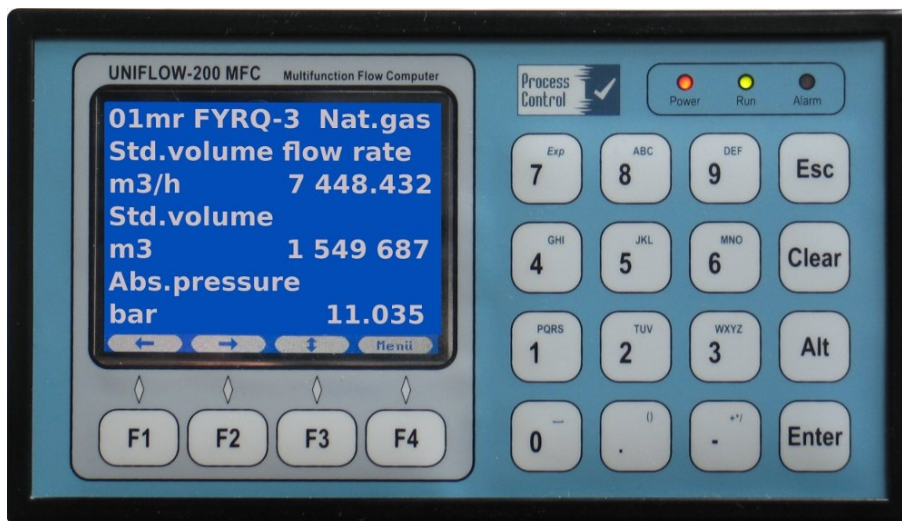


# UNIFLOW-200 MFC



## Flow Computer

for closed conduit and open channel flow measurement

## Instruction manual

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# 1 About this manual

This manual introduces the UNIFLOW-200 multifunction flow computer. It describes the installation procedure and shows how to operate the system including entering and modifying data. Basic maintenance and troubleshooting information is also provided.

The information in this manual is arranged as follows:

**Section 2 – Introduction** provides an overview of the UNIFLOW-200 including the list of metering standards, fluids and flow meters available in the flow computer for configuration.

**Section 3 – Technical specification** contains a complete list of physical, performance, and environmental specifications of the UNIFLOW-200.

**Section 4 – Plug-in boards and hardware operation** provides the list of I/O boards available for selection together with their I/O channel capabilities. This section consists of the short description of the hardware operation of the flow computer.

**Section 5 – Installation and wiring** provides instruction on installing the UNIFLOW-200. It describes the field wiring configurations.

**Section 6 – Basic operation** shows how to use the UNIFLOW-200. This includes keypad functions, screen displays, system initialization, display navigation, data entry, and printing reports.

**Section 7 – Maintenance and troubleshooting** provides maintenance and troubleshooting information, including the basic board-level test procedures.

**Section 8 – Support** describes the software tools provide for the convenience of operation of the UNIFLOW-200.

**Section 9 – Detailed operation – The menu tree** describes in depth the menu structure of the UNIFLOW-200. It guides through the steps required to setup the UNIFLOW-200 for a particular flow measurement task. It gives the full list of options available for selection in the setup procedure.

**Section 10 – Alarms and events** describes the full list of alarms and events that may appear in the alarm and event files.

**Section 11 – Communication** describes the communication capabilities of the UNIFLOW-200.

**Annex A – Reports** gives examples of the periodic reports available in the UNIFLOW-200 for uploading and printing.

**Annex B – Drawings** includes the drawings.

**Annex C – Application note** for HTI4x15 I/O board

## 2 Introduction

UNIFLOW-200 multifunction flow computer is designed to measure flow of fluids flowing in closed conduits (gas, liquid, water and steam) and open channel (water). The flow computer performs the data processing and displaying function in the flow metering system. The flow computer calculates the uncorrected and corrected volume, mass and energy flow rate of the fluid. It totalizes the uncorrected and corrected volume, mass and energy for the accounting periods.

The flow computer was designed to provide cost effective solution for multi stream applications. Benefits of the flow computer allowing remarkable cost reduction comparing to the single stream flow computers:

- sharing of the transmitters between metering streams is possible;
- PRT sensors can be connected directly to the flow computer; no temperature transmitter is required;
- power supply output for transmitters is provided; no separate power supply units required;
- additional I/O modules expand the metering capability of the flow computer with moderated additional cost only;
- flexible communication capabilities allows easy system integration.

The manufacturer Process Control Kft. provides support for the end users to integrate the flow computer into metering systems and into data acquisition and process visualization systems. The manufacturer also can provide complete solution for flow metering task, including the design, manufacturing and implementation if required.

Flow meters that can be selected in the flow computer and the standards related

- pressure differential devices;
  - orifice plate, nozzle, Venturi tube (ISO 5167, edition 1991, 1998 or 2003, GOST 8.563-97, GOST 8.586-2005, AGA3)
  - V-Cone meter (according to manufacturer's method);
  - Annubar (according to manufacturer's method);
  - segmental orifice plate;
  - conditioning orifice plate.
- flow meters with linear output signal;
  - turbine meter;
  - Vortex meter;
  - electromagnetic flow meter;
  - ultrasonic flow meter;
  - mass flow meter;
  - corrected volume flow meter.
- flow meters with nonlinear output signal;
  - rotameter;
  - flow meter with power characteristic.

Fluids that can be selected in the flow computer together with fluid properties calculation

- hydrocarbon gas mixtures (natural gas, coke oven gas, blast furnace gas);
- pure gases (air, nitrogen, oxygen, argon, carbon-monoxide, ethylene, ammonia, propane, general gas)
- steam and hot water as energy supply fluids;
- liquids (crude oil, refined products, lubricating oil, NGL & LPG, UGC, SHL, WFLH, ethanol, general liquid, liquid mixture);

Standards and procedures for fluid properties calculation

- hydrocarbon mixtures
  - compression factor
    - AGA8 (edition 1985 and 1992) detailed and gross methods;AGA NX19;
    - GOST 30319 (GERG91mod, NX19mod, VNIC SMV).
  - calorific values, relative density and base density
    - ISO 6976 (edition 1995), GOST 30319-1, AGA5, GPA 2172-09.
  - dynamic viscosity and isentropic exponent
    - GOST 30319, ISO 20765-1
  - Joule-Thomson coefficient
    - ISO 20765-1, ISO TR 9464
  - gas composition
    - read on-line from a gas chromatograph,
    - downloaded from a supervisory system,
    - fixed value.
- pure gases
  - compression factor, dynamic viscosity and isentropic exponent
- crude oil and refined products
  - temperature volume correction factors
    - ASTM D1250-80/API 2540 Table 23/24A,B,C, Table 53/54A,B,C
    - MPMS Chapter 11.1-2004 (2007)
    - MPMS Chapter 11.2.4-2007 (Tables 23/24E, 53/54E, 59/60E, GPA TP-27)
    - STO Gazprom 5.9 Annex B.1, B.2, B.3
  - pressure volume correction factors
    - API MPMS Chapter 11.2.1M and 11.2.2M
    - API MPMS Chapter 11.2.1 and 11.2.2
    - STO Gazprom 5.9 Annex B.1, B.2, B.3
- steam and water
  - physical properties
    - Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam (IAPWS-IF97)
- ethanol
  - physical properties
    - Council Directive 76/766/EEC
    - Horst Bettin, Frank Spieweck: A Revised Formula for the Calculation of Alcoholometric Tables. PTB-Mitteilungen 100 6/90

UNIFLOW-200 is a Gas-volume electronic conversion device complying with EN 12405 and OIML R140. The UNIFLOW-200 is approved as Calculator for Dynamic measuring system for liquids other than water according to OIML R 117-1. The UNIFLOW-200 calculates the CO<sub>2</sub> emission for gaseous and liquid fuels according to 2007/589/EC and IPCC 1996.

UNIFLOW-200 is capable to provide flow computer function for maximum of 8 metering streams. In other words: in one UNIFLOW-200 we have 8 independent flow computers.

In general each metering stream has the input signals as follows:

- flow meter signal
- signals for correction (pressure, temperature, density, gas composition, etc.)

Depending on the application one single signal for correction can be assigned to several metering streams. If there is no transmitter for a particular signal for correction the flow computer will use a fixed value for that signal.

In case of signal failure the flow computer reverts to the fixed value of that signal and this value will be used in the flow calculation.

Beside the 8 physical metering streams the flow computer is capable to provide 4 virtual metering streams. The virtual metering streams are to produce data from the flow rates of the physical metering streams. The virtual streams can be configured to give sum, difference, product or ratio (or their combination) of the physical streams. It can be used to setup a simple energy balance for a small group of consumers.

For more complex energy systems Process Control Kft. can provide a PC based software package to implement energy balance with data processing, process visualization, trend and archiving as requested.

The accuracy of the flow measurement is a key issue. UNIFLOW-200 high precision inputs, the implementation of the latest editions of the flow metering standards provide minimum contribution of the flow computer in the uncertainty budget of the metering system.

Utilization of the digital communication with the flow meters and transmitters can further reduce the overall uncertainty of the measurement.

## 3 Technical specification

### 3.1 General features

- high capacity 32-bits microprocessor
- modular design, up to 5 I/O boards
- up to 8 physical metering streams
- up to 4 virtual metering streams
- flow meters: orifice plate, nozzle, Venturi tube, segmental orifice plate, Annubar, V-Cone meter, turbine meter, Vortex meter, ultrasonic meter, electromagnetic meter, mass flow meter, rotameter, meter with power characteristic
- fluids: gas, liquid and water steam
- mode of operation: metering mode, configuration mode, test mode
- configuration: from keypad, via serial link, via ethernet link
- password protected parameters, audit trial log
- parameters and totals integrity protection: non volatile memory
- archiving: hourly, shift, daily, multi-day and monthly totals and averages for 400 days
- operator interface: alphanumerical and graphical display
- RS232, RS485, RS422 serial links, 10/100 Ethernet and USB interface
- stream independent signal processing
- high reliability, no battery, no potentiometers
- support: **U200ToolBox** configuration and remote archive uploader software

### 3.2 Technical data

#### Analog inputs

- symmetrical inputs with galvanic isolation
- input range 0-20 mA / 4-20 mA (operator selectable)
- accuracy  $\pm 0,02\%$
- potential drop on input 5,4 V max. per 20mA (100  $\Omega$  + protection)
- equivalent input impedance 270 ohm (100  $\Omega$  + protection)
- potential diff. among inputs 50 V max.

#### PRT/RTD inputs

- sensor type 100, 50, 500 or 1000 ohms PRT standard or individually calibrated
- connection 4-wire
- accuracy  $\pm 0,03\text{ }^{\circ}\text{C}$
- maximum loop resistance 3 kohms
- excitation current 1 mA



**Pulse/frequency inputs**

- Signal type (operator selectable)
  - open collector, potential-free contact - powered from UNIFLOW-200, 12 V/3 mA
  - active signal (externally powered) – square, unipolar
    - 5 V – max. 5 V, signal level change min. 2 V
    - 15 V – max. 15 V, signal level change min. 5 V
  - NAMUR
    - powered from UNIFLOW-200, 8,2 V,
    - input impedance 1 k $\Omega$ ,
    - signal level change, min. 1,5 mA.
- frequency range 0...10000 Hz
- signal form square, unipolar
- signal counting without loss of pulses
- Uncertainty of frequency measurement 0.001 % max.

**Digital inputs**

- potential-free contacts, open collector inputs (transistor) or 24 VDC inputs accepted and used as:
  - static inputs, or
  - pulse inputs (frequency: 100 Hz max., 50 % fill in ratio)
- internal power supply for potential-free inputs: 12 VDC, 6,8 kohm

**Analog outputs**

- output channels with individual galvanic isolation
- current range 0-20 mA / 4-20 mA (operator selectable)
- resolution 12 bits
- load 500 ohm max.

**Digital outputs**

- galvanically isolated open collector (transistor), overvoltage- and overcurrent-protected outputs
- type of outputs
  - dual state static signal
    - flow rate limits
    - analog input limits
    - repeating dual state input signal with negation/delay
    - common alarm output
  - pulse signal
    - pulse output proportional to totals
    - time base
      - Max. frequency: 100 Hz,
      - On/off time duration min. 10 msec
- load 100 mA, 40 Vdc max.

**Digital communication**

- serial links                      overvoltage- and overcurrent-protected
  - mode                              RS232/RS485/RS422 (operator selectable)
  - baud rate                        1200...38400 baud (operator selectable)
  - protocol                         Modbus ASCII and RTU
  - maximum cable length      RS232                              15 m
  - RS485/RS422                      1200 m
- 10/100 Ethernet                protocol: Modbus TCP
- USB 1.1 port                    standard-A receptacle, for data saving to pendrive

**Hot/stand-by interface**

- flow computer status output (to stand-by unit)  
change-over voltage-free contact, maximum load: 100 V, 100 mA
  - operating                        closed contact (NO)
  - fault                              opened contact (NC)
- flow computer status input (from hot unit)  
potential-free contact, open collector inputs (transistor) or 24 VDC input
  - sense                             sensing input

**Keyboard**

- foil protected membrane keyboard

**Display**

- 3,5" QVGA (320 x 240) backlit TFT color LCD

**Performance specification****Maximum Permissible Error (MPE)**

- $\pm 0,03 \%$                       OIML R117, Class 0,3
- $\pm 0,2 \%$                         EN 12405

**Uncertainty**

- $\pm 0,05 \%$                       at reference conditions (+20 °C)
- $\pm 0,005 \%/10^{\circ}\text{C}$             ambient temperature effect

**Operating conditions**

- operating temperature        -10...+60 °C
- operating humidity            10...90 % non-condensing
- EMC                                complies with EU EMC regulation
- storage temperature           -25...+70 °C

**Power requirements**

- power supply 230 VAC +10 %/-15 %, 50 Hz +/-3 Hz  
24 VDC nominal, 20 VDC ... 35 VDC
- power consumption 25 VA max. (depending on the hw configuration)
- transmitter power (output) 1 x 24 Vdc, 200 mA max.

**Case and mounting**

Panel mounted version

- front panel 196 mm W x 110 mm H
- case depth 272 mm
- minimum cabinet depth 320 mm
- panel cutout 186 mm W x 91 mm H
- weight 4.3 kg
- protection IP20
- prepared for sealing
- plug-in connectors
  - 230 V power supply IEC60320 C14 chassis plug
  - 24 VDC plug-in screw terminal
  - input/output signals 25-pin DSUB connector (female)
  - serial links 9-pin DSUB connector (male)
  - 10/100 ethernet RJ45 UTP
  - USB host and device Standard-A receptacle
  - flow computer status plug-in screw terminal

**Protection against electrical shock** Class I (EN 61140)**Certificates**

- EC-type examination certificate MKEH (OMH) TH-8543/3/2008 (EN 12405-1:2005)  
TH-8614/2/2011 (OIML R 117 Class 0,3)
- EMC conformance certificate MEEI M5 2692542 01

**3.3 Accessories**

List of accessories supplied with UNIFLOW-200

25-pin DSUB connector (male)	1 .. 5*
9-pin DSUB connector (female)	1 .. 3**
230 V power cord (2 meters)	1
Fastener for mounting	4
Fastener screw	4
Fuse	1 set
Instruction manual	1

\* Depends on the number of I/O boards fitted

\*\* Depends on the number of serial links fitted

#### 4 Plug-in boards and hardware operation

The modular design of the flow computer allows flexible combination of the I/O board to suit different applications.

The flow computer consists of the modules as listed below:

- mother board part of the base unit
- front panel with keypad and display part of the base unit
- power supply unit part of the base unit
- CPU board part of the base unit
- I/O boards application dependent
- serial extension module application dependent

The maximum number of I/O boards that can be installed is five. The maximum number of metering streams (8) can be defined only if the total number of input and output channels is covered by the properly selected five I/O boards. Otherwise more than one UNIFLOW-200 should be installed.

The base unit provides communication interfaces as listed below:

- serial link (RS232/RS485/RS422) 1
- USB host 1
- 10/100 Ethernet 1

## 4.1 Plug-in boards

The available I/O boards listed in the table below:

I/O board name	Number of channels	Signal	Remark
ANI8	8 1	4-20 (0-20) mA current input 24 VDC/200 mA transmitter power	selectable
ANI4PT2	4 2 1	4-20 (0-20) mA current input PRT/RTD input 24 VDC/200 mA transmitter power	selectable 4-wire connection
PT4	4	PRT/RTD input	4-wire connection
PDIO484	4 8 4	pulse/frequency input digital (contact) input digital (open collector) output	high level (active or passive) active or passive, stat. or pulse static or pulse
AODIO484	4 8 4	4-20 (0-20) mA current output digital (contact) input digital (open collector) output	selectable active or passive, stat. or pulse static or pulse
DE4	4	DE protocol input for single function (SF) or multi function (MF) transmitter with 24 VDC transmitter power supply	2 off MF and 1 off SF or 4 off SF transmitter
HTI4x15	60	HART communication input in multidrop or broadcast mode 4 independent loops. 15 PV per loops	The loops are isolated if external power supply is used

### Table 4-1 I/O board types

The available communication interfaces listed in the table below:

Communication module	Type	Remark
Com1 port	universal serial port	part of the base unit on the CPU board RS232/RS485/RS422 – selectable
SE module	serial extension module	additional com2 and com3 ports RS232/RS485/RS422 – selectable
10/100 port	10/100 baseT Ethernet interface	part of the base unit on the CPU board
USP port	USB 1.1 host	part of the base unit on the CPU board

**Table 4-2 Communication interfaces**

## 4.2 Hardware operation

The flow computer is built on the basis of the ATMEL ATM9200...ARM microprocessor.

The application software of the flow computer runs under the UX200 operating system.

The operating system and the application software are stored in the compact flash memory (PCMCIA device). The boot program is stored in data flash memory. The calculation data are saved periodically into I<sup>2</sup>C flash.

All the parameters, calculation data and archive data are stored in flash memory so that the data are retained in case of power failure.

The working memory of the flow computer is 32 MB SDRAM.

The real time clock chip (DALLAS DS12887) provides the time and date for the operation. It provides also 500 ms interrupts for the processor to synchronize the calculation cycles. The clock chip has its own built-in lithium battery providing independent operation from the external power.

The human – machine interface of the flow computer is the 320x240 dots backlit color LCD and the foil protected membrane keyboard.

There are three LEDs on the front panel.

The POWER LED indicates the presence of power supply.

The RUN LED indicates the normal operation of the flow computer.

The ALARM LED indicates the alarm status.

The Com1, Com2, Com3 serial ports provide asynchrony communication links to other devices. All of them can be configured as RS23 or RS485 or RS422 port. The parameters of the ports are operator selectable.

The 10/100 BaseT Ethernet port allows to connect the flow computer to the LAN or WAN. The parameters of the Ethernet port (IP address, subnet mask, default gateway) are operator selectable. The Ethernet port can be configured to provide DHCP function.

The USB port is provided for easy transfer of the archive data files to pen drive.

The flow computer can accommodate up to five I/O boards for field signal connection. It is recommended to install the I/O boards in the numbered slots starting from one. The type of the I/O boards is recognized automatically by the CPU board.

The status of the flow computer (normal operation or in error) is signaled with a dual state double pole voltage free contact. The state of the contact and the state of the RUN LED are synchronized. See details in the section [9.3.3](#)

The power supply unit provides two independent groups of voltages for the flow computer operation. The voltages are isolated by DC/DC converters for high noise immunity. The voltages are:

- TTL level voltage
  - +5 V (Vcc) to supply the digital circuits
  - prediction of power failure to provide
    - smooth program stopping and
    - finishing the data saving process
- voltage for analogue circuits
  - +24 V for transmitter power supply
  - +/-15 V to supply the analogue circuits

The I/O boards include also DC/DC converters to isolate the field input signals and the communication interfaces from the internal circuits.

The flow computer can be powered from:

- 230 V 50 Hz or
- 24 V DC

power source. Both power sources can be connected simultaneously. If power exists on both power inputs then the flow computer takes power from the 230 V 50 Hz inputs. If the power fails on this input then the flow computer automatically switch to the 24 VDC power input. The power switch over will not affect the operation of the flow computer.

To assure high reliability and low maintenance no potentiometers and no batteries are installed in the flow computer.

## 5 Installation, wiring and start-up

UNIFLOW-200 flow computer is designed for panel mounting. Its outer case is made of painted welded steel list to provide magnetic screening.

The mechanical structure of the flow computer is constructed in such a way that after loosening the two fixing screws on the back side of the unit the complete internal can be pulled out from the front. The terminals and the sockets for the signal connections and the fuse holders are located on the backplane of the unit.

The base unit consists of 4 PCBs, the mother board, the front panel, the power supply and the CPU. The front panel connects to the mother board with flat ribbon cable. The CPU board and the power supply are connected to the mother board with multi-pin sockets. There are 5 off 64-pin sockets on the mother board to accommodate the I/O boards for field signals. The field signals are connected to the 25-pin DSUB sockets located at the rear edge of the I/O boards.

### 5.1 Installation

Installation of the UNIFLOW-200 must conform to all applicable local codes and regulations. All installation procedures should be in accordance with normal practices of good workmanship.

The UNIFLOW-200 panel mount is designed for use within the control room and should be placed in a position that provides ease of use, comfort, and safety for operators and maintenance personnel. The optimum height for viewing and using the display and keypad is at operator eye level.

#### CAUTION

Where one or more units are installed in a confined space or with other heat producing equipment, special attention should be given to the combined heating effect. This combined heat could increase the environmental temperature beyond its acceptable threshold impacting performance.

Prepare the requested cut out in the panel for mounting. Refer to the drawing in the Annex B. Panel thickness should be at least 3 mm to prevent distortion.

Carefully slide the UNIFLOW-200 into the cut out. Secure the unit in the panel by means of the four fastener supplied with the unit.

## 5.2 Wiring

All local wiring practices and regulations should be observed performing the wiring.

The connectors and terminals accepting external wiring are located on the backplane of the flow computer as shown on the figure below.

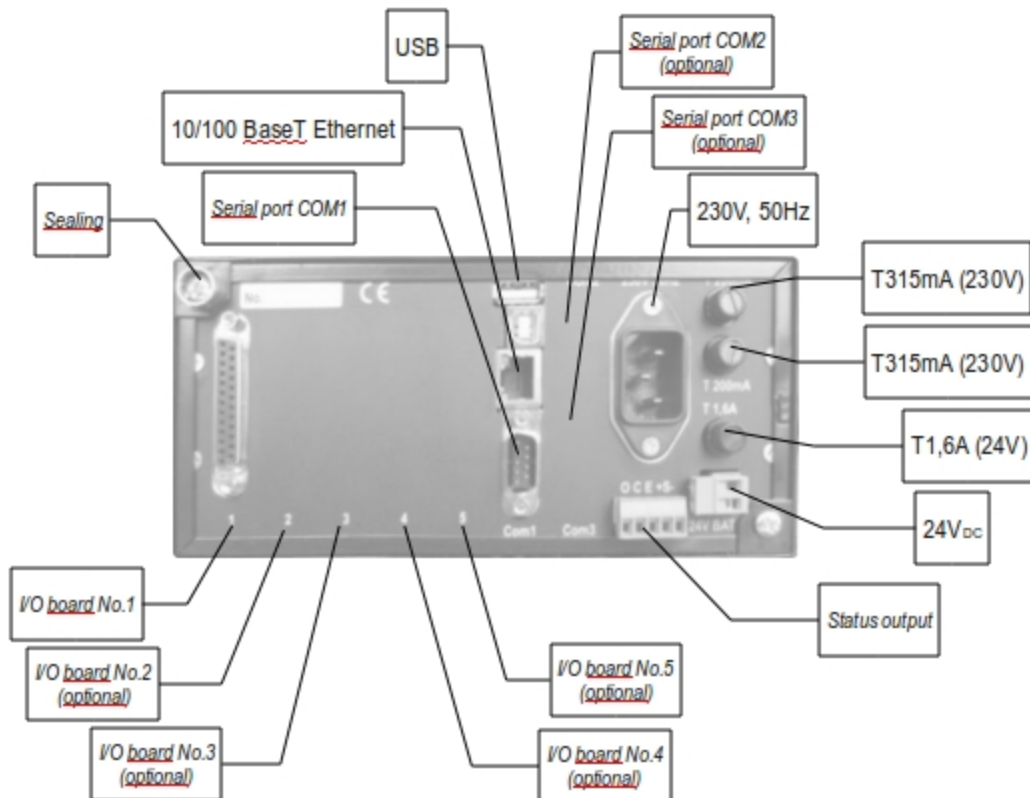


Figure 5-1 Backplane connectors

### Power supply

Two different power supply inputs are available on the UNIFLOW-200. Both power supply input can be connected at the same time.

230 V 50 Hz power supply is connected via IEC60320 C14 chassis plug.

#### CAUTION

UNIFLOW-200 shall be connected to the power supply system with protective ground.

24 VDC power supply connection is made by a plug-in screw terminal. The terminal is labeled 24 V BAT.

### Serial ports

Three communication ports are provided on the backplane of the flow computer.

The ports use 9-pin DSUB male connectors and are labeled COM1, COM2 and COM3.

The pin assignments of the connectors in case of RS232/RS485/RS422 configuration see in the Appendix B.



**Ethernet port**

This port is for high-speed communications using Ethernet local area network architecture. The speed of data transfer is 10/100 Mb/sec using a 10baseT twisted pair. The port uses an RJ45 connector.

**USB port**

USB port is for file transfer from the flow computer to pen drive device. The port uses a standard-A receptacle.

**Status output and Sense input**

A single pole, double throw relay with Normally Open or Normally Closed terminals provides the status (operating and error) of the flow computer. A flow computer failure causes the relay to de-energize. Connection is made by plug-in screw terminals.

Contact is rated at 100 mA, 100 volts and is a Form "C" contact.

The terminals are marked:

O	operating
C	common
E	fault

The Sense input accepts potential-free contact, open collector inputs (transistor) or 24 VDC input from other flow computer working in pair in hot/stand-by mode.

The terminals are marked:

+S	+ signal
S-	- signal

**I/O board connectors**

The backplane has one 25-pin female D-type connectors for field wiring for each I/O board.

See the pin assignment of the connector for each type of the boards in the Annex B

**5.3 Start-up**

After the UNIFLOW-200 has been wired for power and external devices, it may be activated by energizing the external power supply. When power is applied, the unit displays the message **Load in progress... Please be patient.**

After about 1 minute the operating system of the unit starts testing the internal parameters and displays messages indicating whether the parameters pass or fail the test. If some of the parameters are missed or damaged the default parameters are activated.

After the tests the blinking message **Restarted!** appears on the display together with the date and time of the restart and with the current date and time.

There is also a message informing operator if the test of parameters was successful or the test failed and default parameters were activated.

After pressing any key the main menu appears on the display.

If after the start-up the unit displays messages **Parameters are damaged!** and **Check parameters!** then it is necessary to enter the Parameters menu and set the parameters required for the particular application. Before setting up the proper parameters the unit will not start the normal operation, i.e. will not start to perform the measurement.

See the setup procedure in the Section 9.

If after the start-up the unit displays messages **Parameters are OK!** then it starts the normal operation, i.e. it will perform the measurement even if the blinking message Restarted! is seen on the display.

#### CAUTION

If the operating conditions and the parameters of the application were not provided to the manufacturer then UNIFLOW-200 is supplied from the factory with all the input and output channels inactive and all the metering streams are disabled.

It is part of the start-up procedure to setup the unit for the particular application. See the setup procedure in the Section 9.

## 5.4 Start and stop metering streams

Once the metering stream is properly configured it starts the flow calculation and never stops.

When operator modifies any parameter and leaves the Parameters menu the flow calculation is interrupted for few calculation periods while the new parameters are checked.

The metering stream operation can be suspended if in the parameter setup the fluid or the flow meter set to None (see section 9).

## 6 Basic operation

The operation of the UNIFLOW-200 is accomplished through an operator interface comprising an LCD display and a keypad. The layout of the front panel is shown in figure below.

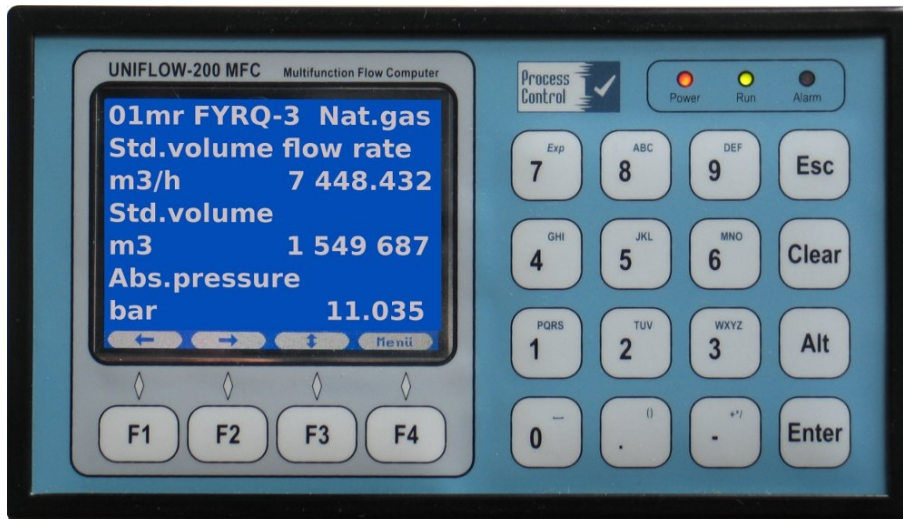


Figure 6-2 Front panel

### 6.1 Keypad

There are 20 keys located on the keypad grouped into 3 functional groups.

#### 6.1.1 Numeric keys

The numeric keys offer the full number set (0 - 9), decimal point (.), and a minus (-) key. They used to enter or change data.

Each numeric key has secondary characters assigned to them.

They are as follows:

Numeric 1 to 8 – alphabetic letters from A to Z and from А to Я (Cyrillic letters)

Numeric 0 – space ( )

Numeric 7 – Exponent (Exp)

Decimal point (.) – opening (()) and closing ()) bracket

Minus sign (-) – plus (+), multiply (\*) and divide (/) sign

The secondary characters activated by repeated key press.

For example pressing the key 9 repeatedly the characters in the input field appears in the following order: 9 D E F É d e f é Ъ E Ж 3 д е ж 3. Both uppercase and lowercase letters can be entered this way.

Letters and special characters are used to

- enter text information (e.g. the name of the metering stream)
- enter equation in virtual stream definition (see Section 9.)

Exponent key is used to enter quantities in scientific notation. The exponent field is activated by pressing Alt key then Exp key. Letter “e” appears in the input field indicating that the exponent part of the number to be entered.

Exponent key available only for the parameters which value in decimal notation exceeds the space available in the input fields.

### 6.1.2 Editing keys

Esc key

- pressing Esc key while editing any data entry field causes the editing stopped, the entered numbers or the selection mode is ignored and the original value of the field is restored;
- pressing Esc key while data page is displayed (and no any data entry field is being edited) causes exit from data page to the parent menu. All the modifications done after the last pressing of the Save key will be ignored and the original values of the data fields will be restored.

Clear key

- pressing Clear key while editing any data entry field causes the last character entered is cleared.

Alt key

- Alt key is used in conjunction with the Exp key to enter number in exponential format.

Enter key

- Enter key is used to finish the data entry and data selection in the data entry fields. Pressing Enter do not causes the entered data is activated. To activate the data the Save key shall be pressed and the Parameters menu item shall be left. Exiting from parameter menu the flow computer shows message Parameter update in progress. The modified parameters will be used in flow calculation after the message disappears.

### 6.1.3 Function keys

There are four function keys located below the display and marked with F1, F2, F3 and F4.

The function keys have no one single particular function. They are multifunctional keys. The valid functions of the keys at each particular display page are indicated in the bottom line of the display.

The function keys are to navigate in the menu tree and select parameters or data items to view, change or save.

The functions of the keys are as follows:

⇐ left arrow

- move to the previous (upper) level of menu tree or return to the parent menu from the data page

⇒ right arrow

- move to the next (lower) level of menu tree
- enter into data page if there is no more menu tree level

↑ up arrow

- move by one item up in the menu list (on the menu page) or data list (on data page)

↓ down arrow

- move by one item down in the menu list (on the menu page) or data list (on data page)

⇕ up-down arrow

- scroll through the menu items or data pages. After the last menu item or data page the first one appears.

⇔ left-right arrow

- move to the next data entry field. After the last field the cursor jumps to the first field.

Save

- save the data on the data page displayed and return to the parent menu

Change

- in the numeric entry field: clears the content of the field and enters the field for editing
- in the selection entry field: pressing Change key repeatedly the option list for the selection scrolls in the selection field. Press Enter when the desired option is displayed to make your selection.

Menu

- leaves the data page and return to the parent menu

OK

- confirm the selection of the highlighted item

## 6.2 Display

The 320 x 240 dots backlit TFT color LCD display offers 14 lines of information displayed as alphanumeric and graphical characters.

There are two different types of display pages available in the UNIFLOW-200:

- menu page

The left pane of the menu page shows the menu tree levels the operator went through to arrive to the current position.

The right pane shows the available menu items for selection. Press ↑ and ↓ key to highlight the desired menu item. Press ⇔ key to enter the next menu level or to data page. Press ⇐ to return the previous menu level.

The figure below shows an example of the menu page

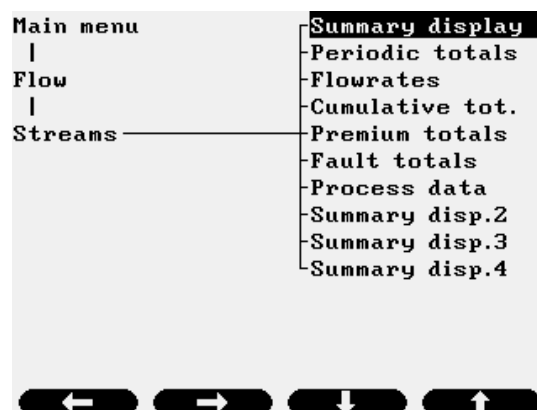


Figure 6-3 Menu page

- data page

The data page is a list of parameters. The description, the value and the unit of measurement of the parameters are shown.

Press  $\uparrow$  and  $\downarrow$  key to highlight the desired data item.

Press Change key to start editing the numeric entry field.

Press Change key repeatedly to scroll through the available options of the selection entry field.

Press OK key to confirm the numeric value entered or the selection highlighted.

Press Save key to save the new value of the parameter and return to the parent menu.

Press Esc key if you want to discard the editing you have done and return to the parent menu.

The figure below shows an example of the data page.

01.Str. M1	
CVOL flowrate	4 065.8723 m <sup>3</sup> /h
ENGY flowrate	149.5568 GJ/h
Gauge pressure	10.1587 bar
Abs. pressure	11.1587 bar
Temperature	18.6464 °C
Temp. at '+' side	18.6464 °C
Inuse diff.press.	18.6055 mbar
Relative density	0.6357
Base density	0.7790 kg/m <sup>3</sup>
Line density	8.6831 kg/m <sup>3</sup>
Inf.cal.value	36.7834 MJ/m <sup>3</sup>
Sup.cal.value	40.7191 MJ/m <sup>3</sup>
2010.09.30. 15:42:07	
<div> <span>←</span> <span>→</span> <span>↑</span> <span>Menu</span> </div>	

Figure 6-4 Data page

#### NOTE

Each page consists of 15 lines.

First line shows the stream identifier string.

Last line shows the function pictogram of the F1 - F4 function keys.

13 data lines can be seen on the screen. If more then 13 data items to be displayed scroll through the data lines with  $\uparrow$  and  $\downarrow$  keys.

## 6.2.1 Navigating the display

From the main menu select the item you require by pressing  $\uparrow$  and  $\downarrow$  keys. Press  $\Rightarrow$  key to enter the next menu level. Select the required sub-menu item by pressing  $\uparrow$  and  $\downarrow$  keys and press  $\Rightarrow$  key to enter the next sub-menu level. Repeating this procedure you arrive to the required data page. Navigating in the menu tree you can see the menu and sub-menu items passed on the left pane of the display.

Pressing  $\Leftarrow$  key returns to the previous menu level.

## 6.3 Security levels

Data are protected with password in the flow computer.

There are three security levels. Each of them has its own password. Depending on the security level the operator logged in he/she has the right to modify different groups of parameters.

At Engineer level both the Operator and Engineer password can be modified.

**CAUTION**

The flow computer shipped with empty password list. It means that pressing Enter when the flow computer requires password you log in at Engineering level allowing modification all the parameters.

Set your own Operator and Engineering level password to protect the parameters against undesired modification. The procedure for password setting is described in Section 9.

Remember the password you entered. If you forget your password you will have to ask the assistance of the manufacturer or you have to return the unit to the manufacturer.

*Guest level*

At Guest level all the parameters can be reviewed at the display but no any modification is allowed.

The default password for Guest level is the Enter key. When the flow computer prompt for the password just press Enter key without entering any codes.

The Guest level password can not be altered.

*Operator level*

At Operator level only the parameters listed in the Operator parameters submenu are available for modification. These parameters include the transmitter ranges, the high and low alarm limits and the keypad values.

The default password for the Operator level is Enter (no password is set).

*Engineer level*

At Engineer level all the parameters are available for editing.

The default password for the Engineer level is Enter (no password is set).

**IMPORTANT**

Once the operator logged in at Operator or Engineer level and the inactivity period (i.e. no any key is pressed) exceeds 2 minutes the flow computer automatically logs out the operator. This is to prevent accidental leaving the flow computer in the state where the parameters can be altered.

## 6.4 The menu system

The main menu consists of items as shown below.

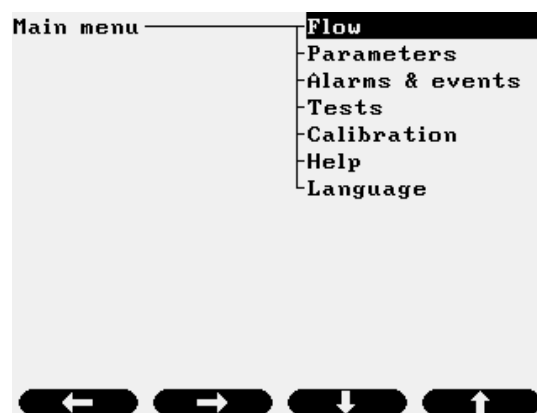


Figure 6-5 Main menu page

The menu items Flow, Alarms & events, Help and language selection (Magyar/English) are accessible without password.

In Flow menu the metering data are shown grouped into different submenus.

In Alarms & events menu the list of unacknowledged and acknowledged alarms can be seen. The alarm log, event log and the downloaded gas composition log are accessible here also.

The menu items Parameters and Tests require password to enter for accessing.

The menu item Calibration is reserved for the manufacturer and for the authority calibrating the flow computer. It is accessible with special password only.

The menu item Language allows selecting the language the flow computer communicates with. Available languages are Magyar (Hungarian), English, Русский (Russian). Changing the language will change the language of the display, the text on the reports, the alarm messages, etc. UNIFLOW-200 is a true multilingual flow computer.

The menu structure (the menu tree) shown on the figures below.

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4
Flow	Streams	Summary display 1	data page (1.1.1)	
		Periodic totals	data page (1.1.2)	
		Flowrates	data page (1.1.3)	
		Cumulative totals	data page (1.1.4)	
		Premium totals	data page (1.1.5)	
		Fault totals	data page (1.1.6)	
		Process data	Flow meter data	data page (1.1.7.1)
			Fluid data	data page (1.1.7.2)
			(*)	
		Summary display 2	data page (1.1.8)	
		Summary display 3	data page (1.1.9)	
		Summary display 4	data page (1.1.10)	
	Plant I/O	I/O board 1	data page (1.2.1)	
		I/O board 2	data page (1.2.2)	
		I/O board 3	data page (1.2.3)	
		I/O board 4	data page (1.2.4)	
		I/O board 5	data page (1.2.5)	
		Modbus signals	data page (1.2.6)	
		Archived periodic totals	data page (1.3.1)	
		Archived batch totals	data page (1.3.2)	
	Archive data			
	Modbus regs	data page (1.4)		
	Data transfer	data page (1.5)		
	Extra sum. display	Extra sum. disp. 1	data page (1.6.1)	
		Extra sum. disp. 2	data page (1.6.2)	
		Extra sum. large. 1	data page (1.6.3)	
		Extra sum. large 2	data page (1.6.4)	
	Batches	data page (1.7)		
	Meter serial test	data page (1.8)		

(\*) Depending on the selected flow meter and the fluid more data pages may exist.

**Figure 6-6 Main menu - Flow**



## Main menu - Parameters

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4	Submenu 5	Submenu 6	Submenu 7
Parameters	IO signals	IO board 1	1. channel	data page (2.1.1.1)			
			2. channel	data page (2.1.1.2)			
			(*)				
			n. channe	data page (2.1.1.n)			
		IO board 2	1. channel	data page (2.2.1.1)			
			2. channel	data page (2.2.1.2)			
			(*)				
			n. channe	data page (2.2.1.n)			
		IO board 3	1. channel	data page (2.3.1.1)			
			2. channel	data page (2.3.1.2)			
			(*)				
			n. channe	data page (2.3.1.n)			
		IO board 4	1. channel	data page (2.4.1.1)			
			2. channel	data page (2.4.1.2)			
			(*)				
			n. channe	data page (2.4.1.n)			
		IO board 5	1. channel	data page (2.5.1.1)			
			2. channel	data page (2.5.1.2)			
			(*)				
			n. channe	data page (2.5.1.n)			
		Modbus signal	1. channel	data page (2.6.1.1)			
			2. channel	data page (2.6.1.2)			
			(*)				
			n. channe	data page (2.6.1.n)			

## (Main menu - Parameters continued)

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4	Submenu 5	Submenu 6	Submenu 7
	Streams	Physical stream	Stream 1.	Fluid	Hydrocarb mixt.	Natural gas	data page (2.2.1.n.1.1.1)
						Coke oven gas	data page (2.2.1.n.1.1.2)
						Blast furnace gas	data page (2.2.1.n.1.1.3)
					Pure gases	Air	data page (2.2.1.n.1.2.1)
						Nitrogen	data page (2.2.1.n.1.2.2)
						Oxygen	data page (2.2.1.n.1.2.3)
						Argon	data page (2.2.1.n.1.2.4)
						Carbon-dioxide	data page (2.2.1.n.1.2.5)
						Hydrogen	data page (2.2.1.n.1.2.6)
						Carbon-monoxide	data page (2.2.1.n.1.2.7)
						Ethylen	data page (2.2.1.n.1.2.8)
						Ammonia	data page (2.2.1.n.1.2.9)
						Propane	data page (2.2.1.n.1.2.10)
						General gas	data page (2.2.1.n.1.2.11)
					Steam	data page (2.2.1.n.1.3)	data page (2.2.1.n.1.3)
					Water	data page (2.2.1.n.1.4)	data page (2.2.1.n.1.4)
					Liquid	Crude oil & product	data page (2.2.1.n.1.5.1)
						Ethanol	data page (2.2.1.n.1.5.2)
						General liquid	data page (2.2.1.n.1.5.3)
						Liquid mixture	data page (2.2.1.n.1.5.4)
					None		
					Other		
				Flow meter	Diff. press. dev.	Orifice plate	data page (2.2.1.n.2.1.1)
						Nozzle	data page (2.2.1.n.2.1.2)
						Venturi tube	data page (2.2.1.n.2.1.3)
						Segm. orif. plate	data page (2.2.1.n.2.1.4)
						V-Cone meter	data page (2.2.1.n.2.1.5)
						Compact orifice	data page (2.2.1.n.2.1.6)
					Annubar	data page (2.2.1.n.2.2)	
					Turbine meter	Gas turbine	data page (2.2.1.n.2.3.1)
						Liquid turbine	data page (2.2.1.n.2.3.2)
					Vortex meter	data page (2.2.1.n.2.4)	
					Mass flow meter	data page (2.2.1.n.2.5)	
					Ultrasonic meter	data page (2.2.1.n.2.6)	
					Rotameterer	data page (2.2.1.n.2.7)	
					El.magnet. meter	data page (2.2.1.n.2.8)	
					CVOL flow meter	data page (2.2.1.n.2.9)	

				Power char. meter	data page (2.2.1.n.2.10)
				None	
				Other	
				Stream	data page (2.2.1.n.2.13)
			Stream setup	data page (2.2.1.n.3)	
			Premium limits	data page (2.2.1.n.4)	
			Limits	data page (2.2.1.n.5)	
			Stream 2., ...8. (**)		

## (Main menu - Parameters continued)

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4	Submenu 5	Submenu 6	Submenu 7
		Virtual stream	Stream 9	Stream setup	data page (2.2.2.m.1)		
				Premium limits	data page (2.2.2.m.1)		
				Limits	data page (2.2.2.m.1)		
			Stream 10., 12. (**)				
			Prem. mode setup	data page (2.2.3)			
			Fault mode setup	data page (2.2.4)			
			Barometric pressure	data page (2.2.5)			
			Averaging	data page (2.2.6)			
	General data	Date/time	data page (2.3.1)				
		Timezone	data page (2.3.2)				
		Period settings	data page (2.3.3)				
		User defined	Display	Summary display	data page (2.3.3.1.1)		
				Extra sum. display	data page (2.3.3.1.2)		
			Reports	data page (2.3.3.2)			
			Trends	data page (2.3.3.3)			
		Password	data page (2.3.4)				
		Reset	Totals reset	data page (2.3.5.1)			
			General reset	data page (2.3.5.2)			
		Version control	data page (2.3.6)				
		Company data	data page (2.3.7)				
		LCD settings	data page (2.3.8)				
		Character type	data page (2.3.9)				
	Interfaces	Serial ports	Serial port 1	data page (2.4.1.1)			
			Serial port 2	data page (2.4.1.2)			
			Serial port 3	data page (2.4.1.3)			
		Ethernet	data page (2.4.2)				
		USB					
	Operator params.	Keypad & limits	data page (2.5.1)				
		Keypad values	data page (2.5.2)				
	Restore	Parameter project	data page (2.6.1)				
		Firmware	data page (2.6.2)				

(\*) The number of channels depends on the type of the I/O board installed. See chapter 4 for details.

(\*\*) Submenus for Stream 2, 3, ..., 8 are identical with those of Stream 1

(\*\*) Submenus for virtual streams 10, 11, 12 are identical with those for Stream 9

Text - options in the shaded cells not yet available

Figure 6-7 Main menu - Parameters

(Main menu continued)

Main menu	Submenu 1	Submenu 2	Submenu 3
Alarms & events	Not acknowledged	data page (3.1)	
	Acknowledged	data page (3.2)	
	Events	Alarm log	data page (3.3.1)
		Event log	data page (3.3.2)
		Downloaded log	data page (3.3.3)
		Premium report	data page (3.3.4)
Tests	IO board 1	data page (4.1)	
	IO board 2	data page (4.2)	
	IO board 3	data page (4.3)	
	IO board 4	data page (4.4)	
	IO board 5	data page (4.5)	
	IO polling	data page (4.6)	
Calibration			
Help	data page (6)		
Language	data page (7)		

**Figure 6-8 Main menu – Alarm and events, Tests, Calibration, Help**

## 6.5 Entering data

There are two different data types in the UNIFLOW-200.

Numeric data can have any numeric value the operators enter (within the limit of the applicable standard).

An example of such value is the orifice bore diameter for example.

Selection data can have value selected from a list of options.

An example of such value is the differential pressure tapping location of the orifice meter. It can be selected from a list comprising corner, flange or D and D/2 tapping.

Changing the value of numeric data or selection of any displayed parameter is straightforward with the UNIFLOW-200.

### 6.5.1 Changing numeric data

Locate the parameter to be changed in the Parameters menu navigating to the appropriate data page. Entering into Parameters menu key in the password corresponding to the security level the desired parameter can be changed.

Select the parameter on the data page using ↑ and ↓ keys.

Press Change key and enter the new value. If necessary, you can edit the new data as you key it in. Use Clear key if you want to delete single figures or characters.

Press OK function key or Enter key to finish editing and accept the entered figures.

Pressing Esc key while editing causes the data entry process aborted and the original value of the parameter is restored.

Select the next parameter to be edited and repeat the procedure above.

When you finish the data editing on the data page press the Save function key to make your modification permanent. Pressing Save key saves the modified parameters and return to the parent menu from the data page.

If instead of Save key you press Esc key all the modification done on the data page are discarded. It causes the original values of the parameters are restored and return to parent menu.

### **6.5.2 Changing selection**

Changing the selection is done in a similar way as changing the numeric data.

The only difference is that the list of available options for selection is scrolled through in the data entry field by pressing Change key repeatedly.

## **6.6 Data pages**

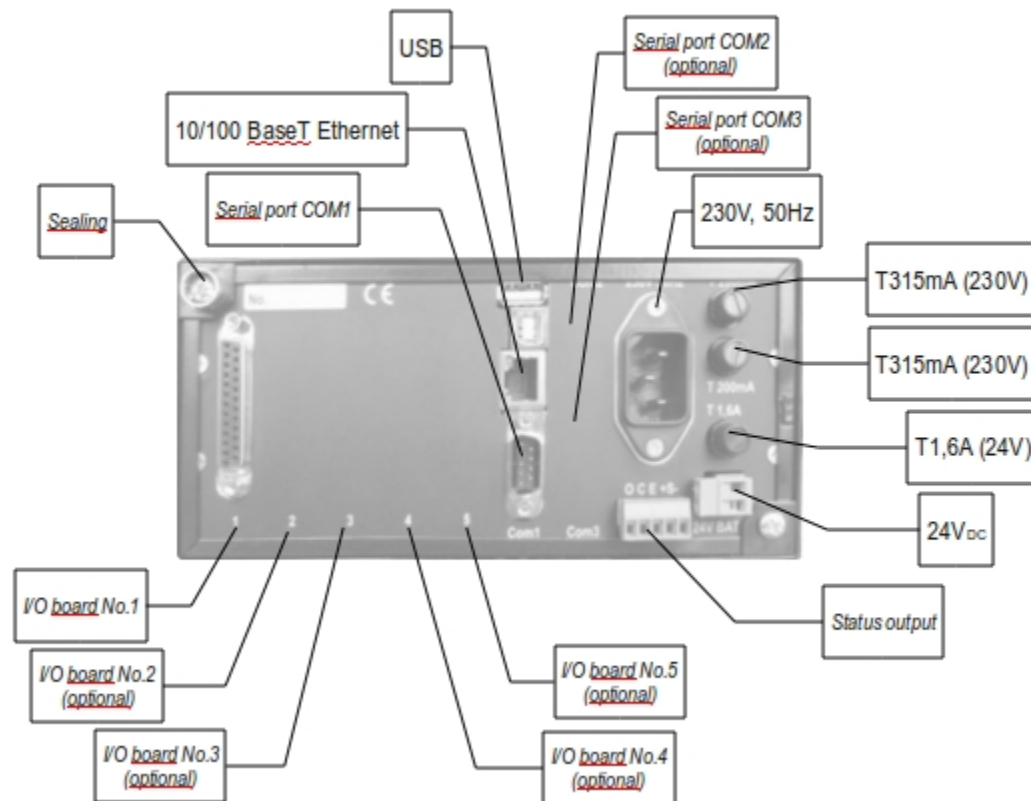
The data pages are listed in the Section 9.

## 7 Maintenance and troubleshooting

In normal operating environment UNIFLOW-200 do not require any periodic maintenance. However the real time IC (Dallas 12887) shall be replaced after 10 years of operation.

If the UNIFLOW-200 fails to start check the fuses.

There are three fuses located on the rear panel of the flow computer as shown on the figure below.



**Figure 7-9 Fuses**

Fuse F1 (T type 1.6 A) protects the 24 VDC power input.

Fuses F2 and F3 (T type 315 mA) protects the 230 V 50 Hz power input.

### CAUTION

Disconnect both 230 V 50 Hz and 24 VDC power inputs before the fuse replacement.

Never use fuses with higher rating than it is recommended. It may cause damage of the instrument.

The signal on the input and output channels can be checked in the menu:

Main menu – Tests – I/O board  $n$ ,

where  $n$  is the number of I/O board to be tested.

The data page of the I/O boards shows:

- current in mA for current input and current output channels;
- resistance for PRT/RTD channels;
- frequency and number of pulses received for pulse input channels;
- state (open or closed) for digital input and digital output channels.



## 8 Support

For convenience of operation there are two software tools available for UNIFLOW-200.

### 8.1 U200ToolBox

It is a Java based application running on PC consists of three tools.

#### 8.1.1 UNISetup

General features of the UNISetup

- connects to UNIFLOW-200 on the Ethernet port;
- uploads application parameters from UNIFLOW-200;
- generates application parameters off-line;
- edits application parameters off-line;
- saves application parameters on the disk drive of the PC;
- downloads application parameters to UNIFLOW-200.

#### 8.1.2 UNIArchive

General features of the UNIArchive

- connects to UNIFLOW-200 on the Ethernet port;
- uploads archive data files from UNIFLOW-200;
- saves archive data file on the disk drive of the PC.

#### 8.1.3 UNIUpdate

- updates the firmware of UNIFLOW-200;
- update file and download code supplied by manufacturer.

See installation and operating instruction of the U200ToolBox in the help file of the software.

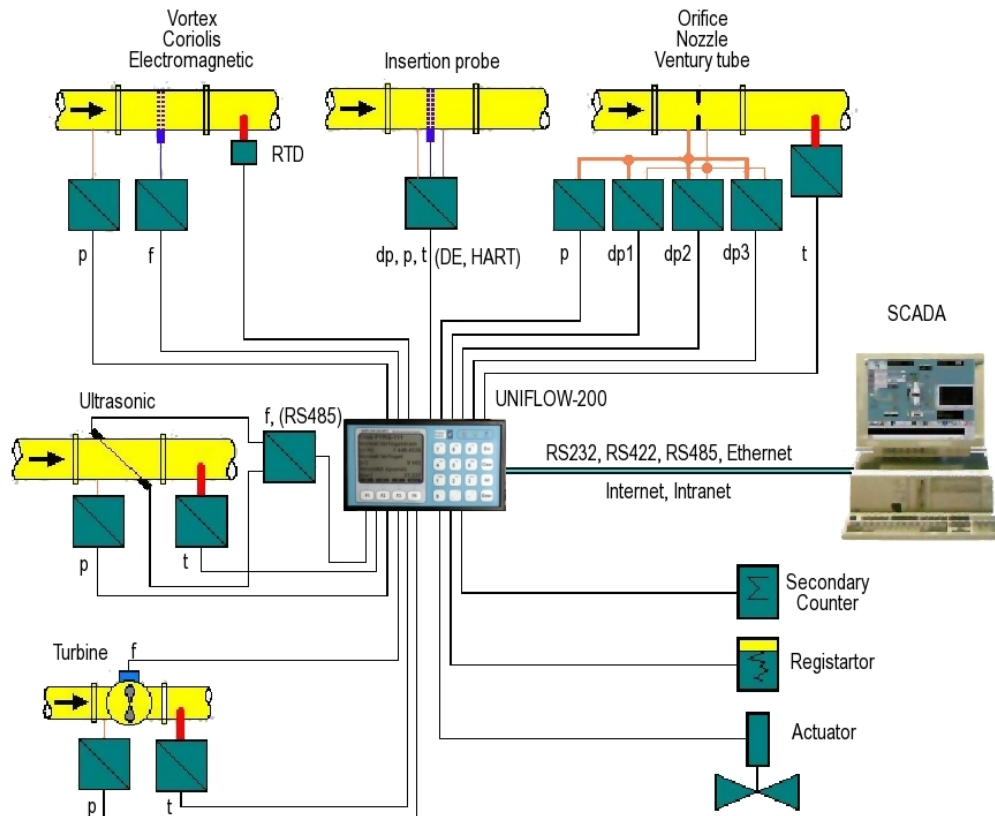
U200ToolBox is available for download on the web site of manufacturer, [www.processcontrol.hu](http://www.processcontrol.hu)

## 8.2 Data visualization system

Effective acquisition, storage, processing and visualization of the large number of data provided by the flow computers are possible only with computer support.

Process Control Kft. developed an Energy accounting software on the basis of the VISION SCADA software package. The Energy accounting software is scalable. It can prove its efficiency for small scale system (few metering streams with one or two UNIFLOW-200 flow computer) and large scale system (up to several hundred metering streams with large number of UNIFLOW-200 flow computers) as well.

The Energy accounting system is assembled from tested functional units (communication subsystem, operator displays, archiving subsystem with archive data retrieval, balances and reports, alarm and event log subsystem, etc.).



**Figure 8-10 Capabilities of UNIFLOW-200**

## 9 Detailed operation – The menu tree

In this section the data pages are described in detail. The order of data pages follows the menu structure.

### 9.1 Flow

In the Flow menu the measured and calculated data can be called on the display. The data are grouped together on several submenu pages as described below.

No password is required to enter the Flow menu and to display any data.

No data modification can be initiated in the Flow menu.

However commands required for certain mode of operation can be entered.

Such commands include:

- flow meter serial test start and stop command
- batch control start and stop command (coming soon)

#### 9.1.1 Stream data

##### 9.1.1.1 Summary display 1, 2, 3 and 4

Route in the menu tree:

Flow	Streams	Summary display 1	data page (1.1.1)
Flow	Streams	Summary display 2	data page (1.1.8)
Flow	Streams	Summary display 3	data page (1.1.9)
Flow	Streams	Summary display 4	data page (1.1.10)

The summary displays collect together the most important metered and calculated data for each metering stream. The data items to be shown on the summary displays are editable. They can be edited in the menu:

Parameters	General data	User defined	Display pages	Summary display
------------	--------------	--------------	---------------	-----------------

The operator can modify the default display or build a totally new one most suitable for the particular application.

There are four summary displays available in the flow computer.

Summary display 1 has the default content as shown in the figure below.

Summary display 2 shows the same data as summary display 1 but with double sized characters for better visibility. This is the default display page appearing on the display if no any key is pressed on the keypad for more then 2 minute.

Summary display 3 shows the previous month data by default.

Summary display 4 shows the current month data by default.

The operator can create his own set of displayed data here if desired.

01.Str. M1	
CUOL flowrate	4 065.8723 m <sup>3</sup> /h
ENGY flowrate	149.5568 GJ/h
Gauge pressure	10.1587 bar
Abs. pressure	11.1587 bar
Temperature	18.6464 °C
Temp. at '+' side	18.6464 °C
Inuse diff.press.	18.6055 mbar
Relative density	0.6357
Base density	0.7790 kg/m <sup>3</sup>
Line density	8.6831 kg/m <sup>3</sup>
Inf.cal.value	36.7834 MJ/m <sup>3</sup>
Sup.cal.value	40.7191 MJ/m <sup>3</sup>
2010.09.30. 15:42:07	
<div> <div>←</div> <div>→</div> <div>↕</div> <div>Menu</div> </div>	

Figure 9-11 The default summary display

The first line of the display identifies the metering stream as follows.

*nn.Str. Stream name*

where *nn* the stream number from 01 to 12

*Stream name* any string entered for the stream as name in the menu

Parameters	Streams	Physical stream	Stream name
------------	---------	-----------------	-------------

Function of the F keys on the summary display data page:

← go to the summary display of the previous metering stream

⇒ go to the summary display of the next metering stream

↕ for Summary display 1 scrolls through data pages

Summary display 1

Summary display 3

Summary display 4

Flow rates

Cumulative totals

Premium totals

Fault totals

↕ for Summary display 2 scrolls through data lines

**Menu** returns to the parent menu.

### 9.1.1.2 Periodic totals

Route in the menu tree:

Flow	Streams	Periodic totals	data page (1.1.2)
------	---------	-----------------	-------------------

The periodic totals data page shows the totals for the current and the previous period of the hour, shift, day, multi day and month as shown on the figure below.

<b>01.Str. M1</b>			
<b>Periodic totals:</b>		<b>CVOL</b>	<b>m<sup>3</sup></b>
<b>Total</b>	<b>previous</b>	<b>current</b>	
hourly	3 842	16	
shift	0	15 820	
daily	12 907	15 820	
multiday	12 907	15 820	
monthly	12 907	15 820	
<b>Max.hourly during the month</b>			
CVOL	4 065	4 064	
(mm.dd.hh)	(09.30.17)	(10.01.11)	

← → ↓ Menu

Figure 9-12 Periodic totals

The first line of the display identifies the metering stream.

Function of the F keys on the periodic totals data page:

- ⇐ go to the periodic totals of the previous metering stream
- ⇒ go to the periodic totals of the next metering stream
- ↓ scrolls through the totals
  - CVOL (volume at base conditions)
  - MASS (mass)
  - ENERGY (energy)
  - UVOL (volume at line conditions)
  - CO2 mass (mass of CO2 emission)
  - Prem. CVOL (premium volume at base conditions)
  - Fault CVOL (fault volume at base conditions)

**Menu** returns to the parent menu.

### 9.1.1.3 Flow rates

Route in the menu tree:

Flow	Streams	Flow rates	data page (1.1.3)
------	---------	------------	-------------------

The flow rates data page shows the instantaneous flow rates as shown on the figure below. The flow rates are displayed in per hour and per day basis as well.

<b>01.Str. NGAS-ORIFICE</b>	
<b>Flowrates</b>	
CUOL flowrate	4 854.1621 m <sup>3</sup> /h
UVOL flowrate	868.3538 m <sup>3</sup> /h
Raw UVOL flowrate	
Mass flowrate	3 317.7522 kg/h
Energy flowrate	181.5792 GJ/h
CO2 flowrate	8 950.1768 kg/h
CUOL flowrate	116 499.890 m <sup>3</sup> /d
UVOL flowrate	20 840.4902 m <sup>3</sup> /d
Raw UVOL flowrate	
Mass flowrate	79 626.0547 kg/d
Energy flowrate	4 357.9004 GJ/d
CO2 flowrate	214 804.250 kg/d
<div> <span>←</span> <span>→</span> <span>↕</span> <span>Menu</span> </div>	

Figure 9-13 Flow rates

The first line of the display identifies the metering stream.

Function of the F keys on the flow rates data page:

- ← go to the flow rates of the previous metering stream
- go to the flow rates of the next metering stream
- ↕ scrolls through data pages
  - Flow rates
  - Cumulative totals
  - Premium totals
  - Fault totals
  - Summary display 1
  - Summary display 3
  - Summary display 4

**Menu** returns to the parent menu.

#### 9.1.1.4 Cumulative totals

Route in the menu tree:

Flow	Streams	Cumulative totals	data page (1.1.4)
------	---------	-------------------	-------------------

The cumulative totals data page shows the non-resettable counters for the totals as shown on the figure below.

01.Str. M1	
Cumulative totals	
CVOL	26 061 m <sup>3</sup>
UVOL	2 337 m <sup>3</sup>
Raw UVOL	
MASS	20 301 kg
ENERGY	957 GJ
CO2 mass	54 326 kg
Flow time	205.8425 h
Fault flow time	75.6793 h
<div> <span>←</span> <span>→</span> <span>↕</span> <span>Menu</span> </div>	

Figure 9-14 Cumulative totals

The first line of the display identifies the metering stream.

Function of the F keys on the cumulative totals data page:

- ⇐ go to the flow rates of the previous metering stream
- ⇒ go to the flow rates of the next metering stream
- ↕ scrolls through data pages
  - Cumulative totals
  - Premium totals
  - Fault totals
  - Summary display 1
  - Summary display 3
  - Summary display 4
  - Flow rates

**Menu** returns to the parent menu.

### 9.1.1.5 Premium totals

Route in the menu tree:

Flow	Streams	Premium totals	data page (1.1.5)
------	---------	----------------	-------------------

The premium totals data page shows the counters for the premium totals measured above the set premium limit as shown on the figure below. Setting of the premium limit see in the menu:

Parameters	Streams	Physical stream	Stream nn	Premium limits
------------	---------	-----------------	-----------	----------------

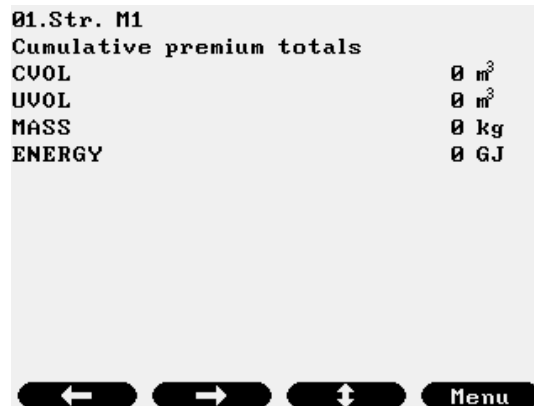


Figure 9-15 Premium totals

The first line of the display identifies the metering stream.

Function of the F keys on the premium totals data page:

- ⇐ go to the flow rates of the previous metering stream
- ⇒ go to the flow rates of the next metering stream
- ⇕ scrolls through data pages
  - Premium totals
  - Fault totals
  - Summary display 1
  - Summary display 3
  - Summary display 4
  - Flow rates
  - Cumulative totals

**Menu** returns to the parent menu.



### 9.1.1.6 Fault totals

Route in the menu tree:

Flow	Streams	Fault totals	data page (1.1.6)
------	---------	--------------	-------------------

The fault totals data page shows the counters for the fault totals measured under fault conditions as shown on the figure below. Description of the fault conditions see in the section 9.3.

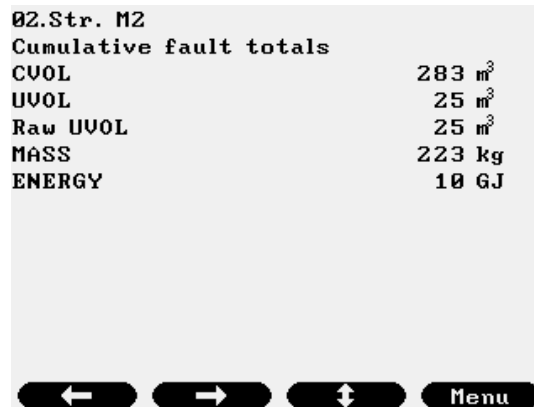


Figure 9-16 Fault totals

The first line of the display identifies the metering stream.

Function of the F keys on the fault totals data page:

- ⇐ go to the flow rates of the previous metering stream
- ⇒ go to the flow rates of the next metering stream
- ⇕ scrolls through data pages
  - Fault totals
  - Summary display 1
  - Summary display 3
  - Summary display 4
  - Flow rates
  - Cumulative totals
  - Premium totals

**Menu** returns to the parent menu.

### 9.1.1.7 Process data

Inside the process data menu two or more data pages may appear. The content of these data pages depends on the flow meter selected and the fluid to be measured.

The process data menu page is shown on the figure below.

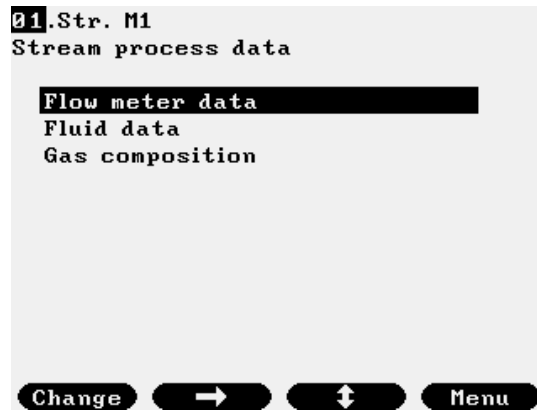


Figure 9-17 Process data menu page

Function of the F keys on the process data menu page:

**Change** change the metering stream the data to be displayed from

⇒ go to the highlighted data page

⇕ select the next data page

**Menu** returns to the parent menu.

#### 9.1.1.7.1 Flow meter data

Route in the menu tree:

Flow	Streams	Process data	Flow meter data	data page (1.1.7.1)
------	---------	--------------	-----------------	---------------------

This data pages shows the parameters of the flow meter under line conditions and the measured and calculated data directly related to the flow meter. The content of the flow meter data pages for different flow meters shown on the figures below.



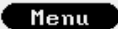


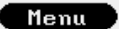
<b>01.Str. NGAS-ORIFICE</b>		<b>01.Str. NGAS-ORIFICE</b>	
Orifice plate data		Orifice plate data	
<b>Flow standard</b>	ISO5167:2003	Beta	0.499955
dP tappings	Flange	Corr.pipe diam.	199.9821 mm
Disch.coeff.(C)	0.603467	Corr.bore diam.	99.9821 mm
Exp.factor (eps)	0.993963	Pressure loss	67.6381 mbar
Vel.of appr.(E)	1.032783	Temp. at '+' side	11.0271 C
Reynolds number	676 414	Flow velocity	12.1606 m/s
Beta	0.499955	Coeff. Kp.	0.000000
Corr.pipe diam.	199.9821 mm	Coeff. Ksh	0.000000
Corr.bore diam.	99.9821 mm	Coeff. Kshf	0.000000
Pressure loss	67.6369 mbar	Coeff. KRe	0.000000
Temp. at '+' side	11.0271 C	Coeff. Kt	0.000000
Flow velocity	12.1610 m/s	<b>Coeff. Ksu</b>	0.000000
  		  	

Figure 9-18 Flow meter data for differential pressure devices (orifice, nozzle, Venturi tube)

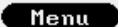




<b>03.Str. NGAS-TURBINE</b>		
Meter data		
	Main signal	Check signal
Pulse number	187 786	187 808
Pulse increment	482	481
Frequency	963.008	963.007
K-factor	3 585.9 pls/m <sup>3</sup>	
Bad pulses		-1
Total bad pulses		22
Flow velocity	8.5482 m/s	
		

Figure 9-19 Flow meter data for pulse output flow meters (turbine meter, Vortex meter, etc.)

<b>02.Str. NGAS-US METER</b>	
FLAWSIC meter data	
<b>UVOL flowrate</b>	--- m <sup>3</sup> /h
Avg gas velocity	--- m/s
path 1	--- m/s
path 2	--- m/s
path 3	--- m/s
path 4	--- m/s
Avg VOS	--- m/s
path 1	--- m/s
path 2	--- m/s
path 3	--- m/s
path 4	--- m/s
Forward UVOL	--- m <sup>3</sup>
   	

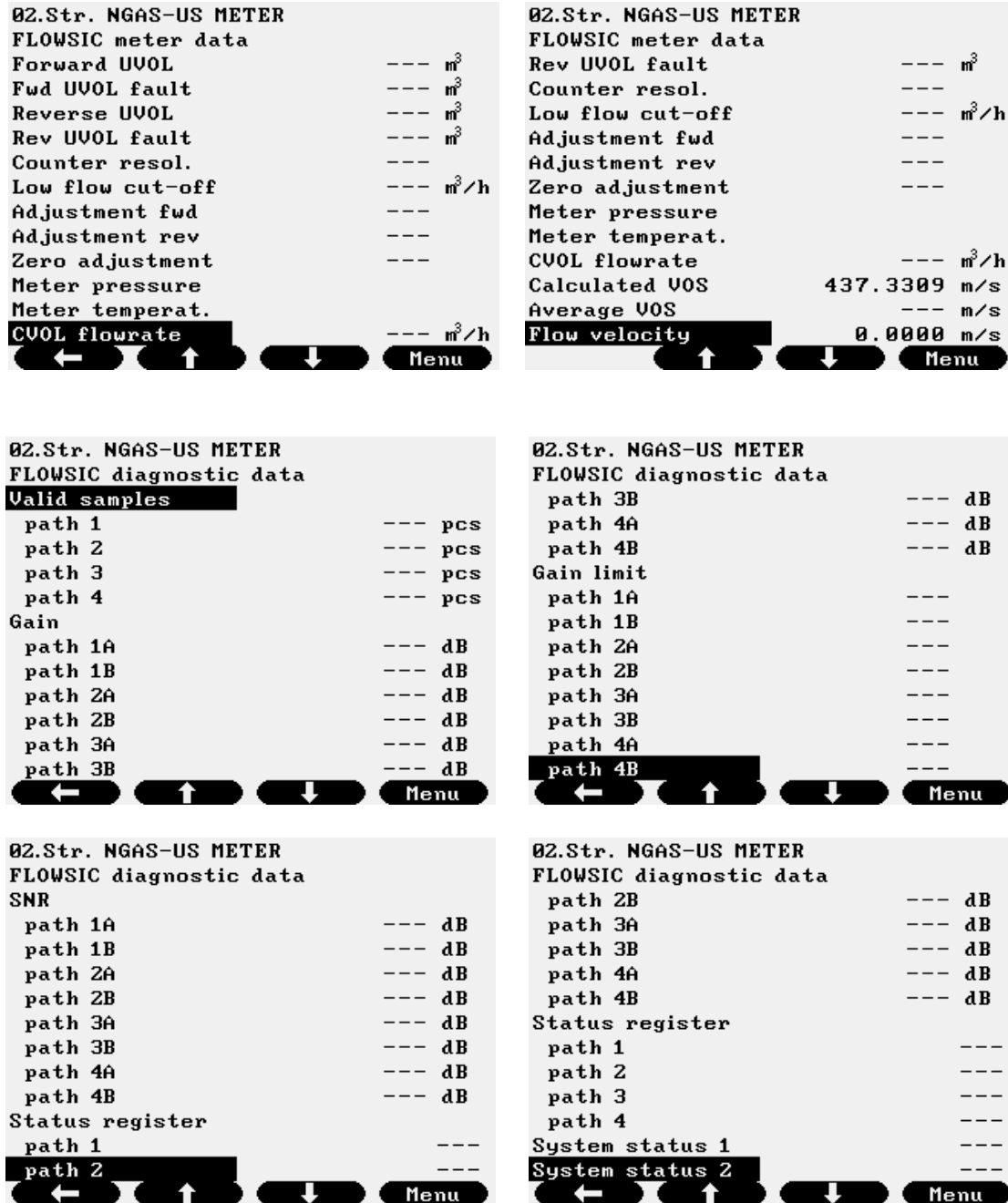


Figure 9-20 Flow meter data (Flowsic-600 US meter, serial communication)

The content of the flow meter data pages for ultrasonic flow meters depends on the type of ultrasonic meter.

Function of the F keys on the flow meter data page:

⇐ returns to the Process data menu page

⇕ scrolls through data lines on the data page if not all the line fit on one display

**Menu** returns to the parent menu.

### 9.1.1.7.2 Fluid data

Route in the menu tree:

Flow	Streams	Process data	Fluid data	data page (1.1.7.2)
------	---------	--------------	------------	---------------------

The fluid data data page shows the fluid properties. The content of the data page highly depends on the fluid selected. Examples of the data pages are shown on the figures below.

01.Str. NGAS-ORIFICE	
Fluid data	
Fluid	Natural gas
<b>Dynamic viscos.</b>	1.0754e-05 Pasec
Isentropic expon.	1.307104
Base compr.fact.	0.998049
Line compr.fact.	0.991211
Line/Base compr.	0.993149
Conversion factor	4.3817
Relative density	0.557761
Base density	0.683486 kg/m <sup>3</sup>
Line density	2.994859 kg/m <sup>3</sup>
Inf.cal.value	33.6783 MJ/m <sup>3</sup>
Sup.cal.value	37.4069 MJ/m <sup>3</sup>
<div> <div>↑</div> <div>↓</div> <div>Menu</div> </div>	

01.Str. NGAS-ORIFICE	
Fluid data	
Fluid	Natural gas
Line compr.fact.	0.991212
Line/Base compr.	0.993149
Conversion factor	4.3818
Relative density	0.557761
Base density	0.683486 kg/m <sup>3</sup>
Line density	2.994872 kg/m <sup>3</sup>
Inf.cal.value	33.6783 MJ/m <sup>3</sup>
Sup.cal.value	37.4069 MJ/m <sup>3</sup>
J-T coefficient	0.4000 °C/bar
Spec.carbon cont.	0.5032 kg/m <sup>3</sup>
<b>Calculated VOS</b>	435.9613 m/s
<div> <div>↑</div> <div>↓</div> <div>Menu</div> </div>	

Figure 9-21 Fluid data for natural gas

04.Str. CR.OIL-LIQ.TURBINE	
Fluid data	
Fluid	crude oil
<b>Uncor.dens.A</b>	780.000000 kg/m <sup>3</sup>
Uncor.dens.B	853.909973 kg/m <sup>3</sup>
D.met.Ahous.T	0.000000 C
D.met.Bhous.T	0.000000 C
Inuse meas.dens	700.000000 kg/m <sup>3</sup>
Base density	696.711275 kg/m <sup>3</sup>
Line density	700.538111 kg/m <sup>3</sup>
Fluid temp.@dens	12.000000 C
Fluid pres.@dens	8.000000 bar
Fp(d)	1.3231e-04 1/bar
CtLd	1.003790
<div> <div>↑</div> <div>↓</div> <div>Menu</div> </div>	

04.Str. CR.OIL-LIQ.TURBINE	
Fluid data	
Fluid	crude oil
CtLd	1.003790
CpLd	1.000927
CtpLd	1.004720
Alpha	0.0012647 1/°C
Fluid temp@meter	11.000000 C
Fluid pres@meter	4.348644 bar
Fp(m)	1.3114e-04 1/bar
CtLm	1.005051
CpLm	1.000439
CtpLm	1.005493
<b>Inf.cal.value</b>	40.360001 MJ/kg
<div> <div>↑</div> <div>↓</div> <div>Menu</div> </div>	

04.Str. CR.OIL-LIQ.TURBINE	
Fluid data	
Fluid	crude oil
Alpha	0.0012647 1/°C
Fluid temp@meter	11.000000 C
Fluid pres@meter	4.348636 bar
Fp(m)	1.3114e-04 1/bar
CtLm	1.005051
CpLm	1.000439
CtpLm	1.005493
Inf.cal.value	40.360001 MJ/kg
Kinematic viscosity	30 mm <sup>2</sup> /s
Dynamic viscosity	0.0210161 Pasec
<b>Specific carbon</b>	0.807420 kg/kg
<div> <div>↑</div> <div>↓</div> <div>Menu</div> </div>	

Figure 9-22 Fluid data for crude oil and refined products

01.Str. ProdPlant1 - ethanol1		01.Str. ProdPlant1 - ethanol1	
Fluid data		Fluid data	
Fluid	ethanol	Fluid	ethanol
Meas.density	805.000000 kg/m <sup>3</sup>	Mix.base dens.	804.839001 kg/m <sup>3</sup>
Mix.line dens.	805.000001 kg/m <sup>3</sup>	Eth.base dens.	789.234963 kg/m <sup>3</sup>
Mix.base dens.	804.839001 kg/m <sup>3</sup>	Ethanol %(m/m)	94.753628 %
Eth.base dens.	789.234963 kg/m <sup>3</sup>	Ethanol %(v/v)	96.627011 %
Ethanol %(m/m)	94.753628 %	Dynamic viscos.	0.001 Pasec
Ethanol %(v/v)	96.627011 %	Fluid temp.@dens	20.000000 °C
Dynamic viscos.	0.001 Pasec	Fluid pres.@dens	3.500000 bar
Fluid temp.@dens	20.000000 °C	Fluid temp@meter	20.000000 °C
Fluid pres.@dens	3.500000 bar	Fluid pres@meter	3.500001 bar
Fluid temp@meter	20.000000 °C	CpLd	1.000200
Fluid pres@meter	3.500001 bar	CpLm	1.000200
↑	↓	↑	↓
Menu		Menu	

Figure 9-23 Fluid data for ethanol

06.Str. GEN.LIQUID-VORTEX	
Fluid data	
Fluid	general liquid
Line density	796.369995 kg/m <sup>3</sup>
Base density	800.000000 kg/m <sup>3</sup>
CtLm	0.995463
CpLm	1.000000
Dynamic viscos.	1.0000e-05 Pasec
←	↕
Menu	

Figure 9-24 Fluid data for general liquid

07.Str. LIQUID MIXT.-CORIOLIS		07.Str. LIQUID MIXT.-CORIOLIS	
Fluid data		Fluid data	
Fluid	Liquid mixture	Fluid	Liquid mixture
Mix.line dens.	850.000000 kg/m <sup>3</sup>	Work.dens.fluid1	846.723389 kg/m <sup>3</sup>
Work.dens.fluid1	846.706482 kg/m <sup>3</sup>	Work.dens.fluid2	725.854614 kg/m <sup>3</sup>
Work.dens.fluid2	725.833191 kg/m <sup>3</sup>	Alpha fluid 1	8.4979e-04 1/°C
Alpha fluid 1	8.4979e-04 1/°C	Beta fluid 1	7.4281e-05 1/bar
Beta fluid 1	7.4291e-05 1/bar	CtLm fluid 1	0.996145
CtLm fluid 1	0.996125	CpLm fluid 1	1.000000
CpLm fluid 1	1.000000	Alpha fluid 2	0.0012512 1/°C
Alpha fluid 2	0.0012512 1/°C	Beta fluid 2	1.1878e-04 1/bar
Beta fluid 2	1.1880e-04 1/bar	CtLm fluid 2	0.994321
CtLm fluid 2	0.994292	CpLm fluid 2	1.000000
CpLm fluid 2	1.000000	Vol.contr.fact	1.000000
←	↕	←	↕
Menu		Menu	

Figure 9-25 Fluid data for liquid mixture

08.Str. STEAM-VENTURI	
Fluid data	
Fluid	water steam
Method	IAPWS-IF97
Phase	superheated steam
Dynamic viscos.	1.8131e-05 Pasec
Isentropic expon.	1.302983
Line density	2.361826 kg/m <sup>3</sup>
Specific enthalpy	2 959.083252 kJ/kg

← ↑ Menu

Figure 9-26 Fluid data for water steam

Function of the F keys on the fluid data data page:

← returns to the Process data menu page

↑ scrolls through data lines on the data page if not all the lines fit on one display

Menu returns to the parent menu.

### 9.1.1.7.3 Gas composition

Route in the menu tree:

Flow	Streams	Process data	Gas composition	data page (1.1.7.3)
------	---------	--------------	-----------------	---------------------

In case of natural gas the gas composition is shown on separate data page as shown below. The data page indicates the composition used in gas properties calculation.

01.Str. NGAS-ORIFICE				01.Str. NGAS-ORIFICE			
N2	0.7632	npentane	0.0098	ammonia	0.0000		
CO2	0.0489	nhexane	0.0196	benzene	0.0000		
H2S	0.0000	nheptane	0.0000	dimet-prop-22	0.0000		
H2O	0.1996	noctane	0.0000	met-pent-2	0.0000		
helium	0.0000	nnonane	0.0000	met-pent-3	0.0000		
methane	95.8377	ndecane	0.0000	dimet-but-22	0.0000		
ethane	0.7925	oxygen	0.0000	dimet-but-23	0.0000		
propane	0.2642	CO	0.0000	ethylene	0.0000		
ibutane	0.0489	H2	1.9569	propylene	0.0000		
nbutane	0.0489	argon	0.0000	meth-alcohol	0.0000		
ipentane	0.0098			sulf-dioxid	0.0000		
Other component		Total:	100.0000	air	0.0000		
← → Menu				← → Total: 100.0000 Menu			

Figure 9-27 Gas composition data for natural gas

Function of the F keys on the gas composition data page:

← returns to the Process data menu page

↑ scrolls through data lines on the data page if not all the lines fit on one display

Menu returns to the parent menu.

### 9.1.2 Plant I/O

Route in the menu tree:

Flow	Plant I/O	I/O board 1	data page (1.2.1)
		I/O board 2	data page (1.2.2)
		I/O board 3	data page (1.2.3)
		I/O board 4	data page (1.2.4)
		I/O board 5	data page (1.2.5)
		Modbus signals	data page (1.2.6)

The data pages in the plant I/O submenu show:

- signals in engineering unit for current, PRT/RTD and frequency input and current output channels;
- states for digital input and digital output channels.

Data pages for the different type of the I/O boards shown on the figures below.

5.IO Board ANI8		
1	DP1	6.339 mbar
2	DP2	27.137 mbar
3	DP3	142.217 mbar
4	P	5.522 bar
5	T	10.294 °C
6	VORTEX	430.086 m³/h
7	CORIOLIS	552.826 kg/h
8	DENSITY	939.646 kg/m³

← → ↕ Menu

Figure 9-28 I/O board *n* data page for ANI8 board

Channel 1, 2 and 3 configured to measure differential pressure

Channel 4 configured to measure pressure

Channel 5 configured to measure temperature on current input

Channel 6 configured to measure volume flow rate on current input

Channel 7 configured to measure mass flow rate on current input

Channel 8 configured to measure density on current input



1.I/O Board ANI4PT2		
1	DP1.M1	45.960 mbar
2	DP2.M1	214.575 mbar
3	P.M1	5.530 bar
4	QM.M5	3643.067 kg/h
5	T.M1	19.466 °C
6		inactive

← → ↑ Menu

Figure 9-29 I/O board *n* data page for ANI4PT2 board

Channel 1 and 2 configured to measure differential pressure  
Channel 3 configured to measure pressure.  
Channel 4 configured to measure mass flow rate signal.  
Channel 5 configured to measure temperature from PRT sensor.

2.I/O Board PDIO484		
1	TURBINE UVOL	100.002 m <sup>3</sup> /h
2	TURBINE FLOW CHE	100.001 m <sup>3</sup> /h
3	DENSITY1	--- kg/m <sup>3</sup>
4	DENSITY2	720.000 kg/m <sup>3</sup>
5	VALVE OPENED	yes
6	VALVE CLOSED	no
7		inactive
8		inactive
9		inactive
10		inactive
11		inactive
12		inactive
13	STREAM1 CVOL FR	0 pulse

← → ↑ Menu

2.I/O Board PDIO484		
4	DENSITY2	720.000 kg/m <sup>3</sup>
5	VALVE OPENED	yes
6	VALVE CLOSED	no
7		inactive
8		inactive
9		inactive
10		inactive
11		inactive
12		inactive
13	STREAM1 CVOL FR	1 pulse
14	STREAM1 HI limit	closed
15	STR1 PRES LO lim	closed
16	VALVE CLOSE	closed

← → ↑ Menu

Figure 9-30 I/O board *n* data page for PDIO484 board

Channel 1 and 2 configured to count high frequency pulses from flow meter  
Channel 3 and 4 configured to measure density frequency from densitometer  
Channel 5 and 6 configured to signal valve open and closed position  
Channel 13 configured to output low frequency pulses proportional to corrected volume  
Channel 14 configured to signal corrected volume flow rate high limit alarm  
Channel 15 configured to signal pressure input low limit alarm  
Channel 16 configured to signal valve position

3.IO Board AODIO484		3.IO Board AODIO484			
1	P.M1	5.531 bar	4	EN.M1	177.788 GJ/h
2	CVOL.M1	4 748.029 m³/h	5		inactive
3	T.M1	19.453 °C	6		inactive
4	EN.M1	177.611 GJ/h	7		inactive
5		inactive	8		inactive
6		inactive	9		inactive
7		inactive	10		inactive
8		inactive	11		inactive
9		inactive	12		inactive
10		inactive	13	COMMON-ERROR	open
11		inactive	14	CVOL-LOlimit.M1	closed
12		inactive	15	CVOL-HIlimit.M1	closed
13	COMMON-ERROR	open	16	TIME BASE	closed

Figure 9-31 I/O board *n* data page for AODIO484 board

- Channel 1 configured to output current proportional to pressure
- Channel 2 configured to output current proportional to corrected volume flow rate
- Channel 3 configured to output current proportional to temperature
- Channel 4 configured to output current proportional to energy flowrate
- Channel 13 configured to signal common alarm
- Channel 14 configured to signal corrected volume flowrate low limit alarm
- Channel 15 configured to signal corrected volume flowrate high limit alarm
- Channel 16 configured to output timed pulses

Modbus signal	
1	FLWSIC-600 --- m <sup>3</sup> /h
2	inactive
3	inactive
4	inactive
5	inactive
6	inactive
7	inactive
8	inactive
9	inactive
10	inactive
11	inactive
12	inactive
13	inactive

Figure 9-32 Modbus signal data page

Channel 1 configured for Sick-Maihak ultrasonic meter

Function of the F keys on the I/O board data page:

- ⇒ display the I/O signals on the board in the next slot
- ⇐ display the I/O signals on the board in the previous slot
- ⇕ scrolls through channels of the I/O board

**Menu** returns to the parent menu.

### 9.1.3 Archive data

Route in the menu tree:

Flow	Archive data	data page (1.3)
------	--------------	-----------------

UNIFLOW-200 has a very extensive data archive.

The archived data divided into two subgroups:

- archived periodic totals;
- archived batch data;

The most convenient way to access the archived data is to read them via the Ethernet link by means of UNIArchive software.

However all the archive data can be called on the display as well, if PC is not available.

#### 9.1.3.1 Archived periodic totals

The archive data data page is shown on the figure below.

01.Str. NGAS-ORIFICE				
Archive hourly values 2010.10.19				
CUOL	m <sup>3</sup>	PressG bar	Temp.	C
	total	average	average	
7	*	*	*	*
8	4 245	4.537870	19.44961	
9	4 753	4.537494	19.43871	
10	4 754	4.538520	19.45577	
11	4 760	4.544064	19.50669	
12	4 756	4.540540	19.44350	
13	4 755	4.539455	19.43900	
14	4 754	4.539127	19.43771	

Select ↓ Chart Menu

Figure 9-33 Archive data data page

Configured to display

- hourly totals for corrected volume;
- hourly average of the gauge pressure;
- hourly average of the temperature

The totals are displayed for 19 October 2010 for the hours from 7 to 14.

Data are displayed in three columns preceding with serial number of the periods in the first column.

The selection of the data to be displayed and the time period is done by the function keys as described below.

Press ⇐ key to select the field to be edited. Press ⇑ key to scroll through the items from selection list in the data field or press Change key to enter the numeric fields. The editable fields and their values are as follows.

- stream number from 01 to 12
- period field: hourly, shift, daily, multi day, monthly
- date field: yyyy mm dd
- variable name field:
  - CVOL m<sup>3</sup> (volume at base conditions);
  - UVOL m<sup>3</sup> (volume at line conditions);
  - MASS kg (mass)
  - ENGY GJ (energy)
  - CO2MASS kg (mass of CO2 emission)
  - RAW UVOL m<sup>3</sup> (volume at line conditions before applying any error curve correction);
  - Temp. °C (temperature)
  - dP mbar (differential pressure)
  - fltCVOL m<sup>3</sup> (fault volume at base conditions);
  - fltUVOL m<sup>3</sup> (fault volume at line conditions);
  - fltMASS kg (fault mass);
  - fltENGY GJ (fault energy);
  - PressG bar (gauge pressure);
  - Dens. kg/m<sup>3</sup> (line density);
  - premCVOL m<sup>3</sup> (premium volume at base conditions);
  - premUVOL m<sup>3</sup> (premium volume at line conditions);
  - premMASS kg (premium mass);
  - premENGY GJ (premium energy);
  - PressA bar (absolute pressure);
  - K (Zl/Zb) (ratio of the compression factor at line conditions to base conditions);
  - No of cycl. (number of calculation cycles);
- variable type subfield:
 

For totals this subfield can be selected as:

  - total (displays the period counter for the selected period);
  - min. (displays the minimum flow rate for the flow corresponding to the total, e.g. minimum mass flow rate for the mass total);
  - max. (displays the maximum flow rate for the flow corresponding to the total, e.g. maximum mass flow rate for the mass total);

For non total variables this subfield can be selected as:

  - average (displays the average value of the variable for the selected period);
  - min. (displays the minimum value for the selected variable in the selected period);
  - max. (displays the maximum value for the selected variable in the selected period);

Press OK key after all the selection is done.

The data are displayed on the screen and the first data line is highlighted.

Press ⇑ and ⇕ keys for scrolling through the data lines.

Press ⇐ key for selecting the editable fields to select different data for different periods to be displayed.

Press Menu key to return to the parent menu.

Function of the F keys on the Archive data page:

- ⇌ select the next field for editing
- ⇕ select the data item in the field being edited
- OK** confirm the selection and display the data
- ↓ select the next data line
- ↑ select the previous data line
- Menu** returns to the parent menu.

### 9.1.3.2 Archived batch data

The archived batch data data page is shown on the figure below.

Archived batch data			2011.01.10
1Str Load_1			
SZEGED			
KRB-349			
Batch started		2011.01.10 13:02:29	
Batch stopped		2011.01.10 15:32:13	
Nr. Mass	kg	Dens. kg/m <sup>3</sup>	Temp. °C
	total	average	average
1	2 495	846.6184	21.1554

Select

↓

Print

Menu

Figure 9-34 Archive batch data page

The navigation on the archived batch data page and the selection of the measured value to be displayed are identical to those for the archived periodic totals.

### 9.1.4 Modbus registers

Route in the menu tree:

Flow	Modbus registers	data page (1.4)
------	------------------	-----------------

The data communication with UNIFLOW-200 is implemented with Modbus protocol.

The content of the Modbus registers can be displayed in this menu item. It can be useful in trouble-shooting if PC is not available for some reason.

The Modbus register data page is shown on the figure below.

Modbus registers			
Command		read	
Number format		integer	
Register mode		Daniel	
Starting register		5 000	
address	hexadec.		integer
5 000	0		0
5 001	795		1 941
5 002	879E		34 718
5 003	4FD02		326 914
5 004	101C90		1 055 888
5 005	1292		4 754
5 006	C5C2		50 626
5 007	B1F8E		728 974
<div> <span>↔</span> <span>Change</span> <span>OK</span> <span>Menu</span> </div>			

Figure 9-35 Modbus registers data page

The register mode can be selected as follows:

- **STD Modbus** (compatible with the standard Modicon format, 2 bytes/register)
- **Daniel Modbus** (compatible with Daniel/Enron/Omni format, 4 bytes/register)

The content of the registers displayed in hexadecimal and decimal format. The number format (short integer, integer, float) displayed as well.

See the register maps for both modes in Section 11.

Function of the F keys on the Modbus registers data page:

- ↔ select the next field for editing
- ⇅ select the data item in the field being edited
- OK** confirm the selection and display the data
- ↓ select the next data line
- ↑ select the previous data line

**Menu** returns to the parent menu.

### 9.1.5 Data transfer

Route in the menu tree:

Flow	Data transfer	data page (1.4)
------	---------------	-----------------

The most convenient way to access the archived data of the UNIFLOW-200 is to read them via the Ethernet link by means of UNIArchive software. If this method of accessing the files is not available for some reason then data retrieval (sending data files to the serial or USB port) can be initiated in this menu.

There are several archive files available in the UNIFLOW-200. All of them can be sent to the serial or USB port, however not all of them are optimized for printer.

The reports Month (short daily) and Month (short hourly) are optimized for printer. The delimiter character is space in these files and they can be printed on standard 80-character wide printer.

The rest of the files have semicolon delimiter character and they are wider than 80 columns. They can be caught on the serial or port of PC by some terminal program and saved on the hard disk for further evaluation or can be written to pen drive on the USB port.

The archive data files sent to the serial or USB port make use of UTF8 encoding. To display the archive data file on external device it shall be set accordingly. Otherwise some of the characters on the reports might not be displayed properly.

The data transfer data page is shown on the figure below.

```

Archive data transfer
Port      USB
Data file Month (short daily)
Month     October 2010
Start     no
  
```

Menu Change ↓ ↑

Figure 9-36 Data transfer data page

The editable fields and their content are as follows:

- Port where the files to be sent)
  - USB;
  - Com1
  - Com2
  - Com3

- Data file (The available reports for selection are)
  - Month (daily short);
  - Month (hourly short);
  - Month (daily defined 1);
  - Month (hourly defined 1);
  - Month (daily defined 2);
  - Month (hourly defined 2);
  - ...
  - Month (daily defined 10)
  - Month (hourly defined 10)
  - Logs;
  - Month (multiday);
  - Month (daily);
  - Month (shift);
  - Month (hourly);
  - Year (monthly);
  - Monthly batches;
  - Meter serial test;
  - Parameter project;
  - Prev. Day (hourly short)
  - Cur. Day (hourly short)
  - Prev. Day (hourly defined 1)
  - Cur. Day (hourly defined 1)
  - Prev. Day (hourly defined 2)
  - Cur. Day (hourly defined 2)
  - ...
  - Prev. Day (hourly defined 10)
  - Cur. Day (hourly defined 10)
- Month. Select the month for which the report to be transferred.
- Start. Select value "Yes" for this field to initiate file sending

There are separate short reports for each metering stream (from 01 to 12). Reports for all streams will be sent out once the Start is selected. Reports denoted with asterisk (\*) (short type reports) are available only for metering streams where the fluid is natural gas.

The non-short reports include data for all the streams.

Sample of the different short reports are shown in Annex A.

Function of the F keys on the Data transfer data page:

⇓ select the next field for editing

⇑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Menu** returns to the parent menu.



### 9.1.6 Extra summary display

Route in the menu tree:

Flow	Extra summary display	Extra sum. disp. 1	data page (1.6.1)
		Extra sum. disp. 2	data page (1.6.2)
		Extra sum. disp. 1 large	data page (1.6.3)
		Extra sum. disp. 2 large	data page (1.6.4)

There are two extra summary displays available in the UNIFLOW-200. Both of them can be displayed with double sized characters as well.

The main difference between the summary display and extra summary display is that on the extra summary display data from different metering streams can be grouped together. In case of multi stream application it helps the operator to overview the desired data from different streams on one single display.

01.Str. NGAS-ORIFICE	
CVOL	42 728 465 m <sup>3</sup>
02.Str. NGAS-US METER	
CVOL	0 m <sup>3</sup>
03.Str. NGAS-TURBINE	
CVOL	115 415 m <sup>3</sup>
04.Str. CR.OIL-LIQ.TURBINE	
CVOL	21 197 m <sup>3</sup>
05.Str. ETHANOL-CORIOLIS	
CVOL	472 m <sup>3</sup>
06.Str. GEN.LIQUID-VORTEX	
CVOL	21 186 m <sup>3</sup>
08.Str. STEAM-VENTURI	
MASS	1 029 594 t
Menu	

Figure 9-37 Extra summary display

The extra summary displays are empty by default.

The operator can edit them in the menu:

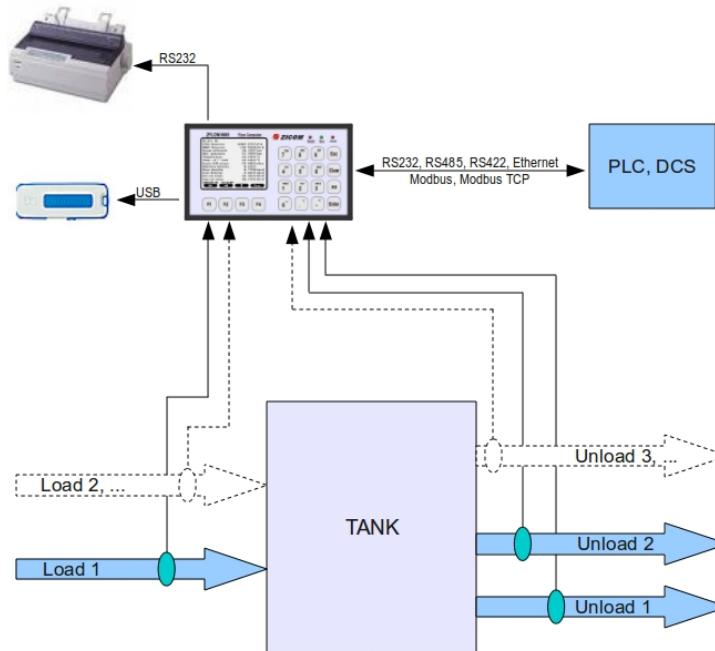
Parameters	General data	User defined	Display pages	Extra sum. display	data page (2.3.3.2.2)
------------	--------------	--------------	---------------	--------------------	-----------------------

### 9.1.7 Batches

Route in the menu tree:

Flow	Batches	data page (1.7)
------	---------	-----------------

The batch measurement was designed for tank loading system shown on the Figure 9-38.



**Figure 9-38 Tank loading/unloading system with batch measurement**

In the batch measurement the flow measured between the batch start and batch stop signal totalized in separate counters as batch totals. Separate averages are also calculated for the batch.

Batch measurement is enabled/disabled for each metering stream in the Stream setup menu. See in 9.2.2.1.3. Stream setup.

The progress of the batch measurement can be monitored and the results of the last batch can be displayed on the batch display as shown below.

Batches					start/stop
1Str Load_1					in progress
2Str Load_2					stopped
3Str Unload_3					stopped
SZEGED					
KRB-349					
Batch started					11.01.10 13:02:29
Batch stopped					
Nr. Mass	kg	ron	kg/m <sup>3</sup>	PressA	bar
0	2 326	851.82940	1.0000009		
Select					Menu

Batches					start/stop
1Str Load_1					stopped
2Str Load_2					stopped
3Str Unload_3					stopped
SZEGED					
KRB-349					
Batch started					11.01.10 13:02:29
Batch stopped					11.01.10 15:32:13
Nr. Mass	kg	ron	kg/m <sup>3</sup>	PressA	bar
1	2 495	851.82940	1.0000009		
Select					Menu

**Figure 9-39 Batch display**

For each stream configured the status of the batch measurement is indicated on the upper part of the display as *stopped* or *started*.

The lower part of the display shows the batch data for the stream being highlighted as follows:

- batch start time
- batch stop time
- batch number (1 to 999, restarts at the beginning of the month)
- three selected measured batch value

The displayed measured batch values are selectable by the operator from the list:

- Mass kg (mass batch total);
- UVOL m<sup>3</sup> (uncorrected volume batch total);
- CVOL m<sup>3</sup> (corrected volume batch total);
- Dens. kg/m<sup>3</sup> (line density batch average);
- Base.D. kg/m<sup>3</sup> (base density batch average);
- Meas.D kg/m<sup>3</sup> (measured density batch average);
- Temp. oC (temperature batch average);
- PressA bar (absolute pressure batch average);
- PressG bar (gauge pressure batch average);

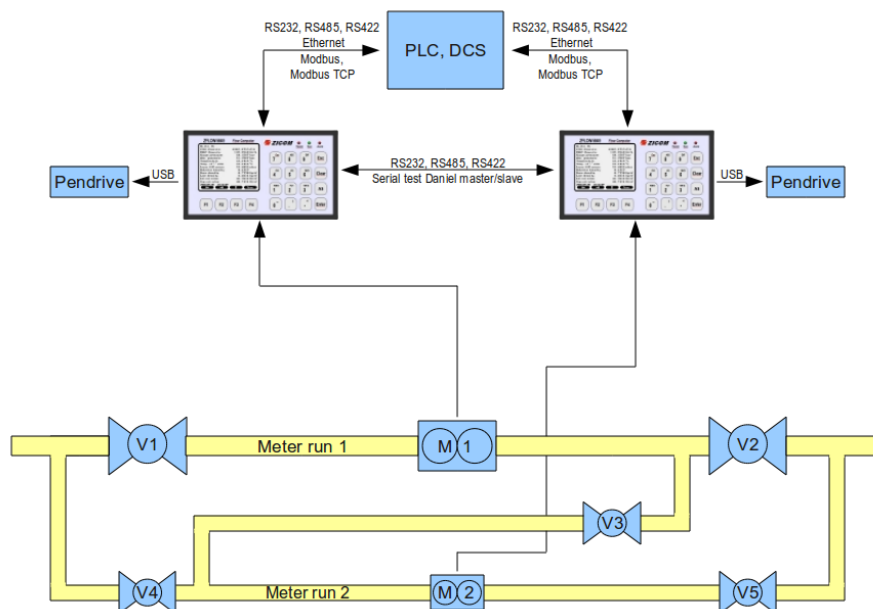
To display the archived batch data see 9.1.3.2.

### 9.1.8 Meter serial test

Route in the menu tree:

Flow	Meter serial test	data page (1.8)
------	-------------------	-----------------

The meter serial test measurement was designed for testing two flow meters connected in serial as shown on the Figure 9-40.



**Figure 9-40 Flow meter serial test measurement**

By opening and closing the appropriate valves flow is directed through both meters M1 and M2. Quantities measured during the preprogrammed test duration are compared and the deviation is determined.

The meter serial test measurement assumes that:

- separate UNIFLOW-200 flow computers are connected to the meters under tested;
- stream 1 is configured for the meter under test in both flow computers;
- stream 8 is used as shadow stream so that stream 8 can not be configured to any other meter;
- during the serial connection the fluid is measured twice. Not to account these quantities twice one of the flow computer shall be set as “custody transfer stream” and the other as “non custody transfer stream”. In the “non custody transfer stream” flow computer the calculation is performed in stream 8 (shadow stream).;
- the two flow computer shall be connected via serial ports. In the “non custody transfer stream” flow computer the serial port function shall be set as “Serial test Master”, while in the “custody transfer stream” flow computer the serial port shall be set as “Serial test Slave”.
- the serial test measurement is enabled in the Stream setup menu. See in 9.2.2.1.3.

#### NOTE

UNIFLOW-200 will not perform any valve control to establish the serial connection of the meters. The appropriate valves shall be controlled manually or by some supervisory system.  
UNIFLOW-200 configured as master in communication will read the data from the slave UNIFLOW-200 measured during the serial test and prepares a serial test comparison report.

The progress of the meter serial test measurement can be monitored and the results of the last test can be displayed on the meter serial test display as shown below.

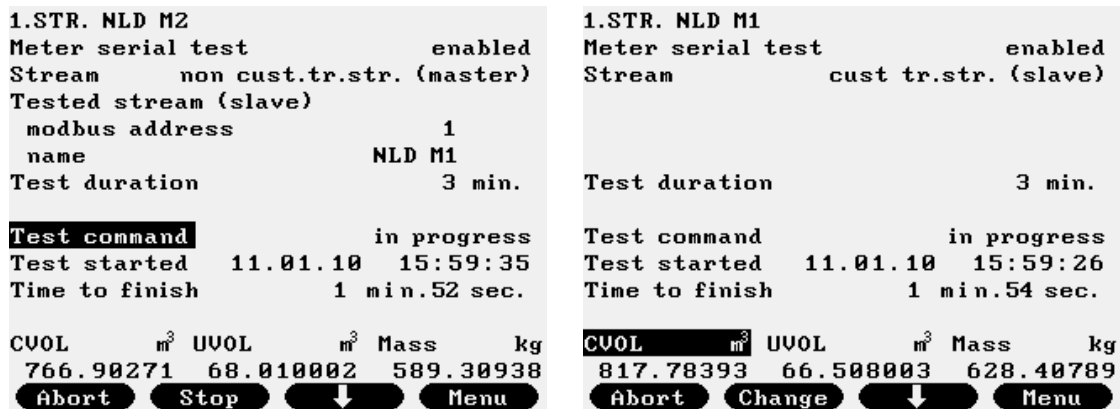


Figure 9-41 Meter serial test display

Function of the F keys on the Meter serial test data page

⇩ select the next field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Menu** Returns to the parent menu.

The data fields on the data page are as follows:

- Meter serial test;
  - enabled; (not editable, set in the stream setup menu)
- Stream;
  - non cust.tr.str. (master); (not editable, set in the stream setup menu)
  - cust.tr.str. (slave); (not editable, set in the stream setup menu)
- Tested stream (slave) (displayed in master device only;
  - modbus address; (not editable, set in the com port setup menu)
  - name; (not editable, name of the stream set in the slave device)
- Test duration;
 

Numeric entry. Enter the duration of the serial test. Valid entry is from 2 to 120 minutes.

- Test command;

Display the status of the test process and this is also the command entry field.

Statuses:

- `idle`; (no test in progress)
- `in progress`; (test in progress)
- `Master com.param.error`; (in Master device only. No com port is configured as Serial test Master)
- `Slave com.param.error`; (in Slave device only. No com port is configured as Serial test Slave)
- `Communication error`; (no communication with the other device)

Highlighting this field command can be selected as follows:

- `start`; (start the serial test, in Master device only)
- `stop`; (stop the serial test, in Master device only. If stop command is selected the test will be interrupted at the end of next minute and the data will be evaluated);
- `abort`; (abort the serial test. If abort command is selected the test will be interrupted immediately and the data will not be evaluated.

- Test started;

Start time of the meter serial test.

- Test stopped;

Stop time of the meter serial test. The last two lines show three of the measured values.

The displayed values are selectable by the operator from the list:

- UVOL m<sup>3</sup> (uncorrected volume);
- CVOL m<sup>3</sup> (corrected volume);
- Mass kg (mass);
- ENGY GJ (energy);
- PressG bar (gauge pressure);
- PressA bar (absolute pressure);
- Temp. oC (temperature);
- ZI (compression factor at line conditions);
- Zn (compression factor at base conditions);
- Rel.Dens. - (relative density);
- Base.D kg/m<sup>3</sup> (base density);
- Dens. kg/m<sup>3</sup> (line density);
- ICV MJ/m<sup>3</sup> (inferior calorific value);
- dP mbar (differential pressure);
- UVOL FR m<sup>3</sup>/h (uncorrected volume flow rate);
- CVOL FR m<sup>3</sup>/h (corrected volume flow rate);
- MASS FR m<sup>3</sup>/h (mass flow rate);
- ENGY FR m<sup>3</sup>/h (energy flow rate);

The results of the serial test are stored in Meter serial test report. The last 10 reports are retained in the archive of the flow computer.

The Meter serial test reports can be retrieved with UNIArchive software tool.

They can also be transferred to pendrive via the USB port of the flow computer. See 9.1.5.

Sample report is shown in Annex A.

## 9.2 Parameters

This chapter guides through the steps required to setup the UNIFLOW-200 for a particular flow measurement task. It gives the full list of options available for selection in the setup procedure.

UNIFLOW-200 is true multi function flow computer. Its capabilities allow configuring it for very wide range of applications. As a consequence the flow computer should be setup for each particular application. The setup is done in the Parameters menu.

Generally the setup is required only before the start-up of the unit. However modification of the parameters may become necessary during the normal operation of the flow computer as well. E.g. changing of the orifice bore diameter in case of orifice plate replacement, or, changing the turbine meter K-factor if the turbine meter is replaced are part of the normal daily operational procedure.

The setup can be done via keypad and display. The UNISetup software is also available at the web site of the manufacturer for download making the setup even more convenient and user friendly.

Entering the Parameters menu requires password. Logging in on Operator security level allows modification of limited set of parameters only. At Engineer level all the parameters are alterable. If operator logs in at Guest level then no parameter modification is allowed but all the parameters can be reviewed.

The signal processing and the flow calculation are not interrupted during the parameter editing.  
In the editing procedure:

- **OK** key accepts the new value of the parameter
- **Save** key stores the new value in a temporary location

The modified new parameters become active (i.e. the flow computer takes their value in the flow calculation) after the operator left the Parameters menu. Message "Parameter update in progress" is shown on the display when new parameters are activated.

The general rules of navigating the menu and editing data see in the Chapter 6.

It is recommended to setup the parameters in the orders as described in this chapter.

### 9.2.1 I/O signal setup

Route in the menu tree:

Parameters	I/O signals	I/O board m	Channel n	data page (2.1.m.n)
------------	-------------	-------------	-----------	---------------------

where:  $m$       serial number of I/O board  
           $n$       serial number of channel on the board  $m$

There are 5 slots in the flow computer capable to accommodate any type of I/O board available. The setup parameters depend on the type of channel being configured. For example the analog input channel is configured in the same way regardless of its location on the ANI8 or ANI4PT2 board.

The physical parameters of the flow measurement and the input and output channels are not hard wired together in the flow computer. It is part of the setup procedure to assign the physical parameter (for example pressure) to the channel where the pressure transmitter signal is wired to (for example channel 1 on board 1).

The figures below show the settings for each type of channels.

First line of each data page indicates the number of board and channel being edited and the type of the I/O board.

#### CAUTION

If the channel status is inactive then the channel can not be used in the flow calculation even if you set all the parameters of the channel.

Do not forget to set the channel **active** if you want to use the signal measured at the channel in the flow calculation.

#### 9.2.1.1 Analogue (4-20 mA) input channel

The analogue (4-20 mA) input channel data page is shown on the figure below.

Function of the F keys on the analogue (4-20 mA) input channel data page

↓ select the next field for editing

↑ select the previous field for editing

⇒ remove the highlighted item from the eventing list and step to the next item

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

5.I0/6.ch.		AN18	5.I0/6.ch.		AN18
Signal name	VORTEX		Signal type	Flowrate	
Signal type	Flowrate		Unit	m <sup>3</sup> /h	
Unit	m <sup>3</sup> /h		Error curve	no	
Error curve	no		LO_current	4 mA	
LO_current	4 mA		HI_current	20 mA	
HI_current	20 mA		LO_scale	0 m <sup>3</sup> /h	
LO_scale	0 m <sup>3</sup> /h		HI_scale	1 000 m <sup>3</sup> /h	
HI_scale	1 000 m <sup>3</sup> /h		LO_limit	0 m <sup>3</sup> /h	
LO_limit	0 m <sup>3</sup> /h		HI_limit	1 000 m <sup>3</sup> /h	
HI_limit	1 000 m <sup>3</sup> /h		LOLO_limit	0 m <sup>3</sup> /h	
LOLO_limit	0 m <sup>3</sup> /h		HIHI_limit	1 000 m <sup>3</sup> /h	
HIHI_limit	1 000 m <sup>3</sup> /h		Eventing	lsc,hsc	
Eventing	lsc,hsc		Signal status	active	
Save	Change	↓	Save	Change	↓
		↑			↑

Figure 9-42 Analogue (4-20 mA) input channel data page

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: FIQ 501 pressure
- Signal type
- Unit



- Supplementary parameter (depending on the signal type)  
Type of the physical parameter measured at the channel, its unit of measurement and the supplementary parameter are selected from the list below:
    - Differential pressure;
      - mbar
      - Pa
      - kPA
      - inH2O
    - Flowrate;
      - m<sup>3</sup>/h
      - kg/h
      - GJ/h
      - MWh/h
      - MVA
      - MCF/h
      - lb/h
      - MMBTU/h
      - bbl/h
      - Mlb/h
- supplementary parameter: Error curve
- yes
    - supplementary parameter 2: error curve correction type
      - linear interpolation, UVOLFR (m<sup>3</sup>/h) - Error (%)
  - no

5.I0/6.ch.			AN18	
Error curve			linear interpolation	
			UVOLFR(m <sup>3</sup> /h)-Error(%)	
No.	flowrate		K	
1	0		0	
2	117		-0.812	
3	479		-0.455	
4	983		0.639	
5	0		0	
6	0		0	
7	0		0	
8	0		0	
9	0		0	
10	0		0	
5.I0/6.ch.			AN18	
4	983		0.639	
5	0		0	
6	0		0	
7	0		0	
8	0		0	
9	0		0	
10	0		0	
11	0		0	
12	0		0	
13	0		0	
14	0		0	
15	0		0	
16	0		0	

Figure 9-43 Error curve data page for flow rate signal

If the error curve correction is selected for the flow rate signal then new data page opens for entering the error curve points. The volume flow rate at line conditions

(in m<sup>3</sup>/h) and the error at that flow rate shall be entered from the calibration certificate of the flow meter.

Maximum of 16 error curve point can be entered.

The flow rates shall be entered in increasing order.

- Pressure;
  - bar
  - kPa
  - MPa
  - PSIA or PSIG – depending on the gauge/absolute pressure transmitter selection

supplementary parameter: type of transmitter

  - Gauge pressure
  - Abs. pressure
- Temperature;
  - °C
  - °F
- Density;
  - kg/m<sup>3</sup>
  - lb/CF
  - RD

supplementary parameter: type of transmitter

  - Line density
  - Base density
  - Relative density (unit changes to – (none) for relative density)
- Special (special signal);
  - %
  - mole%
  - - (none)
  - MJ/m<sup>3</sup>
  - MJ/kg
  - uS
  - BTU/SCF
  - lb/MMSCFKin. viscosity (kinematic viscosity);
  - mm<sup>2</sup>/s
  - cSt
- Level;
  - cm
  - m
  - mm
  - inch

supplementary parameters

  - Level equivalent (in level unit/mA)
  - Zero level (in level unit)

Common parameters for input channels regardless of the signal type

- LO\_current (low scale of the current input);
- HI\_current (high scale of the current input);
- LO\_scale (low scale of the parameter in engineering unit);
- HI\_scale (high scale of the parameter in engineering unit);
- LO\_limit (low alarm limit);
- HI\_limit (high alarm limit);
- LOLO\_limit (low-low alarm limit);
- HIHI\_limit (high-high alarm limit);
- Keypad value; Keypad value is not available for differential pressure, flow rate and level signals. See the activation of the Keypad value in section 9.3. Alarm and events

- Eventing;

It can be selected here that which of the events shall cause an event generated in the event log of the flow computer. The options are:

- lsc (low scale);
  - hsc (high scale);
  - lo (lo limit);
  - hi (hi limit);
  - lolo (lolo limit);
  - hihi (hihi limit);
- Signal status
  - active;
  - inactive;

#### NOTE

The input channels on the DEI4 I/OI board (input for transmitters communicating with Honeywell DE protocol) shall be setup in the same way as analogue (4-20 mA) channels with exception that no LO\_current and HI\_current parameters are available for these channels.

#### IMPORTANT

If the signal configured for any channel is to be used in flow calculation then the unit of measurement shall be selected as follows:

In case of metric unit system:

- pressure signal: bar
- differential pressure signal: mbar
- temperature signal: °C

In case of imperial unit system for gas measurement:

- pressure signal: PSIG or PSIA
- differential pressure signal: inH2O
- temperature signal: °F

### 9.2.1.2 PRT/RTD input channel

The PRT/RTD input channel data page is shown on the figure below.

Function of the F keys on the PRT/RTD input channel data page

- ↓ select the next field for editing
- ↑ select the previous field for editing
- ⇒ remove the highlighted item from the eventing list and step to the next item

**Change** modify the selected data field

**OK** confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

1.I0/5.ch.		ANI4PT2 /PT1	
Signal name	T.M1		
RTD type	Pt100		
Unit	°C		
RTD calibrated?	yes		
CVD constants	yes		
R0 (0°C)	100 ohm		
A	0.0039082998 1/°C		
B	-5.77500e-07 1/°C <sup>2</sup>		
C	-4.18300e-12 1/°C <sup>3</sup>		
LO_scale	-10 °C		
HI_scale	40 °C		
LO_limit	-10 °C		
HI_limit	40 °C		
LOLO_limit	-10 °C		
HIHI_limit	40 °C		
Keypad	11 °C		
Eventing	lsc,hsc		
Signal status	active		

Save Change ↓ ↑

Figure 9-44 PRT/RTD input channel data page

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: FIQ 501 temperature
- RTD type
  - Pt100 (100 ohms at 0 °C) default value - Pt500, Pt1000 and Pt50 on special request;
- Unit
  - °C
  - °F
- RTD calibrated?
  - yes;  
If yes is selected then it is assumed that the Callendar - Van Dusen (CVD) coefficients are available for the sensor. In this case the CVD constants set to yes automatically and the R0, A, B and C can be edited.
  - no;  
If no is selected then the default value of the CVD coefficients (from EN 60751) are used to convert the measured resistance to temperature. If CVD constants set to yes then R0, A, B and C are displayed but can not be edited.

- CVD constants (according to EN 60751);
  - yes;
  - no;
- R0 (at 0 °C), default value = 100;
- A, default value = 3.9083e-3;
- B, default value = -5.775e-7;
- C, default value = -4.183e-12;
- LO\_scale (low scale of the parameter in engineering unit);
- HI\_scale (high scale of the parameter in engineering unit);
- LO\_limit (low alarm limit);
- HI\_limit (high alarm limit);
- LOLO\_limit (low-low alarm limit);
- HIHI\_limit (high-high alarm limit);
- Keypad value; see the activation of the Keypad value in section 9.3 Alarm and events
- Eventing;
 

It can be selected here that which of the events shall cause an event generated in the event log of the flow computer. The options are:

  - lsc (low scale);
  - hsc (high scale);
  - lo (lo limit);
  - hi (hi limit);
  - lololo (lolo limit);
  - hihi (hihi limit);
- Signal status
  - active;
  - inactive;

### 9.2.1.3 Pulse input channel

Depending on the selected signal type of the pulse input the physical parameter represented by the pulse and the data processing are different. The signal types are as follows:

- flow pulse;  
Each pulse represents certain amount of fluid passed through the flow meter. The number of pulses is counted and converted into the totals with the K-factor of the flow meter.
- flow check pulse;  
This type of pulse input is used to check the pulse train integrity from the flow meter to the flow computer. Flow check pulse input channel is selected in pair with flow pulse channel if the flow meter provides dual pulse output.
- flow frequency;  
The frequency of the pulse signal is proportional with the flow rate measured by the meter. The flow computer converts the frequency to the flow rate using the low and high range values and the flow rate then totalized.
- density frequency;  
The frequency is proportional to the density measured with the density transducer. The flow computer converts the frequency to the density according to the equation provided by the manufacturer of the densitometer.

The pulse input data page has different view depending on the signal type. The data pages for each signal type are shown below.

Function of the F keys on the pulse input channel data page

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

⇒ remove the highlighted item from the eventing list and step to the next item

⇒ enter into error curve definition data page

⇐ left the error curve definition data page

2.I0/1.ch. PDIO484 / FI1	
Signal name	TURBINE UVOL
Signal type	Flow pulse
Unit	m <sup>3</sup> /h
Pulse transm.	Active 5V
Min. UVOL FR	0 %
Max. UVOL FR	1 000 m <sup>3</sup> /h
Max. overload	100 %
K-factor mode	pls/m <sup>3</sup>
K-factor	3 600 pls/m <sup>3</sup>
Error curve	yes
LO_limit	0 m <sup>3</sup> /h
HI_limit	1 000 m <sup>3</sup> /h
LOLO_limit	0 m <sup>3</sup> /h

Save Change ↓ ↑

2.I0/1.ch. PDIO484 / FI1	
Min. UVOL FR	0 %
Max. UVOL FR	1 000 m <sup>3</sup> /h
Max. overload	100 %
K-factor mode	pls/m <sup>3</sup>
K-factor	3 600 pls/m <sup>3</sup>
Error curve	yes
LO_limit	0 m <sup>3</sup> /h
HI_limit	1 000 m <sup>3</sup> /h
LOLO_limit	0 m <sup>3</sup> /h
HIHI_limit	1 000 m <sup>3</sup> /h
Eventing	lo,hi
Live/Check signal	Live
Signal status	active

Save Change ↓ ↑

Figure 9-45 Pulse input channel (signal type = flow pulse) data page

The editable fields on the data page are as follows:

- **Signal name**  
Any character string up to 18 characters, for example: FIQ 501 main pulse
- **Signal type**
  - Flow pulse;
- **Unit**
  - m<sup>3</sup>/h
  - kg/h
  - GJ/h
  - MWh/h
  - MVA
  - MCF/h
  - lb/h
  - MMBTU/h
  - bbl/h
  - Mlb/h
- **Pulse transm. (Pulse transmitter type)**
  - active 5 V;
  - active 15 V;
  - OC (open collector) (12 V);
  - NAMUR
- **Min. UVOL FR** (low metering range of the flow meter, volume flow rate at line conditions)
- **Max. UVOL FR** (high metering range of the flow meter, volume flow rate at line conditions)
- **Max. overload** (allowable overload of the flow meter in percent of the high metering range)
- **K-factor mode;**
  - pulse/m<sup>3</sup>;
  - m<sup>3</sup>/pulse;
- **K-factor;**
- **Error curve;**
  - yes; (see error curve data page below if yes is selected)
  - no;
- **LO\_limit** (low alarm limit);
- **HI\_limit** (high alarm limit);
- **LOLO\_limit** (low-low alarm limit);
- **HIHI\_limit** (high-high alarm limit);
- **Eventing;**  
It can be selected here that which of the events shall cause an event generated in the event log of the flow computer. The options are:
  - lo (lo limit);
  - hi (hi limit);
  - lololo (lolo limit);
  - hihhi (hihi limit);
- **Live/check signal**
  - live;

- Hz; (enter check signal is Hz)
- usec; (enter check signal is usec)
- Check signal; (displayed only if Live/check signal set to Hz or usec. This feature is provided for test purpose only. Do not forget to set the Live/check signal to “live” after the test to recover the normal operation of the flow computer.)
- Signal status
  - active;
  - inactive;

2.I0/1.ch.		PDIO484 / FI1	
<b>Error curve</b>		linear interpolation	
		UVOLFR(m <sup>3</sup> /h)-Error(%)	
No.	flowrate	K	
1	0	0	
2	100	1.1	
3	300	0.6	
4	600	0.2	
5	1000	-0.45	
6	0	0	
7	0	0	
8	0	0	
9	0	0	
10	0	0	

2.I0/1.ch.		PDIO484 / FI1	
4		600	
5		1000	
6		0	
7		0	
8		0	
9		0	
10		0	
11		0	
12		0	
13		0	
14		0	
15		0	
16		0	

Figure 9-46 Error curve data page (signal type = flow pulse)

If the error curve correction is selected for the flow rate signal then new data page opens for entering the error curve points.

The editable fields on the error curve data page are as follows:

- Error curve type
    - linear interpolation;
 

Maximum of 16 error curve point can be entered in increasing order.
    - polynomial;
 

The coefficients and the power of the polynomial shall be entered up to 6th power.
- In any of the above two cases the independent and the dependant variable of the error curve selected from the list:
- UVOLFR (m<sup>3</sup>/h) - Error (%);
  - frequency (Hz) - K-factor (pulse/m<sup>3</sup>);
  - UVOLFR (m<sup>3</sup>/h) - K-factor (pulse/m<sup>3</sup>);
  - log(UVOLFR/visc (m<sup>3</sup>/h/cSt) - K-factor (pulse/m<sup>3</sup>);



2.I0/2.ch.		PDI0484 / FI2
Signal name	TURBINE FLOW CHECK	
Signal type	Flow check pulse	
Unit	m <sup>3</sup> /h	
Pulse transm.	Active 5V	
K-factor mode	pls/m <sup>3</sup>	
K-factor	3 600 pls/m <sup>3</sup>	
Live/Check signal	Live	
Signal status	active	

Save Change ↓ ↑

**Figure 9-47 Pulse input channel (signal type = flow check pulse) data page**

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: FIQ 501 check pulse
- Signal type
  - Flow check pulse;
- Unit
  - m<sup>3</sup>/h
  - kg/h
  - GJ/h
  - MWh/h
  - MVA
  - MCF/h
  - lb/h
  - MMBTU/h
  - bbl/h
  - Mlb/h
- Pulse transm. (Pulse transmitter type)
  - active 5 V;
  - active 15 V;
  - open collector (12 V);
  - NAMUR
- K-factor mode;
  - pulse/m<sup>3</sup>;
  - m<sup>3</sup>/pulse;
- K-factor;
- Live/check signal
  - live;
  - Hz; (enter check signal is Hz)
  - usec; (enter check signal is usec)
- Check signal; (displayed only if Live/check signal set to Hz or usec. This feature is provided for test purpose only. Do not forget to set the Live/check signal to "live" after the test to recover the normal operation of the flow computer.)

- Signal status
  - active;
  - inactive;

2.I0/1.ch.		PDI0484 / FI1	
<b>Signal name</b>	TURBINE UVOL	<b>Pulse transm.</b>	Active 5V
<b>Signal type</b>	Flow frequency	<b>Error curve</b>	yes
<b>Unit</b>	m <sup>3</sup> /h	<b>LO_frequency</b>	0 Hz
<b>Pulse transm.</b>	Active 5V	<b>HI_frequency</b>	1 000 Hz
<b>Error curve</b>	yes	<b>LO_scale</b>	0 m <sup>3</sup> /h
<b>LO_frequency</b>	0 Hz	<b>HI_scale</b>	1 000 m <sup>3</sup> /h
<b>HI_frequency</b>	1 000 Hz	<b>LO_limit</b>	0 m <sup>3</sup> /h
<b>LO_scale</b>	0 m <sup>3</sup> /h	<b>HI_limit</b>	1 000 m <sup>3</sup> /h
<b>HI_scale</b>	1 000 m <sup>3</sup> /h	<b>LOLO_limit</b>	0 m <sup>3</sup> /h
<b>LO_limit</b>	0 m <sup>3</sup> /h	<b>HIHI_limit</b>	1 000 m <sup>3</sup> /h
<b>HI_limit</b>	1 000 m <sup>3</sup> /h	<b>Eventing</b>	lo,hi
<b>LOLO_limit</b>	0 m <sup>3</sup> /h	<b>Live/Check signal</b>	Live
<b>HIHI_limit</b>	1 000 m <sup>3</sup> /h	<b>Signal status</b>	active
<b>Save</b>	<b>Change</b>	<b>Save</b>	<b>Change</b>

Figure 9-48 Pulse input channel (signal type = flow frequency) data page

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: FIQ 501 frequency
- Signal type
  - Flow frequency;
- Unit
  - m<sup>3</sup>/h
  - kg/h
  - GJ/h
  - MWh/h
  - MVA
  - MCF/h
  - lb/h
  - MMBTU/h
  - bbl/h
  - Mlb/h
- Pulse transm. (Pulse transmitter type)
  - active 5 V;
  - active 15 V;
  - open collector (12 V);
  - NAMUR
- Error curve;
  - yes; (see error curve data page below if yes is selected)
  - no;
- LO\_Hz (low scale of the frequency input);
- HI\_Hz (high scale of the frequency input);
- LO\_scale (low scale of the parameter in engineering unit);

- HI\_scale (high scale of the parameter in engineering unit);
- LO\_limit (low alarm limit);
- HI\_limit (high alarm limit);
- LOLO\_limit (low-low alarm limit);
- HHHI\_limit (high-high alarm limit);
- Eventing;
 

It can be selected here that which of the events shall cause an event generated in the event log of the flow computer. The options are:

  - lo (lo limit);
  - hi (hi limit);
  - lololo (lolo limit);
  - hihhi (hihi limit);
- Live/check signal
  - live;
  - Hz; (enter check signal is Hz)
  - usec; (enter check signal is usec)
- Check signal; (displayed only if Live/check signal set to Hz or usec. This feature is provided for test purpose only. Do not forget to set the Live/check signal to “live” after the test to recover the normal operation of the flow computer.)
- Signal status
  - active;
  - inactive;

2.I0/1.ch.		PDIO484 / FI1	
<b>Error curve</b>		linear interpolation	
		UVOLEFR(m <sup>3</sup> /h)-Error(%)	
No.	flowrate	K	
1	0	0	
2	100	1.1	
3	300	0.6	
4	600	0.2	
5	1000	-0.45	
6	0	0	
7	0	0	
8	0	0	
9	0	0	
10	0	0	

2.I0/1.ch.		PDIO484 / FI1	
4		600	
5		1000	
6		0	
7		0	
8		0	
9		0	
10		0	
11		0	
12		0	
13		0	
14		0	
15		0	
16		0	

Figure 9-49 Error curve data page (signal type = flow frequency)

If the error curve correction is selected for the flow rate signal then new data page opens for entering the error curve points.

The editable fields on the error curve data page are as follows:

- Error curve type
  - linear interpolation;

Maximum of 16 error curve point can be entered in increasing order.

- polynomial;

The coefficients and the power of the polynomial shall be entered up to 6th power.

In any of the above two cases the independent and the dependant variable of the error curve selected from the list:

- UVOLFR (m<sup>3</sup>/h) – Error (%);
- frequency (Hz) – K-factor (pulse/m<sup>3</sup>);
- UVOLFR (m<sup>3</sup>/h) – K-factor (pulse/m<sup>3</sup>);
- log(UVOLFR/visc (m<sup>3</sup>/h/cSt) – K-factor (pulse/m<sup>3</sup>);

2.I0/3.ch.		PDI0484 / FI3		2.I0/3.ch.		PDI0484 / FI3	
Signal name	DENSITY1			K18	-0.00003	K19	-0.0065
Signal type	Density			K20A	-0	K20B	-0
Unit	kg/m <sup>3</sup>			K21A	-0.0044	K21B	-0.0008
Pulse transm.	Active 5V			L0_scale		500	kg/m <sup>3</sup>
Transm. type	Solatron7835			HI_scale		1100	kg/m <sup>3</sup>
Density const.				L0_limit		500	kg/m <sup>3</sup>
K	1 K0	-1322		HI_limit		1100	kg/m <sup>3</sup>
K1	-0.125	K2	0.00375	L0LO_limit		500	kg/m <sup>3</sup>
K18	-0.00003	K19	-0.0065	HIHI_limit		1100	kg/m <sup>3</sup>
K20A	-0	K20B	-0	Keypad		780	kg/m <sup>3</sup>
K21A	-0.0044	K21B	-0.0008	Eventing	lo,hi		
L0_scale		500	kg/m <sup>3</sup>	Live/Check signal		Live	
HI_scale		1100	kg/m <sup>3</sup>	Signal status		active	
Save	Change	↓	↑	Save	Change	↓	↑

Figure 9-50 Pulse input channel (signal type = density frequency) data page

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: FIQ 501 density
- Signal type
  - Density;
- Unit
  - kg/m<sup>3</sup>
  - lb/CF
  - RD
- Pulse transm. (Pulse transmitter type)
  - active 5 V;
  - active 15 V;
  - open collector (12 V);
  - NAMUR
- Density transmitter type
  - linear;
  - Solatron 3096R; (unit changes to – (none) for relative density)
  - Solatron 3096N;
  - Solatron 7812;
  - Solatron 7835;
- Density cnst (constants for the density transducers from the calibration certificate)
  - Solatron 3096R – K0, K2;
  - Solatron 3096N – K0, K2;

- Solatron 7812 – K0, K1, K2, K3, K4, K18, K19;
- Solatron 7835 – K, K0, K1, K2, K3, K4, K18, K19, K20A, K20B, K21A, K21B;  
(K is a general purpose scale parameter)
- LO\_scale (low scale of the parameter in engineering unit);
- HI\_scale (high scale of the parameter in engineering unit);
- LO\_limit (low alarm limit);
- HI\_limit (high alarm limit);
- LOLO\_limit (low-low alarm limit);
- HIHI\_limit (high-high alarm limit);
- Keypad value; see the activation of the Keypad value in section 9.3 Alarm and events
- Eventing;  
It can be selected here that which of the events shall cause an event generated in the event log of the flow computer. The options are:
  - lsc (low scale);
  - hsc (high scale);
  - lo (lo limit);
  - hi (hi limit);
  - lololo (lolo limit);
  - hihi (hihi limit);
- Live/check signal
  - live;
  - Hz; (enter check signal is Hz)
  - usec; (enter check signal is usec)
- Check signal; (displayed only if Live/check signal set to Hz or usec. This feature is provided for test purpose only. Do not forget to set the Live/check signal to “live” after the test to recover the normal operation of the flow computer.)
- Signal status
  - active;
  - inactive;

#### 9.2.1.4 Digital input channel

Depending on the selected signal type of the digital (2-state) input the parameters and the data pages are different. The signal types are as follows:

- Dual state;  
It is used to indicate two status of any equipment (for example valve) represented by an open and closed state of a contact.
- Pulse;  
It is used to totalize the flow by counting low frequency (50 Hz maximum) pulse train from flow meter.

The data pages for each signal type show below.

Function of the F keys on the digital input channel data page

- ↓ select the next field for editing  
 ↑ select the previous field for editing  
**Change** modify the selected data field  
**OK** Confirm the selection  
**Save** save the selected/entered data and returns to the parent menu.  
 ⇒ remove the highlighted item from the eventing list and step to the next item

2.10/5.ch.		PDIO484 / DI1	
Signal name	VALUE OPENED		
Signal type	Dual state		
Type of contact	NC		
Event when	entering into state		
Log	yes		
Eventing	yes		
Signal status	active		

Save Change ↓ ↑

**Figure 9-51 Digital input channel (signal type = dual state) data page**

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: FV 501 valve status
- Signal type
  - Dual state;
- Type of contact
  - NO (normally open);
  - NC (normally closed);
- Event when
  - entering into state;
  - exiting from state;
  - at changing state;
- Log
  - yes;
  - no;
- Eventing; (generate event in the event log of the flow computer)
  - yes;
  - no;
- Signal status
  - active;
  - inactive;

2.I0/7.ch.		PDI0484 / DI3
Signal name		
Signal type	Pulse	
Unit	m <sup>3</sup>	
Type of contact	NO	
K-factor mode	m <sup>3</sup> /pls	
K-factor	1 m <sup>3</sup> /pls	
Filter const.1	0	
Filter const.2	0	
Signal status	active	

Save Change ↓ ↑

**Figure 9-52 Digital input channel (signal type = pulse) data page**

The editable fields on the data page are as follows:

- Signal name
  - Any character string up to 18 characters, for example: FIQ 501 pulse
- Signal type
  - Pulse;
- Unit
  - m<sup>3</sup>;
  - kg;
  - GJ;
  - MWh;
  - MVAh;
  - MCF;
  - lb;
  - MMBTU;
  - bbl;
  - Mlb
- Type of contact
  - NO (normally open);
  - NC (normally closed);
- K-factor mode;
  - pulse/m<sup>3</sup>;
  - m<sup>3</sup>/pulse;
- K-factor;
- Signal status
  - active;
  - inactive;

### 9.2.1.5 Digital output channel

Depending on the selected signal type of the digital (2-state) output channel the parameters and the data pages are different. The signal types are as follows:

- Pulse;  
It is used to provide pulse output proportional to any total of any metering stream.
- STR FR alarm (stream flow rate alarm);  
It is used to provide alarm output for any flow rate of any metering stream.
- Analog input alarm (for any analogue input);  
It is used to provide alarm output for any analogue input signal limit.
- Digital input alarm (for any digital input);  
It is used to provide alarm output for any digital input.
- Common alarm;  
It is used to provide alarm output in case of general process alarm is active.
- Time base;  
It is used to provide pulses as time base for any external equipment.

The data pages for each signal type show below.

Function of the F keys on the digital output channel data page

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

⇒ remove the highlighted item from the eventing list and step to the next item

2.I0/13.ch.		PDI0484 / D01	
Signal name	STREAM1	CUOL	FR
Signal type	Pulse		
Type of contact	NO		
Stream number	1		
Stream param.	CUOL		
K-factor mode	m <sup>3</sup> /pls		
K-factor	1 m <sup>3</sup> /pls		
Pulse length	1 *10 msec.		
Interpulse gap	1 *10 msec.		
Signal status	active		

Save Change ↓ ↑

Figure 9-53 Digital output channel (signal type = pulse) data page

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: FIQ 501 energy



- Signal type
  - Pulse;
- Type of contact
  - NO (normally open);
  - NC (normally closed);
- Stream number; (from 1 to 12)
- Stream parameter;
  - CVOL; (volume at base conditions);
  - UVOL; (volume at line conditions);
  - MASS (mass);
  - ENGY (energy);
- K-factor mode;
  - pulse/unit;
  - unit/pulse;
  - unit can be m<sup>3</sup>; kg or GJ depending on the stream parameter selected
- K-factor;
- Pulse length; (in 10 ms)
- Interpulse gap; (in 10 ms)
- Signal status
  - active;
  - inactive;

2.I0/14.ch.		PD10484 / D02	
Signal name	STREAM1 HI limit		
Signal type	STR FR alarm		
Stream number	1		
Stream param.	CVOL flowrate		
LO_limit	0 m <sup>3</sup> /h		
HI_limit	8 000 m <sup>3</sup> /h		
LOLO_limit	0 m <sup>3</sup> /h		
HIHI_limit	8 000 m <sup>3</sup> /h		
Eventing	hi		
Type of contact	NO		
Delay	2 sec.		
Signal status	active		
<div> <div>Save</div> <div>Change</div> <div>↓</div> <div>↑</div> </div>			

Figure 9-54 Digital output channel (signal type = STR FR alarm) data page

The editable fields on the data page are as follows:

- Signal name
  - Any character string up to 18 characters, for example: FIQ 501 CVOL FR
- Signal type
  - STR FR alarm;
- Stream number; (from 1 to 12)

- Stream parameter;
  - CVOL FR; (volume flow rate at base conditions);
  - UVOL FR; (volume flow rate at line conditions);
  - MASS FR (mass flow rate);
  - ENGY FR (energy flow rate);
- LO\_limit (low alarm limit for the stream parameter selected);
- HI\_limit (high alarm limit for the stream parameter selected);
- LOLO\_limit (low-low alarm limit for the stream parameter selected);
- HI\_limit (high-high alarm limit for the stream parameter selected);
- Eventing;
 

It can be selected here that which of the events shall cause an event generated in the event log of the flow computer. The options are:

  - lo (lo limit);
  - hi (hi limit);
  - lololo (lolo limit);
  - hihi (hihi limit);
- Type of contact
  - NO (normally open);
  - NC (normally closed);
- Delay; (in seconds)
- Signal status
  - active;
  - inactive;

2.I0/15.ch.		PD10484 / D03	
Signal name	STR1 PRES LO lim		
Signal type	Analog input alarm		
Type of contact	NO		
Input signal	1 board 3 ch.		
Event to alarm	lsc -		
Delay	2 sec.		
Signal status	active		

Save
Change
↓
↑

**Figure 9-55 Digital output channel (signal type = Analog input alarm) data page**

The editable fields on the data page are as follows:

- Signal name
 

Any character string up to 18 characters, for example: FIQ 501 temperature
- Signal type
  - Analog input alarm;

- Type of contact
  - NO (normally open);
  - NC (normally closed);
- Input signal I/O board X channel Y
- Event to alarm
  - lsc (low scale);
  - hsc (high scale);
  - lo (lo limit);
  - hi (hi limit);
  - lolo (lolo limit);
  - hihi (hihi limit);
- Delay; (in s)
- Signal status
  - active;
  - inactive;

2.I0/16.ch.		PDI0484 / D04
Signal name	VALUE CLOSED	
Signal type	Digital input alarm	
Type of contact	NO	
Input signal	2 board 6 ch.	
Delay	5 sec.	
Signal status	active	

OK
↓
↑

**Figure 9-56 Digital output channel (signal type = Digital input alarm) data page**

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters
- Signal type
  - Digital input alarm;
- Type of contact
  - NO (normally open);
  - NC (normally closed);
- Input signal I/O board X channel Y
- Delay; (in s)
- Signal status
  - active;
  - inactive;

3.I0/13.ch.		A0DI0484 / D01	
Signal name	COMMON-ERROR		
Signal type	Common alarm		
Type of contact	NO		
Delay	0 sec.		
Signal status	active		

Save Change ↓ ↑

**Figure 9-57 Digital output channel (signal type = Common alarm) data page**

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: COMMON alarm
- Signal type
  - Common alarm;
- Type of contact
  - NO (normally open);
  - NC (normally closed);
- Delay; (in seconds)
- Signal status
  - active;
  - inactive;

3.I0/16.ch.		A0DI0484 / D04	
Signal name	TIME BASE		
Signal type	Time base		
Type of contact	NO		
Period time	1 sec.		
Pulse length	1 sec.		
Start	08.05.14 yy.mm.dd		
	14:00 hh.mm		
Signal status	active		

Save Change ↓ ↑

**Figure 9-58 Digital output channel (signal type = Time base) data page**

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: TIME BASE

- Signal type
  - Time base;
- Type of contact
  - NO (normally open);
  - NC (normally closed);
- Period time; (in seconds)
- Pulse length; (in seconds)
- Start at       yy.mm.dd  
                  hh:mm
- Signal status
  - active;
  - inactive;

### 9.2.1.6 Analogue (4-20 mA) output channel

The analogue (4-20 mA) data page is shown on the figure below.

Function of the F keys on the analogue (4-20 mA) output channel data page

↓ select the next field for editing

↑ select the previous field for editing

⇒ remove the highlighted item from the eventing list and step to the next item

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

3.IO/2.ch.	A0D10484 / A02	3.IO/2.ch.	A0D10484 / A02
<b>Signal name</b>	CVOL.M1	<b>Assignment</b>	STR flowrate
<b>Assignment</b>	STR flowrate	<b>Stream number</b>	1
<b>Stream number</b>	1	<b>Stream param.</b>	CVOL flowrate
<b>Stream param.</b>	CVOL flowrate	<b>L0_current</b>	4 mA
<b>L0_current</b>	4 mA	<b>HI_current</b>	20 mA
<b>HI_current</b>	20 mA	<b>L0_scale</b>	0 m <sup>3</sup> /h
<b>L0_scale</b>	0 m <sup>3</sup> /h	<b>HI_scale</b>	20 000 m <sup>3</sup> /h
<b>HI_scale</b>	20 000 m <sup>3</sup> /h	<b>L0_limit</b>	0 m <sup>3</sup> /h
<b>L0_limit</b>	0 m <sup>3</sup> /h	<b>HI_limit</b>	20 000 m <sup>3</sup> /h
<b>HI_limit</b>	20 000 m <sup>3</sup> /h	<b>LOLO_limit</b>	0 m <sup>3</sup> /h
<b>LOLO_limit</b>	0 m <sup>3</sup> /h	<b>HIHI_limit</b>	20 000 m <sup>3</sup> /h
<b>HIHI_limit</b>	20 000 m <sup>3</sup> /h	<b>Eventing</b>	lsc,hsc
<b>Eventing</b>	lsc,hsc	<b>Signal status</b>	active
<b>Save</b>	<b>Change</b>	<b>Save</b>	<b>Change</b>
↓	↑	↓	↑

Figure 9-59 Analogue (4-20 mA) output channel data page

The editable fields on the data page are as follows:

- Signal name  
Any character string up to 18 characters, for example: FIQ 501 flow rate

- Assignment
  - Stream (stream flow rate);
    - Stream no;
    - Stream parameter;
      - CVOL FR; (volume flow rate at base conditions);
      - UVOL FR; (volume flow rate at line conditions);
      - MASS FR (mass flow rate);
      - ENG Y FR (energy flow rate);
  - Input signal;
    - Input signal            I/O board X        Channel Y
  - Modbus signal;
    - Channel X

- LO\_current (low scale of the current output);
- HI\_current (high scale of the current output);
- LO\_scale (low scale of the parameter in engineering unit);
- HI\_scale (high scale of the parameter in engineering unit);
- LO\_limit (low alarm limit);
- HI\_limit (high alarm limit);
- LOLO\_limit (low-low alarm limit);
- HHHI\_limit (high-high alarm limit);
- Eventing;

It can be selected here that which of the events shall cause an event generated in the event log of the flow computer. The options are:

- lsc (low scale);
- hsc (high scale);
- lo (lo limit);
- hi (hi limit);
- lololo (lolo limit);
- hihhi (hihi limit);
- Signal status
  - active;
  - inactive;

### 9.2.1.7 HART signal input channel

The HART signal input channel data page is shown on the figure below.

Function of the F keys on HART input channel data page

⇓ select the next field for editing

⇑ select the previous field for editing

⇒ remove the highlighted item from the eventing list and step to the next item

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

4.I0/1.ch.		HTI4x15	
No of Hart loops	1	Transm. addr.	1
Mode	multidrop	PV index	1
Transm. addr.	1	Signal name	
PV index	1	Signal type	Diff. pressure
Signal name		Unit	mbar
Signal type	Diff. pressure	LO_scale	0 mbar
Unit	mbar	HI_scale	0 mbar
LO_scale	0 mbar	LO_limit	600 mbar
HI_scale	0 mbar	HI_limit	0 mbar
LO_limit	600 mbar	LOLO_limit	0 mbar
HI_limit	0 mbar	HIHI_limit	0 mbar
LOLO_limit	0 mbar	Eventing	lsc,hsc
HIHI_limit	0 mbar	Signal status	active
Save	Change	Save	Change
↓	↑	↓	↑

Figure 9-60 HART input channel data page

The editable fields on the data page are as follows:

- HART loop number; (from 1 to 4)
- Transmitter address; (from 0 to 15)  
If address 0 is selected then only one single transmitter can be connected on one loop. In this case transmitter provides both current output and HART output.  
If any address from 1 to 15 is selected then the transmitter signal available on HART only.
- PV index (from 1 to 4)  
The maximum number of PV indexes in one loop is 15.  
See details on the HART transmitter connections in Annex C.
- Signal name  
Any character string up to 18 characters, for example: FIQ 501 pressure
- Signal type
- Unit
- Supplementary parameter (depending on the signal type)  
The signal type (type of the physical parameter measured at the channel), its unit of measurement and the supplementary parameter are selected from the list below:
  - Differential pressure;
    - mbar
    - Pa
    - kPa
    - inH2O
  - Flowrate;
    - m<sup>3</sup>/h
    - kg/h
    - GJ/h
    - MWh/h
    - MVA
    - MCF/h
    - lb/h
    - MMBTU/h

- bbl/h
- Mlb/h

supplementary parameter: Error curve

➤ yes

supplementary parameter 2: error curve correction type

- linear interpolation, UVOLFR ( $\text{m}^3/\text{h}$ ) - Error (%)

➤ no

5.I0/1.ch.		HTI4x15	
Error curve		linear interpolation	
		UVOLFR( $\text{m}^3/\text{h}$ )-Error(%)	
No.	flowrate	K	
1	0	0	
2	0	0	
3	0	0	
4	0	0	
5	0	0	
6	0	0	
7	0	0	
8	0	0	
9	0	0	
10	0	0	

5.I0/1.ch.		HTI4x15	
4	0	0	
5	0	0	
6	0	0	
7	0	0	
8	0	0	
9	0	0	
10	0	0	
11	0	0	
12	0	0	
13	0	0	
14	0	0	
15	0	0	
16	0	0	

Figure 9-61 Error curve data page for flow rate signal

If the error curve correction is selected for the flow rate signal then new data page opens for entering the error curve points. The volume flow rate at line conditions (in  $\text{m}^3/\text{h}$ ) and the error at that flow rate shall be entered from the calibration certificate of the flow meter.

Maximum of 16 error curve point can be entered.

The flow rates shall be entered in increasing order.

- o Pressure;
  - bar
  - kPa
  - MPa
  - PSIA or PSIG – depending on the gauge/absolute pressure transmitter selection
- supplementary parameter: type of transmitter
  - Gauge pressure
  - Abs. pressure
- o Temperature;
  - °C
  - °F
- o Density;
  - $\text{kg}/\text{m}^3$
  - Ib/CF



- RD

supplementary parameter: type of transmitter

- Line density
- Base density
- Relative density (unit changes to – (none) for relative density)

- o Special (special signal);

- %
- mole%
- - (none)
- MJ/m<sup>3</sup>
- MJ/kg
- uS
- BTU/SCF
- lb/MMSCF

- o Kin. viscosity (kinematic viscosity);

- mm<sup>2</sup>/s
- cSt

- o Level;

- cm
- m
- mm
- inch

supplementary parameters

- Level equivalent (in level unit/mA)
- Zero level (in level unit)

Common parameters for input channels regardless of the signal type

- LO\_current (low scale of the current input);
- HI\_current (high scale of the current input);
- LO\_scale (low scale of the parameter in engineering unit);
- HI\_scale (high scale of the parameter in engineering unit);
- LO\_limit (low alarm limit);
- HI\_limit (high alarm limit);
- LOLO\_limit (low-low alarm limit);
- HHHI\_limit (high-high alarm limit);
- Keypad value; Keypad value is not available for differential pressure, flow rate and level signals. See the activation of the Keypad value in section 9.3. Alarm and events
- Eventing;

It can be selected here that which of the events shall cause an event generated in the event log of the flow computer. The options are:

- o lsc (low scale);
- o hsc (high scale);
- o lo (lo limit);
- o hi (hi limit);

- lolo (lolo limit);
- hihi (hihi limit);
- Signal status
  - active;
  - inactive;

#### IMPORTANT

If the signal configured for a channel is to be used in flow calculation then the unit of measurement shall be selected as follows:

In case of metric unit system:

- pressure signal: bar
- differential pressure signal: mbar
- temperature signal: °C

In case of imperial unit system for gas measurement:

- pressure signal: PSIG or PSIA
- differential pressure signal: inH2O
- temperature signal: °F

#### 9.2.1.8 Modbus signal channel

There are 30 Modbus channels available in UNIFLOW-200. They can be configured as input channels

The Modbus channels can be used and shall be setup in the same way as the corresponding input channels. They can be written via the serial and Ethernet link of the flow computer.

The address range of the general purpose Modbus registers is 4000, 4002, 4004, ..., 4058 (30 registers). Data type to be written into these registers is 4 byte floating point data. See 10.4.3.4 for floating point data representation.

There are some special predefined Modbus registers used in the serial communication with the ultrasonic meters as follows:

- registers with address 2700 holds the volume flow rate at line conditions read from the ultrasonic meter on com 1 port;
- registers with address 2708 holds the volume flow rate at line conditions read from the ultrasonic meter on com 2 port;
- registers with address 2716 holds the volume flow rate at line conditions read from the ultrasonic meter on com 3 port;

The Modbus channels used as input channel for flow measurement with ultrasonic meters shall be setup to one of the above register address, depending on the com port the meter connected to.

Function of the F keys on the Modbus channel data page

- ⇓ select the next field for editing
- ⇑ select the previous field for editing
- ⇒ remove the highlighted item from the eventing list and step to the next item

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

Modbus signal setup 1 ch.		Modbus signal setup 1 ch.	
Register mode	UNIFLOW100	Regist.upd.tout.	10 sec
Register address	2700	Signal name	FLWSIC-600
Regist.upd.tout.	10 sec	Signal type	Flowrate
Signal name	FLWSIC-600	Unit	m <sup>3</sup> /h
Signal type	Flowrate	Error curve	no
Unit	m <sup>3</sup> /h	LO_scale	0 m <sup>3</sup> /h
Error curve	no	HI_scale	1000 m <sup>3</sup> /h
LO_scale	0 m <sup>3</sup> /h	LO_limit	0 m <sup>3</sup> /h
HI_scale	1000 m <sup>3</sup> /h	HI_limit	1000 m <sup>3</sup> /h
LO_limit	0 m <sup>3</sup> /h	LOLO_limit	0 m <sup>3</sup> /h
HI_limit	1000 m <sup>3</sup> /h	HIHI_limit	1000 m <sup>3</sup> /h
LOLO_limit	0 m <sup>3</sup> /h	Eventing	lsc,hsc
HIHI_limit	1000 m <sup>3</sup> /h	Signal status	active
Save	↓	↑	Save Change ↓ ↑

Figure 9-62 Modbus channel data page

The Modbus specific editable fields on the data page are as follows:

- Register address;
- Update timeout;

All of the other parameters for Modbus channels are identical with those of the corresponding input channels.

#### IMPORTANT

If the channel status is inactive then the channel cannot be used in the flow calculation even if you set all the parameters of the channel.

Do not forget to set the channel active if you want to use the signal measured at the channel in the flow calculation.

## 9.2.2 Stream setup

After all the field I/O signals required for the particular application are setup and configured the metering streams should be setup.

There are different procedure for setting up physical streams (streams measuring real fluid flow) and virtual streams (streams calculated from the flows of physical streams).

The stream setup in case of physical streams is done in four steps in four different submenus of the parameters menu.

First the fluid to be measured is selected and the physical properties of the fluid shall be defined.

In the second step the flow meter is selected and the parameters of the flow meter shall be entered.

In third step the field I/O signals assigned to the measured input parameters required for flow calculation.

In last step the premium limits are setup for the stream.

Setup procedure for the virtual stream includes the definition of the equation for the flow calculation and the setup of the premium limits.

Entering the physical stream menu item data page appears on the display. The serial number of the stream to be edited shall be selected and the identifier of the stream can be entered. The identifier is a 24 character long alphabetical string.

Note

The identifier of the stream will be part of the file name the archive data stored in.

### 9.2.2.1 Physical stream setup

Route in the menu tree:

Parameters	Streams	Physical stream
------------	---------	-----------------

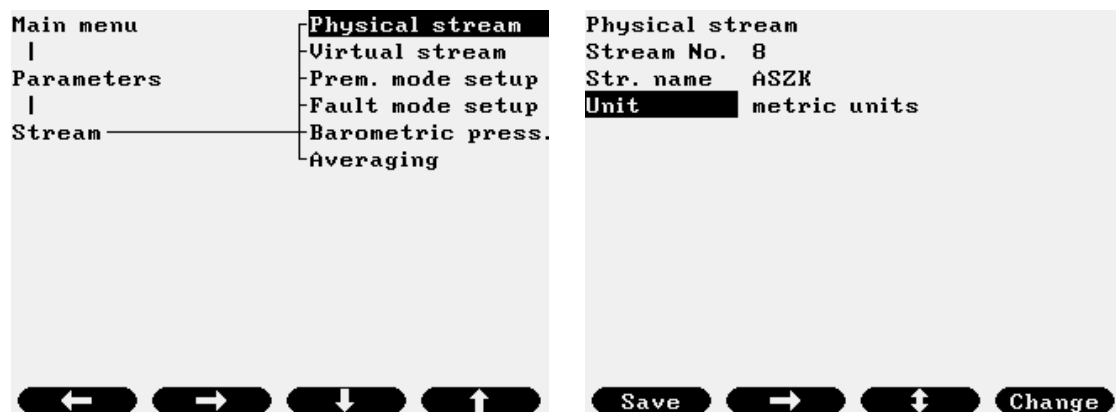


Figure 9-63 Stream selection data page

The system of units shall be selected on this page. Available selections are:

- o metric units;
- o imperial units;

Note:

If the “imperial units” is selected then the fluid selection shall be:

“Hydrocarbon mixture / Natural gas, Coke oven gas, Blast furnace gas” or

“Liquid / Crude oil & products”

No other fluids are supported in imperial units.

In case of “imperial units” the base conditions can be selected as follows:

For gases:

- o base temperature = 59, 60 °F;
- o base pressure = 14.4, 14.5, 14.65, 14.696, 14.7, 14.73, 15.025 PSIA

For liquids:

- o base temperature = 60 °F;
- o base pressure = 0 PSIG

### 9.2.2.1.1 Fluid selection

After the stream is selected the fluid and its properties shall be defined.

Depending on the fluid selected the fluid specific data page appears.

The figures in this chapter explain the parameters of the different fluid to be defined and the options available for selection.

#### 9.2.2.1.1.1 Hydrocarbon mixtures

There are three predefined hydrocarbon mixture can be selected:

- o Natural gas;
- o Coke oven gas;
- o Blast furnace gas.

The data pages for each of them are shown in the paragraphs below.

##### 9.2.2.1.1.1.1 Natural gas

Route in the menu tree:

Parameters	Streams	Physical stream	Stream n.
		Fluid	HC gas mixture
			Natural gas

The natural gas data page is shown on the figure below.

Function of the F keys on the Natural gas data page

- ⇩ select the next field for editing
- ⇧ select the previous field for editing
- ⇒ enter into submenu for gas composition editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

<b>01.Str. NGAS-ORIFICE</b>	
Fluid	Natural gas
Base temperature	15 C
Base pressure	1.01325 bar
Chromat. polling	no
Gas composition	detailed
Comp.downl.timeout	600 sec
Line density mode	PTZ
Base density mode	Calc.from rel.
Rel. density mode	ISO6976
Inf.cal.val. mode	ISO6976
Sup.cal.val. mode	ISO6976
Velocity of sound	ISO 20765-1
Compr.fact.mode	AGA8/92DC
Save	Change
⇩	⇧

<b>01.Str. NGAS-ORIFICE</b>	
Fluid	Natural gas
Rel. density mode	ISO6976
Inf.cal.val. mode	ISO6976
Sup.cal.val. mode	ISO6976
Velocity of sound	ISO 20765-1
Compr.fact.mode	AGA8/92DC
Combust.ref.temp.	15 C
Dynamic visc.mode	GOST 30319.1-96
Isentr. exp. mode	GOST 30319.1-96
J-T coefficient	keypad
keypad value	0.4 °C/bar
Eventing gas comp.	yes
Energy calc. from	sup.cal.value
Save	Change
⇩	⇧

Figure 9-64 Natural gas data page (metric example)

<b>01.Str. NGAS-ORIFICE</b>	
Fluid	natural gas
Base temperature	60 °F
Base pressure	14.73 PSIA
Chromat. polling	no
Gas composition	detailed
Comp.downl.timeout	600 sec
Line density mode	PTZ
Base density mode	GPA 2172-09
Rel. density mode	GPA 2172-09
Inf.cal.val. mode	GPA 2172-09
Sup.cal.val. mode	GPA 2172-09
Velocity of sound	ISO 20765-1
Water cont.mode	sat. @Ps,Ts
Save	Change
⇩	⇧

<b>01.Str. NGAS-ORIFICE</b>	
Fluid	natural gas
Water cont.mode	sat. @Ps,Ts
Saturation pres.	14.73 PSIA
Saturation temp.	60 °F
GPM mode	GPA 2172-09
Compr.fact.mode	AGA8/92DC
Combust.ref.temp.	60 °F
Dynamic visc.mode	GOST 30319.1-96
Isentr. exp. mode	GOST 30319.1-96
J-T coefficient	keypad
keypad value	0.049642 °F/PSIA
Eventing gas comp.	yes
Energy calc. from	sup.cal.value
Save	Change
⇩	⇧

Figure 9-65 Natural gas data page (imperial example)

The data fields on the data page are as follows:

- Base temperature;  
The base temperature selected from list
- In metric units:
  - 15 °C;
  - 20 °C;
  - 0 °C;
- In imperial units:
  - 59 °F;
  - 60 °F;

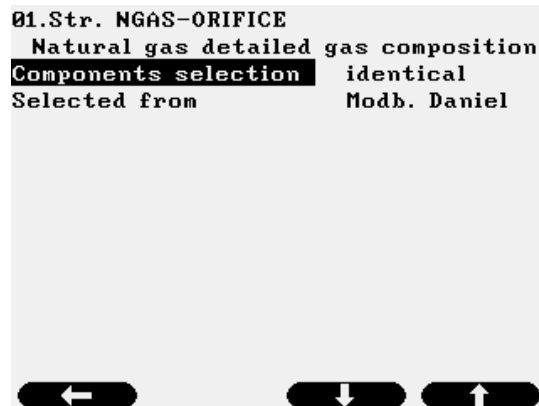
- Base pressure;  
In metric units:  
Not editable, fixed to 1.01325 bar  
In imperial units:
  - 14.4 PSIA;
  - 14.5 PSIA;
  - 14.65 PSIA;
  - 14.696 PSIA;
  - 14.7 PSIA;
  - 14.73 PSIA;
  - 15.025 PSIA;
- Chromatograph polling;
  - no (no chromatograph polling is performed);
  - yes (chromatograph is polled for gas composition).  
NOTE: One of the serial port shall be connected to the gas chromatograph and the port function shall be set according to the type of the gas chromatograph to be polled.  
See 9.2.4.1.
- Gas composition;  
It shall be defined if the properties of the natural gas (density, compression factor, etc.) will be calculated from the detailed gas composition or from the limited set of gas composition. The options are:
  - detailed (gas composition);  
21 components are assumed as defined in the AGA8-92 standard
  - limited (gas composition);  
3 components (N2, CO2, H2) are assumed as defined in the GERG 91 standard and relative/base density and inferior/superior calorific value to be entered.

If detailed composition is selected new menu page appears allowing select data pages for entering detailed gas composition.



Figure 9-66 Natural gas detailed gas composition menu page

Selecting the menu items one by one data pages appear as follows.



**Figure 9-67 Natural gas composition selection data page**

The data fields on the data page are as follows:

- Components selection;  
Reserved for future use
  - identical;

- Selected from;

The detailed gas composition used in the calculation can be selected from:

- Keypad value;  
The fixed values of the concentrations entered by the operator are used.
- Modb. Daniel;  
The gas composition is downloaded into the UNIFLOW-200 on Modbus link (serial or Ethernet) from supervisory system in Daniel/Enron/Omni format. The register formats and map see in the section 10 Communications.
- Modb. STD1;  
The gas composition is downloaded into the UNIFLOW-200 on Modbus link (serial or ethernet) from supervisory system. The register formats and map, can be seen in the section 10 Communications.
- Modb. STD2;  
The gas composition is downloaded into the UNIFLOW-200 on Modbus link (serial or ethernet) from supervisory system. The register formats and map, can be seen in the section 10 Communications.



01.Str. NGAS-ORIFICE				01.Str. NGAS-ORIFICE			
Natural gas detailed gas composition				Natural gas detailed gas composition			
Keypad (mole%)		Total: 100.0001		Keypad (mole%)		Total: 100.0001	
N2	0.7632	npentane	0.0098	ammonia	0	air	0
CO2	0.0489	nhexane	0.0196	benzene	0		
H2S	0	nheptane	0	dimet-prop-22	0		
H2O	0.1996	noctane	0	met-pent-2	0		
helium	0	nnonane	0	met-pent-3	0		
methane	95.8377	ndecane	0	dimet-but-22	0		
ethane	0.7925	oxygen	0	dimet-but-23	0		
propane	0.2642	CO	0	ethylene	0		
ibutane	0.0489	H2	1.9569	propylene	0		
nbutane	0.0489	argon	0	meth-alcohol	0		
ipentane	0.0098	Other components		sulf-dioxid	0		
←	Change	↓	↑	←	Change	↓	↑

Figure 9-68 Natural gas keypad composition data page

Keypad concentration of the 21 components can be entered on this page.

The name of the components abbreviated as follows:

N2	nitrogen
CO2	carbon-dioxide
H2S	hydrogen-sulfide
H2O	water
He	helium
C1	methane
C2	ethane
C3	propane
nC4	n-butane
iC4	i-butane
nC5	n-pentane
iC5	i-pentane
nC6	n-hexane
nC7	n-heptane
nC8	n-octane
nC9	n-nonane
nC10	n-decane
O2	oxygen
CO	carbon-monoxide
H2	hydrogen
Ar	argon

Beside the 21 components from AGA8 additional components from AGA5 and GPA 2172 can be entered as follows

ammonia	Ammonia
benzene	Benzene
dimet-propan-22	22-Dimethyl Propan
met-pent-2	2-Methyl Pentane
met-pent-3	3-Methyl Pentane
dimet-but-22	22-Dimethyl Butane
dimet-but-23	23-Dimethyl Butane

ethylene	Ethylen
propylen	Propylene
meth-alcohol	Methyl Alcohol
sulf-dioxid	Sulfur Dioxide
air	Air

The sum of the entered mole percentage must be in the 95 % - 105 % range. If the sum is outside this range, then the composition is rejected.

If the sum is inside the 95 % - 105 % range then UNIFLOW-200 performs normalization on the concentration and the normalized concentration is stored as keypad values.

The sum of the mole concentrations is checked on the downloaded composition also and the normalization is done if necessary.

01.Str. NGAS-ORIFICE			
Components slave modbus registers			
N2	7 001	nhexane	7 013
CO2	7 002	nheptane	7 014
H2S	7 003	noctane	7 015
H2O	7 004	nnonane	7 016
helium	7 005	ndecane	7 017
methane	7 006	oxygen	7 018
ethane	7 007	CO	7 019
propane	7 008	H2	7 020
nbutane	7 009	rel.dens.	7 021
ibutane	7 010	Inf. cal. value	7 022
npentane	7 011	sup.cal.value	7 023
ipentane	7 012	argon	7 024

Figure 9-69 Natural gas Modbus registers data page

The Modbus registers for the 21 components and for the relative density, inferior calorific value and superior calorific value are displayed here.

The page is read only.

If limited composition is selected data page appears allowing enter the concentration of the nitrogen, carbon-dioxide and hydrogen.

01.Str. NGAS-ORIFICE	
Natural gas limited gas composition	
<b>N2 mode</b>	Modb. Daniel
Modbus address	7 001
Keypad	0.897 mole%
<b>CO2 mode</b>	Modb. Daniel
Modbus address	7 002
Keypad	1.236 mole%
<b>H2 mode</b>	Modb. Daniel
Modbus address	7 020
Keypad	0 mole%

Figure 9-70 Natural gas limited gas composition data page

The data fields on the data page are as follows:

- N2 mode;  
Select the source of the nitrogen concentration from the list:
  - Keypad value;  
The fixed value of the concentration entered by the operator is used.  
Selecting “keypad” data entry field appears to enter the keypad value.
    - N2mol%
  - measured;  
Signal representing the concentration is measured on input channel (analog or Modbus or Hart). One channel in I/O signal setup section should be configured as “Special” signal type with mole % unit.
  - Modb. Daniel;  
Concentration is received as data on Modbus link in Daniel/Enron/Omni format.  
Selecting “Modb. Daniel” data entry fields appear to enter the Modbus register
    - N2 mole% modbus register; (register address where the concentration is downloaded)
  - Modb. STD1;  
Concentration is received as data on Modbus link in Modb. STD1 format.  
Selecting “Modb. STD1” data entry fields appear to enter the Modbus register
    - N2 mole% modbus register; (register address where the concentration is downloaded)
  - Modb. STD2;  
Concentration is received as data on Modbus link in Modb. STD2 format.  
Selecting “Modb. STD2” data entry fields appear to enter the Modbus register
    - N2 mole% modbus register; (register address where the concentration is downloaded)
- CO2;
- H2;  
Data fields for CO2 and H2 identical with those for N2.
- Comp. downl. timeout (Gas composition download timeout);  
If the gas composition selection set to Modb. Daniel, Modb. STD1 or Modb. STD2 and no new gas composition is received within the timeout specified here then alarm is raised and the keypad gas composition will be used in the calculation.
- Line density mode;  
The mode for the line density determination is selected here from the list as follows:
  - PTZ  
Line density calculated from the base density with pressure, temperature and compression factor correction.
  - AGA7  
Line density calculated from the base density with pressure, temperature and compression factor correction as defined in AGA7.
  - AGA8  
Line density is taken from the AGA8 calculation. The version of the AGA8 calculation the line density is taken from is determined in the compression factor mode settings (see below).
  - keypad  
The operator entered keypad value is used in the flow calculation.  
If keypad is selected entry field opens to enter the keypad value.

- measured  
Signal representing the line density is measured on input channel. One channel in I/O signal setup section should be configured as “Line density” signal type.
- Modb. Daniel  
Line density is received as data on Modbus link in Daniel/Enron/Omni format.  
If Modb. Daniel is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
- Modb. STD2  
Line density is received as data on Modbus link in Modb. STD2 data format.  
If Modb. STD2 is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
- Base density mode;  
The mode for the base density determination is selected here from the list as follows:
  - measured  
Signal representing the base density is measured on input channel. One channel in I/O signal setup section should be configured as “Base density” signal type.
  - Calc. from rel. (calculated from relative density)  
Base density is calculated from Relative density
  - Modb. Daniel  
Base density is received as data on Modbus link in Daniel/Enron/Omni format.  
If Modb. Daniel is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
  - keypad  
The operator entered keypad value is used in the flow calculation.  
If keypad is selected entry field opens to enter the keypad value.
  - ISO6976  
Base density is calculated from the detailed gas composition according to ISO6976
  - Modb. STD2  
Base density is received as data on Modbus link in Modb. STD2 format.  
If Modb. STD2 is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
  - GOST 30319-1 (available in metric units only)  
Base density is calculated from the detailed gas composition according to GOST 30319-1 .  
In case of GOST 30319-1 selection the base temperature is automatically set to 20 °C.
  - GPA 2172-09 (available in imperial units only)  
Base density is calculated from the detailed gas composition according to GPA 2172-09.
- Relative density mode;;  
The mode for the relative density determination is selected here from the list as follows:
  - ISO6976  
Relative density is calculated from the detailed gas composition according to ISO6976
  - AGA5  
Relative density is calculated from the detailed gas composition according to AGA5.
  - GPA 2172-09 (available in imperial units only)  
Relative density is calculated from the detailed gas composition according to GPA 2172-09.

- measured  
Signal representing the relative density is measured on input channel. One channel in I/O signal setup section should be configured as “Relative density” signal type.
- Calc. from base (Calculated from Base density)  
Relative density is calculated from Base density
- Modb. Daniel  
Relative density is received as data on Modbus link in Daniel/Enron/Omni format.  
If Modb. Daniel is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
- Modb. STD1  
Relative density is received as data on Modbus link in Modb. STD1 format.  
If Modb. STD1 is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
- Modb. STD2  
Relative density is received as data on Modbus link in Modb. STD2 format.  
If Modb. STD2 is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
- keypad  
The operator entered keypad value is used in the flow calculation.  
If keypad is selected entry field opens to enter the keypad value.
- Inferior calorific value mode;  
The mode for the inferior calorific value determination is selected here from the list as follows:
  - ISO6976  
Inferior calorific value is calculated from the detailed gas composition according to ISO6976
  - GOST 30319-1 (available in metric units only)  
Inferior calorific value is calculated from the detailed gas composition according to GOST 30319-1.
  - AGA5  
Inferior calorific value is calculated from the detailed gas composition according to AGA5.
  - GPA 2172-09 (available in imperial units only)  
Inferior calorific value is calculated from the detailed gas composition according to GPA 2172-09.
  - measured  
Signal representing the inferior calorific value is measured on input channel. One channel in I/O signal setup section should be configured as “Inferior calorific value” signal type.
  - Modb. Daniel  
Inferior calorific value is received as data on Modbus link in Daniel/Enron/Omni format.  
If Modb. Daniel is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
  - Modb. STD1  
Inferior calorific value is received as data on Modbus link in Modb. STD1 format.  
If Modb. STD1 is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
  - Modb. STD2  
Inferior calorific value is received as data on Modbus link in Modb. STD2 format.  
If Modb. STD2 is selected entry field opens to enter the keypad value.

- keypad  
This keypad value will be used in calculation if no data received within the timeout time.
  - keypad  
The operator entered keypad value is used in the flow calculation
- Superior calorific value mode;  
The mode for the superior calorific value determination is selected here from the list as follows:
  - ISO6976  
Superior calorific value is calculated from the detailed gas composition according to ISO6976
  - GOST 30319-1 (available in metric units only)  
Superior calorific value is calculated from the detailed gas composition according to GOST 30319-1.
  - AGA5  
Inferior calorific value is calculated from the detailed gas composition according to AGA5.
  - GPA 2172-09 (available in imperial units only)  
Superior calorific value is calculated from the detailed gas composition according to GPA 2172-09.
  - measured  
Signal representing the superior calorific value is measured on input channel.  
One channel in I/O signal setup section should be configured as “Superior calorific value” signal type.
  - Modb. Daniel  
Superior calorific value is received as data on Modbus link in Daniel/Enron/Omni format.  
If Modb. Daniel is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
  - Modb. STD2  
Superior calorific value is received as data on Modbus link in Modb. STD2 format.  
If Modb. STD2 is selected entry field opens to enter the keypad value.  
This keypad value will be used in calculation if no data received within the timeout time.
  - keypad  
The operator entered keypad value is used in the flow calculation
- Velocity of sound mode;  
The mode for the velocity of sound determination is selected here from the list as follows:
  - ISO 20765-1  
Velocity of sound is calculated from the detailed gas composition according to ISO 20765-1
  - GOST 30319-1  
Velocity of sound is calculated from the adiabatic exponent and density at base conditions according to GOST 30319-1.
- Water content mode (available in imperial units only);  
If any of the Relative density mode, Base density mode, Inferior calorific value mode or Superior calorific value mode is selected as GPA 2172-2009, then the water content mode shall be selected from the list as follows:
  - dry  
Water content is assumed to be 0.
  - saturated @ Ps,Ts

It is assumed that the natural gas is saturated with water at pressure  $P_s$  and temperature  $T_s$ . The concentration of the water is calculated according to GPA 2172-2009. Entry fields for saturation pressure and temperature are opened here.

- Saturation pressure;
- Saturation temperature;
- `saturated @ Pn, Tn`  
It is assumed that the natural gas is saturated with water at base pressure  $P_n$  and base temperature  $T_n$ . The concentration of the water is calculated according to GPA 2172-2009.
- `measured`  
Signal representing the water content value in lbmmscf is measured on input channel. One channel in I/O signal setup section should be configured as "Special" signal type. The unit of measurement for that special signal shall be lbmmscf.
- `keypad`  
The operator entered keypad value is used in the flow calculation. Entry field opens here for keypad value of the water content.
  - keypad value
- `Modbus signal`  
Signal representing the water content value in lbmmscf is measured on Modbus input channel. One Modbus channel in I/O signal setup section should be configured as "Special" signal type. The unit of measurement for that special signal shall be lbmmscf.
- GPM mode (available in imperial units only);  
If any of the Relative density mode, Base density mode, Inferior calorific value mode or Superior calorific value mode is selected as GPA 2172-2009, then the GPM mode shall be selected from the list as follows:
  - GPA 2172-2009  
The GPM (liquid equivalent) of the natural gas is calculated according to GPA 2172-2009.
- Compression factor mode;  
The mode for the compression factor determination is selected here from the list as follows:
  - AGA8-92DC  
Compression factor is calculated according to the AGA8-92DC equation from the detailed gas composition.  
If AGA8-92DC is selected entry field opens to enter the combustion reference temperature. It is selected from the list 0, 15, 20, 25 °C.
  - AGA8-92Gr1  
Compression factor is calculated according to the AGA8-92 Gross method 1 from the superior calorific value, relative density and CO2 content.  
The H2 and CO are taken into the calculation as described in SGERG TM5 1991.  
If AGA8-92Gr1 is selected entry field opens to enter the combustion reference temperature. It is selected from the list 0, 15, 20, 25 °C.
  - AGA8-92Gr2  
Compression factor is calculated according to the AGA8-92 Gross method 2 from the relative density, CO2 and N2 content.  
The H2 and CO are taken into the calculation as described in SGERG TM5 1991.

- GERG91mod (available in metric units only)  
Compression factor is calculated according to the GOST 30319-2 from the base density, CO<sub>2</sub> and N<sub>2</sub> content.  
In case of GERG91mod selection the base temperature is automatically set to 20 °C
- NX19mod (available in metric units only)  
Compression factor is calculated according to the GOST 30319-2 from the base density, CO<sub>2</sub> and N<sub>2</sub> content.  
In case of NX19mod selection the base temperature is automatically set to 20 °C
- VNIC SMV (available in metric units only)  
Compression factor is calculated according to the GOST 30319-2 from the detailed gas composition
- AGA NX19  
Compression factor is calculated according to the AGA NX19 from the relative density, CO<sub>2</sub> and N<sub>2</sub> content. `z keypad`  
The operator entered keypad value is used in the flow calculation.  
If `z keypad` is selected then two entry fields open to enter the base compression factor and line compression factor keypad values.
- AGA8/85  
Compression factor is calculated according to the AGA8 1985 edition from the detailed gas composition.
- Dynamic viscosity mode;  
The mode for the dynamic viscosity determination is selected here from the list as follows:
  - GOST 30319.1-96  
Dynamic viscosity calculated from the base density, N<sub>2</sub> and CO<sub>2</sub> content, pressure and temperature according to GOST 30319.1-96
  - keypad  
The operator entered keypad value is used in the flow calculation
- Isentropic exponent mode;  
The mode for the isentropic exponent determination is selected here from the list as follows:
  - GOST 30319.1-96  
Isentropic exponent is calculated from the base density, CO<sub>2</sub> content, pressure and temperature according to GOST 30319.1-96
  - ISO 20765-1  
Isentropic exponent is calculated according to ISO 20765-1 from the detailed gas composition.
  - keypad  
The operator entered keypad value is used in the flow calculation
- Joule-Thomson coefficient mode;  
The mode for the Joule-Thomson coefficient determination is selected here from the list as follows:
  - ISO TR 9464  
Joule-Thomson coefficient is calculated from the pressure and temperature according to ISO TR 9464
  - ISO 20765-1  
Joule-Thomson coefficient is calculated according to ISO 20765-1 from the detailed gas composition.
  - keypad  
The operator entered keypad value is used in the flow calculation



- Eventing gas composition limits;  
It is operator selectable if the gas composition limits given in Tables 9-2 and Table 9-3 will generate limit alarms and entries in the event log or not.
  - yes
  - no
- Energy calculation from;  
It is operator selectable if the energy flow rate of the natural gas stream shall be calculated from inferior or superior calorific value.
  - superior calorific value;
  - inferior calorific value;

#### NOTE

The available modes of the natural gas properties listed above depends on that if the detailed or limited set of gas composition is given. There is also an interlock in the base and relative density selections.

The Table 9.1. below summarizes the possible modes of the properties.

Table 9.2. and Table 9.3. give the nominal and expanded ranges of gas mixture characteristics for compression factor calculation from detailed and limited set of gas composition.

If the gas mixture characteristics are outside the nominal range but inside the expanded range UNIFLOW-200 generates alarm (if eventing is enabled) but continue the calculation.

Outside the expanded range UNIFLOW-200 generates alarm in any case and tries to continue the compression factor calculation. If due to extreme gas composition the compression factor calculation fails alarm is generated and the last valid calculated compression factor will be used in the flow calculation.

In case of limited gas composition the properties entered must belong to real natural gas. Entering arbitrary calorific value, relative density, CO<sub>2</sub> and N<sub>2</sub> content may lead to calculation failure (convergence error) in the AGA8-92Gr1 and Gr2 calculation.

	If the gas composition is given as			
	detailed gas composition		limited set of gas composition	
	AND Base density mode NOT from Relative density then	AND Base density mode IS from Relative density then	AND Base density mode NOT from Relative density then	AND Base density mode IS from Relative density then
Relative density modes	<ul style="list-style-type: none"> <li>- measured</li> <li>- Calc. from base</li> <li>- Modb. Daniel</li> <li>- Modb. STD1</li> <li>- Modb. STD2</li> <li>- keypad</li> <li>- ISO6976</li> <li>- AGA5</li> <li>- GPA 2172-09 (imperial only)</li> </ul>	<ul style="list-style-type: none"> <li>- Calc. from base</li> <li>- Modb. Daniel</li> <li>- Modb. STD1</li> <li>- Modb. STD2</li> <li>- keypad</li> <li>- ISO6976</li> <li>- AGA5</li> <li>- GPA 2172-09 (imperial only)</li> </ul>	<ul style="list-style-type: none"> <li>- measured</li> <li>- Calc. from base</li> <li>- Modb. Daniel</li> <li>- Modb. STD1</li> <li>- Modb. STD2</li> <li>- keypad</li> </ul>	<ul style="list-style-type: none"> <li>- measured</li> <li>- Modb. Daniel</li> <li>- Modb. STD1</li> <li>- Modb. STD2</li> <li>- keypad</li> </ul>
	AND Relative density mode NOT from Base density then	AND Relative density mode IS from Base density	AND Relative density mode NOT from Base density then	AND Relative density mode IS from Base density
Base density modes	<ul style="list-style-type: none"> <li>- measured</li> <li>- Calc. from rel.</li> <li>- Modb. Daniel</li> <li>- keypad</li> <li>- ISO6976</li> <li>- Modb. STD2</li> <li>- GOST 30319-1 (metric only)</li> <li>- GPA 2172-09 (imperial only)</li> </ul>	<ul style="list-style-type: none"> <li>- measured</li> <li>- Modb. Daniel</li> <li>- keypad</li> <li>- ISO6976</li> <li>- Modb. STD2</li> <li>- GOST 30319-1 (metric only)</li> <li>- GPA 2172-09 (imperial only)</li> </ul>	<ul style="list-style-type: none"> <li>- measured</li> <li>- Calc. from rel.</li> <li>- Modb. Daniel</li> <li>- keypad</li> <li>- Modb. STD2</li> </ul>	<ul style="list-style-type: none"> <li>- measured</li> <li>- Modb. Daniel</li> <li>- keypad</li> <li>- Modb. STD2</li> </ul>
Inferior calorific value modes	<ul style="list-style-type: none"> <li>- measured</li> <li>- Modb. Daniel</li> <li>- Modb. STD1</li> <li>- Modb. STD2</li> <li>- keypad</li> <li>- ISO6976</li> <li>- GOST 30319-1 (metric only)</li> <li>- AGA5</li> <li>- GPA 2172-09 (imperial only)</li> </ul>		<ul style="list-style-type: none"> <li>- measured</li> <li>- Modb. Daniel</li> <li>- Modb. STD1</li> <li>- Modb. STD2</li> <li>- keypad</li> </ul>	
Superior calorific value modes	<ul style="list-style-type: none"> <li>- measured</li> <li>- Modb. Daniel</li> <li>- Modb. STD2</li> <li>- keypad</li> <li>- ISO6976</li> <li>- GOST 30319-1 (metric only)</li> <li>- AGA5</li> <li>- GPA 2172-09 (imperial only)</li> </ul>		<ul style="list-style-type: none"> <li>- measured</li> <li>- Modb. Daniel</li> <li>- keypad</li> <li>- Modb. STD2</li> </ul>	
Compression factor modes	<ul style="list-style-type: none"> <li>- AGA 8/92DC</li> <li>- AGA 8/92Gr1</li> <li>- AGA 8/92Gr2</li> <li>- GERG91mod (metric only)</li> </ul>		<ul style="list-style-type: none"> <li>- AGA8/92Gr1</li> <li>- AGA8/92Gr2</li> <li>- Z keypad</li> </ul>	

	<ul style="list-style-type: none"> <li>- NX19mod (metric only)</li> <li>- VNIC SMV (metric only)</li> <li>- AGA NX19</li> <li>- Z keypad</li> <li>- AGA 8/85</li> </ul>	
Line density modes	<ul style="list-style-type: none"> <li>- PTZ</li> <li>- AGA7</li> <li>- AGA8</li> <li>- keypad</li> <li>- measured</li> <li>- Modb. Daniel</li> <li>- Modb. STD2</li> </ul>	<ul style="list-style-type: none"> <li>- PTZ</li> <li>- keypad</li> <li>- measured</li> <li>- Modb. Daniel</li> <li>- Modb. STD2</li> </ul>

**Table 9-3 Natural gas properties modes**

AGA8-92DC method	Normal range of parameters	Expanded range of parameters
Pressure absolute	0 ... 120 bar	0 ... 1400 bar
Temperature	-10 ... +65 oC	-130 ... +200 oC
Components	mole %	mole %
Methane	45 ... 100	0 ... 100
Nitrogen	0 ... 50	0 ... 100
Carbon-dioxide	0 ... 30	0 ... 100
Ethane	0 ... 10	0 ... 100
Propane	0 ... 4	0 ... 12
Water	0 ... 0.05	0 ... 1
Hydrogen-sulfide	0 ... 0.02	0 ... 100
Hydrogen	0 ... 10	0 ... 100
Carbon-monoxide	0 ... 3	0 ... 3
Oxygen	0	0 ... 21
Butanes	0 ... 1	0 ... 6
Pentanes	0 ... 0.3	0 ... 4
Hexanes plus	0 ... 0.2	0 ... 1
Helium	0 ... 0.2	0 ... 3
Argon	0	0 ... 1

VNIC SMV method	Normal range of parameters	
Pressure absolute	0 ... 120 bar	
Temperature	-3 ... +67 oC	
Components	mole %	
Methane	65 ... 100	
Nitrogen	0 ... 15	
Carbon-dioxide	0 ... 15	
Ethane	0 ... 15	
Propane	0 ... 3.5	
Hydrogen-sulfide	0 ... 30	
Butanes	0 ... 1.5	
Others	0 ... 1.0	

**Table 9-4 Ranges of gas mixture characteristics for compression factor calculation from detailed gas composition**

AGA8/92Gr1 and Gr2 method	Normal range of parameters	Expanded range of parameters
Pressure absolute	0 ... 120 bar	0 ... 120 bar
Temperature	-10 ... +65 oC	-23 ... +77 oC
Superior calorific value	30 ... 45 MJ/m <sup>3</sup>	20 ... 48 MJ/m <sup>3</sup>
Relative density	0.55 ... 0.80	0.55 ... 0.90
Nitrogen	0 ... 20	0 ... 50
Carbon-dioxide	0 ... 20	0 ... 30
Hydrogen	0 ... 10	0 ... 10

GERG91mod	Normal range of parameters	Expanded range of parameters
Pressure absolute	0 ... 120 bar	120 ... 300 bar
Temperature	-23 ... +57 oC	-13 ... +67 oC
Base density	0.668 ... 0.70 kg/m <sup>3</sup>	0.668 ... 1.0 kg/m <sup>3</sup>

NX19mod	Normal range of parameters	Expanded range of parameters
Pressure absolute	0 ... 30 bar	120 ... 300 bar
Temperature	-23 ... +17 °C	-13 ... +17 °C
Base density	0.668 ... 0.70 kg/m <sup>3</sup>	0.668 ... 1.0 kg/m <sup>3</sup>

**Table 9-5 Ranges of gas mixture characteristics for compression factor calculation from limited set of gas composition**

### 9.2.2.1.1.2 Coke oven gas

Route in the menu tree:

Parameters	Streams	Physical stream	Stream n.
------------	---------	-----------------	-----------

Fluid	HC gas mixture	Coke oven gas
-------	----------------	---------------

The coke oven gas data pages are identical with natural gas data pages except the gas composition. The name of the coke oven gas components and their default concentration are listed in the table below.

Components	Abbreviation	Component in AGA8 calculation	mole % (default)
Nitrogen	N2	Nitrogen	2
Carbon-dioxide	CO2	Carbon-dioxide	3
Hydrogen-sulfide	H2S	Hydrogen-sulfide	0
Water	H2O	Water	1
Methane	C1	Methane	23
C2 hydrocarbons	C2Hx	Ethane	2
C3 hydrocarbons	C3Hy	Propane	0
Oxygen	O2	Oxygen	1
Carbon-monoxide	CO	Carbon-monoxide	9
Hydrogen	H2	Hydrogen	58
Ammonia	NH3	Methane	0
Benzene	C6H6	n-Pentane	1

**Table 9-6 Coke oven gas composition**

The data page for coke oven gas composition is shown on the figure below.

Function of the F keys on the Coke oven gas data page

- ↓ select the next field for editing
- ↑ select the previous field for editing
- ← return to previous menu level
- Change** modify the selected data field

<b>01.Str. NGAS-ORIFICE</b>			
Coke oven gas detailed gas composition			
keypad (mole%)			
N2	2	benzene	1
CO2	3	Total:	100
H2S	0		
H2O	1		
methane	23		
C2Hx	2		
C3Hy	0		
oxygen	1		
CO	9		
H2	58		
ammonia	0		
<div> <span>←</span> <span>Change</span> <span>↓</span> <span>↑</span> </div>			

**Figure 9-71 Coke oven gas composition data page**

### 9.2.2.1.1.3 Blast furnace gas

Route in the menu tree:

Parameters	Streams	Physical stream	Stream n.
------------	---------	-----------------	-----------

Fluid	HC gas mixture	Blast furn. gas
-------	----------------	-----------------

The blast furnace gas data pages are identical with natural gas data pages except the gas composition. The name of the blast furnace gas components and their default concentration are listed in the table below.

Components	Abbreviation	Component in AGA8 calculation	mole % (default)
Nitrogen	N2	Nitrogen	57
Carbon-dioxide	CO2	Carbon-dioxide	18
Water	H2O	Water	1
Carbon-monoxide	CO	Carbon-monoxide	21
Hydrogen	H2	Hydrogen	3

**Table 9-7 Blast furnace gas composition**

The data page for blast furnace gas composition is shown on the figure below.

Function of the F keys on the Blast furnace gas data page

- ↓ select the next field for editing
- ↑ select the previous field for editing
- ← return to previous menu level

**Change** modify the selected data field

<b>01.Str. NGAS-ORIFICE</b>	
<b>Blast furn.gas detailed gas composition</b>	
<b>keypad (mole%)</b>	
<b>N2</b>	<b>57</b>
<b>CO2</b>	<b>18</b>
<b>H2O</b>	<b>1</b>
<b>CO</b>	<b>21</b>
<b>H2</b>	<b>3</b>
<b>Total:</b>	<b>100</b>
<div> <span>←</span> <span>Change</span> <span>↓</span> <span>↑</span> </div>	

**Figure 9-72 Blast furnace gas composition data page**

#### 9.2.2.1.1.2 Pure gases

Predefined pure gases are as follows

- Air;
- Nitrogen;
- Oxygen;
- Argon;
- Carbon-dioxide;
- Hydrogen;
- Carbon-monoxide;
- Ethylene;
- Ammonia;
- Propane;
- General gas;

The compression factor, dynamic viscosity and isentropic exponent for these gases are calculated according to HE-64 (calculation procedure of Hungarian Office of Measure).

The data page for pure gases, except “General gas” is shown on the figure below.

Function of the F keys on the Pure gases data page

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**Save** save the selected/entered data and returns to the parent menu.

01.Str. ETHYLENE	
Fluid	ethylene
Base temperature	15 °C
Base pressure	1.01325 bar

Save Change ↓ ↑

Figure 9-73 Predefined pure gas data page

If the measured gas is not listed in the predefined pure gas list then “General gas” shall be selected. In this case the different properties of the gas shall be entered as keypad values or as measured values as appropriate. In latter case the IO channel the measured properties is assigned to shall be defined in the Stream setup menu.

The data page for “General gas” is shown on the figure below.

Function of the F keys on the General gas data page

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**Save** save the selected/entered data and returns to the parent menu.

01.Str. GGAS		01.Str. GGAS	
Fluid	general gas	Fluid	general gas
Base temperature	15 °C	Base density mode	keypad
Base pressure	1.01325 bar	keypad value	0.68 kg/m <sup>3</sup>
Line density mode	PTZ	Rel. density mode	keypad
Base density mode	keypad	keypad value	0.555
keypad value	0.68 kg/m <sup>3</sup>	Inf.cal.val. mode	keypad
Rel. density mode	keypad	keypad value	34.02000 MJ/m <sup>3</sup>
keypad value	0.555	Sup.cal.val. mode	keypad
Inf.cal.val. mode	keypad	keypad value	37.77999 MJ/m <sup>3</sup>
keypad value	34.02000 MJ/m <sup>3</sup>	Line compr.factor	1
Sup.cal.val. mode	keypad	Base compr.factor	1
keypad value	37.77999 MJ/m <sup>3</sup>	Dynamic viscosity	1.0000e-05 Pasec
Line compr.factor	1	Isentr. exp.	1.3
Save Change ↓ ↑		Save Change ↓ ↑	

Figure 9-74 General gas data page



### 9.2.2.1.1.3 Water steam

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
	Fluid	Water steam	

The water steam properties are calculated according to Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam (IAPWS-IF97).

The water steam data page is shown on the figure below.

Function of the F keys on the Water steam data page

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**Save** save the selected/entered data and returns to the parent menu.

```

08.Str. STEAM-VENTURI
Fluid                water steam
Correction           pressure-temperature
Overpres. above sat.pres. 1 %
Phase                superheated
Calc.corr.signal      none
  
```

Save Change ↓ ↑

Figure 9-75 Water steam data page

The data fields on the data page are as follows:

- Fluid;  
Not editable, fixed to water steam.
- Correction;  
The correction mode selected from the list:
  - pressure-temperature  
it is assumed that water steam phase is superheated and both temperature and pressure input is required to calculate the properties of the steam.  
Numeric input
  - overpressure above saturation pressure, in %  
is required in this case. In fact this parameter takes into consideration the uncertainty in pressure measurement.  
The flow computer calculates the saturation pressure for the measured temperature. If the measured pressure is above the saturation pressure plus the overpressure parameter then

UNIFLOW-200 raises alarm. While the pressure is below this limit UNIFLOW-200 continues the calculation with the measured pressure.

- pressure

it is assumed that water steam phase is saturated. The temperature of the steam is calculated from the saturation line and the properties are calculated from the measured pressure and from the saturation temperature.

- temperature

it is assumed that water steam phase is saturated. The pressure of the steam is calculated from the saturation line and the properties are calculated from the measured temperature and from the saturation pressure.

#### 9.2.2.1.1.4 Water

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
		Fluid	Water

The water properties are calculated according to Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam (IAPWS-IF97).

The water data page is shown on the figure below.

Function of the F keys on the Water data page

**Change** modify the selected data field

**Save** save the selected/entered data and returns to the parent menu.

07.Str. HOT WATER

Fluid                      water

Base temperature              15 °C

Base pressure                  1 bar

Save      Change

Figure 9-76 Water data page

The data fields on the data page are as follows:

- Base temperature;  
The base temperature selected from list
  - 15 °C;
  - 20 °C.
- Base pressure;  
Not editable, fixed to 1 bar

### 9.2.2.1.1.5 Liquids

#### 9.2.2.1.1.5.1 Crude oil and products

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
		Fluid	Liquid
			Crude oil & product

The crude oil and product data page is shown on the figure below.

Function of the F keys on the Crude oil and products data page

- ↓ select the next field for editing
- ↑ select the previous field for editing
- ⇒ enter into submenu for gas composition editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

<p><b>04.Str. CR.OIL-LIQ.TURBINE</b></p> <p><b>Fluid</b> crude oil</p> <p>Base temperature 15 C</p> <p>Base pressure 1 barG</p> <p>CTL mode Table 53A,54A(1980)</p> <p>CPL mode Chapter 11.2.1M(1984)</p> <p>Density meas.at header</p> <p>Base density mode calculated</p> <p>Aerometer glass corr. no</p> <p>Rounding no</p> <p>Density at fl.meter calculated</p> <p>Energy flow calc. yes</p> <p>Cal.value mode keypad</p> <p>keypad value 40.36000 MJ/kg</p> <p>Save Change ↓ ↑</p>	<p><b>04.Str. CR.OIL-LIQ.TURBINE</b></p> <p>CPL mode Chapter 11.2.1M(1984)</p> <p>Density meas.at header</p> <p>Base density mode calculated</p> <p>Aerometer glass corr. no</p> <p>Rounding no</p> <p>Density at fl.meter calculated</p> <p>Energy flow calc. yes</p> <p>Cal.value mode keypad</p> <p>keypad value 40.36000 MJ/kg</p> <p>CO2 emission factor 73.30000 kg/GJ</p> <p>Viscosity type kinematic</p> <p>Viscosity mode keypad</p> <p>keypad value 30 mm2/s</p> <p>Save Change ↓ ↑</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 9-77 Crude oil and product data page

The data fields on the data page are as follows:

- Fluid;
  - Select the type of the fluid from the list:
    - crude oil;
    - products;
    - lubricating oil;
    - NGL & LPG
    - UGC STO 5.9 (unstable gas condensat according to Gazprom STO 5.9)
    - SLH STO 5.9 (stable liquid hydrocarbon according to Gazprom STO 5.9)
    - WFLH STO 5.9 (wide fraction of light hydrocarbons according to Gazprom STO 5.9)

- Base temperature;  
See the available options in Table 9-8.
- Base pressure;  
See the available options in Table 9-8.
- CTL mode;  
See the available options in Table 9-8.
- CPL mode;  
See the available options in Table 9-8.

Liquid	CTL mode	Base temperature (metric)	Base pressure (metric)	CPL mode (metric)	Base temperature (imperial)	Base pressure (imperial)	CPL mode (imperial)
Crude oil	Table 53A, 54A (1980)	15 °C	0 barG	Chapter 11.2.1M (1984)	na	na	na
Refined products	Table 53B, 54B (1980) Table 53C, 54C (1980)	15 °C	0 barG	Chapter 11.2.1M (1984)	na	na	na
NGL & LPG	Table 53E, 54E (2007) Table 59E, 60E (2007)	15 °C 20 °C	0 barG	Chapter 11.2.2M (1984)	na	na	na
Crude oil	Table 23A, 24A (1980)	na	na	na	60 °F	0 PSIG	Chapter 11.2.1 (1984)
Refined products	Table 23B, 24B (1980) Table 23C, 24C (1980)	na	na	na	60 °F	0 PSIG	Chapter 11.2.1 (1984)
NGL & LPG	Table 23E, 24E (2007)	na	na	na	60 °F	0 PSIG	Chapter 11.2.2 (1986)
Crude oil, refined products, lubricating oil	Chapter 11.1 (2008)	15 °C 20 °C	0 barG	Chapter 11.1 (2008)	60 °F	0 PSIG	Chapter 11.1 (2008)
Unstable gas condensat	STO Gazporm 5.9 B.1 (2007)	20 °C	1.0132 barA	STO Gazporm 5.9 B.1 (2007)	na	na	na
Stable hydrocarbon liquid	STO Gazprom 5.9 B.2 (2007)	15 °C	0 barG	STO Gazprom 5.9 B.2 (2007)	na	na	na
Wide fraction of light hydrocarbons	STO Gazporm 5.9 B.3 (2007)	15 °C 20 °C	0 barG	STO Gazporm 5.9 B.3 (2007)	na	na	na

**Table 9-8 CTL and CPL modes, base temperature and base pressure options for liquid hydrocarbons**

- Density mode;  
The density mode selected from the list:
  - meas. at fl. meter (measured at flow meter)  
If density is measured at flow meter then:
    - the measured density at flow meter will be converted to base density with the meter pressure and meter temperature;
  - not measured;  
If density is not measured then keypad value for density at base conditions shall be entered. The Base density mode set to keypad automatically.
  - meas. at header (measured at header pipe);  
If density is measured at header pipe then:
    - the measured header density will be converted to base density with the header pressure and header temperature;

- the base density will be converted to density at meter with the meter pressure and meter temperature;
- Base density mode;  
Not editable.  
Set to calculated if the density mode is measured at flow meter or at the header pipe.  
Set to keypad if the density mode is not measured.  
If set to keypad data entry field opens to enter the keypad value.
- Density at flow meter mode;  
Not editable.  
Set to calculated if the density mode is measured at header pipe or not measured.ü  
Set to measured if the density mode is measured at flow meter.
- Energy calculation mode;
  - no;
  - yes;
 If energy calculation is required then new entry fields appear allowing enter the calorific value mode and the keypad calorific value if not measured. Enabling energy calculation enables the CO2 emission calculation as well. The CO2 emission calculation requires the CO2 emission factor to be entered.  
 If the fluid type is Products then the subtype of the fuel for CO2 emission shall be selected.  
 If the fluid type is Crude oil then no subtype selection is required.  
 The default calorific value and CO2 emission factor for the different fuels are shown in the Table 9.4. below. Both the calorific value and CO2 emission factor can be modified to suit local requirements.
- Fuel subtype (if the fluid = Products only);
  - heating oil;
  - fuel oil;
  - low sulfur heating oil;
  - heavy heating oil;
  - gasoline;
  - diesel oil;
- Calorific value mode;
  - keypad;
    - keypad calorific value;
  - measured;
 Signal representing the calorific value is measured on input channel. One channel in I/O signal setup section should be configured as “Calorific value” signal type.
- CO2 emission factor;  
Keypad value for CO2 emission factor;
- Viscosity type;
  - kinematic;
  - dynamic;
 Selection of the desired viscosity type
- Viscosity mode;
  - keypad;
 The operator entered keypad value is used in the flow calculation.

- Modbus signal;  
Signal representing the kinematic viscosity value is measured on Modbus input channel. One Modbus channel in I/O signal setup section should be configured as “Kinematic viscosity” or “Dynamic viscosity” signal type.
- measured; (available for kinematic viscosity only)  
Signal representing the kinematic viscosity value is measured on input channel. One analog channel in I/O signal setup section should be configured as “Kinematic viscosity” signal type.
- Keypad value;  
Keypad value of the viscosity, dynamic or kinematic;

Fuel type	Calorific value, MJ/kg	CO2 emission factor, tCO2/TJ
Crude oil	40.36	73.3
Heating oil	42.0	74.07
Fuel oil	41.0	77.37
Low sulfur heating oil	40.0	77.37
Heavy heating oil	39.5	77.37
Gasoline	44.0	69.3
Diesel oil	42.0	74.07

**Table 9-9 Default values of the calorific value and CO2 emission factors**

Temperature and pressure correction of the measured density to the base density and the base density to the density at meter is done according to the method selected in CTL mode and CPL mode menu. See Table 9-8.

**NOTE**

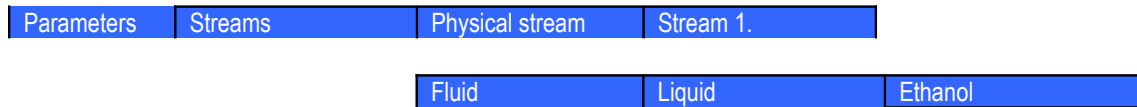
If the fluid type is Product the subtype of the product (gasoline, intermediate, jet fuel, fuel oil) determined automatically based on the density at base conditions. The limits of the base densities for the product subtypes applied as defined in the standards selected in CTL mode selection menu.

**NOTE**

The product subtype classified on the base density different from the fuel subtype described in the CO2 emission section.

### 9.2.2.1.1.5.2 Ethanol

Route in the menu tree:



The ethanol data page is shown on the figure below.

Function of the F keys on the Ethanol data page

- ↓ select the next field for editing
- ↑ select the previous field for editing
- ⇒ enter into submenu for gas composition editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

```

05.Str. ETHANOL-CORIOLIS
Fluid                ethanol
Base temperature     20 °C
Base pressure        1 bar
Line density mode    measured
Volume pres.corr.    yes
Compression factor   1.0000e-04 1/bar
Dynamic viscosity    0.001 Pasec
  
```

Save Change ↓ ↑

Figure 9-78 Ethanol data page

The data fields on the data page are as follows:

- Fluid;  
Not editable, fixed to Ethanol
- Base temperature;  
The base temperature selected from list
  - 20 °C;
  - 15 °C;
  - 0 °C;
- Base pressure;  
Not editable, fixed to 1 bar.

- Density mode;  
The density mode selected from the list:
  - measured;  
Signal representing the line density value is measured on input channel. One channel in I/O signal setup section should be configured as “Line density” signal type. In this case no concentration entry field appears.
  - calculated;  
If density mode is calculated then the concentration of the ethanol (the alcohol strength) shall be provided. The line density will be calculated based on the concentration, temperature and pressure.
- Concentration;
  - measured;  
Signal representing the concentration value is measured on input channel. One channel in I/O signal setup section should be configured as “Special” signal type.
  - keypad;  
- keypad concentration value;
- Unit of measurement for concentration;  
If the concentration is fixed then the unit of measurement is selectable form the list:
  - % (V/V) ;
  - % (m/m) ;
 If the concentration is measured then the unit of measurement is fixed to volume %.
- Volume press. corr. (Pressure volume correction mode);  
If pressure volume correction is enabled then compression factor shall be entered.
  - no;
  - yes;
- Compression factor keypad value;
- Dynamic viscosity keypad value;

#### 9.2.2.1.1.5.3 General liquid

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
		Fluid	Liquid
			General liquid

The general liquid data page is shown on the figure below.

Function of the F keys on the General liquid data page

- ⇓ select the next field for editing
- ⇑ select the previous field for editing
- ⇒ enter into submenu for gas composition editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.



06.Str. GEN.LIQUID-VORTEX	
Fluid	general liquid
Base temperature	15 °C
Base pressure	1 bar
Line density mode	calculated
Base density	800 kg/m <sup>3</sup>
Volume th.exp.fact.	0.001 1/°C
Volume pres.corr.	no
Dynamic viscosity	1.0000e-05 Pasec
Heat capacity	averaging
Cp spec.heat.capac.	3.534 kJ/kgK

Figure 9-79 General liquid data page

The data fields on the data page are as follows:

- Fluid;  
Not editable, fixed to General liquid
- Base temperature;  
The base temperature selected from list
  - 20 °C;
  - 15 °C;
  - 0 °C;
- Base pressure;  
Not editable, fixed to 1 bar.
- Density mode;  
The density mode selected from the list:
  - measured;  
Signal representing the line density value is measured on input channel. One channel in I/O signal setup section should be configured as "Line density" signal type.
  - calculated;  
If density mode is calculated then the density at base conditions shall be provided. The line density will be calculated based on the base density, temperature and pressure.
- Base density keypad value;
- Coefficient of thermal expansion;  
Keypad value shall be entered.
- Pressure volume correction mode;  
If pressure volume correction is enabled then compression factor shall be entered.
  - no;
  - yes;
- Compression factor;  
Keypad value shall be entered.
- Dynamic viscosity;  
Keypad value shall be entered.

- Heat capacity;  
The method of the determination of heat capacity is selected from the list:
  - average;  
Average heat capacity is entered as keypad value.
  - calculated  $a \cdot T(^{\circ}\text{C}) + b$ ;  
Heat capacity is calculated as the linear function of the temperature.
- Cp specific Heat capacity (appears if heat capacity is average);
- a (appears if heat capacity is calculated  $a \cdot T(^{\circ}\text{C}) + b$ );
- b (appears if heat capacity is calculated  $a \cdot T(^{\circ}\text{C}) + b$ );

#### 9.2.2.1.1.5.4 Liquid mixture

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
		Fluid	Liquid
			Liquid mixture

The liquid mixture data page is shown on the figure below.

Function of the F keys on the Liquid mixture data page

- ⇓ select the next field for editing
- ⇑ select the previous field for editing
- ⇒ enter into submenu for gas composition editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

```

07.Str. LIQUID MIXT.-CORIOLIS
Fluid          liquid mixture
Base temperature 15 °C
Base pressure   1 bar
Flow meas.for   Fluid1
Fluid1          crude oil
Fluid2          products
Fluid1 base density 952 kg/m³
Fluid2 base density 780 kg/m³
Vol.contr.fact  1
Volume pres.corr. no
Mixture dyn.viscos. 0.001 Pasec

Save Change ⇓ ⇑
  
```

Figure 9-80 Liquid mixture data page

The liquid mixture fluid option is intended for application where flow of mixture of two different liquids is measured. The density of the mixture is measured as well. Beside the measurement of flow of the mixture the two separate flows for the components the mixture consists of shall be determined. Example of such application is measurement of the mixture of crude oil and gasoline pumped into pipeline.

The data fields on the data page are as follows:

- Fluid;  
Not editable, fixed to Liquid mixture
- Base temperature;  
The base temperature selected from list
  - 20 °C;
  - 15 °C;
  - 0 °C;
- Base pressure;  
Not editable, fixed to 1 bar.
- Flow measured for;  
Selected from the list:
  - fluid 1;
  - fluid 2;
  - mixture;

One metering stream of UNIFLOW-200 measures (calculates) and totalizes flow for one single fluid.

To have flows and totals for the two liquid components and for the mixture three streams shall be defined with identical parameters except this parameter. In each stream its own fluid to be selected in this data entry.
- Fluid 1 type;  
Selected from the list:
  - crude oil;
  - product;
  - NGL & LPG
  - general liquid;
- Fluid 2 type;  
Selected from the list:
  - crude oil;
  - product;
  - NGL & LPG
  - general liquid;
- Fluid 1 base density;  
Keypad value shall be entered.
- Fluid 1 thermal expansion factor;  
Keypad value shall be entered.  
It is appears only if Fluid 1 type is General liquid.  
In case of crude oil and products thermal expansion factor is calculated according to MPMS Chapter 11.1.  
In case of LPG & LNG thermal expansion factor is calculated according to Table 53E/54E (metric units) or Table 23E/24E (imperial units).
- Fluid 2 base density;  
Keypad value shall be entered.  
Fluid 1 base density and Fluid 2 base density must not be equal.

- Fluid 2 thermal expansion factor;  
Keypad value shall be entered.  
It is appears only if Fluid 2 type is General liquid.  
In case of crude oil and products thermal expansion factor is calculated according to Chapter 11.1..  
In case of LPG & LNG thermal expansion factor is calculated according to Table 53E/54E (metric units) or Table 23E/24E (imperial units).
- Volume contraction factor;  
Keypad value shall be entered.  
It takes into account the volume change in case of mixing two different fluids.  
Default value is 1.0 (no change in the volume), allowable range from 0.95 to 1.05
- Pressure volume correction mode;  
It pressure volume correction is enabled then compression factor shall be entered.
  - no;
  - yes;
- Fluid 1 compression factor;  
Keypad value shall be entered.  
It is appears only if Fluid 1 type is General liquid. In case of crude oil and products compression factor is calculated according to MPMS Chapter 11.1.  
In case of LPG & LNG compression factor is calculated according to Chapter 12.2.2M (metric units) or Chapter 12.2.2 (imperial units).
- Fluid 2 compression factor;  
Keypad value shall be entered.  
It is appears only if Fluid 2 type is General liquid. In case of crude oil and products compression factor is calculated according to MPMS Chapter 11.1.  
In case of LPG & LNG compression factor is calculated according to Chapter 11.2.2M (metric units) or Chapter 12.2. (imperial units).
- Mixture dynamic viscosity;  
Keypad value shall be entered.

#### 9.2.2.1.1.5.5 Other

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
------------	---------	-----------------	-----------

Fluid	Liquid	Other
-------	--------	-------

The “Other” fluid selection is intended for the fluids which are not listed in the previous paragraphs and where no flow calculation but only totalization of the flow signal is required.

Example of such measurement is the electrical power measurement.

The unit for the input channel representing the flow rate (in case of the electrical power measurement) shall be selected as MW or MVA in this case.

The flow meter shall be selected as “Other”.

No data page will appear in this case. Message “Other fluid selected” and “Other flow meter selected” will appear on the screen for fluid and flow meter selection respectively.

### 9.2.2.1.2 Flow meter selection

After the fluid is selected and the parameters are setup the flow meter shall be defined.

Depending on the flow meter selected the flow meter specific data page appears.

The figures in this chapter explain the parameters of the different flow meters to be defined and the options available for selection.

Function of the F keys on the Flow meter selection data pages

- ⇓ select the next field for editing
- ⇑ select the previous field for editing
- ⇒ enter into submenu for error curve editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

#### 9.2.2.1.2.1 Differential pressure devices

##### 9.2.2.1.2.1.1 Orifice plate

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
------------	---------	-----------------	-----------

Flow meter	Diff. press. device	Orifice meter
------------	---------------------	---------------

01.Str. NGAS-ORIFICE

Flow meter	Orifice plate
dP tappings	Flange
Flow standard	ISO5167:2003
Pipe diam.at 20°C	200 mm
Bore diam.at 20°C	100 mm
Pipe th. expansion	1.0000e-05 1/°C
Orifice th.expans.	2.0000e-05 1/°C
Temperature tappings	downstream
Measured temp. corr.	yes
Pipe diam.press.corr.	no
P transmit.level corr.	0 mm

Save Change ⇓ ⇑

Figure 9-81 Orifice plate meter data page

The data fields on the data page are as follows:

- dP tappings (Differential pressure tappings);  
Selected from the list:
  - flange;
  - corner;
  - D and D/2;

- Flow standard;  
Selected from the list:
  - ISO5167:1991;
  - ISO5167:1998;
  - ISO5167:2003;
  - GOST 8.563-1997;
  - GOST 8.586-2005;
  - AGA 3
- Pipe diameter at 20 °C;  
Keypad value shall be entered.
- Orifice bore diameter at 20 °C;  
Keypad value shall be entered.

In case of flow standards ISO 5167 (any edition) and AGA 3 the thermal expansion coefficients are entered as follows

- Pipe thermal expansion coefficient;  
Keypad value shall be entered. Orifice plate thermal expansion coefficient;  
Keypad value shall be entered.

In case of flow standards GOST 8.563-1997 or GOST 8.586-2005 the thermal expansion coefficients are entered as follows

- Pipe th. exp. mode (Pipe thermal expansion factor mode)
  - calculated;  
Selection list is opened and the material of the pipe can be selected from the list. See Table 9-10. Thermal expansion coefficient is calculated according to GOST 8.563-1997 or GOST 8.586-2005 respectively.
  - keypad;  
The operator entered keypad value is used in the flow calculation
- Orifice th. exp. mode (Orifice thermal expansion factor mode)
  - calculated;  
Selection list is opened and the material of the pipe can be selected from the list. See Table 9-10. Thermal expansion coefficient is calculated according to GOST 8.563-1997 or GOST 8.586-2005 respectively.
  - keypad;  
The operator entered keypad value is used in the flow calculation

- Temperature tapplings; (Available only if flow standard is ISO 5167 (any redaction))Selected from the list:
  - upstream;
  - downstream;
- Measured temperature correction;  
Appears only if downstream temperature tapping is selected.  
If enabled the in case of ISO5167:1991 flow standard isentropic correction, in case of ISO5167:1998 and ISO5167:2003 flow standard isenthalpic correction is applied to the temperature measured downstream to calculate the upstream temperature.  
No measured temperature correction is applied in case of any other flow standard.

Selected from the list:

- no;
- yes;
- Pipe diameter pressure correction;  
If enabled the then the pipe diameter is corrected for the internal pressure before the thermal expansion calculation is applied.

Selected from the list:

- no;
- yes;
- Pipe wall thickness;  
It is appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pipe Young modulus;  
It is appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pipe wall roughness;  
It is appears only if Flow standard GOST 8.563 or GOST 8.586 is selected.  
Keypad value shall be entered.
- Orifice rounding radius;  
It is appears only if Flow standard GOST 8.563 or GOST 8.586 is selected.  
Keypad value shall be entered.
- Interval between checks;  
It is appears only if Flow standard GOST 8.563 or GOST 8.586 is selected.  
Keypad value shall be entered.
- Pressure transmitter level correction;  
It compensates the hydrostatic pressure of the fluid in the pressure transmitter impulse line. The sign shall be:  
plus (+) if the pressure transmitter located above the pressure tapping points  
minus (-) if the pressure transmitter located below the pressure tapping points  
In case of gas flow measurement the level correction can be neglected.  
Keypad value shall be entered.

No	GOST 8.563-1997	GOST 8.586-2005
1	8	35L
2	10	45L
3	15	20HML
4	15M	12H18N9TL
5	16M	15K_20K
6	20	22K
7	20M	16GS 09G2S
8	25	09G2S
9	30	10
10	35	15

11	H6SzM	20
12	H7SzM	30_35
13	12MH	40_45
14	12H1MF	10G2
15	12H17	38HA
16	12H18N9T	40H
17	12H18N10T	15HM
18	14H17N2	30HM_30HMA
19	15HMA	12H1MF
20	15H1M1F	25H1MF
21	15H5M	25H2M1F
22	15H12ENMF	15H5M
23	17H18N9	18H2N4MA
24	20H23N13	38HN3MFA
25	36H18N25Sz2	08H13
26		12H13
27		20H13
28		30H13
29		10H14G14N4T
30		08H18N10
31		12H18N9T
32		12H18N10_12T
33		08H18N10T
34		08H22N6T
35		37H12N8G8MFB
36		31H19N9MVB
37		06HN28MDT
38		20L
39		25L

Table 9-10 Type of steels in GOST standards



## 9.2.2.1.2.1.2 Nozzle

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
------------	---------	-----------------	-----------

Flow meter	Diff. press. device	Nozzle
------------	---------------------	--------

01.Str. STR1	
Flow meter	Nozzle
Nozzle type	ISA-1932
Pipe diam.at 20°C	200 mm
Bore diam.at 20°C	100 mm
Pipe th. expansion	1.1000e-05 1/°C
Orifice th.expans.	1.6000e-05 1/°C
Temperature tappings	upstream
Pipe diam.press.corr.	no
P transmit.level corr.	0 mm

Save	Change	↓	↑
------	--------	---	---

Figure 9-82 Nozzle data page

The data fields on the data page are as follows:

- Nozzle type;  
Selected from the list:
  - ISA-1932;
  - Long radius;
  - Venturi nozzle;
 The flow standard applied for the nozzle calculation is ISO 5167:2003.

In case of flow standards ISO 5167 (any edition) and AGA 3 the thermal expansion coefficients are entered as follows

- Pipe diameter at 20 oC;  
Keypad value shall be entered.
- Orifice bore diameter at 20 oC;  
Keypad value shall be entered.
- Pipe thermal expansion coefficient;  
Keypad value shall be entered.
- Orifice plate thermal expansion coefficient;  
Keypad value shall be entered.

In case of flow standards GOST 8.563-1997 or GOST 8.586-2005 the thermal expansion coefficients are entered as follows

- Pipe th. exp. mode (Pipe thermal expansion factor mode)
  - calculated;

Selection list is opened and the material of the pipe can be selected from the list. See Table 9-10. Thermal expansion coefficient is calculated according to GOST 8.563-1997 or GOST 8.586-2005 respectively.

- keypad;  
The operator entered keypad value is used in the flow calculation
- Orifice th. exp. mode (Orifice thermal expansion factor mode)
  - calculated;  
Selection list is opened and the material of the pipe can be selected from the list. See Table 9-10. Thermal expansion coefficient is calculated according to GOST 8.563-1997 or GOST 8.586-2005 respectively.
  - keypad;  
The operator entered keypad value is used in the flow calculation
- Temperature tapping;  
Selected from the list:
  - upstream;
  - downstream;
- Measured temperature correction;  
Appears only if downstream temperature tapping is selected.

If enabled the in case of ISO5167 : 1991 flow standard isentropic correction, in case of ISO5167 : 1998 and ISO5167 : 2003 flow standard isenthalpic correction is applied to the temperature measured downstream to calculate the upstream temperature.  
No measured temperature correction is applied in case of any other flow standard.

Selected from the list:

- no;
- yes;
- Pipe diameter pressure correction;  
If enabled the then the pipe diameter is corrected for the internal pressure before the thermal expansion calculation is applied.  
Selected from the list:
  - no;
  - yes;
- Pipe wall thickness;  
It appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pipe Young modulus;  
It appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pressure transmitter level correction;  
It compensates the hydrostatic pressure of the fluid in the pressure transmitter impulse line. The sign shall be:  
plus (+) if the pressure transmitter located above the pressure tapping points  
minus (-) if the pressure transmitter located below the pressure tapping points  
In case of gas flow measurement the level correction can be neglected.  
Keypad value shall be entered.

### 9.2.2.1.2.1.3 Venturi tube

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
------------	---------	-----------------	-----------

Flow meter	Diff. press. device	Venturi tube
------------	---------------------	--------------

01.Str. STR1

Flow meter	Venturi tube
<b>Venturi type</b>	Venturi machined
Pipe diam.at 20°C	200 mm
Bore diam.at 20°C	100 mm
Pipe th. expansion	1.1000e-05 1/°C
Orifice th.expans.	1.6000e-05 1/°C
Temperature tapplings	upstream
Pipe diam.press.corr.	no
P transmit.level corr.	0 mm

Save
Change
↓
↑

Figure 9-83 Venturi tube data page

The data fields on the data page are as follows:

- Venturi type;  
Selected from the list:
  - Venturi machined;
  - Venturi as cast;
  - Venturi rough-welded;
 The flow standard applied for the Venturi tube calculation is ISO 5167:2003.
- Pipe diameter at 20 oC;  
Keypad value shall be entered.
- Orifice bore diameter at 20 oC;  
Keypad value shall be entered.

In case of flow standards ISO 5167 (any edition) and AGA 3 the thermal expansion coefficients are entered as follows

- Pipe thermal expansion coefficient;  
Keypad value shall be entered.
- Orifice plate thermal expansion coefficient;  
Keypad value shall be entered.

In case of flow standards GOST 8.563-1997 or GOST 8.586-2005 the thermal expansion coefficients are entered as follows

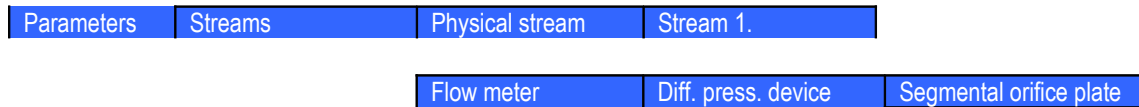
- Pipe th. exp. mode (Pipe thermal expansion factor mode)
  - calculated;

Selection list is opened and the material of the pipe can be selected from the list. See Table 9-10. Thermal expansion coefficient is calculated according to GOST 8.563-1997 or GOST 8.586-2005 respectively.

- keypad;  
The operator entered keypad value is used in the flow calculation
- Orifice th. exp. mode (Orifice thermal expansion factor mode)
  - calculated;  
Selection list is opened and the material of the pipe can be selected from the list. See Table 9-10. Thermal expansion coefficient is calculated according to GOST 8.563-1997 or GOST 8.586-2005 respectively.
  - keypad;  
The operator entered keypad value is used in the flow calculation
- Temperature tapping;  
Selected from the list:
  - upstream;
  - downstream;
- Measured temperature correction;  
Appears only if downstream temperature tapping is selected.  
If enabled the in case of ISO5167 : 1991 flow standard isentropic correction, in case of ISO5167 : 1998 and ISO5167 : 2003 flow standard isenthalpic correction is applied to the temperature measured downstream to calculate the upstream temperature.  
No measured temperature correction is applied in case of any other flow standard.  
Selected from the list:
  - no;
  - yes;
- Pipe diameter pressure correction;  
If enabled the then the pipe diameter is corrected for the internal pressure before the thermal expansion calculation is applied.  
Selected from the list:
  - no;
  - yes;
- Pipe wall thickness;  
It is appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pipe Young modulus;  
It is appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pressure transmitter level correction;  
It compensates the hydrostatic pressure of the fluid in the pressure transmitter impulse line. The sign shall be:  
plus (+) if the pressure transmitter located above the pressure tapping points  
minus (-) if the pressure transmitter located below the pressure tapping points  
In case of gas flow measurement the level correction can be neglected.  
Keypad value shall be entered.

#### 9.2.2.1.2.1.4 Segmental orifice plate

Route in the menu tree:



```

01.Str. STR1
Flow meter      Segm. orif. plate
Pipe diam.at 20°C  200 mm
Error curve      no
Average C        1
P transmit.level corr. 0 mm
  
```

Save Change ↓ ↑

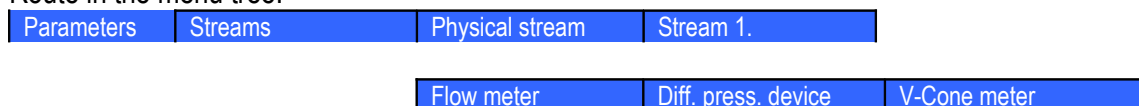
Figure 9-84 Segmental orifice plate data page

The data fields on the data page are as follows:

- Pipe diameter at 20 °C;  
Keypad value shall be entered.
- Calibration curve;  
Selected from the list:
  - no;
  - yes;
 If calibration curve is enabled then maximum 10 differential pressures and the corresponding flow coefficient (C) can be entered here from the calibration certificate of the meter.
  - dP<sub>n</sub>; (n = 1 to 10)
  - C<sub>n</sub>; (n = 1 to 10)
- Average C;  
Appears only if calibration curve is disabled  
Keypad value of the average flow coefficient shall be entered.
- Pressure transmitter level correction;

#### 9.2.2.1.2.1.5 V-Cone meter

Route in the menu tree:



<b>01.Str. STR1</b>	
<b>Flow meter</b>	<b>V-Cone meter</b>
Pipe diam.at 20°C	200 mm
Orifice bore diamet	100 mm
C0 coefficient	0.775
B coefficient	4.0000e-05
Pipe th. expansion	1.1000e-05 1/°C
Orifice th.expans.	1.6000e-05 1/°C
Pipe diam.press.corr.	no
P transmit.level corr.	0 mm

Save Change ↓ ↑

Figure 9-85 V-Cone meter data page

The data fields on the data page are as follows:

- Pipe diameter at 20 oC;  
Keypad value shall be entered.
- Equivalent orifice bore diameter at 20 oC;  
Keypad value shall be entered.
- C0 coefficient;  
Keypad value shall be entered from the certificate of the meter.
- B coefficient;  
Keypad value shall be entered from the certificate of the meter.
- Pipe thermal expansion coefficient;  
Keypad value shall be entered.
- Orifice plate thermal expansion coefficient;  
Keypad value shall be entered.
- Pipe diameter pressure correction;  
If enabled the then the pipe diameter is corrected for the internal pressure before the thermal expansion calculation is applied.  
Selected from the list:
  - no;
  - yes;
- Pipe wall thickness;  
It is appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pipe Young modulus;  
It is appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pressure transmitter level correction;

#### 9.2.2.1.2.1.6 Compact/Conditioning orifice plate

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.
------------	---------	-----------------	-----------

Flow meter	Diff. press. device	Compact orifice
------------	---------------------	-----------------

01.Str. STR1

Flow meter	Compact orifice
dP <b>tappings</b>	Flange
Flow standard	ISO5167:2003
Pipe diam.at 20°C	200 mm
Bore diam.at 20°C	100 mm
Pipe th. expansion	1.1000e-05 1/°C
Orifice th.expans.	1.6000e-05 1/°C
Calibration factor	0.987
Temperature tappings	upstream
Pipe diam.press.corr.	no
P transmit.level corr.	0 mm

Figure 9-86 Compact/conditioning orifice plate data page

The data fields on the data page are as follows:

- dP tappings (Differential pressure tappings);  
Selected from the list:
  - flange;
  - corner;
  - D and D/2;
- Flow standard;  
Selected from the list:
  - ISO5167:1991;
  - ISO5167:1998;
  - ISO5167:2003 ; Pipe diameter at 20 °C;
 Keypad value shall be entered.
- Orifice bore diameter at 20 °C;  
Keypad value shall be entered.
- Pipe thermal expansion coefficient;  
Keypad value shall be entered.
- Orifice plate thermal expansion coefficient;  
Keypad value shall be entered.
- Calibration factor;  
Keypad value shall be entered from the calibration certificate of the meter.
- Temperature tapping;

Selected from the list:

- upstream;
  - downstream;
- Measured temperature correction;  
 Appears only if downstream temperature tapping is selected.  
 If enabled the in case of ISO5167 : 1991 flow standard isentropic correction, in case of ISO5167 : 1998 and ISO5167 : 2003 flow standard isenthalpic correction is applied to the temperature measured downstream to calculate the upstream temperature.  
 No measured temperature correction is applied in case of any other flow standard.  
 Selected from the list:
  - no;
  - yes;
- Pipe diameter pressure correction;  
 If enabled the then the pipe diameter is corrected for the internal pressure before the thermal expansion calculation is applied.  
 Selected from the list:
  - no;
  - yes;
- Pipe wall thickness;  
 It is appears only if Pipe diameter pressure correction is enabled.  
 Keypad value shall be entered.
- Pipe Young modulus;  
 It is appears only if Pipe diameter pressure correction is enabled.  
 Keypad value shall be entered.
- Pipe wall roughness;  
 It is appears only if Flow standard GOST 8.563 is selected.  
 Keypad value shall be entered.
- Orifice rounding radius;  
 It is appears only if Flow standard GOST 8.563 is selected.  
 Keypad value shall be entered.
- Interval between checks;  
 It is appears only if Flow standard GOST 8.563 is selected.  
 Keypad value shall be entered.
- Pressure transmitter level correction;  
 It compensates the hydrostatic pressure of the fluid in the pressure transmitter impulse line. The sign shall be:  
 plus (+) if the pressure transmitter located above the pressure tapping points  
 minus (-) if the pressure transmitter located below the pressure tapping points  
 In case of gas flow measurement the level correction can be neglected.

Keypad value shall be entered.



### 9.2.2.1.2.2 Annubar

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Flow meter	Annubar
------------	---------	-----------------	-----------	------------	---------

The screenshot shows a configuration page for an Annubar flow meter. The title is '01.Str. STR1'. Below it, 'Flow meter' is selected, and 'Annubar' is the chosen type. The 'Type' field is highlighted with a black bar. The configuration parameters are as follows:

Parameter	Value	Unit
Type	DiamondII+_15	
Sensor factors	no	
Structural dP max.	2 000	mbar
Pipe inter.diameter	200	mm
Pipe th.exp.coeff.	1.1000e-05	1/°C
Pipe diam.press.corr.	yes	
Wall thickness	20	mm
Young modulus	2 000 000	bar
P transmit.level corr.	0	mm

At the bottom, there are four buttons: 'Save', 'Change', a down arrow, and an up arrow.

Figure 9-87 Annubar data page

The data fields on the data page are as follows:

- Type

The type of the Annubar meter selected from the list:

- Diamond II+ 10;
- Diamond II+ 15;
- Diamond II+ 25;
- Diamond II+ 35;
- Diamond II+ 45;
- 485 D1;
- 485 D2;
- 485 D3;
- Other;

- Sensor factors;

Selected from the list:

- no;
- yes;

If sensor factors are enabled then entry fields appear as follows.

- sensor width;
- sensor C1 constant;
- sensor C2 constant;
- thermal expansion coefficient;
- minimum Reynolds number;

Sensor width and thermal expansion coefficient are editable for all type of Annubar.

C1 and C2 constant and minimum Reynolds number are editable only if "Other" Annubar type is selected. For standard Annubars the manufacturer's constants are applied.

- Structural dP max;

Keypad value shall be entered.

- Pipe diameter at 20 oC;  
Keypad value shall be entered.
- Pipe thermal expansion coefficient;  
Keypad value shall be entered.
- Pipe diameter pressure correction;  
If enabled the then the pipe diameter is corrected for the internal pressure before the thermal expansion calculation is applied.  
Selected from the list:
  - no;
  - yes;
- Pipe wall thickness;  
It is appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pipe Young modulus;  
It is appears only if Pipe diameter pressure correction is enabled.  
Keypad value shall be entered.
- Pressure transmitter level correction;

### 9.2.2.1.2.3 Gas turbine meter, Liquid turbine meter, Vortex meter, Mass flow meter, Ultrasonic meter, Rotameter, Electromagnetic meter, CVOL flow meter

Route in the menu tree:

Parameters	Streams	Physical stream	Stream n.
------------	---------	-----------------	-----------

Flow meter	Turbine meters	Gas turbine
		Liquid turbine

Parameters	Streams	Physical stream	Stream n.	Flow meter	Vortex meter
					Mass flow meter
					Ultrasonic meter
					Rotameter
					Electromagnetic flow meter
					CVOL flow meter

03.Str. NGAS-TURBINE

Flow meter	Turbine meter
Pipe diam.at 20°C	200 mm
Correction factor	1
P transmit.level corr.	0 mm

Save Change ↓ ↑

**Figure 9-88 Gas turbine meter, Liquid turbine meter, Vortex meter, Mass flow meter, Ultrasonic meter, Rotameter, Electromagnetic meter, CVOL flow meter data page**

The data fields on the data page are as follows:

- Pipe diameter at 20 oC;  
Keypad value shall be entered.
- Correction factor;  
A multiplier can be entered here to apply to the reading of the meter.  
Default value is 1.0.
- Pressure transmitter level correction;  
It compensates the hydrostatic pressure of the fluid in the pressure transmitter impulse line. The sign shall be:  
plus (+) if the pressure transmitter located above the pressure tapping points  
minus (-) if the pressure transmitter located below the pressure tapping points  
In case of gas flow measurement the level correction can be neglected.  
Keypad value shall be entered.

#### 9.2.2.1.2.4 Flow meter with power characteristic

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Flow meter	Power char. meter
------------	---------	-----------------	-----------	------------	-------------------

```

01.Str. STR1
Flowmeter with power characteristic
Correction factor      1
Error curve           no
Multiplier            1
Exponent              0.5
Bias                  0
Pipe diam.at 20°C     200 mm
P transmit.level corr. 0 mm
  
```

Save Change ↓ ↑

Figure 9-89 Flow meter with power characteristic data page

The equation of this type of flow meter implemented in UNIFLOW-200 is as follows:

$$q_v = MF \cdot (A \cdot J^n + B)$$

where:  $q_v$  - volume flow rate, m<sup>3</sup>/h  
 MF - correction factor, -  
 A - multiplier, -  
 n - exponent, -  
 B - bias, -  
 J - input signal, %

The data fields on the data page are as follows:

- Correction factor;  
A multiplier can be entered here to apply to the reading of the meter.  
Default value is 1.0.
- Calibration curve;  
Selected from the list:
  - no;
  - yes;  
If calibration curve is enabled then maximum 10 input signal (%) and the corresponding multiplier can be entered here from the calibration certificate of the meter.
    - Input signal n; (n = 1 to 10)
    - Multiplier n; (n = 1 to 10)
- Exponent
- Bias;
- Pipe diameter at 20 oC;  
Keypad value shall be entered.
- Pressure transmitter level correction;

#### 9.2.2.1.2.5 Other

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Flow meter	Other
------------	---------	-----------------	-----------	------------	-------

The “Other” flow meter selection is intended for the flow meters which are not listed in the previous paragraphs and where no flow calculation but only totalization of the flow signal is required.

Example of such measurement is the electrical power measurement.

The unit for the input channel representing the flow rate (in case of the electrical power measurement) shall be selected as MW or MVA in this case.

The fluid shall be selected as “Other”.

No data page will appear in this case. Message “Other fluid selected” and “Other flow meter selected” will appear on the screen for fluid and flow meter selection respectively.

#### 9.2.2.1.2.6 Stream

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Flow meter	Stream
------------	---------	-----------------	-----------	------------	--------

Flow meter	Stream
Pipe diam.at 20°C	200 mm
Correction factor	1
P transmit.level corr.	0 mm

Save Change ↓ ↑

Figure 9-90 Stream flow meter data page

The “Stream” flow meter selection is intended for the case when the flow signal is set as uncorrected or corrected volume or mass flow rate of any other stream. The assignment of the source stream is done in the Stream setup menu.

Example of such measurement is the multi tariff measurement of the gas flow. It means that different flow rate ranges of the gas are totalized in different streams.

### 9.2.2.1.3 *Stream setup*

After the fluid and the flow meter are selected the stream setup procedure should be completed. In the Stream setup menu the field I/O channels are assigned to the process parameters required in the flow calculation. Some additional parameters required for proper signal processing are entered also.

Depending on the fluid and the flow meter selected specific for that selection Stream setup data page will appear. The number of different fluids and the number of flow meters UNIFLOW-200 is capable to handle is large. To list all the combinations of fluids and flow meters is not practical, if not impossible here.

Some typical data pages are shown below. They show all of the parameters that appear in setup procedure but maybe in different combination.

It is important to note that the signal setup completed in I/O signal setup section must be synchronized with the stream setup. It means that type of the signal and the unit of measurement selected for the signal must correspond to the signal and unit of measurement required in the flow calculation and the I/O channel assigned to.

The limitations listed below should be observed.

Flow signals:

- differential pressure devices and Annubar;
  - unit: mbar;
  - signal mode: 4-20 mA I/O channel, Modbus channel, keypad
- gas and liquid turbine meter, Vortex meter, ultrasonic meter, electromagnetic flow meter, CVOL flow meter
  - unit: m<sup>3</sup>/h (at line conditions, at base conditions in case of CVOL flow meter);
  - signal mode: 4-20 mA I/O channel, pulse I/O channel, Modbus channel, keypad
- rotaméter;
  - unit: m<sup>3</sup>/h (at line conditions);
  - signal mode: 4-20 mA I/O channel, Modbus channel, keypad
- mass flow meter;
  - unit: kg/h;
  - signal mode: 4-20 mA I/O channel, pulse I/O channel, Modbus channel, keypad
- flow meter with power characteristic;
  - unit: %;
  - signal mode: 4-20 mA I/O channel, Modbus channel, keypad

Pressure signal

- unit: bar;
- signal mode: 4-20 mA I/O channel, Modbus channel, keypad

Temperature signal

- unit: °C;
- signal mode: 4-20 mA I/O channel, Pt100 I/O channel, Modbus channel, keypad

## Density signal

- unit: kg/m<sup>3</sup>;
- signal mode: 4-20 mA I/O channel, frequency I/O channel, Modbus channel, keypad

## Calorific value signal

- unit: MJ/m<sup>3</sup> or kg/m<sup>3</sup>;
- signal mode: 4-20 mA I/O channel, Modbus channel, keypad

## Concentration signal

- unit: % (percent);
- signal mode: 4-20 mA I/O channel, Modbus channel, keypad

In the Stream setup menu the unit of measurement for volume, mass and energy shall be selected. In the Table 9-11. below the available units are listed for both metric and imperial systems.

Fluid	Quantity	Metric units		Imperial units	
		Total	Flow rate	Total	Flow rate
Gas	Volume	- m <sup>3</sup> - l	- m <sup>3</sup> /h - l/h	- MCF	- MCF/h
	Mass	- kg - t	- kg/h - t/h	- lb	- lb/h
	Energy	- GJ - MJ - kWh - MWh	- GJ/h - MJ/h - kWh/h - MWh/h	- MMBTU	- MMBTU/h
Liquid	Volume	- m <sup>3</sup> - l	- m <sup>3</sup> /h - l/h	- bbl	- bbl/h
	Mass	- kg - t	- kg/h - t/h	- Mlb	- Mlb/h

	Energy	- GJ - MJ - kWh - MWh	- GJ/h - MJ/h - kWh/h - MWh/h	- MMBTU	- MMBTU/h
Steam	Volume	- m <sup>3</sup> - l	- m <sup>3</sup> /h - l/h	not supported	not supported
	Mass	- kg - t	- kg/h - t/h	not supported	not supported

	Energy	- GJ - MJ - kWh - MWh	- GJ/h - MJ/h - kWh/h - MWh/h	not supported	not supported
--	--------	--------------------------------	----------------------------------------	---------------	---------------

**Table 9-11 Unit of measurements for volume, mass and energy**

Function of the F keys on the Stream setup data pages

⇓ select the next field for editing

⇑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.



### 9.2.2.1.3.1 Stream setup example – fluid: natural gas, flow meter: orifice meter

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Stream set up
------------	---------	-----------------	-----------	---------------

<b>01.Str. NGAS-ORIFICE</b>		<b>01.Str. NGAS-ORIFICE</b>	
Stream setup		Stream setup	
<b>Fluid selected</b>	Natural gas	Switch down	95 %
Units	Total Current	dP cut off	0.1 %
Volume	m <sup>3</sup> m <sup>3</sup> /h	Eventing	yes
MASS	kg kg/h	Pressure	measured
ENERGY	GJ GJ/h	Temperature 1	1 IO 3 ch. measured
Flow meter	orifice plate	Temperature 2	1 IO 5 ch. keypad
Flow signal mode	measured	Keypad value	15 C
No. of dP transm.	2	Stream disabling	no
dP stack type	LH	Batch	no
dP1L	1 IO 1 ch.	<b>Meter serial test</b>	disabled
dP2H	1 IO 2 ch.	Save Change	↓ ↑
Switch up	98 %		
Save	↓ ↑		

<b>01.Str. NGAS-ORIFICE</b>	
Stream setup	
dP cut off	0.1 %
Eventing	yes
Pressure	measured
Temperature 1	1 IO 3 ch. measured
Temperature 2	1 IO 5 ch. keypad
Keypad value	15 C
Stream disabling	no
Batch	no
Meter serial test	disabled
<b>Transm. calibration</b>	no
Save Change	↓ ↑

Figure 9-91 Stream setup data page, fluid: natural gas, flow meter: orifice meter

<b>08.Str. STEAM-VENTURI</b>	
Stream setup	
Stream disabling	from stream
Stream selection	7
Limit to disable	lsc -
Batch	no
Meter serial test	disabled
Transm. calibration	yes
Flow meter	yes
Keypad value	123 mbar
Pres. at flow meter	yes
Keypad value (abs)	10.7 bar
Temp. at flow meter	yes
Keypad value	183.29 °C
Save Change	↓ ↑

Figure 9-92 Stream disabling and transmitter calibration data page

The data fields on the data page are as follows:

- Fluid selected;  
Not editable here, fixed to the fluid selected in the Fluid menu
- Units;  
See the available units for volume, mass and energy in Table 9-11. Flow meter selected;  
Not editable here, fixed to the flow meter selected in the Flow meter menu
- Flow signal mode;  
The mode selected from the list
  - measured;  
It is assumed that differential pressure is measured on input channel(s).  
In this case new data entry fields appear to enter the dP transmitter parameters.
    - No. of dP transm. (Number of dP transmitters);  
Selected from the list;
      - 1 (one differential pressure transmitter);  
The I/O channel measuring the differential pressure is entered.
        - dP1                      IO *n*    Ch *m*  
*n* – number of I/O board  
*m* – number of channel on the I/O board
      - 2 (two differential pressure transmitters);  
The configuration of the dP transmitters in case of 2 transmitters:
        - dP stack type  
Selected from the list
          - LH (low and high range dP transmitters);  
The low or high transmitter reading is used in the flow calculation, depending on the differential pressure measured and the switch down and switch up limits.  
The I/O channels measuring the differential pressure is entered.
            - dP1L                      IO *n*    Ch *m*
            - dP2H                      IO *n*    Ch *m*  
*n* – number of I/O board  
*m* – number of channel on the I/O board
            - Switch up  
Switch from low range to high range transmitter in % of the low range transmitter upper range.
            - Switch down  
Switch from high range to low range transmitter in % of the low range transmitter upper range.
          - HH (two transmitters with identical range);  
The average of the two transmitters reading is used in the flow calculation.  
The I/O channels measuring the differential pressure is entered.
            - dP1H                      IO *n*    Ch *m*
            - dP2H                      IO *n*    Ch *m*  
*n* – number of I/O board  
*m* – number of channel on the I/O board
            - discrepancy (in % of the transmitter range);  
Maximum deviation between the readings of the two transmitters.

- discrepancy timeout (in seconds)  
If the discrepancy exists longer then this timeout time, then alarm is raised.

- 3 (three differential pressure transmitters);

The configuration of the dP transmitters in case of 3 transmitters:

- dP stack type

Selected from the list

- LMH (low, medium and high range dP transmitters);

The low or medium or high range transmitter reading is used in the flow calculation, depending on the differential pressure measured and the switch down and switch up limits.

The I/O channels measuring the differential pressure is entered.

- dP1L                      IO *n*    Ch *m*
- dP2M                      IO *n*    Ch *m*
- dP3H                      IO *n*    Ch *m*

*n* – number of I/O board

*m* – number of channel on the I/O board

- Switch up

Switch from low range to medium range transmitter in % of the low range transmitter upper range. Switch from medium range to high range transmitter in % of the medium range transmitter upper range.

- Switch down

Switch from high range to medium range transmitter in % of the medium range transmitter upper range. Switch from medium range to low range transmitter in % of the low range transmitter upper range.

- LHH (one low range and two high range transmitters);

The low or high transmitter reading is used in the flow calculation, depending on the differential pressure measured and the switch down and switch up limits. The average of the two high range transmitters reading is used as high dP reading.

The I/O channels measuring the differential pressure is entered.

- dP1L                      IO *n*    Ch *m*
- dP2H                      IO *n*    Ch *m*
- dP3H                      IO *n*    Ch *m*

*n* – number of I/O board

*m* – number of channel on the I/O board

- Switch up

Switch from low range to high range transmitter in % of the low range transmitter upper range.

- Switch down

Switch from high range to low range transmitter in % of the low range transmitter upper range.

- discrepancy (in % of the transmitter range);

Maximum deviation between the readings of the two high range transmitters.

- discrepancy timeout (in seconds)  
If the discrepancy exists longer then this timeout time, then alarm is raised.
- HHH (three transmitters with identical range);  
The average of the three transmitters reading is used in the flow calculation if all the discrepancies are within the limit.  
The mid reading is used in the flow calculation if all the discrepancies are outside the limit.  
The average of the two closest readings are used in the flow calculation in all other cases.  
The I/O channels measuring the differential pressure is entered.
  - dP1H                      IO *n*    Ch *m*
  - dP2H                      IO *n*    Ch *m*
  - dP3H                      IO *n*    Ch *m*

*n* – number of I/O board  
*m* – number of channel on the I/O board

  - discrepancy (in % of the transmitter range);  
Maximum deviation between the readings of any two transmitters.
  - discrepancy timeout (in seconds)  
If the discrepancy exists longer then this timeout time, then alarm is raised.
- o modbus sign.;  
It is assumed that differential pressure signal is received on Modbus channel.  
In this case new data entry field appear to enter the dP channel parameters.
  - Channel    *n*;  
      *n* – number of Modbus channel;
- o keypad;  
Keypad flow signal (differential pressure) can be entered here. It serves for testing the flow calculation only.  
NOTE  
If flow signal is set to keypad the flow rate will be displayed but no totalization will be done.
- dP cut off;  
Entered in % of the low range transmitter.  
If the measured differential pressure is below the dP cut off limit then the differential pressure is assumed to be zero.
- Eventing dP cut off;  
It is operator selectable if the dP cut off will generate entry in the event log or not.
  - o yes;
  - o no;
- Pressure signal mode;  
The mode selected from the list
  - o measured;  
It is assumed that pressure is measured on input channel.

The channel number should be entered here.

- IO  $n$  Ch  $m$   
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board

- modb. sign.;

It is assumed that pressure signal is received on Modbus channel.

The channel number should be entered here.

- Channel  $n$ ;  
 $n$  – number of Modbus channel;

- keypad;

Keypad pressure can be entered here if pressure signal is not available.

- Temperature1 signal mode;

The mode selected from the list

- measured;

It is assumed that temperature is measured on input channel.

The channel number should be entered here.

- IO  $n$  Ch  $m$   
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board

- modb. sign.;

It is assumed that temperature signal is received on Modbus channel.

The channel number should be entered here.

- Channel  $n$ ;  
 $n$  – number of Modbus channel;

- keypad;

Keypad temperature can be entered here if temperature signal is not available.

- Temperature2 signal mode;

Temperature2 is intended for ambient temperature measurement.

It is not used in flow calculation.

The mode selected from the list

- measured;

It is assumed that temperature is measured on input channel.

The channel number should be entered here.

- IO  $n$  Ch  $m$   
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board

- modb. sign.;

It is assumed that temperature signal is received on Modbus channel.

The channel number should be entered here.

- Channel  $n$ ;  
 $n$  – number of Modbus channel;

- keypad;

Keypad temperature can be entered here if temperature signal is not available.

Live it to keypad value if no ambient temperature measurement is required.

- Stream disabling;

It is possible to disable the operation of the stream depending on different parameters.

The option is selected from the list:

- `no;`  
Stream never disabled.
- `measured signal;`  
Any I/O channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from `lsc`, `lo`, `lolo` or `none`.  
The upper limit is selected from `hsc`, `hi`, `hihi` or `none`.  
The channel number and the limit causing the stream disabled should be entered here.
  - `IO n Ch m;`  
*n* – number of I/O board  
*m* – number of channel on the I/O board
  - Limit to disable;  
Lower limit
    - `lo` (low alarm limit of the I/O channel);
    - `lolo` (low-low alarm limit of the I/O channel);
    - `lsc` (low scale of the I/O channel);
    - `-` (no lower limit will disable the stream);
 Upper limit
    - `hi` (high alarm limit of the I/O channel);
    - `hihi` (high-high alarm limit of the I/O channel);
    - `hsc` (high scale of the I/O channel);
    - `-` (no upper limit will disable the stream);
- `modbus signal;`  
Any Modbus channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from `lsc`, `lo`, `lolo` or `none`.  
The upper limit is selected from `hsc`, `hi`, `hihi` or `none`.  
The channel number and the limit causing the stream disabled should be entered here.
  - `Channel n;`  
*n* – number of Modbus channel;
  - Limit to disable;  
Lower limit
    - `lo` (low alarm limit of the Modbus channel);
    - `lolo` (low-low alarm limit of the Modbus channel);
    - `lsc` (low scale of the Modbus channel);
    - `-` (no lower limit will disable the stream);
 Upper limit
    - `hi` (high alarm limit of the Modbus channel);
    - `hihi` (high-high alarm limit of the Modbus channel);
    - `hsc` (high scale of the Modbus channel);
    - `-` (no upper limit will disable the stream);

- `from stream;`  
Any stream can be selected.  
One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from `lsc`, `lo`, `lolo` or `none`.  
The upper limit is selected from `hsc`, `hi`, `hihi` or `none`.  
The stream number and the limit causing the stream disabled should be entered here.
  - Stream *n*;  
*n* – serial number of the stream from 1 to 12;
  - Limit to disable;  
Lower limit
    - `lo` (low alarm limit of the Stream *n*);
    - `lolo` (low-low alarm limit of the Stream *n*);
    - `lsc` (low scale of the Stream *n*);
    - `-` (no lower limit will disable the stream);
Upper limit
    - `hi` (high alarm limit of the Modbus channel);
    - `hihi` (high-high alarm limit of the Modbus channel);
    - `hsc` (high scale of the Modbus channel);
    - `-` (no upper limit will disable the stream);

The values of the upper and lower limits are set in the Limits menu of the Stream *n* being the stream disabling the current stream. The type of flow rate (uncorrected or corrected volume, mass or energy flow rate) is selected also in the Limits menu of the Stream *n*. See 9.2.2.1.5.
- Batch;  
Batch measurement is enabled or disabled here.  
The option is selected from the list:
  - `no`;  
No batch measurement performed.
  - `yes`;  
Batch measurement is enabled. New line appears where the source of the batch start/stop signal shall be selected from the list.
    - `from communication interface`; (no other option is available)

The batch measurement starts and stops by writing certain Modbus registers. The mapping of the start/stop Modbus registers and also the registers where the measured data can be read from see in 10.5.2.

The name of the stream entered in 9.2.2.1. will be displayed on the batch report as station name. To display the results of the batch measurements see 9.1.7..
- Meter serial test  
Flow meter serial test measurement can be enabled or disabled here.  
The option is selected from the list:
  - `disabled`;  
No flow meter serial test measurement performed.
  - `enabled`;  
Flow meter serial test measurement is enabled.  
Serial test can be enabled on Stream 1 only.  
Warning message appears:

Proceeding will reset all totals and parameters of stream 8. Proceed?

Selecting yes two new lines appear.

- Shadow stream 8  
In the non custody transfer flow computer the measured values and totals are displayed in stream 8.
- Stream  
The option is selected from the list:
  - `custody transfer stream (slave);`  
The stream being set up will perform the custody transfer measurement during the serial test. It will operate in normal way. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the slave device.
  - `non custody transfer stream (master);`  
The stream being set up will perform non custody transfer measurement during the serial test. It will display and totalize the flow in stream 8 instead of the stream being configured for the particular meter run. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the master device.

See details of the meter serial test measurements in 9.1.8.

- Transmitter calibration  
Calibration of the transmitters can be enabled or disabled here. When calibration is enabled for a certain transmitter keypad value shall be entered for the parameter being measured by that transmitter. In this case the flow calculation will be performed with the keypad value of the parameter. The measured value of the input signal is still displayed in the Flow / Plant I/O / IO Board x menu allowing the calibration of the transmitter without interrupting the flow measurement.  
NOTE: the transmitter calibration shall be disabled after finishing the transmitter calibration to recover the normal operation of the flowcomputer.  
The option is selected from the list::
  - `no;`  
transmitters operate in normal way.
  - `yes;`  
transmitters are being calibrated. If the `yes` option is selected 4 new menu item appears allowing selection of the transmitters one by one, namely:
- Flow meter
  - `no;`  
flow meter operates in normal way.
  - **`yes;`**  
flow meter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Pressure
  - `no;`  
pressure transmitter operates in normal way.
  - **`yes;`**



pressure transmitter is being calibrated.

- Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Temperature 1
  - no;  
temperature 1 transmitter operates in normal way.
  - **yes**;  
temperature 1 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Temperature 2
  - no;  
temperature 2 transmitter operates in normal way.
  - **yes**;  
temperature 2 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.

#### 9.2.2.1.3.2 Stream setup example – fluid: natural gas, flow meter: turbine meter

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Stream set up
------------	---------	-----------------	-----------	---------------

<b>03.Str. NGAS-TURBINE</b>		<b>03.Str. NGAS-TURBINE</b>	
Stream setup		Stream setup	
<b>Fluid selected</b>	Natural gas	<b>Cut off</b>	0.1 %
Units	Total Flowrate	Eventing	yes
Volume	m <sup>3</sup> m <sup>3</sup> /h	Pressure	measured
Mass	kg kg/h	Temperature 1	1 IO 3 ch. measured
Energy	GJ GJ/h	Temperature 2	1 IO 5 ch. keypad
Flow meter	turbine meter	keypad value	15 C
Flow signal mode	measured	Stream disabling	no
Check signal	measured	Batch	no
Signal ratio	2 IO 1 ch.	Meter serial test	disabled
Cut off	2 IO 2 ch.	<b>Transm. calibration</b>	no
Save	↓ ↑	Save Change	↓ ↑

Figure 9-93 Stream setup data page, fluid: natural gas, flow meter: turbine meter

The data fields on the data page are as follows:

- Fluid selected;  
Not editable here, fixed to the fluid selected in the Fluid menu
- Units;  
See the available units for volume, mass and energy in Table 9-11.

- Flow meter selected;  
Not editable here, fixed to the flow meter selected in the Flow meter menu
- Flow signal mode;  
The mode selected from the list
  - `measured;`  
It is assumed that flow signal is measured on input channel(s).  
In this case the I/O channel measuring the flow signal shall be entered.
    - $$\begin{array}{cc} \text{IO } n & \text{Ch } m \\ n - \text{number of I/O board} \\ m - \text{number of channel on the I/O board} \end{array}$$
    - Check signal mode;  
Check signal mode entry field appears in the next line.  
The mode selected from the list
      - `no;`  
No check signal (second pulse train from the turbine meter) exists..
      - `measured;`  
In this case the I/O channel measuring the check signal shall be entered.
        - $$\begin{array}{cc} \text{IO } n & \text{Ch } m \\ n - \text{number of I/O board} \\ m - \text{number of channel on the I/O board} \end{array}$$
      - Signal ratio;  
The ratio of the Main signal frequency to the Check signal frequency shall be entered here.
  - `modb. sign.;`  
It is assumed that flow signal is received on Modbus channel..  
In this case new data entry field appear to enter the flow signal channel parameters.
    - Channel  $n$ ;  
 $n$  – number of Modbus channel;
  - `keypad;`  
Keypad flow signal can be entered here. It serves for testing the flow calculation only.  
NOTE  
If flow signal is set to keypad the flow rate will be displayed but no totalization will be done.
- Cut off;  
Entered in % of the maximum UVOL flow rate as defined in the signal setup menu.  
If the measured flow rate is below the Cut off limit then the flow rate is assumed to be zero.
- Eventing cut off;  
It is operator selectable if the Cut off will generate entry in the event log or not.
  - `yes;`
  - `no;`
- Pressure signal mode;  
The mode selected from the list
  - `measured;`  
It is assumed that pressure is measured on input channel.  
The channel number should be entered here.
    - $$\begin{array}{cc} \text{IO } n & \text{Ch } m \\ n - \text{number of I/O board} \end{array}$$

- $m$  – number of channel on the I/O board
  - modb. sign.;  
It is assumed that pressure signal is received on Modbus channel.  
The channel number should be entered here.
    - Channel  $n$ ;  
 $n$  – number of Modbus channel;
  - keypad;  
Keypad pressure can be entered here if pressure signal is not available.
- Temperature1 signal mode;  
The mode selected from the list
  - measured;  
It is assumed that temperature is measured on input channel.  
The channel number should be entered here.
    - IO  $n$  Ch  $m$   
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board
  - modb. sign.;  
It is assumed that temperature signal is received on Modbus channel.  
The channel number should be entered here.
    - Channel  $n$ ;  
 $n$  – number of Modbus channel;
  - keypad;  
Keypad temperature can be entered here if temperature signal is not available.
- Temperature2 signal mode;  
Temperature2 is intended for ambient temperature measurement.  
It is not used in flow calculation.  
The mode selected from the list
  - measured;  
It is assumed that temperature is measured on input channel.  
The channel number should be entered here.
    - IO  $n$  Ch  $m$   
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board
  - modb. sign.;  
It is assumed that temperature signal is received on Modbus channel.  
The channel number should be entered here.
    - Channel  $n$ ;  
 $n$  – number of Modbus channel;
  - keypad;  
Keypad temperature can be entered here if temperature signal is not available.  
Live it to keypad value if no ambient temperature measurement is required.
- Stream disabling;  
It is possible to disable the operation of the stream depending on different parameters.  
The option is selected from the list:
  - no;  
Stream never disabled.

- `measured signal;`

Any I/O channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from `lsc`, `lo`, `lolo` or `none`.

The upper limit is selected from `hsc`, `hi`, `hihi` or `none`

The channel number and the limit causing the stream disabled should be entered here.

- `IO n Ch m;`  
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board
- Limit to disable;  
Lower limit
  - `lo` (low alarm limit of the I/O channel);
  - `lolo` (low-low alarm limit of the I/O channel);
  - `lsc` (low scale of the I/O channel);
  - `-` (no lower limit will disable the stream);
Upper limit
  - `hi` (high alarm limit of the I/O channel);
  - `hihi` (high-high alarm limit of the I/O channel);
  - `hsc` (high scale of the I/O channel);
  - `-` (no upper limit will disable the stream);

- `modbus signal;`

Any Modbus channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from `lsc`, `lo`, `lolo` or `none`.

The upper limit is selected from `hsc`, `hi`, `hihi` or `none`.

The channel number and the limit causing the stream disabled should be entered here.

- `Channel n;`  
 $n$  – number of Modbus channel;
- Limit to disable;  
Lower limit
  - `lo` (low alarm limit of the Modbus channel);
  - `lolo` (low-low alarm limit of the Modbus channel);
  - `lsc` (low scale of the Modbus channel);
  - `-` (no lower limit will disable the stream);
Upper limit
  - `hi` (high alarm limit of the Modbus channel);
  - `hihi` (high-high alarm limit of the Modbus channel);
  - `hsc` (high scale of the Modbus channel);
  - `-` (no upper limit will disable the stream);

- `from stream;`

Any stream can be selected.

One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from `lsc`, `lo`, `lolo` or `none`.

The upper limit is selected from `hsc`, `hi`, `hihi` or `none`.

The stream number and the limit causing the stream disabled should be entered here.

- `Stream n;`  
 $n$  – serial number of the stream from 1 to 12;

- Limit to disable;  
Lower limit
  - `lo` (low alarm limit of the Stream *n*);
  - `lolo` (low-low alarm limit of the Stream *n*);
  - `lsc` (low scale of the Stream *n*);
  - `-` (no lower limit will disable the stream);
 Upper limit
  - `hi` (high alarm limit of the Modbus channel);
  - `hihi` (high-high alarm limit of the Modbus channel);
  - `hsc` (high scale of the Modbus channel);
  - `-` (no upper limit will disable the stream);

The values of the upper and lower limits are set in the Limits menu of the Stream *n* being the stream disabling the current stream. The type of flow rate (uncorrected or corrected volume, mass or energy flow rate) is selected also in the Limits menu of the Stream *n*. See 9.2.2.1.5.

- Batch;

Batch measurement is enabled or disabled here.

The option is selected from the list:

- `no`;

No batch measurement performed.

- `yes`;

Batch measurement is enabled. New line appears where the source of the batch start/stop signal shall be selected from the list.

- `from communication interface`; (no other option is available)

The batch measurement starts and stops by writing certain Modbus registers. The mapping of the start/stop Modbus registers and also the registers where the measured data can be read from see in 10.5.2.

The name of the stream entered in 9.2.2.1. will be displayed on the batch report as station name. To display the results of the batch measurements see 9.1.7..

- Meter serial test

Flow meter serial test measurement can be enabled or disabled here.

Serial test can be enabled on Stream 1 only.

The option is selected from the list::

- `disabled`;

No flow meter serial test measurement performed.

- `enabled`;

Flow meter serial test measurement is enabled.

Warning message appears:

Proceeding will reset all totals and parameters of stream 8. Proceed?

Selecting yes two new lines appear.

- Shadow stream 8

In the non custody transfer flow computer the measured values and totals are displayed in stream 8.

- Stream

The option is selected from the list:

- `custody transfer stream (slave);`  
The stream being set up will perform the custody transfer measurement during the serial test. It will operate in normal way. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the slave device.
- `non custody transfer stream (master);`  
The stream being set up will perform non custody transfer measurement during the serial test. It will display and totalize the flow in stream 8 instead of the stream being configured for the particular meter run. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the master device.

See details of the meter serial test measurements in 9.1.8.

- Transmitter calibration

Calibration of the transmitters can be enabled or disabled here. When calibration is enabled for a certain transmitter keypad value shall be entered for the parameter being measured by that transmitter. In this case the flow calculation will be performed with the keypad value of the parameter. The measured value of the input signal is still displayed in the Flow / Plant I/O / IO Board x menu allowing the calibration of the transmitter without interrupting the flow measurement. NOTE: the transmitter calibration shall be disabled after finishing the transmitter calibration to recover the normal operation of the flowcomputer.

The option is selected from the list::

- `no;`  
transmitters operate in normal way.
- `yes;`  
transmitters are being calibrated. If the `yes` option is selected 4 new menu item appears allowing selection of the transmitters one by one, namely:
  - Flow meter
    - `no;`  
flow meter operates in normal way.
    - `yes;`  
flow meter is being calibrated.
      - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
  - Pressure
    - `no;`  
pressure transmitter operates in normal way.
    - `yes;`  
pressure transmitter is being calibrated.
      - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
  - Temperature 1
    - `no;`  
temperature 1 transmitter operates in normal way.

- **yes;**  
temperature 1 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Temperature 2
  - no;  
temperature 2 transmitter operates in normal way.
  - **yes;**  
temperature 2 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.

### 9.2.2.1.3.3 Stream setup example – fluid: natural gas, flow meter: ultrasonic meter

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Stream setup
------------	---------	-----------------	-----------	--------------

<b>02.Str. NGAS-US METER</b>		<b>02.Str. NGAS-US METER</b>	
<b>Stream setup</b>		<b>Stream setup</b>	
<b>Fluid selected</b>	Natural gas	<b>Cut off</b>	0.1 %
<b>Units</b>	Total Current	<b>Eventing</b>	yes
<b>Volume</b>	m <sup>3</sup> m <sup>3</sup> /h	<b>Pressure</b>	measured
<b>MASS</b>	kg kg/h		1 IO 3 ch.
<b>ENERGY</b>	GJ GJ/h	<b>Temperature 1</b>	measured
<b>Flow meter</b>	ultrasonic meter		1 IO 5 ch.
<b>Flow signal mode</b>	modb. sign.	<b>Temperature 2</b>	keypad
<b>Channel</b>	1	<b>keypad value</b>	15 C
<b>Cut off</b>	0.1 %	<b>Stream disabling</b>	no
<b>Eventing</b>	yes	<b>Batch</b>	no
<b>Pressure</b>	measured	<b>Meter serial test</b>	disabled
	1 IO 3 ch.	<b>Transm. calibration</b>	no
<b>Save</b>	↓	<b>Save</b>	<b>Change</b>
	↑	↓	↑

Figure 9-94 Stream setup data page, fluid: natural gas, flow meter: ultrasonic meter

The data fields on the data page are as follows:

- Fluid selected;  
Not editable here, fixed to the fluid selected in the Fluid menu
  - Units;  
See the available units for volume, mass and energy in Table 9-11. Flow meter selected;  
Not editable here, fixed to the flow meter selected in the Flow meter menu
  - Flow signal mode;  
The mode selected from the list
    - measured;  
It is assumed that the flow signal is measured on analog input channel.  
The channel number entered here.
      - IO *n* Ch *m*;
      - n* – number of I/O board
      - m* – number of channel on the I/O board
    - modb. sign. (measured at Modbus channel);  
It is assumed that the flow signal is received on Modbus channel. This is the case when UNIFLOW-200 reads volume flow rate data from ultrasonic meter on modbus link.  
In this case new data entry field appear to enter the flow signal channel parameters.
      - Channel *n*;
      - n* – number of Modbus channel;
    - keypad;  
Keypad flow signal (volume flow rate at line conditions) can be entered here. It serves for testing the flow calculation only.
- NOTE



If flow signal is set to keypad the flow rate will be displayed but no totalization will be done.

- Cut off (Low flow cut off);  
Entered in % of the high range of the flow signal input channel.  
If the measured flow is below the low flow cut off limit then the flow is assumed to be zero.
- Eventing low flow cut off;  
It is operator selectable if the low flow cut off will generate entry in the event log or not.
  - yes;
  - no;
- Pressure signal mode;  
The mode selected from the list
  - measured;  
It is assumed that pressure is measured on input channel.  
The channel number should be entered here.  
- IO *n* Ch *m*  
*n* – number of I/O board  
*m* – number of channel on the I/O board
  - modb. sign. (measured at Modbus channel);  
It is assumed that pressure signal is received on Modbus channel.  
The channel number should be entered here.  
- Channel *n*;  
*n* – number of Modbus channel;
  - keypad;  
Keypad pressure can be entered here if pressure signal is not available.
- Temperature1 signal mode;  
The mode selected from the list
  - measured;  
It is assumed that temperature is measured on input channel.  
The channel number should be entered here.  
- IO *n* Ch *m*  
*n* – number of I/O board  
*m* – number of channel on the I/O board
  - modb. sign. (measured at Modbus channel);  
It is assumed that temperature signal is received on Modbus channel.  
The channel number should be entered here.  
- Channel *n*;  
*n* – number of Modbus channel;
  - keypad;  
Keypad temperature can be entered here if temperature signal is not available.
- Temperature2 signal mode;  
Temperature2 is intended for ambient temperature measurement.  
It is not used in flow calculation.  
The mode selected from the list
  - measured;  
It is assumed that temperature is measured on input channel.  
The channel number should be entered here.  
- IO *n* Ch *m*

$n$  – number of I/O board

$m$  – number of channel on the I/O board

- modb. sign.;

It is assumed that temperature signal is received on Modbus channel.

The channel number should be entered here.

- Channel  $n$ ;

$n$  – number of Modbus channel;

- keypad;

Keypad temperature can be entered here if temperature signal is not available.

Live it to keypad value if no ambient temperature measurement is required.

- Stream disabling;

It is possible to disable the operation of the stream depending on different parameters.

The option is selected from the list:

- no;

Stream never disabled.

- measured signal;

Any I/O channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none

The channel number and the limit causing the stream disabled should be entered here.

- IO  $n$  Ch  $m$ ;

$n$  – number of I/O board

$m$  – number of channel on the I/O board

- Limit to disable;

Lower limit

- lo (low alarm limit of the I/O channel);
- lolo (low-low alarm limit of the I/O channel);
- lsc (low scale of the I/O channel);
- - (no lower limit will disable the stream);

Upper limit

- hi (high alarm limit of the I/O channel);
- hihi (high-high alarm limit of the I/O channel);
- hsc (high scale of the I/O channel);
- - (no upper limit will disable the stream);

- modbus signal;

Any Modbus channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none.

The channel number and the limit causing the stream disabled should be entered here.

- Channel  $n$ ;

$n$  – number of Modbus channel;

- Limit to disable;

Lower limit

- lo (low alarm limit of the Modbus channel);
- lolo (low-low alarm limit of the Modbus channel);

- `lsc` (low scale of the Modbus channel);
- `-` (no lower limit will disable the stream);

Upper limit

- `hi` (high alarm limit of the Modbus channel);
- `hihi` (high-high alarm limit of the Modbus channel);
- `hsc` (high scale of the Modbus channel);
- `-` (no upper limit will disable the stream);

- o `from stream;`

Any stream can be selected.

One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from `lsc`, `lo`, `lolo` or none.

The upper limit is selected from `hsc`, `hi`, `hihi` or none.

The stream number and the limit causing the stream disabled should be entered here.

- `Stream n;`  
`n` – serial number of the stream from 1 to 12;  
Limit to disable;
- Lower limit
  - `lo` (low alarm limit of the Stream `n`);
  - `lolo` (low-low alarm limit of the Stream `n`);
  - `lsc` (low scale of the Stream `n`);
  - `-` (no lower limit will disable the stream);
- Upper limit
  - `hi` (high alarm limit of the Stream `n`);
  - `hihi` (high-high alarm limit of the Stream `n`);
  - `hsc` (high scale of the Stream `n`);
  - `-` (no upper limit will disable the stream);

The values of the upper and lower limits are set in the Limits menu of the Stream `n` being the stream disabling the current stream. The type of flow rate (uncorrected or corrected volume, mass or energy flow rate) is selected also in the Limits menu of the Stream `n`. See 9.2.2.1.5.

- Batch;

Batch measurement is enabled or disabled here.

The option is selected from the list:

- o `no;`  
No batch measurement performed.
- o `yes;`  
Batch measurement is enabled. New line appears where the source of the batch start/stop signal shall be selected from the list.
  - `from communication interface;` (no other option is available)

The batch measurement starts and stops by writing certain Modbus registers. The mapping of the start/stop Modbus registers and also the registers where the measured data can be read from see in 10.5.2.

The name of the stream entered in 9.2.2.1. will be displayed on the batch report as station name. To display the results of the batch measurements see 9.1.7..

- Meter serial test

Flow meter serial test measurement can be enabled or disabled here.

The option is selected from the list::

- disabled;  
No flow meter serial test measurement performed.

- enabled;  
Flow meter serial test measurement is enabled.

Warning message appears:

Proceeding will reset all totals and parameters of stream 8. Proceed?

Selecting yes two new lines appear.

- Shadow stream 8

In the non custody transfer flow computer the measured values and totals are displayed in stream 8.

- Stream

The option is selected from the list:

- custody transfer stream (slave);

The stream being set up will perform the custody transfer measurement during the serial test. It will operate in normal way. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the slave device.

- non custody transfer stream (master);

The stream being set up will perform non custody transfer measurement during the serial test. It will display and totalize the flow in stream 8 instead of the stream being configured for the particular meter run. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the master device.

See details of the meter serial test measurements in 9.1.8.

- Transmitter calibration

Calibration of the transmitters can be enabled or disabled here. When calibration is enabled for a certain transmitter keypad value shall be entered for the parameter being measured by that transmitter. In this case the flow calculation will be performed with the keypad value of the parameter. The measured value of the input signal is still displayed in the Flow / Plant I/O / IO Board x menu allowing the calibration of the transmitter without interrupting the flow measurement.

NOTE: the transmitter calibration shall be disabled after finishing the transmitter calibration to recover the normal operation of the flowcomputer.

The option is selected from the list::

- no;  
transmitters operate in normal way.

- yes;  
transmitters are being calibrated. If the yes option is selected 4 new menu item appears allowing selection of the transmitters one by one, namely:

- Flow meter

- no;  
flow meter operates in normal way.

- **y**es;  
flow meter is being calibrated.

- Keypad value

keypad value to be used in the calculation during the transmitter calibration shall be entered.

- Pressure
  - no;  
pressure transmitter operates in normal way.
  - **yes;**  
pressure transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Temperature 1
  - no;  
temperature 1 transmitter operates in normal way.
  - **yes;**  
temperature 1 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Temperature 2
  - no;  
temperature 2 transmitter operates in normal way.
  - **yes;**  
temperature 2 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.

#### 9.2.2.1.3.4 Stream setup – fluid: crude oil, flow meter: liquid turbine meter

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Stream setup
------------	---------	-----------------	-----------	--------------

04.Str. CR.OIL-LIQ.TURBINE			
Stream setup			
Fluid selected	crude oil		
Units	Total	Current	
Volume	m <sup>3</sup>	m <sup>3</sup> /h	
MASS	kg	kg/h	
ENERGY	GJ	GJ/h	
Flow meter	liq.turbine meter		
Flow signal mode	measured		
	2 IO	1 ch.	
Check signal	measured		
	2 IO	2 ch.	
Signal ratio	1		
Bad pulse threshold	5 000		
Save	↓	↑	

04.Str. CR.OIL-LIQ.TURBINE			
Stream setup			
Good pulse threshold	5 000		
Cut off	0.1 %		
Eventing	yes		
Pres. at flow meter	measured		
	1 IO	3 ch.	
Temp. at flow meter	measured		
	1 IO	5 ch.	
Pres. at dens.meter	measured		
	5 IO	4 ch.	
Temp. at dens.meter	measured		
	5 IO	5 ch.	
No. of dens. meters	2		
Save	Change	↓	↑

04.Str. CR.OIL-LIQ.TURBINE			
Stream setup			
	5 IO	5 ch.	
No. of dens. meters	2		
Primary dens. meter	A		
Discrepancy	0.5 kg/m <sup>3</sup>		
'A' dens.meter sign.	measured		
	2 IO	3 ch.	
'B' dens.meter sign.	measured		
	2 IO	4 ch.	
Stream disabling	no		
Batch	no		
Meter serial test	disabled		
Transm. calibration	no		
Save	Change	↓	↑

Figure 9-95 Stream setup data page, fluid: crude oil, flow meter: liquid turbine

In this example it is assumed that the flow is measured by turbine meter with dual pulse train.

The density is measured by two density transmitters at the header pipe.

The pressure of the fluid is measured at the flow meter and at the density meter.

The temperature of the fluid is measured at the flow meter and at the density meter.

The data fields on the data page are as follows:

- Fluid selected;  
Not editable here, fixed to the fluid selected in the Fluid menu
- Units;  
See the available units for volume, mass and energy in Table 9-11. Flow meter selected;  
Not editable here, fixed to the flow meter selected in the Flow meter menu
- Flow signal mode;  
The mode selected from the list

- `measured;`  
It is assumed that the flow signal is measured on pulse or analog input channel.  
The channel number entered here.  
- IO  $n$  Ch  $m$ ;  
   $n$  – number of I/O board  
   $m$  – number of channel on the I/O board
- `modb. sign.` (measured at Modbus channel);  
It is assumed that the flow signal is received on Modbus channel. In this case new data entry field appear to enter the flow signal channel parameters.  
- Channel  $n$ ;  
   $n$  – number of Modbus channel;
- `keypad;`  
Keypad flow signal (volume flow rate at line conditions) can be entered here. It serves for testing the flow calculation only.  
NOTE  
If flow signal is set to keypad the flow rate will be displayed but no totalization will be done.
- Check signal mode;  
The mode selected from the list
  - `none;`
  - `measured;`  
It is assumed that dual pulse train is received from the turbine meter to check the pulse integrity.  
The channel number of the check signal entered here.  
- IO  $n$  Ch  $m$ ;  
   $n$  – number of I/O board  
   $m$  – number of channel on the I/O board
- Signal ratio (Main to check signal ratio);
- Bad pulse threshold;  
If the difference in the number of pulses received on the main and check pulse input channel higher then this limit then pulse input alarm is raised.
- Good pulse threshold;  
If in the pulse input alarm active state the number of pulses received after the pulse input alarm appeared higher then this limit then the pulse input alarm is cleared. However the alarm is logged in the alarm log file.  
If the good pulse threshold set to 0 then no automatic clearing of the pulse alarm is done.
- Cut off (Low flow cut off);  
Entered in % of the high range of the flow signal input channel.  
If the measured flow is below the low flow cut off limit then the flow is assumed to be zero.
- Eventing low flow cut off;  
It is operator selectable if the low flow cut off will generate entry in the event log or not.
  - `yes;`
  - `no;`
- Pres. at flow meter (Pressure at flow meter mode);  
The mode selected from the list
  - `measured;`  
It is assumed that pressure is measured on analog input channel.

The channel number should be entered here.

- IO  $n$  Ch  $m$

$n$  – number of I/O board

$m$  – number of channel on the I/O board

- modb. sign. (measured at Modbus channel);

It is assumed that pressure signal is received on Modbus channel.

The channel number should be entered here.

- Channel  $n$ ;

$n$  – number of Modbus channel;

- keypad;

Keypad pressure can be entered here if pressure signal is not available.

- Temp. at flow meter (Temperature at flow meter mode);

The mode selected from the list

- measured;

It is assumed that temperature is measured on input channel.

The channel number should be entered here.

- IO  $n$  Ch  $m$

$n$  – number of I/O board

$m$  – number of channel on the I/O board

- modb. sign. (measured at Modbus channel);

It is assumed that temperature signal is received on Modbus channel.

The channel number should be entered here.

- Channel  $n$ ;

$n$  – number of Modbus channel;

- keypad;

Keypad temperature can be entered here if temperature signal is not available.

- Pres. at dens. meter (Pressure at density meter mode);

The mode selected from the list

- measured;

It is assumed that pressure is measured on analog input channel.

The channel number should be entered here.

- IO  $n$  Ch  $m$

$n$  – number of I/O board

$m$  – number of channel on the I/O board

- modb. sign. (measured at Modbus channel);

It is assumed that pressure signal is received on Modbus channel.

The channel number should be entered here.

- Channel  $n$ ;

$n$  – number of Modbus channel;

- keypad;

Keypad pressure can be entered here if pressure signal is not available.

- Temp at dens. meter (Temperature at density meter mode);

The mode selected from the list

- measured;

It is assumed that temperature is measured on input channel.

The channel number should be entered here.



- $IO\ n\ Ch\ m$   
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board
- o modb. sign. (measured at Modbus channel);  
 It is assumed that temperature signal is received on Modbus channel.  
 The channel number should be entered here.
  - Channel  $n$ ;  
 $n$  – number of Modbus channel;
- o keypad;  
 Keypad temperature can be entered here if temperature signal is not available.
- No. of dens. meters (Number of density transmitters);  
 Selected from the list
  - o 1 (one);
  - o 2 (two);
 The two densitometer are designated as A and B.
- Primary dens. meter (Primary density transmitter);  
 The density primarily used in the flow calculation selected from the list
  - o A;
  - o B;
  - o average;
- Discrepancy;  
 The maximum discrepancy between the two densitometer readings entered. Required only if two densitometers selected.
- 'A' dens. meter sign. ("A" density transmitter signal mode);  
 The mode selected from the list
  - o measured;  
 It is assumed that density is measured on input channel.  
 The channel number should be entered here.
    - $IO\ n\ Ch\ m$   
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board
  - o modb. sign. (measured at Modbus channel);  
 It is assumed that density signal is received on Modbus channel.  
 The channel number should be entered here.
    - Channel  $n$ ;  
 $n$  – number of Modbus channel;
  - o keypad;  
 Keypad density can be entered here if density signal is not available.
- Stream disabling;  
 It is possible to disable the operation of the stream depending on different parameters.  
 The option is selected from the list:
  - o no;  
 Stream never disabled.
  - o measured signal;

Any I/O channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none

The channel number and the limit causing the stream disabled should be entered here.

- IO *n* Ch *m*;  
*n* – number of I/O board  
*m* – number of channel on the I/O board
- Limit to disable;  
Lower limit
  - lo (low alarm limit of the I/O channel);
  - lolo (low-low alarm limit of the I/O channel);
  - lsc (low scale of the I/O channel);
  - - (no lower limit will disable the stream);
Upper limit
  - hi (high alarm limit of the I/O channel);
  - hihi (high-high alarm limit of the I/O channel);
  - hsc (high scale of the I/O channel);
  - - (no upper limit will disable the stream);

o modbus signal;

Any Modbus channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none.

The channel number and the limit causing the stream disabled should be entered here.

- Channel *n*;  
*n* – number of Modbus channel;
- Limit to disable;  
Lower limit
  - lo (low alarm limit of the Modbus channel);
  - lolo (low-low alarm limit of the Modbus channel);
  - lsc (low scale of the Modbus channel);
  - - (no lower limit will disable the stream);
Upper limit
  - hi (high alarm limit of the Modbus channel);
  - hihi (high-high alarm limit of the Modbus channel);
  - hsc (high scale of the Modbus channel);
  - - (no upper limit will disable the stream);

o from stream;

Any stream can be selected.

One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none.

The stream number and the limit causing the stream disabled should be entered here.

- Stream *n*;  
*n* – serial number of the stream from 1 to 12;
- Limit to disable;

- Lower limit
  - lo (low alarm limit of the Stream *n*);
  - lolol (low-low alarm limit of the Stream *n*);
  - lsc (low scale of the Stream *n*);
  - - no lower limit will disable the stream);
- Upper limit
  - hi (high alarm limit of the Stream *n*);
  - hihhi (high-high alarm limit of the Stream *n*);
  - hsc (high scale of the Stream *n*);
  - - (no upper limit will disable the stream);

The values of the upper and lower limits are set in the Limits menu of the Stream *n* being the stream disabling the current stream. The type of flow rate (uncorrected or corrected volume, mass or energy flow rate) is selected also in the Limits menu of the Stream *n*. See 9.2.2.1.5.

- Batch;

Batch measurement is enabled or disabled here.

The option is selected from the list:

- o no;

No batch measurement performed.

- o yes;

Batch measurement is enabled. New line appears where the source of the batch start/stop signal shall be selected from the list.

- from communication interface; (no other option is available)

The batch measurement starts and stops by writing certain Modbus registers. The mapping of the start/stop Modbus registers and also the registers where the measured data can be read from see in 10.5.2.

The name of the stream entered in 9.2.2.1. will be displayed on the batch report as station name. To display the results of the batch measurements see 9.1.7..

- Meter serial test

Flow meter serial test measurement can be enabled or disabled here.

The option is selected from the list::

- o disabled;

No flow meter serial test measurement performed.

- o enabled;

Flow meter serial test measurement is enabled.

Warning message appears:

Proceeding will reset all totals and parameters of stream 8. Proceed?

Selecting yes two new lines appear.

- Shadow stream 8

In the non custody transfer flow computer the measured values and totals are displayed in stream 8.

- Stream

The option is selected from the list:

- custody transfer stream (slave);

The stream being set up will perform the custody transfer measurement during the serial test. It will operate in normal way. In the data exchange between the two

flow computers taking part in the flow meter serial test this flow computer will be the slave device.

- `non custody transfer stream (master);`

The stream being set up will perform non custody transfer measurement during the serial test. It will display and totalize the flow in stream 8 instead of the stream being configured for the particular meter run. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the master device.

See details of the meter serial test measurements in 9.1.8.

- Transmitter calibration

Calibration of the transmitters can be enabled or disabled here. When calibration is enabled for a certain transmitter keypad value shall be entered for the parameter being measured by that transmitter. In this case the flow calculation will be performed with the keypad value of the parameter. The measured value of the input signal is still displayed in the Flow / Plant I/O / IO Board x menu allowing the calibration of the transmitter without interrupting the flow measurement.

NOTE: the transmitter calibration shall be disabled after finishing the transmitter calibration to recover the normal operation of the flowcomputer.

The option is selected from the list::

- `no;`  
transmitters operate in normal way.
- `yes;`  
transmitters are being calibrated. If the `yes` option is selected 4 new menu item appears allowing selection of the transmitters one by one, namely:
  - Flow meter
    - `no;`  
flow meter operates in normal way.
    - `yes;`  
flow meter is being calibrated.
      - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
  - Pressure
    - `no;`  
pressure transmitter operates in normal way.
    - `yes;`  
pressure transmitter is being calibrated.
      - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
  - Temperature 1
    - `no;`  
temperature 1 transmitter operates in normal way.
    - `yes;`  
temperature 1 transmitter is being calibrated.
      - Keypad value

keypad value to be used in the calculation during the transmitter calibration shall be entered.

- Temperature 2
  - no;  
temperature 2 transmitter operates in normal way.
  - **yes**;  
temperature 2 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.

### 9.2.2.1.3.5 Stream setup example – fluid: crude oil, flow meter: mass flow meter

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Stream set up
------------	---------	-----------------	-----------	---------------

04.Str. CR.OIL-MASSFLOW METER		04.Str. CR.OIL-MASSFLOW METER	
Stream setup		Stream setup	
Fluid selected	crude oil	Cut off	0.1 %
Units	Total Flowrate	Eventing	no
Volume	m <sup>3</sup> m <sup>3</sup> /h	Pres. at flow meter	measured
Mass	kg kg/h		1 IO 3 ch.
Energy	GJ GJ/h	Temp. at flow meter	measured
Flow meter	mass flow meter		1 IO 5 ch.
Flow signal mode	measured	Density signal	measured
	2 IO 1 ch.		2 IO 3 ch.
Check signal	no	Stream disabling	no
Cut off	0.1 %	Batch	no
Eventing	no	Meter serial test	disabled
Pres. at flow meter	measured	Transm. calibration	no
Save	↓ ↑	Save Change	↓ ↑

Figure 9-96 Stream setup data page, fluid: crude oil, flow meter: mass flow meter

In this example it is assumed that the flow is measured by mass flow meter.

The density is measured also by the mass flow meter.

The pressure and the temperature of the fluid are measured at the flow meter.

The data fields on the data page are as follows:

- Fluid selected;  
Not editable here, fixed to the fluid selected in the Fluid menu
- Units;  
See the available units for volume, mass and energy in Table 9-11. Flow meter selected;  
Not editable here, fixed to the flow meter selected in the Flow meter menu
- Flow signal mode;  
The mode selected from the list
  - o measured;  
It is assumed that the flow signal is measured on pulse or analog input channel.  
The channel number entered here.
    - IO *n* Ch *m*;
    - n* – number of I/O board
    - m* – number of channel on the I/O board
  - o modb. sign. (measured at Modbus channel);  
It is assumed that the flow signal is received on Modbus channel. In this case new data entry field appear to enter the flow signal channel parameters.
    - Channel *n*;
    - n* – number of Modbus channel;

- keypad;  
Keypad flow signal (mass flow rate) can be entered here. It serves for testing the flow calculation only.  
NOTE  
If flow signal is set to keypad the flow rate will be displayed but no totalization will be done.
- Cut off (Low flow cut off);  
Entered in % of the high range of the flow signal input channel.  
If the measured flow is below the low flow cut off limit then the flow is assumed to be zero.
- Eventing low flow cut off;  
It is operator selectable if the low flow cut off will generate entry in the event log or not.
  - yes;
  - no;
- Pres. at flow meter (Pressure at flow meter mode);  
The mode selected from the list
  - measured;  
It is assumed that pressure is measured on analog input channel.  
The channel number should be entered here.  
- IO *n* Ch *m*  
*n* – number of I/O board  
*m* – number of channel on the I/O board
  - modb. sign. (measured at Modbus channel);  
It is assumed that pressure signal is received on Modbus channel.  
The channel number should be entered here.  
- Channel *n*;  
*n* – number of Modbus channel;
  - keypad;  
Keypad pressure can be entered here if pressure signal is not available.
- Temp. at flow meter (Temperature at flow meter mode);  
The mode selected from the list
  - measured;  
It is assumed that temperature is measured on input channel.  
The channel number should be entered here.  
- IO *n* Ch *m*  
*n* – number of I/O board  
*m* – number of channel on the I/O board
  - modb. sign. (measured at Modbus channel);  
It is assumed that temperature signal is received on Modbus channel.  
The channel number should be entered here.  
- Channel *n*;  
*n* – number of Modbus channel;
  - keypad;  
Keypad temperature can be entered here if temperature signal is not available.
- Density signal;  
The mode selected from the list
  - measured;  
It is assumed that density is measured on input channel.

The channel number should be entered here.

- IO *n* Ch *m*  
*n* – number of I/O board  
*m* – number of channel on the I/O board

- o modb. sign. (measured at Modbus channel);

It is assumed that density signal is received on Modbus channel.

The channel number should be entered here.

- Channel *n*;  
*n* – number of Modbus channel;

- o keypad;

Keypad density can be entered here if density signal is not available.

- Stream disabling;

It is possible to disable the operation of the stream depending on different parameters.

The option is selected from the list:

- o no;

Stream never disabled.

- o measured signal;

Any I/O channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none

The channel number and the limit causing the stream disabled should be entered here.

- IO *n* Ch *m*;  
*n* – number of I/O board  
*m* – number of channel on the I/O board
- Limit to disable;  
Lower limit
  - lo (low alarm limit of the I/O channel);
  - lolo (low-low alarm limit of the I/O channel);
  - lsc (low scale of the I/O channel);
  - - (no lower limit will disable the stream);
Upper limit
  - hi (high alarm limit of the I/O channel);
  - hihi (high-high alarm limit of the I/O channel);
  - hsc (high scale of the I/O channel);
  - - (no upper limit will disable the stream);

- o modbus signal;

Any Modbus channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none.

The channel number and the limit causing the stream disabled should be entered here.

- Channel *n*;  
*n* – number of Modbus channel;
- Limit to disable;  
Lower limit
  - lo (low alarm limit of the Modbus channel);



- `lolo` (low-low alarm limit of the Modbus channel);
- `lsc` (low scale of the Modbus channel);
- `-` (no lower limit will disable the stream);

Upper limit

- `hi` (high alarm limit of the Modbus channel);
- `hihi` (high-high alarm limit of the Modbus channel);
- `hsc` (high scale of the Modbus channel);
- `-` (no upper limit will disable the stream);

- o `from stream;`

Any stream can be selected.

One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from `lsc`, `lo`, `lolo` or none.

The upper limit is selected from `hsc`, `hi`, `hihi` or none.

The stream number and the limit causing the stream disabled should be entered here.

- Stream `n`;
- `n` – serial number of the stream from 1 to 12;
- Limit to disable;
- Lower limit
  - `lo` (low alarm limit of the Stream `n`);
  - `lolo` (low-low alarm limit of the Stream `n`);
  - `lsc` (low scale of the Stream `n`);
  - `-` no lower limit will disable the stream);
- Upper limit
  - `hi` (high alarm limit of the Stream `n`);
  - `hihi` (high-high alarm limit of the Stream `n`);
  - `hsc` (high scale of the Stream `n`);
  - `-` (no upper limit will disable the stream);

The values of the upper and lower limits are set in the Limits menu of the Stream `n` being the stream disabling the current stream. The type of flow rate (uncorrected or corrected volume, mass or energy flow rate) is selected also in the Limits menu of the Stream `n`. See 9.2.2.1.5.

- Batch;

Batch measurement is enabled or disabled here.

The option is selected from the list:

- o `no`;
- No batch measurement performed.
- o `yes`;
- Batch measurement is enabled. New line appears where the source of the batch start/stop signal shall be selected from the list.
  - `from communication interface`; (no other option is available)

The batch measurement starts and stops by writing certain Modbus registers. The mapping of the start/stop Modbus registers and also the registers where the measured data can be read from see in 10.5.2.

The name of the stream entered in 9.2.2.1. will be displayed on the batch report as station name. To display the results of the batch measurements see 9.1.7..

- Meter serial test

Flow meter serial test measurement can be enabled or disabled here.

The option is selected from the list::

- disabled;  
No flow meter serial test measurement performed.
- enabled;  
Flow meter serial test measurement is enabled.

Warning message appears:

Proceeding will reset all totals and parameters of stream 8. Proceed?

Selecting yes two new lines appear.

- Shadow stream 8

In the non custody transfer flow computer the measured values and totals are displayed in stream 8.

- Stream

The option is selected from the list:

- `custody transfer stream (slave);`  
The stream being set up will perform the custody transfer measurement during the serial test. It will operate in normal way. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the slave device.
- `non custody transfer stream (master);`  
The stream being set up will perform non custody transfer measurement during the serial test. It will display and totalize the flow in stream 8 instead of the stream being configured for the particular meter run. In the data exchange between the two flow computers taking part in the flow meter serial test this flow computer will be the master device.

See details of the meter serial test measurements in 9.1.8.

- Transmitter calibration

Calibration of the transmitters can be enabled or disabled here. When calibration is enabled for a certain transmitter keypad value shall be entered for the parameter being measured by that transmitter. In this case the flow calculation will be performed with the keypad value of the parameter. The measured value of the input signal is still displayed in the Flow / Plant I/O / IO Board x menu allowing the calibration of the transmitter without interrupting the flow measurement.

NOTE: the transmitter calibration shall be disabled after finishing the transmitter calibration to recover the normal operation of the flowcomputer.

The option is selected from the list::

- no;  
transmitters operate in normal way.
- yes;  
transmitters are being calibrated. If the `yes` option is selected 4 new menu item appears allowing selection of the transmitters one by one, namely:
  - Flow meter
    - no;  
flow meter operates in normal way.

- **yes;**  
flow meter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Pressure
  - no;  
pressure transmitter operates in normal way.
  - **yes;**  
pressure transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Temperature 1
  - no;  
temperature 1 transmitter operates in normal way.
  - **yes;**  
temperature 1 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.
- Temperature 2
  - no;  
temperature 2 transmitter operates in normal way.
  - **yes;**  
temperature 2 transmitter is being calibrated.
    - Keypad value  
keypad value to be used in the calculation during the transmitter calibration shall be entered.

### 9.2.2.1.3.6 Stream setup example – fluid: other, flow meter: other (electrical power measurement)

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Stream set up
------------	---------	-----------------	-----------	---------------

07.Str. STR7

Stream setup

**Fluid selected** other

Flow meter other

Flow signal mode measured

1 IO 3 ch.

Cut off 0 %

Eventing no

Units Total Flowrate

MVAh MVA

Stream disabling no

Save
↓
↑

**Figure 9-97 Stream setup data page, fluid: other, flow meter: other (electrical power measurement)**

In this example it is assumed that electrical power measurement is required. The flow signal is proportional to the electrical power. In fact no flow calculation but only the totalization of the flow signal is required.

The data fields on the data page are as follows:

- Fluid selected;  
Not editable here, fixed to the fluid selected in the Fluid menu
- Flow meter selected;  
Not editable here, fixed to the flow meter selected in the Flow meter menu
- Units (Total - Flowrate);  
Not editable here. The unit of measurement for the Total and Flow rate is taken from the flow signal
  - MVAh – MVA; (in the example)
- Flow signal mode;  
The mode selected from the list
  - measured;  
It is assumed that the flow signal is measured on pulse or analog input channel.  
The channel number entered here.
    - IO  $n$  Ch  $m$ ;  
 $n$  – number of I/O board  
 $m$  – number of channel on the I/O board
    - modb. sign. (measured at Modbus channel);  
 It is assumed that the flow signal is received on Modbus channel. In this case new data entry field appear to enter the flow signal channel parameters.
      - Channel  $n$ ;  
 $n$  – number of Modbus channel;

- keypad;

Keypad flow signal can be entered here. It serves for testing the flow calculation only.

NOTE

If flow signal is set to keypad the flow rate will be displayed but no totalization will be done.

- Cut off (Low flow cut off);

Entered in % of the high range of the flow signal input channel.

If the measured flow is below the low flow cut off limit then the flow is assumed to be zero.

- Eventing low flow cut off;

It is operator selectable if the low flow cut off will generate entry in the event log or not.

- yes;

- no;

- Stream disabling;

It is possible to disable the operation of the stream depending on different parameters.

The option is selected from the list:

- no;

Stream never disabled.

- measured signal;

Any I/O channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none

The channel number and the limit causing the stream disabled should be entered here.

- IO *n* Ch *m*;

*n* – number of I/O board

*m* – number of channel on the I/O board

- Limit to disable;

Lower limit

- lo (low alarm limit of the I/O channel);

- lololo (low-low alarm limit of the I/O channel);

- lsc (low scale of the I/O channel);

- - (no lower limit will disable the stream);

Upper limit

- hi (high alarm limit of the I/O channel);

- hihi (high-high alarm limit of the I/O channel);

- hsc (high scale of the I/O channel);

- - (no upper limit will disable the stream);

- modbus signal;

Any Modbus channel signal can be selected. One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none.

The channel number and the limit causing the stream disabled should be entered here.

- Channel *n*;

*n* – number of Modbus channel;

- Limit to disable;  
Lower limit
  - lo (low alarm limit of the Modbus channel);
  - lolo (low-low alarm limit of the Modbus channel);
  - lsc (low scale of the Modbus channel);
  - - (no lower limit will disable the stream);

- Upper limit
  - hi (high alarm limit of the Modbus channel);
  - hihi (high-high alarm limit of the Modbus channel);
  - hsc (high scale of the Modbus channel);
  - - (no upper limit will disable the stream);

o from stream;

Any stream can be selected.

One lower limit and one upper limit can be selected to disable the stream. The lower limit is selected from lsc, lo, lolo or none.

The upper limit is selected from hsc, hi, hihi or none.

The stream number and the limit causing the stream disabled should be entered here.

- Stream  $n$ ;  
 $n$  – serial number of the stream from 1 to 12;  
Limit to disable;
  - Lower limit
    - lo (low alarm limit of the Stream  $n$ );
    - lolo (low-low alarm limit of the Stream  $n$ );
    - lsc (low scale of the Stream  $n$ );
    - - (no lower limit will disable the stream);
  - Upper limit
    - hi (high alarm limit of the Stream  $n$ );
    - hihi (high-high alarm limit of the Stream  $n$ );
    - hsc (high scale of the Stream  $n$ );
    - - (no upper limit will disable the stream);

The values of the upper and lower limits are set in the Limits menu of the Stream  $n$  being the stream disabling the current stream. The type of flow rate (uncorrected or corrected volume, mass or energy flow rate) is selected also in the Limits menu of the Stream  $n$ . See 9.2.2.1.5.

### 9.2.2.1.4 Premium limits

UNIFLOW-200 is prepared to totalize flow in separate counters if the flow rate higher, then a preset limit. The limits for the flow rates are set on this data page.

The premium limit mode, i.e. if the premium flow is calculated on the instantaneous flow rate or on the hourly totals is set in the Premium limit mode setup menu (see section 9.2.2.3)

Function of the F keys on the Premium limits data pages

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Premium limits
------------	---------	-----------------	-----------	----------------

```

01.Str. NGAS-ORIFICE
Str. premium totals setup
Premium limit mode      hourly total
Premium limits
CVOL flowrate           12 000 m³/h
UVOL flowrate           0 m³/h
MASS flowrate           0 kg/h
ENERGY flowrate         0 GJ/h
  
```

Save Change ↓ ↑

Figure 9-98 Premium limits data page

The data fields on the data page are as follows:

- Premium limit mode;  
Not editable here, fixed to the mode selected in the Premium limit mode menu
- CVOL flowrate (volume flow rate at base conditions);
- UVOL flowrate (volume flow rate at line conditions);
- MASS flowrate (mass flow rate);
- ENGY flowrate (energy flow rate);

### 9.2.2.1.5 Limits

The low-low, lo, high, high-high limits can be set for the stream flow rate.

Function of the F keys on the Limits data pages

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Limits
------------	---------	-----------------	-----------	--------

```

01.Str. NGAS-ORIFICE
Str. limits
Flow selected CVOL flowrate
LO_limit      0 m³/h
HI_limit      10 000 m³/h
LOLO_limit     0 m³/h
HIHI_limit     11 000 m³/h
Eventing      hi ,hihi
  
```

Save Change ↓ ↑

Figure 9-99 Limits data page

The data fields on the data page are as follows:

- Flow selected;
  - The type flow rate the limit check is applied to is selected here from the list
    - CVOL flowrate (volume flow rate at base conditions);
    - UVOL flowrate (volume flow rate at line conditions);
    - MASS flowrate (mass flow rate);
    - ENGY flowrate (energy flow rate);
    - CO2 mass (CO2 emission flow rate);
- LO limit;
- HI limit;
- LOLO limit;
- HIHI limit;
- Eventing

It can be enabled or disabled to create entry in the event report in case of any of the limit alarms defined here.



### 9.2.2.2 Virtual stream setup

Virtual streams are designed to perform calculations on the flows determined in the physical streams. Such calculations include for example:

- summing flows of several metering streams to create station totals;
- calculate difference of two flows;
- calculate net efficiency of a boiler;
- calculate pure alcohol flow from the flow of alcohol-water mixture;

First the virtual stream should be selected on the data page shown below.

Stream name can also be entered here.

Route in the menu tree:

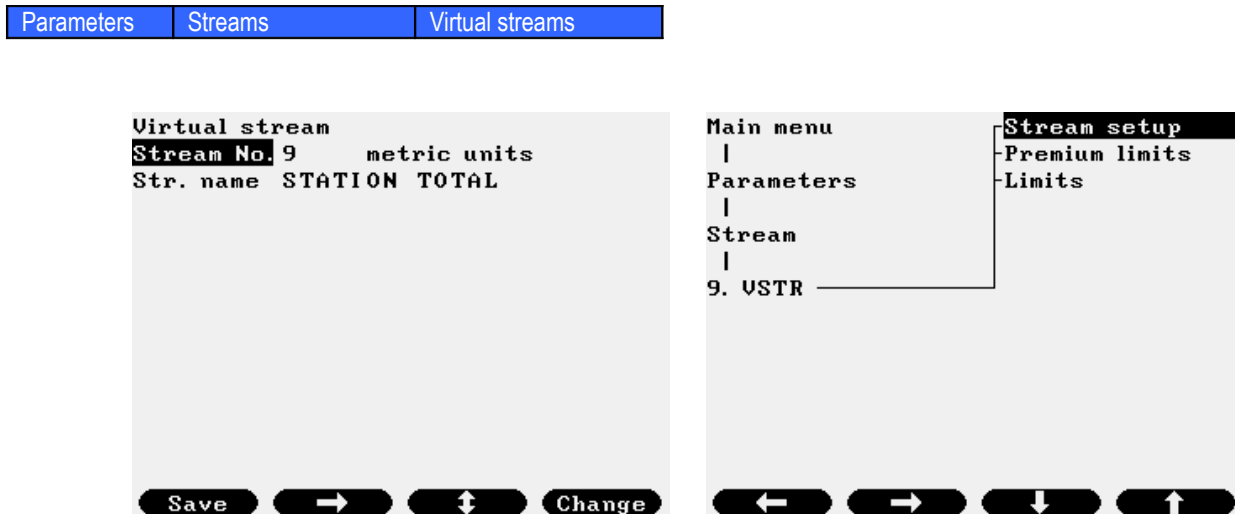


Figure 9-100 Virtual stream selection data page

The system of units shall be selected on this page. Available selections are:

- o metric units;
- o imperial units;

Note:

If the “imperial units” is selected then the unit in all the physical streams flow rate of which processed in this virtual stream shall also be set as “imperial units”. See 9.2.2.1.

If the “imperial units” is selected then the unit of volume, mass and energy are set automatically as follows:

- o volume/volume flow rate    MCF        MCF/h;
- o mass/mass flow rate        lb        lb/h;
- o energy/energy flow rate    MMBTU    MMBTU/h;

and can not be altered.

After selecting the stream to be edited the virtual stream setup data page opens.

### 9.2.2.2.1 Virtual stream setup

Route in the menu tree:

Parameters	Streams	Virtual streams	Stream 9.	Stream setup
------------	---------	-----------------	-----------	--------------

Function of the F keys on the Virtual stream setup data pages

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

09.Vstr.STATION TOTAL

Virtual stream setup

Calc. variable	Units	Total	Flowrate
Volume	m³		m³/h
Mass	kg		kg/h
Energy	GJ		GJ/h

Parameter selection

volume   mass   energy   CO2 mass

Definition

M9 = M1+M2+M3

Save   Change   ↓   ↑

Figure 9-101 Virtual stream setup data page

The data fields on the data page are as follows:

- Calc. variable (Calculated variable);  
Selected from the list

- flow rate;

The virtual stream calculates the flow rates (volume, mass or energy flow rate, depending on the selection in the Parameter selection data field below) according to the equation defined below. The unit of measurement can be selected for the different flow rates.

NOTE

The volume is assumed to be the volume at base conditions.

The selected unit for volume must be the same unit as volume unit in the physical streams processed in virtual stream.

- volume unit (Total – Flowrate);
  - m3 – m3/h;;
  - l – l/h;
- mass unit (Total – Flowrate);
  - kg – kg/h;
  - t – t/h

- energy unit (Total – Flowrate);
  - GJ – GJ/h;
  - MJ – MJ/h;
  - kWh – kWh/h;
  - MWh – MWh/h;
  - kVAh – kVA;
  - MVAh – MVA;
- Parameter selection;
 

The parameter to be processed according to the equation defined below should be selected here from the list. One, two or all three parameters can be selected.

  - volume;
  - mass;
  - energy;
  - CO2 mass;
- o other param. (other parameter);
 

If the calculated parameter is not a flow rate but some other parameter then the name of the calculated parameter and its unit can be entered in the data fields below.

  - Variable name;
  - Unit selection;
    - %;
    - other;
  - Input param. selection (Input parameter selection);
 

The parameter to be processed according to the equation defined below should be selected here from the list.

    - volume;
    - mass;
    - energy;
  - Operation (Operation to be performed);
 

The operation should be selected from the list.

    - integration;
 

Integration (totalization) can be performed if flow rate is selected as the calculated variable.
    - averaging;
 

If the calculated variable is not a flow type parameter (for example concentration) then averaging will be performed on the parameter since the integration is not interpreted on the non flow type parameter.
- Equation setup;
 

The equation describing the calculation to be performed should be entered.

#### Example 1

Summarize the flow rates from stream 1, 2 and 3

Virtual stream M9 will calculate the sum of flow rates and will totalize the sums into the stream 9 counters.

$$M9 = M1 + M2 + M3$$

**Example 2**

Calculate the pure alcohol quantity from the flow and from the alcohol concentration measured on stream 1. The pure alcohol is calculated in "100 liters per degree of alcohol" abbreviated as "hldeg".  
 $M9=M1*MV1/100$

Rules to be followed in the equation setup:

- valid operations: + (summation), - (subtraction), \* (multiplication), / (division)
- equation must fit into one line
- first the multiplication and division performed then the summation and subtraction
- operations equal in rank are performed from left to right
- equation must start with number or identifier, it must not be started with operation sign
- virtual stream with lower serial number can only be referenced

Valid identifiers in the equation setup:

- M1 ... M11      flow rate calculated in streams 1 to 11. Depending on the Parameter selection above it can be volume, mass and energy flow rate.
- MV1 ... MV8      concentration (measured or calculated) in streams 1 ... 8 in % (volume)
- MM1 ... MM8      concentration (measured or calculated) in streams 1 ... 8 in % (mass)

### 9.2.2.2.2 Virtual stream Premium limits

UNIFLOW-200 is prepared to totalize flow in separate counters if the flow rate higher, then a preset limit. The limits for the flow rates are set on this data page.

The premium limit mode, i.e. if the premium flow is calculated on the instantaneous flow rate or on the hourly totals is set in the Premium limit setup menu (see section 9.2.2.3)

Route in the menu tree:

Parameters	Streams	Virtual streams	Stream 9.	Premium limits
------------	---------	-----------------	-----------	----------------

Function of the F keys on the virtual stream premium limits data pages

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

```

09.Vstr. STATION TOTAL
Vstr. premium totals setup
Premium limit mode  hourly total
Premium limits
CVOL flowrate      28 000 m³/h
Mass flowrate      0 kg/h
Energy flowrate    0 GJ/h
  
```

Save Change ↓ ↑

Figure 9-102 Virtual stream premium limits data page

The data fields on the data page are as follows:

- Premium limit mode;  
Not editable here, fixed to the mode selected in the Premium limit mode menu
- CVOL flowrate (volume flow rate at base conditions);
- MASS flowrate (mass flow rate);
- ENGY flowrate (energy flow rate);

### 9.2.2.2.3 Virtual stream Limits

LOLO, LO, HI, HIHI limits can be set for the virtual stream flow rate.

Route in the menu tree:

Parameters	Streams	Virtual streams	Stream 9.	Limits
------------	---------	-----------------	-----------	--------

Function of the F keys on the virtual stream limits data pages

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

```

09.Ustr. STATION TOTAL
Ustr. limits
Flow selected CVOL flowrate
LO_limit      0 m³/h
HI_limit      26 000 m³/h
LOLO_limit    0 m³/h
HIHI_limit    0 m³/h
Eventing      hi
Save Change ↓ ↑
  
```

Figure 9-103 Virtual stream limits data page

The data fields on the data page are as follows:

- Flow selected;
  - The type flow rate the limit check is applied to is selected here from the list
    - CVOL flowrate (volume flow rate at base conditions);
    - MASS flowrate (mass flow rate);
    - ENGY flowrate (energy flow rate);
    - CO2 mass (CO2 emission flow rate);
- LO limit;
- HI limit;
- LOLO limit;
- HIHI limit;
- Eventing

It can be enabled or disabled to create entry in the event report in case of any of the limit alarms defined here.

### 9.2.2.3 Premium mode setup

Route in the menu tree:

Parameters	Streams	Premium mode setup
------------	---------	--------------------

Function of the F keys on the premium mode setup data pages

⇓ select the next field for editing

⇑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

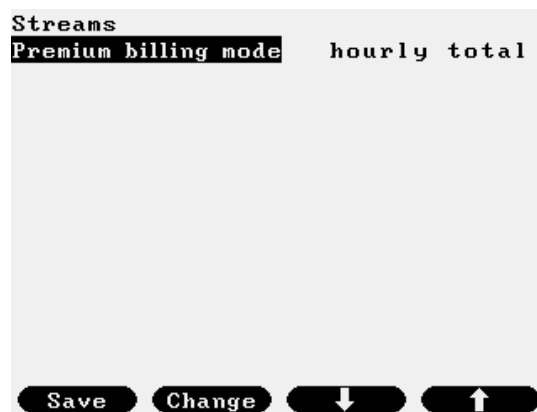


Figure 9-104 Premium mode setup data page

The mode for premium flow calculation should be setup.

The premium mode selected here is valid for all streams. No separate mode for separate streams can be selected.

The data fields on the data page are as follows:

- Premium limit mode;  
Selected from the list
  - `hourly total`;  
Premium limits are evaluated at the end of each hour. If the hourly quantity (volume, mass and energy) exceeds the premium limit then the quantity above the limit is added to separate premium total counter.  
The whole total (including the premium part) is totalized in the cumulative and periodic totals as well.
  - `flow rate`;  
    - hysteresis;
    - timeout

The instantaneous flow rate (volume, mass and energy) is permanently compared to the premium limit. If the flow rate exceeds the premium limit + hysteresis and it exceeds longer than the timeout time, then the flow rate exceeding the premium limit is totalized into separate premium counter. The totalization into the premium counters stops when the flow rate decreases below the premium limit.

Exceeding the premium limit generates an entry in the event log.

The whole total (including the premium part) is totalized in the cumulative and periodic totals as well.



### 9.2.2.4 Fault mode setup

Route in the menu tree:

Parameters	Streams	Fault mode setup
------------	---------	------------------

Function of the F keys on the fault mode setup data pages

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

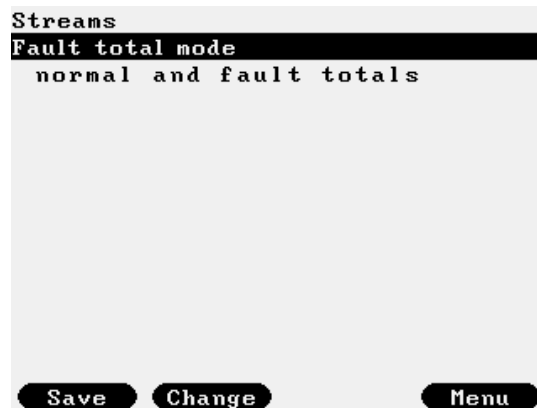


Figure 9-105 Fault mode setup data page

The mode for fault total calculation should be setup.

The fault mode selected here is valid for all streams. No separate mode for separate streams can be selected.

The data fields on the data page are as follows:

- Fault total mode;  
Selected from the list
  - normal and fault totals;  
In fault condition the totals are totalized in normal and fault totals.
  - fault totals only;  
In fault condition the totals are totalized in fault totals only.

The stream considered to be in fault condition if for example:

- input signal fails and the default value of the signal is used in the calculation;
- the difference in the two pulse trains in case of turbine meter exceeds certain limit;
- the beta ration for the orifice meter is outside the limit described in the standard.

Virtual stream is considered to be in fault condition if any of the streams the data used in the virtual stream calculation from is in fault condition.

See the full list of fault conditions in section 9.3.

### 9.2.2.5 Barometric pressure

Route in the menu tree:

Parameters	Streams	barometric pressure
------------	---------	---------------------

Function of the F keys on the barometric pressure data pages

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

The screenshot shows a menu titled 'Streams'. Below it, 'Barometric press.' is highlighted. To the right, 'keypad' is displayed above '1 bar'. Below the main menu items, there are four buttons: 'Save', 'Change', a downward arrow, and an upward arrow.

Figure 9-106 Barometric pressure data page

In corrected volume flow calculation (e.g. in PTZ calculation) the absolute pressure is required. If the transmitter measuring the pressure is gauge pressure transmitter, then UNIFLOW-200 determines the absolute pressure as sum of the measured gauge pressure plus the barometric pressure. It is assumed that the barometric pressure is common for all streams.

The mode for the barometric pressure should be setup here.

The mode selected from the list

- o `measured;`

It is assumed that barometric pressure is measured on analog input channel.

The channel number should be entered here.

- IO *n* Ch *m*

*n* – number of I/O board

*m* – number of channel on the I/O board

- o `modb. sign.` (measured at Modbus channel);

It is assumed that barometric pressure signal is received on Modbus channel.

The channel number should be entered here.

- Channel *n*;

*n* – number of Modbus channel;

- o `keypad;`

Keypad barometric pressure can be entered here if barometric pressure signal is not available.

### 9.2.2.6 Averaging

Route in the menu tree:

Parameters	General data	Averaging setup
------------	--------------	-----------------

Function of the F keys on the Averaging setup data pages

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu

**Menu** returns to the parent menu

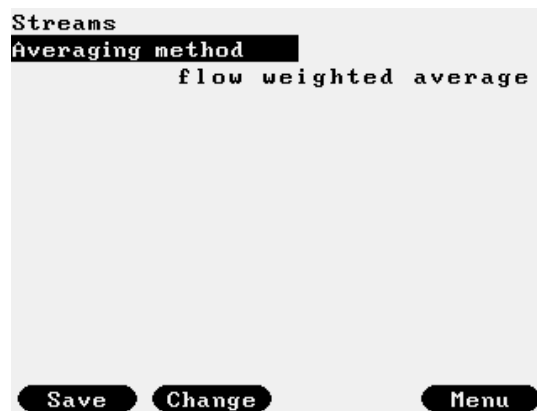


Figure 9-107 Averaging setup data page

The data fields on the data page are as follows:

- Averaging method;
  - arithmetic average;
  - flow weighted average;

In case of arithmetic averaging the value of the parameter to be averaged measured in each calculation cycle will be averaged.

In case of flow weighted averaging the value of the parameter to be averaged measured in each calculation cycle will be weighted with the volume at base condition (CVOL) measured in that cycle before the average is calculated.

#### NOTE

The flow weighted average of a parameter is zero in no flow condition even if the parameter itself is different from zero.

Averages are calculated for each time period defined in the flow computer, i.e. hourly, shift, daily, multiday and monthly averages are calculated.

## 9.2.3 General data

### 9.2.3.1 Date and time

Route in the menu tree:

Parameters	General data	Date and time
------------	--------------	---------------

**Date and time setup**

<b>Year</b>	Month	Day	Hour	Min.
[2010]	[11]	[14]	[11]	[37]

Save Change ← →

Figure 9-108 Date and time data page

The year, month, day, hour, minute of the real time clock is set here.

### 9.2.3.2 Timezone

Route in the menu tree:

Parameters	General data	Timezone
------------	--------------	----------

**Daylight saving time**

<b>Daylight saving</b>	automatic
<b>New timezone?</b>	no
<b>Continent or ocean</b>	Europe
<b>Country</b>	Britain (UK)
<b>Region</b>	London

2011	03.27	00:59:59	->	03.27	02:00:00
2011	10.30	01:59:59	->	10.30	01:00:00
2012	03.25	00:59:59	->	03.25	02:00:00
2012	10.28	01:59:59	->	10.28	01:00:00
2013	03.31	00:59:59	->	03.31	02:00:00
2013	10.27	01:59:59	->	10.27	01:00:00
2014	03.30	00:59:59	->	03.30	02:00:00
2014	10.26	01:59:59	->	10.26	01:00:00

Save Change ↓ ↑

Figure 9-109 Time zone data page

The daylight saving time (DST) rules can be set in this menu item.

The data fields on the data page are as follows:

- Daylight saving;
  - no;  
No adjustment of the internal clock will be applied to follow the daylight saving time clock adjustment.
  - automatic;  
Internal clock will adjusted to follow the daylight saving time clock adjustment automatically.  
If `automatic` is selected then new menu items appears as follows.
- New timezone;
  - no;  
Rules of the default location (Europe, Britain (UK), London) will be applied.
  - yes  
New location can be selected corresponding to the time zone of the location of Uniflow-200.
- Continent or ocean
  - Europe;
  - Indian Ocean;
  - Pacific Ocean;
  - Africa;
  - America;
  - Antarctica;
  - Arctic Ocean;
  - Asia;
  - Atlantic Ocean;
  - Australia;
- Country  
The local country on the selected continent can be selected here from the list
- Region  
The local region inside the country can be selected here from the list.

### 9.2.3.3 Periods setting

The length of the time period for which the totalization is done are set here.

Route in the menu tree:

Parameters	General data	Time periods
------------	--------------	--------------

Function of the F keys on the Time periods data pages

⇓ select the next field for editing

⇑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

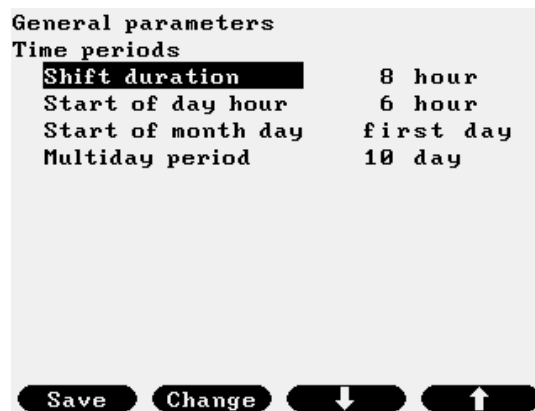


Figure 9-110 Time periods data page

The data fields on the data page are as follows:

- Shift duration;
  - 8 hours;
  - 12 hours;
- Start of day hour;
 

Any hours from 0 to 23
- Start of month day
  - first day;
  - last day;
- Multiday period
  - from 5 to 15 days;

Pressing Save key message appears:

Changing the time period length will erase all the archive data.

Proceed?

If operator selects yes then the new time periods are accepted and archive data are erased.

### 9.2.3.4 User defined setup

#### 9.2.3.4.1 Display

##### 9.2.3.4.1.1 Summary display setup

Route in the menu tree:

Parameters	General data	User defined	Display page setup	Summary display setup
------------	--------------	--------------	--------------------	-----------------------

Function of the F keys on the Summary display setup data pages

⇓ select the next field for editing

⇑ select the previous field for editing

⇒ enter the display page for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

Editing summary display

Stream number	1
Display number	1
Display type	general

Change → ↓ ↑

Figure 9-111 Summary display setup data page

The data fields on the data page are as follows:

- Stream number;
  - Separate summary displays defined for each stream.
    - from 1 to 12;
- Display number;
  - 1;
  - 3;
  - 4;
  - Display 2 is not editable. It is the large character version of display 1.
- Display type;
  - general;
    - Displays the most important metered and calculated data

- prev. month (previous month);  
Displays totals and averages for the previous month.
- curr. month (current month);  
Displays totals and averages for the current month.

The default displays for each display type are shown on the figures below.

Function of the F keys on the Display editing data pages

- ↓ select the next field for editing
- ← select the previous item to display in the selected line
- ⇒ select the next item to display in the selected line

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

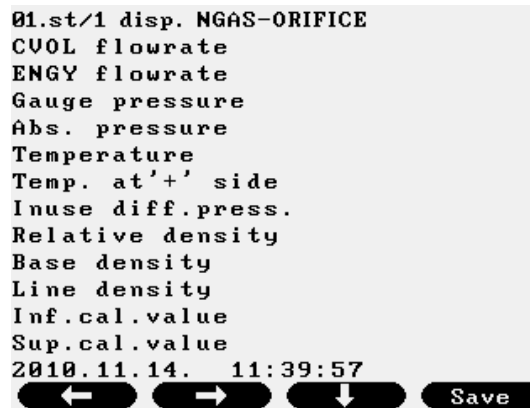


Figure 9-112 Display editing data page, General display

Stream data available for insertion into general display				
Stream data	Physical stream	Virtual stream		
		Flow rate	Other parameter	
			Totalization	Averaging
CVOL flowrate .../h	X	X	–	–
CVOL flowrate .../day	X	X	–	–
UVOL flowrate .../h	X	–	–	–
UVOL flowrate .../day	X	–	–	–
Raw UVOL flowrate .../h	X	–	–	–
Raw UVOL flowrate .../day	X	X	–	–
MASS flowrate .../h	X	X	–	–
MASS flowrate .../day	X	X	–	–
ENGY flowrate .../h	X	X	–	–
ENGY flowrate .../day	X	X	–	–
CVOL	X	X	–	–
UVOL	X	–	–	–
Raw UVOL	X	–	–	–



MASS	X	X	–	–
ENERGY	X	X	–	–
Fault CVOL	X	X	–	–
Fault UVOL	X	–	–	–
Fault Raw UVOL	X	–	–	–
Fault MASS	X	X	–	–
Fault ENERGY	X	X	–	–
Premium CVOL	X	X	–	–
Premium UVOL	X	–	–	–
Premium MASS	X	X	–	–
Premium ENERGY	X	X	–	–
Abs. pressure	X	–	–	–
Gauge pressure	X	–	–	–
Temperature	X	–	–	–
Temperature forward	X	–	–	–
Temperature return	X	–	–	–
Ambient temperature	X	–	–	–
Temperature @“+” side	X	–	–	–
Line density	X	–	–	–
Base density	X	–	–	–
Relative density	X	–	–	–
Inferior calorific value	X	–	–	–
Superior calorific value	X	–	–	–
CO2	X	–	–	–
N2	X	–	–	–
H2O	X	–	–	–
Inuse diff. pressure	X	–	–	–
Diff. pressure Hi	X	–	–	–
Diff pressure Mid	X	–	–	–
Diff pressure Lo	X	–	–	–
Current day CVOL	X	X	–	–
Previous day CVOL	X	X	–	–
Current month CVOL	X	X	–	–
Previous month CVOL	X	X	–	–
Specific carbon content	X	–	–	–
CO2 emission flowrate .../h	X	–	–	–
CO2 emission flowrate .../day	X	–	–	–
CO2 emission mass	X	–	–	–
Line compression factor	X	–	–	–
Conversion factor	X	–	–	–
Flow time	X	–	–	–
Fault flow time	X	–	–	–
Date and time	X	X	X	X
(empty line)	X	X	X	X
Calculated variable (in unit/h)	–	–	X	X
Totalized calculated variable (in unit)	–	–	X	–

Table 9-12 Stream data for general summary display

```

01.st/3 disp. NGAS-ORIFICE
Prv.month avg.press.
Prv.month avg.temp.
Prv.month avg.K

Previous month CVOL
Prev.month flt CVOL
Prv.month UVOL
Prv.month flt UVOL

Prv.month flow time
Prv.month flt ftime

2010.11.14. 11:40:26

```

← → ↓ Save

Figure 9-113 Display editing data page, Previous month display

Stream data available for insertion into previous month display				
Stream data	Physical stream	Virtual stream		
		Flow rate	Other parameter	
			Totalization	Averaging
Previous month average pressure	X	–	–	–
Previous month average temperature	X	–	–	–
Previous month average K(=Zl/Zb)	X	–	–	–
Previous month CVOL	X	X	–	–
Previous month fault CVOL	X	X	–	–
Previous month UVOL	X	–	–	–
Previous month fault UVOL	X	–	–	–
Previous month flow time	X	–	–	–
Previous month fault flow time	X	–	–	–
Date and time	X	–	–	–
(empty line)	X	–	–	–

Table 9-13 Stream data for previous month summary display

```

01.st/4 disp. NGAS-ORIFICE
Cur.month avg.press.
Cur.month avg.temp.
Cur.month avg.K
Current month CVOL
Cur.month flt CVOL
Current month UVOL
Cur.month flt UVOL
Cur.month flow time
Cur.month flt ftime
CVOL
Fault CVOL
UVOL
Fault UVOL

```

← → ↓ Save

Figure 9-114 Display editing data page, Current month display

Stream data available for insertion into current month display				
Stream data	Physical stream	Virtual stream		
		Flow rate	Other parameter	
			Totalization	Averaging
Current month average pressure	X	–	–	–
Current month average temperature	X	–	–	–
Current month average K(=Zl/Zb)	X	–	–	–
Current month CVOL	X	X	–	–
Current month fault CVOL	X	X	–	–
Current month UVOL	X	–	–	–
Current month fault UVOL	X	–	–	–
Current month flow time	X	–	–	–
Current month fault flow time	X	–	–	–
CVOL cumulative total	X	–	–	–
Fault CVOL cumulative total	X	–	–	–
UVOL cumulative total	X	–	–	–
Fault UVOL cumulative total	X	–	–	–
Date and time	X	–	–	–
(empty line)	X	–	–	–

Table 9-14 Stream data for current month summary display

#### 9.2.3.4.1.2 Extra summary display setup

Route in the menu tree:

Parameters	General data	User defined	Display page setup	Extra summary display setup
------------	--------------	--------------	--------------------	-----------------------------

Function of the F keys on the Extra summary display setup data pages

- ⇓ select the next field for editing
- ⇑ select the previous field for editing
- ⇒ enter the display page for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

Str.No.	Item
1	CVOL
2	CVOL
3	CVOL
4	CVOL
5	CVOL
6	CVOL
8	MASS

Navigation buttons: ← → ↓ Save

Figure 9-115 Extra summary display setup data page

The Extra summary display allows group together on single display page data from different streams.

The data fields on the data page are as follows:

- Display number;
  - 1;
  - 2;

After entering the selected display page the stream number and the data item to be displayed can be selected. All the data which can be inserted into general display (see Table 9.5.) can be inserted into extra summary display as well.

### 9.2.3.4.2 Reports

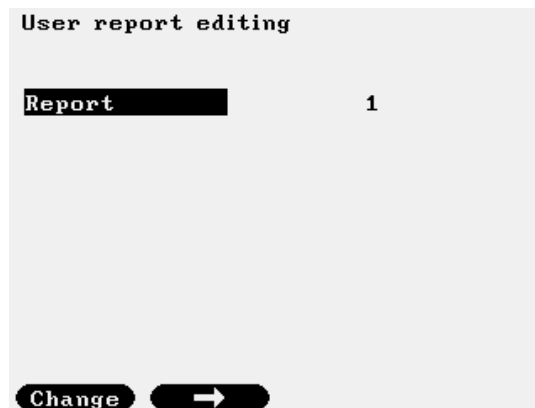
Route in the menu tree:

Parameters	General data	User defined	Reports
------------	--------------	--------------	---------

Function of the F keys on the Reports setup data pages

⇒ enter the display page for editing

**Change** modify the selected data field



**Figure 9-116 User defined report selection data page**

There are two types of user defined reports available to report the hourly quantities and averages.

In User report 1 and User report 2 each report consists of 7 data columns. The first column is reserved for the data and time. The data items to be displayed in column 2 to 7 are freely configurable. After selecting the serial number of the report (1 or 2) the setup data page appears.

Function of the F keys on the User report editing data pages

⇓ select the next field for editing

⇐ select the previous item to display in the selected line

⇒ select the next item to display in the selected line

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

**User report 1**

column	Str.No.	Item
1	---	Date - Time
2	<b>1</b>	UVOL
3	1	CVOL
4	1	ENERGY
5	1	Press average
6	1	Temp average
7	1	Inf.cal.val.aver

←
→
↓
Save

**Figure 9-117 User report editing data page for User report 1 and 2**

The data fields on the data page are as follows:

- Str.No. (Stream number);
  - from 1 to 12; (Selecting --- (dashes) the column will be left empty.)
- Item;
  - UVOL; (uncorrected volume)
  - CVOL; (corrected volume)
  - Mass; (mass)
  - Energy; (energy)
  - CO2 mass; (CO2 emission mass)
  - Fault CVOL; (corrected volume at fault condition)
  - Fault Mass; (mass at fault condition)
  - Fault Energy; (energy at fault condition)
  - Fault CO2 mass; (CO2 emission mass at fault condition)
  - Premium CVOL; (premium corrected volume)
  - Premium Mass; (premium mass)
  - Premium Energy; (premium energy)
  - Premium CO2 mass; (premium CO2 emission mass)
  - Temp average; (average temperature)
  - Press average; (average pressure)
  - dP average; (average differential pressure)
  - Line dens average; (average line density)
  - K(Zl/Zb) average; (average compressibility ratio)
  - Spec.carb.average; (average specific carbon content)
  - Inf.cal.val.average; (average inferior calorific value)
  - Sup.cal.val.average; (average superior calorific value)
  - Rel.dens.average; (average relative density)
  - Flow time; (flow duration)
  - Fault time; (fault flow duration)

User defined report3		
Stream number 1		
Company 1		
Company 2		
Company 3		
Location		
Total col.	Str.No.	Items
1	1	UVOL
2	1	CVOL
3	1	Mass
4	1	Energy
Daily column	Str.No.	Items
1	1	UVOL
2	1	CVOL
3	1	Mass
4	1	Energy
5	1	CO2 mass
6	1	Temp average
7	1	Press average
Hour column	Str.No.	Items
1	1	UVOL
2	1	CVOL

Save Change ↓ ↑

User defined report3		
2	1	CVOL
3	1	Mass
4	1	Energy
Daily column	Str.No.	Items
1	1	UVOL
2	1	CVOL
3	1	Mass
4	1	Energy
5	1	CO2 mass
6	1	Temp average
7	1	Press average
Hour column	Str.No.	Items
1	1	UVOL

Save Change ↓ ↑

User defined report3		
4	1	Energy
5	1	CO2 mass
6	1	Temp average
7	1	Press average
Hour column	Str.No.	Items
1	1	UVOL
2	1	CVOL
3	1	Mass
4	1	Energy
5	1	CO2 mass
6	1	Temp average
7	1	Press average
8	1	dP average

Save Change ↓ ↑

Figure 9-118 User report editing data page for User reports 3 to 10

User report 3 to User report 10 are daily billing reports for streams. Each of the 8 reports can be freely assigned to any stream. See sample of reports in Annex A.

The reports are consist of 5 sections:

- header section;
- totals section;
- daily data section;
- hourly data section;
- footer section.

In the header section general data of the metering stream are indicated.

In the totals section totals are indicated in four columns. The type of totals can be selected from the list as follows:

- UVOL; (uncorrected volume)
- CVOL; (corrected volume)
- Mass; (mass)
- Energy; (energy)
- CO2 mass; (CO2 emission mass)
- Fault CVOL; (corrected volume at fault condition)
- Fault Mass; (mass at fault condition)

- Fault Energy; (energy at fault condition)
- Fault CO2 mass; (CO2 emission mass at fault condition)
- Premium CVOL; (premium corrected volume)
- Premium Mass; (premium mass)
- Premium Energy; (premium energy)
- Premium CO2 mass; (premium CO2 emission mass)

The report will indicate the total for the previous day, for the current day and the cumulative total for the type of total selected.

In the daily data section totals and/or averages are indicated in 7 columns. The type of totals/averages can be selected from the list as follows:

- UVOL; (uncorrected volume)
- CVOL; (corrected volume)
- Mass; (mass)
- Energy; (energy)
- CO2 mass; (CO2 emission mass)
- Fault UVOL; (uncorrected volume at fault condition)
- Fault CVOL; (corrected volume at fault condition)
- Fault Mass; (mass at fault condition)
- Fault Energy; (energy at fault condition)
- Fault CO2 mass; (CO2 emission mass at fault condition)
- Premium UVOL; (premium uncorrected volume)
- Premium CVOL; (premium corrected volume)
- Premium Mass; (premium mass)
- Premium Energy; (premium energy)
- Premium CO2 mass; (premium CO2 emission mass)
- Temp average; (average temperature)
- Press average; (average pressure)
- dP average; (average differential pressure)
- K(Z1/Zb) average; (average compressibility ratio)
- Spec.carb.average; (average specific carbon content)
- Inf.cal.val.average; (average inferior calorific value)
- Sup.cal.val.average; (average superior calorific value)
- Line dens average; (average line density)
- Base dens average; (average base density)
- Rel.dens.average; (average relative density)
- Flow time; (flow duration)
- GC updates; (number of times the gas composition has been updated)
- Fault time; (fault flow duration)

The report will indicate the value of the totals for the previous day, and the minimum, maximum and average values for the non-total parameters.

In the hourly data section totals and/or averages are indicated in 8 columns. The type of totals/averages can be selected from the list as follows:



- UVOL; (uncorrected volume)
- CVOL; (corrected volume)
- Mass; (mass)
- Energy; (energy)
- CO2 mass; (CO2 emission mass)
- Fault UVOL; (uncorrected volume at fault condition)
- Fault CVOL; (corrected volume at fault condition)
- Fault Mass; (mass at fault condition)
- Fault Energy; (energy at fault condition)
- Fault CO2 mass; (CO2 emission mass at fault condition)
- Premium UVOL; (premium uncorrected volume)
- Premium CVOL; (premium corrected volume)
- Premium Mass; (premium mass)
- Premium Energy; (premium energy)
- Premium CO2 mass; (premium CO2 emission mass)
- Temp average; (average temperature)
- Press average; (average pressure)
- dP average; (average differential pressure)
- K(Zl/Zb) average; (average compressibility ratio)
- Spec.carb.average; (average specific carbon content)
- Inf.cal.val.average; (average inferior calorific value)
- Sup.cal.val.average; (average superior calorific value)
- Line dens average; (average line density)
- Base dens average; (average base density)
- Rel.dens.average; (average relative density)
- Flow time; (flow duration)
- GC updates; (number of times the gas composition has been updated)
- Fault time; (fault flow duration)

The report will indicate the value of the totals for each hour during the previous day, and the average values for the non-total parameters.

In the footer section space for signature and three company names are provided.

#### **9.2.3.4.3 Trends**

Reserved for future use

### 9.2.3.5 Password setup

Route in the menu tree:

Parameters	General data	Password setup
------------	--------------	----------------

Function of the F keys on the Password setup data pages

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

**Menu** returns to the parent menu

```

General parameters
Change password
Level                               engineer
Do you want to change
the password?                       yes
    Old password:
    New password: ****
Do you remember it?                 yes
Confirm new passw.: ****

OK                                  Menu

```

Figure 9-119 Password setup data page

The data fields on the data page are as follows:

- Password level;
  - o operator;
  - o engineer;

The Operator and the Engineer password can be modified here.

Only the Engineer is allowed to modify the password for both levels.

First the old password shall be entered.

Then the new password is entered.

UNIFLOW-200 then requires entering the new password once again.

If the new passwords entered twice are identical then the password is changed.

#### CAUTION

The flow computer shipped with empty password list. It means that pressing Enter when the flow computer requires password you log in at Engineering level allowing modification all the parameters.

Set your own Operator and Engineering level password to protect the parameters against undesired modification. Remember the password you entered. If you forget your password you will have to ask the assistance of the manufacturer or you have to return the unit to the manufacturer.

### 9.2.3.6 Reset

#### 9.2.3.6.1 Totals reset

Route in the menu tree:

Parameters	General data	Reset	Totals reset
------------	--------------	-------	--------------

Function of the F keys on the Totals reset data pages

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

**Menu** returns to the parent menu

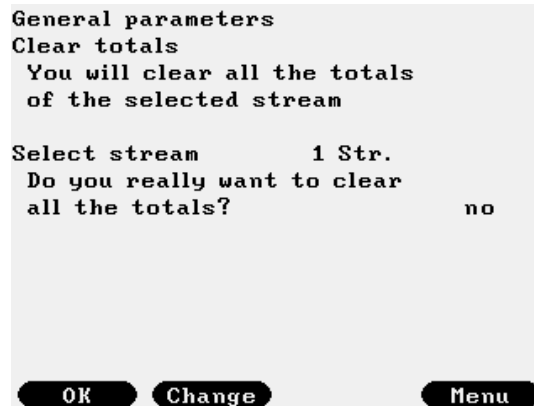


Figure 9-120 Totals reset data page

The Totals reset command clears all the cumulative and periodic totals in the flow computer for the selected streams.

Totals reset allowed on Engineer password level only.

The data fields on the data page are as follows:

- Select stream;
  - from 1 to 12;
  - all;

After the stream or all streams are selected UNIFLOW-200 asks to confirm the reset twice. After confirmation all totals are cleared.

### 9.2.3.6.2 General reset

Route in the menu tree:

Parameters	General data	Reset	General reset
------------	--------------	-------	---------------

Function of the F keys on the General reset data pages

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

**Menu** returns to the parent menu

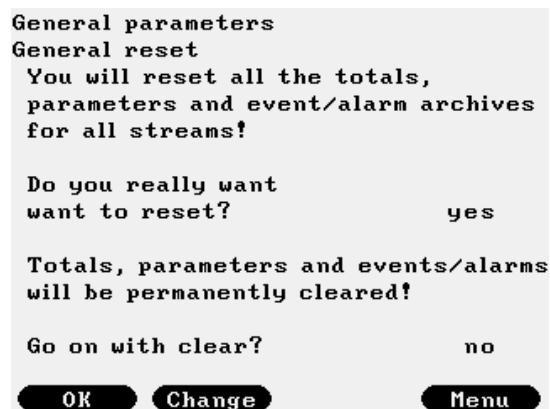


Figure 9-121 General reset data page

The General reset command:

- clears all the cumulative and periodic totals
- clears all the parameters to their default values
- clears the alarm and event log
- sets all I/O signals to inactive
- sets all streams to not defined

in the flow computer.

General reset allowed on Engineer password level only.

Apply the general reset with extreme care.

UNIFLOW-200 asks to confirm the general reset twice. After the two confirmations general reset is done.

### 9.2.3.7 Version control

Data to identify the flow computer hardware and software are provided in this menu.

Route in the menu tree:

Parameters	General data	Machine ID
------------	--------------	------------

Function of the F keys on the Version control data pages

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

**Menu** returns to the parent menu

General parameters	
Machine ID	
Serial no.	200-167
Machine name	UNIFLOW-200 MFC
CPU	120 MHz
Software package	
Op.system	u2_cAL_UX200 v2
Application	u2_cAA_1.1.4.4_130405
PIC	120215
1 pos. ANI4PT2	121217,120222
2 pos. PDI0484	120216,120216
3 pos. AODI0484	120209
4 pos. HTI4x15	120622
5 pos. ANI8	120223,120222
Save	Change
Menu	

Figure 9-122 Version control data page

The data fields on the data page are as follows:

- Serial number;  
Not editable
- Machine name;  
Any character string can be entered.  
The default name is UNIFLOW-200 MFC  
Allowed characters: uppercase and lowercase letters, numbers, space, underscore, hyphen
- Operating system version;  
Not editable
- Application version;  
Not editable
- PIC version;  
Not editable
- 1 pos.;  
Type of the I/O board fitted into slot 1.
- 2 pos.;

- Type of the I/O board fitted into slot 2.
- 3 pos.;
- Type of the I/O board fitted into slot 3.
- 4 pos.;
- Type of the I/O board fitted into slot 4.
- 5 pos.;
- Type of the I/O board fitted into slot 5.

Refer these data if you ask manufacturer assistance.

### 9.2.3.8 Company data

Route in the menu tree:

Parameters	General data	User data
------------	--------------	-----------

Function of the F keys on the Company data data pages

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

Figure 9-123 User data data page

The data fields on the data page are as follows:

- Name;  
Any character string can be entered.  
The default name is empty  
Allowed characters: uppercase and lowercase letters, numbers, space, underscore, hyphen
- Address;  
Any character string can be entered.  
The default address is empty.

### 9.2.3.9 LCD settings

Route in the menu tree:

Parameters	General data	LCD settings
------------	--------------	--------------

Function of the F keys on the LCD settings data pages

↓ decrease the brightness

↑ increase the brightness

↕ select the next field for editing

**Change** change the background color

**OK** Confirm the selection

**Save** save the settings and returns to the parent menu.

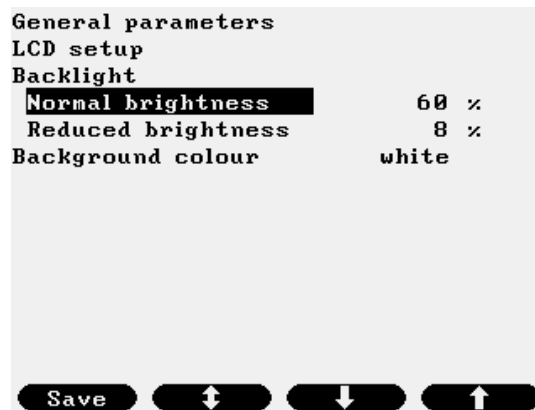


Figure 9-124 LCD settings data page

The data fields on the data page are as follows:

- Normal brightness;  
Set the required brightness in normal brightness mode from 20 to 100 % in 4 % steps.
- Reduced brightness;  
Set the required brightness in reduced brightness mode from 4 to 16 % in 4 % steps.
- Background color;  
Set the required background color from the list:
  - blue;
  - black
  - white;

### 9.2.3.10 Character type

The character type of the display can be selected here. Available selections are:

- Normal font;
- Large font;

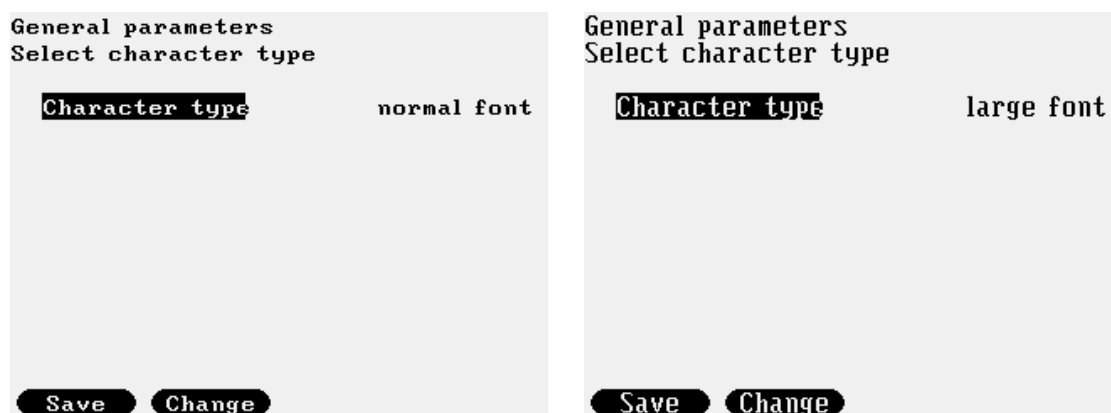


Figure 9-125 Character size selection data page



## 9.2.4 Interfaces

### 9.2.4.1 Serial ports

Settings for Com1, Com2 and Com3 ports are identical.

Route in the menu tree:

Parameters	General data	Interfaces	Com ports	Com1
------------	--------------	------------	-----------	------

Function of the F keys on the Serial ports data pages

⇩ select the next field for editing

⇧ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

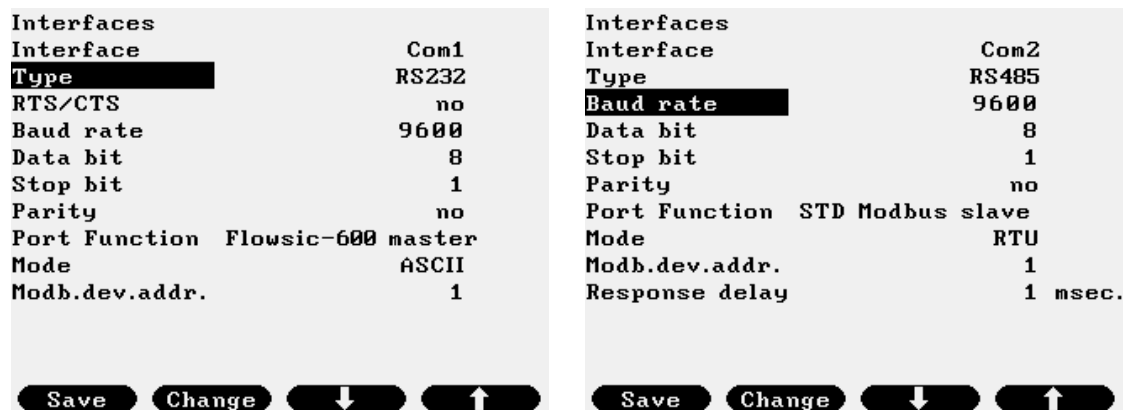


Figure 9-126 Serial ports data page

The data fields on the data page are as follows:

- Type;
  - RS232;
  - RS485;
  - RS422 MD (multidrop);
  - RS422 PP (point to point)
- RTS/CTS (handshake);
  - no;
  - yes;
- Baud rate;
  - 1200;
  - 2400;
  - 4800;

- 9600;
- 19200;
- 38400;
- Data bits;
  - 7;
  - 8;
  - 9;
- Stop bits;
  - 1;
  - 2;
- Parity;
  - none;
  - odd;
  - even;
- Port function;
  - STD Modbus slave;  
See Chapter 10
  - Daniel Modbus slave;  
See Chapter 10
  - Flowsic-600 master;  
Polls Flowsic-600 ultrasonic meter  
Mode fixed to ASCII.
  - QSonic slave;  
Receive data from Instromet ultrasonic meters.  
Mode fixed to Instromet special (displays RTU).
  - Daniel\_US master;  
Polls Daniel ultrasonic meters  
Mode fixed to ASCII.
  - Flexim\_US master;  
Polls Flexim ultrasonic meters  
Mode fixed to RTU.
  - Siemens\_US master;  
Polls Siemens ultrasonic meters  
Mode fixed to RTU.
  - Panamet\_US master;  
Polls Panametrics ultrasonic meters  
Mode fixed to RTU.
  - Krohne\_US master;  
Polls Krohne Altosonic ultrasonic meters  
Mode fixed to RTU.
  - Serial printer; (CP437 setting is suggested)
    - Periodic prints (select if periodic printing enabled or disabled)
      - no  
No periodic printing will be initiated.
      - daily;

The selected reports will be printed at the end of each day.

- daily & hourly;

The selected reports will be printed at the end of each day and at the end of each hour.

If daily or daily & hourly is selected then list of reports appears. It can then be selected for each of them whether print or not to print at the end of period. The reports selectable for printing are as follows:

- Defined report 1;
- Defined report 2;
- Defined report 3;
- Defined report 4;
- Defined report 5;
- Defined report 6;
- Defined report 7;
- Defined report 8;
- Defined report 9;
- Defined report 10;
- Cur.day (hourly short);
- Batch;

- Ser. test master;  
Used in serial test of the flow meters. See. 9.1.8.  
Mode fixed to ASCII.
- Ser. test slave;  
Used in serial test of the flow meters. See. 9.1.8.  
Mode fixed to ASCII.
- Daniel GC master;  
Polls the Daniel gas chromatograph for natural gas composition
- ABB GC master;  
Polls the ABB gas chromatograph for natural gas composition
- Yamatake GC master;  
Polls the Yamatake gas chromatograph for natural gas composition  
Mode fixed to ASCII.
- Yokogawa GC master;  
Polls the Yokogawa gas chromatograph for natural gas composition  
Mode fixed to ASCII.
- Micromotion master;  
Polls the Micromotion meter for mass flow rate, line density, pressure and temperature data.  
Register addresses for line density, pressure and temperature shall be entered then.
- ABB2 GC master;  
Polls the ABB gas chromatograph for natural gas composition. Utilizes register assignment different from ABB GC Master settings. See in Section 10.7.
- FMC300 master;  
Polls the MFC300 (mass flow meter transmitter) for mass flow rate, line density, pressure and temperature data.  
Register addresses for line density, pressure and temperature shall be entered then.

- Mode  
Selected from the list:
  - RTU;
  - ASCII;
- GC number of streams (only if the Port function is GC master)  
Selected from the list:
  - 1 to 4;
 Number of gas streams analyzed by the gas chromatographs.
- GC str1 -> Stream (only if the Port function is GC master)  
Selected from the list:
  - 1 to 8;
 Selected the serial number of the flow computer physical streams the stream 1 of the gas chromatograph is assigned to. The gas composition measured on stream 1 of the gas chromatograph will be used in the calculation of these streams.
- GC str2 -> Stream (only if the Port function is GC master)  
Same as for stream 1 but for stream 2 of the gas chromatograph.
- GC str3 -> Stream (only if the Port function is GC master)  
Same as for stream 1 but for stream 3 of the gas chromatograph.
- GC str4 -> Stream (only if the Port function is GC master)  
Same as for stream 1 but for stream 4 of the gas chromatograph.
- Modb. dev. addr. (Modbus device address);  
Valid addresses from 0 to 256.
- Resp. delay (Response delay) in milliseconds;  
required only if Port type = RS485 or RS422 MD selected.  
UNIFLOW-200 will not send response to query within this delay time

### 9.2.4.2 Ethernet port

Route in the menu tree:

Parameters	General data	Interfaces	Ethernet
------------	--------------	------------	----------

Function of the F keys on the Ethernet port data pages

- ⇓ select the next field for editing
- ⇑ select the previous field for editing
- ⇔ select the next entry field within line

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

The screenshot shows a terminal-style interface for configuring the Ethernet port. It lists several parameters and their current values:

Interfaces	
Interface	Ethernet
IP address	192.168. 0.235
Subnet mask	255.255.255. 0
Default gateway	192.168. 0. 1
Modb.dev.addr.	1
Reg. assignment	Daniel
DHCP server	no

At the bottom of the screen, there are four buttons: 'Save', a double-headed arrow (⇔), a downward arrow (⇓), and an upward arrow (⇑).

Figure 9-127 Ethernet port data page

The data fields on the data page are as follows:

- IP address;
- Subnet mask;
- Default gateway;
- Modb. dev. addr. (Modbus device address);  
Valid addresses from 0 to 256.
- Reg. assignment (Register assignment mode);  
Selected from the list:
  - STD Modbus;  
See in Chapter 10.5.
  - Daniel Modbus;  
See in Chapter 10.6.
- DHCP server;  
Selected from the list:
  - enabled;
  - disabled

The factory default settings of the Ethernet port are as follows:

IP address: 192.169.0.100  
 Subnet mask: 255.255.255.0  
 Default gateway: 192.168.0.1

### 9.2.4.3 USB

Reserved for future use

## 9.2.5 Operator parameters

### 9.2.5.1 Keypad & limits

Data in this menu are allowed to be modified with Operator level password.

Generally the pressure and temperature alarm limits and keypad values belong to this group of parameters.

Route in the menu tree:

Parameters	General data	Operator data	Limits
------------	--------------	---------------	--------

Function of the F keys on the Keypad & limits data pages

- ⇓ select the next field for editing
- ⇑ select the previous field for editing
- ⇕ select the next stream data for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the stream selection field.

01 Str. Operator parameters				01 Str. Operator parameters			
Limits				Limits			
Pressure				Pressure			
LO_scale	(lsc)	0	bar	HI_limit	(hi)	10	bar
HI_scale	(hsc)	10	bar	LOLO_limit	(lolo)	0	bar
LO_limit	(lo)	0	bar	HIHI_limit	(hihi)	10	bar
HI_limit	(hi)	10	bar	Keypad		7	bar
LOLO_limit	(lolo)	0	bar	Temperature			
HIHI_limit	(hihi)	10	bar	LO_scale	(lsc)	-10	°C
Keypad		7	bar	HI_scale	(hsc)	40	°C
Temperature				LO_limit	(lo)	-10	°C
LO_scale	(lsc)	-10	°C	HI_limit	(hi)	40	°C
HI_scale	(hsc)	40	°C	LOLO_limit	(lolo)	-10	°C
LO_limit	(lo)	-10	°C	HIHI_limit	(hihi)	40	°C
				Keypad		11	°C
⇕ Ok Menu				Save Change ⇓ ⇑			

Figure 9-128 Operator data - limits data page

When the data page appears the stream number is highlighted.

Select the stream to be edited pressing ⇕ key. Press OK to confirm the selection. The cursor goes to the first editable field.

After pressing Save the cursor goes to the stream select field.

The data fields on the data page are as follows:

- LO\_range;  
Signal input low metering range.  
Not editable here. Edited in Signals menu at Engineer password level.
- HI\_range;  
Signal input high metering range.  
Not editable here. Edited in Signals menu at Engineer password level.
- LO\_limit;
- HI\_limit;
- LOLO\_limit;
- HHHI\_limit;
- Keypad;

### 9.2.5.2 Keypad values

Data in this menu are allowed to be modified with Operator level password.  
Generally the gas composition keypad values belong to this group of parameters.

Route in the menu tree:

Parameters	General data	Operator data	Keypad values
------------	--------------	---------------	---------------

Function of the F keys on the Operator parameters – Keypad values data pages

- ⇓ select the next field for editing
- ⇑ select the previous field for editing
- ⇕ select the next stream data for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the stream selection field.

01 Str. Operator parameters				01 Str. Operator parameters			
Keypad values				Keypad values			
Relative density		0.555		gas composition (mole%)		Total100.0001	
Inf.cal.value		34.020001 MJ/m³		N2	0.7632	npentane	0.0098
Sup.cal.value		37.779999 MJ/m³		CO2	0.0489	nhexane	0.0196
gas composition (mole%):				H2S	0	nheptane	0
N2	0.7632	ipentane	0.0098	H2O	0.1996	noctane	0
CO2	0.0489	nhexane	0.0196	helium	0	nnonane	0
H2S	0	nheptane	0	methane	95.8377	ndecane	0
H2O	0.1996	noctane	0	ethane	0.7925	oxygen	0
helium	0	nnonane	0	propane	0.2642	CO	0
methane	95.8377	ndecane	0	ibutane	0.0489	H2	1.9569
ethane	0.7925	oxygen	0	nbutane	0.0489	argon	0
propane	0.2642	CO	0	ipentane	0.0098	Other component	
↑		Ok		Save		Change	
Menu						↓	
						↑	

```

01 Str. Operator parameters
Keypad values
gas composition (mole%)Total100.0001
ammonia      0 air      0
benzene      0
dimet-prop-22  0
met-pent-2    0
met-pent-3    0
dimet-but-22  0
dimet-but-23  0
ethylene     0
propylene     0
meth-alcohol  0
sulf-dioxid   0
Save Change ↓ ↑

```

Figure 9-129 Keypad values data page

When the data page appears the stream number is highlighted.

Select the stream to be edited pressing  $\uparrow\downarrow$  key. Press OK to confirm the selection. The cursor goes to the first editable field.

If no gas composition is available in the stream (e.g. the stream measures liquid) then the data page is empty. After pressing Save the cursor goes to the stream select field.

The data fields on the data page are as follows:

- Relative density;
- Inferior calorific value;
- Superior calorific value;
- 21 gas components;

The name of the components abbreviated are as follows:

N2 nitrogen  
 CO2 carbon-dioxide  
 H2S hydrogen-sulfide  
 H2O water  
 He helium  
 C1 methane  
 C2 ethane  
 C3 propane  
 nC4 n-butane  
 iC4 i-butane  
 nC5 n-pentane  
 iC5 i-pentane  
 nC6 n-hexane  
 nC7 n-heptane  
 nC8 n-octane  
 nC9 n-nonane  
 nC10 n-decane  
 O2 oxygen  
 CO carbon-monoxide  
 H2 hydrogen  
 Ar argon



## 9.2.6 Restore

Route in the menu tree:

Parameters	Restore	Param. project
		Firmware

Function of the F keys on the Restore data pages

**Change** modify the selected data field

**OK** Confirm the selection

**Save** save the selected/entered data and returns to the parent menu.

**Menu** returns to the parent menu

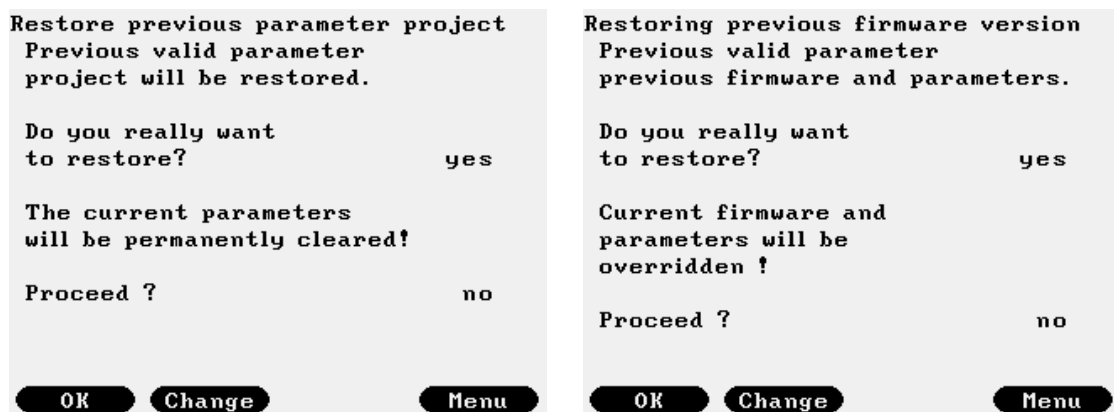


Figure 9-130 Restore data page

In some cases it might be necessary to return to the parameter set or to the firmware being valid before new parameter set or new firmware was downloaded into UNIFLOW-200.

Entering into Restore menu the Parameter project or the Firmware to be restored shall be selected.

Restore is allowed on Engineer password level only.

Apply the Restore with extreme care.

UNIFLOW-200 asks to confirm the Restore twice. After the two confirmations Restore is done.

### 9.3 Alarms and events system

UNIFLOW-200 operates a comprehensive alarming and eventing system, a summary of which is detailed below.

Alarm is considered as a violation of a limit set in the flow computer by operator or by the calculation procedure implemented.

Event is considered any change in the parameter set of the flow computer.

When an alarm occurs it causes:

- visual alarm indication (alarm LED on the front panel) flashing;
- digital alarm output activated;
- entry is added to the unacknowledged alarm list;
- entry is added to the alarm log (alarm set).

When operator acknowledges the alarm:

- it is moved from the unacknowledged alarm list to the acknowledged alarm list;
- alarm led is lit (not flashing);

When the limit violation causing the alarm disappears:

- alarm LED goes off;
- digital alarm output deactivated;
- alarm is cleared from the alarm list (from the acknowledged alarm list if it was acknowledged and from the unacknowledged alarm list if it was not acknowledged. Alarm system works on unlatched basis)
- entry is added to the alarm log (alarm cleared).

When any event appears:

- entry is added to event log indicating the name of the parameter modified, the old value and the new value of the parameter.

There is also a download log in the flow computer. It serves for archiving the natural gas composition downloaded to the flow computer from supervisory system via the Modbus link.

Every time a new gas composition is received on the Modbus link the composition is stored in the download log as a new entry.

### 9.3.1 I/O channel alarms

#### 9.3.1.1 Analog input channel (4-20 mA) alarms

Alarm text	Description
IO../Ch.. Under range	Current < 3.5 mA. Alarm is cleared with hysteresis when current > 4 mA. In the range 3.5 mA < current < 4.0 mA current = 4.0 mA converted into engineering unit.
IO../Ch.. Over range	Current > 20.5 mA. Alarm is cleared with hysteresis when current < 20 mA. In the range 20.0 mA < current < 20.5 mA the measured current is converted into engineering unit.
IO../Ch.. LoLo limit	Parameter in engineering unit < LoLo alarm limit
IO../Ch.. Lo limit	Parameter in engineering unit < Lo alarm limit
IO../Ch..Hi limit	Parameter in engineering unit > Hi alarm limit
IO../Ch..HiHi limit	Parameter in engineering unit > HiHi alarm limit
IO../Ch.. channel failure	Channel data is failed to read
Str.. dP cut-off active	For differential pressure channel only. Measured dP < dP cut-off limit. dP = 0 assumed in flow calculation.
Str.. dP transmitter discrepancy	For differential pressure channel only if two or three dP transmitters with identical range is configured. Deviation between the differential pressures measured at different channels > deviation limit.

Differential pressure signal processing in different regions of the input signal is shown in the table below.

dP_max	-----	transmitter overload (I > 20.5 mA)
dP_HI_current	-----	transmitter upper range value (I = 20.0 mA)
dP_cut-off	-----	dP cut-off limit
dP_LO_current	-----	transmitter lower range value (I = 4.0 mA)
dP_min	-----	open input circuit (I < 3.5 mA)

dP range	Alarm	dP signal processing
0 < dP < dP_min	Under-range	No flow calculation
dP_min < dP < dP_LO_current	Under-range	No flow calculation
dP_LO_current < dP < dP_cut-off	dP cut-off active	dP = 0 assumed
dP_cut-off < dP < dP_HI_current	none	normal flow calculation
dP_HI_currnt < dP < dP_max	none	normal flow calculation
dP_max < dP	Over-range	dp = dP_max assumed, fault totals

#### NOTE

It is operator selectable in the signal setup menu if the under range, over range and Lo, LoLo, Hi, HiHi limits shall generate alarm or not.

### 9.3.1.2 PRT/RTD (Pt100) channel alarms

Alarm text	Description
IO../Ch.. Under range	Temperature < LO_scale.
IO../Ch.. Over range	Temperature > HI_scale.
IO../Ch.. LoLo limit	Temperature < LoLo alarm limit
IO../Ch.. Lo limit	Temperature < Lo alarm limit
IO../Ch..Hi limit	Temperature > Hi alarm limit
IO../Ch..HiHi limit	Temperature > HiHi alarm limit

#### NOTE

It is operator selectable in the signal setup menu if the under range, over range and limits shall generate alarm or not.

### 9.3.1.3 Pulse input channel (flow pulse signal) alarms

Alarm text	Description
Str.. flowrate cut-off active	UVOL flowrate < cut-off flowrate
Str.. flowrate below qmin	UVOL flowrate < qmin flowrate
IO../Ch.. LoLo limit	UVOL flowrate < LoLo alarm limit
IO../Ch.. Lo limit	UVOL flowrate < Lo alarm limit
IO../Ch..Hi limit	UVOL flowrate > Hi alarm limit
IO../Ch..HiHi limit	UVOL flowrate > HiHi alarm limit
Str.. flowrate above qmax	UVOL flowrate > qmax flowrate
Str.. meter overload	UVOL flowrate > $t_m \cdot q_{max}$ flowrate
Str.. meter critical overload	UVOL flowrate > $1.5 \cdot t_m \cdot q_{max}$ flowrate

where  $t_m$  is the maximum overload set in the signal setup menu

Pulse input signal processing in different regions of the input signal is shown in the table below.

$1.5 \cdot t_m \cdot q_{max}$	-----	critical overload flowrate
$t_m \cdot q_{max}$	-----	maximum overload flowrate
$q_{max}$	-----	maximum UVOL flowrate
$q_{min}$	-----	minimum UVOL flowrate
$q_{cut-off}$	-----	cut-off UVOL flowrate
0	-----	no flow

UVOL FR range	Alarm	Signal processing
$0 < \text{UVOL FR} < q_{\text{cut-off}}$	flowrate cut-off active	No flow totalization
$q_{\text{cut-off}} < \text{UVOL FR} < q_{\text{min}}$	under range	Fault totals
$q_{\text{min}} < \text{UVOL FR} < q_{\text{max}}$	none	Normal flow calculation
$q_{\text{max}} < \text{UVOL FR} < t_m * q_{\text{max}}$	over range	Fault totals
$t_m * q_{\text{max}} < \text{UVOL FR} < 1.5 * t_m * q_{\text{max}}$	overload	Fault totals
$1.5 * t_m * q_{\text{max}} < \text{UVOL FR}$	critical overload	$1.5 * t_m * q_{\text{max}}$ flowrate assumed, fault totals

The flowrate is calculated in any cases independently on that if the totalization is allowed or not.

#### NOTE

It is operator selectable in the signal setup menu if the Lo, LoLo, Hi, HiHi limits shall generate alarm or not.

#### 9.3.1.4 Pulse input channel (flow frequency signal) alarms

Alarm text	Description
Alarm text	Description
IO../Ch.. Under range	Frequency < LO_frequency
IO../Ch.. Over range	Frequency > HI_frequency
IO../Ch.. LoLo limit	Parameter in engineering unit < LoLo alarm limit
IO../Ch.. Lo limit	Parameter in engineering unit < Lo alarm limit
IO../Ch..Hi limit	Parameter in engineering unit > Hi alarm limit
IO../Ch..HiHi limit	Parameter in engineering unit > HiHi alarm limit

#### NOTE

It is operator selectable in the signal setup menu if the under range, over range and Lo, LoLo, Hi, HiHi limits shall generate alarm or not.

#### 9.3.1.5 Pulse input channel (density frequency signal) alarms

Alarm text	Description
IO../Ch.. Under range	Parameter in engineering unit < LO_scale
IO../Ch.. Over range	Parameter in engineering unit > HI_scale
IO../Ch.. LoLo limit	Parameter in engineering unit < LoLo alarm limit
IO../Ch.. Lo limit	Parameter in engineering unit < Lo alarm limit
IO../Ch..Hi limit	Parameter in engineering unit > Hi alarm limit
IO../Ch..HiHi limit	Parameter in engineering unit > HiHi alarm limit

#### NOTE

It is operator selectable in the signal setup menu if the under range, over range and Lo, LoLo, Hi, HiHi limits shall generate alarm or not.

**9.3.1.6 Analog output (4-20 mA) channel alarms**

Alarm text	Description
IO../Ch.. Under range	Parameter in engineering unit < LO_scale
IO../Ch.. Over range	Parameter in engineering unit > HI_scale
IO../Ch.. LoLo limit	Parameter in engineering unit < LoLo alarm limit
IO../Ch.. Lo limit	Parameter in engineering unit < Lo alarm limit
IO../Ch..Hi limit	Parameter in engineering unit > Hi alarm limit
IO../Ch..HiHi limit	Parameter in engineering unit > HiHi alarm limit

**NOTE**

It is operator selectable in the signal setup menu if the under range, over range and Lo, LoLo, Hi, HiHi limits shall generate alarm or not.

**9.3.1.7 Pulse output channel alarms**

Alarm text	Description
IO../Ch.. Pulse output overload	Number of pulses to be output > 10 sec * max. output frequency

This alarm may appear if a digital output is configured to output pulses proportional to total and the K-factor (volume/pulses) is improperly set. If the number of accumulated pulses to be output is more than the number of pulses the flow computer capable to output at maximum frequency during 10 seconds then pulse output overload alarm appears.

**9.3.1.8 Modbus (serial communication) channel alarms**

Alarm text	Description
Str.. data update timeout	No new data is received within the timeout time.

This alarm appears if the Modbus channel signal is not updated (not written by external device) within the timeout time specified in the signal setup menu for that channel.

## 9.3.2 Metering stream alarms

### 9.3.2.1 Calculation alarms

This type of alarms related to the calculation algorithm implemented for particular flow calculation. The alarms and the consequences in the flow calculation listed in the table below.

Alarm text	Cause of alarm	Consequences
Gas composition out of range	The total of the natural gas component concentrations received on Modbus link is outside the 95 ... 105 % range	Alarm and keypad composition is used in the calculation
Gas quality out of range	One or more component concentration is outside the range defined in the calculation standard (e.g. AGA8).	Alarm but the calculation proceeds.
Gas quality out of extended range	One or more component concentration is outside the extended range defined in the calculation standard (e.g. AGA8).	Alarm and the calculation proceeds.
Turbine input error	Error in the main and check pulse train ratio.	Alarm but the calculation proceeds.
dP/P ratio out of range	The dP/P ratio out of the range determined by the standard.	Alarm but the calculation proceeds.
Pipe diameter out of the range	The pipe diameter out of the range determined by the standard.	Alarm but the calculation proceeds.
Orifice diameter out of the range	The orifice diameter out of the range determined by the standard.	Alarm but the calculation proceeds.
Beta ratio out of the range	The beta ration out of the range determined by the standard.	Alarm but the calculation proceeds.
Reynolds number out of the range	The Reynolds number out of the range determined by the standard.	Alarm but the calculation proceeds.
ISO5167 calculation fail	No convergence is reached in the ISO 5167 calculation within 10 iterative cycle.	Alarm and the calculation stops.
AGA8 calculation fail	No convergence is reached in the AGA 8 calculation within 10 iterative cycle.	Alarm and the calculation stops.

I/O channel signal representing flow (for example differential pressure or pulse input from turbine meter) has no keypad value. In case of failure of this kind of signals the flow calculation is stopped.

I/O signal other then flow signal (for example pressure or temperature) has keypad value. In case of failure of this kind of signal the flow calculation is continued with the keypad value of the signal.

The complete list of alarms and events listed in 9.3.4.

### 9.3.3 Common alarm and status output

#### 9.3.3.1 Common alarm

A common alarm is defined in UNIFLOW-200.

If any of the I/O or metering stream alarm is active then the common alarm becomes active as well.

The common alarm can be assigned to a digital output channel providing alarm signal for external devices.

The alarm LED on the front panel and the common alarm output change their state as indicated in the table below.

Common alarm	Alarm LED	Alarm output
unacknowledged alarm exists	flashing red	open(*)
acknowledged alarm only exists	constant red	open(*)
no alarm	not lit	closed(*)

(\*) The digital output can be configured to be normally open or normally closed.

#### 9.3.3.2 Status output

The run LED on the front panel and the change over voltage free contact output is provided to signal the operational status/fault of the flow computer.

The run LED and the status output change their state as indicated in the table below.

Flow computer status	RUN LED	Status output	
		In operation output	In fault output
Operating	lit	closed	open
Faulty	not lit	open	closed

### 9.3.4 Alarm list

Potential alarms in UNIFLOW-200 are listed in the table below.

Entry is created in the **alarmlog.txt** file when any of these alarms appear (SET), acknowledged (ACK) and disappear (CLR).

I/O Channel related alarms

No.	Prefix	Alarm	Description
1	IOn/Chm	Data update timeout	No new data is received within the timeout time.
2	IOn/Chm	Hi limit	Measured value > Hi alarm limit
3	IOn/Chm	HiHi limit	Measured value > HiHi alarm limit
4	IOn/Chm	IO channel failure	Channel data is failed to read
5	IOn/Chm	Lo limit	Measured value < Lo alarm limit
6	IOn/Chm	LoLo limit	Measured value < LoLo alarm limit



7 IOn/Chm	Over range	Measured value > Hi scale
8 IOn/Chm	Pulse input overload	Measured frequency > 12 kHz
9 IOn/Chm	Pulse output overload	Pulses to be output requires more then 10 s
10 IOn/Chm	Under range	Measured value < Lo scale

### Stream related alarms

No.	Prefix	Alarm	Description
1	Strn	AGA8 calculation fail	No convergence is reached in the AGA 8 calculation within 10 iterative cycles.
2	Strn	AGA8 extended over-range	Gas composition out of the extended AGA8 range
3	Strn	AGA8 over-range	Gas composition out of the AGA8 range
4	Strn	Base density out of range	Base density out of the range determined by the standard
5	Strn	Beta ratio out of the range	The beta ratio out of the range determined by the standard.
6	Strn	Critical over load	UVOL flowrate > $1.5 \cdot t_m \cdot q_{max}$
7	Strn	CVOL FR above prem.limit	Corrected volume flow rate above premium limit
8	Strn	CVOL FR above prem.limit	Corrected volume flow rate premium limit warning
9	Strn	Densitometer error	Error in densitometer signal
10	Strn	Density calculation fail	No convergence is reached in the density calculation within 10 iterative cycles.
11	Strn	Density converg error	Density calculation convergence error
12	Strn	Density discrepancy	Deviation between the densities measured in two densitometers > deviation limit.
13	Strn	dP cut-off active	Measured dP < dP cut-off limit
14	Strn	dP transmitter discrepancy	Deviation between the differential pressures measured at different channels > deviation limit.
15	Strn	dP/P ratio out of range	The dP/P ratio out of the range determined by the standard
16	Strn	Dynamic viscosity error	Dynamic viscosity error
17	Strn	ENGY FR above prem.limit	Energy flow rate above premium limit
18	Strn	ENGY FR above prem.limit	Energy flow rate premium limit warning
19	Strn	Flowrate cut-off active	$0 < \text{UVOL flowrate} < q_{\text{cut-off}}$
20	Strn	Gas composition out of range	The total of the natural gas component concentrations received on Modbus link is outside the 95 ... 105 % range
21	Strn	Gas quality out of extended range	One or more component concentration is outside the extended range defined in the calculation standard (e.g. AGA8).
22	Strn	Gas quality out of range	One or more component concentration is outside the range defined in the calculation standard (e.g. AGA8).

23 Strn	Gas quality update timeout	No new gas composition data is received within the timeout time.
24 Strn	Increment OOR	Integration increment out of range
25 Strn	Invalid fluid	Invalid fluid selection
26 Strn	ISO5167 calculation fail	No convergence is reached in the ISO 5167 calculation within 10 iterative cycles.
27 Strn	Joule-Thomson Err.	Joule-Thomson coefficient calculation error
28 Strn	Line dens. error	Line density error
29 Strn	Mass FR above prem.limit	Mass flow rate above premium limit
30 Strn	Mass FR above prem.limit	Mass flow rate premium limit warning
31 Strn	Modbus slave error	Modbus slave error
32 Strn	NGL/LPG Consistency Error	NGL/LPG calculation consistency error
33 Strn	NGL/LPG Ctl Error	NGL/LPG Ctl error
34 Strn	NGL/LPG Ctl iteration Error	NGL/LPG Ctl iteration error
35 Strn	NGL/LPG Gamma60 Error	NGL/LPG calculation gamma60 error
36 Strn	NGL/LPG Gamma60 iteration Error	NGL/LPG calculation gamma60 iteration error
37 Strn	NGL/LPG range Error	NGL/LPG calculation range error
38 Strn	NGL/LPG Tr > Tc Error	NGL/LPG Tr > Tc error
39 Strn	Orifice diameter out of the range	The Orifice diameter out of the range determined by the standard.
40 Strn	Out of range PT	Pressure and tempearture out of range
41 Strn	Over load	UVOL flowrate > $t_m * q_{max}$ ( $t_m$ = max. load, %)
42 Strn	Over range	UVOL flowrate > $q_{max}$
43 Strn	P2/P ratio out of range	The P2/P ratio out of the range determined by the standard
44 Strn	Pipe diameter out of the range	The pipe diameter out of the range determined by the standard.
45 Strn	Press. > Steam sat. press.	Pressure > Steam saturation pressure
46 Strn	Pressure extend OOR	Pressure out of extended range
47 Strn	Pressure OOR	Pressure out of range
48 Strn	Product selection failure	Failed to determine the type of refined product on the basis of base density
49 Strn	Pulse input error	Error in the main and check pulse train ratio.
50 Strn	Reynolds number out of the range	The Reynolds number out of the range determined by the standard
51 Strn	Steam calculation failed	Steam calculation failed
52 Strn	Steam calculation warning	Steam calculation warning
53 Strn	Steam sat. press. alarm	Steam saturation pressure alarm
54 Strn	Structural dP overload	Differential pressure > structural maximum dP for Annubar
55 Strn	Temperature out of extended	The temperature out of the extended range

	range	determined by the standard
56 Strn	Temperature out of range	The temperature out of the range determined by the standard
57 Strn	Transmitter setting failure	Failed to set the transmitter range
58 Strn	Under range	UVOL flowrate < qmin
59 Strn	UVOL FR above prem.limit	Uncorrected volume flow rate above premium limit
60 Strn	UVOL FR above prem.limit	Uncorrected volume flow rate premium limit warning
61 Strn	VCR out of range	Volume correction factor out of range
62 Strn	Water not liquid	Error in water-steam phase calculation

### 9.3.5 Event list

Events in UNIFLOW-200 are listed in the table below.

Entry is created in the **eventlog.txt** file when any of these events appear.

No.	Prefix	Alarm	Description
1	date/time	Application software update	Application software updated
2	date/time	Date/time downloaded	Date/time updated via Modbus
3	date/time	DST off	Daylight saving time period ended (European DST rule is followed)
4	date/time	DST off failed	Failed to end daylight saving time period
5	date/time	DST on	Daylight saving time period started (European DST rule is followed)
6	date/time	DST on failed	Failed to start daylight saving time period
7	date/time	Engineer logged in	Operator at engineer password level logged in
8	Strn	General reset	All the parameters, totals, alarms, event are cleared for all streams
9	date/time	Guest logged in	Operator at guest password level logged in
10	date/time	IP address conflict	IP address conflict
11	Strn	New gas composition received	New gas composition received
12	date/time	no. of calc. cycles	Number of calculation cycles
13	date/time	Operator logged in	Operator at operator password level logged in
14	date/time	Parameter setup aborted	Parameter setup aborted
15	date/time	Parameter setup start	Operator entered Parameters menu
16	date/time	Parameter setup stop	Operator left Parameters menu
17	date/time	Power failure	Power failure or power off
18	date/time	Remote parameter setup	Parameters are modified via ethernet interface
19	Strn	Totals reset	Totals are cleared to the selected streams
20	date/time	Warm start	Flow computer restarted after power on or application download
21	date/time	Watchdog restart	Flow computer restarted from watchdog circuit

### 9.3.6 Download log

Gas composition downloaded into UNIFLOW-200 is stored in the **downloadlog.txt** file.  
The structure of the file is as follows.

In case of measuring natural gas using Modbus Daniel mode for the first stream:

Line 1.	Modbus registers (Modb. Daniel): ;7001;7002;7003;7004;7005;7006;7007;7008;7009;7010;7011;7012;7013;7014;7015;7016;7017;7018;7019;7020;7021;7022;7023;7024;7025;7026;
Line 2.	Parameters: ;N2;CO2;H2S;H2O;He;C1;C2;C3;nC4;iC4;nC5;iC5;nC6;nC7;nC8;nC9;nC10;O2;CO;H2;rRo;ICV;SCV;Ar;LD;BD;
Line n.	Timestamp Str1 ;gas composition data

In case of measuring natural gas using Modbus STD1 mode for all streams:

Line 1.	Modbus registers (Modb. STD1): ;818;820;822;824;826;828;830;832;834;836;838;840;842;844;846;848;850;852;854;856;858;860;
Line 2.	Parameters: ;N2;CO2;H2S;H2O;He;C1;C2;C3;nC4;iC4;nC5;iC5;nC6;nC7;nC8;nC9;nC10;O2;CO;H2;RD;ICV;
Line n.	Timestamp Str1-8 ;gas composition data

In case of measuring natural gas using Modbus STD2 mode for the first stream:

Line 1.	Modbus registers (Modb. STD2): ;878;880;882;884;886;888;890;892;894;896;898;900;902;904;906;908;910;912;914;916;918;920;870;872;874;876;
Line 2.	Parameters: ;N2;CO2;H2S;H2O;He;C1;C2;C3;nC4;iC4;nC5;iC5;nC6;nC7;nC8;nC9;nC10;O2;CO;H2;RD;ICV;SCV;Ar;LD;BD
Line n.	Timestamp Str1 ;gas composition data

In case of measuring coke oven gas using Modbus Daniel mode for the first stream:

Line 1.	Modbus registers (Modb. Daniel): ;7001;7002;7003;7004;7006;7007;7008;7018;7019;7020;7028;7029;
Line 2.	Parameters: ;N2;CO2;H2S;H2O;C1;C2;C3;O2;CO;H2;Ammonia;Benzene;
Line n.	Timestamp Str1 ;gas composition data

In case of measuring coke oven gas using Modbus STD2 mode for the first stream:

Line 1.	Modbus registers (Modb. STD2): ;878;880;882;884;888;890;892;912;914;916;1310;1312;
Line 2.	Parameters: ;N2;CO2;H2S;H2O;C1;C2;C3;O2;CO;H2;Ammonia;Benzene;
Line n.	Timestamp Str1 ;gas composition data

In case of measuring blast furnace gas using Modbus Daniel mode for the first stream:

Line 1.	Modbus registers (Modb. Daniel): ;7001;7002;7004;7019;7020;
Line 2.	Parameters: ;N2;CO2;H2O;CO;H2;
Line n.	Timestamp Str1 ;gas composition data

In case of measuring blast furnace gas using Modbus STD2 mode for the first stream:

Line 1.	Modbus registers (Modb. STD2): ;878;880;884;914;916;
Line 2.	Parameters: ;N2;CO2;H2O;CO;H2;
Line <i>n</i> .	Timestamp Str1 ;gas composition data

## 9.4 Tests

The Test menu is intended for quick check of the I/O signals of the flow computer.

Entering Tests menu does not interrupt the flow calculation of the metering streams however it may affect the output signals.

### NOTE

Remove all the field output signal connectors from the flow computer before entering the Test menu. The test values of the output signals (current on the 4-20 mA output channel and state on the digital output channel) set in the Tests menu will appear on the output terminals of the flow computer. These artificial outputs may disturb the normal operation of the equipment connected to the flow computer.

There are separate data pages for each I/O board inserted.

Information displayed on the data pages are shown on the figures below.

### 9.4.1 Tests – ANI4PT2 board

Route in the menu tree:

Tests      Board n.

where  $n$             number of slots the board is inserted

Function of the F keys on the Tests – ANI4PT2 board data pages

**Menu** returns to the parent menu

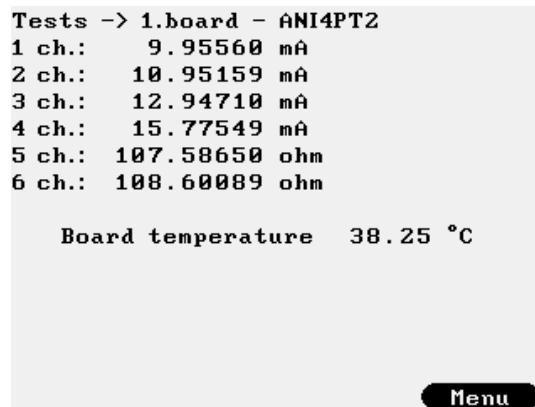


Figure 9-131 Tests – ANI4PT2 board data page

The current in mA and the resistance in Ohms are indicated for each channel. The temperature of the board inside the instrument case is also indicated.

### 9.4.2 Tests – ANI8 board

Route in the menu tree:

Tests      Board n.

where  $n$       number of slots the board is inserted

Function of the F keys on the Tests – ANI8 board data pages

**Menu** returns to the parent menu

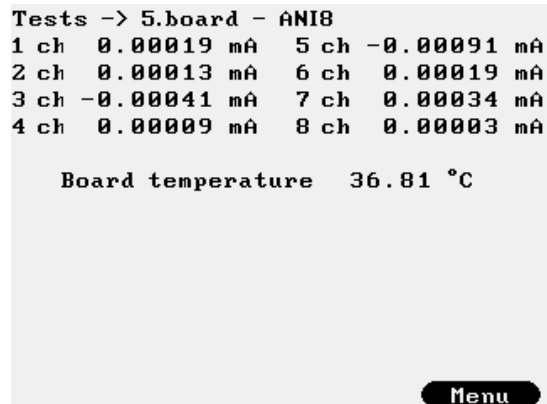


Figure 9-132 Tests – ANI8 board data page

The current in mA is indicated for each channel.

The temperature of the board inside the instrument case is also indicated.

### 9.4.3 Tests – PT4 board

Route in the menu tree:

Tests Board n.

where  $n$  number of slots the board is inserted

Function of the F keys on the Tests – PT4 board data pages

**Menu** returns to the parent menu

```
Tests -> 4.board - PT4
1 ch.: 119.24801 ohm
2 ch.: 120.63384 ohm
3 ch.: 119.39378 ohm
4 ch.: 119.01228 ohm
```

Menu

Figure 9-133 Tests – PT4 board data page

The resistance in Ohms is indicated for each channel.

The temperature of the board inside the instrument case is also indicated.



### 9.4.4 Tests – AODIO484 board

Route in the menu tree:

Tests	Board n.
-------	----------

where  $n$  number of slots the bard is inserted

Function of the F keys on the Tests – AODIO484 board data page

↓ select the next field for editing

↑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Menu** returns to the parent menu

Tests -> 3.board - AODIO484			
1 ch.	12.861	mA	
2 ch.	9.4077	mA	
3 ch.	20.500	mA	
4 ch.	8.0457	mA	
5 ch.	o	13 ch.	c
6 ch.	o	14 ch.	o
7 ch.	o	15 ch.	o
8 ch.	o	16 ch.	o
9 ch.	o		
10 ch.	o		
11 ch.	o		
12 ch.	o		
<div> <div>Menu</div> <div>Change</div> <div>↓</div> <div>↑</div> </div>			

Figure 9-134 Tests – AODIO484 board data page

The current in mA is indicated for the analog output channels.

The state (o for open or c for closed) is indicated for digital input and output channels.

Selecting analog output channel any current from 0 to 21 mA can be entered. UNIFLOW-200 drives the selected output to the set current.

Selecting digital output channel the state of the channel can be set to open or closed.

Leaving the data page UNIFLOW-200 restores the outputs to the value determined by the application.

### 9.4.5 Tests – PDIO484 board

Route in the menu tree:

Tests	Board n.
-------	----------

where  $n$  number of slots the bard is inserted

Function of the F keys on the Tests – PDIO484 board data page

⇓ select the next field for editing

⇑ select the previous field for editing

**Change** modify the selected data field

**OK** Confirm the selection

**Menu** returns to the parent menu

Tests -> 2.board - PDIO484			
Ch.	Signal	Frequency	Pulse/Ref.
1	5V	1000.011	25877
			2174117259
2	5V	1000.011	19158
			2174142978
3	5V	1000.011	19181
			2174159813
4	5V	1000.011	19203
			2174184372
5 ch.		o 13 ch.	0
6 ch.		o 14 ch.	o
7 ch.		0 15 ch.	o
8 ch.		o 16 ch.	o
Menu			

Tests -> 2.board - PDIO484			
3	5V	1000.013	2584636708
			429680
4	5V	1000.013	2584653542
			429702
			2584678101
5 ch.		o 13 ch.	0
6 ch.		o 14 ch.	o
7 ch.		0 15 ch.	o
8 ch.		o 16 ch.	o
9 ch.		o	
10 ch.		o	
11 ch.		o	
12 ch.		o	
Menu			

Figure 9-135 Tests – PDIO484 board data page

The frequency and the pulse counter for the main and check pulse inputs are indicated for the pulse input channels.

The state (o for open or c for closed) is indicated for digital input and output channels.

Selecting digital output channel the state of the channel can be set to open or closed.

Leaving the data page UNIFLOW-200 restores the outputs to the value determined by the application.

## 9.5 Calibration

The Calibration menu is reserved for factory use and for use in the laboratory of the authority calibrating the flow computer. It is accessible with special password only.

## 9.6 Help

The contact details of the manufacturer (phone, fax, email address, website address) are available on this page.

## 9.7 Language/Nyelv/Язык

Route in the menu tree:

Main	Language/Nyelv/Язык.
------	----------------------

Function of the F keys on the Language change data page

**Change** Modify the language

**OK** Confirm the selection

**Menu** Returns to the parent menu

This menu item is to change the working language of the flow computer.

Highlighting the menu item and pressing key ⇨ language change display opens.

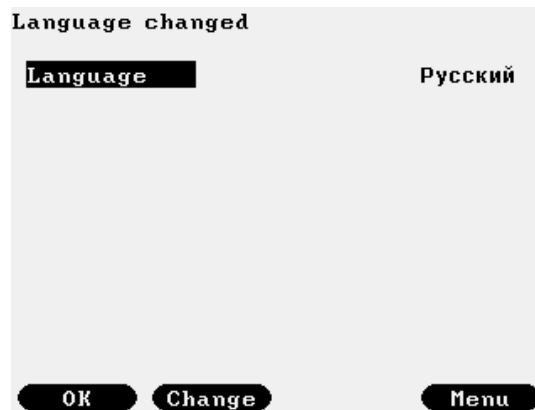


Figure 9-136 Language change display

Available languages are:

- English;
- Hungarian (Magyar);
- Russian (Русский)

After selecting the appropriate language and confirming the selection the flow computer completely change the working language.

The language change will change to the appropriate language:

- display text;
- entries in the alarm and event log and archive records;
- text on the reports;

Changing the working language will not affect the operation of the flow computer. The setup made in one language remains valid after the other display language is selected.

#### CAUTION

The records made in the alarm and event log and in the archive record files before the changing of the language will not be changed to other language.

However all the subsequent records will be done on the language activated.

It is recommended to make a general reset after the changing of the language setting. It will ensure to have single language records in the log files.

## 10 Communication

UNIFLOW-200 equipped with one 100 MHz Ethernet port and maximum of three serial communication ports (Com1, Com2, Com3) allowing integration of the flow computer into data acquisition systems.

UNIFLOW-200 is the slave device in the communication. It means that UNIFLOW-200 can be queried for data and it will respond if the queried registers are defined. Metering data can be read from UNIFLOW-200 flow computer via standard RS232, RS485, RS422 serial link and via 10/100 Ethernet link.

Communication protocols implemented:

Com1, Com2, Com3 ports:	MODBUS
Ethernet port:	MODBUS over TCP

Modbus function codes implemented:

- 3 (0x03) read multiply registers
- 16 (0x10) write multiply registers

Port function of the serial port can be set to:

- STD Modbus slave RTU (2 bytes/register)
- STD Modbus slave ASCII (2 bytes/register)
- Daniel slave RTU (4 bytes/register)
- Daniel slave ASCII (4 bytes/register)

Port function for the serial port shall be set to STD Modbus slave to be able to read data listed in point 10.5 (including 10.5.1., 10.5.2. and 10.5.3.) in standard Modbus format.

Port function for the serial port shall be set to Daniel Modbus slave to be able to read data listed in point 10.6 (including 10.6.1., 10.6.2. and 10.6.3.) in Daniel/Omni/Enron Modbus format.

Register assignment for Ethernet port shall be set to STD MODBUS to be able to read data listed in point 10.5 (including 10.5.1., 10.5.2. and 10.5.3.) in standard Modbus format.

Register assignment for Ethernet port shall be set to Daniel to be able to read data listed in point 10.6 (including 10.6.1., 10.6.2. and 10.6.3.) in Daniel/Omni/Enron Modbus format.

Special functions implemented for polling ultrasonic flow meters:

- Flowsic-600 master (for Sick-Maihak Flowsic-600 ultrasonic meter)
- QSonic slave (for Instromet ultrasonic meters)
- Daniel US master (for Daniel ultrasonic meters)
- Flexim US master (for Flexim ultrasonic meters)
- Siemens US master (for Siemens ultrasonic meters)
- Panam US master (for Panametrics ultrasonic meters)
- Khrono US master (for Khrono ultrasonic meters)

In this special functions not only the flow information (flowrate and/or gas velocity) but the diagnostic information is read from the meters as well.

Special functions implemented for polling gas chromatographs:

- Daniel GC master (for Daniel GC)
- ABB GC master (for ABB GC)
- Yamatake GC master (for Yamatake GC)
- YOKOGAWA GC master (for YOKOGAWA GC)
- ABB2 GC master (for ABB GC)

If one of the com port is configured for chromatograph polling then UNIFLOW-200 will read the natural gas composition from the gas chromatograph and the gas composition will be used in the gas properties calculation. See 9.2.2.1.1.1. and 9.2.4.1.

The serial ports and the USB port can be used as printer port to transfer the archive data to external device (file dumping to serial printer, serial port of PC or USB pen drive). See details in 9.1.5.

The archive data files sent to the serial or USB port make use of UTF8 encoding. To display the archive data file on external device it shall be set accordingly. Otherwise some of the characters on the reports might not be displayed properly.

## 10.1 Serial link setup

The parameters of the serial link are setup in the Parameters/Interfaces/Com ports menu.

After selecting the port to be configured the type (RS232, RS485, RS422) is set together with the data flow parameters (data bits, stop bits, parity, etc.). Then the mode of communication is selected (STD Modbus or Daniel Modbus, RTU or ASCII). Finally the device address shall be set.

If the port type RS485 is set then the response delay can also be set. The default value is 1 ms which is suitable in most of the case but can be modified if required.

In case of RS232 and RS422 port type the response delay can not be set.

## 10.2 Ethernet link setup

The parameters of the Ethernet link are setup in the Parameters/Interfaces/Ethernet menu.

The IP address, the subnet mask and the default gateway should be set together with the Modbus device address.

The register mode can be set to STD or Daniel.

The protocol implemented is MODBUS over TCP.

The flow computer is capable to act as DHCP server if configured so.

## 10.3 Communication device address

If Daniel Modbus slave RTU or Daniel Modbus slave ASCII mode is selected then there are two ways to read the metering data from the flow computer for all 12 metering streams.

All data for all streams can be read on the base device address set in the com port setup menu.

At the same time all metering stream have its own device address and the metering data for a particular stream can be read on this particular device address.

The register address ranges and the device addresses are shown in the table below.

Stream	Registers on the base device address		Stream device address	Registers on the stream device address	
	Totals (4 bytes integer)	Other data (4 bytes float)		Totals (4 bytes integer)	Other data (4 bytes float)
1	5001 - 5148	7001 - 7099	base device address	5001 - 5148	7001 - 7099
2	5201 - 5348	7101 - 7199	base device address + 1	5001 - 5148	7001 - 7099
3	5401 - 5548	7201 - 7299	base device address + 2	5001 - 5148	7001 - 7099
4	5601 - 5748	7301 - 7399	base device address + 3	5001 - 5148	7001 - 7099
5	5801 - 5948	7401 - 7499	base device address + 4	5001 - 5148	7001 - 7099
6	6001 - 6148	7501 - 7599	base device address + 5	5001 - 5148	7001 - 7099
7	6201 - 6348	7601 - 7699	base device address + 6	5001 - 5148	7001 - 7099
8	6401 - 6548	7701 - 7799	base device address + 7	5001 - 5148	7001 - 7099
9	9001 - 9148	8001 - 8099	base device address + 8	5001 - 5148	7001 - 7099
10	9201 - 9348	8101 - 8199	base device address + 9	5001 - 5148	7001 - 7099
11	9401 - 9548	8201 - 8299	base device address + 10	5001 - 5148	7001 - 7099
12	9601 - 9748	8301 - 8399	base device address + 11	5001 - 5148	7001 - 7099

**Table 10-15 Communication device addresses**

**NOTE**

In Daniel Modbus slave mode one UNIFLOW-200 occupies 12 consecutive device addresses. If other devices connected to the serial link (e.g. on RS485 bus) the setting of the device addresses should take it into consideration.

## 10.4 Protocol implementation

### 10.4.1 Implemented Modbus command codes

#### 10.4.1.1 Read multiply registers (code: 3)

Query:

A	F	RAH	RAL	RNH	RNL	CH	CL
---	---	-----	-----	-----	-----	----	----

Response:

A	F	BN	D1	...	Dn	CH	CL
---	---	----	----	-----	----	----	----

#### 10.4.1.2 Write multiply registers (code: 16)

Query:

A	F	RAH	RAL	RNH	RNL	BN	D1	...	CH	CL
---	---	-----	-----	-----	-----	----	----	-----	----	----

Response:

A	F	RAH	RAL	RNH	RNL	CH	CL
---	---	-----	-----	-----	-----	----	----

where:

A - device address

F - function code

RAH, RAL - starting register address, in high byte, low byte order

RNH, RNL - number of registers, in high byte, low byte order

BN - number of bytes (from 0 to 255)

D1 ... Dn - data bytes,  $n = 2 * \text{number of registers}$

CH, CL - CRC check sum, in high byte, low byte order

### Examples

Read stream 6 instantaneous flow data and alarm registers (18 registers) from the flow computer with device address 17 (0x11)

Query

device address	function code	starting register (high byte)	starting register (low byte)	number of register (high byte)	number of register (low byte)	checksum (2 bytes)
0x11	0x03	0x01	0x2c	0x00	0x12	CRC

Response

device address	function code	number of bytes	data bytes (36 bytes)	checksum (2 bytes)
0x11	0x03	0x30	...	CRC



Write zero to the first 4 gas component concentration register

#### Query

device address	function code	starting register (high byte)	starting register (low byte)	number of register (high byte)	number of register (low byte)	byte count (1 byte)	data (16 bytes)	checksum (2 bytes)
0x11	0x10	0x03	0x32	0x00	0x08	0x10	...	CRC

#### Response

device address	function code	starting register (high byte)	starting register (low byte)	number of register (high byte)	number of register (low byte)	checksum (2 bytes)
0x11	0x10	0x03	0x32	0x00	0x08	CRC

### 10.4.2 Calculation of CRC check sum

The polynomial value used in CRC calculation is 0xa001.

CRC is calculated in steps as follows:

1. Load a 16-bit register with 0xffff hex (all 1's). Call this the CRC register.
2. Exclusive OR the first 8-bit byte of the message with the high-order byte of the 16-bit CRC register, putting the result in the CRC register.
3. Shift the CRC register one bit to the right (toward the LSB), zero-filling the MSB. Extract and examine the LSB.
4. (If the LSB was 0): Repeat Step 3 (another shift).
5. (If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001).
6. Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8-bit byte will have been processed.
7. Repeat the steps 2 to 6 with the next byte of the message until all the bytes are processed.
8. The result is the CRC of the message.

### 10.4.3 Data types in the Modbus registers

#### 10.4.3.1 8 bit binary unsigned integer

They are stored in the low order or high order byte of the Modbus registers.

Range: from 0 to 255 (0x00 to 0xff)

Data stored in this form are the parts of the date for example.

In some cases bits of this data type have separate interpretation for example in alarm registers.

#### 10.4.3.2 16 bit binary unsigned integer

They are stored in the Modbus registers.

Range: from 0 to 65535 (0x0000 to 0xffff)

#### 10.4.3.3 32 bit binary signed integer

They are stored in two Modbus registers.

Range: from -2 147 483 648 to 2 147 483 648 (0x0000 to 0x7fffffff positive numbers and 0x80000000 to 0xffffffff negative numbers)

Numbers are stored as follows:

31	30			0
S	absolute value of the number			
High byte		Low byte + 2	Low byte + 1	Low byte
low order Modbus register			high order Modbus register	

The S sign bit is 0 if the number is positive and 1 if the number is negative.

As far as number is stored not in 2's complements form both +0 and -0 are valid.

#### 10.4.3.4 Floating point number

Most of the data are stored in floating point format.

The format used in the flow computer for floating point number is equivalent to the IEEE 754/1985 Short real (single precision) format.

Numbers are stored in three parts: sign, exponent and mantissa on four bytes. Floating point numbers are stored in two Modbus registers.

Range:  $\pm(8.43 \cdot 10^{-37} \dots 3.4 \cdot 10^{-38})$ , and the numbers are accurate up to 7 decimal digits.

Numbers are stored as follows:

31	30	23	22	0
S	Exponent		Mantissa	
High byte		Low byte	High byte	Low byte
High order Modbus register			Low order Modbus register	

The S sign bit is 0 if the number is positive and 1 if the number is negative.

As far as number is stored not in 2's complements form both +0 and -0 are valid.

-0 is not interpreted as number. It is used for special purposes in the flow computer.

Mantissa is stored in normalized form without the most significant bit which is always 1. It means that the 22nd bit is  $2^{-1}$ , the 21st bit is  $2^{-2}$  and the 0. bit is  $2^{-23}$

The exponent field holds the exponent value biased by 127. The bias provides that the exponent field is always positive. The range of the exponent is from -126 to +127.

Floating point number =  $(-1)^S \cdot (1 + \text{bit}_{22} \cdot 2^{-1} + \text{bit}_{21} \cdot 2^{-2} + \dots + \text{bit}_0 \cdot 2^{-23}) \cdot 2^{\text{Exponent}-127}$

## 10.5 Standard Modbus register map (2 byte/register)

Modbus register	Register type	Description	Comment
0	ReadOnly	Str1. (physical stream) data	60 reg./stream
...	ReadOnly	...	
420	ReadOnly	Str8. (physical stream) data	

Offset address	Physical stream data	Explanation	
0-1	pressure	(floating point numbers)	
2-3	temperature1 (main/forward)		
4-5	temperature2 (check/reverse)		
6-7	density		
8-13	1-6. alarm register	alarm code (H)	signal code (L)
		0. bit: LO_range	temperature1 : 0
		1. bit: HI_range	temperature2 : 1
		2. bit: LO_limit	pressure: 2
		3. bit: HI_limit	diff.pressure: 3
		4. bit: cut-off	density: 6
			flow signal: 7
14	7. alarm register	FF (H)	FF (L)
15	8. alarm register	temp. main (H)	hőm. segéd (L)
16	9. alarm register	density (H)	nyomás (L)
		0. bit: LO_range	0. bit: LO_range
		1. bit: HI_range	1. bit: HI_range
		2. bit: LO_limit	2. bit: LO_limit
		3. bit: HI_limit	3. bit: HI_limit
		4. bit: LOLO_limit	4. bit: LOLO_limit
		5. bit: HIHI_limit	5. bit: HIHI_limit
		6. bit: active	6. bit: active
		7. bit: valid	7. bit: valid
17	10. alarm register	stream (H)	flow signal (L)
		0. bit: range	0. bit: LO_range
		1. bit: composition	1. bit: HI_range
		2. bit: method	2. bit: LO_limit
		3. bit: check	3. bit: HI_limit
		4. bit: quantity	4. bit: LOLO_limit
		5. bit: dp/p ratio	5. bit: HIHI_limit
		6. bit: cut-off	6. bit: active
		7. bit: valid	7. bit: valid
18-19	base volume flowrate	(floating point numbers)	
20-21	mass flowrate		
22-23	energy flowrate		
24-25	base volume cumulative total	rollover at 10 000 000	
26-27	mass cumulative total	rollover at 10 000 000	
28-29	energy cumulative total	rollover at 10 000 000	
42-43	premium volume cumulative total	rollover at 10 000 000	
44-45	premium mass cumulative total	rollover at 10 000 000	
46-47	premium energy cumulative total	rollover at 10 000 000	

480	ReadOnly	Str9. (virtual stream) data	(floating point numbers)	42 reg./stream
...	ReadOnly	...		
606	ReadOnly	Str12. (virtual stream) data		

Offset address	Virtual stream data	Explanation
0-1	base volume flowrate	
2-3	mass flowrate	
4-5	energy flowrate	
6-7	base volume cumulative total	rollover at 10 000 000
8-9	mass cumulative total	rollover at 10 000 000
10-11	energy cumulative total	rollover at 10 000 000
24-25	prem. volume cumulative tot.	rollover at 10 000 000
26-27	prem. mass cumulative total	rollover at 10 000 000
28-29	prem. energy cumulative total	rollover at 10 000 000

648	ReadOnly	Flow rates	(floating point numbers)	72 reg./stream
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Offset address	Stream flowrates (for quick access)	Explanation
0-1	Str1. base volume flowrate	
2-3	Str1. mass flowrate	
4-5	Str1. energy flowrate	
...	...	
66-67	Str12. base volume flowrate	
68-69	Str12. mass flowrate	
70-71	Str12. energy flowrate	

816-817	ReadWrite	Barometric pressure	(floating point numbers)	2 register
---------	-----------	---------------------	--------------------------	------------

818	ReadWrite	Natural gas components	(floating point numbers)	44 register
-----	-----------	------------------------	--------------------------	-------------

Offset address	Natural gas components	Explanation
0-1	Nitrogen [mol%]	Modb. STD1 If the source of gas composition selected as Modb. STD1 then gas composition downloaded into this register range will be used in the calculation. The range is common for all streams from 1 to 8
2-3	Carbon-dioxide [mol%]	
4-5	Hydrogen-sulfide [mol%]	
6-7	Water [mol%]	
8-9	Helium [mol%]	
10-11	Methane [mol%]	
12-13	Ethane [mol%]	
14-15	Propane [mol%]	
16-17	normal-Butane [mol%]	
18-19	iso-Butane [mol%]	
20-21	normal-Pentane [mol%]	
22-23	iso-Pentane [mol%]	
24-25	normal-Hexane [mol%]	
26-27	normal-Heptane [mol%]	
28-29	normal-Oktane [mol%]	
30-31	normal-Nonane [mol%]	
32-33	normal-Decane [mol%]	
34-35	Oxygen [mol%]	
36-37	Carbon-monoxide [mol%]	
38-39	Hydrogen [mol%]	
40-41	Relative density [ - ]	
42-43	Inferior calorific value [MJ/m <sup>3</sup> ]	

862	ReadWrite	timeout counter register *	1 register (integer)
-----	-----------	----------------------------	----------------------

\* When the timeout counter value exceeds the update timeout it causes an update timeout alarm. In this alarm condition the component data will be substituted with its keypad value in the subsequent calculations. The register block update automatically clears its own timeout counter register to zero.

863	ReadWrite	Date and time	5 register
-----	-----------	---------------	------------

Offset address	Time	Explanation	
0	alarm, second (0-59)	second alarm (H)	second (L)
1	alarm, minute (0-59)	minute alarm (H)	minute (L)
2	alarm, hour (0-23)	hour alarm (H)	hour (L)
3	day (1-31), week day (1-7)	month day (H)	week day (L)
4	year (0-99), month (1-12)	year (H)	month (L)

870	ReadWrite	Natural gas components - 1 <sup>th</sup> stream	(floating point numbers) 54 register
.....	ReadWrite		
1248	ReadWrite	Natural gas components - 8 <sup>th</sup> stream	

Offset address	Natural gas components	Explanation Modb. STD2
0-1	Superior calorific value	If the source of gas composition selected as Modb. STD2 then gas composition downloaded into this register range will be used in the calculation.
2-3	Argon, mol%	
4-5	Line density	There are separate address range for each of the streams to download the gas composition.
6-7	Base density	
8-9	Nitrogen [mol%]	
10-11	Carbon-dioxide [mol%]	
12-13	Hydrogen-sulfide [mol%]	
14-15	Water [mol%]	
16-17	Helium [mol%]	
18-19	Methane [mol%]	
20-21	Ethane [mol%]	
22-23	Propane [mol%]	
24-25	normal-Butane [mol%]	
26-27	iso-Butane [mol%]	
28-29	normal-Pentane [mol%]	
30-31	iso-Pentane [mol%]	
32-33	normal-Hexane [mol%]	
34-35	normal-Heptane [mol%]	
36-37	normal-Oktane [mol%]	
38-39	normal-Nonane [mol%]	
40-41	normal-Decane [mol%]	
42-43	Oxygen [mol%]	
44-45	Carbon-monoxide [mol%]	
46-47	Hydrogen [mol%]	
48-49	Relative density [ - ]	
50-51	Inferior calorific value	
52	timeout counter register *	1 register (integer)
53	-	

\* When the timeout counter value exceeds the update timeout it causes an update timeout alarm. In this alarm condition the component data will be substituted with its keypad value in the subsequent calculations. The register block update automatically clears its own timeout counter register to zero.

The unit of densities and calorific values depends on the selection of metric or imperial units (see the chapter 9.2.2.1)

	METRIC UNIT	IMPERIAL UNIT
gas components	mole %	mole%
line density	kg/m <sup>3</sup>	lbs/CF
base density	kg/m <sup>3</sup>	lbs/CF
relative density	-	-
calorific value	MJ/m <sup>3</sup>	BTU/SCF

1844	ReadOnly	(IO1 Ch1) analog input	(floating point numbers) 3 reg./channel
...	ReadOnly	...	
1865	ReadOnly	(IO1 Ch8) analog input	
1868	ReadOnly	(IO2 Ch1) analog input	
...	ReadOnly	...	
1889	ReadOnly	(IO2 Ch2) analog input	
1892	ReadOnly	(IO3 Ch1) analog input	
...	ReadOnly	...	
1913	ReadOnly	(IO3 Ch8) analog input	
1916	ReadOnly	(IO4 Ch1) analog input	
...	ReadOnly	...	
1937	ReadOnly	(IO4 Ch8) analog input	

Offset address	Analog input signals (Quick access)	Explanation	
0	state, alarm	state (H)	alarm state (L)
			0. bit: LO_range
			1. bit: HI_range
			2. bit: LO_limit
			3. bit: HI_limit
			4. bit: LOLO_limit
			5. bit: HIHI_limit
			6. bit: active
			7. bit: valid
1-2	measured data		

2004	ReadOnly	Totals grouped together	72 reg. (32 bit signed integer numbers)
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2004	ReadOnly	Str1. (physical stream) totals	6 reg./stream
2010	ReadOnly	Str2. (physical stream) totals	
2016	ReadOnly	Str3. (physical stream) totals	
2022	ReadOnly	Str4. (physical stream) totals	
2028	ReadOnly	Str5. (physical stream) totals	
2034	ReadOnly	Str6. (physical stream) totals	
2040	ReadOnly	Str7. (physical stream) totals	
2046	ReadOnly	Str8. (physical stream) totals	
2052	ReadOnly	Str9. (virtual stream) totals	
2058	ReadOnly	Str10. (virtual stream) totals	
2064	ReadOnly	Str11. (virtual stream) totals	
2070	ReadOnly	Str12. (virtual stream) totals	

Offset address	Physical streams total	Explanation	
0-1	base volume cumulative total	rollover at 1 000 000 000	2 reg.
2-3	mass cumulative total	rollover at 1 000 000 000	
4-5	energy cumulative total	rollover at 1 000 000 000	

2076	ReadOnly	Str1. (physical stream) line volume total	72 reg. (32 bit signed integer numbers) 2 reg./stream
2078	ReadOnly	Str2. (physical stream) line volume total	
2080	ReadOnly	Str3. (physical stream) line volume total	



2082	ReadOnly	Str4. (physical stream) line volume total	
2084	ReadOnly	Str5. (physical stream) line volume total	
2086	ReadOnly	Str6. (physical stream) line volume total	
2088	ReadOnly	Str7. (physical stream) line volume total	
2090	ReadOnly	Str8. (physical stream) line volume total	

Offset address	Physical streams total	Explanation
0-1	line volume cumulative total	rollover at 1 000 000 000 2 reg.

2100	ReadOnly	(IO1 Ch1) analog input	(floating point numbers) 3 reg./channel
...	ReadOnly	...	
2121	ReadOnly	(IO1 Ch8) analog input	
2124	ReadOnly	(IO2 Ch1) analog input	
...	ReadOnly	...	
2145	ReadOnly	(IO2 Ch2) analog input	
2148	ReadOnly	(IO3 Ch1) analog input	
...	ReadOnly	...	
2169	ReadOnly	(IO3 Ch8) analog input	
2172	ReadOnly	(IO4 Ch1) analog input	
...	ReadOnly	...	
2193	ReadOnly	(IO4 Ch8) analog input	
2196	ReadOnly	(IO5 Ch1) analog input	
...	ReadOnly	...	
2217	ReadOnly	(IO5 Ch8) analog input	.

2220	ReadOnly	(IO1 Ch1) analog input	3 reg./channel
...	ReadOnly	...	
2289	ReadOnly	(IO1 Ch24) analog input	
2292	ReadOnly	(IO2 Ch1) analog input	
...	ReadOnly	...	
2361	ReadOnly	(IO2 Ch24) analog input	
2364	ReadOnly	(IO3 Ch1) analog input	
...	ReadOnly	...	
2433	ReadOnly	(IO3 Ch24) analog input	
2436	ReadOnly	(IO4 Ch1) analog input	
...	ReadOnly	...	
2505	ReadOnly	(IO4 Ch24) analog input	
2508	ReadOnly	(IO5 Ch1) analog input	
...	ReadOnly	...	
2577	ReadOnly	(IO5 Ch24) analog input	

2580	ReadWrite	Ch1 Modbus analog input	3 reg./channel
...	ReadWrite	...	
2667	ReadWrite	Ch30 Modbus analog input	

Offset Címek	Analog input signals (Quick access)	Explanation	
0	state, alarms	state (H)	alarm state (L)
			0. bit: LO_range
			1. bit: HI_range
			2. bit: LO_limit
			3. bit: HI_limit
			4. bit: LOLO_limit
			5. bit: HIHI_limit
			6. bit: active
			7. bit: valid
1-2	measured data		

2700	ReadOnly	Line volume flowrate (Flowsic/Instromet US flow meter on Com1 port	(floating point numbers) 2 reg.
2702	ReadOnly	Com1 port, timeout counter register *	2 reg.

2708	ReadOnly	Line volume flowrate (Flowsic/Instromet US flow meter on Com2 port	2 reg.
2710	ReadOnly	Com2 port, timeout counter register *	2 reg.

2716	ReadOnly	Line volume flowrate (Flowsic/Instromet US flow meter on Com3 port	2 reg.
2718	ReadOnly	Com3 port, timeout counter register *	2 reg.

### CO2 emission data block, total length 176 Modbus registers

3000	ReadOnly	Str1. CO2 emission mass	(floating point numbers) 22 reg./stream
3022	ReadOnly	Str2. CO2 emission mass	
3044	ReadOnly	Str3. CO2 emission mass	
3066	ReadOnly	Str4. CO2 emission mass	
3088	ReadOnly	Str5. CO2 emission mass	
3110	ReadOnly	Str6. CO2 emission mass	
3132	ReadOnly	Str7. CO2 emission mass	
3154	ReadOnly	Str8. CO2 emission mass	

Offset address	CO2 emission data by streams	Explanation
0-1	Specific carbon content	
2-3	CO2 emission mass flowrate (instantaneous)	
4-5	CO2 emission, cumulative mass total	
6-7	CO2 emission, previous hour mass total	
10-11	CO2 emission, previous day mass total	
12-13	CO2 emission, previous month mass total	
14-15	CO2 emission, current hour mass total	
16-17	CO2 emission, current day mass total	
20-21	CO2 emission, current month mass total	

### General purpose register block, total length 120 Modbus registers

4000	ReadWrite	1. variable	(floating point numbers) 2+2 reg./variable
4002	ReadWrite	2. variable	
...		...	
4058	ReadWrite	30. variable	
4060	ReadWrite	1. variable timeout counter register *	
4062	ReadWrite	2. variable timeout counter register *	
...		...	
4118	ReadWrite	3. variable timeout counter register *	

\* When the timeout counter value of any particular Modbus signal exceeds the update timeout of that signal it causes an update timeout alarm. In this alarm condition if the Modbus signal is flow signal it will be substituted with zero (0), i.e. zero flow is assumed. If the Modbus signal is not flow signal it will be substituted with its keypad value in the subsequent calculations.

Register update of a variable automatically clears its own timeout counter register to zero.

9800	ReadOnly	Concentrations	32 reg. (floating point numbers)
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9800	ReadOnly	Str1. (physical stream) concentrations	4 reg./stream
9804	ReadOnly	Str2. (physical stream) concentrations	
9808	ReadOnly	Str3. (physical stream) concentrations	
9812	ReadOnly	Str4. (physical stream) concentrations	
9816	ReadOnly	Str5. (physical stream) concentrations	
9820	ReadOnly	Str6. (physical stream) concentrations	
9824	ReadOnly	Str7. (physical stream) concentrations	
9828	ReadOnly	Str8. (physical stream) concentrations	

Offset address	Physical streams total	Explanation
0-1	concentration v/v %	2 reg.
3-4	concentration m/m %	2 reg.

### 10.5.1 Accessing periodic totals

UNIFLOW-200 supports the reading of the periodic totals in one message for each stream separately in this register mode. All the periodic totals (120 registers) must be read in one message. Reading part of the totals is not supported.

The starting address of the periodic totals for stream n. calculated as follows:

$$\text{Starting address} = 20\,000 + 256 * (\text{stream number} - 1)$$

The total length of the data bytes in the response is 240 bytes (60 totals in floating point format, i.e. 120 Modbus registers).

20000	ReadOnly	Str1. periodic totals	120 reg./stream
20256	ReadOnly	Str2. periodic totals	
20512	ReadOnly	Str3. periodic totals	
20768	ReadOnly	Str4. periodic totals	
21024	ReadOnly	Str5. periodic totals	
21280	ReadOnly	Str6. periodic totals	
21536	ReadOnly	Str7. periodic totals	
21792	ReadOnly	Str8. periodic totals	
22048	ReadOnly	Str9. periodic totals	
22304	ReadOnly	Str10. periodic totals	
22560	ReadOnly	Str11. periodic totals	
22816	ReadOnly	Str12. periodic totals	

Offset address	Stream periodic totals (Arch1)	Explanation
0-1	base volume, previous hour	
2-3	base volume, previous 8 hour	
4-5	base volume, previous day	
6-7	base volume, previous month	
10-11	base volume, current hour	
12-13	base volume, current 8 hour	
14-15	base volume, current day	
16-17	base volume, current month	
20-21	mass, previous hour	
22-23	mass, previous 8 hour	
24-25	mass, previous day	
26-27	mass, previous month	
30-31	mass, current hour	
32-33	mass, current 8 hour	
34-35	mass, current day	
36-37	mass, current month	
40-41	energy, previous hour	
42-43	energy, previous 8 hour	
44-45	energy, previous day	
46-47	energy, previous month	
50-51	energy, current hour	
52-53	energy, current 8 hour	
54-55	energy, current day	

56-57	energy, current month	
60-61	premium base volume, previous hour	
62-63	premium base volume, previous 8 hour	
64-65	premium base volume, previous day	
66-67	premium base volume, previous month	
70-71	premium base volume, current hour	
72-73	premium base volume, current 8 hour	
74-75	premium base volume, current day	
76-77	premium base volume, current month	
80-81	premium mass, previous hour	
82-83	premium mass, previous 8 hour	
84-85	premium mass, previous day	
86-87	premium mass, previous month	
90-91	premium mass, current hour	
92-93	premium mass, current 8 hour	
94-95	premium mass, current day	
96-97	premium mass, current month	
100-101	premium energy, previous hour	
102-103	premium energy, previous 8 hour	
104-105	premium energy, previous day	
106-107	premium energy, previous month	
110-111	premium energy, current hour	
112-113	premium energy, current 8 hour	
114-115	premium energy, current day	
116-117	premium energy, current month	

Unit of measurement for the quantities listed in tables above:

	METRIC UNIT	IMPERIAL UNIT (only in case of natural gas measuring)
mass	kg (t)*	lb
mass flowrate	kg/h (t/h)*	lb/h
volume	m <sup>3</sup> (l)*	MCF
volume flowrate	m <sup>3</sup> /h (l/h)*	MCF/h
energy	GJ (MJ, MWh, kWh)*	MMBTU
energy flowrate	GJ/h (MJ/h, MW, kW)*	MMBTU/h
pressure	bar (absolute)	PSIA
temperature	°C	°F
density	kg/m <sup>3</sup>	lb/CF
gas components	mole %	mole%
time	seconds	seconds

\* depending on the settings in the flow computer

## 10.5.2 Accessing batch data

Addresses of Modbus registers related to batch measurement are listed in the table below.  
See also 9.1.7.

Modbus register	Reg. type	Description	Note
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9000	Read/Write	Register block for batch start/stop on stream 1.	40 registers/stream
...	Read/Write	...	
9280	Read/Write	Register block for batch start/stop on stream 8.	

Offset	Batch parameters	Description
0	Batch start/stop	Integer, 1 – start batch, 0 – stop batch (1 reg.)
1	Copy of printed reports	Integer, (0,1,2,3 copy) (1 reg.)
2-21	Tank car route (from/to)	40 x ASCII character (20 reg.)
22-26	Number plate of the car	10 x ASCII character (5 reg.)
27-39	Reserved	(13 reg.)

9320	ReadOnly	Register block for measured batch quantities on stream 1.block	60 registers/stream
...	ReadOnly	...	
9740	ReadOnly	Register block for measured batch quantities on stream 8.block	

Offset	Batch quantities	Description
0	Batch status	Integer, 1 – in progress, 0 – finished (1 reg.)
1-5	Loading station (stream name)	10 x ASCII character (5 reg.)
6-25	Tank car route (from/to)	40 x ASCII character (20 reg.)
26-30	Number plate of the car	10 x ASCII character (5 reg.)
31	Batch start time	Year (H)    Month (L)    Integer
32		Day (H)    Hour (L)
33		Minute (H)    Second (L)    (3 reg.)
34	Batch stop time	Year (H)    Month (L)    Integer
35		Day (H)    Hour (L)
36		Minute(H)    Second (L)    (3 reg.)
37	Reserved	(1 reg.)
38-39	Batch mass [kg]	32 bit signed integer number (2 reg.)
40-41	Batch volume at base condition [l]	32 bit signed integer number (2 reg.)
42-43	Batch average base density [kg/m <sup>3</sup> ]	floating point number (2 reg.)
44-45	Batch average temperature [°C]	floating point number (2 reg.)
46-47	Batch average line density [kg/m <sup>3</sup> ]	floating point number (2 reg.)
48-49	Batch average concentration %(m/m)	floating point number (2 reg.)
50-51	Batch average measured density [kg/m <sup>3</sup> ]	floating point number (2 reg.)
52-53	Batch average absolute pressure [bar]	floating point number (2 reg.)
54-55	Batch average gauge pressure [bar]	floating point number (2 reg.)
56-57	Batch volume at line conditions [l]	32 bit signed integer number (2 reg.)
58-59	Batch average concentration %(v/v)	floating point number (2 reg.)

### 10.5.3 Accessing flow meter serial test data

Addresses of Modbus registers related to meter serial test measurement are listed in the table below. See also 9.1.8.

MASTER/ SLAVE registers (2 byte) read only	SLAVE registers (2 byte) read/write to control serial test	MASTER registers (2 byte) read/write to control serial test from upper level (DCS)	Description	Unit of measur ement	Data format / Note
20		2600	Function 1 – custody transfer measurement 2 – non custody transfer measurement		
21		2601	not used		
22		2602	not used		
23	2051	2603	Duration of the test	minute	16 bit unsigned integer
24	2052	2604	Start command = 0, idle = 1, start	-	16 bit unsigned integer
25	2053	2605	Stop command = 0, idle = 1, stop (finish test) = 2, abort (abort test)	-	16 bit unsigned integer
26		2606	Serial test status = 0, idle = 1, starting = 2, running = 3, data processing = 4, ready	-	16 bit unsigned integer
27		2607	Elapsed time	minute	16 bit unsigned integer
28		2608	Cycle counter	-	16 bit unsigned integer
29		2609	not used		
30			not used		
31-48			Stream name	-	ASCII string – read only
49			Stream serial number (1 to 8)	-	16 bit unsigned integer
50			serial test start Month Year	-	16 bit unsigned integer
51			serial test start Hour Day	-	16 bit unsigned integer
52			serial test start Second Minute	-	16 bit unsigned integer
53			serial test stop Month Year	-	16 bit unsigned integer
54			serial test stop Hour Day	-	16 bit unsigned integer
55			serial test stop Second Minute	-	16 bit unsigned integer
56			not used		



57			not used		
58			serial test volume at line conditions	m3	32 bit float
60			serial test volume at line conditions converted to the pressure and temperature in the master line	m3	32 bit float
62			serial test volume at base conditions	m3	32 bit float
64			serial test mass	kg	32 bit float
66			serial test energy	GJ	32 bit float
68			serial test average pressure	barA	32 bit float
70			serial test average temperature	°C	32 bit float
72			serial test average compression factor at line conditions	-	32 bit float
74			serial test average compression factor at base conditions	-	32 bit float
76			serial test average volume flow rate at line conditions	m3/h	32 bit float
78			serial test average volume flow rate at line conditions converted to the pressure and temperature in the master line	m3/h	32 bit float
80			serial test average volume flow rate at base conditions	m3/h	32 bit float
82			serial test average mass flow rate	kg/h	32 bit float
84			serial test average energy flow rate	GJ/h	32 bit float
86			serial test average relative density	-	32 bit float
88			serial test average base density	kg/m3	32 bit float
90			serial test average line density	kg/m3	32 bit float
92			serial test average relative density converted to the pressure and temperature in the master line	kg/m3	32 bit float
94			serial test average inferior heating value	MJ/m3	32 bit float
96			serial test average differential pressure	mbar	32 bit float
98			serial test average nitrogen	mole%	32 bit float
100			serial test average carbon-dioxide	mole%	32 bit float
102			serial test average H2S	mole%	32 bit float
104			serial test average H2O	mole%	32 bit float
106			serial test average helium	mole%	32 bit float
108			serial test average methane	mole%	32 bit float
110			serial test average ethane	mole%	32 bit float
112			serial test average propane	mole%	32 bit float

114			serial test average n-butane	mole%	32 bit float
116			serial test average i-butane	mole%	32 bit float
118			serial test average n-pentane	mole%	32 bit float
120			serial test average i-pentane	mole%	32 bit float
122			serial test average hexane	mole%	32 bit float
124			serial test average heptane	mole%	32 bit float
126			serial test average octane	mole%	32 bit float
128			serial test average nonane	mole%	32 bit float
130			serial test average decane	mole%	32 bit float
132			serial test average oxygen	mole%	32 bit float
134			serial test average carbon-monoxide	mole%	32 bit float
136			serial test average hydrogen	mole%	32 bit float
138			serial test average total moles	mole%	32 bit float

Note: batch data and serial test data are available in metric units only.

## 10.6 Daniel Modbus register map (4 byte/register)

### 10.6.1 Registers for system date and time modification via Modbus link

Register address	Data type	Description
1	16 bit integer	Downloaded Year (4 digits) (1900...2999)
2	16 bit integer	Downloaded Month (1...12)
3	16 bit integer	Downloaded Day (1...31)
4	16 bit integer	Downloaded Hour (0...23)
5	16 bit integer	Downloaded Minute (0...59)
6	16 bit integer	Downloaded Second (0...59)
7	16 bit integer	Accept time Write 1 to this register to accept the downloaded date and time and set it as current date and time. After accepting the time flow computer writes it to 0.
8 ... 10	16 bit integer	n/a
11	16 bit integer	System clock Year (4 digits)
12	16 bit integer	System clock Month
13	16 bit integer	System clock Day
14	16 bit integer	System clock Hour
15	16 bit integer	System clock Minute
16	16 bit integer	System clock Second
17 ... 20	16 bit integer	n/a

Modify the time in steps:

1. Write the desired new date and time into registers 1 to 6.
2. Write 1 to register 7. Writing register 7 to 1 can be done in one message together with the date and time writing.
3. UNIFLOW-200 accepts the new date and time and writes register 7 back to 0.

### 10.6.2 Registers for totals

Register address	Data type	Description
5001	32 bit integer	Current hour base volume
5002	32 bit integer	Current day base volume
5003	32 bit integer	Current multiday base volume
5004	32 bit integer	Current month base volume
5005	32 bit integer	Previous hour base volume
5006	32 bit integer	Previous day base volume
5007	32 bit integer	Previous multiday base volume
5008	32 bit integer	Previous month base volume
5009	32 bit integer	Base volume cumulative total
5010	32 bit integer	n/a
5011	32 bit integer	Current hour carbon mass
5012	32 bit integer	Current day carbon mass
5013	32 bit integer	Current multiday carbon mass

5014	32 bit integer	Current month carbon mass
5015	32 bit integer	Previous hour carbon mass
5016	32 bit integer	Previous day carbon mass
5017	32 bit integer	Previous multiday carbon mass
5018	32 bit integer	Previous month carbon mass
5019	32 bit integer	Carbon mass cumulative total
5020	32 bit integer	n/a
5021	32 bit integer	Current hour energy
5022	32 bit integer	Current day energy
5023	32 bit integer	Current multiday energy
5024	32 bit integer	Current month energy
5025	32 bit integer	Previous hour energy
5026	32 bit integer	Previous day energy
5027	32 bit integer	Previous multiday energy
5028	32 bit integer	Previous month energy
5029	32 bit integer	Energy cumulative total
5030	32 bit integer	n/a
5031	32 bit integer	n/a
5032	32 bit integer	n/a
5033	32 bit integer	n/a
5034	32 bit integer	n/a
5035	32 bit integer	n/a
5036	32 bit integer	n/a
5037	32 bit integer	n/a
5038	32 bit integer	n/a
5039	32 bit integer	n/a
5040	32 bit integer	n/a
5041	32 bit integer	Current day premium base volume
5042	32 bit integer	Current multiday premium base volume
5043	32 bit integer	Current month premium base volume
5044	32 bit integer	Previous hour premium base volume
5045	32 bit integer	Previous day premium base volume
5046	32 bit integer	Previous multiday premium base volume
5047	32 bit integer	Previous month premium base volume
5048	32 bit integer	Premium base volume cumulative total
5049	32 bit integer	n/a
5050	32 bit integer	n/a
5051	32 bit integer	n/a
5052	32 bit integer	n/a
5053	32 bit integer	n/a
5054	32 bit integer	n/a
5055	32 bit integer	n/a
5056	32 bit integer	n/a
5057	32 bit integer	n/a
5058	32 bit integer	n/a
5059	32 bit integer	n/a
5060	32 bit integer	n/a
5061	32 bit integer	Current hour line volume
5062	32 bit integer	Current day line volume
5063	32 bit integer	Current multiday line volume

5064	32 bit integer	Current month line volume
5065	32 bit integer	Previous hour line volume
5066	32 bit integer	Previous day line volume
5067	32 bit integer	Previous multiday line volume
5068	32 bit integer	Previous month line volume
5069	32 bit integer	Line volume cumulative total
5070	32 bit integer	n/a
5071	32 bit integer	Current hour fault base volume
5072	32 bit integer	Current day fault base volume
5073	32 bit integer	Current multiday fault base volume
5074	32 bit integer	Current month fault base volume
5075	32 bit integer	Previous hour fault base volume
5076	32 bit integer	Previous day fault base volume
5077	32 bit integer	Previous multiday fault base volume
5078	32 bit integer	Previous month fault base volume
5079	32 bit integer	Fault base volume cumulative total
5080	32 bit integer	n/a
5081	32 bit integer	n/a
5082	32 bit integer	n/a
5083	32 bit integer	n/a
5084	32 bit integer	n/a
5085	32 bit integer	n/a
5086	32 bit integer	n/a
5087	32 bit integer	n/a
5088	32 bit integer	n/a
5089	32 bit integer	n/a
5090	32 bit integer	n/a
5091	32 bit integer	Current month maximum hourly base volume
5092	32 bit integer	Current month maximum hourly base volume, month
5093	32 bit integer	Current month maximum hourly base volume, day
5094	32 bit integer	Current month maximum hourly base volume, hour
5095	32 bit integer	Previous month maximum hourly base volume
5096	32 bit integer	Previous month maximum hourly base volume, month
5097	32 bit integer	Previous month maximum hourly base volume, day
5098	32 bit integer	Previous month maximum hourly base volume, hour
5099	32 bit integer	n/a
5100	32 bit integer	n/a
5101	32 bit integer	Current day hourly base volume at end-of-day hour+1 hour
5102	32 bit integer	Same for +2 hours
5103	32 bit integer	Same for +3 hours
5104	32 bit integer	Same for +4 hours
5105	32 bit integer	Same for +5 hours
5106	32 bit integer	Same for +6 hours
5107	32 bit integer	Same for +7 hours
5108	32 bit integer	Same for +8 hours
5109	32 bit integer	Same for +9 hours
5110	32 bit integer	Same for +10 hours
5111	32 bit integer	Same for +11 hours
5112	32 bit integer	Same for +12 hours
5113	32 bit integer	Same for +13 hours

5114	32 bit integer	Same for +14 hours
5115	32 bit integer	Same for +15 hours
5116	32 bit integer	Same for +16 hours
5117	32 bit integer	Same for +17 hours
5118	32 bit integer	Same for +18 hours
5119	32 bit integer	Same for +19 hours
5120	32 bit integer	Same for +20 hours
5121	32 bit integer	Same for +21 hours
5122	32 bit integer	Same for +22 hours
5123	32 bit integer	Same for +23 hours
5124	32 bit integer	Same for +24 hours
5125	32 bit integer	Current day hourly energy at end-of-day hour+1 hour
5126	32 bit integer	Same for +2 hours
5127	32 bit integer	Same for +3 hours
5128	32 bit integer	Same for +4 hours
5129	32 bit integer	Same for +5 hours
5130	32 bit integer	Same for +6 hours
5131	32 bit integer	Same for +7 hours
5132	32 bit integer	Same for +8 hours
5133	32 bit integer	Same for +9 hours
5134	32 bit integer	Same for +10 hours
5135	32 bit integer	Same for +11 hours
5136	32 bit integer	Same for +12 hours
5137	32 bit integer	Same for +13 hours
5138	32 bit integer	Same for +14 hours
5139	32 bit integer	Same for +15 hours
5140	32 bit integer	Same for +16 hours
5141	32 bit integer	Same for +17 hours
5142	32 bit integer	Same for +18 hours
5143	32 bit integer	Same for +19 hours
5144	32 bit integer	Same for +20 hours
5145	32 bit integer	Same for +21 hours
5146	32 bit integer	Same for +22 hours
5147	32 bit integer	Same for +23 hours
5148	32 bit integer	Same for +24 hours

### 10.6.3 Registers for other measured data

Register address	Data type	Description
7001	32 bit floating	Downloaded Nitrogen
7002	32 bit floating	Downloaded Carbon-dioxide
7003	32 bit floating	Downloaded Hydrogen-sulfide
7004	32 bit floating	Downloaded Water
7005	32 bit floating	Downloaded Helium
7006	32 bit floating	Downloaded Methane
7007	32 bit floating	Downloaded Ethane
7008	32 bit floating	Downloaded Propane

7009	32 bit floating	Downloaded n-Butane
7010	32 bit floating	Downloaded i-Butane
7011	32 bit floating	Downloaded n-Pentane
7012	32 bit floating	Downloaded i-Pentane
7013	32 bit floating	Downloaded n-Hexane
7014	32 bit floating	Downloaded n-Heptane
7015	32 bit floating	Downloaded n-Octane
7016	32 bit floating	Downloaded n-Nonane
7017	32 bit floating	Downloaded n-Decane
7018	32 bit floating	Downloaded Oxygen
7019	32 bit floating	Downloaded Carbon-monoxide
7020	32 bit floating	Downloaded Hydrogen
7021	32 bit floating	Downloaded Relative density
7022	32 bit floating	Downloaded Inferior calorific value
7023	32 bit floating	Downloaded Superior calorific value
7024	32 bit floating	Downloaded argon
7025	32 bit floating	Line density
7026	32 bit floating	Base density
7027	32 bit floating	Specific carbon content
7028	32 bit floating	n/a
7029	32 bit floating	n/a
7030	32 bit floating	n/a
7031	32 bit floating	Fluid pressure, absolute
7032	32 bit floating	Fluid temperature
7033	32 bit floating	Differential pressure
7034	32 bit floating	Base volume flowrate
7035	32 bit floating	Energy flowrate
7036	32 bit floating	Line volume flowrate
7037	32 bit floating	n/a
7038	32 bit floating	n/a
7039	32 bit floating	Carbon mass flowrate
7040	32 bit floating	n/a
7041	32 bit floating	Current day average pressure, absolute
7042	32 bit floating	Current day average temperature
7043	32 bit floating	Current day average compression factor ( $K=Z_{line}/Z_{base}$ ), -
7044	32 bit floating	Previous day average pressure, absolute
7045	32 bit floating	Previous day average temperature
7046	32 bit floating	Previous day average compression factor ( $K=Z_{line}/Z_{base}$ ), -
7047	32 bit floating	Current month average pressure, absolute
7048	32 bit floating	Current month average temperature
7049	32 bit floating	Current month average compression factor ( $K=Z_{line}/Z_{base}$ ), -
7050	32 bit floating	Previous month average pressure, absolute
7051	32 bit floating	Previous month average temperature
7052	32 bit floating	Previous month average compression factor ( $K=Z_{line}/Z_{base}$ ), -
7053	32 bit floating	n/a
7054	32 bit floating	n/a
7055	32 bit floating	Pressure measured at IO channel
7056	32 bit floating	Differential pressure (dP low) measured at IO channel
7057	32 bit floating	Differential pressure (dP medium) measured at IO channel
7058	32 bit floating	Differential pressure (dP high) measured at IO channel

7059	32 bit floating	Temperature measured at 4-20 mA IO channel
7060	32 bit floating	n/a
7061	32 bit floating	Relative density measured at IO channel
7062	32 bit floating	CO2 content measured at IO channel, mole%
7063	32 bit floating	N2 content measured at IO channel, mole%
7064	32 bit floating	Inferior calorific value measured at IO channel
7065	32 bit floating	Temperature measured at Pt100 IO channel
7066	32 bit floating	n/a
7067	32 bit floating	Linear gas velocity
7068	32 bit floating	n/a
7069	32 bit floating	n/a
7070	32 bit floating	n/a
7071	32 bit floating	Current hour fault time, hour
7072	32 bit floating	Current day fault time, hour
7073	32 bit floating	Current multiday fault time, hour
7074	32 bit floating	Current month fault time, hour
7075	32 bit floating	Previous hour fault time, hour
7076	32 bit floating	Previous day fault time, hour
7077	32 bit floating	Previous multiday fault time, hour
7078	32 bit floating	Previous month fault time, hour
7079	32 bit floating	Fault time cumulative total, hour
7080	32 bit floating	n/a
7081	32 bit floating	n/a
7082	32 bit floating	n/a
7083	32 bit floating	n/a
7084	32 bit floating	n/a
7085	32 bit floating	n/a
7086	32 bit floating	n/a
7087	32 bit floating	n/a
7088	32 bit floating	n/a
7089	32 bit floating	n/a
7090	32 bit floating	n/a
7091	32 bit floating	Current hour flow time, hour
7092	32 bit floating	Current day flow time, hour
7093	32 bit floating	Current multiday flow time, hour
7094	32 bit floating	Current month flow time, hour
7095	32 bit floating	Previous hour flow time, hour
7096	32 bit floating	Previous day flow time, hour
7097	32 bit floating	Previous multiday flow time, hour
7098	32 bit floating	Previous month flow time, hour
7099	32 bit floating	Flow time cumulative total, hour

Unit of measurement for the quantities listed in tables above are as follows:

	METRIC UNIT	IMPERIAL UNIT
mass	kg (t)*	lb
mass flowrate	kg/h (t/h)*	lb/h
volume	m3 (or l)*	MCF
volume flowrate	m3/h (or l/h)*	MCF/h



energy	GJ (MJ, MWh, kWh)*	MMBTU
energy flowrate	GJ/h (MJ/h, MW, kW)*	MMBTU/h
pressure	bar	PSIA or PSIG
temperature	°C	°F
density line, base	kg/m <sup>3</sup>	lb/CF
relative density	-	-
calorific value	MJ/m <sup>3</sup>	BTU/SCF
gas component content	mole %	mole%
differential pressure	mbar	inchH <sub>2</sub> O
linear gas velocity	m/s	ft/s
compression factor	-	-
specific carbon content	kg/m <sup>3</sup>	lb/CF
time	seconds	seconds

\* depending on the settings in the flow computer

## 10.7 Register maps of the Modbus Slave devices

Uniflow-200 is capable to communicate with different Modbus Slave devices (gas chromatographs, ultrasonic meters, mass flow meters). The Modbus registers read from these Modbus Slave devices are summarized below. In case of difficulties in establishing communication with Modbus Slave devices it is recommended to check if the registers in the Modbus Slave device are mapped as listed in the Tables below.

### 10.7.1 Register map of Sick-Maihak Flowsic-600 ultrasonic meter

Register number	Data type	Description	Unit	Remark
3002	int16	System control		
3003	int16	System status		
3004	int16	Path 1 status		
3005	int16	Path 2 status		
3006	int16	Path 3 status		
3007	int16	Path 4 status		
3008	int16	Path 1 valid samples		
3009	int16	Path 2 valid samples		
3010	int16	Path 3 valid samples		
3011	int16	Path 4 valid samples		
3012	int16	AGC level path 1A		
3013	int16	AGC level path 1B		
3014	int16	AGC level path 2A		
3015	int16	AGC level path 2B		
3016	int16	AGC level path 3A		
3017	int16	AGC level path 3B		
3018	int16	AGC level path 4A		
3019	int16	AGC level path 4B		
7001	float32	Volume flow rate at line conditions	m <sup>3</sup> /h	
7002	float32	Volume flow rate at base conditions	m <sup>3</sup> /h	
7003	float32	Velocity of sound	m/s	
7004	float32	Gas velocity	m/s	
7005	float32	Path 1 VOS	m/s	

7006	float32	Path 2 VOS	m/s	
7007	float32	Path 3 VOS	m/s	
7008	float32	Path 4 VOS	m/s	
7009	float32	Path 1 gas velocity	m/s	
7010	float32	Path 2 gas velocity	m/s	
7011	float32	Path 3 gas velocity	m/s	
7012	float32	Path 4 gas velocity	m/s	
7013	float32	SNR 1A	dB	
7014	float32	SNR 1B	dB	
7015	float32	SNR 1A	dB	
7016	float32	SNR 1B	dB	
7017	float32	SNR 1A	dB	
7018	float32	SNR 1B	dB	
7019	float32	SNR 1A	dB	
7020	float32	SNR 1B	dB	
7021	float32	Gas temperature	K	
7022	float32	Gas pressure	bar (abs)	
7036		Low flow cut-off	m <sup>3</sup> /h	
7037		Adjust factor forward		
7038		Adjust factor reverse		
7039		Zero flow offset	m <sup>3</sup> /h	

### 10.7.2 Register map of Daniel ultrasonic meter (Mark III electronics)

Register number	Data type	Description	Unit	Remark
62	int16	Chord A status		
63	int16	Chord B status		
64	int16	Chord C status		
65	int16	Chord D status		
66	int16	System status		

67	int16	Percentage of good batch firings (path A1).	%	
68	int16	Percentage of good batch firings (path B1).	%	
69	int16	Percentage of good batch firings (path C1).	%	
70	int16	Percentage of good batch firings (path D1).	%	
71	int16	Percentage of good batch firings (path A2).	%	
72	int16	Percentage of good batch firings (path B2).	%	
73	int16	Percentage of good batch firings (path C2).	%	
74	int16	Percentage of good batch firings (path D2).	%	
77	int16	Gain (path A1)		
78	int16	Gain (path A2)		
79	int16	Gain (path B1)		
80	int16	Gain (path B2)		
81	int16	Gain (path C1)		
82	int16	Gain (path C2)		
83	int16	Gain (path D1)		
84	int16	Gain (path D2)		
352	float32	Chord A flow velocity	m/s	
354	float32	Chord B flow velocity	m/s	
356	float32	Chord C flow velocity	m/s	
358	float32	Chord D flow velocity	m/s	
360	float32	Average flow velocity	m/s	
362	float32	Chord A sound velocity.	m/s	
364	float32	Chord B sound velocity.	m/s	
366	float32	Chord C sound velocity.	m/s	
368	float32	Chord D sound velocity.	m/s	
370	float32	Average sound velocity.	m/s	
394	float32	Low flow cut-off	m <sup>3</sup> /h	
1500	int32	Forward uncorrected volume (integer portion).	m3	
1502	int32	Reverse uncorrected volume (integer portion).	m3	

10600	float32	Flow-condition temperature.	°C	
10602	float32	Flow-condition pressure	MPa	
10624	float32	Flow-condition volumetric flow rate (includes expansion and profile-effect correction).	m <sup>3</sup> /h	
10626	float32	Base-condition volumetric flow rate.	m <sup>3</sup> /h	

### 10.7.3 Register map of Flexim Fluxus ultrasonic meter

Register number	Data type	Description	Unit	Remark
1000	int16	Gas temperature status		
1001	float32	Gas temperature	°C	
1032	int16	Gas pressure status		
1033	float32	Gas pressure	bar	
1064	int16	Signal amplitude status		
1065	float32	Signal amplitude		
1080	int16	Velocity of sound status		
1081	float32	Velocity of sound	m/s	
1096	int16	Velocity of gas status		
1097	float32	Velocity of gas	m/s	
1112	int16	Volume flow rate at line conditions status		
1113	float32	Volume flow rate at line conditions	m <sup>3</sup> /h	
1128	int16	Volume flow totalizer at line conditions (positive) status		
1129	float32	Volume flow totalizer at line conditions (positive)	m <sup>3</sup>	
1144	int16	Volume flow totalizer at line conditions (negative) status		
1145	float32	Volume flow totalizer at line conditions (negative)	m <sup>3</sup>	
1160	int16	Volume flow rate at base conditions status		
1161	float32	Volume flow rate at base conditions	m <sup>3</sup> /h	

### 10.7.4 Register map of Siemens 1010GCGDN ultrasonic meter

Register number	Data type	Description	Unit	Remark
41001	float32	Volume flow rate at line conditions, path 1	m <sup>3</sup> /h	
41003	float32	Volume flow rate at line conditions, path 2	m <sup>3</sup> /h	
41005	float32	Volume flow rate at line conditions	m <sup>3</sup> /h	
41007	float32	Average volume flow rate at line conditions	m <sup>3</sup> /h	
41009	float32	Raw volume flow rate at line conditions, path 1	m <sup>3</sup> /h	
41011	float32	Raw volume flow rate at line conditions, path 2	m <sup>3</sup> /h	
41013	float32	Gas velocity	m/s	
41015	float32	Volume flow totalizer at line conditions	m <sup>3</sup>	
41017	float32	Velocity of sound path 1	m/s	
41019	float32	Velocity of sound path 2	m/s	
41021	float32	Average velocity of sound	m/s	
41023	float32	Specific gravity		
41025	float32	Base specific gravity		
41027	float32	Temperature RTD1	°C	
41029	float32	Temperature RTD1	°C	
41031	float32	Delta time path 1	uS	
41033	float32	Delta time path 2	uS	
41035	float32	Analogue input 1		
41037	float32	Analogue input 2		
41039	float32	Analogue input 3		
41041	float32	Analogue input 4		
30001 ... 30004	char	Site name		
30005	char	Date		
30007	char	Time		
30009	int16	Signal strength path 1		
30010	int16	Signal strength path 2		

30011	int16	Average signal strength		
30012	int16	Aeration		
30013	int32	Status/Alarm path 1		
30015	int32	Status/Alarm path 2		
30017	int32	Status/Alarm site		

### 10.7.5 Register map of Panametrics GC868 ultrasonic meter

Register number	Data type	Description	Unit	Remark
3	int32	Velocity of gas	m/s	m/s= int32 / 100
5	float32	Volume flow rate at line conditions	m <sup>3</sup> /h	
7	float32	Volume flow rate at base conditions	m <sup>3</sup> /h	
9	int32	Volume flow totalizer at line conditions (forward)	m <sup>3</sup>	
11	int32	Volume flow totalizer at line conditions (reverse)	m <sup>3</sup>	
13	int16	Divider for volume totalizers		
14	float32	Mass flow rate	kg/h	
16	int32	Mass flow totalizer (forward)	kg	
18	int32	Mass flow totalizer (reverse)	kg	
20	int16	Divider for mass totalizers		
21	int32	Timer		
23	int16	Error code		
24	int32	Velocity of sound	m/s	m/s= int32 / 1000
26	int32	Density	kg/m <sup>3</sup>	
28	int32	Signal strength upstream		'=int32 / 10
30	int32	Signal strength downstream		'=int32 / 10
32	int32	Gas temperature	°C	
34	int32	Gas pressure	bar	
36	float32	Signal quality upstream		
38	float32	Signal quality downstream		
40	float32	Amplitude discrimination upstream		
42	float32	Amplitude discrimination downstream		

44	float32	SNR upstream		
46	float32	SNR downstream		

### 10.7.6 Register map of Krohne Altosonic V12 ultrasonic meter

NOTE: All the registers read by Uniflow-200 shall be configured in the Altosonic V12 as holding registers. Uniflow-200 read registers with Modbus command code 3.

Register number	Data type	Description	Unit	Remark
5000	int32	Test data		
5002	int32	System status		
5004	int32	Path 1 status		
5006	int32	Path 2 status		
5008	int32	Path 3 status		
5010	int32	Path 4 status		
5012	int32	Path 5 status		
5014	int32	Path 6 status		
5016	int32	Temperature status		
5018	int32	Totalizer status		
7000	float32	Test data		
7002	float32	Channel gain AB1	dB	
7004	float32	Channel gain AB2	dB	
7006	float32	Channel gain AB3	dB	
7008	float32	Channel gain AB4	dB	
7010	float32	Channel gain AB5	dB	
7012	float32	Channel gain AB6	dB	
7014	float32	Channel gain BA1	dB	
7016	float32	Channel gain BA2	dB	
7018	float32	Channel gain BA3	dB	
7020	float32	Channel gain BA4	dB	
7022	float32	Channel gain BA5	dB	



7024	float32	Channel gain BA6	dB	
7026	float32	Channel SNR AB1	dB	
7028	float32	Channel SNR AB2	dB	
7030	float32	Channel SNR AB3	dB	
7032	float32	Channel SNR AB4	dB	
7034	float32	Channel SNR AB5	dB	
7036	float32	Channel SNR AB6	dB	
7038	float32	Channel SNR BA1	dB	
7040	float32	Channel SNR BA2	dB	
7042	float32	Channel SNR BA3	dB	
7044	float32	Channel SNR BA4	dB	
7046	float32	Channel SNR BA5	dB	
7048	float32	Channel SNR BA6	dB	
7050	float32	Gas temperature	°C	
7052	float32	Gas dynamic viscosity	cP	
7054	float32	Gas density	kg/m <sup>3</sup>	
7056	float32	Volume flow rate at line conditions	m <sup>3</sup> /s	
7058	float32	Gas velocity	m/s	
7060	float32	Velocity of sound	m/s	
7062	float32	Gas velocity path 1	m/s	
7064	float32	Gas velocity path 2	m/s	
7066	float32	Gas velocity path 3	m/s	
7068	float32	Gas velocity path 4	m/s	
7070	float32	Gas velocity path 5	m/s	
7072	float32	Gas velocity path 6	m/s	
7074	float32	Velocity of sound path 1	m/s	
7076	float32	Velocity of sound path 2	m/s	
7078	float32	Velocity of sound path 3	m/s	
7080	float32	Velocity of sound path 4	m/s	
7082	float32	Velocity of sound path 5	m/s	
7084	float32	Velocity of sound path 6	m/s	
7086	float32	Reliability path 1	%	
7088	float32	Reliability path 2	%	

7090	float32	Reliability path 3	%	
7092	float32	Reliability path 4	%	
7094	float32	Reliability path 5	%	
7096	float32	Reliability path 6	%	
7098	float32	Average gas velocity path 1	m/s	
7100	float32	Average gas velocity path 2	m/s	
7102	float32	Average gas velocity path 3	m/s	
7104	float32	Average gas velocity path 4	m/s	
7106	float32	Average gas velocity path 5	m/s	
7108	float32	Average gas velocity path 6	m/s	
7110	float32	Average velocity of sound path 1	m/s	
7112	float32	Average velocity of sound path 2	m/s	
7114	float32	Average velocity of sound path 3	m/s	
7116	float32	Average velocity of sound path 4	m/s	
7118	float32	Average velocity of sound path 5	m/s	
7120	float32	Average velocity of sound path 6	m/s	
7122	float32	Average velocity of sound	m/s	
7124	float32	Volume flow rate at line conditions	m <sup>3</sup> /h	
7126	float32	Volume flow rate standard deviation	%	
7128	float32	Volume flow rate standard deviation, running	%	
7130	float32	Velocity of sound standard deviation	%	
7132	float32	Gas velocity standard deviation path 1	%	
7134	float32	Gas velocity standard deviation path 2	%	
7136	float32	Gas velocity standard deviation path 3	%	
7138	float32	Gas velocity standard deviation path 4	%	
7140	float32	Gas velocity standard deviation path 5	%	
7142	float32	Gas velocity standard deviation path 6	%	
7144	float32	Velocity of sound standard deviation path 1	%	
7146	float32	Velocity of sound standard deviation path 2	%	
7148	float32	Velocity of sound standard deviation path 3	%	
7150	float32	Velocity of sound standard deviation path 4	%	
7152	float32	Velocity of sound standard deviation path 5	%	
7154	float32	Velocity of sound standard deviation path 6	%	

7504	float32	Meter constant forward		
7506	float32	Meter constant reverse		
7536	float32	Max flow rate forward	m <sup>3</sup> /s	
7538	float32	Max flow rate reverse	m <sup>3</sup> /s	
7540	float32	Low flow cut-off forward	m/s	
7542	float32	Low flow cut-off reverse	m/s	
8000	int64	Test data		
8004	int64	Volume flow totalizer at line conditions (forward)	m <sup>3</sup> *1e-6	
8008	int64	Volume flow totalizer at line conditions (reverse)	m <sup>3</sup> *1e-6	
8012	int64	Fault volume flow totalizer at line conditions (forward)	m <sup>3</sup> *1e-6	
8016	int64	Fault volume flow totalizer at line conditions (reverse)	m <sup>3</sup> *1e-6	

### 10.7.7 Register map of Emerson Micromotion mass flow meter

Register number	Data type	Description	Unit	Remark
39	int16	Standard or special mass flow unit		
40	int16	Density unit		
41	int16	Temperature unit		
42	int16	Standard or special volume unit		
44	int16	Pressure unit		
45	int16	Standard or special mass total or inventory unit		
46	int16	Standard or special volume total or inventory unit		
247	float32	Mass flow rate		
249	float32	Density		see note
251	float32	Temperature		see note
253	float32	Volume flow rate		

257	float32	Pressure (internally derived)		see note
259	float32	Mass total		
261	float32	Volume total		
263	float32	Mass inventory		
265	float32	Volume inventory		
422	int16	bit4 flow direction		

NOTE: Mass flow, density, pressure and temperature are assigned to internal Modbus registers of the flow computer. These Modbus registers then shall be configured as Modbus signals and can be utilized in stream setup as input signals for flow calculation.

### 10.7.8 Register map of MFC300 mass flow meter transmitter

Register number	Data type	Description	Unit	Remark
30000	float32	Flow Velocity	m/s	
30002	float32	Volume Flow	m <sup>3</sup> /h	see note
30004	float32	Mass Flow	kg/h	see note
30006	float32	Temperature	°C	see note
30008	float32	Density	kg/m <sup>3</sup>	see note
30010	float32	Concentration 1		
30012	float32	Concentration 2 or Diagnosis 3		
30014	float32	Concentration Flow 1		
30016	float32	Concentration Flow 2		
30018	float32	Diagnosis 1		
30020	float32	Diagnosis 2		
30022	float32	Display Channel 1 Represents the value on the first line of the first measurement screen in SI units		
30024	float32	Display Channel 2 Represents the value on the first line of the second measurement screen in SI units		

30026	float32	Operating time	s	
30050	float64	Counter 1	m3 or kg	see note
30054	float64	Counter 2	m3 or kg	see note
30058	float64	Counter 3 Note: this counter is only available for converter with IO2!	m3 or kg	see note
30062	byte4	Long Status Sensor		
30064	byte4	Long Status Device		

**NOTE:**

- Unit of volume flow must be set to m3/h and the unit of mass flow must be set to kg/h.
- Mass flow, density and temperature are assigned to internal Modbus registers of the flow computer. These Modbus registers then shall be configured as Modbus signals and can be utilized in stream setup as input signals for flow calculation.
- Units of Counters 1, 2, 3 are depending on the settings in FMC300.

### 10.7.9 Register map of Danalyzer gas chromatograph

Register number	Data type	Description	Unit	Remark
3034	int16	Stream last analysed		
3041	int16	Start of cycle month		
3042	int16	Start of cycle day		
3043	int16	Start of cycle year		
3044	int16	Start of cycle hour		
3045	int16	Start of cycle minute		
3058	int16	New data flag		
3059	int16	Analysis/calibration flag		
3061	int16	Stream last analyzed		
7001	float32	C6+	mole%	
7002	float32	Propane	mole%	
7003	float32	I-butane	mole%	

7004	float32	N-butane	mole%	
7005	float32	Neo-pentane	mole%	
7006	float32	I-pentane	mole%	
7007	float32	N-pentane	mole%	
7008	float32	Nitrogen	mole%	
7009	float32	Methane	mole%	
7010	float32	Carbon-dioxide	mole%	
7011	float32	Ethane	mole%	
7033	float32	Superior heating value	MJ/m <sup>3</sup>	
7035	float32	Relative density	--	
7087	float32	Inferior heating value	MJ/m <sup>3</sup>	

### 10.7.10 Register map of Yamatake HGC gas chromatograph

Register number	Data type	Description	Unit	Remark
3034	int16	Stream last analysed		
3041	int16	Start of cycle month		
3042	int16	Start of cycle day		
3043	int16	Start of cycle year		
3044	int16	Start of cycle hour		
3045	int16	Start of cycle minute		
3058	int16	New data flag		
3059	int16	Analysis/calibration flag		
3061	int16	Stream last analyzed		

7001	float32	C6+	mole%	
7002	float32	Propane	mole%	
7003	float32	I-butane	mole%	
7004	float32	N-butane	mole%	
7005	float32	Neo-pentane	mole%	
7006	float32	I-pentane	mole%	
7007	float32	N-pentane	mole%	
7008	float32	Nitrogen	mole%	
7009	float32	Methane	mole%	
7010	float32	Carbon-dioxide	mole%	
7011	float32	Ethane	mole%	
7033	float32	Superior heating value	MJ/m <sup>3</sup>	
7035	float32	Relative density	--	
7087	float32	Inferior heating value	MJ/m <sup>3</sup>	

### 10.7.11 Register map of ABB NGC820X gas chromatograph

Register number	Data type	Description	Unit	Remark
3034	int16	Stream last analyzed		
3041	int16	Start of cycle month		
3042	int16	Start of cycle day		
3043	int16	Start of cycle year		
3044	int16	Start of cycle hour		
3045	int16	Start of cycle minute		
3058	int16	New data flag		
3059	int16	Analysis/calibration flag		

3061	int16	Stream last analyzed		
7001	float32	Propane	mole%	
7002	float32	I-butane	mole%	
7003	float32	N-butane	mole%	
7004	float32	Neo-pentane	mole%	
7005	float32	I-pentane	mole%	
7006	float32	N-pentane	mole%	
7007	float32	C6+	mole%	
7008	float32	Nitrogen	mole%	
7009	float32	Methane	mole%	
7010	float32	Carbon-dioxide	mole%	
7011	float32	Ethane	mole%	
7012	float32	Hexane	mole%	
7013	float32	Heptane	mole%	
7014	float32	Octane	mole%	
7015	float32	Nonane	mole%	
7033	float32	Superior heating value	MJ/m <sup>3</sup>	
7034	float32	Inferior heating value	MJ/m <sup>3</sup>	
7035	float32	Relative density	--	

### 10.7.12 Register map of Yokogawa gas chromatograph

Register number	Data type	Description	Unit	Remark
41001	float32	C6+ stream 1	mole%	
41003	float32	Propane stream 1	mole%	
41005	float32	I-butane stream 1	mole%	
41007	float32	N-butane stream 1	mole%	



41009	float32	I-pentane stream 1	mole%	
41011	float32	N-pentane stream 1	mole%	
41013	float32	Nitrogen stream 1	mole%	
41015	float32	Methane stream 1	mole%	
41017	float32	Carbon-dioxide stream 1	mole%	
41019	float32	Ethane stream 1	mole%	
41021	float32	C6+ stream 2	mole%	
41023	float32	Propane stream 2	mole%	
41025	float32	I-butane stream 2	mole%	
41027	float32	N-butane stream 2	mole%	
41029	float32	I-pentane stream 2	mole%	
41031	float32	N-pentane stream 2	mole%	
41033	float32	Nitrogen stream 2	mole%	
41035	float32	Methane stream 2	mole%	
41037	float32	Carbon-dioxide stream 2	mole%	
41039	float32	Ethane stream 2	mole%	
41041	float32	C6+ stream 3	mole%	
41043	float32	Propane stream 3	mole%	
41045	float32	I-butane stream 3	mole%	
41047	float32	N-butane stream 3	mole%	
41049	float32	I-pentane stream 3	mole%	
41051	float32	N-pentane stream 3	mole%	
41053	float32	Nitrogen stream 3	mole%	
41055	float32	Methane stream 3	mole%	
41057	float32	Carbon-dioxide stream 3	mole%	
41059	float32	Ethane stream 3	mole%	
41061	float32	C6+ stream 4	mole%	
41063	float32	Propane stream 4	mole%	
41065	float32	I-butane stream 4	mole%	
41067	float32	N-butane stream 4	mole%	
41069	float32	I-pentane stream 4	mole%	
41071	float32	N-pentane stream 4	mole%	
41073	float32	Nitrogen stream 4	mole%	

41075	float32	Methane stream 4	mole%	
41077	float32	Carbon-dioxide stream 4	mole%	
41079	float32	Ethane stream 4	mole%	

### 10.7.13 Register map of ABB2 gas chromatograph

Register number	Data type	Description	Unit	Remark
30001	int16	Stream 1 sample time		
30002	int16	Stream 1 sample time		
30003	int16	Stream 1 sample time		
30004	int16	Stream 1 Hydrogen	mole %	
30005	int16	Stream 1 I-butane	mole %	
30006	int16	Stream 1 N-butane	mole %	
30007	int16	Stream 1 1,3-butadiene	mole %	
30008	int16	Stream 1 Total C5	mole %	
30009	int16	Stream 1 Total C6	mole %	
30010	int16	Stream 2 sample time		
30011	int16	Stream 2 sample time		
30012	int16	Stream 2 sample time		
30014	int16	Stream 2 I-butane	mole %	
30015	int16	Stream 2 N-butane	mole %	
30016	int16	Stream 2 1,3-butadiene	mole %	
30017	int16	Stream 2 Total C5	mole %	
30018	int16	Stream 2 Total C6	mole %	
30021	int16	Stream 21 Air with nitrogen	mole %	
30022	int16	Stream 21 Methane	mole %	
30023	int16	Stream 21 CO2	mole %	
30024	int16	Stream 21 Ethylene	mole %	
30025	int16	Stream 21 Ethane	mole %	

30026	int16	Stream 21 Propylene	mole %	
30027	int16	Stream 21 Prpadiene	mole %	
30031	int16	Stream 22 Air with nitrogen	mole %	
30032	int16	Stream 22 Methane	mole %	
30033	int16	Stream 22 CO2	mole %	
30034	int16	Stream 22 Ethylene	mole %	
30035	int16	Stream 22 Ethane	mole %	
30036	int16	Stream 22 Propylene	mole %	
30037	int16	Stream 22 Prpadiene	mole %	

## Annex A. Reports

### Archive reports naming conventions

The archive report files can be transferred from the UNIFLOW-200 to external device in two ways.

- reports are transferred to serial or USB ports from the menu Flow - > Data transfer.
- reports are read by UNIArchive program.

The naming convention for the reports and report file names is as follows.

Content of the report	Report name on the Flow - > Data transfer menu	File name in UNIArchive
Limited set of daily data for the current month	Month (daily short) (month shall be selected in separate field, previous 12 month data are available for selection)	<i>nnstr_streamname_yyyy_mm_dd_daily.txt</i> Example: 01str_M123_2013_04_12_daily.txt
Limited set of daily data for the previous months		<i>nnstr_streamname_yyyy_mm_daily.txt</i> Example: 01str_M123_2013_03_daily.txt
Limited set of hourly data for the current month	Month (hourly short) (month shall be selected in separate field, previous 12 month data are available for selection)	<i>nnstr_streamname_yyyy_mm_dd_hourly.txt</i> Example: 01str_M123_2013_04_12_hourly.txt
Limited set of hourly data for the previous months		<i>nnstr_streamname_yyyy_mm_hourly.txt</i> Example: 01str_M123_2013_03_hourly.txt
User defined set No.1 of daily data for the current month	Month (daily defined 1) (month shall be selected in separate field, previous 12 month data are available for selection)	<i>01rp_yyyy_mm_dd_daily.txt</i> Example: 01rp_2013_04_12_daily.txt
User defined set No.1 of daily data for the previous month		<i>01rp_yyyy_mm_daily.txt</i> Example: 01rp_2013_03_daily.txt
User defined set No.1 of hourly data for the current month	Month (hourly defined 1) (month shall be selected in separate field, previous 12 month data are available for selection)	<i>01rp_yyyy_mm_dd_hourly.txt</i> Example: 01rp_2013_04_12_hourly.txt
User defined set No.1 of hourly data for the previous month		<i>01rp_yyyy_mm_hourly.txt</i> Example: 01rp_2013_03_hourly.txt
User defined set No.2 of daily data for the current month	Month (daily defined 2) (month shall be selected in separate field, previous 12 month data are available for selection)	<i>02rp_yyyy_mm_dd_daily.txt</i> Example: 02rp_2013_04_12_daily.txt
User defined set No.2 of daily data for the previous month		<i>02rp_yyyy_mm_daily.txt</i> Example: 02rp_2013_03_daily.txt
User defined set No.2 of hourly data for the current month	Month (hourly defined 2) (month shall be selected in separate field, previous 12 month data are available for selection)	<i>02rp_yyyy_mm_dd_hourly.txt</i> Example: 02rp_2013_04_12_hourly.txt
User defined set No.2 of hourly data for the previous month		<i>02rp_yyyy_mm_hourly.txt</i> Example: 02rp_2013_03_hourly.txt
Hourly data for the indicated month for stream <i>nn</i>	Month (hourly) (month and stream shall be selected in separate field)	<i>yyyy_mm_month_hourly_nnstr.txt</i> Example: 2013_04_month_hourly_01str.txt
Shift data for the indicated month for all 12 streams	Month (shift) (month shall be selected in separate field)	<i>yyyy_mm_month_shift.txt</i> Example: 2013_04_month_shift.txt

Daily data for the indicated month for all 12 streams	Month (daily) (month shall be selected in separate field)	yyyy_mm_month_daily.txt Example: 2013_04_month_daily.txt
Multiday data for the indicated month for all 12 streams	Month (multiday) (month shall be selected in separate field)	yyyy_mm_month_multiday.txt Example: 2013_04_month_multiday.txt
Monthly data for the indicated year for all 12 streams	Year (monthly) (year shall be selected in separate field)	yyyy_monthly.txt Example: 2013_monthly.txt
Alarm log	Logs (all three logs transferred)	alarmlog.txt
Event log		eventlog.txt
Downloaded gas composition		downloadlog.txt
Monthly batch data for the selected month	Monthly batches	batch.txt
Meter serial test data. The last 10 serial test reports are stored.	Meter serial test	meterserialtest.txt
Limited set of hourly data for the current day. The content of the report is identical with the Month (hourly short) report but data included for the previous day only.	Prev. day (hourly short) (stream shall be selected in separate field)	nnstrd_streamname_previous_day_hourly.txt Example: 01strd_M123_previous_day_hourly.txt
Limited set of hourly data for the previous day. The content of the report is identical with the Month (hourly short) report but data included for the current day only.	Cur. day (hourly short) (stream shall be selected in separate field)	nnstrd_streamname_yyyy_mm_dd_hourly.txt Example: 01strd_M123_2013_04_12_hourly.txt
User defined set No.1 of hourly data for the previous day. The content of the report is identical with the Month (hourly defined 1) report but data included for the previous day only.	Prev. day (hourly defined 1)	01rpd_previous_day_hourly.txt Example: 01rpd_previous_day_hourly.txt
User defined set No.1 of hourly data for the current day. The content of the report is identical with the Month (hourly defined 1) report but data included for the current day only.	Cur. day (hourly defined 1)	01rpd_yyyyy_mm_dd_hourly.txt Example: 01rpd_2013_04_12_hourly.txt
User defined set No.2 of hourly data for the previous day. The content of the report is identical with the Month (hourly defined 2) report but data included for the previous day only.	Prev. day (hourly defined 2)	02rpd_previous_day_hourly.txt Example: 02rpd_previous_day_hourly.txt
User defined set No.2 of hourly data for the current day. The content of the report is identical with the Month (hourly defined 2)	Cur. day (hourly defined 2)	02rpd_yyyyy_mm_dd_hourly.txt 02rpd_2013_04_12_hourly.txt

report but data included for the current day only.		
User defined set No.3 of hourly data for the previous day.	Prev. day (hourly defined 3)	03rpds_previous_day_hourly.txt Example: 03rpds_previous_day_hourly.txt
User defined set No.3 of hourly data for the current day.	Cur. day (hourly defined 3)	03rpds_yyyy_mm_dd_hourly.txt Example: 03rpds_2013_04_12_hourly.txt
User defined set No.4 to 10 of hourly data for the previous day.	Prev. day (hourly defined 4 to 10)	04 to 10rpds_previous_day_hourly.txt Example: 05rpds_previous_day_hourly.txt
User defined set No.4 to 10 of hourly data for the current day.	Cur. day (hourly defined 4 to 10)	04 to 10rpds_yyyy_mm_dd_hourly.txt Example: 05rpds_2013_04_12_hourly.txt
where: <i>nn</i> – stream number		where: <i>nn</i> – stream number <i>yyyy</i> – year <i>mm</i> – month <i>dd</i> – day <i>streamname</i> – stream name as entered in the Parameters -> Stream -> Physical stream and Parameters -> Stream -> Virtual stream menu

## Month (daily short) report example

```

=====
Month (daily short)
Previous month flows in daily details 2013.07.01 06:00 -
=====
11PTYXY
=====
Type of flowmeter: Turbine flowmeter
Machine: UNIFLOW-200 MFC_200-063
Branch: Tarif_1 2.str.

Time          UVOL      CVOL      Energy   P_avg.   T_avg.   K_avg.   Inf.c.v
-            m3        Sm3        GJ        barA      oC        -        MJ/m3
2013/06/02 06:00 683941 7686908 261474 26.005 380.00 1.0074 34.016
2013/06/03 06:00 683925 7686730 261469 26.005 380.00 1.0074 34.016
2013/06/04 06:00 683933 7686818 261472 26.005 380.00 1.0074 34.016
2013/06/05 06:00 683934 7686819 261471 26.005 380.00 1.0074 34.016
2013/06/06 06:00 681336 7657637 260478 26.005 380.00 1.0074 34.016
2013/06/07 06:00 17011 191192 6504 26.005 380.00 1.0074 34.016
2013/06/08 06:00 683819 7685529 261428 26.005 380.00 1.0074 34.016
2013/06/09 06:00 55858 627801 21355 26.005 380.00 1.0074 34.016
2013/06/10 06:00 0 0 0 26.005 380.00 1.0074 34.016
2013/06/11 06:00 * * * * * * *
2013/06/12 06:00 * * * * * * *
2013/06/13 06:00 * * * * * * *
2013/06/14 06:00 * * * * * * *
2013/06/15 06:00 * * * * * * *
2013/06/16 06:00 * * * * * * *
2013/06/17 06:00 * * * * * * *
2013/06/18 06:00 * * * * * * *
2013/06/19 06:00 * * * * * * *
2013/06/20 06:00 * * * * * * *
2013/06/21 06:00 * * * * * * *
2013/06/22 06:00 * * * * * * *
2013/06/23 06:00 * * * * * * *
2013/06/24 06:00 * * * * * * *
2013/06/25 06:00 * * * * * * *
2013/06/26 06:00 * * * * * * *
2013/06/27 06:00 * * * * * * *
2013/06/28 06:00 * * * * * * *
2013/06/29 06:00 * * * * * * *
2013/06/30 06:00 * * * * * * *
2013/07/01 06:00 0 0 0 26.005 380.00 1.0074 34.016

Previous month flows
UVOL: 4173757 Sm3
CVOL: 46909434 m3
Energy: 1595651 GJ
Premium CVOL: 0 m3

Previous month averages
P_average: 26.0050 bar
T_average: 380.0000 °C
K_average: 1.0074 -

Previous month maximal hourly corrected volume
CVOL_hourly_max: 320285 m3
Max_month: 6 month
Max_day: 1 day
Max_hour: 12 hour

Previous month
Flow time: 188.3019 hours
Fault flow time: 146.4619 hours
=====
02str_Tarif_1_2013_06_daily.txt
=====

```

## Month (hourly short) report example

```

=====
Month (hourly short)
Previous month flows in hourly details 2013.07.01 06:00 -
=====
11PTYXY

=====
Type of flowmeter: Turbine flowmeter
Machine: UNIFLOW-200 MFC_200-063
Branch: Tarif_1 2.str.

Time          UVOL      CVOL      Energy    P_avg.    T_avg.    K_avg.    Inf.c.v
-            m3         Sm3         GJ         barA       oC         -         MJ/m3
2013/06/01 07:00 28497    320284    10895     26.005    380.00    1.0074    34.016
2013/06/01 08:00 28497    320284    10894     26.005    380.00    1.0074    34.016
2013/06/01 09:00 28498    320284    10895     26.005    380.00    1.0074    34.016
2013/06/01 10:00 28497    320284    10894     26.005    380.00    1.0074    34.016
2013/06/01 11:00 28497    320284    10895     26.005    380.00    1.0074    34.016
2013/06/01 12:00 28497    320285    10895     26.005    380.00    1.0074    34.016
2013/06/01 13:00 28497    320284    10894     26.005    380.00    1.0074    34.016
2013/06/01 14:00 28498    320284    10895     26.005    380.00    1.0074    34.016
2013/06/01 15:00 28497    320284    10895     26.005    380.00    1.0074    34.016
2013/06/01 16:00 28497    320284    10894     26.005    380.00    1.0074    34.016
2013/06/01 17:00 28497    320284    10895     26.005    380.00    1.0074    34.016
2013/06/01 18:00 28497    320284    10895     26.005    380.00    1.0074    34.016
2013/06/01 19:00 28498    320284    10894     26.005    380.00    1.0074    34.016
2013/06/01 20:00 28497    320284    10895     26.005    380.00    1.0074    34.016
2013/06/01 21:00 28497    320285    10895     26.005    380.00    1.0074    34.016
2013/06/01 22:00 28497    320284    10894     26.005    380.00    1.0074    34.016
2013/06/01 23:00 28498    320284    10895     26.005    380.00    1.0074    34.016
2013/06/02 00:00 28497    320284    10895     26.005    380.00    1.0074    34.016
2013/06/02 01:00 28497    320284    10894     26.005    380.00    1.0074    34.016
2013/06/02 02:00 28497    320284    10895     26.005    380.00    1.0074    34.016
2013/06/02 03:00 28497    320284    10894     26.005    380.00    1.0074    34.016
2013/06/02 04:00 28498    320284    10895     26.005    380.00    1.0074    34.016
2013/06/02 05:00 28497    320285    10895     26.005    380.00    1.0074    34.016
...
2013/06/30 07:00 *         *         *         *         *         *         *
2013/06/30 08:00 *         *         *         *         *         *         *
2013/06/30 09:00 *         *         *         *         *         *         *
2013/06/30 10:00 *         *         *         *         *         *         *
2013/06/30 11:00 *         *         *         *         *         *         *
2013/06/30 12:00 *         *         *         *         *         *         *
2013/06/30 13:00 *         *         *         *         *         *         *
2013/06/30 14:00 *         *         *         *         *         *         *
2013/06/30 15:00 *         *         *         *         *         *         *
2013/06/30 16:00 *         *         *         *         *         *         *
2013/06/30 17:00 *         *         *         *         *         *         *
2013/06/30 18:00 *         *         *         *         *         *         *
2013/06/30 19:00 *         *         *         *         *         *         *
2013/06/30 20:00 *         *         *         *         *         *         *
2013/06/30 21:00 *         *         *         *         *         *         *
2013/06/30 22:00 *         *         *         *         *         *         *
2013/06/30 23:00 *         *         *         *         *         *         *
2013/07/01 00:00 *         *         *         *         *         *         *
2013/07/01 01:00 *         *         *         *         *         *         *
2013/07/01 02:00 *         *         *         *         *         *         *
2013/07/01 03:00 *         *         *         *         *         *         *
2013/07/01 04:00 *         *         *         *         *         *         *
2013/07/01 05:00 *         *         *         *         *         *         *
2013/07/01 06:00 0         0         0     26.005    380.00    1.0074    34.016
=====
02str_Tarif_1_2013_06_hourly.txt

```



## Periodic print: Cur. Day (hourly short) report example

```

=====
Prev. Day (hourly short)
Previous day flows in hourly details 2013.07.01 06:00 -
=====
11PTYXY
=====

Type of flowmeter:      Nozzle
Machine:                UNIFLOW-200 MFC_200-063
Branch:                 STO 1.str.

Time                    UVOL      CVOL      Energy    P_avg.    T_avg.    K_avg.    Inf.c.v
-                      MCF       SMCf      MMBTU     PSIA      °F        -         BTU/SCF
2013/06/30 07:00       *        *        *         *         *         *         *
2013/06/30 08:00       *        *        *         *         *         *         *
2013/06/30 09:00       *        *        *         *         *         *         *
2013/06/30 10:00       *        *        *         *         *         *         *
2013/06/30 11:00       *        *        *         *         *         *         *
2013/06/30 12:00       *        *        *         *         *         *         *
2013/06/30 13:00       *        *        *         *         *         *         *
2013/06/30 14:00       *        *        *         *         *         *         *
2013/06/30 15:00       *        *        *         *         *         *         *
2013/06/30 16:00       *        *        *         *         *         *         *
2013/06/30 17:00       *        *        *         *         *         *         *
2013/06/30 18:00       *        *        *         *         *         *         *
2013/06/30 19:00       *        *        *         *         *         *         *
2013/06/30 20:00       *        *        *         *         *         *         *
2013/06/30 21:00       *        *        *         *         *         *         *
2013/06/30 22:00       *        *        *         *         *         *         *
2013/06/30 23:00       *        *        *         *         *         *         *
2013/07/01 00:00       *        *        *         *         *         *         *
2013/07/01 01:00       *        *        *         *         *         *         *
2013/07/01 02:00       *        *        *         *         *         *         *
2013/07/01 03:00       *        *        *         *         *         *         *
2013/07/01 04:00       *        *        *         *         *         *         *
2013/07/01 05:00       *        *        *         *         *         *         *
2013/07/01 06:00       4         51       46       174.05    57.20    0.9780    897.68

Previous day flows
UVOL:      4      SMCf
CVOL:      52      MCF
Energy:     46     MMBTU
Premium CVOL: 0     MCF

Previous day averages
P_average:   174.0453 PSIA
T_average:   57.2000 °F
K_average:   0.9780 -

Previous day maximal hourly corrected volume
CVOL_hourly_max: 0      MCF
Max_month:      0      month
Max_day:        0      day
Max_hour:       0      hour

Previous day
Flow time:      0.0190 hours
Fault flow time: 0.0190 hours
=====
01strd_STO_previous_day_hourly.txt
=====

```

Periodic print: Prev. Day (hourly defined 1) report example

```
=====
Previous day, hourly defined rep.2
Previous day flows in hourly details 2013.07.01 06:00 -
=====
11PTYXY

=====
Machine:                UNIFLOW-200 MFC_200-063

Time                    -   1.Str   2.Str   3.Str   4.Str   -
-                      -   CVOL   CVOL   CVOL   CVOL   -
-                      -   m3     m3     m3     m3     -
2013/06/30 07:00        1234    5678    9012    3456
2013/06/30 08:00        1234    5678    9012    3456
2013/06/30 09:00        1234    5678    9012    3456
2013/06/30 10:00        1234    5678    9012    3456
2013/06/30 11:00        1234    5678    9012    3456
2013/06/30 12:00        1234    5678    9012    3456
2013/06/30 13:00        1234    5678    9012    3456
2013/06/30 14:00        1234    5678    9012    3456
2013/06/30 15:00        1234    5678    9012    3456
2013/06/30 16:00        1234    5678    9012    3456
2013/06/30 17:00        1234    5678    9012    3456
2013/06/30 18:00        1234    5678    9012    3456
2013/06/30 19:00        1234    5678    9012    3456
2013/06/30 20:00        1234    5678    9012    3456
2013/06/30 21:00        1234    5678    9012    3456
2013/06/30 22:00        1234    5678    9012    3456
2013/06/30 23:00        1234    5678    9012    3456
2013/07/01 00:00        1234    5678    9012    3456
2013/07/01 01:00        1234    5678    9012    3456
2013/07/01 02:00        1234    5678    9012    3456
2013/07/01 03:00        1234    5678    9012    3456
2013/07/01 04:00        1234    5678    9012    3456
2013/07/01 05:00        1234    5678    9012    3456
2013/07/01 06:00        1234    5678    9012    3456
=====
02rpd_previous_day_hourly.txt
=====
```

## Periodic print: Prev. Day (hourly defined 3) report example

```

=====
Daily billing report (User report 3)
Flows in hourly details      Printed: 2013.07.02 06:00 -
=====
11PTYXY

Meter Location: SH2
=====
Machine:                UNIFLOW-200 MFC_200-063
Gas Day :2013/07/01
Contract Time: 6
Meter Tube Inside Diam: 7.874016 inches  Orifice Plate Diam. : 3.937008 inches
VOLUME factor: 28.000000
Run Time : 23.055694  GC updates : 0
Alarms : 24
Events : 10

C1=98.259332 C2=0.000000 C3=0.000000 IC4=0.000000 NC4=0.000000
H2O=1.740665 IC5=0.000000 NC5=0.000000 C6+=0.000000 CO2=0.000000 N2=0.000000

Previous Day Total      :      0      0      0      0
Current Day Total      :    1772    50137    3131172    45007
Cumulative Total       :    55885    2219188    104427317    2174591

1.Str  1.Str  1.Str  1.Str
UVOL    CVOL    MASS    Energy
MCF      MCF      lb      MMBTU
-----
Previous Day Total      :      0      0      0      0
Current Day Total      :    1772    50137    3131172    45007
Cumulative Total       :    55885    2219188    104427317    2174591

1.Str  1.Str  1.Str  1.Str  1.Str  1.Str  1.Str  1.Str
P avg  Temp.a  dp avg  K avg  Sup.c.v  Rel.dens  1.dens.a
-      °F      inchH2O  -      BTU/SCF  -      lb/CF
GasDayMax.  633.440  50.97  175.0432  0.9131  997.95  0.5562  2.992
Min.        174.045  50.95  174.9975  0.9131  997.95  0.5562  0.758
Avg.        525.232  52.43  545.5416  0.9284  997.95  0.5562  2.466

1.Str  1.Str  1.Str  1.Str  1.Str  1.Str  1.Str  1.Str
UVOL    CVOL    MASS    Energy    P avg  Temp.a  Sup.c.v  F.time
MCF      MCF      lb      MMBTU    PSIA    °F      BTU/SCF  h
06-07    13      167    10469    150    174.045  57.20  997.95  0.0611
07-08    225    2743    171307    2462    174.045  57.20  997.95  1.0000
08-09    225    2740    171144    2459    174.045  57.20  997.95  0.9990
09-10    225    2742    171305    2462    174.045  57.20  997.95  1.0000
10-11    225    2742    171301    2462    174.045  57.20  997.95  1.0000
11-12    86     2186    136521    1961    492.628  52.88  997.95  0.9958
12-13    42     2045    127738    1835    633.441  50.97  997.95  1.0000
13-14    42     2045    127735    1835    633.428  50.97  997.95  1.0000
14-15    42     2045    127733    1836    633.411  50.97  997.95  1.0000
15-16    42     2045    127729    1835    633.395  50.96  997.95  1.0000
16-17    42     2045    127727    1835    633.381  50.96  997.95  1.0000
17-18    42     2045    127724    1835    633.376  50.96  997.95  1.0000
18-19    42     2045    127724    1835    633.372  50.96  997.95  1.0000
19-20    42     2045    127724    1835    633.371  50.96  997.95  1.0000
20-21    42     2044    127709    1834    633.381  50.96  997.95  0.9999
21-22    42     2045    127727    1835    633.383  50.96  997.95  1.0000
22-23    42     2045    127731    1835    633.398  50.96  997.95  1.0000
23-00    42     2045    127731    1836    633.407  50.97  997.95  1.0000
00-01    42     2045    127735    1835    633.422  50.97  997.95  1.0000
01-02    42     2045    127733    1835    633.418  50.97  997.95  1.0000
02-03    42     2045    127733    1835    633.415  50.97  997.95  1.0000
03-04    42     2045    127733    1835    633.416  50.97  997.95  1.0000
04-05    42     2045    127735    1835    633.422  50.97  997.95  1.0000
05-06    42     2045    127735    1835    633.428  50.97  997.95  1.0000

P T/A:      *      *      *      *      *      *      *      *
C T/A:    1772    50137    3131172    45007    525.232    52.43    997.95    23.0557

```

Reason for Irregularity or Remark : \_\_\_\_\_

Acknowledged By : \_\_\_\_\_

```

( _____ COMP1)  ( _____ COMP2)  ( _____ COMP3)
=====
03rpd previous_day_hourly.txt

```

## Annex B. Drawings

### TERMINALS

ANI8 0/4-20mA analogue input module		
Channel No	25-pin 'D sub'	
	(+)	(-)
1	14	1
2	15	2
3	16	3
4	17	4
5	18	5
6	19	6
7	20	7
8	21	8
24V <sub>out</sub>	22	9 (AGND)

PT4 Pt100 RTD input module		
Channel No	25-pin 'D sub'	
	(+)	(-)
1	14 (U) 15 (I)	1 (U) 2 (I)
2	16 (U) 17 (I)	3 (U) 4 (I)
3	18 (U) 19 (I)	5 (U) 6 (I)
4	20 (U) 21 (I)	7 (U) 8 (I)
24V <sub>out</sub>	22	9 (AGND)

ANI4/PT2 0/4-20mA analogue and Pt100 RTD input module		
Channel No	25-pin 'D sub'	
	(+)	(-)
1	14	1
2	15	2
3	16	3
4	17	4
5 Pt100	18(U) 19(I)	5(U) 6(I)
6 Pt100	20(U) 21(I)	7(U) 8(I)
24V <sub>out</sub>	22	9

#### NOTE

Maximum load of the 24V<sub>out</sub> transmitter power output is 200 mA total (as sum of loads on every board providing transmitter power output).  
Terminal pairs of the pulse inputs and 4 terminal points of the RTD inputs not in use must be connected together (short circuited).

PDIO484 Pulse/frequency and digital input and digital output module		
Channel No	25-pin 'D sub'	
	(+)	(-)
1 (p_in)	14	1
2 (p_in)	15	2
3 (p_in)	16	3
4 (p_in)	17	4
5 (d_in)	22	13
6 (d_in)	9	13
7 (d_in)	23	13
8 (d_in)	10	13
9 (d_in)	24	13
10 (d_in)	11	13
11 (d_in)	25	13
12 (d_in)	12	13
13 (d_out)	18	5
14 (d_out)	19	6
15 (d_out)	20	7
16 (d_out)	21	8

DEI4 Input module for smart transmitters with Honeywell DE protocol		
Channel No	25-pin 'D sub'	
	(+)	(-)
1	14	1
2	15	2
3	16	3
4	17	4

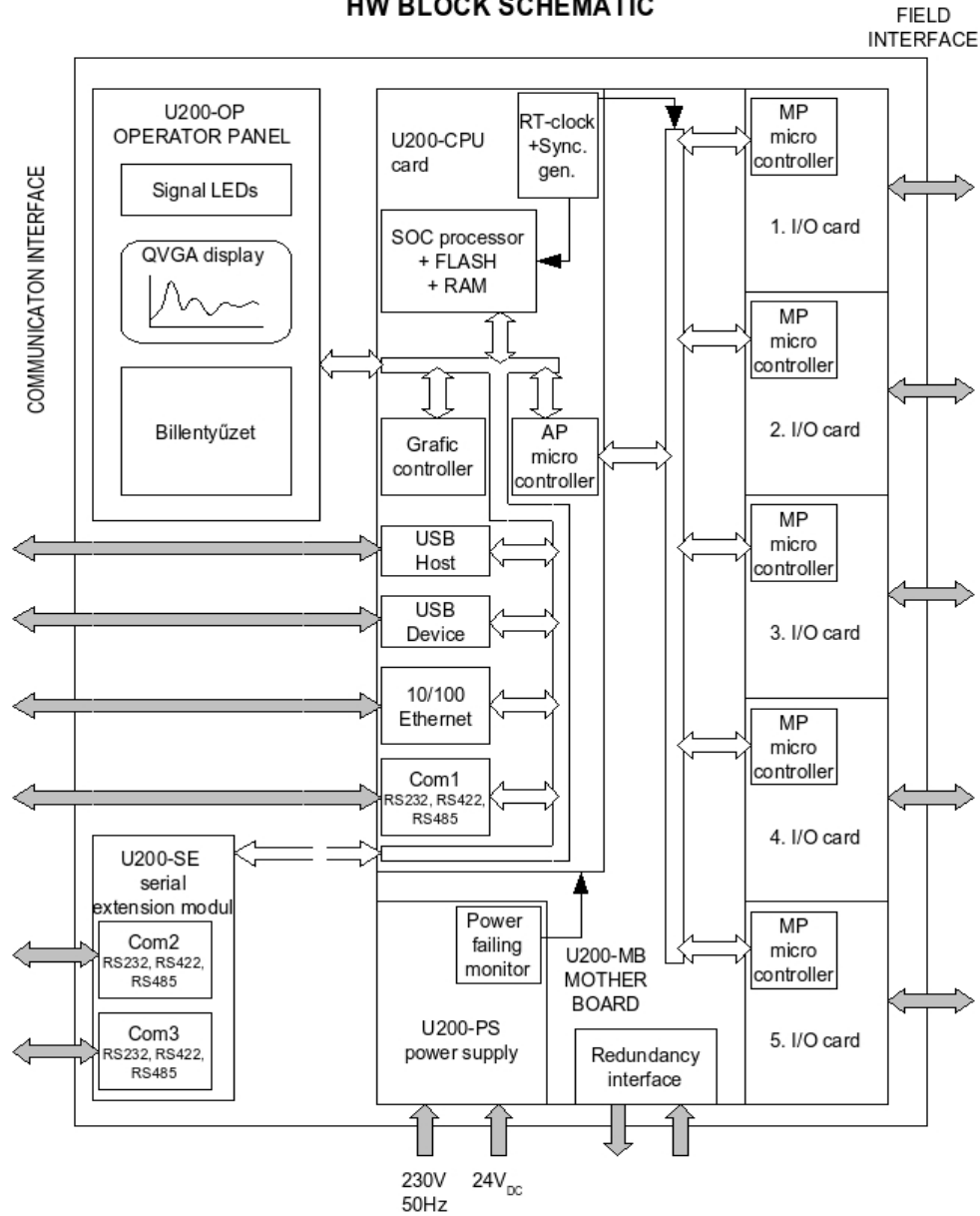
HTI4x15 Input module for smart transmitters with HART protocol		
Loop No	25-pin 'D sub'	
	(+)	(-)
1	14	1
2	15	2
3	16	3
4	17	4
24V <sub>out</sub>	22	9

AODIO484 0/4-20mA analogue and digital output and digital input module		
Channel No	25-pin 'D sub'	
	(+)	(-)
1 (a_out)	14	1
2 (a_out)	15	2
3 (a_out)	16	3
4 (a_out)	17	4
5 (d_in)	22	13
6 (d_in)	9	13
7 (d_in)	23	13
8 (d_in)	10	13
9 (d_in)	24	13
10 (d_in)	11	13
11 (d_in)	25	13
12 (d_in)	12	13
13 (d_out)	18	5
14 (d_out)	19	6
15 (d_out)	20	7
16 (d_out)	21	8

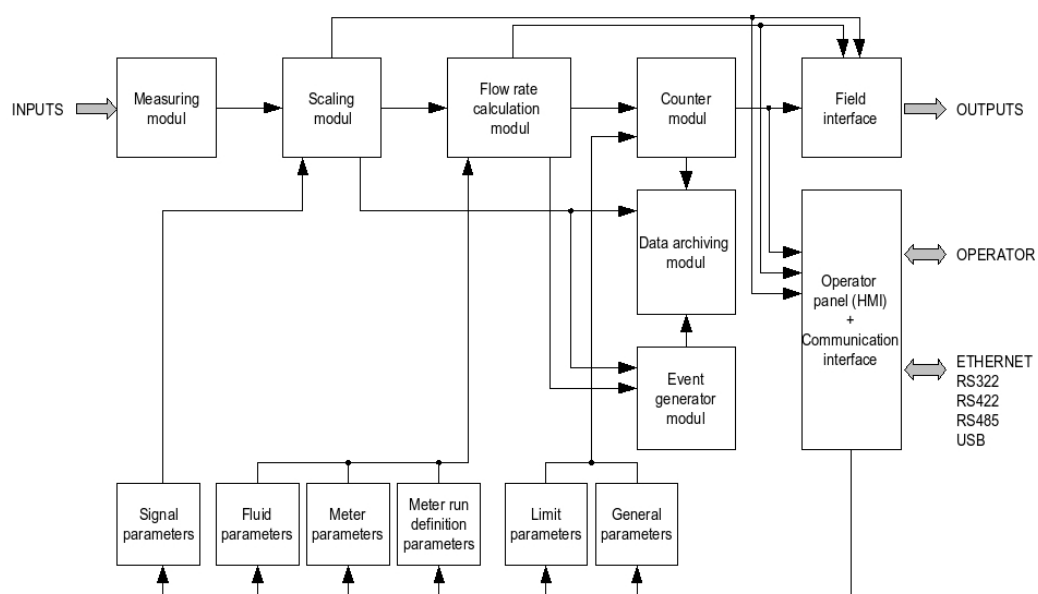
COM1, COM2, COM3			
9-pin 'D sub'	RS232	RS485	RS422
1			
2	RxD		Rx+ (A)
3	TxD	RxTx-	Tx- (Z)
4			
5	GND	GND	GND
6			
7	RTS	RxTx+	Tx+ (Y)
8	CTS		Rx- (B)
9			

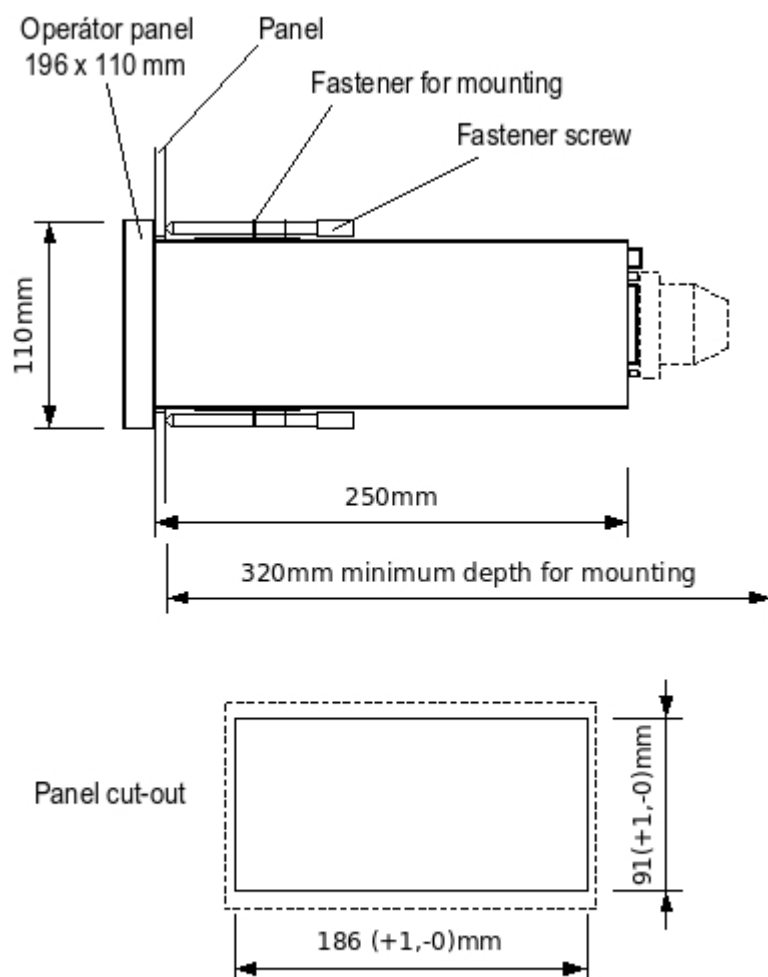
MB, Hot/stand-by interface and flow computer status	
Terminal label	Signal
O	Operating (output)
C	Common (output)
E	Fault (output)
+S	Sense+ (input)
-S	Sense- (input)

## UNIFLOW-200 FLOW COMPUTER HW BLOCK SCHEMATIC

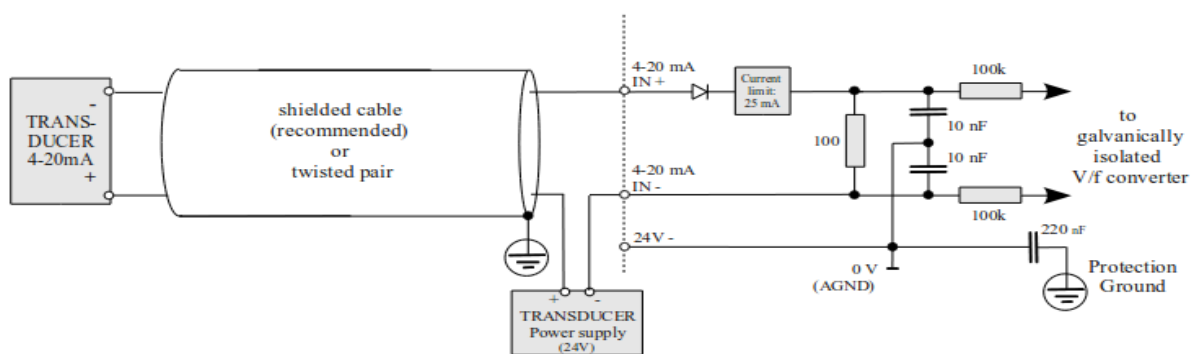


# UNIFLOW-200 FLOW COMPUTER SW BLOCK SCHEMATIC

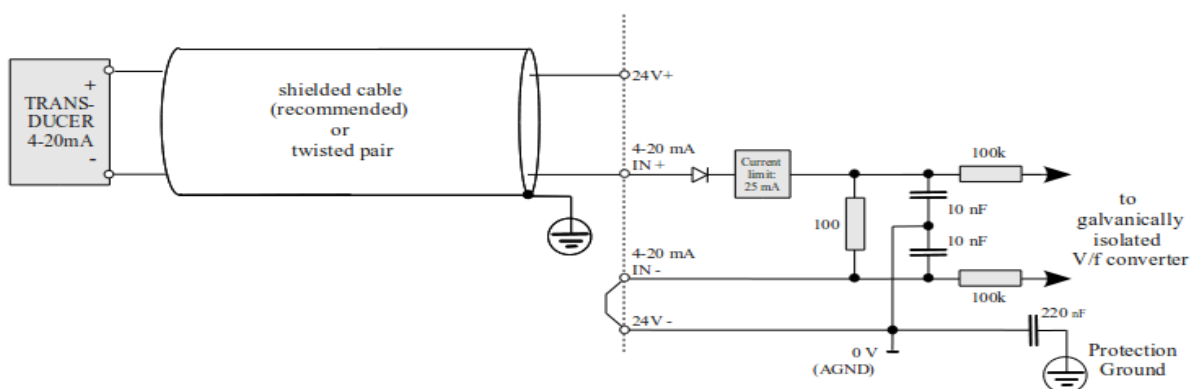




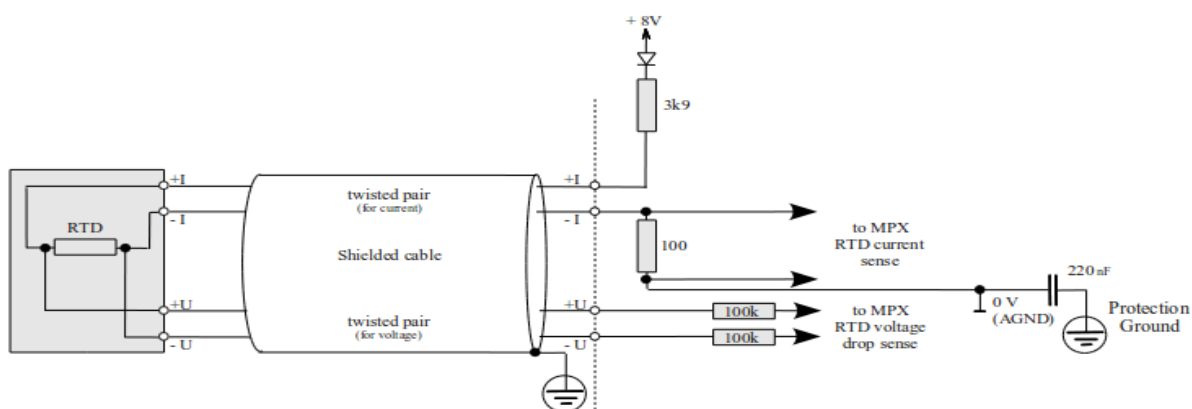
## Mounting and cut-out



**4-20 mA Input and wiring  
loop powered using satellite power supply**

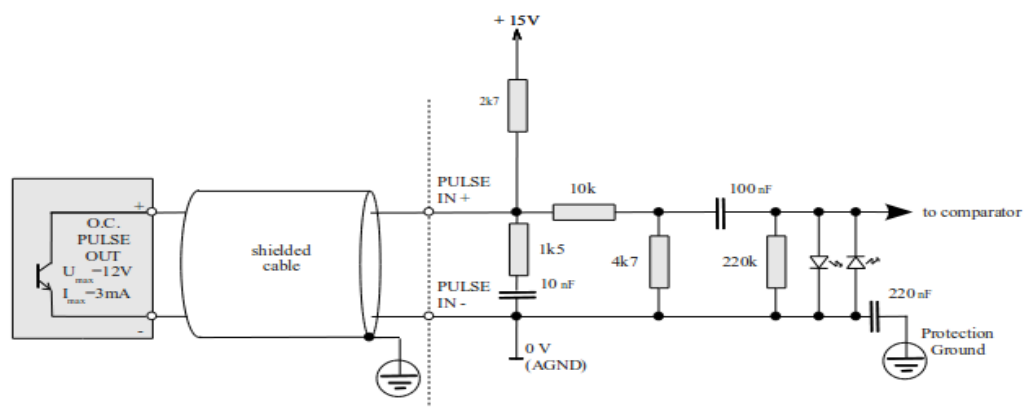


**4-20 mA Input and wiring  
loop powered by the flow computer (1x24V, 20 mA max.)**

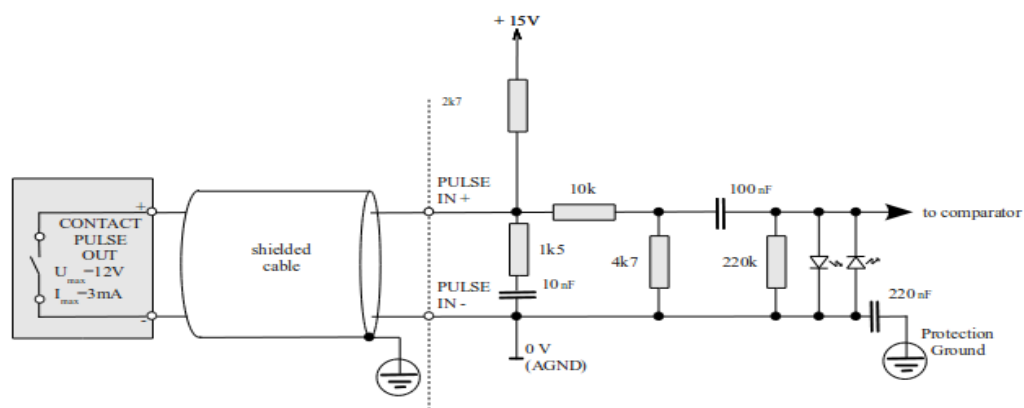


**PRT/RTD Input and wiring**

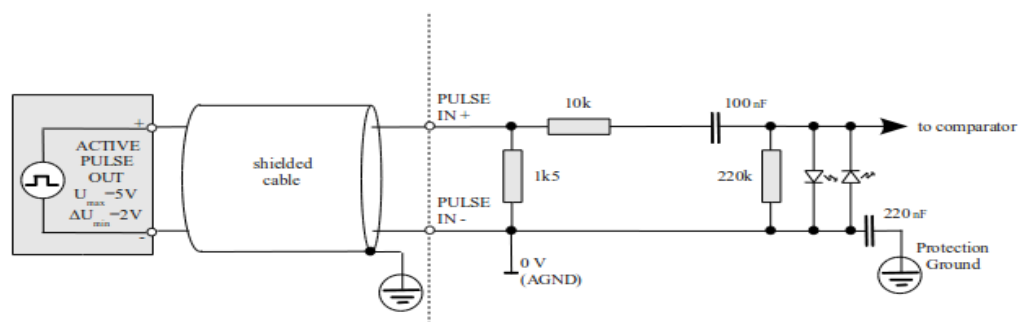
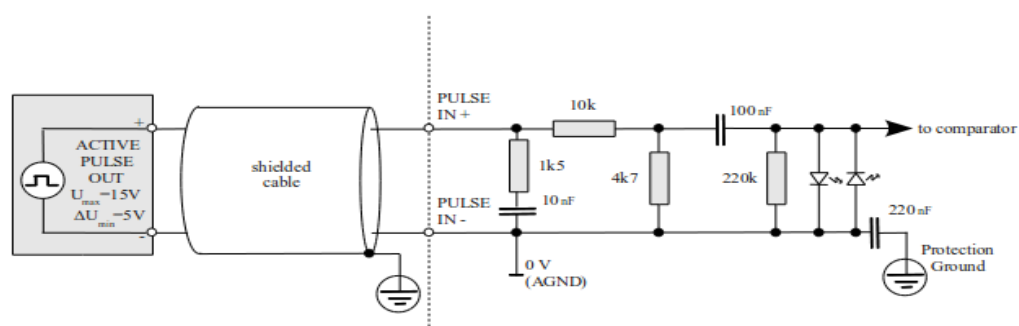




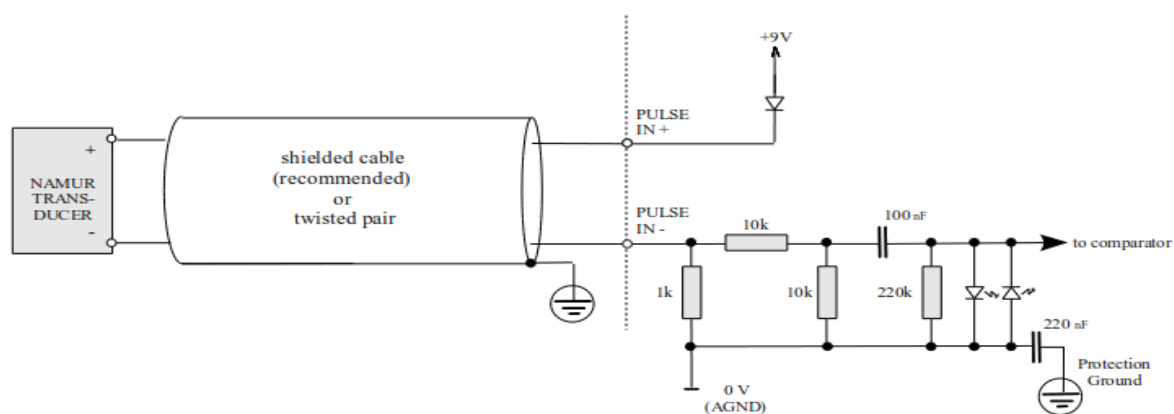
**Pulse Input and wiring for transducers  
with Open Collector (NPN) output**



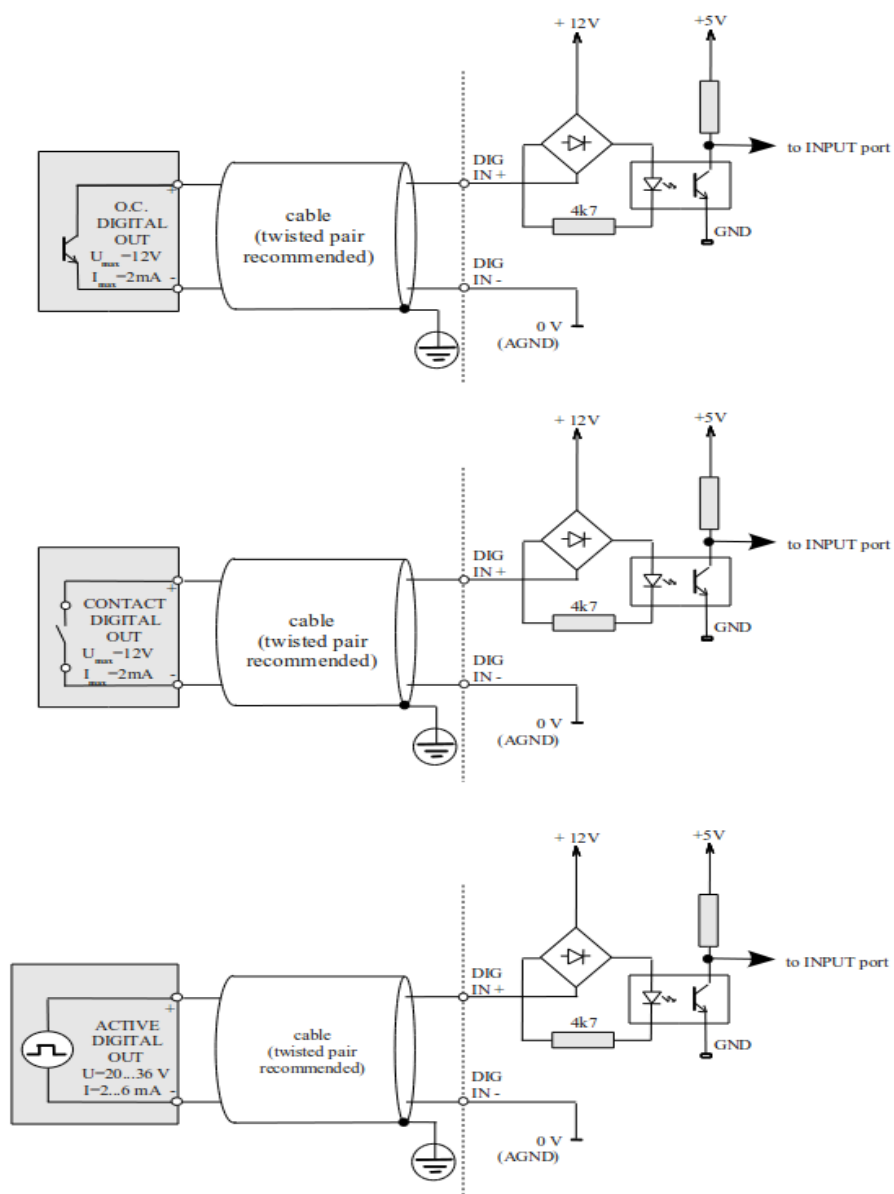
**Pulse Input and wiring for transducers  
with potential free contact output**



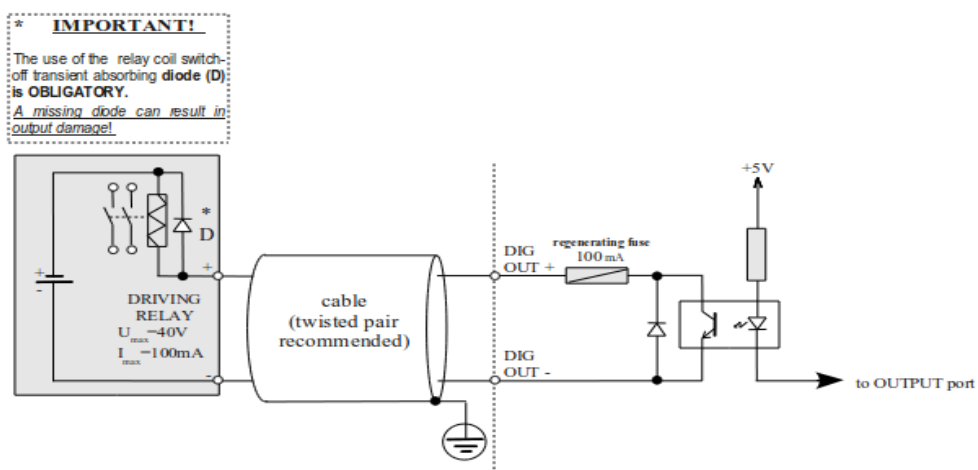
**Pulse Input and wiring for transducers  
with voltage output**



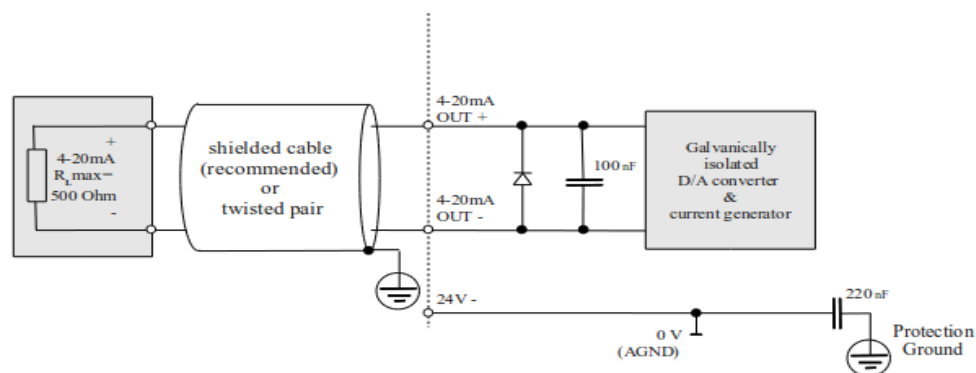
**Pulse Input and wiring for transducers  
with voltage output**



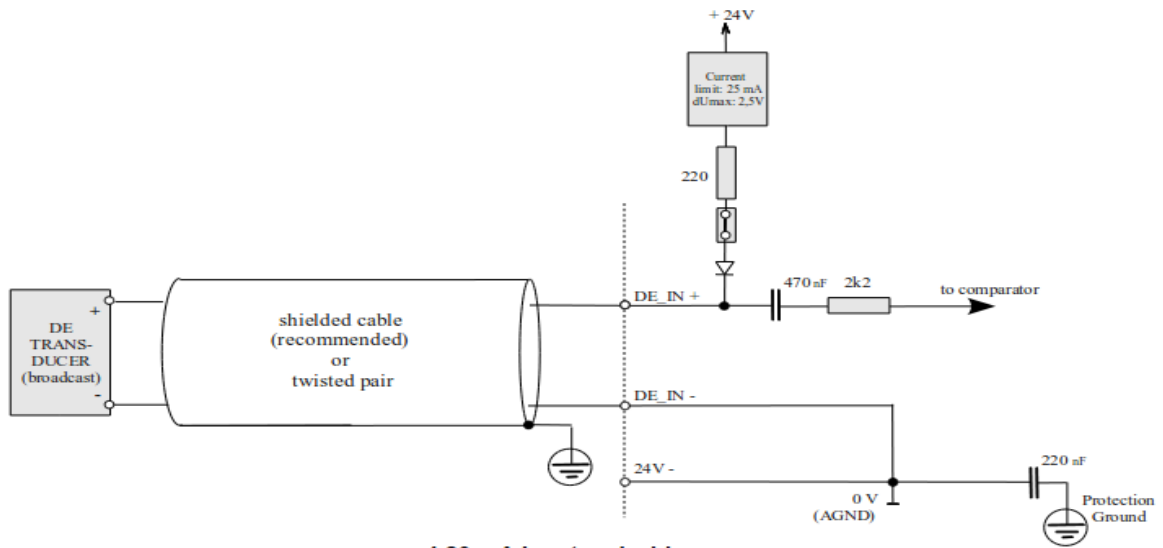
Digital Input and wiring



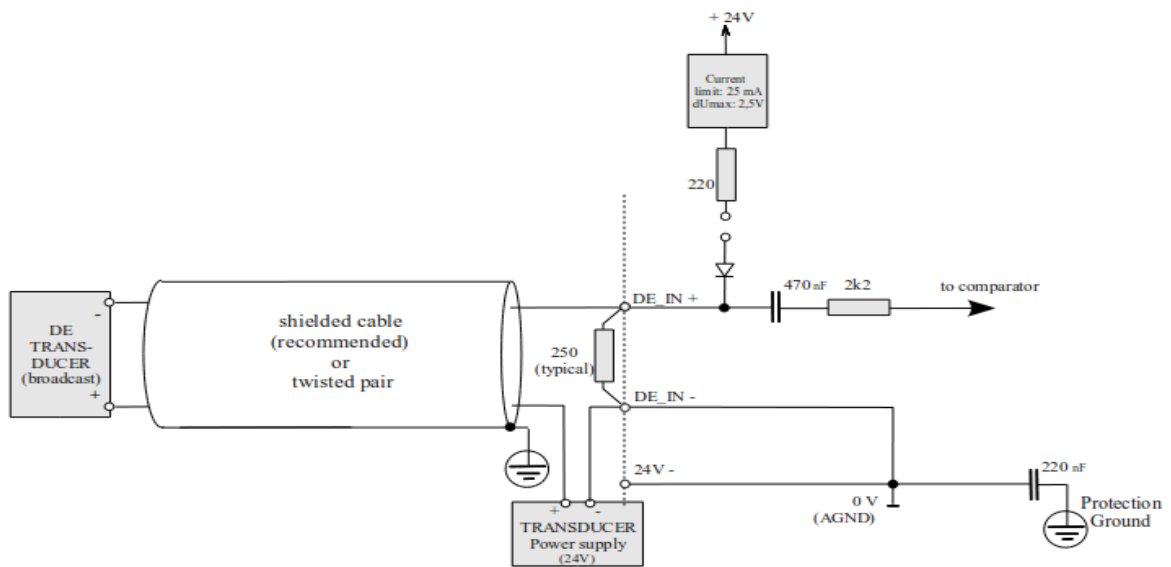
Digital Output and wiring



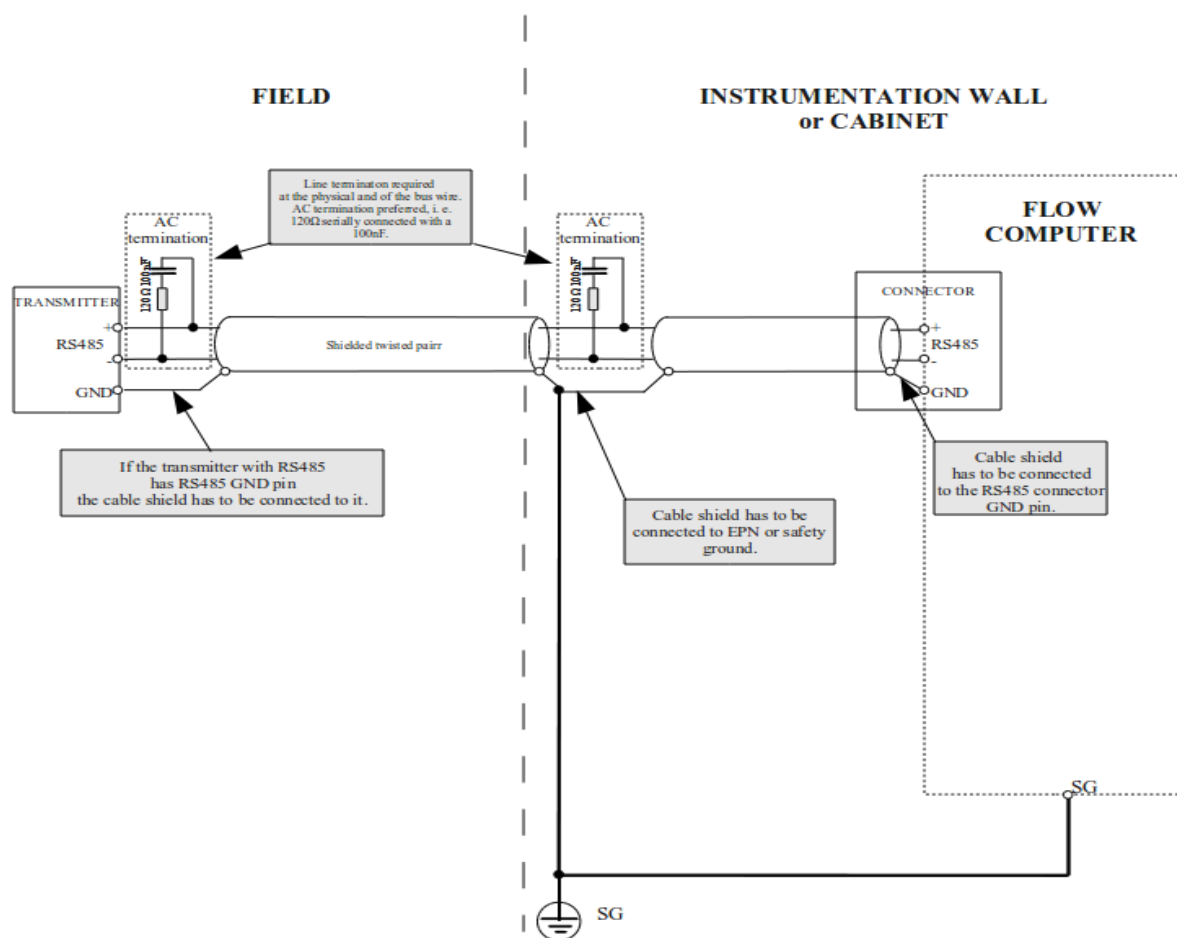
4-20 mA Output and wiring



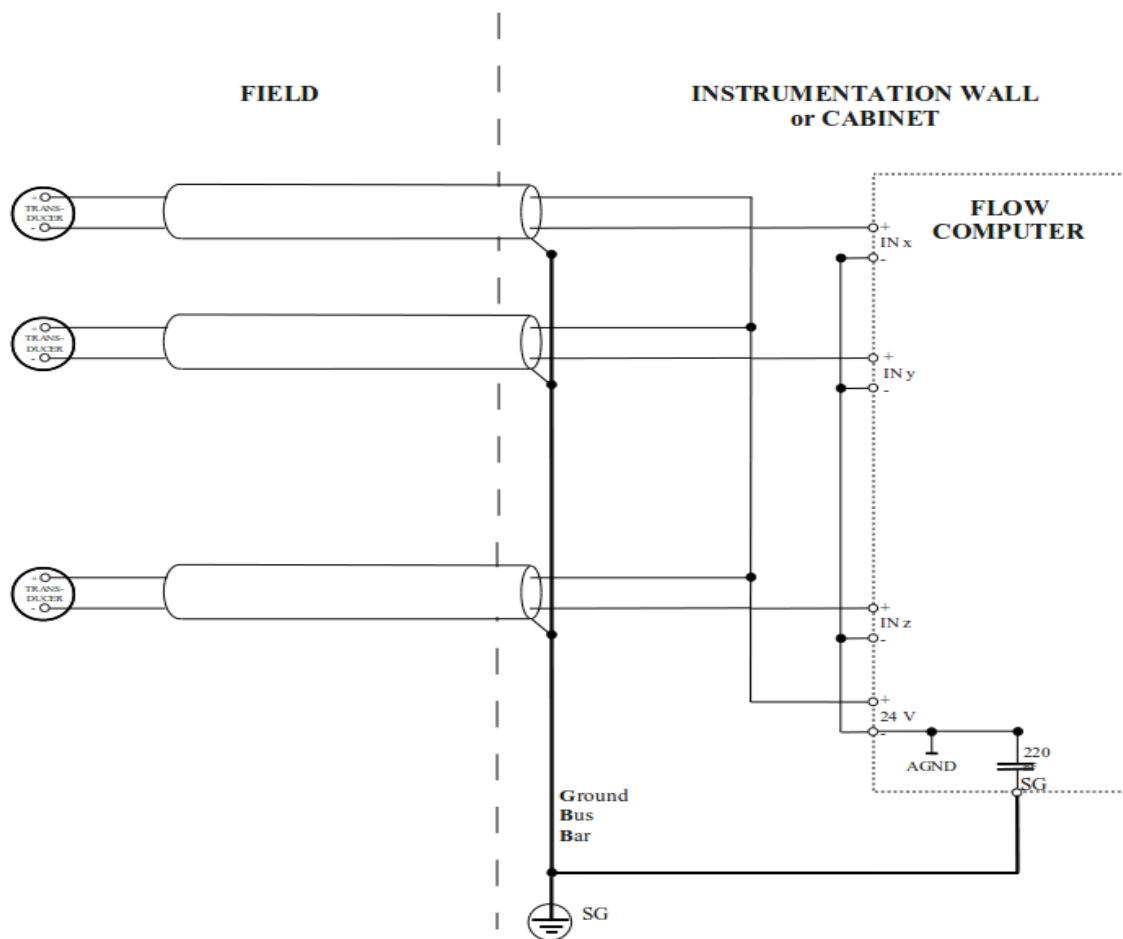
**4-20 mA Input and wiring  
for transducers communicating by Honeywell DE protocol  
loop powered by the flow computer**



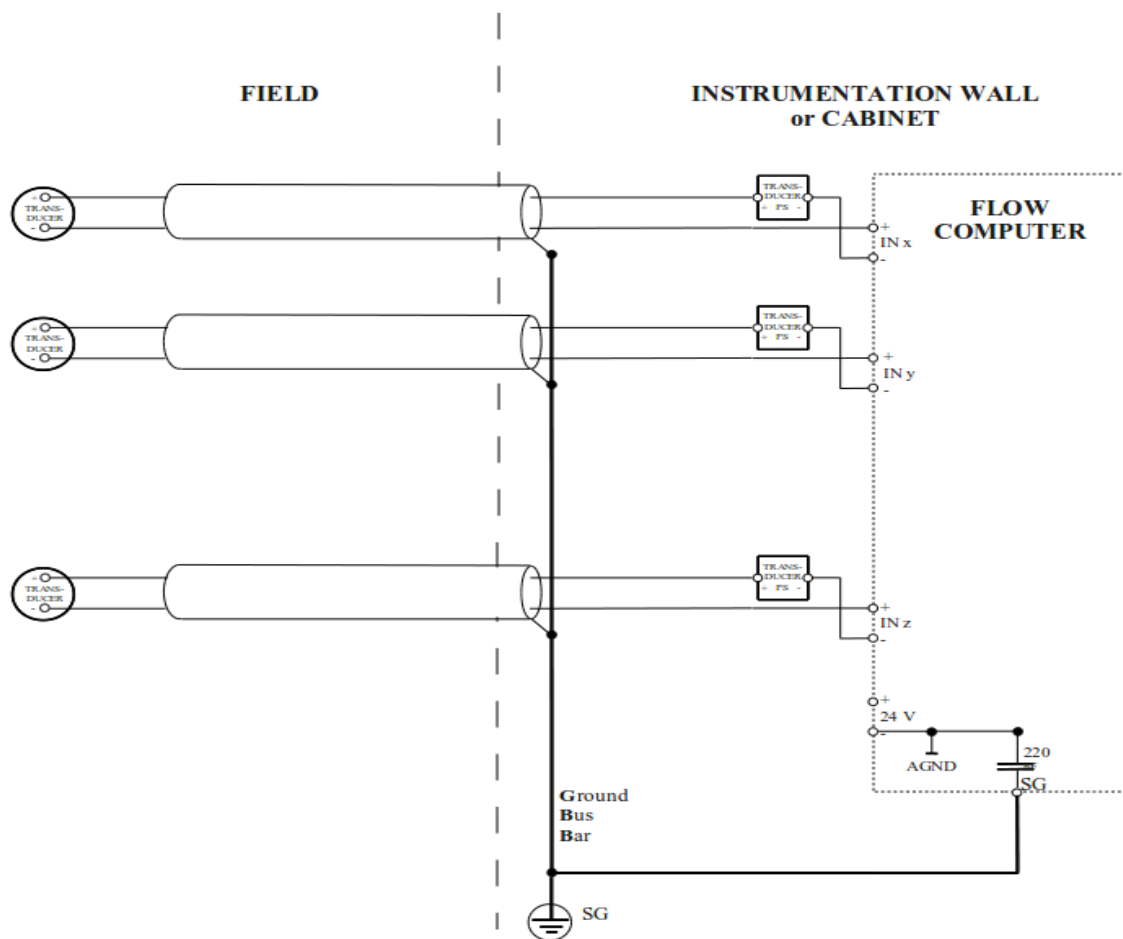
**4-20 mA Input and wiring  
for transducers communicating by Honeywell DE protocol  
loop powered using satellite power supply**



Connection to transmitter equipped with RS485 interface

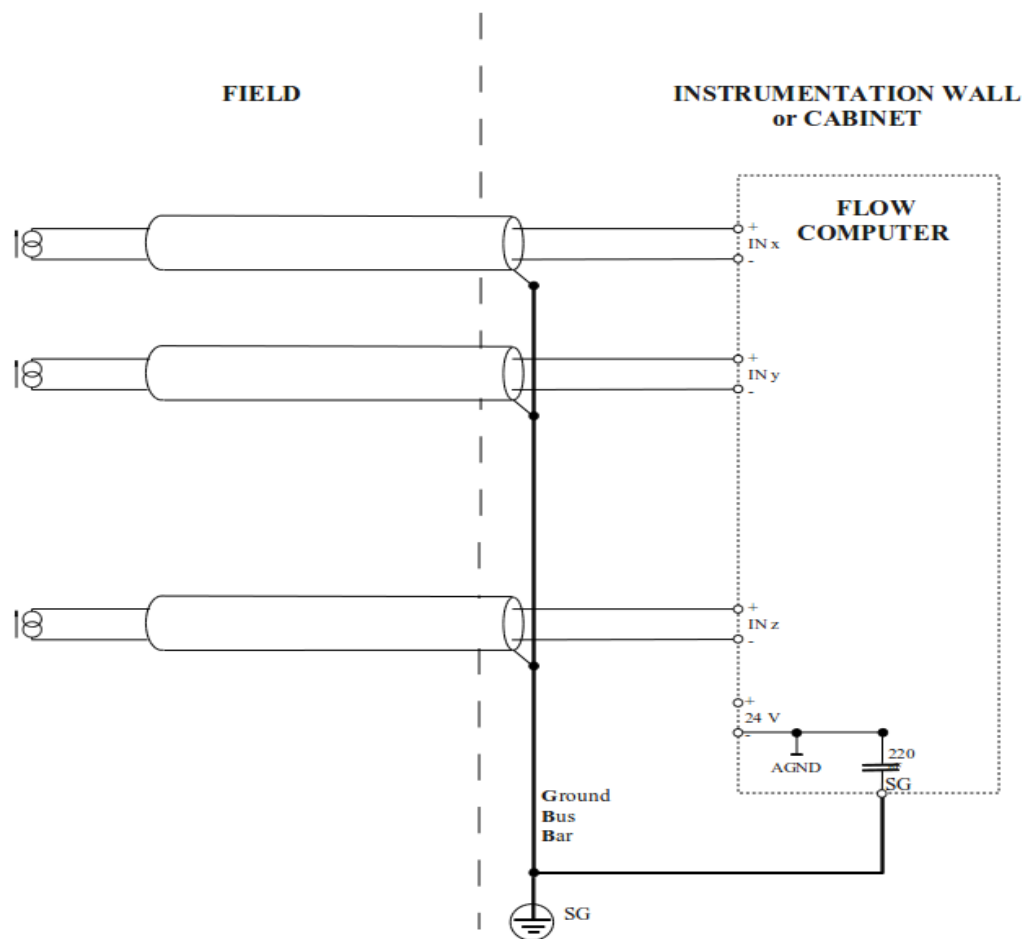


Wiring of the 4-20 mA inputs,  
loop powered by the flow computer

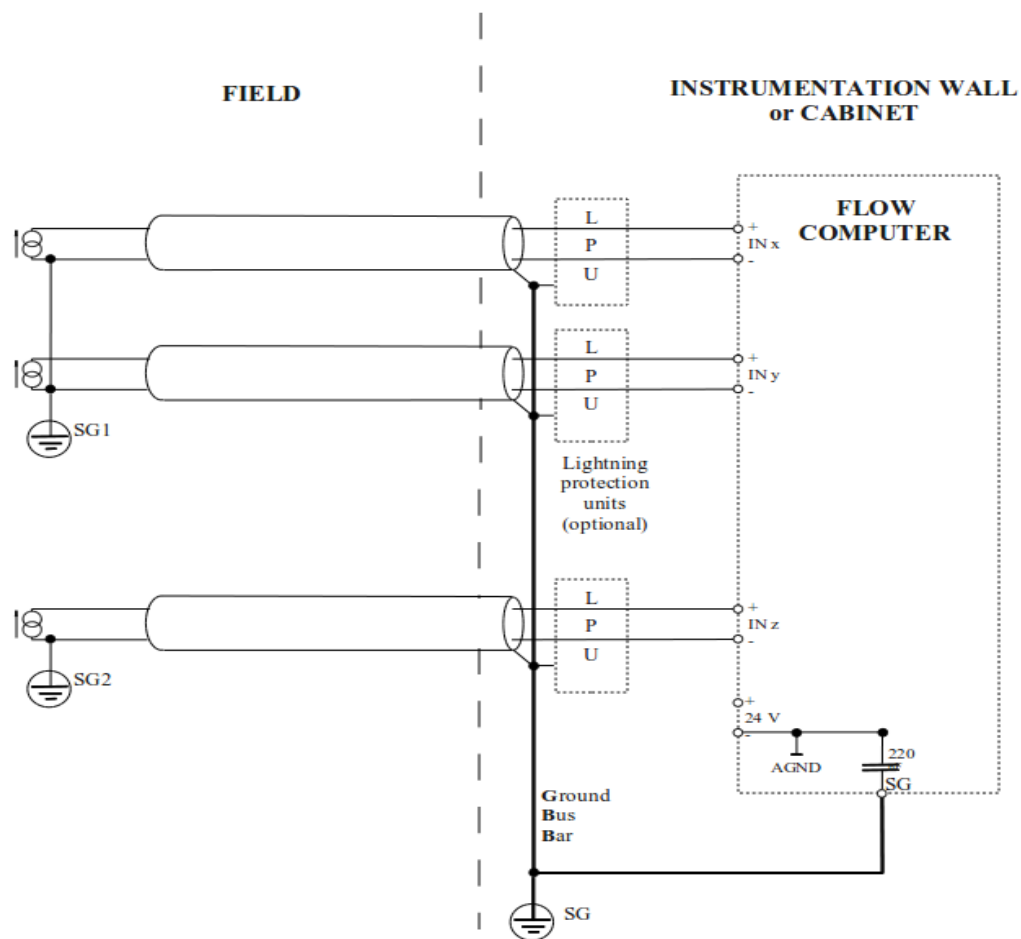


**Wiring of the 4-20 mA inputs,  
loop powered using satellite power supplies**

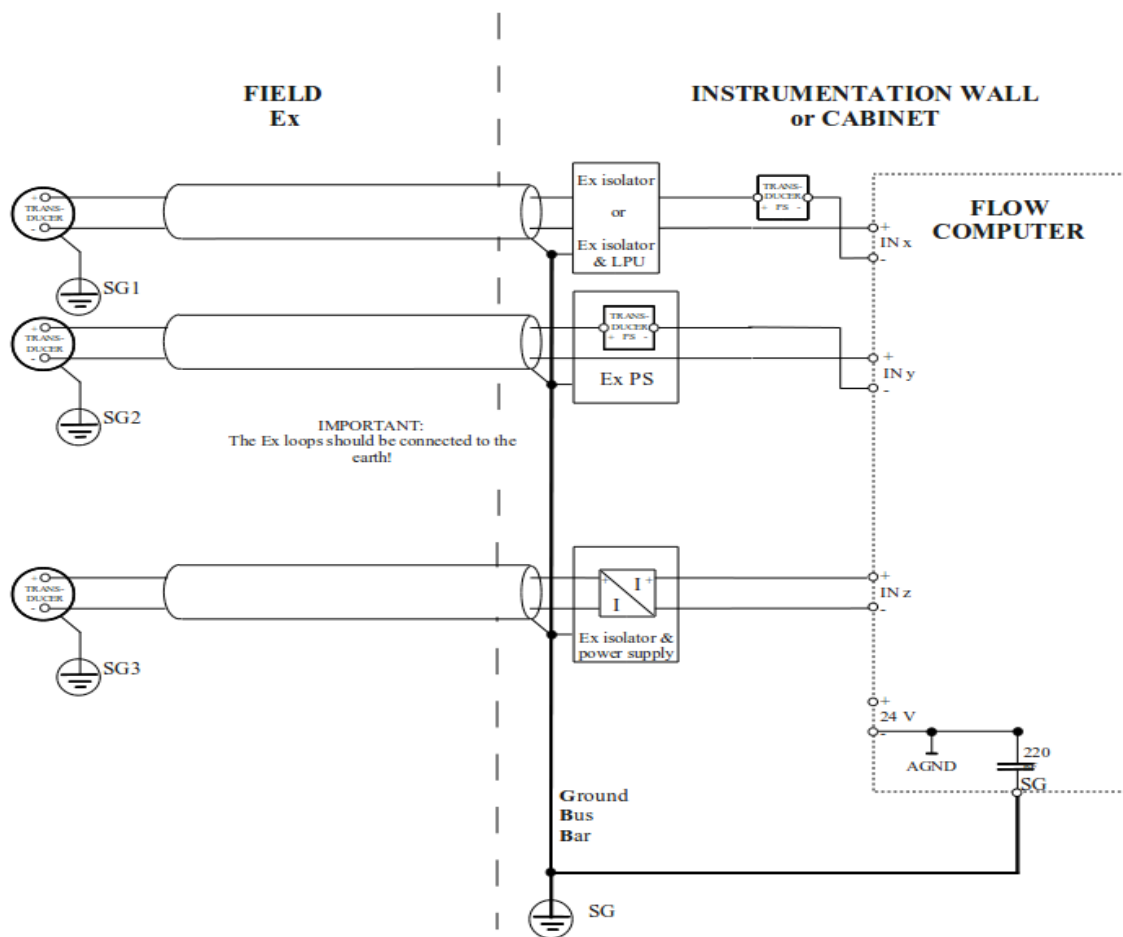




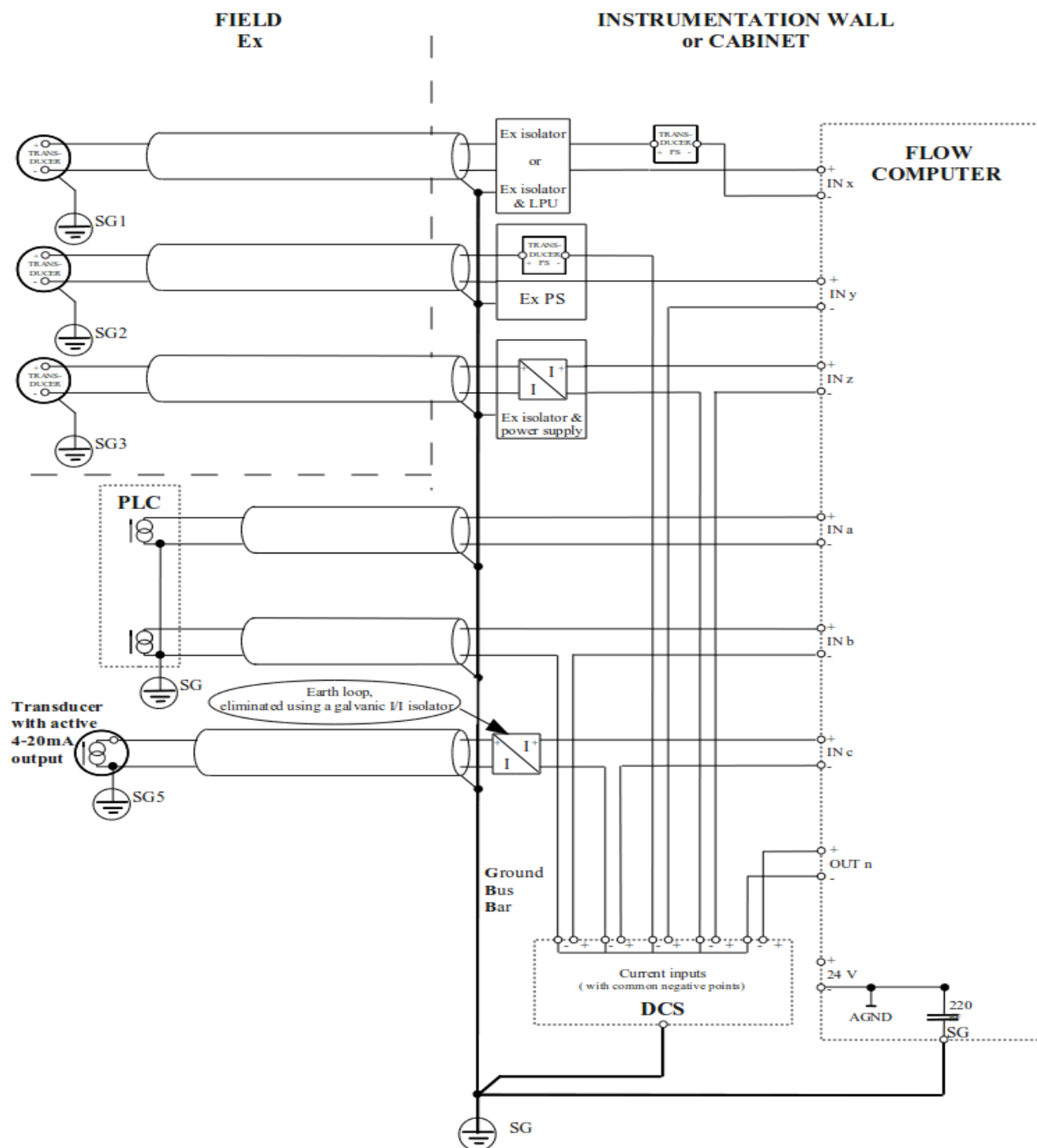
**Wiring of the 4-20 mA inputs,  
transducers with active outputs isolated from the earth**



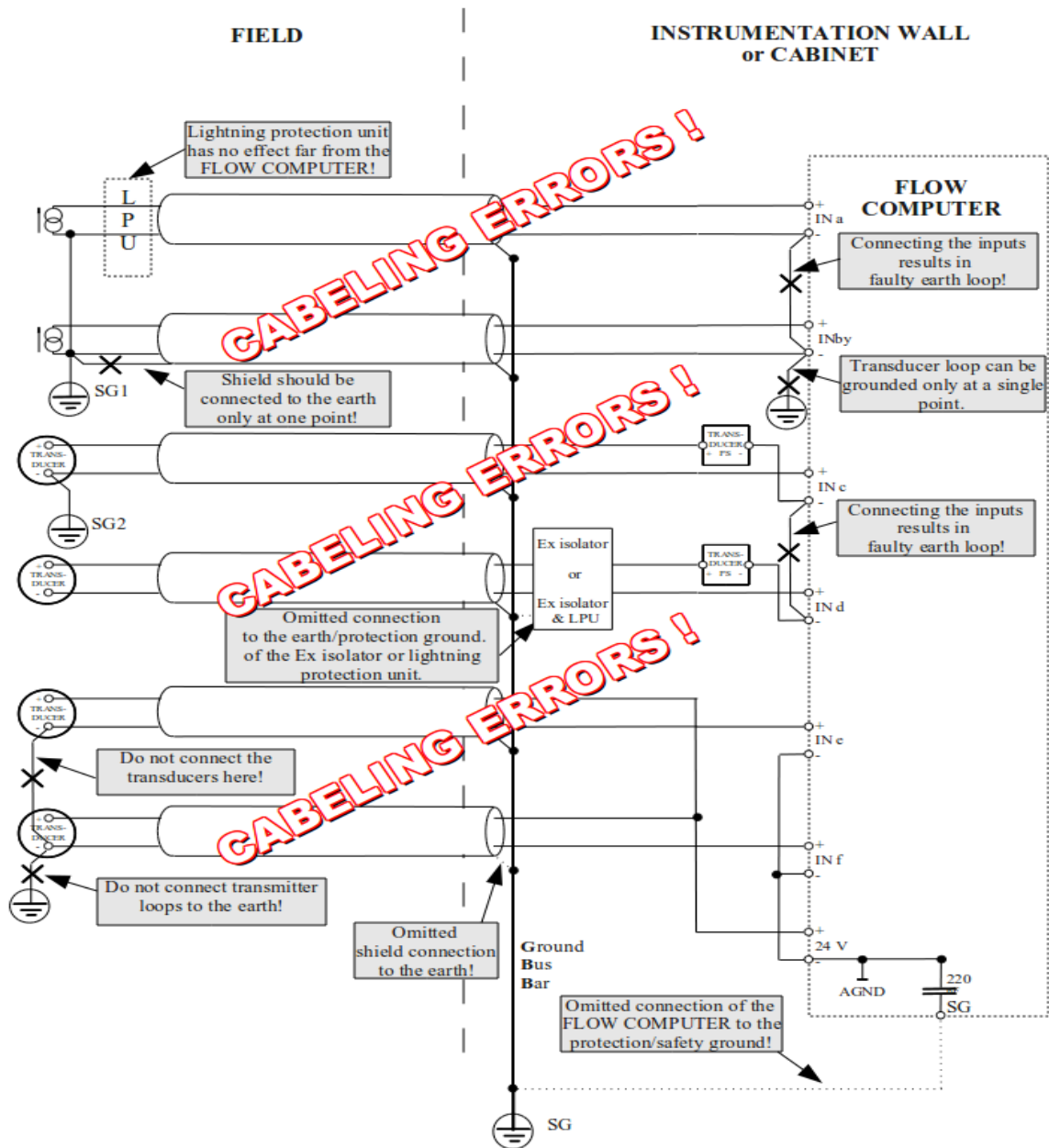
**Wiring of the 4-20 mA inputs,  
transducers with active outputs connected to the earth  
and optional lightning protection**



**Wiring of the 4-20 mA inputs  
in case of explosive (Ex) environment**



**Wiring of the 4-20 mA inputs  
in case of different type devices,  
connected to the earth in different places**



Typical mistakes of the 4-20 mA input wiring

## Annex C. Application note for HTI4x15 I/O board

The HTI4x15 I/O board is designed to communicate with transmitters with HART protocol. One board is capable to serve 4 HART loops with maximum 15 process variable (PV) on each loop. The maximum number of input channels on one board is  $4 \times 15 = 60$ .

### Multidrop mode

In multidrop mode one loop can accommodate maximum 15 transmitters and maximum 15 PVs can be read. If more than one PV is read from one transmitter then the maximum number of transmitter in one loop is decreased accordingly.

The parameters of the HART channels are setup in the I/O signal setup menu. The process variables from the transmitters are assigned to the channels of the IO board. The assignment shall be started from channel 1 and shall be continuous.

Parameters to be defined for each channel are as follows:

- serial number of HART loop (1 to 4);
- polling address of the transmitter (1 to 15)
- serial number of the process variable (1 to 4)

The low scale and high scale values for the channel must be set equal to the low scale and high scale value set in the transmitter.

### Transmitter mode

In transmitter mode only one transmitter is connected on one loop. In this mode the transmitter current signal can be connected to some external device (e.g. PLC or DCS) analog input board while UNIFLOW-200 will read the process variable from the transmitter on HART protocol.

The polling address in transmitter mode must be set to 0.

### Transmitter settings

The parameters of the transmitter shall be setup before it is connected to UNIFLOW-200. The hand held communicator can be used to setup the transmitter.

Precautions to be observed in transmitter setup:

- the low scale and high scale values in the transmitter must be equal with the ones set in the UNIFLOW-200;
- the polling address must be from 0 to 15;
- transmitters connected to one loop must have different polling addresses;
- no transmitter can be set to burst mode.

### Wiring and cabling

Transmitters shall be wired as shown in Annex B.

The load resistance in the HART loop (if there is no other consideration) shall be  $R_t = 250$  ohms. HART recommend resistance from 230 to 1100 ohms.

Rules to be followed selecting the loop resistance:

- the minimum operational voltage should be provided for all the transmitters connected in one loop. This minimum voltage is from 6 to 10 V depending on the manufacturer and type of the transmitter. The  $R_t$  load resistance determined from the equation:

$$U_{transmitter\_min} < U_{power} - n * 4 \text{ mA} * (R_t + R_{wire})$$

where:  $U_{power}$  - voltage of the power supply  
 $n$  - number of transmitters in one loop  
 $R_{wire}$  - resistance of the cable

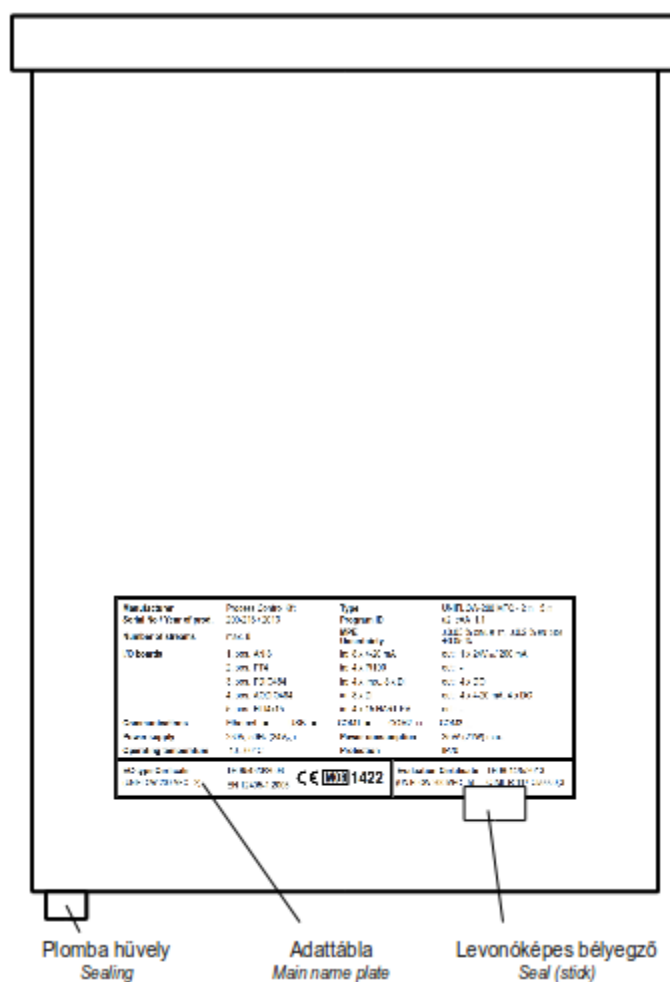
- the RC time-lag shall be calculated for the cable. The RC time-lag depends on the
  - $R_t$  resistance;
  - quality of the cable (resistance, capacitance, isolation material);
  - input capacitance of the HART transmitters;
  - presence of other equipment in the loop.

The RC time-lag shall not exceed 65 microseconds.

<b>Manufacturer</b>	Process Control Kft.	<b>Type</b>	UNIFLOW-200 MFC - 2 <input type="checkbox"/> 5 <input type="checkbox"/>
<b>Serial No / Year of prod.</b>	200-218 / 2013	<b>Program ID</b>	u2_cAA_1.1
<b>Number of streams</b>	max. 8	<b>MPE Uncertainty</b>	±0.03 % OIML R117, ±0.2 % EN12405 ±0.05 %
<b>I/O boards</b>	1. pos. ANI8	in: 8 x 4-20 mA	out: 1 x 24V <sub>DC</sub> / 200 mA
	2. pos. PT4	in: 4 x Pt100	out: -
	3. pos. PDIO484	in: 4 x imp., 8 x DI	out: 4 x DO
	4. pos. AODIO484	in: 8 x DI	out: 4 x 4-20 mA, 4 x DO
	5. pos. HTI4x15	in: 4 x 15 HART PV	out: -
<b>Communications</b>	Ethernet <input checked="" type="checkbox"/> USB <input checked="" type="checkbox"/>	COM1 <input checked="" type="checkbox"/> COM2 <input type="checkbox"/>	COM3 <input type="checkbox"/>
<b>Power supply</b>	230V, 50Hz (24V <sub>DC</sub> )	<b>Power consumption</b>	25VA (21W) max.
<b>Operating temperature</b>	-10...60°C	<b>Protection</b>	IP20

<b>EC-type Certificate</b> (UNIFLOW-200 MFC - 2)	TH-8543/3/2008 EN 12405-1:2005	<b>CE M08 1422</b>	<b>Evaluation Certificate</b> (UNIFLOW-200 MFC - 5)	TH-8614/5/2013 OIML R 117 Class 0,3
-----------------------------------------------------	-----------------------------------	--------------------	--------------------------------------------------------	----------------------------------------



Main name plate and seal position