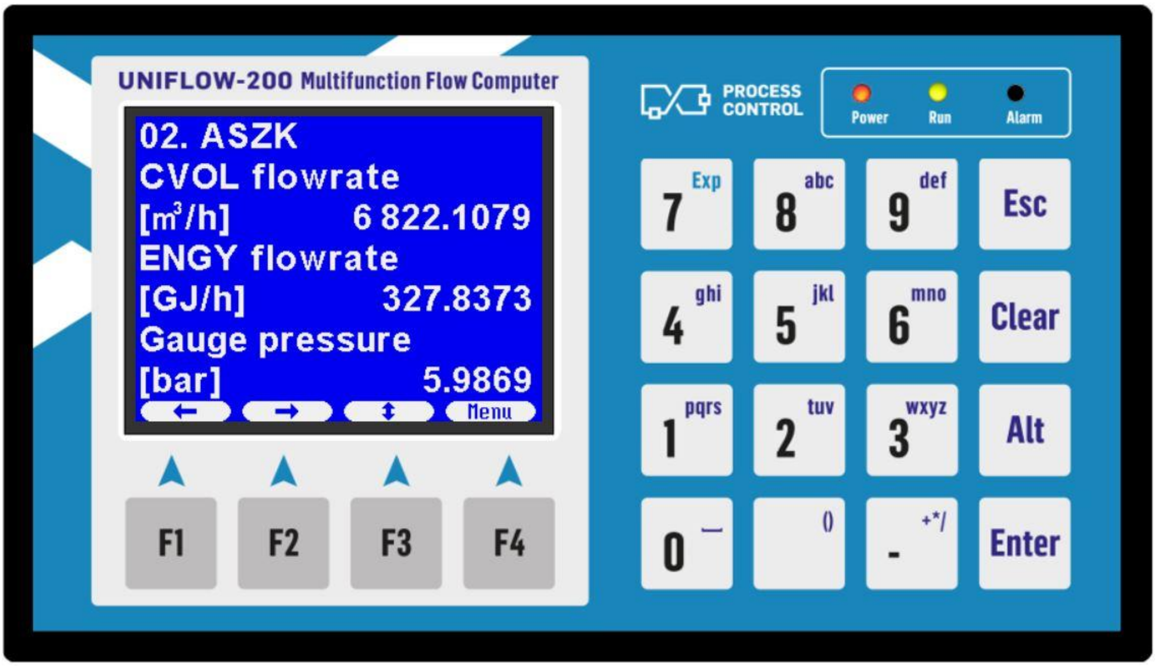
UNIFLOW-200 MFC



Flow Computer

for closed conduit and open channel flow measurement

Instruction manual

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Rev.5e	April 2020	200213 and above

Contents

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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.

Section 12 – PID Control describes the operation of the PID control implemented in 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 volume at line and at base conditions, mass and energy flow rate of the fluid. It totalizes the volume at line and at base conditions, 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 edition 1990 or 2012)
    - 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;
    - volume at base conditions 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 (1985 and 1992) detailed and gross methods; AGA NX19;
    - GERG88;
    - GOST 30319-96 (GERG91mod, NX19mod, VNIC SMV), GOST 30319-2015.
  - calorific values, relative density and base density
    - ISO 6976 (1995 and 2016), GOST 30319-96, AGA5, GPA 2172-09.
  - dynamic viscosity
    - GOST 30319-96, GOST 30319-2015
  - isentropic exponent
    ISO 20765-1, GOST 30319-96, GOST 30319-2015
  - velocity of sound
    ISO 20765-1, GOST 30319-96, GOST 30319-2015
  - 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.
UNIFLOW-200 is approved as Calculator for Dynamic measuring system for liquids other then water according to OIML R 117-1.
UNIFLOW-200 calculates the CO2 emission for gaseous and liquid fuels according to 601/2012/EU and IPCC 1996.

UNIFLOW-200 is capable to provide flow computer function up to 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 here 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 revert 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.

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 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 +/- 0,02 %
- potential drop on input 5,4 V max. per 20mA (100 Ω + protection)
- equivalent input impedance 270 ohm (100 Ω + 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 +/- 0,03 ^{o}C
- maximum loop resistance 3 kohms
- excitation current 1 mA

Pulse/frequency inputs

- Signal type (operator selectable)
    - open collector, potencial-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 inpedance 1 kΩ,
        - 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/RS4222 1200 m
- 10/100 Ehernet — protocol: Modbus TCP
- USB 1.1 port — standard-A receptacle, for data saving to flash drive

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)

- +/- 0,03 % — OIML R117, Class 0,3
- +/- 0,2 % — EN 12405
- +/- 0,05 % — OIML R140

Operating conditions

- operating temperature — -10…+60 ^oC
- operating humidity — 10…90 % non-condensing
- EMC — complies with EU EMC regulation
- storage temperature — -25…+70 ^oC

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 number and type of IO boards fitted)
- 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 (including EMC conformance):
  Government Office of the Capital City Budapest, Metrological and Technical Supervisory Department, Section of Mechanical Measurements, Hungary
  TH-8543/6/2018 (EN 12405-1:2005+A2:2010)
  TH-8614/6/2013 (OIML R 117 Class 0,3)

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 boards 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 then 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
PITC4641	4 6 4 1	pulse/frequency input digital (contact) input digital (open collector) output raw pulse output	high level (active or passive) active or passive, stat. or pulse static or pulse to prover computer
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^{2}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 asynchronous communication links to external devices. All of them can be configured as RS23 or RS485 or RS422 port. The parameters of the ports (baud rate, data bits, stop bits, parity) 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 flash 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 signalled 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 loosing 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.

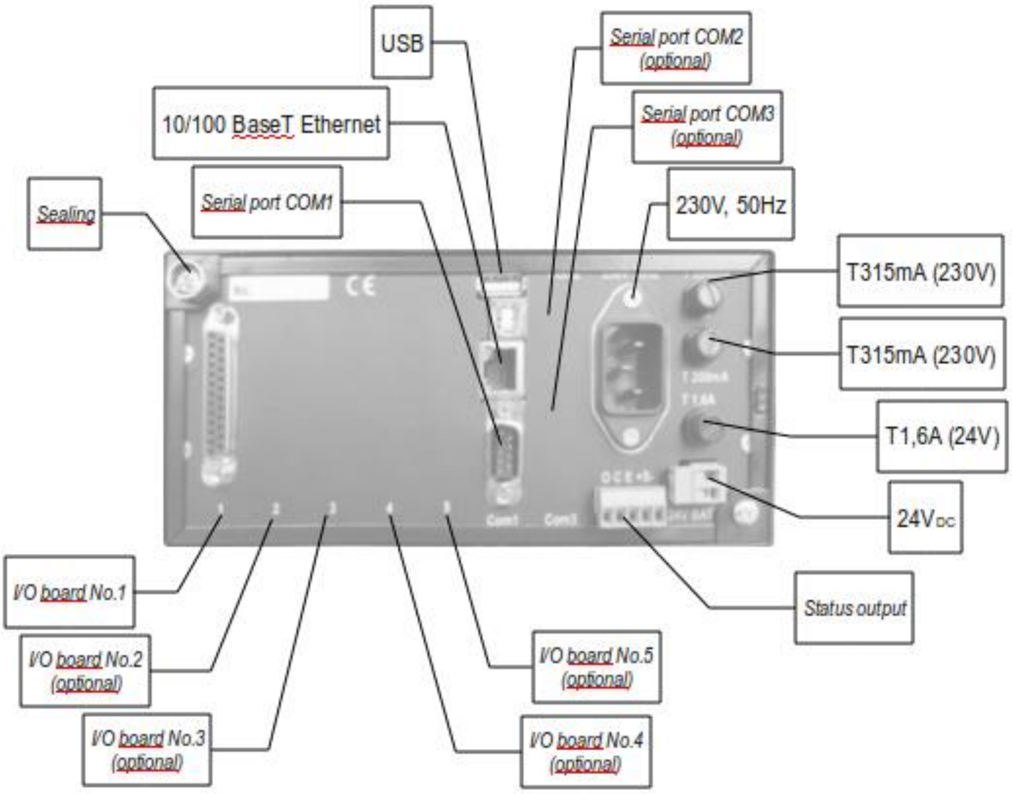


Figure 5-1 Backplane connectors

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 flash 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.

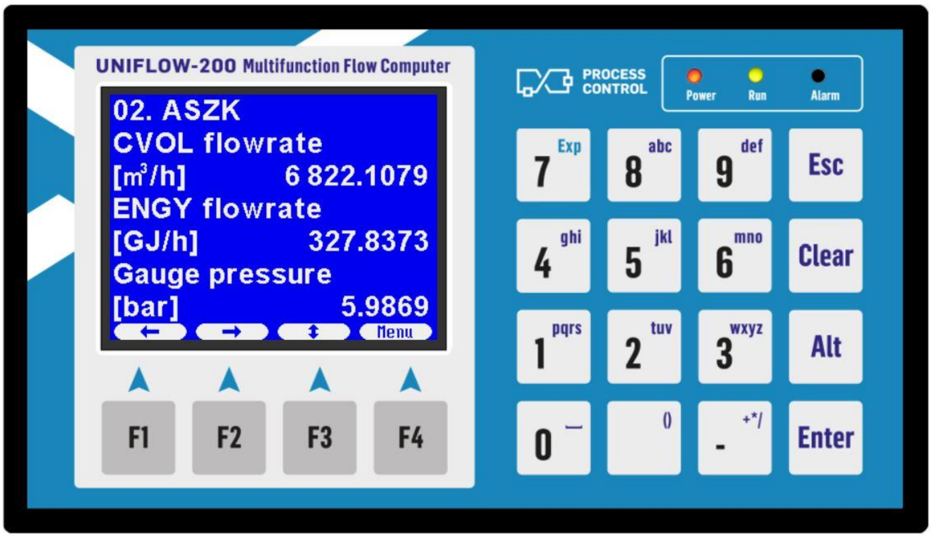


Figure 6-2 Front panel

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 A 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 Д Е Ж З д е ж з. 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 multi-functional 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

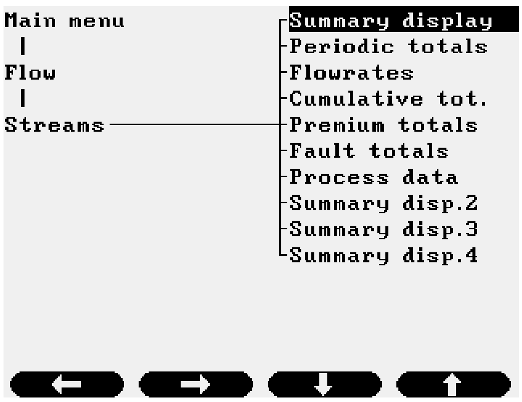


Figure 6-3 Menu page

- 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 ⇧ and ⇩ 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.

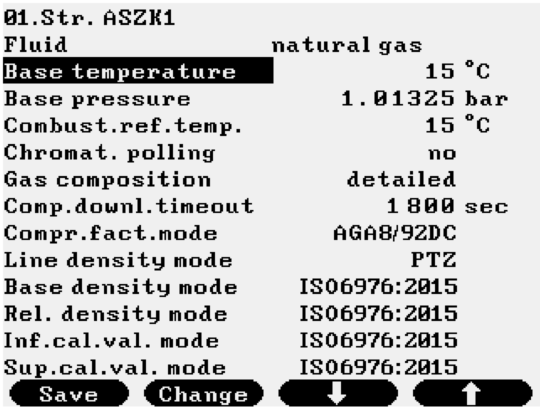


Figure 6-4 Data page

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 ⇧ and ⇩ keys.

6.2.1 Navigating the display

From the main menu select the item you require by pressing ⇧ and ⇩ keys. Press ⇨ key to enter the next menu level. Select the required sub-menu item by pressing ⇧ and ⇩ keys and press ⇨ 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 ⇦ 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.

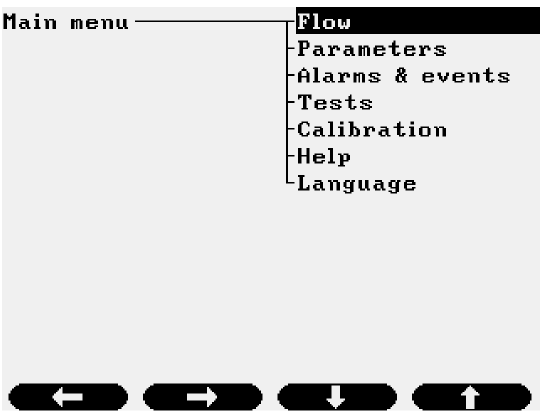


Figure 6-5 Main menu page

The menu items Flow, Alarms & events, Help and language selection (Magyar/English/Русский/Română) 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), Român (Romanian). Changing the language will change the language of the display, 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	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)	
	Archive data	Archived periodic totals	data page (1.3.1)	
		Archived batch totals	data page (1.3.2)	
	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	Tank loading	data page (1.7.1)	
		Pipeline interface	data page (1.7.2)	
	Meter serial test	data page (1.8)		
	PID	PID1	data page (1.9.1)(**)	
		PID2	PIC control loop	data page (1.9.2.1)(***)
			FIC control loop	data page (1.9.2.2) (***)
		…		
		PID8		

(*) Depending on the selected flow meter and the fluid more data pages may exist.
(**) In case of single loop
(***) In case of dual loop

Figure 6-6 Main menu – Flow

Main menu – Parameters

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4
Parameters	IO signals	IO board 1	1. channel	data page (2.1.1.1)
			2. channel	data page (2.1.1.2)
			(*)	
			n. channel	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. channel	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. channel	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. channel	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. channel	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. channel	data page (2.6.1.n)

(Main menu - Parameters continued)

Main menu	Submenu 1	Submenu 4	Submenu 5	Submenu 6	Submenu 7
Parameters	Streams				
	Submenu 2				
	Physical stream				
	Submenu 3				
	Stream 1.				
		Fluid	Hydrocarbon 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)
			Water steam	data page (2.2.1.n.1.3)	
			Water	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)	
			Rotameter	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
Parameters		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)		
		Totals format	data page (2.2.7)		
	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)	
				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 port	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

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)	
	Modbus regs	data page (4.7)	
	IO polling	data page (4.8)	
Calibration			
Help	data page (6)		
Language	data page (7)		

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

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.

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.

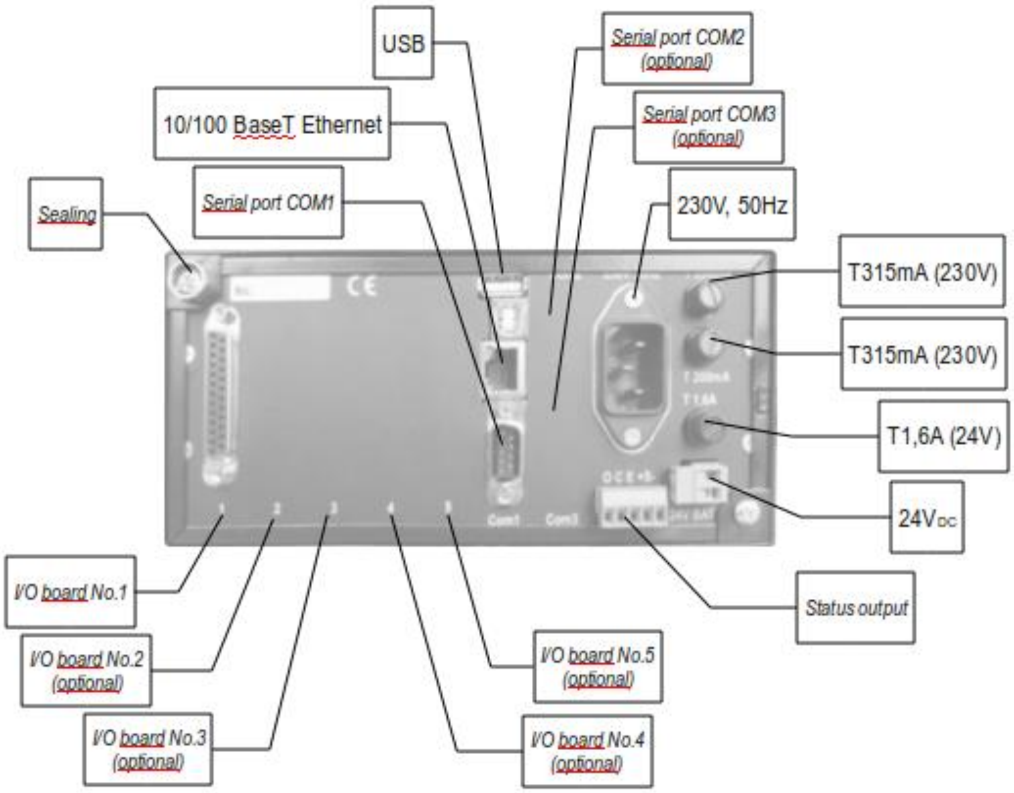


Figure 7-9 Fuses

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 then 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 software tool is 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.

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

9.1.1 Stream data

9.1.1.1 Summary display 1, 2, 3 and 4

Route in the menu tree:

Main menu	Submenu 1	Submenu 2	Submenu 3
Flow	Streams	Summary display	data page (1.1.1)
		Summary display 2	data page (1.1.8)
		Summary display 3	data page (1.1.9)
		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:

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4	Submenu 5
Parameters	General data	User defined	Display	Summary display	data page (2.3.3.1.1)

The operator can modify the default display or build a very 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.

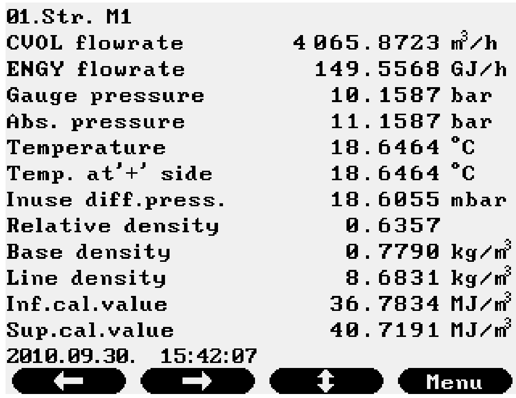


Figure 9-10 The default summary display

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 stream parameters.

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
Cumulative premium totals
Cumulative 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:

Main menu	Submenu 1	Submenu 2	Submenu 3
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.

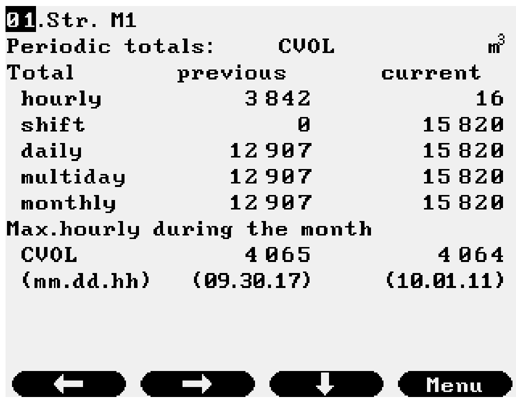


Figure 9-11 Periodic totals

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:

Main menu	Submenu 1	Submenu 2	Submenu 3
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.

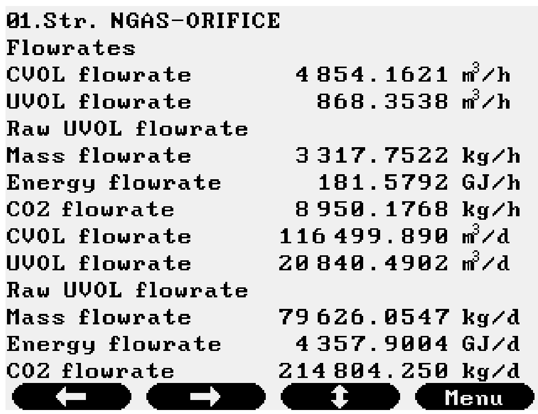


Figure 9-12 Flow rates

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
- Cumulative premium totals
- Cumulative 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:

Main menu	Submenu 1	Submenu 2	Submenu 3
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.

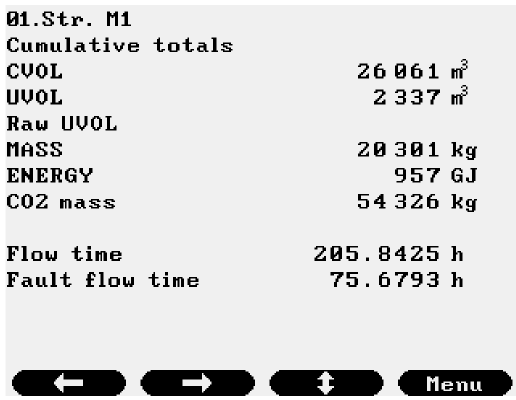


Figure 9-13 Cumulative totals

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
- Cumulative premium totals
- Cumulative 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:

Main menu	Submenu 1	Submenu 2	Submenu 3
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:

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4
Parameters	Streams	Physical stream	Stream nn	Premium limits

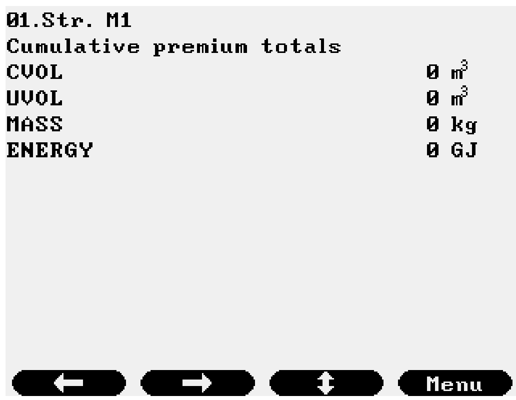


Figure 9-14 Premium totals

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
    Cumulative premium totals
    Cumulative 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:

Main menu	Submenu 1	Submenu 2	Submenu 3
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.

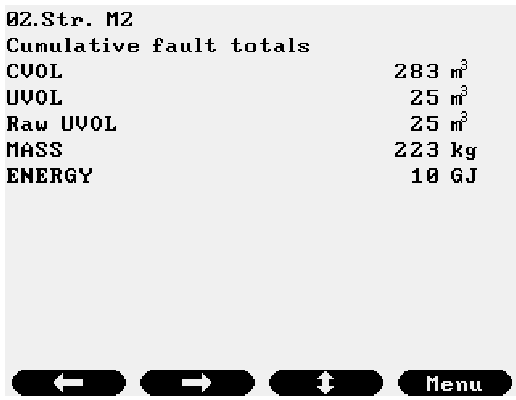


Figure 9-15 Fault totals

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

- Cumulative fault totals
- Summary display 1
- Summary display 3
- Summary display 4
- Flow rates
- Cumulative totals
- Cumulative 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.

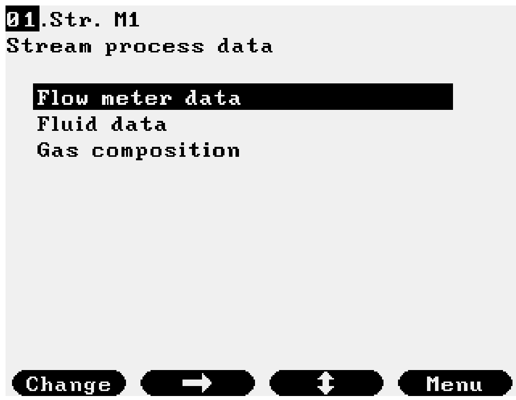


Figure 9-16 Process data menu page

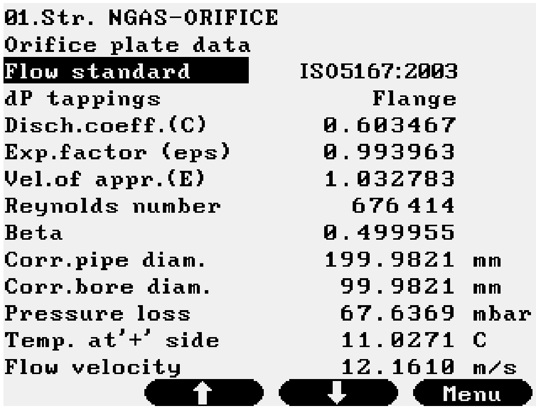
Function of the F keys on the process data menu page:
Change change the metering stream the data to be displayed from
⇨ go to the highlighted data page
⇳ select the next data page
Menu returns to the parent menu.

9.1.1.7.1 Flow meter data

Route in the menu tree:

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4
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.



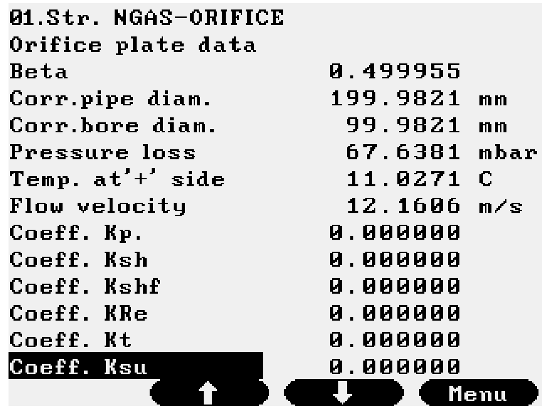


Figure 9-17 Flow meter data for differential pressure devices (orifice, nozzle, Venturi tube)

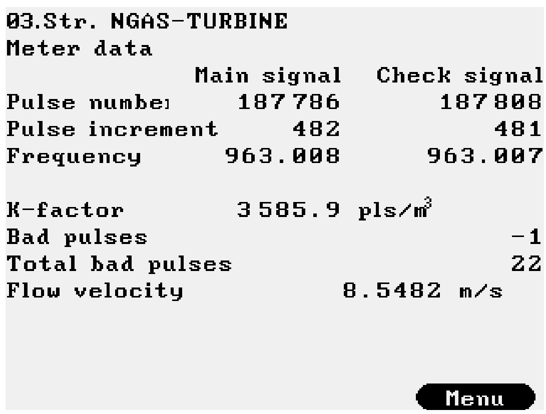
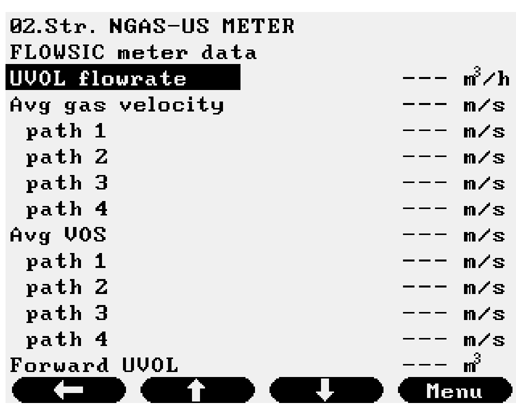


Figure 9-18 Flow meter data for pulse output flow meters (turbine meter, Vortex meter, etc.)



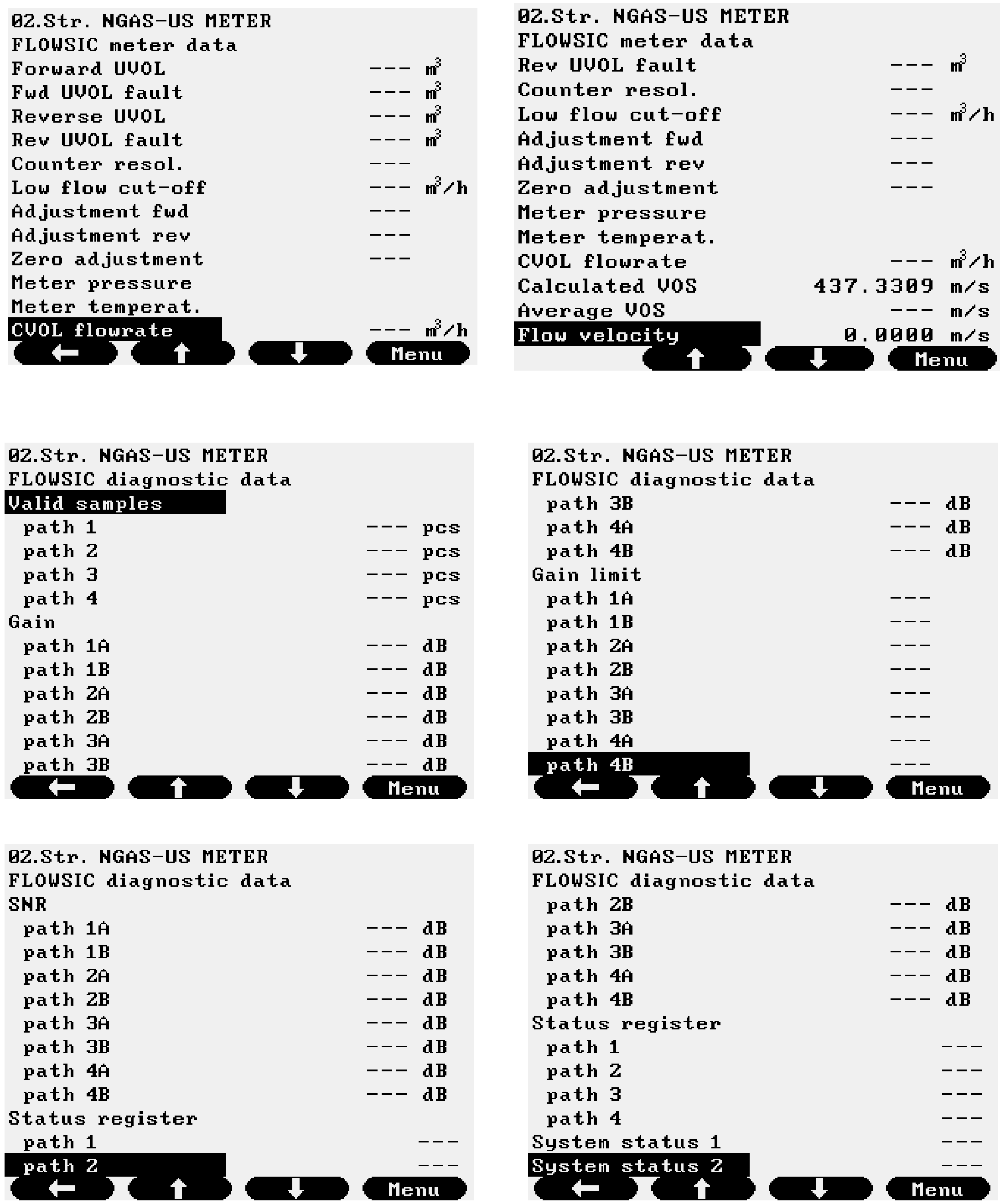


Figure 9-19 Flow meter data (Flowsic-600 US meter, serial communication)

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:

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4
Flow	Streams	Process data	Fluid data	data page (1.1.7.2)

The fluid 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.

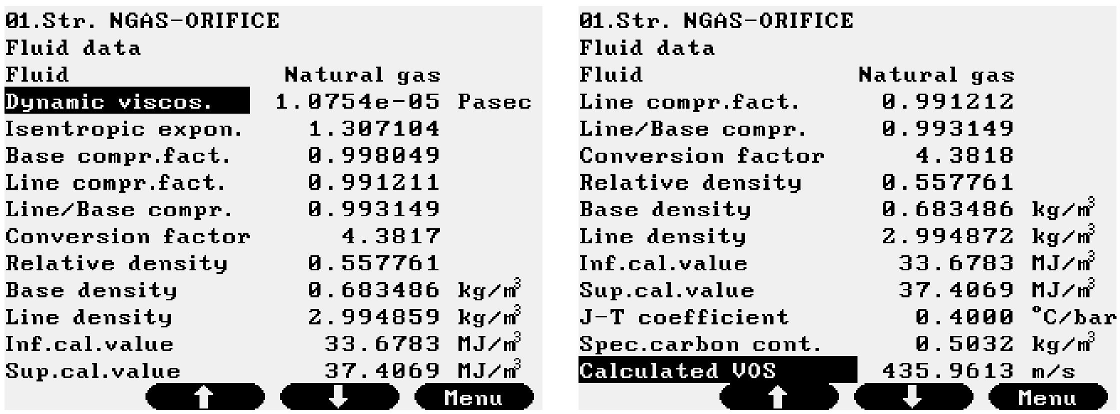


Figure 9-20 Fluid data for natural gas

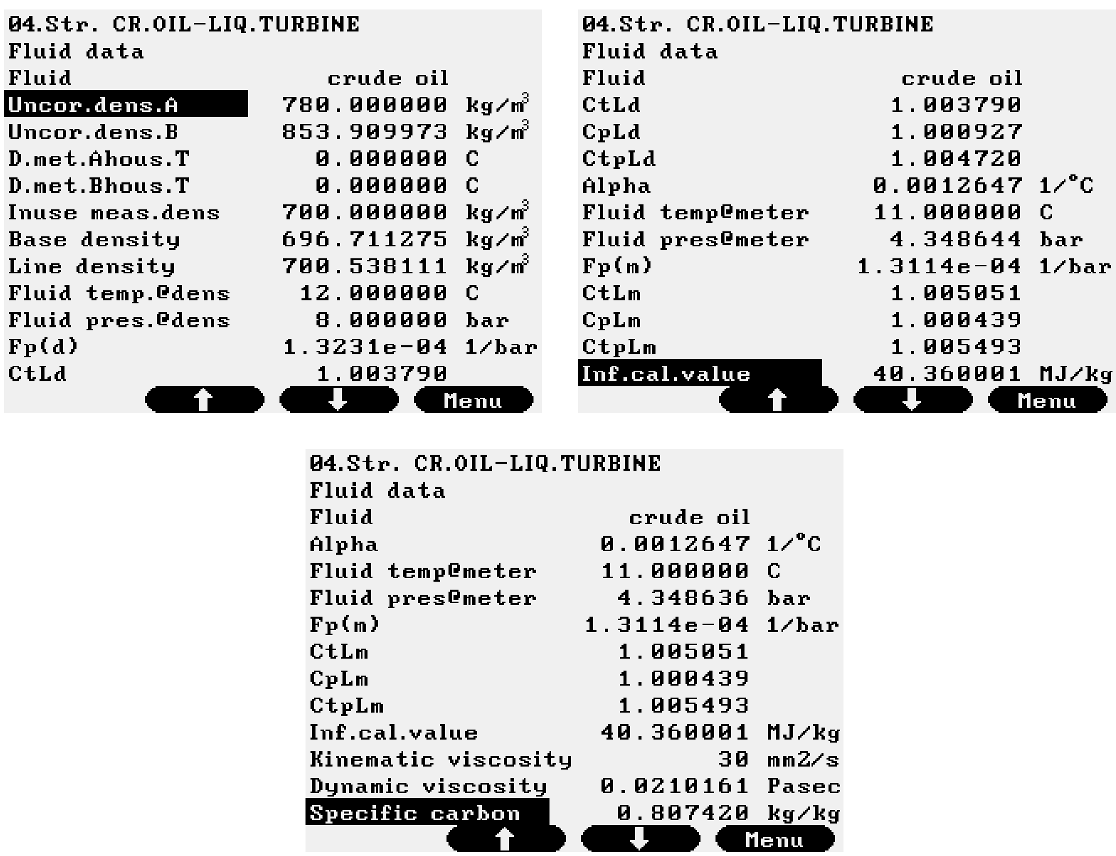


Figure 9-21 Fluid data for crude oil and refined products

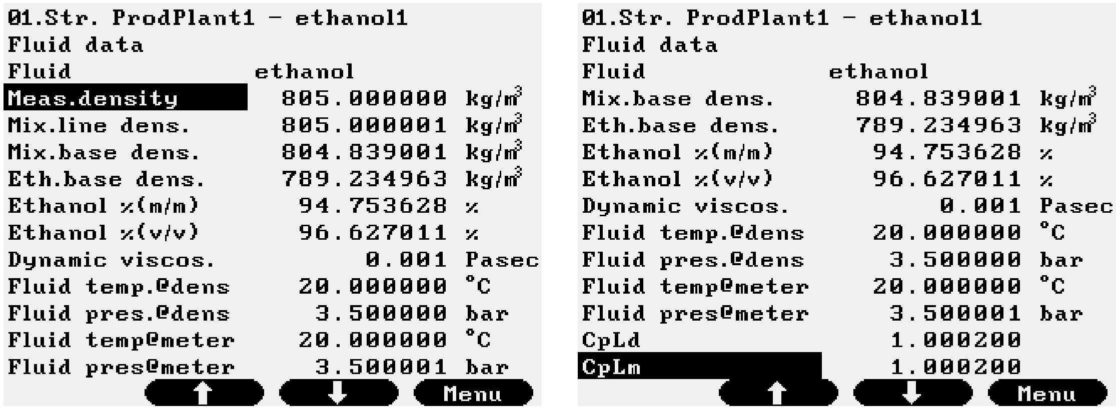


Figure 9-22 Fluid data for ethanol

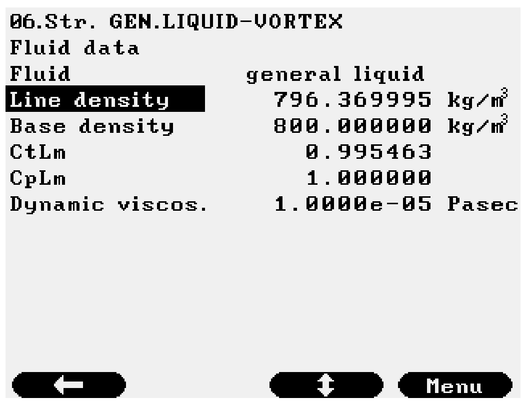


Figure 9-23 Fluid data for general liquid

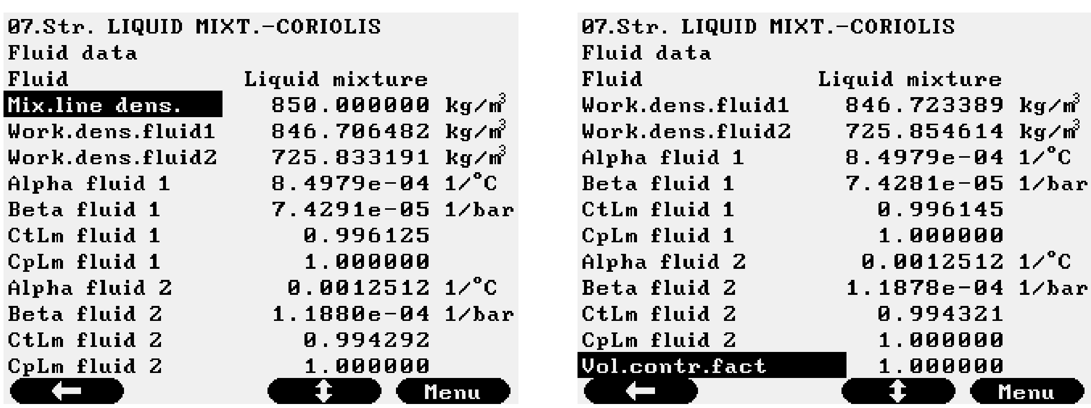


Figure 9-24 Fluid data for liquid mixture

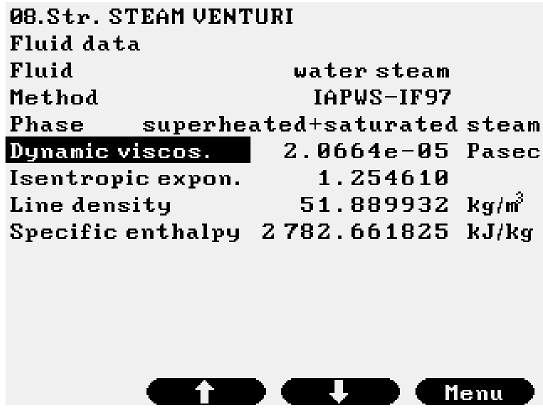


Figure 9-25 Fluid data for water steam

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:

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4
Flow	Streams	Process data	Gas composition	data page (1.1.7.3)

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

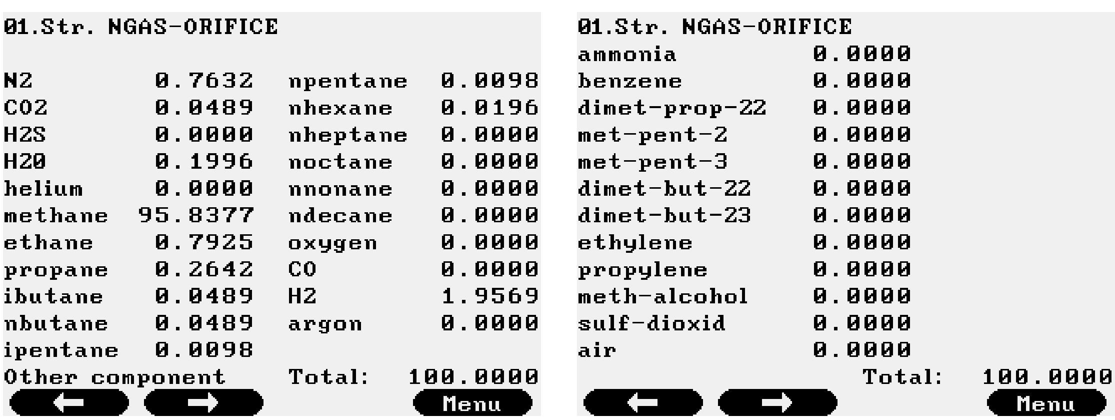


Figure 9-26 Gas composition data for natural gas

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:

Main menu	Submenu 1	Submenu 2	Submenu 3
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.

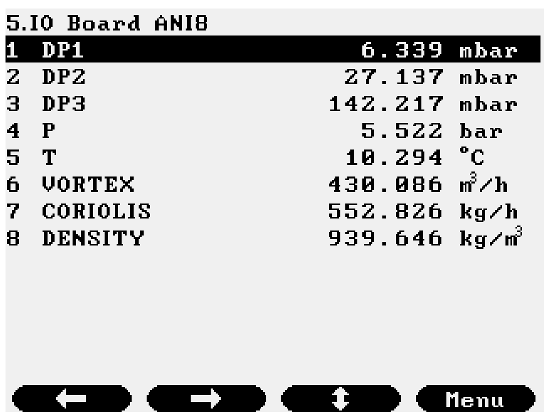


Figure 9-27 I/O board *n* data page for ANI8 board

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

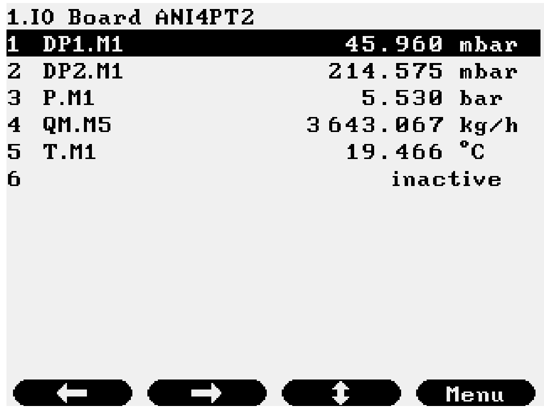


Figure 9-28 I/O board *n* data page for ANI4PT2 board

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.
Channel 6 is not used, it is inactive.

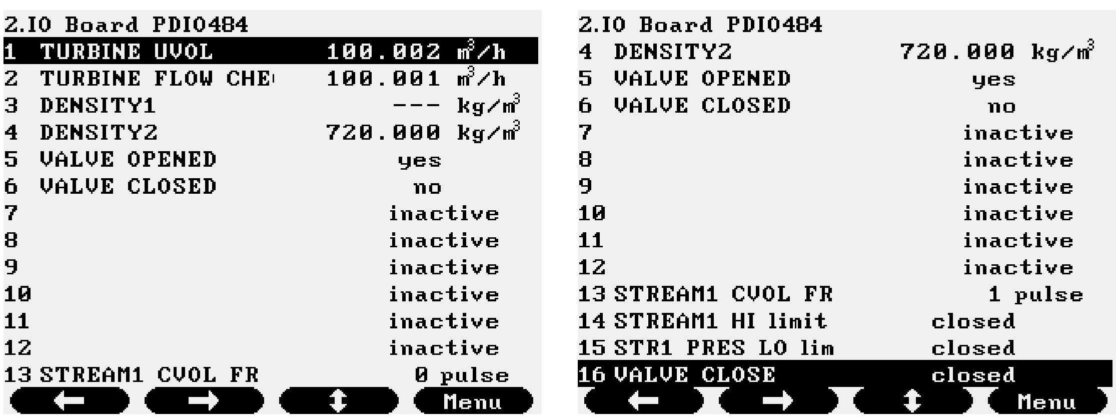


Figure 9-29 I/O board *n* data page for PDIO484 board

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 volume at base conditions
Channel 14 configured to signal volume at base conditions flow rate high limit alarm
Channel 15 configured to signal pressure input low limit alarm
Channel 16 configured to signal valve position

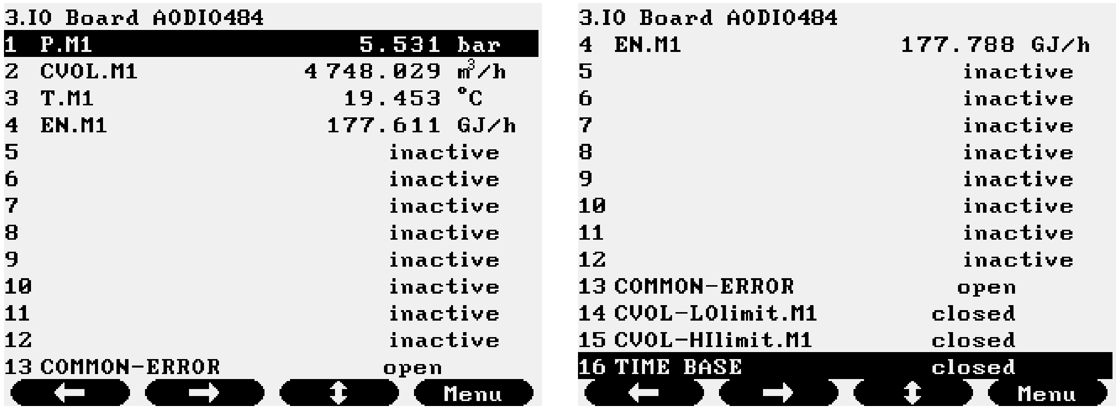


Figure 9-30 I/O board *n* data page for AODIO484 board

Channel 1 configured to output current proportional to pressure
Channel 2 configured to output current proportional to volume at base conditions 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 volume at base conditions flowrate low limit alarm
Channel 15 configured to signal volume at base conditions flowrate high limit alarm
Channel 16 configured to output timed pulses

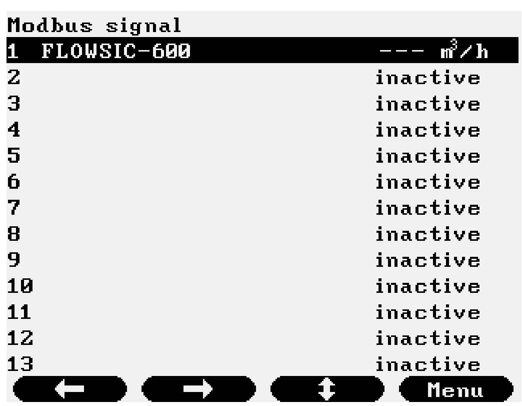


Figure 9-31 Modbus signal data page

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:

Main menu	Submenu 1	Submenu 2	Submenu 3
Flow	Archived data	Periodic totals	data page (1.3.1)
		Batch data	data page (1.3.2)

UNIFLOW-200 has an 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.

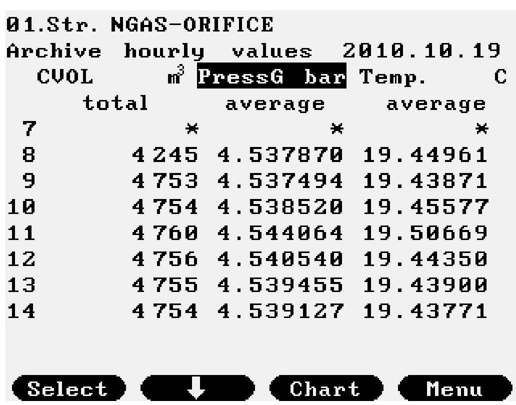


Figure 9-32 Archive data data page

Configured to display

- hourly totals for volume at base conditions;
- 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 m3` (volume at base conditions);
  - `UVOL m3` (volume at line conditions);
  - `MASS kg` (mass)
  - `ENGY GJ` (energy)
  - `CO2MASS kg` (mass of CO2 emission)
  - `RAW UVOL m3` (volume at line conditions before applying any error curve correction);
  - `Temp. °C` (temperature)
  - `dP mbar` (differential pressure)
  - `fltCVOL m3` (fault volume at base conditions);
  - `fltUVOL m3`(fault volume at line conditions);
  - `fltMASS kg` (fault mass);
  - `fltENGY GJ` (fault energy);
  - `PressG bar` (gauge pressure);
  - `Dens. kg/m3` (line density);
  - `Rel.Dens. –` (relative density);
  - `premCVOL m3` (premium volume at base conditions);
  - `premUVOL m3` (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);
  - `inf.cal` MJ/m3 (inferior calorific value);
  - `sup.cal` MJ/m3 (superior calorific value)
  - `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 he 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.

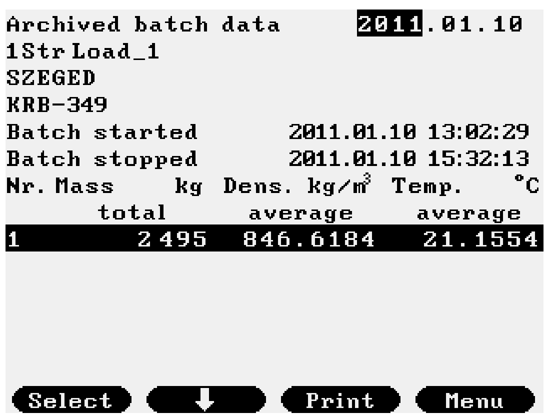


Figure 9-33 Archive batch data page

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:

Main menu	Submenu 1	Submenu 2
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.

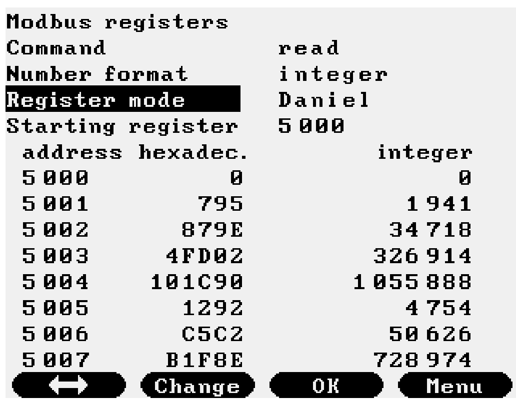


Figure 9-34 Modbus registers data page

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 he 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:

Main menu	Submenu 1	Submenu 2
Flow	Data transfer	data page (1.5)

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 theses 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 then 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.

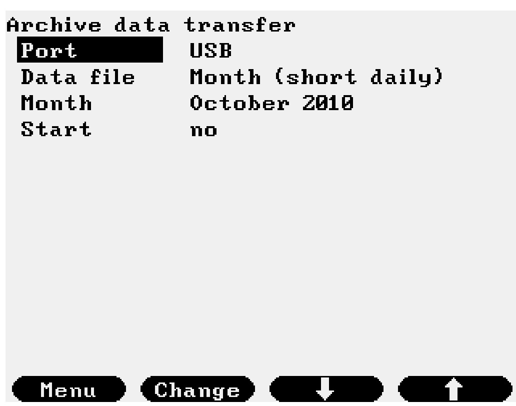


Figure 9-35 Data transfer data page

The editable fields and their content are as follows:

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

- Data file (The available reports for selection are)
    - Select all
    - 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;
    - Snapshot
    - 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:

Main menu	Submenu 1	Submenu 2	Submenu 3
Flow	Extra sum. display	Extra sum. disp1	data page (1.6.1)
		Extra sum. disp2	data page (1.6.2)
		Extra sum. large1	data page (1.6.3)
		Extra sum. large2	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.

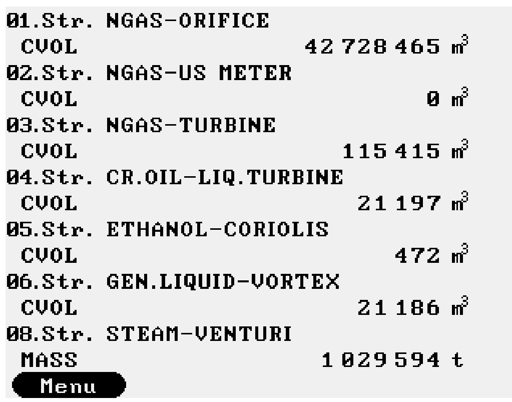


Figure 9-36 Extra summary display

The extra summary displays are empty by default.
The operator can edit them in the menu:

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4
Parameters	General data	User defined	Display	Summary display

9.1.7 Batches

9.1.7.1 Tank loading batch

Route in the menu tree:

Main menu	Submenu 1	Submenu 2	Submenu 3
Flow	Batches	Tank loading	data page (1.7.1)

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

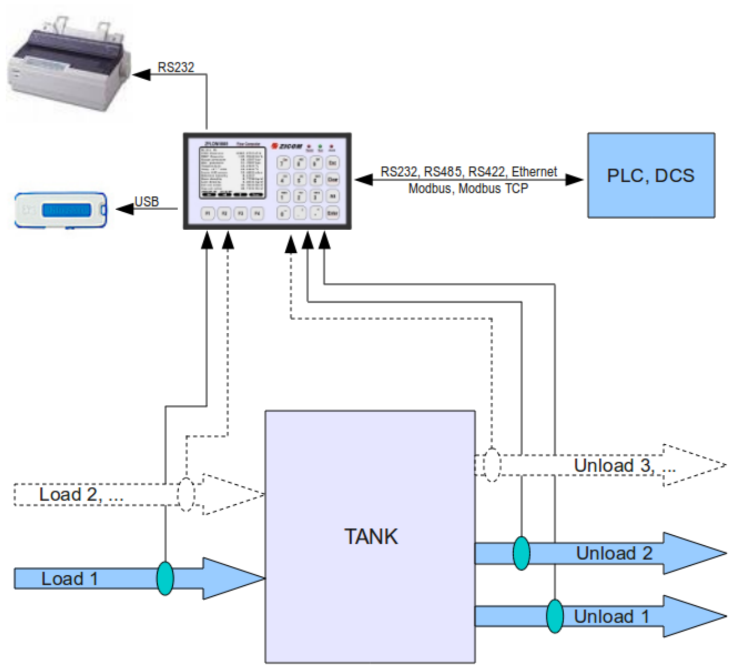


Figure 9-37 Tank loading/unloading system with batch measurement

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.

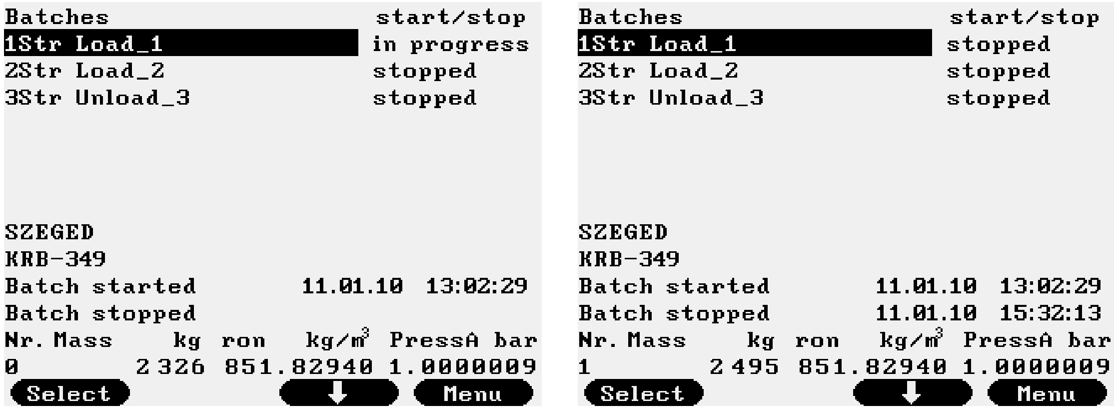


Figure 9-38 Batch display for tank loading/unloading

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 m³ (volume at line conditions batch total);
- CVOL m³ (volume at base conditions batch total);
- Dens. kg/m³ (line density batch average);
- Base.D. kg/m³ (base density batch average);
- Meas.D kg/m3 (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.

9.1.7.2 Pipeline interface batch

Route in the menu tree:

Main menu	Submenu 1	Submenu 2	Submenu 3
Flow	Batches	Pipeline interface	data page (1.7.2)

The batch measurement was designed to measure different kind of liquids flowing in the same pipeline each after other.

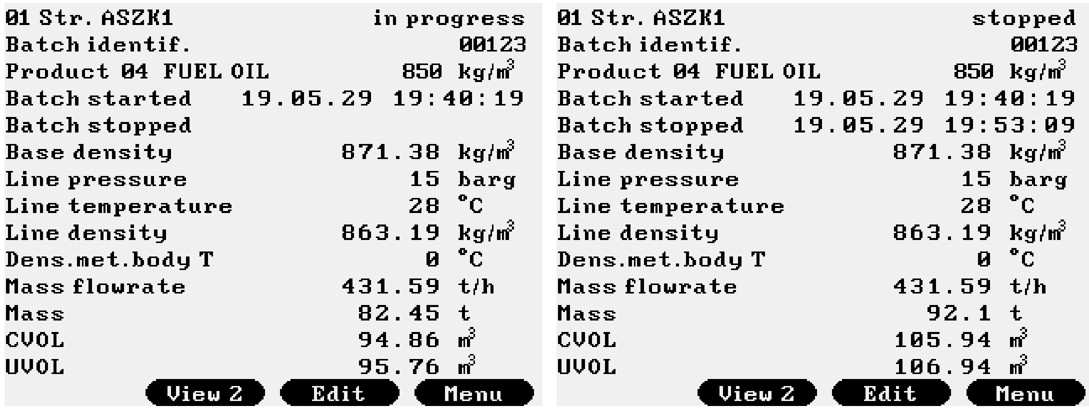


Figure 9-39 Batch display for pipeline interface batch

For each stream configured the status of the batch measurement is indicated in the top line of the display as `in progress` or `stopped`.

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

- batch identifier
- product information
- batch start time
- batch stop time
- nine selected measured batch variable

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

- Mass kg (mass batch total);
- CVOL (volume at base conditions batch total);
- UVOL (volume at line conditions batch total);
- CVOL flowrate (volume at base conditions flow rate)
- UVOL flowrate (volume at line conditions flow rate)
- Mass flowrate (mass flow rate)
- Line pressure;
- Line temperature;
- Line density;
- Base density;
- Dens.met.body T (density meter body temperature);

To display the archived batch data see 9.1.3.2.

9.1.8 Meter serial test

Route in the menu tree:

Main menu	Submenu 1	Submenu 2
Flow	Meter serial yesy	data page (1.8)

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.

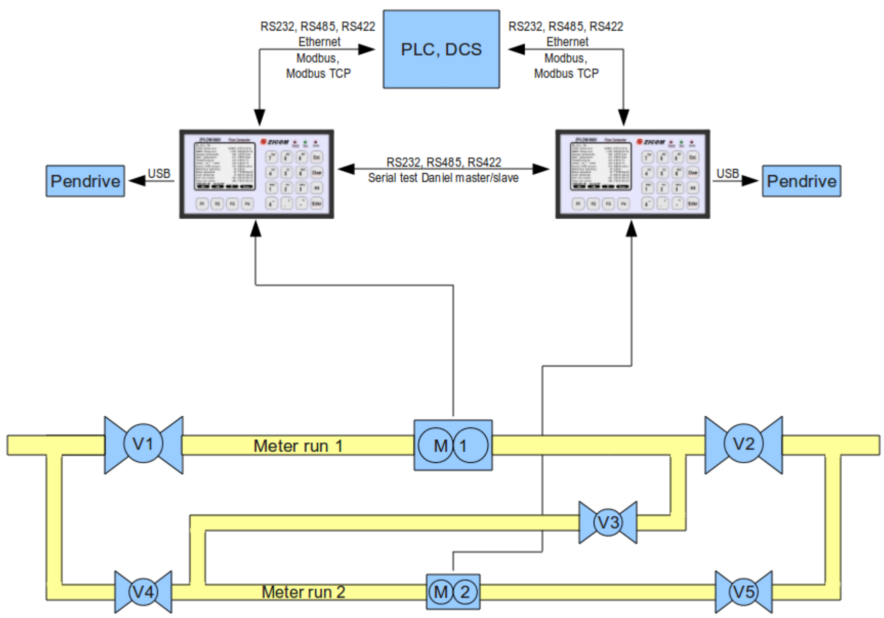


Figure 9-40 Flow meter serial test measurement

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.

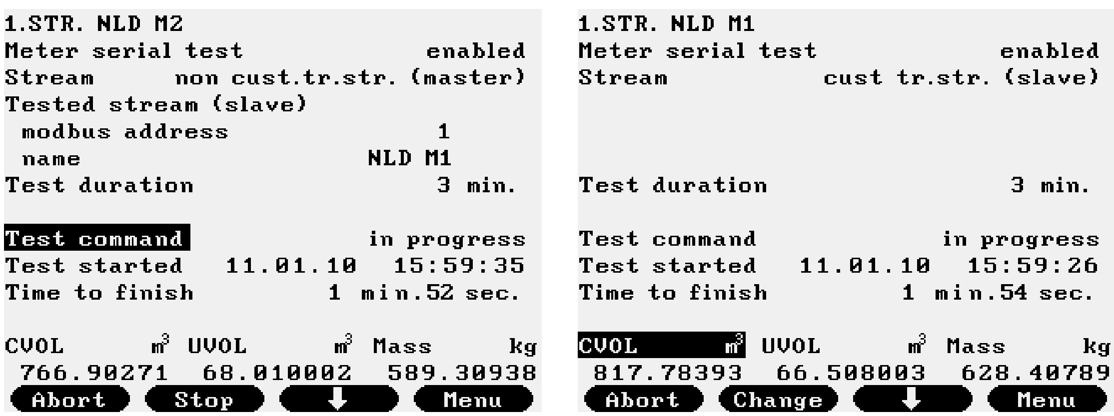


Figure 9-41 Meter serial test display

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^3 (volume at line conditions);
  - CVOL m^3 (volume at base conditions);
  - Mass kg (mass);
  - ENGY GJ (energy);
  - PressG bar (gauge pressure);
  - PressA bar (absolute pressure);
  - Temp. oC (temperature);
  - Zl (compression factor at line conditions);
  - Zn (compression factor at base conditions);
  - Rel.Dens. - (relative density);
  - Base.D kg/m^3 (base density);
  - Dens. kg/m^3 (line density);
  - ICV MJ/m3 (inferior calorific value);
  - dP mbar (differential pressure);
  - UVOL FR m^3/h (volume at line conditions flow rate);
  - CVOL FR m^3/h (volume at base conditions flow rate);
  - MASS FR m^3/h (mass flow rate);
  - ENGY FR m^3/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 flash drive via the USB port of the flow computer. See 9.1.5.
Sample report is shown in Annex A.

9.1.9 PID

See in Section 9.2.7.

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.

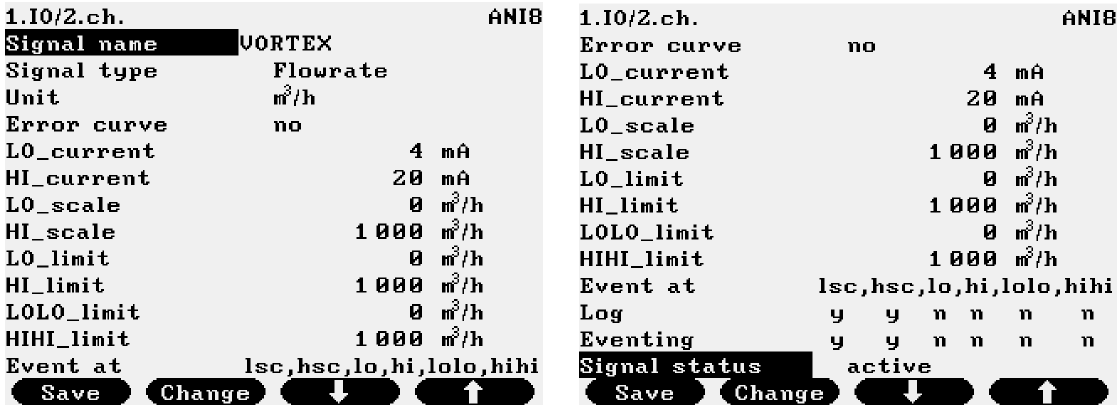


Figure 9-42 Analogue (4-20 mA) input channel data page

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:

- o `Differential pressure`;
  - `mbar`
  - `Pa`
  - `kPA`
  - `inH2O`
- o `Flowrate`;
  - `m3/h`
  - `kg/h`
  - `GJ/h`
  - `MWh/h`
  - `MVA`
  - `MCF/h`
  - `CF/h`
  - `lb/h`
  - `MMBTU/h`
  - `bbl/h`
  - `Mlb/h`

  supplementary parameter: Error curve

  - ➢ `yes`

    supplementary parameter 2: error curve correction type

    - ▪ `linear interpolation, UVOLFR (m3/h) – Error (%)`

➢ no

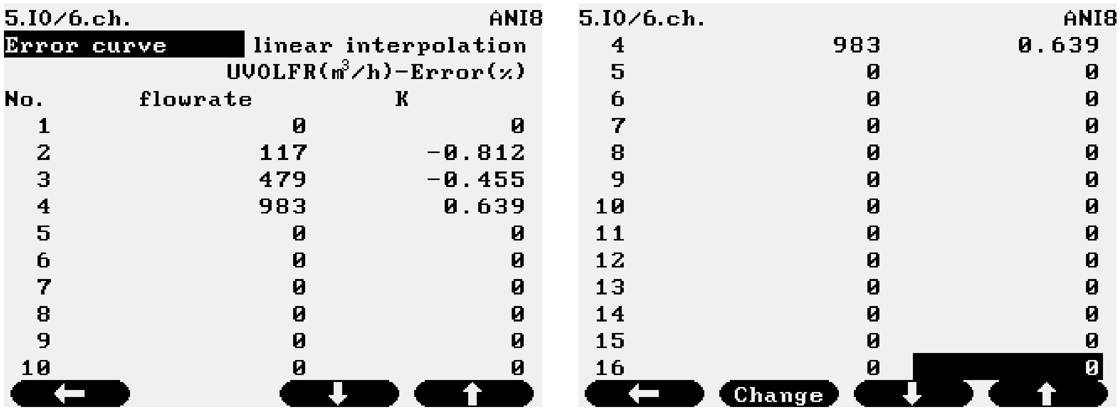


Figure 9-43 Error curve data page for flow rate signal

Error curve is available for the signals representing:
- volume flow rate at line conditions expressed in m³/h, MCF/h, CF/h, bbl/h
- mass flow rate expressed in kg/h, lb/h, Mlb/h

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 m³/h) or mass flow rate 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;
  - kg/m³
  - lb/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/m³
  - `MJ/kg`
  - `uS`
  - `BTU/SCF`
  - `lb/MMSCF`
- o `Kin. viscosity` (kinematic viscosity);
  - mm²/s
  - `cSt`
- o `Level`;
  - `m`
  - `cm`
  - `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
- Event at;
  It can be selected here that which of the events shall initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
  - o `lsc` (low scale);
  - o `hsc` (high scale);
  - o `lo` (lo limit);
  - o `hi` (hi limit);
  - o `lolo` (lolo limit);
  - o `hihi` (hihi limit);
- Log;

- Eventing;
  Selecting `y(yes)` in the "Log" line causes an entry shall be generated in the log file.
  Selecting `n(no)` in the Log line causes no entry is generated in the log file. In this case no `y(yes)` can be selected in the "Eventing" line
  If in the "Log" line `y(yes)` is selected, then in the "Eventing" line `y(yes)` or `n(no)` can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.
- 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: ^{o}C

In case of imperial unit system for gas measurement:

- pressure signal: PSIG or PSIA
- differential pressure signal: inH2O
- temperature signal: ^{o}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.

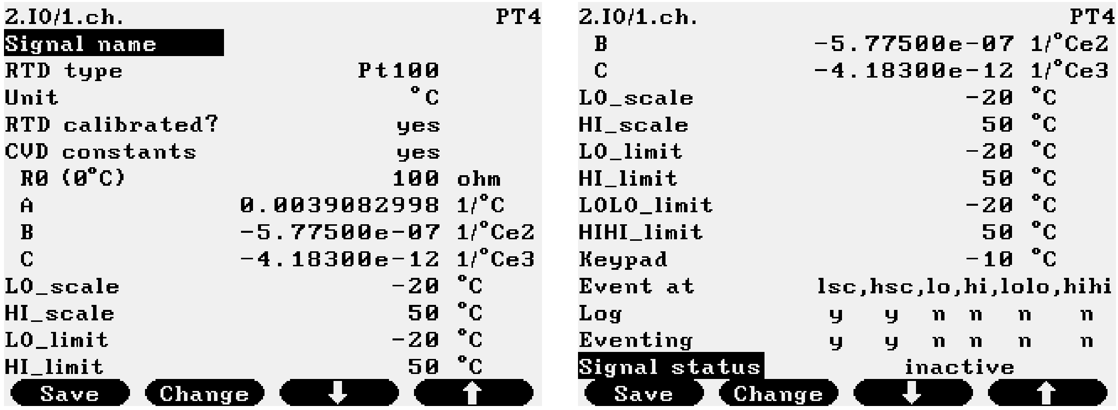


Figure 9-44 PRT/RTD input channel data page

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 oC), 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 initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
  - `lsc` (low scale);
  - `hsc` (high scale);
  - `lo` (lo limit);
  - `hi` (hi limit);
  - `lolo` (lolo limit);
  - `hihi` (hihi limit);
- Log
- Eventing
  Selecting `y(yes)` in the "Log" line causes an entry shall be generated in the log file.
  Selecting `n(no)` in the Log line causes no entry is generated in the log file. In this case no `y(yes)` can be selected in the "Eventing" line.
  If in the "Log" line `y(yes)` is selected, then in the "Eventing" line `y(yes)` or `n(no)` can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.
- 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

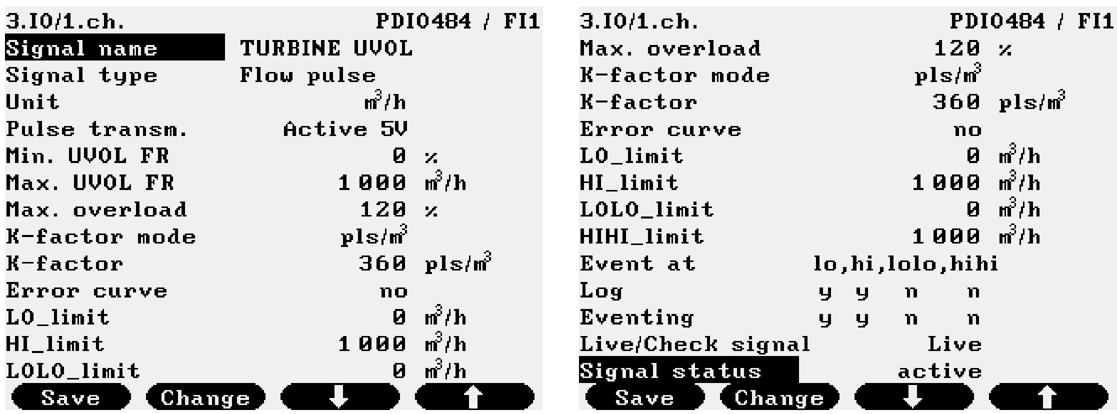


Figure 9-45 Pulse input channel (signal type = flow pulse) data page

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
  - o Flow pulse;
- Unit
  - o m3/h
  - o kg/h
  - o GJ/h
  - o MWh/h
  - o MVA
  - o MCF/h
  - o lb/h
  - o MMBTU/h
  - o bbl/h
  - o Mlb/h
- Pulse transm. (Pulse transmitter type)
  - o active 5 V;
  - o active 15 V;
  - o OC (open collector) (12 V);
  - o NAMUR
- Min. UVOL FR (low metering range of the flow meter, volume flow rate at line conditions, in % of the high metering range)

- 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/unit` (volume or mass or energy);
  - `unit/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 initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
  - `lo` (lo limit);
  - `hi` (hi limit);
  - `lolo` (lolo limit);
  - `hihi` (hihi limit);
- Log
- Eventing
  Selecting `y(yes)` in the "Log" line causes an entry shall be generated in the log file.
  Selecting `n(no)` in the Log line causes no entry is generated in the log file. In this case no `y(yes)` can be selected in the "Eventing" line.
  If in the "Log" line `y(yes)` is selected, then in the "Eventing" line `y(yes)` or `n(no)` can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.
- 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`;

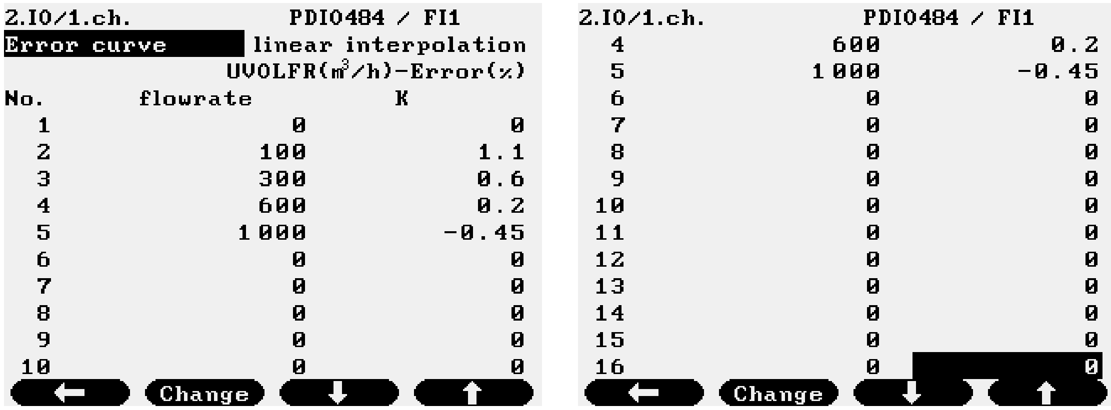


Figure 9-46 Error curve data page (signal type = flow pulse)

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 dependent variable of the error curve selected from the list:
  - `UVOLFR (m³/h) - Error (%);`
  - `frequency (Hz) - K-factor (pulse/m3);(**)`
  - `UVOLFR (m³/h) - K-factor (pulse/m3);`
  - `log(UVOLFR/visc (m3/h/cSt) - K-factor (pulse/m3);`

  (*) error curve is available for the units m^3/h, kg/h, MCF/h, lb/h, bbl/h, Mlb/h.
  (**) only if linear interpolation is selected

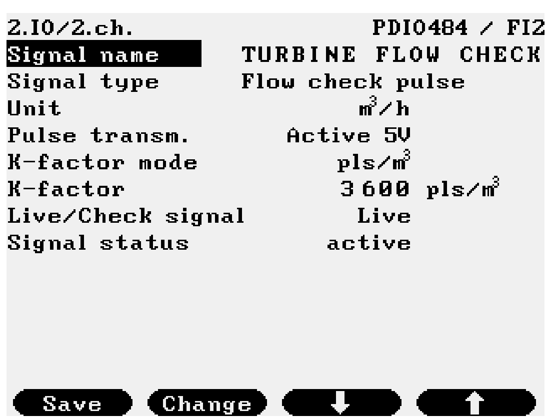


Figure 9-47 Pulse input channel (signal type = flow check pulse) data page

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
  - `m3/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/unit` (volume or mass or energy)`;`
  - `unit/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`;

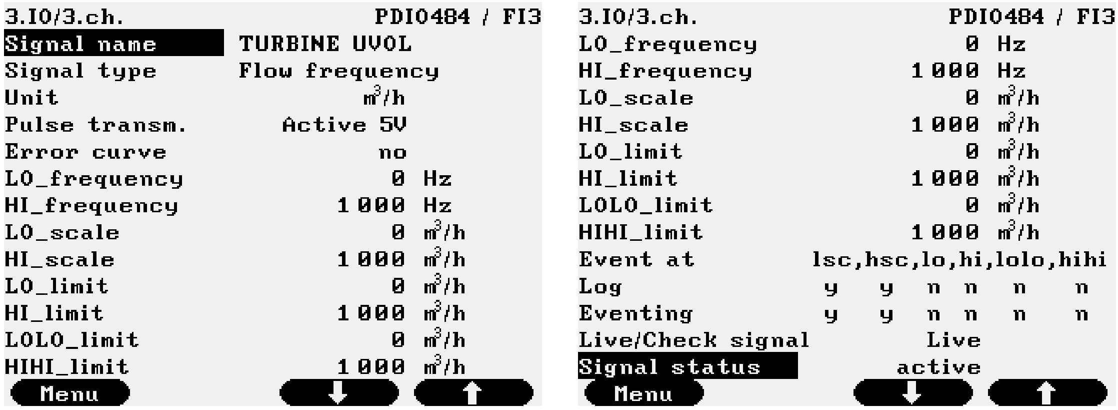


Figure 9-48 Pulse input channel (signal type = flow frequency) data page

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
  - `m3/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);
- HIHI_limit (high-high alarm limit);

- Eventing;
  It can be selected here that which of the events shall initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
  - `lo` (lo limit);
  - `hi` (hi limit);
  - `lolo` (lolo limit);
  - `hihi` (hihi limit);
- Log
- Eventing
  Selecting `y(yes)` in the "Log" line causes an entry shall be generated in the log file.
  Selecting `n(no)` in the Log line causes no entry is generated in the log file. In this case no `y(yes)` can be selected in the "Eventing" line.
  If in the "Log" line `y(yes)` is selected, then in the "Eventing" line `y(yes)` or `n(no)` can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.
- 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;`

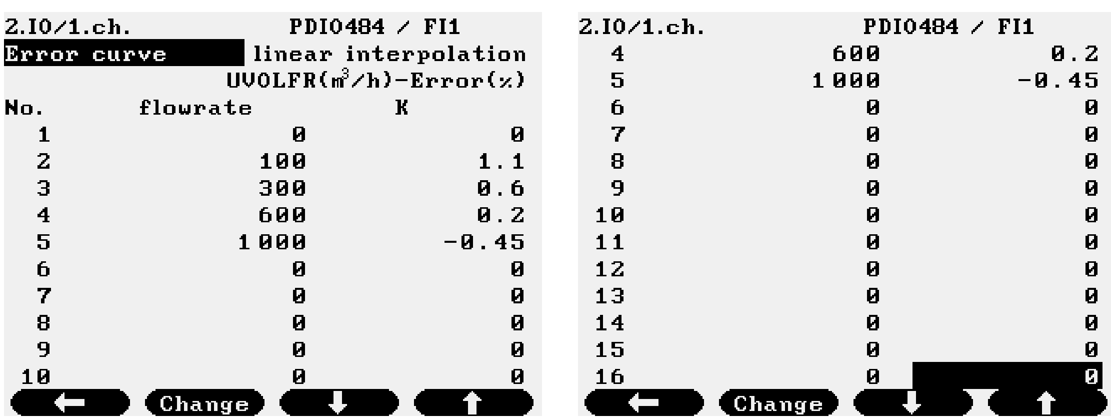


Figure 9-49 Error curve data page (signal type = flow frequency)

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^3/h) - Error (%);
- frequency (Hz) - K-factor (pulse/m3);(**)
- UVOLFR (m^3/h) - K-factor (pulse/m3);
- log(UVOLFR/visc (m3/h/cSt) - K-factor (pulse/m3);

(*) error curve is available for the units m^3/h, kg/h, MCF/h, lb/h, bbl/h, Mlb/h.
(**) only if linear interpolation is selected

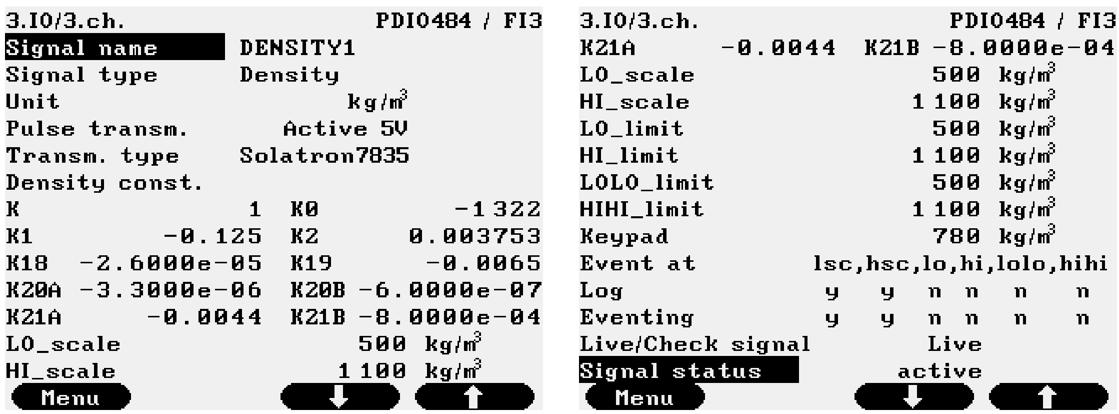


Figure 9-50 Pulse input channel (signal type = density frequency) data page

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/m3
  - 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 generals 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
- Event at;
  It can be selected here that which of the events shall initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
  - `lsc` (low scale);
  - `hsc` (high scale);
  - `lo` (lo limit);
  - `hi` (hi limit);
  - `lolo` (lolo limit);
  - `hihi` (hihi limit);
- Log
- Eventing
  Selecting `y(yes)` in the “Log” line causes an entry shall be generated in the log file.
  Selecting `n(no)` in the Log line causes no entry is generated in the log file. In this case no `y(yes)` can be selected in the “Eventing” line.
  If in the “Log” line `y(yes)` is selected, then in the “Eventing” line `y(yes)` or `n(no)` can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.
- 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

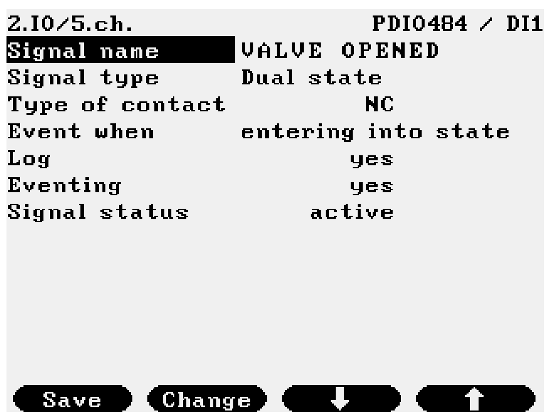


Figure 9-51 Digital input channel (signal type = dual state) data page

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;`

- o at changing state;
- Log
  - o yes;
  - o no;
- Eventing; (generate event in the event log of the flow computer)
  - o yes;
  - o no;
- Signal status
  - o active;
  - o inactive;

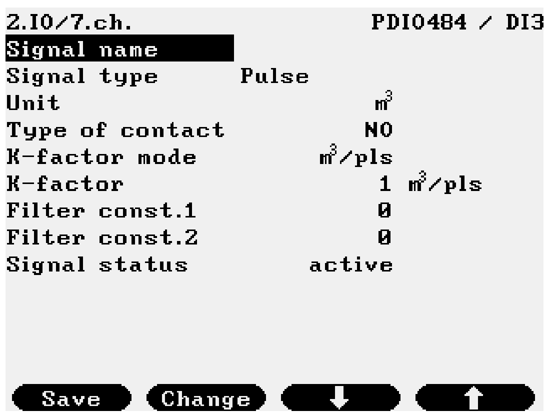


Figure 9-52 Digital input channel (signal type = pulse) data page

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
  - o Pulse;
- Unit
  - o m3;
  - o kg;
  - o GJ;
  - o MWh;
  - o MVAh;
  - o MCF;
  - o lb;
  - o MMBTU;
  - o bbl;
  - o Mlb
- Type of contact
  - o NO (normally open);
  - o NC (normally closed);
- K-factor mode;

    - `pulse/unit` (volume or mass or energy);
    - `unit/pulse;`
- K-factor;
- Filter constant 1
- Filter constant 2
  Filter constant are to apply digital filtering to the low frequency input signal.
  0 < Filter constant < 1. If Filter constant = 0 then filter is switched off.
  Recommended value for the filter constant depending on the time constant of the process is according to the table below:

Time constant (s)	Filter constant
1	0.3935
5	0.0952
10	0.0488
30	0.0165
60	0.0083

- 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.
- STR fault alarm (stream in fault state);
  It is used to provide alarm output for a particular stream it the stream is in fault state.
- 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.
- Batch control;
  It is used to control the batching process.

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

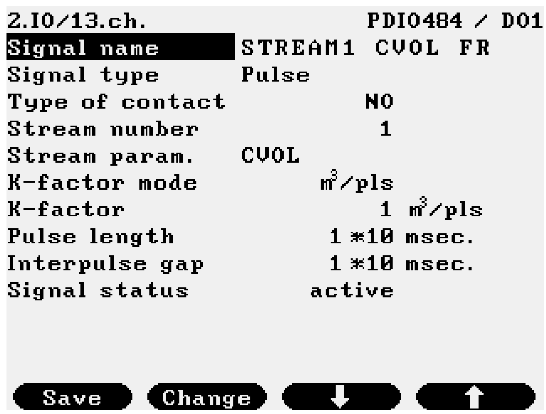


Figure 9-53 Digital output channel (signal type = pulse) data page

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^3; 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;`

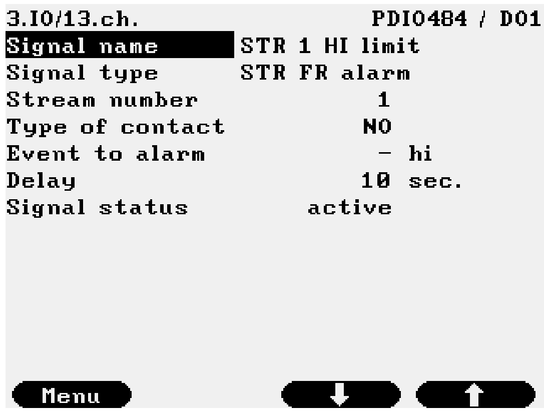


Figure 9-54 Digital output channel (signal type = STR FR alarm) data page

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)
  The type of the flow rate (UVOL FR, CVOL FR, MASS FR, ENGY FR) and the value of the lolo, lo, hi, hihi limits are set in the stream definition section. See 9.2.2.1.5.
- Type of contact
  - `NO` (normally open);
  - `NC` (normally closed);
- Event to alarm;
  It can be selected here that which of the events shall cause an alarm in the flow computer. The options are:
  - `- (none)`
  - `lo` (lo limit);
  - `hi` (hi limit);
  - `lolo` (lolo limit);
  - `hihi` (hihi limit);
- Type of contact
  - `NO` (normally open);
  - `NC` (normally closed);
- Delay; (in seconds)
- Signal status

- `active;`
- `inactive;`

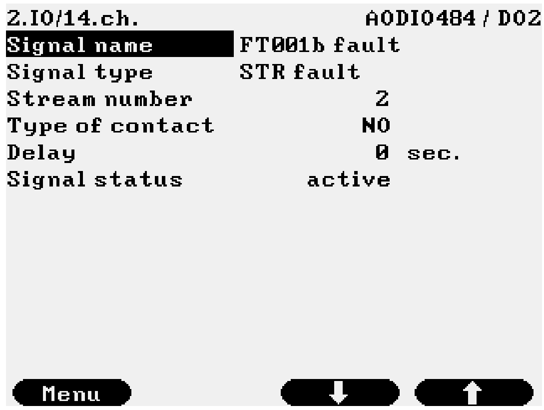


Figure 9-55 Digital output channel (signal type = STR fault alarm) data page

The editable fields on the data page are as follows:

- Signal name
  Any character string up to 18 characters, for example: FT001b
- Signal type
  - `STR fault`;
- Stream number; (from 1 to 12)
- Type of contact
  - `NO` (normally open);
  - `NC` (normally closed);
- Delay; (in seconds)
- Signal status
  - `active;`
  - `inactive;`

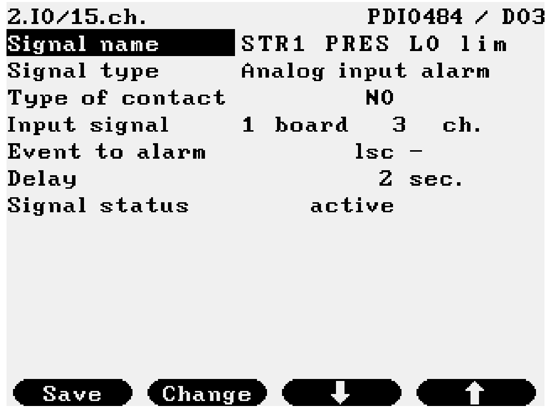


Figure 9-56 Digital output channel (signal type = Analog input alarm) data page

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;`

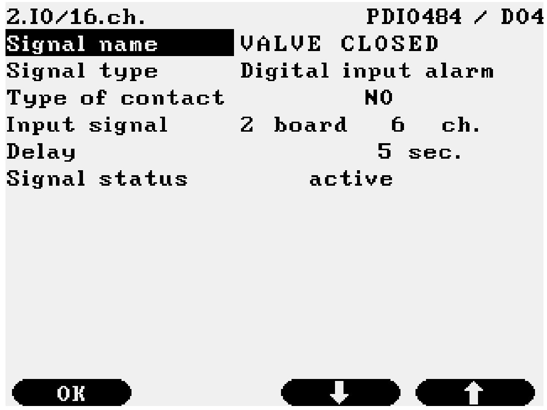


Figure 9-57 Digital output channel (signal type = Digital input alarm) data page

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;`

Figure 9-58 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;`

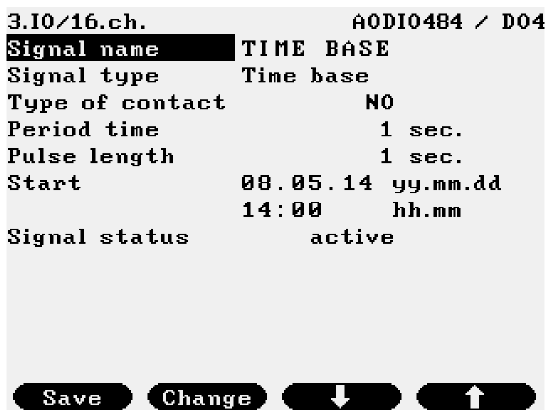


Figure 9-59 Digital output channel (signal type = Time base) data page

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;`

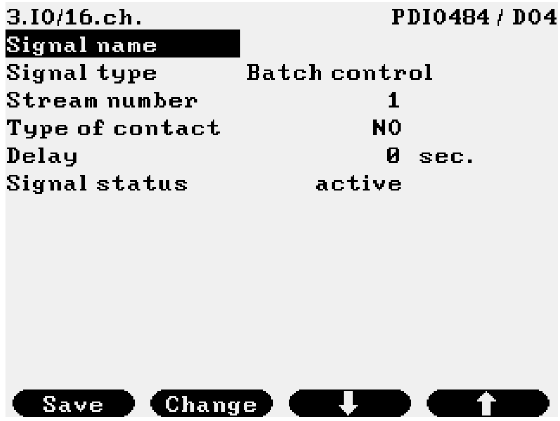


Figure 9-60 Digital output channel (signal type = Batch control) data page

The editable fields on the data page are as follows:

- Signal name
  Any character string up to 18 characters, for example: LOADING
- Signal type
  - `Batch control;`
- Stream number (stream serial number the digital output is assigned to)
- Type of contact
  - `NO` (normally open);
  - `NC` (normally closed);
- Delay; (in seconds)
- 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.

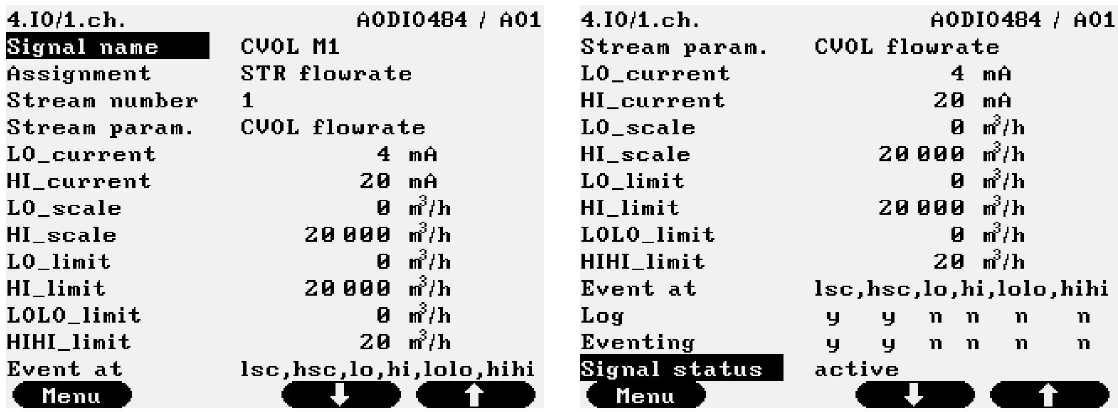


Figure 9-61 Analogue (4-20 mA) output channel data page

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
  - `STR flowrate` (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);
      - ENGY FR (energy flow rate);
  - `Input signal;`
    - Input signal X I/O board Y Channel
  - `Modbus signal;`
    - Channel X
  - PID CO (PID loop control output);
- 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);
- HIHI_limit (high-high alarm limit);
- Event at;
  t can be selected here that which of the events shall initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
  - `lsc` (low scale);
  - `hsc` (high scale);
  - `lo` (lo limit);

  - `hi` (hi limit);
  - `lolo` (lolo limit);
  - `hihi` (hihi limit);
- Log
- Eventing
  Selecting `y(yes)` in the "Log" line causes an entry shall be generated in the log file.
  Selecting `n(no)` in the Log line causes no entry is generated in the log file. In this case no `y(yes)` can be selected in the "Eventing" line.
  If in the "Log" line `y(yes)` is selected, then in the "Eventing" line `y(yes)` or `n(no)` can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.
- 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.

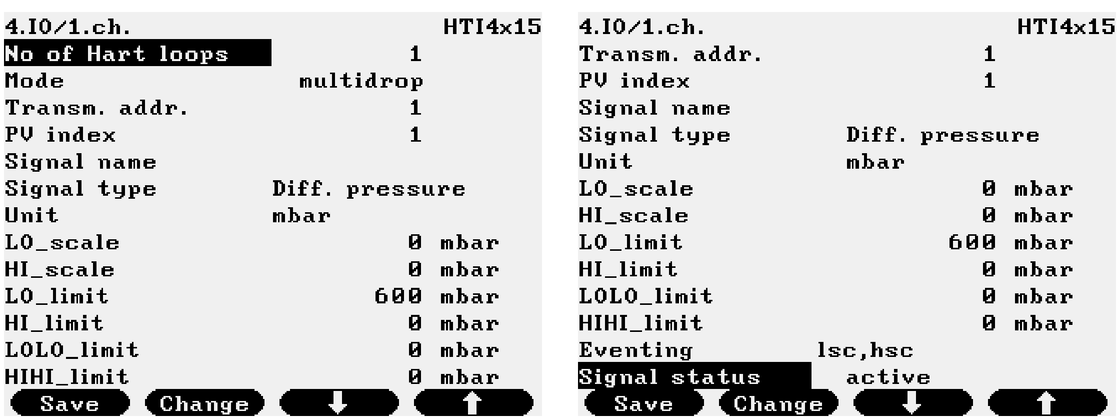


Figure 9-62 HART input channel data page

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:
  - o Differential pressure;
    - mbar
    - Pa
    - kPa
    - inH2O
  - o Flowrate;
    - m^3/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^3/h) – Error (%)
    - ➢ no

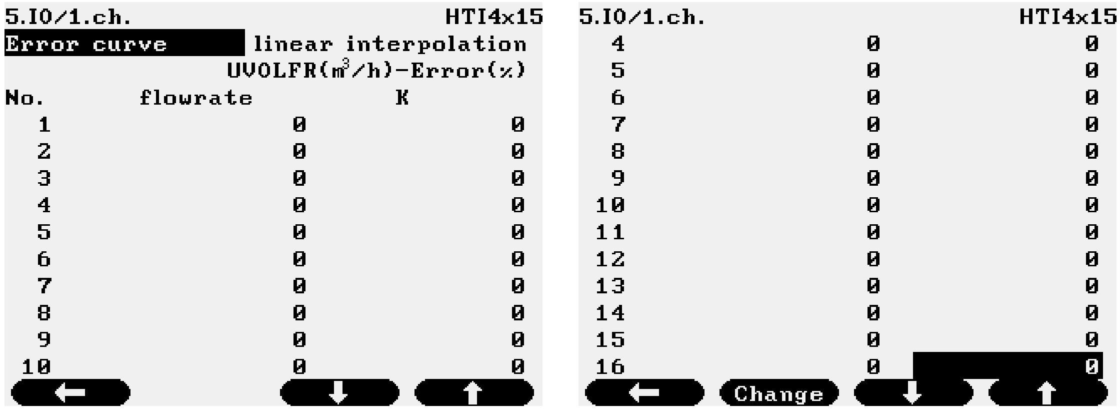


Figure 9-63 Error curve data page for flow rate signal

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^3/h) and the error (in %) 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/m³`
  - `Ib/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/m³`

  - MJ/kg
  - uS
  - BTU/SCF
  - lb/MMSCF
- o Kin. viscosity (kinematic viscosity);
  - mm^2/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);
- 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
- Event at;
  It can be selected here that which of the events shall initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
  - o lsc (low scale);
  - o hsc (high scale);
  - o lo (lo limit);
  - o hi (hi limit);
  - o lolo (lolo limit);
  - o hihi (hihi limit);
- Log
- Eventing
  Selecting y(yes) in the “Log” line causes an entry shall be generated in the log file.
  Selecting n(no) in the Log line causes no entry is generated in the log file. In this case no y(yes) can be selected in the “Eventing” line.
  If in the “Log” line y(yes) is selected, then in the “Eventing” line y(yes) or n(no) can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.
- Signal status

- o `active`;
- o `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.

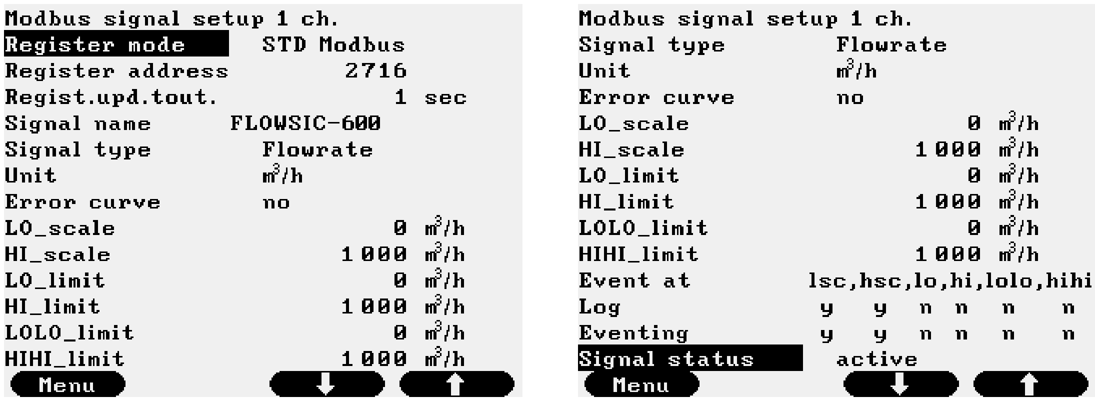


Figure 9-64 Modbus channel data page

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

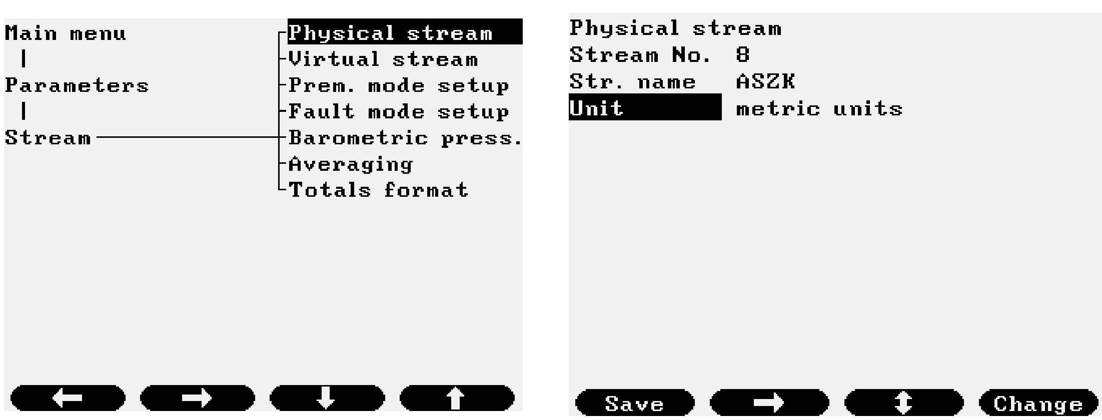


Figure 9-65 Stream selection data page

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

- `metric units;`
- `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:

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

For liquids:

- `base temperature = 60 °F;`
- `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:

- `Natural gas;`
- `Coke oven gas;`
- `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	Hydrocarb. miixture	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.

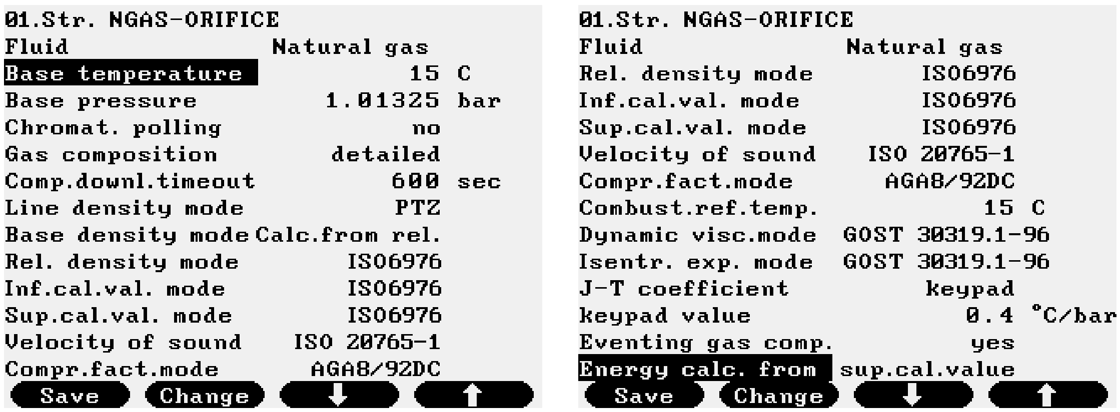


Figure 9-66 Natural gas data page (metric example)

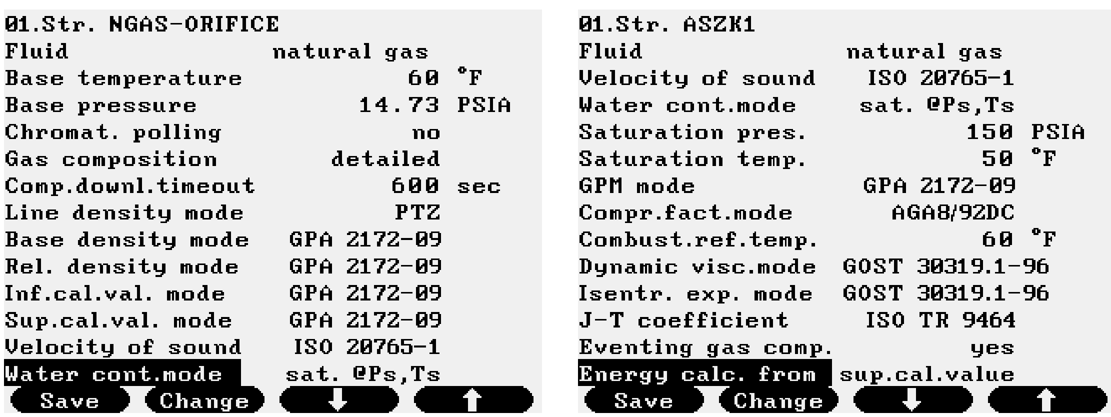


Figure 9-67 Natural gas data page (imperial example)

The data fields on the data page are as follows:

- Base temperature;
  The base temperature selected from list
  In metric units:
  - 15 °C;
  - 15.556 °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.

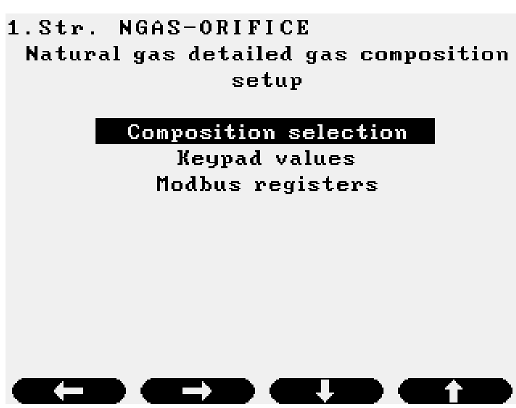


Figure 9-68 Natural gas detailed gas composition menu page

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

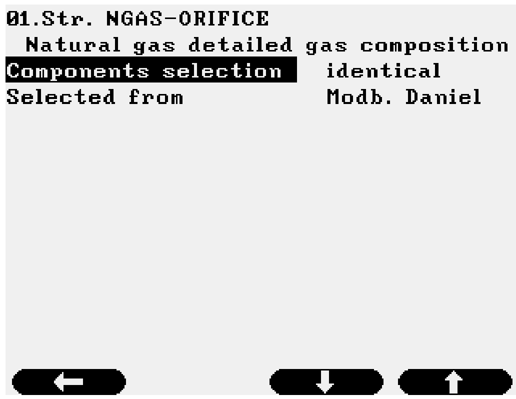


Figure 9-69 Natural gas composition selection data page

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, is shown 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, is shown in the section 10 Communications.

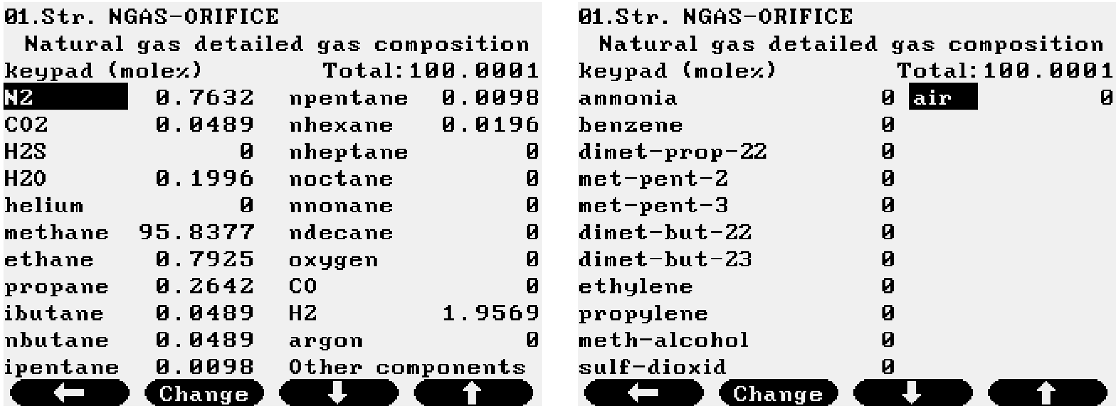


Figure 9-70 Natural gas keypad composition data page

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	7001	nhexane	7013
CO2	7002	nheptane	7014
H2S	7003	noctane	7015
H2O	7004	nnonane	7016
helium	7005	ndecane	7017
methane	7006	oxygen	7018
ethane	7007	CO	7019
propane	7008	H2	7020
nbutane	7009	rel.dens.	7021
ibutane	7010	Inf. cal. value	7022
npentane	7011	sup.cal.value	7023
ipentane	7012	argon	7024

Figure 9-71 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.

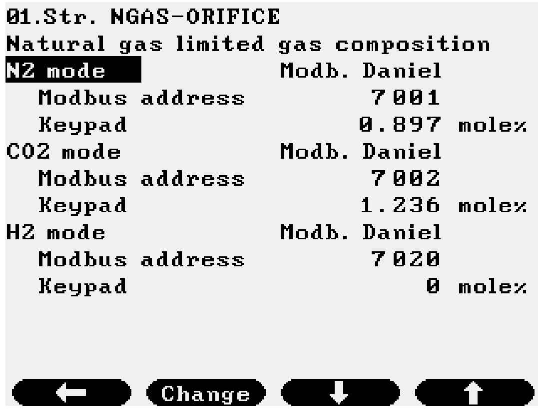


Figure 9-72 Natural gas limited gas composition data page

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 mode;
- H2 mode;
  Data fields for CO2 mode and H2 mode identical with those for N2 mode.

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.

- 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.
- SGERG88
  Compression factor is calculated according to the SGERG 88 according to ISO 12213-3 from the base density, superior calorific value, CO2 and H2 content.
- GERG91mod (available in metric units only)
  Compression factor is calculated according to the GOST 30319.2-96 from the base density, CO2 and N2 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 30319.2-96 from the base density, CO2 and N2 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 30319-2-96 from the detailed gas composition.
- AGA NX19
  Compression factor is calculated according to the AGA NX19 from the relative density, CO2 and N2 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.
- GOST 30319.2-2015
  Compression factor is calculated according to the GOST 30319-2.2015 standard from the base density, CO2 and N2 content.
- GOST 30319.3-2015
  Compression factor is calculated according to the GOST 30319-3.2015 standard from the detailed gas composition.

- 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.
  - `AGA8/92DC`
    Line density is taken from the AGA8/92DC calculation.
  - `keypad`
    The operator entered keypad value is used in the flow calculation.
    If `keypad` is selected entry field opens to enter the keypad value.
  - `GOST 30319.2-2015`
    Line density is calculated according to the GOST 30319-2.2015 standard.
  - `GOST 30319.3-2015`
    Line density is calculated according to the GOST 30319-3.2015 standard.
  - `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.
  - `ISO6976:1995`
    Base density is calculated from the detailed gas composition according to ISO 6976:1995 standard.

  - `ISO6976:2016`
    Base density is calculated from the detailed gas composition according to ISO 6976:2016 standard.
  - `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 30319.1-96` (available in metric units only)
    Base density is calculated from the detailed gas composition according to GOST 30319.1-96 standard.
    In case of GOST 30319.1-96 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:
  - `ISO6976:1995`
    Relative density is calculated from the detailed gas composition according to ISO6976:1995 standard.
  - `ISO6976:2016`
    Relative density is calculated from the detailed gas composition according to ISO6976:2016 standard.
  - `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:

- `ISO6976:1995`
  Inferior calorific value is calculated from the detailed gas composition according to ISO6976:1995 standard.
- `ISO6976:2016`
  Inferior calorific value is calculated from the detailed gas composition according to ISO6976:2016 standard.
- `GOST 30319.1-96` (available in metric units only)
  Inferior calorific value is calculated from the detailed gas composition according to GOST 30319.1-96 standard.
- `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.
  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:
  - `ISO6976:1995`
    Superior calorific value is calculated from the detailed gas composition according to ISO6976:1995 standard.
  - `ISO6976:2016`
    Superior calorific value is calculated from the detailed gas composition according to ISO6976:2016 standard.
  - `GOST 30319.1-96` (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

- 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, N2 and CO2 content, pressure and temperature according to GOST 30319.1-96
  - `GOST 30319.2-2015`
    Dynamic viscosity calculated from the base density, N2 and CO2 content, pressure and temperature according to GOST 30319.2-2015
  - `GOST 30319.3-2015`
    Dynamic viscosity calculated from the detailed gas composition, pressure and temperature according to GOST 30319.3-2015
  - `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, CO2 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.
  - `GOST 30319.2-2015`
    Isentropic exponent is calculated from the base density, CO2 content, pressure and temperature according to GOST 30319.2-2015
  - `GOST 30319.3-2015`
    Isentropic exponent is calculated from the detailed gas composition, pressure and temperature according to GOST 30319.3-2015
  - `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

- 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 30319.1-96`
    Velocity of sound is calculated according to GOST 30319.1-96.
  - `GOST 30319.2-2015`
    Velocity of sound is calculated according to GOST 30319.2-2015.
  - `GOST 30319.3-2015`
    Velocity of sound is calculated according to GOST 30319.3-2015.
  - `keypad`
    The operator entered keypad value is used.

- 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 saturation pressure Ps and saturation temperature Ts. 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 Pn and base temperature Tn. 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

o 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 GMP mode shall be selected from the list as follows:
  - o GPA 2172-2009
  The GPM (liquid equivalent) of the natural gas is calculated according to GPA 2172-2009.

- 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.
  - o yes
  - o 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.
  - o superior calorific value;
  - o 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. bellow 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_2 and N_2 content may lead to calculation failure (convergence error) in the AGA8-92Gr1 and Gr2 calculation.

<table>
<tr><td></td><td colspan="4">If the gas composition is given as</td></tr>
<tr><td></td><td colspan="2">detailed gas composition</td><td colspan="2">limited set of gas composition</td></tr>
<tr><td></td><td>AND Base density mode NOT from Relative density then</td><td>AND Base density mode IS from Relative density then</td><td>AND Base density mode NOT from Relative density then</td><td>AND Base density mode IS from Relative density then</td></tr>
<tr><td>Relative density modes</td><td>- measured
- Calc. from base
- Modb. Daniel
- Modb. STD1
- Modb. STD2
- keypad
- ISO6976:1995
- ISO6976:2016
- AGA5
- GPA 2172-09 (imperial only)</td><td>- measured
- Modb. Daniel
- Modb. STD1
- Modb. STD2
- keypad
- ISO6976:1995
- ISO6976:2016
- AGA5
- GPA 2172-09 (imperial only)</td><td>- measured
- Calc. from base
- Modb. Daniel
- Modb. STD1
- Modb. STD2
- keypad</td><td>- measured
- Modb. Daniel
- Modb. STD1
- Modb. STD2
- keypad</td></tr>
<tr><td></td><td>AND Relative density mode NOT from Base density then</td><td>AND Relative density mode IS from Base density</td><td>AND Relative density mode NOT from Base density then</td><td>AND Relative density mode IS from Base density</td></tr>
<tr><td>Base density modes</td><td>- measured
- Calc. from rel.
- Modb. Daniel
- keypad
- ISO6976:1995
- ISO6976:2016
- Modb. STD2
- GOST 30319.1-96 (metric only)
- GPA 2172-09 (imperial only)</td><td>- measured
- Modb. Daniel
- keypad
- ISO6976:1995
- ISO6976:2016
- Modb. STD2
- GOST 30319.1-96 (metric only)
- GPA 2172-09 (imperial only)</td><td>- measured
- Calc. from rel.
- Modb. Daniel
- Modb. STD2
- keypad</td><td>- measured
- Modb. Daniel
- Modb. STD2
- keypad</td></tr>
<tr><td>Inferior calorific value modes</td><td colspan="2">- measured
- Modb. Daniel
- Modb. STD1
- Modb. STD2
- keypad
- ISO6976:1995
- ISO6976:2016
- GOST 30319.1-96 (metric only)
- AGA5
- GPA 2172-09 (imperial only)</td><td colspan="2">- measured
- Modb. Daniel
- Modb. STD1
- Modb.. STD2
- keypad</td></tr>
<tr><td>Superior calorific value modes</td><td colspan="2">- measured
- Modb. Daniel
- Modb. STD2
- keypad
- ISO6976:1995
- ISO6976:2016
- GOST 30319.1-96 (metric only)
- AGA5
- GPA 2172-09 (imperial only)</td><td colspan="2">- measured
- Modb. Daniel
- Modb. STD2
- keypad</td></tr>
</table>

Compression factor modes	- AGA 8/92DC - AGA 8/92Gr1 - AGA 8/92Gr2 - SGERG 88 - GERG91mod (metric only) - NX19mod (metric only) - VNIC SMV (metric only) - AGA NX19 - Z keypad - AGA 8/85 - GOST 30319.2-2015 - GOST 30319.3-2015	- AGA8/92Gr1 - AGA8/92Gr2 - SGERG 88 - GERG91mod (metric only) - NX19mod (metric only) - AGA NX19 - Z keypad - GOST 30319.2-2015
Line density modes	- PTZ - AGA7 - AGA8/92DC (Note 1) - keypad - GOST 30319.2-2015 (metric only) - GOST 30319.3-2015 (metric only, Note 1) - measured - Modb. Daniel - Modb. STD2	- PTZ - AGA7 - keypad - GOST 30319.2-2015 (metric only) - measured - Modb. Daniel - Modb. STD2
Dynamic viscosity mode	- GOST 30319.1-96 (metric only) - GOST 30319.2-2015 (metric only) - GOST 30319.3-2015 (metric only, Note 1) - keypad	- GOST 30319.1-96 (metric only) - GOST 30319.2-2015 (metric only) - keypad
Izentropic exponent mode	- GOST 30319.1-96 (metric only) - ISO 20765-1 - GOST 30319.2-2015 (metric only) - GOST 30319.3-2015 (metric only, Note 1) - keypad	- GOST 30319.1-96 (metric only) - GOST 30319.2-2015 (metric only) - keypad
Joule-Thomson coefficient mode	- ISO 20765-1 - ISO TR 9464 - keypad	- ISO TR 9464 - keypad
Velocity of sound mode	- ISO 20765-1 - GOST 30319.1-96 (metric only) - GOST 30319.2-2015 (metric only) - GOST 30319.3-2015 (metric only, Note 1) - keypad	- GOST 30319.1-96 (metric only) - GOST 30319.2-2015 (metric only) - keypad

Note 1 Available only if “Compression factor mode” is AGA8/92DC or GOST 30319.3-2015.

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

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 and SGERG 88 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/m3	20 … 48 MJ/m3
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 method	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^3	0.668 … 1.0 kg/m^3

NX19mod method	Normal range of parameters	Expanded range of parameters
Pressure absolute	0 … 30 bar	120 … 300 bar
Temperature	-23 … +17 ^{o}C	-13 … +17 ^{o}C
Base density	0.668 … 0.70 kg/m^3	0.668 … 1.0 kg/m^3

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

9.2.2.1.1.1.2 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 of 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-sulphide	H2S	Hydrogen-sulphide	0
Water	H2O	Water	1
Methane	C1	Methane	23
Ethane	C2H6	Ethane	2
Ethylene	C2H4	Ethane	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

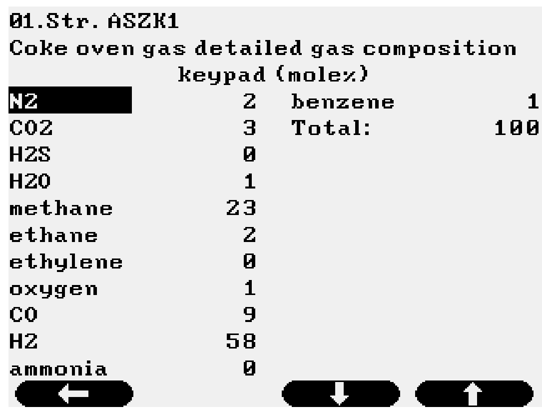


Figure 9-73 Coke oven gas composition data page

9.2.2.1.1.1.3 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

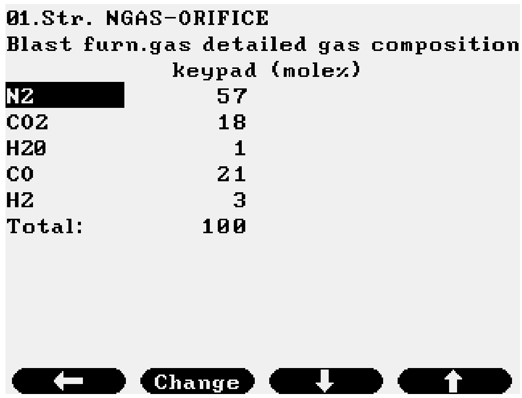


Figure 9-74 Blast furnace gas composition data page

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 Measures). The calculation methods described in HE-64 based on the text books, articles as listed in the bibliography of the HE-64.

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.

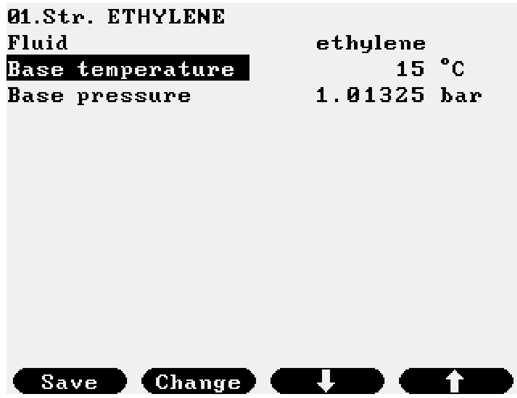


Figure 9-75 Predefined pure gas data page

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.

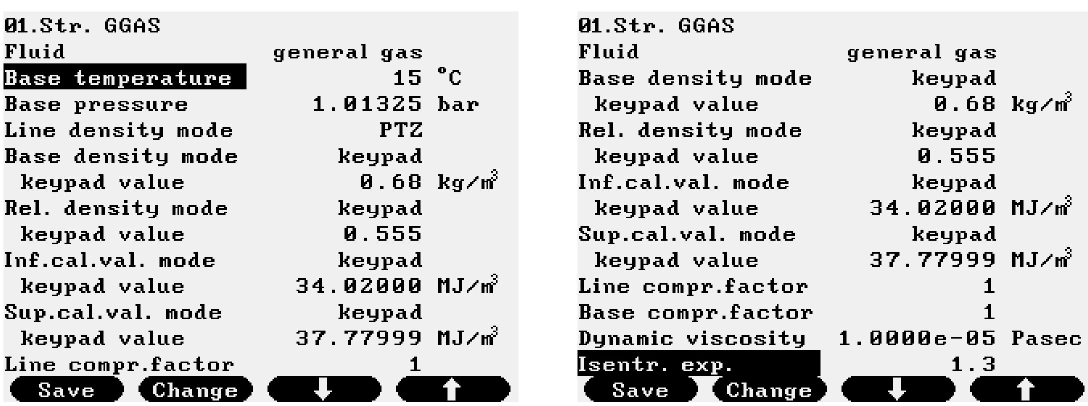


Figure 9-76 General gas data page

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.

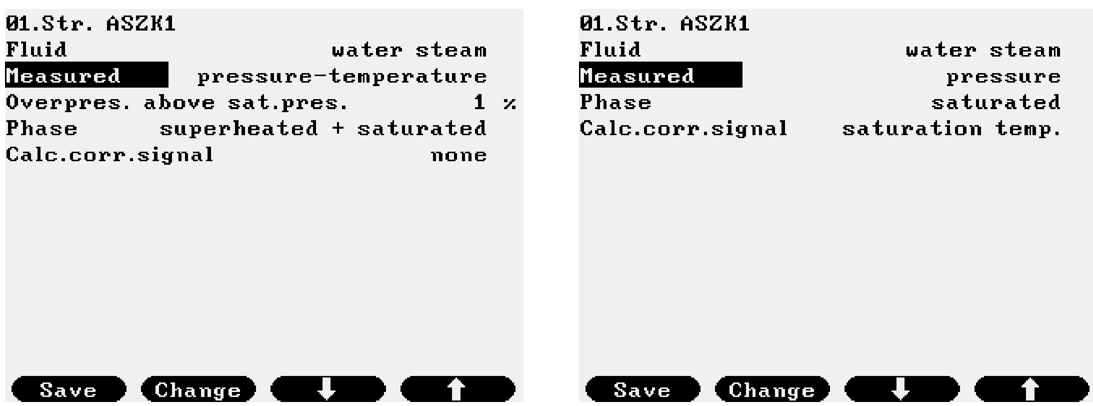


Figure 9-77 Water steam data page for superheated and saturated steam

The data fields on the data page are as follows:

- Fluid;
  Not editable, fixed to water steam.
- Measured;
  The measured parameters are 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.

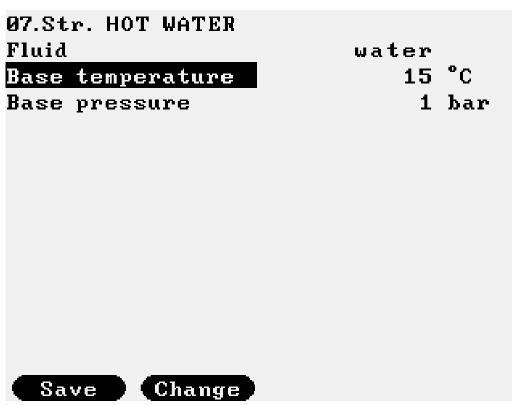


Figure 9-78 Water data page

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.

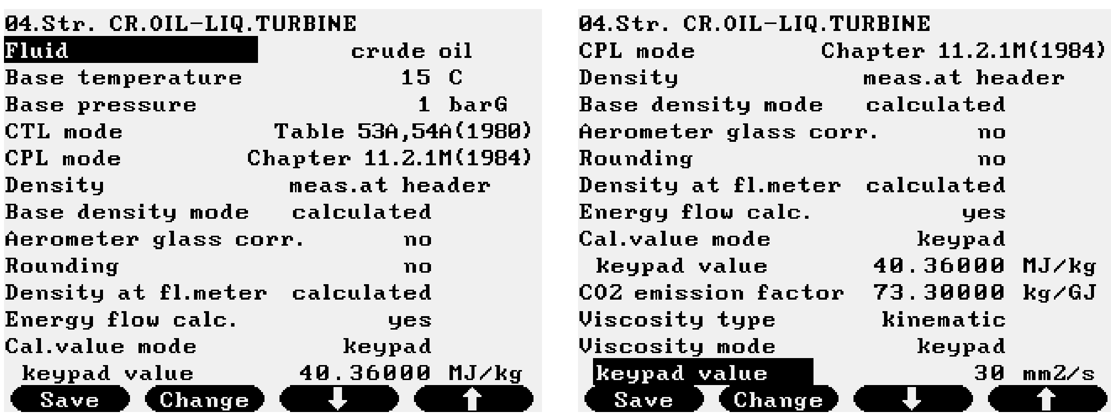


Figure 9-79 Crude oil and product data page

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 condensate 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 condensate	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 Gazprom 5.9 B.3 (2007)	15 °C 20 °C	0 barG	STO Gazprom 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;
  The density mode selected from the list:
  - `calculated;`
    The base density is calculated from the measured (at header or at meter) density. In case of line density transmitter failure the keypad value of the line density is used in the base density calculations.
  - `Calculated/external;`
    The base density is calculated from the measured (at header or at meter) density. In case of line density transmitter failure the base density is assumed to be constant. The value of the base density is selected from the Product definition table, defined in the Stream setup menu. The product definition table consists of maximum 16 products with the corresponding keypad base densities. The product the base density of which to be used in the calculation is defined via communication interface.
    This option is used when Batching is enabled and the Batch type is "Pipeline product interface".

  Set to calculated if the density mode is measured at flow meter or at the header pipe.
  Set to external if the density mode is not measured.
  If set to external, source of the base density (measured, Modbus, keypad) is defined in the stream setup menu.
- Density at flow meter mode;
  Not editable.
  Set to calculated if the density mode is measured at header pipe or not measured.
  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:

Parameters	Streams	Physical stream	Stream 1.

Fluid	Liquid	Ethanol

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.

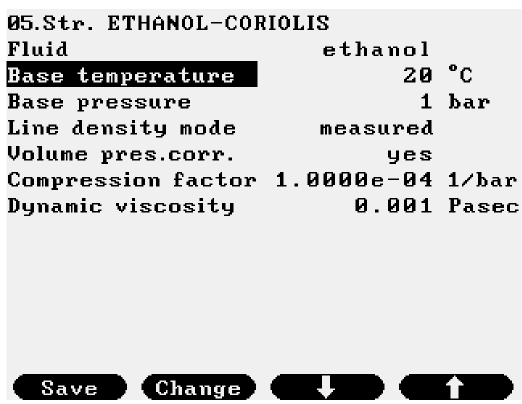


Figure 9-80 Ethanol data page

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);` (volume %)
  - `%(m/m);` (mass %)

  If the concentration is measured then the unit of measurement is fixed to volume %.
- Volume press. corr. (Pressure volume correction mode);
  It 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.

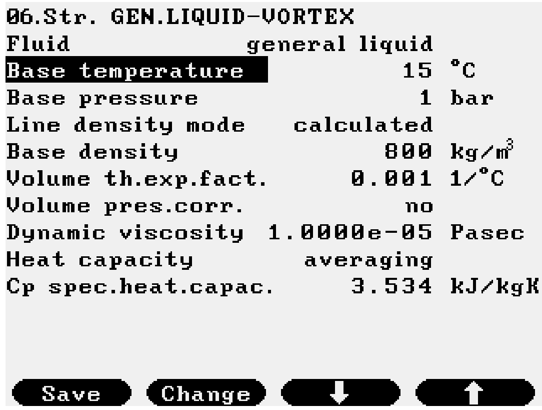


Figure 9-81 General liquid data page

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;
  It 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.

- o `calculated a*T(°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*T(°C)+b)`;
- `b` (appears if heat capacity is `calculated a*T(°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.

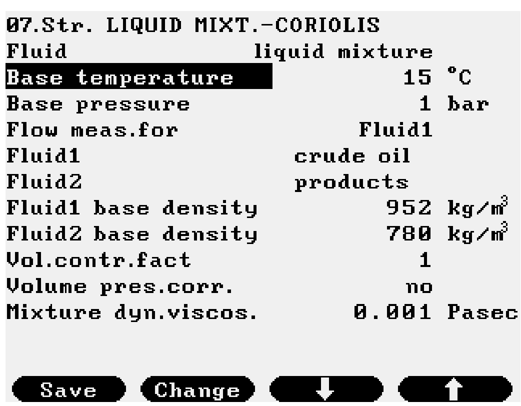


Figure 9-82 Liquid mixture data page

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 53A/54A and 53B/54B respectively.
  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 53A/54A and 53B/54B respectively.
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

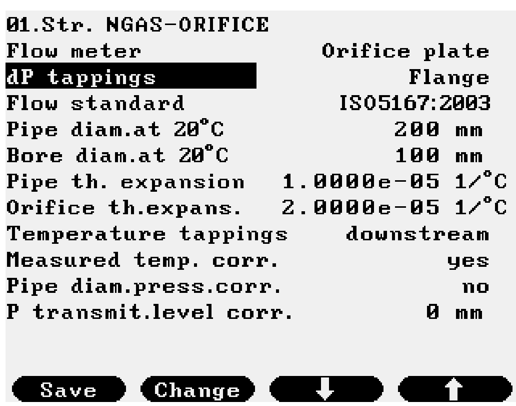


Figure 9-83 Orifice plate meter data page

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:
- `ISO 5167:1991;`
- `ISO 5167:1998;`
- `ISO 5167:2003;`
- `GOST 8.563:1997;`
- `GOST 8.586:2005;`
- `AGA 3:1990`
- `AGA 3:2012`

- 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 (any edition) the thermal expansion coefficients are entered as follows

- Pipe thermal expansion coefficient;
  Keypad value shall be entered.
- Orifice 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 tappings; (Available only if flow standard is ISO 5167 (any edition))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 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		31H19N9MVBT
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

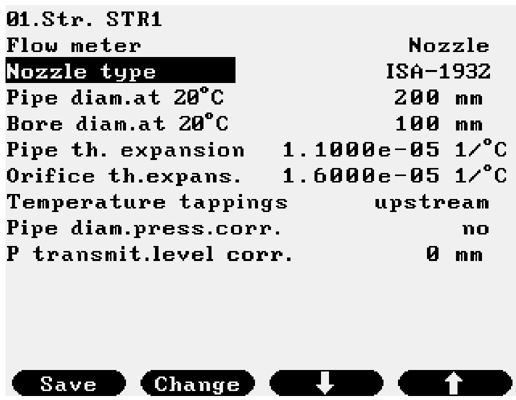


Figure 9-84 Nozzle data page

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 (any edition) 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 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.

9.2.2.1.2.1.3 Venturi tube

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.

Flow meter	Diff. press. device	Venturi tube

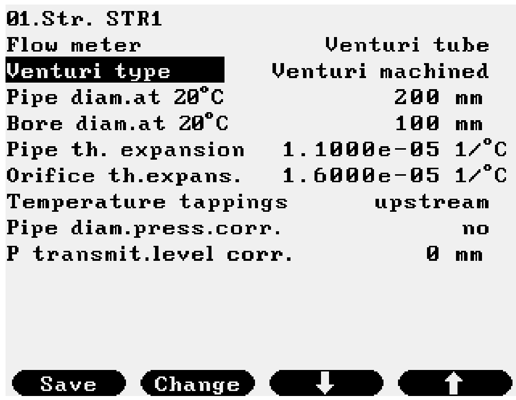


Figure 9-85 Venturi tube data page

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 (any edition) 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:

Parameters	Streams	Physical stream	Stream 1.

Flow meter	Diff. press. device	Segmental orifice plate

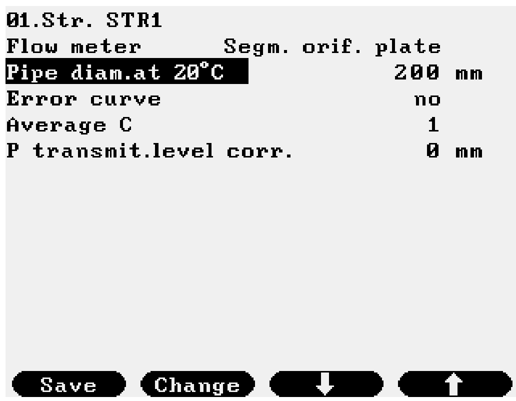


Figure 9-86 Segmental orifice plate data page

The data fields on the data page are as follows:

- Pipe diameter at 20 oC;
  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.
    - dPn; (n = 1 to 10)
    - Cn; (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;
  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.

9.2.2.1.2.1.5 V-Cone meter

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.

Flow meter	Diff. press. device	V-Cone meter

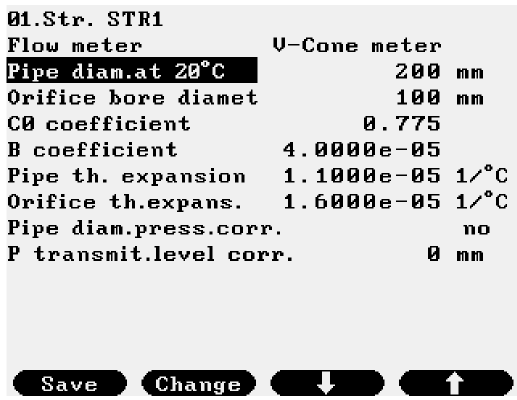


Figure 9-87 V-Cone meter data page

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;
  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.

9.2.2.1.2.1.6 Compact/Conditioning orifice plate

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.

Flow meter	Diff. press. device	Compact orifice

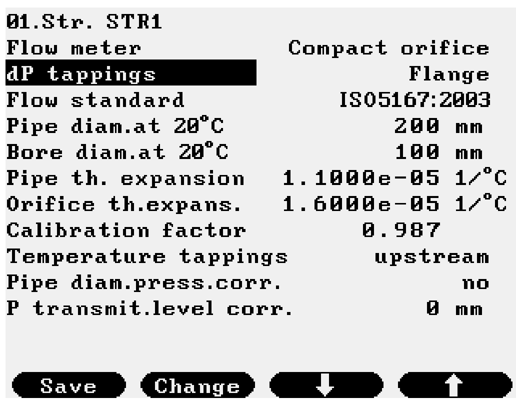


Figure 9-88 Compact/conditioning orifice plate data page

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.
- 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

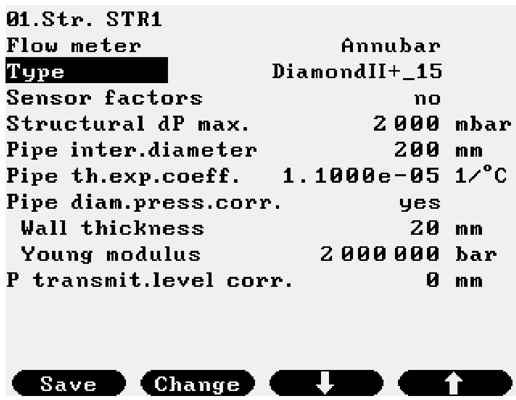


Figure 9-89 Annubar data page

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;

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.

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

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

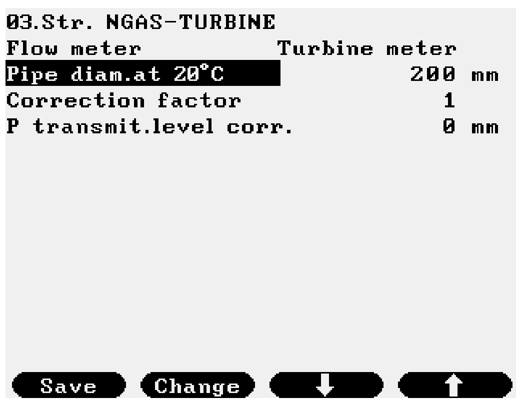


Figure 9-90 Gas turbine meter, Liquid turbine meter, Vortex meter, Mass flow meter, Ultrasonic meter, Rotameter, Electromagnetic meter, CVOL flow meter, Stream data page

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

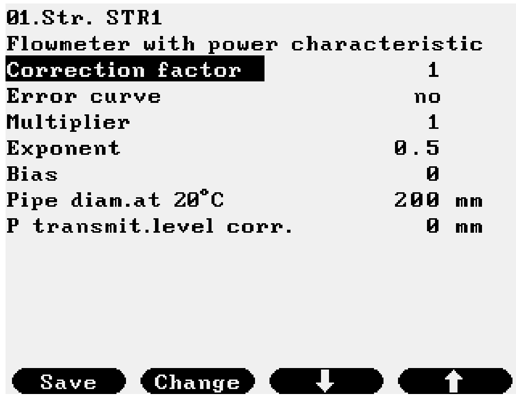


Figure 9-91 Flow meter with power characteristic data page

The equation of this type of flow meter implemented in UNIFLOW-200 is as follows:

$$q_V = \mathrm{MF} \cdot (A \cdot J^n + \mathrm{B})$$

where: q_V - volume flow rate, m^3/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

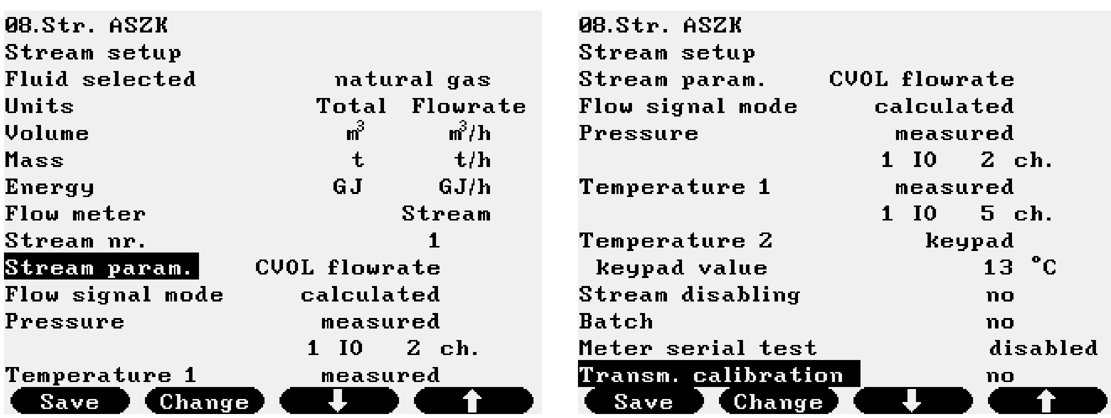


Figure 9-92 Stream flow meter definition in Stream setup menu

The “Stream” flow meter selection is intended for the case when the flow signal is set as volume at line or at base conditions 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 operate with 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: m3/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: m3/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: oC;
- signal mode: 4-20 mA I/O channel, Pt100 I/O channel, Modbus channel, keypad

Density signal

- unit: kg/m3;
- signal mode: 4-20 mA I/O channel, frequency I/O channel, Modbus channel, keypad

Calorific value signal
- unit: MJ/m3 or kg/m3;
- 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^3 - $10^3 \cdot m^3$ - $10^6 \cdot m^3$ - l - ml	- m^3/h - $10^3 \cdot m^3$/h - $10^6 \cdot m^3$/h - l/h - ml/h	- MCF - MMCF	- MCF/h - MMCF/h
	Mass	- kg - g - t	- kg/h - g/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^3 - $10^3 \cdot m^3$ - $10^6 \cdot m^3$ - l - ml	- m^3/h - $10^3 \cdot m^3$/h - $10^6 \cdot m^3$/h - l/h - ml/h	- bbl	- bbl/h
	Mass	- kg - g - t	- kg/h - g/h - t/h	- Mlb	- Mlb/h
	Energy	- GJ - MJ - kWh - MWh	- GJ/h - MJ/h - kWh/h - MWh/h	- MMBTU	- MMBTU/h

Steam	Volume	- m3 - $10^3 \cdot m^3$ - $10^6 \cdot m^3$ - l - ml	- m3/h - $10^3 \cdot m^3/h$ - $10^6 \cdot m^3/h$ - l/h - ml/h	not supported	not supported
	Mass	- kg - g - t	- kg/h - g/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

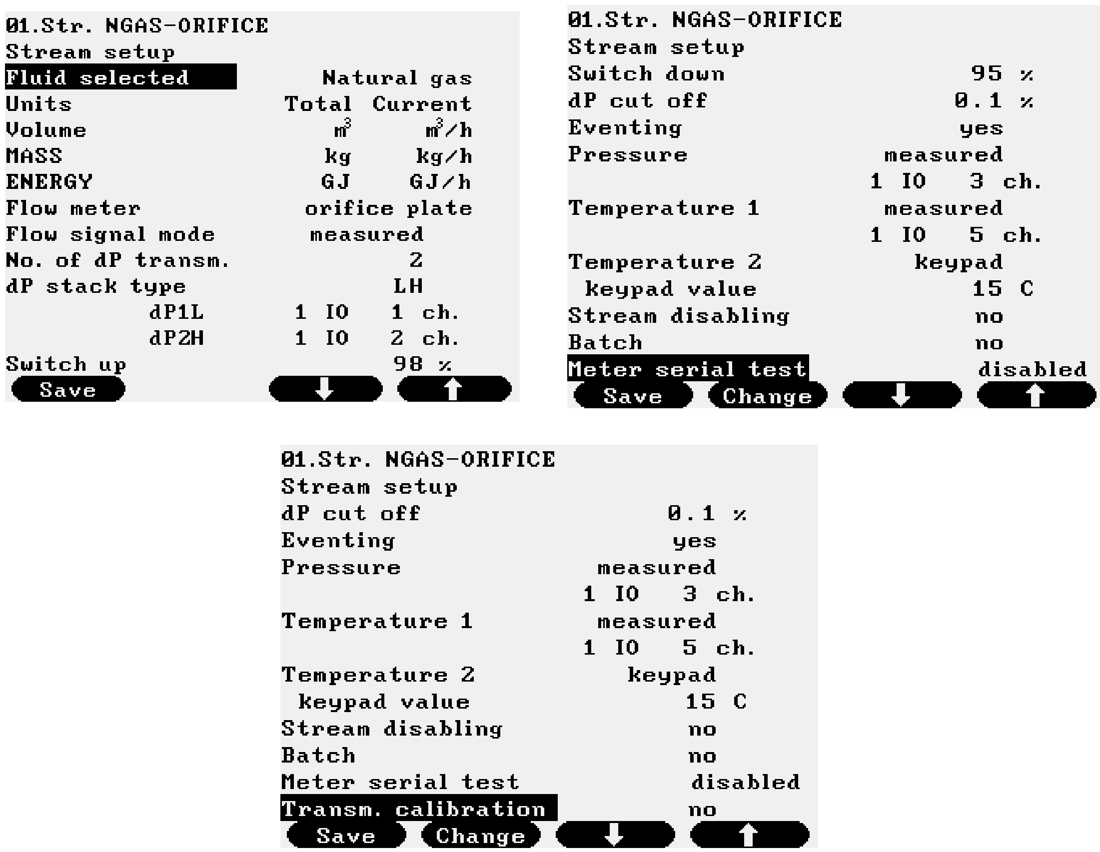


Figure 9-93 Stream setup data page, fluid: natural gas, flow meter: orifice meter

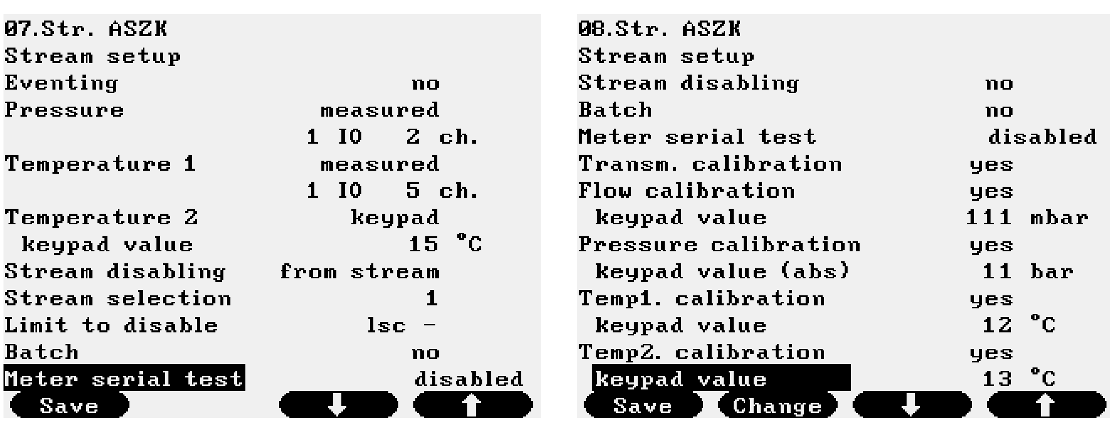


Figure 9-94 Stream disabling and transmitter calibration data page

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;
  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.
- `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;
- `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.
  - `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.;`
  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.
  - `input 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 (volume at line or at base conditions, 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 data entry lines appear where the parameters of the batch measurement shall be enter.
    - Batch start/stop
      The batch start/stop method is selected here from the list of options:
      `- from communication interface;`
      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.
      `- start key/required quantity;`
      The batch measurement starts with pulse (pulse length min. 1 s) applied to the appropriate digital input.
      The batch measurements stops when the required quantity (mass or volume) passed the meter run. The batch measurement can be stopped in case of emergency applying pulse (pulse length min. 1 s) to the appropriate digital input.
      In case of this start/stop method new data entry lines appear as follows:

- Required quantity
  Selected from the list:
  - `volume` (required quantity is entered in volume units at base conditions);
  - `mass` (required quantity is entered in mass units);
- Batch quantity
  Numeric entry field to enter the required batch quantity.
- Batch start input (digital input channel to start batch measurement)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch stop input (digital input channel to stop batch measurement in case of emergency)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch control input (digital output channel set to active state during the batch measurement)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch type
  The type of batch measurement is selected here from the list of options:
  - `Tank loading/unloading;`
    Conventional tank loading batch measurement (see 9.1.7.1).
  - `Pipeline product interface;`
    Different kind of fluids flowing in the same pipeline each after other measured as batches (see 9.1.7.2).
    Available only if batch start/stop method is "from communication interface".
    In case to Pipeline product interface batch type new data entry line appear:
- Product info
  Entering into this entry line new data entry display appears where up to 16 different product type and the corresponding density at base conditions shall be entered. See also in 9.2.2.1.1.5. Liquids.

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 flow computer.
  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

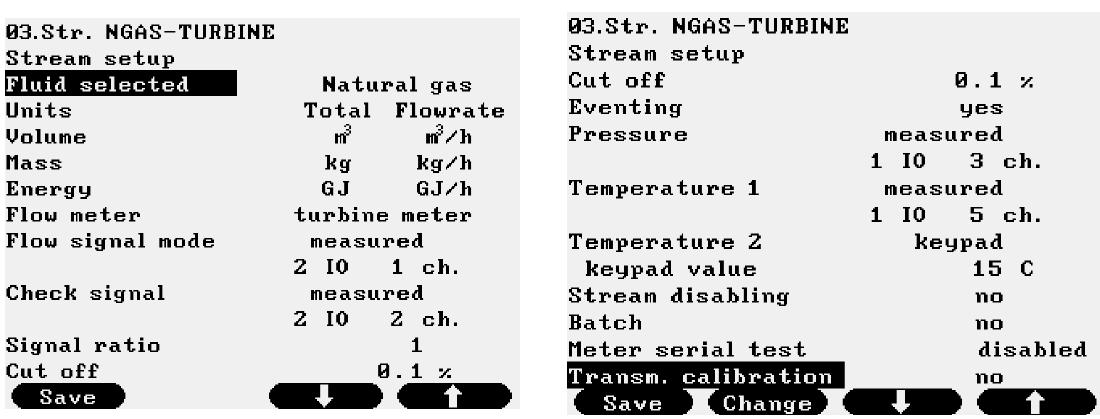


Figure 9-95 Stream setup data page, fluid: natural gas, flow meter: turbine meter

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;
  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.
    - IO *n* Ch *m*
      n – number of I/O board
      m – number of channel on the I/O board
    - 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.
        - IO *n* Ch *m*
          n – number of I/O board
          m – number of channel on the I/O board
      - 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.
    - 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.

- `input 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 (volume at line or at base conditions, 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 data entry lines appear where the parameters of the batch measurement shall be enter.
    - Batch start/stop
      The batch start/stop method is selected here from the list of options:
      `- from communication interface;`
      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.
      `- start key/required quantity;`
      The batch measurement starts with pulse (pulse length min. 1 s) applied to the appropriate digital input.
      The batch measurements stops when the required quantity (mass or volume) passed the meter run. The batch measurement can be stopped in case of emergency applying pulse (pulse length min. 1 s) to the appropriate digital input.
      In case of this start/stop method new data entry lines appear as follows:
    - Required quantity
      Selected from the list:
      - `volume` (required quantity is entered in volume units at base conditions);
      - `mass` (required quantity is entered in mass units);
    - Batch quantity
      Numeric entry field to enter the required batch quantity.
    - Batch start input (digital input channel to start batch measurement)
      - IO *n* Ch *m*

n – number of I/O board
m – number of channel on the I/O board

- Batch stop input (digital input channel to stop batch measurement in case of emergency)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch control input (digital output channel set to active state during the batch measurement)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch type
  The type of batch measurement is selected here from the list of options:
  - `Tank loading/unloading;`
    Conventional tank loading batch measurement (see 9.1.7.1).
  - `Pipeline product interface;`
    Different kind of fluids flowing in the same pipeline each after other measured as batches (see 9.1.7.2).
    Available only if batch start/stop method is "from communication interface".
    In case to Pipeline product interface batch type new data entry line appear:
- Product info
  Entering into this entry line new data entry display appears where up to 16 different product type and the corresponding density at base conditions shall be entered. See also in 9.2.2.1.1.5. Liquids.

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.

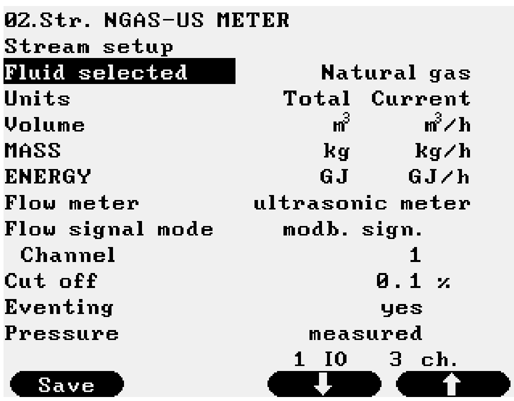
- Keypad value
  keypad value to be used in the calculation during the transmitter calibration shall be entered.

- 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



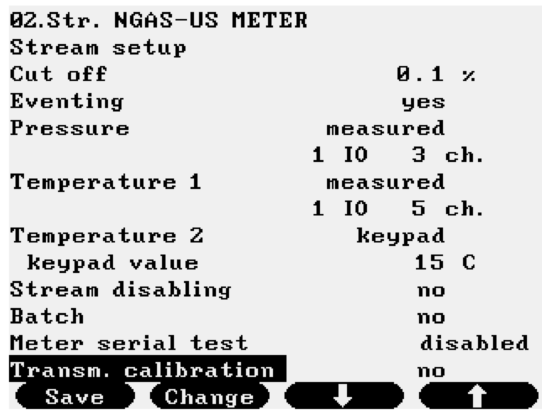


Figure 9-96 Stream setup data page, fluid: natural gas, flow meter: ultrasonic meter

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.
  - `input 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 (volume at line or at base conditions, 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 data entry lines appear where the parameters of the batch measurement shall be enter.
  - Batch start/stop
    The batch start/stop method is selected here from the list of options:
    `- from communication interface;`
    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.

`- start key/required quantity;`
The batch measurement starts with pulse (pulse length min. 1 s) applied to the appropriate digital input.
The batch measurements stops when the required quantity (mass or volume) passed the meter run. The batch measurement can be stopped in case of emergency applying pulse (pulse length min. 1 s) to the appropriate digital input.
In case of this start/stop method new data entry lines appear as follows:

- Required quantity
  Selected from the list:
  - `volume` (required quantity is entered in volume units at base conditions);
  - `mass` (required quantity is entered in mass units);
- Batch quantity
  Numeric entry field to enter the required batch quantity.
- Batch start input (digital input channel to start batch measurement)
  - IO *n*   Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch stop input (digital input channel to stop batch measurement in case of emergency)
  - IO *n*   Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch control input (digital output channel set to active state during the batch measurement)
  - IO *n*   Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch type
  The type of batch measurement is selected here from the list of options:
  `- Tank loading/unloading;`
  Conventional tank loading batch measurement (see 9.1.7.1).
  `- Pipeline product interface;`
  Different kind of fluids flowing in the same pipeline each after other measured as batches (see 9.1.7.2).
  Available only if batch start/stop method is “from communication interface”.
  In case to Pipeline product interface batch type new data entry line appear:
- Product info
  Entering into this entry line new data entry display appears where up to 16 different product type and the corresponding density at base conditions shall be entered. See also in 9.2.2.1.1.5. Liquids.

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.

9.2.2.1.3.4 Stream setup – fluid: crude oil, flow meter: liquid turbine meter

Route in the menu tree:

Parameters	Streams	Physical stream	Stream 1.	Stream setup

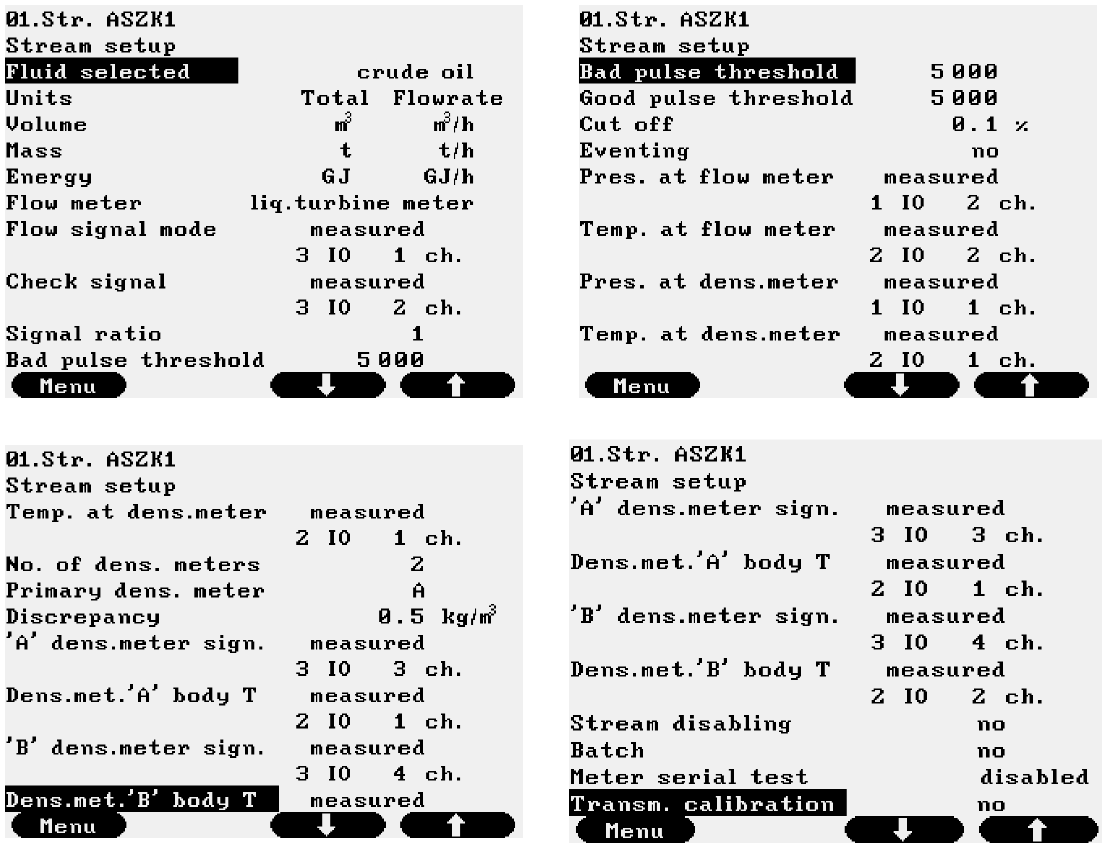


Figure 9-97 Stream setup data page, fluid: crude oil, flow meter: liquid turbine

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;
  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
- `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.

- No. of dens. meters (Number of density transmitters);
  Selected from the list
  - `1` (one);
  - `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
  - `A;`
  - `B;`
  - `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
  - `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
  - `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;
  - `keypad;`
    Keypad density can be entered here if density signal is not available.Dens.met."A" body T ("A" density transmitter body temperature);

  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.

- 'B' dens. meter sign. ("B" density transmitter signal mode);
  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
  - `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;
  - `keypad;`
    Keypad density can be entered here if density signal is not available.
- Dens.met.'B' body T ('B' density transmitter body temperature);
  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.

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.
- `input 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 (volume at line or at base conditions, 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 data entry lines appear where the parameters of the batch measurement shall be enter.
    - Batch start/stop
      The batch start/stop method is selected here from the list of options:
      `- from communication interface;`
      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.
      `- start key/required quantity;`
      The batch measurement starts with pulse (pulse length min. 1 s) applied to the appropriate digital input.
      The batch measurements stops when the required quantity (mass or volume) passed the meter run. The batch measurement can be stopped in case of emergency applying pulse (pulse length min. 1 s) to the appropriate digital input.
      In case of this start/stop method new data entry lines appear as follows:
    - Required quantity
      Selected from the list:
      - `volume` (required quantity is entered in volume units at base conditions);
      - `mass` (required quantity is entered in mass units);
    - Batch quantity
      Numeric entry field to enter the required batch quantity.
    - Batch start input (digital input channel to start batch measurement)
      - IO *n* Ch *m*
        n – number of I/O board
        m – number of channel on the I/O board
    - Batch stop input (digital input channel to stop batch measurement in case of emergency)
      - IO *n* Ch *m*

n – number of I/O board
m – number of channel on the I/O board

- Batch control input (digital output channel set to active state during the batch measurement)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch type
  The type of batch measurement is selected here from the list of options:
  - `Tank loading/unloading;`
    Conventional tank loading batch measurement (see 9.1.7.1).
  - `Pipeline product interface;`
    Different kind of fluids flowing in the same pipeline each after other measured as batches (see 9.1.7.2).
    Available only if batch start/stop method is "from communication interface".
    In case to Pipeline product interface batch type new data entry line appear:
- Product info
  Entering into this entry line new data entry display appears where up to 16 different product type and the corresponding density at base conditions shall be entered. See also in 9.2.2.1.1.5. Liquids.

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.

9.2.2.1.3.5 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

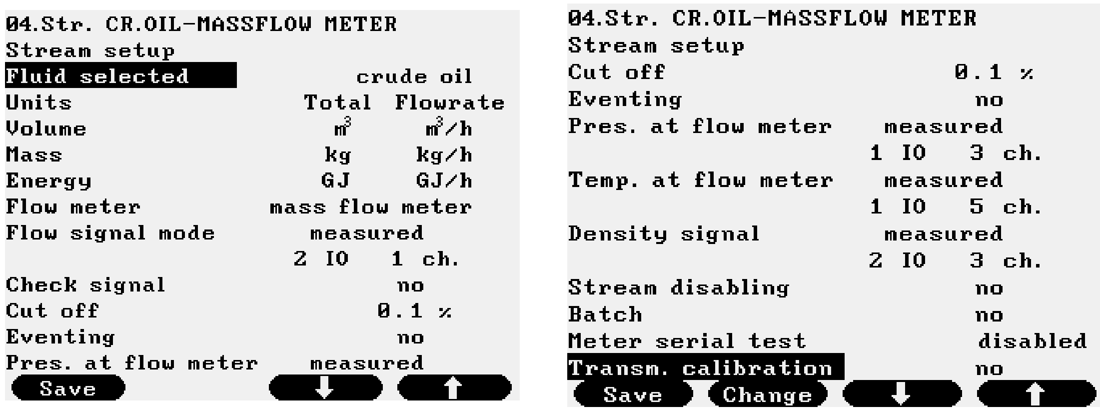


Figure 9-98 Stream setup data page, fluid: crude oil, flow meter: mass flow meter

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;
  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 (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

- `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;

- `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:

  - `no`;

    Stream never disabled.

  - `input 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 (volume at line or at base conditions, 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 data entry lines appear where the parameters of the batch measurement shall be enter.

- Batch start/stop

The batch start/stop method is selected here from the list of options:

`- from communication interface;`

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.
`- start key/required quantity;`
The batch measurement starts with pulse (pulse length min. 1 s) applied to the appropriate digital input.
The batch measurements stops when the required quantity (mass or volume) passed the meter run. The batch measurement can be stopped in case of emergency applying pulse (pulse length min. 1 s) to the appropriate digital input.
In case of this start/stop method new data entry lines appear as follows:

- Required quantity
  Selected from the list:
  - `volume` (required quantity is entered in volume units at base conditions);
  - `mass` (required quantity is entered in mass units);
- Batch quantity
  Numeric entry field to enter the required batch quantity.
- Batch start input (digital input channel to start batch measurement)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch stop input (digital input channel to stop batch measurement in case of emergency)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch control input (digital output channel set to active state during the batch measurement)
  - IO *n* Ch *m*
    n – number of I/O board
    m – number of channel on the I/O board
- Batch type
  The type of batch measurement is selected here from the list of options:
  - `Tank loading/unloading;`
    Conventional tank loading batch measurement (see 9.1.7.1).
  - `Pipeline product interface;`
    Different kind of fluids flowing in the same pipeline each after other measured as batches (see 9.1.7.2).
    Available only if batch start/stop method is “from communication interface”.
    In case to Pipeline product interface batch type new data entry line appear:
- Product info
  Entering into this entry line new data entry display appears where up to 16 different product type and the corresponding density at base conditions shall be entered. See also in 9.2.2.1.1.5. Liquids.

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

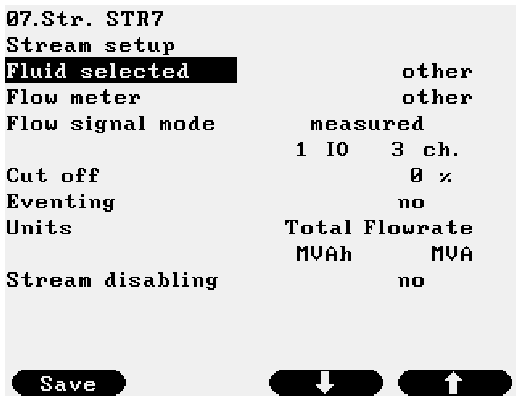


Figure 9-99 Stream setup data page, fluid: other, flow meter: other (electrical power measurement)

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;
  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 analogue 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.
  - `input 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 (volume at line or at base conditions, 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 he 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

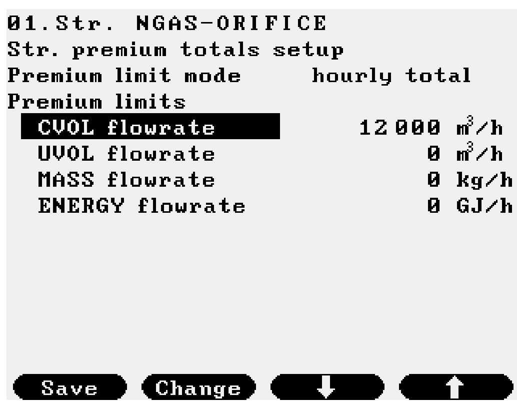


Figure 9-100 Premium limits data page

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

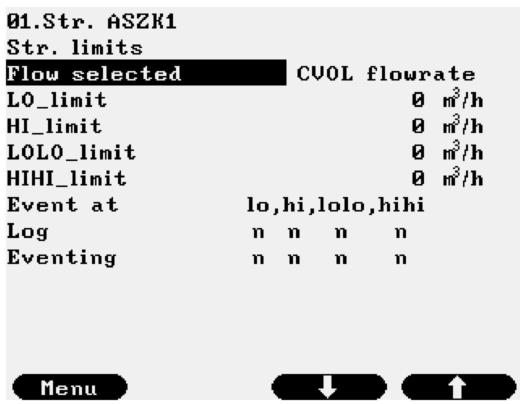


Figure 9-101 Limits data page

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;`
- `Event at`
  It can be selected here that which of the events shall initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
  - `lo` (lo limit);
  - `hi` (hi limit);

  - `lolo` (lolo limit);
  - `hihi` (hihi limit);
- Log
- Eventing

  Selecting `y(yes)` in the "Log" line causes an entry shall be generated in the log file.
  Selecting `n(no)` in the Log line causes no entry is generated in the log file. In this case no `y(yes)` can be selected in the "Eventing" line.
  If in the "Log" line `y(yes)` is selected, then in the "Eventing" line `y(yes)` or `n(no)` can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.

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:

Parameters	Streams	Virtual streams

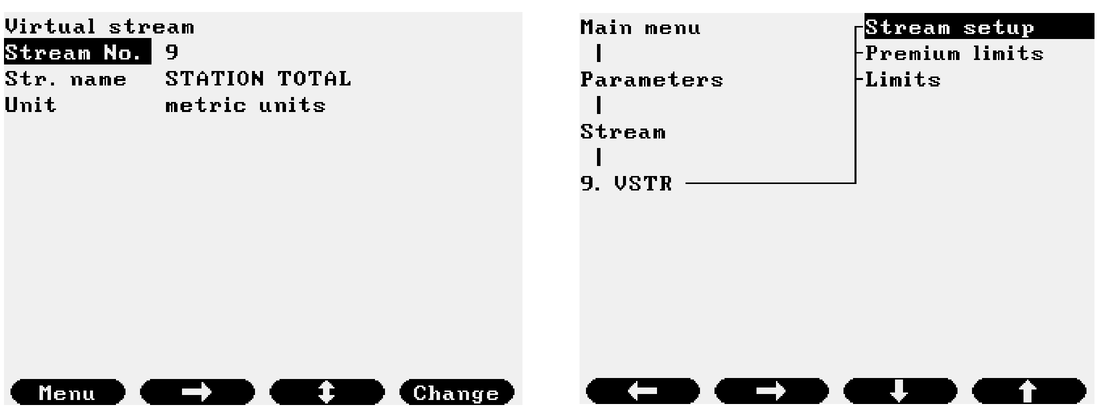


Figure 9-102 Virtual stream selection data page

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

  - `metric units;`
  - `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:

- volume/volume flow rate `MCF` `MCF/h;`
- mass/mass flow rate `lb` `lb/h;`
- 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.

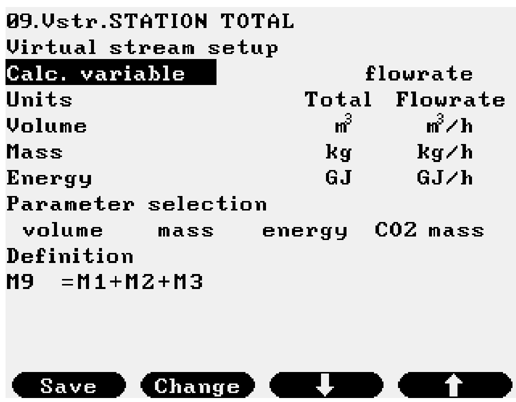


Figure 9-103 Virtual stream setup data page

The data fields on the data page are as follows:

- Calc. variable (Calculated variable);
  Selected from the list
  - o `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, three or all four 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 in 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 starts 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 he 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.

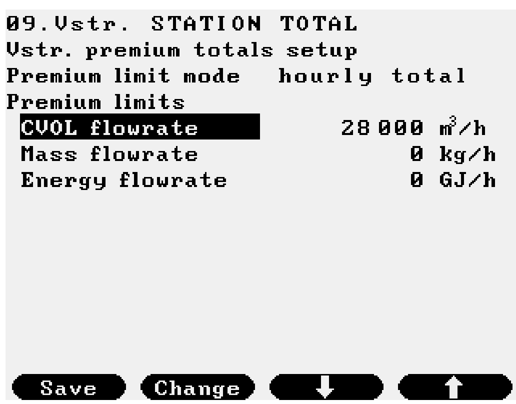


Figure 9-104 Virtual stream premium limits data page

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.

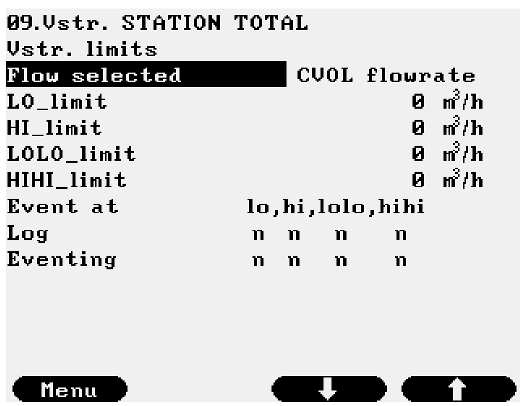


Figure 9-105 Virtual stream limits data page

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;`
- `Event at`
  It can be selected here that which of the events shall initiate an entry in the event log file of the flow computer and which of the events shall generate event in the alarm system. The options are:
    - `lo` (lo limit);

    - `hi` (hi limit);
    - `lolo` (lolo limit);
    - `hihi` (hihi limit);
- Log
- Eventing
  Selecting `y(yes)` in the "Log" line causes an entry shall be generated in the log file.
  Selecting `n(no)` in the Log line causes no entry is generated in the log file. In this case no `y(yes)` can be selected in the "Eventing" line.
  If in the "Log" line `y(yes)` is selected, then in the "Eventing" line `y(yes)` or `n(no)` can be selected, i.e. the operator can decide if the event generates event in the alarm system or not.

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.

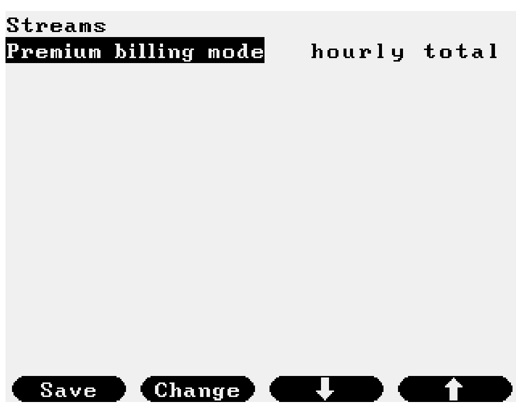


Figure 9-106 Premium mode setup data page

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 then 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.

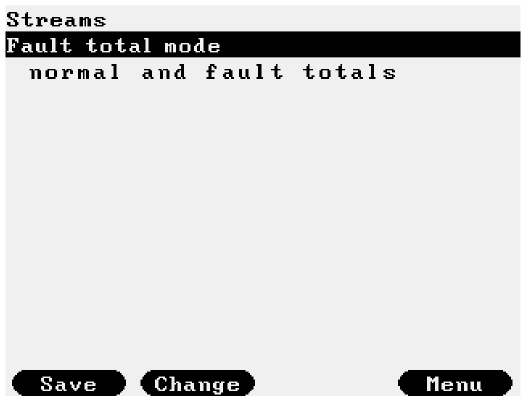


Figure 9-107 Fault mode setup data page

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 ratio 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.

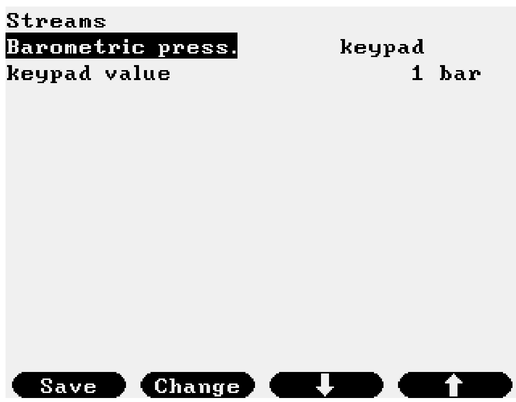


Figure 9-108 Barometric pressure data page

In volume at base conditions 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

- `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
- `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;
- `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

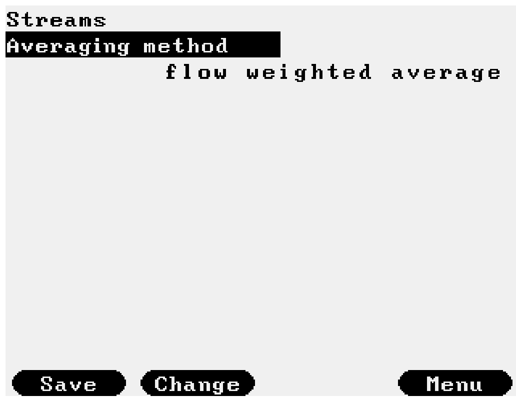


Figure 9-109 Averaging setup data page

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

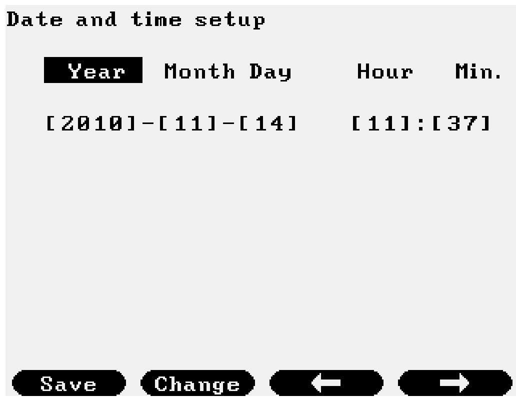


Figure 9-110 Date and time data page

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

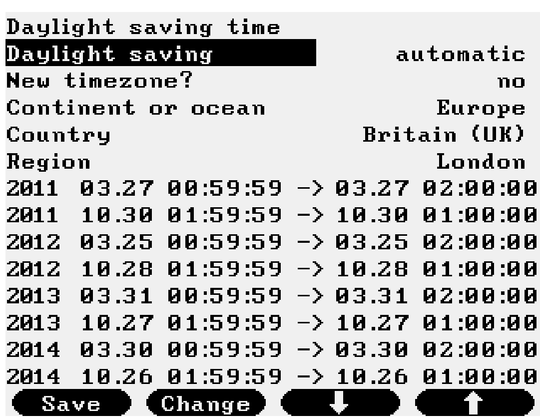


Figure 9-111 Time zone data page

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.

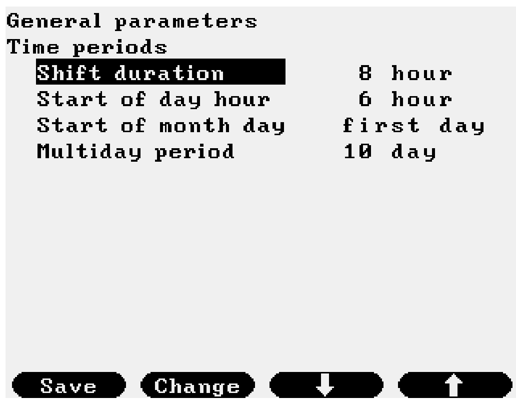


Figure 9-112 Time periods data page

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.

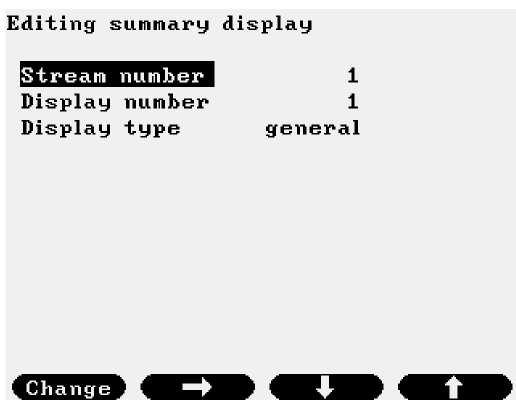


Figure 9-113 Summary display setup data page

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.

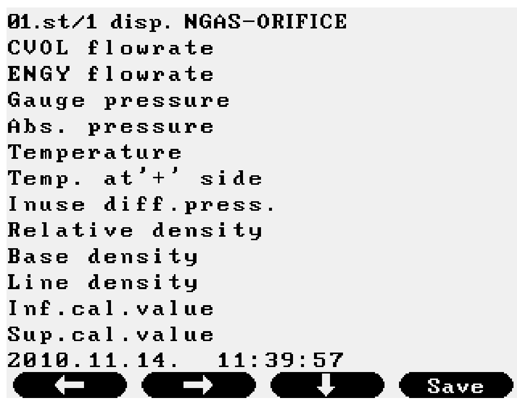


Figure 9-114 Display editing data page, General display

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		–	–
`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	x	–	–
CO2 emission flowrate …/day	x	x	–	–
CO2 emission mass	x	x	–	–
Line compression factor	x	–	–	–
Conversion factor	x	–	–	–
Base compression factor	x	–	–	–
Line/Base compression factor	x	–	–	–
Flow time	x	–	–	–
Fault flow time	x	–	–	–
Ethanol %(m/m)	x			
Ethanol %(v/v)	x			
Pressure at density meter	x			
Temperature at density meter	x			
Density meter 1 body temperature	x			
Density meter 2 body temperature	x			
Inuse measured density	x			
Batch MASS	x			
Batch CVOL	x			
Batch UVOL	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

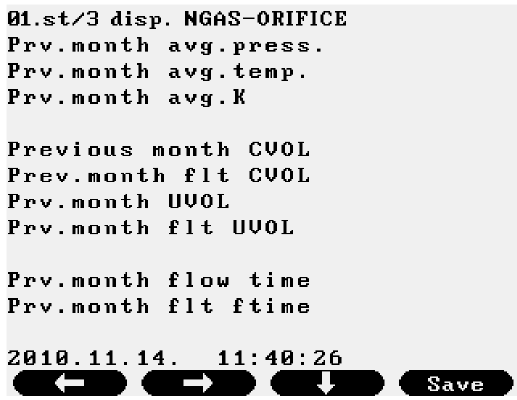


Figure 9-115 Display editing data page, Previous month display

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 max hourly CVOL	x	–	–	–
Previous month max CVOL time	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

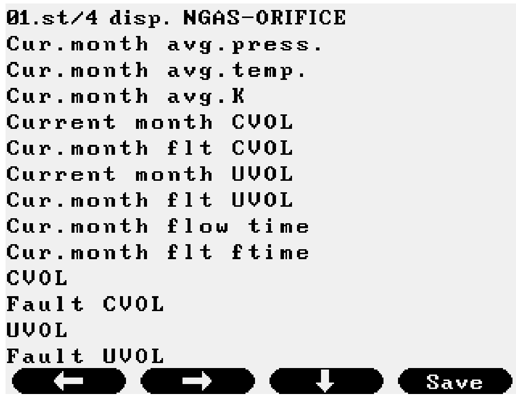


Figure 9-116 Display editing data page, Current month display

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 hour CVOL	x	-	-	-
Current month CVOL	x	x	–	–
Current month fault CVOL	x	x	–	–
Current hour UVOL	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.

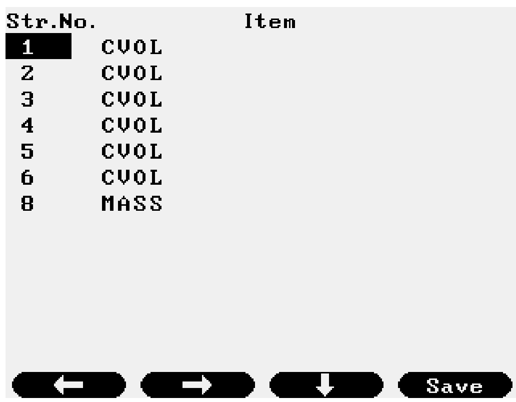


Figure 9-117 Extra summary display setup data page

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

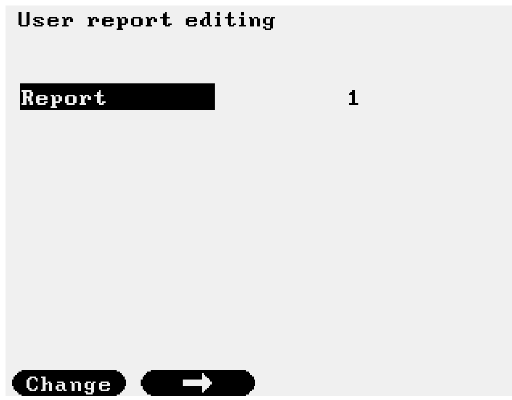


Figure 9-118 User defined report selection data page

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.

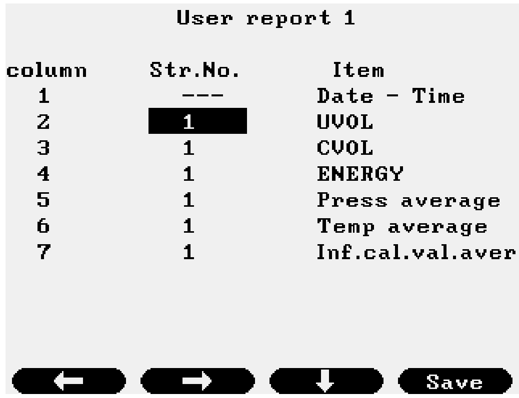


Figure 9-119 User report editing data page for User report 1 and 2

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;` (volume at line conditions)
    - `CVOL;` (volume at base conditions)
    - `Mass;` (mass)
    - `Energy;` (energy)
    - `CO2 mass;` (CO2 emission mass)
    - `Fault CVOL;` (volume at base conditions 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 volume at base conditions)
    - `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)

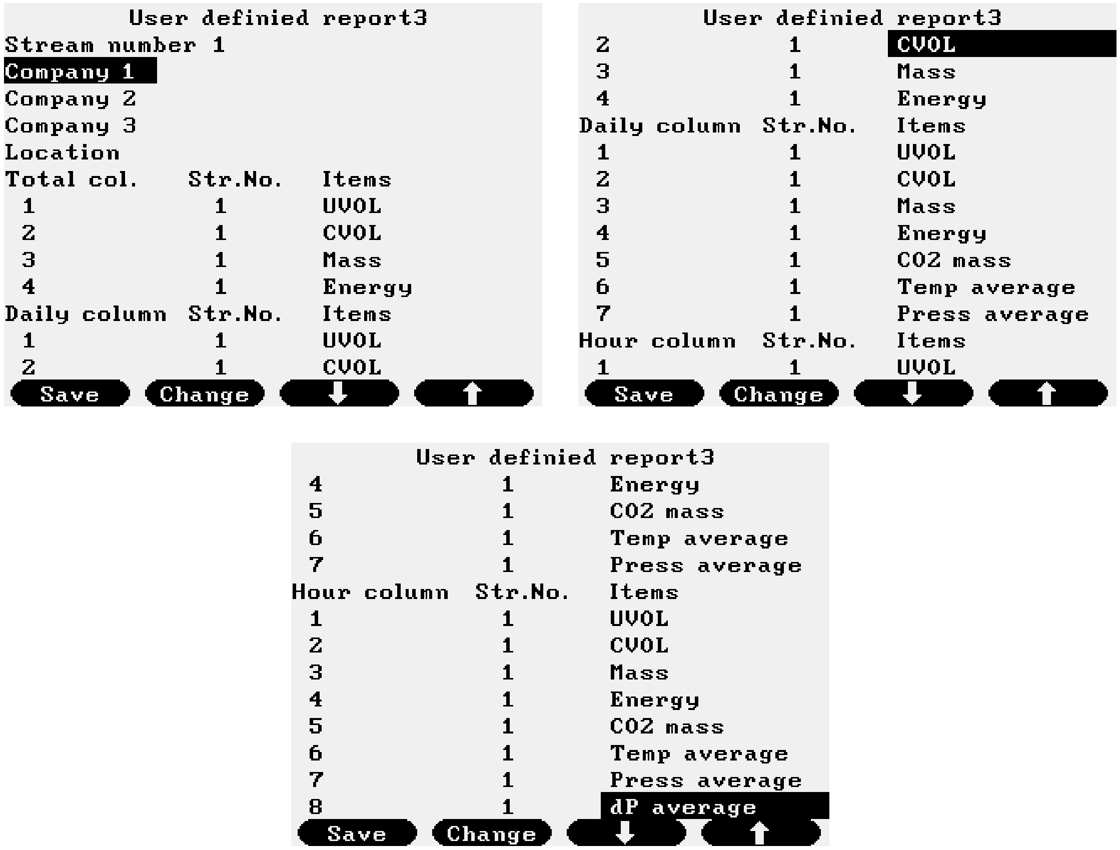


Figure 9-120 User report editing data page for User reports 3 to 10

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:

- o `UVOL;` (volume at line conditions)
- o `CVOL;` (volume at base conditions)
- o `Mass;` (mass)
- o `Energy;` (energy)
- o `CO2 mass;` (CO2 emission mass)
- o `Fault UVOL;` (volume at line conditions at fault condition)
- o `Fault CVOL;` (volume at base conditions 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 volume at line conditions)
- `Premium CVOL;` (premium volume at base conditions)
- `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;` (volume at line conditions)
- `CVOL;` (volume at base conditions)
- `Mass;` (mass)
- `Energy;` (energy)
- `CO2 mass;` (CO2 emission mass)
- `Fault UVOL;` (volume at line conditions at fault condition)
- `Fault CVOL;` (volume at base conditions 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 volume at line conditions)
- `Premium CVOL;` (premium volume at base conditions)
- `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 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;` (volume at line conditions)
- `CVOL;` (volume at base conditions)
- `Mass;` (mass)
- `Energy;` (energy)
- `CO2 mass;` (CO2 emission mass)
- `Fault UVOL;` (volume at line conditions at fault condition)
- `Fault CVOL;` (volume at base conditions 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 volume at line conditions)
- `Premium CVOL;` (premium volume at base conditions)
- `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

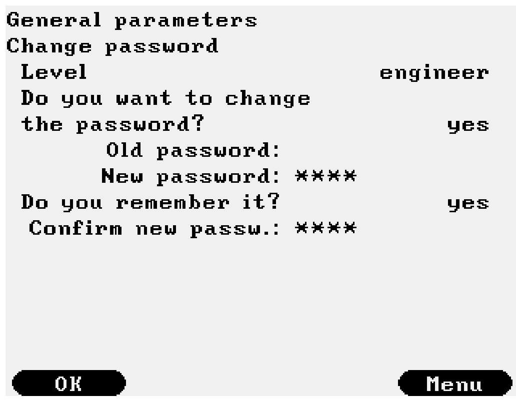


Figure 9-121 Password setup data page

The data fields on the data page are as follows:

- Password level;
  - operator;
  - 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

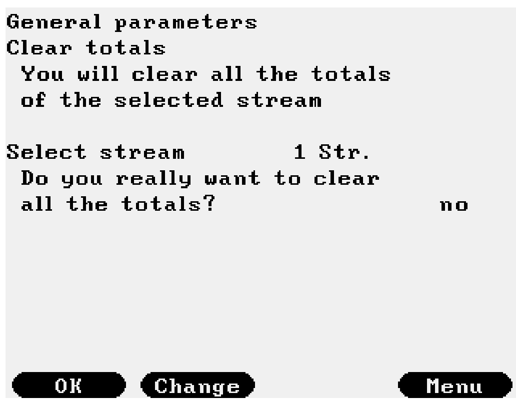


Figure 9-122 Totals reset data page

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

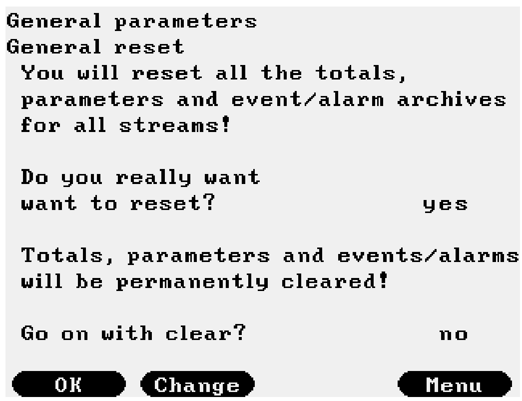


Figure 9-123 General reset data page

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 elements 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

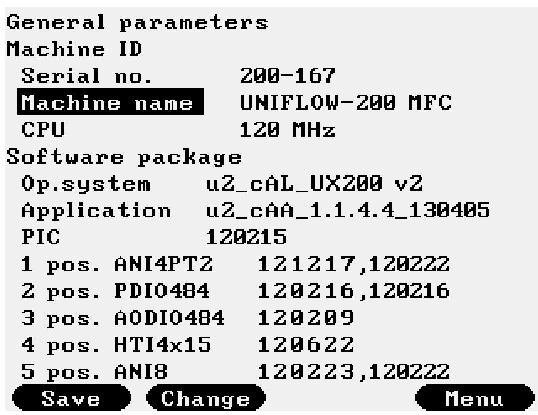


Figure 9-124 Version control data page

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.

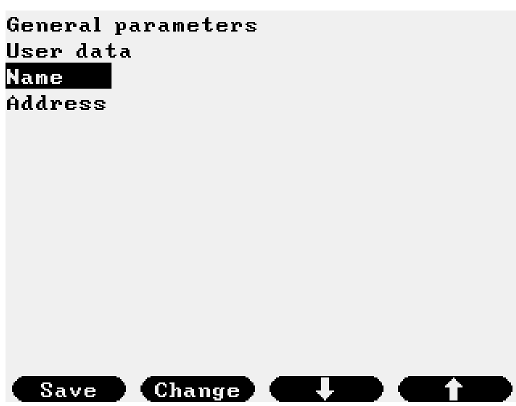


Figure 9-125 User data data page

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.

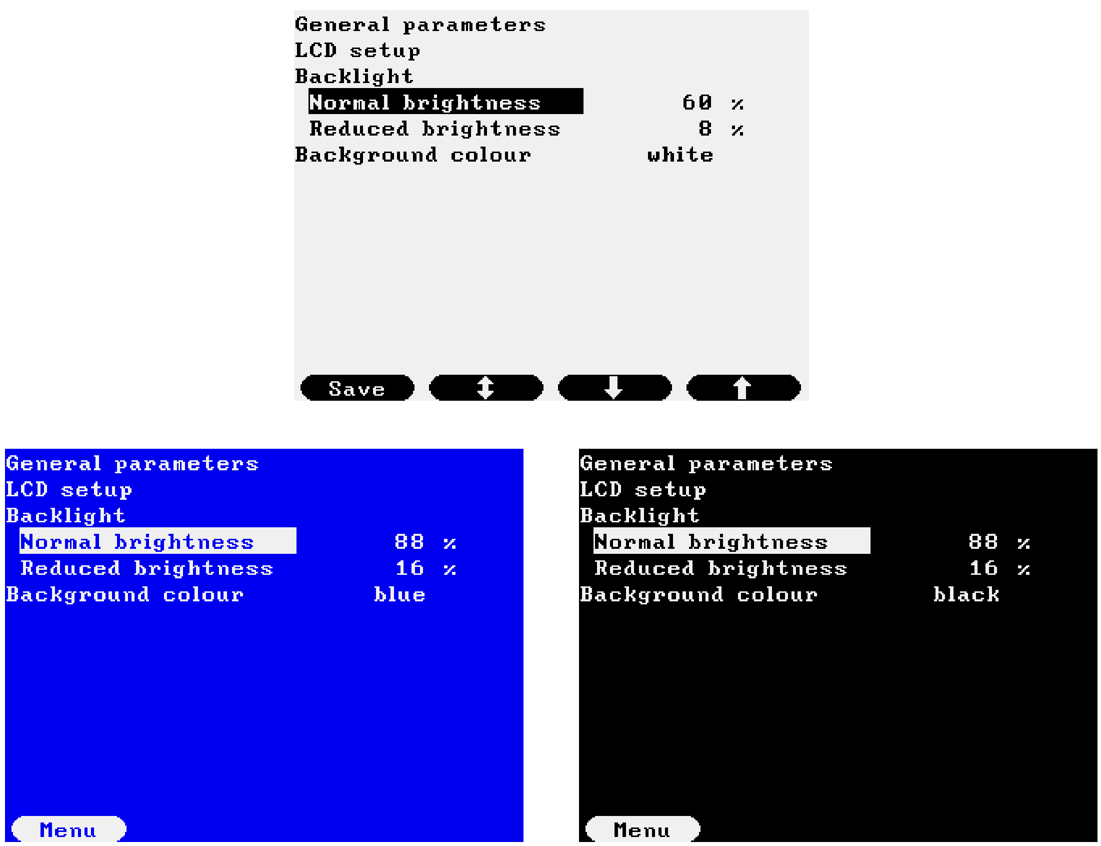


Figure 9-126 LCD settings data page in different colours

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:
  - o blue;
  - o black
  - o white;

9.2.3.10 Character type

The character type of the display can be selected here. Available selections are:

- Normal font;
- Large font;

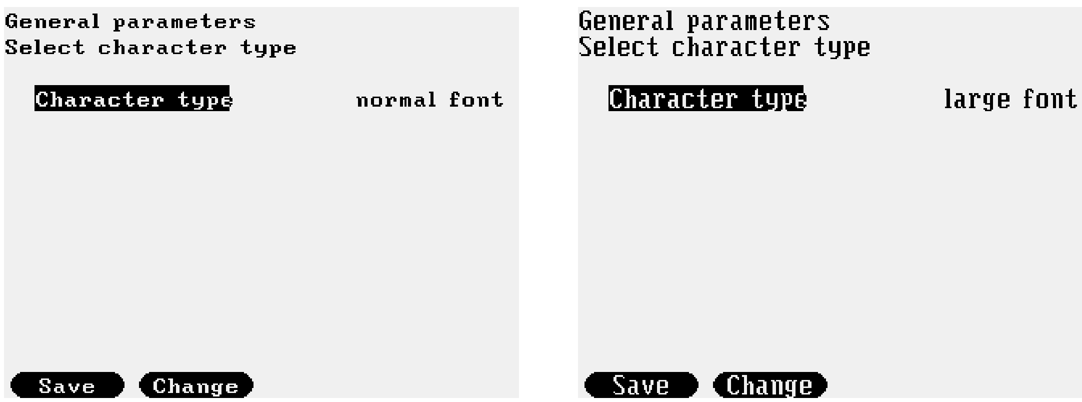


Figure 9-127 Character size selection data page

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.

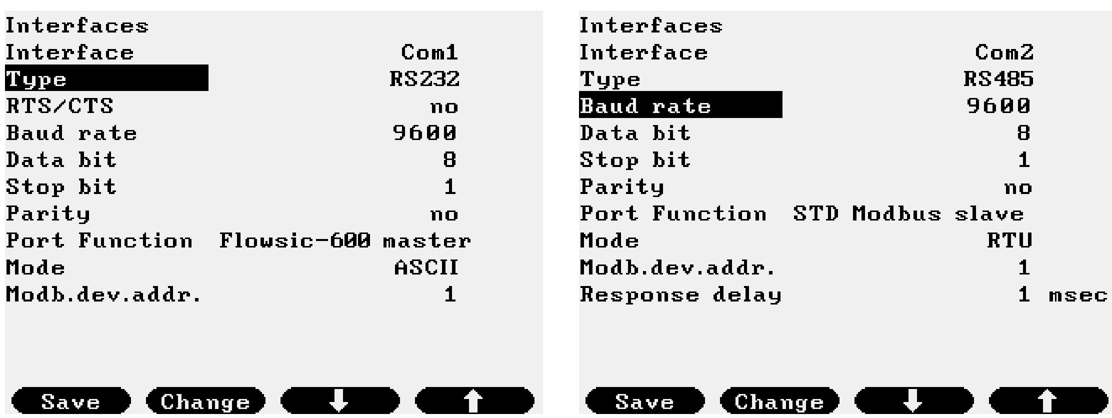


Figure 9-128 Serial ports data page

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;`

    Measured and calculated data can be read from the Uniflow-200 with standard Modbus communication. See details and the Modbus register map in Chapter 10

  - `Daniel Modbus slave;`

    Measured and calculated data can be read from the Uniflow-200 with Daniel/Omni/Enron Modbus communication. See details and the Modbus register map in Chapter 10

  - `Ultrasonic meter;`

    Selecting ultrasonic meter, new entry line appears to select the type of the ultrasonic meter from the list:
    - `Caldon US master`
    - `Daniel US master`
    - `Flexim US master`
    - `Flowsic-600 US master`
    - `Krohne US master`
    - `Panamet US master`
    - `QSonic US Uniform`
    - `QSonicPlus US master`
    - `RMA US master`
    - `RMG US master`
    - `Siemens US master`

    Register address for flow rate data read from US meters is displayed.
    UVOL flow rate register addresses fixed to
    - 2700 for Com1
    - 2708 for Com2
    - 2716 for Com3

    Note! In the Modbus signal setup (see 9.2.1.8.) these register addresses must be assigned to the Modbus signal.
    Modbus mode (RTU or ASCII) and Modbus device address is displayed according to the default settings of the US meter manufacturer.

List of registers read from ultrasonic meter see in 10.7.

- `Chromatograph;`

  Selecting chromatograph, new entry line appears to select the type of the chromatograph from the list:
  - `ABB GC master;`
  - `ABB2 GC master;`
  - `Daniel GC master;`
  - `Yamatake GC master;`
  - `Yokogawa GC master;`

  Modbus mode (RTU or ASCII) and Modbus device address is displayed according to the default settings of the chromatograph manufacturer.
  List of registers read from chromatographs see in 10.7.
  In case of Chromatograph function new data entry lines appear as follows:
  - GC number of streams;
    Selected from the list:
    - `1 to 4;`
  - GC str1 -> Stream
    Selected from the list:
    - `1, 2, 3, 4, 5, 6, 7, 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 calculations of these streams.
    Any number of stream can be assigned to gas chromatograph stream 1.
  - GC str2 -> Stream
    Selected from the list:
    - `1, 2, 3, 4, 5, 6, 7, 8;`

    Same as for GC stream 1
  - GC str3 -> Stream
    Selected from the list:
    - `1, 2, 3, 4, 5, 6, 7, 8;`

    Same as for GC stream 1
  - GC str4 -> Stream
    Selected from the list:
    - `1, 2, 3, 4, 5, 6, 7, 8;`

    Same as for GC stream 1

- `Other;`

  Selecting other, new entry line appears to select the type of the device to communicate with from the list:
  - `Emerson 3095FB MVT;`

    Additional data entry lines for Emerson 3095FB multivariable transmitter
    - DP differential pressure register address (fixed to 2700 for Com1, 2708 for Com2 and 2716 for Com3);
    - SP static pressure register address (shall be selected from the range 4000 to 4058);
    - PT temperature register address (shall be selected from the range 4000 to 4058);

- `Krohne MFC300 master;`
  Additional data entry lines for Krohne MFC300 Coriolis flow meter
  - Mass flow rate register address (fixed to 2700 for Com1, 2708 for Com2 and 2716 for Com3);
  - Line density register address (shall be selected from the range 4000 to 4058);
  - Temperature register address (shall be selected from the range 4000 to 4058);
  - UVOL flow rate register address (shall be selected from the range 4000 to 4058);
  - Counter 1 register address (shall be selected from the range 4000 to 4058);
  - Counter 2 register address (shall be selected from the range 4000 to 4058);

- `Micromotion master;`
  Additional data entry lines for Micromotion Coriolis flow meter
  - Mass flow rate register address (fixed to 2700 for Com1, 2708 for Com2 and 2716 for Com3);
  - Line density register address (shall be selected from the range 4000 to 4058);
  - Temperature register address (shall be selected from the range 4000 to 4058);
  - Pressure register address (shall be selected from the range 4000 to 4058);

- `Meter serial test master;`
  Used in serial test of the flow meters. See. 9.1.8.
  Mode fixed to ASCII.
  Number of slaves shall be selected (from 1 to 4 maximum) and Modbus device address for each Slave shall be entered here.

- `Meter serial test slave;`
  Used in serial test of the flow meters. See. 9.1.8.
  Mode fixed to ASCII.
  Modbus device address for the Slave shall be entered.

- `Prover slave;`
  Used in connection with the Prover computer. See uniflow-200 Prover Computer Instruction Manual.
  Mode fixed to ASCII.
  Modbus device address for the Slave shall be entered.

- `Serial printer` (CP437 setting is suggested)`;`
  Additional data entry lines for the serial printer:
  - Periodic prints (select if periodic printing is required or not)
    - 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 da8y 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;`

- Mode
  Selected from the list:
  - `RTU;`
  - `ASCII;`
- 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.

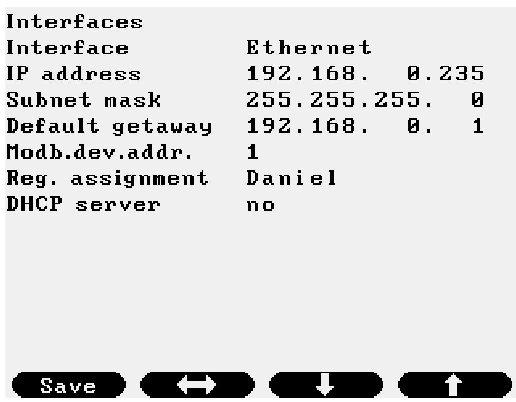


Figure 9-129 Ethernet port data page

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;
    Communication on the Ethernet port shall be done with standard Modbus.
    See details in Chapter 10.5.
  - Daniel Modbus;
    Communication on the Ethernet port shall be done with Daniel/Omni/Enron Modbus.
    See details 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: 192.168.0.100
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.

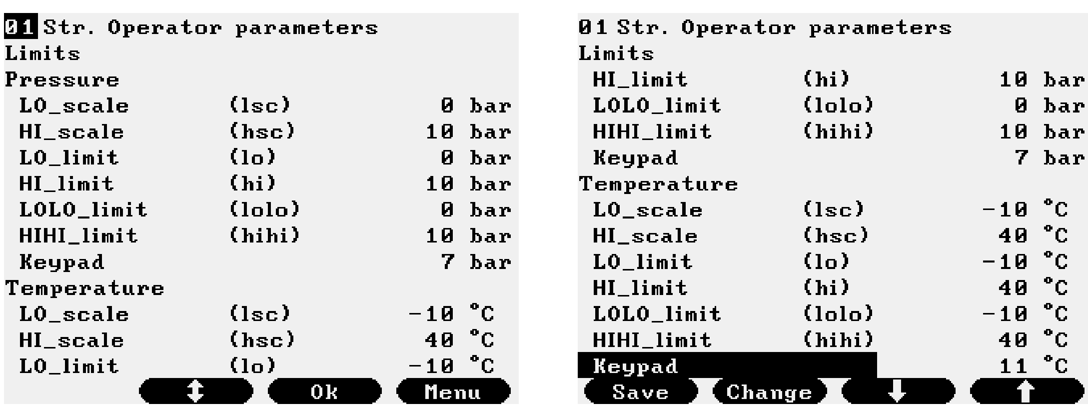


Figure 9-130 Operator data - limits data page

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;
- HIHI_limit;
- Keypad;

9.2.5.2 Keypad values

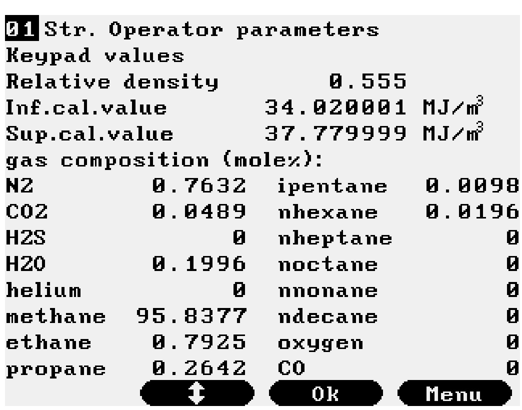
Data in this menu are allowed to be modified with Operator level password.
Generally the gas composition keypad values belong to this group of parameters.

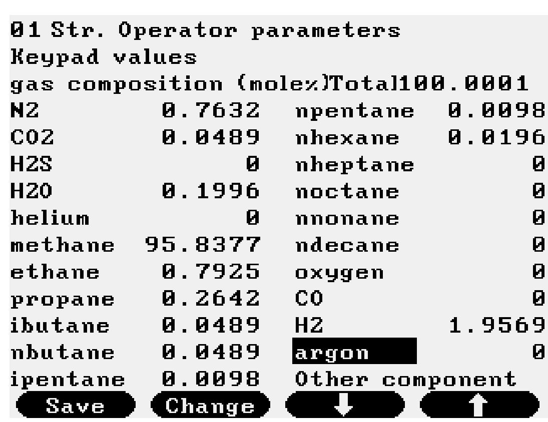
Route in the menu tree:

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.





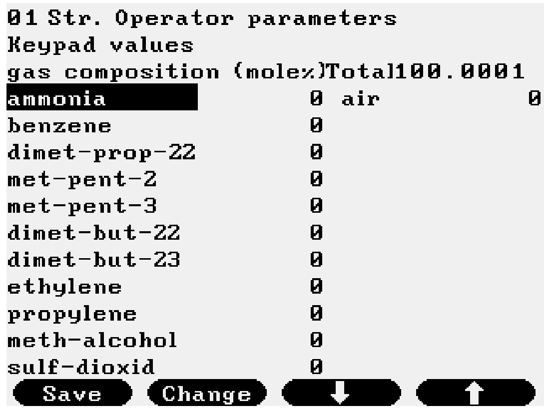


Figure 9-131 Keypad values data page

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.
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

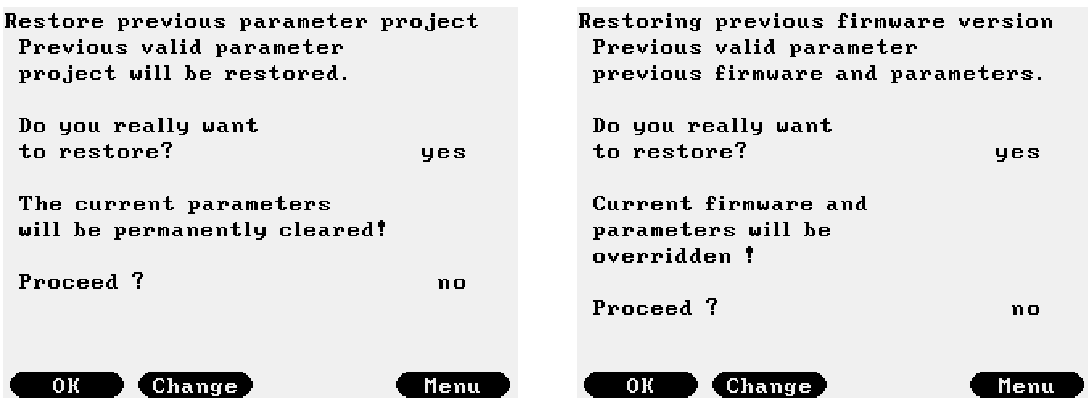


Figure 9-132 Restore data page

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.
Be patient. It might take several minutes for Uniflow-200 to finish the restore process.
Never power cycle Uniflow-200 during the restore process. It might make Uniflow-200 unusable and it shall be returned to the manufacturer for repair.

9.2.7 PID Control

9.2.7.1 Operation of the PID control

Uniflow-200 is capable to act as a traditional PID (Proportional Integral Derivative) controller. Maximum of 8 control loops can be configured in each Uniflow-200.

Each control loop can be defined as:
- single loop controller
- dual loop controller for unidirectional flow
- dual loop controller for bidirectional flow

The dual loop controller can be configured to control pressure and flow as follows:
- Pout/max – qmax/q controller
- Pin/min – qmax/q controller

See later the detailed explanation.

9.2.7.1.1 Single loop controller

Block diagram of the single variable control loop is shown on the picture below.

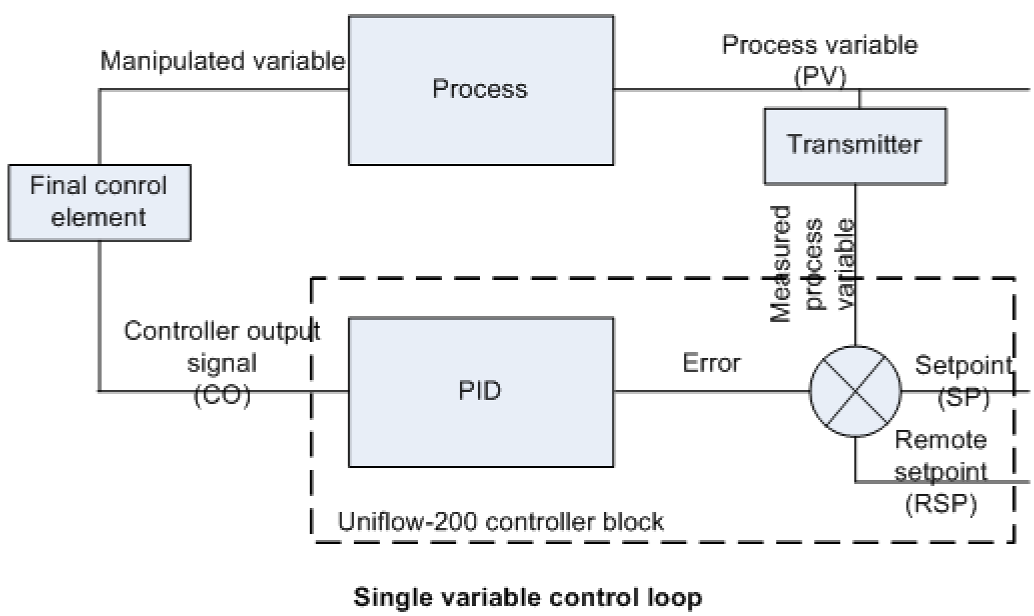


Figure 9-133 Single variable control loop

The purpose of the operation of the PID loop is to keep the process variable (PV) as close as possible to the desired set point (SP) by adjusting the manipulated variable.
The process variable is measured directly by sensor or transmitter or calculated from the measured signal. The control block continuously calculates the difference between the current value of the process variable and the setpoint, i. e. the error. If the error is not zero, then the control block modifies the controller output signal. The modified signal gets to the final control element (which is most of the time a control valve) and modify its position.

The final control element modifies generally some fluid or energy flow rate (this is the manipulated variable), which affects the value of the process variable in such a way that it gets closer to the setpoint.

In the controller block of the Uniflow-200 the process variable can be selected as:
- analog input (e. g. pressure);
- any calculated flow rate (volume at line conditions, volume at base conditions, mass or energy) of any metering stream.

The controller output signal is one of the analog output signal of the Uniflow-200.

9.2.7.1.2 Dual loop controller

The dual loop controller block consists of two control loops inside one control block.
One of them is a pressure control loop (PIC) the other is a flow control loop (FIC). Both control loops are permanently in operation and based on their own process variable, setpoint and tuning parameters both of them calculate their own controller output signal. The two signals go through a signal selection block which passes over the lowest signal to the output of the dual loop control block, i. e. to the analog output channel of Uniflow-200 and finally to the final control element.
The dual control loop block is designed to perform typical for natural gas industry control functions as follows:

- flow control with outlet pressure upper limit control, or, outlet pressure control with flow rate upper limit control (Pout/max – q max/q);
- flow control with inlet pressure lower limit control, or, inlet pressure control with flow rate upper limit control (Pin/min – q max/q);

The control function is selected during the set up of the control block.

9.2.7.1.2.1 Dual loop controller with outlet pressure control

Block diagram of the dual loop controller performing flow control with outlet pressure upper limit control, or, outlet pressure control with flow rate upper limit control is shown on the picture below.

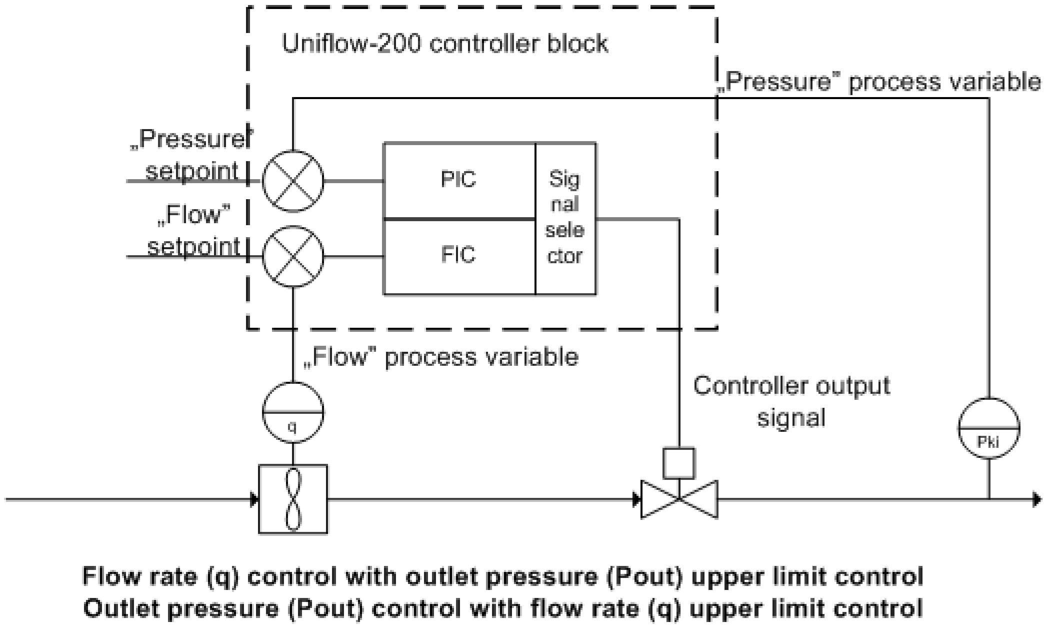


Figure 9-134 Dual loop controller with outlet pressure control

Operation of the control block is explained through a numerical example below.
The control action of the PIC loop is "reverse" in this configuration. Reverse control action means that in case of positive error (error = PV – SP, i. e. PV > SP, the outlet pressure is higher then the desired outlet pressure) the controller output signal is decreasing (the control valve closes) and in case of negative error (PV < SP, the outlet pressure is lower then the desired outlet pressure) increasing (the control valve opens).
The control action of the FIC loop is also "reverse" in this configuration. It means that in case of positive error (error = PV – SP, i. e. PV > SP, the flow rate is higher then the desired flow rate) the controller output signal is decreasing (the control valve is closing) and in case of negative error (PV < SP, the flow rate is lower then the desired flow rate) increasing (the control valve is opening).

Lets have the FIC loop setpoint 20 000 m3/h and the PIC loop setpoint 60 bar.
Let suppose that the controlled system is in equilibrium which means that the consumers on the pipeline connected to the outlet side of the control valve take off gas quantity from the pipeline equal to the quantity passed through the control valve and fed into the pipeline.

Lets have
- pressure at the inlet side of the control valve: 62 bar
- pressure at the outlet side of the control valve: 58 bar
- output signal of the FIC loop 50 % (this is the lowest from the two output signals so that it gets to the outlet of the control block);
- outlet signal of the PIC loop 100 % (the error = PV (58 bar) – SP (60 bar) is negative, so that because of the reverse control action the output signal reaches 100 % after certain period of time);
- volume flow rate through the control valve at 50 % opening stage 20 000 m3/h.

Let suppose that consumers at the outlet side reduced the quantity of the gas taken off from the pipeline. As a consequences the pressure increases at the outlet side of the control valve.

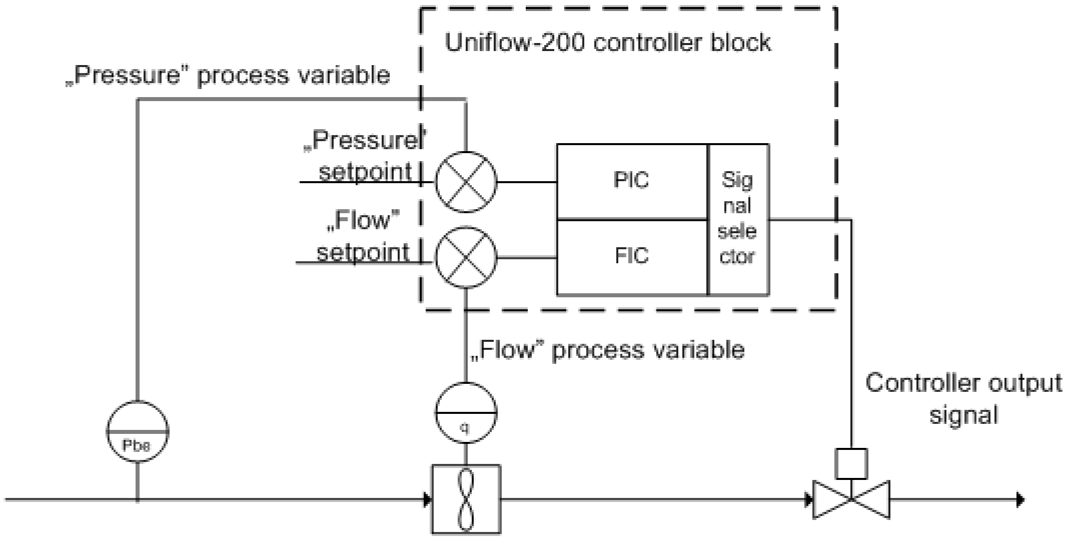
With higher outlet pressure the differential pressure across the valve decreases so that the flow rate through the valve decreases. The FIC control loop will have negative error (= PV – SP), and having reverse control action it will increase the FIC loop output signal. The FIC control loop is trying to increase the flow rate to achieve setpoint.
As the intake flow higher than the off-take flow after certain period of time the pressure reaches the outlet pressure setpoint at the outlet side of the control valve. At that moment the error in the PIC loop become positive so that, because of the reverse control action the PIC loop decreases its output signal. When the decreasing PIC output signal become lower than the increasing FIC loop output signal the PIC loop takes over the control, the output signal of the control block decreases so that the control valves is closing and the flow rate through the valve is decreasing.
PIC loop keeps the outlet pressure at the desired setpoint while the flow rate will be lower than the flow rate setpoint.
As far as the error in the FIC loop will be negative all the time, the FIC loop output signal reaches 100 % after certain period of time.

If later the quantity of the gas taken off by the consumers increases then the pressure decreases, the error of the PIC loop become negative and the PIC loop increases its output signal (reverse action) and opens the control valve. The flow rate increases then.
When the flow rate reaches the FIC loop setpoint the FIC loop error become positive and the FIC loop decreases its output signal (reverse action).
When the decreasing FIC output signal become lower than the increasing PIC loop output signal the FIC loop takes over the control, the output signal of the control block decreases so that the control valves closes and the flow rate through the valve is decreasing.
FIC loop keeps the flow reat at the desired setpoint while the outlet pressure will be lower than the outlet pressure setpoint.
As far as the error in the PIC loop will be negative all the time, the PIC loop output signal reaches 100 % after certain period of time.

The dual loop controller
- controls the flow rate when the flow rate reaches the FIC loop setpoint (the outlet pressure will be below the PIC loop setpoint in this case) and
- controls the outlet pressure when the outlet pressure reaches the PIC loop setpoint (the flow rate will be below the FIC loop setpoint in this case).

9.2.7.1.2.2 Dual loop controller with inlet pressure control

Block diagram of the dual loop controller performing flow control with inlet pressure lower limit control, or, inlet pressure control with flow rate upper limit control is shown on the picture below.



Flow rate (q) control with inlet pressure (Pin) lower limit control
Inlet pressure (Pin) control with flow rate (q) upper limit control

Figure 9-135 Dual loop controller with inlet pressure control

Operation of the control block is explained through a numerical example below.
The control action of the PIC loop is "forward" in this configuration. Forward control action means that in case of positive error (error = PV – SP, i. e. PV > SP, the inlet pressure is higher then the desired inlet pressure) the controller output signal is increasing (the control valve opens) and in case of negative error (PV < SP, the inlet pressure is lower then the desired inlet pressure) decreasing (the control valve closes).
The control action of the FIC loop is "reverse" in this configuration. It means that in case of positive error (error = PV – SP, i. e. PV > SP, the flow rate is higher then the desired flow rate) the controller output signal is decreasing (the control valve closes) and in case of negative error (PV < SP, the flow rate is lower then the desired flow rate) increasing (the control valve opens).

Lets have the FIC loop setpoint 20 000 m3/h and the PIC loop setpoint 60 bar.
Let suppose that the controlled system is in equilibrium which means that the suppliers on the pipeline connected to the inlet side of the control valve put gas quantity into the pipeline equal to the quantity passed through the control valve and taken off from the pipeline.

Lets have
- pressure at the inlet side of the control valve: 62 bar
- pressure at the outlet side of the control valve: 58 bar
- output signal of the FIC loop 50 % (this is the lowest from the two output signals so that it gets to the outlet of the control block);
- outlet signal of the PIC loop 100 % (the error = PV (62 bar) – SP (60 bar) is positive, so that because of the forward control action the output signal reaches 100 % after certain period of time);
- volume flow rate through the control valve at 50 % opening stage 20 000 m3/h.

Let suppose that suppliers at the inlet side reduced the quantity of the gas put into the pipeline. As a consequences the pressure decreases at the inlet side of the control valve.
With lower inlet pressure the differential pressure across the valve decreases so that the flow rate through the valve decreases. The FIC control loop will have negative error (= PV – SP), and having reverse control action it will increase the FIC loop output signal. The FIC control loop is trying to increase the flow rate to achieve setpoint.
As the intake flow rate lower than the flow rate through the control valve after certain period of time the pressure reaches the inlet pressure setpoint at the inlet side of the control valve. At that moment the error in the PIC loop become negative so that, because of the forward control action the PIC loop decreases its output signal. When the decreasing PIC output signal become lower than the increasing FIC loop output signal the PIC loop takes over the control, the output signal of the control block decreases so that the control valves is closing and the flow rate through the valve is decreasing.
PIC loop keeps the inlet pressure at the desired setpoint while the flow rate will be lower than the flow rate setpoint.
As far as the error in the FIC loop will be negative all the time, the FIC loop output signal reaches 100 % after certain period of time.

If later the quantity of the gas put by the suppliers into the pipeline increases then the pressure increases, the error of the PIC loop become positive and the PIC loop increases its output signal (forward action) and opens the control valve. The flow rate increases then.
When the flow rate reaches the FIC loop setpoint the FIC loop error become positive and the FIC loop decreases its output signal (reverse action).
When the decreasing FIC output signal become lower than the increasing PIC loop output signal the FIC loop takes over the control, the output signal of the control block decreases so that the control valves closes and the flow rate through the valve is decreasing.
FIC loop keeps the flow rate at the desired setpoint while the inlet pressure will be higher than the inlet pressure setpoint.
As far as the error in the PIC loop will be positive all the time, the PIC loop output signal reaches 100 % after certain period of time.

The dual loop controller

- controls the flow rate when the flow rate reaches the FIC loop setpoint (the inlet pressure will be above the PIC loop setpoint in this case) and
- controls the inlet pressure when the inlet pressure reaches the PIC loop setpoint (the flow rate will be below the FIC loop setpoint in this case).

9.2.7.1.2.3 Dual loop controller for bidirectional flow

Block diagram of the dual loop controller for bidirectional flow is shown on the picture below.

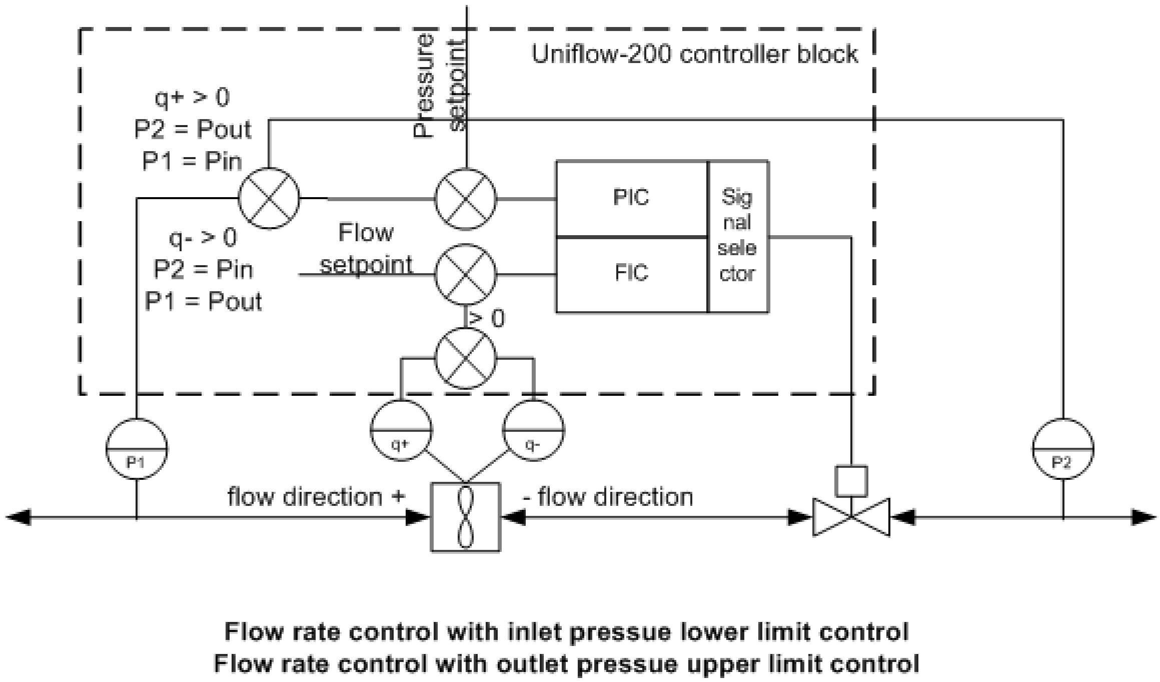


Figure 9-136 Dual loop controller for bidirectional flow

In case of bidirectional flow measurement (e. g. with ultrasonic flow meter) Uniflow-200 measures and totalizes the flow in separate metering streams for the positive (+) and negative (-) flow direction.
In the dual loop controller for bidirectional flow the process variable of the FIC loop is automatically selected, depending on the flow direction.

If the outlet pressure is controlled with flow rate control:
- in case of positive flow direction pressure P2 will be the outlet pressure;
- in case of negative flow direction pressure P1 will be the outlet pressure;

If the inlet pressure is controlled with flow rate control:
- in case of positive flow direction pressure P1 will be the inlet pressure;
- in case of negative flow direction pressure P2 will be the inlet pressure;

Depending on the control function to be performed and the flow direction the pressure process variable selected automatically.

Otherwise the controller block works as described in par. 13.6.1.2.1. and 13.6.1.2.2.

9.2.7.2 Calculation algorithm of the controller

Outlet signal of the control loops in the Uniflow-200 is calculated according to the formulas show below.

$$u_k = u_{Pk} + u_{Ik} + u_{Dk}$$

$$u_{Pk} = K_P e_k$$

$$u_{Ik} = u_{Ik-1} + \frac{TK_P}{T_I} e_k$$

$$u_{Dk} = \frac{T_D}{T_D + NT} u_{Dk-1} + \frac{T_D N}{T_D + NT} K_P (e_k - e_{k-1})$$

$$e_k = PV_k - SP_k$$

where:
u – output signal of the control algorithm;
K_P – proportional gain;
T_I – integration time, s;
T_D – derivative time, s;
e – error;
PV – process variable;
SP – setpoint;
N – filter constant (N=10)
T – calculation cycle time (T = 0.5 s)
lower indices
P – proportional term;
I – integral term;
D – derivative term;
k – *k*-th calculation cycle;
k-1 – *k*-1-th calculation cycle ;

9.2.7.3 Set up the PID control

Parameters of the PID control set up can be accessed via menu tree: Main menu / Parameters / PID.

9.2.7.3.1 General set up

Data entry display for the single loop and dual loop controller is shown on the picture below.

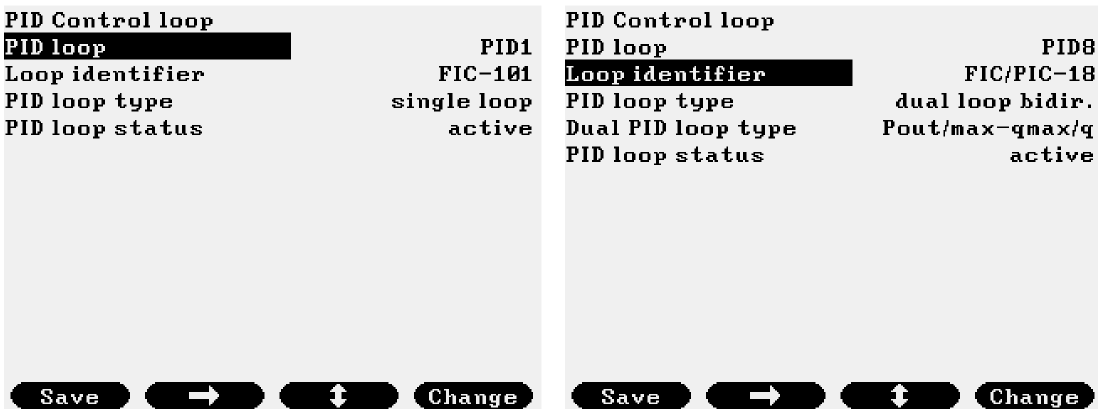


Figure 9-137 PID control loop general setup

Parameters to be set up on this screen are as follows:

PID loop	Identifier of the control loop, selected from list: - PID1; - PID2; …, - PID8;
Loop identifier	Name of the control loop, any text, e. g. FIC-101
PID loop type	Type of the control loop, selected from list: - single loop - dual loop unidirectional - dual loop bidirectional
Dual PID loop type	(only if dual loop controller) Control task, selected from list: - Pout/max – qmax/q; - Pin/min – qmax/q;
PID loop status	Status of the control loop, selected from list: - active; - inactive;

After setting up the general parameters pressing key ⇨ leads to the screen for selecting further group of parameters to be set up:

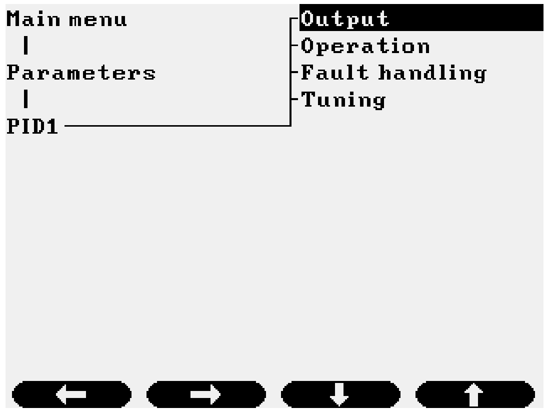


Figure 9-138 PID control loop general setup, parameter group selection

There are separate data entry screens to enter parameters related to:
- output
- operation
- fault handling
- tuning
of the control loop.

9.2.7.3.2 Output

Output signal is defined and set up on the screen below. Screen is identical for single and dual loop controller.

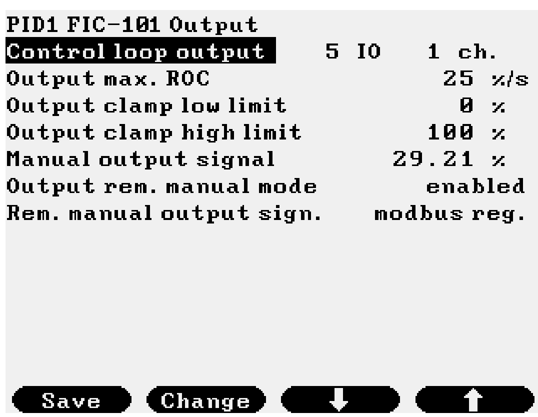


Figure 9-139 PID control loop setup, output

Control loop output X IO. Y ch.	Analog output channel assigned to the control loop output. Only analog output channel of AODIO484 board is a valid selection. The channel should be set up as „PID CO” in the IO board set up menu.
Output max ROC	Maximum rate of change of the output signal in %/s.
Output clamp low limit	Output clamping low limit, output signal never goes below this limit.

Output clamp high limit	Output clamping high limit, output signal never goes above this limit.
Output manual	Output signal value when controller set to manual mode
Output remote manual mode	Enable/disable manipulating output signal in Manual mode via writing Modbus register. Selected from list: - enabled - disabled
Remote manual signal	Source of the remote manual signal. Selected from list: - Modbus reg. (only selection)

The analog output channel of the AODIO484 board assigned to the control loop output should be set up as shown on the picture below. Assignment of the channel shall be set to „PID CO" (PID controller output).

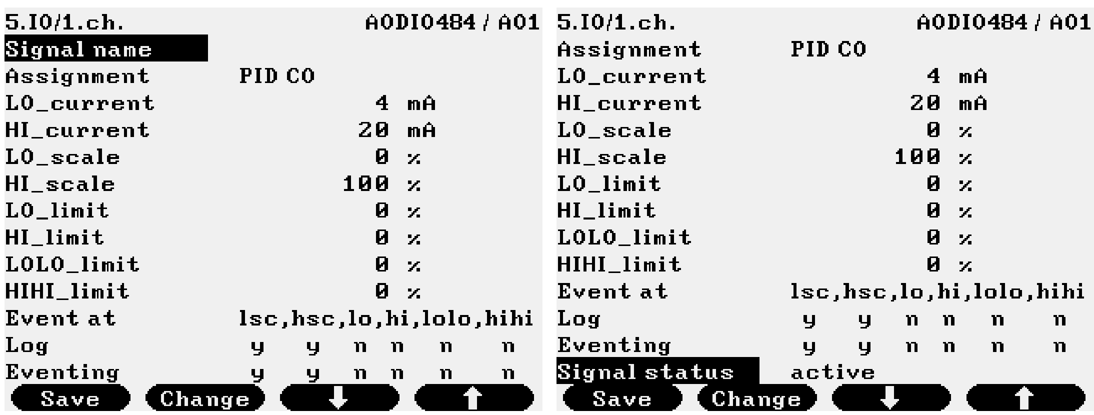


Figure 9-140 PID control loop setup, analogue output

9.2.7.3.3 Operation

Parameters related to the operation of the control loop shown on the picture below (single loop controller).

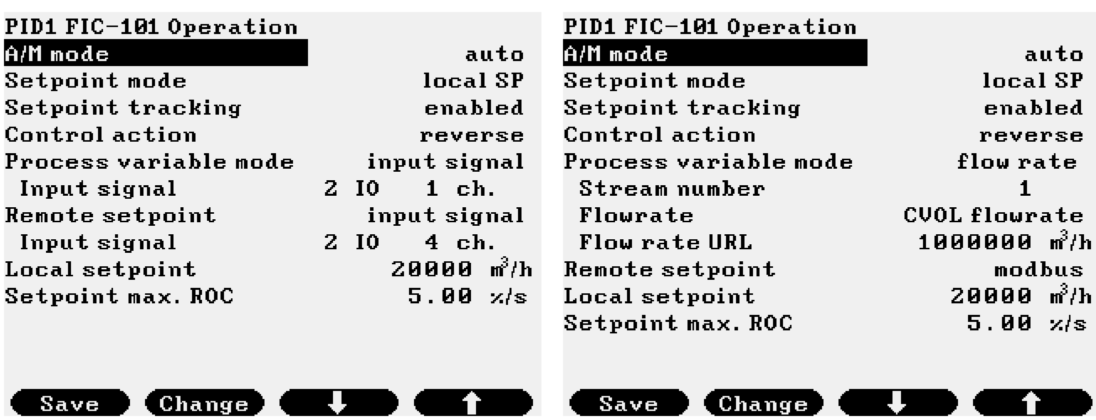


Figure 9-141 PID control loop setup, operation, single loop

A/M mode	Auto/Manual mode of the control loop. Selected from list:

	- auto; - manual;
Setpoint mode	Setpoint selection. Selected from list: - local SP - remote SP
Setpoint tracking	Enable/disable setpoint tracking. Selected from list: - enabled - disabled If setpoint tracking is enabled, then: - in Manual mode the local setpoint follows the process variable; - in Auto mode the manual output value follows the controller output; - in Remote setpoint mode the local setpoint follows the remote setpoint.
Control action	Selected from list: - forward (in case of positive error (= PV – SP) controller output signal increases, in case of negative error, decreases); - reverse (in case of positive error (= PV – SP) controller output signal decreases, in case of negative error, increases);
Process variable mode	Selected from list: - measured (IO board, channel); measured X IO Y ch. - flow rate (of the selected stream); STR X (stream selected from list from 1 to 12) Stream parameter (selected from list) - UVOL flow rate; - CVOL flow rate; - Mass flow rate; - Energy flow rate; Flow rate upper range limit (numeric entry)
Remote setpoint mode	Selected from list: - measured (IO board, channel); measured X IO Y ch. - Modbus register (see Modbus register map in 13.6.4.);
Setpoint	Local setpoint, numeric entry.
Setpoint max. ROC	Maximum rate of change of the setpoint, in %/s. The new local or remote setpoint will reach its final value with this maximum ROC. For example in case of 1 %/s ROC, entering new setpoint value 80 % instead of old value 40 %, the setpoint will change from 40 % to 80 % in 40 seconds.

Parameters related to the operation of the control loop shown on the picture below (dual loop controller).

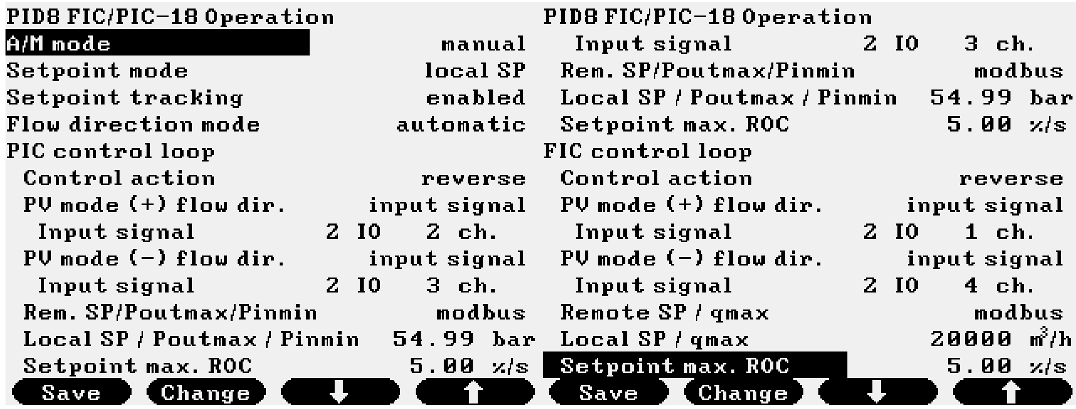


Figure 9-142 PID control loop setup, operation, dual loop

A/M mode	Auto/Manual mode of the control loop. Selected from list: - auto; - manual;
Setpoint mode	Setpoint selection. Selected from list: - local (SP) - remote (RSP)
Setpoint tracking	Enable/disable setpoint tracking. Selected from list: - enabled - disabled If setpoint tracking is enabled, then: - in Manual mode the local setpoint follows the process variable; - in Auto mode the manual output value follows the controller output; - in Remote setpoint mode the local setpoint follows the remote setpoint.
Flow direction mode	Method of determination of the flow direction (only in dual loop bidirectional controller). Selected from list: - automatic (if the volume flow rate >0 in the metering stream for the (+) direction flow then flow direction is considered positive. If the volume flow rate >0 in the metering stream for the (-) direction flow then flow direction is considered negative. If the flow rate = 0 then flow direction is considered as last valid direction); - fixed manual (+) direction; - fixed manual (-) direction; - Modbus register (flow direction is determined by the content of certain Modbus registers. See 13.6.4. for the Modbus map. If register content = 1, positive direction, if register content = 2, negative direction.
PIC loop Control action	Selected from list (not alterable in dual loop controller) - forward (in case of positive error (= PV – SP) controller output signal increases, in case of negative error, decreases) – fixed for inlet pressure control;

	- reverse (in case of positive error (= PV – SP) controller output signal decreases, in case of negative error, increases) – fixed for outlet pressure control;
PIC loop Process variable mode for (+) flow direction	Selected from list (not alterable) - measured (IO board, channel); measured X IO Y ch.
PIC loop Process variable mode for (-) flow direction	Selected from list (not alterable) - measured (IO board, channel); measured X IO Y ch.
PIC loop Remote setpoint/Poutmax /Pinmin mode	Selected from list: - measured (IO board, channel); measured X IO Y ch. - Modbus register (see Modbus register map in 13.6.4.);
PIC loop Setpoint	Local setpoint, numeric entry.
PIC loop Setpoint max. ROC	Maximum rate of change of the setpoint, in %/s. The new local or remote setpoint will reach its final value with this maximum ROC. For example in case of 1 %/s ROC, entering new setpoint value 80 % instead of old value 40 %, the setpoint will change from 40 % to 80 % in 40 seconds.
FIC loop Control action	Selected from list (not alterable in dual loop controller) - reverse (in case of positive error (= PV – SP) controller output signal decreases, in case of negative error, increases) – fixed for flow rate control;
FIC loop Process variable mode for (+) flow direction	Selected from list: - measured (IO board, channel); measured X IO Y ch. - flow rate (of the selected stream); STR X (stream selected from list from 1 to 12) Stream parameter (selected from list) - UVOL flow rate; - CVOL flow rate; - Mass flow rate; - Energy flow rate; Flow rate upper range limit (numeric entry)
FIC loop Process variable mode for (-) flow direction	Selected from list: - measured (IO board, channel); measured X IO Y ch. - flow rate (of the selected stream); STR X (stream selected from list from 1 to 12) Stream parameter (selected from list) - UVOL flow rate; - CVOL flow rate; - Mass flow rate; - Energy flow rate;

	Flow rate upper range limit (numeric entry)
FIC loop Remote setpoint/qmax mode	Selected from list: - measured (IO board, channel); measured X IO Y ch. - Modbus register (see Modbus register map in 13.6.4.);
FIC loop Setpoint/qmax	Local setpoint, numeric entry.
FIC loop Setpoint max. ROC	Maximum rate of change of the setpoint, in %/s. The new local or remote setpoint will reach its final value with this maximum ROC. For example in case of 1 %/s ROC, entering new setpoint value 80 % instead of old value 40 %, the setpoint will change from 40 % to 80 % in 40 seconds.

9.2.7.3.4 Fault handling

Fault handling is set up on the screen below. Screen is identical for single and dual loop controller.

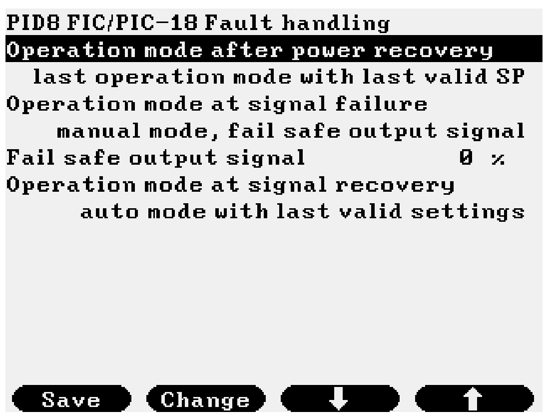


Figure 9-143 PID control loop setup, fault handling

Operation mode after power recovery	Desired operation mode when power recovered after power failure. Selected from list: - manual mode; - last operation mode with local setpoint; - last operation mode with last valid setpoint;
Operation mode at signal failure	Desired operation mode when process variable and/or setpoint signal fails (invalid). Selected from list: - manual mode, last valid output signal; - manual mode, fail safe output signal; Output signal fail safe value in % (numeric entry)
Operation mode at signal recovery	Desired operation mode when failed process variable and/or setpoint signal recovered. Selected from list: - manual mode; - automatic mode with last valid settings;

9.2.7.3.5 Tuning

Data entry screens for tuning parameters are shown on the picture below for single loop and dual loop controllers.

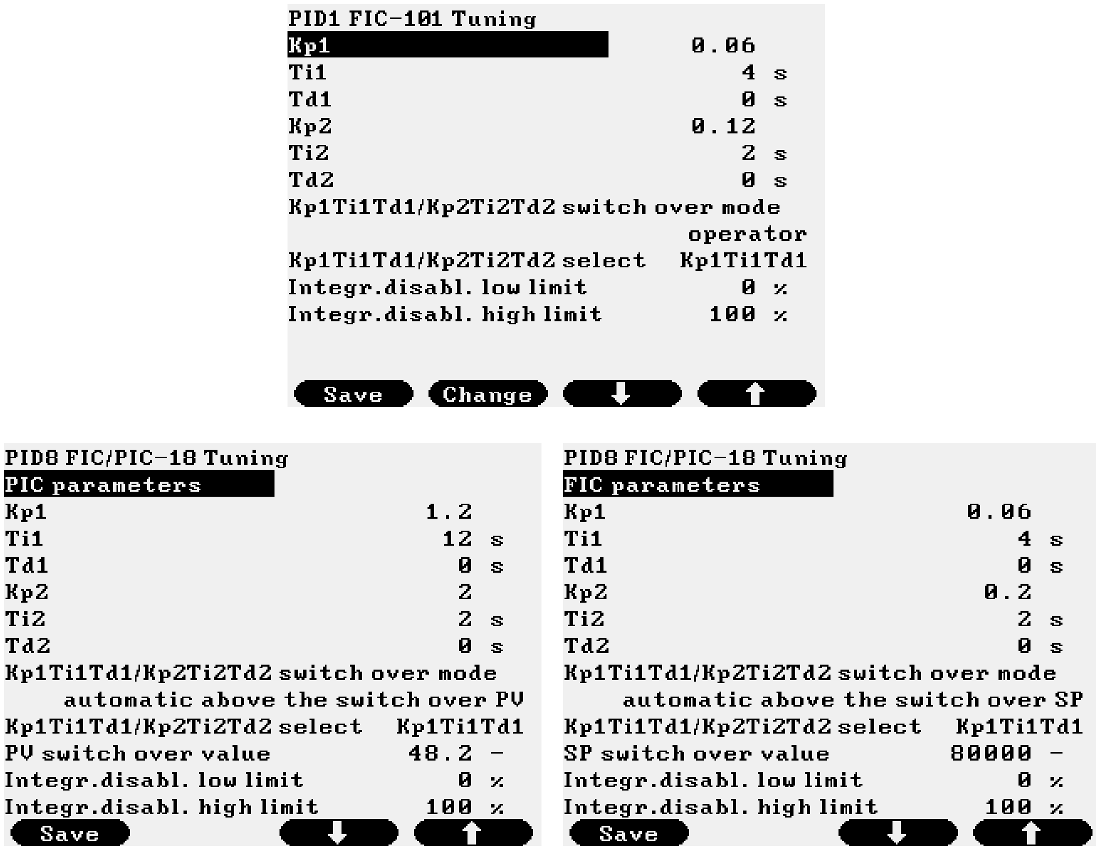


Figure 9-144 PID control loop setup, tuning

For single loop controller tuning parameters are according to table below. For dual loop controller tuning parameters are the same but there are separate set of parameters for FIC loop and PIC loop.

Kp1	Gain in tuning set No.1
Ti1	Integration time in tuning set No.1
Td1	Derivative time in tuning set No.1
Kp2	Gain in tuning set No.2
Ti2	Integration time in tuning set No.2
Td2	Derivative time in tuning set No.2
Kp1Ti1Td1/Kp2Ti2Td2 switch over mode	Switch over mode between tuning set No.1 and No.2. Selected from list: - disabled (no switch over, tuning set No.1 in use); - operator (operator selects the tuning set in use);

	- automatic above the switch over setpoint (tuning set No.2 selected automatically if setpoint is above the given limit); - automatic above the switch over process variable (tuning set No.2 selected automatically if process variable is above the given limit));
Kp1Ti1Td1/Kp2Ti2Td2 selection	Tuning set. Selected from list: - Kp1Ti1Td1; - Kp2Ti2Td2;
SP/PV switch over value	PV or SV limit for automatic switch over between tuning set No.1 and No.2
Integration term disabling low limit	Integration term is disabled below this limit of the controller output signal, %
Integration term disabling high limit	Integration term is disabled above this limit of the controller output signal, %

9.2.7.4 Operation of the PID control

The screen for operation of the PID control is accessible via path Main menu / Flow / PID as shown on the picture below.

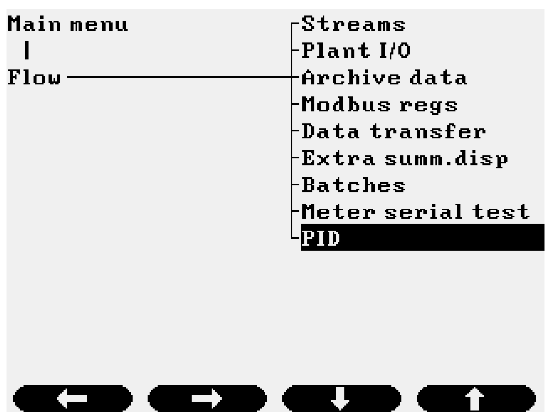


Figure 9-145 Accessing PID control operation screen

After entering into menu select the required PID control loop from PID1 to PID8 by pressing Change button. If inactive PID loop is selected then message shown on the picture below will be displayed.

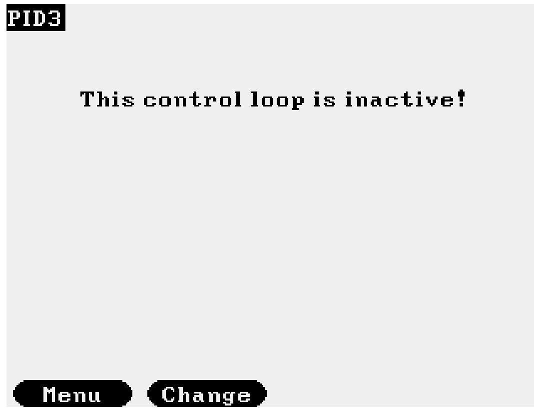


Figure 9-146 PID control operation, control loop inactive screen

Selecting active PID loop and pressing OK the operational screen of the PID loop is displayed.

9.2.7.4.1 Operation of single loop controller

Operational screen of the single loop controller shown on the picture below.

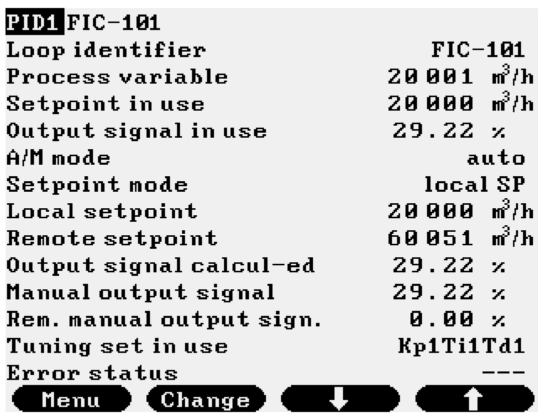


Figure 9-147 PID control operation, single loop controller

Items displayed on the screen are as follows:

Process variable	Current value of the process variable measured on the input channel or calculated in the metering stream.
Setpoint in use	Value of the setpoint used in control (local or remote, depending on the setpoint mode).
Output signal in use	Output signal of the control loop going to the analog output.
A/M mode	Auto/Manual mode of the controller, selected from the list: - auto; - manual
Setpoint mode	Setpoint mode selection. Selected from list: - local (SP)

	- remote (RSP)
Local setpoint	Entry field for local setpoint. If setpoint mode is set to remote and setpoint tracking is enabled then local setpoint follows the remote setpoint.
Remote setpoint	Indicates the value of the remote setpoint received on input channel or in Modbus register
Output signal calculated	The calculated value of the controller output signal.
Output signal manual	Entry field for the output signal. In manual mode it will be the in use output signal. In auto mode, if setpoint tracking is enabled, it follows the calculated value of the output signal.
Output signal remote manual	Manual value of the output signal written via Modbus register. Valid if output remote manual mode is enabled If the PID loop in manual mode, then output signal can be modified writing the desired output signal value into the dedicated Modbus register. See Modbus register map in 13.6.4. The value written into the Modbus register must differ from the previous value of the register to be transferred to the output.
Tuning set in use	The tuning parameter set currently in use. Selected from list: - Kp1Ti1Td1; - Kp2Ti2Td2.
Error status	Error status of the PID loop. Valid error status: - no error - PV invalid - SP invalid

9.2.7.4.2 Operation of dual loop controller

In case of dual loop controller there are separate operational screen for the FIC loop and PIC loop. After selecting the desired loop (FIC or PIC) and pressing ⇨ button the operational screen of the selected loop will be displayed.

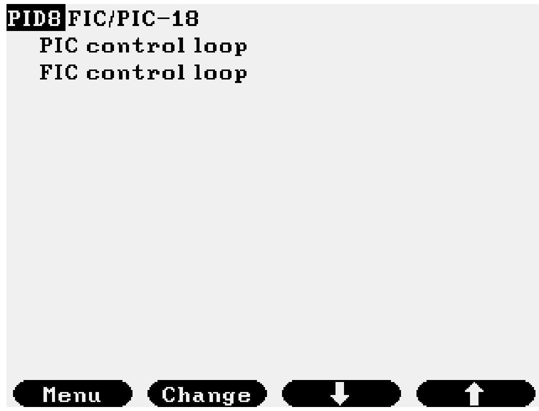


Figure 9-148 PID control operation, dual loop controller

The operational screen of the PIC loop is shown on the picture below.

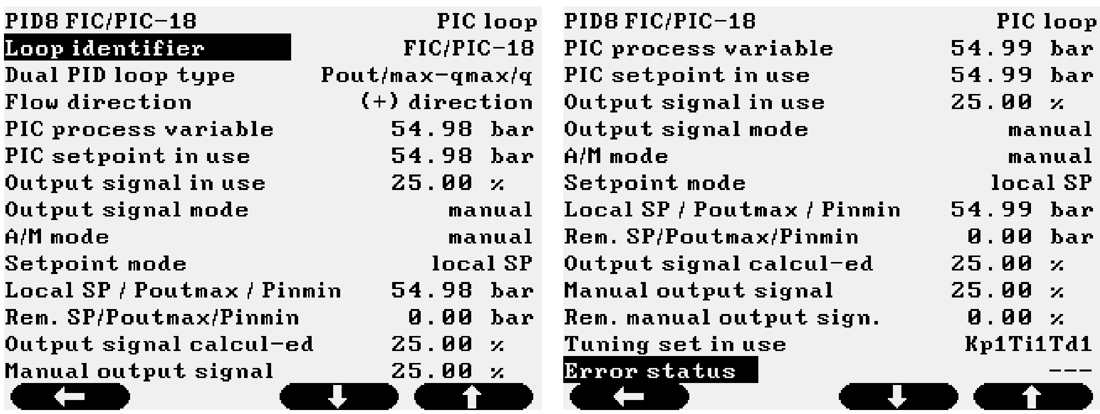


Figure 9-149 PID control operation, dual loop controller, PIC loop

Dual PID loop type	The control task selected during the set up for the dual loop controller (Pout/max – qmax/q or Pin/min – qmax/q) not alterable here.
Flow direction	Current flow direction, positive (+) or negative (-) indicated. Not alterable here.
PIC process variable	Current value of the process variable measured on the input channel
PIC setpoint in use	Value of the setpoint used in control (local or remote, depending on the setpoint mode).
Output signal in use	Output signal of the dual control block going to the analog output.
Output signal mode	Indicates which control loop calculated output signal goes to the output of the control block. Valid values are: PIC (if the calculated output signal of the PIC loop is in use) FIC (if the calculated output signal of the FIC loop is in use) Manual (if control loop in manual mode
A/M mode	Auto/Manual mode of the controller, valid for both PIC and FIC loop, selected from the list:

	- auto; - manual.
Setpoint mode	Setpoint mode selection. Selected from list: - local (SP) - remote (RSP)
Local setpoint/Poutmax/ Pinmin	Entry field for local setpoint. In case of Pout/max – qmax/q control, value of the Poutmax In case of Pin/min – qmax/q control, value of the Pinmin If setpoint mode is set to remote and setpoint tracking is enabled then local setpoint follows the remote setpoint.
Remote setpoint/Poutmax/Pinmin	Indicates the value of the remote setpoint received on input channel or in Modbus register. In case of Pout/max – qmax/q control, value of the Poutmax In case of Pin/min – qmax/q control, value of the Pinmin
Output signal calculated	The calculated value of the PIC loop output signal.
Output signal manual	Entry field for the output signal. In manual mode it will be the in use output signal. In auto mode, if setpoint tracking is enabled, it follows the calculated value of the output signal.
Output signal remote manual	Manual value of the output signal written via Modbus register. Valid if output remote manual mode is enabled. If the PID loop in manual mode, then output signal can be modified writing the desired output signal value into the dedicated Modbus register. See Modbus register map in 13.6.4. The value written into the Modbus register must differ from the previous value of the register to be transferred to the output.
Tuning set in use	The tuning parameter set currently in use in the PIC loop. Selected from list: - Kp1Ti1Td1; - Kp2Ti2Td2.
Error status	Error status of the PIC loop. Valid error status: - no error - PV invalid - SP invalid

The operational screen of the FIC loop is shown on the picture below.

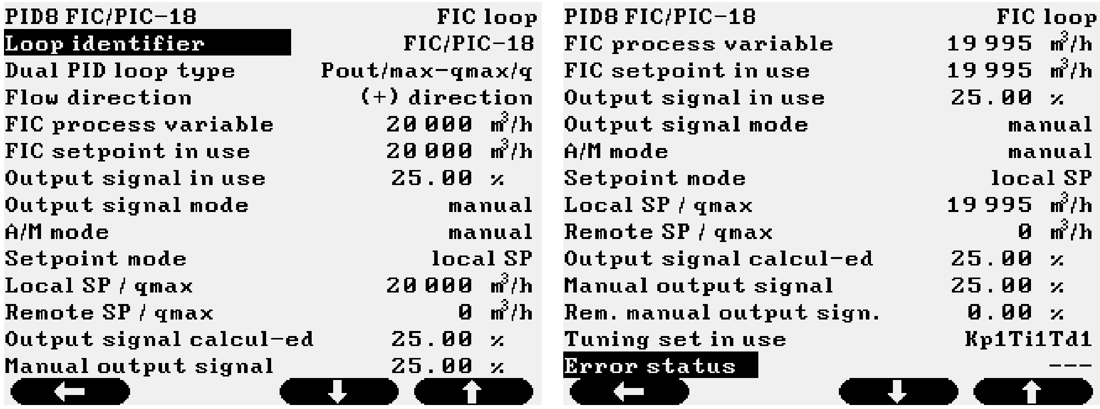


Figure 9-150 PID control operation, dual loop controller, FIC loop

Dual PID loop type	The control task selected during the set up for the dual loop controller (Pout/max – qmax/q or Pin/min – qmax/q) not alterable here.
Flow direction	Current flow direction, positive (+) or negative (-) indicated. Not alterable here.
FIC process variable	Current value of the process variable measured on the input channel or calculated in the metering stream.
FIC setpoint in use	Value of the setpoint used in control (local or remote, depending on the setpoint mode).
Output signal in use	Output signal of the dual control block going to the analog output.
Output signal mode	Indicates which control loop calculated output signal goes to the output of the control block. Valid values are: PIC (if the calculated output signal of the PIC loop is in use) FIC (if the calculated output signal of the FIC loop is in use) Manual (if control loop in manual mode
A/M mode	Auto/Manual mode of the controller, valid for both PIC and FIC loop, selected from the list: - auto; - manual.
Setpoint mode	Setpoint mode selection, valid for both PIC and FIC loop, selected from list: - local (SP) - remote (RSP)
Local setpoint/qmax	Entry field for local setpoint. In case of Pout/max – qmax/q or Pin/min – qmax/q control, value of the qmax. If setpoint mode is set to remote and setpoint tracking is enabled then local setpoint follows the remote setpoint.
Remote setpoint/qmax	Indicates the value of the remote setpoint received on input channel or in Modbus register. In case of Pout/max – qmax/q control Pin/min – qmax/q control, value of the qmax.

Output signal calculated	The calculated value of the FIC loop output signal.
Output signal manual	Entry field for the output signal. In manual mode it will be the output signal in use. In auto mode, if setpoint tracking is enabled, it follows the calculated value of the output signal.
Output signal remote manual	Manual value of the output signal written via Modbus register. Valid if output remote manual mode is enabled. If the PID loop in manual mode, then output signal can be modified writing the desired output signal value into the dedicated Modbus register. See Modbus register map in 13.6.4. The value written into the Modbus register must differ from the previous value of the register to be transferred to the output.
Tuning set in use	The tuning parameter set currently in use in the FIC loop. Selected from list: - Kp1Ti1Td1; - Kp2Ti2Td2.
Error status	Error status of the FIC loop. Valid error status: - no error - PV invalid - SP invalid

9.2.7.5 Modbus register map of the PID control parameters

Uniflow-200 communication description see in Annex A. In this paragraph the Modbus register map related to PID control is described.
Table below gives the register addresses of the parameters which can be read or write via communication interface of Uniflow-200.
Meaning of letter X in the register addresses in the table:
X = 1 – for PID loop PID1
X = 2 – for PID loop PID2
…
X = 8 – for PID loop PID8
There are 2 sets of register addresses in the table, “Standard Modbus” and “Daniel Modbus”.
If the communication with Uniflow-200 accomplished via serial port with port function set to “STD Modbus slave” or via Ethernet port with register assignment set to „STD Modbus” then “Standard Modbus” registers shall be addressed.
If the communication with Uniflow-200 accomplished via serial port with port function set to “Daniel Modbus slave” or via Ethernet port with register assignment set to „Daniel Modbus” then “Daniel Modbus” registers shall be addressed.
Changing the “modes” shall be dona writing the appropriate code into registers marked with rw (read/write).
Statuses shall be read from the registers marked with ro (read only).

No.	Description	Standard Modbus register address	Daniel Modbus register address	rw= read/write ro= read only int=16 bit integer float=32 bit float	Note
1	A/M mode selection: 1 – auto, 2 – manual	15X00	15X00	int rw	For single loop control
2	Setpoint mode selection: 1 – local, 2 - remote	15X01	15X01	int rw	
3	Tuning set selection: 1 – PID1, 2 – PID2	15X02	15X02	int rw	
4	A/M mode selection: 1 – auto, 2 – manual (common for PIC and FIC)	15X03	15X03	int rw	For dual loop control
5	Setpoint mode selection: 1 – local, 2 – remote (common for PIC and FIC)	15X04	15X04	int rw	
6	Tuning set selection for PIC loop: 1 – PID1, 2 - PID2	15X05	15X05	int rw	
7	Tuning set selection for FIC loop: 1 – PID1, 2 - PID2	15X06	15X06	int rw	
8	Flow direction: 1 – (+)positive, 2 - (-)negative	15X07	15X07	int rw	
9	PID loop status: 1 – active, 2 – inactive	15X08	15X08	int ro	General settings
10	PID loop type: 1 – single loop, 2 – dual loop unidirectional, 3 – dual loop bidirectional	15X09	15X09	int ro	
11	Dual PID loop type: 1 - Pout/max – qmax/q, 2 - Pin/min – qmax/q	15X10	15X10	int ro	
12	A/M mode status: 1 – auto, 2 - manual	15X11	15X11	int ro	For single loop control
13	Setpoint mode status: 1 – local, 2 - remote	15X12	15X12	int ro	
14	Tuning set status: 1 – PID1, 2 – PID2	15X13	15X13	int ro	
15	Error status (bitwise coded): bit0 – no error, bit1- PV invalid, bit2 – SP invalid	15X14	15X14	int ro	
16	A/M mode status: 1 – auto, 2 – manual (common for PIC and FIC)	15X15	15X15	int ro	For dual loop control
17	Setpoint mode status: 1 – local, 2 - remote	15X16	15X16	int ro	
18	Tuning set status for PIC loop: 1 – PID1, 2 – PID2	15X17	15X17	int ro	
19	Tuning set status for FIC loop: 1 – PID1, 2 – PID2	15X18	15X18	int ro	
20	Error status for PIC loop (bitwise coded): bit0 – no error, bit1- PV invalid, bit2 – SP invalid	15X19	15X19	int ro	
21	Error status for FIC loop (bitwise coded): bit0 – no error, bit1- PV invalid, bit2 – SP invalid	15X20	15X20	int ro	
22	Flow direction status: 1 – (+)positive, 2 - (-)negative	15X21	15X21	int ro	
23	Remote set point	15X22	15X22	float rw	For single loop control
		15X23			
24	Output remote manual signal	15X24	15X23	float rw	
		15X25			
	PIC loop rempte setpoint/Poutmax/Pinmin	15X26	15X24	float rw	For dual loop control
		15X27			

26	not used	15X28 15X29	15X25	float rw	
27	FIC loop remote setpoint/qmax	15X30 15X31	15X26	float rw	
28	Output remote manual signal	15X32 15X33	15X27	float rw	
	Process variable	15X34 15X35	15X28	float ro	For single loop control
30	Setpoint in use	15X36 15X37	15X29	float ro	
31	Output signal in use	15X38 15X39	15X30	float ro	
32	Local setpoint	15X40 15X41	15X31	float ro	
33	Output signal calculated	15X42 15X43	15X32	float ro	
34	Output signal manual	15X44 15X45	15X33	float ro	
	PIC loop process variable	15X46 15X47	15X34	float ro	For dual loop control
36	PIC loop setpoint in use	15X48 15X49	15X35	float ro	
37	PIC loop output signal calculated	15X50 15X51	15X36	float ro	
38	PIC loop local setpoint	15X52 15X53	15X37	float ro	
39	PIC loop remote setpoint	15X54 15X55	15X38	float ro	
40	FIC loop process variable	15X56 15X57	15X39	float ro	
41	FIC loop setpoint in use	15X58 15X59	15X40	float ro	
42	FIC loop output signal calculated	15X60 15X61	15X41	float ro	
43	FIC loop local setpoint	15X62 15X63	15X42	float ro	
44	FIC loop remote setpoint	15X64 15X65	15X43	float ro	
45	Output signal in use	15X66 15X67	15X44	float ro	
46	Output signal manual	15X68 15X69	15X45	float ro	

Table 9-15 Modbus register map of the PID control parameters

9.3 Alarms and events system

UNIFLOW-200 operates a comprehensive alarming and eventing system, a summary of which is described 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.

The alarm log, event log and download log content is not alterable.

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 > tm * qmax flowrate
Str.. meter critical overload	UVOL flowrate > 1.5 * tm * qmax flowrate

where *tm* 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 * tm * q_max	-----------	critical overload flowrate
tm * qmax	-----------	maximum overload flowrate
qmax	-----------	maximum UVOL flowrate
qmin	------------	minimum UVOL flowrate
q_cut-off	------------	cut-off UVOL flowrate
0	------------	no flow

UVOL FR range	Alarm	Signal processing
0 < UVOL FR < q_cut-off	flowrate cut-off active	No flow totalization

q_cut-off < UVOL FR < qmin	under range	Fault totals
qmin < UVOL FR < qmax	none	Normal flow calculation
qmax < UVOL FR < tm * qmax	over range	Fault totals
tm * qmax < UVOL FR < 1.5 * tm * qmax	overload	Fault totals
1.5 * tm * qmax < UVOL FR	critical overload	1.5 * tm * qmax 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 then 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.

9.3.2.2 Stream fault alarm

This is a common alarm for the stream.

If any of the stream related alarm(s) (see list in the 9.3.4.) is active, the stream fault alarm will be activated and entry into the alarm log will be registered.
Stream fault alarm can be assigned to any digital output so that the status of the digital output will indicate presence of the stream fault alarm.

9.3.3 Common alarm and status output

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.

9.3.3.1 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 * tm * qmax
7	Strn	CVOL FR above prem.limit	Volume at base conditions flow rate above premium limit
8	Strn	CVOL FR above prem.limit	Volume at base conditions 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 < UVOL flowrate < q_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 > tm * qmax (tm = max. load, %)
42 Strn	Over range	UVOL flowrate > qmax
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 range	The temperature out of the extended 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	Volume at line conditions flow rate above premium limit
60 Strn	UVOL FR above prem.limit	Volume at line conditions 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 Events 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;H20;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;H20;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 mesuring 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;H20;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 mesuring 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;H20;C1;C2;C3;O2;CO;H2;Ammonia;Benzene;
Line *n*.	Timestamp Str1 ;gas composition data

In case of mesuring 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;H20;C1;C2;C3;O2;CO;H2;Ammonia;Benzene;
Line *n*.	Timestamp Str1 ;gas composition data

In case of mesuring 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;H20;CO;H2;
Line *n*.	Timestamp Str1 ;gas composition data

In case of mesuring 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;H20;CO;H2;
Line *n*.	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 bard is inserted

Function of the F keys on the Tests – ANI4PT2 board data pages
Menu returns to the parent menu

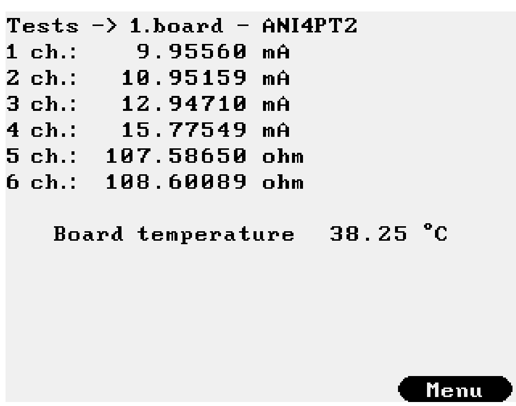


Figure 9-151 Tests – ANI4PT2 board data page

The current in mA and the resistance in Ohms are indicated for each channel.
The temperature of the board inside the instrument case in 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

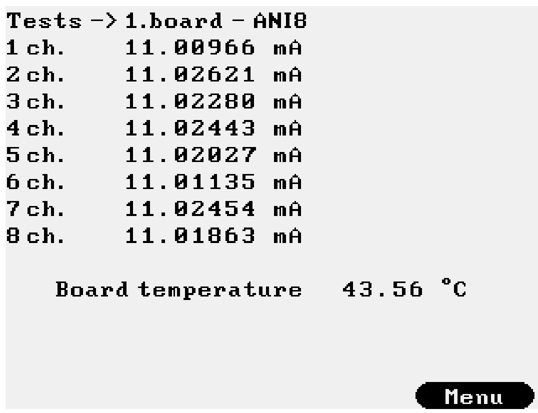


Figure 9-152 Tests – ANI8 board data page

The current in mA is indicated for each channel.
The temperature of the board inside the instrument case in also indicated.

9.4.3 Tests – PT4 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 – PT4 board data pages
Menu returns to the parent menu

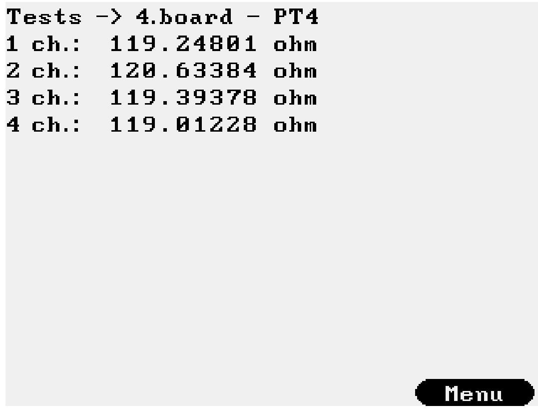


Figure 9-153 Tests – PT4 board data page

The resistance in Ohms is indicated for each channel.
The temperature of the board inside the instrument case in 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

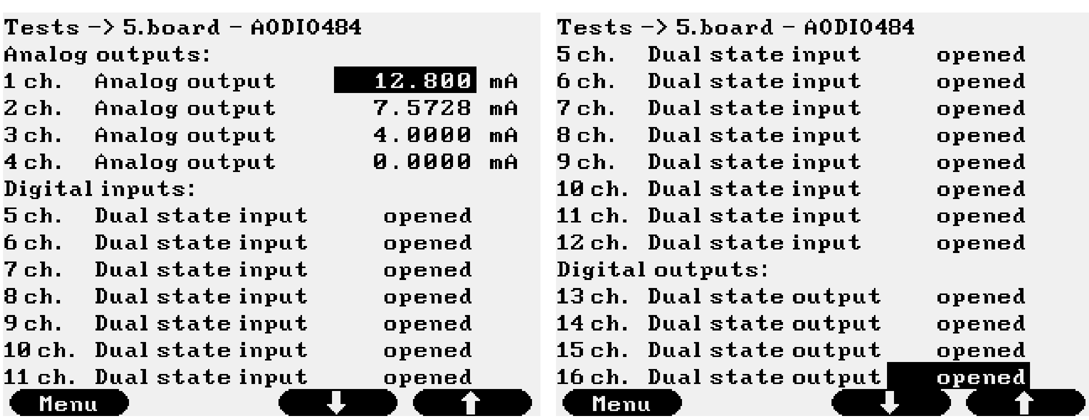


Figure 9-154 Tests – AODIO484 board data page

The current in mA is indicated for the analog output channels.

The state (opened or 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

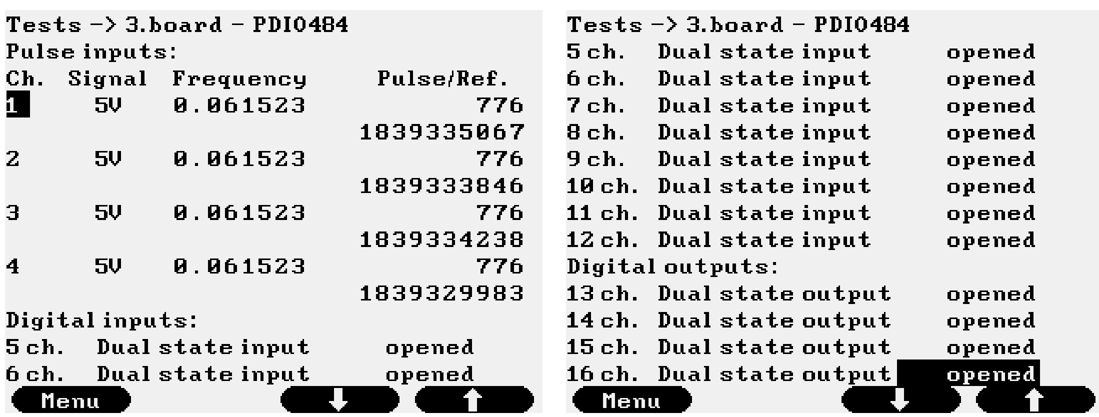


Figure 9-155 Tests – PDIO484 board data page

The frequency and the pulse counter for the main and check pulse inputs are indicated for the pulse input channels.
The state (opened or closed) is indicated for digital input and output channels.

Selecting digital output channel the state of the channel can be set to opened or closed.

Leaving the data page UNIFLOW-200 restores the outputs to the value determined by the application.

9.4.6 Tests – PITC4641 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 – PITC4641 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

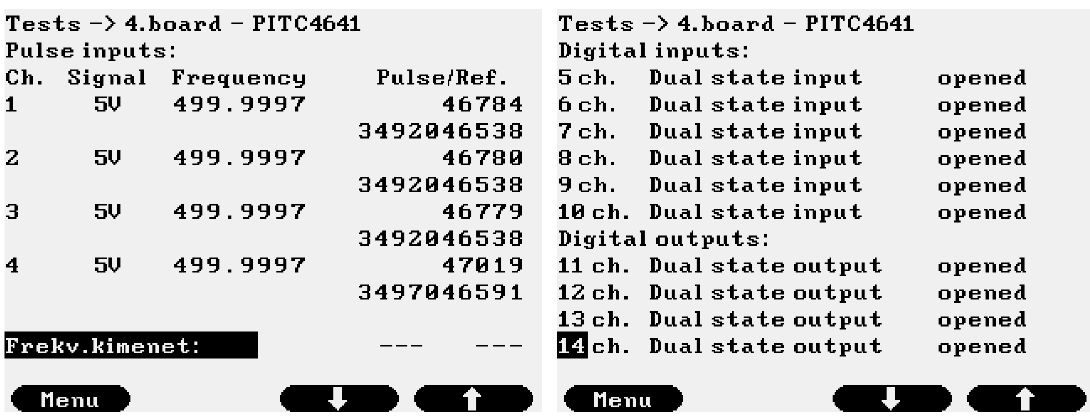


Figure 9-156 Tests – PITC4641 board data page

The frequency and the pulse counter for the main and check pulse inputs are indicated for the pulse input channels.
Frequ. output indicates the frequency passed from one of the pulse input channels to the raw pulse output channel. Active when one of the streams defined in the flow computer is selected for proving in the connecting prover computer. See in Uniflow-200 Prover Computer Instruction Manual.

The state (opened or closed) is indicated for digital input and output channels.

Selecting digital output channel the state of the channel can be set to opened 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.

9.5.1 Rosemount 3095 calibration

If Rosemount 3095 multivariable transmitter with Modbus protocol is connected to Uniflow-200 on one of the serial link and the measured parameters (differential pressure, pressure, temperature) are assigned to one of the metering streams, then the calibration of this transmitter can be initiated here.
After entering the engineering level password the transmitter calibration display appears:

Route in the menu tree:
Calibration

Function of the F keys on the Calibration 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

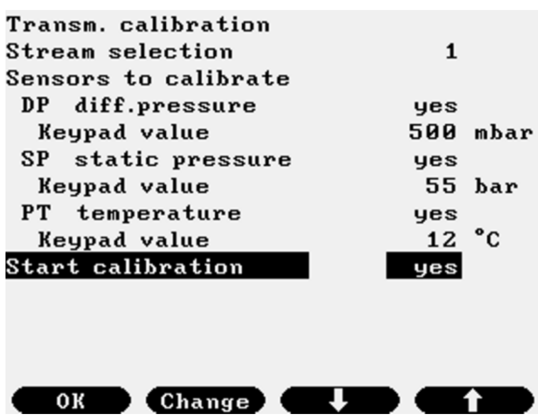


Figure 9-157 Transmitter calibration display

Select the stream in which the signals measured by the transmitter are used.
Select the sensors to be calibrated (DP, SP, PT) and enter the Keypad values. Keypad values will be used in the flow calculation during the calibration. Enter 0 keypad value for DP to stop the flow calculation during the calibration.
Change `Start calibration` field to `yes` and press OK.
Message box appears on the display requiring that the Write protection jumper to be set to OFF position. With jumper in ON position Uniflow-200 will not start the calibration. If the jumper is in OFF position then the sensor calibration page appears on display.

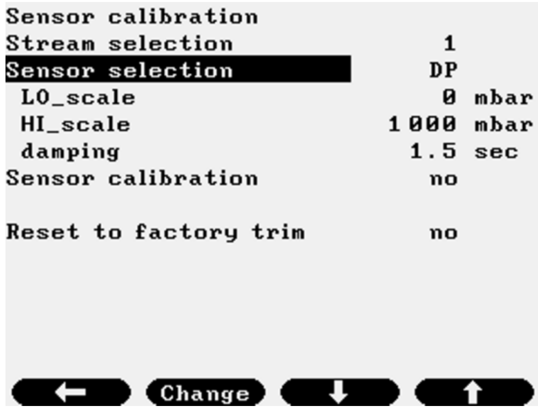


Figure 9-158 Sensor calibration display

Select the sensor (DP, SP, PT) to be calibrated. The LO scale, HI scale value for the selected sensor will be displayed as defined in the Modbus signal definition section. If you modify the LO scale or HI scale value here, the modified values will be written to the Modbus signal parameters. The damping parameter value is read from the transmitter.
There is an option "`Reset to factory trim`" on the display, allowing to restore the sensor offset (zero) and slope (span) value to the factory default value.

To calibrate the selected sensor set the `Sensor calibration` command to `yes` and press OK. Message box appears requiring to apply LO scale value signal to sensor. The measured value of the signal is displayed in the message box.

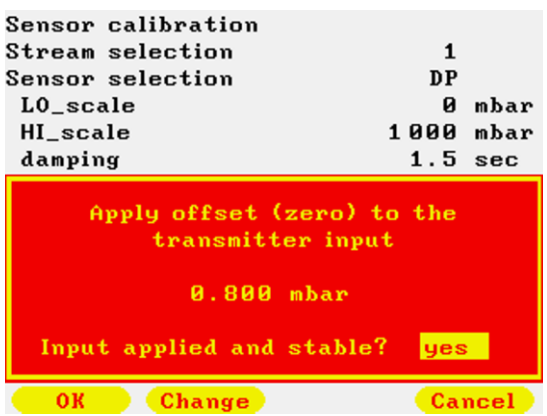


Figure 9-159 DP sensor offset calibration display

When the signal is applied and the reading is stable press OK. New message box appears confirming the successful setting of the transmitter offset.

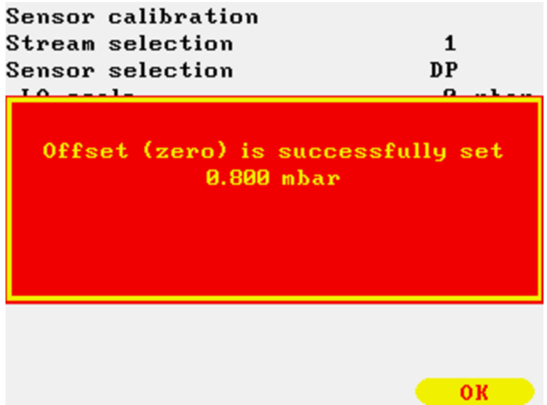


Figure 9-160 DP sensor offset calibration finished display

New message box appears requiring to apply HI scale value signal to sensor. The measured value of the signal is displayed in the message box.

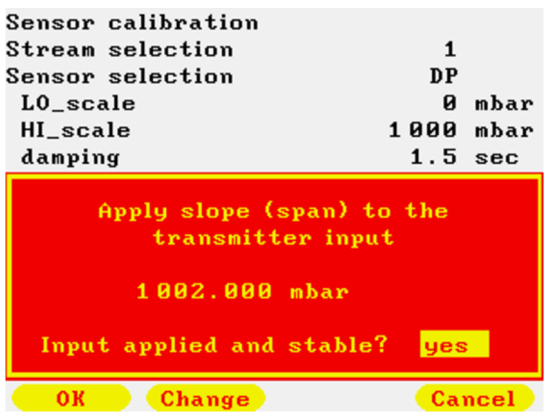


Figure 9-161 DP sensor slope calibration display

When the signal is applied and the reading is stable press OK. New message box appears confirming the successful setting of the transmitter slope (span).

Figure 9-162 DP sensor slope calibration finished display

In the next message box the value of the sensor damping can be entered and written into the transmitter.

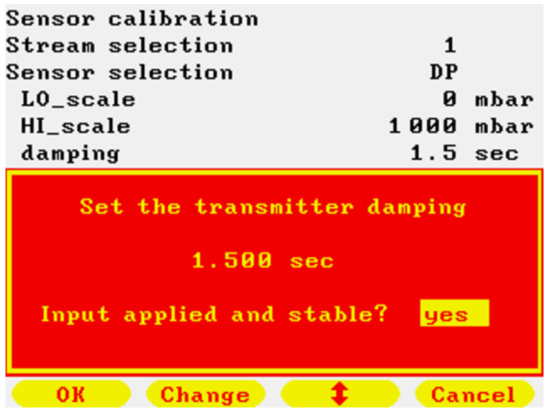


Figure 9-163 DP sensor damping display

Figure 9-164 DP sensor damping finished display

After the offset (zero), the slope (span) and the damping was successfully set message box appears indicating the end of sensor calibration.

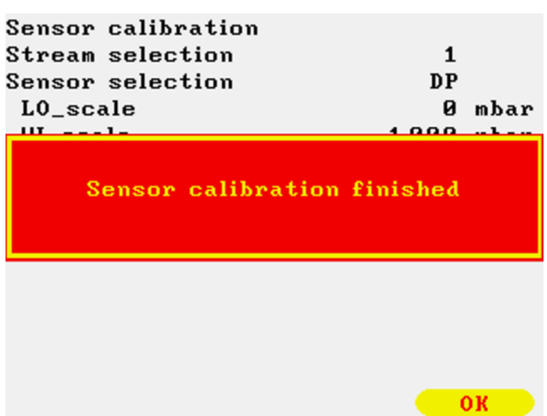


Figure 9-165 DP sensor calibration finished display

Repeat the above steps for the other sensors to be calibrated. After finishing the last sensor calibration message box appears indicating the end of calibration.

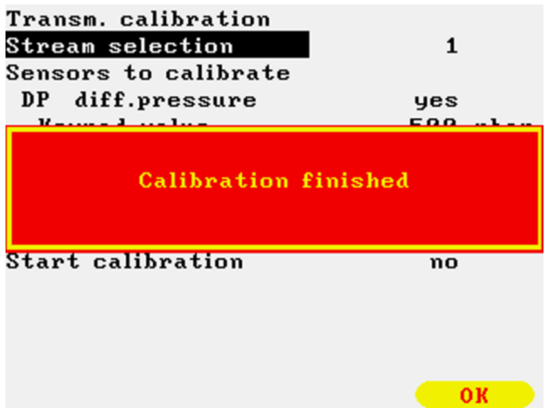


Figure 9-166 Calibration finished display

All the steps of the transmitter calibration are recorded in the Events archive.

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/Limba

Route in the menu tree:

Main	Language/**Nyelv/Язык/Limba**.

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.

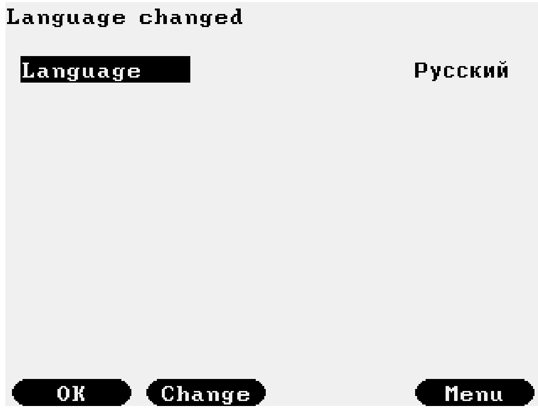


Figure 9-167 Language change display

Available languages are:

- English;
- Hungarian (Magyar);
- Russian (Русский)
- Român (Romanian)

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 languge:

- 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, Cm3) 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:

- Caldon US master (for Caldon ultrasonic meters)
- Daniel US master (for Daniel ultrasonic meters)
- Flexim US master (for Flexim ultrasonic meters)
- Flowsic-600 master (for Sick-Maihak Flowsic-600 ultrasonic meter)
- Khrone US master (for Khrone ultrasonic meters)
- Panam US master (for Panametrics ultrasonic meters)
- QSonic US Uniform (for Instromet ultrasonic meters with Uniform protocol)
- QSonicPlus US master (for Instromet ultrasonic meters with Modbus protocol)
- RMA US master (for RMA ultrasonic meters)
- RMG US master (for RMG ultrasonic meters)
- Siemens US master (for Siemens ultrasonic meters)

In this special functions not only the flow information (flow rate and/or gas velocity) but the diagnostic information is read from the meters as well.

Special functions implemented for polling gas chromatographs:

- ABB GC master (for ABB GC)
- ABB2 GC master (for ABB GC)
- Daniel GC master (for Daniel GC)
- Yamatake GC master (for Yamatake GC)
- Yokogawa GC master (for Yokogawa 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 flash 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 or RS422MD 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 RS422PP 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 (8 physical and 4 virtual 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.

	Registers on the base device address			Registers on the stream device address	
Stream	Totals (4 bytes integer)	Other data (4 bytes float)	Stream device address	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 10-16 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 * 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: +/-($8.43*10^{-37}$ … $3.4*10^{-38}$), 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 filed 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 = $(-1)*S*(1+bit22*2^{-1}+bit21*2^{-2}+\ldots+bit0*2^{-23})*2^{Exponent-127}$

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		(32 bit floating)
2-3	temperature1 (fluid/forward)		(32 bit floating)
4-5	temperature2 (ambient/reverse)		(32 bit floating)
6-7	density at line conditions		(32 bit floating)
8-13	1-6. alarm register (16 bit int.)	alarm code (H byte)	signal code (L byte)
		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. fluid (H byte)	temp. ambient (L byte)
16	9. alarm register	density (H byte)	pressure (L byte)
		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 byte)	flow signal (L byte)
		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	volume at base conditions (CVOL) flowrate		(32 bit floating)
20-21	mass flowrate		
22-23	energy flowrate		
24-25	volume at base conditions (CVOL) 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		(32 bit floating)	42 reg./stream
...	ReadOnly	...			
606	ReadOnly	Str12. (virtual stream) data			

Offset address	Virtual stream data	Explanation
0-1	volume at base conditions (CVOL) flowrate	
2-3	mass flowrate	
4-5	energy flowrate	
6-7	volume at base conditions (CVOL) 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	(32 bit floating)	72 reg./stream

Offset address	Stream flowrates (for quick access)	Explanation
0-1	Str1. volume at base conditions (CVOL) flowrate	
2-3	Str1. mass flowrate	
4-5	Str1. energy flowrate	
...	...	
66-67	Str12. volume at base conditions (CVOL) flowrate	
68-69	Str12. mass flowrate	
70-71	Str12. energy flowrate	

816-817	ReadWrite	Barometric pressure	(32 bit floating)	2 register

818	ReadWrite	Natural gas components	(32 bit floating)	44 register

Offset address	Natural gas components	Explanation Modbus STD1
0-1	Nitrogen [mole%]	If the source of gas composition selected
2-3	Carbon-dioxide [mole%]	as Modbus STD1 then gas composition
4-5	Hydrogen-sulfide [mole%]	downloaded into this register range will be
6-7	Water [mole%]	used in the calculation.
8-9	Helium [mole%]	The range is common for all streams from 1 to 8
10-11	Methane [mole%]	
12-13	Ethane [mole%]	
14-15	Propane [mole%]	
16-17	normal-Butane [mole%]	
18-19	iso-Butane [mole%]	
20-21	normal-Pentane [mole%]	
22-23	iso-Pentane [mole%]	
24-25	normal-Hexane [mole%]	
26-27	normal-Heptane [mole%]	
28-29	normal-Octane [mole%]	
30-31	normal-Nonane [mole%]	
32-33	normal-Decane [mole%]	
34-35	Oxygen [mole%]	
36-37	Carbon-monoxide [mole%]	
38-39	Hydrogen [mole%]	
40-41	Relative density [-]	
42-43	Inferior calorific value [MJ/m^3]	

862	ReadWrite	timeout counter register *	1 register (16 bit 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)	day of month (H)	day of week (L)
4	year (0-99), month (1-12)	year (H)	month (L)

870	ReadWrite	Natural gas components - 1th stream	(32 bit floating) 54 register
.....	ReadWrite		
1248	ReadWrite	Natural gas components - 8th stream	

Offset address	Natural gas components	Explanation Modbus STD2
0-1	Superior calorific value	If the source of gas composition selected
2-3	Argon, mole%	as Modbus STD2 then gas composition
4-5	Line density	downloaded into this register range will be
6-7	Base density	used in the calculation.
8-9	Nitrogen [mole%]	There are separate address range for each
10-11	Carbon-dioxide [mole%]	of the streams to download the gas
12-13	Hydrogen-sulfide [mole%]	composition.
14-15	Water [mole%]	
16-17	Helium [mole%]	
18-19	Methane [mole%]	
20-21	Ethane [mole%]	
22-23	Propane [mole%]	
24-25	normal-Butane [mole%]	
26-27	iso-Butane [mole%]	
28-29	normal-Pentane [mole%]	
30-31	iso-Pentane [mole%]	
32-33	normal-Hexane [mole%]	
34-35	normal-Heptane [mole%]	
36-37	normal-Octane [mole%]	
38-39	normal-Nonane [mole%]	
40-41	normal-Decane [mole%]	
42-43	Oxygen [mole%]	
44-45	Carbon-monoxide [mole%]	
46-47	Hydrogen [mole%]	
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^3	lbs/CF
base density	kg/m^3	lbs/CF
relative density	-	-
calorific value	MJ/m^3	BTU/SCF

1844	ReadOnly	(IO1 Ch1) analog input	(32 bit floating) 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)

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	volume at base conditions (CVOL) 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) volume at line conditions (UVOL) total	72 reg. (32 bit signed integer numbers) 2 reg./stream
2078	ReadOnly	Str2. (physical stream) volume at line conditions (UVOL) total	

2080	ReadOnly	Str3. (physical stream) volume at line conditions (UVOL) total	
2082	ReadOnly	Str4. (physical stream) volume at line conditions (UVOL) total	
2084	ReadOnly	Str5. (physical stream) volume at line conditions (UVOL) total	
2086	ReadOnly	Str6. (physical stream) volume at line conditions (UVOL) total	
2088	ReadOnly	Str7. (physical stream) volume at line conditions (UVOL) total	
2090	ReadOnly	Str8. (physical stream) volume at line conditions (UVOL) total	

Offset address	Physical streams total	Explanation
0-1	volume at line conditions (UVOL) cumulative total	rollover at 1 000 000 000 2 reg.

2100	ReadOnly	(IO1 Ch1) analog input	(32 bit floating) 3 reg./channel
...	ReadOnly	...	
2121	ReadOnly	(IO1 Ch8) analog input	
2124	ReadOnly	(IO2 Ch1) analog input	
...	ReadOnly	...	
2145	ReadOnly	(IO2 Ch8) 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 Ch9) analog input	3 reg./channel
...	ReadOnly	...	
2241	ReadOnly	(IO1 Ch16) analog input	
2244	ReadOnly	(IO2 Ch9) analog input	
...	ReadOnly	...	
2265	ReadOnly	(IO2 Ch16) analog input	
2268	ReadOnly	(IO3 Ch9) analog input	
...	ReadOnly	...	
2289	ReadOnly	(IO3 Ch16) analog input	
2292	ReadOnly	(IO4 Ch9) analog input	
...	ReadOnly	...	
2313	ReadOnly	(IO4 Ch16) analog input	
2316	ReadOnly	(IO5 Ch9) analog input	
...	ReadOnly	...	
2337	ReadOnly	(IO5 Ch16) analog input	

2340	ReadOnly	(IO1 Ch17) analog input	3 reg./channel
...	ReadOnly	...	
2361	ReadOnly	(IO1 Ch24) analog input	
2364	ReadOnly	(IO2 Ch17) analog input	
...	ReadOnly	...	
2385	ReadOnly	(IO2 Ch24) analog input	
2388	ReadOnly	(IO3 Ch17) analog input	
...	ReadOnly	...	
2409	ReadOnly	(IO3 Ch24) analog input	
2412	ReadOnly	(IO4 Ch17) analog input	
...	ReadOnly	...	
2433	ReadOnly	(IO4 Ch24) analog input	
2436	ReadOnly	(IO5 Ch17) analog input	
...	ReadOnly	...	
2457	ReadOnly	(IO5 Ch24) analog input	

2460	ReadOnly	(IO1 Ch25) analog input	3 reg./channel
...	ReadOnly	...	
2481	ReadOnly	(IO1 Ch32) analog input	
2484	ReadOnly	(IO2 Ch25) analog input	
...	ReadOnly	...	

2505	ReadOnly	(IO2 Ch32) analog input	
2508	ReadOnly	(IO3 Ch25) analog input	
...	ReadOnly	...	
2529	ReadOnly	(IO3 Ch32) analog input	
2532	ReadOnly	(IO4 Ch25) analog input	
...	ReadOnly	...	
2553	ReadOnly	(IO4 Ch32) analog input	
2556	ReadOnly	(IO5 Ch25) analog input	
...	ReadOnly	...	
2577	ReadOnly	(IO5 Ch32) analog input	

2580	ReadWrite	Ch1 Modbus analog input	3 reg./channel
...	ReadWrite	...	
2667	ReadWrite	Ch30 Modbus analog input	

Offset Address	Analog input signals (Quick access)	Explanation	
0	state, alarms	state (H)	alarm state (L)
		0. bit = 1 (ch in alarm)	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	(32 bit float)	

2670	ReadOnly	IO1 digital inputs	2 reg./IO
2672	ReadOnly	IO2 digital inputs	
2674	ReadOnly	IO3digital inputs	
2676	ReadOnly	IO4 digital inputs	
2678	ReadOnly	IO5 digital inputs	

Offset Address	Digital input signal	Explanation
0	Status (16 bit)	1 bit / channel (1 = active, 0=inactive) (1-16. channel, 1. channel. = 0. bit)
1	Value (16 bit)	1 bit / channel (0=open, 1=closed) (1-16. channel., 1. channel. = 0. bit)

2680	ReadOnly	IO1 digital outputs	2 reg./IO
2682	ReadOnly	IO2 digital outputs	
2684	ReadOnly	IO3digital outputs	
2686	ReadOnly	IO4 digital outputs	
2688	ReadOnly	IO5 digital outputs	

Offset Address	Digital input signal	Explanation
0	Status (16 bit)	1 bit / channel (1 = active, 0=inactive) (1-16. channel, 1. channel. = 0. bit)
1	Value (16 bit)	1 bit / channel (0=open, 1=closed) (1-16. channel., 1. channel. = 0. bit)

2700	ReadOnly	Volume at line conditions (UVOL) flowrate (US flow meter on Com1 port	2 reg. (32 bit float)
2702	ReadOnly	Com1 port, timeout counter register *	2 reg.

2708	ReadOnly	Volume at line conditions (UVOL) flowrate (US flow meter on Com2 port	2 reg.
2710	ReadOnly	Com2 port, timeout counter register *	2 reg.

2716	ReadOnly	Volume at line conditions (UVOL) flowrate (US flow meter on Com3 port	2 reg.
2718	ReadOnly	Com3 port, timeout counter register *	2 reg.

2730	ReadOnly	(IO1 Ch1) analog output	3 reg./channel
...	ReadOnly	...	
2739	ReadOnly	(IO1 Ch4) analog output	
2742	ReadOnly	(IO2 Ch1) analog output	
...	ReadOnly	...	
2751	ReadOnly	(IO2 Ch4) analog output	
2754	ReadOnly	(IO3 Ch1) analog output	
...	ReadOnly	...	
2763	ReadOnly	(IO3 Ch4) analog output	
2766	ReadOnly	(IO4 Ch1) analog output	
...	ReadOnly	...	
2775	ReadOnly	(IO4 Ch4) analog output	
2778	ReadOnly	(IO5 Ch1) analog output	
...	ReadOnly	...	
2787	ReadOnly	(IO5 Ch4) analog output	

Offset Address	Analog output signals	Explanation	
0	state, alarms	state (H)	alarm state (L)
		0. bit = 1 (ch in alarm)	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	(32 bit float)	

CO2 emission data block, total length 176 Modbus registers

3000	ReadOnly	Str1. CO2 emission	(32 bit float) 22 reg./stream
3022	ReadOnly	Str2. CO2 emission	
3044	ReadOnly	Str3. CO2 emission	
3066	ReadOnly	Str4. CO2 emission	
3088	ReadOnly	Str5. CO2 emission	
3110	ReadOnly	Str6. CO2 emission	
3132	ReadOnly	Str7. CO2 emission	
3154	ReadOnly	Str8. CO2 emission	

Offset address	CO2 emission data by streams	Explanation
0-1	Specific carbon content	(32 bit float)
2-3	CO2 emission mass flowrate (instantaneous)	(32 bit float)
4-5	CO2 emission, cumulative mass total	(32 bit integer)
6-7	CO2 emission, previous hour mass total	(32 bit integer)
10-11	CO2 emission, previous day mass total	(32 bit integer)
12-13	CO2 emission, previous month mass total	(32 bit integer)
14-15	CO2 emission, current hour mass total	(32 bit integer)
16-17	CO2 emission, current day mass total	(32 bit integer)
20-21	CO2 emission, current month mass total	(32 bit integer)

General purpose register block, total length 120 Modbus registers

4000	ReadWrite	1. variable	(32 bit float) 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	Ethanol concentrations	32 reg. (32 bit floating)

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:

Starting address = 20 000 + 256 * (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	volume at base conditions (CVOL), previous hour	
2-3	volume at base conditions (CVOL), previous 8 hour	
4-5	volume at base conditions (CVOL), previous day	
6-7	volume at base conditions (CVOL), previous month	
10-11	volume at base conditions (CVOL), current hour	
12-13	volume at base conditions (CVOL), current 8 hour	
14-15	volume at base conditions (CVOL), current day	
16-17	volume at base conditions (CVOL), 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 volume at base conditions (CVOL), previous hour	
62-63	premium volume at base conditions (CVOL), previous 8 hour	
64-65	premium volume at base conditions (CVOL), previous day	
66-67	premium volume at base conditions (CVOL), previous month	
70-71	premium volume at base conditions (CVOL), current hour	
72-73	premium volume at base conditions (CVOL), current 8 hour	
74-75	premium volume at base conditions (CVOL), current day	
76-77	premium volume at base conditions (CVOL), 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	m3 (l)*	MCF
volume flowrate	m3/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/m3	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
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.)

Modbus register	Reg. type	Description	Note
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^3]	floating point number (2 reg.)		
44-45	Batch average temperature [°C]	floating point number (2 reg.)		
46-47	Batch average line density [kg/m^3]	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^3]	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.
Flow meter serial test data are available via link (Ethernet or serial) set to Daniel Modbus register assignment.

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 measurement	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			not used		
54			serial test stop Month|Year	-	16 bit unsigned integer

55			serial test stop Hour|Day	-	16 bit unsigned integer
56			serial test stop Second|Minute	-	16 bit unsigned integer
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 superior heating value	MJ/m3	32 bit float
98			serial test average differential pressure	mbar	32 bit float
100			serial test average nitrogen	mole%	32 bit float
102			serial test average carbon-dioxide	mole%	32 bit float
104			serial test average H2S	mole%	32 bit float
106			serial test average H2O	mole%	32 bit float

108			serial test average helium	mole%	32 bit float
110			serial test average methane	mole%	32 bit float
112			serial test average ethane	mole%	32 bit float
114			serial test average propane	mole%	32 bit float
116			serial test average n-butane	mole%	32 bit float
118			serial test average i-butane	mole%	32 bit float
120			serial test average n-pentane	mole%	32 bit float
122			serial test average i-pentane	mole%	32 bit float
124			serial test average hexane	mole%	32 bit float
126			serial test average heptane	mole%	32 bit float
128			serial test average octane	mole%	32 bit float
130			serial test average nonane	mole%	32 bit float
132			serial test average decane	mole%	32 bit float
134			serial test average oxygen	mole%	32 bit float
136			serial test average carbon-monoxide	mole%	32 bit float
138			serial test average hydrogen	mole%	32 bit float
140			serial test average argon	mole%	32 bit float
142			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 volume at base conditions (CVOL)
5002	32 bit integer	Current day volume at base conditions (CVOL)
5003	32 bit integer	Current multiday volume at base conditions (CVOL)
5004	32 bit integer	Current month volume at base conditions (CVOL)
5005	32 bit integer	Previous hour volume at base conditions (CVOL)
5006	32 bit integer	Previous day volume at base conditions (CVOL)
5007	32 bit integer	Previous multiday volume at base conditions (CVOL)
5008	32 bit integer	Previous month volume at base conditions (CVOL)
5009	32 bit integer	Volume at base conditions (CVOL) 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 volume at base conditions (CVOL)
5042	32 bit integer	Current multiday premium volume at base conditions (CVOL)
5043	32 bit integer	Current month premium volume at base conditions (CVOL)
5044	32 bit integer	Previous hour premium volume at base conditions (CVOL)
5045	32 bit integer	Previous day premium volume at base conditions (CVOL)
5046	32 bit integer	Previous multiday premium volume at base conditions (CVOL)
5047	32 bit integer	Previous month premium volume at base conditions (CVOL)
5048	32 bit integer	Premium volume at base conditions (CVOL) 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 volume at line conditions (UVOL)
5062	32 bit integer	Current day volume at line conditions (UVOL)

5063	32 bit integer	Current multiday volume at line conditions (UVOL)
5064	32 bit integer	Current month volume at line conditions (UVOL)
5065	32 bit integer	Previous hour volume at line conditions (UVOL)
5066	32 bit integer	Previous day volume at line conditions (UVOL)
5067	32 bit integer	Previous multiday volume at line conditions (UVOL)
5068	32 bit integer	Previous month volume at line conditions (UVOL)
5069	32 bit integer	Volume at line conditions (UVOL) cumulative total
5070	32 bit integer	n/a
5071	32 bit integer	Current hour fault volume at base conditions (CVOL)
5072	32 bit integer	Current day fault volume at base conditions (CVOL)
5073	32 bit integer	Current multiday fault volume at base conditions (CVOL)
5074	32 bit integer	Current month fault volume at base conditions (CVOL)
5075	32 bit integer	Previous hour fault volume at base conditions (CVOL)
5076	32 bit integer	Previous day fault volume at base conditions (CVOL)
5077	32 bit integer	Previous multiday fault volume at base conditions (CVOL)
5078	32 bit integer	Previous month fault volume at base conditions (CVOL)
5079	32 bit integer	Fault volume at base conditions (CVOL) 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 volume at base conditions (CVOL)
5092	32 bit integer	Current month maximum hourly volume at base conditions (CVOL), month
5093	32 bit integer	Current month maximum hourly volume at base conditions (CVOL), day
5094	32 bit integer	Current month maximum hourly volume at base conditions (CVOL), hour
5095	32 bit integer	Previous month maximum hourly volume at base conditions (CVOL)
5096	32 bit integer	Previous month maximum hourly volume at base conditions (CVOL), month
5097	32 bit integer	Previous month maximum hourly volume at base conditions (CVOL), day
5098	32 bit integer	Previous month maximum hourly volume at base conditions (CVOL), hour
5099	32 bit integer	n/a
5100	32 bit integer	n/a
5101	32 bit integer	Current day hourly volume at base conditions (CVOL) 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	Downloaded Ethylene
7031	32 bit floating	Fluid pressure, absolute
7032	32 bit floating	Fluid temperature
7033	32 bit floating	Differential pressure
7034	32 bit floating	Volume at base conditions (CVOL) flowrate
7035	32 bit floating	Energy flowrate
7036	32 bit floating	Volume at line conditions (UVOL) 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=Zline/Zbase), -
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=Zline/Zbase), -
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=Zline/Zbase), -
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=Zline/Zbase), -
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/m3	lb/CF
relative density	-	-
calorific value	MJ/m3	BTU/SCF
gas component content	mole %	mole%
differential pressure	mbar	inchH2O
linear gas velocity	m/s	ft/s
compression factor	-	-
specific carbon content	kg/m3	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 described 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 Caldon LEFM 380Ci ultrasonic meter

Register address	Data type	Description	Unit	Remark
5000	float32	Volume flow rate at line conditions	m3/h	
5002	float32	Fluid Temperature Input	deg C	
5004	float32	Average Cf (VOS)	m/s	
5006	float32	Meter Body Temp	deg C	
5008	float32	Pressure	bar	
5010	float32	Average fluid velocity	m/s	
5012	float32	Profile Factor Meter has Calculated	-	
5014	float32	Flatness Ratio	-	
5016	float32	Swirl Ratio	-	
5018	float32	Asymmetry Ratio	-	
5020	float32	Plane Ratio	-	
5022	float32	A/I 1	V	
5024	float32	A/I 2	V	
5050	float32	Velocity of Sound Path 1	m/s	
5052	float32	Velocity of Sound Path 2	m/s	
5054	float32	Velocity of Sound Path 3	m/s	
5056	float32	Velocity of Sound Path 4	m/s	
5058	float32	Velocity of Sound Path 5	m/s	
5060	float32	Velocity of Sound Path 6	m/s	
5062	float32	Velocity of Sound Path 7	m/s	
5064	float32	Velocity of Sound Path 8	m/s	
5066	float32	Measured Fluid Velocity Path 1	m/s	
5068	float32	Measured Fluid Velocity Path 2	m/s	

5070	float32	Measured Fluid Velocity Path 3	m/s	
5072	float32	Measured Fluid Velocity Path 4	m/s	
5074	float32	Measured Fluid Velocity Path 5	m/s	
5076	float32	Measured Fluid Velocity Path 6	m/s	
5078	float32	Measured Fluid Velocity Path 7	m/s	
5080	float32	Measured Fluid Velocity Path 8	m/s	
5082	float32	Normalized Velocity Path 1	-	
5084	float32	Normalized Velocity Path 2	-	
5086	float32	Normalized Velocity Path 3	-	
5088	float32	Normalized Velocity Path 4	-	
5090	float32	Normalized Velocity Path 5	-	
5092	float32	Normalized Velocity Path 6	-	
5094	float32	Normalized Velocity Path 7	-	
5096	float32	Normalized Velocity Path 8	-	
5098	float32	Average Gain Path 1	dB	
5100	float32	Average Gain Path 2	dB	
5102	float32	Average Gain Path 3	dB	
5104	float32	Average Gain Path 4	dB	
5106	float32	Average Gain Path 5	dB	
5108	float32	Average Gain Path 6	dB	
5110	float32	Average Gain Path 7	dB	
5112	float32	Average Gain Path 8	dB	
5114	float32	Gain Path1 UP	dB	
5116	float32	Gain Path2 UP	dB	
5118	float32	Gain Path3 UP	dB	
5120	float32	Gain Path4 UP	dB	
5122	float32	Gain Path5 UP	dB	
5124	float32	Gain Path6 UP	dB	
5126	float32	Gain Path7 UP	dB	
5128	float32	Gain Path8 UP	dB	
5130	float32	Gain Path1 Down	dB	
5132	float32	Gain Path2 Down	dB	
5134	float32	Gain Path3 Down	dB	

5136	float32	Gain Path4 Down	dB	
5138	float32	Gain Path5 Down	dB	
5140	float32	Gain Path6 Down	dB	
5142	float32	Gain Path7 Down	dB	
5144	float32	Gain Path8 Down	dB	
5146	float32	Transit time down Path 1	ns	
5148	float32	Transit time down Path 2	ns	
5150	float32	Transit time down Path 3	ns	
5152	float32	Transit time down Path 4	ns	
5154	float32	Transit time down Path 5	ns	
5156	float32	Transit time down Path 6	ns	
5158	float32	Transit time down Path 7	ns	
5160	float32	Transit time down Path 8	ns	
5162	float32	Transit time up Path 1	ns	
5164	float32	Transit time up Path 2	ns	
5166	float32	Transit time up Path 3	ns	
5168	float32	Transit time up Path 4	ns	
5170	float32	Transit time up Path 5	ns	
5172	float32	Transit time up Path 6	ns	
5174	float32	Transit time up Path 7	ns	
5176	float32	Transit time up Path 8	ns	
5178	float32	Delta Time Path 1	ns	
5180	float32	Delta Time Path 2	ns	
5182	float32	Delta Time Path 3	ns	
5184	float32	Delta Time Path 4	ns	
5186	float32	Delta Time Path 5	ns	
5188	float32	Delta Time Path 6	ns	
5190	float32	Delta Time Path 7	ns	
5192	float32	Delta Time Path 8	ns	
5194	float32	Turbulent Intensity Path 1	%	
5196	float32	Turbulent Intensity Path 2	%	
5198	float32	Turbulent Intensity Path 3	%	
5200	float32	Turbulent Intensity Path 4	%	

5202	float32	Turbulent Intensity Path 5	%	
5204	float32	Turbulent Intensity Path 6	%	
5206	float32	Turbulent Intensity Path 7	%	
5208	float32	Turbulent Intensity Path 8	%	

10000	int16	Positive Totalizer MSB	m3	
10001	int16	Positive Totalizer LSB	m3	
10002	int16	Negative Totalizer MSB	m3	
10003	int16	Negative Totalizer LSB	m3	
10004	int16	Years	year	
10005	int16	Month	month	
10006	int16	Hours Day	day	
10007	int16	Hours	hours	
10008	int16	Minutes	minutes	
10009	int16	Seconds	seconds	
10010	int16	Board Status	-	
10011	int16	MeterStateVector	-	
10012	int16	Firmware Version	-	
10013	int16	Firmware Revision 1	-	
10014	int16	Firmware Revision 2	-	
10015	int16	Firmware Revision 3	-	
10016	int16	Checksum of Executable Code	-	
10017	int16	Checksum of Parameter Set	-	
10018	int16	Number of Times Parameter Set has sent	-	
10019	int16	Switch Settings	-	
10020	int16	Analog Input Status	-	
10051	int16	Performance 1	%	
10052	int16	Performance 2	%	
10053	int16	Performance 3	%	
10054	int16	Performance 4	%	
10055	int16	Performance 5	%	
10056	int16	Performance 6	%	

10057	int16	Performance 7	%	
10058	int16	Performance 8	%	
10059	int16	Average Up/Dn SNR Path 1	-	
10060	int16	Average Up/Dn SNR Path 2	-	
10061	int16	Average Up/Dn SNR Path 3	-	
10062	int16	Average Up/Dn SNR Path 4	-	
10063	int16	Average Up/Dn SNR Path 5	-	
10064	int16	Average Up/Dn SNR Path 6	-	
10065	int16	Average Up/Dn SNR Path 7	-	
10066	int16	Average Up/Dn SNR Path 8	-	
10067	int16	SNR Up 1	-	
10068	int16	SNR Up 2	-	
10069	int16	SNR Up 3	-	
10070	int16	SNR Up 4	-	
10071	int16	SNR Up 5	-	
10072	int16	SNR Up 6	-	
10073	int16	SNR Up 7	-	
10074	int16	SNR Up 8	-	
10075	int16	SNR Dn 1	-	
10076	int16	SNR Dn 2	-	
10077	int16	SNR Dn 3	-	
10078	int16	SNR Dn 4	-	
10079	int16	SNR Dn 5	-	
10080	int16	SNR Dn 6	-	
10081	int16	SNR Dn 7	-	
10082	int16	SNR Dn 8	-	
10083	int16	Path Status 1	-	
10084	int16	Path Status 2	-	
10085	int16	Path Status 3	-	
10086	int16	Path Status 4	-	
10087	int16	Path Status 5	-	
10088	int16	Path Status 6	-	
10089	int16	Path Status 7	-	

10090	int16	Path Status 8	-	

10.7.2 Register map of Daniel ultrasonic meter (Mark III electronics)

Register address	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^3/h	
1500	int32	Forward volume at line conditions (integer portion).	m3	
1502	int32	Reverse volume at line conditions (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^3/h	
10626	float32	Base-condition volumetric flow rate.	m^3/h	

10.7.3 Register map of Flexim Fluxus ultrasonic meter

Register address	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^3/h	
1128	int16	Volume flow totalizer at line conditions (positive) status		
1129	float32	Volume flow totalizer at line conditions (positive)	m^3	
1144	int16	Volume flow totalizer at line conditions (negative) status		
1145	float32	Volume flow totalizer at line conditions (negative)	m^3	
1160	int16	Volume flow rate at base conditions status		
1161	float32	Volume flow rate at base conditions	m^3/h	

10.7.4 Register map of Sick-Maihak Flowsic-600 ultrasonic meter

Register address	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^3/h	
7002	float32	Volume flow rate at base conditions	m^3/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^3/h	
7037		Adjust factor forward		
7038		Adjust factor reverse		
7039		Zero flow offset	m^3/h	

10.7.5 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 address	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^3	
7056	float32	Volume flow rate at line conditions	m^3/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^3/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^3/s	
7538	float32	Max flow rate reverse	m^3/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^3*1e-6	
8008	int64	Volume flow totalizer at line conditions (reverse)	m^3*1e-6	
8012	int64	Fault volume flow totalizer at line conditions (forward)	m^3*1e-6	
8016	int64	Fault volume flow totalizer at line conditions (reverse)	m^3*1e-6	

10.7.6 Register map of Panametrics GC868 ultrasonic meter

Register address	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^3/h	
7	float32	Volume flow rate at base conditions	m^3/h	
9	int32	Volume flow totalizer at line conditions (forward)	m^3	
11	int32	Volume flow totalizer at line conditions (reverse)	m^3	
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^3	
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		

10.7.7 Register map of Instromet QSonic Uniform ultrasonic meter

Uniflow-200 receives U_DATA data package (message code: 37) from Instromet QSonic meters set to communicate according to Uniform protocol.
See details in documents: Elster-Instromet Digital Communication: UNIFORM Protocol (Measured Data) Document Code: 99.01.02C.02/2/G

10.7.8 Register map of Instromet QSonicPlus ultrasonic meter

Register address	Data type	Description	Unit	Remark
0	int16	InstrType		
1	int16	NumPath		
2	int16	SequenceNum LO		
3	int16	SequenceNum HI		
4	int16	SampleRate		
5	int16	ValidSamples L1		
6	int16	ValidSamples L2		
7	int16	ValidSamples L3		
8	int16	ValidSamples L4		
9	int16	ValidSamples L5		
10	int16	ValidSamples L6		
11	int16	ValidSamples L7		
12	int16	ValidSamples L8		
13	int16	AGC L1A	dB	
14	int16	AGC L1B	dB	
15	int16	AGC L2A	dB	
16	int16	AGC L2B	dB	
17	int16	AGC L3A	dB	
18	int16	AGC L3B	dB	
19	int16	AGC L4A	dB	

20	int16	AGC L4B	dB	
21	int16	AGC L1A	dB	
22	int16	AGC L1B	dB	
23	int16	AGC L2A	dB	
24	int16	AGC L2B	dB	
25	int16	AGC L3A	dB	
26	int16	AGC L3B	dB	
27	int16	AGC L4A	dB	
28	int16	AGC L4B	dB	
29	int16	SNR L1A	dB	
30	int16	SNR L1B	dB	
31	int16	SNR L2A	dB	
32	int16	SNR L2B	dB	
33	int16	SNR L3A	dB	
34	int16	SNR L3B	dB	
35	int16	SNR L4A	dB	
36	int16	SNR L4B	dB	
37	int16	SNR L1A	dB	
38	int16	SNR L1B	dB	
39	int16	SNR L2A	dB	
40	int16	SNR L2B	dB	
41	int16	SNR L3A	dB	
42	int16	SNR L3B	dB	
43	int16	SNR L4A	dB	
44	int16	SNR L4B	dB	
45	int16	OperationalStatus		
46	int16	Status2		
200	int32	Diabits L1		
201	int32	Diabits L2		
202	int32	Diabits L3		
203	int32	Diabits L4		
204	int32	Diabits L5		

205	int32	Diabits L6		
206	int32	Diabits L7		
207	int32	Diabits L8		
208	int32	FwdVolume		
209	int32	RevVolume		
210	int32	FwdErrVolume		
211	int32	RevErrVolume		
212	int32	Checksum1		
213	int32	Checksum2		
400	float32	Speed of Sound	m/s	
401	float32	Velocity of gas	m/s	
402	float32	Pressure	kPa	
403	float32	Temperature	K	
404	float32	QLine	m3/h	
405	float32	QBase	m3/h	
406	float32	Cpp L1	m/s	
407	float32	Cpp L2	m/s	
408	float32	Cpp L3	m/s	
409	float32	Cpp L4	m/s	
410	float32	Cpp L5	m/s	
411	float32	Cpp L6	m/s	
412	float32	Cpp L7	m/s	
413	float32	Cpp L8	m/s	
414	float32	Vpp L1	m/s	
415	float32	Vpp L2	m/s	
416	float32	Vpp L3	m/s	
417	float32	Vpp L4	m/s	
418	float32	Vpp L5	m/s	
419	float32	Vpp L6	m/s	
420	float32	Vpp L7	m/s	
421	float32	Vpp L8	m/s	
422	float32	Spare		

423	float32	SwirlAngle		
424	float32	MeterFactor		

10.7.9 Register map of RMA Ecosonic12 ultrasonic meter

Register address	Data type	Description	Unit	Remark
1100	int32	Tot. volume FR1		
1102	int32	Tot. volume FR2		
1104	int32	Tot. volumeErr FR1		
1106	int32	Tot. volumeErr FR2		
1508	float32	Qm vol. flow rate	m3/h	
1510	float32	Velocity of Gas average	m/s	
1512	float32	SoS average	m/s	
1514	float32	Pressure (mbarA)	mbarA	
1516	float32	Temperature	°C	
1518	float32	Pressure (barA)	barA	
3000	int16	System state		
3001	int16	PT download request		if = 0 not to download PT if <> 0 download PT
3014	int16	AGC Path1 DirA	dB	
3015	int16	AGC Path1 DirB	dB	
3016	int16	AGC Path2 DirA	dB	
3017	int16	AGC Path2 DirB	dB	
3018	int16	AGC Path3 DirA	dB	
3019	int16	AGC Path3 DirB	dB	
3020	int16	AGC Path4 DirA	dB	
3021	int16	AGC Path4 DirB	dB	
3022	int16	AGC Path5 DirA	dB	
3023	int16	AGC Path5 DirB	dB	

3024	int16	AGC Path6 DirA	dB	
3025	int16	AGC Path6 DirB	dB	
3026	float32	Speed of Sound Path1	m/s	
3028	float32	Speed of Sound Path2	m/s	
3030	float32	Speed of Sound Path3	m/s	
3032	float32	Speed of Sound Path4	m/s	
3034	float32	Speed of Sound Path5	m/s	
3036	float32	Speed of Sound Path6	m/s	
3050	float32	Velocity of gas Path1	m/s	
3052	float32	Velocity of gas Path2	m/s	
3054	float32	Velocity of gas Path3	m/s	
3056	float32	Velocity of gas Path4	m/s	
3058	float32	Velocity of gas Path5	m/s	
3060	float32	Velocity of gas Path6	m/s	
3062	float32	SNR Path 1 DirA		
3064	float32	SNR Path 1 DirB		
3066	float32	SNR Path 2 DirA		
3068	float32	SNR Path 2 DirB		
3070	float32	SNR Path 3 DirA		
3072	float32	SNR Path 3 DirB		
3074	float32	SNR Path 4 DirA		
3076	float32	SNR Path 4 DirB		
3078	float32	SNR Path 5 DirA		
3080	float32	SNR Path 5 DirB		
3082	float32	SNR Path 6 DirA		
3084	float32	SNR Path 6 DirB		
3086	int16	Performance Path1	%	
3087	int16	Performance Path2	%	
3088	int16	Performance Path3	%	
3089	int16	Performance Path4	%	

3090	int16	Performance Path5	%	
3091	int16	Performance Path6	%	
1518	float32	Absolute Pressure (barA) to download (read/write)	barA	
1524	float32	Temperature to download (read/write)	°C	

10.7.10 Register map of RMG USZ08 ultrasonic meter

Register address	Data type	Description	Unit	Remark
3000	float64	Tot. volume d1	see 7032	
3004	float64	Tot. volume d2	see 7032	
3008	float64	Tot. volumeErr d1	see 7032	
3012	float64	Tot. volumeErr d2	see 7032	
4040	int16	path-1 status		
4041	int16	path-2 status		
4042	int16	path-3 status		
4043	int16	path-4 status		
4044	int16	path-5 status		
4045	int16	path-6 status		
4046	int16	path-7 status		
4047	int16	path-8 status		
6020	float32	Speed of Sound Path1	m/s	
6022	float32	Speed of Sound Path2	m/s	
6024	float32	Speed of Sound Path3	m/s	
6026	float32	Speed of Sound Path4	m/s	
6028	float32	Speed of Sound Path5	m/s	
6030	float32	Speed of Sound Path6	m/s	
6032	float32	Speed of Sound Path7	m/s	
6034	float32	Speed of Sound Path8	m/s	

6040	float32	p1.1 AGC level	dB	
6042	float32	p2.1 AGC level	dB	
6044	float32	p3.1 AGC level	dB	
6046	float32	p4.1 AGC level	dB	
6048	float32	p5.1 AGC level	dB	
6050	float32	p6.1 AGC level	dB	
6052	float32	p7.1 AGC level	dB	
6054	float32	p8.1 AGC level	dB	
6060	float32	p1.2 AGC level	dB	
6062	float32	p2.2 AGC level	dB	
6064	float32	p3.2 AGC level	dB	
6066	float32	p4.2 AGC level	dB	
6068	float32	p5.2 AGC level	dB	
6070	float32	p6.2 AGC level	dB	
6072	float32	p7.2 AGC level	dB	
6074	float32	p8.2 AGC level	dB	
6200	float32	Velocity vc1	m/s	
6202	float32	Velocity vc2	m/s	
6204	float32	Velocity vc3	m/s	
6206	float32	Velocity vc4	m/s	
6208	float32	Velocity vc5	m/s	
6210	float32	Velocity vc6	m/s	
6212	float32	Velocity vc7	m/s	
6214	float32	Velocity vc8	m/s	
6220	float32	vw (raw gas velocity)	m/s	
6222	float32	vwc (ave. gas velocity)	m/s	
6224	float32	Qm (raw flow rate)	m3/h	
6226	float32	Qmc (corr. flow rate)	m3/h	
6228	float32	SoS average	m/s	
6230	float32	Qm vol. flow rate		

			m3/h	
6264	float32	Qm damped	m3/h	
6640	float32	p1.1 SNR	dB	
6642	float32	p2.1 SNR	dB	
6644	float32	p3.1 SNR	dB	
6646	float32	p4.1 SNR	dB	
6648	float32	p5.1 SNR	dB	
6650	float32	p6.1 SNR	dB	
6652	float32	p7.1 SNR	dB	
6654	float32	p8.1 SNR	dB	
6660	float32	p1.2 SNR	dB	
6662	float32	p2.2 SNR	dB	
6664	float32	p3.2 SNR	dB	
6666	float32	p4.2 SNR	dB	
6668	float32	p5.2 SNR	dB	
6670	float32	p6.2 SNR	dB	
6672	float32	p7.2 SNR	dB	
6674	float32	p8.2 SNR	dB	
7000	int16	Valid samples G1		
7001	int16	Valid samples G2		
7002	int16	Valid samples G3		
7003	int16	Valid samples G4		
7004	int16	Valid samples G5		
7005	int16	Valid samples G6		
7006	int16	Valid samples G7		
7007	int16	Valid samples G8		
7030	int16	Velocity unit		0x0000 = m/s 0x0001 = ft/s
7031	int16	Flow rate unit		0x0000 = m3/h 0x0001 = acfh

7032	int16	Volume unit		0x0000 = m3 0x0001 = acf

10.7.11 Register map of Siemens 1010GCGDN ultrasonic meter

Register address	Data type	Description	Unit	Remark
41001	float32	Volume flow rate at line conditions, path 1	m^3/h	
41003	float32	Volume flow rate at line conditions, path 2	m^3/h	
41005	float32	Volume flow rate at line conditions	m^3/h	
41007	float32	Average volume flow rate at line conditions	m^3/h	
41009	float32	Raw volume flow rate at line conditions, path 1	m^3/h	
41011	float32	Raw volume flow rate at line conditions, path 2	m^3/h	
41013	float32	Gas velocity	m/s	
41015	float32	Volume flow totalizer at line conditions	m^3	
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		

10.7.12 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^3	
7034	float32	Inferior heating value	MJ/m^3	
7035	float32	Relative density	--	

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 Propadiene	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 Propadiene	mole %	

10.7.14 Register map of Daniel 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^3	
7035	float32	Relative density	--	
7087	float32	Inferior heating value	MJ/m^3	

10.7.15 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^3	
7035	float32	Relative density	--	
7087	float32	Inferior heating value	MJ/m^3	

10.7.16 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%	

10.7.17 Register map of Emerson 3095FB multiparameter transmitter

Register number	Data type	Description	Unit	Remark
1003	coil	Calibration flag		
1031	coil	Restore factory default setting for DP		
1032	coil	Restore factory default setting for SP		
1033	coil	Restore factory default setting for PT		
1051	coil	Transmitter critical alarm		
1052	coil	Transmitter warning		
7401	float32	DP (differential pressure)		
7402	float32	SP (static pressure)		
7403	float32	PT (temperature)		
7419	float32	DP offset		
7420	float32	DP span		
7421	float32	DP damping		
7422	float32	SP offset		
7423	float32	SP span		
7424	float32	SP damping		
7425	float32	PT offset		
7426	float32	PT span		
7427	float32	PT damping		

10.7.18 Register map of Krohne MFC300 mass flow meter transmitter

Register number	Data type	Description	Unit	Remark
30000	float32	Flow Velocity	m/s	

30002	float32	Volume Flow	m3/h	see note
30004	float32	Mass Flow	kg/h	see note
30006	float32	Temperature	°C	see note
30008	float32	Density	kg/m3	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.

10.7.19 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.

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)	*nn*str_*streamname_yyyy_mm_dd*_daily.txt Example: 01str_M123_2013_04_12_daily.txt
Limited set of daily data for the previous months		*nn*str_*streamname_yyyy_mm*_daily.txt 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)	*nn*str_*streamname_yyyy_mm_dd*_hourly.txt Example: 01str_M123_2013_04_12_hourly.txt
Limited set of hourly data for the previous months		*nn*str_*streamname_yyyy_mm*_hourly.txt 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)	*01rp_yyyy_mm_dd_daily*.txt Example: 01rp_2013_04_12_daily.txt
User defined set No.1 of daily data for the previous month		*01rp_yyyy_mm_daily*.txt 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)	*01rp_yyyy_mm_dd_hourly*.txt Example: 01rp_2013_04_12_hourly.txt
User defined set No.1 of hourly data for the previous month		*01rp_yyyy_mm_hourly*.txt 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)	*02rp_yyyy_mm_dd_daily*.txt Example: 02rp_2013_04_12_daily.txt
User defined set No.2 of daily data for the previous month		*02rp_yyyy_mm_daily*.txt 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)	*02rp_yyyy_mm_dd_hourly*.txt Example: 02rp_2013_04_12_hourly.txt
User defined set No.2 of hourly data for the previous month		*02rp_yyyy_mm_hourly*.txt Example: 02rp_2013_03_hourly.txt
Hourly data for the indicated month for stream *nn*	Month (hourly) (month and stream shall be selected in separate field)	*yyyy_mm*_month_hourly_*nn*str.txt 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)	*yyyy_mm*_month_shift.txt 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)	*nn*strd_*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)	*nn*strd_*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: *nn* – stream number		where: *nn* – stream number *yyyy* – year *mm* – month *dd* – day *streamname* – 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       oF        -  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

                             -    1.Str    2.Str    3.Str    4.Str         -
 Time                        -     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

                              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
               P avg    Temp.a    dp avg     K avg   Sup.c.v  Rel.dens  l.dens.a
 -              PSIA        °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
 Time      UVOL     CVOL     MASS   Energy    P avg   Temp.a  Sup.c.v   F.time
 hour       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)
================================================================================
================================================================================
03rpds_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
$24V_{out}$	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)
$24V_{out}$	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)
$24V_{out}$	22	9

NOTE
Maximum load of the $24V_{out}$ 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 protocoll		
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 protocoll		
Loop No	25-pin 'D sub' (+)	(-)
1	14	1
2	15	2
3	16	3
4	17	4
$24V_{out}$	22	9

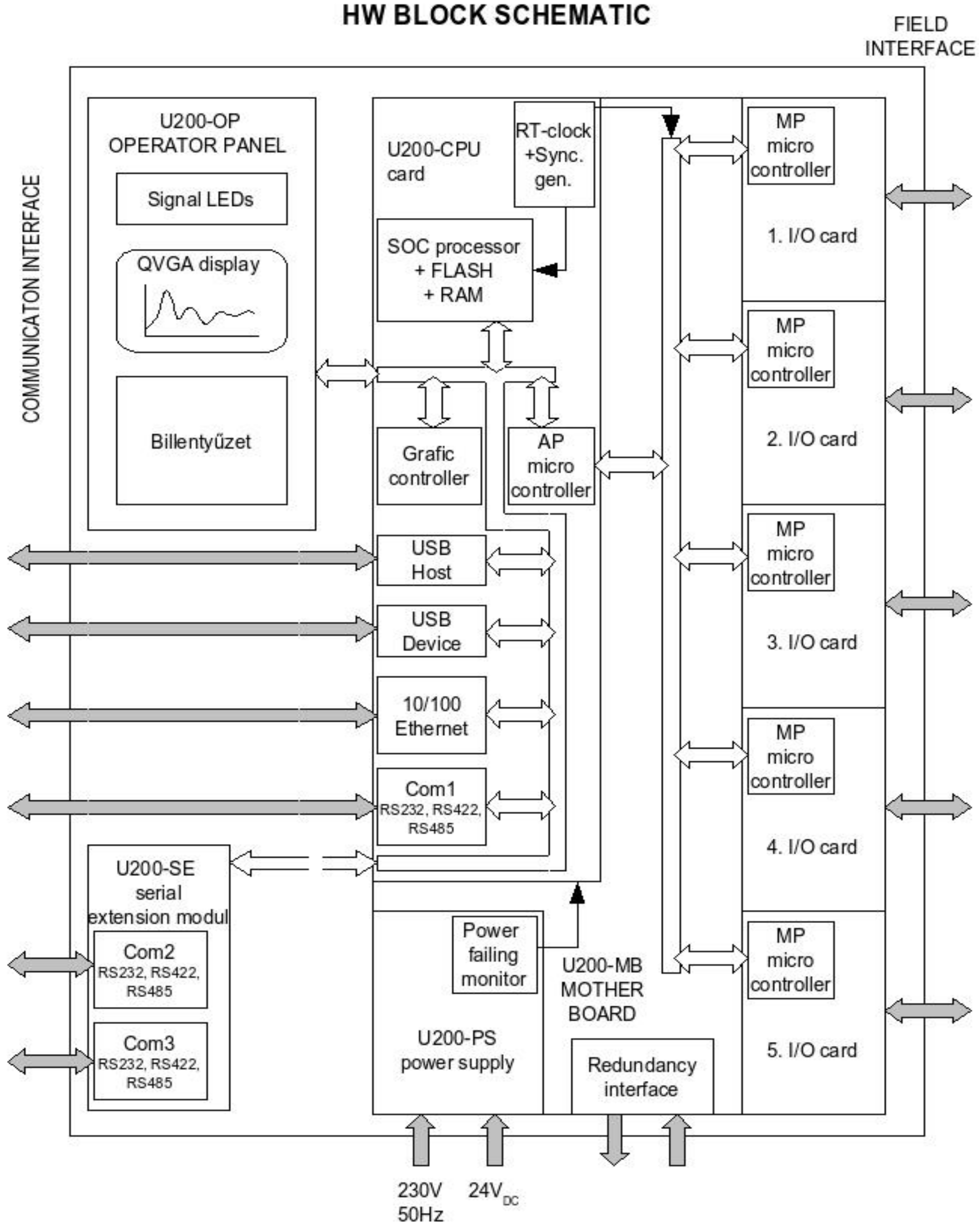
AODIO484

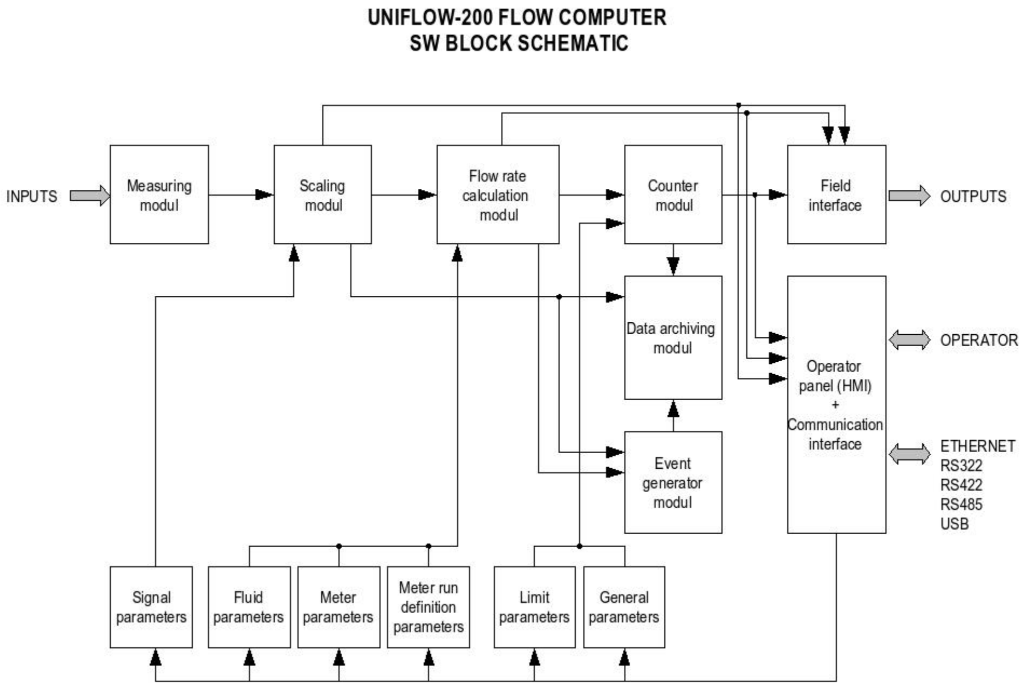
0/4-20mA analogue and digital output and digital input module		
Channel No	25-pin 'D sub' (+)	(-)
1 (a_out)	14	1
2 (a_out)	15	2
3 (a_out)	16	3
4 (a_out)	17	4
5 (d_in)	22	13
6 (d_in)	9	13
7 (d_in)	23	13
8 (d_in)	10	13
9 (d_in)	24	13
10 (d_in)	11	13
11 (d_in)	25	13
12 (d_in)	12	13
13 (d_out)	18	5
14 (d_out)	19	6
15 (d_out)	20	7
16 (d_out)	21	8

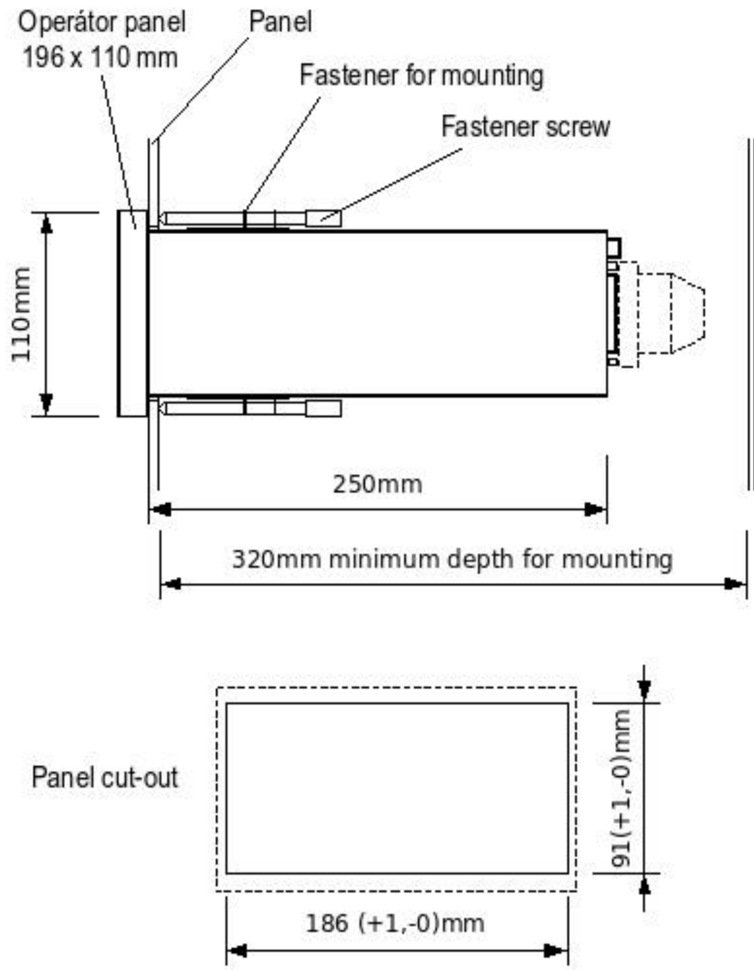
COM1, COM2, COM3			
9-pin 'D sub'	RS232	RS485	RS422
1			
2	RxD		Rx+ (A)
3	TxD	RxTx-	Tx- (Z)
4			
5	GND	GND	GND
6			
7	RTS	RxTx+	Tx+ (Y)
8	CTS		Rx- (B)
9			

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)

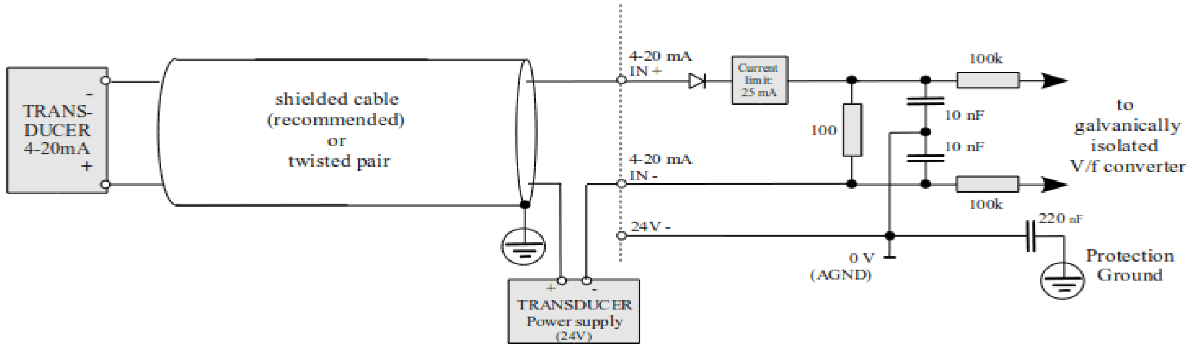
UNIFLOW-200 FLOW COMPUTER
HW BLOCK SCHEMATIC



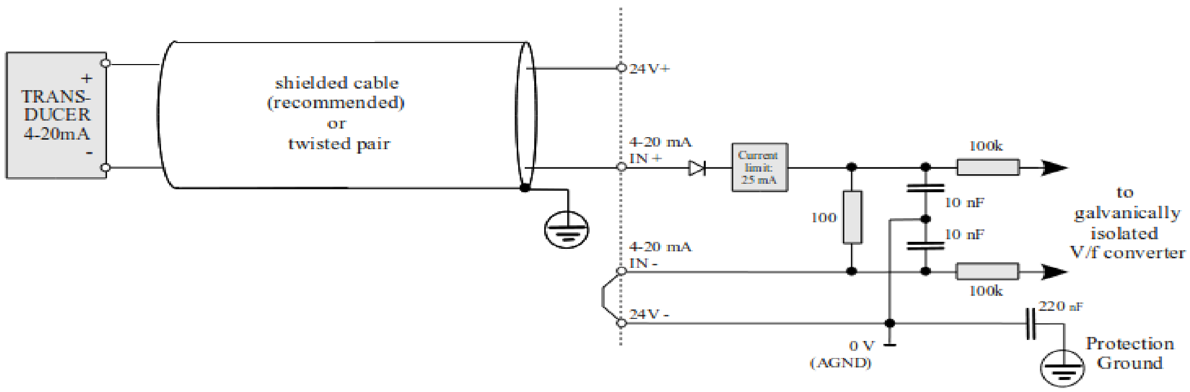

UNIFLOW-200 FLOW COMPUTER
SW BLOCK SCHEMATIC
INPUTS
Measuring modul
Scaling modul
Flow rate calculation modul
Counter modul
Field interface
OUTPUTS
Data archiving modul
Operator panel (HMI) + Communication interface
OPERATOR
Event generator modul
ETHERNET
RS322
RS422
RS485
USB
Signal parameters
Fluid parameters
Meter parameters
Meter run definition parameters
Limit parameters
General parameters



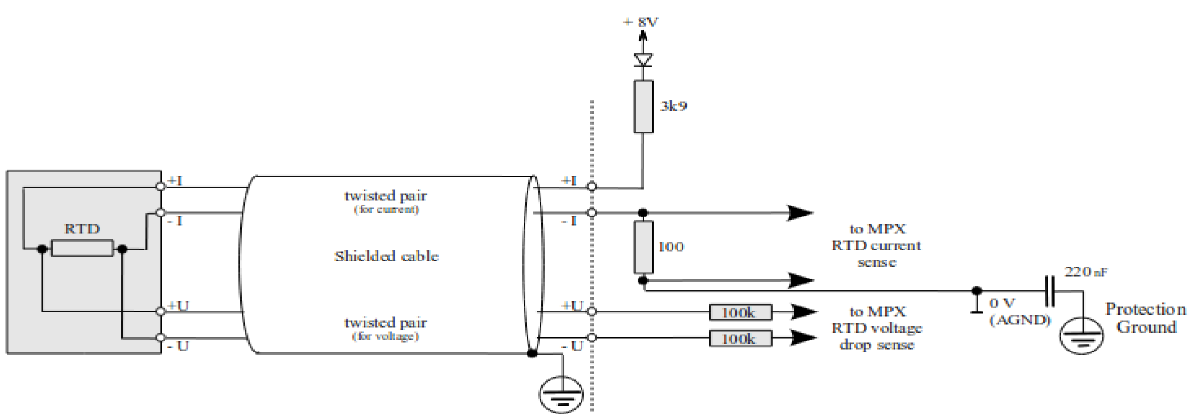
Mounting and cut-out



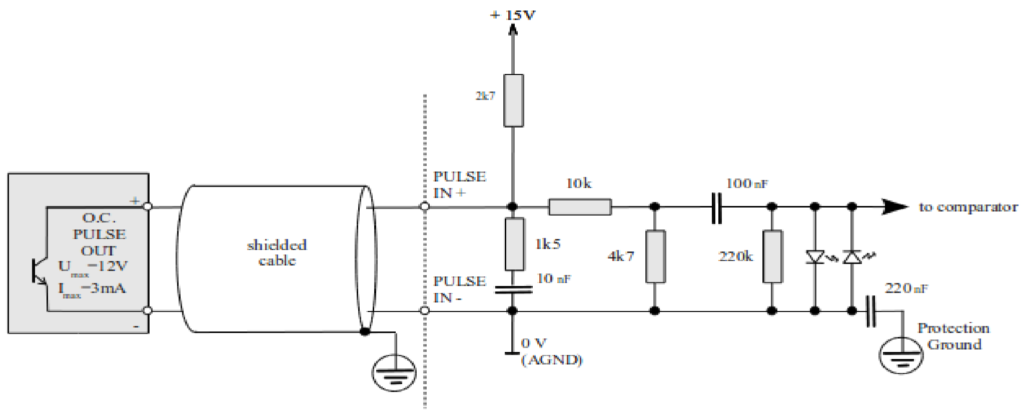
4-20 mA Input and wiring
loop pewered using satellite power supply



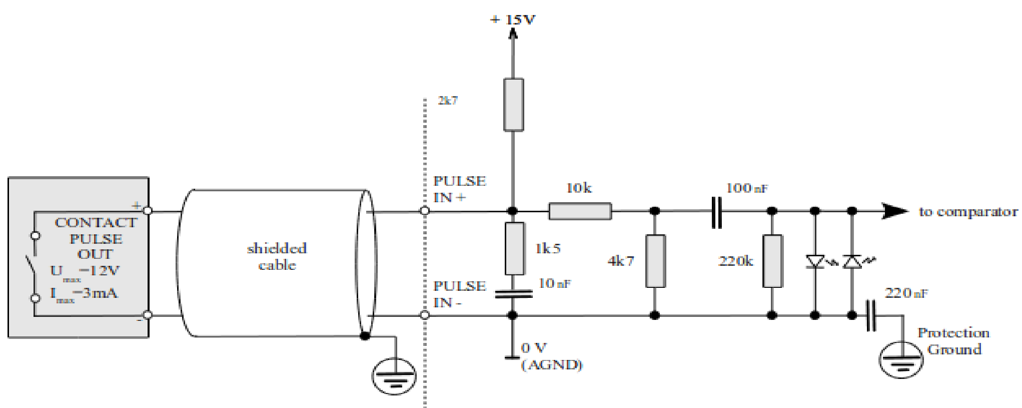
4-20 mA Input and wiring
loop pewered by the flow computer (1x24V, 20 mA max.)



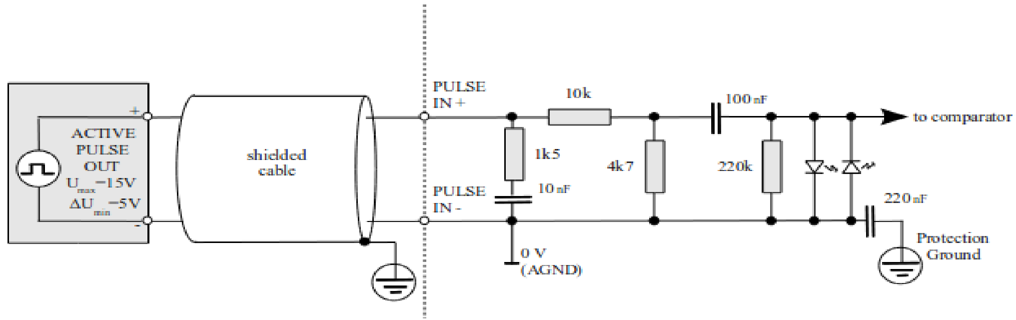
PRT/RTD Input and wiring

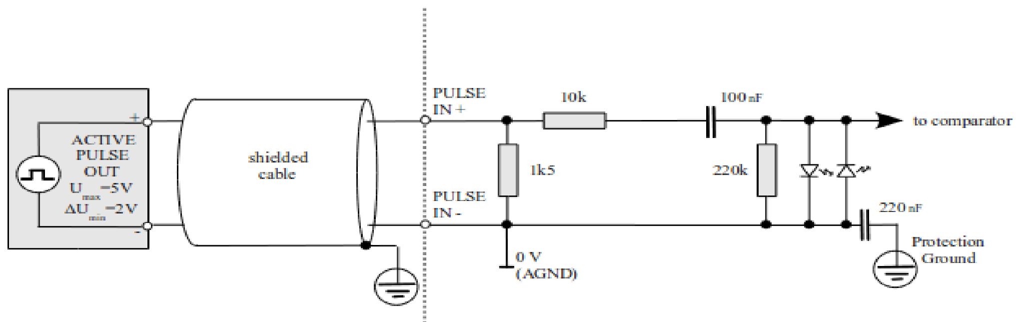


Pulse Input and wiring for transducers with Open Collector (NPN) output

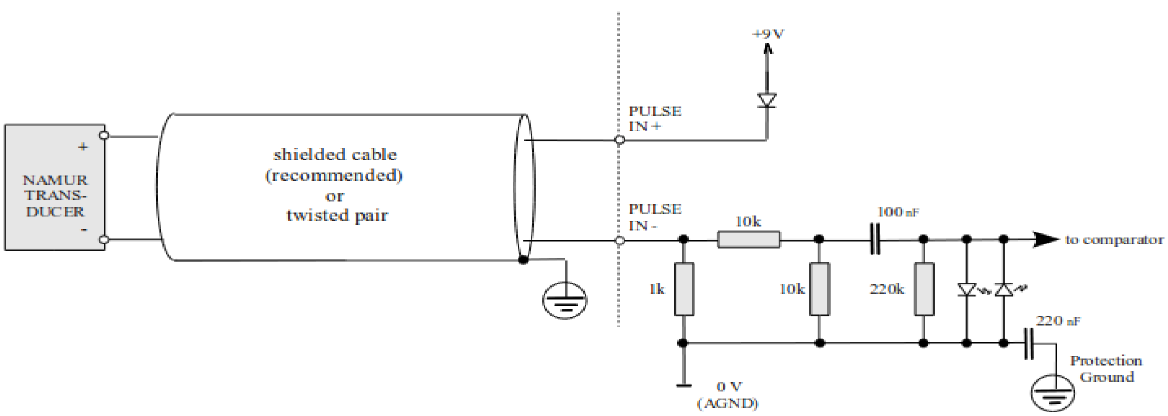


Pulse Input and wiring for transducers with potential free contact output

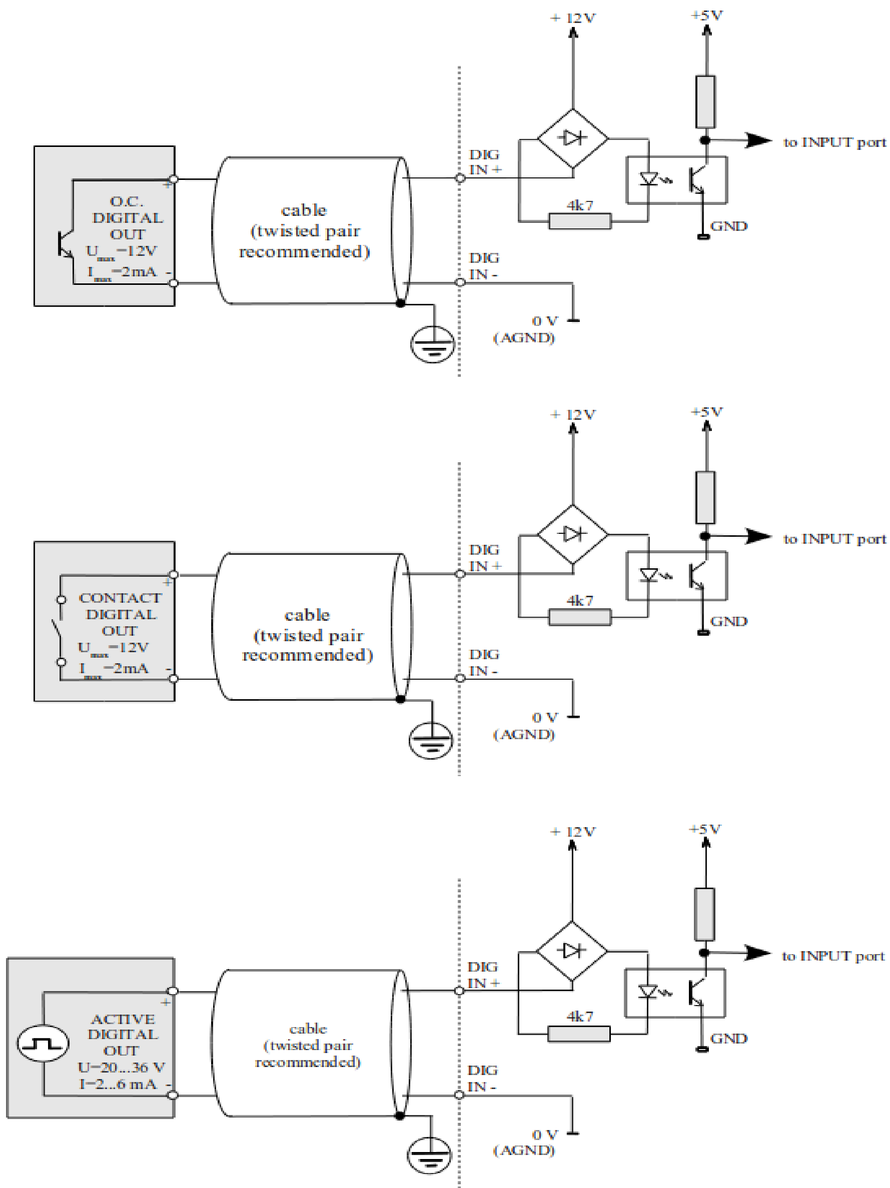




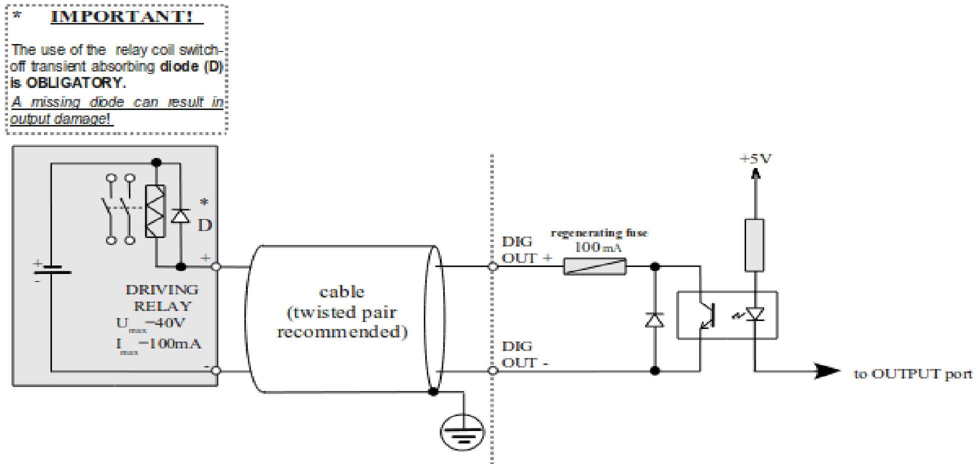
Pulse Input and wiring for transducers with voltage output



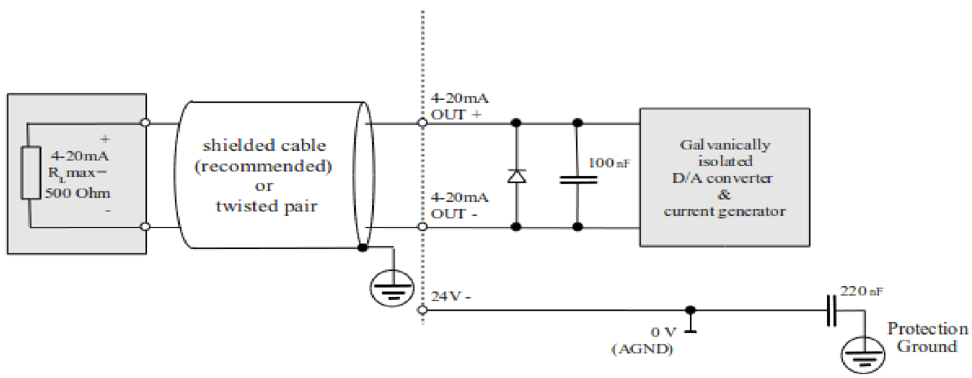
Pulse Input and wiring for transducers with voltage output



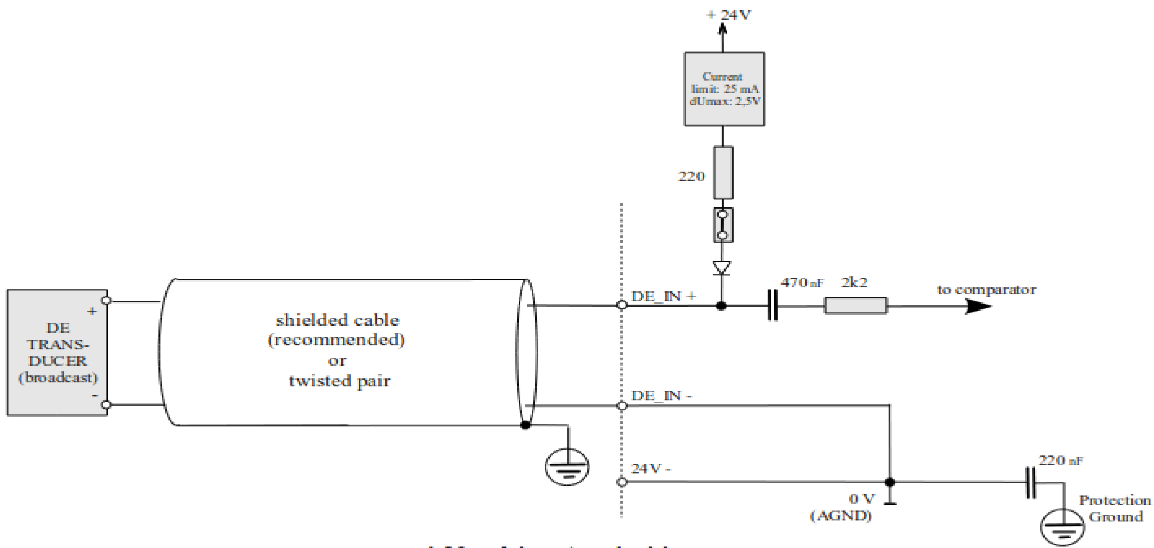
Digital Input and wiring



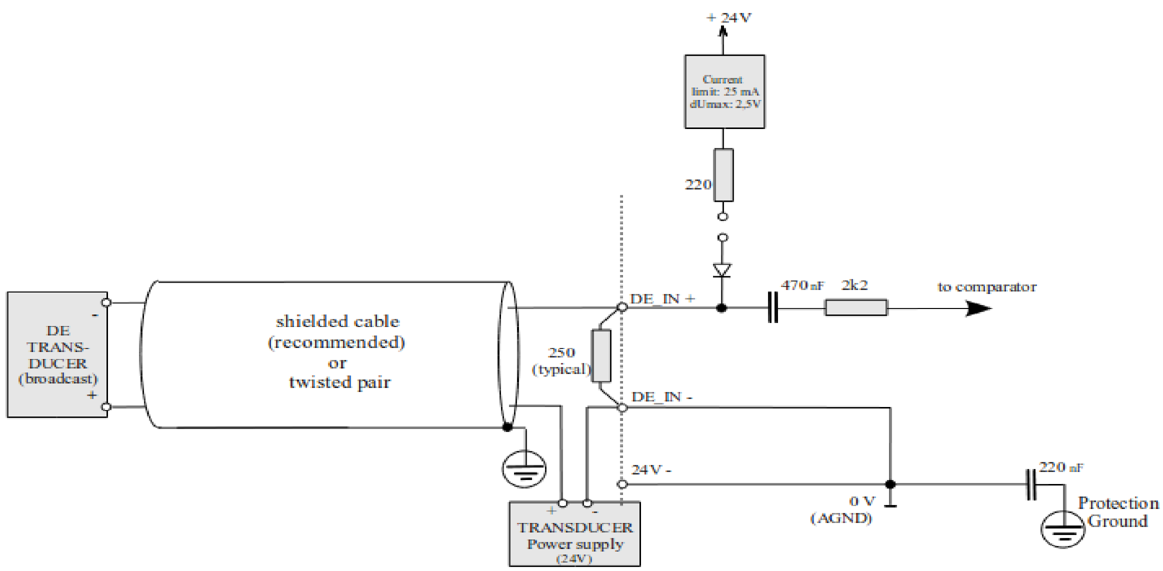
Digital Output and wiring



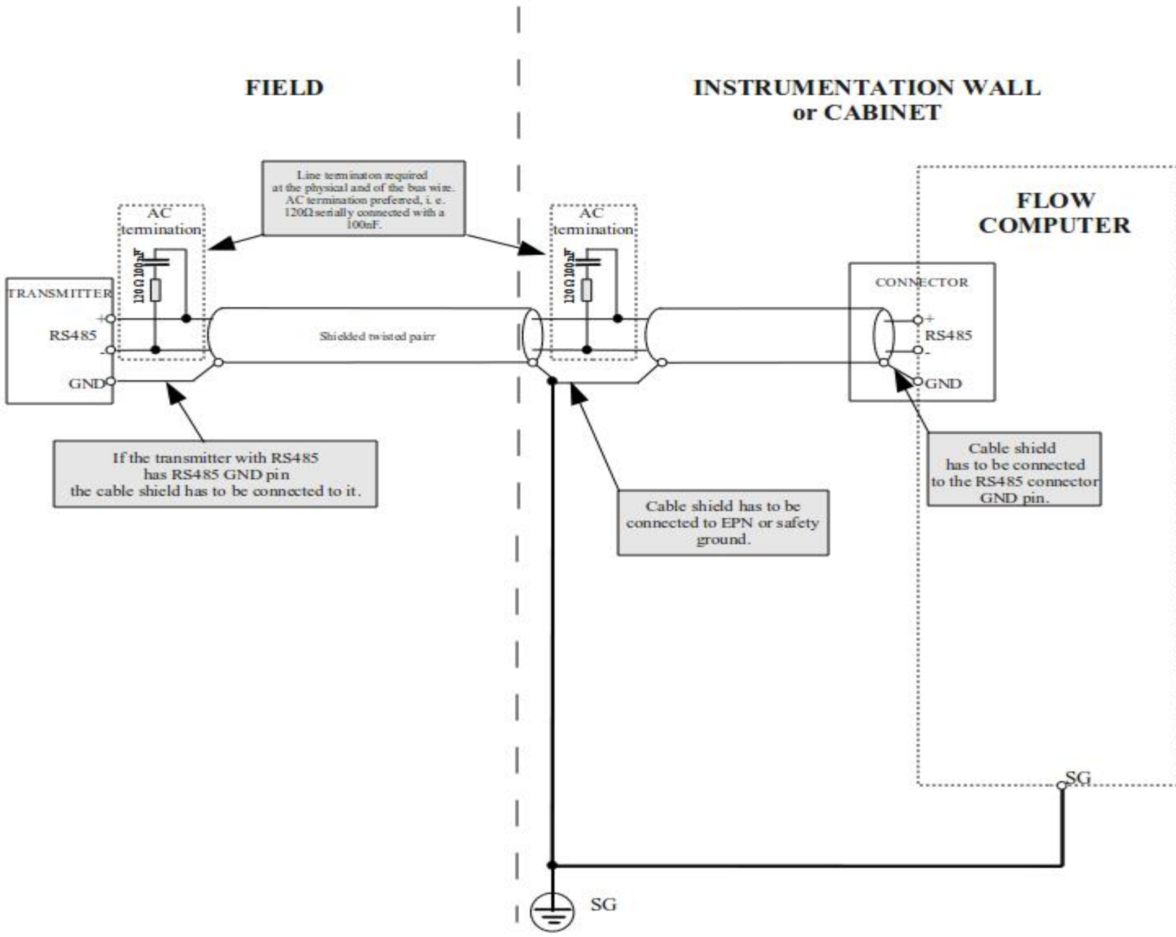
4-20 mA Output and wiring



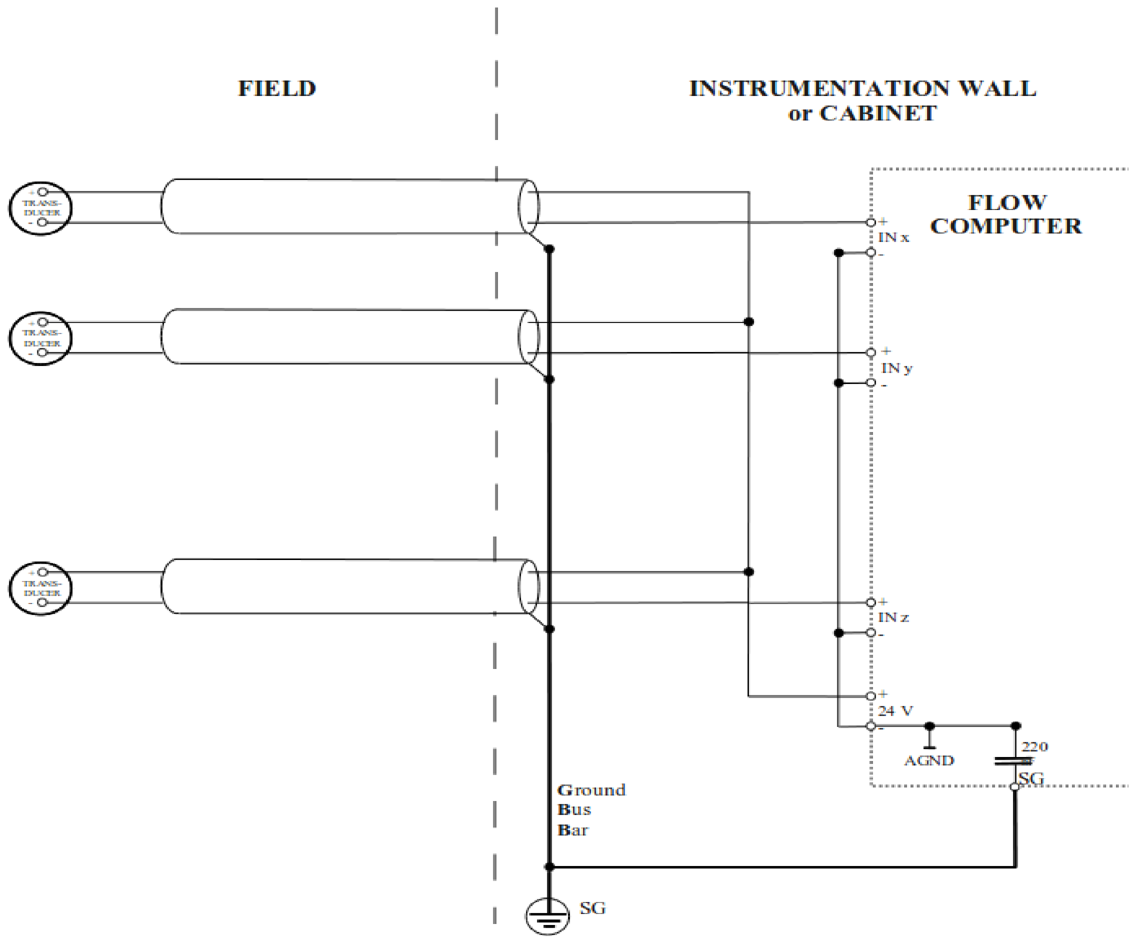
4-20 mA Input and wiring
for transducers communicating by Honeywell DE protocol
loop pewered by the flow computer



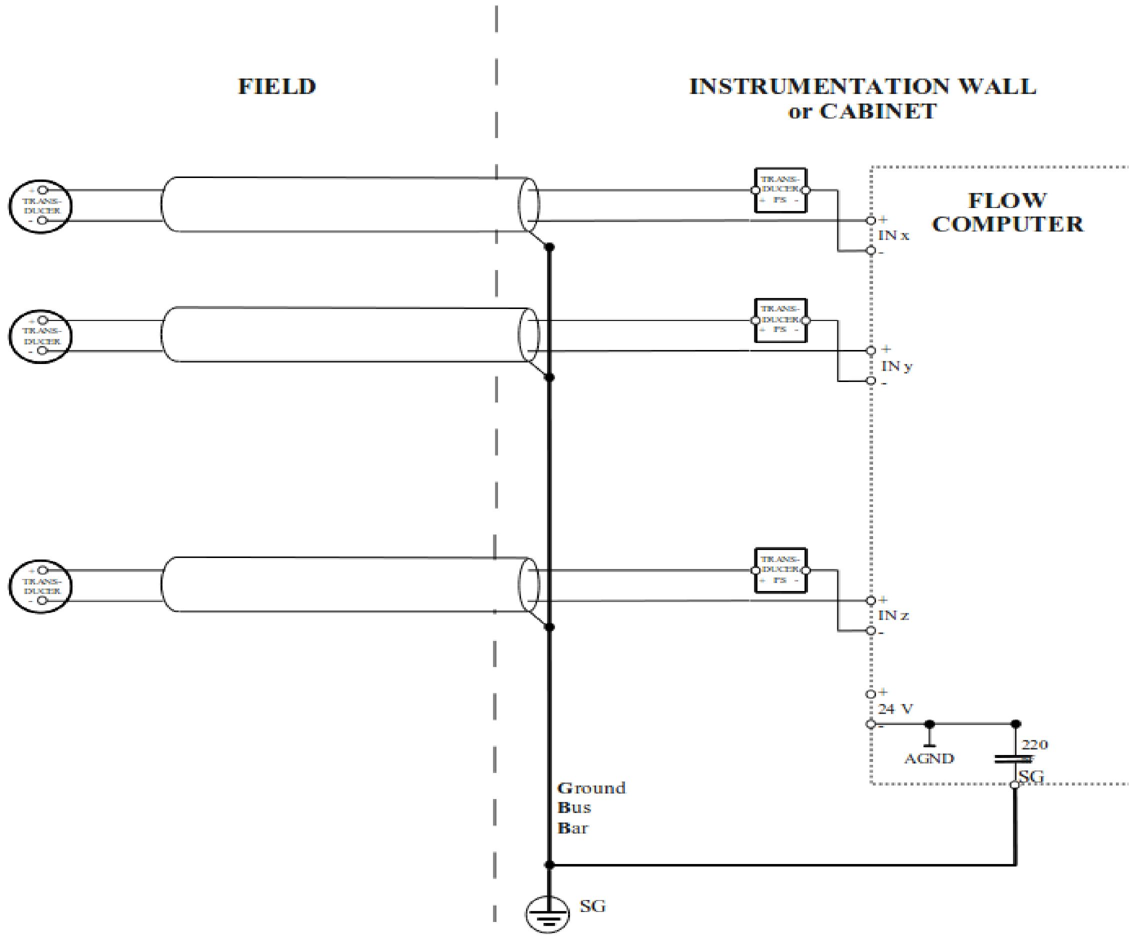
4-20 mA Input and wiring
for transducers communicating by Honeywell DE protocol
loop pewered using satellite power supply



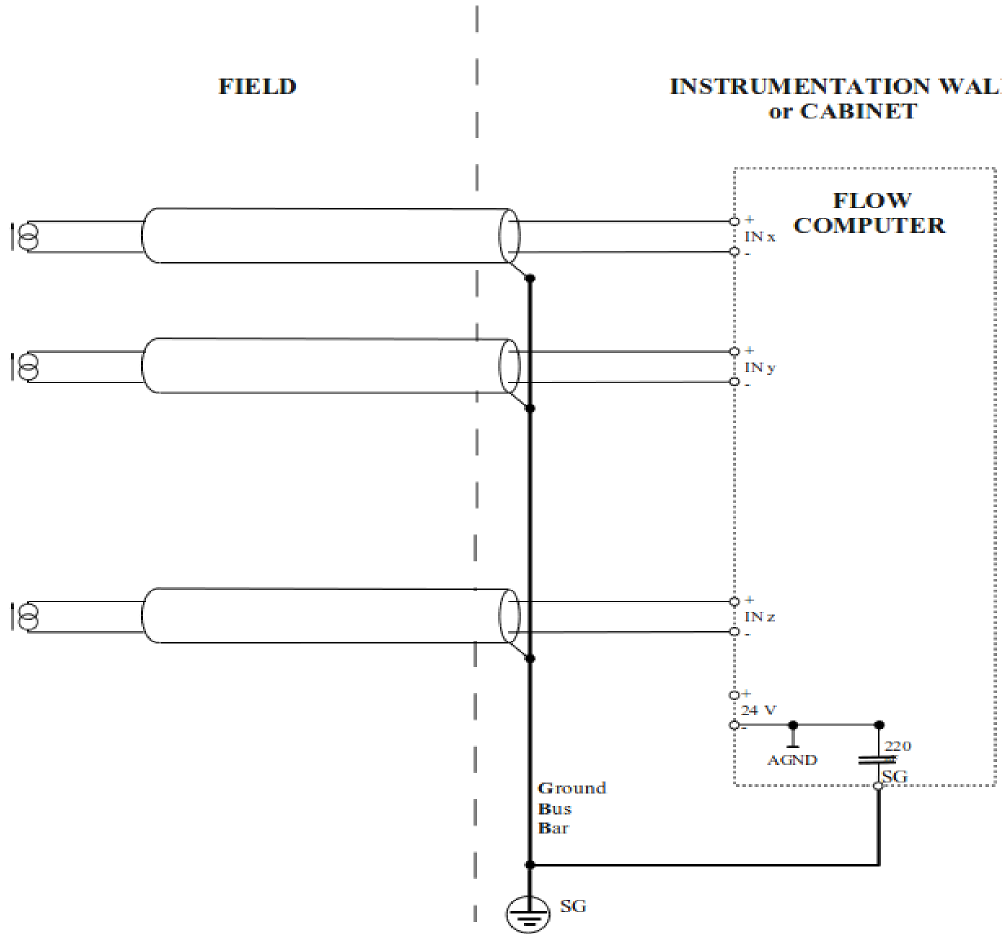
Connection to transmitter equipped with RS485 interface



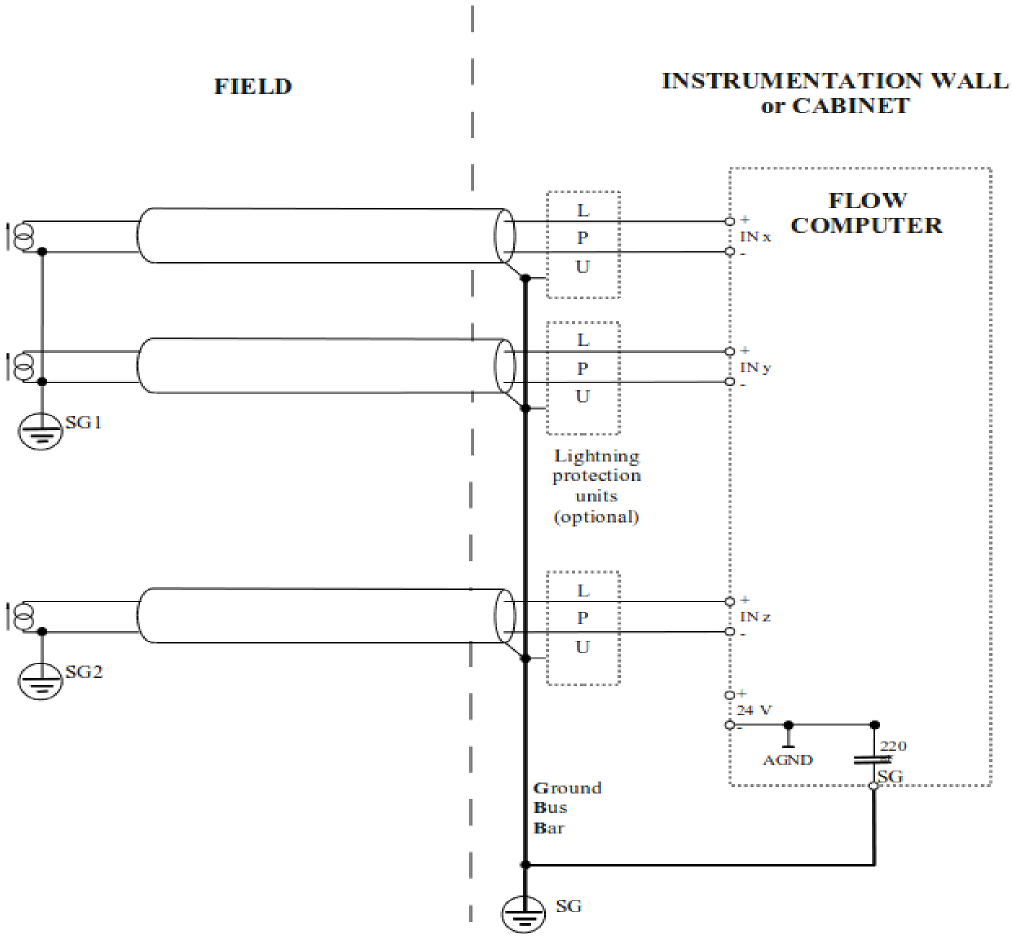
Wiring of the 4-20 mA inputs,
loop powered by the flow computer



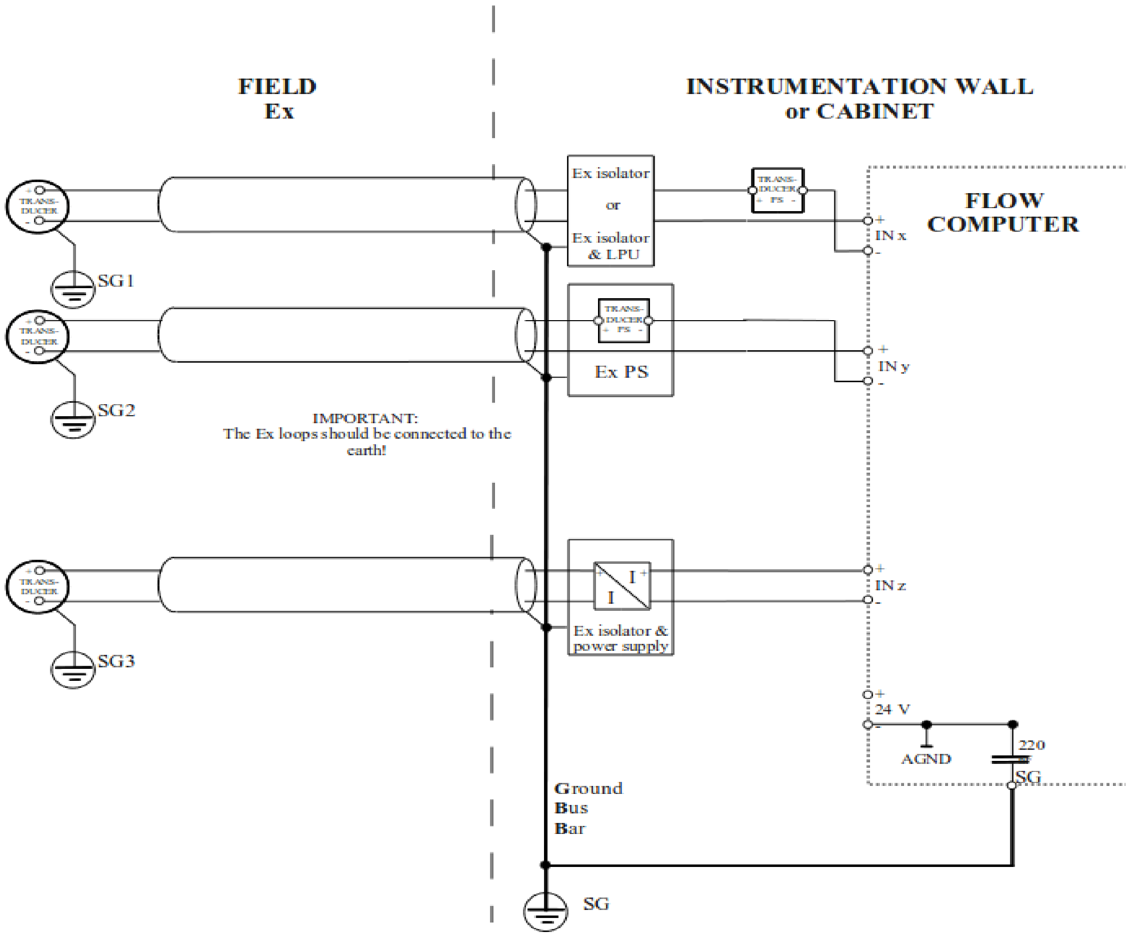
Wiring of the 4-20 mA inputs,
loop powered using satellite power supplies



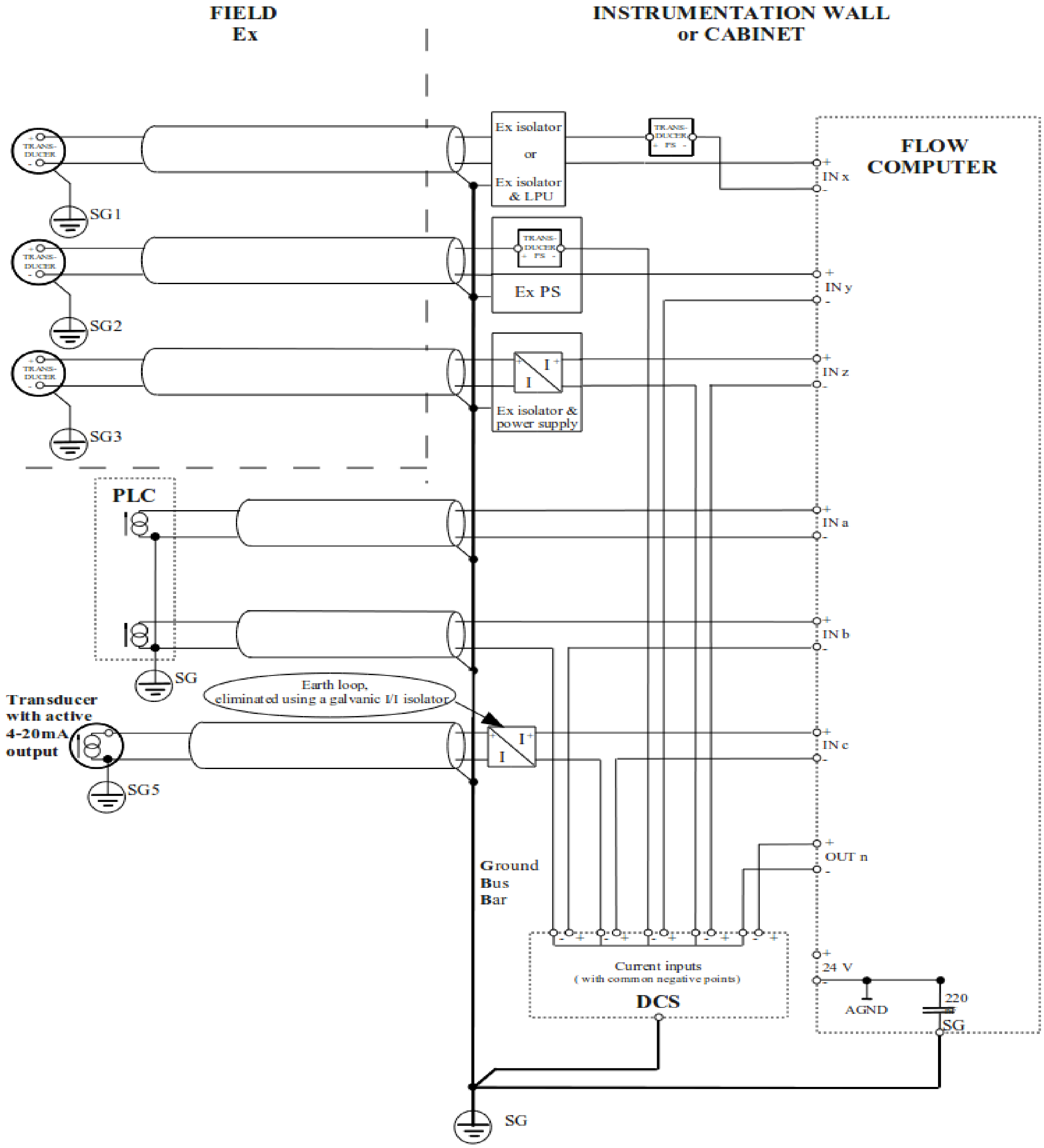
**Wiring of the 4-20 mA inputs,
transducers with active outputs isolated from the earth**



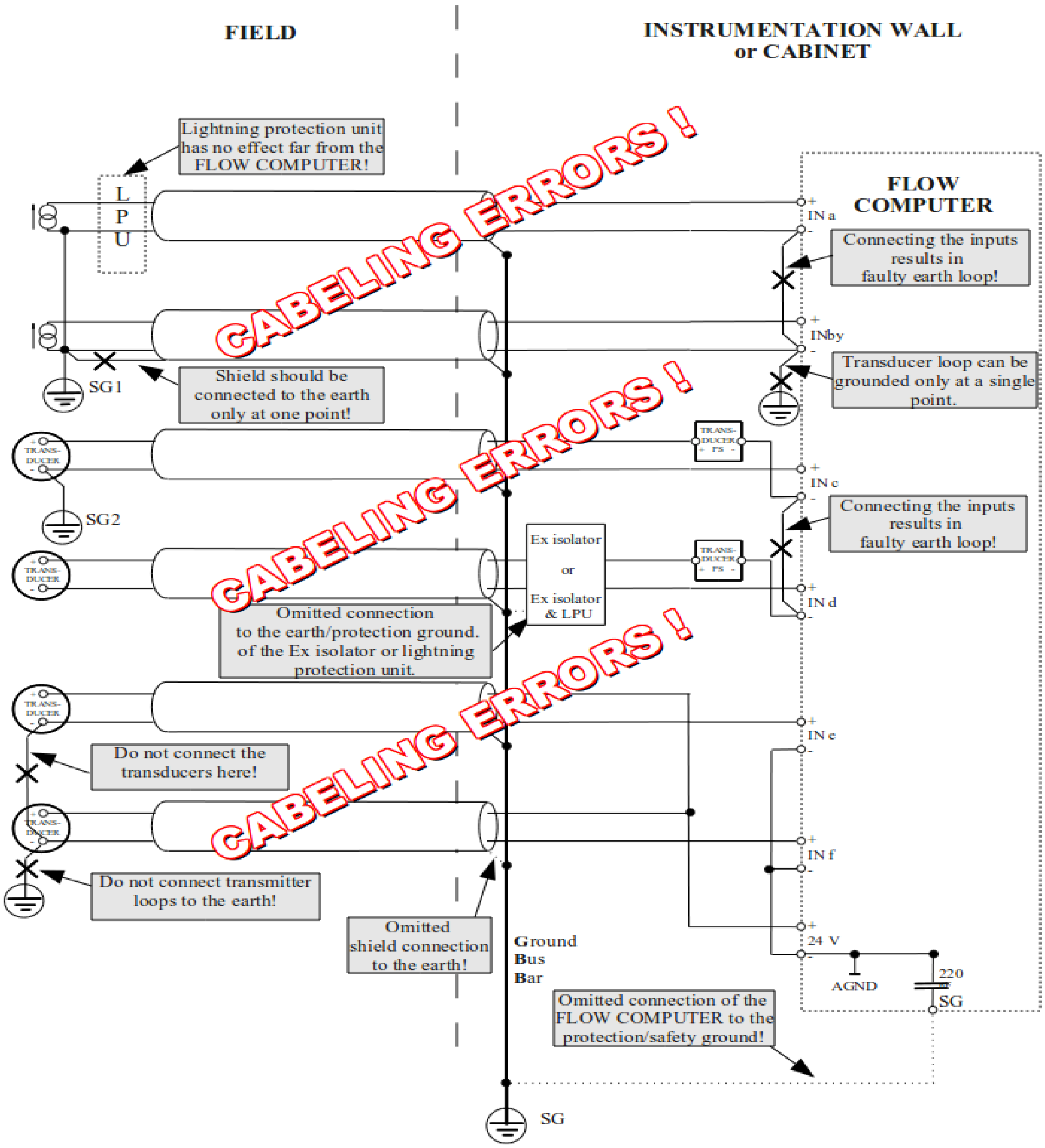
Wiring of the 4-20 mA inputs,
transducers with active outputs connected to the erth
and optional lightning protection



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 notes 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 4x15=60.

Multidrop mode

In multidrop mode one loop can accommodate maximum 15 transmitters and maximum 15 PVs can be read. If more then 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 form the equation:

$U_{\mathrm{transmitter\_min}} < \mathrm{U_{power}} - n * 4\mathrm{mA} * (R_t + \mathrm{R_{wire}})$

where: U_{power} - voltage of the power supply

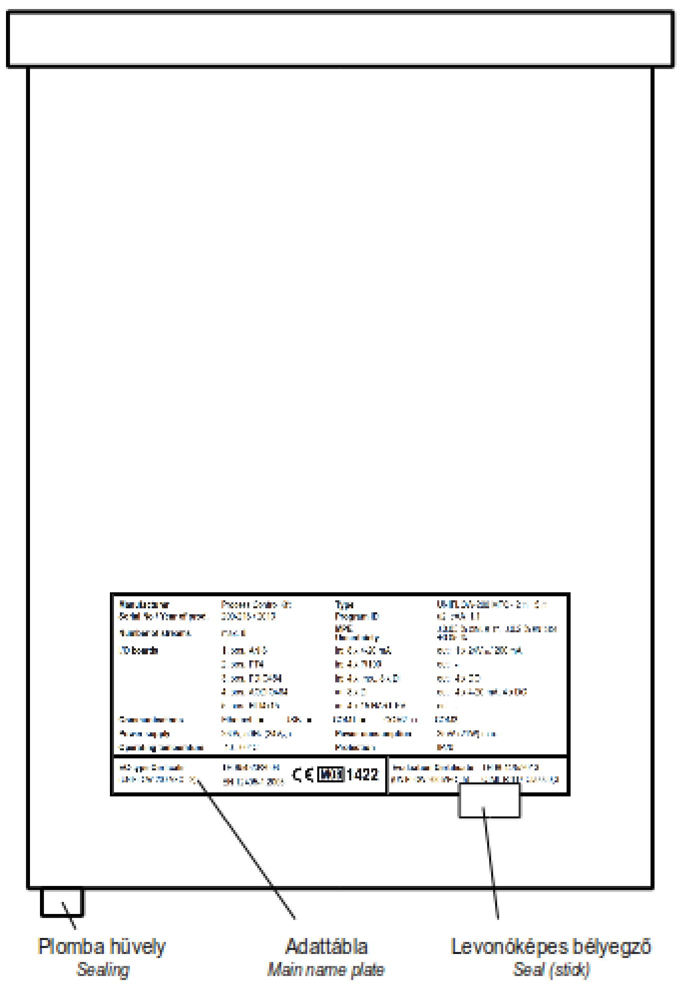
n - number of transmitters in one loop

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.

Manufacturer	Process Control Kft.	**Type**	UNIFLOW-200 MFC - 2 □ 5 □
Serial No / Year of prod.	200-218 / 2013	**Program ID**	u2_cAA_1.1
Number of streams	max. 8	**MPE** **Uncertainty**	±0.03 % OIML R117, ±0.2 % EN12405 ±0.05 %
I/O boards	1. pos. ANI8	in: 8 x 4-20 mA	out: 1 x $24V_{DC}$ / 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: -
Communications	Ethernet ■ USB ■	COM1 ■ COM2 □	COM3 □
Power supply	230V, 50Hz ($24V_{DC}$)	**Power consumption**	25VA (21W) max.
Operating temperature	-10...60°C	**Protection**	IP20
EC-type Cerficate (UNIFLOW-200 MFC - 2)	TH-8543/3/2008 EN 12405-1:2005	CE M08 1422	**Evaluation Certificate** TH-8614/5/2013 (UNIFLOW-200 MFC - 5) OIML R 117 Class 0,3



Main name plate and seal position