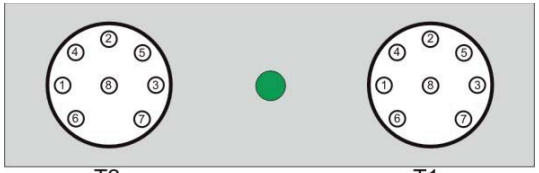
MobilControl MC 4000

Hand Held Service instrument with data logger for
pressure, min / max & differential pressure, temperature, flow / rpm and hydraulic horsepower

OWNER'S MANUAL

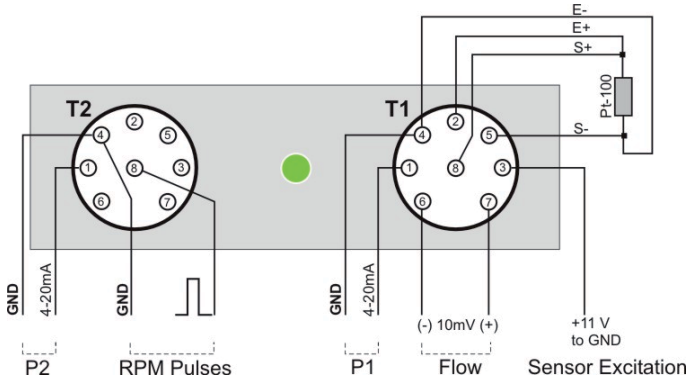
7 TERMINALS

7.1 Plugs T1 and T2



T2			T1		
1	P2	4-20mA	1	P1	4-20mA
2			2	Pt-100	(E+)
3			3	+11 V	Excitation
4	GND		4	GND	
5			5	Pt-100	(S-)
6			6	10mV	(-)
7			7	10mV	(+)
8	Pulses		8	Pt-100	(S+)

7.2 Connecting of Process Sensors P1, P2, Q, T, RPM



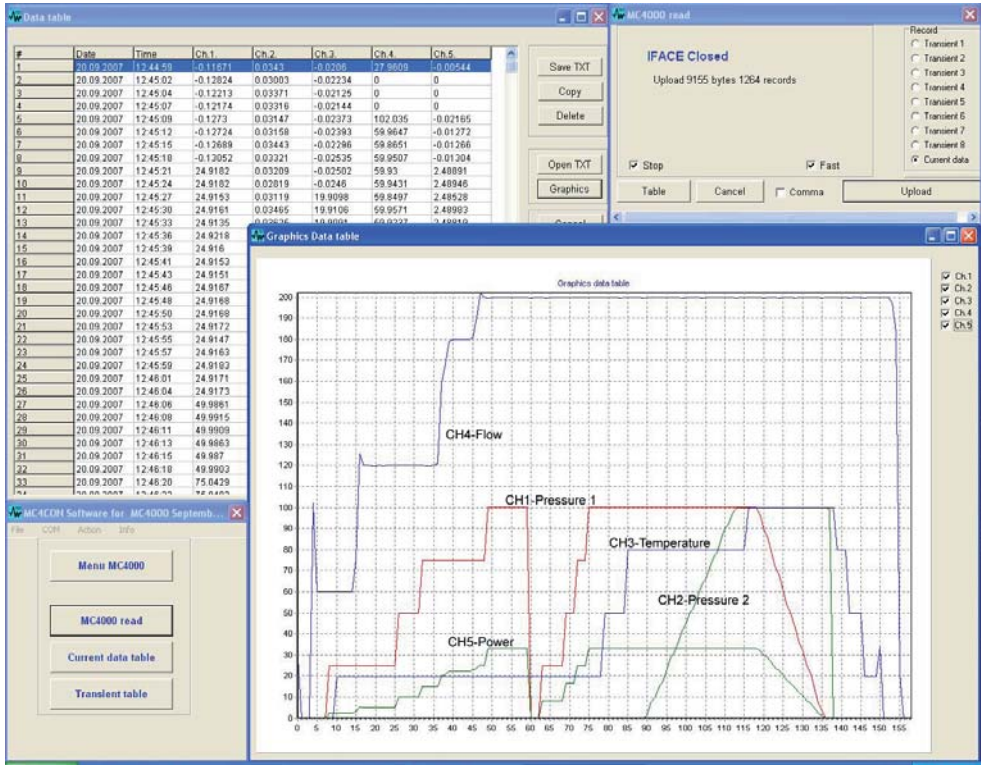
7.3

Single cable type: see below for P2/Q2 or RPM	**Multi cable type: PQT403SA for P1, Q1, T**

Pressure:	**PML403SA (L= 3m)**
	PML406SA (L= 6m)
	PML410SA (L= 10m)
Flow	**QML403SA (L= 3m)**
Revolution	**NML403SA (L= 3m)**

Explanation: **P=** pressure **ML=** measuring Lead, **4** = series, **03** = L 3m, **A** = Amphenol-socket.

6.5 Record of 4 Signal Channels and calculated Power.



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Hand Held Service instrument with data logger for
pressure, min / max & differential pressure, temperature, flow / rpm and hydraulic horsepower

Five sensor inputs for:

2 pressure transmitters 0…10 000 psi
1 temperature sensor -40°F… 350°F
1 turbine or gear flow sensor 0…350 US gal / min
1 speed sensor up to 60 000 rpm
min / max & differential pressure P1-P2
hydraulic horsepower calculation

Features:

up to 2.5 MB data logging storage (560 000 values)
add. 8 peak pressure storage memory, recording rate 1 kHz (260 000 values)

6.4 Setting Parameters from the PC

The Datalogger MC4000 can be programmed from the PC by using ***MC4000.men*** from the software package ***MC4CON***. A mouse click at ***Menu MC4000*** will open the ***Menu MC4000 Setup***:

Activate the ***Menu MC4000*** in the **MC4CON**.

Menu MC4000 Setup with ***Noname*** appears.
Switches OPEN, CANCEL, READ and SEND are available:

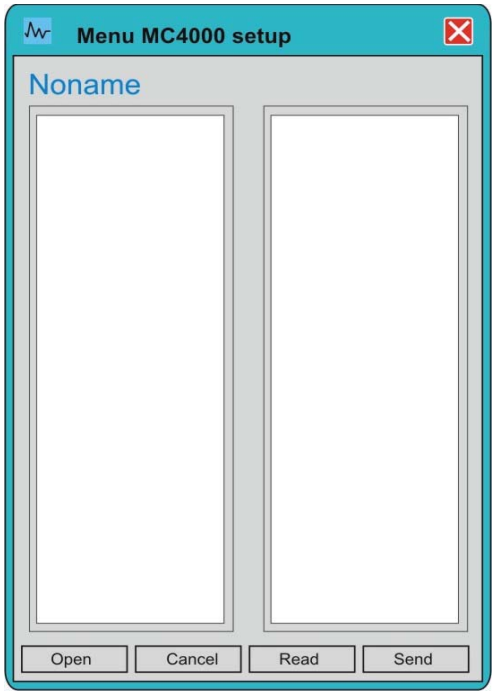
Open Opens the Communication File
Cancel Closes the window
Read Displays the memorized parameters in MC4000
Send Transmits parameters from the PC into MC4000

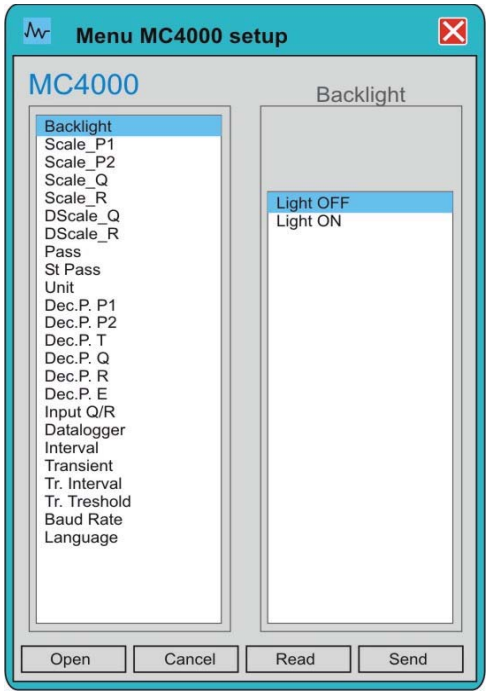
The software package ***MC4CON*** contains the Communication File ***MC4000.men***.

Open In the *Device Select* open the File ***MC4000.men***. The left window shows the parameters.

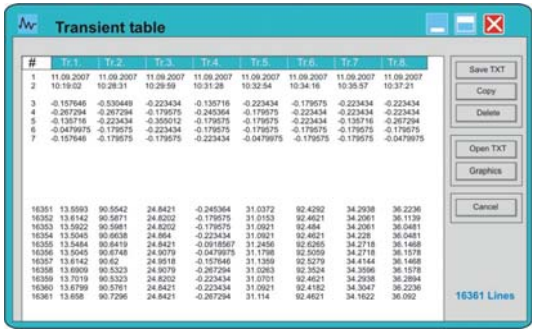
Read Select the parameter in the left window and click at ***Read***. The value appears in the right window.

Send To change the value of the marked parameter, write the new value and click at ***Send***. The value will be stored in the MC4000.





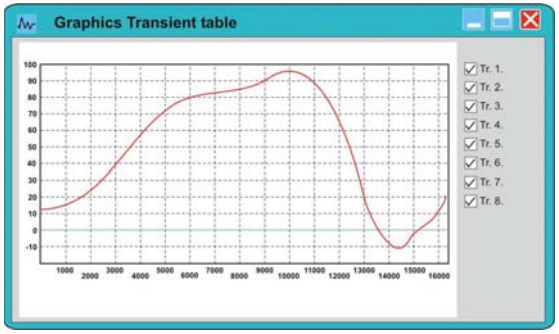
6.3.2 Transient Table



Open the communication with *MC4000 read* in the menu window *MC4CON*. Cross one of the transients and click at UPLOAD.
The stored data will be transferred to the PC and displayed as tables and graphics.

The table contains the measurements in all 8 channels Tr.1 - Tr.8. Each transient contains 16 362 records.

6.3.3 Graphics Transient table



Stored transients are displayed as graphics. More than one recorded transients are displayed in different colours.

The MobilControl MC4000 is a hand held service instrument, powered by an rechargeable battery. The charging time is controlled and indicated with a flashing green LED. With connected mains charger the battery can be charged also during the operation. Optional cable for operation from a car battery 12/24 VDC is available.

1 SPECIFICATIONS

Inputs:
- P1 4-20mA, 13 ohm shunt, pressure sensor, 2-wire terminals operation
- P2 4-20mA, 13 ohm shunt, pressure sensor, 2-wire terminals operation
- T Pt-100, range -50 ... 500.0 °C, temperature sensor, 4 terminals operation
- Q Sinewave 100mV … 5Vp-p, flow turbine, 2 terminals operation, range 0.5Hz ... 10 kHz, scalable
- UPM Positive pulses 5 … 24V, active pick-up, 3 terminals operation, range 30 ... 60 000 rpm scalable

Accuracy: ± (0.1% + 1 digit) from range

Display: Graphic LCD display with back light, 128x64 pixel. The back light can be switched off. With activated back light the operation from the battery is limited.

ADC: 16bit, linearity ± (1 LSB + 1 digit).

Memory: **Peak & Negative Peak** stores the maximum and the minimum of P1 and P2. The stored values can be recalled at the display or the memory can be reset.

Datalogger with standard capacity of 512kB can store up to 16 000 samples in all four signal channels, calculated power, date and time, totally 112 000 measured values. With optional **2MB Memory** up to 80 000 samples in all four channels, calculated power, date and time, totally 560 000 measured values can be stored. The sampling rate is selectable from 2 sec. to 60 minutes.

Eight Transients with 32 768 measured values of the pressure signal channel P1 , totally 260.000 values, can be stored at a rate of up to 1 000 samples per second. The sampling rate can be set from 1 msec to 10 msec. The start level of recording is programmable. Up to eight transients can individually be measured and recorded.

Tara: Tara can be activated in both pressure channels P1 and P2, forcing the display to zero.

Keypad: 9 keys

Excitation: 11V max. 50mA for P1, P2 and RPM measurements

Supply: Battery 6V, 2Ah. Mains Charger 100-240VAC. The charging is controlled and indicated with flashing LED. Fully charged battery permits 4-8 h operation with two pressure sensors connected and the back light switched-off.

Terminals: Two round screw connectors with 8 pin each.
USB Data Terminal type USB A-USB B
Battery charger plug Texas type. EU, UK or US models / adaptors available.

2 MEASURING MODE

The Datalogger MC4000 is put into operation with the key ON. The display shortly shows the logo followed with the instrument's identification, self-diagnosis, software version and serial number, battery capacity, date and time and free memory storage capacity available. After this the display changes into the measuring mode. The screen is divided into four windows. The two left windows are assigned to two pressure sensors, the right upper window measures the temperature and the right lower window shows the flow or the rpm. The flow or the rpm are menu selectable. Not connected sensors are indicated with horizontal lines (----).

2.1 Function of keys MENU, ESC and SET

The key **MENU** opens the menu. With the same key the menu scrolls at the display. If continuously pressed, the menu automatically scrolls in 1 second intervals.

The key **ESC** permits backwards steps in the menu. After three steps the display terminates the menu and switches back into the measuring mode.

The key **SET** activates Tara in both pressure channels P1 and P2:

>OFFSET	P1	SET	Tara P1 is activated and sets the display to zero
OFFSET	P1	RESET	Tara P1 is deactivated
OFFSET	P2	SET	Tara P2 is activated and sets the display to zero
OFFSET	P2	RESET	Tara P2 is deactivated

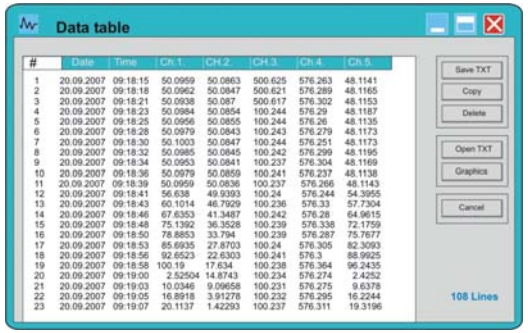
6.3 Reading of the stored Data

Select ***MC4000 read*** from ***MC4CON.*** Select the required memory slot for *Transients* or the *Datalogger Current Data*, cross ***Fast*** and click ***Upload***. The Data will be transferred to the PC.

IMPORTANT
The Baud Rate of the Datalogger and the PC must be identical.

By selecting of the ***Current Data Table*** the memorized Datalogger measurements are transferred to the PC. By selecting of the ***Transient Table*** one of the selected transients will be transferred to the PC. If more transient slots contain records, they have to be transferred one after the other.
At the transmission end of the recorded ***Current Data Table*** or the ***Transient Table*** the measurements will be displayed as tables and graphics. The graphics are displayed in various colours.
For fast transmission cross ***Fast***. The data from the Datalogger are transferred to the PC after activation of ***Upload***.

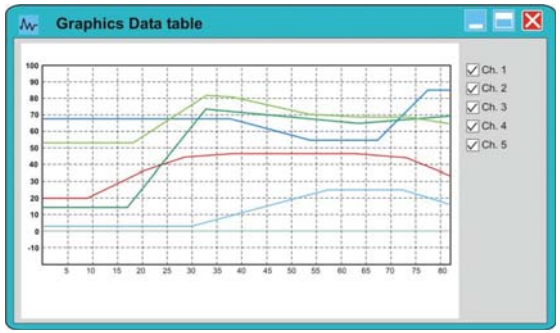
6.3.1 Current Data Table



Open the communication with *MC4000 read* in the menu window *MC4CON*. Cross *Current table* and click at UPLOAD.
The stored data will be transferred to the PC and displayed as tables and graphics.

Data of the day and the real time are automatically added.

The channel 5 displays the power calculated from the Pressure P1 and the flow in the channel 4.



Graphics of the memorized measurements.

6 COMMUNICATION

The bi-directional communication with the PC is supported by the software package ***MC4CON***. The installation at the PC under Windows requires 8MB capacity of the HD.

MC4CON permits bi-directional communication between the PC and the MobilControl MC 4000. The instrument can be fully programmed from the PC in the download mode. In the upload mode all recorded Data and Transients can be transferred to the PC and handled under Windows. The USB port has Baud Rates 9 600, 19 200 and 115 200 bd.

The Baud Rate of the PC and the Datalogger must be identical.

6.1 Communication Program *MC4CON*

The Datalogger is connected to the PC by means of the provided USB cable. ***MC4CON.exe*** at CD is installed at the PC and the program opened.

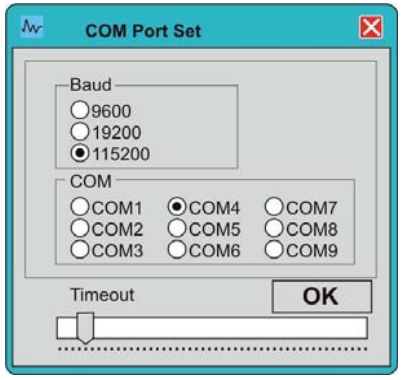
Menu MC4000: *MC4000.men* in the *File* permits setting of all Datalogger parameters from the PC. In the upload mode all parameters from the Datalogger can be transferred to the PC, modified there upon demand and downloaded back to the Datalogger MobilControl MC 4000 and stored there.

MC4000 read: The stored data in MC4000 can be uploaded to the PC as tables and graphics.

Current Data Table: The stored data in all five channels are uploaded to the PC and displayed as tables and graphics.

Transient Table: The recorded transients in all eight memory slots are uploaded to the PC and displayed as tables and graphics.

6.2 Setting of the Data Port Parameters



BAUD: Baud Rate 9 600, 19 200, 115 200 bd

COM: Available COM-Port of the PC

TIMEOUT: The Timeout will be set to approx. 10%. This setting is available due speed variety of different PCs. The Timeout setting of 10% as shown is suitable for the majority of PCs at the market.

OK: The setting has to be confirmed with OK.

2.2 Function of keys UP and DOWN

The keys **UP** or **DOWN** permit selection of following modes:

- Peak & Negative Peak, Pressure Difference, Power
- Large Display Mode of P1 or P2
- Large Display Mode of Temperature
- Large Display Mode of Flow or RPM

MEASURING MODE with the key UP

MEASURING MODE with the key DOWN

2.3 Function of keys LEFT and RIGHT

LEFT: Reset of the Peak & Negative Peak Memory

RIGHT: Return to the Measuring Mode

3 MENU

The key **MENU** opens the instrument's menu. The same key scrolls the menu at the display. The parameters are protected with a password. Without password the function of Datalogger, the recording of the transients and the display back light can be activated.

The menu positions can be changed with the arrow keys. The new setting is stored with the key **OK**. The display response with *STORE*. The key **ESC** permits scrolling the menu backwards at the display. This key permits three backwards steps before the display changes back into the measuring mode.

The first step in the menu is the Datalogger Memory. It can be activated, closed or erased.

DATALOGGER M
STORE OFF

Selection: STORE OFF
STORE ON
STORE DELETE

With MEMORY ON the recording intervals can be selected:

STORE INTERVAL
2 sec

Selection: 2 sec, 5 sec, 15 sec, 30 sec, 60 sec, 120 sec, 300 sec, 600 sec,
1 200 sec, 1 800 sec, 2 700 sec, 3 600 sec, 7 200 sec

Eight memory slots N1-N8 are available for fast transient measurements in the Pressure channel P1. Each memory slot can individually be activated and the content shown at the display as graphics. The memory slot can be erased and new measurements initialized.

TRANSIENTS
NO 1 OFF

Selection: NO 1 SHOW
NO 1 START
NO 1 DELETE

TRANSIENTS
NO 2 OFF

Selection: NO 2 SHOW
NO 2 START
NO 2 DELETE

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TRANSIENTS
NO 8 OFF

Selection: NO 8 SHOW
NO 8 START
NO 8 DELETE

Eight transient memory slots are available. Each slot has a capacity of 32 000 samples.
Sample rate of 1 msec permits 32 seconds recording time.

By selecting **DISPLAY** the stored measurements will be displayed as graphics.

By selecting **ERASE** the memory will be erased and the stored information lost.

By selecting **MEASUREMENT** the recording starts.

SAMPLING RATE
1 msec

Selection: 1 msec, 2 msec, 5 msec,
10 msec

THRESHOLD
SIGNAL > 10%

Selection: >10%, <10% ….. >90%, <90%
The recording begins when the signal value is larger than the selected level. When the recording has to start at zero signal level, the value <10% has to be selected.

BACKLIGHT
LIGHT OFF

Selection: LIGHT ON
LIGHT OFF
When the back light is switched-on, the power consumption from the battery is large and the operation time of the Datalogger shorter.

5 ADDITIONAL READINGS

5.1 Peak & Negative Peak

During the entire instrument's operation the maximum and the minimum measurement in signal channels P1 and P2 are automatically memorized. They can be recalled at the display with the key UP or DOWN. The key UP recalls the maximum of P1 and P2. The small arrows at the display point up. The key DOWN recalls the minimum of P1 and P2. The small arrows at the display point down.

5.2 Pressure Difference

In the upper right window the display shows the pressure difference between P1-P2. Both sensors must have the identical max presssure range, i.e. both sensors max 400 bar. The both left windows show the stored maximum and minimum readings.

5.3 Power

The lower right window shows the momentary value of power measured in units selected in the menu (EU, UK, US). The pressure units are *bar* or *psi*, the temperature *°C* or *°F* and power calculations *kW* or *HP*. It is important that the pressure is entered and scaled in correct units (bar, psi) - see § 3 - menu steps SCALE P1 and SCALE P2.

Example
Pressure 100 bar, Flow 200 LPM

Flow Q: 200 LPM (Pulses from the flow turbine)
Pressure P1: 100 bar (4-20mA = 0-100 bar from the pressure transducer P1)

Power = Pressure P x Flow Q : 600

PW = 100 x 200 : 600 = 33.33 kW (DIN)

When the pressure and the flow are programmed in UK or US units, the power is calculated in HP:
UK gal = 4 546 Litre
US gal = 3 785 Litre
1 bar = 14,225 psi

PW = 1422.5 x 43.99 : 1432 = 43.7 HP (UK)
PW = 1422.5 x 52.84 : 1720 = 43.7 HP (US)

The beginning of recording is announced with a short acoustic sound signal. The recording stops automatically after the 32 000 samples are stored.

The records are displayed as graphics.

TRANSIENTS
NO 1 SHOW

Selection: NO 1 SHOW

Eight transients can be stored, each with 32 000 measurements. At the selected sampling rate of 1 msec the recording time takes 32 seconds. The sampling rate is selectable from 1 msec to 10 msec.

The recording starts with the selection **MEASUREMENT**.
By selecting **DISPLAY** the recorded data appear at the display as graphics.
By selecting **ERASE** all data in the memory will be erased.

Recording Rate:

SAMPLING RATE
1 msec

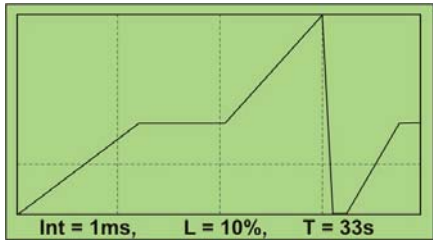
Selection: 1 msec, 2 msec, 5 msec, 10 msec

The recording will be initialized as soon as the input signal exceeds the level programmed in the menu:

THRESHOLD
SIGNAL <10%

Selection: >10%, <10% ….. >90%, <90%
The recording starts as soon as the input signal exceeds the selected level. For records which have to begin at zero signal level, the value <10% has to be selected.

At the end of the record cycle the display automatically shows the graphics corresponding to the stored transient.



SET PASSWORD
P 1001

Selection: P1001, P2010, P0102, P1201, P2021, P0121, P1020, P2100, P0002, P1200, P0001, P1010, P2102, P0201, P1021, P2121, P0020, P1100, P2002, P0200.
The entry into the menu is possible only with a correct password. The suitable password will be selected in menu step PASSWORD NEW as one of 20 memorized number combinations. With incorrect password the setting of parameters is locked.

DATE AND TIME
09:16:57
04.07.08

Selection: Hours : Min : Sec
Day : Month : Year

SCALE P1
+ 100.00

Scaling for pressure sensor P1. The flashing digit can be selected with the horizontal arrow, the value with vertical arrow. The scaling corresponds to the pressure P1 at the sensor output of 20mA.

DEC. POINT P1
CCC.d

The display resolution can be set. The floating point arithmetic moves the decimal point automatically when the display arrives at the full range.

SCALE P2
+ 200.00

Scaling for pressure sensor P2. The flashing digit can be selected with the horizontal arrow, the value with vertical arrow. The scaling corresponds to the pressure P2 at the sensor output of 20mA.

DEC. POINT P2
CCC.d

The display resolution can be set. The floating point arithmetic moves the decimal point automatically when the display arrives at the full range.

SEL. FLOW-RPM
SELECT FL-1

Selection: OFF Disabled
FL-1 Flow Q1 Channel 1
RPM Revolutions / min. in Channel 2
FL-2 Flow in Channel 2
Select: FL-1 Flow Q1 Channel 1
SCALE Q1 max l/min turbine range
DSCALE Q1 max l/min Hz value from label. of the flow turbine = actual calibration factor

SCALE FLOW-1
+ 1.00000

DSCALE FLOW -1
+ 1.00000

DEC. PO. FLOW -1
CCC.d

SEL. FLOW-RPM
SELECT FL-2

Select: FL-2 Flow Q2 Channel 2

SCALE Q-2 max. l/min turbine range
DSCALE Q-2 max l/min Hz value from label of the gear flow meter = actual calibration factor

SCALE FLOW-2
+ 1.00000

DSCALE FLOW-2
+ 1.00000

DEC. PO. FLOW-2
CCC.d

SEL. FLOW-RPM
SELECT RPM

Select: RPM Revolutions / min Channel 2

SCALE 1
DSCALE 1 with 1 diamond grade reflex mark, or: 2,3,4 according to numbers used

SCALE RPM
+ 1.00000

DSCALE RPM
+ 1.00000

DEC. POINT T CCC.d	Display resolution of Temperature.
DEC. POINT E CCC.d	Display resolution of Power.
UNITS EU	Selection of Norms: EU, US, UK
BAUD RATE BD 115200	Communication Speed: 9 600, 19 200, 115 200 bd.
NEW PASSWORD P 1001	Selection of Password: P1001, P2010, P0102, P1201, P2021, P0121, P1020, P2100, P0002, P1200, P0001, P1010, P2102, P0201, P1021, P2121, P0020, P1100, P2002, P0200.

The password selected in this menu step has to be used by entering into the menu in order to change the parameters. Without password only the function of Datalogger and Transient Recorder is available. The process parameters remain locked.

LANGUAGE ENGLISH	Language: GERMAN, ENGLISH

The menu is terminated when the key ESC is pressed three times. The display changes back to the 4-channel measuring mode.

4 DATALOGGER

4.1 Recording of Measurements

All measurements shown at the display can be recorded in the internal memory. The serial USB data port permits the upload of the stored data to the PC and their processing under Windows / Excel.

4.2 Activation of the Memory

In the first menu step the Datalogger Memory can be activated, closed or erased.

DATALOGGER M STORE OFF	Memory is deactivated
DATALOGGER M STORE ON	This command initializes the recording. The data are recorded at the selected interval rate. The date and the time are automatically added from internal RTC to each record.
DATALOGGER M STORE DELETE	This command erases the memory. All records will get lost.

4.3 Selection of the Recording Interval

The interval is the time between two consecutive recording cycles.

STORE INTERVAL 2 sec	Selection: 2 sec, 5 sec, 15 sec, 30 sec, 60 sec, 120 sec, 300 sec, 600 sec, 1 200sec, 1 800 sec, 2 700 sec, 3 600 sec, 7 200 sec

4.4 Fast Transients of the Pressure Channel P1

Up to eight transients in the Pressure Channel P1 can be recorded. Eight memory slots N1-N8 are available. Each memory slot has a space for 32 000 samples. The stored transients can be displayed at the front LCD display or uploaded to the PC for further Windows operations. The Memory slots can be erased upon demand.

TRANSIENTS NO 1 OFF	Memory deactivated

Before the new record is initialized, the memory has to be erased.

TRANSIENTS NO 1 DELETE	Selection: NO 1 DELETE

The recording begins when the measured signal exceeds the selected Threshold - see Threshold.

TRANSIENTS NO 1 START	Selection: NO 1 STARTING the RECORD