MultiSystem 4010

Universal Portable Measuring System

Operating Instructions

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Contents

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1. Safety

1.1. General Safety and Warning Hints

- Never cut, damage or modify the power pack cables or place things on it.
- Never touch the power pack with wet or moist hands. Only connect the power pack to power supplies for which it is suited (see technical data).
- Unplug the mains cable during a thunderstorm, or if you determine smoke or smell, or if the mains cable is damaged.
- Assure sufficient grounding of your installations. Inadequate grounding may lead to measuring peaks.

1.2. Hints for the Use of the Measuring Instrument

- Never expose the instrument to excessive heat or moisture; obtain the technical data.
- Do not store the instrument in humid or dusty locations or at temperatures below freezing point.
- Never dip the instrument into water or other liquids. Never let liquids come into the instrument.
- Never open the instrument and do not use it, after it fell down or the housing is damaged.
- Avoid strong magnetic fields. Keep distance of electric motors or other instruments that generate electro-magnetic fields. Strong magnetic fields may cause malfunctions and influence measuring values.
- Avoid the formation of condensed water. If condensed water has formated you should let the instrument acclimate before you switch it on. Otherwise it could be damaged.

1.3. Hints for the Use of Sensors and Cables

- Protect the sensors from exceeding the allowed power range, mechnical overload and wrong pin assignment.
- Assure to enter the sensor parameters correctly when using sensors without ISDS (Intelligent Sensor Detection System).
- The measuring cables MK 01 and MKS may not be lengthened. Otherwise the shielding will be interrupted.
- The data of an ISDS sensor are read into the measuring instrument during switch-on procedure. If you connect new sensors, you will have to switch the instrument off and on.

1.4. Hints for the Use of rechargeable Batteries

- Keep batteries away from heat sources and open fire.
- Never dip batteries into water.
- Never short-circuit the contacts of batteries.
- Never dismount, repair or modify batteries.
- Use only batteries that are mounted or delivered by the manufacturer.
- Load only the battery while it is mounted in the instrument.
- Used batteries are special waste. Cover the contacts with insulation tape.

2.   Introduction

> **Important Information**
>
> *The information contained in this section is important. If you neglect them, you might loose possible guarantee demands.*

2.1.   Range of Validity

The manual on hand is valid for measuring instruments named "MultiSystem 4010". It adresses to the operator of this instrument, that means the person, who works with the instrument.

The manual is not a technical manual. Please contact our service staff for questions, that exceed the contents of this manual.

2.2.   Copyright

The measuring instrument and this manual are protected on copyright. Manufacture without license will be prosecuted by law. All rights reserved on this manual, even the reproduction and/or duplication in any thinkable form, e.g. by photocopying, printing, on any data recording media or translated. Reproduction of this manual is only permitted with a written approval of the manufacturer.

The technical state by the time of delivery of instrument and manual is decisive, if no other information is given. Technical changes without special announcements are reserved. Earlier manuals are no longer valid.

The general conditions of sale and delivery of Hydrotechnik GmbH are valid.

2.3.   Limitation of Liability

We guarantee the faultless functioning of our product in accordance with our advertising, the product information edited by Hydrotechnik GmbH and this manual. Further product features are not guaranteed. We take no liability for the economy and faultless function if the product is used for a different purpose than that described in the chapter „Use as agreed".

Compensation claims are generally impossible, except if intention or culpable negligence by the manufacturer is proved, or if assured product features are not provided. If the product is used in environments, for which it is not suited or which do not represent the technical standard, we are not responsible for the consequences.

We are not responsible for damages at installations and systems in the surroundings of the product, which are caused by a fault of the product or an error in this manual.

We are not responsible for the violation of patents and/or other rights of third persons outside the Federal Republic of Germany.

We are not liable for damages, which result from improper operation according to this manual. We are not liable for missed profit and for consecuting damages due to non regardance of safety advice and warning hints. We don't accept liability for damages which result from the use of accessoires which are not delivered and/or approved by the manufacturer.

Hydrotechnik products are designed for a long life. They represent the standard of technique and science and were checked on all functions individually before delivery. The electrical and mechanical

construction corresponds to the current norms and regulations. The manufacturer is doing product and market research for the further development and permanent improvement of their products.

In case of faults and/or technical trouble please contact the Hydrotechnik service staff. We assure that suitable measures will be taken immediately. The Hydrotechnik GmbH guarantee regulations are valid, which we will send to you on demand.

2.4. Use as Agreed

The measuring instrument "MultiSystem 4010" is a mobile hand-held device for the collection, recording and evaluation of measured data, coming from sensors connected to the instrument. You may connect various sensors to the instrument that correspond with the requirements stated in the section „Technical Data".

Any other use of this measuring instrument is regarded as „not intented use". Please contact our service staff if you have questions exceeding the contents of this manual or if you want to use the device for a different purpose. We will be very much pleased to help you.

2.5. Warranty Regulations

In accordance to our warranty regulations we guarantee the condition without defects for this measuring instrument for a duration of six months. Wearing parts and storage batteries are excepted from this warranty. The warranty is spoiled if repair work or interventions are executed by unauthorized persons.

Within the warranty period we repair damage or defects which are caused by a manufacturing fault. We only accept warranty claims if they are reported to us immediately after their discovery, but latest six months after delivery. The warranty benefit is by our choice through repair of defective parts or replacement by intact parts.

Send your instrument with an invoice copy or delivery note copy to our service department. The address is given at the end of this manual.

2.6. Obligations to the Customer

The operating authority of this product has to assure, that only persons who

- know the regulations on working safety and accident prevention
- have been instructed in the operation of this product
- have read and understood this manual

can operate this product. Persons who operate this instrument are obliged to

- obey all regulations on working safety and accident prevention
- read this manual completely, especially the safety instructions in the first chapter.

2.7. Authorized Personnel

Persons are authorized if they have a professional education, technical experience, knowledge of the important norms and regulations and if they are able to estimate their duties and recognize possible danger at an early time.

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Operator of the instrument

Persons are authorized if they are trained in the operation of the instrument and have read and understood this manual completely.

Personell for installation and maintenance

Persons are authorized if they are trained in all aspects of the instrument and have read and understood this manual completely.

3. Description of the Measuring System

3.1. Qualities of the MultiSystem 4010

The MultiSystem 4010 is a practical, user-friendly hand-held measuring instrument for all daily measuring duties. During start-up the device automatically detects connected ISDS sensors and uses all parameters: measuring range, physical measurand, units, output signal and characteristic curve (linearisation). A mix up of sensors or faulty entries are reliably avoided.

You may connect up to five sensors at a time and record their measured values. Five virtual channels may be used for calculations, e.g. as difference, sum, performance or the first derivation (e.g. speed calculated from distance). As an option you may use these channels to show measured values read from a CAN bus. The recording of extreme values (the measured highest and lowest values) is permanently active and can be displayed with one key pressure. You may also connect sensors without ISDS to the MultiSystem 4010. Enter the sensor parameters in the channel menu manually.

It is possible to transfer all measuring series via an USB cord to a PC, or use the online mode to display the values on a computer. The software **HYDRO**com is delivered free and provides extensive software support with functions to evaluate, present and print measured values.

3.2. Inputs and Connectors
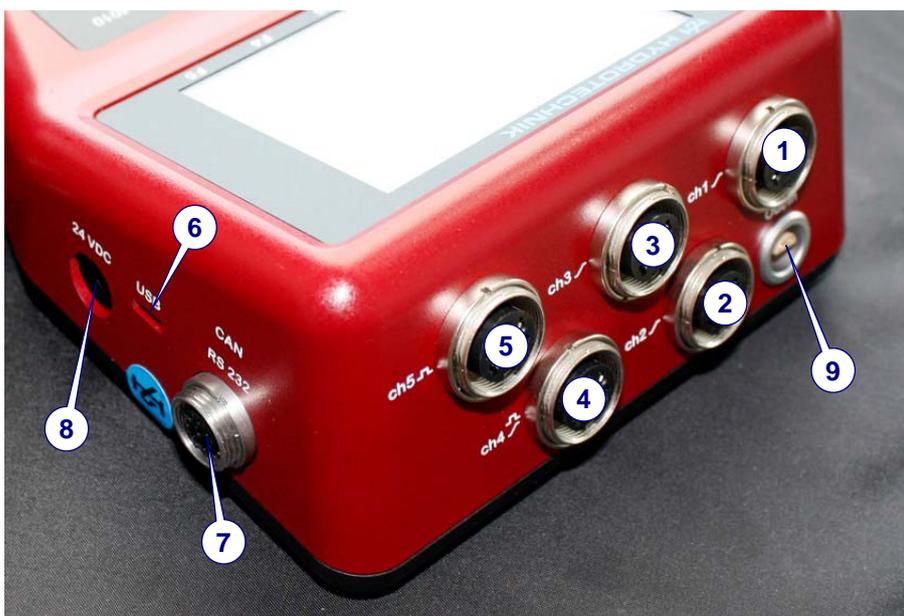
1/2/3   Input ch1 / ch2 / ch3 – analog inputs
4   Input ch4 – combined input analog / frequency
5   Input ch5 – frequency input
6   USB interface
7   Combined jack CAN / **HYDRO**boot
8   Power supply – power pack
9   Digital input / output

3.2.1.   Analog inputs (ch1 / ch2 / ch3)
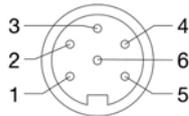
Signal input	20mA (selectable 0 … 20 mA or 4 … 20 mA)
	10 V (selectable 0 ... 10 V or 2 ... 10 V
Resolution	12 bit analog / digital converter
Measuring rate	1.0 ms = 1 kHz
Filter function	input filter 5 kHz
Connector	6 pole device jack
Protection type	IP40
Error limits	< ± 0.2 % of final value
Linearity error	< ± 0.1 % of final value
Temp.coefficient	0.1 % per 10 °C

Pin assignment

Pin	Function	Ri.	Ci.	Limitation	Protection type
1	Signal I [mA]	50 Ω	100 nF	5.6 V DC	transile diode
2	GND				
3	Ub*			100 mA	current limitation
4	Signal U [V]	11 kΩ	22 nF		transile diode
5	Shield				
6	ISDS				

Ub*: supply voltage at mains operation 24 V DC

3.2.2.   Combined input analog / frequency (ch4)
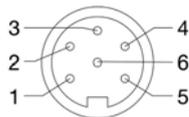
Signal input	switchable analog- / frequency input; selectable 0 … 20 mA / 4 … 20 mA)
	f-input (0.25 Hz … 5 kHz w.d., 0.25 Hz … 20 kHz wo.d.), signal type PNP
Resolution	12 bit analog/digital converter
Measuring rate	1 ms (1 kHz)
Filter function	input filter 5 kHz

Connector	6 pole device jack
Protection type	IP40
Error limits	≤ ±0.15 % of final value (analog) / ≤ ±0.05 % of measured value (frequency)
Linearity error	≤ ±0.10 % of final value (analog) / none (frequency)
Temp.coefficient	≤ 0.1 % per 10 °C (analog) / none (frequency)

Pin assignment

Pin	Function	Ri.	Ci.	Limitation	Protection type
1	Signal I [mA]	50 Ω	100 nF	5.6 V DC	transile diode
1	Frequency signal	4.75 kΩ	1 nF	36 V DC	VDR transile diode
2	GND				
3	Ub*			100 mA	current limitation
4	Direction signal	4.75 kΩ	1 nF	36 V DC	VDR transile diode
5	Shield				
6	ISDS				

Ub*: supply voltage at mains operation 24 V DC
1: channel set to analog measurement
2: channel set to frequency measurement

3.2.3. Frequency / counter input (ch5)
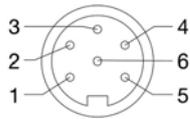
Signal input	5 ... 30 VDC, 0.25 Hz … 5 kHz w.d., 0.25 Hz … 20 kHz wo.d., signal type PNP and NPN
Connector	6 pole device jack
Protection type	IP40
Error limits	≤ ±0.05 % of measured value

Pin assignment

Pin	Function	Ri.	Ci.	Limitation	Protection type
1	Frequency signal	4.75 kΩ	1 nF	36 V DC	VDR transile diode
2	GND				
3	Ub*			100 mA	PTC
4	Direction signal	4.75 kΩ	1 nF	36 V DC	VDR transile diode
5	Sield				
6	ISDS				

Ub*: supply voltage at mains operation 24 V DC

3.2.4. Digital trigger input (ch6)
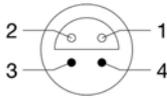
Pins of the digital input/output; the trigger input is separated galvanically.

Pin assignment

Pin	Function	Limitation	Protection type
3	Signal*	33 V DC	VDR transile diode
4	GND		

*: 1 mA constant current

	Attention
⚠	**Damage to the instrument possible!** *This input may not be connected to inductive consuments directly (e.g. coil of a magnetic valve). Otherwise the instrument can be damaged.*

3.2.5. Digitaler trigger output (ch7)
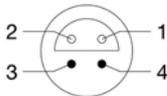
Jacks of the digital input / output.

Pin assignment

Pin	Function	Limitation	Protection type
1	GND		
2	Signal	Ub*/10 mA	VDR transile diode

3.2.6. Interface CAN / RS232
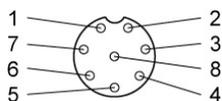
Use   CAN, MultiXtend, HYDROboot
Connector   8 pole M12-1 jack
Protection type IP40

Pin assignment

Pin	Function
1	GND
2	power supply for MultiXtend or CAN sensors*
3	DTR
4	CAN_H
5	TXD
6	RTS from PC (input)
7	GND
8	RXD

*: ~ 21.5 VDC / 200 mA (mains operation) / ~ Ub / 200 mA (battery)

3.2.7. USB interface

Micro USB interface for PC communikation

Function	Color	Remarks
Signal D+	green	twisted cable
Signal D–	white	twisted cable
VCC	red	delivers max. 500 mA from host for device power supply (not used by instrument)
GND	black	–

3.3. Display

The instrument has a color display where all information and measured values are displayed. Some icons may be displayed in the bottom line:

Recording bar   indicates a running recording:

08%   trigger recording not started, filling the pretrigger memory

20%   trigger incident not happened, pretrigger is full

75%   recording in progress

SD   SD card: a formatted SD card is inserted

⟵⟶   USB: instrument connected to a PC via the USB interface

▮ ▯   batteries: charging status of the batteries; recharging required when icon is red

⏻   mains operation: batteries are being recharged

During normal operation either the battery or the mains operation icon is displayed. If the battery icon flashes during mains operation, either no batteries are built in, they are defective or deeply discharged, or the battery cable is not connected properly.

3.4. Keyboard

The MultiSystem 4010 is equipped with a valuable keypad that is insensitive against humidity and dirt. The 26 keys are occupied as follows:

F1 ... F5   Function keys; the current occupation is shown in the bottom line of the display above the corresponding key

ON OFF   Keys to switch the instrument on and off

    Cursor keys; move highlighting bars or the cursor into the desired direction

ENT   Enter key; confirms entries or commands

MENU   Menu key; opens the main menu from where all instrument functions are accessible

ESC   Escape key; aborts entries or commands
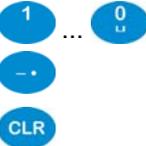
1 ... 0   Ten key pad; used to enter numbers and letters

–·   Key to enter punctuation marks and special characters

CLR   Clear key to delete a single character during entries

3.5.   Evaluation Software

⚠️	**Important** **Instrument not compatible with elder software versions!** *Use* **HYDRO***com* **6** *with at least version 6.3.0.20 for the communication with the MultiSystem 4010. Otherwise the measuring data cannot be transferred correctly. The current version is contained on the data CD of your instrument or in the dowload section of www.hydrotechnik.com.*

The evaluation software **HYDRO***com* is part of the delivery. After transfering the measuring data to a PC you may use the application to evaluate, process and present them.

3.6.   Technical Data

Casing	ABS plastic
Weight	841 g
Protection type	IP40
CE-label	complies with EN 50 081-1 and EN 50082-1 – RoHS
Power supply	internally: NiMh batteries, 14.4V / 2,150 mAh; externally: 24 V DC / 630 mA
Dimensions	225 x 123 x 60 mm (L x W x H)
Interfaces	USB 2.0, CAN, RS232
Environmental temperature	0 … +45 °C
Relative humidity	0 … 80% (not condensing)
Storage temperature	-20 … +50 °C
Value display	5 digit
Trigger	channel, key
Scan rate	settable from 1 ms to 999 min
Measuring rate	1 ms (1 kHz)
Memory	SD carde 2 GB, max. 100 measuring series max. 4 MB / measuring series (1 million values)
Error limits	analog: ± 0.2% of final value; digital: ± 0.02 % of measured value

4. Start-up

4.1. Check Delivery

The measuring instrument is delivered by Hydrotechnik and transported by suited shipping companies. At the time of delivery you should check:

• Does the number of delivered items corresponds with the Hydrotechnik delivery note?
• Is the packing free of visible damage?
• Are measuring instrument and accessories free of visible damage?
• Are there any indications of rough treatment during transportation (e.g. burn marks, scratches, color)?

To maintain all demands against the shipping company you should document all possible transportation damage (e.g. by taking photos and signing a written protocol), before you put the instrument into operation.

Hydrotechnik is not responsible for transportation damage and will take no liability.

4.2. Lieferumfang

Carefully remove the transportation packing. Please obtain all rules and regulations for the disposal of packing materials. After unpacking you should find the following parts:

• Measuring instrument MultiSystem 4010, 3160-00-75.00
• CD with software **HYDRO**com, 8874-16-00.01
• Power pack, 230 VAC / 24 VDC, 625 mAh, 8812-20-02.00
• USB data transmission cable, 8824-F8-01.50

Check the range of delivery in accordance to the delivery note and the order documents. Report differences instantly to Hydrotechnik. Later claims on incomplete delivery cannot be accepted.

4.3. Charge Batteries

	Attention
⚠	**Battery performance endangered!** *Charge the instrument batteries for 14 to 16 hours before you put the instrument into operation. Otherwise there is the danger of excessive discharge, which would influence the battery performance negatively.*

The internal NiMH batteries of the instrument are charged when the device is connected to mains power with a Hydrotechnik power pack. The batteries are slightly pre-charged and should be charged for 14 to 16 hours before the instrument is put into operation. Empty batteries are indicated with a flashing battery icon in red color.

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Hints for the treatment of the batteries

The life cycle of NiMH cells can be very long, but it depends on the conditions of use. Avoid a complete discharge, continuous charging and immediate re-charging after every use. This triggers the memory effect with a minimization of the battery capacity and possible remanent damage. You can regenerate the battery by several discharge and charge cycles.

In case of low battery power a hint "Load batteries" will be displayed. In this case you should maintain a 16 hour charging time. In case of longer periods without use you should discharge and charge the batteries monthly.

5. First Steps

This section provides information for the daily use of the instrument. These operations are explained:

- switch instrument on and off
- select operation language
- connect sensors
- enter sensor parameters
- collect measuring data
- connect to a PC and transfer measuring data
- delete measuring data
- reset the instrument

After this chapter you will find a complete description of the instrument software with a chronological presentation and explanation of all menus.

	Information
	*The software **HYDRO**com is part of the delivery but will not be described in this manual. Please see the online help and the software manual.*

5.1. Switch Instrument On and Off

	Information
	Assure before switching on that the desired ISDS sensors are connected (see section 5.4 on page 16).
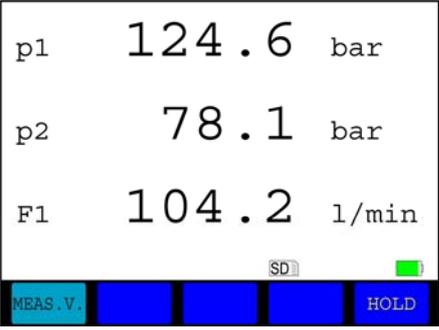
Switch on: ON (> 2 sec.)	p1 124.6 bar
Wait for the self-test until the measured values are displayed	p2 78.1 bar
Use the instrument	F1 104.2 l/min
Switch off: OFF (> 2 sec.)	MEAS.V. HOLD

	Information
i	*When using ISDS sensors the sensor parameters will be set automatically. When using other sensors you will have to program the parameters before you can execute measurements.*

5.2.   Select Operation Language

	Device (1/2)
Open function: MENU ⇕ [Device] ENT ENT	Language English
	Date 07.06.11
	Time 10:47
Do selection: ⇕	ISDS Ja
	Units SI
Confirm selection: ENT	Filter Inactive
	Filter settings ▸▸
Accept changes: F5	
	CAN SETUP INFO OK

5.3.   Set Date and Time

	Device (1/2)
Open function: MENU ⇕ [Device] ENT	Language English
Highlight item „Date": ⇕ ENT	Date 07.06.11
	Time 10:47
Enter and confirm date: 0 7 0 6 1 1 ENT	ISDS Ja
	Units SI
Highlight item „Time": ⇕ ENT	Filter Inactive
	Filter settings ▸▸
Enter and confirm time: 1 0 4 7 ENT	
Accept changes: F5	CAN SETUP INFO OK

5.4. Connect Sensors

1. Switch the instrument off.
2. Connect the desired sensors to the inputs (see section 3.2 on page 6).
3. Switch the instrument on.

5.5. Enter Sensor Parameters

i	**Information**
	The sensor parameters will be detected automatically when you have connected ISDS sensors. You may skip this section.

i	**Information**
	The parameters of sensors without ISDS functionality must be entered manually. You find this information on the type plate or in the documentation or calibration certificate of the sensor.

Open menu „Channels": MENU ⇔ ENT

Highlight desired measuring channel: ⇔

Start programming: ENT

Highlight menu item: ⇔

Select menu item: ENT

Highlight a setting: ⇔ …   or enter a value,
e.g. 12.5: 1 2ABC -. 5JKL

Confirm setting or value: ENT

Terminate programming: F5

Leave „Channel" menu: ESC

```
                Channels
C1:  p1  0-20mA              0/200
C2:  p2  0-20mA              0/200
C3:  p3  0-20mA              0/200
C4:  Z1  Zähler w.D.         1
C5:  f1  Frequenz n.D.       1
C6:  E1  Trigger-Input
C7:  A1  Trigger-Output
C8:  C1  CAN Id=0x0
C9:  C2  CAN Id=0x0
C10: C3  CAN Id=0x0
C11: C4  CAN Id=0x0
C12: C5  CAN Id=0x0
```

```
             Channel (C1)
Meas. variable   p (bar)
Index variable   1
         Name    C1
  Signal type    0-20mA
Measuring range  0.000        200.0
  Zero point     0.000
  Linearisation  No

                              OK
```

Available variables	the instrument is able to process 37 different measurands, e.g. pressure, temperature and rotational speed; assure to select the measurand of the connected sensor
Index variable	if identic variables are programmed for several channels, they will be indexed automatically in the order of their programming
Name	you may add a name to each measuring channel

Signal type	select the sensor output signal ("0/20 mA", "4/20 mA", "0/10 V", "2/10 V")
Measuring range	enter beginning and end of the measuring range and confirm both entries with ENT
Zero point	press ENT to execute the automatic zero point equalisation; assure that the sensor has no load and press F4 to run the equalisation; a possible zero point deviation will be calculated in the software
Linearisation	you may enter a calibration table for the connected sensor after setting „Yes" at the menu item „Linearisation"; please see the corresponding section on page 23

5.6. Collect Measuring Data

Measured values are collected as measuring series that can be configured in the menu „Memory".

Select function: MENU ⬦ ENT	
Select channels to be recorded: ENT ⬦ ENT	
Confirm selection: F5	
Open recording functions: ⬦ ENT	
Highlight setting: ⬦	or enter a value, e.g. 12.5: 1 2ABC -. 5JKL
Confirm setting or value: ENT	
Terminate programming: F5	

```
                    Memory
         Channels   p1  p2

      Storing time  10     sec
        Scan rate   1      msec

     Trigger event  p1
         Condition  greater
             Value  200.0
        Pretrigger  20%




                                   OK
```
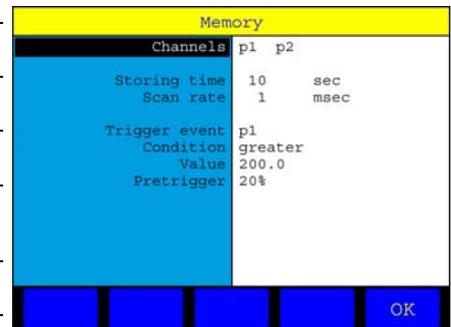
Channels	activate the channels that shall be recorded
Storing time	decide how long measured values shall be recorded and choose the time units
Scan rate	enter the intervals between two measurements and choose the time units

> **Information**
>
> *Storing time and scan rate define, how long and often values are recorded. It is recommended to keep the amount of recorded measuring data as small as possible to ease the later evaluation and presentation.*

|	
Trigger event	a trigger is a condition that must happen before a recording may start or end; here "p1" is defined, that means the recording will start if the p1-value exceeds 200. Please see section 6.6 on page 33 for information on the use of triggers.

5.7.   Connect PC and transfer Measuring Data

	Information
(i)	*The software **HYDRO**com must be installed on your PC before you are able to transfer measuring data.*

1. Switch on measuring instrument and PC.
2. Plug the delivered USB cable into the connector at the side of the instrument (see section 3.2 on page 6).
3. Plug the USB cable into an USB interface of your PC.
4. Wait until the instrument has been detected properly.
5. Execute the data transfer like described in the software manual.

5.8.   Delete Measuring Data

Saved measuring series can be deleted in the delete menu:

Open the function: [MENU] ⇕ [Memory] [F3]	
Select measurement series: ⇕ [ENT]	
Start deletion: [F5]	
Confirm deletion: [F2]	
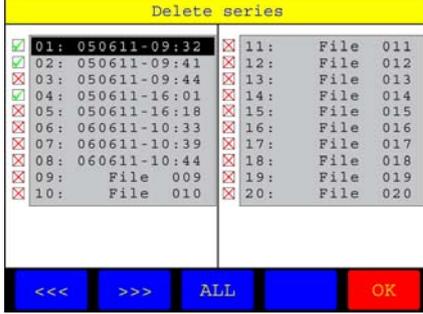
In the shown example the measuring series 01, 02 and 04 are selected for deletion, a green check mark is displayed left of them. Now you may:

[F1]   selects all measuring series for deletion

[F2]   previous page

[F3]   next page

[F5]   deletes the selected measuring series

5.9. Reset Instrument

	Important Information
ℹ️	*All customer-specific parameters and settings (channels, display, memory, presentation, …) and saved measuring data are deleted by a reset.*

```
MultiSystem 4010
      CAN
   Version 1.2
 Time: 11:05:30
 Date: 21.07.2011

   S/N: 4010.4
```

Switch instrument off: OFF

Switch instrument on: ON

Wait until the beginning of the initialization is displayed and then press: 1 2 3

Select the desired language ⇕

Confirm the reset: ENT

```
MultiSystem 4010
      CAN
   Version 1.2
Tim Deutsch :30
Date English 2011
    French

   S/N: 4010.4
```

A red message will be displayed where the reset into the selected language is confirmed.

6. Operation

The operation software of the MultiSystem 4010 is shown and explained chronologically in the following sections.

6.1. General Information

Input is required and possible at many positions within the operation software. Then one of three input types will be required.

Selection from Lists

A list selection is possible, e.g. when selecting the measurand during channel programming:

```
Channel (C1)
Meas. Variable  p (bar)
Index Variable  1  p(bar)
Name            Vo p(mbar)
Signal type     0- p(Pa)
Measuring range 0. p(MPa)  .0
Zero point      0. p(psi)
Linearisation   Ne T(°C)
                   T(°F)
                   U(V)

                          OK
```
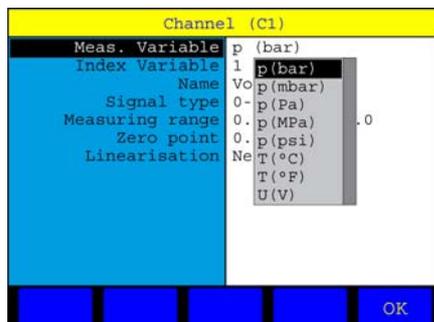
Use the arrow keys to highlight the list desired list item and then press ENT.

Numerical Input

Use the numeric keys of the instrument. Press (··) to enter the decimal point and confirm the input with (ENT). The value „125.2" is entered in this way:

(1) (2 ABC) (5 JKL) (··) (2 ABC) (ENT)

Alphanumeric Input

During the input in options requiring alphanumeric characters, the second occupations of the numeric keys is active. Press a key repeatedly to select the available character:

Number of key pressures

	1x	2x	3x	4x	5x	6x	7x	8x	9x	10x	11x	12x	13x	14x	15x
1	1														
2 ABC	A	B	C	2	Ä	Æ									
3 DEF	D	E	F	3	É										
4 GHI	G	H	I	4											
5 JKL	J	K	L	5											
6 MNO	M	N	O	6	Ö	Ø									
7 PQRS	P	Q	R	S	7										
8 TUV	T	U	V	8	Ü										
9 WXYZ	W	X	Y	Z	9										
-·	–	.	+	,	/	*	(	)	?	!	@	°	:	²	%
0		0	bei 1x Drücken erscheint eine Leerstelle												

Repeat the key pressures quickly, otherwise the cursor jumps to the next digit. Press (CLR) to delete the character left of the cursor.

Move the cursor with the arrow keys and use the four function keys:

(F2) toggles between small and CAPITAL letters

(F3) deletes the last character

(F4) inserts a character left of the cursor

(F5) deletes all characters

6.2.   Measured Value Display

```
p1    124.6  bar       p1    124.6  204.7
                                         12.5

p2     78.1  bar       p2     78.1  144.1
                                         76.9

F1    104.2  l/min     F1    104.2  109.0
                                         101.4
            SD    ▮              SD    ▮
MEAS.V.        HOLD    MINMAX DELETE        HOLD
```

The current measured values are displayed after initialisation. You may select the shown channels in the display menu. Use one of two display modes:

- measured values with units (left image)
- measured values with minimal and maximal values (right image)

The active display mode is displayed in the lower left corner. Press [F1] to toggle the display mode and [F5] to stop the refresh of the values ("freeze" the display). Press [F5] again to enable the refresh.

Press [F2] in MinMax mode to delete the extreme values. Then the new extreme values will be measured instantly.

6.3.   Main Menu

All settings and programmings of the instrument are done in the menu structure accessible from the main menu. Press [MENU] to open it:
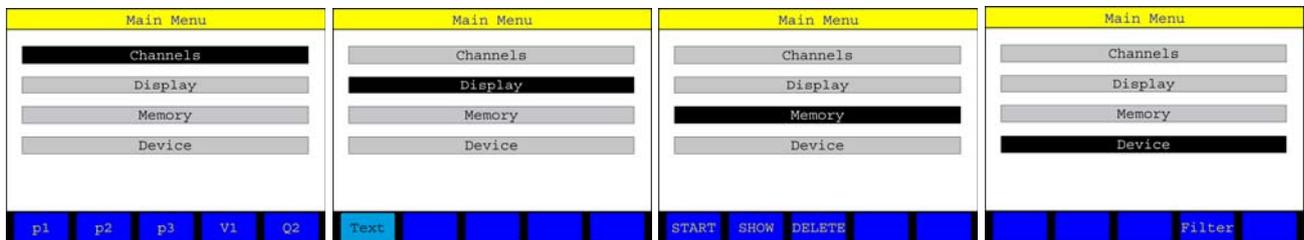
Use the arrow keys to highlight a menu and press [ENT] to open it:

Channels	contains all commands and functions to program the channels of the instrument
Display	select channels to be displayed and configure the display
Memory	configure recordings and manage saved measuring data
Device	general settings to adapt the instrument for your personal needs

When a menu is highlighted, the F-keys are occupied with several functions:

Quick access keys „Channel" menu

[F1] [F2] [F3] [F4] [F5] opens the channel programming for the measuring channels C1 … C5

Quick access keys „Display" menu

[F1] toggles the display modes „Text" / „Graphic"

Quick access keys „Memory" menu

[F1]   starts the recording

[F2]   opens the presentation menu where you can display recorded measuring data

[F3]   opens the delete menu where you may delete recorded measuring data

Quick access keys „Device" menu

[F4] enables or disables the defined filter settings

6.4. Configure Channels

Highlight „Channels" in the main menu and press :

```
            Channels
 C1:  p1  0-20mA          0/200
 C2:  p2  0-20mA          0/200
 C3:  p3  0-20mA          0/200
 C4:  V1  Counter w.D         1
 C5:  Q1  Frequency n.D.      1
 C6:  E1  Trigger input
 C7:  A1  Trigger output
 C8:  --  UNDEF.
 C9:  --  UNDEF.
 C10: --  UNDEF.
 C11: --  UNDEF.
 C12: --  UNDEF.
```

You can see a list of all twelve channels of the instrument. The first five are the physical input channels (see section 3.2 on page 6), C6 and C7 are the trigger input resp. output. The other channels can be used for calculations or may be occupied with digital input signals (e.g. CAN, option).

Use the arrow keys to highlight a channels and press to open it.

6.4.1. Analog Input Channels (C1 … C3)

Highlight one of the channels C1 … C3 in the channel menu and press :

```
          Channel(C1)
 Meas. Variable  p (bar)
 Index Variable  1
          Name   Reflow
   Signal type   0-20mA
Measuring range  0.000    200.0
    Zero point   0.533
  Linearisation  No



                           OK
```

Use the arrow keys to highlight a menu item and press to edit the displayed value / setting. The menu items have these functions:

Meas. Variable	type and units of the measurand of the sensor connected to this channel
Index Variable	identic variables are indexed automatically
Name	enter the desired name of the channel
Signal type	select the signal type of the connected sensor (0/4-20 mA or 0/2-10 V)
Measuring range	enter the start and end values of the measuring range
Zero point	function to execute a zero point equalisation of the sensor; connect the sensor with a load of „0" (e.g. no pressure), highlight „Zero point" and press ; press to start the equalisation, then the compensation value will be displayed
Linearisation	here you may enter (or select) a linearisation table to compensate the linearity error of the sensor (see below)

Press after finishing the inputs to save all settings.

How to use a Linearisation Table

A linearisation table contains must- and is-values for several reference points of the sensor measuring range. They are determined during the calibration of the sensor and are used to (partly) compensate the linearisation error of the sensor. The measuring error of a sensor can be reduced significantly by using a linearisation table.

The instrument can use linearisation tables with ten must-is value pairs. These are either transferred by ISDS from the sensor to the instrument, or must be entered manually. Up to five manually entered linearisation tables can be saved and re-used.

(i)	**Information**
	Please see the calibration certificate of the sensor for the must- and is-values.

1. Open the configuration menu of the channel, highlight the item „Linearisation" and press ENT to set the setting to "Yes".

2. Highlight the item „Table" and press ENT:
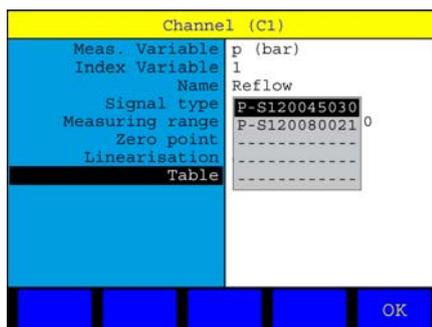
3. Highlight one of the saved linearisation tables or an empty space and press ENT:
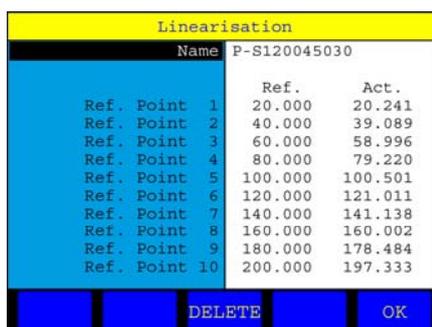
4. Enter a name for the linearisation table (e.g. serial number of the sensor).

5. Highlight the line „Ref. Point 1" and press ENT.

6. Enter the must-value („Ref.") and confirm with ENT.

7. Enter the corresponding is-value („Act.") and confirm with ENT.

8. Repeat that to enter all must-is-values.

9. Press ESC after entering the last value to leave the input mode.

10. Press F5 to save the linearisation table.

6.4.2.   Combined Input Channel (C4)

Highlight channel C4 in the channel menu and press ENT :
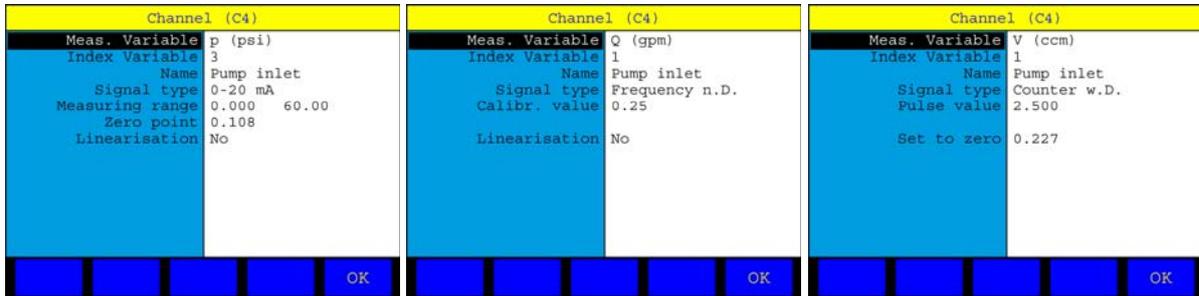
The combined input channels can be used for sensors with analog or frequency output signal. The channel is set by selecting the appropriate signal type.

Use the arrow keys to highlight a menu item and press ENT to modify the value/setting. Different menu items will be displayed, dependant on the use of the combined input channel.

Use as analog input channel *(left image)*

The configuration is the same as that of the analog input channels C1 … C3 described in section 6.4.1 on page 22.

Use as frequeny channel *(center image)*

Meas. variable	type and units of the measurand of the sensor connected to this channel
Index Variable	identic variables are indexed automatically
Name	enter the desired name of the channel
Signal type	select the signal type of the connected sensor: frequency either with or without direction detection
Calibr. value	enter the factor used to multiple the frequency value to calculate the measured value (e.g. the number of cogs when measuring the rotational speed at a cogged wheel)
Linearisation	here you may enter or select a linearisation table to reduce the linearisation error of the sensor (see explanations in the section „How to use a linearisation table" on page 23)

Use as counter channel *(right image)*

|	
Meas. variable	type and units of the measurand of the sensor connected to this channel
Index Variable	identic variables are indexed automatically
Name	enter the desired name of the channel
Signal type	select counter either with or without direction detection
Pulse value	enter the volume that shall be calculated for each counting impulse (e.g. the geometric tooth volume for gear flow meters)
Linearisation	here you may enter or select a linearisation table to reduce the linearisation error of the sensor (see explanations in the section „How to use a linearisation table" on page 23)

Press F5 after finishing the inputs to save all settings.

6.4.3. Frequency input channel (C5)

Highlight channel C5 in the channel menu and press ENT. The channel can be used as frequency or counter channel, please see section 6.4.2 on page 24 for information on the programming.

6.4.4. Trigger input channel (C6)

Highlight channel C6 in the channel menu and press ENT:

```
Channel (C6: Trigger input)
Meas. variable  E1 (Level)
         Name  C6



                                OK
```
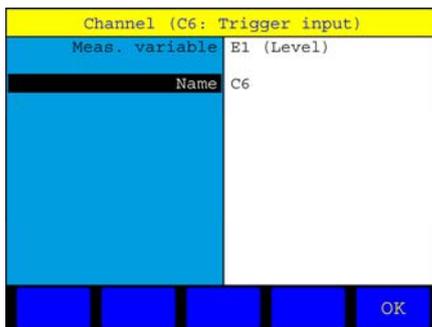
You may feed an external signal via the trigger input channel into the instrument to start a recording. Please see section 3.2.4 on page 9 for information on allowed trigger signals.

This channel may also be used to start recordings on several measuring instruments simultaneously. Please see the section "Simultaneous recording on connected instruments" on page 26.

Here you may only enter a name. Press F5 to save the entered name.

6.4.5. Trigger output channel (C7)

Highlight channel C7 in the channel menu and press ENT:

```
Channel (C7: Trigger output)
Meas. variable  A1 (Level)
         Name  C7
Operation mode  Meas. channel
       Source  p1
    Condition  greater
        Value  120.0


                                OK
```
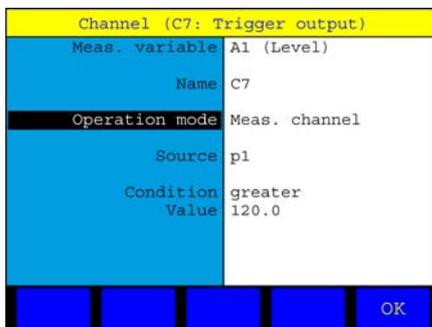
The trigger channel may be used to start a simultaneous recording on connected instruments. Please see the section "Simultaneous recording on connected instruments" on page 26.

Here you may define these parameters:

Name	enter a name for the channel
Operation mode	select one of four modes
Inactive	channel not used
Meas. channel	a measuring channel is supervised for the entry of a certain incident that can be defined with the parameters "Source", "Condition" and "Value" (see below); if it happens, the ouput will be switched
Trigger event	switches the output when the recording is started by a defined trigger (see section 6.6 on page 33); this function is used to synchronize recordings on connected instruments (see below)

Manual   the output can be switched using the parameter „Condition"

If „Meas. channel" is selected, further parameters will be displayed:

Source   select the measuring channel that shall be supervised for the incident that shall switch the output

Condition   select either „greater" or „lower"; the output will be switched if the value at the selected channel exceeds / falls below the defined value

Value   enter the value for the condition

In the image channel p1 is supervised, the output will be switched if the measured value exceeds 120.

Simultaneous recording on connected instruments

You need a special cable (order N° 8824-F2-00.50) to connect two MultiSystem 4010, or the MultiXtend Trigger (order N° 316A-A0-00.50) to connect up to five instruments. Then it becomes possible to start build up a master-slave connection and start a recording on all instruments simultaneously.

At the **Master Instrument** you should program a recording that is started by a trigger event. Then select "Trigger event" as operation mode of the trigger output. As soon as the trigger event happens, the output will be switched.

At the **Slave Instruments** you should program a recording that is started by the trigger event „Channel E1 – ON". Then the recording will be started as soon as the trigger input receives the signal from the trigger output of the master instrument.

6.4.6.   Free channels (C8 … C12)

These channels can be used for calculations or as CAN channels (option).
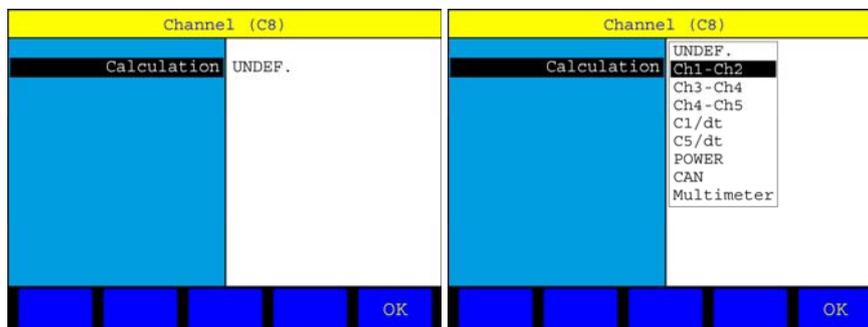
Press ENT and select one of the available occupations:

UNDEF.   channel is not used

Ch1-Ch2   calculation of the difference of the measured values from channel 1 and 2

Ch3-Ch4   calculation of the difference of the measured values from channel 3 and 4

Ch4-Ch5   calculation of the difference of the measured values from channel 4 and 5

Ch1/dt   calculates the first derivation of the measured values from channel 1

Ch5/dt   calculates the first derivation of the measured values from channel 5

POWER   uses the formula „Ch1 x Ch5 / 600" to calculate the hydraulic power; pressure is measured on channel 1, volume flow rate on channel 5

CAN   a signal from a connected CAN bus (option) is assigned to the channel

Multimeter   the signal from a Multimeter connected to the instrument is assigned to this channel

Highlight an item and confirm with (ENT). Further options are displayed due to the selected occupation.

### Settings at the functions "ChX-ChY" and "POWER"

```
        Channel (C8)
    Calculation  Ch1-Ch2
   Meas. variable  dP
   Index variable  1
          Units  bar
           Name  Pressure loss
     Align. diff.  0.105




                          OK
```
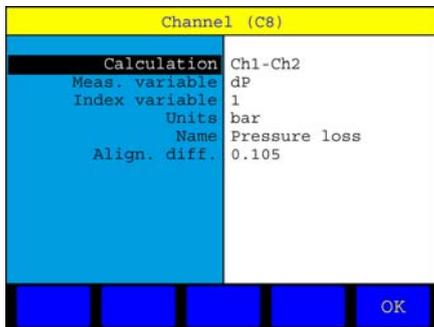
Define these options here:

Meas. variable	enter the variable resulting from the calculation
Index variable	enter the index number of the variable if you have several identic
Units	enter the name of the units resulting from the calculation
Name	enter a name for the channel
Align. diff.	function to compensate the measuring difference between two sensors; connect both sensors and put an identic load on them (e.g. 0 bar); then highlight this function and press (ENT); the instrument determins both measured values and uses a difference for the compensation during the following measuring

Press (F5) to save the channel settings.

Settings at the function "Chx/dt"

```
        Channel (C8)
    Calculation  Ch1/dt
   Meas. variable  D
   Index variable  1
           Unit  cm
           Name  Way
          Level  0.500
      Gate time  250




                          OK
```
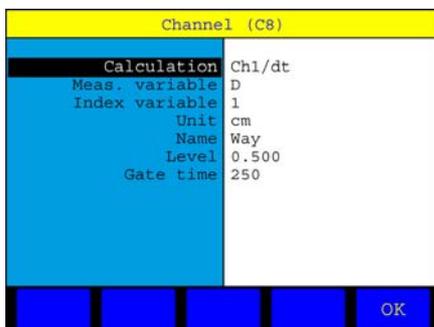
You may use this function e.g. to calculate speed from a measured way. You may define a threshold value ("Level") to prevent the calculation of absurd values for small way measurements. This assures that a certain way has to be measured before a calculation is executed. The gate time assures for a defined level that a calculation is executed after a certain time. This is the only way to assure the calculation of a speed "0".

Define these options:

Meas. variable	enter the variable resulting from the calculation
Index variable	enter the index number of the variable if you have several identic
Units	enter the name of the units resulting from the calculation
Name	enter a name for the channel
Level	value for that the basic measured value must change, before a calculation is executed

Gate time	maximal waiting time in milli-seconds until a new calculation is executed

Press **F5** to save the channel settings.

Settings at the function „CAN" (Option)

At first the standard parameters for the measured data are displayed:

Meas. variable	enter the variable resulting from the calculation
Index variable	enter the index number of the variable if you have several identic
Units	enter the name of the units resulting from the calculation
Name	enter a name for the channel
Parameter	highlight this menu item and press **ENT** to display the CAN specific parameters:

Here you may enter the CAN parameters of the connected sensor or MultiXtend module. The required information can be found in the documentation of the device.

Specification	select between CAN 2.0A (standard for Hydrotechnik products) or CAN 2.0B (e.g. at some third-party sensors)
Timeout	enter the timeout period in seconds; the instrument will wait for this time for new signals, before an error message is displayed
Identifier	enter the identifier of sensor or MultiXtend device; you may either enter it in decimal (standard) or hexadecimal places; press **F1** to toggle the entry mode after selecting the menu item
Format	select the CAN data format (TEXT, BINARY BYTE, BINARY BIT, PDO or FLOAT)
Offset	enter the number of bytes of the CAN message after that the data bytes start
Number bytes	enter the number of bytes containing the measured value
Byte order	select between Little and Big Endian)

Press **F5** to save the CAN parameters.

Settings at the function „Multimeter" (Option)

```
          Channel (C8)
Calculation  Multimeter

      Name
Signal type  Voltcraft VC 9x0



                              OK
```
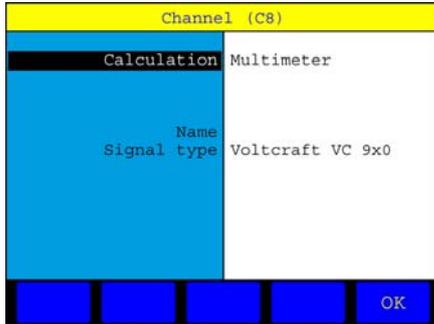
Here you may assign a name to the channel and select the type of the connected Multimeter.
Currently the types Voltcraft VC 820, VC 920, 940 and 960 are supported.

Press F5 to save the channel settings.

6.4.7.   Configure channels for particle counter Patrick

> **Information**
>
> *The values for Node-ID, baud rate and interface can be set in the Patrick operation menu. Only use the settings programmed there, or set them to the standard settings used in the following sections.*

The instrument must be equipped with the option „CAN" to be able to connect the particle counter Patrick (3160-00-76.00). Additionally you need the cable 8824-T6-05.00 (length 5.0 m) or 8824-T6-10.00 (length 10.0 m).

Patrick produces measuring data for the four particle size classes 4 / 6 / 14 / 21 µm according to ISO- or SAE-norms. One free channel is required to display each particle size class, the MultiSystem 4010 is able to display the maximum of five size classes. Typically only four size classes either according ot ISO or SAE will be displayed.

Configure a channel for a size class

Open the menu "Channels", highlight a free channel (e.g. Ch8) and press ENT. Set the options as shown here:

```
          Channel(C8)
   Calculation  CAN
 Meas. variable  P
Index variable  1
        Units  SC
         Name  ISO 4µm
    Parameter  ►►



                              OK
```
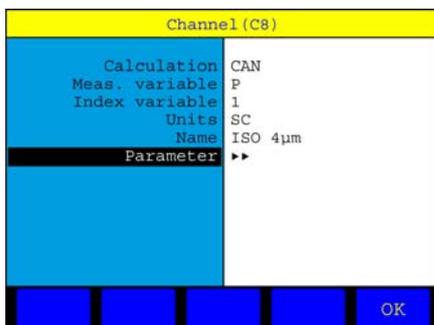
The calculation is CAN, since Patrick sends the data via CAN bus. The variable P stands for particle, the index is 1 for particle size class ISO 4 µm, what is used as name, too. You have to enter a name as units, here "SC" (= size class).

Then highlight „Parameter" and press ⒆ to set the CAN parameters like shown here:

```
CAN parameter (Parameter)
Specification  CAN 2.0A
      Timeout  1  (sec)
   Identifier  509        (1FD)
       Format  BINARY (BYTE)
       Offset  4
 Number bytes  1
   Byte order  Little Endian
       Filter  No
Command byte (0)  0          (0h)
Index word (1-2)  0          (0h)
  Calculation  OFS./FACTOR
 Offset value  0
 Factor value  1.0000
Type of value  UNSIGNED

                              OK
```
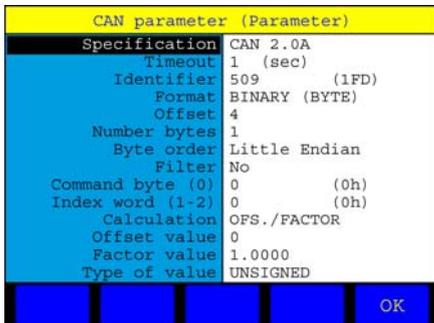
All parameters must be defined exactly like shown, otherwise there will be no communication. Specific for the size class ISO 4 µm are the options „Identifier" and „Offset". For ISO size classes you should enter an identifier resulting from the addition of the Patrick Node-ID (see type plate or Patrick operation menu) plus 384 (here Node-ID 125: identifier = 125 + 384 = 509). For SAE size classes you must add 640 to the Patrick Node-ID.

Press ⒡⒌ to save the CAN parameters and ⒡⒌ again to save the settings for channel 8.

### Configure channels for further ISO/SAE size classes

This is done in the same way like described for channel 8. Some parameters must be changed for each size class **(IP* = Identifier Patrick, see type plate)**:

Parameter	ISO classes			
	4 µm	6 µm	14 µm	21 µm
Channel	C8	C9	C10	C11
Index variable	1	2	3	4
Name	ISO 4 µm	ISO 6 µm	ISO 14 µm	ISO 21 µm
Identifier	IP* + 384	IP* + 384	IP* + 384	IP* + 384
Offset	4	5	6	7

Parameter	SAE classes			
	4 µm	6 µm	14 µm	21 µm
Channel	C8	C9	C10	C11
Index variable	1	2	3	4
Name	SAE 4 µm	SAE 6 µm	SAE 14 µm	SAE 21 µm
Identifier	IP* + 640	IP* + 640	IP* + 640	IP* + 640
Offset	4	5	6	7

More CAN settings

Now you muste enable the power supply and send a start command to Patrick. Highlight the item „Device" in the main menu and press F1 :
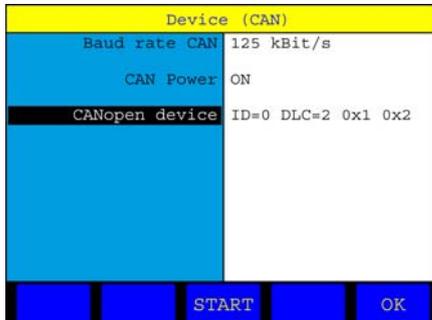
Stellen Sie die Baudrate auf den im Patrick-Bedienmenü eingestellten Wert (hier: „125 kBit/s") ein und aktivieren Sie die Stromversorgung des CAN Bus (CAN Power „EIN").

Drücken Sie zunächst F5 um Spannung auf die CAN Schnittstelle zu legen. Schließen Sie nun den Partikelzähler an und öffnen Sie anschließend wieder den gezeigten Bildschirm. Markieren Sie die Option „CANopen Gerät" und drücken Sie F3 um die Kommunikation zwischen Messgerät und Patrick zu starten. Kehren Sie anschließend zum Hauptmenü zurück.

Set the baud rate to the value contained in the Patrick operation menu (here: „125 kBit/s") and enable the CAN bus power supply (CAN Power „ON").

Now press F5 to put voltage on the CAN interface. Connect Patrick and then open this screen again. Highlight the option „CANopen device" and press F3 to start the communication between instrument and Patrick. Then return to the main menu.

Display channels

Open the menu „Display" and select the channels C8 … C11 for display. Please see chapter 6.5 on page 31 for more information.

6.5.   Configure Display

Highlight „Display" in the main menu and press ENT:
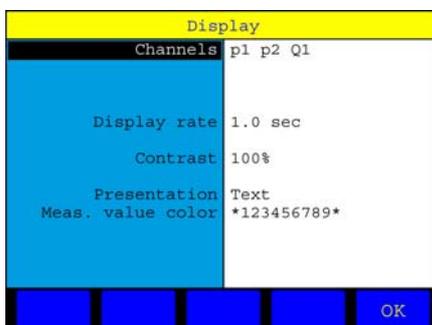
Here you may select which channels are displayed and how:

Channels   press ENT and select the channels to be displayed:

```
                    Display
   ☑  C1:  p1              ☒  C8:   B1
   ☑  C2:  p2              ☒  C9:   B2
   ☒  C3:  T1              ☒  C10:  B3
   ☒  C4:  V1              ☒  C11:  B4
   ☑  C5:  Q1              ☒  C12:  B5
   ☒  C6:  E1
   ☒  C7:  A1


                                          OK
```
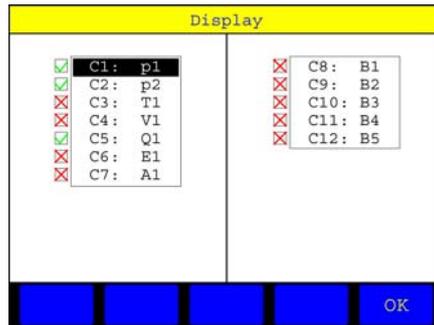
Highlight a channel and press ENT to display / hide it. All channels with a green check mark will be displayed. Press F5 to confirm the channel selection.

Display rate	define how often the display shall be refreshed with new measured values; this settings does not influence the scan rate, that means those time intervals after that new measured values are requested from the sensor
Contrast	controls the brightness of the display
Presentation	select whether the measured values shall be displayed as text or line diagram („Graphic"); if you select „Text" you may select the color of the measured values in the line below; if "Graphic" is selected, further settings will be displayed:

```
                    Display
        Channels  p1 p2 Q1


     Display rate  1.0 sec

        Contrast   100%

     Presentation  Graphic y=f(t)

          Scaling  ▸▸

    Colors/Symbols  ▸▸

                                          OK
```
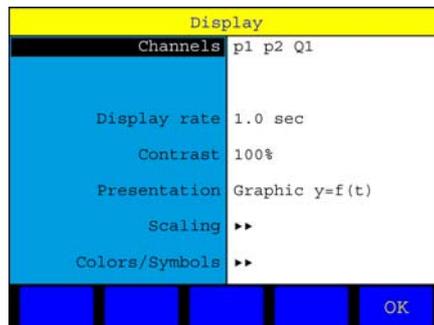
Scaling	defines which part of the measuring range of each channel will be displayed:

```
                   Scaling
                    Min        Max
          C1:p1      50        100
          C2:p2      50        100
          C3:T1     -20        120
          C4:V1       0        100
          C5:Q1       0        300
          C6:E1       0        100
          C7:A1       0        100
          C8:B1       0        100
          C9:B2       0        100
         C10:B3       0        100
         C11:B4       0        100
         C12:B5       0        100

         AUTO   ALL   C1:p1   OK
```

Press F2 to toggle between the input modes „User" (manual input of scaling values) and „Auto".

|	
USER	highlight a channel, press ENT and enter the lower limit of the desired display range; press ENT, enter the upper limit and confirm with ENT; repeat that for all desired channels
AUTO	press F4 to define the scaling range for the highlighted channel automatically, or F3 to do this for all channels; the sensor measuring ranges will be used as scaling ranges
	Confirm the scaling with F5.
Colors/Symbols	here you may select the colors and symbols used to distinguish the channels in the line diagram:
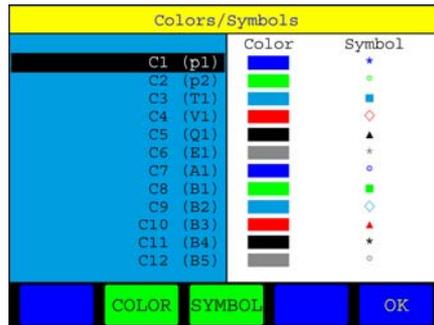
Highlight a channel, press 🔵ENT, select the desired colors and confirm with 🔵ENT; select the desired symbol and confirm with 🔵ENT; repeat this for all desired channels.

Press 🔵F2 to enable/disable the colors, or 🔵F3 to enable/disable the symbols; press 🔵F5 to confirm the settings.

Press 🔵F5 to terminate the settings in the display menu.

## 6.6. Program a Recording

Highlight „Memory" in the main menu and press 🔵ENT:
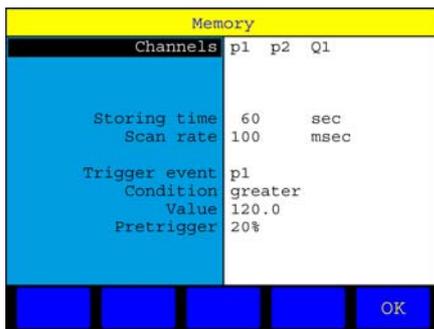
In this menu you define, which channels are recorded and how:

Channels   highlight the function and press 🔵ENT to select the channels to be recorded:
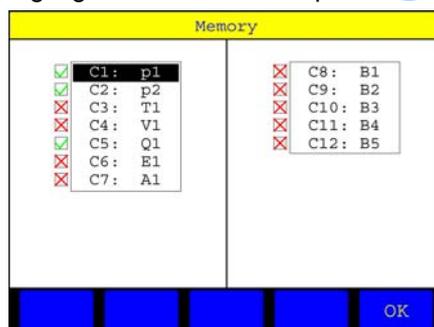
Highlight a channel and press 🔵ENT to check / uncheck it; all channels with green check marks will be recorded; press 🔵F5 to finish the channel selection

Storing time   defines how long the recording shall last; first enter a value and then select the time unit second, minute or hour

Scan rate   defines the time intervals between two measured values; first enter a value and then select the time unit milli-second, second or minute

Trigger event   by defining a trigger you may start the recording at exactly that moment when interesting data are measured; one of the channels Ch1 … Ch7 can be supervised for the fulfillment of a condition; with the trigger event "Key" you may start the

recording with a single key pressure from the measured value display; select the desired channel or the option "Key"

Condition	select one of four conditions:
greater	the condition if fulfilled when the trigger value is exceeded
smaller	the condition if fulfilled when the trigger value is fallen below
rising	the condition is fulfilled when the trigger value is fallen below by more than 5 % and then exceeded (rising edge)
falling	the condition is fulfilled when the trigger value is exceeded by more than 5 % and then fallen below (falling edge)
Value	enter the trigger value here
Pretrigger	the recording may start before the trigger event happens; the defined percentage of the recording time will be used to save values before the trigger event

Press F5 to confirm the settings in the memory menu.

Example for a Trigger Recording

You supervise a pressure system and want to record data as soon as the pressure p1 falls below the value 120 bar. But you also want to record the last 30 seconds before this event (pretrigger, see below) and record data for a total time of 100 seconds. This is the correct configuration:
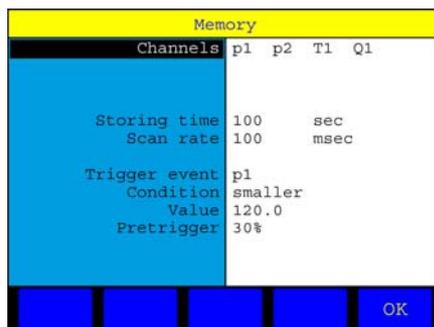

How the Pretrigger works

If a recording has been configured with a pretrigger, the instrument will start to fill a buffer memory (trigger memory) with measuring data immediately after leaving the menu "Start memory". This is indicated by a bar chart.

As long as the trigger buffer is not full, the bar is colored red (08%). The recording can be started, but there are not enough measuring data for the desired pretrigger. The recording time will be reduced accordingly (example: programmed recording time 100 sec., pretrigger 50 %, trigger event after 30 sec., total recording time 80 sec.).

If the trigger buffer is full, the bar is colored green (20%). If the trigger event does not happen yet, the measuring values in the trigger buffer will be overwritten, so that the most topical values are in the memory. If the recording is started, the values from the trigger buffer are recorded and completed to the programmed recording time. The recording bar will be displayed blue on white (75%).

6.7. Start a Recording

Highlight the item „Memory" in the main menu and press [F1]:
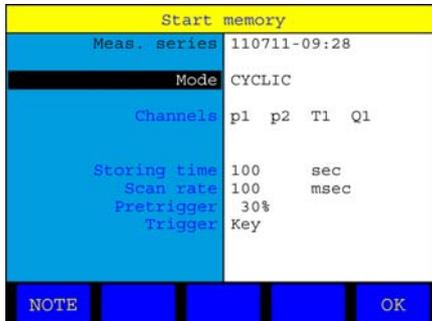
Several data regarding the intented recording are displayed here. Beside current date and time (these are used to identify the recording and as file name) you can see the most important recording parameters as set in the memory menu (see section 6.6 on page 33).

Here you have to additional options:

Mode	select between STANDARD (recording will be executed once) and CYCLIC (after the recordinf the instrument will be on stand-by to repeat the recording with identic parameters)
Note	you may add some text to the recording that will be saved together with the measuring data

Press [F5] to start the recording. The instrument will immediately start to record measuring data, if no trigger has been defined. If trigger and pretrigger are defined, the instrument will immediately start to fill the trigger buffer. The recording starts as soon as the trigger event happens.

Key as Trigger

If you have selected the trigger event „Key"(see section 6.6 on page 33), you may start the recording with one key pressure:
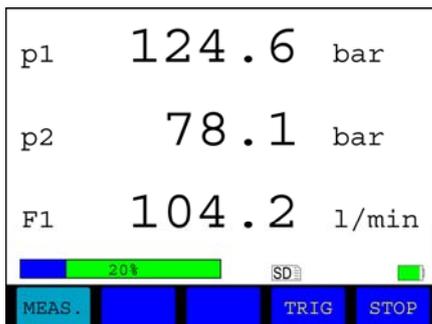

The recoding bar in the left lower corner indicates that the trigger buffer is full and takes 20 % of the total recording time. Press [F4] to start the recording. Press [F5] to stop the recording. Then a shortened measurement series will be written into the memory.

Screens during a recording
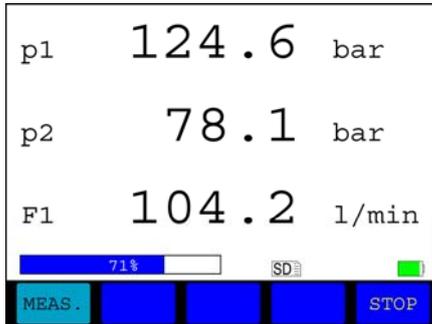
normal recording
measurement series completed for 71 %
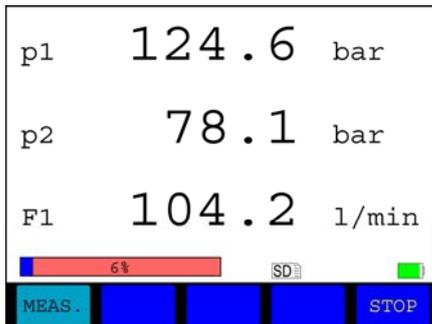
trigger recording
trigger buffer not filled
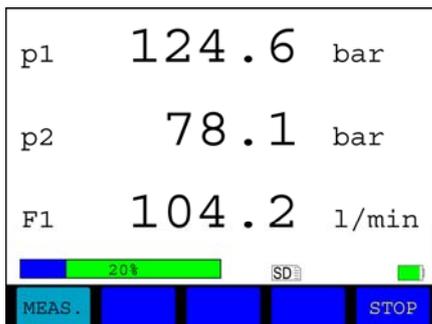
trigger recording
trigger buffer full
waiting for trigger event

During cyclic recording the key F3 is occupied with „C-Stop". Press this key to terminate the recording cycle.

6.8.   Present Measurement Series

Recorded measurement series can be presented and analysed in different ways. Highlight the item „Memory" in the main menu and then press F2 :
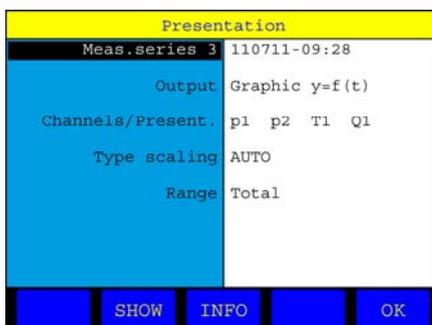

Use the available functions to present a recorded measurement series:

| Meas. series x | shows the measurement series selected for presentation; press ENT to select a different one: |
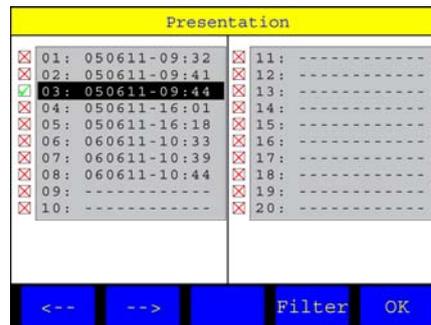
Highlight the desired measurement series and press F5. Use F1 / F2 to scroll through the pages of the list. Press F4 to sort the list:
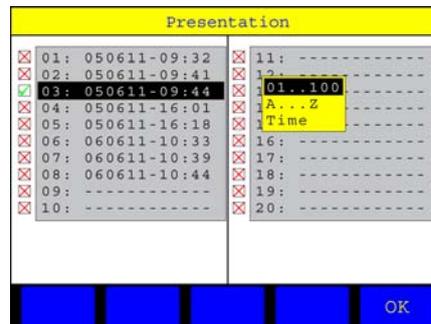
Highlight a sort option (numerical, alphabetical, recording time) and press F5.

Output	select one of three ways to present the data:
Graphic y=f(t)	the measuring data will be presented as line diagram over the time
Table	the measuring data will be presented as a table
Statistics	statistical information on the measurement series will be displayed
Channels/Present.	here you may select the channels of the measurement series that shall be presented and setup the presentation
Type scaling	select between automatic and manual scaling; at manual scaling you may enter a range for each channel that shall be presented:
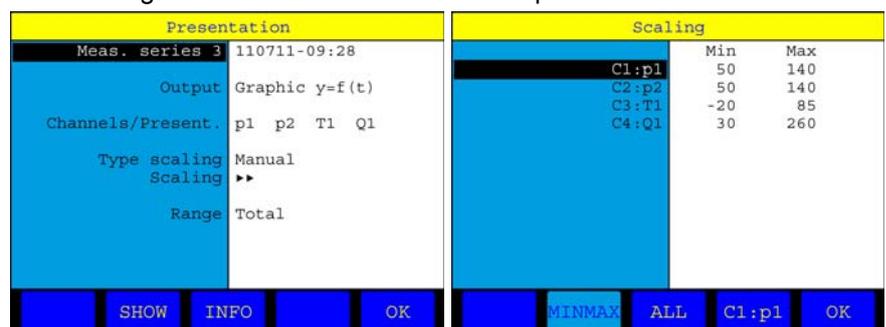
put the option „Type scaling" to „Manual", highlight the option „Scaling" and press ENT; highlight a channel, press ENT and input the start and end value of the data range that shall be presented

press F4 to define the scaling range for the selected channel automatically, or F3 to do this for all channels; press F2 to select between „MINMAX" (the scaling range will be read out of the measurement data) and „GRAPHIC" (the scaling defined in the display menu will be used); confirm the scaling with F5

Range   here you may do a time based selection of the measuring data; set the option from „Total" to „Clipping":
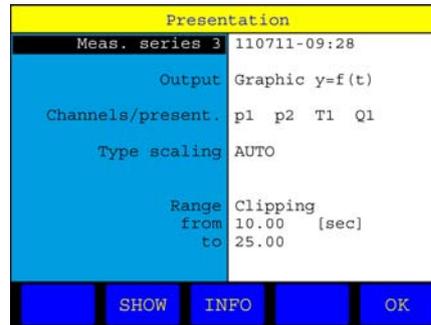
enter the values for „from" and „to"; then only the defined time range will be presented

Press F2 to present the selected measurement data or F5 to close the menu.

	Information
(i)	*The definition of a scaling and/or time range does not influence the measurement series. All values will remain there unchanged.*

6.8.1. Graphical presentation

After pressing F2 the presentation will be calculated and then displayed:
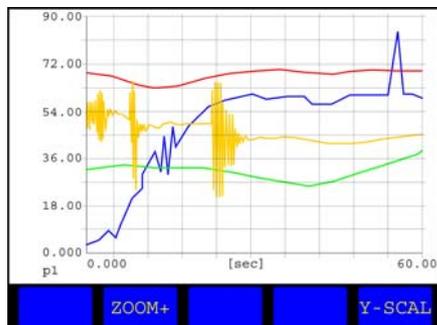
Here you may use two functions to modify the presentation:

Zoom+   enlarges an area of the line diagram; press F2:
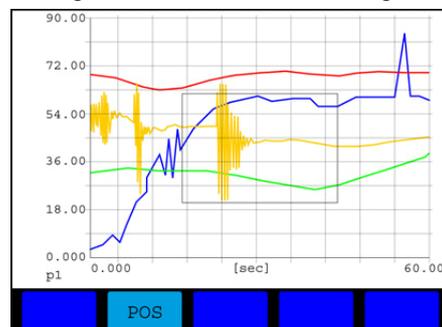
a rectangle is shown in the center of the diagram; this shows the area that will be enlarged; since F2 is occupied with the function „POS" you may use the arrow keys to shift the rectangle; then press F2 to switch to „SIZE"; now you may use the arrow keys to change the size of the rectangle; press ENT to apply the zoom:
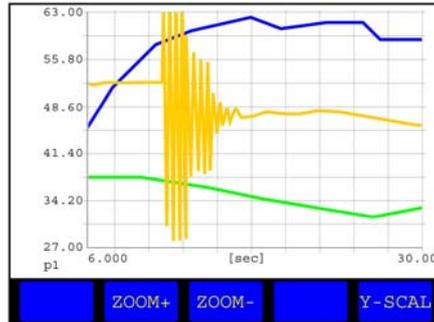
the desired area has been enlarged, you may now continue to zoom in or out

Y-scaling   switched the scaling of the Y-axis between the shown channels

Press ESC to close the presentation.

6.8.2.   Table presentation

After pressing F2 the table will be calculated and then presented:

[sec]	p1	p2	T1	Q1
0.000	104.1	48.3	26.0	200.1
1.000	107.3	33.5	26.3	191.4
2.000	132.5	18.4	26.5	104.6
3.000	205.6	81.1	26.7	105.5
4.000	222.0	90.6	27.0	110.1
5.000	231.6	98.5	27.4	163.9
6.000	171.2	120.5	27.7	190.7
7.000	148.4	129.6	27.7	181.9
8.000	109.5	141.7	27.6	144.5
9.000	107.4	183.3	27.7	113.7
10.000	101.4	135.8	27.2	151.6

DETAIL

Here you can see the measured values as a table. This will always contain eleven lines, the first and the last measured value and nine interim values.

If you want to analyse the measured data, you should press F2, highlight a line and press ENT. Then the table will be calculated with the highlighted line, the line below and nine new interim values. That can be repeated until the desired measured values are displayed. Press F3 to return to the initial table. Press ESC to close the presentation.

6.8.3.   Statistical data presentation

After pressing F2 the presentation will be calculated and then displayed:

	Min	Max	Average
p1	101.4	248.7	123.5
p2	16.7	191.0	83.7
T1	26.0	27.8	27.3
Q1	103.9	208.4	161.1

For all channels you can see the minimal, maximal and arithmetic mean value. If a certain range is selected in the menu "Presentation – Complexity", the calculated values will change correspondingly.

Press [ESC] to close the presentation.

6.8.4. Show information on measuring series

Press [F3] to display information on the measuring series selected for presentation:

```
┌──────────────────────────────────────┐
│       Information on series (1/2)   ► │
├──────────────────────────────────────┤
│ Meas. series:      110711-09:23       │
│ from:              11.07.2011 09:23   │
│                                       │
│ Channels:          p1  p2  T1  Q1     │
│                                       │
│ Storing time:      100 sec            │
│ Scan rate:         100 msec           │
│                                       │
│ Trigger:           Taste              │
│ Temps trigger:     12 sec             │
│                                       │
│                                       │
└──────────────────────────────────────┘
```
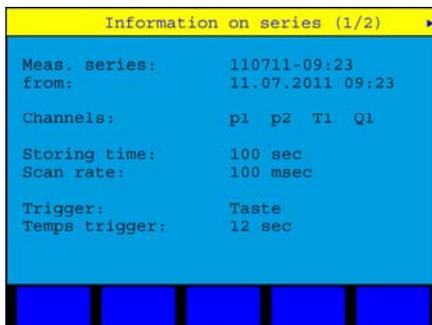
Here you can see the available information on the measuring series. The trigger time shows, how much time expired after starting the recording before the trigger event happened. Press [ESC] to close the information screen.

6.9.   Delete Measuring Series

Recorded measuring series can be deleted from the instrument. Highlight the item „Memory" in the main menu and press [F3]:

```
┌──────────────────────────────────────┐
│            Delete series              │
├──────────────────────────────────────┤
│ ☒ 01: 050611-09:32   ☒ 11: --------- │
│ ☒ 02: 050611-09:41   ☒ 12: --------- │
│ ☑ 03: 050611-09:44   ☒ 13: --------- │
│ ☒ 04: 050611-16:01   ☒ 14: --------- │
│ ☒ 05: 050611-16:18   ☒ 15: --------- │
│ ☒ 06: 060611-10:33   ☒ 16: --------- │
│ ☒ 07: 060611-10:39   ☒ 17: --------- │
│ ☒ 08: 060611-10:44   ☒ 18: --------- │
│ ☒ 09: ------------   ☒ 19: --------- │
│ ☒ 10: ------------   ☒ 20: --------- │
│                                       │
│  <--    -->    ALL          OK        │
└──────────────────────────────────────┘
```

Highlight a measuring series and press [ENT] to select / de-select it for deletion. A green check-mark will be displayed left of the item. Select all measuring series that you want to delete, or press [F3] to select / de-select all. Use [F1] [F2] to scroll through the pages with measuring series.

Press [F5] after selecting all measuring series to be deleted:

```
┌──────────────────────────────────────┐
│            Delete series              │
├──────────────────────────────────────┤
│ ☒ 01: 050611-09:32   ☒ 11: --------- │
│ ☒ 02: 050611-09:41   ☒ 12: --------- │
│ ☑ 03: 050611-09:44   ☒ 13: --------- │
│ ☒ 04: 050611-16:01   ☒ 14: --------- │
│ ☒ 05: 050611-16:18   ☒ 15: --------- │
│ ☒ 06: 060611-10:33   ☒ 16: --------- │
│ ☒ 07: 060611-10:39   ☒ 17: --------- │
│ ☒ 08: 060611-10:44   ☒ 18: --------- │
│ ☒ 09: ------------   ☒ 19: --------- │
│ ☒ 10: ------------   ☒ 20: --------- │
│                                       │
│         Are you sure?                 │
│                                       │
│         Yes         No                │
└──────────────────────────────────────┘
```
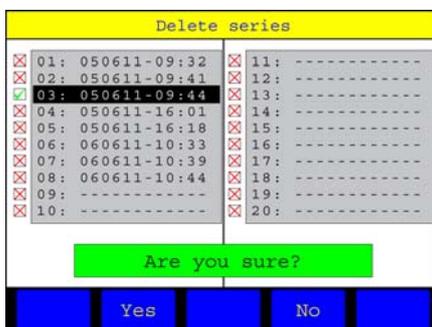
Press [F2] to delete the selected measuring series, or press [F4] to abort.

6.10. Instrument Settings

Highlight the item „Device" in the main menu and press ENT :

Device(1/2) ►	◄ Device(2/2)
Language English	Company Hydrotechnik GmbH
	65549 Limburg
Date 12-07-11	Holzheimer Str.
Time 08:47	
	Baud rate RS232 1200 kBit/s
ISDS Yes	
Units SI	
Filter Inactive	
Filter settings ►►	
CAN SETUP INFO OK	CAN SETUP INFO OK
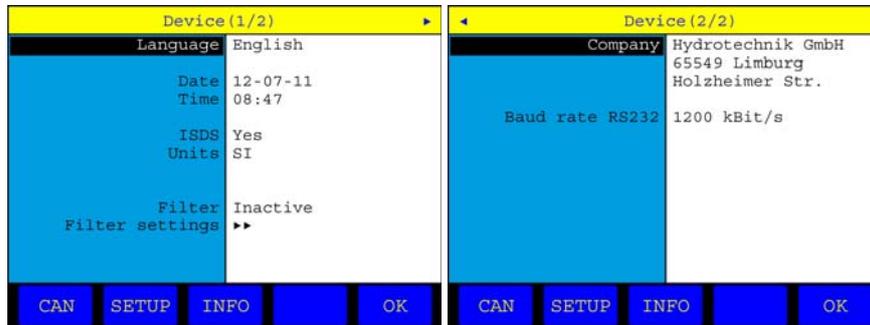
These are the two screens with basic device settings. Press ◁▷ to toggle between both pages. They contain these options:

Language	operation language of the instrument
Date	current date, used in the names of measuring series
Time	current time, used in the names of measuring series
ISDS	enables the automatic detection of sensors with Hydrotechnik ISDS; this option should be enabled if you use such sensors; if you want to use ISDS sensor for unusual purposes (e.g. pressure sensors to measure force), you should disable this option; if you select "Yes preferred", detected ISDS sensors will be selected for display and recording automatically
Units	select between metric (SI) and anglo-american (US) unit system (e.g. bar – psi)
Filter	enable / disable filtering
Filter settings	see section 6.10.2 on page 42
Company	enter the name of your company; this will be saved together with measuring data
Baud rate RS232	select the transmission speed of the RS 232 interface

Confirm the settings with F5 . Use three function keys to open submenus:

F1   dialog to set the CAN parameters (option, see section 6.10.1 on page 41)

F2   further instrument settings (see section 6.10.3 on page 43)

F3   information on the instrument (see section 6.10.4 on page 44)

6.10.1. CAN settings

Open the submenu „Device" from the main menu and press F1 :

| Device (CAN) |
|---|
| Baud rate CAN 10 kBit/s |
| CAN Power OFF |
| CANopen device ID=0 DLC=2 0x1 0x2 |
| |
| |
| OK |
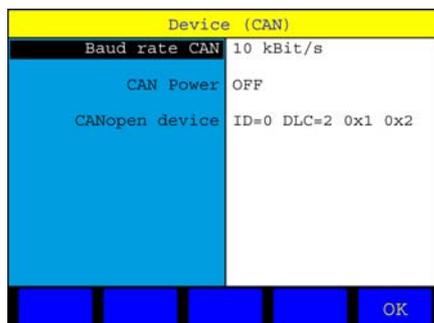
Here you may set the parameters of the optional CAN function:

Baud rate CAN	select the data transmission speed of the CAN bus; this must be identic for all participants, otherwise communication will not be possible
CAN Power	select whether a supply power shall be emitted via the CAN interface
CANopen device	highlight this line and press (F3) to send the start command into the CAN bus

6.10.2. Filter settings

Highlight the item „Filter settings" in the device menu and press (ENT):

```
           Filter settings
        AD-channels
    Meas. channel 1   1 ms
    Meas. channel 2   1 ms
    Meas. channel 3   8 ms
    Meas. channel 4  16 ms

       Freq.-channels
        Gate time Q1 0001  (*10 ms)
    Lowest Frequency 1.00 Hz
        Gate time f1 0001  (*10 ms)
    Lowest frequency 1.00 Hz


                              OK
```
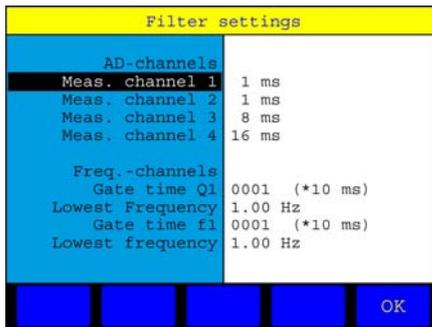
Here you may use several software filters:

Filter for analog input channels (AD-channels)

The analog input channels are scanned with 1 ms. With the software filter mean values can be calculated from several measured values to smooth the input signal. You may select between "1 ms" (no smoothing) and "2/4/8/16 ms" (mean value caculation from 2/4/8/18 measured values). At "16 ms" the instrument will deliver a new measured value each 16 ms.

Filter for frequency input channels

ℹ️	**Information**
	The parameters for the combined input channel Ch4 will only be displayed if it is programmed as frequency input channel.

You may define two parameters for each frequency input channel:

Gate time	a new measured value will not be accepted until the gate time expired; enter a multiple og 10 ms
Lowest frequency	select the lowest frequency that shall be measured; this influences the behavior of the instrument, when the measured value „Zero" is displayed
Example	a lowest frequency of „0.25 Hz" is defined and the measured object (e.g. a turbine flow meter) stops running; this would have to be displayed as a measured value of „0.00"; since the instrument is requested to measure down to 0.25 Hz, it will wait four seconds for a new measured value, until "0.00" is displayed
	In this case you should use a lowest frequency of 10 or 100 Hz, then the stopping of the turbine will be displayed after 0.1 or 0.01 seconds.

Confirm the settings with (F5).

6.10.3. Setup of the instrument

	Attention
⚠️	**Possible loss of data!** *All measuring data and possible customer-specific settings (e.g. linearisation tables) will get lost by formatting the internal storage medium. These data cannot be restored.*

Open the submenu „Device" and press F2 :
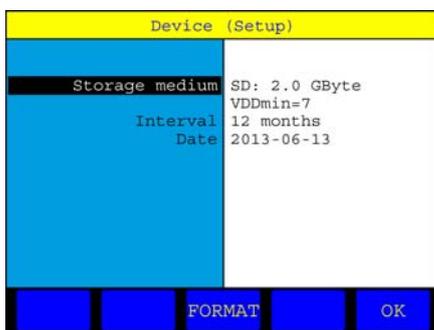
Hier sind grundlegende Funktionen enthalten:

Speichermedium — zeigt Art und Größe des im Messgerät enthaltenen Speichermediums; während diese Option markiert ist, ist F3 mit dem Befehl „FORMAT" belegt; drücken Sie diese Taste, um das Speichermedium zu formatieren:

Press F2 to format the storage medium, or F4 to abort the formatting; during the formatting, all data contained on the medium (e.g. measured values) will be deleted irretrievably.

Interval — enter an interval after that you want to be reminded for a required calibration of the instrument; this selection can only be done once and cannot be changed later

Date — shows the date of the next required calibration

Confirm the settings with F5 .

6.10.4. Information on the instrument

Open the submenu „Device" and press F3 :

```
             Device (Info)
      Software  Version: 1.3d
                Build: 037

Activ. options  CAN

      Hardware  CPU=LM3S9D96A1
                FPGA=260511
                JpHw=0x01
                JpSw=0x0001
                Calib=13.06.2013
 Serial number  40100004
```

Here you can see information on the software and hardware of your instrument. Open this submenu when you contact the Hydrotechnik customer support. They will ask for this information.

Press ESC to close the screen.

7.   Cleaning and Maintenance

7.1.   Cleaning

⚠	**Attention**
	Damage to the instrument is possible!
	Switch the instrument off and cut-off the power supply BEFORE starting to clean. This prevents the risk of a short-circuit, and thereby possible damage to the device.

⚠	**Attention**
	Damage to the instrument is possible!
	Do NOT use any aggressive cleaning materials, solvents, benzin or similar chemicals when cleaning the device. This prevents the risk of damage to the casing and/or dulling the display.

If the casing becomes dirty, wipe it with soft, slightly damp cloth. Any ingrained dirt can be removed with a mild household cleaning product.

7.2.   Calibration • Maintenance • Repair

	Attention
⚠️	**Possible loss of data!**
	The internal memory and the storage medium can be deleted during calibration and repair. All measuring data and customer-specific parameters will be lost irretrievably!

This device works maintenance-free. However it is essential to recalibrate it regularly. If the device is in continuous use, we recommend a recalibration every 2 years. Hydrotechnik runs an efficient calibration laboratory accredited by the DAkks, where measuring instrument and sensors (even from third parties) can be checked and calibrated precisely.

In case of a repair you should contact our customer service department. It is very helpful if you have the following information on hand. Please add this information in written to your instrument if you send it to us:

• Complete address information (company, department, contact person, address, phone and fax number, eMail address)
• Rejected part (instrument, sensor, cable, power pack)
• In the case of communication problems with your PC: used PC (CPU, RAM, HDD), operating system (e.g. Windows 95/98/SE/2000/NT/XP/Vista/7, others), HYDROcom software version
• Fault description (leave the settings at the instrument like at the time of the error; describe your measuring task, sensor connection, device settings: like e.g. recording parameters, trigger, number of collected measured values, …)

Address of the Hydrotechnik Customer Support

Hydrotechnik GmbH

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Tel.: 06431 – 4004 0 • Fax: 06431 – 45308
E-Mail: info@hydrotechnik.com • Internet: www.hydrotechnik.com