HYDROTECHNIK
Limburg
Messen mit System

User Manual

for

Panel mounted instrument

Series Compare

L3C00-00-20.01E

Version 3.0

Please read the instructions carefully, before putting the measuring instruments into operation.

Foreword

The following user manual describes all analogue and digital panel mounted instruments of series COMPARE, manufactured by HYDROTECHNIK.

In today's metrology, sensors with standardised output signals are used for a trouble-free transfer of measuring signals. To follow this aspect, our panel mounted instruments were designed for the connection to sensor-input signals of 0 to 20 mA or 4 to 20 mA.
An analogue measuring instrument of series COMPARE is used for evaluation.
To acquire sensors with frequency signals, an input signal range for square wave signals from the TTL-level up to the max. sensor supply voltage of 15 VDC is provided.
The evaluation is carried out with a digital measuring instrument of series COMPARE.

The state-of-the-art instruments of series COMPARE are very accurate and easy to use.
Their compact design with the dimensions 96 x 48 mm allows the mounting into all customary housings and front elements. The instruments are used and programmed through the front, only, without having to remove the front frame.
To acquire data easily, the instrument can be connected to a PC through interfaces.
A broad range of sensors from the HYDROTECHNIK standard programme allows a fast connection and the evaluation of the sensor signals. Here you can see the technical features of the panel mounted instrument of series COMPARE, at a glance:

- **standardised fitting dimensions 96 x 48 mm according to DIN 43 718**
- **very good legibility of the LED-display, even from larger distances**
- **acquisition of analogue sensor-signals 0 to 20 mA and 4 to 20 mA**
- **acquisition of frequency signals (1 Hz to 10.000 Hz)**
- **interfaces RS232 or RS485**
- **storage of extreme values (min./max.)**
- **adjustment of limit values (min./max.) whichserve for example for the external control of contactors through potential-free relay contacts**
- **1-channel or 2-channel measuring value acquisition for calculation of difference, sum, division and multiplication**
- **linearisation software for adaptation of characteristic curves from HYDROTECHNIK pressure- and volume flow rate sensors**
- **data acquisition at the PC with software HYDROcomsys**
- **adhesive foil to inscribe the different measuring units easily**
- **analogue outputs 0 to 20 mA/0 to 10 V or 4 to 20 mA/2 to 10 V**
- **voltage supply either in 24 VDC, 230 VAC or 115 VAC as an option**

You will surely have no problems in handling the COMPARE-instrument, but you will only be able to use all possibilities of the instrument, if you know it well.
Should you have any difficulties in understanding nevertheless, please do not hesitate to contact us, we will do our best to help you.

We reserve the right to make modifications, necessary for the technical progress.

We wish you a lot of success for the application of our panel mounted instruments of series:

Compare

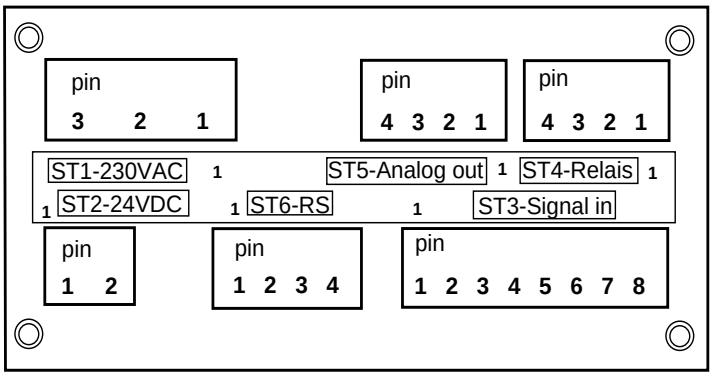
programme version 3.0

Index

1. Connection of the measuring instrument

Terminal connections on the back

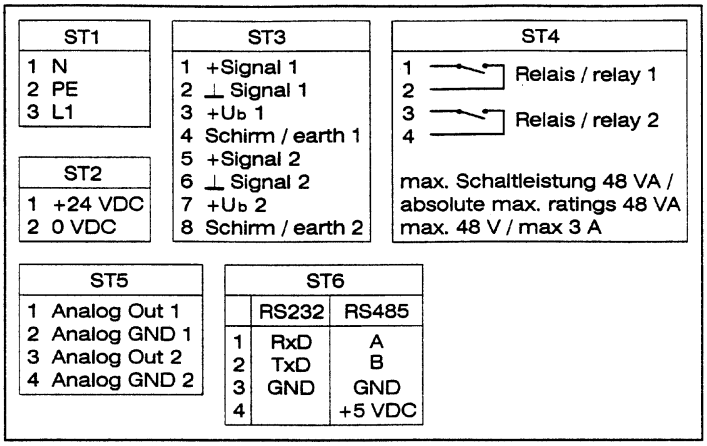
pic. 1



When connecting, please pay attention to the right connection of the pins and their order. In the second picture you can see the corresponding designations.

Corresponding pin connection ST1 to ST6

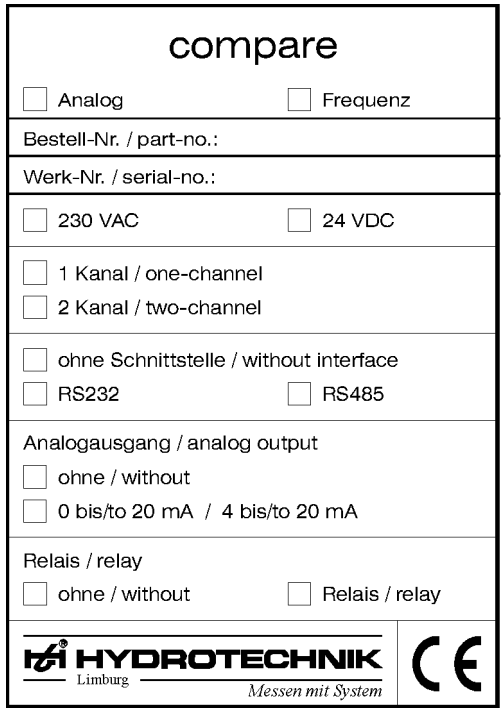
pic. 2



designation/function
ST1: mains voltage 230 VAC or 115 VAC
ST2: low voltage 24 VDC
ST3: measuring signal input for signal 1 and 2
ST4: relay 1 and 2 (closing contact)
ST5: analogue output 1 and 2
ST6: interface output either RS232 or RS485

The indicated numbers correspond to the pin connections.

pic. 3



Please see from the label (pic. 3), which type of measuring instrument you have, which performance it has and with which voltage it may be operated. Only after having checked this, you should connect the corresponding voltage. Please, have your instrument connected by a well-trained expert.

The squares, marked with a "X", describe the performance of the instrument.

1.1 Preparation for connection

a. Disconnect the power supply.

b. Connect the different leads of the power supply with the terminal screw and plug it into the corresponding connector (measuring signal input ST3: 8-poles).
Please connect the other end of the measuring cable with the sensor.
When using a HYDROTECHNIK sensor, you can see the pin-connection and the colour of the cables in the table, shown below.

c. Option: Switch output
Please connect the different leads of the relay output with the terminal plug and plug it into the corresponding connector (relays ST4: 4-poles).

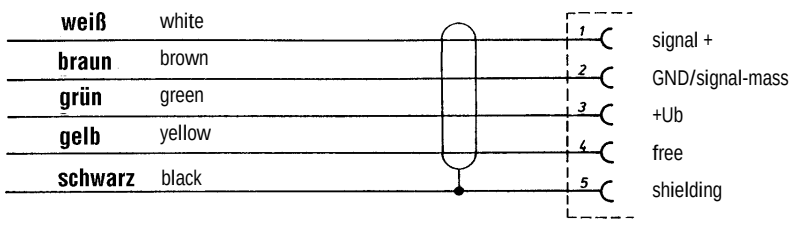
d. Option: Analogue output
Please connect the different leads of the analogue output with the terminal plug and plug it into the corresponding connector (analogue output ST5: 4-poles).

e. Option: Interface
Please connect the different leads of the interface with the terminal plug and plug it into the corresponding connector (interface ST6: 4-poles).

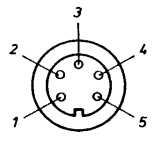
1.2 Pin connection of HYDROTECHNIK sensors

The user can order a ready-made connection cable SK11 (length: 22 cm), which makes the connection of the HYDROTECHNIK-sensors easier. The free cable ends are directly connected to the plug connection ST3. Here, you should take into consideration, if your instrument is a one- or a two-channel measuring instrument. If it is a one-channel instrument the input signal 1 needs to be used, if it is a two-channel instrument both signal inputs (signal 1 and signal 2) should be connected. In this case two SK 11 are necessary. As an extension of the measuring cable the MK01 can be manufactured in different lengths.

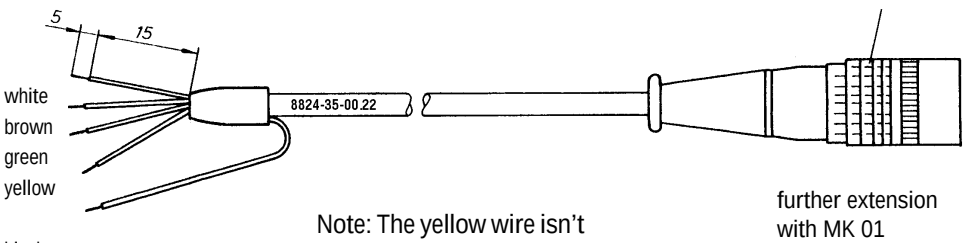
Adaptor cable SK 11 for connection to measuring input ST3- (signal in)



view A



cable socket 5-poles



Note: The yellow wire isn't used and must be cut-off

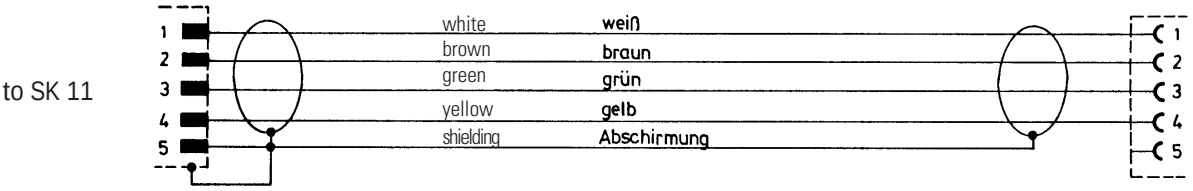
further extension with MK 01

Connection to Compare instrument ST3-signal in

colour	Signal 1	Signal 2
white	1	5
brown	2	6
green	3	7
yellow	free	free
black	4	8

Measuring cable MK01 with pin connection, standard length 2,5 m
serves for the extension of adaptor connection cable SK11

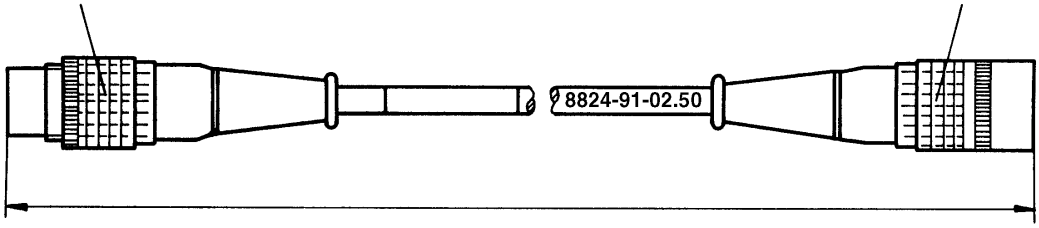
sensor connection



cable plug 5-poles

measuring cable MK 01
part-number 8824-91-02.50

cable socket 5-poles



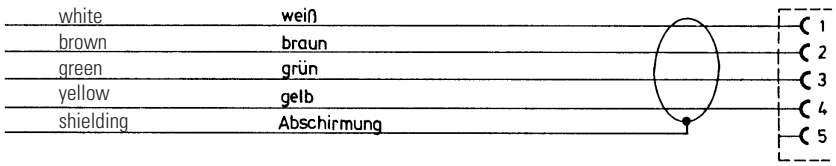
Please take into consideration, that the measuring cable MK 01 can't be used as an extension of the same cable, as the screening is interrupted at this cable type.
This cable should only be used with its complete length for the connection to the sensor.

If you want to do without the short adaptor connection cable SK11 in connection with MK01, you will have to manufacture a cable with a socket on one side and with free cable ends on the other or you will have to order it directly with the correct length at HYDROTECHNIK.

When manufacturing the cable by yourself, you should pay attention to the fixed wiring of the connections in any case (see following drawing). The free cable ends are directly connected to plug connection ST3.

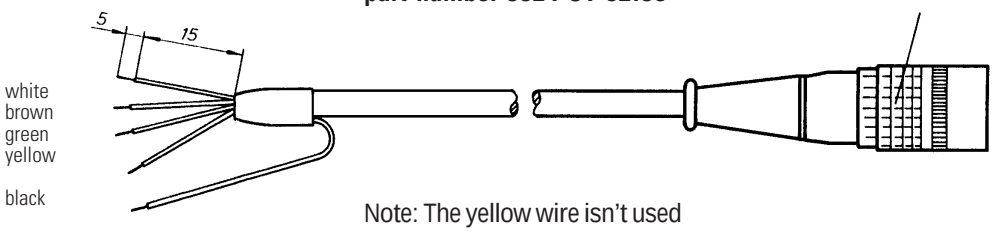
to input ST3- (signal in)

sensor connection



measuring cable MK 15
part-number 8824-C1-02.50

cable socket 5-poles



Note: The yellow wire isn't used
and must be cut-off

Connection to Compare instruments ST3-signal in

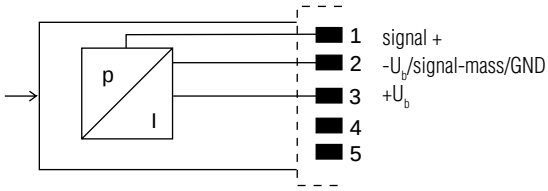
Colour	Signal 1	Signal 2
white	1	5
brown	2	6
green	3	7
yellow	free	free
black	4	8

Sensors for pressure measurement

Pressure sensor PR15

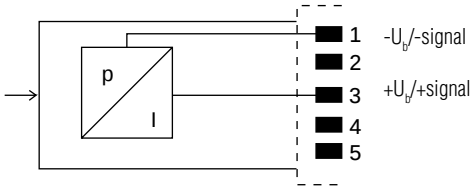
Connection scheme

3-wire technique 0 to 20 mA



Pressure sensor type HD

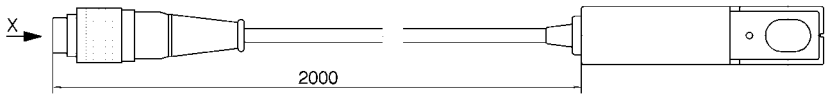
2-wire technique 4 to 20 mA



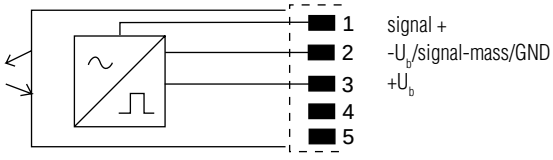
required measuring cable for both types:
measuring cable MK01: part-no.: 8824-91-02.50

Sensor for RPM measurement

Rev. speed probe DS 03



Output: square-wave signal

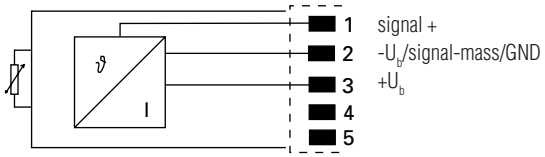


when required extension by measuring cable
MK01: part-no.: 8824-91-02.50

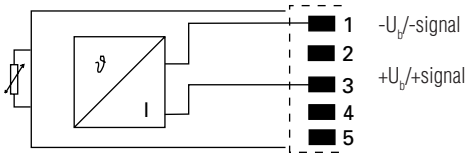
Sensor for temperature measurement

Temperature sensor
(screw-in sensor)

3-wire technique 0 to 20 mA



2-wire technique 4 to 20 mA

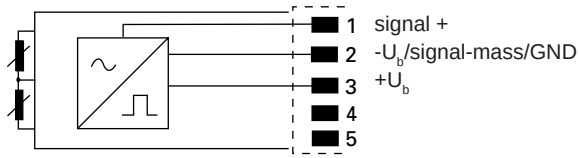


required measuring cable:
measuring cable MK01: part-no.: 8824-91-02.50

Sensor for volume flow rate measurement

Gear flow meters type GFM

Magnetoresistor sensor with amplifier
output: square wave signal



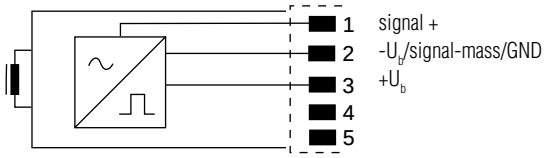
required measuring cable:
measuring cable MK01: part-no.: 8824-91-02.50

Sensor for volume flow rate measurement

Turbine RE3

Turbine RE4

Inductive transducer with amplifier:
square wave signal

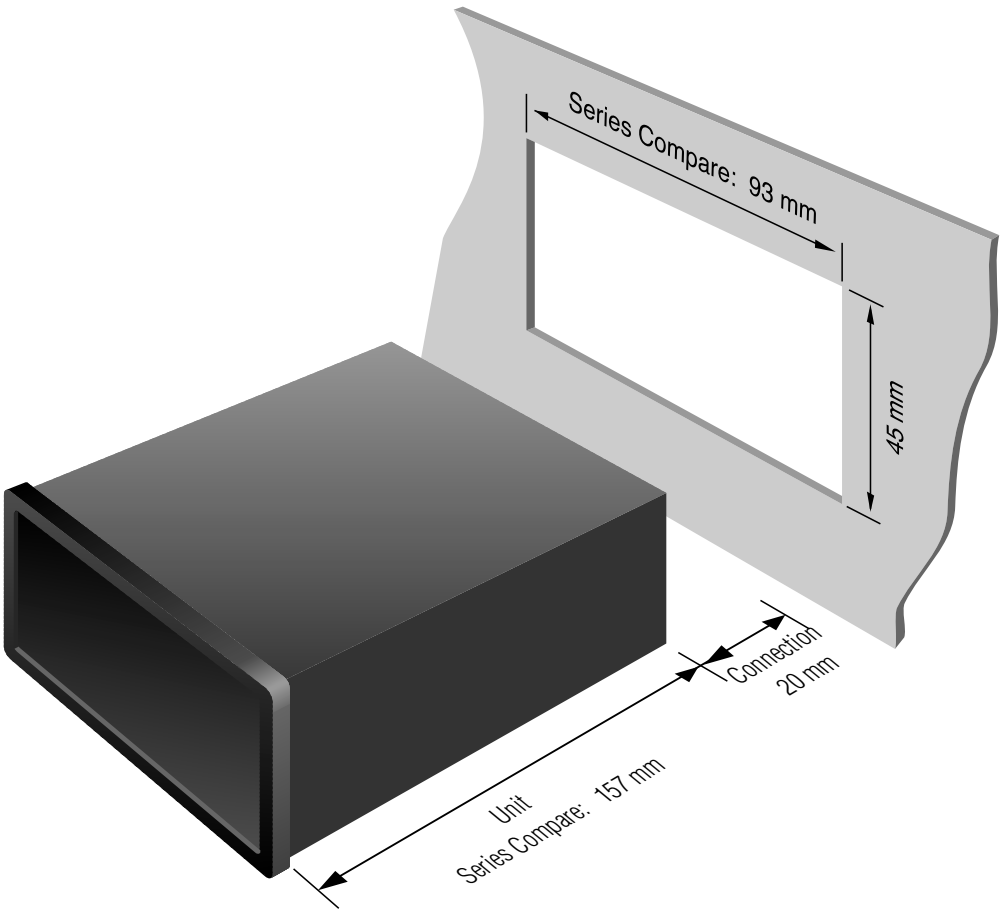


When using an inductive transducer without amplifier, pin 3 can not be connected.
Pin 1 and 2 are without indication of polarity.

required measuring cable:
measuring cable MK01: part-no.: 8824-91-02.50

1.3 Fitting situation

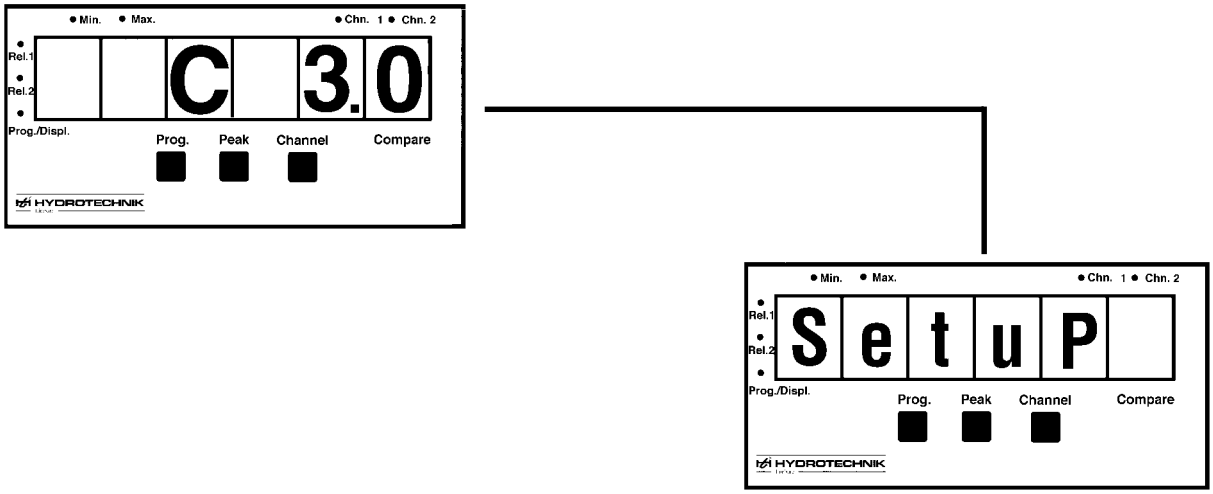
To fit the instrument into a front panel, please see the dimensions in the illustration, shown below, and prepare the panel correspondingly.



After having lead the connection cables through the opening of the panel and connected them with the measuring instrument, you only have to press the instrument into the opening from the front side until the upper and lower holding clamps snap-in.

2. First putting into operation

When putting the measuring instrument into operation for the first time, it will display the version number “C 3.0” quickly and move directly into the display “Setup” afterwards.

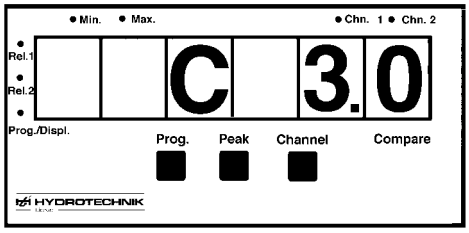


That means, the instrument needs to be adjusted to a physical measurable variable, first.

Generally, there are two types of instruments available:
1) an analogue instrument for connection to sensors with an output signal of 0 to 20 mA or 4 to 20 mA
2) a digital instrument for connection to sensors with a frequency signal (TTL-level up to 15 VDC)

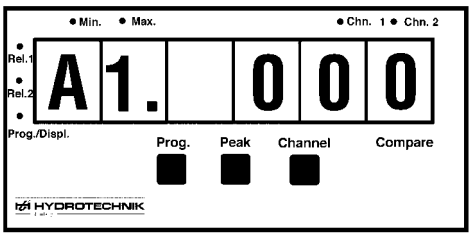
Please press any one of the following keys:

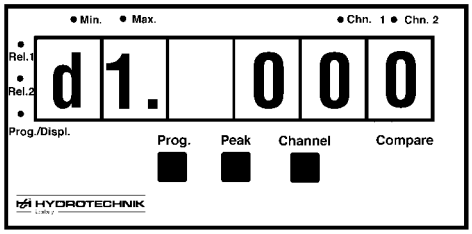
Prog. or **Peak** or **Channel**



When the version number of the instrument is displayed, please press key **Prog.** three times to start the **“Setup”**:

One of the displays, mentioned below, will be shown.
If the display shows **“A1”** your instrument is an analogue instrument, if it shows **“d1”**, it is a digital instrument.

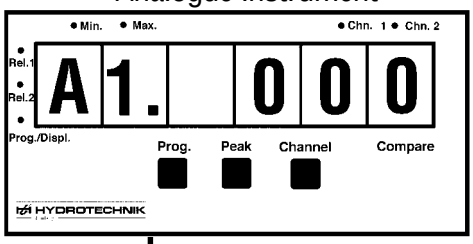




Now you have to adjust the physical measurable variable. That means, you fix, if you want to measure pressure or temperature with your analogue instrument or if you want to measure volume flow rate or RPM with your digital instrument. In the following you will find a flow diagram on how to adjust each type of instrument. **Without these adjustments the instrument won't work !**

The input is carried out with key **Channel**

Analogue instrument



Channel 1	**Input**
P (bar,psi)	001
s (mm)	002
F (kN)	003
T (°C,°F)	005
Q (l/min)	010
Q (l/h)	011

Input for 1-channel instrument.

Prog.

Channel 2	**Input**
P (bar,psi)	001
s (mm)	002
F (kN)	003
T (°C,°F)	005
Q (l/min)	010
Q (l/h)	011

additional input for 2-channel instrument

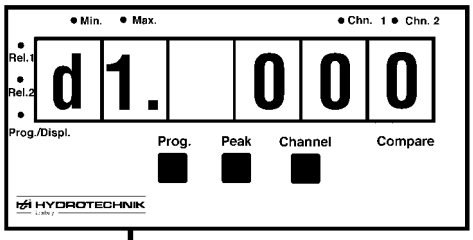
Prog.

Channel 3	**Input**
subtraction	020
addition	021
division	022
multiplication	023

additional input for 2-channel instrument **please take into account: addition and subtraction only possible if the same measuring units were chosen**

Prog.

Digital instrument



Channel 1	**Input**
Q (l/min)	010
Q (l/h)	011
n (U/min)	012
V (cm^3)	013
V (l)	014

Input for 1-channel instrument, the volume measurement (V) is only possible in channel 1 or, if detection of direction is requested, in channel 2. (further description of quantity measurement see page 36)

Prog.

Channel 2	**Input**
Q (l/min)	010
Q (l/h)	011
n (U/min)	012
detection of direction	030

additional input for 2-channel instrument

If the detection of direction is active, channel 3 can't be used.

Prog.

Channel 3	**Input**
subtraction	020
addition	021
division	022
multiplication	023

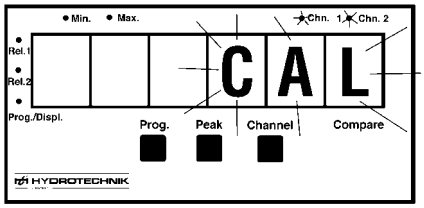
additional input for 2-channel instrument **please take into account: addition and subtraction only possible if the same measuring units were chosen**

Prog.

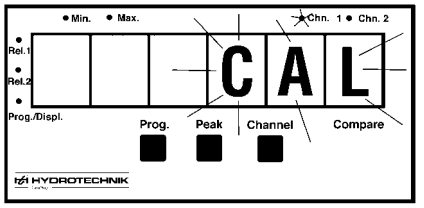
To help the user to distinguish, we have attached to each instrument a foil with adhesive labels, indicating all possible measuring units. You can stick a label with the corresponding measuring unit on the front of the instrument.

2.1 Adjustment of the channel to be calibrated

If you have made all inputs, described in the previous chapter, you are requested by the flashing display of "CAL" to enter the calibration value.

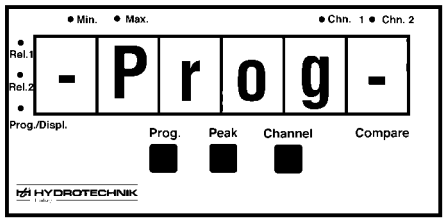


At certain adjustments of a two-channel instrument, both, the LED of channel 1 and of channel 2, can flash. The calibration of, for example, channel 1 is selected with key **Channel**



Now the LED of channel 1 is flashing and **"CAL"** is continuously flashing in the display.
In instruments with only one channel, channel 1 is invoked automatically.

If you press key **Prog.** for more than two seconds, you will get into the programming mode.



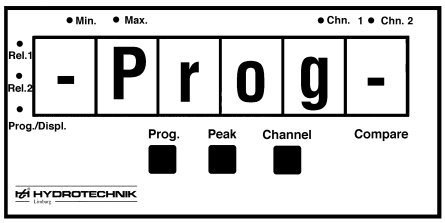
This display is shown as long as key "Prog" is pressed. Afterwards the first input step will be carried out.

The measuring instruments of series COMPARE, version 3.0 can measure one or two measuring signals at the same time, e.g. frequency F1 and F2 or pressure p1 and p2.
From these two measuring signals an additional third measurable variable can be calculated, for example when measuring pressure, this can be the pressure differential p3 = p1 - p2. The two-channel instrument provides the user with two measuring values and one calculated measuring value as channel 3.
Please take into consideration, that all measuring values can only be selected and displayed one after the other.
As the signals, mentioned-above, might have been measured by different sensors, each measuring channel uses its own programmable system parameters to display the corresponding measuring value correctly.
The third measuring channel doesn't need any sensor-specific programming, as the measuring result is taken from the measuring channels 1 and 2.
This fact explains the necessity of entering the calibration values for channel 1 and 2, as without these calibration values, no measuring values can be calculated and displayed.

In the following table the programming for all analogue or digital measuring instruments is explained in detail.

Please take into consideration, that there is a difference between the programming steps of the analogue or the digital instrument.

After the request for programming the instrument shows the max. possible programming steps for two-channel instruments. It is also possible, that less programming steps are displayed, this depends on the features of the measuring instrument.



Analogue

Channel 1
Programming steps

Sensor type: 0 to 20/4 to 20 mA
Input of calibration value: (zero)
Input of calibration value: (full scale)
Factor: conversion factor
Manual zero point:
Relay 1+2: (switch-on value)
Relay 1+2: (switch-off value)
Analogue output 1+2: (0 mA)
Analogue output 1+2: (20 mA)
Interface type: *)
Filter: *)

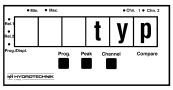
Channel 2
Programming steps

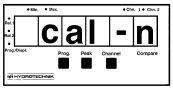
Sensor type: 0 to 20/4 to 20 A
Input of calibration value zero)
Input of calibration value: (full scale)
Factor: conversion factor
Manual zero point:
Relay 1+2: (switch-on value)
Relay 1+2: (switch-off value)
Analogue output 1+2: (0 mA/0 V)
Analogue output 1+2: (20 mA/10 V)
Interface type:
Filter:

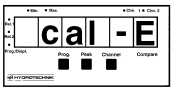
Channel 3
Programming steps

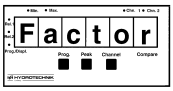
Manual zero point:
Relay 1+2: (switch-on value)
Relay 1+2: (switch-off value)
Analogue output 1+2: (0 mA/0 V)
Analogue output 1+2: (20 mA/10 V)
Interface type:
Filter:

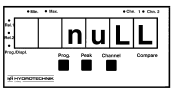
Possible displays

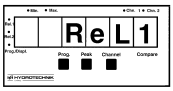


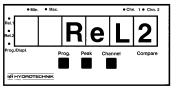


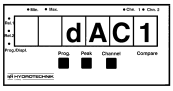


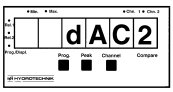


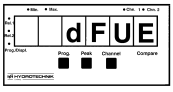


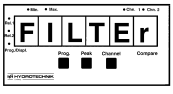












Digital

Channel 1
Programming steps

Input of calibration value:
Factor: Conversion factor
Manual zero point:
Relay 1+2: (switch-on value)
Relay 1+2: (switch-off value)
Analogue output 1+2: (0 mA)
Analogue output 1+2: (20 mA)
Interface type: *)
Filter: *)

Channel 2
Programming steps

Input of calibration value:
Factor: Conversion factor
Relay 1+2: (switch-on value)
Relay 1+2: (switch-off value)
Analogue output 1+2: (0 mA/0 V)
Analogue output 1+2: (20 mA/10 V)
Interface type:
Filter:

Channel 3
Programming steps

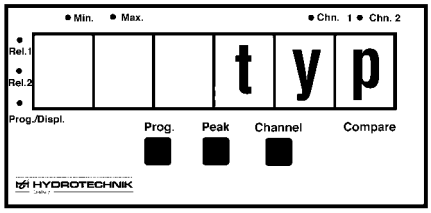
Manual zero point:
Relay 1+2: (switch-on value)
Relay 1+2: (switch-off value)
Analogue output 1+2: (0 mA/0 V)
Analogue output 1+2: (20 mA/10 V)
Interface type:
Filter:

Please take into account, that the programming steps for channel 2 and 3 don't exist in one-channel instruments.

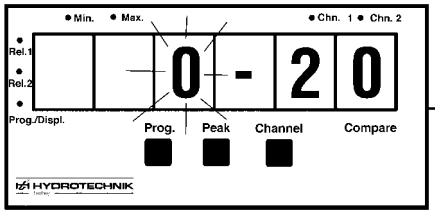
***): Only possible at one-channel instruments !**

3. Description of all programming possibilities

3.1 Selection of the sensor input signal for 0 to 20 mA or 4 to 20 mA sensors

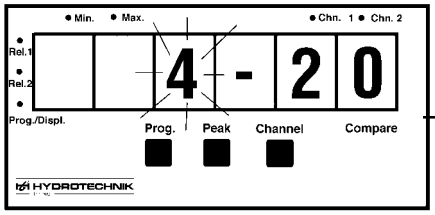


Selection 0 to 20 mA

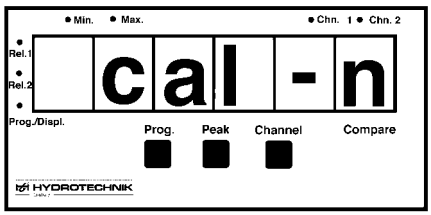


Peak

Selection 4 to 20 mA



3.2 Input of calibration value



Input of calibration value for analogue instruments (n = start of measuring range), not necessary for digital instruments.

Now, all possible programming steps will be explained in detail, so that you can use them in the right way, later.
Please understand, that we had to refrain from a separation into analogue and digital instruments for clarity's sake.
In the following manual the input possibilities are described for channel 1, only.

Prog.

After having pressed key for approx. 2 seconds, you will enter into the first programming step.
Please see the flow diagram on page 13, again.
The first step in analogue instruments is the input of the **"type"**, digital instruments will show **"CAL-E"** (input of calibration value).

For the input of **"type"** the LED for channel 1 or 2 is flashing, according to the selected measuring channel. Now you can select the sensor signal 0 to 20 mA

Channel

or 4 to 20 mA with key .

Prog.

Please confirm your selection with key .

The instrument automatically jumps to the input of **CAL-n**.

Peak

With key the place for the number, and with key

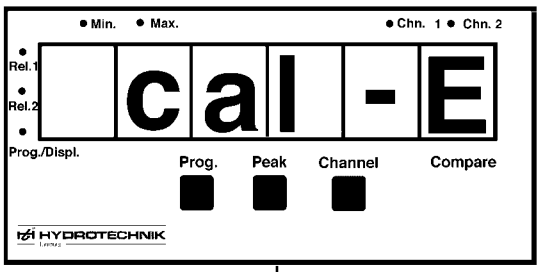
Channel

the numbers 0 to 9 are adjusted by pressing it several times.
Analogue instruments require the start- or end value for the measuring range, relating to the sensor output signal.

For example: The measuring range of a pressure sensor is 0 to 600 bar, this shall correspond to an output signal of 0 to 20 mA. Therefore you have to enter 0 as a start- and 600 as an end value.
Digital instruments require the input **CAL-E**, only.
For a measurement of RPM, the corresponding sensor supplies 60 pulses per rotation, therefore you will have to enter the numbers 6 and 0 as a calibration value.

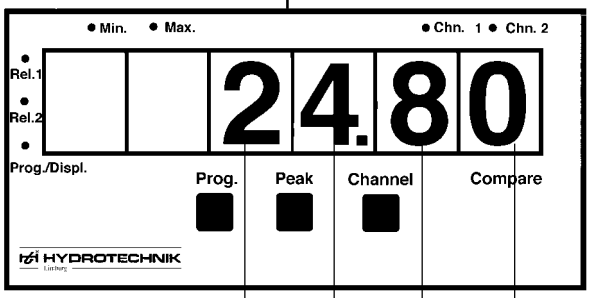
Input of calibration value

- measuring range end value at analogue instr.
- a certain calibration factor at digital instr.



Peak

Detailed description of the operating steps



Channel – 2 –

Peak

Channel – 4 –

Peak

Channel – 8 –

Peak

Channel – 0 –

Peak

Channel – , – Prog.

After having adjusted the start value, the next programme step “CAL-E” will be shown, if you press key **Prog.** .

To enter the corresponding numbers, you will have to press key **Peak** .

Here, the first digit, the red LED “Prog/Displ” and the red LED “Chn. 1” are flashing.
In the example, the value to be entered is 24,80.

The number is adjusted by pressing key **Channel** as long as the requested value is shown.

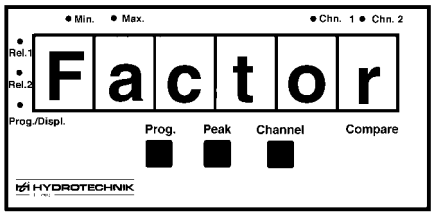
With key **Peak** the next digit is selected, which is now flashing.
This is made with every digit, until the requested value is shown.

Finally, the decimal point is selected with key **Channel** .

By pressing key **Prog.** the input is finished.

Here you can see a scheme for the complete input of the calibration value for the above-mentioned example. All further programming or entering should be made according to this scheme.

3.3 Conversion by input of factor



Examples:
Input of factor 10,00 = multiplication with 100
Input of factor 0,01 = division by 10

The word “Factor” is shown in the display.

With help of a factor that can freely be selected, the original measuring value can be converted into other dimensions.

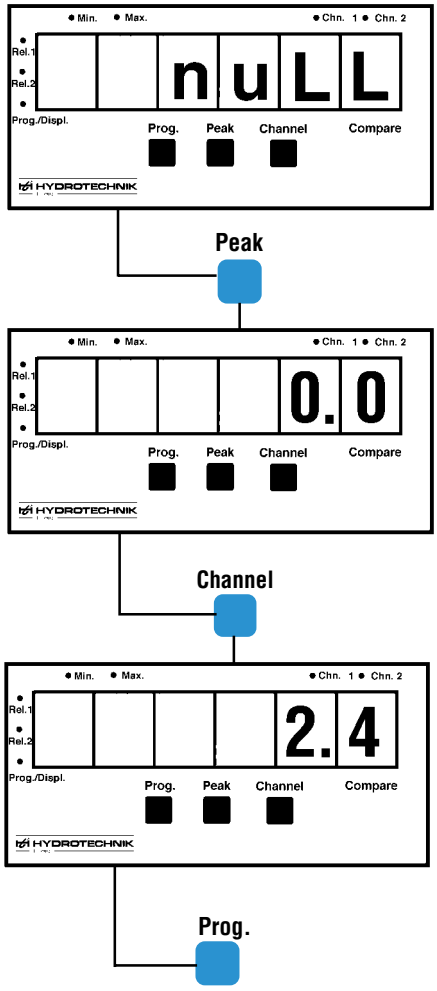
For example:
The RPM of a motor that drives a fan through a belt shall be measured. However the measurement is only possible at the fan. Here, the transmission is in no relation to the rev. speed of the motor. In this case you can enter the transmission ratio as a factor to receive the real RPM of the motor.

Four numbers and a decimal point can be freely entered for the factor.

When adjusting the factor “0”, factor “1” is adapted automatically.

After having entered the factor you will get into the next programme step by pressing key **Prog.** .

3.4 Zero point correction



The display “zero” is shown (manual zero point).

In this programme you can correct the zero point, what is very useful when a pressure sensor has a zero point deviation.

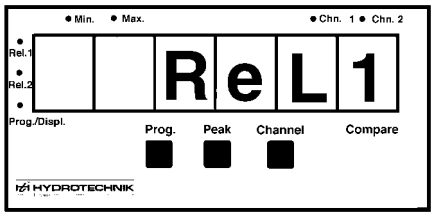
A stroke of key **Peak** displays the zero point, stored at present.
In the example, this zero point is 0,0. To find out, if for example the pressure sensor has a zero point deviation, you will have to press key **Channel** .

In the example a deviation of 2,4 bar is shown in the display.
To store this value key **Prog.** needs to be pressed.

At the same time the next programme step is invoked.

The programme will take the offset of the pressure sensor (zero point deviation) into consideration for all further pressure measurements and will correct it correspondingly.
As a result, the measuring value display will show the pressure measuring value without zero point deviation.

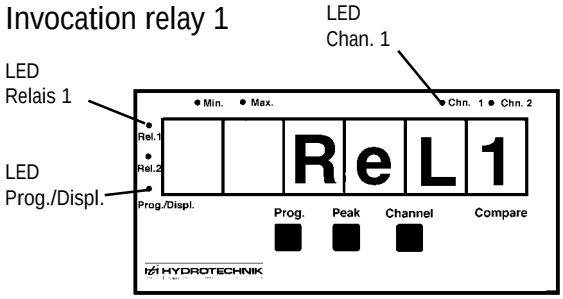
3.5 Programming of the min.- and max. limit value for relay 1 and 2



The display **ReL 1** (relay output) is shown.

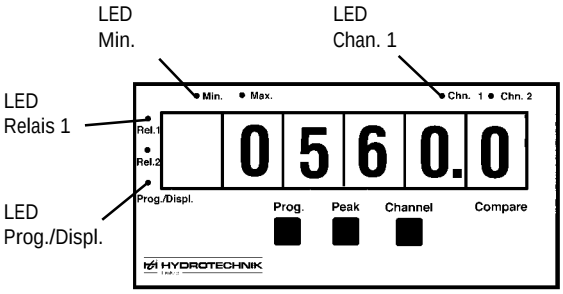
The measuring instrument can be equipped with max. two all-or-nothing relays.
The two relays REL1 and REL2 are equipped with potential-free closing contacts, the corresponding situation is shown in the measuring menu by the two LEDs “Rel 1” or “Rel 2” on the left side of the display. If one of the LEDs is illuminated, the corresponding contact is closed.

Invocation relay 1



In the example the programming for channel 1 is described.
Both relay functions can be assigned separately or together to each of the three channels.
For example: channel 1 with relay 1
channel 2 with relay 2
channel 3 with relay 1
When the last programming or fixing is finished, this adjustment will be valid and the previous adjustment will be deleted automatically.

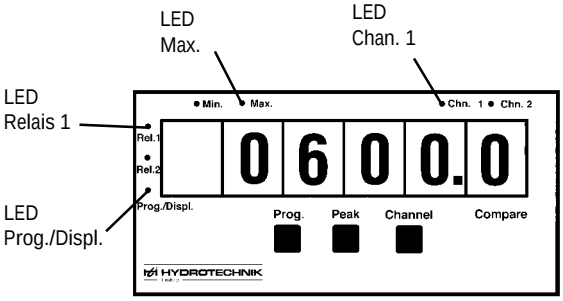
Lower limit value



For each relay that is programmed, you will have to define a switch-on and a switch-off value.
The current relay to be programmed can be recognised by the flashing LED “Rel. 1”.
Besides this, the channel to which you have assigned the switching relay is flashing, too.
In the example this is channel 1.
The LED of Chan.1 and the LED of Prog./Displ. are flashing.

The switching limit to be adjusted is additionally marked by a flashing LED “min.” or “max.”.

Upper limit value



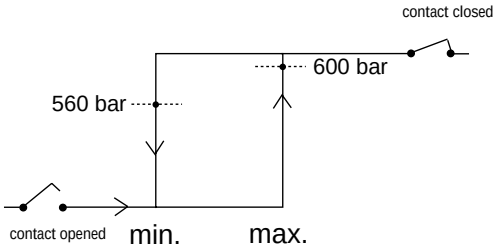
For example: In Channel 1 the relay 1 is programmed with the following pressure limit values:
min. = 560 bar and max. = 600 bar

The selected pressure values should be entered according to the already-known method. The pictures on the left side show the programmed values for:

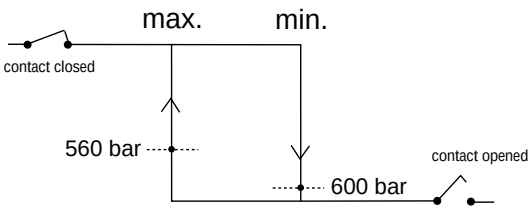
min.: 560 bar and max.: 600 bar

After that, the entered values need to be confirmed by a stroke of key **Prog.** .

Diagram of a switching function



Up to a pressure of 600 bar the contact is opened, when this value is exceeded the contact will be closed and opened again when the pressure falls below 560 bar.



Up to a pressure of 600 bar the contact is closed, when 600 bar are exceeded the contact will be opened and when falling below 560 bar it is closed again.

The programming of relay 2 is made in the same way as already described for relay 1.
Relay 2 can be assigned to the second or third channel. However, in this case, you have to select channel 2 or 3 to be able to do the programming for the selected channel.

Explanation of the function for later measurements:

Relay 1 closes the contact as soon as the **max.-value (600 bar)** is exceeded and opens again, when pressure falls below the **min.-value (560 bar)**.
The adjusted hysteresis is 40 bar.

In the above-mentioned example, the pressure limit values could also be entered the other way around:

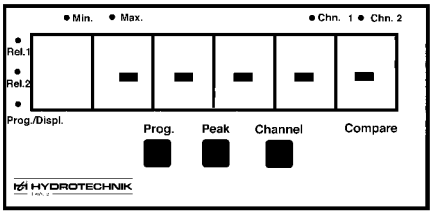
min.: 600 bar and max.: 560 bar

Here, the switching function of relay 1 is inverted.

If the max.-value of 600 bar is exceeded, a contact is opened and is only closed again, if the value of 560 bar is fallen below.

Please take care, that the hysteresis isn't selected too small.
As you always have to reckon with pressure deviations when measuring pressure in hydraulic systems, it is not sensible to select a min.-value, which is too close to the max.-value (e.g. 599 bar min and 600 bar max.). The pressure deviations would continuously cause, for example, an alarm or the switching-off of an externally connected machine.

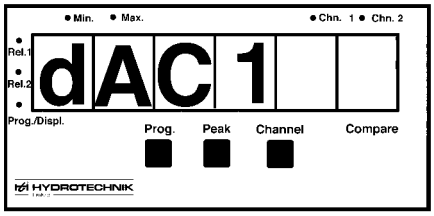
Switching-off a relay with the software



If a switching output shall not be used, we recommend to switch it off by a corresponding programming.
This is carried out by the input of at least two minus signs. Then, all other digits will automatically be marked with minus-signs (see picture on the left side).
It is absolutely sufficient to delete the min.-value by entering the minus-signs, the max.-value will automatically be deleted in the background.

Please take into consideration, that the switching contacts will automatically be opened at a power failure of the instrument.

3.6 Adjustment analogue output



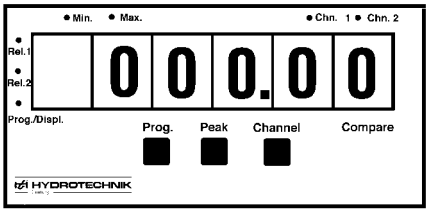
By pressing key **Prog.** you select the next programme step analogue output:

dAC1 or dAC2

Flashing LEDs mark, if channel 1 or 2 was selected. If for example channel 1 is active, the following LEDs will flash:

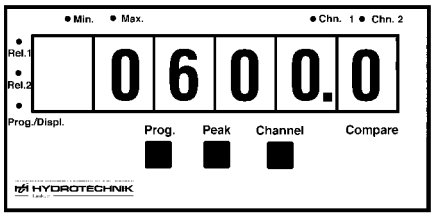
Prog/Displ. - Min. - Chn.1

Adjustment of the beginning of the measuring range



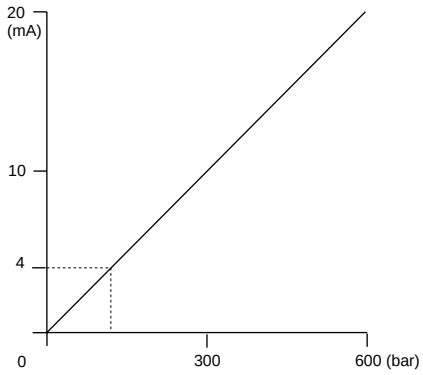
Each analogue output requires two limit values to be entered.
Example for an input for channel 1:
The limit values for a pressure sensor with a measuring range of 0 to 600 bar shall be entered.

Adjustment of the end of the measuring range



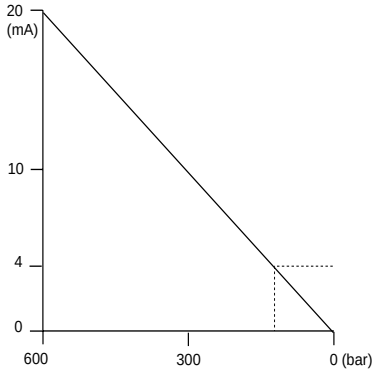
You have to enter the value for the beginning of the measuring range “0,0” and for the end of the measuring range “600,0” (see pictures) and confirm every input with key **Prog.** .

Diagram 1: analogue output

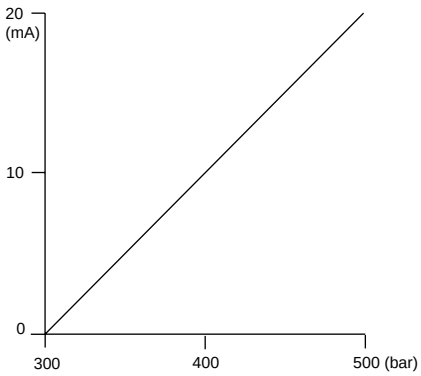


The selected measuring range of the pressure sensor from 0 to 600 bar corresponds to a current output signal of 0 to 20 mA (or 4 to 20 mA) see diagram 1.

Diagram 2: analogue output inverted



The analogue output signal can be inverted. You only have to exchange the start- against the end value and vice versa.
That means, 600 bar corresponds to 0 mA and 0 bar corresponds to 20 mA, see diagram 2.

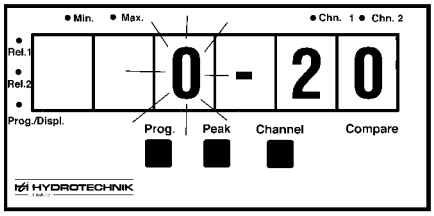


If you want to restrict the measuring range from 0 to 600 bar to e.g. 300 to 500 bar, the resulting output signal range will be proportional to the new adjusted measuring range, that means:

300 to 500 bar = 0 to 20 mA

Therefore, measuring values below 300 bar or 500 bar will be restricted to 0 mA or 20 mA, see diagram on the left side.
The analogue output signal can be inverted, too.

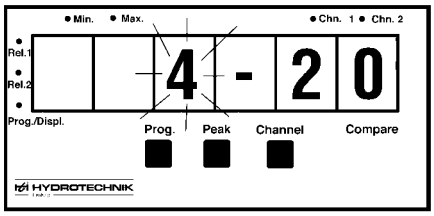
Adjustment analogue output signal 0 to 20 mA



In another programme step the instrument asks, if the analogue output shall have an output signal of 0 to 20 mA or 4 to 20 mA (see pictures). The selection is to be carried out with one of these keys:

Peak or **Channel**

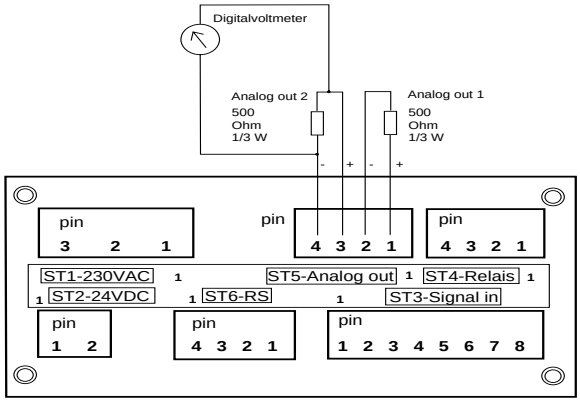
Adjustment analogue output signal 4 to 20 mA



Here, key **Prog.** should be used for confirmation of the selection, too.

Analogue output 0 to 10 V / 2 to 10 V

If a voltage is requested as an output signal, this can be realised easily.
Two 500 Ohm-resistors need to be connected to the connector **ST5-analogue out** between pin 1 and 2 and pin 3 and 4 on the back of the instrument (see picture).
A voltage, parallel to the resistor, can be taken, which corresponds to the current signal, adjusted previously:

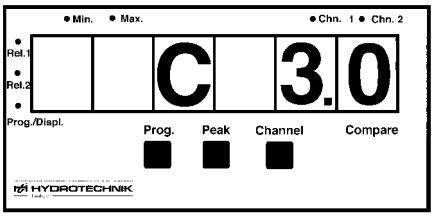


0 to 20 mA = 0 to 10 V
or
4 to 20 mA = 2 to 10 V

The programming for the second and third channel is carried out in the same way as already described on page 20.

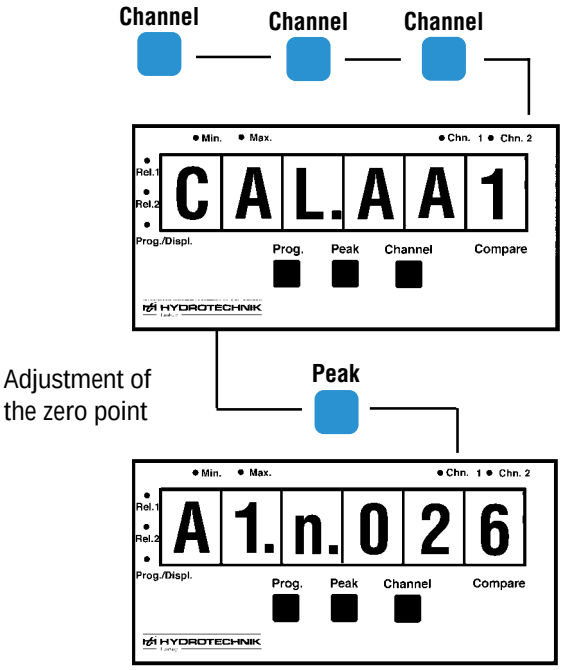
3.7 Calibration analogue output

A calibration of the analogue output is necessary to exactly adapt the different input resistors of the connected instruments, e.g. writers, PLC-controllers, etc., to the output current or -voltage. The zero point and the final value of the analogue output can be adjusted. The adjustment is made via the software of the instrument, not with adjustment potentiometers, as usual.



Invocation of the analogue output

To calibrate the analogue output, you have switch the instrument off and on again.

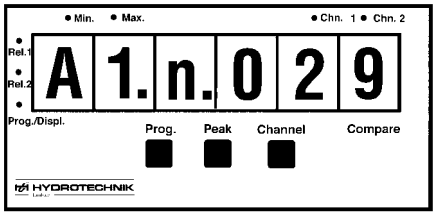


Immediately after **"C 3.0"** has been displayed, you have to press key **Channel** three times.

The following display will appear and ask for the adjustment of analogue output A1 (Channel 1).
It is useful to connect a digital voltmeter to the corresponding analogue output (in the example channel 1 parallel to output pin 1 and 2 or via the connected resistor).

By pressing key **Peak** you will get into the mode for correction or adjustment of the zero point.
The display shows **"A1.n."** and a tree-digit, hexa-decimal number, which, however, is unimportant for the user, as a digital voltmeter is used for the adjustment, anyway.

Example of a modified zero point correction



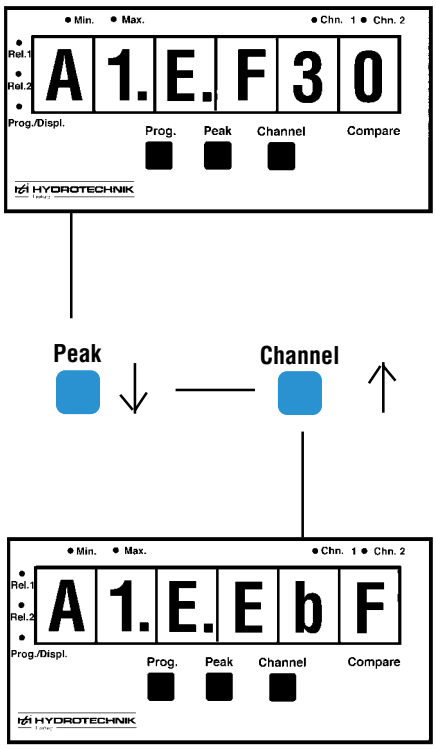
Example of a modified zero point correction

To correct the zero point the keys **Peak** and **Channel** are used.

By pressing key **Peak** ↓ several times, you reduce the zero point up to negative values.
Please pay attention to the digital voltmeter, the display may have a negative sign.

With key **Channel** ↑ the zero point value can be increased and set to positive signs.
With both keys, you can adjust the zero point exactly.

Adjustment of the max. current- or voltage value



Example for a modified, max. current- or voltage value

For the adjustment of the max. current or voltage you have to press key **Prog.** .

The request for input **"A1.E"** and the three-digit, hexadecimal number will be displayed automatically. For the exact adjustment of the max. voltage value, e.g. 10.00, you can use the keys

Peak ↓ and **Channel** ↑

as already described for the zero point adjustment.

After having adjusted the zero point and the max. current or voltage value you have to confirm you adjustments with key **Prog.** , the instrument will store these values.

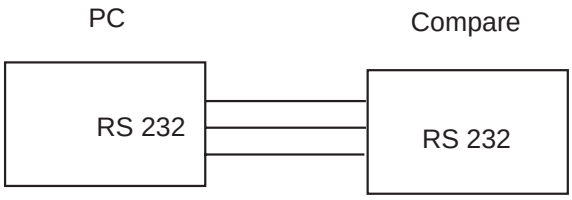
A two-channel instrument will request the adjustment of the analogue output channel 2, additionally, a one-channel instrument will automatically show the measuring value display mode.

For the alignment of the analogue output the adjustment can be accelerated if one of the keys

Peak ↓ or **Channel** ↑

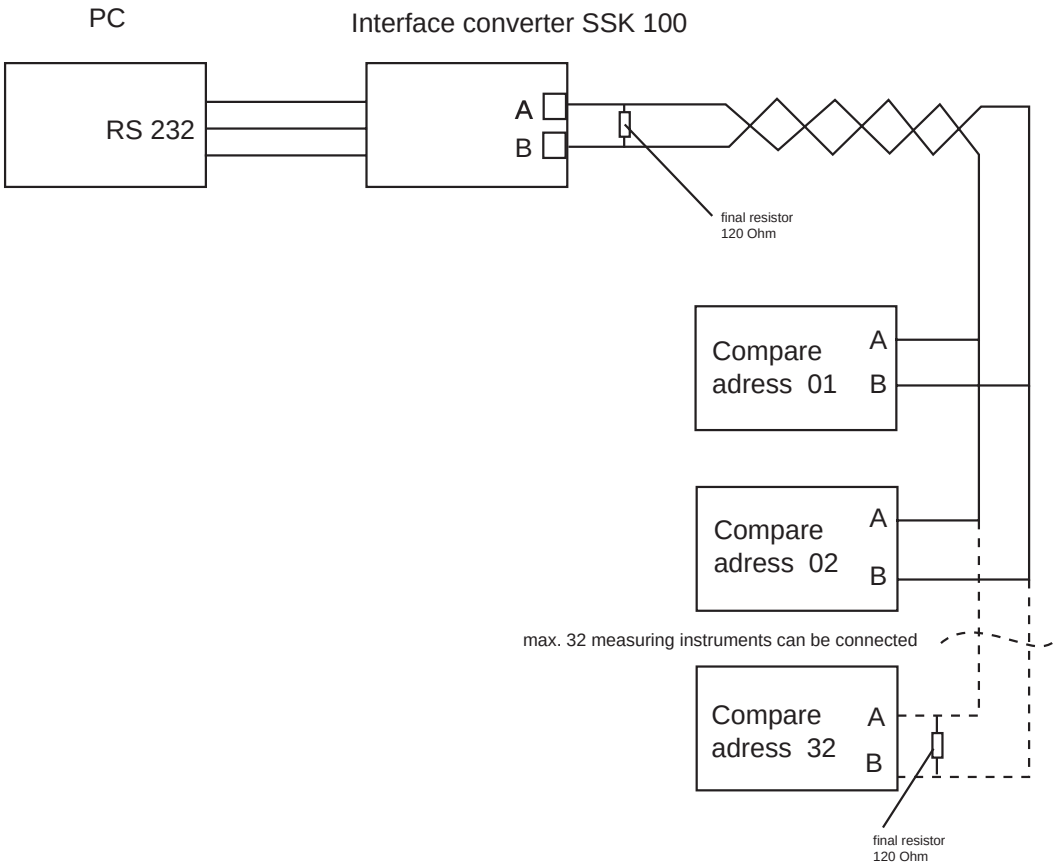
is pressed more than ten times.
The input steps will be slowed-down automatically, if you press another key.
In doing so, you can carry out a faster alignment with the digital voltmeter.
Please try this possibility !

3.8 Interface RS 232

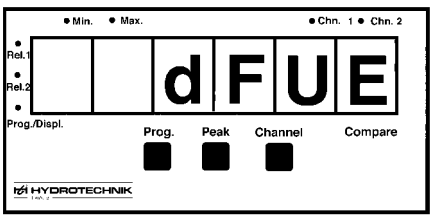


An adjustment of the interface RS 232 isn't provided.
You have to connect the PC to the Compare instrument via a corresponding data cable.
Data transmission: 1 startbit, 8 data bits, 1 stop bit, no parity bit, 9600 Baud.
The max. possible length of the cable between PC and Compare-instrument is 25 m.
Connection cable 3-wire, screened.
Adjustments in the Compare-instrument: none.

3.9 Interface RS 485

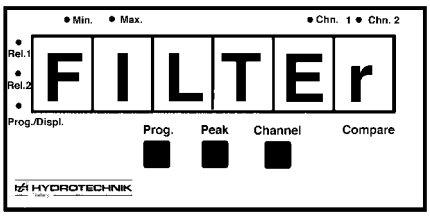


Up to 32 Compare-instrument can be connected to the interface RS 485. For data transmission an interface converter needs to be connected between the PC and the Compare-instruments.
Data transmission: 1 start bit, 8 data bits, 1 stop bit, no parity bit, 9600 Baud.
Connection cable from interface converter to Compare instruments: 2-wire, twisted, max. cable length: approx. 500 m.
Adjustments at the Compare instrument: for every Compare instrument to be connected a different address needs to be chosen resp. entered into the instrument.
Final resistors (120 Ohm) should be connected to the interface converter and to the last adjusted Compare-instrument, all other resistors can be removed.



In the programming mode, the step „dFUE" needs to be selected.
With the keys **Peak** and **Channel**, the given addresses (rising or falling) from 01 to 32 (32 to 01) can be chosen. With key **Prog.** the input of the address needs to be confirmed.

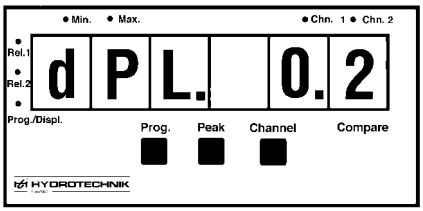
3.10 Filter adjustments



With this function you can adjust and influence the speed with which the measuring values shall be displayed. This adjustment is always valid for the complete instrument but can be modified anytime.

Display speed

By pressing key **Peak** you will enter the following display.



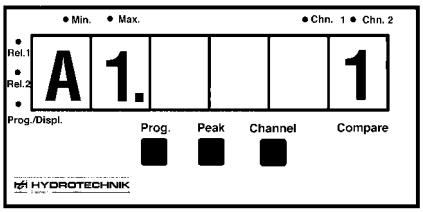
Display speed means the speed, with which a measuring value change is shown in the display. If the measuring values are changing very quickly, it will be sensible to slow the speed down, as otherwise your eyes won't be able to follow the display.
The following display periods can be selected with key **Peak** :

0,2 s • 0,5 s • 1,0 s • 2,0 s • 5,0 s • 10,0 s and 20,0 s

The corresponding selection should be confirmed with key **Prog.** .

The instrument automatically changes into a display for the adjustment of the delay time for the analogue output.
The delay time is a time constant, resulting from the input measuring signal and the output signal of the analogue output.
With key **Peak** you can select the following delay factors for the analogue output:

Delay for the analogue output

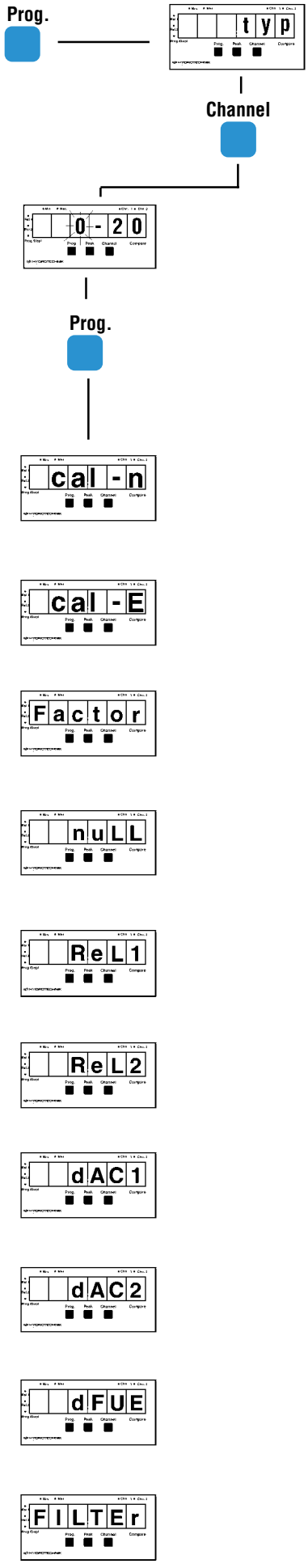


1 ms • 2 ms • 5 ms • 10 ms • 20 ms • 50 ms • 100 ms • 150 ms und 200 ms

Here you have to confirm your selection with key **Prog.** , too.

The adjustments (filters) are always valid for the complete instrument and can be changed anytime.

4. Invocation and checking of all programmed system parameters



When all programming possibilities are finished, the system parameters can be checked.

With key **Channel** the corresponding channel is selected

and the LED “Chan. 1” or “Chan. 2” is illuminated.

By pressing key **Prog.** quickly, you can invoke all

programmed parameters one after the other.
To have the corresponding adjustment for each invocation displayed, you will have to press key **Channel** additionally.

By pressing the keys **Prog.** and key **Channel**

consecutively, first the system parameter and afterwards the programmed adjustments are displayed.

For the better understanding, all possible system parameters are mentioned here.
Of course, they can deviate from your parameters, as they depend on the type and options of the instrument you use.
As an example, the programmed adjustment is additionally shown here in the first step besides the invocation of the system parameter for the selection of the sensor input signal **TYPE**. As all further operational steps are carried out in the same way, a further explanation will be superfluous.

After all system parameters were displayed, you get automatically back into the measuring value display.

5. Display of extreme values (min./max.)

If you expect pressure peaks during the monitoring of pressure, the display of pressure peaks in a running measurement will be a very useful possibility.
According to the maximum indicator principle, the maximum amplitude of a pressure peak or the minimum pressure will be acquired.

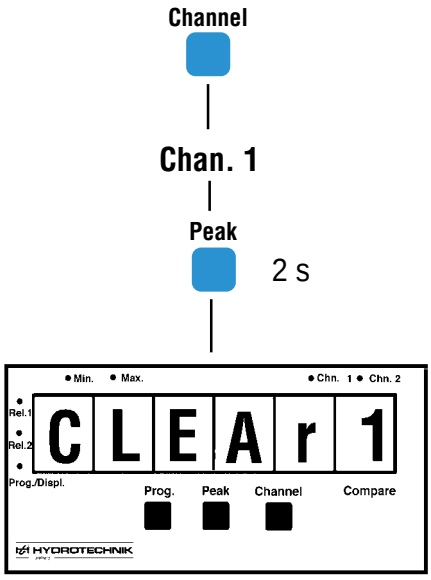
The min./max. values are displayed by selecting the measuring channel

with key **Channel** .

The corresponding LED **"Chan. 1"** or **"Chan. 2" or both LEDs will be illuminated.**

A stroke of key **Peak** will switch the display to the

min. value (visible by LED "Min.").
If you press this key again, you will switch the display to the max. value (LED "Max." will be illuminated) and a further pressing of the same key will cause the display of the normal measuring values, again. None of the LEDs "Min." and "Max." will be illuminated.



If there is another pressure or the checks are changed by the customer, the min./max. values can be deleted. During the deletion, the note **"CLEAR"** and the number of the channel that was deleted, are displayed.

By pressing key **Peak** for longer than 2 seconds,

both, the min. and the max. value of the previously selected channel, will be deleted automatically.

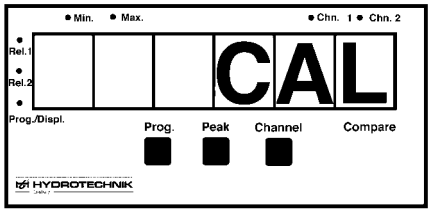
In the example you can see the deletion of channel 1.

If, however, the values in channel 3 are deleted, this will cause a general deletion of all measuring channels (Chan.1 to Chan. 3).

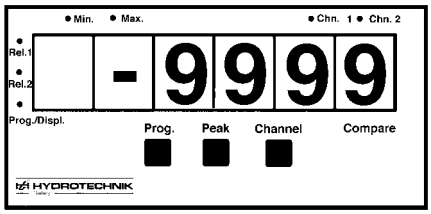
For your information:

Even if the instrument is in the normal measuring mode, all min. and max. values will be measured continuously. The measured values won't be stored after having switched-off the instrument. The measuring values, existing at that moment, will be displayed, if the instrument is switched-on again.

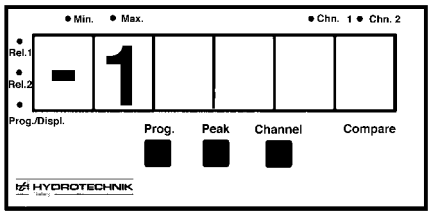
6. Error messages



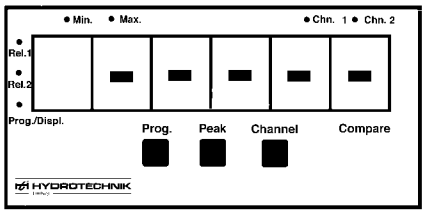
The most important system parameter is the calibration value.
If this value has been deleted after a software reset or programmed with value “0” by mistake, the display shows **“CAL”** (see picture). The LED **“Chan.”** of the measuring channel, where the calibration value is missing, is flashing additionally.
For an instrument with two channels, you have to programme one calibration value for each measuring channel. However, you could work, for example, with channel 2 while **“Cal”** flashes in channel 1.



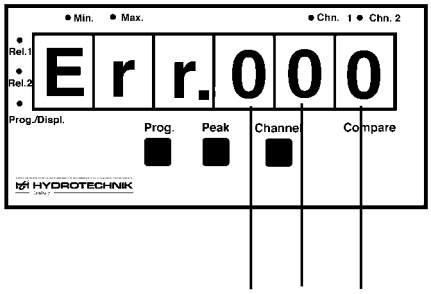
This display appears, when the input measuring range is exceeded or fallen below:
If a negative sign and “9999” is displayed, the instrument fell **below** that value, if a positive sign and “9999” is shown, the value was **exceeded**. For the channel, in which the valid measuring range was left, the corresponding LED **“Chan.”** flashes.



Here, the measuring result can’t be displayed any more, as the limit of ±**9999** was exceeded.



The minimum power of **4 mA (- 5%)** doesn’t exist for the measuring channels, that need a signal current of 4 to 20 mA.
The **LED “Chan.”** flashes for the measuring channel, where the minimum power wasn’t provided.

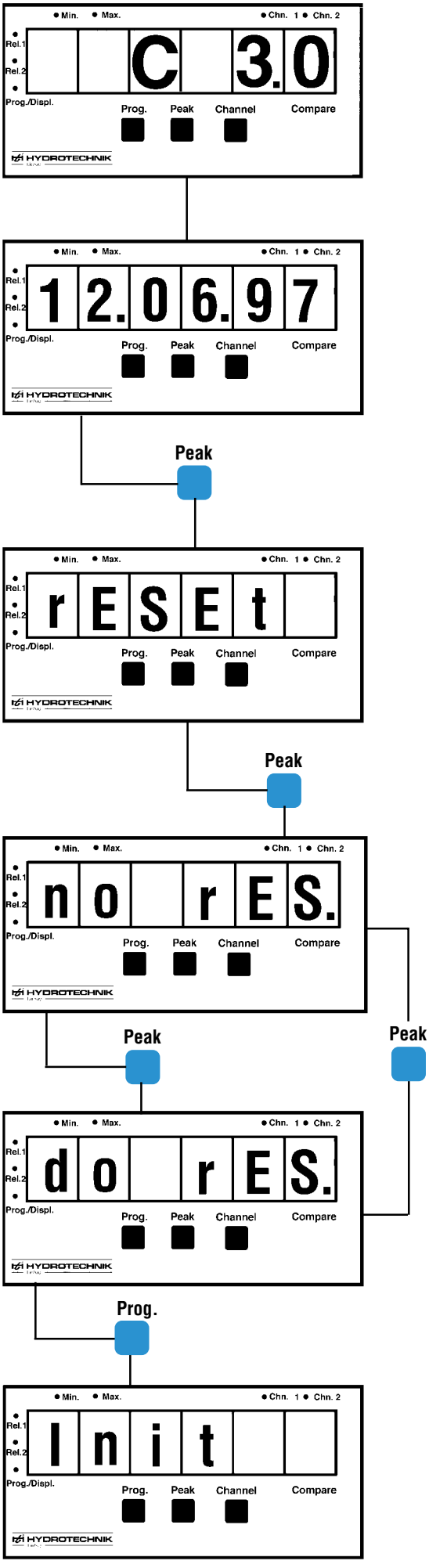


Further error messages are displayed by **"Err."** and a three-digit combination of numbers, they result from an invalid programming of the instrument and are as follows:

0 0 0	-	problem that can't be located any further
0 0 1	-	RAM-memory component defective
0 0 2	-	EEPROM-memory component defective
0 0 4	-	measuring channel without function, carry-out special function "Setup"
0 0 6	-	interface defective
0 0 8	-	hardware configuration has changed, please store new configuration, Attention: system reset
0 1 1	-	the display can't show the value
0 1 4	-	calibration of AD-converter faulty
0 2 1	-	sensor supply for channel 1 is missing
0 2 2	-	sensor supply for channel 2 is missing

If one of these messages occurs in the display and you aren't able to solve the problem, please get into contact with our service-department.

7. System reset



If your instrument can't be operated any more, due to an unknown error, it can be started again by a "reset" command. To carry out the reset, you have to interrupt the power supply for a short moment and connect it again, afterwards. "CAL" will be displayed. During this short display period, the following keys should be pressed, one after the other:

Prog. and **Peak** and **Channel**

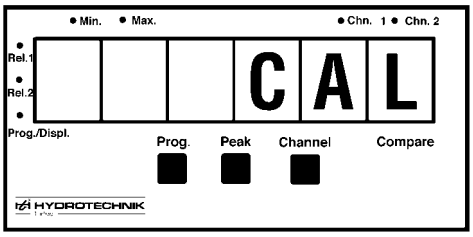
Now, the date when the programme version C 3.0 was established, will be displayed.

Key **Peak** needs to be pressed.

The programme asks you to carry out a "reset". You will have the possibility to carry out the reset or to cancel it.

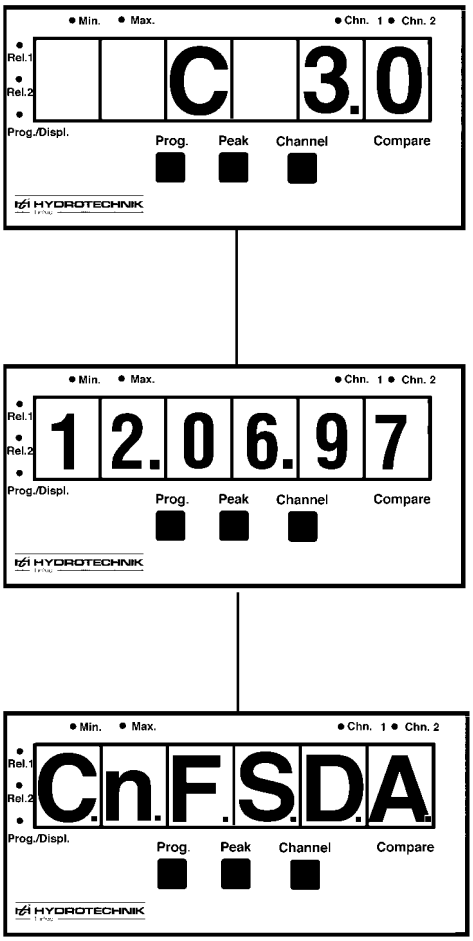
If you press key **Peak** several times, the two possibilities will be shown alternately.
If you want to carry out a reset, you will have to press key **Prog.** .

When "Init" is shown in the display, all system parameters will be reset.



The instrument shows **"CAL"** and all adjustments need to made as already described from page 13, chapter 2.1, on.

8. Display and recognition of the installed hardware components



The user has the possibility to have the internal hardware components of the instrument displayed. That means, the software is able to display the configuration of the hardware with a special code.

To make use of this possibility, you will have to disconnect the instrument from the power supply, first and connect it again.
The display shows "CAL" and while this message is displayed, you will have to press the following keys, one after the other:

Prog. and **Peak** and **Channel** .

The date, when programme version **C 3.0** was established, will be displayed.

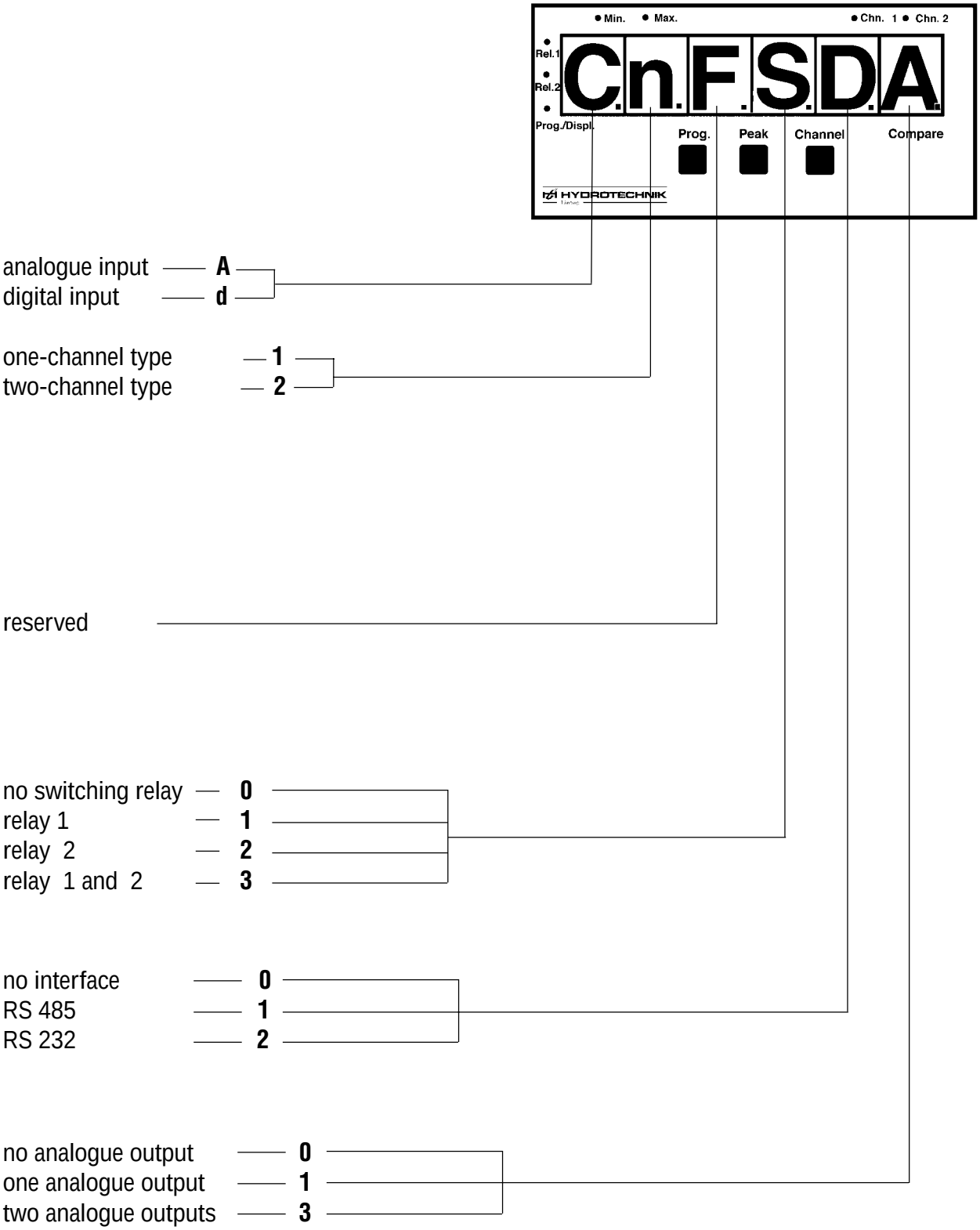
No further keys need to be pressed !!!

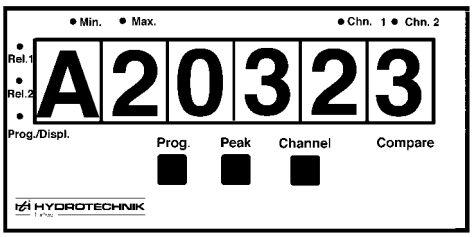
After a period of approx. 8 seconds, the instrument will show the encoded display, which you can see in the picture on the left side.

On the next page you will find the special code, which informs you about the internal hardware configuration of your instrument.
Every instrument can be identified in this way.

Code for the installed hardware components

In the example, the display shows the code “CnFSDA”.
In the following, it is explained in more detail:





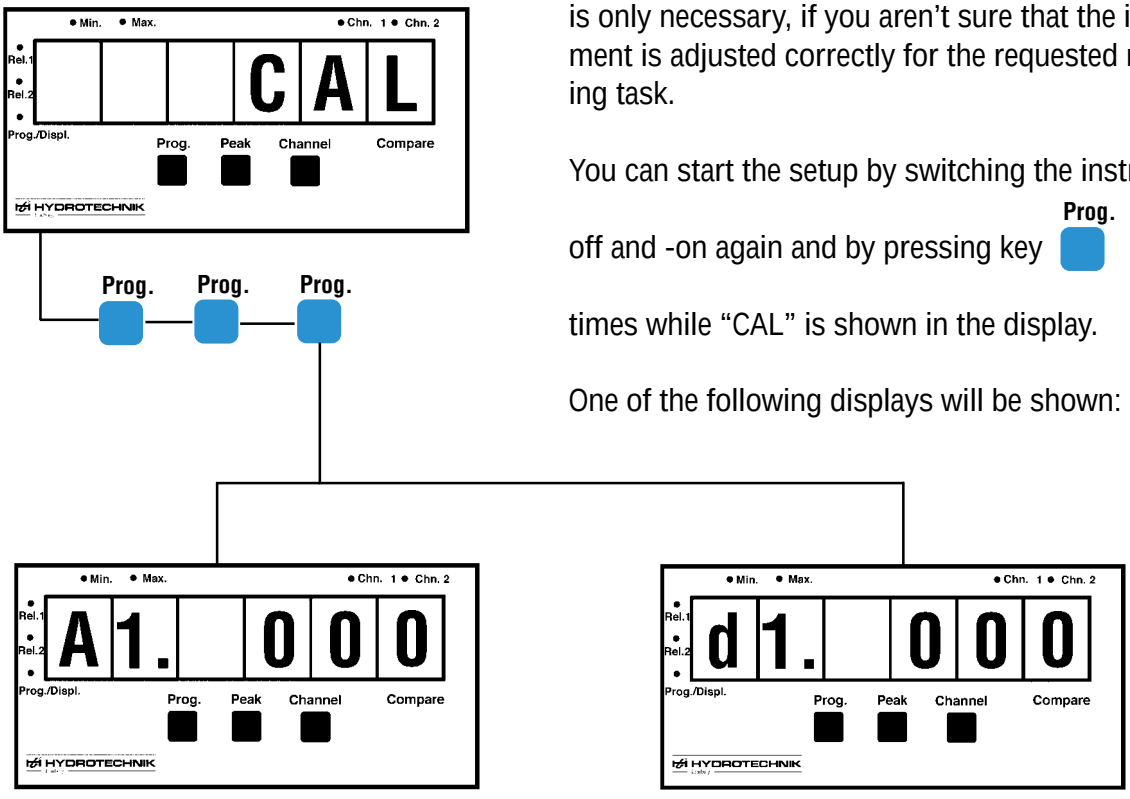
By pressing key **Peak** you can see the codenumber of the instrument.
In the example this is the combination:

A 20323

According to this code, the letters and numbers indicate the following instrument configuration:

A: analogue input
2: two-channel
0: reserved
3: relay 1 and 2
2: interface RS 232
3: two analogue channels

9. New Setup



After having checked the instrument's configuration, you can carry out an additional setup. However, this is only necessary, if you aren't sure that the instrument is adjusted correctly for the requested measuring task.

You can start the setup by switching the instrument off and -on again and by pressing key **Prog.** three times while "CAL" is shown in the display.

One of the following displays will be shown:

Either a "A1" (for analogue instrument) or a "d1" (for digital instrument) is shown in the display.
The adjustments that are necessary were already described on page 12.

Please take into consideration, that the measuring instrument won't work without any further inputs.

10. Technical data

Working voltage: 230 V ±10% / 50 Hz if requested 110 V ±10% / 50Hz or 24 V ± 6 V direct voltage

Attention: All programmed values will remain in the instrument, even if the voltage is interrupted.

Attention: Measurements of volume flow rate can only be carried-out with measuring turbines, the inductive transducer of which has an integrated amplifier.
That means, the signals are square wave signals with a signal amplitude of 5 to 10 V.

The instrument is equipped with max. 2 limit values and each one of these values closes one relay.
Switch load: max. 48 V / 3 A, switching contacts will automatically be opened at a power loss.

Input signal:	analogue: 0 to 20 / 4 to 20 mA 1 ms scanning rate digital: 0 to 10 kHz 5 to 10 V, square wave signal
Display:	14 mm LED 7-segment, colour red
Measuring display rate:	adjustable from 0,2 to 20 s
Sensor supply:	15 VDC, max. 40 mA
Power consumption:	max. 6 W at 230 VAC, 4,8 W at 24 VDC
Input frequency:	0 to 5.000 Hz / 5 to 10 V
Analogue output signal:	0 to 20 mA / 4 to 20 mA, max. apparent ohmic resistance: 500 Ohm
Error limit:	for analogue instruments (display) ± 0,5% of full scale for digital instruments (display) ± 1 µs period duration

CE

Our measuring systems are manufactured according to the European production standards and fulfill the EC-directives concerning the electromagnetic compatibility (EMC) according to EN 50081 and EN 50082

11. Information on guarantee

Within the framework of our guarantee conditions we guarantee the unobjectionable manufacture of our technical instruments.

The guarantee is valid for 6 months.

In principle, the general terms of business are valid.

The right to claim under guarantee becomes invalid, when repairs or interventions are executed by persons, who were not authorised by us.

Within the six months of the guarantee, we will remove free of charge damages or defects, which can be proved to be based on a works' mistake, as far as the customer informs us immediately after having detected it, but within six months at the latest.

The fulfilling of the guarantee is done in a way, that defective parts are repaired or replaced by unobjectionable parts at our choice, free of charge.

Instruments, for which you want to claim under guarantee, have to be sent carriage paid together with the corresponding copy of the invoice or the delivery note to:

HYDROTECHNIK - Service

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12. Maintenance

Your measuring instrument is a precision instrument, which will work without trouble for many years, if it is treated correspondingly.

However, in the case that interference occurs nevertheless, please do not try to repair the instrument yourself!

Leave the maintenance or the repair up to our **HYDROTECHNIK-SERVICE.**

Adress: HYDROTECHNIK GmbH
Holzheimer Straße 94 - 96
D-65549 Limburg
Tel.: 0 64 31 - 40 04 · 0
Fax 0 64 31 - 4 53 08

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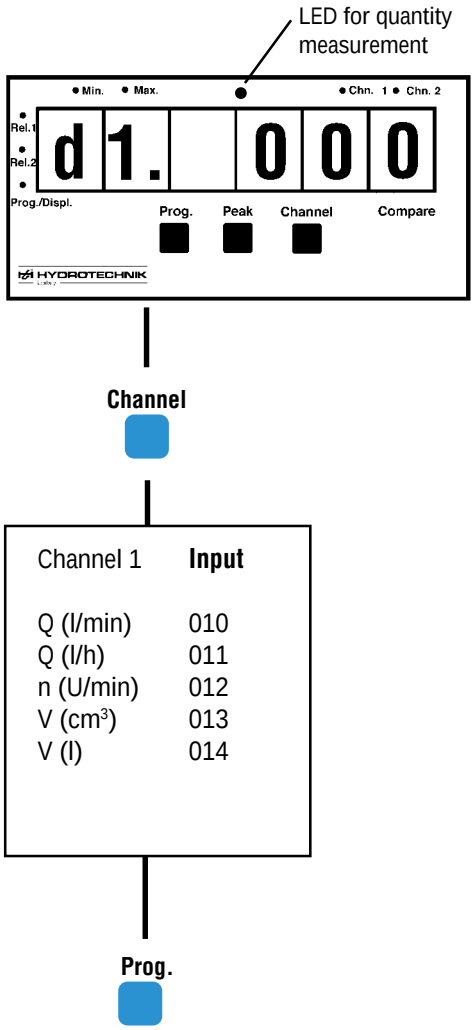
13. Quantity measurement

Adjustment to quantity measurement
(see page 11)



Quantities can only be measured with a Compare instrument that is able to proceed digital signals (frequencies).
The quantity measurement is adjusted in the setup-programme of the measuring instrument, e.g. to „013“ in cm^3 or „014“ in litres.
The description of the setup can be found on page 11.

For the quantity measurement the geometric tooth volume „vgz“ needs to be entered as a calibration value. The geometric tooth volume can be seen in the calibration certificate of the volume flow rate sensor.
Please take into consideration that the calibration value needs to be entered in programming step „cal E“.
A more detailed description of the input of the calibration value can be seen on page 16.

The quantity measurement (counting) will only be active, if you press the key on the right side **Channel** after having switched-on the instrument.

Another stroke of this key avoids the continuous counting of the quantity.
You can see by the illuminated red LED in the middle of the display (see picture above) that a quantity measurement (counting) has been started.

By pressing the middle key **Peak** the displayed quantity (counting) can be set to zero. Then, the display will show 0,0.

HYDROTECHNIK - Service

HYDROTECHNIK Limburg
Messen mit System

HYDROTECHNIK GmbH
Holzheimer Straße 94 - 96
D-65549 Limburg
Tel.: 0 64 31 - 40 04 · 0
Fax 0 64 31 - 4 53 08

Should your Multi-System 5000 require repair, we depend on your support.
Please describe your complaint as precisely as possible. That enable us to locate the error more easily and you will profit from shorter repair times.

If we have any additional queries, please state the person to contact:

Company:	
Department:	
Name:	
Telephone:	
Fax:	

☒ Please tick the appropriate answer:

Part to repaired:	**Your PC**	**operating system**	**software**
Measuring instr. **Sensor** **Cable** **Supply unit**	**386** **486** **Pentium** **P 2**	**DOS** **Windows 3.1x or** **Windows 95** **NT**	**HYDROcomsys/DOS: version** **HYDROcomsys/Windows: version**

How to describe an error:

Please leave all parameters etc. unchanged after an error occurs.
Briefly describe your measuring task, connection of sensor, parameter adjustments (for example memory parameters, trigger, how many measuring values are acquired, type of printer, etc.

Your description:

Order data for panel mounted instrument series SEG 1000	Part-number
SEG 1000 - analogue, for signal 0 to 20 mA / 4 to 20 mA	
- SEG 1000, 230 VAC only display	**3192-01-01.00**
- SEG 1000, 230 VAC with option analogue output	**3192-01-03.00**
- SEG 1000, 230 VAC with option limit value	**3192-01-05.00**
- SEG 1000, 230 VAC with option analogue output and limit value relay	**3192-01-07.00**
- SEG 1000, 24 VDC only display	**3192-01-02.00**
- SEG 1000, 24 VDC with option analogue output	**3192-01-04.00**
- SEG 1000, 24 VDC with option limit value	**3192-01-06.00**
- SEG 1000, 24 VDC with option analogue output and limit value relay	**3192-01-08.00**
SEG 1000 - digital, for frequency signals	
- SEG 1000, 230 VAC only display	**3192-02-01.00**
- SEG 1000, 230 VAC with option analogue output	**3192-02-03.00**
- SEG 1000, 230 VAC with option limit value	**3192-02-05.00**
- SEG 1000, 230 VAC with option analogue output and limit value relay	**3192-02-07.00**
- SEG 1000, 24 VDC only display	**3192-02-02.00**
- SEG 1000, 24 VDC with option analogue output	**3192-02-04.00**
- SEG 1000, 24 VDC with option limit value	**3192-02-06.00**
- SEG 1000, 24 VDC with option analogue output and limit value relay	**3192-02-08.00**

Design in 115 VAC on request

Sensors (series SEG 1000 and Compare)			Part-number
- Pressure (output signal 4 to 20 mA)	Measuring range in bar	0 to 60 (... 870)	**3403-21-A4.37**
Pressure sensor type HD	(in psi)	0 to 200 (... 2900)	**3403-10-A4.37**
		0 to 400 (... 5800)	**3403-15-A4.37**
		0 to 600 (... 8700)	**3403-18-A4.37**
Pressure sensor type PR 15		-1 to +6 (-14,5... 87)	**3403-32-71.37**
		0 to 1000 (... 14500)	**3403-29-71.37**
- Pressure (when selecting the pressure sensors with an output signal of **0 to 20 mA,** you only have to replace the last two numbers .37 with the numbers **.33**)		**for example:**	3403-21-A4 **.33**
- Volume flow rate	Measuring range in l/min	7,5 to 75 (2... 20)	**31V7-21-35.00**
Measuring turbine RE 3 (inductive transducer with amplifier)	(in gal/min)	15 to 300 (4... 79)	**31V7-30-35.00**
Output signal (square wave)		25 to 600 (6,6... 158,5)	**31V7-40-35.00**
With MINIMESS and p/T-test points (series 1620 - M 16 x 2)			
(Please see our brochure RE 3/RE 4 for further details)			
- Volume flow rate	Measuring range in l/min	1,0 to 10 (0,26... 2,6)	**31V7-01-35.00**
Measuring turbine RE 4, (inductive transducer with amplifier)	(in gal/min)	7,5 to 75 (2... 20)	**31V7-70-35.00**
Output signal (square wave)		15 to 300 (4... 79)	**31V7-71-35.00**
With MINIMESS and p/T-test points (series 1620 - M 16 x 2)		25 to 600 (6,6... 158,5)	**31V7-72-35.00**
(Please see our brochure RE 3/RE 4 for further details)			
- Volume flow rate	Measuring range in l/min	0,005 to 1 (0,0013... 0,25)	**3143-01-35.00**
Gear flow meter type GFM	(in gal/min)	0,05 to 5 (0,013... 1,3)	**3143-02-35.00**
Output signal (square wave)		0,2 to 30 (0,05... 8)	**3143-03-35.00**
With MINIMESS and p/T-test points		0,7 to 70 (0,18... 18,5)	**3143-04-35.00**
(series 1620 - M 16 x 2)		3,0 to 300 (0,79... 79,25)	**3143-05-35.00**
(Please see our brochure GFM 4 for further details)			
- Rev. speed sensor, infra-red sensor type DS 03 with 25 pieces of reflective foil	Measuring range in min^{-1}(rpm)	1 to 9999 (1... 9999)	**3130-02-01.00**
- Reflective foil (spare part, 50 pieces)			**8840-02-01.01**
- Inductive transducer with amplifier Output signal: square wave 5 - 10 V (rev. speed measurement on gear wheels)			**3107-00-09.00**
- Temperature	Measuring range in °C (°F)	-50 to +200 (-58... +392)	
Temperature-screw-in sensor Pt 100, 3-wire technique 0 to 20 mA for p/T-test point 1620 / 04			**3973-04-01.00**
Temperature-screw-in sensor Pt 100, 2-wire technique 4 to 20 mA for p/T-test point 1620 / 04			**3969-04-01.00**
(Further technical details can be seen in our brochure „Sensors for pressure, temperature and RPM“)			

Further additional sensors for special measuring tasks on request.

Accessories (series SEG 1000 and Compare)			Part-number
- Measuring cable MK 15 (direct connection between Compare /SEG and sensors, length: 2,5 m)			**8824-C1-02.50**
- Label set (self-adhesive foil with different units of measurement)			**8081-32-04.00**
- Cable, four-wire with screening:			**8824-02-02.01**
- Cable plug, five-pole with strain relief: for self-mounting			**8808-04-00.01**
- Cable socket, five-pole with strain relief:			**8808-05-00.01**
- Direct connection for pressure sensor type HD	- straight	(series 1620 - M 16x2)	**2103-07-08.62**
- Direct connection for pressure sensor type HD	- 90°	(series 1620 - M 16x2)	**2146-13-05.00**
- Direct connection for pressure sensor type PR 15	- straight	(series 1620 - M 16x2)	**2146-05-30.00**
- Direct connection for pressure sensor type PR 15	- 90°	(series 1620 - M 16x2)	**2146-54-19.40**
- p/T-test point 1620 (M 16 x 2) screw-in thread M 10 x 1			**2149-04-19.13**
- p/T-test point 1620 (M 16 x 2) screw-in thread DIN ISO 228-G 1/4			**2149-04-15.13**
- Additional sealing for SEG 1000 (sealing between frame of housing and mounting panel, IP 65)			**8804-00-00.31**
- Additional sealing for Compare (sealing between frame of housing and mounting panel)			**8804-00-00.32**

Order data for panel mounted instruments: series Compare	Part-number
Compare - analogue, for signals 0 to 20 mA / 4 to 20 mA - one-channel	
- Compare, 24 VDC with interface RS 232	**3C3A-00-20.00**
- Compare, 24 VDC with interface RS 485	**3C3A-00-10.00**
- Compare, 24 VDC with interface RS 232, analogue output and limit value relay	**3C3A-00-21.20**
- Compare, 24 VDC with interface RS 485, analogue output and limit value relay	**3C3A-00-11.20**
- Compare, 230 VAC with interface RS 232	**3C2A-00-20.00**
- Compare, 230 VAC with interface RS 485	**3C2A-00-10.00**
- Compare, 230 VAC with interface RS 232, analogue output and limit value relay	**3C2A-00-21.20**
- Compare, 230 VAC with interface RS 485, analogue output and limit value relay	**3C2A-00-11.20**
Compare - digital, for frequency signals - one-channel	
- Compare, 24 VDC with interface RS 232	**3C3D-00-20.00**
- Compare, 24 VDC with interface RS 485	**3C3D-00-10.00**
- Compare, 24 VDC with interface RS 232, analogue output and limit value relay	**3C3D-00-21.20**
- Compare, 24 VDC with interface RS 485, analogue output and limit value relay	**3C3D-00-11.20**
- Compare, 230 VAC with interface RS 232	**3C2D-00-20.00**
- Compare, 230 VAC with interface RS 485	**3C2D-00-10.00**
- Compare, 230 VAC with interface RS 232, analogue output and limit value relay	**3C2D-00-21.20**
- Compare, 230 VAC with interface RS 485, analogue output and limit value relay	**3C2D-00-11.20**
Compare - analogue, for signals 0 to 20 mA / 4 to 20 mA - two-channel	
- Compare, 24 VDC with interface RS 232	**3C3B-00-20.00**
- Compare, 24 VDC with interface RS 485	**3C3B-00-10.00**
Compare - digital, for frequency signals - two-channel	
- Compare, 24 VDC with interface RS 232	**3C3E-00-20.00**
- Compare, 24 VDC with interface RS 485	**3C3E-00-10.00**

Software only for panel mounted instruments series Compare		Part-number
- Data transmission cable (single connection of a Compare instrument to PC-interface RS 232, 9-pole D-Sub-socket, one free cable end, length: 2,0 m)		**8824-C4-02.00**
- RS 232-adaptor (9-pole D-Sub-plug to 25-pole D-Sub-socket)		**8808-38-01.01**
- Cable for RS 485 (2-pole connection cable with screening, two free cable ends)		**8824-C6-02.00**
- Interface converter SSK 100 - RS 485 to RS 232 (for connection of max. 31 instruments of series Compare to the serial PC-interface RS 232 via 25-pole D-Sub-socket)		**3160-01-22.02**
- Software support for series Compare for display and evaluation of measuring values on PC-XT/AT/PS/2		
- HYDROcomsys/DOS-software package from DOS 4.0 on included in the delivery range	Diskette 3 1/2" German Diskette 3 1/2" English	**8874-01-01.02** **8874-01-01.05**
- HYDROcomsysWin (Windows-version) included in the delivery range	Diskette 3 1/2" German Diskette 3 1/2" English	**8874-01-01.21** **8874-01-01.23**
- Software Compare for pressure and volume flow rate for linearisation of pressure- and volume flow rate sensors	Diskette 3 1/2" German	**8874-06-01.02**