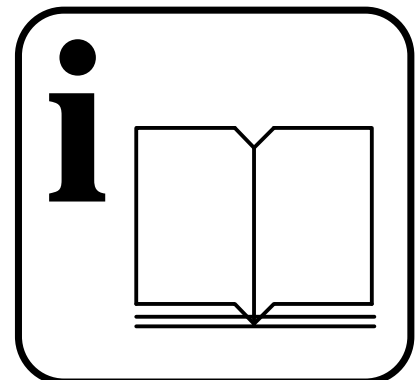
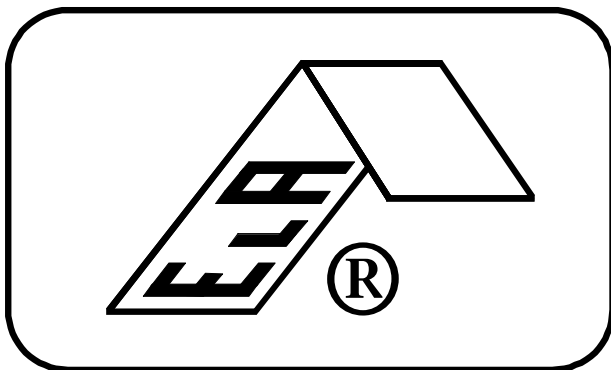
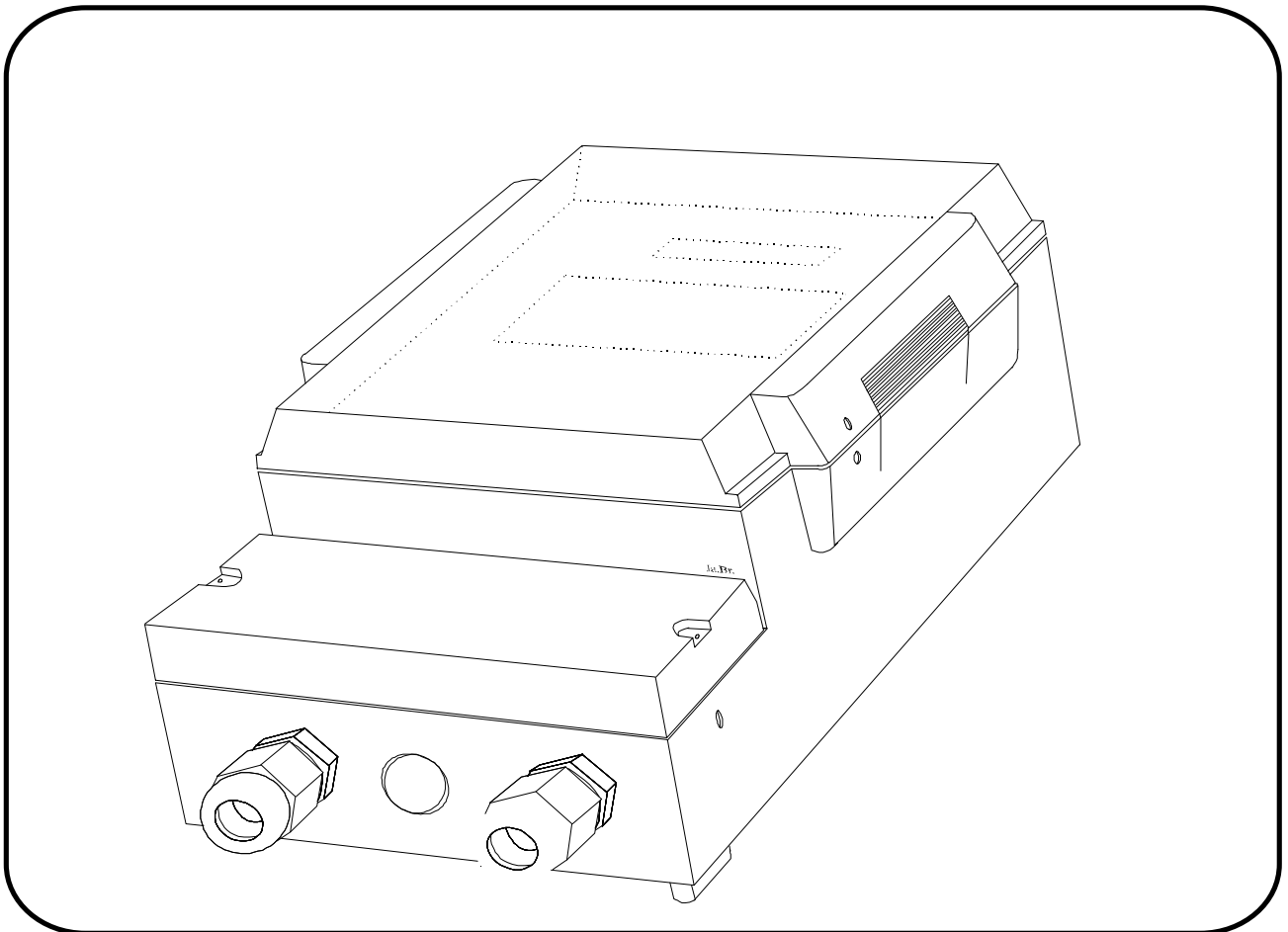


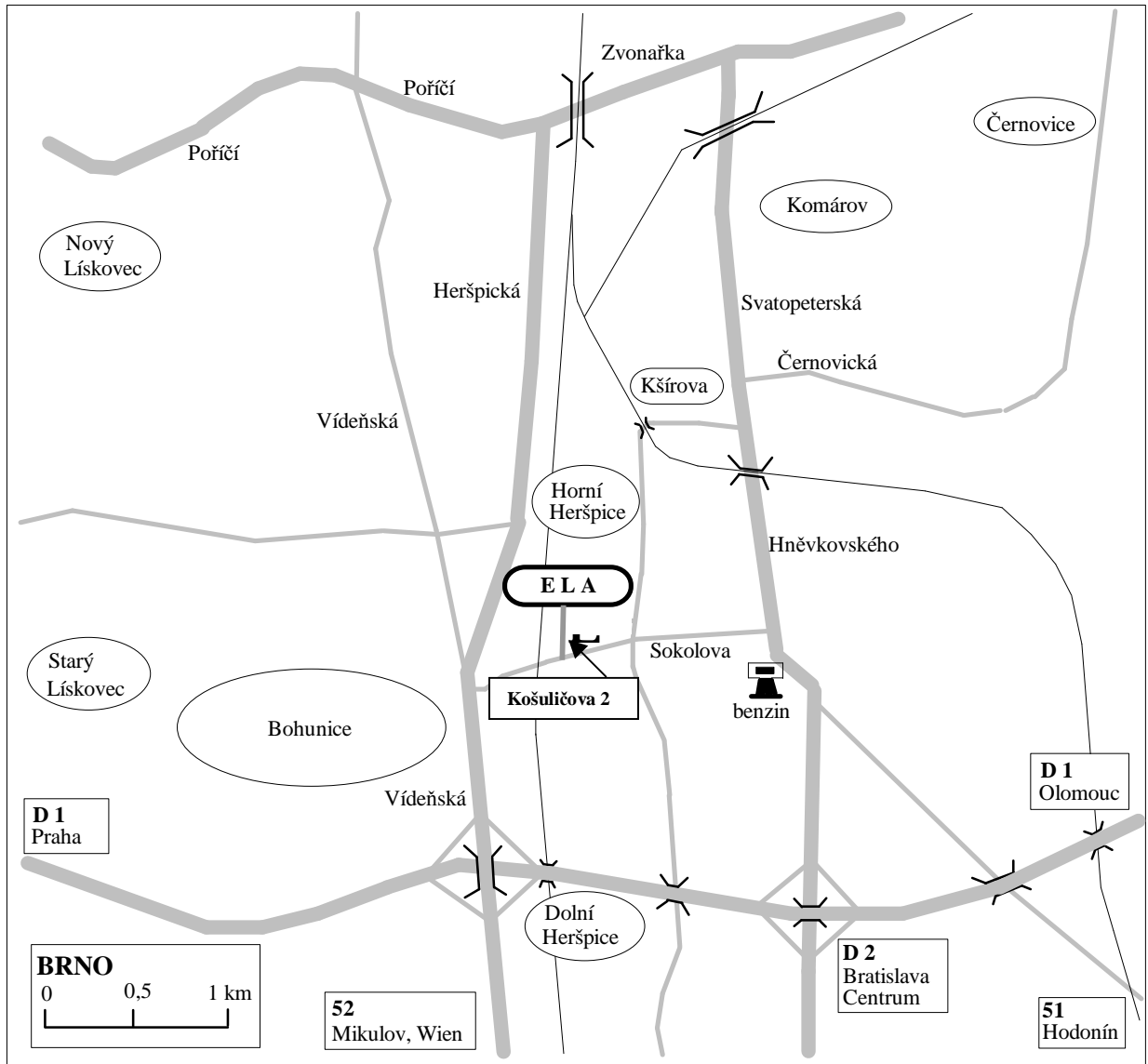
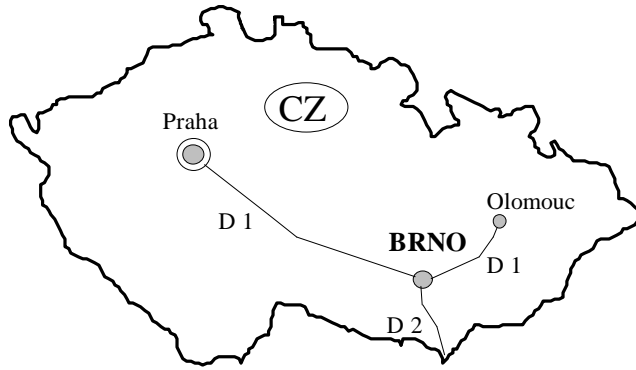
MAGNETO – INDUCTIVE FLOWMETER M Q I 99 SMART

Certificated product approved by ČMI, ref. no. 2664/97/010 in compliance with Act on Metrology
no. 505/1990 Coll., § 6 and 7, the official mark of the approved type TCM 142/97 - 2664

USER GUIDE



Shop address: **Košuličova 2**
Brno 619 00



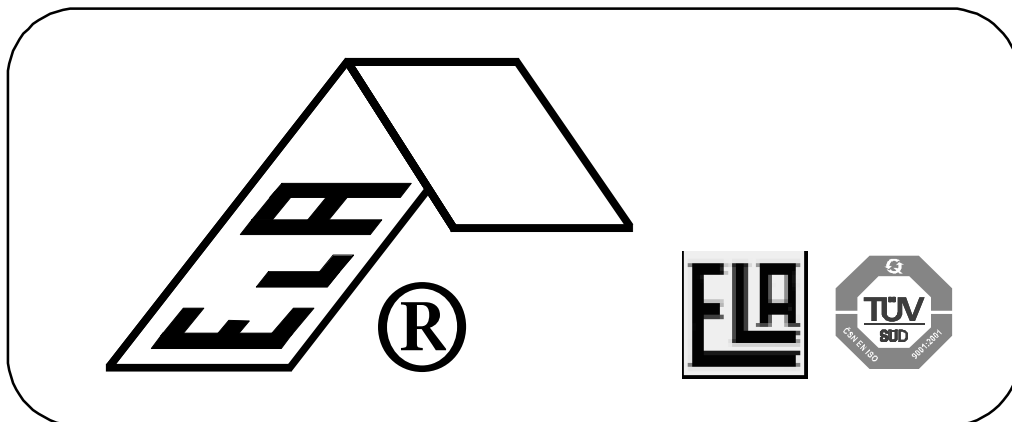
NOTE:

Because every product is subjected to a development, it can happen that during a period some changes may appear which are not included in the User Guide. Possible differences from the description in this Guide can be found by pressing keys on the keyboard in SMART menu. All unclear items should be directly consulted in factory.

ELA, spol. s r.o.

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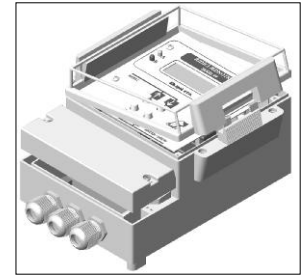
e-mail: info@elabrno.cz, ela@elabrno.cz
http: www.elabrno.cz

Ordering codes of magnetic-inductive flowmeters and level indicators type M

(plastic box of control unit type BOPLA, IP 65)

Example of admissible ordering codes:

- M Q I 99 SMART
- M Q U 99 -
- M Q U 99 SMART
- 2 M Q U 99 SMART
- M H U 99 -
- 2 M H U 99 SMART



M 99

Quantity		Function of control unit		Type of sensor		Generation		Software of unit	
description	Code	description	Code	description	Code	description	Code	description	Code
1 sensor	-	Flowmeter	Q	Magnetic-inductive	I		99	option	SMART
2 sensors	2	Level indicator	H	Ultrasonic	U		99		

Ordering codes of magnetic-inductive flowmeters type M

(alluminium box of control unit type ELA, IP 67)

Example of admissible ordering codes:

- M Q I 99 C
- M Q I 99 S
- M Q I 99



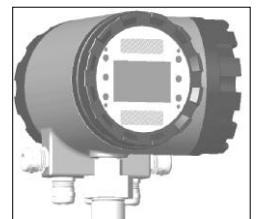
Quantity		Function of control unit		Type of sensor		Generation		Type of set	
description	Code	description	Code	description	Code	description	Code	description	Code
1 sensor	-	Flowmeter	Q	Magnetic-inductive	I		99	Compact	C
								Separated	S

Ordering codes of magnetic-inductive flowmeters type F

(alluminium box of control unit type ELA, IP 67)

Example of admissible ordering codes:

- F Q I - C
- F Q I - S
- F Q I -



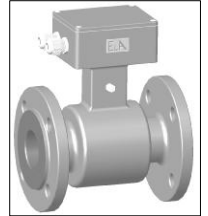
Quantity		Function of control unit		Type of sensor		Generation		Type of set	
description	Code	description	Code	description	Code	description	Code	description	Code
1 sensor	-	Flowmeter	Q	Magnetic-inductive	I		-	Compact	C
								Separated	S

Ordering codes of magnetic-inductive flowmeters **type S**

(compact magnetic-inductive flowmeter without display and power supply)

Example of admissible ordering codes:

- S - I - 4-20
 - S - I - 0-20
 - S - I - 0-5
 - S - I -



Quantity		Function of control unit		Type of sensor		Generation		Specification of I out	
description	Code	description	Code	description	Code	description	Code	description	Code
1 sensor	-	Flowmeter	-	Magnetic-inductive	I		-	analogue output in mA	4-20 0-20 0-5

Ordering codes of compact ultrasonic level indicators **type P**

(compact ultrasonic level indicator without display and power supply)

Example of admissible ordering codes:

- P - U - 0,5
 - P - U - 2
 - P - U - 4
 - P - U - 6
 - P - U - 10
 - P - U -



Quantity		Function of control unit		Type of sensor		Generation		Measurement range	
description	Code	description	Code	description	Code	description	Code	description	Code
1 sensor	-	Level indicator	-	Ultrasonic	U		-	0 - 0,4 m	0,5
								0 - 1,8 m	2
								0 - 3,5 m	4
								0 - 5,2 m	6
								0 - 9,65 m	10

Introduction:

Checkmag magnetic-inductive flowmeters are precise measuring devices intended for the measurement of liquid flow of electrically conductive media. The meters may be used for measurements, registration, dosing, mixing, etc. as operating and/or certificated meters according to Act no. 505/1990 Coll. on Metrology.

Checkmag application

- Ø Water management, drinking and waste water measurement
- Ø Chemical, textile, paper, mining industry
- Ø Food industry
- Ø Power engineering and heating plants
- Ø Agriculture

Checkmag Advantages:-

- Ø Independent of power supply fluctuation and line voltage interference
- Ø Independent of pressure, temperature and density, etc of the media
- Ø No pressure losses
- Ø No disturbances of measured liquid consistency

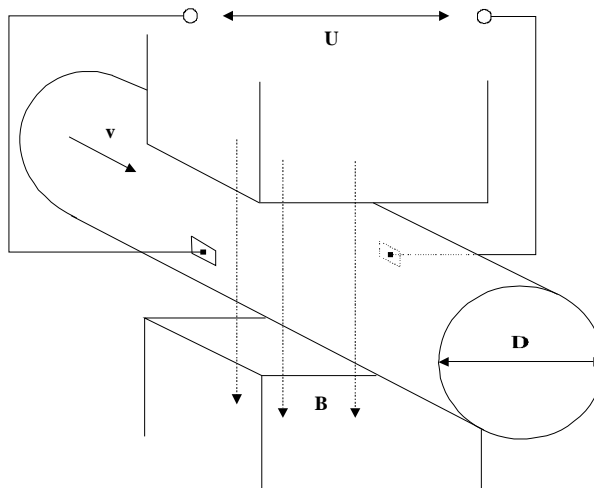
Do not install where:-

- Ø Liquid conductivity, is 5 $\mu\text{S}/\text{cm}$, or less
- Ø Partly filled pipe is possible
- Ø Non lamina flow occurs
- Ø Velocities less than 0.5 m/sec

The principle of inductive sensor operation

The measurement is based on the principle of Faraday's law of electromagnetic induction. In compliance with this law, electric voltage is induced in an electrically conductive body, which moves across a magnetic field. The following equation is applied for voltage to be induced (generally):

$$\underline{U = B \times D \times v} \quad \text{where:} \quad \begin{array}{ll} U = \text{inductive voltage} & D = \text{piping diameter} \\ v = \text{mean flow speed vector} & B = \text{magnetic induction} \end{array}$$



If magnetic induction B and piping diameter D are constant, then induction voltage is proportional to the mean flow speed.

Liquid is flowing via a flowmeter perpendicularly to the direction of the magnetic field. Electric voltage which is monitored by two electrodes placed perpendicularly to both magnetic field and flow is induced by a stream of liquid with minimum electrical conductivity.

Excitation current with a rectangular waveform is generated in a converter and fed to sensor coil windings generating the flowmeter magnetic field. The forced-current system provides constant excitation under all conditions that can occur during the operation.

Specifications:

Measurement conditions:

Measurement is independent of:

- Ø Temperature and pressure
- Ø Density and viscosity
- Ø Solid contents
- Ø Usual magnetic field interference levels

The following conditions must be achieved for reliable Checkmag operation and measurement precision.

- Ø Minimum liquid conductivity > 20 µs/cm for demineralised cold water
> 5µs/cm for other fluids
- Ø Flowrate minimum 0.1 m/sec., max. 10 m/sec.
- Ø Steady flowrate straight lengths - upstream 5 DN
- downstream 3 DN
for any DN changes a bevel up to 8° is included in straight lengths
- Ø Sensor completely filled with liquid,
- Ø High-quality connection between sensor and liquid to be measured, earthing,

Measurement precision is negatively affected by:

- Ø Liquid aeration, air bubbles
- Ø Strong stray earth currents
- Ø Non lamina flow
- Ø Solids or magnetic metals in the medium to be measured

Checkmag assembly

Sensor assembly:

- Ø A measuring tube is produced from non-magnetic material with welded flanges. The measuring tube is lined with an insulated lining of the required properties (depending upon the measured medium). A system of magnetic circuit excitation coils that generate the magnetic field are fixed on the body of the measuring tube.
- Ø A pair of electrodes that are located opposite one another are installed inside the measuring tube, with the lining are produced from stainless steel or other similar material (according to the chemical resistance required for the measured medium).
- Ø The complete electrical section is placed inside a steel housing (welded) with an outlet (neck) for cables.
- Ø On the outlet, the signal cable with a standard length of 8 metres is fixed via a cable seal (different lengths may be ordered). The welded housing provides high protection, and the surface finish provides permanent climatic resistance.

Converter:

- Ø The electronic control and evaluation unit is remote mounted with an alphanumeric display.

Additional assemblies:

- Ø Checkmag flowmeter may be produced as a „certificated meter“ in compliance with the Act on Metrology no. 505/1990 Coll. All meteorological features of the meter according to the customer's request are verified and marked by the official mark and cannot be modified.
- Ø Multi-point calibration. The flowmeters are calibrated to three points in the basic option. According to the customer's requirements, the number of calibration points may be increased.
- Ø Increased electrical protection IP 68: the requirement must be clearly specified (immersion depth and time, explosive environment, etc.).
- Ø Higher PN, different built-in sensor lengths, other flange assemblies (DIN, ANSI, etc.) on request
- Ø ACQ controlled data acquisition software – it allows evaluating the statistical data received from a flowmeter on any PC.

Checkmag connection and assembly

Converter connection to power supply must be performed in compliance with the standards and rules to be effective:

Connection of electrical instruments and appliances

Protection against electric shock.

Heavy current distribution network in industrial plants.

Safety operational rules for electrical installations operated by low-level experienced personnel.

- Ø If requested our Service Division will carry out commissioning. If work is done by any different organisation, the warranty can be cancelled in the case of such unauthorised work.
- Ø Electrical protection allows the use of the instrument in all kinds of active, passive and complex environments, and after an agreement with us, it is possible to carry out some additional modifications even for severe climatic conditions.
- Ø Signal and output cable routing should not be located near power output distribution network or in common ducts.

Table for 1 m / s flowrates

DN	m ³ / h	l / min.	l / s
10	0,283	4,712	0,079
20	1,131	18,85	0,314
25	1,767	29,452	0,491
32	2,895	48,255	0,804
40	4,524	75,398	1,257
50	7,069	117,81	1,964
65	11,946	199,1	3,318
80	18,096	301,59	5,027
100	28,274	471,23	7,854
125	44,179	736,31	12,272
150	63,617	1060,3	17,671
200	113,10	1885	31,42
250	176,71	2945,2	49,087
300	254,47	4241,2	70,686
350	346,36	5772,7	96,211
400	452,39	7539,8	125,66
500	706,86	11781	196,35
600	1017,9	16965	282,74
800	1809,6	30159	502,65
1000	2827,4	47124	785,4

Constructional dimensions and weights of inductive sensors

DN	PN	Dimensions [mm]						n	Weight kg
		A	B	D1	D2	d			
10	16	150	150	90	60	14	4	4,5	
20		150	105	75	14	4	6,5		
25		150	115	85	14	4	6,5		
32		160	135	100	18	4	7		
40		170	145	110	18	4	7		
50		200	170	160	125	18	4	8,5	
65			190	180	145	18	4	12	
80			230	195	160	18	8	12,5	
100			250	250	215	180	18	8	14
125		280		245	210	18	8	19	
150	300	320	280	240	23	8	23		
200	350	380	335	295	23	12	34		
250	400	445	405	355	27	12	55		
300	500	500	460	410	27	12	73		
350		520	520	470	27	16	150		
400	600	615	580	525	30	16	200		
500		750	710	650	33	20	290		
600		870	840	770	36	20	420		
800	800	1050	1020	950	40	24	610		
1000	1000	1285	1255	1170	42	28	950		



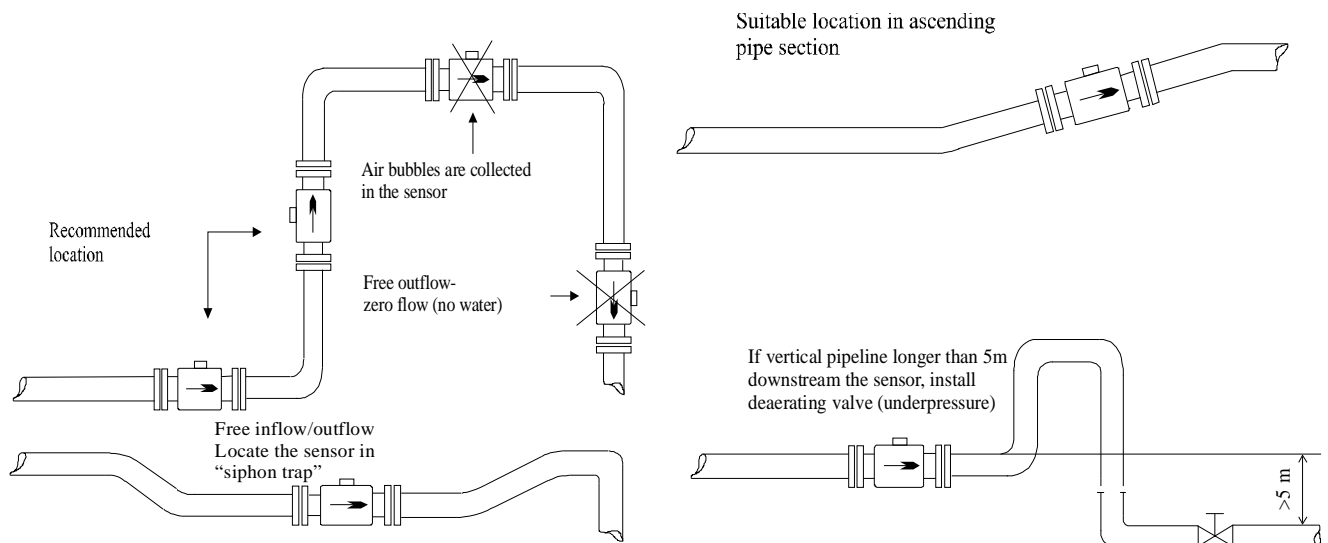
Signal cable connection:

- Ø Signals which are transmitted from a sensor electrode circuit to the converter will be in a range of millivolts. They will be very sensitive to magnetic and electrostatic interference from neighbouring high-voltage cables, power supply cables and high power output motors, etc. The interference is mainly compensated for by the converter connection, nevertheless if possible, it is necessary to prevent all spurious signals.
- Ø The signal cable is of a special construction and length and is a part of the shipment, its length should not be changed (for certificated meter must not be changed). The proper cable connection to the converter is important; doing so may cause measurement failures. Special requirements are laid on shielding, and the measurement precision depends on its quality.
- Ø The cable must not be extended.
- Ø The shielding must be well insulated on the whole route from ground and the other metal subjects. It is recommended that the cable is located in a separate conduit or trays.

Sensor location and its position in piping

- Ø The inductive flowmeter sensor can be installed in any position according to requirements, however for horizontal assembly, the electrode axis must always be horizontal.
- Ø Sensor must remain full of liquid.
- Ø It is recommended that the flow direction should follow the arrow on the sensor cover; the converter is also preset for this direction. On the operating meter, it is possible to adjust the reverse flow direction by changing the Checkmag converter parameter.
- Ø Bolts and nuts – verify if there is a sufficient space for their installation near flanges.
- Ø Vibration and deflection of piping – fix the piping on both sides from the flowmeter to avoid any deflection and vibrations.
- Ø If you install any pipes with higher internal diameters, install a reducer; this will provide an axial shift without increased mechanical stress of piping and sensor flanges.
- Ø To improve flow, use only the recommended straight lengths upstream (5DN) and downstream (3DN). Any change of a diameter with an angle up to 8° is excluded from the above-mentioned straight lengths. Suitably assembled flow deflectors and a combination of diffusers are used in more sophisticated installations.
- Ø When you install the sensor in insulated piping (e.g. glass, artificial mass, etc.), use proper sealing ground rings. A conductive connection between a sensor ground point and the liquid to be measured is needed for a proper measurement!

Recommended positions for sensor installation



Recommendations for installation

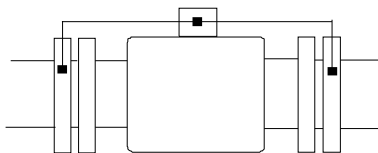
To avoid any measurement errors which are caused by air bubbles or failures on the lining, pay attention to the following recommendations:

- Ø During assembling correctly seat the sensor, tighten screws uniformly and move on a diagonal one after another.
- Ø It should be noted that the parallelism of flanges has a greater effect on packing than excessive tightening forces on curved and seated flanges.
- Ø The sensor must be installed inside piping so that the axis of sensor electrode is always **horizontal**.
- Ø A PTFE (teflon) lining calls for extra care during handling and assembly. During installation/operation avoid excessive underpressure in pipes. Please do not change and damage the outlet extension on both ends of the sensor. The sensors are shipped from the factory with special covers to avoid any shape deformations. (PTFE elastic memory should cause a partial compensation in future). Please remove the covers just before installation, and when you insert it between counterflanges, replace by a number of smooth metal sheet pieces which are removed just before tightening the bolts.
- Ø Packing – The extended part of lining does not operate properly as a seal, hence appropriate packing must be inserted between sensor and pipeline. If the packing protrudes into a flow profile at any point, this will cause turbulence and reduce the measurement quality.
- Ø During installation, make sure the sensor slides into piping if the pipeline is not flexible enough. It is recommended that installation inserts (especially for greater internal diameters) should be used. During installation of the sensor, counterflanges must not be welded (danger of the sensor lining failure).

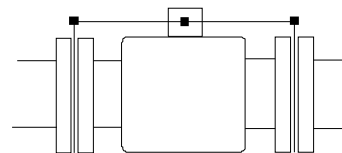
Checkmag grounding

- Ø For reliable and proper operation of the inductive meter, it is necessary to use high-quality protective grounding.
- Ø Internal flowmeter cables and power supply PE (PEN) conductors provide protective grounding.
- Ø Working grounding is also provided via internal cables and a high-quality connection of the sensor body with two metal pipe counterflanges. It is recommended that a connection made with M6 welded screws or bored threaded holes is used. The connection under flange fixing screws is not recommended because of possible corrosion resulting in measurement failures.
- Ø When assembled into piping made from non-conductive material (or with non-conductive lining), it is necessary to provide working grounding with liquid by a different method, e.g. by grounding rings – valid for DN 10 ÷ DN 40. The rings can be ordered from factory, their material and chemical resistance must comply with the liquid to be measured – usually produced from the same material as sensor electrodes. The flowmeters from DN 50 ÷ DN 1000 are equipped of grounding electrode. Function of grounding electrode is same as grounding ring.
- Ø When assembled, it is necessary to insert the packing on both sides of the grounding ring. Make sure that no parts will protrude into a internal sensor profile (turbulence).

Drawing of sensor working grounding inside pipeline



Use of grounding rings



Electrodes

- Ø The electrode material must be selected according to its chemical resistance of the liquid to be measured.
- Ø The electrode purity can affect the measurement precision, and high impurity concentration can affect the measurement process (liquid insulation).
- Ø Immediately after shipping, it is not necessary to clean the electrodes before installing the sensor inside piping. Clean with a fine cloth, or use a chemical detergent. Avoid any damage of the lining!
- Ø If the electrodes must be cleaned during operation, either mechanical or electrolytic methods may be used.
- Ø Mechanical cleaning can only be used for a suitable sensor assembly, otherwise dismantle the sensor from the pipeline. After cleaning reinstall the sensor.
- Ø Any electrolytic method is advantageous for its simplicity, however it can only be applied for the contamination that can be removed by electrolysis (low contamination and deposit).
- Ø All detailed instructions are available from the flowmeter manufacturer on request.
- Ø If a flowmeter operates under normal conditions, for most liquids it is not necessary to clean flowmeters during their life, only self-cleaning by flowing liquid is satisfactory (a recommended velocity is over 3 m/s).

Checkmag commissioning

Checking installation and connections.

- Ø Proper sensor and grounding
- Ø Tightening all cable connection clamps and plug in all connectors.
- Ø Verify the completeness of the shipped set according to the serial numbers of sensor and converter.
- Ø Verify proper supply voltage; see the label on the converter.
- Ø Verify proper electrical protection.
- Ø If the installation is fault-free, fill the pipeline with liquid and verify the sensor tightness inside the pipeline. After short washout, switch the system on-off-on.

Service

- Ø The commercial, service and technical assistance for - **M Q I 99 SMART** is provided by **Ela Brno, Ltd** in cooperation with **Petr Bajsa, Address: Košuličova 6, 619 00 Brno, CZ: Fax+420 543 251 594, Phone +420 602 737 201.**
- Ø The Service Division secures all activities that are related to the commissioning and all parameter changes at site (with the exception of certificated meters).
- Ø Arkon Flowmeters can authorise another organisation to provide service. The organisation must be able to submit the appropriate approval/certificate on request. The producer carries out recalibration of all meters and their repairs.

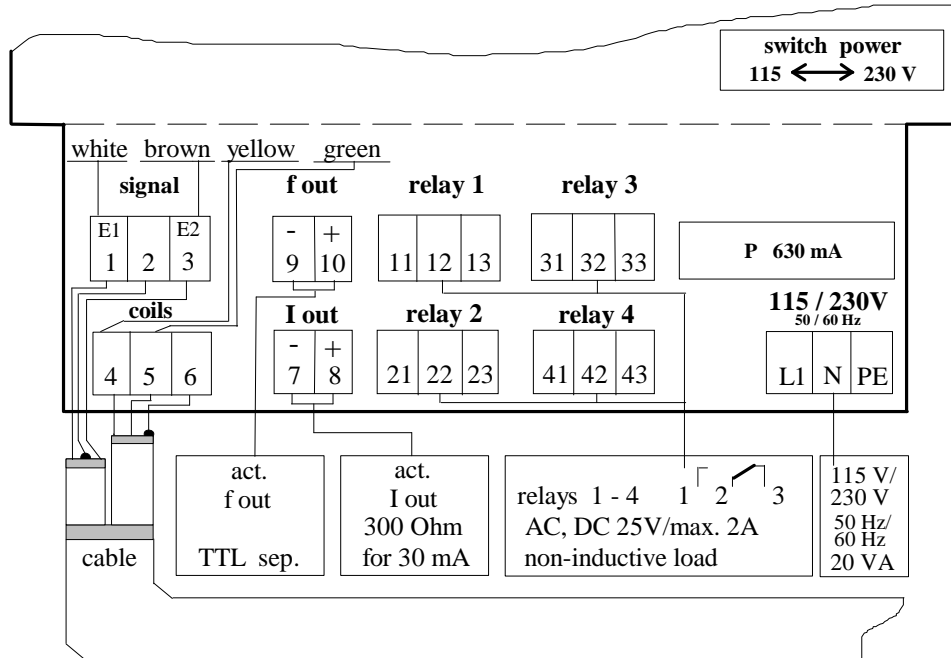
Checkmag inductive sensor – specifications:

∅ Nominal sizes	DN 10 ÷ 1000
∅ Interconnecting cable	Remote version – standard 8 m / 2 x 2 x 0,25 mm ²
∅ Control principle	Pulse DC
∅ Excitation coils supply	From the transmitter
∅ Class of excitation coils isolation	E
∅ Connection	flanged DIN (ANSI, BS) / hygienic DIN 11 851
∅ Maximum Pressure	standard 1,6 MPa (0,6 / 1,0 / 2,5 / 4,0 MPa)
∅ Protection	standard IP 67 / NEMA 5 (IP 68 / NEMA 6)
∅ Liner	hard + soft rubber DN 10 ÷ DN 1000 / Teflon PTFE DN 10 ÷ DN 500
∅ Temperature tolerance for liner	hard + soft rubber -5°C ÷ +90°C / Teflon PTFE -25°C ÷ +150°C
∅ Electrodes	Stainless steel 316Ti, L (Hastelloy / Tantalum / Titanium / Platinum)
∅ Outer casing and flanges	Carbon steel standard (Stainless steel 304, 321)
∅ Flow tube	Stainless steel 321
∅ External coating	Acrymetal multi component lacquer
∅ Ambient temperature	-20°C ÷ +60°C
∅ Accessories options	Stainless steel Earthing rings for plastic pipe
∅ Special Options	Hygienic stainless steel version – Teflon liner – screwed fitting Flanged stainless steel version – Teflon / rubber liner Wafer version – rubber liner

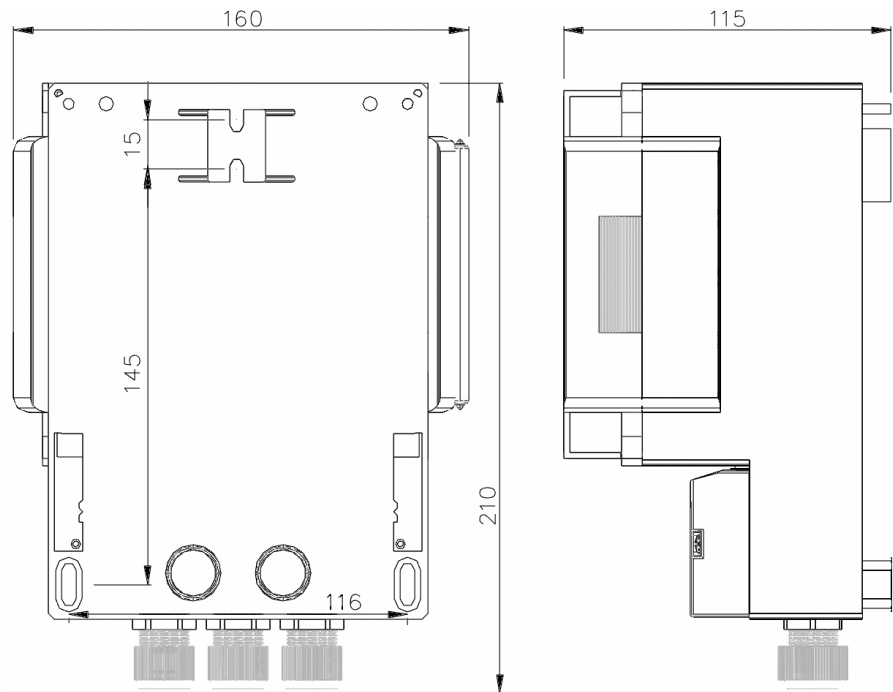
Specification for – M Q I 99 SMART control unit:

∅ Medium electrical conductivity	≥ 5 μS/cm
∅ Input resistance	≥ 10 ¹⁰ Ω
∅ Measurement accuracy	0,5 % of reading in range of 10 ÷ 100% Q _{max}
∅ Filtration measurement	Multi-mode adjustment
∅ Low flow rejection	Adjustable in steps of 0,1%
∅ Flow direction	Bi-directional measurement distinguished by sing
∅ Zero flow	Automatic zero point setting
∅ Data storing	Storing total volume reading even in case of power failure
∅ Statistics	5-minute/hourly/daily/monthly averages
∅ Real time	Clock and calendar including leap years until 2099
∅ Quantity display	LCD alphanumeric display, 2 x 16 pixels, back illumination
∅ Control	Keyboard (4 keys)
∅ Programmable modes	Empty pipe detection, cleaning electrodes
∅ <u>Outputs (galvanically separated)</u>	
∅ analogue active	standardised 0 - 20 mA / 500 Ω, 4 - 20 mA / 500 Ω, 0 - 5 mA / 2 kΩ, , or generally selected -30 to +30 mA / 300 Ω including negative mode (current vrs. output quantity curve is a descending function)
∅ pulse	programmable number of pulses per litre, number of pulse per m ³ , further see Instructions for use
∅ frequency (open collector) (on request)	0 ÷ 1 kHz / 0 ÷ 100% Q, TTL
∅ binary	4 x relays of operational status indication (comparators, failure, pulse output of total volume (especially for forward and backward flow directions, comparators (4 modes) – non-inductive load 3A / 50V AC / DC.
∅ Communication (on request)	RS 232C, RS 485, selectable baud rate, special protocol ELA, for displaying stored data, ACQ software for data acquisition (evaluation on a common PC WIN)
∅ Cable outlets	3 x PG 11
∅ Power supply (AC ^ DC)	230 V / 50 Hz / 15 VA
∅ Electric protection	IP 65
∅ Ambient temperature	-20 to + 50° C
∅ Dimensions	210 x 160 x 115 mm (h x w x d)
∅ Weight	2,5 kg

Series 99 converter terminal board connection
(relays 1 to 4 in idle state)



Converter dimensions



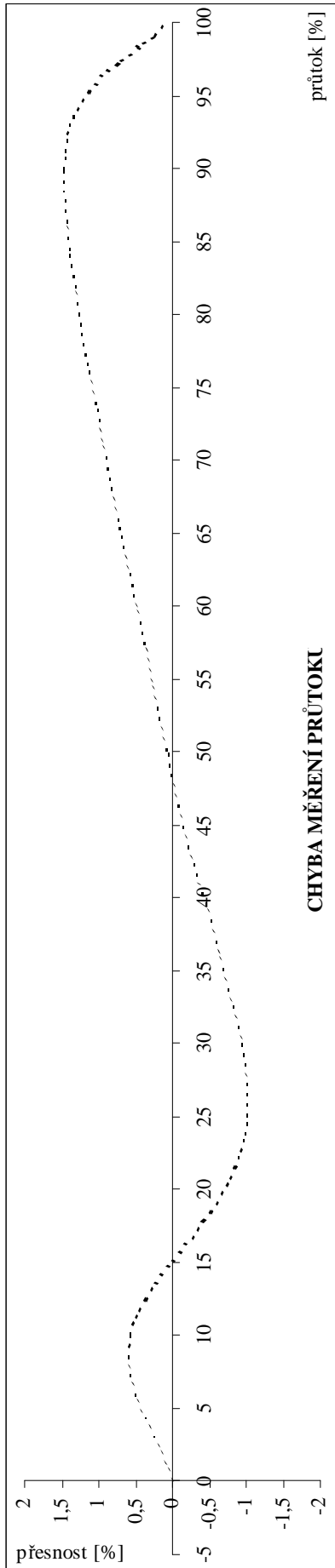
Additional devices

- ∅ The additional devices are intended for remote control of the converter output signals (displaying and processing).
- ∅ The additional devices are not usually included in Checkmag shipment, but their type should be approved by the manufacturer. In such a case, the manufacturer is only responsible for the suitability of input parameters, and all other parameters are set according to the manufacturer's specifications of the additional devices.
- ∅ If Checkmag is used as a certificated meter, the additional devices that have passed a separate type test or have been included in the Checkmag type test can be used.

Packaging, transportation and storage

- ∅ If a set is ordered without installation, the sensor is packed in corrugated paper and the converter is enclosed in a cardboard box.

The system can be transported by a carrier, customer, manufacturer or by mail. The customer pays costs.



Adjustment protocol

Customer:

Measuring site:

Serial number:

Measurement range:

ČMI certificated meter

Test room:

Sensor DN:

Sensor PN:

Sensor electrodes:

Sensor: lining:

Sensor: max. temp.

Sensor: cable length

Sensor elect. protection

Sensor measured medium

Sensor exciting current

Converter type

Outputs:

Converter forced current :

Converter relay 1

Converter relay 2

Converter relay 3

Converter relay 4

Converter data line

Calibrated by :

Date:

Constant :

Note:

Warranty:

Instrument:

Serial number:

Dispatch date from storehouse:

Commissioning:

Date:

Company:

The manufacturer warrants that the instrument corresponds to Technical Specifications, and to be free from defect in workmanship and material and complete. During installation and commissioning, all hints that are presented in Technical Specifications and related norms and safe work rules must be met. The supplier is fully responsible for completeness and proper product operation. The customer during the acceptance of product must check the completeness. The manufacturer does not warrant – before the warranty period will elapse – for damages caused by improper or unqualified operation or using the flowmeter under such conditions that do not correspond to those given in Technical Specifications. The manufacturer reserves to perform all warranty and after-warranty repairs. For warranty repairs, please submit your warranty sheet. If the conditions presented in both Technical Specifications and Warranty are met, the warranty period is twelve months from the date of commissioning by the manufacturer or another authorised company, however at most 18 months from the date of shipment to the site.

Flowmeter repair:

Date:

Company:

Flowmeter repair:

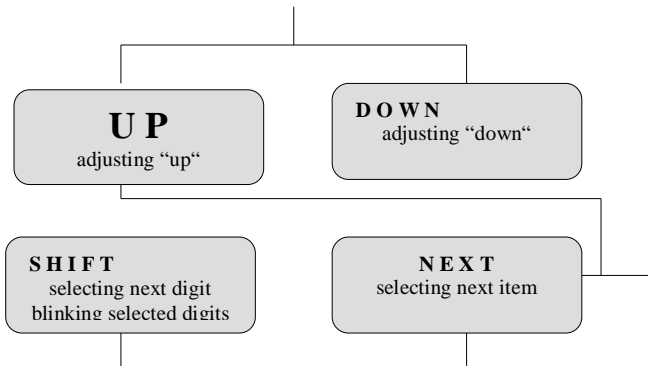
Date:

Company:

Instructions for use:

Keyboard

RESET: resetting adjusted number



ENTER: return to menu, confirmation

ESCAPE: return to menu

S + Q menu description – user mode:

S + Q - Displaying current flow in both directions, total volume in both directions, closing a relay. Individual items can be selected in **MAIN** menu, **Display** box.

RUN menu description – measurement mode, reading the statistic data:

Standard view - Moving from user menu and return.
Q(t) record - Recording 5 average flowrates.
H-statistics - Hourly statistics: total volume, operational time and flowmeter failure time.
D-statistics - Daily statistics: total volume, operational time and flowmeter failure time.
M-statistics - Monthly statistics: total volume, operational time and flowmeter failure time.
Date/time view - Displaying the date and time.
Password check - Selecting four-digit password which is necessary for moving from RUN to MAIN menu.
Version - Instrument type and program version.

MAIN menu description – instrument adjustment:

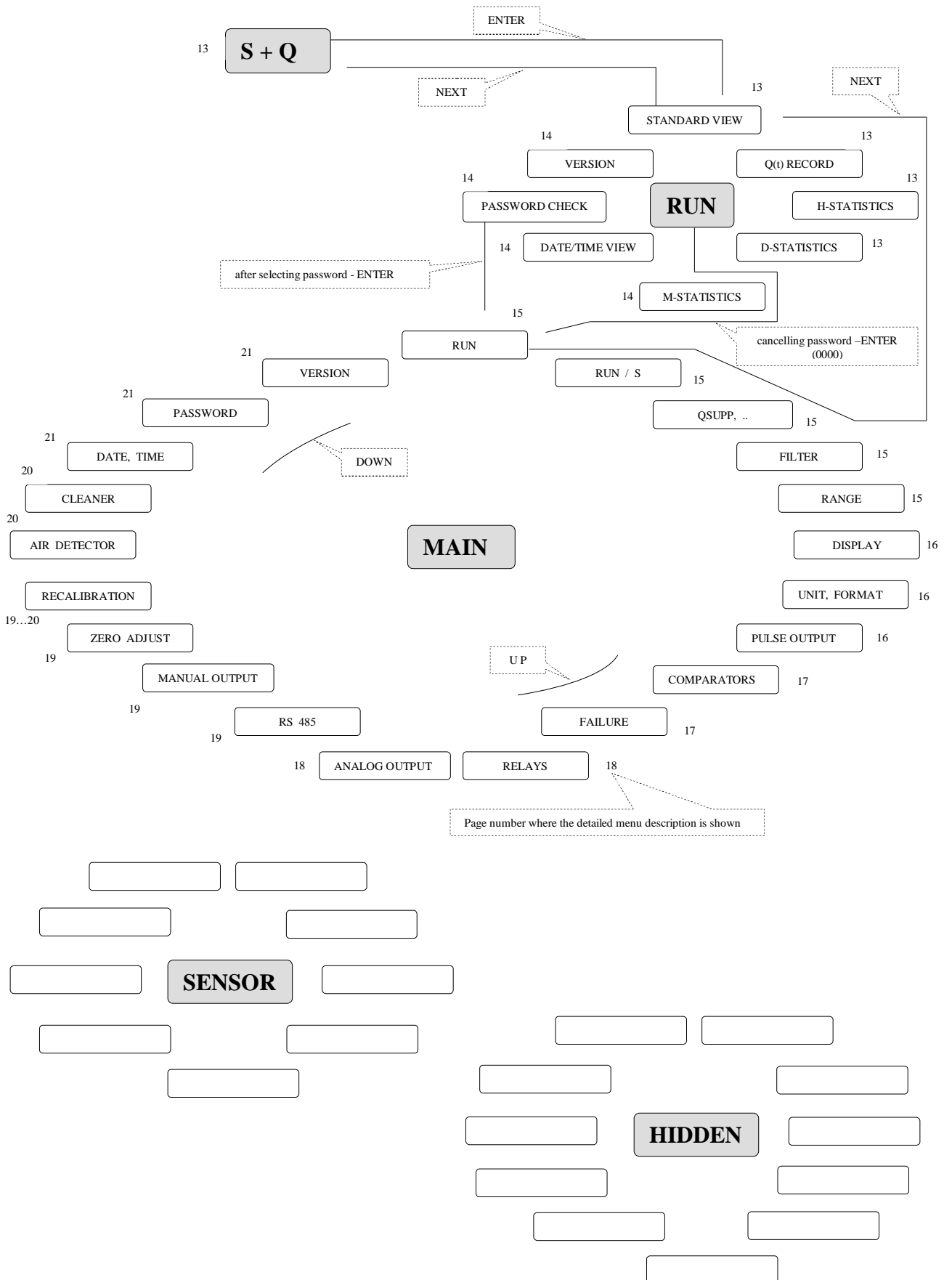
Run - Moving to measurement mode, reading the statistical data and return.
Run / s - Running in service mode (intended for installing and testing the instrument).
Qsupp, .. - low flow rejection limit, identifying positive flow direction, *measurement delay after switching on.*
Filter - *filtration constant and filter delay.*
Range - *current flow range.*
Display - time parameters that display the individual quantities, displaying individual quantities.
Unit, format - flowrate unit Q and format of displaying the quantities Q, S+ and S- .
Pulse output - pulse output for the external counter, total volume per one pulse, pulse width.
Comparators - four flow comparators with 4 modes, static or pulse mode.
Failure - intended for future checking status parameters.
Relays - assigning the functions for relays 1 to 4, external counter pulse output, 1 to 4 comparator outputs, failure, aerating the sensor.
Analog output - assigning output quantity, output range, nominal current (0-20, 4-20, 0-5, 0-10 mA), extending current range above the upper limit of nominal current (e.g. up to 24 mA), negative output range.
RS 485 - *entering transmission line parameters (ELA – format).*
Manual output - manual control (testing) of 1 to 4 relays, current and frequency outputs.
Zero adjust - adjusting device zero point: performed during calibration in factory, after installation can be completed.
Recalibration - *adjusting parameters of automatic internal recalibration in the measurement mode.*
Air detector - *adjusting detection parameters of empty piping .*
Cleaner - *adjusting parameters for cleaning sensor electrode.*
Date, time - adjusting the date and time: for initialisation press only NEXT key and hold for 3 seconds.
Password - adjusting the password for moving cross the main menu - MAIN, SENSOR and HIDDEN. Adjustment range = 0001 – 9999, value = 0000 – cancelling the password.
Version - instrument type and program version.

SENSOR and HIDDEN menu description - The area intended for the basic device adjustment, calibration under normal conditions – not available!

CAUTION:

The description in the MAIN, SENSOR and HIDDEN menu written in Italics should not be changed. The parameters are preset with respect to the given location and the sensor type.

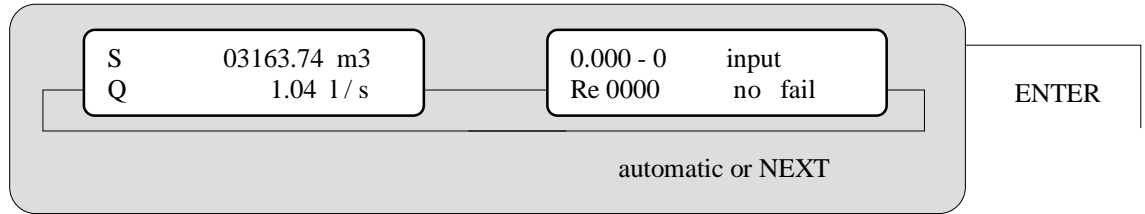
Graphic structure of individual Series 99 menus



Instructions for use – detailed menu descriptions:

S + Q – user mode:

The program identification and the program version will be displayed during the first three seconds after switching on the instrument. The individual screens of selected quantities will alter (in preset time intervals) automatically after the elapse of a 3-second interval, pressing the NEXT button may also alter the screens. The screens and the intervals may be selected in the MAIN menu, and Display screen.

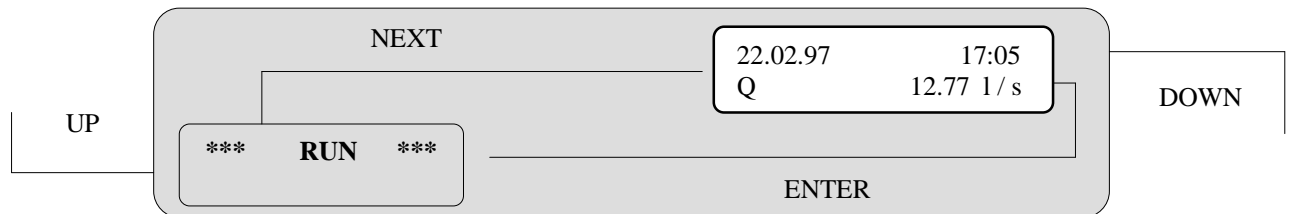


Standard view – moving from the user mode and return: The measurement is proceeding.



Q (t) record – recording 5-minute average flowrates Q: The measurement is proceeding.

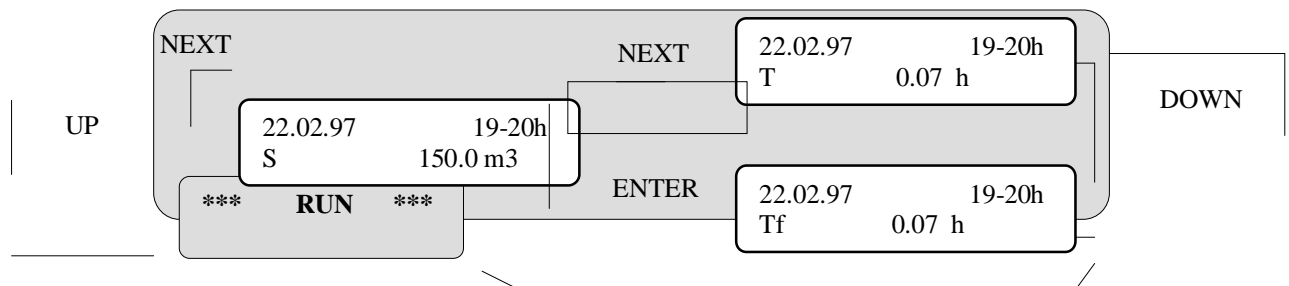
Key functions – UP or DOWN - selection in 5-minute steps, UP+DOWN resets hours and minutes, SHIFT+UP or DOWN - selects the days.



H-statistics – hourly statistics: total volume S, measurement time T and failure time Tf for every hour:

The measurement is proceeding.

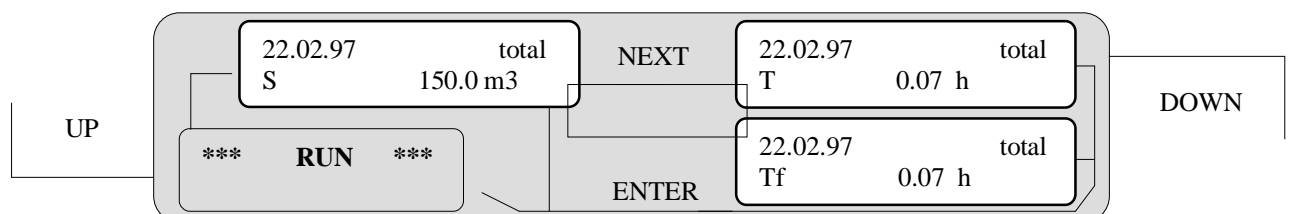
Key functions - UP or DOWN, selection in hours, UP+DOWN resets the clock, SHIFT+UP or DOWN selects the days.



D-statistics – daily statistics: total volume S, measurement time T and failure time Tf for every day:

The measurement is proceeding.

Key functions - UP or DOWN, selection in days, SHIFT+UP or DOWN, selection in months.

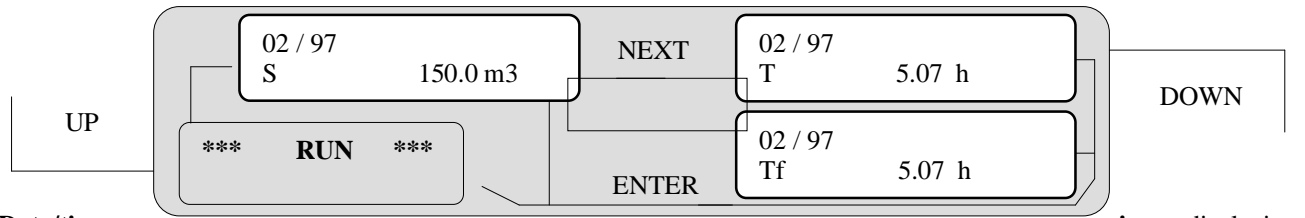


Instructions for use – detailed menu description:

M-statistics – monthly statistics: total volume S, measurement time T and failure interval Tf for every month:

The measurement is proceeding.

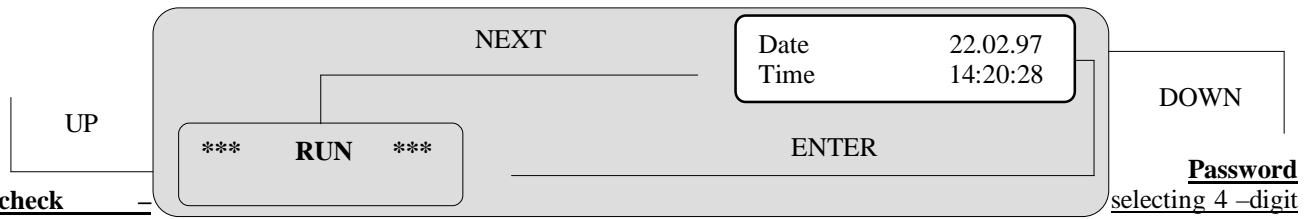
Key functions - UP or DOWN selection in months.



Date/time

the date and time: The measurement is proceeding.

view – displaying



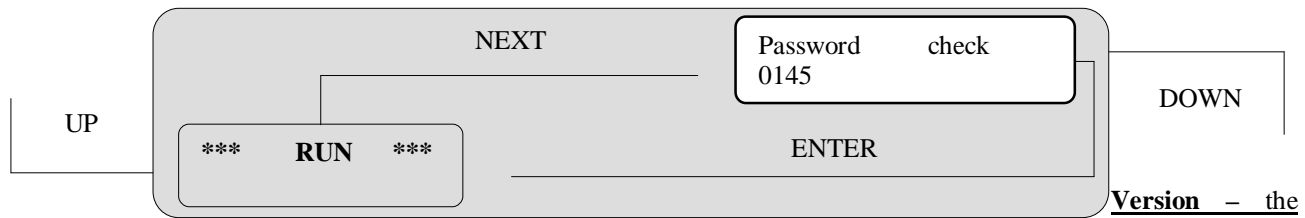
check

password: The measurement is proceeding.

Password
selecting 4 –digit measurement is

The password is necessary for moving from RUN to MAIN. The access code for moving in the device menu is set in the factory usually to the value of last three digits of the flowmeter serial number. For example the serial number is 97145 – then the password = **0145**.

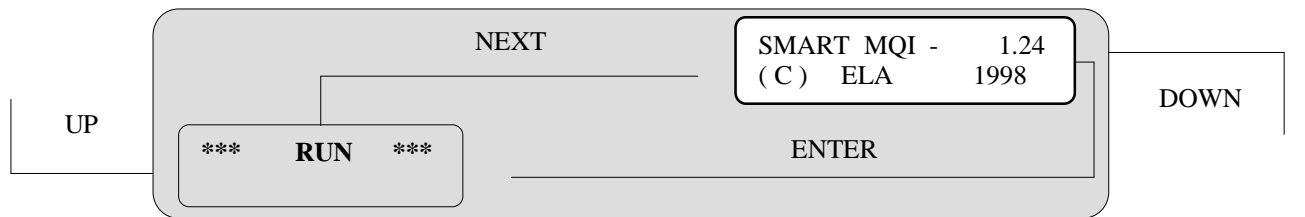
Key functions - SHIFT selecting the next digit (selected digits are blinking), UP or DOWN selecting the numbers.



instrument

version: The measurement is proceeding.

Version – the type and program



ELA spol. s.r.o.

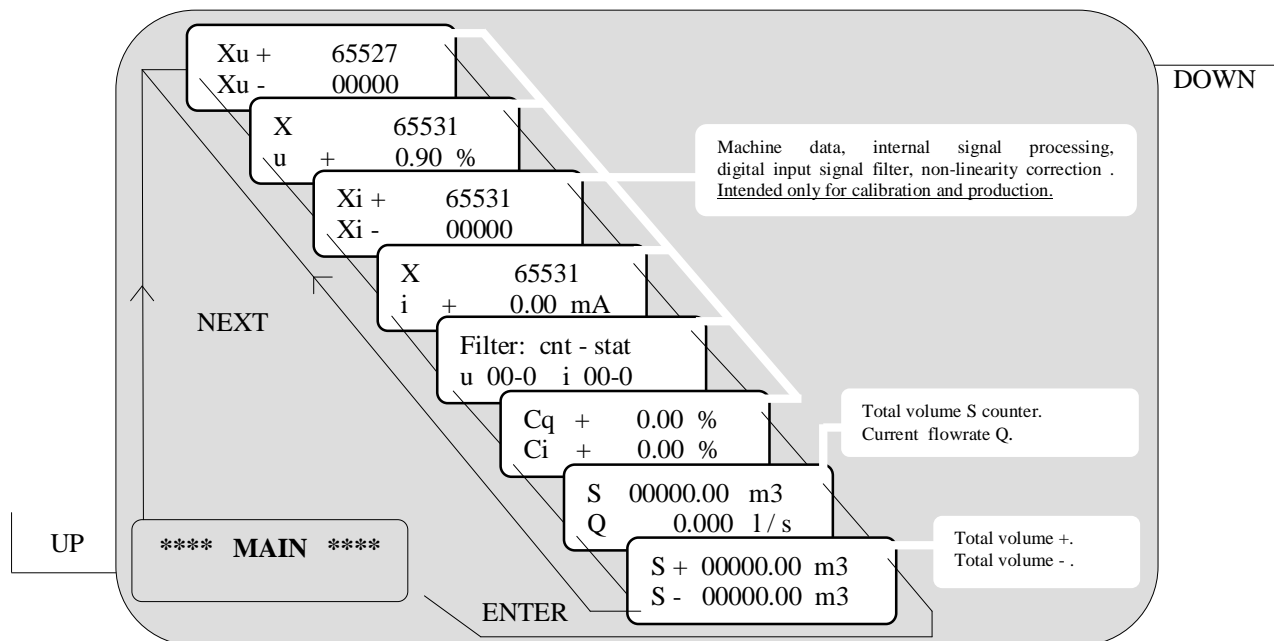
Instructions for adjustment – detailed menu description:

Run – moving to the measurement mode and return:

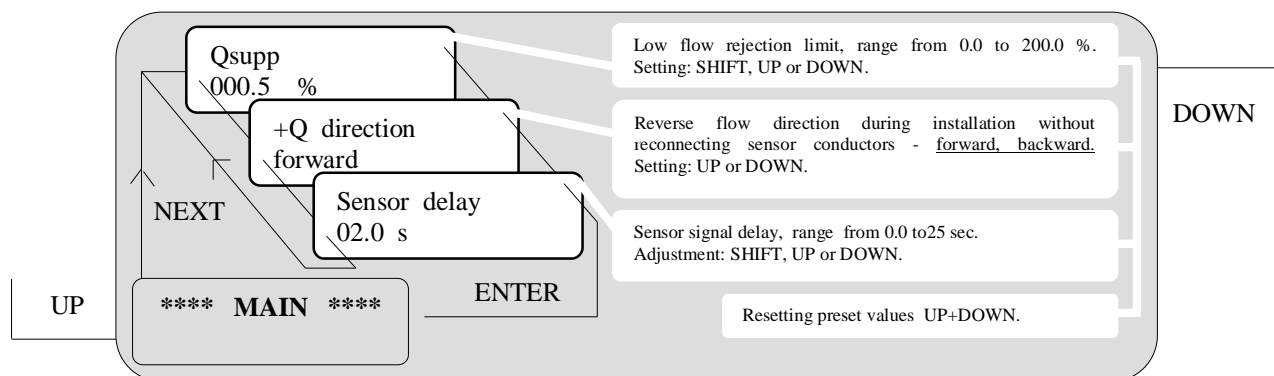


Run /s – the measurement process in the service mode:

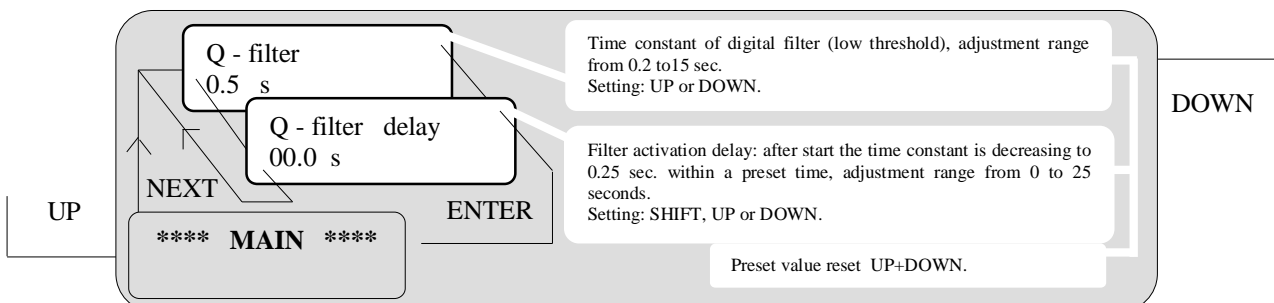
This is intended for installing and testing the device. The measurement process is launched in the service mode by pressing the NEXT key. The proper measurement runs in the same way as in the user mode, however the method of displaying the quantities on the screen is modified according to service control. Eight screens can be scrolled on the display by pressing the NEXT key.



Osupp. .. – low flow rejection limit, identification of positive flow direction, measurement delay after starting the flowmeter:

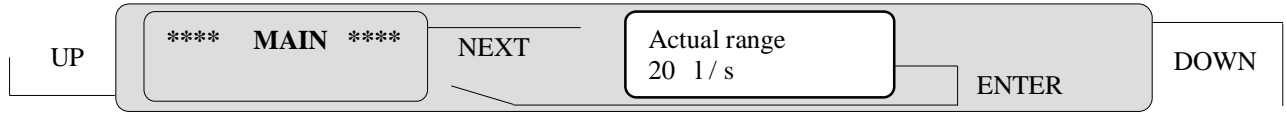


Filter – filtration constant and filter delay:

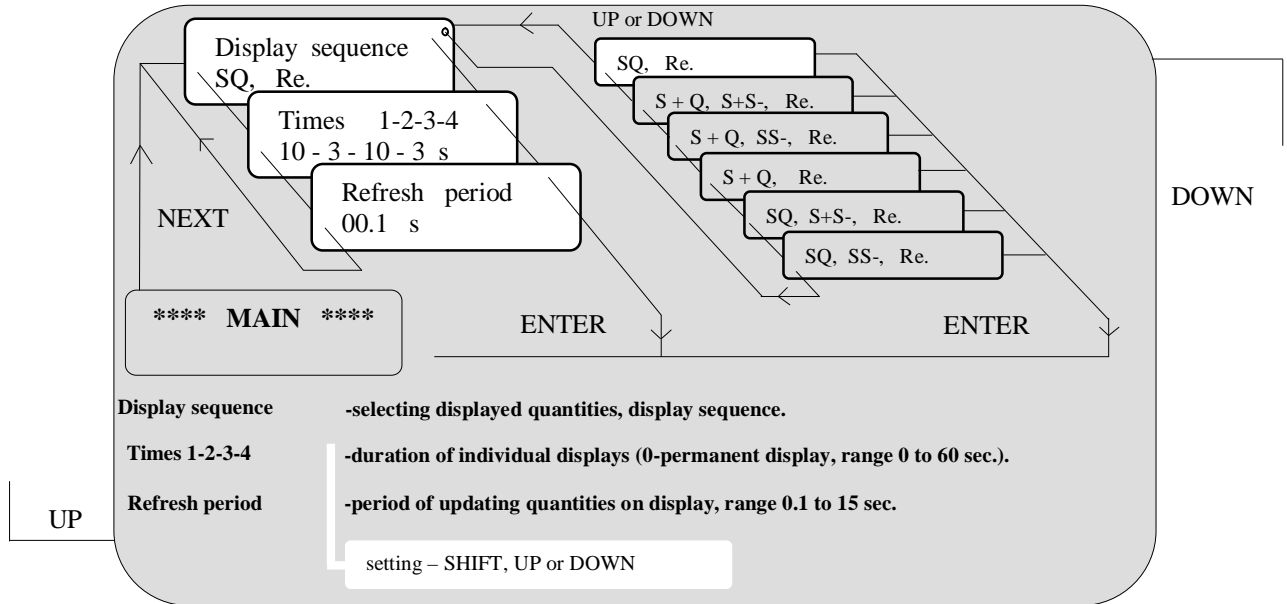


Instructions for adjustment - detailed menu description:

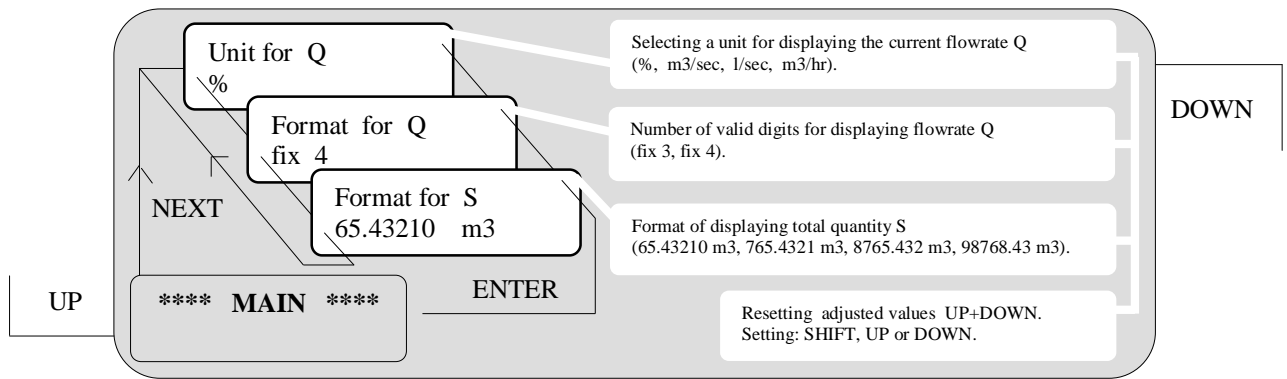
Range – current flowrate range: *however the instrument operates up to 200 percent of this value!*
Read only parameter.



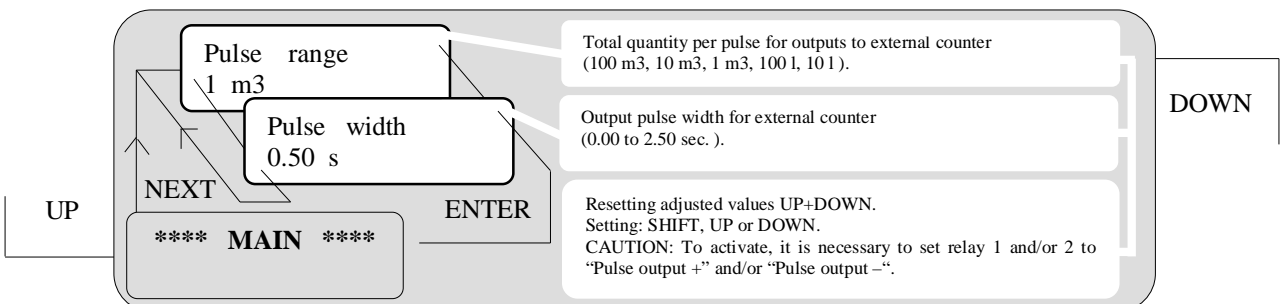
Display – time parameters displaying individual quantities, format of displaying individual quantities:



Unit, format – flowrate unit Q and format of displaying quantities Q, S+ and S-:

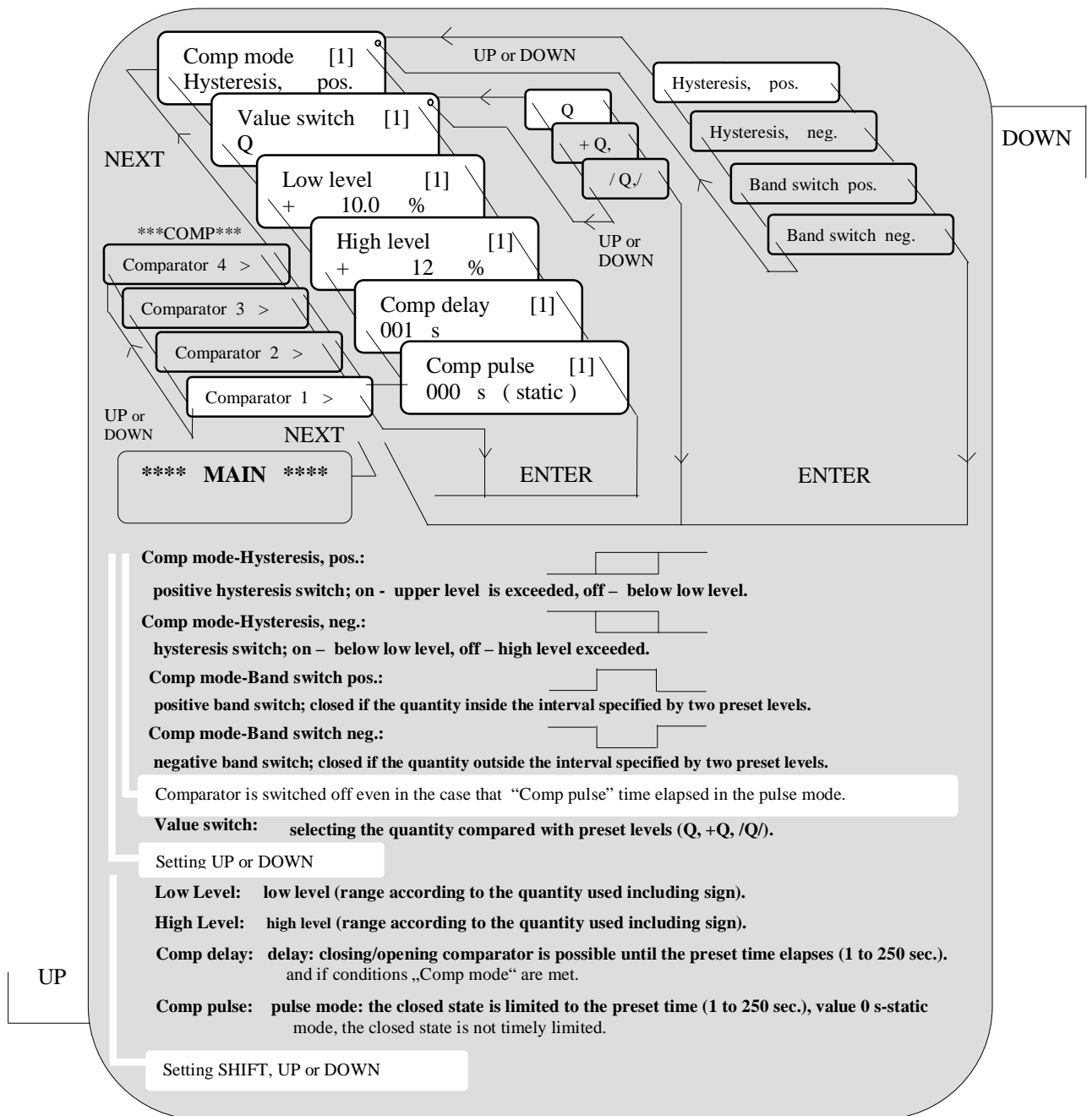


Pulse output – pulse output for external counter, total quantity per 1 pulse, pulse width.



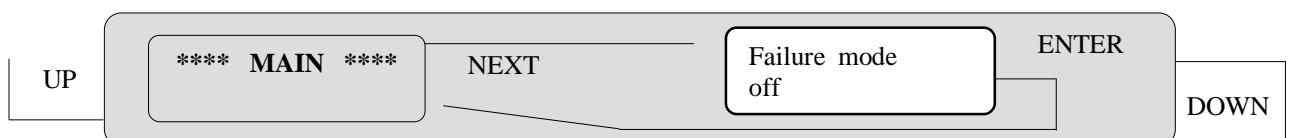
Instructions for adjustment - detailed menu description:

Comparators – four flow comparators with 4 modes, static and/or pulse modes are available:



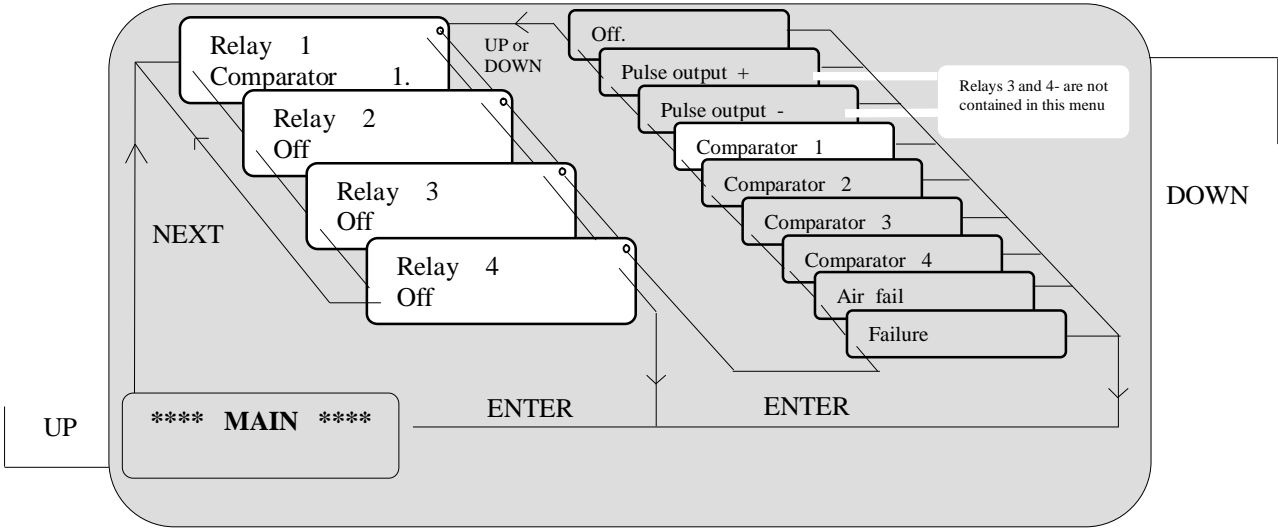
CAUTION: In addition to setting the quantities in compliance with the above-mentioned table, it is necessary to select a relay in „Comparators 1 to 4“ mode. Otherwise the comparator has no effect on SMART outputs.

Failure – intended for a future parameter extension that will control the status:

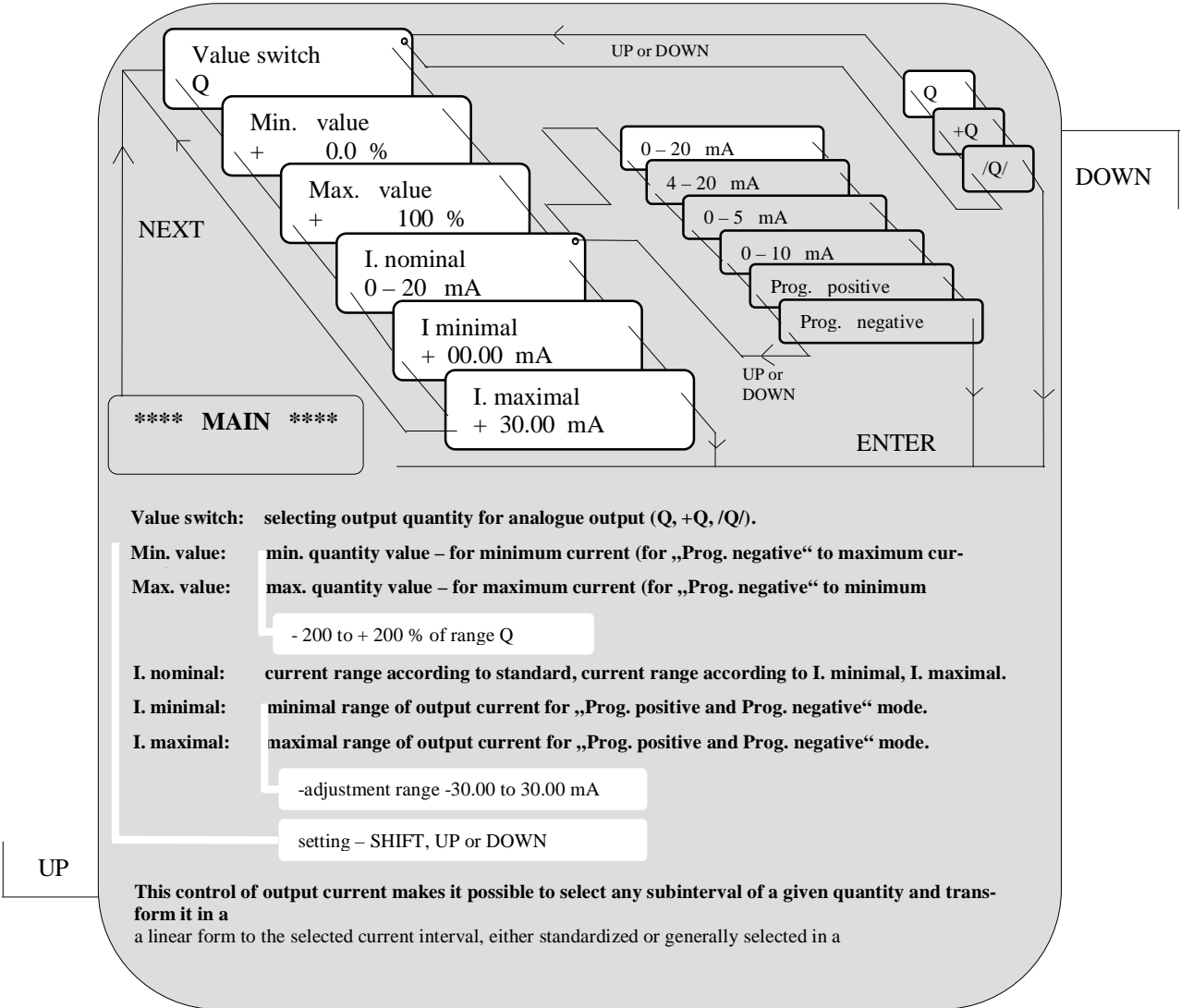


Instructions for adjustment – detailed menu description:

Relays – assigning the functions for relay 1 to 4, pulse output for external counter, 1 to 4 comparator output, sensor failure and sensor aeration:



Analog output – assigning output quantity, output range, nominal current, current range extension:

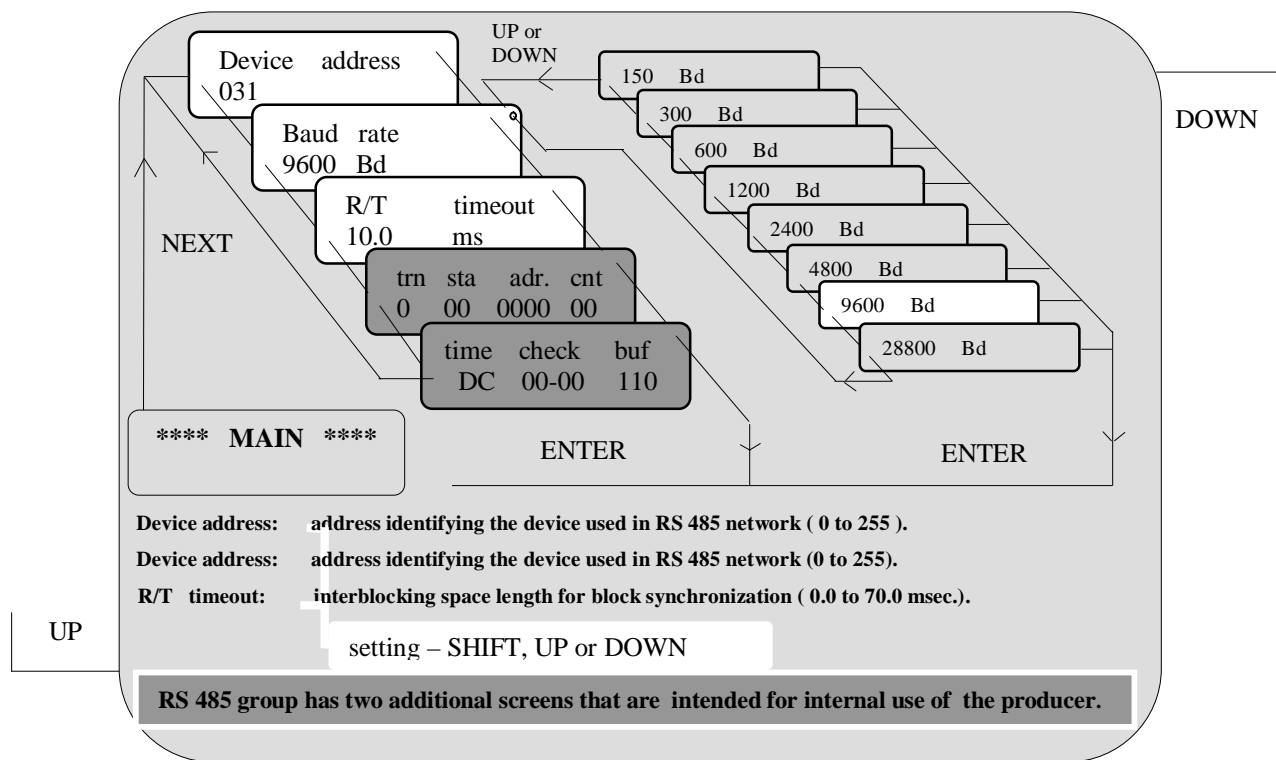


ELA spol. s.r.o.

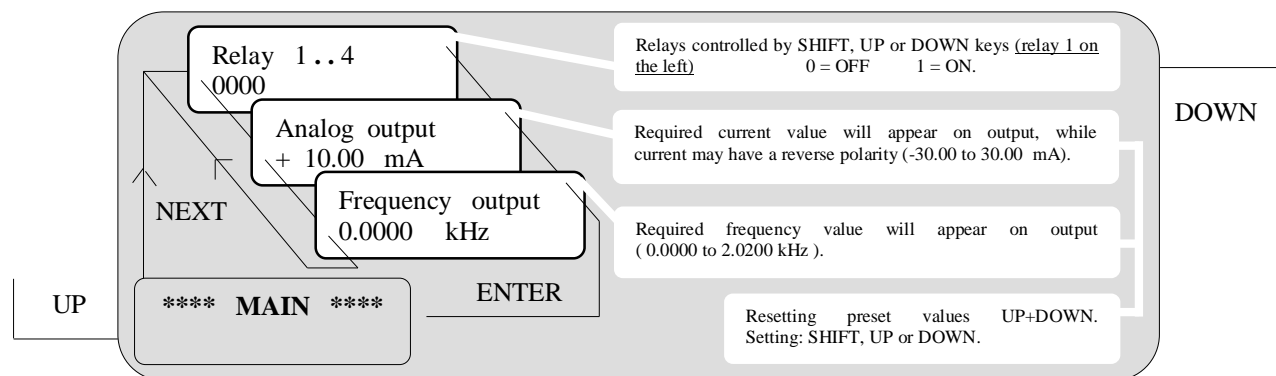
Instructions for adjustment - detailed menu description:

RS 485 – entering transmission line parameters:

The communication line makes it possible to transfer not only all basic device quantities (Q, S, S+, S-), but also all statistic records. This output is programmed to the transmission format. This is a binary asynchronous protocol which is written by the manufacturer's company and described in , ELA 2 Protocol for SMART Checkmag flowmeters“ documentation (not commonly shipped).



Manual output – manual control (testing) of 1 to 4 relays, and current and frequency output:

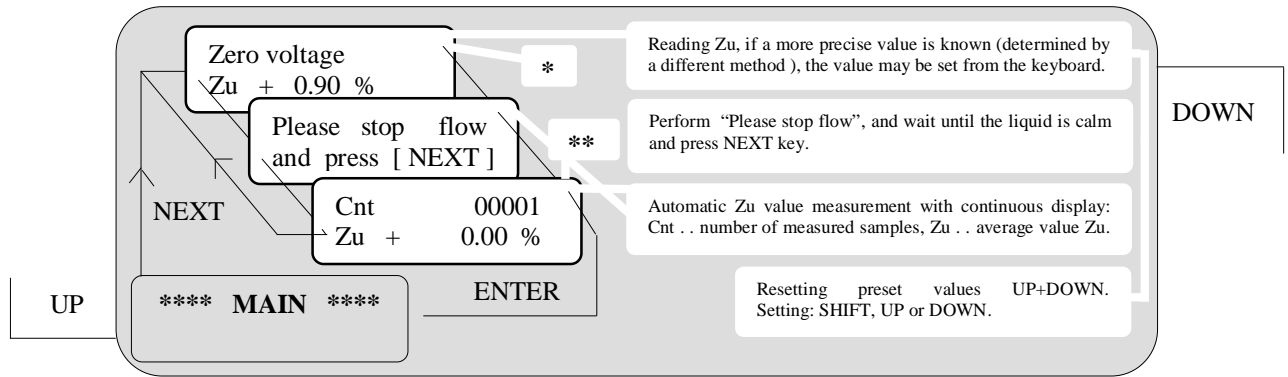


Zero adjust – setting the zero point of the device, performed during calibration in factory, any readjustment during installation is possible:

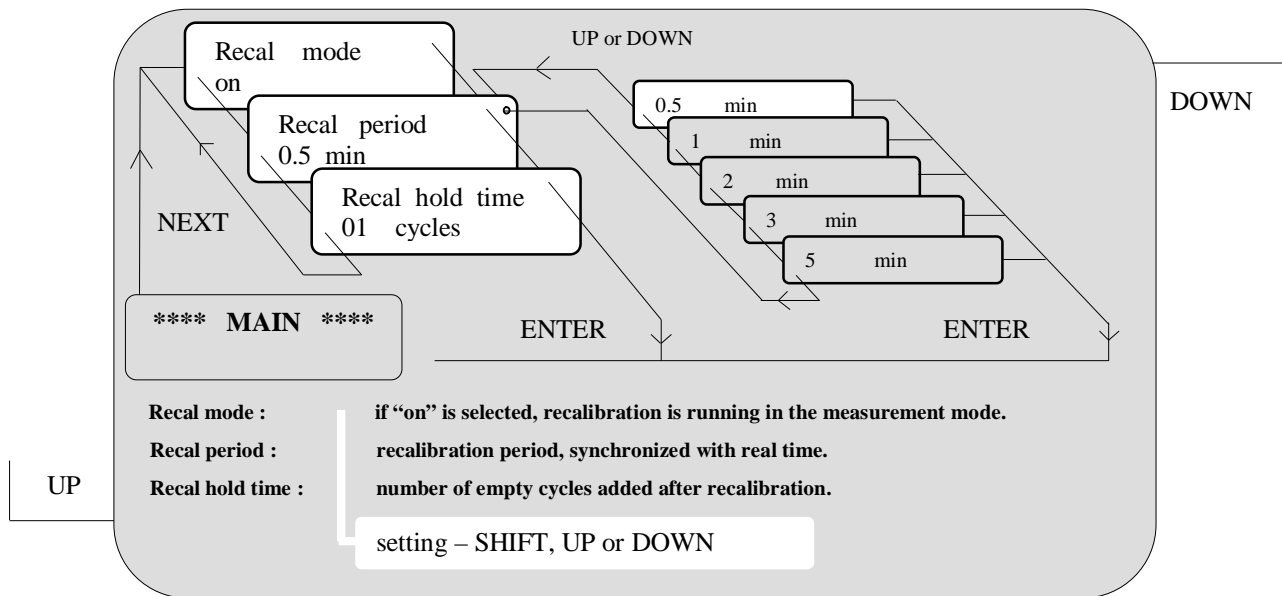
Consult the manufacturer if you want to change zero adjust. The adjustment is given by the quantity value Zu [%] that can be measured or set from the keyboard.

Legend to the following graphics:

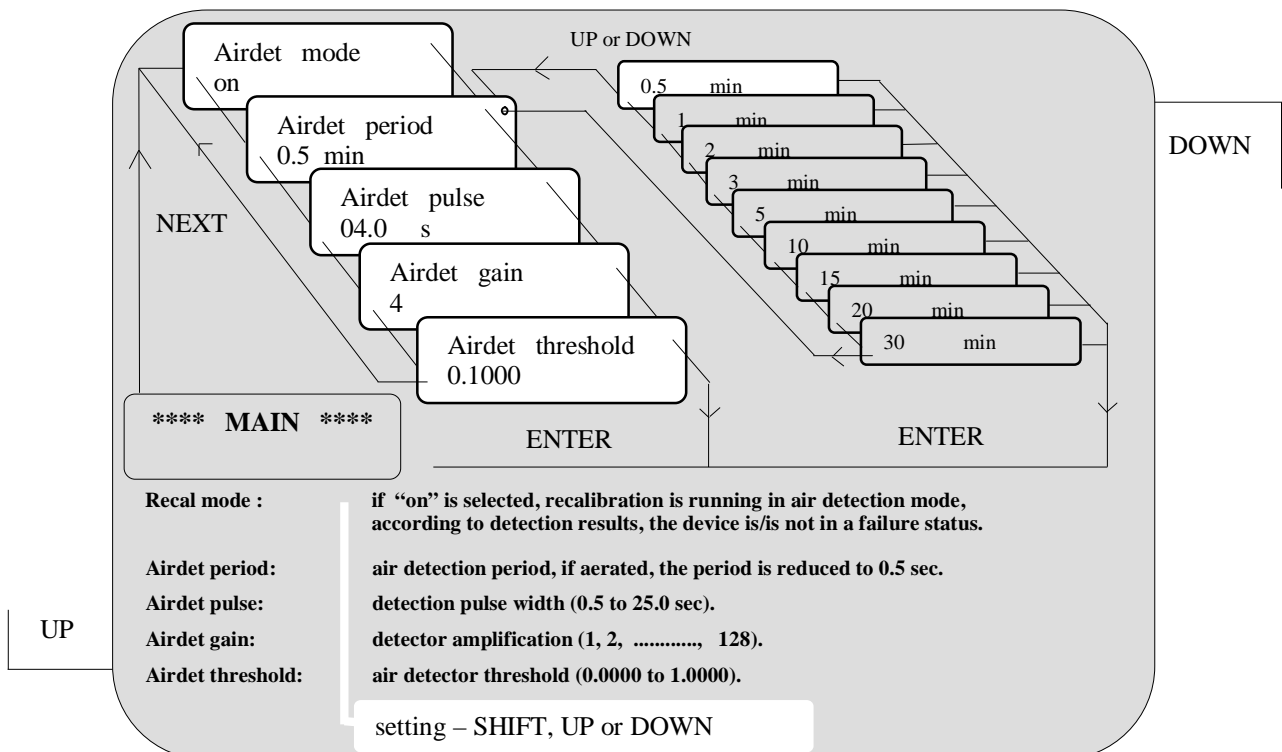
- * Press NEXT key in the case that the Zu value should be measured, otherwise use ENTER or ESCAPE to return to menu.
- ** The measurement is completed automatically when the preset number of samples (limit) has been measured (this number of samples is optimised in the factory). Only in an emergency, should pressing NEXT or ESCAPE key from the keyboard be used to interrupt the measurement.



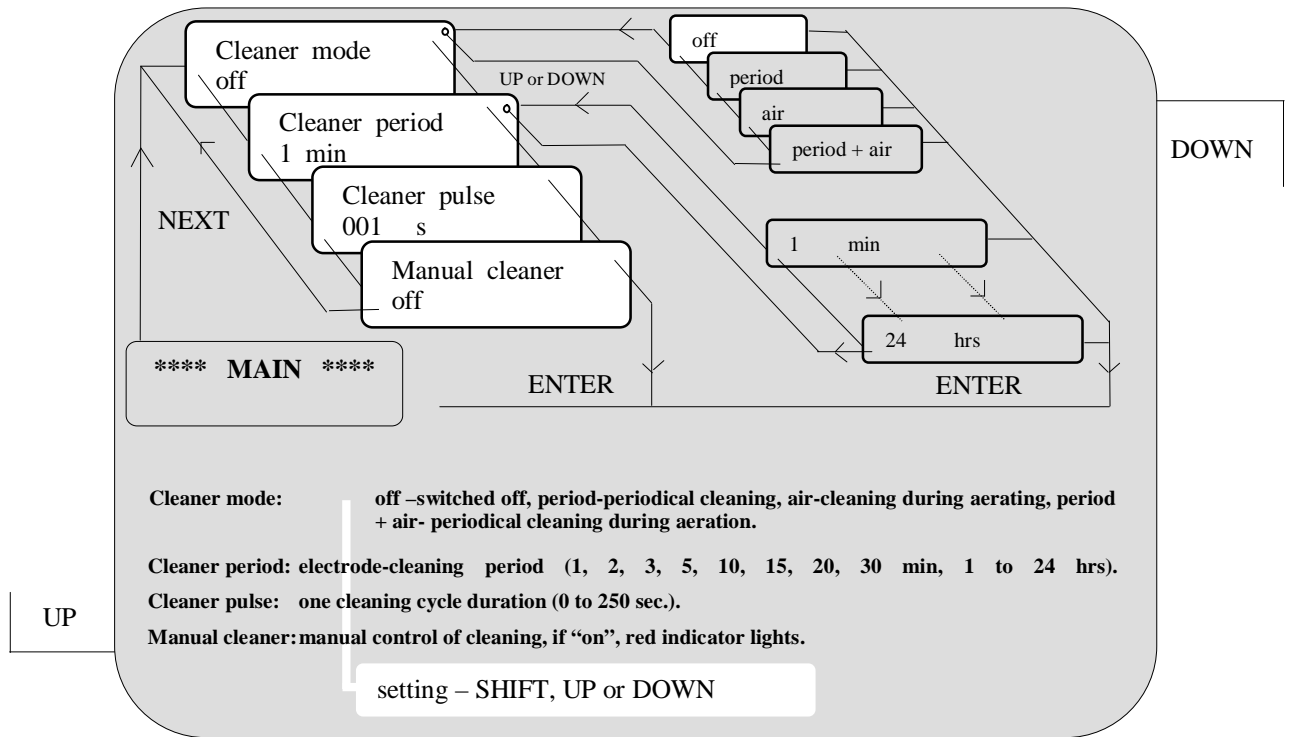
Recalibration – setting parameters of automatic internal recalibration in the measurement mode:



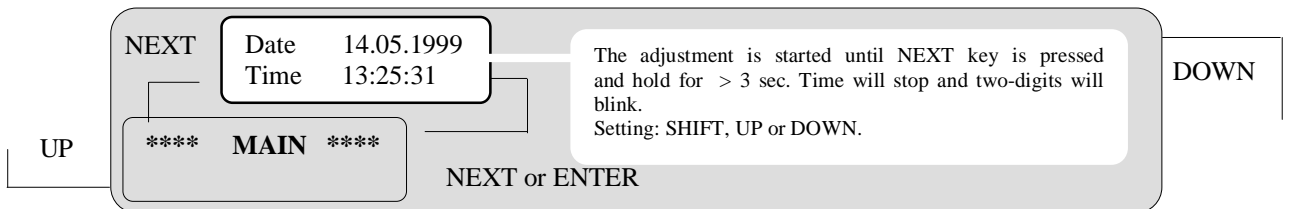
Air detector – setting parameters for empty pipe detection:



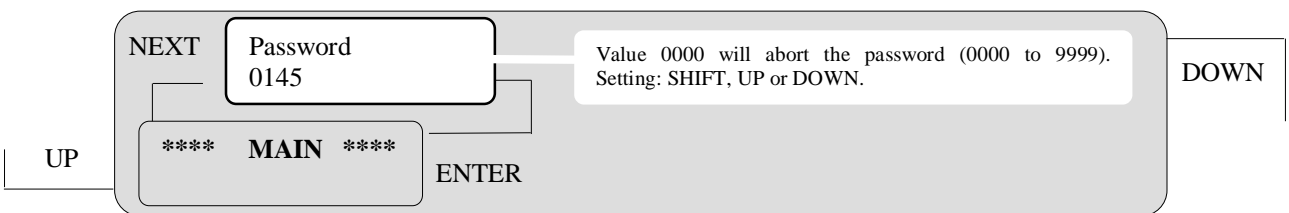
Cleaner – setting parameters for electrode cleaning:



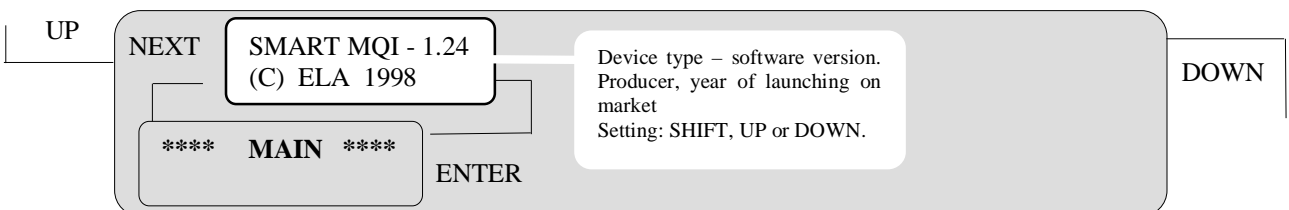
Date, time – setting the date and time, for initialisation press NEXT key and hold for 3 sec.:



Password - setting access password:



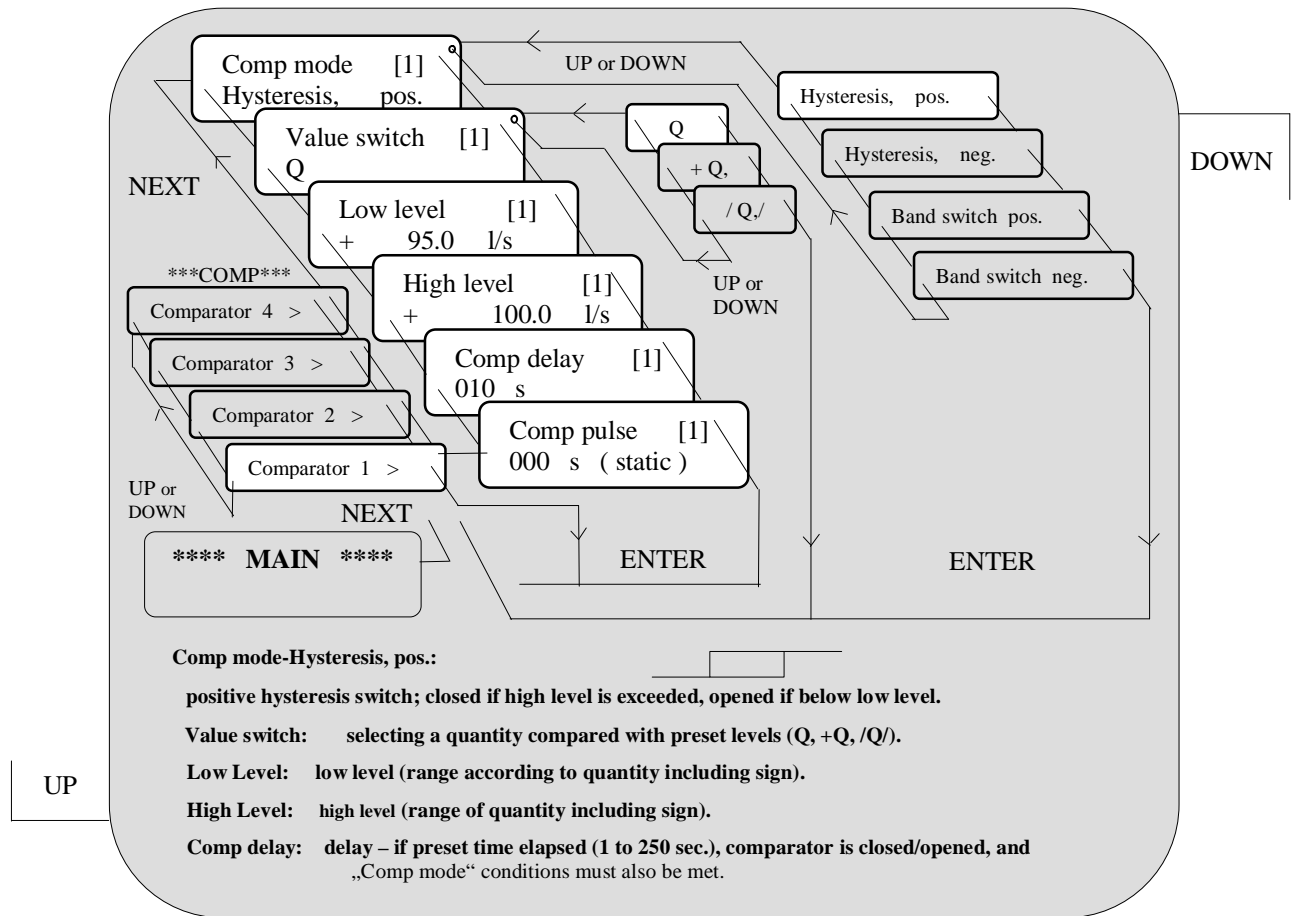
Version – device type and program version:



ELA spol. s.r.o.

Example:

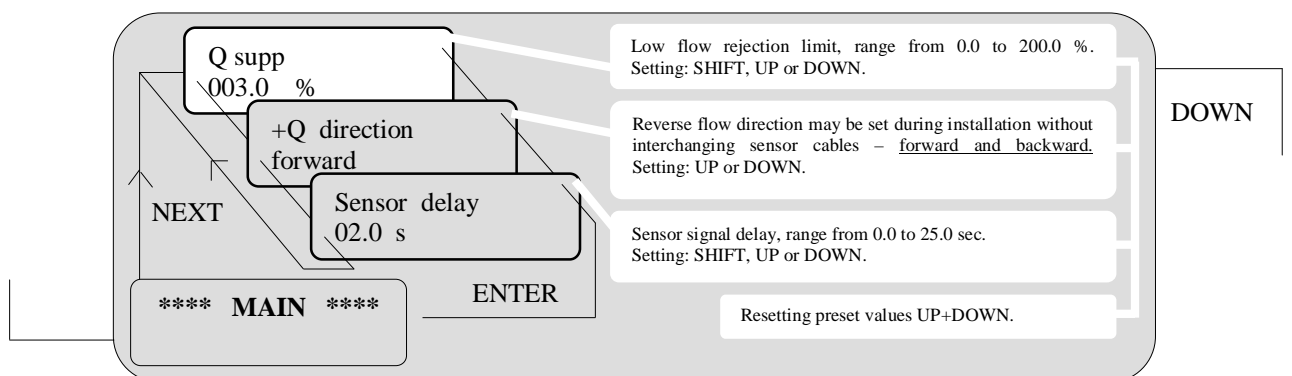
If flow is higher than 100 l/sec., it is necessary to close a relay contact in the SMART unit. Adjust the following parameters:



Relay 1 – for Comparator 1 must also be assigned in the **Relays** menu to the preset comparator. The preset comparator including the assigned relay will close/open relay 1 if current flowrate exceeds 100 l/sec. with a preset delay of 10 sec. The closed relay 1 will open if flowrate reduces below 95 l/sec. with a delay 10 sec.

Example:

The flowrates below the low limit of up to 3 percent of the range must be blocked (i.e. sneak flowrate). Adjust the following parameters:



The preset low limit will prevent to measure in a range lower than 3 percent for a flowmeter (including the counter integration).

All other corrections and adjustment of SMART device may be carried out similarly according to the instructions for adjustment.

Data acquisition program and basic information:

ACQ 2.4 evaluation program (shipped on a special order)

This program makes it possible to transfer the statistic register values from the SMART device, to a PC disk and to display the data on a PC monitor or print hardcopies of numerical values and graphics on a printer.

Data transmission from SMART device to a PC disk

This is a preparatory phase that secures the data transmission from the statistical registers of the SMART device to a PC disk. The data from one calendar month is transmitted as an integral part and the data will be stored to one DAT file on a PC disk. DAT files will be used for all other operations that are performed with measured values.

Numerical report of flowrates

The data from every calendar day is represented in one table. This table contains 5-minute flowrate averages Q that are acquired during the whole day. Daily minimum / maximum values including their corresponding times are shown below the table. One table is printed on one page, however the data are scrolled in sequences on the monitor.

Graphic flowrate report

The data from every calendar day is plotted in one chart. The chart shows 5-minute flowrate averages Q during the whole day. The data is presented by either points or continuous curves.

Statistical data report

The following statistical data are presented:

Qsum	...	total volume	[m ³]
Tsum	...	measurement time	[h]
Qstř	...	mean flowrate	[l/s]

The statistical data report is printed in one following modes:

"Daily"	...	all data from a day is printed in table including summary and hourly data
"Monthly"	...	all data from a month is printed in table including monthly summary data and daily data
"Yearly"	...	annual data is printed in table including annual summary data and monthly data

The printed report includes the data from a selected year. In "Daily" mode, tables are printed from a selected initial date up to a final date inclusively (e.g. from 9/1 to 1/2 inclusively). In "Monthly" mode, tables are printed from a selected initial month up to a final month inclusively. In "Yearly" mode, the complete yearly data is printed (one table).

One table is printed on one page, however the data is scrolled in sequences on the monitor.

Graphic statistical data

In graphic mode, the data of total volume Q_{sum} is also printed in three modes:

"Daily"	...	a bar graph for every day that shows total volume Q_{sum} for individual hours
"Monthly"	...	a bar graph for every month that shows total volume Q_{sum} for individual days
"Yearly"	...	a bar graph for every year that shows total volume Q_{sum} for individual months

The selection of the year and an initial and final date (or month) is the same as for the numerical data report.

Minimum PC configuration for ACQ 2.4

PC / AT 286, graphic card and VGA monitor, printer for graphic hardcopies, serial port RS 232C (one of COM1 to COM4, that is not used), operating system MS-DOS 3.3.

If the connection cable between a flowmeter and a PC is longer than 10 m, please use SMART device with a RS 485 port.

The RS 232C / RS 485 converter must be installed between serial port and RS 485 port (shipped by ELA Arkon Flowmeters.).

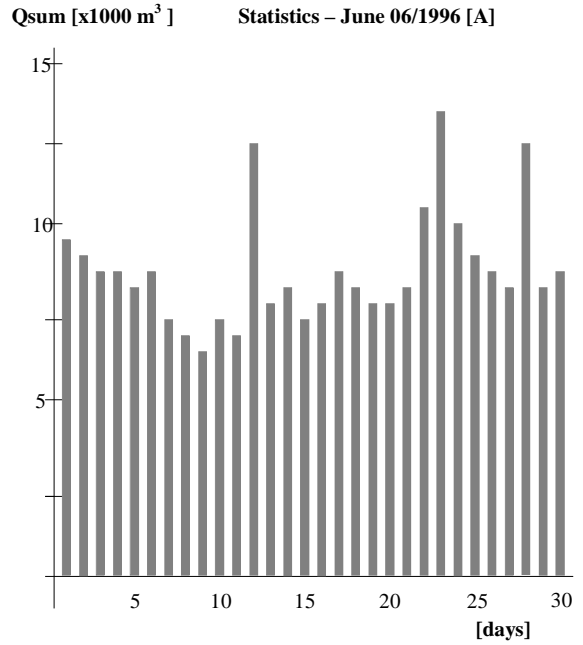
The following page shows the examples of ACQ 2.4 program reports.

Example of ACQ 2.4 program report
Graphic report of statistical data (total volume Qsum)

Example of ACQ 2.4 program report

Numeric report of statistical data (total volume Qsum, measurement time Tsum and mean flowrate Qstr)

ELA,ACQ 2.4	ČOV Hranice		
	Statistics – June 06/1996		
Interval	Qsum	Tsum	Qstr
[day]	[m ³]	[hr]	[l/sec.]

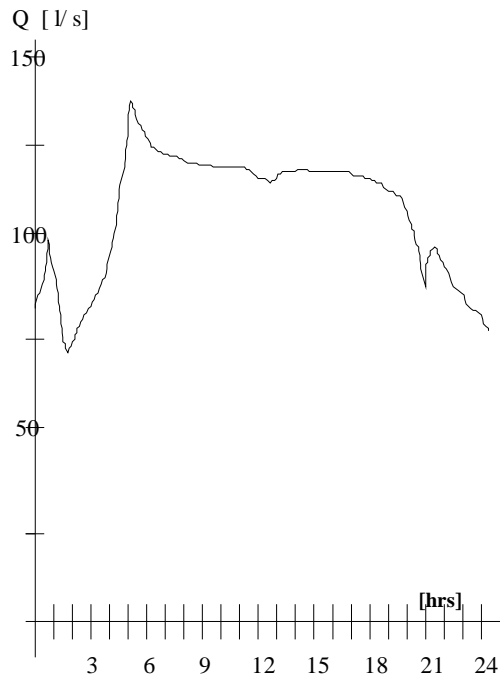


total

Numerical report of 5-minute average flowrates Q, daily minimum and maximum including appropriate times see below table

ELA,ACQ 2.4	ČOV Hranice	
	Flowrates Q[l/sec.], June 21, 1996	

current flowrates, 20/6/1996 [A]



Daily extreme values: Qmin = 46.6 l/sec. at 13:30
 Qmax = 159.9 l/sec. at 16:20