EchoTREK

SE/SG-300 series two-wire
compact ultrasonic level transmitters

INSTALLATION
and
PROGRAMMING MANUAL

1st edition

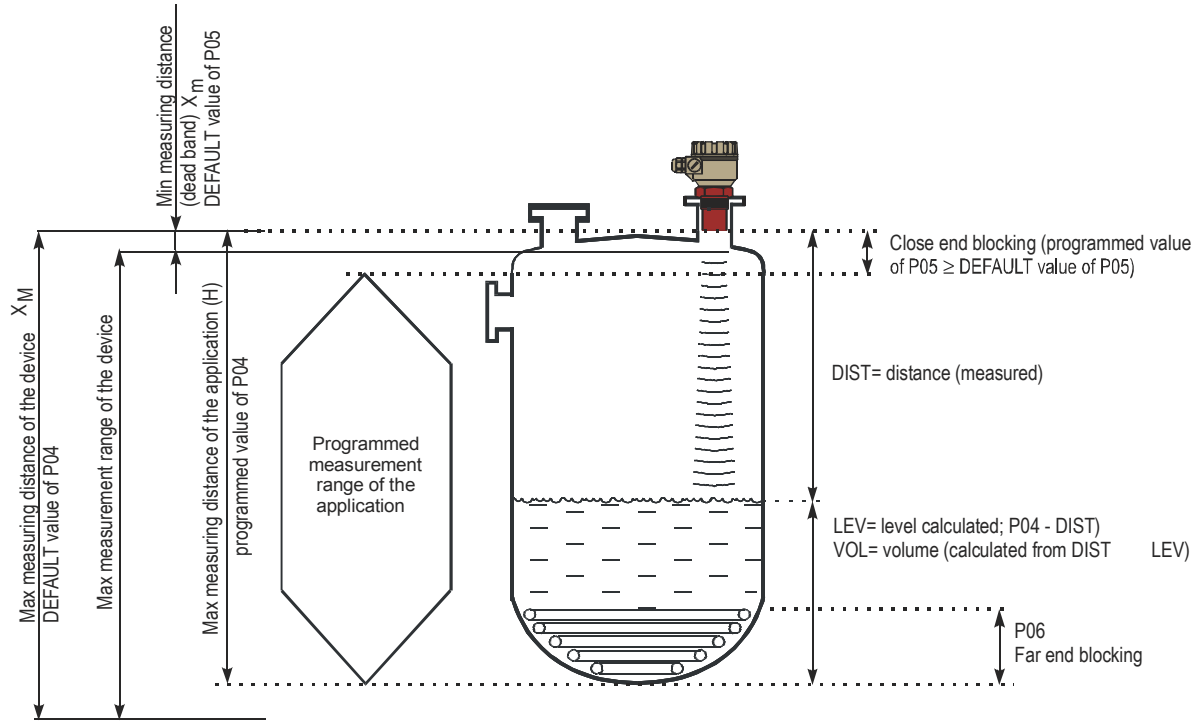$C\epsilon$

BASIC CONCEPTS AND ELEMENTS OF THE ULTRASONIC MEASUREMENT

Min measuring distance (dead band) X_m DEFAULT value of P05

X_M

Max measuring distance of the device DEFAULT value of P04

Max measurement range of the device

Max measuring distance of the application (H) programmed value of P04

Programmed measurement range of the application

Close end blocking (programmed value of P05 ≥ DEFAULT value of P05)

DIST= distance (measured)

LEV= level calculated; P04 - DIST)
VOL= volume (calculated from DIST   LEV)

P06
Far end blocking

CONTENTS

1. INTRODUCTION

Application

The EchoTREK compact ultrasonic level transmitters from NIVELCO are an excellent tool for the level measurement of liquids.

Level measurement technology based on the non-contacting ultrasonic principle is especially suited for applications where, for any reason, no physical contact can be established to the surface of the material to be measured.

Such reasons may include corrosive attack by the process medium against the measuring device material (acids), possible contamination (sewage) or particles of the process medium adhering to the measuring device (adhesive materials).

Principle of Operation

The ultrasonic level metering technology is based on the principle of measuring the time required for the ultrasound pulses to make a round trip from the sensor to the level to be measured and back. The sensor emits an ultrasonic pulse train and receives the echoes reflected. The intelligent electronic device processes the received signal by selecting the echo reflected by the surface and calculates from the time of flight the distance between the sensor and the surface which constitutes the basis of all output signals of the EchoTREK

A Total beam angle of 5°-7° at –3 dB as is featured by most of Nivelco's SenSonic transducers ensuring a reliable measurement in narrow silos with uneven side walls as well as in process tanks with various protruding objects. Furthermore, as a result of the narrow beam angle - the emitted ultrasonic signals have an outstanding focusing - deep penetration through gases, vapour and foam is ensured.

X	D
1 m	0,21 m
2 m	0,3 m
5 m	0,56 m
10 m	1 m
15m	1,45 m
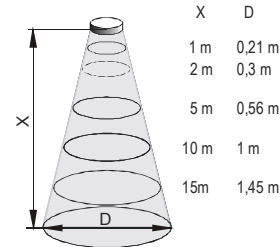
The Diameters corresponding to 5° beam angle.

Dead Band is a feature common to all ultrasonic level meters.

It is specified as "Minimum measuring distance" in the Technical Data Table. Measurement within this range can not be interpreted.

Minimum measuring distance (X_m) is determined by the design of the unit within which the measuremnt is not possible (Dead Zone). This distance can be extended by programming in order to avoid disturbing effects of possible disturbing echos coming from fixed objects. (Close-end Blocking).

Maximum measuring distance (X_M) is the greatest distance (determined by the design of the unit) which can be measured by the unit under ideal conditions. The maximum measuring distance of the actual application (H) must not be greater than X_M.

2. ORDER CODES

Note: not all combinations are possible

EchoTREK S ☐ ☐ - 3 ☐ ☐ - ☐

TYPE	CODE
Transmitter	E
Transmitter with local indicator	G

TRANSDUCER / HOUSING	CODE
PP/Aluminium	A
PVDF/Aluminium	B
PTFE/Aluminium	T
SS316Ti/Aluminium	S
PP/Plastic	P
PVDF/Plastic	V
PTFE/Plastic	F
SS316Ti/Plastic	M

MEASURING RANGE *	CODE
12; 15 m	4
7; 10 m	6
6; 8 m	7
12; 15 m	8
3; 4 m	9

MOUBTING	CODE
BSP thread *	0
NPT thread	N
DN 80 PN 16 / PP	2
DN 100 PN 16 / PP	3
DN 125 PN 16 / PP	4
DN 150 PN 16 / PP	5
DN 200 PN 16 / PP	6
200 mm bracket	K
500 mm bracket	L
700 mm bracket	M

SUPPLY / OUTPUT	CODE
4 … 20 mA / 12 … 36 VDC	2
4 … 20 mA + HART / 12 … 36 VDC	4

* Measuring range depends on the material of the transducer

3. TECHNICAL DATA

General data

Transducer materials	Polypropylene (PP) Kynar (PVDF) Teflon (PTFE) Stainless Steel (DIN 1.4571, AISI SS316Ti)
Housing material	Plastic: PBT fibre-glass reinforced, flame-retardant (DuPont®) Aluminium: Powder paint coated
Process temperature	PP, PTFE and PVDF versions: -30 °C ... +90 °C Stainless Steel versions : -30°… +100°C (120° for max. 2 hours)
Ambient temperature	-30°C ... +60°C with SAP-200 –25 °C ... +60 °C
Pressure (Absolute)	0.5** ... 3 bar (0.05 ... 0.3 MPa) Stainless steel versions 0.9 ... 1.1 bar (0.09 ... 0.11 MPa)
Seals	PP transducer: EPDM All other transducer versions: FPM (Viton)
Ingress protection	Sensor: IP68 Housing: IP67 (NEMA 6)
Power supply / Consumption	11.4 ... 36 VDC 48 mW ... 720 mW galvanic isolation; protection against surge transients
Accuracy *	$\pm$ (0.2% of the measured distance plus 0.05% of the range)
Resolution	Depending on the measured distance < 2 m: 1 mm, 2...5 m: 2 mm, 5...10 m: 5 mm, > 10 m: 10 mm
Outputs	Analogue: 4 … 20 mA, R_{max} 600 Ohm, isolated, secondary lightning protection
	Loop power test connectors: 2 mm socket for ampermeter, 200 mV, 0.5%
	Display: 6 digits, icons and bargraph, (on SAP-200 display module only)
	Serial communication: HART interface (close end resistor 250 Ohm)
Electrical connection	2 x Pg16 and 2 x ½" NPT for cable protection pipe Cable diameter: 10 … 14 mm ; Wire cross section: 0.5 ... 1.5 mm²
Electrical protection	Class I with aluminium housing, Class II with plastic housing

*   *Under optimal conditions of reflection and stabilised transducer temperature.*

**   *At pressures under 1 bar absolute, please consult your distributor*

Special data of the two-wire EchoTREK with PP and PVDF transducers

Type	SE☐-39☐-☐ SG☐-39☐-☐	SE☐-38☐-☐ SG☐-38☐-☐	SE☐-37☐-☐ SG☐-37☐-☐	SE☐-36☐-☐ SG☐-36☐-☐	SE☐-34☐-☐ SG☐-34☐-☐
Transducer material	PP or PVDF	PP or PVDF	PP or PVDF	PP or PVDF	PP or PVDF
Maximum measuring distance * [m / ft]	4	6	8	10	15
Min. measuring distance* (Dead band) [m / ft]	0.2	0.25	0.35	0.35	0.45
Total beam angle (-3 dB)	6°	5°	7°	5°	5°
Measurement frequency	80 kHz	80 kHz	50 kHz	60 kHz	40 kHz
Process connection	1 ½" thread	2" thread	2" thread	Flange	Flange

* (from the transducer face)

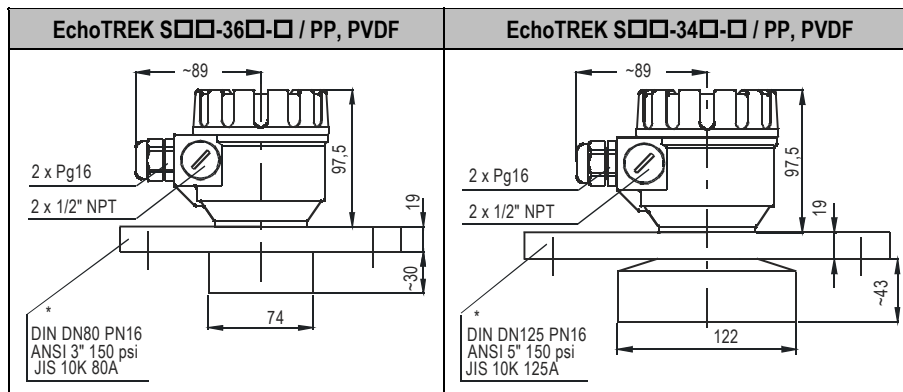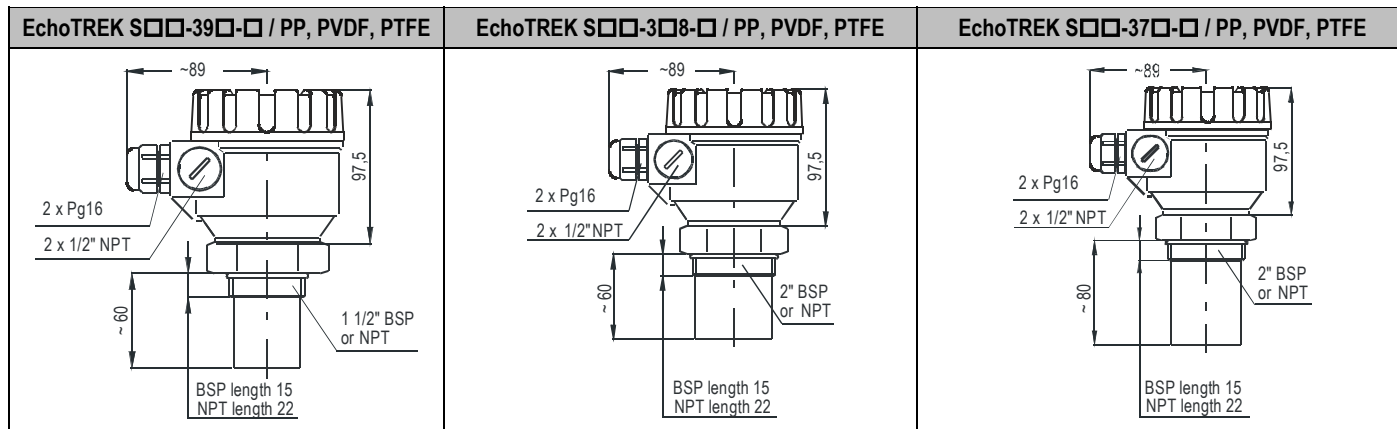**Special data of the two-wire EchoTREK PTFE and Stainless Steel transducers**

Type	SE☐-39☐-☐ SG☐-39☐-☐	SE☐-38☐-☐ SG☐-38☐-☐	SE☐-37☐-☐ SB☐-37☐-☐	SE☐-36☐-☐ SG☐-36☐-☐	SE☐-34☐-☐ SG☐-34☐-☐
Transducer material	PTFE	PTFE	PTFE	St. St.	St. St.
Maximum measuring distance * [m/ft]	3	5	6	7	12
Min. measuring distance* (Dead band) [m/ft]	0.2	0.25	0.35	0.4	0.55
Total beam angle (-3 dB)	6°	5°	7°	5°	5°
Measurement frequency	80 kHz	80 kHz	50 kHz	60 kHz	40 kHz
Process connection	1 ½" thread	2" thread	2" thread	Flange	Flange

* (from transducer face)

SAP-200 Display Module

Field indication	6 digits Custom LCD, icons and bargraph,
Ambient temperature	-25°C … +60°C
Housing material	PBT fibre-glass reinforced plastic, (DuPont®)

Dimensions of the two-wire EchoTREK

EchoTREK S□□-39□-□ / PP, PVDF, PTFE	EchoTREK S□□-3□8-□ / PP, PVDF, PTFE	EchoTREK S□□-37□-□ / PP, PVDF, PTFE

~89 · 97,5 · 2 x Pg16 · 2 x 1/2" NPT · ~60 · 1 1/2" BSP or NPT · BSP length 15 NPT length 22

~89 · 97,5 · 2 x Pg16 · 2 x 1/2"NPT · ~60 · 2" BSP or NPT · BSP length 15 NPT length 22

~89 · 97,5 · 2 x Pg16 · 2 x 1/2" NPT · ~80 · 2" BSP or NPT · BSP length 15 NPT length 22

EchoTREK S□□-36□-□ / PP, PVDF	EchoTREK S□□-34□-□ / PP, PVDF

~89 · 97,5 · 2 x Pg16 · 2 x 1/2" NPT · 19 · ~30 · 74 · * DIN DN80 PN16 ANSI 3" 150 psi JIS 10K 80A

~89 · 97,5 · 2 x Pg16 · 2 x 1/2" NPT · 19 · ~43 · 122 · * DIN DN125 PN16 ANSI 5" 150 psi JIS 10K 125A

* Min required flange size

EchoTREK S□S-36□-□/ SS316 Ti

~89
97,5
~147
20,5

2 x Pg16
2 x 1/2" NPT

DIN DN80 PN16
ANSI 3" 150 psi

EchoTREK S□S-34□-□/ SS316 Ti

~89
97,5
~157
25

2 x Pg16
2 x 1/2" NPT

DIN DN125 PN16
ANSI 5" 150 psi

Cover

Display Module

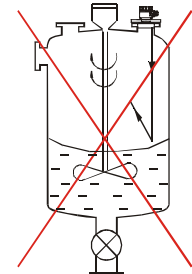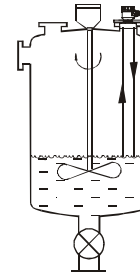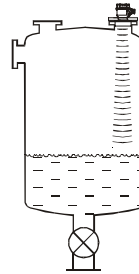Electronics

Enclosure

Transducer
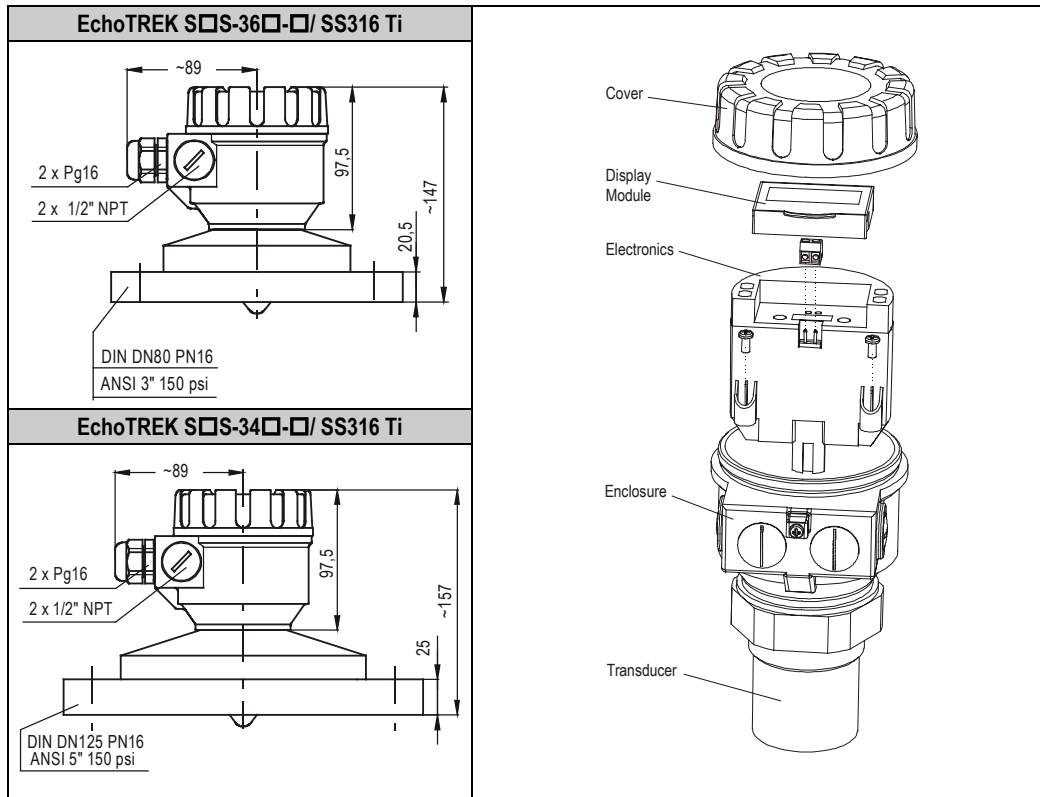
3.1 Accessories

– Warranty sheet
– Installation and Programming Manual

— 2 x Pg16 cable gland
— SAP-200 Display Module (option)
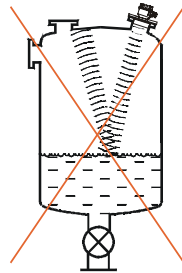
4. INSTALLATION

4.1 Liquid Level Measurement

POSITION

The optimal position of the EchoTREK is on the radius
r = (0.3 … 0.5) R of the (cylindrical) tank / silo.
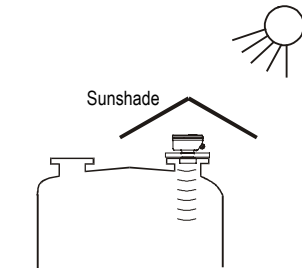(Take also sonic cone on page 1 into consideration.)

SENSOR ALIGNMENT

The sensor face has to be parallel to
the surface of the liquid within ± 2-3°.

TEMPERATURE

Make sure that the transmitter will
be protected against overheating by
direct sunshine.

Sunshade

OBSTACLES

Make sure that no in-flow path or objects (e.g. cooling pipes, ladders, bracing members, thermometers, etc.) or no tank wall of the ragged surface protrude into the sensing cone of the ultrasonic beam. One fix object in the tank / silo that disturb the measurement can be blocked out by the appropriate programming of the EchoTREK
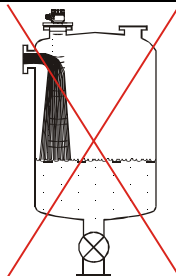
STAND-OFF PIPE

The structure of the stand off pipe should be rigid; the inner rim where the ultrasonic beam leaves the pipe should be rounded.
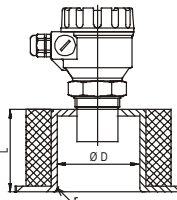
L	D_{min}		
	S ☐ ☐ - 39 ☐	S ☐ ☐ - 38 ☐	S ☐ ☐ - 37 ☐
150	50	60	60
200	50	60	75
250	65	65	90
300	80	75	105
350	95	85	120

FOAM

Foaming of the liquid surface may render ultrasonic level metering impossible. If possible, a location should be found, where foaming is the least (device should be located as far as possible from liquid inflow) or a stilling pipe or well should be used.
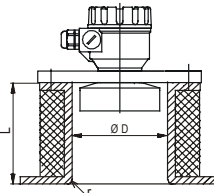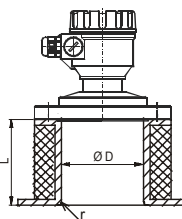
L	D_{min}	
	S ☐ ☐ - 36 ☐	S ☐ ☐ - 34 ☐
90	80	*
200	80	*
350	85	*
500	90	*

* For values contact your distributor

WIND

Intensive air (gas) movements in the vicinity of the ultrasonic cone is to be avoided. A strong draft of wind may "blow away" the ultrasound.
Devices with lower measuring frequency (40, 20 kHz) are recommended.

L	D_{min}	
	S ☐ S – 36 ☐	S ☐ S – 34 ☐
320	80	-
440	-	125

FUMES/VAPOURS

For closed tanks containing chemicals or other liquids, which creats fume/gases above the liquid surface especially for outdoor tanks exposed to the sun, a strong reduction of the nominal measuring range of the ultrasonic device is to be considered during device selection.

Devices with lower measuring frequency (40, 20 kHz) are recommended in these cases units.

4.2 Open Channel Flow Measurement

- For ultimate accuracy, install the sensor as close as possible above the expected maximum water level (see minimum measuring range).
- Install the device in a place defined by the characteristics of the metering channel along the longitudinal axis of the flume or weir. In case of Parshall flumes supplied by NIVELCO the location of the sensor is marked.
- In some cases foam may develop on the surface. Make sure that the surface, opposite to the sensor remain free of foam for proper sound reflection.
- From the point of view of measurement accuracy the length of the channel sections preceding and following the measuring flume and their method of joining to the measuring channel section are of critical importance.
- Despite of the most careful installation, the accuracy of flow metering will be lower than that of specified for the distance measurement. It will be determined by the features of the flume or weir applied.

4.3 Electrical Connection

- After removal of the cover of the housing and taking out the display module (if any), the screw terminals can be accessed. Suggested cable core cross section 0.5 ... 1.5 mm^2
- The unit has to be grounded by the inner or outer grounding screw. For practical purposes units with plastic housing has to be grounded by the outer grounding screw.
- The unit may be damaged by electrostatic discharge (EDS), via its terminal, thus apply the precautions commonly used to avoid electrostatic discharge e.g. by touching a properly grounded point before removing the cover of the enclosure.
- After connecting the cable and unit programmed proper sealing and closing should be ensured.
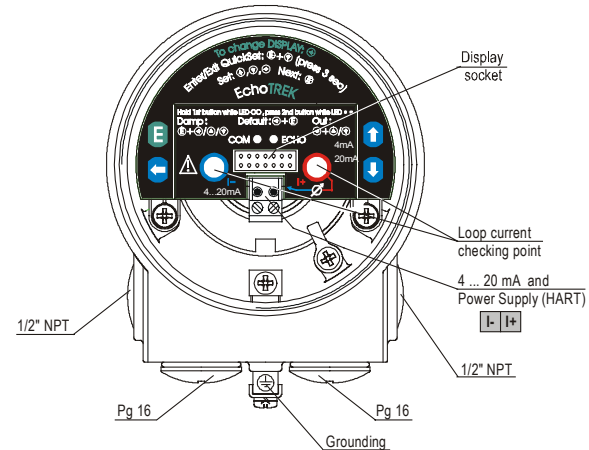
4.4 Loop Curent Checking

After removing the cover (and the Display Module if there is any) the actual loop current can be measured with an accuracy of 0.5% by connecting an ampermeter (in the range of 200 mV) to the points indicated on the drawing above

5. PROGRAMMING

The EchoTrek can be programmed by the following two ways:

- **Programming without Display Module** see 5.1.
  Assignment of the levels to the 4 and 20 mA current output, error indication by the analogue signal and damping can be set.

- **With the SAP-200 Display Module**, see 5.2.
  All features of the unit can be set, such as measurement configuration and optimisation, 32-point linearisation, dimensions for 11 tanks with different shape and for 21 different open channels (flume, weir, etc).

Devices with the type number **EchoTREK SG...** are already equipped with the SAP-200.

The EchoTREK is fully operational without the SAP-200. The SAP-200 is only needed for programming and/or displaying measurement values.

The unit will measure during programming in accordance with the previous parameters. The new, modified parameters will only be effective after returning to the Measurement Mode

If the transmitter is left in Programming Mode by mistake, it will automatically return to Measurement Mode after 30 minutes and will operate with the parameters entered during the last completed programming.

The EchoTREK will be delivered with the following **Factory Default**:

$\Rightarrow$ Current output, display and bargraph: LEVEL
$\Rightarrow$ Current output and bargraph proportional to the level
$\Rightarrow$ 4 mA: assigned to the minimum level 0%
$\Rightarrow$ 20 mA: assigned to the maximum level 100%
$\Rightarrow$ Error indication by the current output: hold last value
$\Rightarrow$ Damping: 60 sec

5.1 Programming without Display Module

Programming is only possible if the EchoTREK is in Level Measuring Mode and receives valid echo i.e. "ECHO" LED is lit !

The following can be programmed without display module
- Assignment of the 4 mA to a required e.g. min. level / max. distance
- Assignment of the 20 mA to a required e.g. max. level / min. distance
- Error indication by the current output (Hold, 3.6 mA or 22 mA)
- Damping (10, 30 or 60 sec)
- Reset to the factory default

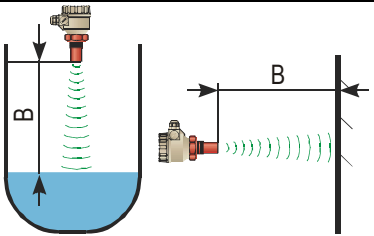*Note: Current output can also be assigned in inverted mode:*
4 mA = 100% (Full), 20 mA = 0% (Empty)

Procedure of programming: press button in the relevant sequence and check the state of the LED-s. Symbols for the states of the LED-s:
$\bigcirc$ = LED is off, $\mathbb{C}$ = LED is blinking, $\bullet$ = LED is on, $\mathbb{C}\mathbb{D}$ = LEDs are blinking alternatively $\otimes$ = Dont care

Minimum level, (0%, empty tank) assignment to 4 mA

Action	Led state following the action	
1) Check for a valid ECHO	$\otimes\bullet$ =	Valid ECHO, transmitter programmable
2) Press NEXT ⊙ button steadily	$\bigcirc\bigcirc$ =	EchoTREK in programming mode
3) Press UP ⊙ button steadily	$\bullet\bullet$ =	4 mA assigned to the distance (see picture)
4) Release buttons	$\bullet\bullet$ =	Programming completed

Use level in tank or a fix target e.g. the wall

Maximum level (100%, full tank) assignment to 20 mA

Action	Led state following the action	
1) Check for a valid ECHO	⊗○ =	Valid ECHO, transmitter programmable
2) Press NEXT ⊕ button steadily	●● =	EchoTREK in programming mode
3) Press UP ⊕ button steadily	○○ =	20 mA as signed to the distance (see picture)
4) Release buttons	●● =	Programming completed
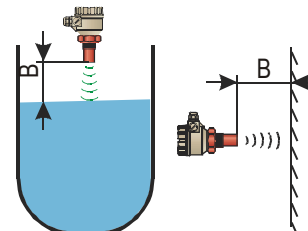
Use level in tank or a fix target e.g. the wall

"Error state" indication by the analogue signal (Check for a valid echo as above)

As a result of this setting the value of the analogue output will be 3,8 mA; 22 mA or according last value (hold) until the error is ceased.

Action	Led state following the action	
1) Press ⊕ button steadily	○○ =	EchoTREK in programming mode
2) Press any of the DOWN ⊕, ENTER Ⓔ, NEXT ⊕ buttons steadily	●● =	– hold last value – 3,6 mA – 22 mA
3) Release buttons	○○ =	Programming completed

Damping time setting (Check for a valid echo as above)

Action	Led state following the action
1) Press ENTER Ⓔ button steadily	○○ = EchoTREK in programming mode

2) Press any of the NEXT ⦾,
                             UP ⦿,
                             DOWN ⦿
     buttons steadily
	●● = – 10 sec
	            – 30 sec
	            – 60 sec

3) Release buttons	○○ = Programming completed

RESET: Returning to the default (Check for a valid echo as above)

Action	Led state following the action
1) Press NEXT ⦾ button steadily	○○ = EchoTREK in programming mode
2) Press ENTER Ⓔ button steadily	●● = Default loaded

Indication of mistakes (by LEDs) made during programming

Action	Led state following the action	Possible correction
Attempted programming	●◑ = blinking twice = no Echo	Find a valid Echo
Attempted programming	●◑ = blinking three times = no access possible	With SAP-200 only See 5.2 (P99)
Attempted programming	●◑ = blinking four times = EchoTREK not in Level Meas Mode	With SAP-200 only See 5.2 (P01)

5.2 Programming with the SAP-200 Display Module

The EchoTREK should be adjusted to the process by programming the parameters. The SAP-200 Display Module can be used to display the parameters during programming and measurement values during measurement.

The SAP-200 supports two separately accessible programming modes representing 2-layers of programming complexity, depending on user choice.

```
        ┌─────────────────────────────┐
        │   PLUG-IN DISPLAY MODULE    │
        └─────────────────────────────┘
            ↓                    ↓
   ┌──────────────┐      ┌──────────────┐
   │   QUICKSET   │      │     FULL     │
   │              │      │  PARAMETER   │
   │              │      │   ACCESS     │
   └──────────────┘      └──────────────┘
```
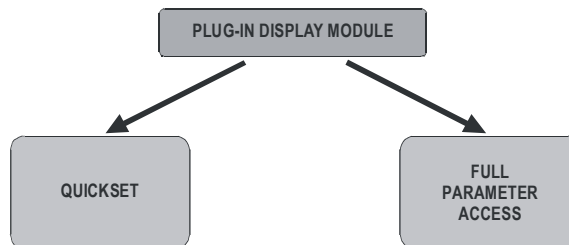
QUICKSET (5.2.4)
Recommended as a simple and fast way to set up the EchoTREK by 6 basic parameters
for the following basic settings, marked by abbreviationseasy to remember
- Engineering unit for the display (Metric or US)
- Maximum measuring distance (H)
- Assignment of min level to 4 mA
- Assignment of max level to 20 mA
- Error indication by the current output
- Damping time

Full Parameter Access (5.2.5)
All features of the EchoTREK such as:
- Measurement configuration
- Outputs
- Measurement optimalisation
- 11 pre-programmed tank shapes for volume calculation
- 21 pre-programmed formula for flow metering
- 32-point linearisation

5.2.1 SAP-200 Display Module

Symbols used on the LCD:

- **DIST** – Distance (measuring) mode
- **LEV** – Level (measuring) mode
- **VOL** – Volume (measuring) mode
- **FLOW** – Open channel (flow metering) mode
- **PROG** - Programming mode
  (device under programming)
- **T1** - TOT1 volume flow totaliser
  (resetable aggregate)
- **T2** - TOT2 volume flow totaliser (aggregate)
- **FAIL** - Measurement / device error
- ↑ ↓- Level changing direction
- Bargraph assigned to the current output or
  echo strength

Symbols used on the frame:

- **M** – Metric system
- **US** – US calculation system

LEDs lit

- **COM –** digital (Hart) communication
- **ECHO** – presence of valid echo

5.2.2 Steps of the SAP-200 Display Module

Programming will be performed by the pressing and releasing the relevant one or two keys (simultaneously).

Single key pressing

ENTER Ⓔ   to select parameter address and go to parameter value
                   to save parameter value and return to parameter address
NEXT   ◉   to move the blinking (changability) of the digit to the left
UP   ◉   to increase value of the blinking digit
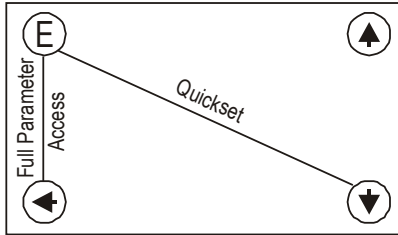DOWN ◉   to decrease value of the blinking digit

yy:xxxx
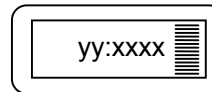
yy   parameter address (P01, P02…P99)
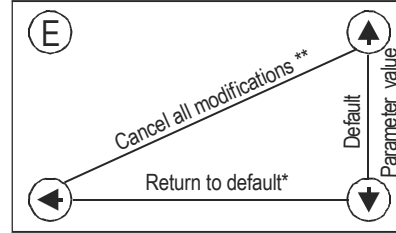xxxx   parameter value (dcba)
≡≡≡   bargraph

Double key pressing

Press the two keys simultaneously for desired programming step.
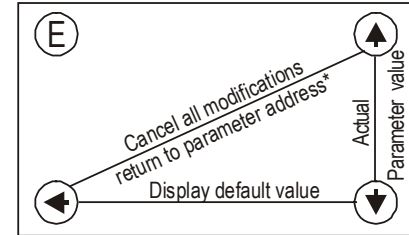
| Enter into or quit programming modes | Basic steps while parameter address is blinking | Basic steps while parameter value is blinking |

* LOAD readout   ** CANCEL readout

* cancellation immediately active

GET LEVEL function

Special function used only in level and distance measurement modes   *UP* ⊕ + *DOWN* ⊕

Notes:

If after pressing ENTER ⓔ *blinking does not spring over from the parameter address to the parameter value this means that*

- *the parameter is either a read-out type, or*
- *the secret code prevents the modification (see P99)*

If the modification of the parameter value is not accepted i.e. the parameter value keeps blinking after pressing ENTER ⓔ*,*

- *the modified value is either out of the range, or*
- *the code entered is not a valid code*

5.2.3 Indications of the SAP-200 and LED Status
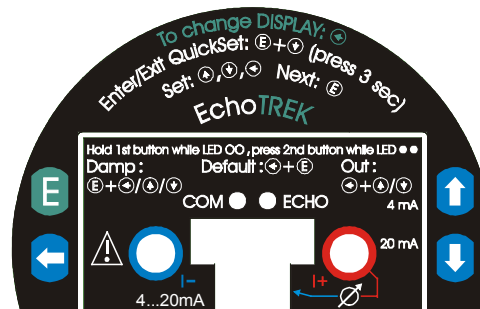
LED indication

- **ECHO**-LED

  lit in case of
  valid echo.

- **COM**-LED
  see description of HART

SAP-200 indications

Depending on the measurement one of the below symbols will lit and the process value displayed (see P01 chapter 6.1). Engineering units will be indicated directly (°C, °F and mA) and by the lit arrow showing towards them on the frame

- DIST   distance
- LEV   level
- VOL   volume
- FLOW   flow
- T1/T2   totalised values
- FAIL   (blinking) Error code displayed

For paging readouts NEXT ⊛ key should be pressed.

The following process values can be displayed

- Volume / Flow – if programmed so
- Level – if programmed so
- Distance – if programmed so
- Warning indications – FAIL blinking

Display screens can be scrolled by pressing key NEXT ⊛. To return to the screen of the selected measurement mode key ENTER Ⓔ should be pressed (see P01 chapter 6.1)

Temperature can be displayed by pressing UP ⊛.

(°C/°F)
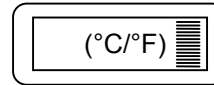
Current output value can be displayed by pressing DOWN ⊛.

(mA)

(Vol/Flow)

See **P01** for possible readouts

(Distance)

(Error)
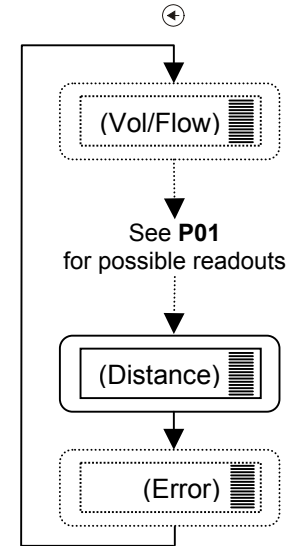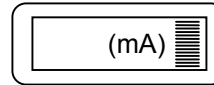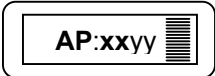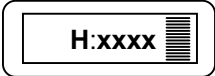
5.2.4 QUICKSET

Recommended as a simple and fast way to start up EchoTREK.

QUICKSET programming (aided by 6 screens) is used in uncomplicated level metering applications to set the 6 basic parameters. The other parameters can only be modified in the Full Parameter Access Mode see 5.1 (P01).

The instructions of this programming mode are also to be found on the front panel above the Display Module socket.

Keys	Function
ENTER Ⓔ + DOWN ⊙ (press for min 3 secs!)	Enter or exit QUICKSET programming mode
UP ⊙, DOWN ⊙, NEXT ⊙	Increase/decrease and move left the blinking digit
UP ⊙ + DOWN ⊙	"GET LEVEL" - display actual level measured by the EchoTREK
ENTER Ⓔ	Save readout and step to the next screen
NEXT ⊙ + UP ⊙	Quit Current Output Scaling without saving the modifications (CANCEL))
NEXT ⊙ + DOWN ⊙	Display of the DEFAULT value.

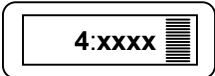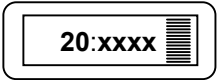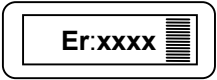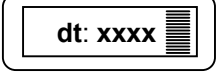| Screens	Actions
AP:**xx**yy ▤	**AP***plication* **xx**= select "EU" (European) for metric or "US" for US engineering units *(Use UP ⊙ / DOWN ⊙ keys)* yy= indicating "Li" for liquids DEFAULT: EU *Programming of this parameter will result in loading the factory default with the corresponding engineering units.*
H:**xxxx** ▤	**H** = **xxxx** *maximum measuring distance* – Distance between transducer face and tank bottom Manual: set value *(Use UP ⊙ / DOWN ⊙ / NEXT ⊙ keys)* and save it *(by ENTER Ⓔ)* Automatic: use the "GET LEVEL" function *(UP ⊙ + DOWN ⊙)* to obtain actual measured value with level in tank or a fixed target, i.e. wall. ("GET LEVEL" functions only if ECHO LED is lit) and save it as above. DEFAULT: maximum measuring distance [m], see Technical Data Table
4:**xxxx** ▤	**4** mA **xxxx** – *level value* assigned to 4 mA current output Manual: set level value *(by UP ⊙ / DOWN ⊙ / NEXT ⊙ keys)* and save it *(by ENTER Ⓔ)* Automatic: use the "GET LEVEL" function *(UP ⊙ + DOWN ⊙)* to display the actual measured value with level in tank or a fixed target, i.e. wall. ("GET LEVEL" functions only if ECHO LED is lit) and save it as above. DEFAULT: 0 m (0%, Empty tank)

Screens	Actions
20:xxxx ▤	**20** mA **xxxx** – *level value* assigned to 20 mA current output Manual: set level value *(Use* UP ⊕ */* DOWN ⊕ */* NEXT ⊛ *keys)* and save it (by ENTER Ⓔ) Automatic: use the "GET LEVEL" function *(UP* ⊕ *+ DOWN* ⊕*)* to obtain actual measured value with level in tank or a fixed target, i.e. wall. ("GET LEVEL" functions only if ECHO LED is lit) and save it as above. DEFAULT: max. level = max. measuring distance – dead band [m] (100%, Full tank) (See Technical Data Table)
Er:xxxx ▤	**Error indication** by the current output – select "Hold", 3.6 mA or 22 mA (by UP ⊕ / DOWN ⊕ key) and save it as above**.** DEFAULT: hold last value
dt: xxxx ▤	**d***amping* **time:** select required damping time *(*by UP ⊕ */* DOWN ⊕ key*)* and save it as above. DEFAULT: 60 sec for liquids, 300 sec for solids

Note: – Current output can also be programmed for inverted operation: 4 mA= 100% (Full), 20 mA= 0% (Empty)
– Description of failures can be found under the chapter 7 Error codes.

5.2.5 Full Parameter Access

Full Parameter Access is the highest programming level to access all features provided by the EchoTREK

Description of all parameters can be found under the chapter "Parameter" (Chapter 6.).

Keys	Function
ENTER Ⓔ + NEXT ⊛ (press for 3 seconds)	Enter or exit Full Parameter Access programming mode.

In this programming mode, the display will indicate:
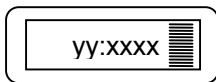
yy:xxxx ▤	yy Parameter Address (P01, P02 … P99) xxxx Parameter Value (dcba) ▤ bargraph

Measuring is going on during programming in accordance with the old parameter set. New parameter set will be valid after returning to the Measurement to the Programming Mode.

Steps and indications of the Full Parameter Access programming mode

pressing **Keys**	while **Parameter Address is blinking**	while **Parameter Value is blinking**
ENTER Ⓔ	Go to the Parameter Value	Save the modification of the Parameter Value and return to the Parameter Address
NEXT ⊙ + UP ⊛	Cancel all modifications of the actual programming phase. Pressing for 3 sec is required while CANCEL will be displayed for warning	Neglect the modification of the Parameter Value. and return to the Parameter Address without saving the modifications
NEXT ⊙ + DOWN ⊛	Reset entire device to Factory Default. Since this action will reset all parameters, "LOAD" will appear on the display: - to confirm, press - to escape, press any other key - Exception: clearing TOT 1 (See at P77)	Display default of the Parameter Values (it can be saved by pressing ENTER Ⓔ)
NEXT ⊙	Move blinking (changeability) of the digit to the left	
UP ⊛ / DOWN ⊛	Modify the blinking digit (increase, decrease) or scroll up/down	

6. PARAMETERS – DESCRIPTIONS AND PROGRAMMING

6.1 Measurement Configuration

P00: - cba   Application/Engineering Units

Programming of this parameter will result in loading the factory default with the corresponding engineering units.

a	Operating (measurement) mode
0	Liquid level measurement

b	Engineering units (according to "c")	
	Metric	**US**
0	m	ft
1	cm	inch

Attention: mind the sequence!
When programming this parameter the
right value "a" will be blinking first.

c	Calculation system
0	Metric
1	US

FACTORY DEFAULT: 000

P01: - ba   Measurement Mode – Bargraph

Parameter value „a" will determine the basic measurement value that will be displayed and proportional with the current output. Depending on the value of "a" process values as listed in the 3d column can also be displayed by pressing NEXT ⊕. For return to the display of the basic value the ENTER Ⓔ key should be pressed.

a	Measurement Mode	Display symbol	Displayed values
0	Distance	**DIST**	Distance
1	Level	**LEV**	Level, Distance
2	Level in percentage	**LEV%**	Level%, Level, Distance
3	Volume	**VOL**	Volume, Level, Distance
4	Volume in percentage	**VOL%**	Volume%, Volume, Level, Distance
5	Flow	**FLOW**	Flow, TOT1, TOT2, Level, Distance

Attention: mind the sequence! When programming this parameter the right value "a" will be blinking first.

Parameter value "b" will determine that the height of the Bargraph will be proportional to the current output or to the Echo strength.

b	Bargraph indication
0	Echo strength
1	Current output

FACTORY DEFAULT: 11

P02: - cba   Calculation units

a	Temperature
0	°C
1	°F

Attention: mind the sequence! When programming this parameter the right value "a" will be blinking first.

This table is interpreted according to **P00(c)**, **P01(a)** and **P02(c)** and is irrelevant in case of percentage measurement (**P01(a)= 2** or **4**)

b	Volume		Weight (set also P32)		Volume flow	
	Metric	US	Metric	US	Metric	US
0	m^3	ft^3	-	lb (pound)	m^3/time	ft^3/time
1	liter	gallons	tons	tons	liter/time	gallons/time

c	Time
0	Sec
1	Min
2	Hour
3	Day

FACTORY DEFAULT: 000

It is important to keep in mind that the instrument is measuring distance as basic quantity.

Measured Distance	Resolution
X_{min} – 2m	1mm
2m – 5m	2mm
5m – 10m	5mm
10m over	10mm

The resolution depending on the distance can be considered as a kind of rounding that will be contained in all further value (of level, volume or volume flow) calculated. Therefore if programmed for DIST or LEV measurement the setting of P03 is irrelevant.

Displayed VOL or FLOW

Displaeyed Value	Display Format
0,000 – 9,999	x,xxx
10,000 – 99,999	xx,xx
100,000 – 999,999	xxx,x
1000,000 – 9999,999	xxxx,x
10000,000 – 99999,999	xxxxx,x
100000,000 – 999999,999	xxxxxx,x
1 millió – $9,99999*10^9$	x,xxxx : e (exponential format)
$1*10^{10}$ over	(overflow) Err4

Obviously the decimal position will be shifted with increasing value displayed. (See table at the left).

Values over one million will be displayed in exponential format whereas the value (e) represents the exponent. Over the value of $1x10^{10}$ Err4 (overflow) will be displayed.

Rounding

Parameter Value "a"	Steps In The Displayed Value
0	1 (no rounding)
1	2
2	5
3	10
4	20
5	50

A couple of millimetres of fluctuation of the basic DIST value (e.g. due to waves) will be enlarged by the mathematical operations. This enlarged fluctuation in displaying VOL or FLOW can (if disturbing) be avoided by rounding to be set in P03. Rounding value 2, 5, 10 etc represents the steps by which the calculated value will be changed in its (one or two) last digit(s).

Examples:
P03=1   steps by 2:   1,000; 1,002; 1,004
P03=5   steps by 50:   1,000; 1,050; 1,100 or 10,00; 10,05(0); 10,10(0); 10,15(0)
(the 0 from the steps 50, 100, 150 etc will not be displayed)

FACTORY DEFAULT: 0

P04	Maximum Distance to be Measured (H)

The maximum distance to be measured is the greatest distance between the surface of the transducer and the level to be measured.
This is the only parameter that has to be programmed for each application other than distance (however to avoid disturbing effect of possible multiple echos it is suggested to do this in distance measurement applications too).
Values of the maximum measuring distance will be displayed as below.

Engineering Unit	Display Format
m	x,xxx or xx,xx
cm	xxx,x
ft	xx,xx or xxx,x
inch	xxx,x

The factory programmed, greatest distances (DEFAULT values) which **can be measured** by the units are listed in the table below. For the actual application the maximum distance **to be measured** i.e. the distance between the sensor and the bottom of the tank should be entered in P04.
To obtain the best accuracy, measure this distance in the empty tank with the EchoTREK by using the "GET LEVEL" function (by double key pressing of UP ⊕ + DOWN ⊕) provided the bottom is flat. Enter the actual measured value displayed as P04.

EchoTREK	Maximum measuring distance [m]		
	Transducer material PP / PVDF	Transducer material PTFE	Transducer material Stainless steel
S-39	4/13	3/10	-
S-38	6/20	5/16	-
S-37	8/26	6/20	-
S-36	10/33	-	7/23
S-34	15/49	-	12/39

FACTORY DEFAULT: according to the table

P05:	Minimum measuring distance (Dead zone- Close-end blocking)

The EchoTREK will not accept any echo within the blocking distance set here.

Automatic Close-end-blocking (Automatic Dead Band control)
By using the factory default value, the unit will automatically set the smallest possible close-end-blocking distance i.e. the dead band.

Manual close-end-blocking

Manual close-end-blocking should be used for example to block out the echo originating from the bottom rim of a stand-off pipe or from any object protruding into the ultrasonic cone near to the transmitter.

By entering a value, higher than the factory default, the minimum measuring range will be extended and fixed to the specified value.

To return to the factoryprogrammed (DEFAULT value) of the minimum measuring distance press NEXT ⊕ + DOWN ⊕ .

EchoTREK	Minimum measuring distance X_M		
	Sensor material PP / PVDF	Sensor material PTFE	Sensor material Stainless steel
S-39	0.2	0.2	-
S-38	0.25/0	0.25	-
S-37	0.35	0.35	-
S-36	0.35	-	0.4
S-34	0.45	-	0.55

FACTORY DEFAULT: automatic dead band control

Far end blocking is used to neglect incorrect level/volume readings and output actions below a pre-set level programmed in P06.

A). Level measurement

The far-end blocking can be used to avoid disturbing effect of stirrer or heaters at the bottom of the tanks.

If the level of the medium sinks below the blocked out range:

- **"Sub 0"** will be indicated for the level and volume
- Distance value is not interpretable
- Current output will hold the value corresponding to the far end blocking level
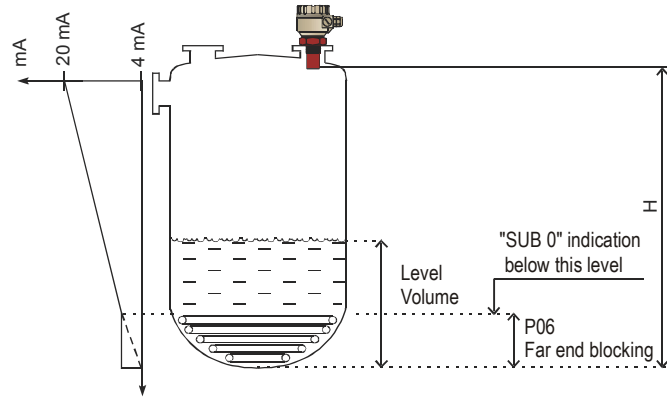
If the medium level is above the blocked out range:
The calculation of level and volume will be based on the programmed tank dimensions, therefore the measured or calculated process values will not be influenced in any way, by the far end blocking value.

B). Open channel flow metering

Far end blocking will be used for those small levels below which the accurate volume flow calculation is no longer possible.

If the liquid level in the flume/weir falls below the blocked out range:
The EchoTREK will act as follows:
- Indicate "**No Flow**" on the Display
- Hold last valid data on the current output.

If the level in the flume/weir is above the blocked out range:
The calculation of volume flow will be based on the programmed flume/weir data; therefore the measurement values will not be influenced in any way, by the far end blocking value.

FACTORY DEFAULT: 0

6.2 Current Output

P10:   **Value (of distance, level, volume or flow) assigned to 4 mA current output**

P11:   **Value (of distance, level, volume or flow) assigned to 20 mA current output**

Values are interpreted according to **P01(a)**. Please note that in case of programming for (LEV or VOL) % measurement the min and max value has to be entered in the relevant engineering units of LEV (m, ft) or VOL (m^3, ft^3).

Assignment can be made so that the proportion between the change of the (measured or calculated) process value and the change of the current output be either direct or inverse. E.g. lev 1 m assigned to 4mA and lev 10 m assigned to 20 mA represents direct proportion and lev 1 m assigned to 20 mA and lev 10 m assigned to 4 mA represents the inverse proportion.

FACTORY DEFAULT:
P10   0 level   (max distance)
P11   max level (min distance) H

P12:   - - - a   Error indication by the current output

In case of error the EchoTREK will provide one of the current outputs below. (For errors and their interpretation see Chapter 7).

a	ERROR INDICATION (ACCORDING TO **NAMUR**)
0	Hold last value
1	3.6 mA
2	22 mA

FACTORY DEFAULT: 0

6.3 Measurement Optimisation

P20: - - - a   Damping

This parameter can be used to reduce unwanted fluctuation of the display and output.

a	Damping time (seconds)	LIQUIDS	
		None/moderate fume or waves	Heavy/dense fume or turbulent waves
0	no filter		
1	3	applicable	not recommended
2	6	recommended	applicable
3	10	recommended	recommended
4	30	recommended	recommended
5	60	recommended	recommended

FACTORY DEFAULT: 60 sec

P22: - - - a   Dome top tank compensation

This parameter can be used to reduce disturbing effect of possible multiple echos.

a	Compensation	Applied
0	OFF	In case the EchoTREK is not mounted in the centre of the top and the top is flat.
1	ON	In case the EchoTREK is mounted in the centre of a tank with dome-shaped top

FACTORY DEFAULT: 0

**P24: - - - a   Target tracking speed**

In this parameter evaluation can be speed up at the expense of the accuracy.

a	Tracking speed	Remark
0	Standard	For most applications
1	Fast	For fast changing level
2	Special	Only for special applications (measuring range is reduced to 50% of the nominal value) The measuring window is inactive and the EchoTREK will respond practically instantly to any target. Recommended to fast target tracking, but usually not applicable for level metering.

FACTORY DEFAULT: 0

P25: - - - a   Selection of Echo within the measuring window

A so-called measuring window is formed around the echo signal. The position of this measuring window determines the flight time for calculation of the distance to the target. (the picture below can be seen on the test oscilloscope)
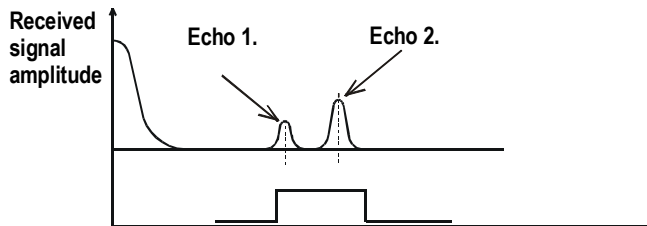
Some applications involve multiple (target + disturbing) echoes even within the measuring window. Basic echo selection will be done by the Quest + software automatically. This parameter only influences the echo selection within the measuring window.

a	Echo in the window to be selected	Remark
0	With the highest amplitude	For most applications (both with liquids and solids)
1	First one	For liquids applications with multiple echoes within the Measuring Window

FACTORY DEFAULT: 0

P26:   Level elevation rate (filling speed) (m/h)

P27:   Level descent rate (emptying speed) (m/h)

These parameters provide additional protection against echo loss in applications involving very heavy fuming.
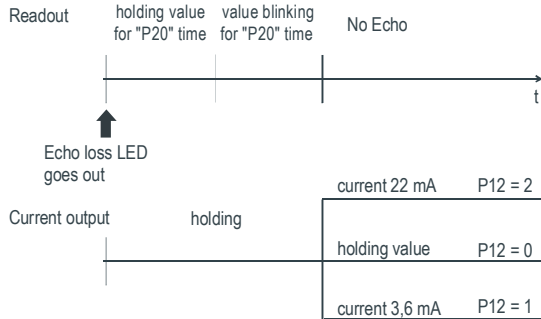
The parameters must not be smaller than the fastest possible filling/emptying rate of the actual technology.

For all other applications, use the factory default setting.

FACTORY DEFAULT**:**
2000 for both P26 and P27

a	Echo loss indication	Remark
0	Delayed indication	During echo-loss, display and analogue output will hold last value. If the echo-loss prevails for 10 sec plus the time period set in **P20** (damping time), the reading on the display will change to "no Echo" and the outputs will change according to the "Error Indication Mode" preset in **P12** Readout — holding value for "P20" time — value blinking for "P20" time — No Echo — t Echo loss LED goes out Current output — holding current 22 mA P12 = 2 holding value P12 = 0 current 3,6 mA P12 = 1
1	No indication	For the time of echo-loss, display and analogue output will hold last value.
2	Advance to full	During echo-loss in case of filling, the reading on the display and analogue output will shift towards the "full" tank state with a level elevation rate (filling speed) preset in **P26**
3	Immediate indication	In case of echo-loss, the display will immediately change to "no Echo", and the outputs will change according to the "Error Indication Mode" preset in **P12**
4	Empty tank indication	Echo-loss may occur in completely empty tanks with a spherical bottom due to deflection of the ultrasonic beam, or in case of silos with an open outlet. If the echo is lost when the tank is completely empty, the indication will correspond to empty tank, in all other cases echo-loss indication will function according to the "Delayed".

FACTORY VALUE: 0

P29:	Blocking out of disturbing object

One fixed object in the tank, disturbing the measurement, can be blocked out.

Enter distance of the object from the transducer. Use the Echo Map (**P70**) to read out the precise distance of disturbing objects.

FACTORY DEFAULT: 0

P31:	Sound velocity at 20°C (m/sec or ft/sec depending on P00(c))

Use this parameter if the sound velocity in the gases above the measured surface differs largely from that of in air.

Recommended for applications where the gas is more or less homogeneous. If it is not, the accuracy of the measurement can be improved using 32-point linearisation (**P48**, **P49**).

For sound velocities in various gases see section "Sound Velocities".

FACTORY DEFAULT: Metric (P00: "EU"): 343.8 m/s, US (P00: "US"): 1128 ft/s

P32:	Specific gravity

If you enter a value (other than "0") of specific gravity in this parameter, the weight will be displayed instead of VOL.

FACTORY DEFAULT: 0 [kg/dm^3] or [lb/ft^3] depending on P00(c)

6.4 Volume Measurement

P40: - - ba   Tank shape

| ba	Tank shape	Also to be set	
b0	Standing cylindrical tank shape (value of "b" as below)	P40(b), P41	**Attention!** The value „a" determining the shape of the tank should be set first.
01	Standing cylindrical tank with conical bottom	P41, P43, P44	
02	Standing rectangular tank (with chute)	P41, P42, (P43, P44, P45)	
b3	Lying cylindrical tank shape (value of "b" as bellow)	P40(b), P41, P42	
04	Spherical tank	P41	

FACTORY DEFAULT: 00

P41-45:   Tank dimensions
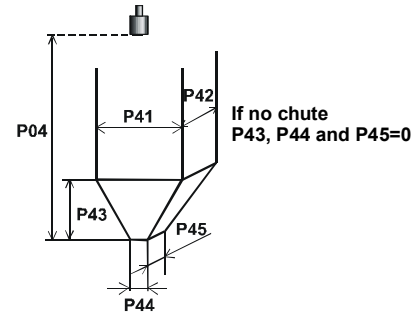
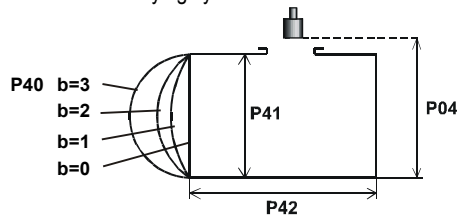Standing cylindrical tank with hemispherical bottom
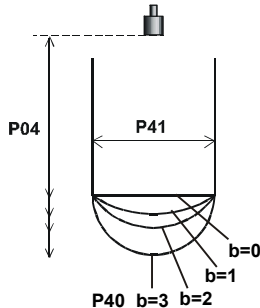
Standing cylindrical tank with conical bottom
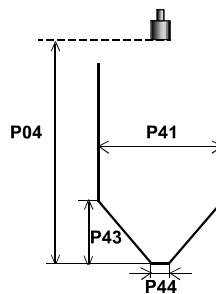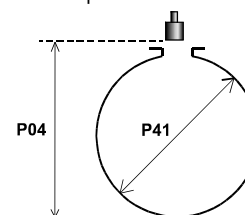
Standing rectangular tank with or without chute

If no chute
P43, P44 and P45=0

Lying cylindrical tank

Spherical tank

6.5 Volume Flow Measuring

P40:   - - ba   Devices, formula, data

ba		Devices, formula, data					Also to be set
		Type	Calculation formula	Qmin [l/s]	Qmax [l/s]	"P" [cm]	
00	Nivelco Parshall flume	GPA-1P1	$Q[l/s]= 60.87*h^{1.552}$	0.26	5.38	30	P46
01		GPA-1P2	$Q[l/s]= 119.7*h^{1.553}$	0.52	13.3	34	P46
02		GPA-1P3	$Q[l/s]= 178.4*h^{1.555}$	0.78	49	39	P46
03		GPA-1P4	$Q[l/s]= 353.9*h^{1.558}$	1.52	164	53	P46
04		GPA-1P5	$Q[l/s]= 521.4*h^{1.558}$	2.25	360	75	P46
05		GPA-1P6	$Q[l/s]= 674.6*h^{1.556}$	2.91	570	120	P46
06		GPA-1P7	$Q[l/s]= 1014.9*h^{1.556}$	4.4	890	130	P46
07		GPA-1P8	$Q[l/s]= 1368*h^{1.5638}$	5.8	1208	135	P46
08		GPA-1P9	$Q[l/s]= 2080.5*h^{1.5689}$	8.7	1850	150	P46
09	General PARSHALL flume						P46, P42
10	PALMER-BOWLUS (D/2)						P46, P41
11	PALMER-BOWLUS (D/3)						P46, P41
12	PALMER-BOWLUS (Rectangular)						P46, P41, P42
13	Khafagi Venturi						P46, P42
14	Bottom-step weir						P46, P42
15	Suppressed rectangular or BAZIN weir						P46, P41, P42
16	Trapezoidal weir						P46, P41, P42
17	Special trapezoidal (4:1) weir						P46, P42
18	V-notch weir						P46, P42
19	THOMSON (90°-notch) weir						P46
20	Circular weir						P46, P41
21	General flow formula: $Q[l/s]= 1000*P41*h^{P42}$, h [m]						P46, P41, P42

FACTORY DEFAULT: 0

P41-45:   Flume/weir dimensions

FACTORY DEFAULT: 0

P40= 00	**Nivelco Parshall flumes (GPA1P1 … GPA-1P9)**	
. . . .	For further details see the Manual of the Parshall flume	
P40= 09	**General Parshall flume** $0.305 < P42(\text{width}) < 2.44$ $$Q[\text{m}^3/\text{s}] = 0.372 * P42 * (h/0.305)^{1.569 * s^{0.026}}$$ $2.5 < P42$ $Q[\text{m}^3/\text{s}] = K * P42 * h^{1.6}$ $P = 2/3 * A$	
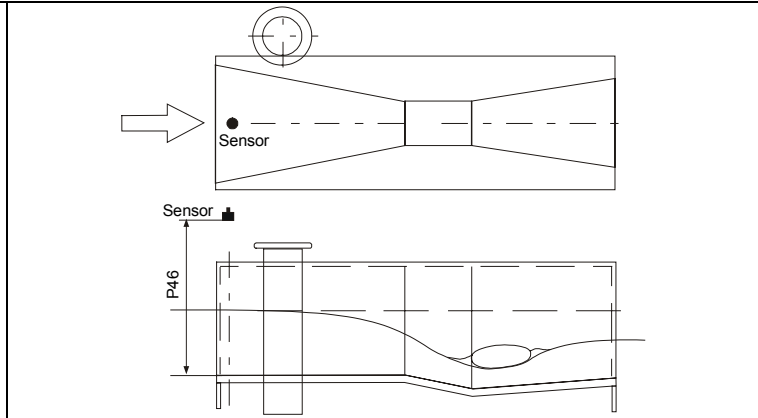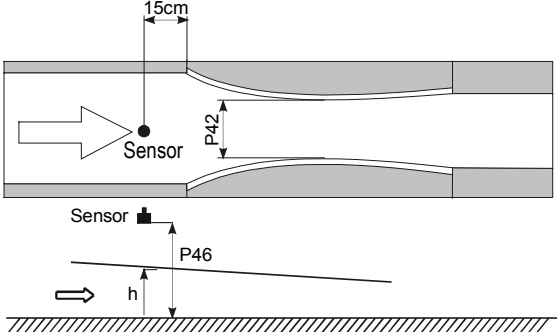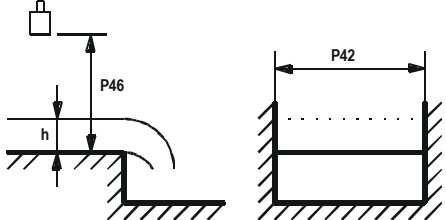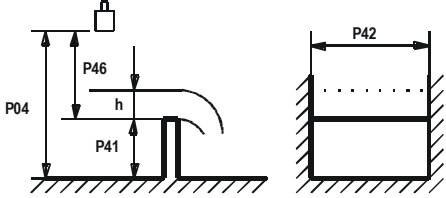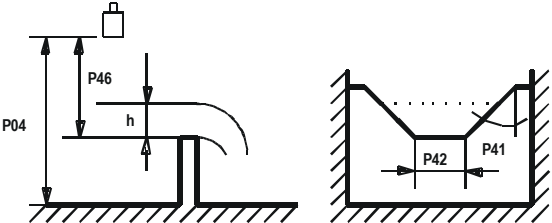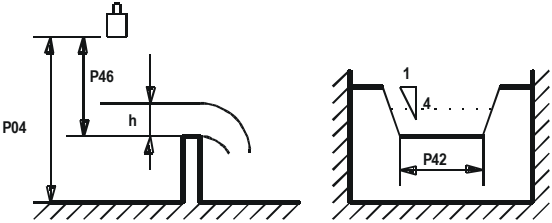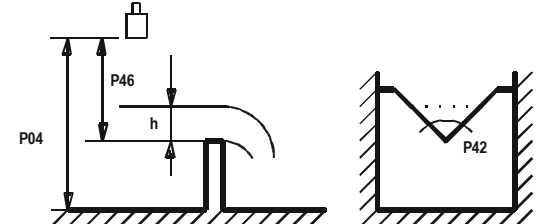
Table for P40=09:

s[m]	K
3.05	2.450
4.57	2.400
6.10	2.370
7.62	2.350
9.14	2.340
15.24	2.320
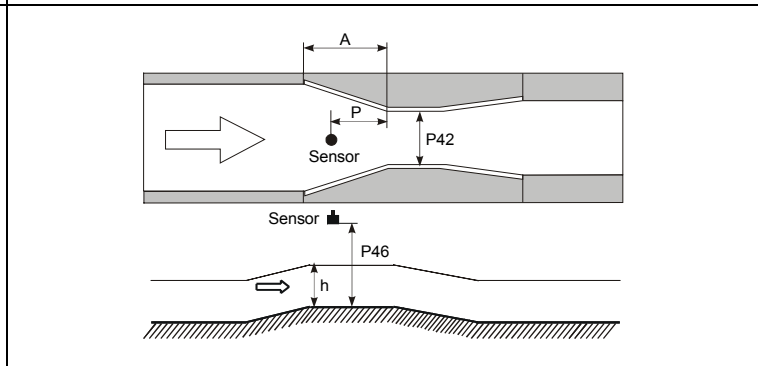
P40= 10	**Palmer-Bowlus (D/2) flume**	
	$Q[m^3/s] = f(h1/P41)*P41^{2.5}$, where $h1[m] = h+(P41/10)$	
P40= 11	**Palmer-Bowlus (D/3) flume**	
	$Q[m^3/s] = f(h1/P41)*P41^{2.5}$, where $h1[m] = h+(P41/10)$	
P40= 12	**Palmer-Bowlus (Rectangular) flume**	
	$Q[m^3/s] = C*P42*h^{1.5}$, where $C = f(P41/P42)$	

P40= 13	**Khafagi Venturi flume** $Q[m^3/s] = P42*1.744*h^{1.5} + 0.091*h^{2.5}$	
P40= 14	**Bottom step weir** $0.0005 < Q[m^3/s] < 1$ $0.3 < P42[m] < 15$ $0.1 < h[m] < 10$ $Q[m^3/s] = 5.073*P42*h^{1.5}$ Accuracy: $\pm 10\%$	
P40= 15	**Suppressed rectangular or BAZIN weir** $0.001 < Q[m^3/s] < 5$ $0.15 < P41[m] < 0.8$ $0.15 < P42[m] < 3$ $0.015 < h[m] < 0.8$ $Q[m^3/s] = 1.7599*[1+(0.1534/P41)]*P42*(h+0.001)^{1.5}$ Accuracy: $\pm 1\%$	

P40= 16	**Trapezoidal weir** $0.0032 < Q[m3/s] < 82$ $20 < P41[°] < 100$ $0.5 < P42[m] < 15$ $0.1 < h[m] < 2$ $Q[m3/s]= 1.772*P42*h1.5+1.320*tg(P41/2)*h2.47$ Accuracy: $\pm 5\%$	
P40= 17	**Special Trapezoidal (4:1) weir** $0.0018 < Q[m3/s] < 50$ $0.3 < P42[m] < 10$ $0.1 < h[m] < 2$ $Q[m3/s]= 1.866*P42*h1.5$ Accuracy: $\pm 3\%$	
P40= 18	**V-notch weir** $0.0002 < Q[m3/s] < 1$ $20 < P42[°] < 100$ $0.05 < h[m] < 1$ $Q[m3/s]= 1.320*tg(P42/2)*h2.47$ Accuracy: $\pm 3\%$	

P40= 19	**THOMSON (90°-notch) weir** $0.0002 < Q[m3/s] < 1$ $0.05 < h[m] < 1$ $Q[m3/s] = 1.320 * h^{2.47}$ Accuracy: $\pm 3\%$	
P40= 20	**Circular weir** $0.0003 < Q[m^3/s] < 25$ $0.02 < h[m] < 2$ $Q[m^3/s] = m * b * D^{2.5}$ $m = 0.555 + 0.418h/P41 + (P41/(0.11*h))$ Accuracy: $\pm 5\%$	

P46:   **Distance between transducer face and level of Q=0**

P46 is *always* the distance between the transducer face and the level, where the volume flow is 0.

FACTORY DEFAULT: 0

6.6 32-Point Linearisation

P47: - - - a   **Linearisation**

Linearisation is the method of assigning requested (calibrated or calculated) level, volume or flow to values measured by the transmitter.

It can be used for instance if the sound velocity is not known (LEVEL$\Rightarrow$LEVEL) or in the case of tank with other shape than under 6.4 or open channel other than under 6.5 (LEVEL $\Rightarrow$ VOLUME or LEVEL $\Rightarrow$ FLOW).

a	Linearisation
0	OFF (FACTORY DEFAULT)
1	ON

P48:   **Linearisation table**

Data-pairs of the linearisation table are handled in a 2x32 matrix, consisting of two columns.

Left column "L"	Right column "r"
LEVEL measured	LEVEL or VOLUME or FLOW to be transmitted and displayed

The left column values (indicated on the display as "L") contain the measured LEVEL values.
The right column values (indicated on the display as "r") contain the calibrated values and are interpreted according to the selected measurement value in **P01(a)**.
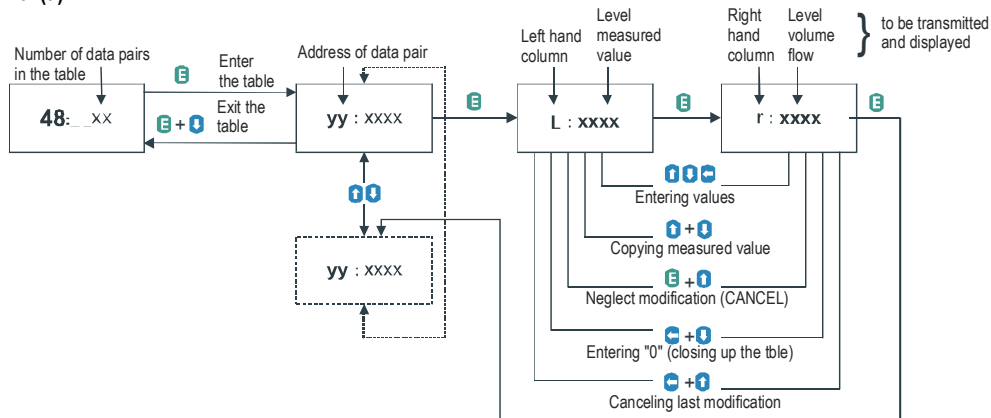
Conditions of correct programming of the data pairs

Left column "**L**"	Right column "**r**"
L(1)= 0	**r**(1)
L(i)	**r**(i)
:	:
L(j)	**r**(j)

The table must always start with: L(1)= 0 and r(1)= value (assigned to 0 level)

The table must be ended either with the 32nd data pair i.e. j=32 or if the linearisation table contains less than 32 data-pairs j<32, the table must be closed by a level value "0" e.g. **L**(j<32)= 0.

The EchoTREK will ignore data after recognising level value "0" with serial number other than "1".

If the above conditions are not met, error codes will be displayed (see chapter: Error Codes).

6.7 Informational Parameters (Read Out Parameters)

P60:   **Overall operating hours of the unit (h)**

Indication varies according to the elapsed time:

Operating hours	Indication form
0 to 999.9h	xxx,x
1000 to 9999h	xxxx
Over 9999h	X,xx: e meaning x,xx 10^e

P61:   **Time elapsed after last switch-on (h)**

Indication same as in **P60**.

P64:   **Actual temperature of the transducer (°C/°F)**

P65:   **Maximum temperature of the transducer (°C/°F)**

P66:   **Minimum temperature of the transducer (°C/°F)**

In case of a breaking in the temperature measuring Pt10 element „PtErr" will be displayed (See Chapter 7). The transmitter will perform temperature correction corresponding to 20ºC.

P70:   Number of Echoes / Echo Map

EchoTREK is monitoring the echo conditions.

Entering this parameter will save the actual echo map.

Number, distance and amplitude of these echoes can be read-out one by one.

70 : _ _ XX

Number of echos

yy : xxxx
(DISTANCE)

yy : xxxx
(AMPLITUDE)

yy : xxxx
(DISTANCE)

yy : xxxx
(AMPLITUDE)

yy Serial number of the echo

xx value of DIST or AMPL
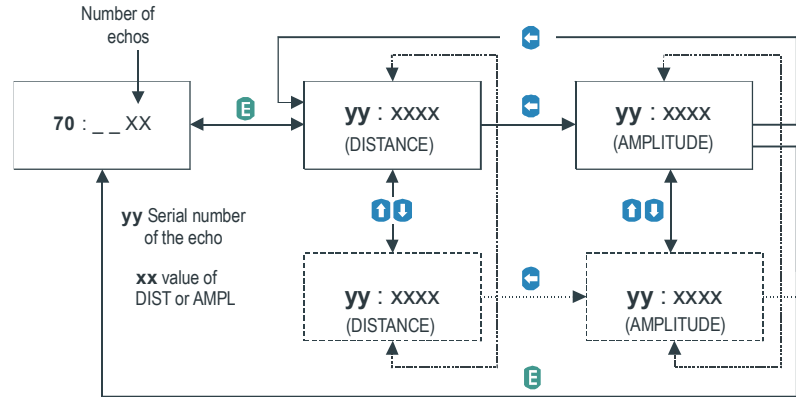
P71:   Distance of the of Measuring Window

P72:   Amplitude of the Echo in the Measuring

P73:   Echo Position (time) :(ms)

P74:   Signal To Noise Ratio

Ratio	Measurement conditions
Over 70	Excellent
Between 70 and 30	Good
Under 30	Unreliable

P75:   Blocking Distance

The actual close-end blocking distance will be displayed (provided automatic blocking was selected in **P05)**.

6.8 Additional Parameters of the Flow Metering

P76: **Head of flow (LEV)**

The Headwater value can be checked here. This is the "h" value in the formula for flow calculation.

P77: **TOT1 volume flow totaliser (resetable)**

P78: **TOT2 volume flow totaliser (non-resetable)**

Resetting TOT1 totaliser:
1). Go to the parameter **P77.**
2). Press NEXT ⊛ + DOWN ⊛ simultaneously.
3). Display will indicate: "t1 Clr".
4.) Press ENTER Ⓔ to delete.

6.9 Test Parameters

P80: **Current output test (mA)**

Going to this parameter, the actual current output (corresponding to the measured process value) will be displayed. By pressing ENTER Ⓔ the (now blinking) current value can be set for any value between 3,9 and 20.5 mA. The current output has to show the same value which can be checked by an ampere meter, according to the description under 4.4. Press ENTER Ⓔ to quit test mode and return the parameter address

P97: b:a.aa Software code

a.aa: Number of the software version
b: Code of the special version

6.10 Simulation

This function enables the user to test the settings of the outputs. The EchoTREK can simulate the static or continuous change of level according to the simulation cycle time, high level and low level set in P85, P86 and P87. (The simulation levels must be within the programmed measuring range set in **P04** and **P05**.)

After selecting simulation type in **P85** and setting simulation values Measurement Mode has to be re-entered. While the EchoTREK is in simulation mode the DIST, LEV or VOL symbol will be blinking. To quit Simulation Mode **P84= 0** should be set.

P84: - - - x   Selection of the simulation

X	Simulation type
0	No simulation
1	The level changes continuously up and down between the level values set in **P86** and **P87** with a cycle time set in **P85**
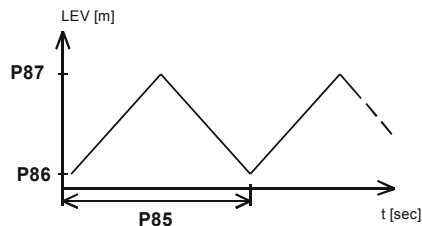
P85:	Cycle time for simulation (sec)
P86:	Simulated low level value (m)
P87:	Simulated high level value (m)

6.11 Access Lock

P99: dcba   Access Lock by Secret Code

The purpose of this feature is to provide protection against accidental (or intentional) re-programming of parameters.
The Secret Code can be any value other than **0000**. Setting a Secret Code will automatically be activated when the EchoTREK is returned to the Measurement Mode. If the Secret Code is activated, the parameters can only be viewed, this is indicated by the a flashing colon ":" between the parameter address and the parameter value.
In order to program the device locked by a secret code, first enter the Secret Code in **P99**. The Secret Code is re-activated each time the EchoTREK is returned to Measurement Mode.
To delete the Secret Code, enter the Secret Code in **P99**. After confirming it with **[E]** re-enter the parameter **P99** and enter **0000**.
[dcba (Secret Code) **]** → **[E]** → **[E]** → **[0000]** → **[E]** ⟹ **Secret Code deleted**

7. ERROR CODES

Error Code	Error description	Causes and solutions
1	Memory error	Contact local agent
No Echo or 2	Echo loss	No echo received (no reflection) See Action 5 and 6
3	Hardware error	Contact local agent
4	Display overflow	Check settings
5	Sensor error or improper installation/mounting, level in the dead band	Verify sensor for correct operation and check for correct mounting according to the User's Manual
6	The measurement is at the reliability threshold	Better location should be tried.
7	No signal received within the measuring range specified in P04 and P05	Review programming, also look for installation mistake
12	Linearisation table error: both L(1) and L(2) are zero (no valid data-pairs)	See the Section "Linearisation"
13	Linearisation table error: there are two same L(i) data in the table	See the Section "Linearisation"
14	Linearisation table error: the r(i) values are not monotone increasing	See the Section "Linearisation"
15	Linearisation table error: measured Level is higher than the last Volume or Flow data-pair	See the Section "Linearisation"
16	The check sum of the program in the EEPROM is wrong	Contact local agent
17	Parameter consistency failure	Check programming
18	Hardware failure	Contact local agent

8. PARAMETER TABLE

Par.	Page	Description	Value				Par.	Page	Description	Value			
			d	c	b	a				d	c	b	a
P00	21	Application/Engineering Units					P32	31	Specific gravity				
P01	22	Measurement Mode					P33		N.A.				
P02	22	Calculation units					P34		N.A.				
P03	23	Rounding					P35		N.A.				
P04	24	Maximum Measuring Distance					P36		N.A.				
P05	25	Minimum Measuring Distance					P37		N.A.				
P06	26	Far End Blocking					P38		N.A.				
P07		N.A.					P39		N.A.				
P08		N.A.					P40	33	Selection of tank shape/ open channel				
P09		N.A.					P41	32	Dimensions of tank / Open Channel				
P10	27	Value assigned to „4 mA"					P42	32	Dimensions of tank / Open Channel				
P11	27	Value assigned to „20 mA"					P43	32	Dimensions of tank / Open Channel				
P12	27	"Error" indication by the current output					P44	32	Dimensions of tank / Open Channel				
P13		N.A.					P45	32	Dimensions of tank / Open Channel				
P14		N.A.					P46	38	Dist. Btw. Transducer face and level of Q=0				
P15		N.A.					P47	39	Linearisation				
P16		N.A.					P48	39	Linearisation table				
P17		N.A.					P49		N.A.				
P18		N.A.					P50		N.A.				
P19		N.A.					P51		N.A.				
P20	28	Damping					P52		N.A.				
P21		N.A.					P53		N.A.				
P22	28	Dome top tank compensation					P54		N.A.				
P23		N.A.					P55		N.A.				
P24	28	Target tracking speed					P56		N.A.				
P25	29	Selection of Echo in the measuring window					P57		N.A.				
P26	29	Level elevation rate					P58		N.A.				
P27	29	Level descent rate					P59		N.A.				
P28	30	Echo loss indication					P60	40	Overall operating hours of the unit				
P29	31	Blocking out of disturbing object					P61	40	Time elapsed after last switch-on				
P30		N.A.					P62		N.A.				
P31	31	Sound velocity in different gases					P63		N.A.				

Par.	Page	Description	Value				Par.	Page	Description	Value			
			d	c	b	a				d	c	b	a
P64	40	Actual temperature of the transducer					P82		N.A.				
P65	34	Maximum temperature of the transducer					P83		N.A.				
P66	40	Minimum temperature of the transducer					P84	43	Simulation mode				
P67		N.A.					P85	43	Simulation cycle time				
P68		N.A.					P86	43	Simulation low level				
P69		N.A.					P87	43	Simulation high level				
P70	41	Echo Map					P88		N.A.				
P71	41	Distance of the measuring window					P89		N.A.				
P72	41	Amplitude of the in the measuring window					P90		N.A.				
P73	41	Distance of the in the measuring window					P91		N.A.				
P74	41	Signal / noise ratio					P92		N.A.				
P75	41	Blocking Distance					P93		N.A.				
P76	42	Waterhead of the flow					P94		N.A.				
P77	42	TOT1 volume flow totaliser					P95		N.A.				
P78	42	TOT2 volume flow totaliser					P96		N.A.				
P79		N.A.					P97	42	Software code				
P80	42	Current generator test					P98		N.A.				
P81		N.A.					P99	43	Access lock				

9. SOUND VELOCITIES IN DIFFERENT GASES

The following table contains the sound velocity of various gases measured at.

Gases		Sound Velocity (m/s)
Acetaldehyde	C_2H_4O	252.8
Acetylene	C_2H_2	340.8
Ammonia	NH_3	429.9
Argon	Ar	319.1
Bensol	C_6H_6	183.4
Carbon dioxide	CO_2	268.3
Carbon monoxide	CO	349.2
Carbon tetrachloride	CCl_4	150.2
Chlorine	Cl_2	212.7
Dimethyl ether	CH_3OCH_3	213.4
Ethane	C_2H_6	327.4
Ethanol	C_2H_3OH	267.3
Ethylene	C_2H_4	329.4
Helium	He	994.5
Hydrogen sulphide	H_2S	321.1
Methane	CH_4	445.5
Methanol	CH_3OH	347
Neon	Ne	449.6
Nitrogen	N_2	349.1
Nitrogen monoxide	NO	346
Oxygen	O_2	328.6
Propane N.A.	C_3H_8	246.5
Sulphur hexafluoride	SF_6	137.8