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USER MANUAL FLOW TRANSMITTER

GECO 4W

V 4.0x



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1 - INTRODUCTION

1.1 Preliminary

The use of these instrument is intended exclusively to competent and specialized personnel only. The purpose of this manual is the transmission of the necessary informations needed for the competent and sure use of the products.

They are the result of a continuous and systematic elaboration of data of technical tests, recorded and validated by the builder, in realization of the internal safety procedures and in respect of the quality of the informations.

The informations reported below are suited only for specialized and competent personnel, capable to interact with the products in safety conditions either for people, for plant and the equipments and for environment, being able to individuate the main and simpler anomalous working conditions and to make simple operations of functional test, in the full conformity to present safety and health rules.

Also the informations regarding commissioning, mounting, unmounting, maintenance and adding of extra accessories, devices or tools are suited, and hence executable, only by specialized, specifically informed and trained personnel, or directly by SITEL Control technical support, in the full conformance to the builder recommendations and to present safety and health rules.

All SITEL Control devices are not suited to be internally serviced or repaired on field.

For a correct present and future use of the product it is necessary to conserve this manual in its full readability. In the case of its damage or loss, or also only for reasons of deeper need of technical and operative instructions, please contact the technical support of SITEL Control. For the purpose to avoid any problem of use of this instruments it is strictly necessary that the user, before to start to operate, reads with deep attention all the informations included in this manual.

In a second phase, with the purpose to find easier the needed informations, it will be possible to make reference directly to the main index located at the beginning of the manual.

1.2 Legend of safety symbols



Attention, danger (ISO 7000, -0434)



Power supply in direct or alternate current (IEC 60417, -5033)



Ground terminal (IEC 60417, -5017)



Geco 4W fulfil present European directives related to electromagnetic compatibility and safety (EMC directive 89/336/EEC; LDV directive 73/23/EEC; Italian law on workers dl 626/94.

1.3 Instrument presentation

Ultrasound flow transmitters GECO 4W are designed to be employed in the most hostile environmental conditions, covering application either on metal and plastic pipes, from 25 to 5000 (2,5, to 200 inches) of diameter.

Their enclosure is made in ABS, with IP67 protection grade; the clamp-on, ultrasound sensors designed to be applied on the outside wall of pipes, are designed and rate IP68 protection grade.

The electronics elaborate the signal fully digitally, using the most advanced technology for ultrasound flow measurement: it uses the transit time technology associated with and advanced, proprietary digital coding/decoding with cross-correlation techniques.

The measure of the fluid velocity, at the base of the measurement principle, is done on the very accurate computing of the transit times and then is related with pipe features to calculate its volumetric or mass flow.

GECO 4W is an ultrasound flow transmitter, powered at 24 Vdc (or 115/230 Vac as option) with two active, independent analog outputs.

Its maximum power consumption is of 6W.

2 – GENERAL DESCRIPTION

2.1 Mechanic characteristics

All the electrical and the electronic parts of the instrument are enclosed in its rugged enclosure made in ABS; this enclosure is particularly suitable for aggressive, wet environment and it is rated IP67.

All sensors are made by special, high-technology plastic sealed in a metallic (brass or stainless steel) enclosure, all rated IP68 and suitable to withstand prolonged periods of immersion.

See Picture 1 for mechanical characteristics of GECO 4W flow transmitter.

Picture 1: mechanical dimensions of GECO 4W Flow Transmitter and its relative wall mounting holes mask



Length: 195 mm (7,68 inches)

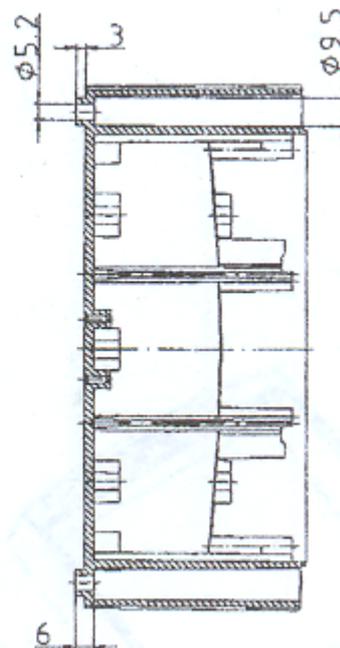
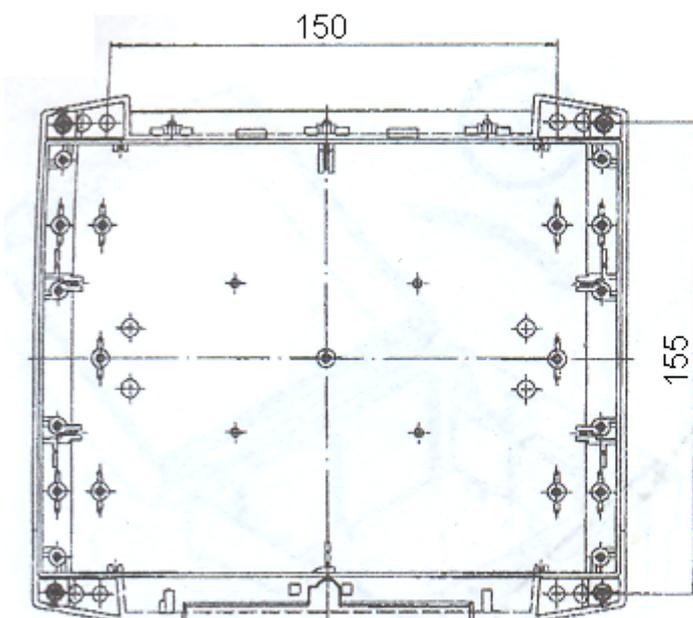
Height: 184 mm (210 with cable glands)

(7,24 inches - 8,27 with cable glands)

Thickness: 110 mm (4,33 inches)

Weight: 1350 grams (2,97 pounds-a.c. version)

1050 grams (2,31 pounds-d.c. version)



note: all the quotes are in mm

2.2 Electrical characteristics

Power supply:	Voltage = 12÷24 Vdc or, as option, 115/230 Vac 50/60 Hz Current = max 270 mA (with display backlight on and High voltage sensor eccitation)
Protection grade:	IP67
Analog output:	2 x 4-20 mA active and independent programmable range, maximum load 1000 ohm
Optional outputs:	Nr. 2 pulse outputs for external totalization (pure contact, 60 V and 150 mA max) USB or RS232 or RS485

2.3 Technical specifications Geco 4W

These values are reported to the standard models in catalogue: many of these characteristics can be modified as far as possible for adapting them to particular demands; in case of need please to contact the commercial office.

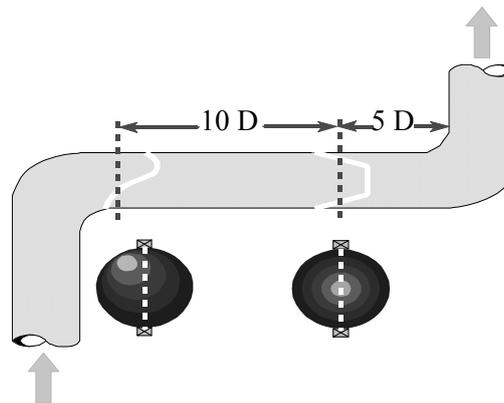
Measurement range:	Fluid velocity: from -12 to +12 m/s (- 40 to 40 ft/s) Sensors temperature: from -20 to + 60 °C and from -20 to + 170°C (-4 to 140 °F and -4 to 340 °F)
Pipes diameter:	from 25 mm to 5000 mm (1 to 200 inches)
Pipe material:	All metal materials and most plastics ones (PP, PE, Acrylic, Nylon)
Response time:	200 ms
Distance sensors/transmitter:	max 150 m (480 ft.)
Accuracy:	std 1% of the reading, 0,5% with calibration
Repeatability	0,2% of the reading
Rangeability	400:1

3 - COMMISSIONING

3.1 Consideration of sensors positioning on pipe and measure section

Straight parts on the pipe are required for the installation of the clamp-on sensors. To get the maximum efficiency and measurement accuracy, at least then 10 diameters of straight pipe upstream and 5 diameter downstream the sensors are required; this be sure to have a full developed flow profile. See Picture 1.

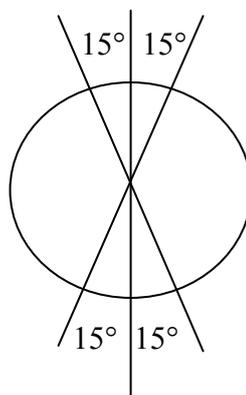
.Picture 1: optimal choice of sensor mounting position on the pipe



It is possible to operate also with less diameters of straight pipe upstream or downstream the point of sensors mounting, reducing however the accuracy of measure. The eventual error will depend from the feature of the application, like the speed of fluid, the presence in the vicinities of elbow curves, valves, etc.

Please pay attention to the following considerations:

- ⚠ The most correct position to install the sensors is on horizontal pipe or on vertical ascending pipe. The descending vertical position is not recommended because it is possible that the pipe is not full. Avoid also to install the sensors on the vertical axis of the pipe because there may be wastes on the bottom and gas on the top.
- ⚠ In general, the sensors are installed on the horizontal axis as the better flow condition or in any case with a minimum angle of 15 degrees from vertical axis, especially on a pipe that could be not full.



3.2 Sensor mounting method

3.2.1 Sensors GSP and GSZ for pipe from 80 to 5000 mm (3 to 200 inches)

The mounting of these sensors is made by U shaped fixtures , that are fixed on the pipe by means of metal screw stripes. The distance reference is the vertical sensor locking screw or a line on the side of the fixture.



- ⚠ Apply a moderate quantity of couplant on the central part of the touching surface of both sensors. An excessive quantity may introduce extra noise and coupling problems.
- ⚠ Insert the sensor under the fixture and screw it in place without forcing the blocking screws.
- ⚠ Check also the correct longitudinal alignment of the sensor versus the pipe, In case, correct its orientation using the two lateral screws of the supporting fixture.



3.4 Power supply

Flow transmitter GECO 4W should be powered at 24 Vdc, respecting the + and – as indicated on screw terminal block. The screen of the cable should be connected to ground terminal.

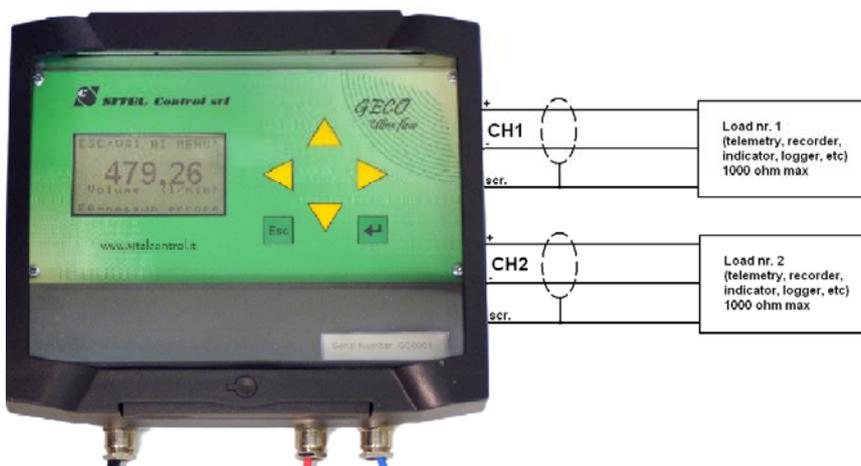
⚡ Connect the screen of the cable to ground; this, beside to warranty the electrical safety, will also improve the rejection to electromagnetic disturbances.

⚠ Use only a screened cable of adapt gauge to connect the instrument.

3.5 Analog Output

The flow transmitter GECO 4W is equipped as standard of two active and independent fully programmable analog outputs. Acquire the output signal as indicated in Picture 5.

Picture 5: diagram of connection of the 4-20 mA



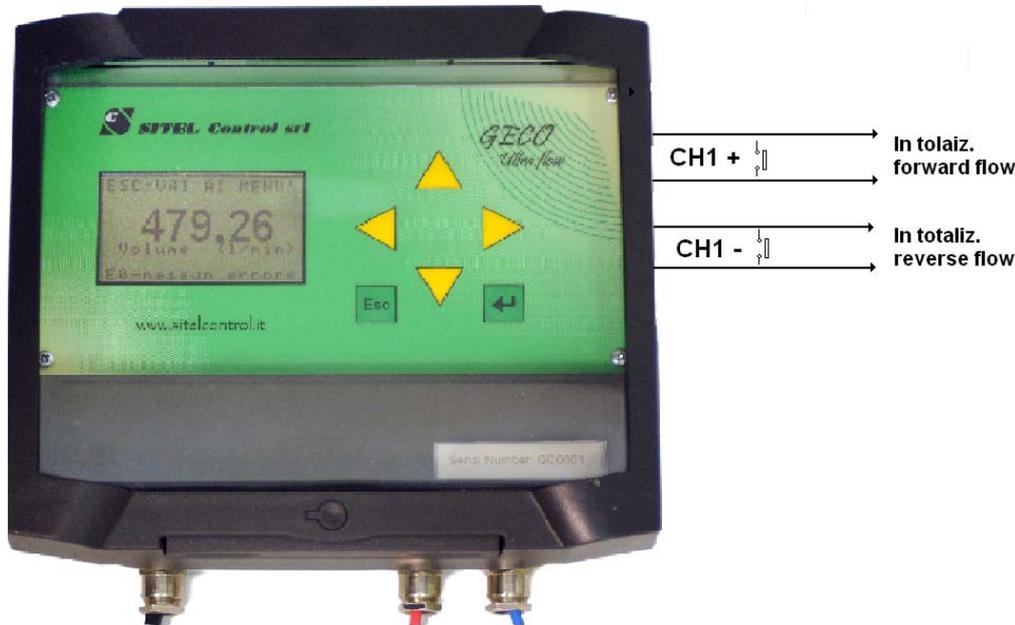
⚠ The maximum driveable load for each output is of 1000 ohm

⚠ It is advisable that the current loop voltage terminal should be insulated from ground in any place of the plant.

3.6 Pulse outputs for external totalization

Optionally, GECO 4W can be equipped with two pulses outputs for external totalization, one referred to forward flow and the other to the reverse one. Both the output are pure contact insulated ones (60 V, 150 mA maximum).

Picture 6: Connection diagram for pulse outputs



3.7 Sensors connection

Sensors of **GSP** and **GSZ** models are normally supplied with their cables and connectors already prepared whose length is defined at the order. Connect the cable with red mark (upstream sensor) to screw terminal block marked **S1.1** GECO 4W transmitter; in particular the central pole of the screened cable must be connected to the terminal marked with “+” sign,, instead one of the black wires to the terminal marked with “-“ sign. Then proceed in the same way to connect the cable with blue mark (downstream sensor) to screw terminal block marked **S1.2**. Then connect the remaining two black wires to the ground terminals (marked by the ground symbol).

To finish, connect the circular connectors on the sensors make sure that the circular ring is fully screwed on the sensor.

Sensors of **PSP** and **PSZ** models are provided with cables permanently connected to them whose length is predefined at the order. For the connection to GECO 4W transmitter, please follow the same procedure as for **GSP** and **GSZ** sensors, obviously omitting the last step regarding connectors.



In the case in which the connection of upstream and downstream sensors are swapped each other, the instrument will display a flow rate of correct absolute value, but with opposite sign respect the real direction of the flow.

4 – SET- UP OF WORK PARAMETERS

Before to be able to use the instrument, it is necessary to proceed to its correct programming.

Once powered-up, after a short displaying of a welcome screenshot, a some information about the firmware version and an initialization time, the instrument, if programmed correctly, will enter directly measurement mode, displaying the flow rate in the measurement unit selected. In case the instrument was not jet programmed, or in case of wrong setup or in presence of other problems, it will display an error message in the bottom line of the LCD display. For the meaning of error message please refer to the dedicated paragraph.

Following all the details regarding programming are explained:

Keeping pressed for about 0,5s key “←”, into measurement mode, or in “*Totalizers*” or “*Diagnostics*” mode, the display backlight is activated. To deactivate it press again key “←” for about 0,5s; in case it will not be deactivated manually, it automatically switch off after about 3 minutes. If is needed that the backlight will be active during the set-up of instrument configuration, please activate it before exit the measurement mode; it will remain active for all the time you will be in the settings menu.

Keeping pressed for about 0,5s key “**Esc**”, Geco exits measure mode and it is possible to access the first level of the instrument menu, that comprises the following items:

- Settings
- Totalizers
- Diagnostics

Use keys “▲” and “▼” to scroll the list; Use key “←” to select the highlighted item; Use instead key “**Esc**” to return to measure mode.

4.1 Settings menu

Setting menu allows to set-up all the parameters needed for the correct work of the flow transmitter. Is composed by the following sub menu.:

- Plant data
- Display setup
- Outputs setup
- Instrum.(ent) setup
- Advanc.(ed) setup

4.1.1 Settings menu / Plant data

This menu allows you to program all the parameters relative to the plant in which Geco 2W is installed, i.e.:

- Sensors setup
- Fluid data
- Pipe data

4.1.1.1 Settings menu / Plant data / Sensors setup

This item allows to set the model of transducers in use and their parameters, that are:

Sensor model: it allows to select the model of the sensors in use: the possible choices are:

Not listed/spec.(ial) – to be used when are used sensors different from the ones listed below

SITEL Cnt.PZG 11

SITEL Cnt.PZG11S

SITEL Cnt.PXG 12

SITEL Cnt.PXG12S

SITEL Cnt.PZP 13

SITEL Cnt.PXP 14

SITEL Cnt.PZG 15

SITEL Cnt.PZP 21

SITEL Cnt.PXP 22

SITEL Cnt.PZG 51

SITEL Cnt.PZG51S

SITEL Cnt.PXG 52

SITEL Cnt.PXG52S

GE-Panamet. #30

GE-Panamet. #116

Keys “◀” and “▶” permit to select transducers model. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Wedge temperat.(ure): it permits to set the temperature of the wedge of the sensor that is in contact with the pipe; insert here the value of this temperature expressed in °C or °F, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; (tenths, units, tens, hundreds) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc”key.

Frequency: it allows to setup the nominal working frequency of the transducers in use; the possible choices are:

0,5 MHz

1 MHz

2 MHz

4 MHz

Keys “◀” and “▶” permit to select the desired frequency value. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.



Note: It is possible to setup this parameter freely only if “*Not listed/spec*” was selected in “**Sensors models**” . Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “Esc” key to return to previous menu.

Wedge angle: It allows to setup the value of the wedge angle of the sensors in use. Please insert the value in sexagesimal degrees.

Use “◀” and “▶” keys to select the digit to be modified; (tenths, units, tens) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.



Note: It is possible to setup this parameter freely only if “*Not listed/spec*” was selected in “**Sensors models**” . Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “Esc” key to return to previous menu.

Sound speed: allows to setup the value of sound propagation speed in the material of which the sensors are built Insert the value expressed in meters /second or in feet /second, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; (units, tens, hundreds, thousands and tens of thousands) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key. If a new valued is inserted and confirmed with “↵” key, the instrument will asks to insert also the corresponding new value for the sound speed variation against temperature coefficient of the material of which the sensor is built; it will be expressed in (m/s)/°C or in (ft/s)°F according with the unit system selected (see below). Use “◀” and “▶” keys to select the digit to be modified; (thousandths, hundredths, tenths, unit and sign) and “▲” and “▼” key to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.



Note: It is possible to setup this parameter freely only if “*Not listed/spec*” was selected in “**Sensors models**” . Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “Esc” key to return to previous menu.

Delay time: it allows to setup the delay time of sound propagation in the bulk of the sensor; please insert it in microseconds.

Use “◀” and “▶” keys to select the digit to be modified; (tenths, unit and tens) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.



Note: It is possible to setup this parameter freely only if “*Not listed/spec*” was selected in “**Sensors models**” . Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “**Esc**” key to return to previous menu.

4.1.1.2 Settings menu / Plant data / Fluid data

In this section, it is possible to set-up the following parameters related to the fluid of which you are about to measure the flow rate, that are:

Fluid type: it allows to setup the kind of the fluid to be measured; possible choices are:

Custom fluid (every fluid different from normal water)
Normal water

Keys “◀” and “▶” permit to select the desired fluid type. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “**Esc**” key.

Temperature: it allows to setup the temperature of the fluid under measurement. Insert its value expressed in °C or °F, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; (tenths, unit, tens and hundreds) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “**Esc**” key.

Sound speed: it allows to setup the sound propagation speed in the fluid to be measured; insert the value expressed in meters /second or in feet /second, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; (units, tens, hundreds, thousands and tens of thousands) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “**Esc**” key.



Note: It is possible to setup this parameter freely only if “*Custom fluid*” was selected in “**Fluid type**”. Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “**Esc**” key to return to previous menu.

Cinematic visc. (osity): it allows to setup the value of the cinematic viscosity of the fluid in use; insert its value expressed in centistokes.

Use “◀” and “▶” keys to select the digit to be modified; thousandths, hundredths, tenths, unit and tens) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “**Esc**” key.



Note: It is possible to setup this parameter freely only if “*Custom fluid*” was selected in “**Fluid type**”. Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “**Esc**” key to return to previous menu.

Density: it allows to setup the density of the fluid in use; please insert its value expressed in Kilogrammes/liter or in pounds/m³ according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; thousandths, hundredths, tenths, unit and tens) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “**Esc**” key.



Note: It is possible to setup this parameter freely only if “*Custom fluid*” was selected in “**Fluid type**”. Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “**Esc**” key to return to previous menu.

Reynolds correc.(tion): it allows to choice if to use or not the flow rate correction related to the Reynolds number of the fluid in use; the possible choices are:

NO

YES

Keys “◀” and “▶” permit to make the choice. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “**Esc**” key.

4.1.1.3 Settings menu / Plant data / Pipe data

In this section, it is possible to set-up the following parameters related to the pipe on which you are applying the instrument.

Material: it is possible to select the material of which the pipe is made. The possible choices are:

Custom material (to be used if the pipe material is not among the ones preset)
Carbon steel
Stainless st.(eel) 302
Stainless st.(eel) 303
Stainless st.(eel) 304
Stainless st.(eel) 316
Copper
Annealed copper

Rolled copper
Naval brass
Iron
Ductile iron
Cast iron
Nylon
Nylon 6-6
Polyethylene (HD)
Polyethylene (LD)
Polypropylene
PVC /CPVC
Acrylic
Plexiglas
Cement-Asbestos

Keys “◀” and “▶” permit to select the pipe material. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Diameter / circ.(umference): it allows to setup the external diameter or the circumference of the pipe. Insert the value expressed in mm or in inches, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; thousandths, hundredths, tenths, units, tens, hundreds, thousands) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.

Wall thickness: it allows to setup the thickness of the wall of the pipe; insert the value expressed in mm or in inches, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; thousandths, hundredths, tenths, units and tens) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.

Sound speed: it allows to setup the sound propagation speed in the material that constitutes the pipe; insert the value expressed in meters /second or in feet /second, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; (units, tens, hundreds, thousands and tens of thousands) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.



Note: It is possible to setup this parameter freely only if “*Custom material*” was selected in “**Material**”. Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “Esc” key to return to previous menu.

Coating: this item permits to setup the type of coating (if present) that coats the inside or the outside wall of the pipe; the following sub menu are present:

Coating material: it allows to setup the material of which is coated the pipe; the possible choices are:

No coating (to be used when the pipe has not coat)

Custom coating (to be used when the pipe coating material is not among the preset ones)

Acylic

Concrete

Rubber

Teflon

Keys “◀” and “▶” permit to select the coating material. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Coating thickness: it allows to setup the thickness of the pipe coating. insert the value expressed in mm or in inches, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; thousandths, hundredths, tenths, units and tens) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.



Note: It is possible to setup this parameter freely only if “*Custom coating*” was selected in “**Coating material**”. Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO
PRESET !**

In this case, the only action permitted is to press “Esc” key to return to previous menu.

Coat.(ing) sound speed: it allows to setup the sound propagation speed in the material that constitutes the pipe coating; insert the value expressed in meters /second or in feet /second, according with the unit system selected (see below).

Use “◀” and “▶” keys to select the digit to be modified; (units, tens, hundreds, thousands and tens of thousands) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.



Note: It is possible to setup this parameter freely only if “*Custom coating*” was selected in “**Coating material**”. Otherwise the instrument will display the following message:

**NOT ALLOWED !
THIS PARAMETER
IS AUTO**

PRESET !

In this case, the only action permitted is to press “**Esc**” key to return to previous menu.

Transverses nr.: it allows to setup the number of diagonal transverses that the ultrasound signal makes inside the pipe from one transducer to the other. The value is adjustable from 1 to 9 using “▲” and ”▼” keys. To store the new value, press “←→” keys: **the transmitter will calculate and display immediately the correct distance at which the transducers should be mounted on the pipe**; (expressed in mm or in inches, according with the unit system selected -see below).

it also possible under particular circumstances to modify manually this value to obtain a fine calibration of the transmitter; For this purpose, refer also to the paragraph dedicated to diagnostics. Use “◀” and “▶” keys to select the digit to be modified; thousandths, hundredths, tenths, units, tens, hundreds an thousands) and “▲” and ”▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “←→” key; to return to previous menu discarding any change press “**Esc**” key.

4.1.2 Settings menu / Display setup

In this section, it is possible to set-up various options related to data display, that are:

Measurement unit: it allows to setup the measurement unit in which the flow rate is displayed on the instrument. The possible choices are, depending with the unit system selected (see below):

Decimal metric units system

Velocity (m/s)

Volume (l/s)

Volume (l/min)

Volume (l/h)

Volume (hl/s)

Volume (hl/min)

Volume (hl/h)

Volume (m³/s)

Volume (m³/min)

Volume (m³/h)

Mass (Kg/s)

Mass (Kg/min)

Mass (Kg/h)

Sp.(eed) of snd(sound) (m/s)

English / USA units system

Velocity (ft/s)

Volume (Gal/s)

Volume (Gal/min)

Volume (Gal/h)

Volume (Barrels/s)

Volume (Barrels/min)

Volume (Barrels/h)

Volume (ft³/s)

Volume (ft³/min)

Volume (ft³/h)

Mass (Pounds/s)

Mass (Pounds/min)

Mass (Pounds/h)

Sp.(eed) of snd(sound) (ft/s)

Keys “◀” and “▶” permit to select the preferred measurement unit. To save the new settings and return to previous menu press “←→” key; to return to previous menu cancelling any eventual modifications press instead “**Esc**” key.

Min.(imum) valid veloc(ity): it allows to setup the minimum velocity of the flow below that the flow is considered null (0).

Use “◀” and “▶” keys to select the digit to be modified; (thousandths, hundredths, tenths and units,) and “▲” and ”▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “←→” key; to return to previous menu discarding any change press “**Esc**” key.

Totalizers setup: this item permits to setup the measurement unit for the flow totalizers and/or to reset them to 0. it comprises the two following settings:

Unit of measure: it allows to setup the measurement unit in which the totalized flow is displayed on the instrument. The possible choices are, depending with the unit system selected (see below):

Decimal metric units system

Litres
Hectolitres
Cubic meters
Kilograms
Tonns

English / USA units system

Gallons
MGallons
Cubic feet
Pounds
Tons

Keys “◀” and “▶” permit to select the preferred measurement unit. To save the new settings and return to previous menu press “↩” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Totalizers reset: it allows to reset to 0 both flow totalizers (forward and reverse): the possible choices are:

NO
YES

Keys “◀” and “▶” permit to make the choice. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Contrast adjust.(ment): It permits to adjust the contrast of LCD display in order to adapt it to the various ambient light condition and to the viewing angle.

Use keys “▲” and “▼” to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.

4.1.3 Settings menu / Output setup

In this section, it is possible to set-up the parameters related to the analog output and to the pulses one for totalization. It comprises two submenu, that are:

Analog output: permette di impostare tutti i parametri relativi all’uscita analogica, che sono:

Measurement unit: it allows to setup the measurement unit in which the flow rate is output on the analog output. The possible choices are, depending with the unit system selected (see below):

Decimal metric units system

Velocity (m/s)
Volume (l/s)
Volume (l/min)
Volume (l/h)
Volume (hl/s)
Volume (hl/min)
Volume (hl/h)
Volume (m³/s)
Volume (m³/min)
Volume (m³/h)
Mass (Kg/s)
Mass (Kg/min)
Mass (Kg/h)

Sp.(eed) of snd(sound) (m/s)

English / USA units system

Velocity (ft/s)
Volume (Gal/s)
Volume (Gal/min)
Volume (Gal/h)
Volume (Barrels/s)
Volume (Barrels/min)
Volume (Barrels/h)
Volume (ft³/s)
Volume (ft³/min)
Volume (ft³/h)
Mass (Pounds/s)
Mass (Pounds/min)
Mass (Pounds/h)

Sp.(eed) of snd(sound) (ft/s)

Keys “◀” and “▶” permit to select the preferred measurement unit. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Bottom range 4 mA: it allows to setup the value, expressed in the measurement unit selected at the previous item, for the begin of the analog output range; below this value, the transmitter will give an output of about 3,5 mA (under range).

Use “◀” and “▶” keys to select the digit to be modified; (thousandths, hundredths, tenths, units, tens, hundreds, thousand and tens of thousands) and “▲” and “▼” keys to vary its

value from 0 to 9 moving the cursor on the most left position is also possible to modify the sign (+ or -). To save the new input value and return to previous menu, press “←” key; to return to previous menu discarding any change press “Esc” key.

Top range 20 mA: it allows to setup the value, expressed in the measurement unit selected at the item “**Measurement unit**”, for the top of the analog output range; over this value, the transmitter will give an output of about 21 mA (over range).

Use “◀” and “▶” keys to select the digit to be modified; (thousandths, hundredths, tenths, units, tens, hundreds, thousand and tens of thousands) and “▲” and “▼” keys to vary its value from 0 to 9 moving the cursor on the most left position is also possible to modify the sign (+ or -). To save the new input value and return to previous menu, press “←” key; to return to previous menu discarding any change press “Esc” key.

Errors management: it allows to select the behaviour of the analog output in case of error conditions. The possible choices are:

Last valid meas.(ure): The current value on the analog output remains frozen to the one of last valid measure before the onset of the error condition.

3,5 mA-underrange: The current value on the analog output at the onset of the error condition will go to 3,5 mA, that normally represent the under range flow condition.

21 mA- overrange: The current value on the analog output at the onset of the error condition will go to 21 mA, that normally represent the over range flow condition.

Keys “◀” and “▶” permit to select the desired behaviour. To save the new settings and return to previous menu press “←” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Simulation test: if this item is selected, the instrument will send on the analog output a fixed current value. The selectable values are:

4 mA
12 mA
20 mA

Keys “▲” and “▼” permit to choose the desired value.

If “Esc” key is pressed, the instrument will return to previous menu without perform analog output simulation; if “←”, it will give in output a current value equal to the selected one +/- 0,03 mA with the purpose to test the current loop and the correct setup of all the data acquisition system connected. To end the test and to return to previous menu, press “Esc” key. During the test, on the LCD display will be displayed the following message (xx.xx is the selected value):

ANALOG OUTPUT TEST

**A FIXED SIGNAL
OF xx,xx mA IS
ON OUTPUT NOW !**

Esc: exit

Pulse output: It allows to setup the number of litres in step of 10, flowed them a logic pulse will be generated on the output.

Use “◀” and “▶” keys to select the digit to be modified; (tens , hundreds, thousands and tens of thousands) and “▲” and “▼” keys to vary its value from 0 to 9. To save the new input value and return to previous menu, press “↵” key; to return to previous menu discarding any change press “Esc” key.

Note: also when the English system of measurement units is selected, the pulse output unit remains expressed in litres; this for not to waste precision during conversion procedures.

4.1.4 Settings menu/ Measure setup

This item permits to setup the following features:

Sensors excitat.(ion): it allows to select the excitation mode for the transducers as required from measurement conditions; the possible choices are:

Normal

High voltage

Keys “◀” and “▶” permit to select the average time desired. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Average: it allows to setup the time constant for the calculation or the moving average of the performer measurements; the possible choices are:

1 second

2 seconds

4 seconds

8 seconds

Auto damping 1s(econd)

Auto damping 2s(econds)

Auto damping 4s(econds)

Keys “◀” and “▶” permit to select the average time desired. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

Language: it allows to select the language in which all the instrument menus are displayed. The possible choices are:

Italian

English

P.O.07/ F

Keys “◀” and “▶” permit to select the language desired. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

When the instrument is set on English language, also the following item will be present, to allow to select the measurement units system desired

Units system: it allows to select the desired measurement units system for all the physical quantities used in the instrument: the possible choices are:

Metric (I.S.)

English (U.S.)

Keys “◀” and “▶” permit to select the units system desired. To save the new settings and return to previous menu press “↵” key; to return to previous menu cancelling any eventual modifications press instead “Esc” key.

4.1.5 Settings menu/ Advanc.(ed) setup

Service menu: This menu contains all the settings relate to the calibration and to factory tests of the instrument. It is strictly reserved to SITEL Control engineers and thus is password protected.

4.2 Totalizers menu

The totalizers menu permits to view the total values of direct and reverse flow.

As selected, this item will view the page with the forward flow totalizer; from there pressing “▼” key, is possible to view the reverse flow totalizer page; then, from there, pressing “▲” key, it is possible to return to view the forward one again and so on... A pressure of about 0,5 seconds on “Esc” key, will make instrument to return to main menu.

4.3 Diagnostics menu

Diagnostics menu permits to display the value of some parameters that are useful to the setup and to the troubleshooting of the instrument.

After selected, this item will display the first page of the diagnostics, in which the following parameters are displayed.

I.sig. up: intensity of the signal from the upstream transducer to the downstream one; this value for the best measurement should be comprised between results 1100 and 1350 points, and as close as possible the one of **I.segn.dn**.

I.sig.dn: intensity of the signal from the downstream transducer to the upstream one; this value for the best measurement should be comprised between results 1100 and 1350 points, and as close as possible the one of **I.segn.up**.

ΔSig.: absolute value of the difference between **I.sig. up** and **I.sig.dn**; as previously stated above, it should be the minimum possible.

Q.Sig.: quality of received signal during measurement, It should be as high and as more stable as possible. If **Q.Sig.** < 40 % the measure may be unreliable.

Att.up: setting of the automatic gain control during the signal measurement from the upstream to the downstream sensor: it should be as close as possible to the one of **Att.dn**.

Att.dn: setting of the automatic gain control during the signal measurement from the downstream to the upstream sensor: it should be as close as possible to the one of **Att.up**.

For the absolute value of these two parameters, refer to the following table:

8 < Att. xx < 19	signal is not sufficient
20 < Att. xx < 50	signal is just sufficient
51 < Att. xx < 125	signal is discrete
126 < Att. xx < 180	signal is good
181 < Att. xx < 252	signal is optimum
253 < Att. xx < 255	signal is too strong

By pressing "▼" key , it is possible to view the second page of diagnostics that contains the following other parameters:

Tud: Transit time (in microseconds) from the upstream to downstream signal.

Tdu: Transit time (in microseconds) from the downstream to upstream signal.

ΔT: difference measured in nanoseconds between **Tud** and **Tdu**. It is proportional to the flow velocity.

SoS: actual measured sound speed in the fluid; the more this value is closest to the theoretical one for that fluid at that temperature, the more the measure and the instrument setup are accurate.

Peak up: Relative temporal position of the peak of signal from the upstream transducer to the downstream one versus the reception time window.

Peak dn: Relative temporal position of the peak of signal from the downstream transducer to the upstream one versus the reception time window.

For the value of this two parameters, refer to the following table:

Peak xx < 350 or **Peak xx** > 650: the sensor are to be repositioned better or the quantity of couplant used is not correct, or the parameters programming was wrong.

350 < **Peak xx** < 450 or 550 < **Peak xx** < 650: the sensors are positioned in manner just acceptable; for a better accuracy is suggested to reposition them.

450 < **Peak xx** < 490 or 510 < **Peak xx** < 550: the sensors are positioned in quite accurate manner.

490 < **Peak xx** < 510 : the sensors are positioned in perfect manner.

By pressing "▼" key , it is possible to view the third page of diagnostics that contains the following other parameters:

Re: Value of the measured Reynolds number.

KRe: value o the Reynolds correction constant calculated for the fluid under measurement in the present conditions.

Fv: value of the flow velocity in m/s or in Ft/s.

Pressing key "▲" is possible to return to the previous page of diagnostics, and so on.

A pressure of about 0,5 seconds on "Esc" key , will instead make instrument to return to main menu.

4.4 Error messages

In the case there were an error condition that compromises the correct working of the instrument, an error message will be displayed on the bottom line of the LCD display.

The possible error messages are listed below, together with the possible causes and solutions.

Ex-Undet.(erminate) error: this message is displayed briefly just after the instrument initialization or after the resolution of a previous error condition.

E1-Low signal: this message is displayed if the amplitude of the received signal is not sufficient for a stable and reliable measurement. This may happen for the following reasons:

- Sensor not connected or not correctly positioned on the pipe.
- Incorrect or unmade setup of working parameters.
- Cables between sensors and transmitter broken or defective.
- Empty pipe or pipe containing a lot of air bubbles.
- Wrong coupling between sensors and pipe (wrong distance, lack or excessive quantity of couplant, loosen screwing).
- Sensors or transmitter defective.

For its fixing, may be useful to verify the diagnostics parameters of diagnostics page nr 1.

E2-Soundspeed: this message is displayed if the sound speed measured in the fluid is very different from the theoretical one set. This may happen if:

- Sensors not correctly positioned on the pipe.
- Wrong parameters setup.
- Pipe containing a lot of air bubbles.
- Wrong coupling between sensors and pipe (wrong distance, lack or excessive quantity of couplant, loosen screwing).

For its fixing, may be useful to verify the diagnostics parameters of diagnostics page nr 2.

E3-Sig.(nal) quality: this error message is displayed when the received signal is so distorted that its correlation with the original transmitted one is impossible. This may happen for the following reasons:

- Pipe containing a lot of air bubbles.
- Weak and unstable coupling between sensors and pipe (wrong distance, lack or excessive quantity of couplant, loosen screwing).
- Cables between sensors and transmitter with loosen connections or defective.

For its fixing, may be useful to verify the diagnostics parameters of diagnostics page nr 2.

E4-cycle skip: This message is displayed if the signal received is very unstable.

For its causes and possible solutions, refer to the one of **E3-Sig.(nal) quality**.

E5-Bad correlat.(ion) : This message is displayed if the signal received is distorted and not resembles to the original transmitted. For its causes and possible solutions, refer to the one of **E3-Sig.(nal) quality**.

E15-Window setup: This message may appear during the instrument initialization; if it should remain displayed for more than 60 seconds it may significate an error in the setup of pipe , fluid or sensors parameters.

5 - DIRECTIONS OF USE

SITEL Control technicians are available to examine all the possible applications, even the most unusual.

Please feel free to contact us, you will find qualified personnel who are capable to face any installation need .

6 - MANTAINANCE

6.1 Check of the hermetic sealing of sensors, connectors and transmitter box

After commissioning, mainly in cases in which the instrument is mounted outside or in environments subjected to liquid dropping, or showers, or to high moisture, is necessary to verify periodically the hermetic sealing of all the parts of which the system is composed, in order, if the case, to intervene quickly to avoid serious damages.

6.2 Check of transducers screwing and of the conditions of couplant

Periodically, mainly in the seasonal changes, is advisable to check the screwing on the sensors on pipe, replacing if the case the couplant present on the base surface of them, after having removed the old one, either from sensors themselves, either from pipe surface, using a alcohol wetted cloth.

6.3 Check of calibration

The full verify of the correct calibration it is possible only using dedicated, high-sophisticated instrumentation, so it is possible to perform it only in SITEL Control laboratories.

However the quality and the stability of the sensors and of the electronic components employed makes it usually not necessary, even if, after a long time of working it may be necessary mainly to overcome the negative effect of the degradation of the contact surface between pipe and sensors.

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7 – RISKS ANALYSIS

The GECO-4W series instruments have been designed to respond to the usual safety regulations; there won't be any risk for the operators if employed correctly.

Please do not use the instrument for purposes different from the ones it has been built for.

GECO-4W has not been designed for applications where a malfunctioning can be hazardous to human life or cause great economical and/or environmental damages.

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8 – TABLES

8.1 Identification table of ANSI standard pipes (Carbon Steel and alloys; Stainless Steel)

A) *ANSI B 36.10 Iron pipe size designation*

B) *ANSI B 36.10 Schedule carbon steels*

C) *ANSI B 36.19 Schedule stainless steels*

Nominal diameter	External diameter es Inch (mm)	Iron pipe size designation (carbon st. alloys) (A)	Schedule Carbon steel alloys (B)	Sched. stainless steel (C)	Pipe thickness Inch (mm)
1"	1,315" (33,4)	-	-	5S	0,065" (1,651)
		-	-	10S	0,109" (2,768)
		STD	40	40S	0,133" (3,378)
		XS	80	80S	0,179" (4,546)
		-	160	-	0,250" (6,35)
		XXS	-	-	0,358" (9,09)
1 ¼"	1,66" (42,164)	-	-	5S	0,065" (1,651)
		-	-	10S	0,109" (2,768)
		STD	40	40S	0,140" (3,556)
		XS	80	80S	0,191" (4,851)
		-	160	-	0,250" (6,35)
		XXS	-	-	0,382" (9,702)
1 ½"	1,9" (48,26)	-	-	5S	0,065" (1,651)
		-	-	10S	0,109" (2,768)
		STD	40	40S	0,145" (3,683)
		XS	80	80S	0,200" (5,08)
		-	160	-	0,281" (7,137)
		XXS	-	-	0,400" (10,16)
2"	2,375" (60,325)	-	-	5S	0,065" (1,651)
		-	-	10S	0,109" (2,768)
		STD	40	40S	0,154" (3,911)
		XS	80	80S	0,218" (5,537)
		-	160	-	0,344" (8,737)
		XXS	-	-	0,436" (11,07)
2 ½"	2,875" (73,025)	-	-	5S	0,083" (2,108)
		-	-	10S	0,120" (3,04)
		STD	40	40S	0,203" (5,156)
		XS	80	80S	0,276" (7,01)
		-	160	-	0,375" (9,525)
		XXS	-	-	0,552" (14,02)
3"	3,5" (88,9)	-	-	5S	0,083" (2,108)
		-	-	10S	0,120" (3,04)
		STD	40	40S	0,216" (5,486)
		XS	80	80S	0,300" (7,62)
		-	160	-	0,438" (11,12)
		XXS	-	-	0,600" (15,24)
3 ½"	4" (101,6)	-	-	5S	0,083" (2,108)
		-	-	10S	0,120" (3,04)
		STD	40	40S	0,226" (5,74)
		XS	80	80S	0,318" (8,07)
		-	-	-	-
		XXS	-	-	0,636" (16,15)

Nominal diameter	External diameter es Inch (mm)	Iron pipe size designation (carbon st. alloys) (A)	Schedule Carbon steel alloys (B)	Sched. stainless steel (C)	Pipe thickness Inch (mm)
4"	4,5" (114,3)	-	-	5S	0,083" (2,108)
		-	-	10S	0,120" (3,04)
		STD	40	40S	0,237" (6,019)
		XS	80	80S	0,337" (8,559)
		-	120	-	0,438" (11,12)
		-	160	-	0,531" (13,48)
		XXS	-	-	0,674" (17,12)
5"	5,536" (140,614)	-	-	5S	0,109" (2,768)
		-	-	10S	0,134" (3,40)
		STD	40	40S	0,258" (6,553)
		XS	80	80S	0,375" (9,525)
		-	120	-	0,500" (12,7)
		-	160	-	0,625" (15,87)
		XXS	-	-	0,750" (19,05)
6"	6,625" (168,275)	-	-	5S	0,109" (2,108)
		-	-	10S	0,134" (3,40)
		STD	40	40S	0,280" (7,112)
		XS	80	80S	0,432" (10,97)
		-	120	-	0,562" (14,27)
		-	160	-	0,719" (18,26)
		XXS	-	-	0,864" (21,94)
8"	8,625" (219,075)	-	-	5S	0,109" (2,108)
		-	-	10S	0,148" (3,759)
		-	20	-	0,250" (6,35)
		-	30	-	0,277" (7,035)
		STD	40	40S	0,322" (8,178)
		-	60	-	0,406" (10,31)
		XS	80	80S	0,500" (12,70)
		-	100	-	0,594" (15,08)
		-	120	-	0,719" (18,26)
		-	140	-	0,812" (20,62)
		XXS	-	-	0,875" (22,22)
-	160	-	0,906" (23,01)		
10"	10,750" (273,05)	-	-	5S	0,134" (3,40)
		-	-	10S	0,165" (4,191)
		-	20	-	0,250" (6,35)
		-	30	-	0,307" (7,797)
		STD	40	40S	0,365" (9,271)
		XS	60	80S	0,500" (12,70)
		-	80	-	0,594" (15,08)
		-	100	-	0,719" (18,26)
		-	120	-	0,844" (21,43)
		XXS	140	-	1,000" (25,40)

Nominal diameter	External diameter es Inch (mm)	Iron pipe size designation (carbon st. alloys) (A)	Schedule Carbon steel alloys (B)	Sched. stainless steel (C)	Pipe thickness Inch (mm)
12"	12,750" (323,85)	-	-	5S	0,156" (3,962)
		-	-	10S	0,180" (4,572)
		-	20	-	0,250" (6,35)
		-	30	-	0,330" (8,382)
		STD	-	40S	0,375" (9,525)
		-	40	-	0,406" (10,31)
		XS	-	80S	0,500" (12,70)
		-	60	-	0,562" (14,27)
		-	80	-	0,688" (17,47)
		-	100	-	0,844" (21,43)
		XXS	120	-	1,000" (25,40)
		-	140	-	1,125" (28,57)
		-	160	-	1,312" (33,32)
		14"	14,000" (355,6)	-	-
-	-			10S	0,188" (4,775)
-	10			-	0,250" (6,35)
-	20			-	0,312" (7,924)
STD	30			-	0,375" (9,525)
-	40			-	0,438" (11,12)
XS	-			-	0,500" (12,70)
-	60			-	0,594" (15,08)
XXS	-			-	0,625" (15,87)
-	80			-	0,750" (19,05)
-	100			-	0,938" (23,8)
-	120			-	1,094" (27,78)
-	140			-	1,250" (31,75)
-	160			-	1,406" (35,71)
16"	16" (406,4)	-	-	5S	0,165" (4,19)
		-	-	10S	0,188" (4,775)
		-	10	-	0,250" (6,35)
		-	20	-	0,312" (7,924)
		STD	30	-	0,375" (9,525)
		XS	40	-	0,500" (12,70)
		-	60	-	0,656" (16,66)
		-	80	-	0,844" (21,43)
		-	100	-	1,031" (26,18)
		-	120	-	1,219" (30,96)
		-	140	-	1,439" (36,55)
		-	160	-	1,594" (40,48)

Nominal diameter	External diameter es Inch (mm)	Iron pipe size designation (carbon st. alloys) (A)	Schedule Carbon steel alloys (B)	Sched. stainless steel (C)	Pipe thickness Inch (mm)		
18"	18" (457,2)	-	-	5S	0,165" (4,19)		
		-	-	10S	0,188" (4,775)		
		-	10	-	0,250" (6,35)		
		-	20	-	0,312" (7,924)		
		STD	-	-	0,375" (9,525)		
		-	30	-	0,438" (11,12)		
		XS	-	-	0,500" (12,70)		
		-	40	-	0,562" (14,27)		
		-	60	-	0,750" (19,05)		
		-	80	-	0,938" (23,82)		
		-	100	-	1,156" (29,36)		
		-	120	-	1,375" (34,90)		
		-	140	-	1,562" (39,67)		
-	160	-	1,781" (45,23)				
20"	20" (508)	-	-	5S	0,188" (4,775)		
		-	-	10S	0,218" (5,537)		
		-	10	-	0,250" (6,35)		
		STD	20	-	0,375" (9,525)		
		XS	30	-	0,500" (12,70)		
		-	40	-	0,594" (15,08)		
		-	60	-	0,812" (20,62)		
		-	80	-	1,031" (26,18)		
		-	100	-	1,281" (32,53)		
		-	120	-	1,500" (38,10)		
		-	140	-	1,750" (44,45)		
		-	160	-	1,969" (50,01)		
		22"	22" (558,8)	-	-	5S	0,188" (4,775)
-	-			10S	0,218" (5,537)		
-	10			-	0,250" (6,35)		
STD	20			-	0,375" (9,525)		
XS	30			-	0,500" (12,70)		
-	60			-	0,875" (22,22)		
-	80			-	1,125" (28,57)		
-	100			-	1,375" (34,92)		
-	120			-	1,625" (41,27)		
-	140			-	1,875" (47,62)		
-	160			-	2,125" (53,97)		
24"	24" (609,6)			-	-	5S	0,218" (5,537)
				-	10	10S	0,250" (6,35)
		STD	20	-	0,375" (9,525)		
		XS	-	-	0,500" (12,70)		
		-	30	-	0,562" (14,27)		
		-	40	-	0,688" (17,47)		
		-	60	-	0,969" (24,61)		
		-	80	-	1,219" (30,96)		
		-	100	-	1,531" (38,88)		
		-	120	-	1,812" (46,02)		
		-	140	-	2,062" (52,37)		

Nominal diameter	External diameter es Inch (mm)	Iron pipe size designation (carbon st. alloys) (A)	Schedule Carbon steel alloys (B)	Sched. stainless steel (C)	Pipe thickness Inch (mm)
26"	26" (660,4)	-	10	-	0,312" (7,92)
		STD	-	-	0,375" (9,525)
		XS	20	-	0,500" (12,70)
28"	28" (711,2)	-	10	-	0,312" (7,92)
		STD	-	-	0,375" (9,525)
		XS	20	-	0,500" (12,70)
		-	30	-	0,625" (15,87)
30"	30" (762)	-	-	5S	0,250" (6,35)
		-	10	10S	0,312" (7,92)
		STD	-	-	0,375" (9,525)
		XS	20	-	0,500" (12,70)
		-	30	-	0,625" (15,87)
		-	40	-	0,750" (19,05)
32"	32" (812,8)	-	10	-	0,312" (7,92)
		STD	-	-	0,375" (9,525)
		XS	20	-	0,500" (12,70)
		-	30	-	0,625" (15,87)
		-	40	-	0,688" (17,47)
34"	34" (863,6)	-	10	-	0,344" (8,737)
		STD	-	-	0,375" (9,525)
		XS	20	-	0,500" (12,70)
		-	30	-	0,625" (15,87)
		-	40	-	0,688" (17,47)
36"	36" (914,4)	-	10	-	0,312" (7,92)
		STD	-	-	0,375" (9,525)
		XS	20	-	0,500" (12,70)
		-	30	-	0,625" (15,87)
		-	40	-	0,750" (19,05)
42"	42" (1066,8)	STD	-	-	0,375" (9,525)
		XS	20	-	0,500" (12,70)
		-	30	-	0,625" (15,87)
		-	40	-	0,750" (19,05)
48"	48" (1219,2)	STD	-	-	0,375" (9,525)
		XS	-	-	0,500" (12,70)

8.2 Table of soundspeeds in normal water for temperatures from 0°C TO 260 °C (0 TO 500 °F)

Temperature (°C)	Soundspeed (m/s)	Temperature (°F)	Soundspeed (ft/s)
0	1402	32	4599,7
1	1407	33,8	4616,1
2	1412	35,6	4632,5
3	1417	37,4	4648,9
4	1421	39,2	4662,0
5	1426	41	4678,4
6	1430	42,8	4691,5
7	1434	44,6	4704,7
8	1439	46,4	4721,1
9	1443	48,2	4734,2
10	1447	50	4747,3
11	1451	51,8	4760,4
12	1455	53,6	4773,6
13	1458	55,4	4783,4
14	1462	57,2	4796,5
15	1465	59	4806,4
16	1469	60,8	4819,5
17	1472	62,6	4829,3
18	1476	64,4	4842,5
19	1479	66,2	4852,3
20	1482	68	4862,1
21	1485	69,8	4872,0
22	1488	71,6	4881,8
23	1491	73,4	4891,7
24	1493	75,2	4898,2
25	1496	77	4908,1
26	1499	78,8	4917,9
27	1501	80,6	4924,5
28	1504	82,4	4934,3
29	1506	84,2	4940,9
30	1509	86	4950,7
31	1511	87,8	4957,3
32	1513	89,6	4963,9
33	1515	91,4	4970,4
34	1517	93,2	4977,0
35	1519	95	4983,5
36	1521	96,8	4990,1
37	1523	98,6	4996,7
38	1525	100,4	5003,2
39	1527	102,2	5009,8
40	1528	104	5013,1
41	1530	105,8	5019,6
42	1532	107,6	5026,2
43	1534	109,4	5032,7
44	1535	111,2	5036,0

Temperature (°C)	Soundspeed (m/s)	Temperature (°F)	Soundspeed (ft/s)
45	1536	113	5039,3
46	1538	114,8	5045,9
47	1539	116,6	5049,2
48	1540	118,4	5052,4
49	1541	120,2	5055,7
50	1543	122	5062,3
51	1543	123,8	5062,3
52	1544	125,6	5065,6
53	1545	127,4	5068,8
54	1546	129,2	5072,1
55	1547	131	5075,4
56	1548	132,8	5078,7
57	1548	134,6	5078,7
58	1549	136,4	5082,0
59	1550	138,2	5085,2
60	1550	140	5085,2
61	1551	141,8	5088,5
62	1552	143,6	5091,8
63	1552	145,4	5091,8
64	1553	147,2	5095,1
65	1553	149	5095,1
66	1553	150,8	5095,1
67	1554	152,6	5098,4
68	1554	154,4	5098,4
69	1554	156,2	5098,4
70	1554	158	5098,4
71	1554	159,8	5098,4
72	1555	161,6	5101,6
73	1555	163,4	5101,6
74	1555	165,2	5101,6
75	1555	167	5101,6
76	1555	168,8	5101,6
77	1554	170,6	5098,4
78	1554	172,4	5098,4
79	1554	174,2	5098,4
80	1554	176	5098,4
81	1554	177,8	5098,4
82	1553	179,6	5095,1
83	1553	181,4	5095,1
84	1553	183,2	5095,1
85	1552	185	5091,8
86	1552	186,8	5091,8
87	1552	188,6	5091,8
88	1551	190,4	5088,5
89	1551	192,2	5088,5
90	1550	113	5039,3
91	1549	114,8	5045,9
92	1549	116,6	5049,2

Temperature (°C)	Soundspeed (m/s)	Temperature (°F)	Soundspeed (ft/s)
93	1548	199,4	5078,7
94	1547	201,2	5075,4
95	1547	203	5075,4
96	1546	204,8	5072,1
97	1545	206,6	5068,8
98	1544	208,4	5065,6
99	1543	210,2	5062,3
100	1543	212	5062,3
104	1538	219,2	5045,9
110	1532	230	5026,2
116	1524	240,8	4999,9
121	1526	249,8	5006,5
127	1507	260,6	4944,2
132	1497	269,6	4911,4
138	1487	280,4	4878,5
143	1476	289,4	4842,5
149	1465	300,2	4806,4
154	1453	309,2	4767,0
160	1440	320	4724,4
166	1426	330,8	4678,4
171	1412	339,8	4632,5
177	1398	350,6	4586,6
182	1383	359,6	4537,3
188	1368	370,4	4488,1
193	1353	379,4	4438,9
199	1337	390,2	4386,4
204	1320	399,2	4330,7
210	1302	410	4271,6
216	1283	420,8	4209,3
221	1264	429,8	4146,9
227	1244	440,6	4081,3
232	1220	449,6	4002,6
238	1200	460,4	3937,0
243	1180	469,4	3871,3
249	1160	480,2	3805,7
254	1140	489,2	3740,1
260	1110	500	3641,7