

SGM-100H

Transit time ultrasonic flowmeter

825B108B

Features

Rechargeable battery:	10h lasting
Battery charger:	100 \pm 253Vac
Display:	alphanumeric 4x16 digits
Keypad:	16+2 pushing buttons
Displayed data:	flow rate, flow totalizer and more
Housing:	ABS
Linearity:	\pm 0.5%
Repeatability:	\pm 0.2%
Total accuracy:	\pm 1%
Response time:	Programmable 0 \div 999s
Max medium speed:	\pm 32 m/s
Clamp-on transducers:	
	S1 type-suitable for pipes from DN15 to DN100 (0\div70°C)
	M1 type-suitable for pipes from DN50 to DN700 (0\div70°C)
	L1 type-suitable for pipes from DN300 to DN4000 (0\div70°C)
Clamp-on transducers mounted on metric frame:	
	S1F type-suitable for pipes from DN15 to DN100 (0\div70°C)
	M1F type-suitable for pipes from DN50 to DN700 (0\div70°C)
Clamp-on transducers for high temperature:	
	S1H type-suitable for pipes from DN15 to DN100 (0\div160°C)
	M1H type-suitable for pipes from DN50 to DN700 (0\div160°C)
Flow measurement unit:	Selectable
Totalizer:	7 digits for positive, negative and net flow
Data logger:	Built-in Can store up to 2000 records
Communication interface:	RS-232C



General

The **SGM-100H** is composed by a digital converter and two clamp-on ultrasonic transducers. It is designed to measure the fluid velocity of a liquid inside a closed conduit. The transducers are a non-contacting, clamp-on type, which provide benefits of non-fouling operation and easy installation. The DSP digital technology (Digital Signal Processing) ensure a low sensibility of the instrument against potential transient factors.

0. Working principle

The **SGM-100H** utilizes two transducers which work as ultrasonic transmitters and receivers. They are clamped on the outside of a closed pipe at a specific distance from each other. They can be mounted in V position (the sound crosses the pipe twice), in W position (the sound crosses the pipe 4 times) or in Z position (mounted on opposite sides of the pipe - the sound crosses the pipe once). The selection of the mounting position depends on pipe and on liquid characteristics.

the **SGM-100H** operates by alternately transmitting and receiving a frequency modulated burst of sound energy between the two transducers and measuring the transit time that takes the sound to travel between them. The difference in measured transit time is directly and exactly related to the velocity of the liquid inside the pipe (fig.1). a figura 1.

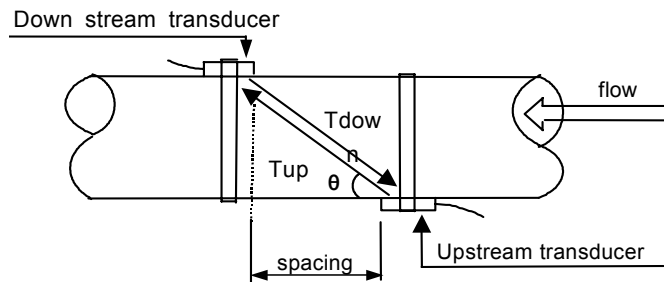


Fig.1

$$V = \frac{MD}{\sin 2\theta} \times \frac{\Delta T}{T_{up} \cdot T_{down}}$$

Where:

- θ = include angle for the flow direction
- M = transit time of the ultrasonic signal
- D = Internal pipe diameter
- T_p = Transit time in the forward direction
- T_{down} = Transit time in the reverse direction
- ΔT = $T_{up} - T_{down}$

1 Features

1.1 Applications

The **SGM-100H** can be applied to a wide range of measurement. The range of pipe dimensions is from 20 to 6000 mm (from 0,5 to 200 inches) and the liquids can be: ultra-pure, potable water, chemicals, raw sewage, cooling water, river water, plant effluent ecc. As the instrument and the transducers are non-contacting and have no moving parts, the flow meter cannot be affected by system pressure, fouling or wear. Standard transducers are rated to 110°C.

1.2 Data Integrity

All configuration values setted by the user are saved into the EE PROM, which is protected by a password to avoid accidental changes or resets.

A time-keeper is integrated in the flow meter for the index of date totalizing and works as the time base of flow accumulation. It keeps operating as long as the battery's terminal voltage is over 1.5V. In case of battery failure it will loose time values and the user must re-enter them.

An improper time value affects no other functions but the date totalizer.

1.3 Product identification

Every instrument has an 8 digit identification number (ESN) which provides the information of version and manufacturing date. It is displayed on menu M61 and can be employed for instrumentation management.

1.4 Specifications

Linearity:	0,5%
Repeatability:	0,2%
Accuracy:	±1% of reading at rates > 0,2m/s
Response time:	1÷999 seconds
Maxspeed:	±32m/s
Pipe sizes:	DN15÷DN4000, using different transducers
Rate units:	Meter, cubic meter, feet, cubic feet, liter, USA gallon, Imperial gallon, Oil barrel, USA liquid barrel, Imperial liquid barrel, Million USA gallon - configurable by the user
Totalizers:	7 digits for positive, negative and net flow
Liquid types:	Vitually all liquids which transmit acustic waves
Security:	Setup values modificatio lockout. Acces code needs to be unlocked
Display:	Grafic 4 lines, 16 digits
Communication interface:	RS-232-C - Protocol available on request
Transducers:	Clamp-on (0÷70°C) - Clamp-on on metric frame (0÷70°C) - Clamp-on for high temperature (0÷160°C)
Transducer connec. cable length:	Standard 2 x 5 meters, max 2 x 50 meters.
Power supply:	3AAA Ni-mH integrate batteries. When fully recharged they last about 10 hours. 100÷253Vac for the charger.
Data logger:	Built-in - Can store up to 2000 records
Housing material:	ABS
Case dimensions:	460 (L) x 400 (W) x 110 (H) mm
Weight:	4,5 kg

1.5 Mounting kit

Clamp-on trasducers

Standard HM (50-700mm)

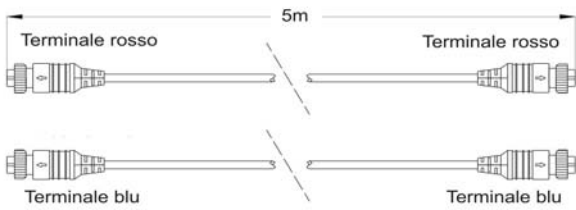


HANDHELD Flowmeter

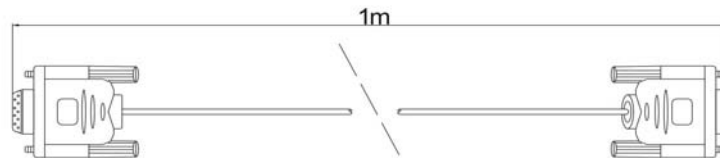
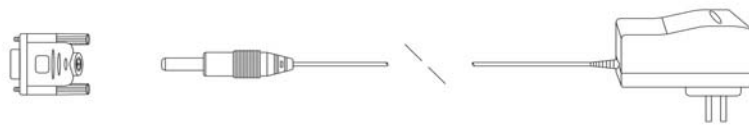
Upstream trasducer socket Downstream trasducer socket



Cable 2x 5m



Converted Terminal and AC/DC adapter



Cable of RS-232-C interface

2 Operation

The **SGM-100H** can operate either from the built-in NI-mH rechargeable battery, which will last over 10 hours when fully recharged.

The battery charging circuits employ a scheme of constant-current and constant-voltage. It has the peculiarity of fast charging at the beginning and very low charging when the battery approaches the full recharge. Generally when the green Led starts lightening, the battery is nearly 95% recharged and when the red LED is off, the battery is 98% recharged.

When fully recharged, the terminal voltage reaches around 4.25V (displayed on window M07). When the battery is nearly run-down the voltage collapses below 3V. The user can estimate the battery duration by checking its voltage. An integrated estimator software monitors the battery duration, but it can present a relatively big estimation error when the voltage is between 3,70 and 3,90V.

2.1 Power on

Press **ON** to switch on the flow meter and press **OFF** to switch it off.

Once the instrument is switched on, it will run a self diagnostic program. If there's any anomaly the corresponding error message will be displayed. Generally, there should be no display of error messages, and the flow meter will go to the most commonly used Menu Window Number 01 (short for M01) to display the Velocity, Flow Rate, Positive Totalizer, Signal Strength and Signal Quality, based on the pipe parameters configured last time by the user or by the initial program.

The operation on the keypad does not interfere with the measurement because of the simultaneous processing technology.

When power is on, the user can see on menu window M01 that it is adjusting the gain of the amplifier. Progress 1, 2 and 3 will be displayed on the right lower corner of the display and after the adjustment the flowmeter will go into the normal measurement mode, with "R" displayed on the left upper corner.

If the instrument is running for the first time or it has been installed in a new position, the user needs to enter new pipe parameters. Any parameter will be recorded permanently into the NVRAM of the **SGM-100H**, until new modification.

2.2 Keypad

The **SGM-100H** keypad has 16+2 keys.

Keys from **0** to **9** and **.** are to enter numbers or menu numbers.

Key **▲/+** is for entering the previous menu window. It can be also used to increase a numeric value.

Key **▼/-** is for entering the next menu window. It can be also used to decrease a numeric value.

Key **◀** is for moving left or to delete the left character.

Key **ENT** is for selecting a menu option or for confirming a modification.

Key **MENU** is for the direct menu window jump over.



2.3 Menu windows

The interface has about 100 different menu windows, numbered from M00 to M99 and from M+1 to M+9.

There are two methods to enter menu windows:

(1) Direct entering by pressing **MENU** followed by two digit-number keys. For example, to enter M11 menu (pipe

external diameter) press in sequence **MENU** **1** **1**

(2) Research by **▲/+** and **▼/-**, scrolling the window numbers. By pressing **▲/+** the user will display the previous menu window and by pressing **▼/-** will display the next one.

There are three different types of menu windows:

(1) for number/value entering, like pipe diameter dimensions

(2) for options selection, like pipe material

(3) for values display, like velocity, flow rate ecc.

For number entering windows press directly the digit-numbers and **ENT** to confirm. For example, if the external diameter of the pipe is 219.2345, select the menu window M11 and press in sequence:

2 **1** **9** **●** **2** **3** **4** **5** **ENT**

For selecting and modifying the parameters, press **ENT** and select the option by pressing **▲/+** and **▼/-**. Press then **ENT** to confirm.

For example, if the pipe material is SS316, select menu window M14, press **ENT** and select the pipe material by pressing **▲/+** or **▼/-** or by digiting the number showed before the material (in this case 1).

Press then **ENT** to confirm the choice.

2.4 Menu windows types

M00÷M09 for values display (flowrate, velocity, date and time, totalizer, battery volatge and estiomated working time)

M10÷M29 for entering pipe parameters

M30~M38 for selecting flow rate unit and totalizer unit

M40÷M49 for response time, zero and calibration setup and password modification

M50÷M53 for data logger setup

M60÷M78 for time-keeper setup, ESN information and alarms

M82 for totalizer data display

M90÷M94 for diagnostic

M97÷M99 command windows (contact SGM LEKTRA)

M+0÷M+8 additional functions, as calculator, and for displaying total working hours, turn-on and turn-off times

2.5 Parameters configuration

In order to achieve a proper measurement, proceed with the configuration of the following parameters:

(1) Pipe external diameter

(2) Pipe wall thickness

(3) Pipe material. In case of non standard materials (not listed) it's necessary to enter also the relevant medium sound speed.

(4) Liner material, if present, and the relevant medium sound speed and thickness

(5) Liquid type. In case of non standard liquids (not listed) it's necessary to enter also the relevant medium sound speed.

(6) Transducers type

(7) Transducers mounting method

(8) Transducers mounting distance (showed on menu window M25)

For standard pipe materials and standard liquids refer to the following instructions:

(1) Press **MENU** **1** **1** to input the pipe external diameter and press **ENT** to confirm.

(2) Press **▼/-** to enter menu M12 and input the pipe wall thickness. Press **ENT** to confirm.

(3) Press **▼/-** to enter menu M14 and press **ENT** to enter selection mode. Use **▲/+** or **▼/-** to select the material and press **ENT** to confirm.

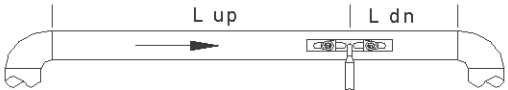
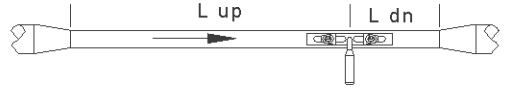
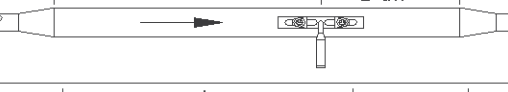
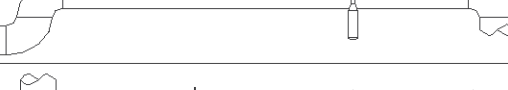
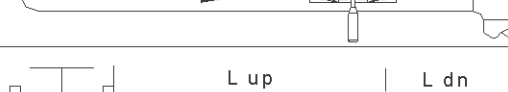


(4) Press **▼/-** to enter menu M16 and press **ENT** to enter selection mode. Use **▲/+** or **▼/-** to select the lining material and press **ENT** to confirm.

- (5) Press $\nabla/-$ to enter menu M20 and press ENT to enter selection mode. Use $\blacktriangle/+$ or $\nabla/-$ to select the liquid and press ENT to confirm.
- (6) Press $\nabla/-$ to enter menu M23 and press ENT to enter selection mode. Use $\blacktriangle/+$ or $\nabla/-$ to select the trasducers and press ENT to confirm.
- (7) Press $\nabla/-$ to enter menu M24 and press ENT to enter selection mode. Use $\blacktriangle/+$ or $\nabla/-$ to select trasducers mounting method and press ENT to confirm
- (8) Press $\nabla/-$ to enter menu M24 to install the trasducers on the pipe and then press $\nabla/-$ to go to menu M01 to check the parameters.

3 Installation

3.1 Transducers mounting allocation

The first step of the installation process is the selection of an optimum place in order to obtain a more accurate measurement. For this reason it is important to have a basic knowledge of the piping and of its plumbing system. An optimum place would be defined as a straight pipe length full of liquid, horizontally or vertically positioned.

Piping configuration and trasducer position	Upstream dimension	Downstream dimension
	L up [D]	L dn [D]
	10D	5D
	10D	5D
	10D	5D
	12D	5D
	20D	5D
	20D	5D
	30D	5D

Selection principles for an optimum installation:

- (1) Install the trasducers on the longer length of the pipe and make sure that the pipe is completely full of liquid.
- (2) Make sure that the temperature on the location does not exceed the temperature range of the trasducers. In general the closer to the room temperature the better.
- (3) Take the pipe fouling into consideration. Select a straight length of a relatively newer pipe. If the condition is not satisfying, consider the fouling thickness as part of the liner for a better result.
- (4) Some pipes have a kind of plastic liner, and between the external pipe and the liner there may be a certain thickness difference that will prevent the ultrasonic waves from direct travelling. Whenever possible try to avoid this kind of pipes; if impossible use the plug-in trasducers.

3.2 Trasdurers installation

The SGM-100H trasducers are made of piezoelectric crystals, both for transmitting and receiving the ultrasonic signals through the wall of the liquid piping system. The measurement is realized by measuring the traveling time difference of the ultrasonic signals. Since the difference is very small, the spacing and the alignment of the trasducers are important factors for the accuracy of the measurement and the performance of the measuring system.

How to proceed with the installation:

- (1) Locate an optimum position on the pipe, which has to be in good condition (no rust)
- (2) Clean and dust the pipe surface.
- (3) Apply adequate coupler on the spot where the trasducers have to be installed and leave no gap between the pipe surface and the trasducers.

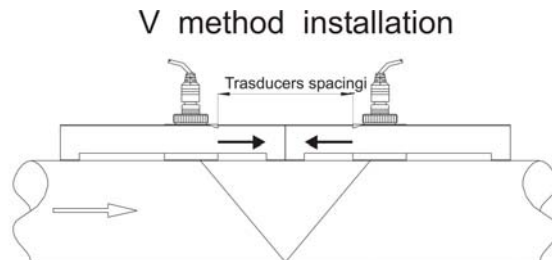
To avoid gas bubbles (gas fase) inside the upper part of the pipe, the trasducers should be installed horizontally by the side of the pipe.

3.2.1 Trasdurers spacing

The spacing value shown in menu M25 refers to inner distance between the two trasducers. The actual trasducers spacing should be as close as possible to the spacing value. (see figures on next page).

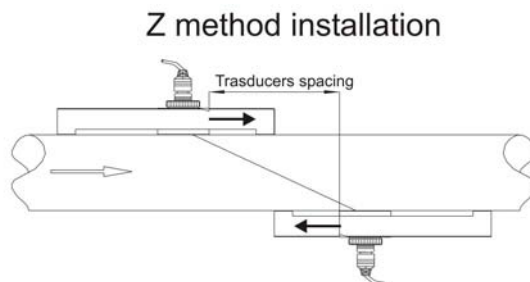
3.2.2 V method installation

It is the most common used method for pipe with diameters ranging from 15 to 300 millimeters.



3.2.3 Z method installation

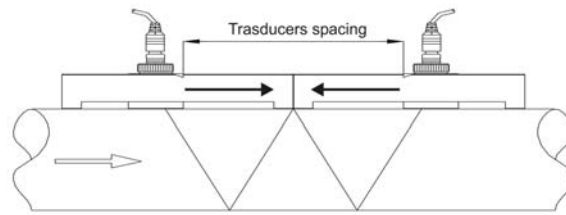
It is commonly used when the pipe diameter is between 300 and 500 millimeters.



3.2.4 W method installation

It is usually used on little pipes with a diameter from 10 to 100 millimeters.

W method installation



3.3 Installation Check-up

Through the checkup of the installation, one can: check the receiving signal strength, the signal quality Q value, the traveling time difference of the signals, the estimated liquid speed, the measured traveling time of the signals and the calculated traveling time ratio.

3.3.1 Signal strength

Signal strength indicates the amplitude of receiving ultrasonic signals by a 3-digit number. [000] means there is no signal detected, and [999] refers to the maximum signal strength that can be received.

Although the instrument works well if the signal strength ranges from 500 to 999, stronger signal strength should be pursued, because a stronger signal means a better result. The following methods are recommended to obtain stronger signals:

- 1) Relocate a more favorable location, if the current location is not good enough for a stable and reliable flow reading, or if the signal strength is lower than 700.
- (2) Try to polish the external surface of the pipe, and apply more coupler to increase the signal strength.
- (3) Adjust the transducers both vertically and horizontally while checking the varying signal strength, stop at the highest position, and then check the transducers spacing to make sure the transducers spacing is the same as shown in menu M25.

3.3.2 Signal quality (Q)

Signal quality is indicated as the Q value on the instrument. A higher Q value would mean a higher Signal and Noise Ratio (short for SNR), and accordingly a higher degree of accuracy would be achieved. Under normal pipe condition, the Q value is in the range of 60÷90, the higher the better.

Causes for a lower Q value could be:

- (1) Interference of other instruments and devices such as a powerful transverter working nearby. Try to relocate the flow meter to a new place where the interference can be reduced.
- (2) Bad sonic coupling for the transducers with the pipe. Try to apply more coupler or clean the surface etc
- (3) Pipes are difficult to be measured. Relocation is recommended.

3.3.3 Total transit time and Delta Time

The numbers displayed on menu window M93 are called total transit time and delta time respectively. They are the primitive data for the instrument to calculate the flow rate inside the pipe. So the flow rate indication will vary accordingly with the total time and delta time. The total transit time should remain stable or vary little.

If the delta time fluctuates higher than 20%, it means there are certain kinds of problems with the transducer installation.

3.3.4 Time ratio between the Measured Total Transit Time and the Calculated Time

This ratio would be used to check the transducer installation. If the pipe parameters are entered correctly and the transducers are installed properly, the value for this ratio should be in the range of 100±3. If this range is exceeded, the user should check:

- (1) If the pipe parameters are correctly entered.
- (2) If the actual spacing of the transducers is right and the same as what the window M25 shows.
- (3) If the transducers are installed properly in the right directions.
- (4) If the mounting location is good and if the pipe has changed shape.
- (5) If there is too much fouling inside the pipe.

4 Use

4.1 How to check if the instrument works properly

When 'R' is displayed in the lowest right corner of LCD display, the instrument is working properly.

If an 'H' flashes on that place, there could be poor signal received. Please refer to the chapters on diagnosis.

If an 'I' is displayed, it means that there is no signal detected.

If a 'J' is displayed, it means that the hardware of this instrument could be out of order. Refer to the chapter on diagnosis.

4.2 How to check the liquid flow direction

Make sure that the instrument works properly

Check the flow rate for the indication. If the displayed value is POSITIVE, the direction of the flow will be from the RED transducer to the BLUE transducer; if the displayed value is NEGATIVE, the direction will be from the BLUE transducer to the RED transducer.

4.3 How to select unit system

Use menu window M30 for the selection of unit system in English or Metric system.

4.4 How to select a required flow rate unit

Use menu window M31 to select the flow unit first and then the timing unit.

4.5 How to use the totalizer multiplier

Use window M33 to select a proper totalizer. Make sure that the totalizer pulse is appropriately speeded. It should not be too fast and neither too slow. A speed of producing a pulse in several seconds or minutes is preferable.

If the totalizer multiplier is too small, there can be a loss of accumulation pulse because the output device can output only one pulse in a measurement period (500milliseconds)

If the totalizer multiplier is too large, the output pulse will be too fewer for the devices that are connected with the instrument for a quicker response.

4.6 How to enable or disable the totalizers

Use M34, M35 and M36 to turn on or turn off the POS, NEG, or NET totalizer respectively.

4.7 How to reset the totalizers

Use M37 to reset the proper totalizer.

4.8 How to restore the flow meter with default value setup by the producer

Use M37, when the 'selection' message is displayed. Press the dot key first and the message 'Master Erase' will display, then press the backspace key

The master erase step will erase all the parameters entered by the user and setup the instrument with default values.

4.9 How to use the damper

The damper acts as a filter for a stable reading. If '0' is entered in window M40, that means there is no damping. A bigger number brings a more stable effect. But bigger damper numbers will prevent the instrument from acting quickly. Numbers from 0 to 10 are commonly used for the damper value.

4.10 How to use the zero-cutoff function

The number displayed in window M41 is called the low-cutoff value. The flow meter will replace these flow rate values that are absolutely less than the low-cutoff value with '0'. This means the flow meter will avoid any invalid accumulation when the actual flow is below the zero-cutoff value.

The low-cutoff value does not affect the flow measurement when the actual flow is absolutely greater than the low-cutoff value.

4.11 How to setup a zero point

There exists a 'Zero Point' with certain installation which means the flow meter will display a non-zero value when the flow is absolutely stopped. In this case, setting a zero point with the function in window M42 will bring a more accurate measurement result.

Make sure that the flow is absolutely stopped, then run the function in window M42 by pressing the ENT key.

4.12 How to get a range factor for calibration

A range factor is the ratio between the 'actual flow rate' and the value indicated by the flow meter. The range factor can be determined by calibration with flow calibration equipment.

4.13 How to use the operation locker

The system locker in window M47 provides a means of preventing accidental configuration changes or totalizer resets. When the system is locked, menu window browsing can be done without affecting any change, but any modifications are prohibited.

The system can be locked without a password or with a one 1 to 4 digit password. With a no-password locking, directly press the ENT key when the password input prompt displays.

If the password is forgotten, please contact the factory.

4.14 How to use the built-in data logger

The data logger has a space of 24K bytes of memory, which will hold about 2000 lines of data.

Use M50 to turn on the logger and for the selection for the items that is going to be logged.

Use M51 for the times when the logging begins and at how long an interval sustains and how long the data logging will last.

Use M52 for the direction of logging data. The default setting will permit the logging data to be stored in the logger buffer.

Logging data can be redirected to the RS-232C interface without being stored into the logger buffer.

Use M53 to view the data in the logger buffer.

Dumping the logging data through the RS-232C interface and the clearing of the buffer can be operated with a function in window M52.

4.15 How to use the Frequency Output

The frequency output signal, which represents the flow rate, is intended to make connection with other instruments.

The Frequency Output is totally user-configurable. Generally, four parameters should be configured for the setups.

Enter the lower flow rate value in window M68 and the higher flow rate value in window M69.

Enter the frequency range in window M67.

For example, assume that the flow rate varies in a range 0m³/h to 3000m³/h, and an output signal is at a maximum frequency of 1000Hz, the minimum of 200Hz is going to be required for other instrumentation. The user should enter 0 in M68 and 3000 in M69, and enter 200 and 1000 in window M67.

Please note that the user has to make the selection with OCT setups in window M78 by selecting the 13th option reading like 'FO output' to direct the frequency output to the OCT OUTPUT hardware device.

4.16 How to use the Totalizer Pulse Output

The totalizer output will produce a pulse output with every unit flow of the totalizer.

Refer to point 4.4 and 4.5 for the setups of the totalizer units and multiplier.

The totalizer pulse output can only be realized by mapping the pulse output to the OCT or BUZZER hardware devices.

For example, assume that the POS totalizer pulse output is needed, and every pulse should represent 0.1 cubic meter of liquid flow; the pulse output will be mapped to the internal Buzzer, so that with every 0.1 cubic meter of flow the BUZZER will beep for a while.

The following setups should be taken/performed:

Select the unit Cubic Meter under window M32.

Select the Multiplier as '2. X0.1' under window M33.

Select the output option '9. POS INT Pulse' under window M77. (INT stands for totalized)

4.17 How to produce an alarm signal

There are 2 types of hardware alarm signals that are available with this instrument. One is acoustic (Buzzer) and the other is the attivation of an Open Collector output (OCT). For both the Buzzer and OCT output the triggering sources of the event include the following:

- (1) no receiving signal
- (2) poor signal received
- (3) flow meter not in normal measurement mode
- (4) reverse flow
- (5) overflow of the Frequency Output
- (6) flow out of the setted range

There are two out-of-normal-range alarms in this instrument. They are called #1 Alarm and #2 Alarm. The flow range can be user-configurable through M73, M74, M75, M76.

For example, assume that the Buzzer should start beeping when the flow rate is less than 300 m³/h and greater than 2000m³/h, the following steps for setups would be recommended:

- (1) enter 300 under M73 for #1 alarm low flow rate
- (2) enter 2000 under M74 for #1 alarm high flow rate
- (3) select the item '6. Alarm #1' under M77.

4.18 How to use the acoustic alarm (Buzzer)

The built-in buzzer is user-configurable. It can be used as an alarm. Use M77 for setups.

4.19 How to use the OCT output (Open Collector)

The OCT output is user-configurable, which can be performed by selecting the proper input source such as pulse output. Use M78 for the setups. Please make sure that the Frequency Output shares the OCT.

The OCT output shares pins with the RS-232C interface, and the terminal is at Pin 6 and the ground (GND) is at Pin 6.

4.20 How to modify the built-in calendar

Modification will be required only in such cases as when the battery is totally consumed, or when the changing of the battery takes a long time.

Press the ENT key under M61 for Modification. Use the dot key to skip over these digits that need no modification.

4.21 How to adjust the LCD contrast

Use M70 to the LCD contrast. The adjusted result will be stored in the EEPROM so that the MASTER ERASE will make no effect on the contrast.

4.22 How to use the RS232 serial interface

Use M62 for the setup of the RS-232C serial interface.

4.23 How to view the Date Totalizers

Use M82 to view the date totalizers that are comprised of a daily totalizer, a monthly totalizer and a yearly totalizer.

4.24 How to use the Working Timer

Use this function to check the duration of a certain operation. For example, use it as a timer to show how long a fully charged battery will last.

In menu M72, press **ENT** and select YES to reset the timer.

4.25 How to use the manula totalizer

Use M28, pressing **ENT** to start and to stop it.

4.26 How to check the ESN and other minor details

Every set of the series flow meter utilizes a unique ESN to identify the meter. The ESN is an 8-digit number that provides the information of version and manufacturing date. The user can also employ the ESN for instrumentation management. The ESN is displayed in window M61.

Other details about the instrument are the total working hours displayed in window M+1, and the total power-on times displayed in window M+4.

4.27 How to check how long the battery will last

Use menu M07.

4.28 How to charge the built-in battery

Refer to paragraph 2.

5 Menu structure



5.1 Menu windows







WARNING!!!! On the menu window from M00 to M09 the display will not show the menu number on the top left corner!

- M00 Displays the positive, negative and net totalizers, signal strength, signal quality and working status
- M01 Displays POS totalizer, flow rate , velocity signal strength, signal quality and working status
- M02 Displays NEG totalizer, flow rate , velocity signal strength, signal quality and working status
- M03 Displays NET totalizer, flow rate , velocity signal strength, signal quality and working status
- M04 Displays date and time, flow rate, signal strength, signal quality and working status
- M05 Displays date and time, velocity, signal strength, signal quality and working status
- M06 Displays the wave shape of the receiving signal
- M07 Displays the battery terminal voltage and its estimated lasting time
- M08 Displays all the detailed working status, signal strength and signal quality
- M09 Displays total daily flow, velocity, signal strength and signal quality

- M10 For entering external pipe perimeter
- M11 For entering external pipe diameter (from 0 to 6000mm)
- M12 For entering pipe wall thickness
- M13 For entering pipe internal diameter
- M14 Pipe material selection. Standard material (no sound speed needed) are:
(0) carbon steel (1) stainless steel (2) cast iron (3) ductile iron (4) copper
(5) PVC (6) aluminum (7) asbestos (8) fiberglass (9) other
- M15 For entering the sound speed value of the pipe material (non standard materials)
- M16 Lining material selection (select " none" for pipes without lining). Standard materials (no sound speed needed) are: (1) Tar Epoxy (2) Rubber (3) Mortar (4) Polypropylene (5) Polystyrol
(6) Polystyrene (7) Polyester (8) Polyethylene (9) Ebonite (10) Teflon (11) other
- M17 For entering the sound speed value of the lining material (non standard material)
- M18 For entering lining thickness (if any lining present)
- M19 For entering the pipe internal wall ABS thickness

SGM-100H - Menu structure

- M20 Liquid type selection. Standard liquids are:(0) Water (1) Sea Water (2) Kerosene (3) Gasoline (4) Fuel oil (5) Crude Oil (6) Propane at -45C (7) Butane at 0C (8)Other liquids (9) Diesel Oil (10)Caster Oil (11)Peanut Oil (12) #90 Gasoline (13) #93 Gasoline (14) Alcohol (15) Hot water at 125C
- M21 For entering the sound speed value of the liquid (non standard liquids)
- M22 For entering the viscosity of the liquid (non standard liquids)
- M23 Transducers selection
- M24 Transducers mounting method selection: (0) V-method (1) Z-method (2) N-method (3) W-method
- M25 Displays the transducers mounting spacing
- M26 Entry to store the parameter configuration (NVRA)
- M27 Entry to load one set of saved parameters
- M28 Save last correct values in case of poor signal conditions (select YES or NO - YES is the default setup)
- M29 Not used
- M30 Unit system selection. Default value is "Metric". The change to/from English will not affect the totalizers.
- M31 Unit of measurement selection. The flow rate can be expressed in: 0. Cubic meter (m3) 1. Liter (lt) 2. USA gallon (gal) 3. Imperial Gallon (igl) 4. Million USA gallon (mg) 5. Cubic feet (cf) 6. USA liquid barrel (bal) 7. Imperial liquid barrel(ib) 8. Oil barr (ob)
The flow unit in terms of time can be per day, per hour, per minute or second. So there are 36 different flow rate units in total for selection.
- M32 Totalizer working unit selection
- M33 Totalizer multiplier selection (from 0.001 to 10000)
- M34 Enable/disable the differential flow totalizer (NET)
- M35 Enable/disable the direct flow
- M36 Enable/disable the reverse flow totalizer (NEG)
- M37 (1) Totalizer reset (2) Restore default parameter setted by the producer (press  and after the message Maste Erase is displayed, press ).
- M38 Start/stop the totalizer for calibration
- M39 Language selection
- M40 Damper setting. Input range from 0 to 999s (default value = 10s)

- M41 Low cut-off value setup
- M42 Zero point setup (flow stopped)
- M43 Clears the zero point set by the user and restore the one set by the producer
- M44 Flow "0" setup. Generally this value should be 0.
- M45 Scale factor. Default value is '1'
- M46 Network Identification Number
- M47 System locker
- M48 Not used
- M49 Communication tester
- M50 Option selection for the built-in logger.
- M51 Time setup for data logger
- M52 Data logging output setup: to RS232 - to buffer - to buffer and buffer clearing
- M53 Logger buffer display. It works as a file editor. Use     to browse the buffer. If the logger is on, the display will automatically refresh once new data are stored.
- M54 Not used
- M55 Not used
- M56 Not used
- M57 Not used
- M58 Not used
- M59 Not used
- M60 Calendar. Press  to modify and use  to skip the digit that need no adjusting
- M61 Displays version information and Electronic Serial Number (Electronic Serial Number)
- M62 RS232 setup. Baud rate can be from 75 to 115200 bps.
- M63 Not used
- M64 Not used
- M65 Not used

M66	Not used
M67	Input the frequency range for the frequency output. The highest range is 0Hz-9999Hz. Default value is 1-1001 Hz
M68	Enter a flow rate value that corresponds to lower frequency
M69	Enter a flow rate value that corresponds to higher frequency
M70	LCD display backlight control. The entered value indicates how many seconds the backlight will be on with every key pressing.
M71	LCD contrast control
M72	Working timer. It can be cleared by pressing <input type="button" value="F1"/> and then selecting YES.
M73	Enter lower flow rate value that will trigger the #1 alarm.
M74	Enter higher flow rate value that will trigger the #1 alarm
M75	Enter lower flow rate value that will trigger the #2 alarm.
M76	Enter higher flow rate value that will trigger the #2 alarm
M77	Buzzer setup
M78	OCT (Open Collector Transistor Output) setup.
M79	Not used
M80	Not used
M81	Not used
M82	Totalizer date
M83	Not used
M84	Not used
M85	Not used
M86	Auto CTRL Enable
M87	Power selection
M88	RCV window start
M89	RCV window end

- M90 Displays signal strength, signal quality and time ratio on the upper right corner
- M91 Displays the Time Ratio between the measured total transit time and the calculated time. If the pipe parameters are entered correctly and the transducers are installed properly, the value should be in the range of 100 ± 3 %
- M92 Displays the estimated fluid sound speed.
- M93 Displays total transit time and delta time
- M94 Displays the Reynolds number and the pipe factor used by the flow rate program.
- M95 Not used
- M96 Not used
- M97 Not used
- M98 Not used
- M99 Not used

- M+0 Displays the 64 recorded instrument power-on and power-off date and time with and the relevant flow rate
- M+1 Displays the working time of the instrument
- M+2 Display the last power-off date and time
- M+3 Displays the last power-off flow rate
- M+4 Displays the total switch-on times
- M+5 Scientific calculator
- M+6 Velocity Change
- M+7 Protocol select
- M+8 Displays the wave shape of the receiving signal
- M+9 Not used
- M-0 Hardware adjusting window (only for the producer)

6 Troubleshooting

6.1 Circuit hardware error and solutions

The **SGM-100H** has a self-diagnosis system which detects hardware problems. The instrument will show “*F” in the top left corner of the display and it will be necessary to power on again the SGM-100H in order to see the error message and the solution:

Error message	Cause	Solutions
ROM Testing Error Segment Test Error	Software problems	1) Power on again 2) Contact the producer
Stored data error	The parameters entered by the user lost intergration	Press ENT to restore the default configuration
Time slow error Timer fast error	Problems with the time keeper or with the crystal oscillator	1) Power on again 2) Contact the producer
Date time error	Numerci error in the calendar	Initialize the calendar in menu M61
Reboot repetytively	Hardware problems	Contact the producer

6.2 Operating error codes and solutions

When the instrument detects an operating error, a letter will appear on the top left corner of the dispaly. In menu window M08 can be displayed the error message. Refer to the following table for the solution:

Error code	Message displayed on M08	Cause	Solutions
R	System Normal	No error	
I	Detected No Signal	1) No signal detected 2) Transducers installed improperly 3) Too much fouling 4) Pipe liner too thick 5) Transducers cable connected improperly	1) Change measuring location 2) Clean the pipe surface 3) Check the cables 4) Check the transducers
J	Hardware Error	Hardware problems	Contact the producer
H	PoorSig Detected	1) Poor signal detected 2) Transducers installed improperly 3) Too much fouling 4) Pipe liner too thick 5) Transducers cable connected improperly	1) Change measuring location 2) Clean the pipe surface 3) Check the cables 4) Check the transducers
Q	Frequ OutputOver	The output frequency is out of the range set by the user	Check the values entered in M66,M67,M68 and M69 and try to enter an higher value on M69
F	System RAM error Date time error CPU or IRQ error ROM parity error	1) Temporary problems with RAM, RTC 2) Permanent hardware problems	1) Power on again 2) Contact the producer
1 2 3	Adjusting gain	The instrument is running the automatic chek-up. The numbers indicate the progressive steps	
K	Empty pipe	1) No liquid inside the pipe 2) Setup error on M29	1) Relocate the transducers where the pipe is full of liquid 2) Enter 0 on M29

6.3 Other problems and solutions

- 1) The actual flow inside the pipe is not standstill, but the instrument displays 0.0000 for the flow rate, and 'R' displaying signal strength and the signal quality Q (value) has a satisfactory value.
The problem are likely caused by the user who has used the 'Set Zero' function on this non-standstill flowing pipe. To solve this problem, use the 'Reset Zero' function on menu window M43.
- 2) The displayed flow rate is much lower or much higher than the actual flow rate in the pipe under normal working conditions.
 - a) There is probably an offset value wrongly entered by the user in M44. Enter '0' in M44.
 - b) Check the transducers installation
 - c) There is a 'Zero Point' setted. Try to 'zero' the instrument by using M42 and make sure that the flow inside the pipe should be standstill.
- 3) The battery cannot work as long as the the time period indicated in menu M07.
 - a) The battery should be replaced due to the end of the service life
 - b) Newly changed battery does not fit the battery estimating software
 - c) The battery has not been fully recharged or the recharge has been stopped too many times
 - d) The remaining volatge is in the range of 3.70 and 3,90V

7 Communication protocol

7.1 General

The **SGM-100H** has a standard communication interface and a complete set of communication protocol.

7.2 Interface pin-out definition

Pin	1	for battery recharge, positive input
	2	RXD
	3	TXD
	4	not used
	5	GND
	6	OCT output
	7	not used
	8	for battery recharge, negative input
	9	RING input for MODEM connection

7.3 The Protocol

The Protocol isa composed by a set of basic commands (string in ASCII format) ending with a carriage return (CR) and line feed (LF). Commonly used commands are listed below:

Command	Function	Data Format
DQD(CR)	Return flow rate per day	±d.dddddddE±dd(CR) LF *
DQH(CR)	Return flow rate per hour	±d.dddddddE±dd(CR) LF
DQM(CR)	Return flow rate per minute	±d.dddddddE±dd(CR) LF
DQS(CR)	Return flow rate per second	±d.dddddddE±dd(CR) LF
DV(CR)	Return flow velocity	±d.dddddddE±dd(CR) LF
DI+(CR)	Return POS totalizer	±dddddddE±d(CR) LF **
DI-(CR)	Return NEG totalizer	±dddddddE±d(CR) LF
DIN(CR)	Return NET totalizer	±dddddddE±d(CR) LF
DID(CR)	Return Identification Number	dddd(CR) LF
DL(CR)	Return signal strength and quality	S=ddd,ddd Q=dd (CR)(LF)
DT(CR)	Return date and time	yy-mm-dd hh:mm:ss(CR)(LF)
M@(CR)***	Send a key value as if a key is pressed	
LCD(CR)	Return the current window display	
FOddd(CR)	Force the FO output with a frequency in dddd Hz	
ESN(CR)	Return the ESN for the instrument	Dddddddd(CR)(LF)
RING(CR)	Handshaking Request by a MODEM	
OK(CR)	Response from a MODEM	No action
GA	Command for GSM messaging	Please contact factory for detail
GB	Command for GSM messaging	
GC	Command for GSM messaging	
DUMP(CR)	Return the buffer content	In ASCII string format
DUMP0(CR)	Clear the whole buffer	In ASCII string format
DUMP1(CR)	Return the whole buffer content	In ASCII string Format, 24KB in length
W	Prefix before an Identification Number in a network environment. The IDN is a word, ranging 0-65534.	
N	Prefix before an Identification Number in a network environment. The IDN is a single byte value, ranging 00-255.	
P	Prefix before any command	
&	Command connector to make a longer command by combining up to 6 commands	

- Notes**
- * CR = Carriage Return e LF= Line Feed.
 - ** 'd' = numeric digit 0-9
 - *** @ stands for the key value, e.g., 30H for the '0' key.

7.4 Protocol prefix utilisation

1) Prefix P

The prefix P can be added before any command in the above table to have the returning data followed with two bytes of CRC check sum, which is the adding sum of the original character string.

Take the DI+(CR) command as an example. Assume that DI+(CR) would return +1234567E+0m3(CR)(LF)(the string in hexadecimal is 2BH, 31H, 32H, 33H, 34H, 35H, 36H, 37H, 45H, 2BH, 30H, 6DH, 33H, 20H, 0DH, 0AH) , then PDI(CR) would return +1234567E+0m3!F7(CR)(LF). '!' acts as the starter of check sum which is yielded by adding up the string 2BH, 31H, 32H, 33H, 34H, 35H, 36H, 37H, 45H, 2BH, 30H, 6DH, 33H, 20H.

Please note that there will be SPACES (20H) before '!'.

2) Prefix W

The prefix W should be used in the network environment. The usage format is W + digit string which stands for the IDN + basic command.

The digit string should have a value between 0 and 65534 except 13(0DH), 10 (0AH), 42(2AH,*), 38(26H, &).

For example, if the IDN=12345 instrument is addressed and returning the velocity of that instrument is requested, the command will be W12345DV(CR).

3) Prefix N

The prefix N is a single byte IDN network prefix, not recommended in a new design. It is reserved only for the purpose of the compatibility with the former versions

Command Connector &







The & command connector can connect up to 6 basic commands to form a longer command so that it will make the programming much easier.

For example, assume that the measurement of an instrument with IDN=4321 are going to be returned, and (then) all the following 3 values— (1) flow rate (2) velocity (3)POS totalizer—will be returned simultaneously. The combined command would be W4321DQD&DV&DI+(CR), and the result would be:

```
+1.234567E+12m3/d(CR)
+3.1235926E+00m/s(CR)
+1234567E+0m3(CR)
```

7.5 Codes for keypad

The codes for the keypad should be used when the instrument is connected with other terminals that operate the instrument by transmitting the 'M' command along with the keypad code. By this function, remote operation of this instrument can be realized, even via the Internet.

Key	Hexadecimal key code	Decimal key code	ASCII code	Key	Hexadecimal key code	Decimal key code	ASCII code
0	30H	48	0	8	38H	56	8
1	31H	49	1	9	39H	57	9
2	32H	50	2		3AH	58	:
3	33H	51	3		3BH,0BH	59	;
4	34H	52	4		3CH,0CH	60	<
5	35H	53	5		3DH,0DH	61	=
6	36H	54	6		3EH	62	>
7	37H	55	7		3FH	63	?

SGM-100H - Warranty

Products supplied by GESINT SRL are guaranteed for a period of 12 (twelve) months from delivery date according to the conditions specified in our sale conditions document. GESINT SRL can choose to repair or replace the Product. If the Product is repaired it will maintain the original term of guarantee, whereas if the Product is replaced it will have 12 (twelve) months of guarantee. The warranty will be null if the Client modifies, repairs or uses the Products for other purposes than the normal conditions foreseen by instructions or Contract. In no circumstances shall GESINT SRL be liable for direct, indirect or consequential or other loss or damage whether caused by negligence on the part of the company or its employees or otherwise howsoever arising out of defective goods.

SGM-100H - Factory Test Certificate

In conformity to the company and check procedure I certify that the equipment:

SGM-100H..... part nb.

is conform to the technical requirements on Technical Data and it is made in conformity to the procedure

Quality Control Manager:

Production and check date:



GESINT.

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