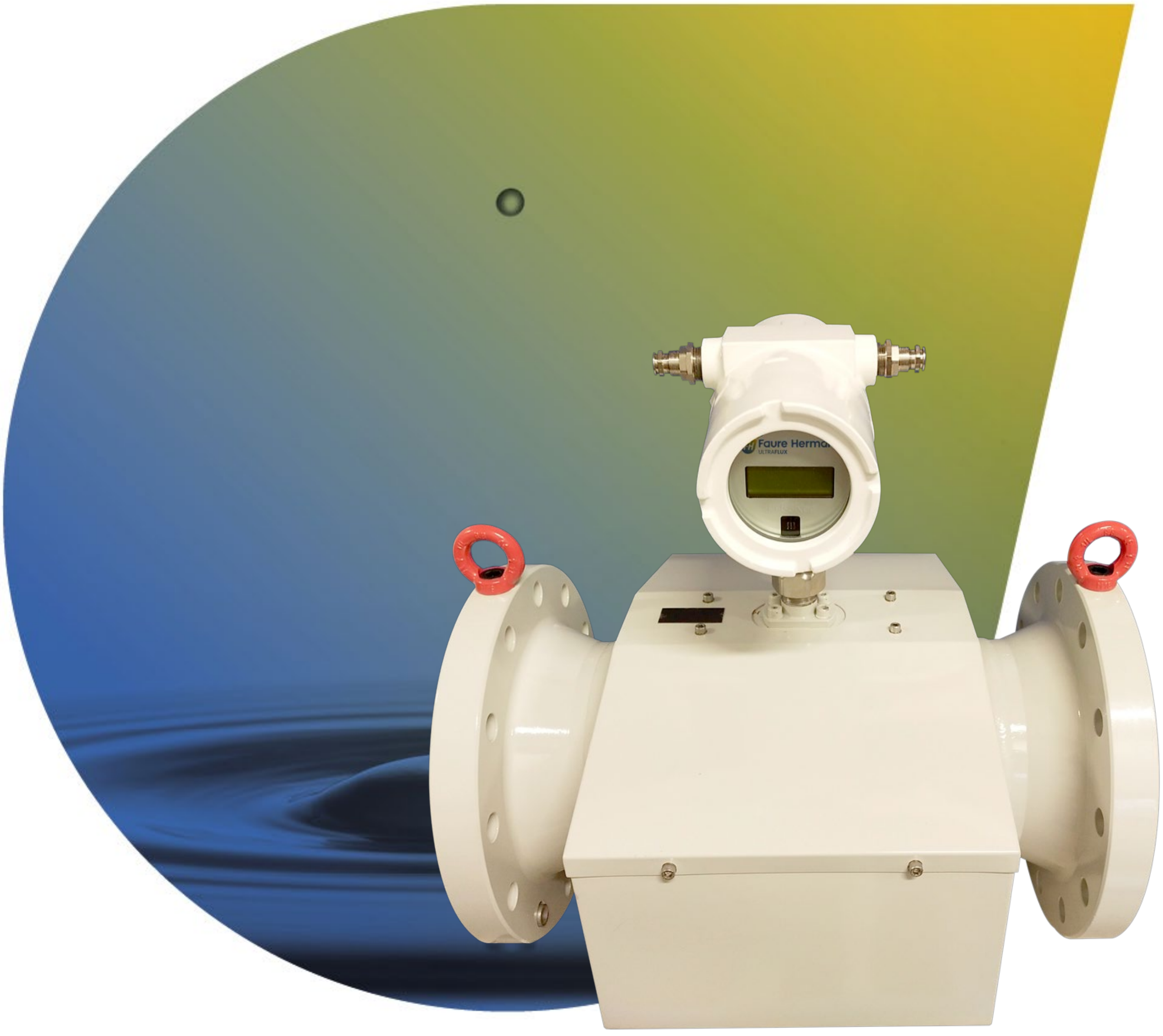


FH83 Neo

User's Manual

Contents

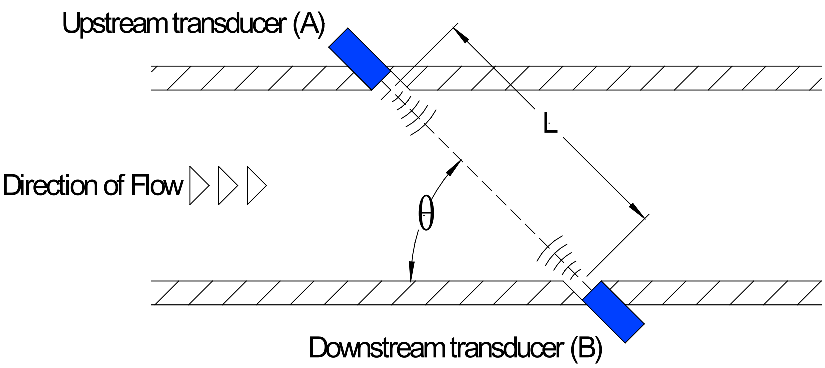
Chapter 1: General overview

The FH83Neo is a 3 paths Ultrasonic flowmeter developed to meet oil and petrochemical markets needs and requirements. The FH83Neo Ultrasonic flowmeters are suitable for use in hazardous area thanks to explosion proof certification in accordance with ATEX and IECEx standards (II 2 G - compatible with installation in zone 1).
By using the most innovative ultrasonic technology the FH83Neo product line successfully covers a wide range of applications and flow conditions including laminar, turbulent, asymmetric flow velocity profiles and swirls.
The FH83Neo Ultrasonic flowmeter is designed for process applications of liquids, crude or refined hydrocarbons, whose viscosity is lower than 180 cSt, including LPG.
The integration of all components into a single compact and integrated metering solution allows for an especially comfortable installation and commissioning.
The FH83Neo does not generate any pressure drop. Its integrity is preserved even after being disturbed by gas pockets, solid bodies, spheres or scrapers.
Calibrated individually in our facilities, the FH83Neo generates accurate measurements. FH83Neo installation and commissioning does not require specialist's intervention.

Remark:
The FH83Neo is delivered with an individual calibration certificate.

Measuring principle

The velocity of flow along the path between two paired transducers is determined by the method called "Transit Time" method based on the expression below:



$$V = \frac{L}{2.\cos\theta}\frac{\Delta T}{T_{AB}.T_{BA}}$$

where $\Delta T = T_{BA} - T_{AB}$

TAB: transit time of the ultrasonic wave from the upstream transducer to the downstream one
TBA: transit time of the ultrasonic wave from the downstream transducer to the upstream one.

Remark:
The expression above is independent of the velocity of sound inside the product flowing in the pipe.
This velocity can be computed by the meter by using the following expression: $c = \frac{L}{2}\left(\frac{1}{T_{AB}} + \frac{1}{T_{BA}}\right)$

Size and Flowrate

FAURE HERMAN offers 11 standard FH83Neo flowmeter sizes, from 3" (DN80) to 24" (DN600).
Other sizes can be studied upon request.
Refer to Appendix I the dimensions and weight of each of these meters.
As a standard, the FH83Neo body is made of either carbon steel or stainless steel. Other material can be provided as an option.

The FH83Neo bodies cover the following sizes and pressure ratings:

- Diameters: DN80 to DN600 (3" to 24”) (others upon request)
- Flanges: ANSI #150, 300, 600 or 900

Size		Min linear flow (V = 0.5 m/s)		Max nominal flow (V = 10 m/s)		Max design flow (V = 13 m/s)		Typical Kfactor	
“	mm	m³/h	BPH	m³/h	BPH	m³/h	BPH	p/m³	p/Bbl
3	80	7,75	48.5	155	975	200	1,250	64 000	10,000
4	100	13.5	85	270	1,000	350	2,200	32 000	5,000
6	150	30	190	610	3,800	790	4,500	16 000	2,500
8	200	55	345	1 100	6,900	1 400	8,800	8 000	1,300
10	250	87	545	1 750	11,000	2 250	14,150	6 000	1,000
12	300	127	800	2 550	16,000	3 300	20,750	4 000	650
14	350	155	975	3 100	19,500	4 000	25,150	3 000	480
16	400	205	1,290	4 100	25,800	5 350	33,650	2 200	350
18	450	265	1,665	5 250	33,000	6 850	43,100	1 600	250
20	500	330	2,075	6 600	41,500	8 550	54,000	1 400	220
24	600	485	3,050	9 650	61,000	12 550	79,000	1 000	160

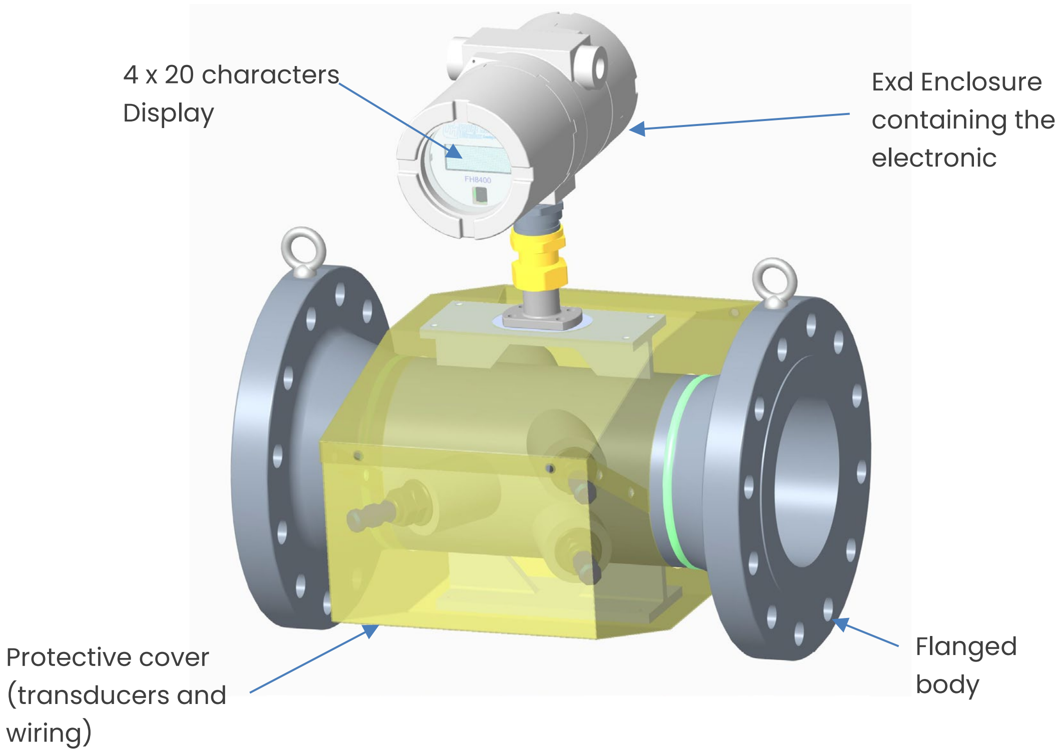
Other configurations

The FH83Neo is also available in 1 and 2 paths versions.

Constitutive parts

The FH83Neo Ultrasonic flowmeter provides a compact and integrated metering solution, consisting of:

- Flanged body in either carbon steel, stainless steel, or other optional materials,
- Up to 6 ultrasonic transducers interchangeable under service conditions,
- Explosion proof flow converter/Totalizer.



Under standard conditions, the FH83Neo is delivered with:

- Individual calibration certificate.
- ATEX certificates and its elements.
- User's manual.

FH83Neo inputs-outputs

The FH83Neo Ultrasonic flowmeter integrates the following I/O ports:

- 1 or 2 selectable 4-20mA analogue outputs are available for either flowrate, VOS, VOF or volume reading.
- 2 x logic outputs
- 2 x 4-20mA analogue inputs
- 2 x pulses outputs
- 1 x Serial port (RS485)

Data and Event loggers

The FH83Neo includes two loggers: Data and Event l.
The Data logger records values in a non-volatile memory (756 available records), with a storage period which can be chosen from 1 s to 24 h, such as the metering mode, flowrate, and flow velocity (refer to complete list of stored data).

Remark:
The total recording duration depends on the selected period. The table below gives the recording duration for several period values.

Recording period	Total available recording duration (approx..)
1 s	12 min
10 s	2 h 06 min
1 min	12 h
10 min	5 days 6 h
1 h	31 days 12 h
24 h	2 years 36 days

The event logger records in a non-volatile memory (756 available records) some events such as the FH83Neo power on or off, change of state of alarms, changeover from a metering mode to another (see page 45 for complete list of recorded events).

Both Data and Event loggers can be read by means of either FHview software or any DCS (Distributed Control System) linked to the FH83Neo.
Reset of both loggers can be individually exercised by means of the remote-control device, the FHview software or through the DSC.

Remark:
Both loggers operate according to the cyclic memory principle: when all available records are used, the most recent records erase the oldest ones.

Maximum line pressure

The FH83Neo is designed for a maximum fluid pressure of 150 bar (1,450 psi), equivalent to #900.
FH83Neo complies with Pressure Equipment Directive 2014/68/EU.

Pressure drop

The FH83Neo is a full-bore flowmeter which does not generate more pressure drop than an equivalent length of pipe.

Power supply

The FH83Neo can be powered by a 18 - 36 Vdc power supply 300mA min - Consumption: 8 W, or with a 110-230V power supply.

Protection for hazardous area

The FH83Neo Ultrasonic flowmeter can be used in hazardous areas:

- Protection of electronic boards in explosion proof enclosure FHB100: Ex db IIB T6 Gb
- Protection of ultrasonic transducers in explosion proof housing FHP100: Ex db IIB T6 to T4 Gb

Max Fluid Temperature (°C)	80	95	100
Temperature Class	T6	T5	T4

- Protection of the remote control: Ex ib IIB T4 Gb (intrinsic safety)

Protection of power supply and the instrumentation cables (customers' scope): the protection must be made accordingly to the local standards and rules. In particular, the cables must correspond to one of the following standards: IEC 60092-300 series / NEK600, BS 6883 / 7197, NF M 87-202.
Make sure that any personnel who works on the transducer housings or the electronic enclosure is correctly trained and qualified following EN and IEC 60079-14, and that the local regulations in force will be strictly followed.

Remark:
The FH83Neo is delivered with ATEX certificates and corresponding elements.

Other characteristics

- Repeatability: according to OIML R117-1 or API MPMS 4.8 or customer specifications
- Ambient temperature: from -40 to +60 °C (-40 to +140 °F)
- For high ambient temperatures, the electronic enclosure must be protected from direct sun rays.
- Fluid temperature: from -40 to +100 °C (-40 to +212 °F)
- Fluid kinematic viscosity: from 0.6 to 60 cSt (up to 180 cSt for large sizes)
- Fluid density: from 400 to 1 500 kg/m3
- Ingress Protection: IP66 / NEMA 4X
- Available flanges: #150 (ISO PN 20), #300 (ISO PN 50), #600 (ISO PN 100), #900 (ISO PN 150)

- EMC according to directive 2014/30/UE requirements following NF EN 61326-1 (05/2013): EN 61000-4-2 to 4-6, EN 61000-4-11 Immunity, EN 55011 Emissions standards.
- The apparatus emission level complies with limits Class A for conducted emission and with limits Class B for radiated emission with DC power supply.

- FH83Neo, respects "Low Voltage" directive 2014/35/UE directive requirements following IEC 61010-1 (2017) / Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: General requirements.

- Back-up battery allowing data and parameters storage during at least 10 years
- Material used for the meter body: stainless steel or carbon steel (Other materials may be available upon request)
- Material used for electronic enclosure: Copper-free Cast aluminum (Stainless steel may be available upon request)

Chapter 2: Commissioning

Reception and storage

Check the general appearance of the packing and FH83Neo in order to identify possible damages inflicted during transportation.

Remove the equipment inside its packaging and check its general condition and the presence of this manual and the calibration certificate.

- Before installing the equipment, it is recommended to keep it in its initial packing.
- Flanges of the FH83Neo equipped with protection covers which must be removed only for its installation on the pipe.
- Store the FH83Neo in a dry and clean place. The storage temperature should be between -40 and +60 °C (-40 and +140 °F)
- In case of extended storage (typically more than one year), we recommend to re-calibrate the meter prior to the installation.

If the equipment is damaged and/or the documentation is not complete, contact the Support Department immediately, by phone or via our website:

Customer support	
Hotline:	+33 (0)2 43 60 28 55 +1 713 623 0808 (USA)
Email:	services@faureherman.com
Website:	https://faureherman.com/

FH83Neo handling

Like any measurement device, the FH83Neo must be handled with the greatest care.

The handling must be done as follows:

- With lifting rings fitted on the FH83Neo, for equipment with a weight > 35 kilos
- With straps on both sides of the flowmeter body when there are no lifting rings

FH83Neo position on metering line

FH83Neo Ultrasonic flowmeters can be installed horizontally, or vertically if the flow is upward. In all cases, the primary direction of flow shown on the nameplate must be observed.
FAURE HERMAN recommends an upstream straight length of 10 to 30 times the pipe diameter (10 to 30D) depending on upstream flow disturbances. A flow conditioner may be used upstream to reduce the impact of these disturbances.
The downstream recommended minimum straight length is 3D.
Please, contact FAURE HERMAN so as to determine the most suitable flow conditioner to be used with regard to your application.

Preparation for installation

Before integrating the meter into the measuring line, check the following points:

- No significant deposits or pollution in the upstream pipe section.
- Respect of primary flow direction (plate).
- Matching of flange dimensions and joint faces, between upstream/downstream piping and equipment.
- Alignment of the meter with upstream/downstream pipes and absence of obstacles to the flow
- Orientation of electrical I/O.

⚠ **Like all measuring instruments, FH83Neo must be handled with care**

Properties of the measured fluid

Reliability of measurements can be seriously impacted by the presence of gas and/or solid particles in the measured liquid.

Presence of gas, in the form of bubbles, emulsion or pocket can results in a significant degradation of performance. It is therefore recommended to ensure that there is no risk of gas injection/generation upstream of the measurement and to install a purge or degassing system upstream of the meter if necessary. For an installation in elevation, it is strongly recommended not to position the meter in a "high" area where a gas pocket could form due to gravity and/or volume contraction during a stop.

Installing the FH83Neo

- Check that meter and pipe are correctly aligned.
- Before installing the meter on the pipe, carefully check the cleanliness of flanges in order to obtain an absolute tightness between meter and pipes.
- Check that the meter positioning does not cause any traction effort on flanges and cables.

Cabling the FH83Neo:

Please follow FHB100 Instructions Manual TEC 21.03.05

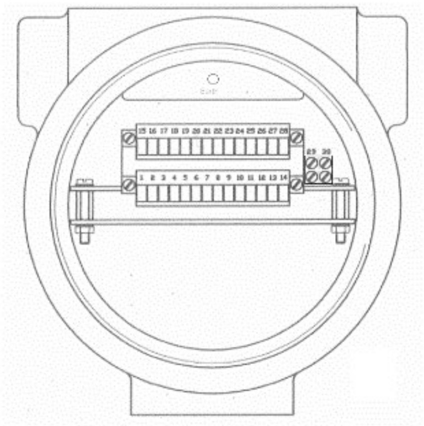
FH83Neo User Terminals

FH83Neo USER TERMINALS

N	L	PE	
Neutral	Phase	Earth	
110-230 VAC			FH83Neo can be powered either with 110-230 VAC or 18-36 VDC

TOP LINE													
15	16	17	18	19	20	21	22	23	24	25	26	27	28
T+	T-	P+	P-	Earth	TOR in	TOR in	Earth	Out 1	Out 1	Out 2	Out 2	Earth	NC
4-20 mA Inputs					Logic Inputs			4-20 mA Outputs					

BOTTOM LINE													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
+	-	Earth	P 1	P 2	0 V	Earth	485+	485-	Earth	Out 1	Out 1	Out 2	Out 2
18-36 VDC			Pulses Outputs				RS485			Logic Outputs			

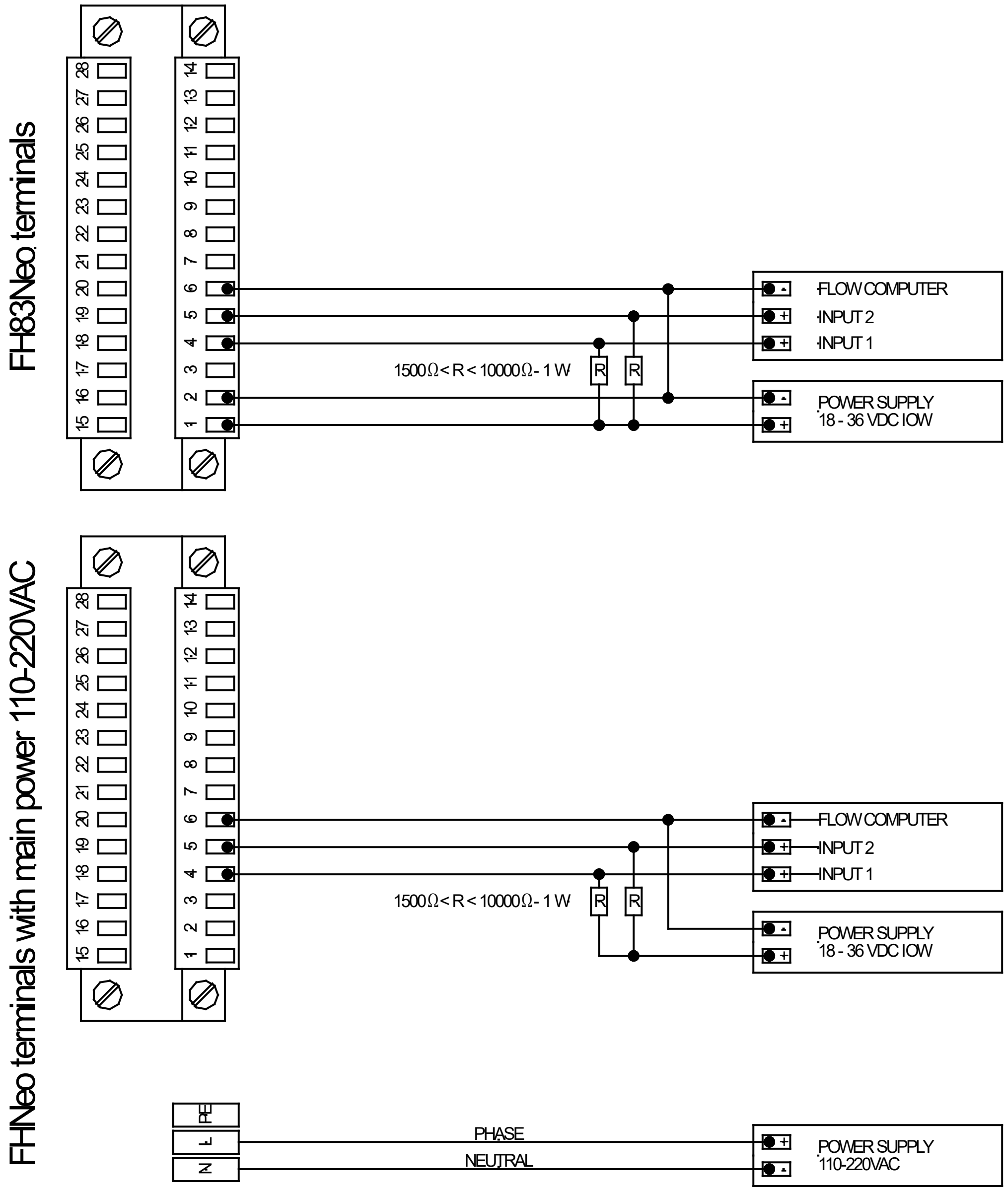


1	18-36 VDC power (+)	15	T+ 4/20mA input
2	18-36 VDC power (-)	16	T- 4/20mA input
3	Earth power (for VDC or VAC)	17	P+ 4/20mA input
4	P1+ pulse output	18	P- 4/20mA input
5	P2+ pulse output	19	Earth 4/20mA inputs
6	0V pulse outputs	20	TOR In logic input
7	Earth pulse outputs	21	TOR In logic input
8	RS485+	22	Earth logic inputs
9	RS485-	23	Out1 4/20mA output / HART+
10	Earth RS485	24	Out1 4/20mA output / HART+
11	Out1 logic output	25	Out2 4/20mA output
12	Out1 logic output	26	Out2 4/20mA output
13	Out2 logic output	27	Earth 4/20mA outputs
14	Out2 logic output	28	NC

N	110-230 VAC Neutral
L	110-230 VAC Phase
PE	Protection Earth

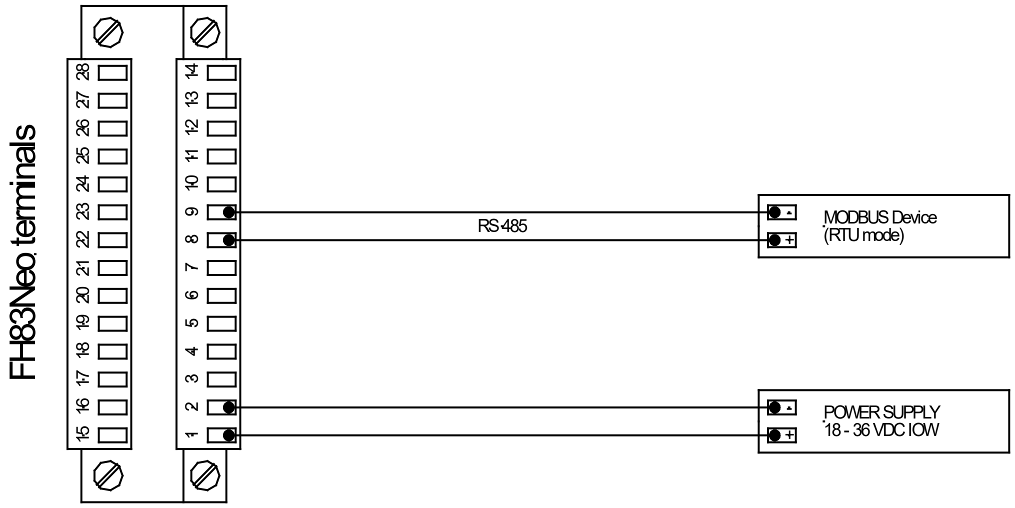
Connecting the FH83Neo pulse output to a flow computer

Please follow FHB100 Instructions Manual TEC210305



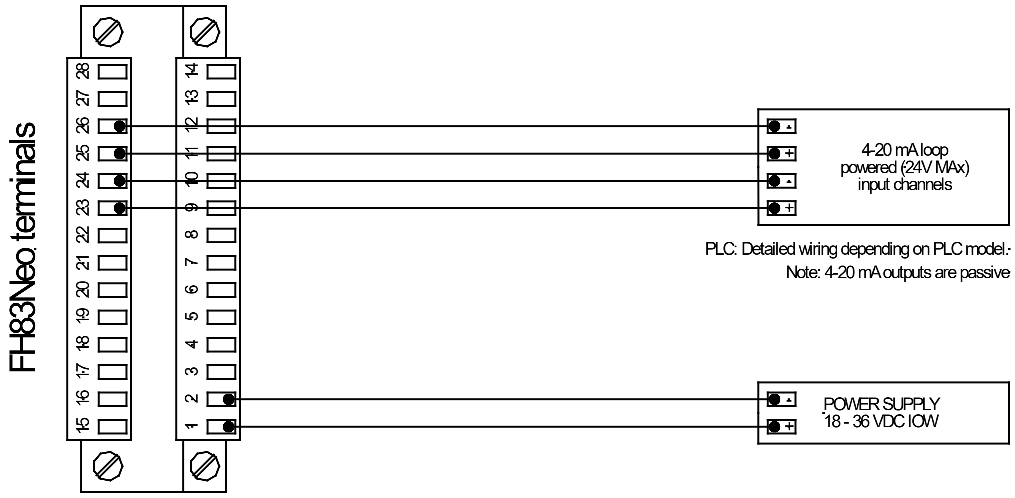
Connecting the FH83Neo RS485 interface to a MODBUS device

Please follow FHB100 Instructions Manual TEC210305



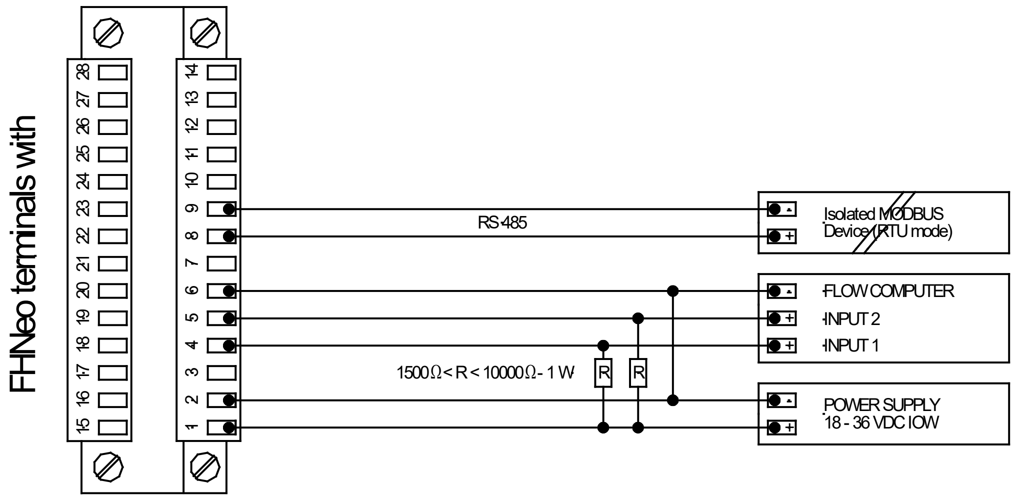
Connecting the FH83Neo analog 4-20 mA output

Please follow FHB100 Instructions Manual TEC210305



Connecting the FH83Neo pulse output to a flow computer and the RS485 interface to a MODBUS Device

Please follow FHB100 Instructions Manual TEC210305



Earthing the meter to the pipe

As the meter's electronics is floating-potential designed, the meter can be connected to the pipe (without risk of damage in case of pipe with cathodic protection).

Setting the FH83Neo's parameters

The FH83Neo parameter setting is described in the next chapter.

On site Commissioning

Make sure that measurement is not altered by gas pockets or bubbles as well as particles in suspension. (gas pockets or bubbles and particles in suspension impede the propagation of ultrasonic waves. If their number is too large, the measurement may become invalid).

Chapter 3: Using the FH83Neo remote control

The parameter setting of the FH83Neo can be achieved by means of the remote-control device delivered with the FH83Neo or with FHview PC software.

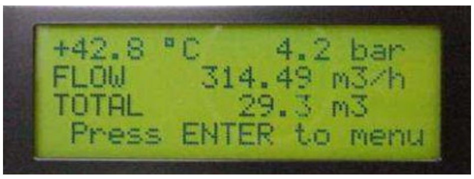
Remote-control device keypad

Information displayed in measure mode

In measure mode, the screen displays the following information

- Number of operating paths (beams)
- Velocity of sound in fluid
- Temperature
- Pressure
- Flow rate
- Volume

The first two parameters are displayed alternately.
Flow rate and volume are displayed permanently.



Remark:
temperature and pressure inputs are only optional.

General parameter setting procedure

From the local display, enter the parameter setting mode by pressing the Enter key of the remote-control device.
Use the ↑ and ↓ keys for selecting a sub-menu or a parameter.
The selected option is indicated by an arrow → on the left of the item. The parameters stored in the FH83Neo are indicated by a * character.

For the numerical values, select the value of each digit separately. (The sign is modified by means of the ↓ and ↑ keys). Press the Enter key to validate the selected parameter or value.

Remark:
Each parameter setting screen includes an "Exit" line and a "Stop" / "Start" line. (The "Stop" / "Start" line is displayed only when the FH83Neo is in non-custody transfer mode.)
The "Exit" Line allows to return into the measure mode display.
The "Stop" / "Start" line allows to stop and restart the meter. (The stopping and restarting of the meter are recorded in the Event logger.)

Principle of menus and sub-menus numbering

Each menu or sub-menu is numbered by means of a 1, 2, 3 or 4 digits.
Example: The 113 menu corresponds to the following structure:
1. Settings
11 4/20 + Alarm units
113 Volume

⚠ **Important: The sub-menus of the 2nd, 3rd and 4th levels are numbered from 0.**

Menus and sub-menus structure

- **"1 Settings":** Setting of the parameters having no influence on the measurement
- **"10 Display units"**: Selection of the display units
- **"11 4/20 + Alarm units"**: Selection of the units used for the analog outputs and alarms
  Remark: *It is possible to define separately the display units and the units used for 4-20 mA outputs and the alarms.*

- **"12 Set 4/20 Outputs"**: Allocation of the analog outputs and calibration of the corresponding 4 and 20 mA limits
- **"13 Set T Input"**: Calibration of the 4 and 20 mA limits of the temperature input
- **"14 Set P Input"**: Calibration of the 4 and 20 mA limits of the pressure input
- **"15 Set Alarms"**: Setting of the alarms
- **"16 Set Serial bus"**: Setting of the serial link
- **"17 Set Loggers"**: Selection of the Data logger storage period and reset of the Data or Event loggers
- **"18 Real Time Clock"**: Updating of the date and time
- **"19 Set Backlight"**: Setting of the backlight

- **"2 Reset Totalizer":** Reset of the totalizer
- **"3 Corrected diameter":** Value of the inside diameter (in mm, with 1 µm resolution) according to temperature
- **"4 Serial Number":** Display of the FH83Neo serial number
- **"5 Configuration":** Setting of the measurement parameters (parameters modifiable only in non-custody transfer mode after a meter stop)
- **"50 Calibration":** Definition of the damping (filter time constant) and display of the factory set parameters
- **"51 Set Pulse Output":** Definition of K-factor unit
- **"6 Zeroing":** Adjustment of the zero, normally achieved in factory and accessible only in non-custody transfer mode after a meter stop

Selection of units

• Display unit for flow rate
"100 Flowrate" menu
Possible units: m3/h ; m3/min ; m3/s ; l/h ; l/min ; l/s ; GPM (US Gallon/min) ; BPH (Barrel/hour)

• Display unit for temperature
"101 Temperature" menu
Possible units: °C ; °F ; K

• Display unit for pressure
"**102 Pressure**" menu
Possible units: bar; kPa ; psi

• Display unit for totalizer
"103 Totalizer" menu
Possible units: m3; l; USG; Bbl

• Display unit for velocity of sound (VOS)
"104 VOS" menu
Possible units: m/s ; ft /s

• Transmission unit for velocity of sound (VOS)
"110 VOS" menu
Possible units: m/s ; ft /s

• Transmission unit for velocity of flow
"111 VOF" menu
Possible units: m/s ; ft /s

• Transmission unit for flow rate
"112 Flow rate" menu
Possible units: m3/h ; m3/min ; m3/s ; l/h ; l/min ; l/s ; GPM ; BPH

• Transmission unit for totalizer
"113 Totalizer" menu
Possible units: m3; l; USG; Bbl

• Transmission unit for pressure
"114 Pressure" menu
Possible units: bar; kPa; psi

• Transmission unit for temperature
"115 Temperature" menu
Possible units: °C; °F; K

Setting the analog outputs

• Allocation of output n° 1
"1200 Set 04-20 Var" menu

Output n° 1 can be allocated to one of these variables:

- Velocity of sound
- Velocity of flow
- Flow
- Totalizer
- Pressure
- Temperature
- Gain

Gain corresponds to the average value, for paths in operation, of the attenuation of ultrasonic waves through the fluid.
The acceptable values go from -2 dB (not very attenuated signal; risk of saturation above) to -45 dB (strongly attenuated signal; risk of interference below)

• Calibration of 4 and 20 mA limits for analog output n° 1
"1201 Set 04 mA Value" and **"1202 Set 20 mA Value"** menus

• Calibration of 4 and 20 mA limits for analog output n° 2
"1210 Set 04 mA Value" and **"1211 Set 20 mA Value"** menus

Setting the temperature input

"130 Set 04 mA Value" and **"131 Set 20 mA Value"** menus
Define the values corresponding respectively to 4 and 20 mA, the unit being the one defined in the "115" menu.

Setting the pressure input

"140 Set 04 mA Value" and **"141 Set 20 mA Value"** menus
Define the values corresponding respectively to 4 and 20 mA, the unit being the one defined in the "114" menu.

Setting the alarms

• Allocation of alarm n° 1
"150 Set Alarm1 Var" menu
The alarm can be allocated to one of these variables:

- Velocity of sound
- Velocity of flow
- Flow rate
- Volume
- Pressure
- Temperature
- Gain
- Number of paths in operation (opening of the contact if the number of paths in operation becomes inferior to this value)

• Switching mode of alarm n° 1
"151 Set Alarm1 Lim" menu

Possible choices: < and > (except for the alarm allocated to the number of paths in operation where comparison corresponds systematically to <)
The alarm is active (opening of the contact) when the parameter value becomes inferior or superior to the value defined in the menu 152.

• Threshold of the alarm n° 1
"152 Set Alarm1 Val" menu structured as follows:
<Variable allocated to the alarm> Limit Value
<threshold value> <unit defined in the 11 menu>

• Summary of alarm n° 1
"153 Alarm1 registered" menu

• Setting of the alarm n° 2
154, 155, 156 and 157 menus corresponding respectively to 150, 151, 152 and 153 menus

Setting the serial link

• Selection of the link protocol
"160 Modbus / Hart" menu
In Modbus link, the FH83Neo works in slave mode (query by the device linked to the FH83Neo, response by the FH83Neo)

Remark:
If the Hart protocol is selected, the transmission rate is set to 1,200 bauds.

• Modbus protocol baud rate
"161 Modbus Baudrate" menu (displayed only if the selected protocol is Modbus)
Possible choices: 9,600 and 19,200 bauds
Make sure that both equipment (FH83Neo and control-command system) have the same baud rate.

• Modbus slave number
"162 Modbus address" menu (displayed only if the selected protocol is Modbus)

Setting the data logger and resetting both loggers

• Choosing the data logger storage period
"170 Set Data Freq" menu
Possible values: 1 s; 5 s; 10 s; 30 s; 1 min; 2 min; 5 min; 10 min; 15 min; 30 min; 1 hr; 2 hrs; 6 hrs; 12 hrs; 24 hrs

• Resetting the Data Logger
"171 Clear Data Log" menu

• Resetting the Event logger
"172 Clear Event Logger" menu

Setting FH83Neo date and time

• Setting the date
"180 Date Setting" menu
Date is stored and displayed in the international format: dd/mm/yy

Remark:
Day, month and year must be validated separately.

• Setting the time
"181 Clock Setting" menu
The time is stored and displayed in the format hh:min.

Setting the backlight

• **"19 Set Backlight"** menu

Possible choices:
On (permanent backlight)
Off (backlight switched off)
Timer (backlight switched on during about 10 s after pressing the key)

Resetting the totalizer

• **"2 Reset Totalizer"** menu

Display of the temperature corrected inside diameter

• "**3 Corrected diameter**" menu

Display of the serial number

• "**4 Serial Number**"

Time constant of the floating average filter

• "**500 Damping**" menu
Indicate the number of flow measurements used for the calculation of the average flow rate. (The average flow rate is displayed by the FH83Neo and is used for the pulse outputs, the analog outputs and the alarms, and is transmitted via the serial link.)
The greater the "Damping" parameter is, the more filtered the fluctuations and fast variations are.

Factory set parameters

Those can be found under the calibration coefficients (501 menu), the inside diameter (502 menu) and the diameter temperature correction factor (503 menu) menus.
The serial number is composed of up to 20 characters.

Setting the K-factor

• K-factor unit
"**510 Set KF Unit**" menu
Possible choices: pulses/m^3; pulses/litre; pulses/USG; pulses/barrel

• Value of the K-factor
"**511 Set KF**" menu
Indicate the K-factor value (number of pulses per volume unit) according to the unit selected in menu 510.

Zeroing

• "**6 Zeroing**" menu

The FH83Neo zero (nil flow rate value for a nil flow) is set in factory. On site zeroing must be done only by Faure Herman or by an authorized operator.

Chapter 4:
Spare parts and Maintenance

The FH83Neo Ultrasonic flow meter is a maintenance-free instrument, mainly because it does not have any moving part. However, it might happen that users have to replace transducers, gasket or electronics.

⚠ **The replacement of any parts requires turning OFF the power supply. Once power supply is off, wait at least one minute before opening the converter's enclosure.**

Spare parts

To reduce the downtime period which might be due to either transducer, gasket or electronics failures, Faure Herman recommends the following spare parts:

- A transducer set (transducer, wires set, cable gland, etc.)
- A gasket
- Complete electronics set

⚠ **The replacement of the electronics must be done by a FAURE HERMAN technician or trained by FAURE HERMAN personnel with qualification following IEC and EN 60079-14.**

Refer to **FAURE HERMAN FHB100 Electronic Housing Instructions Manual TEC210305.**
Refer to **FAURE HERMAN FHP100 Transducer Housing Instructions Manual TEC210308**

Removing and replacing the transducers or gasket

In case of failed beam, identify the missing ultrasonic path and the failed transducer(s) by using FHview. One path corresponds to two transducers.

- To determine the failed transducer, measure its capacitance on the connector at the end of its cable.
- The value must be about 1nF for half inch transducer.
- Refer to **FAURE HERMAN FHP100 Transducer Housing Instructions Manual TEC210308.**
- Refer to **FAURE HERMAN FHB100 Electronic Enclosure Instructions Manual TEC210305.**

Performing a zeroing procedure

- If possible, turn down the flow as soon as possible and keep the pipe at the working pressure or at a pressure greater than 4 bars.
- Shut off the closest upstream and downstream valves if possible. The pressure shall stay at the value obtained in the previous step.
- Wait 10 to 15 minutes for the random velocities to become quiet.
- Perform the zeroing operation by using the remote-control device.

Chapter 5:
Modbus transmission tables

Available tables

The FH83Neo integrates 8 data tables:

Table n° 1 (reference address 0h):
Table containing the main measure data, in particular:
- **display units**
- **units used for the 4-20 mA and the alarms**
- **flow rate in m3/s**
- **temperature in °C**
- **pressure in bar**
- **volume in m3**
- **velocity of flow in m/s**
- **average velocity of sound in m/s**
- **same measure data in selected units**

Table n° 2 (reference address 100h)
Table containing the alarm and working data of the FH83Neo, in particular
- alarm counters
- number of paths in operation
- average value of the signal attenuation
- working mode (non-custody)
- alarm settings

Table n° 3 (reference address 200h)
Table containing the variables measured by the paths, in particular:
- for each path, velocity of flow, velocity of sound, signal attenuation

Table n° 4 (reference address 400h)
Table containing the custody and calibration parameters and, in particular
- K-factor value and unit
- filter time constant
- inside diameter
- calibration coefficients

Table n° 5 (reference address 500h)
Table containing the non-custody parameters, in particular:
- setting of the 2 analog outputs
- setting of the temperature and pressure inputs
- date and time of the FH83Neo

Table n° 6 (reference address 600h)
Table containing the release numbers of the FH83Neo components

Table n° 7 (reference address 1000h)
Table containing the Data logger data, in particular:

- contents of the last record
- number of the last record
- number of the record to be read
- Data logger period

Table n° 8 (reference address 1800h)
Table containing the Event logger data, in particular:

- contents of the last record
- number of the last record
- number of the record to be read

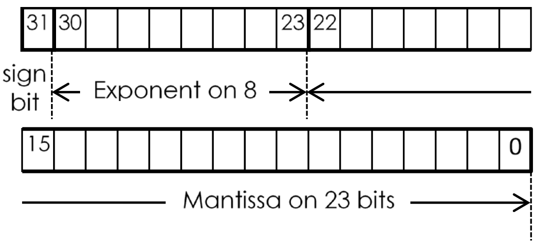
Main characteristics of the transmission

- Protocol used: Modbus RTU (8-bit binary transmission)
- Working mode of the FH83Neo: slave
- Baud rate: 9,600 or 19,200 bauds
- Number of bits: 8
- Number of start bits: 1
- Number of stop bits: 1
- Parity: None
- Error check: CRC16

Transmission formats

A Modbus word is composed of two bytes.
Data are transmitted according to one the following formats:

- Integer (symbol INT): 1 Modbus word, that is 2 bytes
- Long integer (symbol LINT): 2 Modbus words, that is 4 bytes
- IEEE 32-bit floating number (symbol FLOAT): 2 Modbus words, that is 4 bytes, constituted as follows.



$$V = (-1)^S \left(1 + \frac{M}{2^{23}}\right) \times 2^{E-127}$$

Example: Given the value 40.21.80.40h

0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

(S = 0, E = 128, M = 218040h = 2195520)

$$V = (-1)^0 \left(1 + \frac{2195520}{2^{23}}\right) \times 2^{128-127} = 2.523452759$$

Data are put in the tables starting with the most significant byte (MSB), except for the CRC 16 control word which is transmitted beginning by the least significant byte.
The Modbus functions accepted by the FH83Neo are the function 3 (reading of n words) and the function 16 (writing of n words).

Framework for the reading of "n" Modbus words (1 ≤ n ≤ 125)

Request

Slave number	Function code (3)	Address of the 1st word	Number of words (n)	CRC16 Control
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Slave number	Function code (3)	Number of read bytes	Value of the 1st word		Value of the last word	CRC16 Control
1 byte	1 byte	1 byte	2 bytes		2 bytes	2 bytes

Framework for the writing of "n" Modbus words (1 ≤ n ≤ 123)

Request

Slave number	Function code (16)	Address of the 1st word	Number of words (n)	Nb of bytes in words	Value of the 1st word		Value of the last word	CRC16 control
1 byte	1 byte	2 bytes	2 bytes	1 byte	2 bytes		2 bytes	2 bytes

Response

Slave number	Function code (16)	Address of the 1st word	Number of words (n)	CRC16 control
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Structure of the table n°1

Reference address 000h; main measure data

Displayed Values

Modbus Adress		Name and Description	Format	Access
Dec+1	Hex			
1	000h	DISPLAYED FLOWRATE Gross flow expressed in the unit selected for the display (see 040h)	FLOAT	R
3	002h	DISPLAYED VELOCITY of FLUID Fluid velocity expressed in the unit selected for the display (see 041h)	FLOAT	R
5	004h	DISPLAYED VELOCITY of SOUND Sound velocity expressed in the unit selected for the display (see 042h)	FLOAT	R
7	006h	DISPLAYED TEMPERATURE Temperature expressed in the unit selected for the display (see 043h) Remark: 0 if temperature sensor not wired	FLOAT	R
9	008h	DISPLAYED PRESSURE Pressure expressed in the unit selected for the display (see 044h) Remark: 0 if pressure sensor not wired	FLOAT	R
11	00Ah	DISPLAYED TOTALIZER Totalizer expressed in the unit selected for the display (see 045h)	FLOAT	R

Units for the 4–20 mA outputs and alarms

Modbus Address Dec+1	Modbus Address Hex	Name and Description	Format	Access
13	00Ch	FLOWRATE UNIT Unit used for gross flow (4-20 mA and alarms) 1 m3/h 2 m3/min 3 m3/s 4 l/h 5 l/min 6 l/s 7 GPM 8 BPH	INT	R/W
14	00Dh	VELOCITY of FLUID UNIT Unit used for Velocity of Fluid (4-20 mA and alarms) 1 m/s 2 ft/s	INT	R/W
15	00Eh	VELOCITY of SOUND UNIT Unit used for Velocity of Sound (4-20 mA and alarms) 1 m/s 2 ft/s	INT	R/W
16	00Fh	TEMPERATURE UNIT Unit used for Temperature (4-20 mA and alarms) 1 °C 2 °F 3 K	INT	R/W

	Modbus Address		Name and Description	Format	Access
	Dec+1	Hex			
Units for 4-20 mA and alarms (followed)	17	010h	PRESSURE UNIT Unit used for pressure (4-20 mA and transmission) 1 bar 2 kPa 3 psi	INT	R/W
Units for 4-20 mA and alarms (followed)	18	011h	TOTALIZER UNIT Unit used for totalizer (4-20 mA and transmission) 1 m3 2 l 3 USG 4 Bbl	INT	R/W
Values expressed in SI units	19	012h	FLOWRATE in SI UNIT Flow rate expressed in m3/s	FLOAT	R
Values expressed in SI units	21	014h	TEMPERATURE in SI UNIT Temperature expressed in °C	FLOAT	R
Values expressed in SI units	23	016h	PRESSURE in SI UNIT Pressure expressed in bar	FLOAT	R
Values expressed in SI units	25	018h	TOTALIZER in SI UNIT Totalizer expressed in m^3	FLOAT	R
Values expressed in SI units	27 to 34	01Ah to 021h	Words not used	FLOAT	R
Values expressed in SI units	35	022h	VELOCITY of SOUND in SI UNIT VOS expressed in m/s	FLOAT	R
Values expressed in SI units	37	024h	VELOCITY of FLUID in SI UNIT VOF expressed in m/s	FLOAT	R
Values expressed in SI units	39 to 64	026h to 03Fh	Words not used		

	Modbus Adress		Name and Description	Format	Access
	Dec+1	Hex			
Display Units	65	040h	FLOWRATE DISPLAYED UNIT Unit used for the display of the flow rate (see 00Ch for the list of units)	INT	R/W
Display Units	66	041hh	VELOCITY of FLUID DISPLAYED UNIT Unit used for the display of the velocity of fluid (see 00Dh for the list of units)	INT	R/W
Display Units	67	042h	VELOCITY of SOUND DISPLAYED UNIT Unit used for the display of the velocity of sound (see 00Eh for the list of units)	INT	R/W
Display Units	68	043h	TEMPERATURE DISPLAYED UNIT Unit used for the display of the temperature (see 00Fh for the list of units)	INT	R/W
Display Units	69	044h	PRESSURE DISPLAYED UNIT Unit used for the display of the pressure (see 010h for the list of units)	INT	R/W
Display Units	70	045h	TOTALIZER DISPLAYED UNIT Unit used for the display of the totalizer (see 011h for the list of units)	INT	R/W
Totalizer Reset	71	046h	TOTALIZER RESET Write a 1 value to reset the totalizer Remark: This word is reset to 0 when the totalizer reset is over.	INT	R/W

Structure of the table n°2

Reference address 100h; alarm and operation data

<table>
<tr><th rowspan="2"></th><th colspan="2">Modbus Adress</th><th colspan="2" rowspan="2">Name and Description</th><th rowspan="2">Format</th><th rowspan="2">Access</th></tr>
<tr><th>Dec+1</th><th>Hex</th></tr>
<tr><td rowspan="2">Alarm counters</td><td>257</td><td>100h</td><td colspan="2">ALARM 1 COUNTER
Counter of occurrences of alarm 1</td><td>INT</td><td>R</td></tr>
<tr><td>258</td><td>101h</td><td colspan="2">ALARM 2 COUNTER
Counter of occurrences of alarm 2</td><td>INT</td><td>R</td></tr>
<tr><td rowspan="2">Measure Validity</td><td>259</td><td>102h</td><td colspan="2">VALID BEAMS
Number of Valid Beams</td><td>INT</td><td>R</td></tr>
<tr><td>260</td><td>103h</td><td colspan="2">SIGNAL
Average attenuation of Ultrasonic signals, dB</td><td>FLOAT</td><td>R</td></tr>
<tr><td rowspan="4">Work Mode</td><td rowspan="4">262</td><td rowspan="4">105h</td><td colspan="2">WORKING MODE
FH83Neo working mode</td><td rowspan="4">FLOAT</td><td rowspan="4">R</td></tr>
<tr><td>FFFFh</td><td>Non-custody mode</td></tr>
<tr><td>0000h</td><td>Custody mode</td></tr>
<tr><td>AAAAh</td><td>Factory mode</td></tr>
<tr><td rowspan="2">Reset Alarms</td><td>263</td><td>106h</td><td colspan="2">ALARM CLEAR
Reset of both alarm counters (write a 0 value for resetting)</td><td>INT</td><td>W</td></tr>
<tr><td>264</td><td>107h</td><td colspan="2">Word reserved for internal use</td><td></td><td></td></tr>
</table>

	Modbus Adress		Name and Description	Format	Access
	Dec+1	**Hex**			
Definition of alarm 1	265	108h	ALARM 1 VARIABLE Variable assigned to the alarm 1 1 Velocity of sound 2 Velocity of fluid 3 Flowrate 4 Volume 5 Pressure 6 Temperature 7 Gain 8 Number of valid paths	INT	R/W
Definition of alarm 1	266	109h	ALARM 1 LIMIT Type of comparison with the alarm 2 threshold 1 > 2 <	INT	R/W
Definition of alarm 1	267	10Ah	ALARM 1 THRESHOLD Value of alarm 1 threshold	FLOAT	R/W
Definition of alarm 1	269	10Ch	ALARM 1 UNIT Unit assigned to the alarm 1 threshold	INT	R/W
Definition of alarm 2	270	10Dh	ALARM 2 VARIABLE Variable assigned to the alarm 2 (refer to 108h for the list of units)	INT	R/W
Definition of alarm 2	271	10Eh	ALARM 2 LIMIT Type of comparison with alarm 2 threshold (refer to 109h)	INT	R/W
Definition of alarm 2	272	10Fh	ALARM 2 THRESHOLD Value of alarm 2 threshold	FLOAT	R/W
Definition of alarm 2	274	111h	ALARM 2 UNIT Unit assigned to the alarm 2 threshold	INT	R/W
Alarm thresholds in SI Unit	275	112h	ALARM 1 THRESHOLD in SI UNIT Value of the alarm 1 threshold expressed in SI unit of variable assigned to alarm 1 (for example, m3/s if the variable assigned to the alarm 1 is the flowrate)	FLOAT	R
Alarm thresholds in SI Unit	277	114h	ALARM 2 THRESHOLD in SI UNIT Value of the alarm 2 threshold expressed in SI unit of variable assigned to alarm 1	FLOAT	R

Structure of the table n°3

Reference address 200h; data measured by paths

	Modbus Adress		Name and Description	Format	Access
	Dec+1	Hex			
Values calculated for path 1	513	200h	BEAM01 VELOCITY of FLUID (VOF) Velocity of fluid, in m/s, computed for path 1 Remark: The value is equal to 0 if the path is not valid.	FLOAT	R
	515	202h	BEAM01 VELOCITY of SOUND (VOS) Velocity of sound, in m/s, computed for path 1 Remark: The value is equal to 0 if the path is not valid.	FLOAT	R
	517	204h	BEAM01 SIGNAL Attenuation, in dB, computed for path 1	FLOAT	R
	519	206h	BEAM01 BIAS_STAT Correction brought to path 1 (bias)	FLOAT	R
	521 to 528	208h to 20Fh	Words not used		
Values calculated for other paths	529 to 535	210h to 216h	Velocity of fluid, velocity of sound, signal attenuation and correction for path 2	FLOAT	R
	537 to 544	218h to 21Fh	Words not used		
	545 to 551	220h to 226h	Velocity of fluid, velocity of sound, signal attenuation and correction for path 3	FLOAT	R
	553 to 560	228h to 22Fh	Words not used		
	561 to 810	230h to 329h	Words not used		
Zeroing	511	32Ah	ZEROING PROCESSING Processing of the FH83Neo zeroing (0 to 100%)	LONG	R

Structure of the table nº 4

Reference address 400h; custody and calibration parameters

<table>
<tr><th rowspan="2"></th><th colspan="2">Modbus Adress</th><th rowspan="2">Name and Description</th><th rowspan="2">Format</th><th rowspan="2">Access</th></tr>
<tr><th>Dec+1</th><th>Hex</th></tr>
<tr><td rowspan="2">Kfactor definition</td><td>1025</td><td>400h</td><td>KFACTOR VALUE
K-factor value expressed in unit stored in 402h</td><td>FLOAT</td><td>R/W</td></tr>
<tr><td>1027</td><td>402h</td><td>KFACTOR UNIT
Kfactor unit<table><tr><td>1</td><td>R/W</td></tr><tr><td>2</td><td>R/W</td></tr><tr><td>3</td><td>R/W</td></tr><tr><td>4</td><td>R/W</td></tr></table></td><td></td><td>R/W</td></tr>
<tr><td rowspan="9">Tuning values</td><td>1029</td><td>404h</td><td>NOMINAL DIAMETER
Flowmeter diameter</td><td>FLOAT</td><td>R/W</td></tr>
<tr><td>1031</td><td>406h</td><td>TOTALIZER VALUE BEFORE POWER OFF
Value of the totalizer before the last power off</td><td>FLOAT</td><td>R/W</td></tr>
<tr><td>1033</td><td>408h</td><td>TEMPERATURE COEFF
EXPANSION TEMPERATURE COEFFICIENT
in 10-6 m/m/°C</td><td></td><td></td></tr>
<tr><td>1035</td><td>40Ah</td><td>DAMPING
Filter time constant</td><td>FLOAT</td><td>R/W</td></tr>
<tr><td>1037</td><td>40Ch</td><td>COEFF 1
Calibration coefficient 1</td><td>FLOAT</td><td>R/W</td></tr>
<tr><td>1039</td><td>40Eh</td><td>COEFF 2
Calibration coefficient 2</td><td>FLOAT</td><td>R/W</td></tr>
<tr><td>1041</td><td>410h</td><td>COEFF 3
Calibration coefficient 3</td><td>FLOAT</td><td>R/W</td></tr>
<tr><td>1043</td><td>412h</td><td>COEFF 4
Calibration coefficient 4</td><td>FLOAT</td><td>R/W</td></tr>
</table>

Tuning values (followed)

Modbus Adress		Name and Description	Format	Access
Dec+1	Hex			
1045	414h	COEFF 5 Calibration coefficient 5	FLOAT	R/W
1047	416h	COEFF 6 Calibration coefficient 6	FLOAT	R/W
1049	418h	COEFF 7 Calibration coefficient 7	FLOAT	R/W
1051	41Ah	COEFF 8 Calibration coefficient 8	FLOAT	R/W
1053	41Ch	COEFF 9 Calibration coefficient 9	FLOAT	R/W
1055	41Eh	COEFF 10 Calibration coefficient 10	FLOAT	R/W
1057	420h	KFACTOR in SI UNIT Kfactor expressed in pulses/m3	FLOAT	R
1061	424h	REAL INSIDE DIAMETER Real (measured) inside diameter in mm	FLOAT	R/W

Structure of the table n° 5

Reference address 500h ; non-custody parameters

	Modbus Adress		Name and Description	Format	Access
	Dec+1	Hex			
Analog Output 1 setting	1281	500h	4-20 mA OUTPUT 1 UNIT Depending on variable assigned to the analog output 1, unit used by the output (see words 00Ch to 011h of table 1)	INT	R
Analog Output 1 setting	1282	501h	4-20 mA OUTPUT 1 - 4 mA VALUE Scale limit assigned to the 4 mA value of the analog output 1, in unit stored in 500h	FLOAT	R/W
Analog Output 1 setting	1284	503h	4-20 mA OUTPUT 1 - 20 mA VALUE Scale limit assigned to the 20 mA value of the analog output 1, in unit stored in 500h	FLOAT	R/W
Analog Output 1 setting	1286	505h	4-20 mA OUTPUT 1 – TYPE Variable assigned to Analog Output 1 1 Velocity of sound 2 Velocity of fluid 3 Flowrate 4 Volume 5 Pressure 6 Temperature 7 Gain	INT	R/W
	1287 to 1289	506h to 508h	Words not used		
Temperature setting	1290	509h	INPUT TEMPERATURE: 4 mA VALUE Scale limit assigned to 4 mA value of temperature input, expressed in unit defined in table 1's 00Fh word	FLOAT	R/W
Temperature setting	1292	50Bh	INPUT TEMPERATURE: 20 mA VALUE Scale limit assigned to 20 mA value of temperature input, expressed in unit defined in table 1's 00Fh word	FLOAT	R/W

	Modbus Adress		Name and Description	Format	Access
	Dec+1	Hex			
Pressure setting	1294	50Dh	INPUT PRESSURE: 4 mA VALUE Scale limit assigned to 4 mA value for pressure input expressed in unit defined in table 1's 010h word	FLOAT	R/W
	1296	50Fh	INPUT PRESSURE: 20 mA VALUE Scale limit assigned to 20 mA value for pressure input expressed in unit defined in table 1's 010h word	FLOAT	R/W
FH83Neo Date and Time	1298	511h	YEAR	INT	R/W
	1299	512h	MONTH	INT	R/W
	1300	513h	DAY	INT	R/W
	1301	514h	HOUR	INT	R/W
	1302	515h	MINUTE	INT	R/W
	1303	516h	SECOND	INT	R/W
	1304	517h	Word not used		
Temperature & Pressure Calibration	1305	518h	INPUT TEMPERATURE: 4 mA CALIBRATION VALUE Calibration value for 4 mA limit of temperature input	FLOAT	R
	1307	51Ah	INPUT TEMPERATURE: 20 mA CALIBRATION VALUE Calibration value for 20 mA limit of temperature input	FLOAT	R
	1309	51Ch	INPUT PRESSURE: 4 mA CALIBRATION VALUE Calibration value for 4 mA limit of pressure input	FLOAT	R
	1311	51Eh	INPUT PRESSURE: 20 mA CALIBRATION VALUE Calibration value for 20 mA limit of pressure input	FLOAT	R

	Modbus Adress		Name and Description	Format	Access
	Dec+1	Hex			
4 and 20 mA scale limits in SI units	1313	520h	4-20 mA OUTPUT 1: 4 mA in SI UNIT Scale limit assigned to 4 mA value for analog output 1, in SI unit corresponding to the variable assigned to the output	FLOAT	R
	1315	522h	4-20 mA OUTPUT 1: 20 mA in SI UNIT Scale limit assigned to 20 mA value for analog output 1, in SI unit corresponding to the variable assigned to the output	FLOAT	R
	1317	524h	Word not used		
	1318	525h	INPUT TEMPERATURE: 4 mA in SI UNIT Scale limit assigned to 4 mA value for temperature input, in °C	FLOAT	R
	1320	527h	INPUT TEMPERATURE: 20 mA in SI UNIT Scale limit assigned to 20 mA value for temperature input, in °C	FLOAT	R
	1322	529h	INPUT PRESSURE: 4 mA in SI UNIT Scale limit assigned to 4 mA value for pressure input, in bar	FLOAT	R
	1324	52Bh	INPUT PRESSURE: 20 mA in SI UNIT Scale limit assigned to 20 mA value for pressure input, in bar	FLOAT	R
	1326 to 1337	52Dh to 538h	Words not used		
Analog Out 1 Calibration	1338	539h	4-20 mA OUTPUT 1: 4 mA CALIBRATION VALUE Calibration value for 4 mA limit of output 1	FLOAT	R
	1340	53Bh	4-20 mA OUTPUT 1: 20 mA CALIBRATION VALUE Calibration value for 20 mA limit of output 1	FLOAT	R
	1342 to 1360	53Dh to 54Fh	Words not used		

	Modbus Adress		Name and Description	Format	Access
	Dec+1	Hex			
Analog Output 2 setting	1361	550h	4-20 mA OUPUT 2 UNIT Depending on variable assigned to the analog output 2, unit used by the output (see words 00Ch to 011h of table 1)	INT	R
	1362	551h	4-20 mA OUPUT 2: 4 mA VALUE Scale limit assigned to 4 mA value for analog output 2, in unit stored in 550h	FLOAT	R/W
	1364	553h	4-20 mA OUPUT 2: 20 mA VALUE Scale limit assigned to 20 mA value for analog output 2, in unit stored in 550h	FLOAT	R/W
	1366	555h	4-20 mA OUPUT 2: TYPE Variable assigned to the analog output (see 505h)	INT	R/W
Analog Out 2 Scale limits (SI)	1367	556h	4-20 mA OUTPUT 2: 4 mA in SI UNIT Scale limit assigned to 4 mA value for analog output 2, in SI unit corresponding to the variable assigned to the output	FLOAT	R
	1369	558h	4-20 mA OUTPUT 2: 20 mA in SI UNIT Scale limit assigned to 20 mA value for analog output 2, in SI unit corresponding to the variable assigned to the output	FLOAT	R
	1371 to 1375	55Ah to 55Eh	Words not used		
A Out 2 Calibration	1376	55Fh	4-20 mA OUTPUT 2: 4 mA CALIBRATION VALUE Calibration value for 4 mA limit of output 2	FLOAT	R
	1378	561h	4-20 mA OUTPUT 2: 20 mA CALIBRATION VALUE Calibration value for 20 mA limit of output 2	FLOAT	R
	1380 to 1410	563h to 581h	Words not used		

Structure of the table n° 6

Reference address 600h; version of the components.

The version number and the release dates are expressed in ASCII by means of 64 character chains (32 Modbus containing each two characters) ended by CR LF \0.
Example: V 2.0 17/11/2002 \n.

Modbus Adress		Name and Description	Format	Access
Dec+1	Hex			
1537	600h	METER TYPE Type of flowmeter (example: FH83Neo-3)	32*INT	R
1569	620h	METER S/N Flowmeter Serial Number	32*INT	R
1601	640h	INTERFACE BOARD CPU CODE	32*INT	R
1633 to 1696	660h to 6Ah	Words not used		
1697	6A0h	PROCESS BOARD DSP CODE	32*INT	R

Structure of the table extended calibration coefficients type 2

Reference address 700h; extended calibration coefficients type 2 over the 10 standards coefficients

The number of extended calibration coefficients is at maximum 125 + 2 and is equal to the product of the 2 values of parameters "Number of points in X" (abscissa axis) and "Number of points in Y" (ordinate axis) plus 2: *ex. if NX = 6 and NY = 5, so the first 30 coefficients starting at address 702h are used.*

Modbus Address		Name and Description	Format	Access
Dec+1	Hex			
1793	700h	NUMBER of POINT X Number of points in abscissa of the extended calibration type 2	INT	R/W
1794	701h	NUMBER of POINT Y Number of points in ordinate of the extended calibration type 2	INT	R/W
1795	702h	COEFF T2-1 Extended calibration coefficient 1	FLOAT	R/W
1797	704h	COEFF T2-2 Extended calibration coefficient 2	FLOAT	R/W
1799	706h	COEFF T2-3 Extended calibration coefficient 3	FLOAT	R/W
1801	708h	COEFF T2-4 Extended calibration coefficient 4	FLOAT	R/W
1803 to 2041	70Ah to 7F8h	COEFF T2-5 … COEFF T2-124 Extended calibration coefficient 5 to 124	120* FLOAT	R/W
2043	7FAh	COEFF T2-125 Extended calibration coefficient 125	FLOAT	R/W

Structure of the table n° 7

Reference address 1000h; consultation of the data logger

<table>
<tr><th colspan="2">Modbus Adress</th><th rowspan="2">Name and Description</th><th rowspan="2">Format</th><th rowspan="2">Access</th></tr>
<tr><th>Dec+1</th><th>Hex</th></tr>
<tr><td>4097
to
4352</td><td>1000h
to
10FFh</td><td>DATA LOGGER RECORD
Data logger record corresponding to the number given in 1101h</td><td></td><td></td></tr>
<tr><td>4353</td><td>1100h</td><td>MOST RECENT RECORD NUMBER
Number of the last record performed by the FH83Neo</td><td>INT</td><td>R</td></tr>
<tr><td>4354</td><td>1101h</td><td>RECORD NUMBER
Number of transmitted record or number of record to be read</td><td>INT</td><td>R/W</td></tr>
<tr><td>4355</td><td>1102h</td><td>DATA LOGGER PERIOD
Recording period of the data logger
<table>
<tr><td>1</td><td>1 s</td></tr>
<tr><td>2</td><td>5 s</td></tr>
<tr><td>3</td><td>10 s</td></tr>
<tr><td>4</td><td>30 s</td></tr>
<tr><td>5</td><td>1 min</td></tr>
<tr><td>6</td><td>2 min</td></tr>
<tr><td>7</td><td>5 min</td></tr>
<tr><td>8</td><td>10 min</td></tr>
<tr><td>9</td><td>15 min</td></tr>
<tr><td>10</td><td>30 min</td></tr>
<tr><td>11</td><td>1 h</td></tr>
<tr><td>12</td><td>2 h</td></tr>
<tr><td>13</td><td>6 h</td></tr>
<tr><td>14</td><td>12 h</td></tr>
<tr><td>15</td><td>24 h</td></tr>
</table></td><td>INT</td><td>R/W</td></tr>
<tr><td>4356</td><td>1103h</td><td>DATA LOGGER CLEAR
Reset of the data logger by writing a 0 value</td><td>INT</td><td>W</td></tr>
</table>

Structure of a Data logger record

Modbus Adress		Name and Description	Format	Access
Dec+1	Hex			
4097	1000h	FLOWRATE Gross flowrate, in m3/s	FLOAT	R
4099	1002h	VELOCITY of FLUID Velocity of fluid, in m/s	FLOAT	R
4101	1004h	VELOCITY of SOUND Velocity of sound, in m/s	FLOAT	R
4103	1006h	TEMPERATURE Temperature, in °C	FLOAT	R
4105	1008h	PRESSURE Pressure, in bar	FLOAT	R
4107	100Ah	SIGNAL Average signal, in dB	FLOAT	R
4109	100Ch	FLUID VELOCITY on BEAM 1 Fluid velocity on beam 1, in m/s	FLOAT	R
4111	100Eh	FLUID VELOCITY on BEAM 2	FLOAT	R
4113	1010h	FLUID VELOCITY on BEAM 3	FLOAT	R
4115 to 4144	1012h to 102Fh	Words not used		
4145	1030h	VELOCITY of SOUND on BEAM 1 Velocity of sound on beam 1, in m/s	FLOAT	R
4146	1032h	VELOCITY of SOUND on BEAM 2	FLOAT	R
4148	1034h	VELOCITY of SOUND on BEAM 3	FLOAT	R
4151 to 4179	1036h to 1052h	Words not used		
4181	1054h	SIGNAL on BEAM 1 Signal attenuation on beam 1, in dB	FLOAT	R
4183	1056h	SIGNAL on BEAM 2	FLOAT	R
4185	1058h	SIGNAL on BEAM 3	FLOAT	R
4187 to 4352	105Ah to 10FFh	Words not used		

Structure of the table n° 8

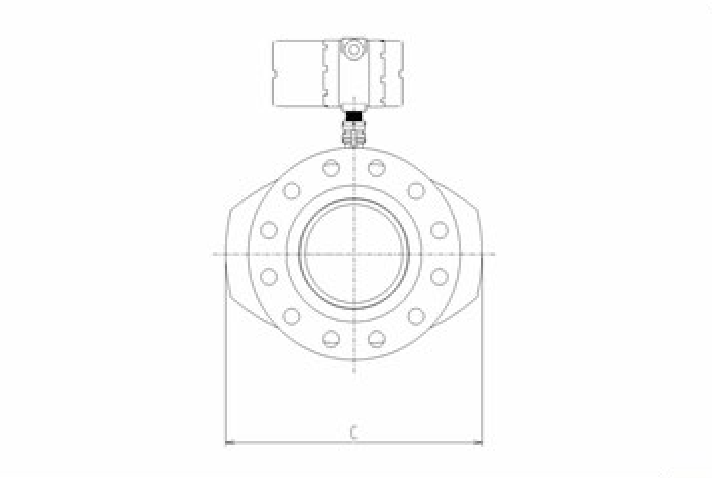
Reference address 1800h; consultation of the Event logger

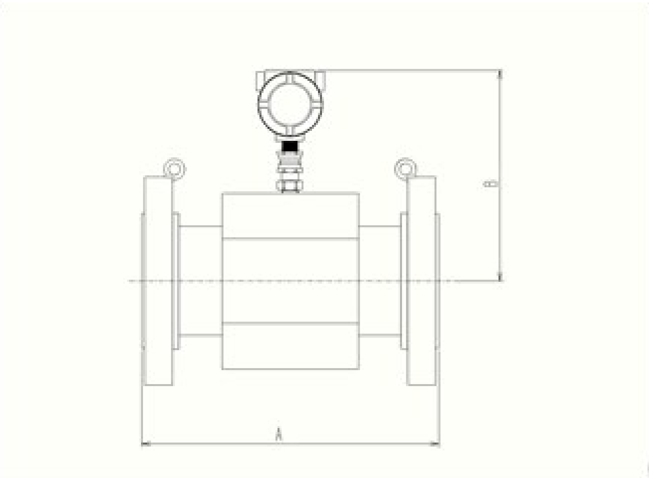
Modbus Adress		Name and Description	Format	Access
Dec+1	Hex			
6145 to 6152	1800h to 1807h	EVENT LOGGER RECORD Event logger record corresponding to the number given in 1809h		
6153	1808h	MOST RECENT RECORD NUMBER Number of the last record performed by FH83Neo	INT	R
6154	1809h	RECORD NUMBER Number of the transmitted record or number of the records to be read	INT	R/W
6155	180A	EVENT LOGGER CLEAR Reset of the event logger by writing a 0 value	INT	W

Structure of an Event logger record

<table>
<tr><th colspan="2">Modbus Adress</th><th rowspan="2">Name and Description</th><th rowspan="2">Format</th><th rowspan="2">Access</th></tr>
<tr><th>Dec+1</th><th>Hex</th></tr>
<tr><td>6144</td><td>1800h</td><td>RECORD NUMBER
Number of current record</td><td>INT</td><td>R</td></tr>
<tr><td>6146</td><td>1801h</td><td>STATUS REGISTER
4-byte status register<table>
<tr><th>Bit</th><th></th></tr>
<tr><td>0</td><td>Power ON</td></tr>
<tr><td>1</td><td>Power OFF</td></tr>
<tr><td>2</td><td>Alarm 1 ON</td></tr>
<tr><td>3</td><td>Alarm 1 OFF</td></tr>
<tr><td>4</td><td>Alarm 2 ON</td></tr>
<tr><td>5</td><td>Alarm 2 OFF</td></tr>
<tr><td>6 and 7</td><td>Operating mode
(00: non-custody mode)</td></tr>
<tr><td>8</td><td>Flowrate ON</td></tr>
<tr><td>9</td><td>Flowrate OFF (VOF = VOS = 0 on all beams)</td></tr>
<tr><td>10</td><td>Liquid presence</td></tr>
<tr><td>11</td><td>Liquid absence (VOF = VOS = 0 on all beams)</td></tr>
<tr><td>12 to 31</td><td>Bit not used</td></tr>
</table></td><td>INT</td><td>R</td></tr>
<tr><td>6148</td><td>1803h</td><td>YEAR</td><td>INT</td><td>R</td></tr>
<tr><td>6149</td><td>1804h</td><td>DAY</td><td>INT</td><td>R</td></tr>
<tr><td>6150</td><td>1805h</td><td>HOUR</td><td>INT</td><td>R</td></tr>
<tr><td>6151</td><td>1806h</td><td>MINUTE</td><td>INT</td><td>R</td></tr>
<tr><td>6152</td><td>1807h</td><td>SECOND</td><td>INT</td><td>R</td></tr>
</table>

Appendix I – Dimensions and weight vs meter size





METER SIZE		A #150-#300		A #600 - #900		B		C		Approx. Weight	
"	mm	"	mm	"	mm	"	mm	"	mm	lbs	kg
3	80	13.8	350	17.7	450	13.2	335	14.6	370	79	36
4	100	15.7	400	19.7	500	14.4	365	15.7	400	84	38
6	150	18.7	475	21.7	550	15.7	400	18.1	460	126	57
8	200	21.7	550	23.6	600	16.7	425	20.1	510	203	92
10	250	23.6	600	29.5	750	17.7	450	22.4	570	271	123
12	300	27.6	700	31.5	800	18.7	475	24.8	630	419	190
14	350	29.5	750	33.5	850	19.7	500	26.0	660	487	221
16	400	31.5	800	35.4	900	20.7	525	28.3	720	635	288
18	450	33.5	850	37.4	950	21.7	550	30.3	770	783	355
20	500	35.4	900	39.4	1000	22.6	575	32.3	820	974	442
24	600	37.4	950	43.3	1100	24.6	625	37.0	940	1,437	652

Appendix II – FH83Neo HART Commands

Appendix III – Operating restrictions & recommendations

Nominal operating conditions of the equipment are specified on its nameplate.
This domain is mainly defined in terms of:

- Minimum/Maximum – Flowrate
- Maximum – Pressure
- Minimum/Maximum – Temperature

Flowrate restrictions specify the equipment optimal performance domain (measurement accuracy and repeatability).

⚠ **Pressure and temperature restrictions involve equipment mechanical dimensions and define the authorized operating range.**

> ***Remark:***
> *When operating temperature is higher than the indicated value, the maximum authorized pressure shall be reduced, in strict application of the ASME B31.3 or NF EN 1759-1 Standard*

Gasket

Be sure to use gaskets that are suitable for flange types and comply with ASME B16.20 and ASME B16.21 or NF EN 1514 and NF EN 12560.

⚠ **Never reuse used seals.**

Flange bolting

The material of flange bolting shall be chosen in ASTM A 193 B7 (rods) and ASTM A 194 2H (nuts) according to EN ISO 898-1 standard for temperature between -45°C and +480°C.

Tightening torque

Size & Torque values - Uncoated bolts				Size & Torque values - Coated bolts			
M	N.m	NPS	ft-lb	M	N.m	NPS	ft-lb
14	110	1/2	60	14	85	1/2	45
16	160	5/8	120	16	130	5/8	90
20	350	3/4	210	20	250	3/4	160
24	550	7/8	350	24	450	7/8	250
27	800	1	500	27	650	1	400
30	1,150	1 1/8	750	30	900	1 1/8	550
33	1,550	1 ¼	1,050	33	1,200	1 ¼	800
36	2,040	1 ⅜	1,400	36	1,600	1 ⅜	1,050
39	2,650	1 ½	1,800	39	2,050	1 ½	1,400
42	3,350	1 ⅝	2,350	42	2,550	1 ⅝	1,800

Recommended tightening torque for Klingersil gasket type

When the meter is associated with one or more upstream and/or downstream pipes on delivery (e.g. spool piece integrating a flow conditioner), the tightening of the relevant bolts must be checked before commissioning.

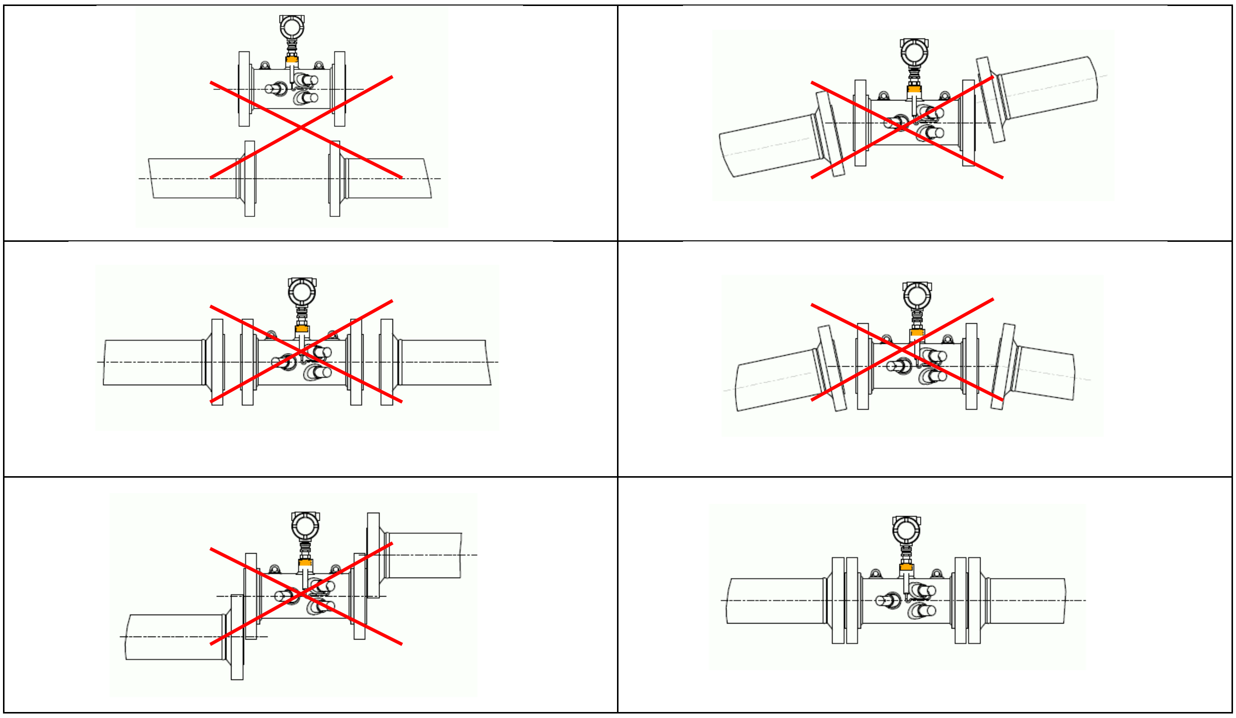
A label is fixed to the flanges at the factory before delivery.

Equipment installation

Before installation, keep the equipment in its original packing, sheltered from bad weather and possible impacts.
The equipment mechanical installation on the measurement line shall not generate excessive stresses. Especially, the alignment of upstream and downstream flanges shall allow to avoid the transmission of stresses on the equipment body.

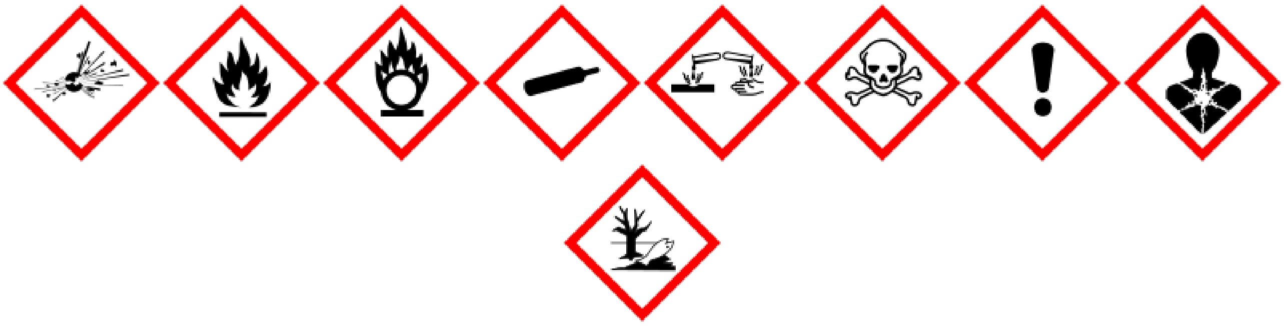
The equipment shall be installed by means of the suitable tools.

- Never use a hammer or impact wrench.
- No equipment element is designed to contribute to the tightening of connecting rods.
- Specific tools shall be used, when necessary, for the spacing between upstream and downstream flanges.



Removal from measurement line

The equipment is designed to operate under pressure and must be depressurized and drained before being removed from the measurement line.



Make sure that the line is completely depressurized before loosening the connecting bolts, and that the liquid will be completely collected in a retention tank (or equivalent).

Flow Conditioning

Performance of Ultrasonic flowmeters can be affected by the rotation of the fluid stream and the dissymmetry of the upstream flow profile induced by the configuration of the pipes (elbows, reductions of section…) and accessories (valves, filter, pump…) located upstream. Flow conditioning devices must be installed upstream of the meters to reduce the effect of these disturbances (API MPMS 5.8, ISO 12242).

FAURE HERMAN can associate such devices with its meters as well as upstream and downstream pipes allowing the respect of the applicable standards recommending straight upstream with flow conditioning device and downstream lengths (respectively 10 x DN and 5 x DN).

It is strongly recommended to calibrate meters equipped with these straight lengths with or without a flow conditioning device.

Appendix IV - Safety Information

Important information to read before installation

This manual contains important safety instructions. It is essential that you read and understand the operations to be performed before installing, connecting and commissioning the equipment.
Failure to follow these instructions and warnings may result in damage to the equipment and/or danger to operating personnel.

Personnel requirements

Ensure that operators and maintenance personnel have all safety equipment applicable to the area of operation (safety glasses, hearing protection, safety shoes, etc.) and are trained for the activities involved.
Unauthorized personnel must not have access to installation and/or maintenance operations on the equipment.

Risks resulting from failure to follow instructions and warnings

Failure to follow these instructions and warnings may:

- Expose personnel to mechanical, electrical and/or chemical hazards
- Damage the equipment (meter)
- Pollute the environment by releasing harmful or polluting substances

Safety instructions

Power supply must be disconnected and possibly meter depressurized before any work is performed to avoid electrical and pressure-related hazards.
The safety instructions in this manual as well as all safety regulations and recommendations in force in the country of installation must be observed.

Operating conditions

Operating range indicated on the meter's nameplate must be strictly observed. The reliability and performance of the equipment are only guaranteed if it is installed and operated as specified in this manual.
Installation, operation and maintenance of the equipment must be carried out using the appropriate tools.
Never use hammers or tools that may generate sparks or damage the electrical protection of the equipment (enclosure, cable glands, conduit, etc.). If impact wrenches are used, make sure to respect the torque values specified in this manual.
Installation, service and maintenance of the equipment must be performed by qualified personnel.
All spare parts must be approved by FAURE HERMAN.
For any further information concerning the installation, use or maintenance of the equipment, please contact the Support Service by phone or via the website:

Customer support	
Hotline:	+33 (0)2 43 60 28 55 +1 713 623 0808 (USA)
Email:	services@faureherman.com
Website:	https://faureherman.com/

Repair and maintenance

Repairs and modifications to the equipment are only possible after formal agreement from FAURE HERMAN.
The use of spare parts not recognized by FAURE HERMAN releases FAURE HERMAN from its responsibility for all consequences linked to this original modification.

Return

Contact FAURE HERMAN before returning the equipment to the factory.
If the meter has been used to measure dangerous, toxic or corrosive liquids, the operator must make sure that it has been properly rinsed and decontaminated before being returned to the factory.

Appendix V - ATEX & IEC Ex Installation

This equipment ATEX and IECEx certified complies with the essential health and safety requirements for the design and construction of equipment intended for use in potentially explosive atmospheres (Directive 2014/34/EU).
Ensure that the equipment is used in full compliance with the instructions given in the ATEX certificate and the nameplate.
This equipment incorporates ATEX certified electrical, and non-electrical components relating to the design and construction of equipment for use in potentially explosive atmospheres (Directive 2014/34/EU).

General safety information

⚠ **The equipment must remain de-energized during the installation and maintenance phases.**

For safe operation, the equipment must be used in accordance with the criteria defined by the ATEX/IECEx certificate and nameplate. Be sure to observe all instructions concerning the equipment and components contained in this manual.
The equipment must be installed and used only in areas that comply with its protection rating as specified on the rating plate.
If the equipment is connected to other electrical systems, check that the electrical protection systems are fully compatible.

Risk Analysis (Directive 2014/68/EU)

Suitable Resistance	Requirement
Excessive temperature and pressure.	Consideration of temperature and pressure limits by design. Limitations are indicated on the equipment plate. It is the user's responsibility to install suitable devices to limit pressure and temperature.
Influence of wind/snow.	No influence given the small surfaces.
Earthquakes	The equipment is not intended to be use in seismic zones. If this is not the case, it is the user's responsibility to provide the appropriate protection devices.
Reaction of the supports, fixings and piping.	The equipment is intended to be connected to other piping and does not have any specific supports.
Thermal fatigue.	Design according to ASME B31.3. Material selection.
Mechanical fatigue.	Measuring instrument. It is the user's responsibility to provide a stress-free installation.
Vibrations.	Measuring instrument. It is the user's responsibility to provide an isolated installation far from sources of vibration.
Handling and Operations	**Comments**
Closing and opening.	The equipment does not have an opening or closing mechanism.
Hazardous emissions from valves.	The equipment does not have a valve.
Access to the interior.	The equipment has no access (manhole cover …).
Surface temperature.	It is the user's responsibility to report hot surfaces.
Decomposition of unstable fluid.	The equipment is used during fluid transfer, not for storage.
Handling.	Equipment with a mass of more than 30 kg is equipped with lifting rings for safe handling.

Purge and Venting	Comments
Water hammer	Measuring instrument. It is the user's responsibility to install devices to prevent water hammer.
Collapse under the effect of the vacuum.	Minimum operating pressure greater than 1 bar.g indicated on the plate. The equipment is not designed to operate under vacuum.
Corrosion and Chemical attack	**Comments**
Uniformly generalized	Consideration of a corrosion allowance. Choice of materials and application of paints adapted to the environment. It is the user's responsibility to periodically check the condition of his installation.
Selective.	Choice of materials.

Galvanic.	Choice and compatibility of materials. It is up to the user to put in place the appropriate devices (grounding braid, cathodic protection ...).
By differential ventilation.	Choice of materials. Keeping equipment full of liquid.
Cavernous by inter granular puncture.	Choice of materials. Compliance with NACE MR0175 requirements if applicable.
Ammonia.	Choice of materials.
Under stress.	Choice of materials. Compliance with NACE MR0175 requirements if applicable.
Wear	**Comments**
Corrosion erosion.	Choice of materials. Application of a corrosion allowance. Application of paints adapted to the environment.
Corrosion cavitation.	Choice of materials. Measuring instrument. It is the user's responsibility to install devices to avoid cavitation.
Abrasion	Choice of materials. Application of a corrosion allowance. It is the user's responsibility to periodically check the condition of the equipment.

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