Fluenta Flare Gas Meter

FGM 130 Installation & Hook-up Instructions
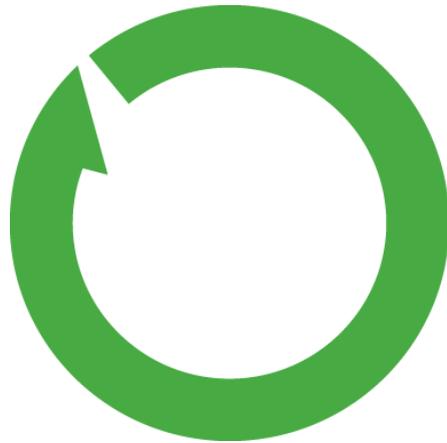
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1. General Information

1.1 Introduction

This section describes the FGM 130 Flow Computer hardware and software, and the device integrity. The hardware specifications for the microcomputer and the display/keyboard is also included.

1.2 Hardware Description

The Flow Computer Unit, shown in *Figure 2*, consists of a microcomputer module with inputs from a signal processing electronics module and with outputs to a display and a non resettable counter. The operator interface consists of a display and keyboard unit. The Flow Computer Unit is mounted in a standard 19" rack.

1.2.1 Microcomputer

The microcomputer module consists of the SBS VCPU33-C4E VMEbus computer board with the following features:

Processor
MC68EC030 40 MHz microprocessor, 32 bit.

Memory
2 Mb zero wait state battery backed CMOS static RAM. Used for System execution and storing of parameters and intermediate data. The Lithium battery provides for data retention for at least 1 year in case of power failure.
512 kb EPROM. Used for holding the initial system parameters at power up.

VME Communication
The VCPU33-C4E computer module interconnects with the VMEbus through a standard DIN 41612 triple-row, 96-pin male connector (P1). The VCPU33-C4E computer module meets all Motorola VMEbus specifications.

Serial Communication
The two asynchronous RS 232C serial ports interface the Flow Computer to the Modbus serial communication link and the Communication switch, which multiplexes the communication to the display/keypad, the HART transmitter input, and the local "Service port" terminal.

1.2.2 Display/Keyboard

The display will show all data that are available in the flow computer. Any alarms or error messages that might arise can be read and the source of the alarm can be determined. The user can through the display and keyboard change some parameters by entering new values. The display is a 8x40 character LCD display, normally used as 3 equal 2x40 character displays, one for each system. By the use of simple operations on the keyboard the desired data can be fetched from the instrument and if necessary transferred to other units. The operation of the keyboard is described in more detail in Section 2.2 and 2.3.

1.2.3 Non resetable counter module

The non-resetable counter will show the accumulated volume or accumulated mass.

1.3   Software Description

The software program implemented on the flow computer runs under the real-time multitasking operating system pSOS. All software is written in C.

1.3.1 Intialisation Module

At power up control is first passed to the Initialization Module. This module does a bit pattern check in the parameter ROM and the battery backed CMOS RAM to determine whether "cold" or "warm" start should be performed.

A "cold" start indicates that data has been lost from battery backed CMOS RAM due to battery failure or that battery backup has not been installed. At "cold" start all critical system parameters are loaded from ROM and the system is set up with system default values.

During a "warm" start critical system parameters are loaded from battery backed CMOS RAM, so that parameters modified by the operator are retained and do not need to be reentered. When system parameters have been loaded into RAM the other tasks are set to their initial states and the program start running.

The Initialization Module also performs saving of modified system parameters to battery backed CMOS RAM.

1.3.2 Flow Rate Calculation Module

The Flow Rate Calculation Module loops continuously, calculating new flow rates and totalized volumes based on results from the other program tasks.

1.3.3 Data Acquisition Module

The Data Acquisition Module loops continuously, reading data from the temperature, pressure and specific gravity inputs, the chirp values and, depending on the flow, data from the cw detector. During the same cycle it enables the next chirp, and conditionally, the next cw, keeping track of whether the next measurement is upstream or downstream. Throughout the loop it updates the flow counter. The updating of the flow counter is done at a regular basis, with counts passed from the Filtering Module.

1.3.4 Sorting Module

The sorting Module reads, checks and sorts data from the data area where the Data Acquisition Module stored them. The upstream and downstream chirp values are read and sorted in increasing order in two arrays. These arrays are then passed to the Filtering Module, Ref. Section 1.3.5. The inputs for temperature, pressure and specific gravity are read and checked against their specified upper and lower limit values. In case an out-of-limit value is read an error indication is given at the display. These values are passed to the Filtering Module and the Input/output Module, Ref. Section 1.3.6.

1.3.5 Filtering Module

The Filtering Module receives data from the Sorting Module, check the data and performs all the mathematical operations before data is sent to the input/output Module and the Data Acquisition Module. Based on a filtering criterion, the upstream and downstream chirp arrays are filtered until all remaining values are within an acceptable range as defined by a filtering algorithm. If the dispersion of the data is too large, the arrays might be reduced to a size below a defined minimum size. As this could indicate a transducer defect, an error warning will be given. Now the velocity, volume flowrate and mass flow are calculated, total volume and mass integrated and the incremental values passed to the Data Acquisition Module. All calculated values are also available to the input/output Module.

1.3.6 Input/Output Module

This module basically does all the I/O requested by the system and the operator. It is called by the Main Processing Module when the Filtering Module finishes its calculations, and presents the data on the display. When a command is entered from the keyboard, the command is decoded by the Flow Computer and the appropriate action taken. If the command indicates a parameter modification and an enable code has not yet been given, an error message is displayed and the command is rejected. If the given command indicates a parameter modification and it is accepted, then the parameter and the new value is passed to the Initialisation Module which saves the new value in battery backed CMOS RAM. Finally the module does an error indication check and performs the action to be taken if an error is detected. Control is passed from the input/output Module back to the Main Processing Module, which then waits for a flag from the Data Acquisition Module indicating that a new array of data is ready to be processed.

1.4 Device Integrity

Memory Self-Check

To prevent unauthorized or accidental modifications of system parameters, new parameter values can not be entered, unless an enable code has been given. However, data can still be displayed through use of the preprogrammed function keys. When the keyboard is enabled in the "Command"or "Service" mode, it is reset to the disabled state through a keyboard disable timeout routine if more than 5 minutes has passed since the last operator entry on the keyboard or through input of an invalid enable code.

1.5 Hardware Specifications

VMEbus Computer

VCPU33-C4E computer

CHARACTERISTICS	SPECIFICATIONS
Power requirements	+5 VDC, 0.9 A
Operating temperature	0 - 70 °C

2   Controlling the Flow Computer

2.1   Introduction

The operator interface of the flow computer is based on a Powertip PG 1602 consisting of a 8 x 40-character alphanumeric display and a 32-key data/function keyboard. The display/keyboard unit is shown in *Figure 1* below.
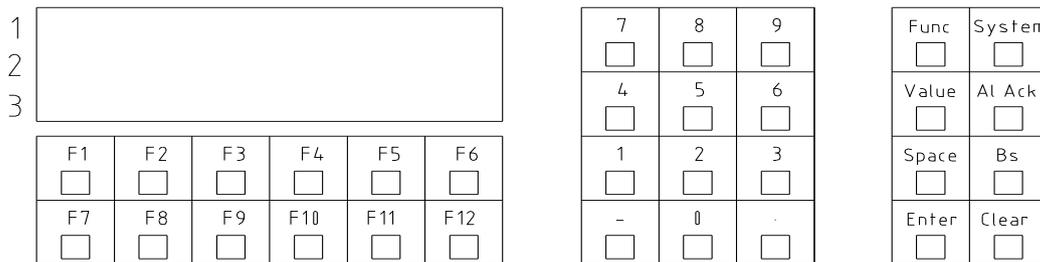
Figure 1, FGM 130 - Display Unit

2.2   Display Functions

The following functions are available on the display unit:

- volume flowrate
- mass flowrate
- flow velocity
- temperature
- pressure
- specific gravity
- totalized volume flow
- totalized mass
- system parameters
- error messages
- other messages and parameter from the flow computer unit

2.3   Keyboard Function

The keyboard functions are implemented with emphasis on a functional operator interface. Pre-programmed function keys allow input of complex data strings in just one stroke. A command disable state eliminates the possibility of accidental modification of system parameters. Still all display commands are available to the operator.

The keyboard is operating in three modes; the display mode, the operator mode and the service mode
The display mode is the default mode, and allows the operator to view different output data. In this mode the operator and service mode are disabled, any attempts on entering data returns an error message. Since the display mode is the most frequently used mode, all display commands are handled with just one key stroke.

The operator and the service mode is entered by giving an enable code. The Flow Computer returns an acknowledge message, "OPERATOR MODE" or "SERVICE MODE", for a few seconds and activates "O" or "S" on character no. 40 in the upper character row.

Operator mode: The flow computer will accept commands from 1 to 199.
Service mode: The flow computer will also accept commands above 200.

The operator and service mode demands more key pressing than was the case in the display mode. To modify a system parameter a command indicating which parameter is to be modified must be given followed by the new value for that parameter.

2.3.1 Detailed Key Description

Func

The Function key is used to enter a command, and the response from the display will be "Command". The computer is now waiting for a command to be set. This key shall always be used together with the "Value" key.

Value

The "Value" key shall be pressed to tell the computer that a value is following. This key will always be used together with the "Function" key.

Al. Ack.

Pressing the "Al. Ack" causes the Flow Computer to display all errors, if any, that have occurred since Alarm Acknowledge was last activated.
Note! Displayed alarm messages will be deleted.

Bs

By pressing this key you move cursor one position back, and erase the last figure written.

Clear

Pressing the Clear key you will clear the screen buffer, and cause the input buffer to be displayed.

Enter

Enter is used to send output messages to the Flow Computer.

-

This key is used for negative values.

.

This will, in the future, be used for entering of decimal values. Today, a decimal factor is used.

2.3.2 Pre-programmed Function Keys for Output Control

F1

Display Volume Flowrate (Sm³/hr)
Display Total Volume (Sm³)   (Ref. Appendix D for resolution)

F2

Display Mass Flowrate (kg/hr)
Display Total Mass (kg)   (Ref. Appendix D for resolution)

F3

Display Temperature (°C)
Display Pressure (barA)

F4

Display Velocity (m/s)

F5

Display last ten days totalled volume and mass

F6

Display last day-totalled volume and mass

F7

Listing of program specific parameters

F12

Press F12 to switch between SI units and US

NOTE : Function Keys F1 – F7, and F12 are one stroke keys.

2.3.3 Input/Output Function Keys

Func

Pressing "Function" followed by a "0" causes the Flow Computer to wait for an enable code.
The enable code consists of numbers from 0 - 9. The enable code has to be entered followed by an

Enter

Func

Pressing "Function" causes the Flow Computer to ask for a command. The command must be followed immediately by a

Value

Pressing "Value" causes the Flow Computer to ask for a value. The value must be followed by an

Enter

The key-combination used to enter a new value must be as follows:

Func   "Command"

Value   "Value"

Enter

3   Hardware Preparation and Installation Instructions

3.1   Introduction

This section provides the unpacking, hardware preparation and installation instructions for the FLUENTA AS FGM 130 Flow Computer Unit.

3.2   Unpacking Instructions

Unpacking equipment from shipping box. Refer to packing list and verify that all items are present. Save packing material for storing and reshipping of the equipment.

3.3   VCPU33-C4E Module Preparation

The VCPU33-C4E microcomputer is shipped turn-key ready, however, in order to ensure proper operation of the FGM 130 Flow Computer, certain mandatory checks and preparations are required.

NOTE:
During hardware preparation the power must be turned OFF.

3.3.1 Battery Backup Jumper Connection

A jumper connects the backup battery to the module. This jumper connects pins 1-2 on header J2, Ref. Figure 4. The VCPU33-C4E is shipped with this jumper disconnected, thus disabling any battery backup power and maximising battery life. With the jumper installed, the battery preserves critical system parameters in the CMOS RAM.

Shelf life (battery not connected by jumper from J2-1 to 2) is estimated to 10 years, and typical operating life of the battery is estimated to 3 years.
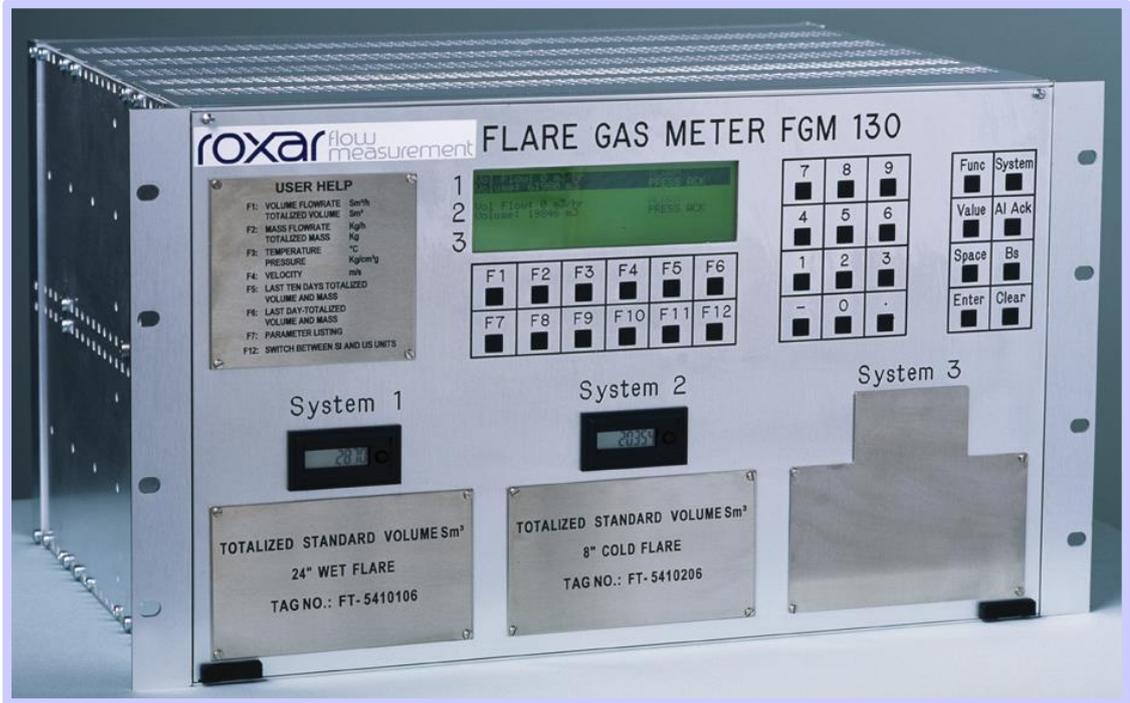
Figure 2, FGM 130 - Front layout.
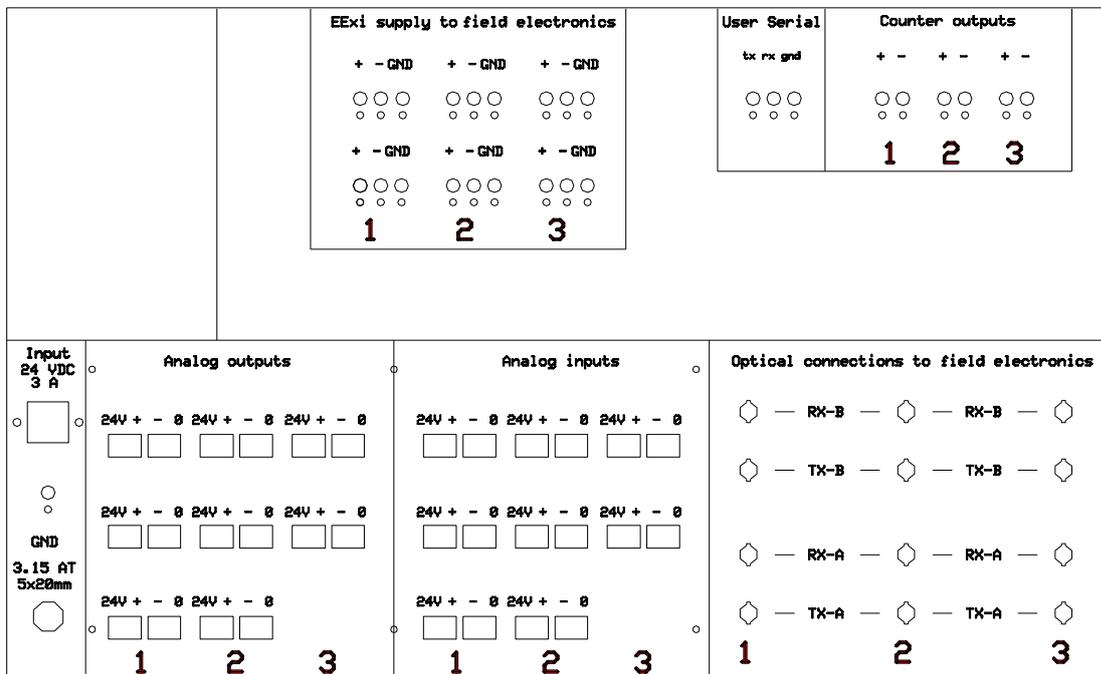
Figure 3, FGM 130 - Rear view.
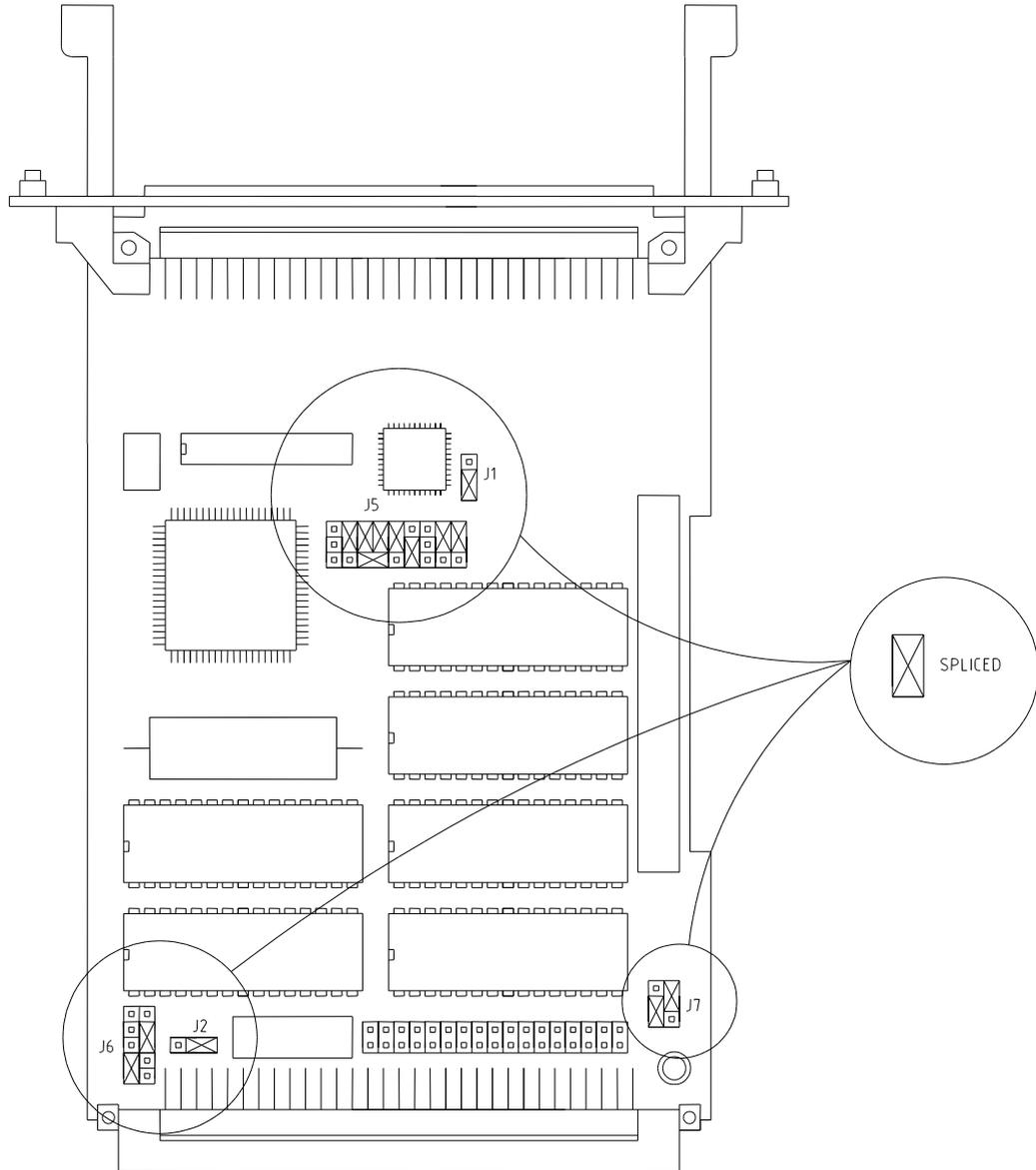
Figure 4, FGM 130 V332, Jumper Location.

The jumper for J2 is included, and must be installed by the user, if not already installed by Fluenta AS. Do as follows :
- Loosen the screws on the upper part of the FGM 130 front plate.
- Carefully pull the V332 module out of the rack, and place it on a static free surface.
- Install the J2 jumper connector between pin 1 and 2, Ref. *Figure 4*.
- Place the V332 module in the rack and tighten the front panel screws properly.

NOTE: This applies for the V332 CPU board only.

CAUTION:
DO NOT REMOVE JUMPER J2 AFTER SOFTWARE HAS BEEN INSTALLED, AND AVOID TOUCHING AREAS OF INTEGRATED CIRCUIT, AS STATIC DISCHARGE MAY DAMAGE CIRCUITS.

4 Operating Procedure

4.1 Introduction

This section provides information about how to operate the FGM 130 Flow Computer unit. Detailed description of the power-up sequence and test, the Flow Computer configuration, and calibration of the 4-20 mA analogue inputs are given. Also a parameter configuration example is given in order to ease the configuration sequence.

4.2 Power-Up Sequence

The power-up sequence describes the necessary handling of the Flow Computer in order to make it run.

1. Loosen upper screws on front panel, check all terminal connections and the system itself for proper mounting (Ref. Section 3 for details).

2. Make sure that the power cable is connected to a suitable power source.

3. Turn the power switch from 0 to 1.

4. Fasten screws on front panel properly.

The display will turn on and display either "COLD START" or "WARM START" for a few seconds, after which the measured volume flow rate will be displayed.

4.2.1 Cold Start

During a "COLD START", system set-up parameters are loaded from ROM, hence default values are used during execution. A "COLD START" is generated by a specific command (ref. appendix C). For details about default values for the system parameters, please see appendix D.

4.2.2 Warm Start

During a "WARM START", system set-up parameters are loaded from battery backed CMOS RAM, hence operator defined set-up parameters are maintained. The operator don't have to reconfigure the FGM 130, but should perform verification of parameters in order to maintain system performance. Power failure etc. will generate a "WARM START".

4.3 Flow Computer Configuration

The flare specific parameters are for instance:

-   Analogue input specifications (range limits)
-   Analogue output specifications (range limits, parameter specifications)
-   Alarm limits
-   Flare specific values (pipe diameter, inclination angle)
-   Fall back / Fixed values for pressure and temperature
-   Calibration values

Appendix A - C explains all relevant commands for the flare gas meter, and by using these commands all values measures and calculated in the flow computer are available at the display. Note that most commands require the computer to be in "SERVICE MODE" to be executed. To enter service mode press:

Func

GIVE COMMAND: **0**

Value

GIVE VALUE: **4774** (8899 for Operator Mode)

Enter

After a few seconds "S" is lit and the Flow Computer sends the message "SERVICE MODE" to indicate that it is now ready to accept commands. The computer will leave service mode automatically after 10 minutes, if no keys are pressed.

4.4 Control of System Parameters

Check that the values of the system default parameters are correct by going through the checklists below. To display the required values, use "VALUE:" 1.

◊ Press F1 to check that the Standard Volume resolution is correct

Units: Temperature : ^{o}C
Pressure : bar A
Analogue Output Channel 1 : HP: Sm^{3}/h
Analogue Output Channel 2 : Not Used
Analogue Output Channel 3 : Not Used
Pipe Diameter : m

VALUES BELOW ARE TYPICAL VALUES. CLIENT TO ADVISE PROJECT SPECIFIC VALUES

SYSTEM PARAMETER CHECK-LIST FOR FLOW COMPUTER							
		SYSTEM 1		**SYSTEM 2**		**SYSTEM 3**	
PARAMETER	**FUNCTION**	**VALUE**	**CHK'D**	**VALUE**	**CHK'D**	**VALUE**	**CHK'D**
ALARM LIMITS	2	1		1		1	
Upper Temperature Lower Temperature Upper Pressure Lower Pressure							
RANGE LIMITS	3	1		1		1	
Upper Temperature Lower Temperature Upper Pressure Lower Pressure Analogue Output Channel 1 High Analogue Output Channel 1Low Analogue Output Channel 2 High Analogue Output Channel 2 Low Analogue Output Channel 3 High Analogue Output Channel 3 Low							
FIXED VALUES	4	1		1		1	
Temperature Pressure Specific Gravity		20.0 1.013 1.000		20.0 1.013 1.000		20.0 1.013 1.000	
CALIBRATION VALUES	231	1		1		1	
Processing time upstream Processing time downstream Optical delay							
CW DELAY	236	1		1		1	
CW Delay							
PIPE DIAMETER	265	1		1		1	
Pipe Diameter							

Table 1, FGM 130 - System Parameter Check List.

4.5   Error Check

This section describes errors, and the handling of these, of such a manner that they can not be indicated at the display by the Flow Computer. (Ref. Appendix C for error messages and error indications at the display).

The error check is organised with an error indication description with a list of probable error causes, and a troubleshooting guide.

The error indication describes how the error will be indicated to the operator.

The operator should not perform extensive troubleshooting beyond what is described in this section. For repair and module replacement, contact Fluenta AS.

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Haraldsgate 90
PO Box 420
N-5501 Haugesund
NORWAY

Phone: +47 21 02 18 27

E-mail: support@fluenta.com

NOTE!

During troubleshooting, the power must be turned OFF!

ERROR INDICATION	ERROR
Display power ON, no data update at display	- Communication error between the VCPU33-C4E module and the interface module. - Interface module damaged. - Communication error between the VCPU33-C4E module and the signal processing module.
****** CRITICAL FAULT, SYSTEM WILL HANG ******	
TROUBLESHOOTING GUIDE	
- Check the ribbon cable between the VCPU33-C4E module and the interface module. - Check the connectors on the VCPU33-C4E module and the interface module (ref. section 3.3.2 for detailed information and handling). - Check the interface module for damage. - Make sure that the VCPU33-C4E module and the signal processing modules are properly mounted in the rack.	

ERROR INDICATION	ERROR
Display power lost, no data update at display.	- Power-supply to the display lost.
TROUBLESHOOTING GUIDE	
- Check the power-supply cable to the display. - Check the 5 VDC power supply.	

ERROR INDICATION	ERROR
No system parameters operating as normal.	- Error on VCPU33-C4E CPU module.
****** CRITICAL FAULT, SYSTEM WILL HANG ******	
TROUBLESHOOTING GUIDE	
- Ship VCPU33-C4E CPU module to Fluenta AS for service/replacement.	

ERROR INDICATION	ERROR
No power on display.	- Power failure
****** CRITICAL FAULT, SYSTEM WILL HANG ******	
TROUBLESHOOTING GUIDE	
- Check that the power switch was in position 1 (should be in position 0 during troubleshooting). - Check the power supply.	

Table 2, FGM 130 - Troubleshooting Guide.

4.6 Error Messages

This describes the errors indicated by the Flow Computer on the alphanumeric display

When an error occurs, the display will indicate the error by flashing "ALARM" and "PRESS ACK ALARM". By pressing the key "AL. ACK" the computer will show what kind of alarm who has occurred. The alarms will be logged in an internal error register in the Flow Computer. The error log register has a memory of 10 errors.

When there has been an alarm situation, and the situation has normalised before "AL. ACK" has been pushed, the flashing "ALARM" will disappear, and 2 stars will show in the end the display.

When a measurement error occurs, the Flow Computer will automatically start calculating with the last acceptable velocity value. Segment in the first line will light when the Flow Computer is calculating with the last acceptable velocity value. The acceptance criteria for velocity values are based on the sound velocity variations.
If the computer receives signals again within 10 minutes which is within the set deviation from the historical sound velocity, the Computer will start using the measured value for calculations, and the period which the Computer used the last acceptable velocity value will be logged in the error log register.

The error log register can be viewed by pressing "FUNCTION" **102** "VALUE" **0**. This command will cause the Flow Computer to sequentially display the 10 last measurement errors that has occurred, with start and end time for each error. By pressing "FUNCTION" **103** "VALUE" **0**, the computer will display the same log as for the command **102**, but it will also reset the error log.

If "Alarm Acknowledge" is activated and no errors has occurred, the messages "NO ERROR" will be displayed. The Flow Computer will display the last error messages until an output display command is given.

ERROR MESSAGE	DESCRIPTION
Temperature Error	Measured temperature is outside the alarm limits. PROBABLE CAUSE: - Temperature probe damaged. - Temperature analogue input defect. - Communication error between temperature probe and analogue input. - Extreme operation conditions.
Pressure Error	Measured pressure is outside the alarm limits. PROBABLE CAUSE: - Pressure probe damaged. - Pressure analogue input defect. - Communication error between pressure probe and analogue input. - Extreme operation conditions.
Specific Grav. Error	Measured specific gravity is outside the alarm limits. PROBABLE CAUSE: - Densiometer is damaged. - Specific gravity analogue input defect. - Communication error between densiometer and analogue input. - Extreme operation conditions.
Measurement Error	Possible invalid data from ultrasonic transducers PROBABLE CAUSE: - Ultrasonic transducer unit defect. - Optical fibre defect. - Power failure on transducer unit. - Extreme operation conditions (rapidly changing process).
CMOS Ram Error	Bit pattern test in CMOS RAM has failed. PROBABLE CAUSE: - CMOS RAM chip is defect.

Table 3, FGM 130 - Error Messages.

APPENDIX A

COMMAND CODES

This appendix describes the commands most frequently used by the operator in order to control the FGM 130 Flow Computer.

The commands are listed in increasing order, and each command is presented as:

COMMAND:
The command number the operator should enter in order to execute this command.

DESCRIPTION:
A brief description of the command.

DEFAULT VALUE:
The default value for this parameter the Flow Computer is shipped with. This value can indicate a reset value specified by device data or a switch setting, like 0 (Off).

UNITS:
Units in which the value for the specific parameter is entered.

A summary of the commands is given on the following page.

COMMAND	DESCRIPTION
1	Display output data units.
2	Display alarm limit values for analogue inputs.
3	Display range limit values for analogue inputs and analogue outputs.
4	Display fixed value for analogue inputs.
5	Display "Use fixed value" index for analogue inputs.
8	Display acc. volume and mass over 24 hours, standard from 12:00 to 12:00.
9	Display logging time for accumulated volume and mass.
10	Set temperature upper alarm limit value.
11	Set temperature lower alarm limit value.
12	Set fixed value for temperature.
14	Set temperature "Use fixed vale" index.
20	Set pressure upper alarm limit value.
21	Set pressure lower alarm limit value.
22	Set fixed value for pressure.
24	Set pressure "Use fixed value" index.
30	Set specific gravity upper alarm limit value.
31	Set specific gravity lower alarm limit value.
32	Set fixed value for specific gravity.
34	Set specific gravity "Use fixed value" index.
41	Set Weight factor.
43	Correction factor, Weight and Alpha
44	Establish new "historical" sound velocity.
50	Display Density and Molecular Weight
52	Display Isentropic Exponent
53	Display sound velocity and "historical" sound velocity
58	Warm start numbers since last cold start
61	Set/switch between English and Spanish language
70	Display last acceptable value or zero if "Measurement Alarm" occurs

Table 4, FGM 130 - Command Codes.

COMMAND : **1**
DESCRIPTION : Display output data units.

Value = 1 => Display units for ALL output data.

2 => Display units for Standard Volume Flow rate.
2 => Display units for Total Volume.

3 => Display units for Mass Flow rate.
3 => Display units for Total Mass.

4 => Display units for Temperature.
4 => Display units for Pressure.

5 => Display units for Specific Gravity.
5 => Display units for Velocity.

COMMAND : **2**
DESCRIPTION : Display upper and lower alarm limit values for ALL
analogue inputs.

Value = 1 => Display upper and lower alarm limit values for ALL analogue inputs.

2 => Temperature UPPER alarm limit value.
2 => Temperature LOWER alarm limit value.

3 => Pressure UPPER alarm limit value.
3 => Pressure LOWER alarm limit value.

4 => Specific Gravity UPPER alarm limit value.
4 => Specific Gravity LOWER alarm limit value.

COMMAND : **3**
DESCRIPTION : Display range limit values for analogue inputs and
analogue outputs.

Value = 1 => Display range limit values for ALL analogue inputs and for all three output channels.
2 => Temperature range HIGH limit value.
2 => Temperature range LOW limit value.
3 => Pressure range HIGH limit value.
3 => Pressure range LOW limit value.
4 => Specific Gravity range HIGH limit value.
4 => Specific Gravity range LOW limit value.
5 => Output channel 1 range HIGH limit value.
5 => Output channel 1 range LOW limit value
6 => Output channel 2 range HIGH limit value.
6 => Output channel 2 range LOW limit value.
7 => Output channel 3 range HIGH limit value.
7 => Output channel 3 range LOW limit value.

COMMAND : 4
DESCRIPTION : Display fixed values for analogue inputs.

Value	=	1	=>	Display fixed values for ALL analogue inputs.
		2	=>	Temperature fixed value.
		2	=>	Pressure fixed value.
		3	=>	Specific Gravity fixed value.

COMMAND : 5
DESCRIPTION : Display "Use fixed value" Index for analogue inputs.

Value	=	1	=>	Display "Use fixed value" Index for ALL analogue inputs.
		2	=>	Temperature "Use fixed value" Index.
		2	=>	Pressure "Use fixed value" Index.
		3	=>	Specific Gravity "Use fixed value" Index.

Value	=	0	=>	Use fixed value.
		1	=>	Use last value within limits.

If an out-of-limit value is measured on any input, this Index tells the system whether to use the fixed value or the last measured value that was within the limits as an estimate for this input value.

COMMAND : 8
DESCRIPTION : Display accumulated volume and mass over 24 hours, standard from 12:00
to 12:00.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : volume Sm³
mass kg

Value:	0	=>	Displays the last 10 24-hour intervals of accumulated volume and mass. Volume and mass is displayed for each 24-hour interval and not as accumulated values for the whole period.
	1	=>	Displays accumulated volume and mass for the last 24 hours. Standard from 12:00 to 12:00.

Please refer to Command 101 in Appendix B for details on how to set logging time.

Display format:

From	MM/DD/YYYY
From	HH/MM/SS
To	MM/DD/YYYY
To	HH/MM/SS
Volume:	xxxxxxxxx (Sm³)
Mass:	xxxxxxxxx (kg)

For this delivery, resolution is given in Appendix D

COMMAND : 9
DESCRIPTION : Displays logging time for accumulated volume and mass.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : -

COMMAND **: 10**
DESCRIPTION : Set upper alarm limit value for temperature.

DEFAULT VALUE   :
DECIMAL FACTOR   : 100
UNITS   : °C

This value indicates the highest value for temperature the system will allow until an alarm is generated. The Flow Computer will take action in case of alarm causing values are measured, by using substitute values for this parameter until the temperature is again within its specified limits or the error has been fixed. The substitute value can either be the last value measured within the allowed alarm range or a fix value set by the operator. (Ref. Command 12 and 14 for more information).

COMMAND **: 11**
DESCRIPTION : Set lower alarm limit for temperature.

DEFAULT VALUE   :
DECIMAL FACTOR   : 100
UNITS   : °C

This value indicates the lowest value for temperature the system will allow until an alarm is generated. Also, the Flow Computer will use a substitute value for this input until the measured temperature again is within the specified alarm range. The substitute value can either be the last value measured within the allowed alarm range or a fix value specified by the operator. (Ref. Command 12 and 14 for details).

(Ref. Command 10 for example of setting of alarm limit value.)

COMMAND **: 12**
DESCRIPTION : Set fixed value for temperature

DEFAULT VALUE   : 20.00
DECIMAL FACTOR   : 100
UNITS   : °C

The fixed value is used as a substitute value in case of out of alarm range values are measured. Optionally, the last measured value within the specified allowed range can be used as the substitute value. (Ref. Command 14 for more details).

COMMAND **: 14**
DESCRIPTION : Set temperature "Use fixed value" index.

DEFAULT VALUE   : 1
DECIMAL FACTOR   : -
UNITS   : -

Index
Value =   0   =>   Use fixed value.
             1   =>   Use last measured value within alarm limits (Default).

If an out-of-limit value is measured, this index tells the Flow Computer whether to use the fixed value or the last measured temperature value that was measured within the limits as a substitute value.

COMMAND **: 20**
DESCRIPTION : Set upper alarm limit value for pressure.

DEFAULT VALUE : -
DECIMAL FACTOR : 1000
UNITS : Bar A

This value indicates the highest value for pressure the system will allow until an alarm is given. The Flow Computer will use a substitute value for this input until the measured pressure again is within the specified alarm range. The substitute value can either be the last measured value within the alarm range or a fixed value specified by the operator.
(Ref. Command 22 and 24 for details).

COMMAND **: 21**
DESCRIPTION : Set lower alarm limit value for pressure.

DEFAULT VALUE : 1.013
DECIMAL FACTOR : 1000
UNITS : Bar A

This value indicates the lowest value for pressure the system will allow until an alarm is given. The Flow Computer will use a substitute value for this input until the measured pressure again is within the specified alarm range. The substitute value can either be the last measured value within the alarm range or a fixed value specified by the operator.
(Ref. Command 22 and 24 for details).

COMMAND **: 22**
DESCRIPTION : Set fixed value for pressure

DEFAULT VALUE : 1.013
DECIMAL FACTOR : 1000
UNITS : Bar A

The fixed value is used as a substitute value in case of out of range values are measured. Optionally, the last measured value within the specified allowed range can be used as the substitute value. (Ref. Command 24 for more details).

COMMAND **: 24**
DESCRIPTION : Set pressure "Use fixed value" index.

DEFAULT VALUE : 1
DECIMAL FACTOR : -
UNITS : -

Index
Value = 0 => Use fixed value.
1 => Use last measured value within alarm limits (Default).

If an out-of-limit value is measured, this index tells the Flow Computer whether to use the fixed value or the last measured pressure value that was within the limits as a substitute value.

COMMAND   : 30
DESCRIPTION : Set upper alarm limit value for specific gravity.

DEFAULT VALUE   : 2.000
DECIMAL FACTOR   : 1000
UNITS   : -

This value indicates the highest value for specific gravity that the system will allow until an alarm is given. The Flow Computer will use a substitute value for this input until the measured specific gravity again is within the specified gravity again is within the specific alarm range. The substitute value can either be the last measured value within the alarm range or a fixed value specified by the operator.
(Ref. Command 32 and 34 for details).

COMMAND   : 31
DESCRIPTION : Set lower alarm limit value for specific gravity.

DEFAULT VALUE   : 0.500
DECIMAL FACTOR   : 1000
UNITS   : -

This value indicates the lowest value for specific gravity that the system will allow until an alarm is given. The Flow Computer will use a substitute value for this input until the measured specific gravity again is within the specified alarm range. The substitute value can either be the measured value within the alarm range or a fixed value specified by the operator.
(Ref. Command 32 and 34 for details).

COMMAND   : 32
DESCRIPTION : Set fixed value for specific gravity.

DEFAULT VALUE   : 1.000
DECIMAL FACTOR   : 1000
UNITS   : -

The fixed value is used as a substitute value in case of out of alarm range values are measured. Optionally, the last used as the substitute value. (Ref. Command 34 for more details)

COMMAND   : 34
DESCRIPTION : Set specific gravity "Use fixed value" index.

DEFAULT VALUE   : 1
DECIMAL FACTOR   : -
UNITS   : -

Index
Value   =   0   =>   Use fixed value.
               1   =>   Use last measured value within alarm limits.

If an out-of-limit value is measured, this index tells the Flow Computer whether to use the fixed value of the last measured specific gravity value that was within the limits as a substitute value.

COMMAND   : 41
DESCRIPTION : Set Weighting factor

DEFAULT VALUE   : -
DECIMAL FACTOR   : 10
UNITS   : Float value between 0 and 1, entered as a value between 0 and 10.

COMMAND : 43
DESCRIPTION : Display Correction factor, Weight and Alpha.

DEFAULT VALUE : 1
DECIMAL FACTOR : -
UNITS : -

COMMAND : 44
DESCRIPTION : Establish new "historical" sound velocity.

DEFAULT VALUE : 0
DECIMAL FACTOR : -
UNITS : -

VALUE : 0 : Use old "historical" sound velocity.
1 : Establish new "historical" sound velocity.

New historical sound velocity is established by averaging the next 100 calculated sound velocities.

COMMAND : 50
DESCRIPTION : Display density and molecular weight.

DEFAULT VALUE : -
DECIMAL FACTOR: -
UNITS : kg/m³ - g/mol

The value is arbitrary for this command.

Display: Density (kg/m³)
Molecular Weight (g/mol)

COMMAND : 52
DESCRIPTION : Display isentropic exponent.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : -

The value is arbitrary for this command.
The command displays V, the relationship Cp/Cv.

COMMAND : 53
DESCRIPTION : Display sound velocity and "historical" sound velocity.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : m/s

The value is arbitrary for this command.

COMMAND : 58
DESCRIPTION : Warm Start numbers since last Cold Start.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : -

COMMAND   **: 61**
DESCRIPTION : Switch between English and Spanish text.

DEFAULT VALUE   : 0
DECIMAL FACTOR   : -
UNITS   : -

To set or switch between English and Spanish language, follow instructions displayed on screen, or simply press value 0 for English text and value 1 for Spanish text.

COMMAND   **: 70**
DESCRIPTION : Display and use zero (0) or last acceptable value (1) if Measurement Alarm

DEFAULT VALUE   : 0
DECIMAL FACTOR   : -
UNITS   : -

APPENDIX B

CONFIGURATION CODES

In this appendix commands mainly used for system configuration are described. The values for the parameter setting commands are determined by the technical data for the device specified. Hence, these commands will be necessary to implement at first time power-up, or if a device is replaced.

Also, if a power fail should occur, the operator should verify the parameter settings by using the proper commands described in Appendix A.

The commands are listed in increasing order, with each command presented as follows:

COMMAND   The command number the operator should enter in
                       order to execute this command.

DESCRIPTION   A brief description of the command.

DEFAULT VALUE   The parameter default value the Flow Computer is shipped with.
                       This value can indicate a parameter preset value specified by technical
                       data, or a switch setting, like 0 (Off).

DECIMAL FACTOR   The Flow Computer accepts only decimal numbers for parameter value
                       inputs. In order for the operator to enter real numbers, the numbers
                       must be multiplied with a given factor. The Flow Computer will then
                       convert this number to a real number internally divide by the same
                       factor.

UNITS   Units in which the parameter value should be entered.

COMMAND	DESCRIPTION
100	Set and display system time and date.
101	Set new logging time for 24 hour accumulation of volume and mass.
102	Display log for measurement errors.
103	Display and clear log for measurement errors.
107	Display system identification number.
108	Display the software version number.
109	Display reference temperature.
110	Set temperature range upper limit value.
111	Set temperature range lower limit value.
120	Set pressure range upper limit value.
121	Set pressure range lower limit value.
130	Set specific gravity range upper limit value.
131	Set specific gravity range lower limit value.
133	Use fixed value or measured density for mass calculation
138	Display raw data for Max Mean Up and Max Mean Down
140	Display / Set Molecular Weight
161	Display Normal, Standard or pre-set Volume Flow
170	Set Output Channel 1 range upper limit value.
171	Set Output Channel 1 range lower limit value.
172	Set Output Channel 2 range upper limit value.
173	Set Output Channel 2 range lower limit value.
174	Direct output value to Output Channel 1.
175	Direct output value to Output Channel 2.
176	Set Output Channel 3 range upper limit value.
177	Set Output Channel 3 range lower limit value.
178	Direct output value to Output Channel 3.
180	Set starting value for totalized standard volume.
181	Set starting value for totalized actual volume.
182	Set totalized mass starting value.
184	Set Output Channel 1 unit.
185	Set Output Channel 2 unit.
186	Set Output Channel 3 unit.
190	Display On/Off switch for sound velocity calculation.
191	Display tolerance limit for dev. in sound velocity with respect to "historical".
194	Set low-level velocity cut-off Limit.
195	Display low-level velocity cut-off Limit.
196	Set velocity display mode.
197	Calibration of analogue input channels.
198	On/Off switch for calculation of sound velocity.
199	Set tolerance limit for dev. in calc. sound vel. with respect to "historical".

COMMAND : **100**
DESCRIPTION : Set and display system time and date.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : Date: MM/DD/YY
    Time: HH/MM/SS

Value: 1 => Set system date.
        Give date as: MM-DD-YY
    2 => Set system time.
        Give time as: HH-MM-SS
    3 => Display Date: MM-DD-YY
        Time: HH-MM-SS

COMMAND : **101**
DESCRIPTION : Set new logging time for 24 hour accumulation of volume and mass.

DEFAULT VALUE : 12-00-00
DECIMAL FACTOR : -
UNITS : Hours (24 hour clock)

The logging time is set as full hour from 0 to 23. The flow computer will automatically display the new logging time as:

"Log time HH-MM-SS"

The logging time can only be set to full hours.

COMMAND : **102**
DESCRIPTION : Display log for measurement errors.

DEFAULT VALUE :
DECIMAL FACTOR :
UNITS :

Value: 0 => Displays last 10 measurement errors in log (Last error displayed first).
    1 => Displays last measurement error in log.

COMMAND : **103**
DESCRIPTION : Display and clear log for measurement errors

DEFAULT VALUE :
DECIMAL FACTOR :
UNITS :

Value: 0 => Displays last 10 measurement errors in log.
        Clears log after display.
    1 => Displays last measurement error in log.
        Clears log after display.

COMMAND **: 107**
DESCRIPTION : Display system identification number.

DEFAULT VALUE   :
DECIMAL FACTOR   :
UNITS   :

Value: 1   =>   Displays the system identification number stored in the programme.

COMMAND **: 108**
DESCRIPTION : Display the software version number.

DEFAULT VALUE   : -
DECIMAL FACTOR   : -
UNITS   : -

COMMAND **: 109**
DESCRIPTION : Display reference temperature

DEFAULT VALUE   : 15.0
DECIMAL FACTOR   : 100
UNITS   : °C

Value: 1   This command displays the reference temperature used in calculations for
standard conditions.

COMMAND **: 110**
DESCRIPTION : Set temperature range upper limit value.

DEFAULT VALUE   : -
DECIMAL FACTOR   : 100
UNITS   : °C

The temperature range upper limit value is determined by the technical data for the temperature probe used.
This parameter applies directly in the calculations of standardised volume flow rate and mass.

NOTE!
Wrong setting will cause volume and mass flow rate to be erroneous.

COMMAND **: 111**
DESCRIPTION : Set temperature range lower limit value.

DEFAULT VALUE   :
DECIMAL FACTOR   : 100
UNITS   : °C

This temperature range lower limit value is determined by the technical data for the temperature probe used.
This parameter applies directly in the calculations of standardised volume flow rate and mass.

NOTE!
Wrong setting will cause volume and mass flow rate to be erroneous.

COMMAND : 120
DESCRIPTION : Set pressure range upper limit value.

DEFAULT VALUE :
DECIMAL FACTOR : 1000
UNITS : Bar A

The pressure range upper limit value is determined by the technical data for the pressure probe used. This parameter applies directly in the calculations of velocity, standardised volume flow rate and mass.

NOTE!
Wrong setting will cause volume and mass flow rate to be erroneous.

COMMAND : 121
DESCRIPTION : Set pressure range lower limit value.

DEFAULT VALUE : 1.013
DECIMAL FACTOR : 1000
UNITS : Bar A

The pressure range lower limit value is determined by the technical data for the pressure probe used. This parameter applies directly in the calculations of velocity, standardised volume flowrate and mass.

NOTE!
Wrong setting will cause volume and mass flow rate to be erroneous.

COMMAND : 130
DESCRIPTION : Set specific gravity range upper limit value.

DEFAULT VALUE : 2.000
DECIMAL FACTOR : 1000
UNITS : -

The specific gravity range upper limit value is determined by the technical data for the densiometer used. This parameter applies in the calculations of massflow and mass. The operator should refer to the technical data for the densiometer used for this installation before any modifications to this parameter is done. Wrong setting will cause the mass and volume flow rate to be erroneous.

NOTE!
The specific gravity input is optional, and the FGM 100 Ultrasonic gas flow meter is not shipped with a densiometer, unless specified. Thus, the default value of 2.000 may not be applicable for this installation. It is only intended as an initialisation default value.

COMMAND : 131
DESCRIPTION : Set specific gravity range lower limit value.

DEFAULT VALUE : 0.500
DECIMAL FACTOR : 1000
UNITS : -

The specific gravity range lower limit value is determined by the technical data for the densiometer used. This parameter applies in the calculations of mass flow and mass. The operator should refer to the technical data for the densiometer used for this installation before any modifications to this parameter is done. Wrong setting will cause the mass and volume flow rate to be erroneous.

NOTE!
The specific gravity input is optional, and the FGM 100 Ultrasonic gas flow meter is not shipped with a densiometer, unless specified. Thus, the default value of 0.500 may not be applicable for this installation. It is only intended as a initialisation default value.

COMMAND : 133
DESCRIPTION : Use fixed value (0) or measured density (1) for mass calculation

DEFAULT VALUE : 0
DECIMAL FACTOR : -
UNITS : -

COMMAND : 138
DESCRIPTION : Display raw data for Max Mean Up and Max Mean Down

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : -

The value is arbitrary for this command.

COMMAND : 140
DESCRIPTION : Display and set Molecular Weight

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : -

This command is only relevant for Special system with temperature estimation.

COMMAND : 161
DESCRIPTION : Display and set Normal, Standard or pre-set Volume Flow

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : -

COMMAND : 170
DESCRIPTION : Set Output Channel 1 range upper limit value.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : -

By using this command, the operator can specify the full scale output value to Output Channel 1.

NOTE!
The full scale value for Output Channel 1 must be an integer number between 0 and 1,073,741,823. A value higher than this will cause the Output Channel 1 to be erroneous.

COMMAND : 171
DESCRIPTION : Set Output Channel 1 range lower limit value.

DEFAULT VALUE : -
DECIMAL FACTO : -
UNIT : -

By using this command, the operator can specify the low limit value for the Output Channel 1. This value is normally set to 0, and is under normal conditions not necessary to modify.

NOTE!

The lowest allowed value for the low limit (zero output) is 0. A negative number will cause Output Channel 1 to be erroneous.

COMMAND : 172
DESCRIPTION : Set Output Channel 2 range upper limit value.

DEFAULT VALUE : -
SCALE FACTOR : -
UNITS : -

By using this command, the operator can specify the full scale output value to Output Channel 2.

NOTE!
The full scale value for Output Channel 2 must be an integer number between 0 and 1,073,741,823. A value higher than this will cause the Output Channel 2 to be erroneous.
COMMAND : 173
DESCRIPTION : Set Output Channel 2 range lower limit value.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNIT : -

By using this command, the operator can specify the low limit value for the Output Channel 2. This value is normally set to 0, and is under normal conditions not necessary to modify.

NOTE!
The lowest allowed value for the low limit (zero output) is 0. A negative number would cause the Output Channel 2 to be erroneous.

COMMAND : 174
DESCRIPTION : Set direct output value to Output Channel 1.

DEFAULT VALUE : 1 (Off)
DECIMAL FACTOR : 10
UNITS :

Any positive command value not equal to 1 will override the Flow Computer output, and the value to the Output Channel 1 is set directly. This command is used for calibration of the Output Channel 1. Refer to Section 4.6 for detailed information about the calibration procedure.

NOTE!
Make sure that the direct output value is set to 1 (Off) during normal operation!

COMMAND : 175
DESCRIPTION : Direct output value to Output Channel 2.

DEFAULT VALUE : 1 (Off)
DECIMAL FACTOR : 10
UNITS : -

Any positive command value not equal to 1 will override the Flow Computer output, and the value to the Output Channel 2 is set directly. This command is used for calibration of the Output Channel 2. Refer to Section 4.6 for detailed information about the calibration procedure.

NOTE!
Make sure that the direct output value is set to 1 (Off) during normal operation!
COMMAND : 176
DESCRIPTION : Set Output Channel 3 range upper limit value.

DEFAULT VALUE : -

DECIMAL FACTOR   : -
UNITS   : -

By using this command, the operator can specify the full scale output value to Output Channel 3.

NOTE!
The full scale value for Output Channel 3 must be an integer number between 0 and 1,073,741,823. A value higher than this will cause the Output Channel 3 to be erroneous.

COMMAND   : 177
DESCRIPTION : Set Output Channel 3 range lower limit value.

DEFAULT VALUE   : -
DECIMAL FACTOR   : -

By using this command, the operator can specify the low limit value for the Output Channel 3. This value is normally set to 0, and is under normal conditions not necessary to modify.

NOTE!
The lowest allowed value for the low limit (zero output) is 0. A negative number will cause Output Channel 1 to be erroneous.

COMMAND   : 178
DESCRIPTION : Direct output value to Output Channel 3.

DEFAULT VALUE   : 1 (Off)
DECIMAL FACTOR   : 10
UNITS   : -

Any positive command value not equal to 1 will override the Flow Computer output, and the value to the Output Channel 3 is set directly. This command is used for calibration of the Output Channel 3. Refer to Section 4.6 for detailed information about the calibration procedure.

NOTE!
Make sure that the direct output value is set to 1 (Off) during normal operation!

COMMAND   : 180
DESCRIPTION : Set starting value for totalized standard volume.

DEFAULT VALUE   : -
DECIMAL FACTOR   : -
UNITS   : Sm^3.

The command value determines the starting value for the totalized standard volume. This feature can be used for synchronisation of the mechanical counter, or to zero the count at time 0.

NOTE!
The maximum starting value for totalized standard volume is 1,073,741,823. Any value above this will cause the starting value to be erroneous.

COMMAND   : 181
DESCRIPTION : Set starting value for totalized actual volume.

DEFAULT VALUE   : -
DECIMAL FACTOR   : -
UNITS   : m³.

The command value determines the starting value for the totalized actual volume. This feature can be used for synchronisation of the mechanical counter, or to zero the count at time 0.

NOTE!
The maximum starting value for totalized actual volume is 1,073,741,823. Any value above this will cause the starting value to be erroneous.

COMMAND   : 182
DESCRIPTION : Set starting value for totalized mass.

DEFAULT VALUE   : -
DECIMAL FACTOR   : -
UNITS   : kg

The command value determines the starting value for the incremental mass. This feature can be used for synchronisation of the mechanical counter, or to zero the count at time 0.
The totalized mass overflow bit must be set if the starting value exceeds 1,073,741,823.

NOTE!
The maximum starting value for totalized mass is 1,073,741,823. Any value above this will cause the starting value to be erroneous.

COMMAND   : 184
DESCRIPTION : Set Output Channel 1 unit.

DEFAULT VALUE   :
DECIMAL FACTOR   : -

This command enables the operator to change the parameter being output on Output Channel 1 to one of the following:

       0 -   STANDARD VOLUME FLOW Sm^3/h
       1 -   ACTUAL VOLUME FLOW m^3/h
       2 -   MASS FLOW   kg/h
       3 -   DENSITY (STANDARD CONDITIONS) kg/m^3
       4 -   ACTUAL DENSITY kg/m^3
       5 -   MOLECULAR WEIGHT   g/mol
       6 -   ALARM   (4 mA : NO ALARM, 20 mA : ALARM)
       7 -   ALARM   (4 mA : ALARM, 20 mA : NO ALARM)
       8 -   TEMPERATURE   °C
       9 -   PRESSURE   BAR A

COMMAND **: 185**
DESCRIPTION : Set Output Channel 2 unit.

DEFAULT VALUE :
DECIMAL FACTOR: -

This command enables the operator to change the parameter being output on Output Channel 2 to one of the following:

0 -	STANDARD VOLUME FLOW	Sm^3/h
1 -	ACTUAL VOLUME FLOW	m^3/h
2 -	MASS FLOW	kg/h
3 -	DENSITY (STANDARD CONDITIONS)	kg/m^3
4 -	ACTUAL DENSITY	kg/m^3
5 -	MOLECULAR WEIGHT	g/mol
6 -	ALARM	(4 mA : NO ALARM, 20 mA : ALARM)
7 -	ALARM	(4 mA : ALARM, 20 mA : NO ALARM)
8 -	TEMPERATURE	$°C$
9 -	PRESSURE	BAR A

COMMAND **: 186**
DESCRIPTION : Set Output Channel 3 unit.

DEFAULT VALUE:
DECIMAL FACTOR: -

This command enables the operator to change the parameter being output on Output Channel 3 to one of the following:

0 -	STANDARD VOLUME FLOW	Sm^3/h
1 -	ACTUAL VOLUME FLOW	m^3/h
2 -	MASS FLOW	kg/h
3 -	DENSITY (STANDARD CONDITIONS)	kg/m^3
4 -	ACTUAL DENSITY	kg/m^3
5 -	MOLECULAR WEIGHT	g/mol
6 -	ALARM	(4 mA : NO ALARM, 20 mA : ALARM)
7 -	ALARM	(4 mA : ALARM, 20 mA : NO ALARM)
8 -	TEMPERATURE	^0C
9 -	PRESSURE	BAR A

COMMAND **: 190**
DESCRIPTION : Display On/Off switch for sound velocity calculation.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNITS : -

COMMAND **: 191**
DESCRIPTION : Display tolerance limit for % deviation in sound velocity with respect to "historical" value.

DEFAULT VALUE : 50 %
DECIMAL FACTOR : -
UNITS : %
The value is arbitrary for this command.

This command shows the acceptable percentage deviation in sound velocity before an alarm is activated. Display format:

"S_V_Limit xx.y %"   (Sound velocity limit)

COMMAND   **: 194**
DESCRIPTION : Set low-level velocity cut-off limit.

DEFAULT VALUE   : -
DECIMAL FACTOR   : -
UNITS   : m/s

This command displays the low-level velocity cut-off limit.

COMMAND   **: 195**
DESCRIPTION : Display low-level velocity cut-off limit.

DEFAULT VALUE   : -
DECIMAL FACTOR   : -
UNITS   : m/s

This command displays the low-level velocity cut-off limit.

COMMAND   **: 196**
DESCRIPTION : Set velocity display mode.

DEFAULT VALUE   : 0
DECIMAL FACTOR   : -
UNITS   : -

| Value: | 0 | => | Displays measured velocity, but if the velocity is below the low velocity cut-off limit, the computer will show v = 0.0 m/s. |
| | 1 | => | Displays measured velocity. |

COMMAND   **: 197**
DESCRIPTION : Calibration of analogue input channels.

DEFAULT VALUE   : -
DECIMAL FACTOR   : -
UNITS   : -

| Value | 0 | => | Terminate calibration of analogue channels. The system will use measured values for pressure, temperature and specific gravity in calculations. |
| | 1 | => | Calibrate analogue channels. The computer will use fixed values for pressure, temperature and specific gravity in flow calculations routines. At the same time the digital values from the A/D converts are shown on the display. The analogue channels can then be calibrated without influencing the measurement. |

COMMAND : 198
DESCRIPTION : On/Off switch for calculation of sound velocity.

DEFAULT VALUE : 1
DECIMAL FACTOR : -
UNITS : -

Value: 0 => Sound velocity and density not calculated.

1 => Sound velocity and density calculated.

Command 133 decides whether calculated or measured
density is used in calculation of mass flow.

COMMAND : 199
DESCRIPTION : Set tolerance limit for % deviation in calculated sound velocity with respect
to "historical" value.

DEFAULT VALUE : 30 %
DECIMAL FACTOR : 10
UNITS : -

APPENDIX C

CONTROL CODES

In this appendix commands mainly used for system control & testing are described.
The commands are listed in increasing order, with each command presented as follows:

COMMAND   The command number the operator should enter in
                     order to execute this command.

DESCRIPTION   A brief description of the command.

DEFAULT VALUE   The parameter default value the Flow Computer is shipped with.
                     This value can indicate a parameter preset value specified by technical
                     data, or a switch setting, like 0 (Off).

UNITS   Units in which the parameter value should be entered.

COMMAND	DESCRIPTION
210	Set value for temperature.
211	Set value for pressure.
212	Set value for specific gravity.
213	Set value for CHIRP upstream transit time.
214	Set value for CHIRP downstream transit time.
215	Set value for CW upstream phase.
216	Set value for CW downstream phase.
220	Use CHIRP or CHIRP + CW for calculations.
230	Display and Set Chirp, Down-delay time offset.
231	Display downstream, upstream and optical delays.
232	Display and Set Chirp, Up-delay time offset.
233	Display and Set Optical-delay time, offset.
235	Set CW-delay time, offset value.
236	Display CW delay time offset value.
238	Display up- and downstream transit times, delta CW, flow- and sound velocity.
239	Display CW time difference.
240	Set CW - Chirp combination or just Chirp series.
241	Display CW – Chirp status, combination or just Chirp.
242	Set compressibility factor for operational conditions.
243	Set compressibility factor for standard conditions.
244	Set kinematic viscosity for standard conditions.
245	Display compressibility factor for operational conditions.
246	Display compressibility factor for standard conditions.
247	Display cinematic viscosity for standard conditions.
248	Display Status code and Fail Count for HART transmitters.
249	Activate/deactivate HART transmitter readings.
250	Display entered values.
251	Use default "Given Values" / Disable "Given Values".
255	Activate/deactivate ASCII parameter listing to "Service port".
264	Set pipe diameter.
265	Display pipe diameter.
266	Display density algorithm, factor A and B.
268	Display sound velocity, min. and max. value registered.
270	Display last sound velocity value registered.
271	Display start-up value for sound velocity.
273	Display sinus and cosinus to path angle exalted in 2.
275	Display CW-Chirp velocity switching limits.
277	Display test sum 1 and 2.
278	Set transducer tip distance, if 45 degree angle used.
279	Display transducer tip distance, if 45 degree angle used.

COMMAND	DESCRIPTION
280	Set maximum velocity jump acceptable before measurement alarm occurs.
281	Set maximum velocity acceptable before measurement alarm occurs.
282	Set minimum velocity acceptable before measurement alarm occurs.
283	Display and set HART transmitter filter.
290	Display and set used Chirp pattern number.
295	Display Modbus configuration parameters.
296	Display and set Modbus Function codes 3 and 6 Integer Values.
297	Display and set Modbus Code3Division parameter.
377	Flag for cold start.
401	Display and list the FGM 130 configuration parameters

COMMAND : 210
DESCRIPTION : Set value for temperature (will be used in the calculation instead of measured
            temperature).

DEFAULT VALUE : -
DECIMAL FACTOR : 100
UNITS : ^{0}C

COMMAND : 211
DESCRIPTION : Set value for pressure (will be used in the calculation instead of measured
            pressure).

DEFAULT VALUE : 0
DECIMAL FACTOR : 1000
UNITS : Bar A

COMMAND : 212
DESCRIPTION : Set value for specific gravity (will be used in calculation of mass).

DEFAULT VALUE : 1
DECIMAL FACTOR : 1000
UNITS : -

COMMAND : 213
DESCRIPTION : Set value for CHIRP upstream transit time.

DEFAULT VALUE : 0
DECIMAL FACTOR : 1
UNITS : 400 ns

COMMAND : 214
DESCRIPTION : Set value for CHIRP downstream transit time.

DEFAULT VALUE : 0
DECIMAL FACTOR : 1
UNITS : 400 ns

COMMAND : 215
DESCRIPTION : Set value for CW phase upstream.

DEFAULT VALUE : -
DECIMAL FACTOR : 1
UNITS : 100 ns

COMMAND : 216
DESCRIPTION : Set value for CW phase downstream.

DEFAULT VALUE : -
DECIMAL FACTOR : 1
UNITS : 100 ns

COMMAND **: 220**
DESCRIPTION : CW switching on (0) / off (1).

DEFAULT VALUE   : 0   Chirp or CW/Chirp is velocity controlled.
                                    1   CW measurements are turned OFF, only Chirp measurements used.

COMMAND **: 230**
DESCRIPTION : Set and view Chirp down delay time.

DEFAULT VALUE   : 0

COMMAND **: 231**
DESCRIPTION : Display downstream, upstream and optical delays.

COMMAND **: 232**
DESCRIPTION : Set and view Chirp up delay time.

COMMAND **: 233**
DESCRIPTION : Set and view optical delay time.

COMMAND **: 235**
DESCRIPTION : Set and view CW offset value.

DEFAULT VALUE   : 0

COMMAND **: 236**
DESCRIPTION : Display CW offset value.

DEFAULT VALUE   : -

COMMAND **: 238**
DESCRIPTION : Display upstream and downstream transit times, flow velocity, delta CW and
                                sound velocity.

COMMAND **: 239**
DESCRIPTION : Display delta CW.

COMMAND **: 240**
DESCRIPTION : Set CW-Chirp combination.

DEFAULT VALUE   : 0

This command specifies on which basis the flow velocity is calculated.

Value: 0   =>   Calculates velocity on the basis of CHIRP.
                 1   =>   Calculates velocity on the basis of CHIRP and CW.

COMMAND **: 241**
DESCRIPTION : Display CW-Chirp combination.

DEFAULT VALUE   : -

COMMAND : 242
DESCRIPTION : Set compressibility factor for operational conditions.

DEFAULT VALUE : 1
DECIMAL FACTOR : 1000

COMMAND : 243
DESCRIPTION : Set compressibility factor for standard conditions.

DEFAULT VALUE : 1
DECIMAL FACTOR : 1000

COMMAND : 244
DESCRIPTION : Set kinematic viscosity for standard conditions.

DEFAULT VALUE : 15×10^{-6}
DECIMAL FACTOR : 10000000

COMMAND : 245
DESCRIPTION : Display compressibility factor for operational conditions.

COMMAND : 246
DESCRIPTION : Display compressibility factor for standard conditions.

COMMAND : 247
DESCRIPTION : Display kinematic viscosity for standard conditions.

COMMAND : 248
DESCRIPTION : Display status codes and communication fail counts for HART transmitters.

Status codes : 1: OK.
2: Timeout, transmitter not responding.
3: Wrong code in transmitter response.
4: Checksum error.
5: Wrong format in transmitter response.
6: NaN (Not A Number).

Fail counts : Number of communication fail counts for a specific transmitter since last Warm start or last manually reset.

COMMAND : 249
DESCRIPTION : Activate/deactivate HART transmitter readings.

COMMAND : 250
DESCRIPTION : Display entered values.

Value : 0: Display no values.
1: Display all values.
2: Display temperature only.
3: Display pressure only.
4: Display density only.
5: Display CHIRP up only.
6: Display CHIRP down only.
7: Display CW up only.
8: Display CW down only.

This command displays the values entered using commands 210 - 216.

72.110.601

COMMAND : 251

DESCRIPTION Use default "Given Values" / Disable "Given Values".

DEFAULT VALUE : 0 (Disable "Given Values")
DECIMAL FACTOR : -
UNIT : -

Value : 0: Disable "Given Values". Values for parameters that can be directly entered
from the keypad are set to the following:

Temperature:	999.0	(Disabled)
Pressure:	999.0	(Disabled)
Spec. Gravity:	999.0	(Disabled)
DensMode:	Original setting	
Chirp Up:	999	(Disabled)
Chirp Down:	999	(Disabled)
CW Up:	999	(Disabled)
CW Down:	999	(Disabled)

Value :1: Use default "Given Values". Values for parameters that can be directly entered
from the keypad are set to the following:

Temperature:	20.00	[°C]
Pressure:	1.013	[barA]
Spec. Gravity:	1.000	
DensMode:	0	
Chirp Up:	9000	[400 ns]
Chirp Down:	8500	[400 ns]
CW Up:	100	[100 ns]
CW Down:	20	[100 ns]

COMMAND : 255

DESCRIPTION : Activate/deactivate ASCII parameter listing to "Service port".

Value : 0: Deactivate ASCII parameter listing. (Default)
1: Activate ASCII parameter listing to "Service port".

COMMAND : 264

DESCRIPTION : Set pipe diameter.

UNITS : millimetres

COMMAND : 265

DESCRIPTION : Display pipe diameter.

UNITS : millimetres

COMMAND : 266

DESCRIPTION : Display density algorithm factor A and B.

COMMAND : 268

DESCRIPTION : Display min. and max. sound velocity value registered.

COMMAND : 270

DESCRIPTION : Display last sound velocity value registered.

COMMAND : 271
DESCRIPTION : Display sound velocity start up value.

COMMAND : 273
DESCRIPTION : Display sine and cosine to path angle exalted in 2.

COMMAND : 275
DESCRIPTION : Display velocity limits for switching between CW/Chirp and Chirp.

COMMAND : 277
DESCRIPTION : Display test sum 1 and 2.

COMMAND : 278
DESCRIPTION : Set transducer distance if 45-degree angle between transducer tips.

COMMAND : 279
DESCRIPTION : Display transducer distance if 45-degree angle between transducer tips.

COMMAND : 280
DESCRIPTION : Set maximum velocity jump acceptable before measurement alarm occurs

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNIT : [m/s]

COMMAND : 281
DESCRIPTION : Set maximum velocity acceptable before measurement alarm occurs.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNIT : [m/s]

COMMAND : 282
DESCRIPTION Set minimum velocity acceptable before measurement alarm occurs.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNIT : [m/s]

COMMAND : 283
DESCRIPTION Display and set HART transmitter filter.

DEFAULT VALUE : 3
DECIMAL FACTOR : -
UNIT : -

This command allows the user to display, and set, the number of consecutive communication fails with the HART transmitters or values outside Alarm limits tolerated before an ALARM is given.

COMMAND : 290
DESCRIPTION Display and set Chirp pattern number used.

DEFAULT VALUE : 0
DECIMAL FACTOR : -
UNIT : -

This command allows the user to display, and set, which Chirp pattern to be used by the FGM 130:

0:	Chirp pattern 1, 2, 3 or 4 automatically selected by FGM 130 based on measured flow velocity
1:	The FGM 130 will use Chirp pattern 1 independent of flow conditions.
2:	The FGM 130 will use Chirp pattern 2 independent of flow conditions.
3:	The FGM 130 will use Chirp pattern 3 independent of flow conditions.
4:	The FGM 130 will use Chirp pattern 4 independent of flow conditions.

COMMAND : 295
DESCRIPTION Display Modbus configuration parameters.

DEFAULT VALUE : -
DECIMAL FACTOR : -
UNIT : -

This command allows the user to display the Modbus configuration parameters for the system. The following parameters will be displayed:

ModbusComType:	RTU/ASCII/PCDA
Modbus Addr.:	<address>
Baudrate:	<baudrate>
Parity/bits	(No/Odd/Even) (7/8)
ModbusCode3Integer:	FALSE/TRUE
ModbusCode3Div:	(1) Standard , (2) Modicon compatible

COMMAND : 296
DESCRIPTION Display/Set Modbus Function Code 3 and 6 IntegerValues.

DEFAULT VALUE : 0
DECIMAL FACTOR : -
UNIT : -

Value : **0**: **FALSE**: uses 32-bit floating point values for function codes 3 and 6 (default).

Function code 3;	ASCII and RTU (read register(s)): uses 32-bit float in reply/response.
Function code 6;	ASCII and RTU (write register(s)): interprets input data as 32-bit float and uses 32-bit float in reply/response.

1: **TRUE**: uses 16-bit integer values for function codes 3 and 6 **RTU**.

Function code 3;	ASCII and RTU (read register(s)): uses 16-bit integer in reply/response.
Function code 6;	**RTU** (write register(s)): interprets input-data as 16-bit integer and uses 16-bit integer in reply/response.

NOTE!
Function code 6; **ASCII (write register(s)): interprets input-data as 32-bit float and uses 32-bit float in reply/response.**

COMMAND : 297
DESCRIPTION Display/Set Modbus Code3Div parameter.

DEFAULT VALUE : 1 (Standard Modbus configuration)
DECIMAL FACTOR : -
UNIT : -

Value : 1: Standard Modubus configuration
2: Modicon compatible Modbus configuration.

Some supervisory systems multiply the "no. of registers" in the request by 2, e.g if 2 registers are to be read, the "no. of registers" in the request is specified with 4. The FGM 130 must handle this when interpreting the request, and by enabling a special parameter in the configuration setup, the "no. of registers" in the request is automatically divided by 2.

This parameter is only applied for reading of 32-bit float registers, both for ASCII and RTU data.

COMMAND : 377
DESCRIPTION : Flag for cold start.

This command results in a cold start. When the command has been entered then:
- turn OFF the flow computer.
- wait a few seconds.
- turn ON the flow computer.

The flow computer will display "COLD START" and all parameters in the RAM have now been loaded from the program.

COMMAND : 401
DESCRIPTION : Displays parameter values entered.

This commands outputs the system configuration parameter list to the local Display and to the "Service port" in the Flow Computer. As an alternative, one-stroke function key **F7** can be used.

APPENDIX D

INSTALLATION SPECIFIC INFORMATION

Flow Computer Configuration

All system parameters have a factory set value. Check these parameter values against user specified parameter values and change them if necessary. To check the factory set parameter values against user specified parameter values we recommend you use the Parameter Listing in this section. (Make a copy of it for later use!)

Parameter Configuration Example

In this example we will demonstrate how to set the service mode for listing of all parameters, going through all the details carefully. Throughout the example, the Flow Computer response is given in double quotes.

But before you can give the command enter the service mode enable code.

Func

"GIVE COMMAND"　　　　**0**

Value

"GIVE VALUE"　　　　**4774**　　(8899 for Operator Mode)

Enter

After a few seconds **S** is displayed on Flow Computer sends the message "SERVICE MODE" to indicate that it is now ready to accept commands.

By enter Command 401 and value 1 we can force the computer to list all parameters loaded in memory of the Flow Computer CPU-board. Alternatively, use the F7 key on the keypad.

Func

"GIVE COMMAND:"　　**401**

Value

"GIVE VALUE:"　　　　**1**

Enter

Listed up with 4 seconds interval.

FLUENTA

Please note that the values on the following page are typical values and must be comprehended likewise.

****************** Fluenta AS *****************
*********** FGM 130 parameter list ***********

System: 1

Kinematic visc: 0.0000150
Pipe diameter: 0.3050 m
Trans. distance: 0.4310 m
Delay Up: 5420
Delay Down: 5419
Delay Optic: 3
Range (Hi & Lo)
      Temp Range Hi: 75.00 ~C
      Temp Range Lo: -10.00 ~C
ALARM LIMITS
      Temp Alarm Hi: 75.00 ~C
      Temp Alarm Lo: -10.00 ~C
Range (Hi & Lo)
      Press Range Hi: 3.000 BarA
      Press Range Lo: 0.000 BarA
ALARM LIMITS
      Press Alarm Hi: 3.000 BarA
      Press Alarm Lo: 0.000 BarA
Range (Hi & Lo)
      Sp Grav Range Hi: 2.000
      Sp Grav Range Lo: 0.50
ALARM LIMITS
      Sp Grav Alarm Hi: 2.000
      Sp Grav Alarm Lo: 0.000
Temp   (F): 20.00 ~C
Press   (F): 1.013 BarA
Sp Grav (F): 1.000
Temp Index : 1
Press Index: 1
Sp Grav Index: 1
CW factor: 2
S_V Limit: 70.0%
Weight: 0.4
CW/Chirp -> Chirp : 15 m/s
Chirp -> CW/Chirp : 14 m/s
Z standard: 1.000
Z operational: 1.000
Ref. Temp: 15.00 ~C
Cutoff velocity: 0.00 m/s
Output 1 Hi: 3000.0
Output 1 Lo: 0.0
Output 2 Hi: 200000.0
Output 2 Lo: 0.0
Output 3 Hi: 200000.0
Output 3 Lo: 0.0
Factor Kf: 1.00
Scaling factor, volume: 1
Transducer angle: 45.0
Cw period: 148
Dens Mode: 0

BarA / Kpa: 0
Scaling factor, mass: 1
Mass to Counter: 0
Max Mean Up: 13770
Max Mean Down: 10710
Tx Index: 1
AnOut1 Select: 0
AnOut2 Select: 0
AnOut3 Select: 2
Chirp Select: Vel. dependent
Chirp Limit1: 25 m/s
Chirp Limit2: 50 m/s
Chirp Limit3: 150 m/s

********** System Parameters **********

ID number: 0-2004
SW Version: 7.05
Date: 16-02-2004
Time: 10:37:43

Display Mode: 0
Number of Systems: 1
Communication Type: 1
Modbus address: 224
Baud rate: 9600
RS485 Conf: 0
RS485 Start: 1
RS485 End: 1
Accept Neg.Flow: 0
Modbus Integer Values: 0
ModbusCode3Div: 1
System1 Use HART: 0
System2 Use HART: 0
System3 Use HART: 0
System1 Dual Press.: 0
System1 Dual Temp.: 0
System2 Dual Press.: 0
System2 Dual Temp.: 0
System3 Dual Press.: 0
System3 Dual Temp.: 0
Special code: 0
Modbus common-reg address: 0
System1 Modbus out-reg address: 10000
System1 Modbus user-reg address: 11000
System1 Modbus serv-reg address: 12000
System1 Modbus acc-reg address: 13000
Modbus parity: 0
Modbus databits: 8
Log Time: 00:00:00
Max Velocity Jump: 80 m/s
Max Velocity: 130 m/s
Min Velocity: -3 m/s
Resolution (US units): 3
Xmtr al. filter: 3