

FEATURES

- A SINGLE, TWO INDEPENDENT OR A DUAL FLOW COMPUTER
- FOR VOLUME, COMPENSATED VOLUME AND MASS OF LIQUIDS AND GASES
- VOLUME AND MASS OF STEAM, SATURATED OR SUPERHEATED
- PER CHANNEL:
 - FLOW INPUT – UNIVERSAL PULSE WITH 24VDC / 20 mA POWER FOR THE SENSOR, OR 4-20 mA LOOP POWER, 0.01% FS
 - 30 POINTS LINEARIZATION FOR THE PULSE INPUT
 - TEMPERATURE / DENSITY INPUT LOOP POWER 4-20 mA, 0.01% FS
 - PRESSURE INPUT LOOP POWER 4-20 mA, 0.01% FS
 - ISOLATED ANALOG OUTPUT 0.05% FS, 4-20 mA, 0-5V OR 0-10V FOR RATE, RATE A+B, PRESSURE OR TEMPERATURE
 - ISOLATED PULSE OUTPUT UP TO 10 kHz, 100V / 100 mA, FOR TOTAL, TOTAL A-B OR TOTAL A+B
 - 250VAC / 5 A ALARM RELAY WITH PROGRAMMABLE HYSTERESIS FOR RATE, RATE A+B, PRESSURE OR TEMPERATURE
 - SEVEN DIGIT RATE, EIGHT DIGIT TOTAL
 - SEPARATE UNITS FOR RATE AND TOTAL
 - MANY PRESET LIQUIDS AND GASES
 - PROGRAMMABLE DECIMAL PLACES
- 85-250 VAC, OR 12VDC OR 24 VDC, ALL WITH HIGH ISOLATION, SURGE, REVERSE POLARITY, UNDER-VOLTAGE, OVER-CURRENT AND SHORT CIRCUIT PROTECTION
- BRIGHT TRANSMISSIVE COLOR GRAPHIC DISPLAY WITH A WHITE BACKLIGHT
- FULLY COMPLIANT, PROGRAMMABLE RS485, 1/8 LOAD, MODBUS RTU FOR BAUD RATES UP TO 115 200
- SCROLL DROP LIST MENUS, SIMPLE TO USE
- MULTILEVEL MENUS, THE FIRST CAN BE LOCKED
- 72 X144 mm PANEL MOUNT ENCLOSURE
- Weight 0.45 kg (1.0 lb)
- ALL SOFTWARE OPTIONS CAN BE ENABLED ON THE FIELD WITH PASSWORDS
- VERY EASY TO PROGRAM AND USE

APPLICATIONS

- FLOW RATE AND TOTAL MEASUREMENT AND CONTROL OF LIQUIDS, GASES AND / OR STEAM
- FUEL USAGE MEASUREMENT
- COMBINED FLOW DELIVERY MEASUREMENT
- BATCH APPLICATIONS
- METERING PUMPS PRECISE CONTROL FOR DOSING APPLICATIONS



1. DESCRIPTION

GFC300 is a flow computer that can be ordered as a single channel, dual channel or just with a dual hardware and be field upgraded later with passwords to the full dual functionality. Both channels can work independently measuring different fluids or they can be related and measure rate A+B, total A-B or total A+B and control the outputs with them.

Each channel can measure volume, compensated volume or mass of liquids, gases or steam independently. Each channel has one universal flow, one temperature and one pressure input.

The flow signal can be pulse open drain / collector, npn, pnp, reed switch, waves, dry contact, logical signals and coils without an external preamplifier. The flow signal can also be analog linear to the flow rate or a differential pressure signal that needs a square root extraction.

The temperature and pressure can be set manually if no sensors are being used.

The density of liquids and gases can be set manually, calculated or taken from a density meter connected to the temperature analog input.

The steam density is very accurately calculated in a very large temperature and pressure range.

Separate volume or mass units can be chosen for rate and total, each channel.

Using the fast RS485 MODBUS communication rate and total for each channel as well as rate A+B, total A-B, total A+B and many other parameters can be read remotely many times a second.

Many liquids, gases and temperature sensors are preset which simplifies the programming.

A variety of isolated high accuracy programmable outputs can connect GFC300 to any device.

Drop list color menus that you scroll are very intuitive and easy to use.

Icons for disconnected analog input, alarm, pulse output or communication are displayed along with a horizontal bar representing the analog output. Flow signal (frequency, current or delta P), temperature, pressure, density and Z factor are also displayed.

There is a special test menu where very easily all inputs and outputs can be checked and precisely tested.



2. ABSOLUTE MAXIMUM RATINGS *

Operating temperature	-20 °C to +70 °C
Power:	
AC version	264 VAC, 47-400 Hz
12 VDC version	18 VDC
24 VDC version	36 VDC
Alarm relay current	5 A / 250 VAC , 5A / 30 VDC
Pulse output current	100 mA DC
Pulse output voltage	100 V
Voltage for the an. output, 4-20 mA loop power	42 VDC
Current for the pulse input sensor	20 mA DC

*** NOTICE: Stresses above those ratings may cause permanent damage to the device.**

3. CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Power Supply	High isolation, surge, over-voltage/current protected				
AC voltage option	47 – 400 Hz	85		250	VAC
Isolated 12 VDC option	Reverse polarity protected	9	12	18	VDC
Isolated 24 VDC option	Reverse polarity protected	18	24	36	VDC
Power Consumption	Efficiency over 77%				
85-250 VAC version	115 VAC, 60 Hz, dual hardware, all 6 inputs at 20 mA			5	VA
Pulse Input					
Voltage for the sensor	Regulated, filtered and protected, max 20 mA		24		V DC
Input threshold, high	Rectangular wave 5 V, 50 % duty cycle		1.86		V
Input threshold, low	Rectangular wave 5 V, 50 % duty cycle		1.44		V
Coil voltage	Symmetrical signal from the coil (sine, triangle, saw etc)	20			mVpp
Input frequency range	Rectangular wave, 50 % duty cycle	0 - 10			kHz
Analog inputs					
Voltage for the loop	Regulated, filtered and protected		24		VDC
Input resistance	25 °C		157		ohm
Full scale error	25 °C, 4 – 20 mA		0.01	0.03	% FS
Temperature coefficient	-20 °C to +70 °C			25	ppm/°C
Output 4-20 mA option	High isolation, loop power, 2 wire				
Power supply	-20 °C to +70 °C, Note 1	9.5		36	V DC
Resolution	-20 °C to +70 °C, 9.5 – 36 V		4		uA
Error	250 ohm load, 24 V, 25 °C, Note 2			0.05	% FS
Power supply error	9.5 - 36V, no load, 25 °C			0.5	uA/V
Temperature coefficient	-20 °C to +70 °C, 24 V		35		ppm/ °C
Output 0–5/10 V option	High isolation, no external power required, 2 wire				
Resolution			1.2/2.4		mV
Error	100 kohm load, 24 V, 25 °C, Note 2			0.05	% FS
Temperature coefficient	-20 °C to +70 °C, 24 V		25		ppm/ °C
Pulse Output, open drain	High isolation, reverse polarity to 100 mA protected, 2 wire				
Output ON resistance	-20 °C to +70 °C, 100 mA			1.5	ohm



Output OFF leakage	-20 °C to +70 °C, 100 V DC			1	uA
Maximum frequency	The durations of the pulse and the pause are equal	10	11.1		kHz
Relay contact	Normal open				
Current	30 VDC or 250 VAC, resistive load			5	A
RS485	2 wire				
Load	1/8 of the standard RS485 driver load		1/8		
Weight	Dual hardware		1.0		lb
			0.45		kg
Enclosure	Panel mount, 72x144 mm, Self-extinguishing PPO, black				

Note 1: The minimum voltage for the 4-20 mA output to operate is $V = 9.5 + R \text{ load [ohm]} * 0.020$ [V DC]
 For a GFC300 with a load of 250 ohm, the minimum voltage would be 14.5 V DC.

Note 2: The parameter includes all errors, non-linearity and noise at constant voltage and temperature

3.1. BUTTONS

There are four buttons: **SET**  and **UP**, **LEFT** and **DOWN** arrows.

- **SET** is used to enter and exit menus and confirm options chosen
- **UP** is used to scroll up or increment
- **DOWN** is used to scroll down or decrement
- **LEFT** is used to move the cursor (blinking digit or icon) to the left or return to a previous menu

There are two types of buttons accepted by the GFC300 flow computer:

- Short is when the button is pressed and released in less than 0.5 second
- Long is when it is kept pressed for more than 5 seconds
- All other durations are ignored

NOTE: The UP and DOWN buttons will not change the digit at the cursor if the settings are locked.

3.2. INPUTS AND CHANNELS

GFC300 can be ordered with a single channel hardware or a dual channel hardware. Ordering with a dual hardware will allow for a lower price at the time of order but make possible the field upgrade later.

Example: You need a single flow computer now but you think you may need another one or dual functionality later. You order a lower cost GFC300 with a dual hardware and single functionality. Later you need a second flow computer and/or dual functionality. Just by calling or e-mailing G Instruments you receive special passwords. You enter these passwords in a special menu and the second flow computer and / or the dual functionality is enabled in a couple of minutes without any interruption of your application.

Both channels can have the same or different hardware: for an instance channel A can have a 4-20 mA analog output while channel B can have a 0-5 V or 0-10V output, or other combinations.

All outputs are isolated each other, from the inputs and from the power. The inputs are not isolated each other.

Each channel has one universal flow input that can be switched to accepts pulses or 4-20 mA



loop power signal linear to the flow rate (in flow rate units) or coming from a differential pressure sensor (in delta P units) needing a square root extraction to get the flow rate.

The flow signal must be proportional to the volume (in volume units).

- Pulse input from flow sensors in volume units. This input can power the sensor with 24 VDC and accept open drain/collector npn/pnp sensors, reed switches, dry contacts, different types of waves, logical signals and coils. There is no need for external amplifiers for the coils or linearizers. This input can be linearized with a curve (calibration table) of up to 30 points.
- Using the DIP switches on the rear panel of GFC300 the same input can be switched to accept analog 4-20 mA signal that can be linear to the volume flow rate or a differential pressure signal that needs square root extraction to calculate the volume flow rate.

The “flow input type” menu must be properly set for the input chosen above.

Each channel also has one analog 4-20 mA loop power input for temperature and one more for pressure.

When measuring liquid mass of a generic liquid a density meter can be used instead of a temperature sensor. It must be connected to the temperature input and the density source in the “**sources**” menu must be switched to “**analog input**”.

3.3. OUTPUTS

GFC300 has one isolated analog, one isolated pulse and one relay output per channel.

3.3.1. Isolated Analog output

It can be 4-20 mA loop power or 0 – 5 V, or 0 – 10 V. The voltage options do not need external power and use two wire. It can be programmed to represent the flow rate of its own channel, rate A+B, temperature or pressure. **SET4** is the rate (temperature, pressure, density) at 4 mA (0V for voltage output). **SET20** is the rate at 20 mA (5V or 10V).

Example: You program **SET4** = 1000 GPM and **SET20** = 320 GPM. Then the analog output will be inverse and change from 20 mA down to 4 mA when the flow rate changes from 320 to 1000 GPM.

3.3.2. Isolated Pulse output

The pulse output is 100V / 100 mA open drain, sinking (npn) with reverse polarity for up to 100 mA protection.

SETP parameter means how many gallons (other volume or mass units) have to pass through the flow meter in order to produce one output pulse. This output can represent the flow of its own channel, channel A-B or A+B.

Example: If **SETP** = 10.0, the output will produce one pulse at every 10 gallons (lbs, CF, tons etc) **SETP** has to be set in a way ensuring the frequency of the pulses will not exceed 10 kHz. Otherwise the frequency will be limited by GFC300 and some pulses may be lost.

3.3.3. Alarm Relay output

It can represent the flow rate of its own channel, rate A+B, temperature or pressure. The **ALARM** setting needs to be set in order to properly use this output. Also the alarm can be set to be **HIGH** or **LOW** with a



HYSTERESIS in percents.

Example: The **ALARM** = 100 GPM, alarm type is **HIGH**, the **HYSTERESIS** is 20%. The relay contact will close when the flow rate reaches 110 GPM and will open when it falls below 90 GPM. Hysteresis of 20 % means 10 % above and 10 % below the **ALARM** setting.

3.4. DISPLAY

It is a bright color graphic transmissive display with a white back light. It shows rate and total for each channel, temperature, pressure, flow input (frequency, current or delta P), density and Z factor. If the flow input is analog the display will show mA or differential pressure. If the flow input is pulse the display will show frequency in Hz. A horizontal bar for the analog output and icons for all analog inputs, output pulses, alarm or communication in progress. Rate is 7 digits, the total is 8 digits. Their values are updated twice a second.

If the flow computer has a dual hardware and is enabled as dual there will be 3 screens: one for channel A, one for channel B and one showing most important data for both. Switching between those 3 screens is by pressing **UP** or **DOWN** arrow.

- F** – analog flow input is bad or disconnected
 - T** - the temperature input is bad or disconnected
 - D** - the density input is bad or disconnected
 - P** - the pressure input is bad or disconnected
 - U** - the pulse output is producing pulses
 - R** - the alarm relay contact is closed
 - C** shows when GFC300 receives some data over the RS485 MODBUS line
- A horizontal bar shows the analog output



3.4.1. Menus

There are a few levels of menus. The first level is designed to be used by the end user or not skilled personnel. All important settings are hidden in the upper level menus. The first level menu can be locked. Then the user can only see but not change the settings in that menu.

3.4.1.1. First Level Menu

Entering the first level menu is by pressing and holding for 5 seconds the **SET** button. If the flow computer is dual a small menu to choose the channel will appear. If it is single the first menu for channel A will appear.



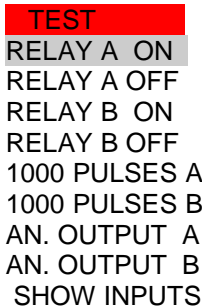
Using **UP** and **DOWN** buttons choose the setting you want to see or change and press **SET**. The current value of that setting will appear and the decimal point will be blinking. You can increase or decrease the decimal places by pressing **UP** or **DOWN** while the decimal point is blinking. Pressing **LEFT** will move the cursor to the left. When finished press **SET**.

NOTE: The software will not accept zero for KFACTOR or SETP.

If **ABOUT** is chosen a new screen will appear and show the version, the serial number of GFC300, all software options enabled and if the hardware is single or dual. Press any button to go back to the first menu.



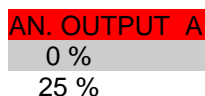
Test menu can not be entered at all if the first level menu is locked. If it is not locked the test menu will appear and all inputs and outputs can be tested. To enter the test menu you need to press **SET** and hold it for 5 seconds.



Choosing 1000 pulses item will produce exactly 1000 pulses on the pulse output A or B with a frequency of 100 Hz.

Choosing **SHOW INPUTS** will show the flow inputs (current or frequency) and the current of the analog inputs for temperature/density and pressure.

To test the analog output choose **AN. OUTPUT**. A new menu will appear.



50 %
75 %
100 %

When finished press **LEFT** to return to the first menu and press **LEFT** one more time to exit this first level menu and return to the normal mode. GFC300 will store all settings automatically.

NOTE: There is a time out which will reset the flow computer and all changes will be lost. They will be stored only when you exit all the menus (by pressing LEFT) and return to the normal mode.

3.4.1.2. Hidden Menus

Enter the first level menu as described in 3.4.1.1. Scroll down to **SETP**. Press and hold for 5 seconds the **LEFT** button. Then there will be a time slot of 3 seconds to release **LEFT**, press shortly **SET** and **LEFT** again.

The first hidden menu (**second level**) will appear:



Pressing **SET** on **CHANNEL A** will enter **the third level** menu for all settings related to channel A. If GFC300 has a dual hardware and is enabled to be dual pressing **SET** on **CHANNEL B** will do the same for channel B.

RS485 communication protocol is MODBUS RTU. The **MODBUS address**, the baud rate and the parity can be easily programmed.

The **MATH** menu can be entered only if having dual hardware and dual computer. No math (independent channels), rate A+B, total A-B or total A+B can be chosen. In these cases the display will show:

rate A+B, total A and total B
or rate A, rate B and total A-B
or rate A, rate B and total A+B

NOTE: In any of the cases above both channels must have the same units for total and rate. It is the user's responsibility to make sure both channels have the same units for their rates and the same units for their totals.

NOTE: Total A - B will never go negative.

Using the **SINGLE/DUAL** menu GFC300 can be programmed to work in a dual mode **only if it has a dual hardware and the "D" option enabled.**



The options that you purchased later can be enabled using the menu **OPTIONS EN**. The software will not allow you to enter a password for an option that you already have. For the newly purchased options you have to enter the passwords that you received from G Instruments. There is a separate password for each option.

OPTIONS

The options that can be enabled at the time of order at the factory or by passwords later in the field are:

P = PULSE OUTPUT
A = ALARM RELAY
C = PULSE CURVE
O = ANALOG OUTPUT
G = GAS EQUATIONS
D = DUAL COMPUTER
B = MODBUS COMM.
M = MATH. CALC.
S = STEAM EQUATIONS

Each channel will have full hardware for all of the above options but the software for them will be enabled or disabled. If ordered at the time of the purchase of GFC300, they will be enabled by the factory. If you want to purchase some option(s) later, contact G Instruments to receive a special password for each option which will allow you to upgrade in a couple of minutes without interrupting the work of your equipment and without the need to disconnect and ship your GFC300 to the factory.

MODBUS communication can be enabled on either single or dual flow computer. But math calculations can not be enabled on a single hardware or a single computer. For math, a dual hardware and a dual computer (option D enabled) are needed.

Third level menu

If you pressed **SET** on "CHANNEL A" (or B) on the second level (SETTINGS) menu, the third level will appear:

CHANNEL A
UNITS
REF. CONDITIONS
WORK CONDITIONS
ANALOG INPUTS
EQUATION TYPE
FLUID TYPE
FLOW INPUT
FR DEC PLACES
TOT DEC PLACES
SOURCES
CLEAR TOTAL
ALARM TYPE
CURVE POINTS
FILTER/RESPONSE

A variety of volume, mass, time, temperature, pressure, differential pressure and density units can be



chosen in the **UNITS** menu.

In **REFERENCE CONDITIONS** menu reference temperature, pressure, density and Z factor have to be entered.

In **WORK CONDITIONS** menu manual temperature, manual pressure, thermal volume expansion coefficient, Z factor at average working conditions, atmospheric pressure and failsafe values for temperature, pressure, flow rate and density can be entered. The quality (dryness) of saturated steam can also be entered.

TIP: All analog inputs have a failsafe value. It will be used automatically if the signal of that analog input gets below about 3.8 mA (disconnected or bad sensor). Always program those failsafe values.

MANUAL TEMPERATURE and/or PRESSURE can be used if no sensor for them is connected.

The **THERMAL VOLUME EXPANSION COEFFICIENT** is used for measuring liquid compensated volume or liquid mass.

Z FACTOR is used for measuring gas compensated volume or gas mass.

ATMOSPHERIC PRESSURE is needed for measuring gases and superheated steam if the pressure sensor is for gauge pressure.

The **FAILSAFE VALUES** will be automatically used in case the analog input for temperature, pressure, flow or density is disconnected or bad.

STEAM QUALITY (DRYNESS) is used for measuring mass of saturated (wet) steam. Dry steam has 1.0 quality, liquid phase only has 0.0 quality. A typical value in practice can be around 0.95 .

ANALOG INPUTS menu is the place where you need to enter the temperature, pressure, density, flow rate and the differential pressure at 4 mA and at 20 mA. A cut-off in percents for the analog flow input can also be entered in this menu.

EQUATION TYPE menu will give the following choices:

EQUATION A
LIQUID VOLUME
LIQ COMP. VOL
LIQUID MASS
GAS VOLUME
GAS COMP. VOL
GAS MASS
STEAM VOLUME
STEAM MASS

The **LIQUID VOLUME** and the **GAS VOLUME** equations will just calculate the volume rate and total. These equations do not need temperature or pressure but sensors can be used to monitor the



temperature and/or the pressure.

The **LIQUID COMPENSATED VOLUME** equation needs the liquid temperature, reference temperature, and thermal volume expansion coefficient of the liquid in order to compensate for the thermal expansion of the liquid.

The **LIQUID MASS** equation needs:

- temperature of the liquid, reference temperature, reference density (at reference temperature) and the volume thermal expansion coefficient of that liquid

OR

- a 4-20 mA signal proportional and linear to the density of the liquid, connected to the temperature input

The thermal volume expansion coefficient of the liquid must be entered in 10 of power -6 units.

Example: The liquid volume expansion coefficient is 0.003200 per degree. You need to enter 3200.

NOTE: All of the above is valid if a generic liquid has been chosen in the FLUID TYPE menu. If a liquid from the list has been chosen the software will not need reference density and expansion coefficient because they are preprogrammed for that specific liquid.

The **GAS COMPENSATED VOLUME** equation needs temperature, pressure, reference temperature, reference pressure, reference Z factor and a Z factor for the current temperature and the pressure of the gas.

The **GAS MASS** equation needs the same plus a density at reference temperature and pressure. The Z factor at working conditions must be entered manually in the **WORK CONDITIONS** menu if a generic gas is chosen in the **FLUID TYPE** menu.

If a gas from the list has been chosen GFC300 will very accurately calculate the Z factor at the measured temperature and pressure in a very large temperature and pressure range and provide more accurate flow rate and total readings.

STEAM VOLUME will calculate the volume only of the steam without any corrections.

MASS of saturated steam equation needs both **temperature and quality** of the steam. GFC300 will very accurately calculate the density and then the mass of the steam.

MASS of superheated steam equation needs both **temperature and pressure** of the steam. GFC300 will very accurately calculate the density and then the mass of the steam.

In the **FLUID TYPE** menu the choices are:

- Liquids: generic, gasoline, diesel, kerosene, propane LPG, anh. ammonia, benzene, acetone and ethanol
- Gases: generic, dry air, argon, carbon dioxide, carbon monoxide, hydrogen, methane, nitrogen and oxygen
- Steam: saturated or superheated



More liquids and gases will be added in the next versions of the software.

The choices for **FLOW INPUT** are:

- pulse with a **KFACTOR**. A valid **KFACTOR** must be entered in the first level menu.
- pulse with a calibration curve (table) of up to 30 points. The software will allow this choice only if the option **C** is enabled. In this case a valid calibration curve must be entered prior to using the channel.
- analog 4-20 mA linear to flow rate, in flow rate units. Neither **KFACTOR** nor curve data is needed.
- analog 4-20 mA coming from a differential pressure sensor (in delta P units) that needs a square root extraction in order to get the flow rate.
The **KFACTOR** will be used to calculate the flow rate according to the equation

$$\text{Flow Rate} = \text{KFACTOR} * \text{square_root}(\text{differential pressure})$$

In the **SOURCES** menu:

- The **TEMPERATURE SOURCE** can be a manually entered temperature or a temperature transmitter connected to the analog input. It must be 4-20 mA loop power and linear to temperature. If a generic temp. transmitter has been chosen temperatures at 4 mA and at 20 mA must be entered in the **ANALOG INPUTS** menu. If a temp. transmitter from the list is chosen, the software will not need them because they are pre-programmed.
- The density source (for generic liquids) can be a manually entered **REFERENCE DENSITY** (at **REFERENCE TEMPERATURE**) or a signal from a density meter connected the temperature input. It must be 4-20 mA loop power and linear to density. Densities at 4 and at 20 mA have to be entered in the **ANALOG INPUTS** menu.

For generic gases GFC300 will use the density at reference temperature and pressure (**REFERENCE DENSITY**).
- The **PRESSURE SOURCE** can be a manually entered pressure or a signal from a pressure sensor. It must be 4-20 mA loop power and linear to pressure. Pressures at 4 and at 20 mA have to be entered in the **ANALOG INPUTS** menu.

To **CLEAR THE TOTAL** of the channel press **SET** button and hold it for 5 seconds while on that line of the menu.

The **ALARM TYPE** can be high or low. High means the relay contact will close when the variable is above the alarm setting plus half of the hysteresis. The contact will open when the variable is lower than the alarm set point minus half of the hysteresis. For low alarm the action is reversed.

In the **CURVE POINTS** menu a calibration table for the flow meter can be entered. This way the flow meter linearity, accuracy and turn down ratio can be greatly improved. Each point consists of a frequency in [Hz] and a **KFACTOR** for the flow meter at that frequency. If all 30 points are entered the software will automatically return to the previous menu. If the points are less than 30, enter zero for both the frequency and the **KFACTOR** to indicate that no more points will be entered. The software will sort the points and validate them.



NOTE: The software will not accept zero for a KFACTOR unless the frequency entered before it is also zero.

In the **FILTER/RESPONSE** menu a digital filter (damping) can be programmed. The least damping corresponds to the fastest response and the highest filtering – to the slowest response. There is also an **AUTO** setting that will provide both high filtering and fast response.

NOTE: There is a time out which will reset the flow computer and all changes will be lost. They will be stored only when you exit all the menus (by pressing LEFT) and return to the normal mode.

NOTE: Total A and total B are stored in the non-volatile memory every 50 seconds. Before powering down the flow computer make sure that there was no flow for the last minute. All important settings are stored in a non-volatile memory and will not be lost.

3.5. COMMUNICATION

GFC300 has a RS485 two wire communication port with high surge and transients protection. The communication protocol is MODBUS RTU. The MODBUS address, the baud rate and the parity are programmable. Shorting the termination jumper next to the terminals on the rear panel connects a 120 ohm 0.5W resistor between A (D+) and B (D-). This is needed only if GFC300 is at the very end of the buss and/or far from the MODBUS master. For better quality of communication and achieving higher baud rates a shielded twisted pair (STP) should be used.

The RS485 port is not isolated from the inputs of GFC300, but it is isolated from the power and all outputs.

The MODBUS software of GFC300 supports functions 0x03 (read holding registers) and 0x04 (read input registers). Exceptions 1, 2, 3 and 6 are handled.

<u>Register Address</u>	<u>Register Type</u>	<u>Read/Write</u>	<u>Description</u>	<u>Format</u>
80	Input	R	Flow Rate A, High. NOTE 1	IEEE-754 floating point
81	Input	R	Flow Rate A, Low. NOTE 1	NOTE 2
82	Input	R	Flow Rate B, High. NOTE 1	IEEE-754 floating point
83	Input	R	Flow Rate B, Low. NOTE 1	NOTE 2
36	Input	R	Total A, High. NOTE 3	IEEE-754 floating point
37	Input	R	Total A, Low. NOTE 3	NOTE 2
84	Input	R	Total B, High. NOTE 3	IEEE-754 floating point
85	Input	R	Total B, Low. NOTE 3	NOTE 2
86	Input	R	Total A-B or Total A+B, High. NOTE 4	IEEE-754 floating point
87	Input	R	Total A-B or Total A+B, Low. NOTE 4	NOTE 2
88	Input	R	Rate A+B, High. NOTE 5	IEEE-754 floating point
89	Input	R	Rate A+B, Low. NOTE 5	NOTE 2
90	Input	R	Rate volume unit for channel A.	NOTE 6



91	Input	R	Rate volume unit for channel B.	NOTE 6
92	Input	R	Total volume unit for channel A.	NOTE 6
93	Input	R	Total volume unit for channel B.	NOTE 6
94	Input	R	Mass rate unit for channel A.	NOTE 7
95	Input	R	Mass rate unit for channel B.	NOTE 7
96	Input	R	Mass total unit for channel A.	NOTE 8
97	Input	R	Mass total unit for channel B.	NOTE 8
98	Input	R	Time unit for channel A	NOTE 9
99	Input	R	Time unit for channel B	NOTE 9
100	Input	R	Equation for channel A	NOTE 10
101	Input	R	Equation for channel B	NOTE 10
102	Input	R	Math calculation	NOTE 11

Note 1: This register is not available when a math calculation rate A+B has been programmed

Note 2: This is a IEEE-754 floating point number. High word contains the exponent and the most significant byte of the mantissa. The low word contains the middle and the least significant byte of the mantissa. Both high and low must be read, merged and used like a IEEE-754 floating point number.

Note 3: This register is not available when a math calculation total A+B or total A-B is programmed

Note 4: This register is available only when a math calculation total A-B or total A+B is programmed

Note 5: This register is available only when a math calculation of rate A+B is programmed

Note 6: 0 = gal, 1 = ighal, 2 = ft³, 3 = SCF, 4 = hL, 5 = m³, 6 = MCF, 7 = AF, 8 = SCC, 9 = L, 10 = qts, 11 = bbl 31.0 gal, 12 = bbl 31.5 gal, 13 = bbl 36.0 gal, 14 = bbl 40.0 gal, 15 = bbl 42.0 gal, 16 = bbl 55.0 gal

Note 7: 0 = lb, 1 = kg, 2 = g, 3 = t, 4 = ts, 5 = tl (ton, ton short and ton long)

Note 8: 0 = lb, 1 = kg, 2 = g, 3 = t, 4 = ts, 5 = tl, 6 = hlb, 7 = klb, 8 = Mlb (hecto_lb, kilo_lb, mega_lb)

Note 9: 0 = per second, 1 = per minute, 2 = per hour, 3 = per day

Note 10: 0 = liquid volume, 1 = liq compensated volume, 2 = liq mass, 3 = gas volume, 4 = gas comp. volume, 5 = gas mass, 6 = steam volume, 7 = steam mass

Note 11: 0 = no math, 1 = rate A+B, 2 = total A-B, 3 = total A+B

4. APPLICATION

4.1. Liquid volume

4.1.1. Pulse input with a KFACTOR

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a **KFACTOR** in pulses per total volume unit. You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.1.2. Pulse input with a calibration curve (table)

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a calibration table. All **KFACTOR**s must be in pulses per total volume unit. Option **C** must be enabled. You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.1.3. Analog input linear to flow rate, in flow rate units

Connect the analog signal to the flow input and set the DIP switch for analog input.

Enter flow rate for 4 and for 20 mA in the **ANALOG INPUTS** menu.

You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.



4.1.4. Differential pressure sensor in delta P units, needing a square root extraction

Connect the analog signal to the flow input and set the DIP switch for analog input. Enter a **KFACTOR**. Enter differential pressure for 4 and for 20 mA in the **ANALOG INPUTS** menu.

You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.2. Liquid compensated volume

4.2.1. Pulse input with a KFACTOR

Connect the flow signal to the pulse input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a **KFACTOR** in pulses per total volume unit.

- **Generic liquid:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu
Enter a thermal volume expansion coefficient for the reference temperature in the **WORK CONDITIONS** menu
- **Liquid from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

A pressure sensor can be connected but it is not needed for the calculations.

4.2.2. Pulse input with a calibration curve (table)

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a calibration table. All **KFACTORs** must be in pulses per total volume unit. Option **C** must be enabled.

- **Generic liquid:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu
Enter a thermal volume expansion coefficient for the reference temperature in the **WORK CONDITIONS** menu
- **Liquid from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

A pressure sensor can be connected but it is not needed for the calculations.

4.2.3. Analog input linear to flow rate

Connect the analog signal to the flow input and set the DIP switches for analog input. Enter flow rate for 4 and for 20 mA in the **ANALOG INPUTS** menu.

- **Generic liquid:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu



Enter a thermal volume expansion coefficient for the reference temperature in the **WORK CONDITIONS** menu

- **Liquid from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

A pressure sensor can be connected but it is not needed for the calculations.

4.2.4. Differential pressure sensor

Connect the analog differential pressure signal to the flow input and set the DIP switches for analog input. Enter differential pressure for 4 and for 20 mA in the **ANALOG INPUTS** menu. Enter a **KFACTOR**

- **Generic liquid:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu
Enter a thermal volume expansion coefficient for the reference temperature in the **WORK CONDITIONS** menu
- **Liquid from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

A pressure sensor can be connected but it is not needed for the calculations.

4.3. Liquid mass

4.3.1. Pulse input with a KFACTOR

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a **KFACTOR** in pulses per total volume unit.

- **Generic liquid:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu
Enter a thermal volume expansion coefficient for the reference temperature in the **WORK CONDITIONS** menu
Enter a reference density in the **REF. CONDITIONS** menu and set density source to manual

OR

- **Generic liquid:** connect a density meter to the temperature input, switch the density source to analog input and enter density for 4 and 20 mA
- **Liquid from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.



A pressure sensor can be connected but it is not needed for the calculations.

4.3.2. Pulse input with a calibration curve (table)

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a calibration table. All **KFACTOR**s must be in pulses per total volume unit.

Option **C** must be enabled.

- **Generic liquid:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu
Enter a thermal volume expansion coefficient for the reference temperature in the **WORK CONDITIONS** menu
Enter a reference density in the **REF. CONDITIONS** menu and set density source to manual

OR

- **Generic liquid:** connect a density meter to the temperature input, switch the density source to analog input and enter density for 4 and 20 mA
- **Liquid from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

A pressure sensor can be connected but it is not needed for the calculations.

4.3.3. Analog input linear to flow rate

Connect the analog signal to the flow input and set the DIP switches for analog input.

Enter flow rate for 4 and for 20 mA in the **ANALOG INPUTS** menu.

- **Generic liquid:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu
Enter a thermal volume expansion coefficient for the reference temperature in the **WORK CONDITIONS** menu
Enter a reference density in the **REF. CONDITIONS** menu and set density source to manual

OR

- **Generic liquid:** connect a density meter to the temperature input, switch the density source to analog input and enter density for 4 and 20 mA
- **Liquid from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

A pressure sensor can be connected but it is not needed for the calculations.

4.3.4. Differential pressure sensor



Connect the analog differential pressure signal to the flow input and set the DIP switches for analog input. Enter differential pressure for 4 and for 20 mA in the **ANALOG INPUTS** menu. Enter a **KFACTOR**

- **Generic liquid:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu
Enter a thermal volume expansion coefficient for the reference temperature in the **WORK CONDITIONS** menu
Enter a reference density in the **REF. CONDITIONS** menu and set density source to manual

OR

- **Generic liquid:** connect a density meter to the temperature input, switch the density source to analog input and enter density for 4 and 20 mA
- **Liquid from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter a reference temperature in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

A pressure sensor can be connected but it is not needed for the calculations.

4.4. Gas volume

4.4.1. Pulse input with a KFACTOR

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a **KFACTOR** in pulses per total volume unit. You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.4.2. Pulse input with a calibration curve (table)

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a calibration table. All **KFACTORs** must be in pulses per total volume unit. Option **C** must be enabled. You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.4.3. Analog input linear to flow rate

Connect the analog signal to the flow input and set the DIP switch for analog input. Enter flow rate for 4 and for 20 mA in the **ANALOG INPUTS** menu.

You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.4.4. Differential pressure sensor

Connect the analog signal to the flow input and set the DIP switch for analog input. Enter a **KFACTOR**. Enter differential pressure for 4 and for 20 mA in the **ANALOG INPUTS** menu.

You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.5. Gas compensated volume

4.5.1. Pulse input with a KFACTOR

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a **KFACTOR** in pulses per total volume unit.



- **Generic gas:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter a reference temperature, a reference pressure and a reference Z factor.
Enter a Z factor for the average working temperature and pressure in the **WORK CONDITIONS** menu
- **Gas from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter a reference temperature, a reference pressure and a reference Z factor in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.5.2. Pulse input with a calibration curve (table)

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a calibration table. All **KFACTOR**s must be in pulses per total volume unit.

Option **C** must be enabled.

- **Generic gas:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter a reference temperature, a reference pressure and a reference Z factor.
Enter a Z factor for the average working temperature and pressure in the **WORK CONDITIONS** menu
- **Gas from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter a reference temperature, a reference pressure and a reference Z factor in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.5.3. Analog input linear to flow rate

Connect the analog signal to the flow input and set the DIP switch for analog input.

Enter flow rate for 4 and for 20 mA in the **ANALOG INPUTS** menu.

- **Generic gas:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.



Enter a reference temperature, a reference pressure and a reference Z factor.
Enter a Z factor for the average working temperature and pressure in the **WORK CONDITIONS** menu

- **Gas from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter a reference temperature, a reference pressure and a reference Z factor in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.5.4. Differential pressure sensor

Connect the analog signal to the flow input and set the DIP switch for analog input.

Enter differential pressure for 4 and for 20 mA in the **ANALOG INPUTS** menu. Enter a **KFACTOR**.

- **Generic gas:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter a reference temperature, a reference pressure and a reference Z factor.
Enter a Z factor for the average working temperature and pressure in the **WORK CONDITIONS** menu
- **Gas from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter a reference temperature, a reference pressure and a reference Z factor in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.6. Gas mass

4.6.1. Pulse input with a KFACTOR

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a **KFACTOR** in pulses per total volume unit.

- **Generic gas:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter reference temperature, reference pressure, reference density and a reference Z factor.
Enter a Z factor for the average working temperature and pressure in the **WORK CONDITIONS** menu



- **Gas from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter reference temperature, reference pressure, reference density and a reference Z factor in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.6.2. Pulse input with a calibration curve (table)

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a calibration table. All **KFACTORs** must be in pulses per total volume unit.

Option **C** must be enabled.

- **Generic gas:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter reference temperature, reference pressure, reference density and a reference Z factor.
Enter a Z factor for the average working temperature and pressure in the **WORK CONDITIONS** menu
- **Gas from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter reference temperature, reference pressure, reference density and a reference Z factor in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.6.3. Analog input linear to flow rate

Connect the analog signal to the flow input and set the DIP switch for analog input.

Enter flow rate for 4 and for 20 mA in the **ANALOG INPUTS** menu.

- **Generic gas:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.
Enter reference temperature, reference pressure, reference density and a reference Z factor.
Enter a Z factor for the average working temperature and pressure in the **WORK CONDITIONS** menu
- **Gas from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.



Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.

Enter reference temperature, reference pressure, reference density and a reference Z factor in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.6.4. Differential pressure sensor

Connect the analog signal to the flow input and set the DIP switch for analog input.

Enter differential pressure for 4 and for 20 mA in the **ANALOG INPUTS** menu. Enter a **KFACTOR**.

- **Generic gas:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.

Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.

Enter reference temperature, reference pressure, reference density and a reference Z factor.

Enter a Z factor for the average working temperature and pressure in the **WORK CONDITIONS** menu

- **Gas from the list:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.

Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.

Enter reference temperature, reference pressure, reference density and a reference Z factor in the **REF. CONDITIONS** menu

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.7. Steam volume

4.7.1. Pulse input with a KFACTOR

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a **KFACTOR** in pulses per total volume unit. You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.7.2. Pulse input with a calibration curve (table)

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a calibration table. All **KFACTORs** must be in pulses per total volume unit. Option **C** must be enabled. You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.7.3. Analog input linear to flow rate

Connect the analog signal to the flow input and set the DIP switch for analog input.

Enter flow rate for 4 and for 20 mA in the **ANALOG INPUTS** menu.

You can connect a temperature sensor and / or pressure sensor but they are not needed for the



calculations.

4.7.4. Differential pressure sensor

Connect the analog signal to the flow input and set the DIP switch for analog input. Enter a **KFACTOR**. Enter differential pressure for 4 and for 20 mA in the **ANALOG INPUTS** menu.

You can connect a temperature sensor and / or pressure sensor but they are not needed for the calculations.

4.8. Steam mass

4.8.1. Pulse input with a KFACTOR

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a **KFACTOR** in pulses per total volume unit.

- **Saturated steam:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu. Enter the steam quality in the **WORK CONDITIONS** menu
- **Superheated steam:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu. Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.8.2. Pulse input with a calibration curve (table)

Connect the pulse signal to the flow input and set the DIP switches according to the wiring diagrams in paragraph 4.9.1. Enter a calibration table. All **KFACTORs** must be in pulses per total volume unit.

Option **C** must be enabled.

- **Saturated steam:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu. Enter the steam quality in the **WORK CONDITIONS** menu
- **Superheated steam:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu. Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.8.3. Analog input linear to flow rate

Connect the analog signal to the flow input and set the DIP switch for analog input.

Enter flow rate for 4 and for 20 mA in the **ANALOG INPUTS** menu.

- **Saturated steam:** Connect a temperature sensor or enter a manual temperature and



accordingly set the temperature source in the **SOURCES** menu.
Enter the steam quality in the **WORK CONDITIONS** menu

- **Superheated steam:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.8.4. Differential pressure sensor

Connect the analog signal to the flow input and set the DIP switch for analog input.

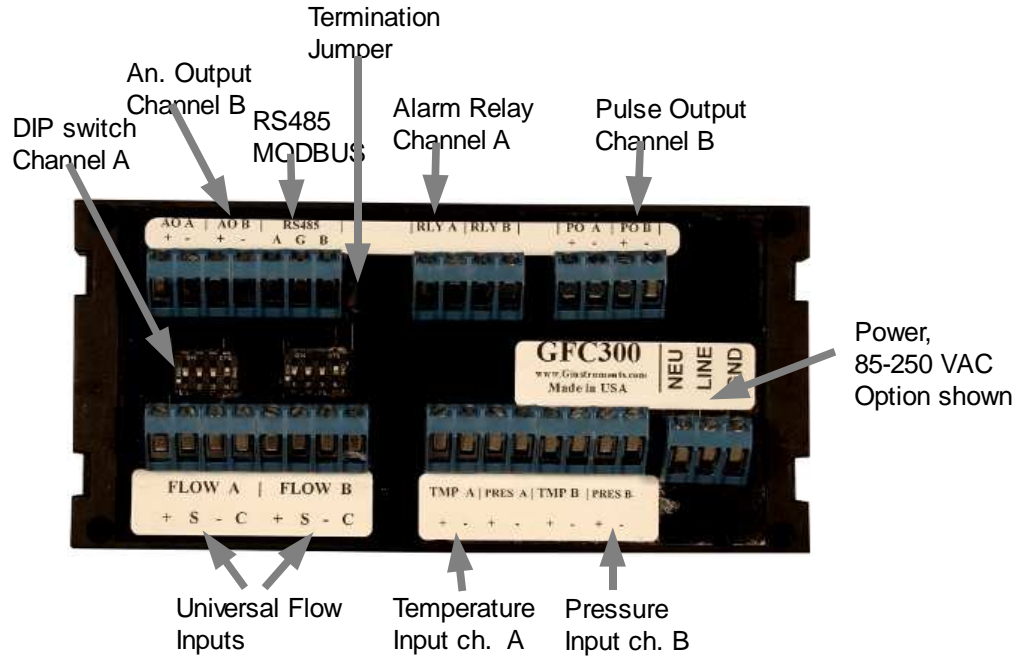
Enter differential pressure for 4 and for 20 mA in the **ANALOG INPUTS** menu. Enter a **KFACTOR**.

- **Saturated steam:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Enter the steam quality in the **WORK CONDITIONS** menu
- **Superheated steam:** Connect a temperature sensor or enter a manual temperature and accordingly set the temperature source in the **SOURCES** menu.
Connect a pressure sensor or enter a manual pressure and accordingly set the pressure source in the **SOURCES** menu.

Enter temperature for 4 and 20 mA in the **ANALOG INPUTS** menu if a generic temperature sensor has been chosen for temperature source.

Enter pressure for 4 and 20 mA in the **ANALOG INPUTS** menu if analog input has been chosen for pressure source.

4.9. ELECTRICAL



GFC300 has (per channel) one flow input, two analog 4-20 mA loop power inputs, one analog output, one normal open relay contact output, and one open drain pulse output.

The flow input can be switched to accept pulses or 4-20 mA loop power signal.

In addition GFC300 has a RS485 two wire communication port.

The power supply options are 85-264VAC using three terminals, 12VDC and 24VDC using two terminals.

NOTE: Double check which power supply option you have against the wiring before applying the power. Applying higher voltage than allowed for the option you have will damage the device.

4.9.1. Wiring the flow input

The flow input can be switched to accept pulses from open drain / collector, npn, pnp, reed switch, dry contact, waves, logical signals and coils. It has four terminals and provides power for the flow sensor, if needed. The power is 24 VDC regulated, filtered and protected, maximum current is 20 mA.

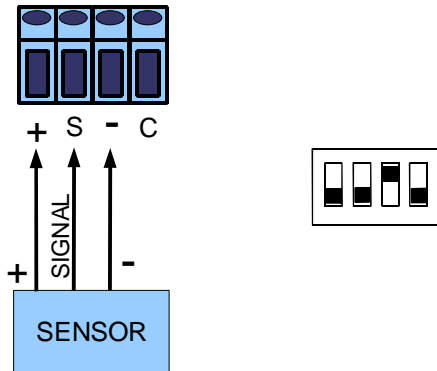
If you would like to power your pulse flow sensor from the GFC300, double check if the sensor can work with 24 VDC / max 20 mA.

The flow input can also be switched to accept analog 4-20 mA loop power signal.

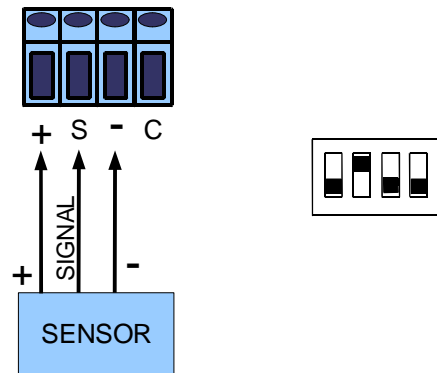
NOTE: There is no isolation between the pulse input and the analog inputs. There is no isolation between the inputs of both channels.

All inputs are isolated from all outputs and from the power.

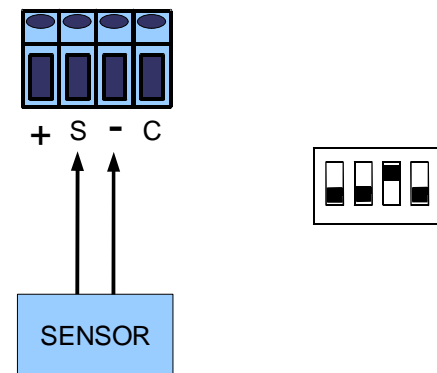
4.9.1.1. NPN Open drain / collector



4.9.1.2. PNP Open drain / collector

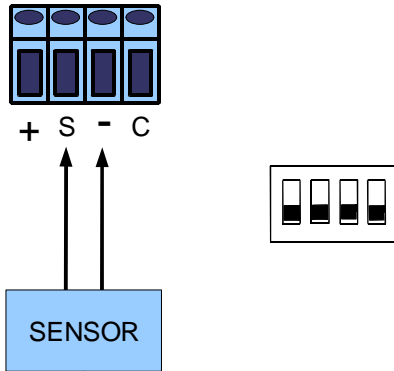


4.9.1.3. Reed switch, dry contact

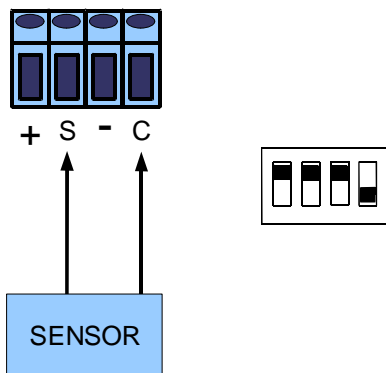


NOTE: A small capacitor in parallel may be needed. Different reed switches and dry contacts have different bouncing time. Test and evaluate carefully to determine the right capacitor.

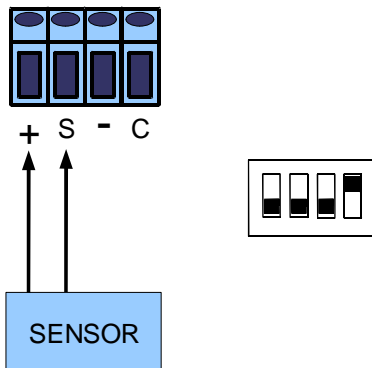
4.9.1.4. Wave (square, sine, triangle, saw etc.), Logical Signal (CMOS, TTL etc.)



4.9.1.5. Coils



4.9.1.6. Analog 4-20 mA loop power for flow rate or differential pressure





4.9.2. Wiring the temperature and pressure inputs

Each channel has two analog 4-20 mA loop power inputs. The power is supplied by GFC300 so you need to use only two wires. The power is 24VDC, regulated, filtered and protected.

The analog channels are named TEMP A and PRES A for channel A, and TEMP B and PRES B for channel B.

TEMP A and TEMP B are for temperature sensors or density meter signals.

PRES A and PRES B are for pressure sensors.

All sensors must be two wire loop power 4-20 mA.

Connect **plus** of the sensor to **plus** of the input, and **minus** to **minus**.

4.9.3. Wiring the analog output

The analog output can be loop power 4-20 mA, 0 – 5 V or 0 -10V.

Double check which one you have before making the connections.

- The 4-20 mA loop power is passive and needs the other device or an external isolated power supply to provide the power to the loop. The minimum voltage must be 9.5 V plus the voltage drop on the receiving device.

Connect **plus** of the output to **plus** of the other devices' input, and **minus** to **minus**.

- Both (0-5V and 0-10V) voltage options are two wire and do not need external power. Connect **plus** of the output to **plus** of the other devices' input, and **minus** to **minus**.

4.9.4. Wiring the pulse output

The pulse output is open drain, sinking (nnp). The device that will receive the pulses has to have a pull-up resistor built-in or added externally to the terminals.

Connect the **plus** of the pulse output to the **signal terminal** of the other device. That same terminal has to have the pull-up resistor. Then connect the **minus** of the pulse output to the **minus** of the other device.

4.9.5. Wiring the RS485 communication port

For best performance use twisted pair, preferably shielded twisted pair (STP). Connect the **A (D+)** signal to terminal **A** and the **B (D-)** wire to terminal **B**. If GFC300 is at the very end of the RS485 buss a termination of the line may be needed. If that is the case short the jumper next to the terminals on the right. Not more than one device at each end of the buss should have a termination.

The RS485 port is not isolated from the pulse and the analog inputs, but it is isolated from the power and all outputs.



4.9.6. Wiring the power

NOTE: Double check which power supply option you have against the wiring before applying the power. Applying higher voltage than allowed for the option you have will damage the device.

- 12 VDC - There will be two terminals for this option. We strongly recommend the **minus** to be connected to earth ground, if the application allows.
- 24 VDC - There will be two terminals for this option. We strongly recommend the **minus** to be connected to earth ground, if the application allows.
- 85 – 264 VAC, 47-400 Hz. There will be three terminals in this case. The **line** (115VAC or 220 VAC line) wire **must** be connected to **LINE** terminal.
The **neutral** wire **must** be connected to the **NEU** terminal.
The **earth ground** wire **must** be connected to the **GND** terminal.

Always use and properly connect earth ground wire when having the 85-264 VAC option.
Always disconnect the high voltage before doing work on GFC300.

4.10. MECHANICAL

GFC300 is a panel mount device. Its front has dimensions 144 x 72 mm (5.67" x 2.84").

It requires a cut out on the panel with dimensions 138 x 68 mm (5.43" x 2.68"). The cut out should not exceed 139 x 68.7 mm (5.57" x 2.7").

The depth needed behind the panel is 153 mm (6").

The front panel is not weather proof. For a weather proof (front only) option IP65 contact G Instruments. We also offer an option for IP54 protection.

Please note that they may require longer lead time.

5. ORDERING

- At the time of order you need to specify if you want single or dual hardware, what power supply option and the type of the analog output of each channel.
- Then you need to specify what software options (features) you need.
- Single hardware will have the full hardware for channel A and RS485 port.
- Dual hardware will have the full hardware for both channels and RS485 port.
- The power options are: isolated 12VDC (9 – 18 VDC) or isolated 24 VDC (18 – 36VDC) or isolated 85 -264 VAC.
- The analog output options are: isolated 4-20 mA loop power (passive) or isolated 0 – 5V or isolated 0 – 10 V

For ordering please use the following G Instruments part numbers:



<i>Description</i>	<i>G Instruments PN</i>
GFC300 single hardware, 4-20 mA output, AC power	30250
GFC300 single hardware, 4-20 mA output, 12 VDC power	30251
GFC300 single hardware, 4-20 mA output, 24 VDC power	30252
GFC300 single hardware, 0 – 5 V output, AC power	30260
GFC300 single hardware, 0 – 5 V output, 12 VDC power	30261
GFC300 single hardware, 0 – 5 V output, 24 VDC power	30262
GFC300 single hardware, 0 – 10 V output, AC power	30270
GFC300 single hardware, 0 – 10 V output, 12 VDC power	30271
GFC300 single hardware, 0 – 10 V output, 24 VDC power	30272
GFC300 dual hardware, 4-20 mA output, AC power	30280
GFC300 dual hardware, 4-20 mA output, 12 VDC power	30281
GFC300 dual hardware, 4-20 mA output, 24 VDC power	30282
GFC300 dual hardware, 0 – 5 V output, AC power	30290
GFC300 dual hardware, 0 – 5 V output, 12 VDC power	30291
GFC300 dual hardware, 0 – 5 V output, 24 VDC power	30292
GFC300 dual hardware, 0 – 10 V output, AC power	30300
GFC300 dual hardware, 0 – 10 V output, 12 VDC power	30301
GFC300 dual hardware, 0 – 10 V output, 24 VDC power	30302

Example: By ordering 30291-PAODM you will receive

- GFC300 with dual hardware
- isolated 0-5 V analog output
- isolated 12 VDC power
- enabled pulse output
- enabled alarm relay
- enabled analog output
- enabled dual functionality
- enabled math calculations



IMPORTANT NOTICE

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