



FEATURES

- USES API TABLES 24B, 24D, 54B AND 54D
- CORRECTION FOR GENERAL LIQUIDS, REFINED PETROLEUM PRODUCTS AND LUBRICATION OILS
- CONNECTS DIRECTLY TO A Pt100 RTD
- 0.02% FS TYPICAL ERROR , -45 TO +100 °C
- RATES AND TOTALS FOR BOTH NET AND GROSS VOLUME
- BOTH TOTALS RESETTABLE, UP TO 1 BILLION
- DISPLAYS TEMPERATURE IN °C OR °F
- SINGLE KFACTOR OR 10 POINT CALIBRATION CURVE
- KFACTORS FROM 0.00001 TO 9,999,999
- MILLILITERS, LITERS, GALLONS, CUBIC FEET, CUBIC METERS, ACRE FEET
- PER SECOND, PER MINUTE, PER HOUR, PER DAY
- UNIVERSAL INPUT POWERING THE FLOW SENSOR
- ISOLATED 12 BIT ANALOG 4-20 mA OUTPUT
- ISOLATED NO POLARITY PULSE OUTPUT
- ISOLATED NO POLARITY DIGITAL OUTPUT
- PROGRAMMABLE FOR:
 - RATE ALARM, HIGH OR LOW
 - TEMPERATURE / RTD ALARM
- ALL OUTPUTS CAN REPRESENT net OR GROSS, PROGRAMMABLE
- ALL SETTINGS STORED IN A NON-VOLATILE MEMORY
- SETTINGS LOCK/UNLOCK FOR SECURITY
- HIGH CONTRAST IN THE ENTIRE TEMPERATURE RANGE
- SIMPLE PROGRAMMING, SMALL SIZE

APPLICATIONS

- FLOW RATE AND TOTAL MEASUREMENT AND CONTROL OF MANY GENERAL LIQUIDS, REFINED PETROLEUM PRODUCTS AND LUBRICATION OILS
- SCADA

1. DESCRIPTION

GFC201 is a low power flow computer / totalizer with an universal input and a variety of outputs. It provides power for many types of sensors and accepts their signal to measure flow rate and total of many types of general liquids, refined petroleum products and lubrication oils. It connects directly to a Pt100 RTD to measure accurately the temperature of the liquid. It calculates and displays net rate, gross rate, net total, gross total and temperature in °C or °F.

GFC201 has an isolated pulse output for net or gross total, an isolated 4-20 mA output for net or gross flow rate. It also has a second isolated digital output that can be programmed for net or gross rate alarm, or for a temperature alarm.

GFC201 can detect broken wires, broken RTD, shorted RTD, too low or too high temperature and trigger that alarm. The alarm output is normally closed and will open when GFC201 detects a wrong condition in the wiring, the RTD or the temperature reading.

For better accuracy GFC201 provides calibration curve capabilities for up to 10 points. In seconds the operator can switch between a single KFACTOR and the curve of up to 10 points.

The device has a version in one inch wider enclosure – GFC201E.

GFC201 is the perfect solution for flow measurement and control applications that require high accuracy and reliability, temperature correction of the volume measured, high isolation, multi-functionality, small size, industrial grade performance and low maintenance.

2. ABSOLUTE MAXIMUM RATINGS *

Operating temperature	-20 °C to +70 °C
Power supply voltage	40 VDC
Voltage for the analog output	40 VDC
Digital outputs current	100 mA DC/AC. Alarm or pulse output
Digital outputs voltage	100 V DC, 70V AC. Alarm or pulse output

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

3. CHARACTERISTICS

Parameter	Conditions	Min	Typical	Max	Units
Power supply	-20 °C to +70 °C	8		36	V DC
Input					
Voltage for the flow sensor	Same as the power supply	8		36	V DC
Threshold, low	Wave or logical signal (CMOS, TTL etc.)		1,2		V DC
Threshold, high	Wave or logical signal (CMOS, TTL etc.)		1.6		V DC
RTD Input					
RTD type	Pt100, alpha 0.00385				
Connection	3 wire				
Error	From -45 to + 100 °C		0.02		% FS
Analog Output					
Power supply	-20 °C to +70 °C, Note 1	7.2		36	V DC
Resolution	-20 °C to +70 °C, 7.2 – 36 V		4		uA
Error	250 ohm load, 24 V, 25 °C, Note 2			0.05	% FS
Power supply error	7.2 - 36V, no load, output disabled, 25 °C			0.5	uA/V
Temperature coefficient	-20 °C to +70 °C, 24 V		35		ppm/°C
Current, output disabled	SET20 = 0.0, 24 V DC supply, 25 °C		3.85		mA
Digital and Pulse Outputs					
Output ON resistance	-20 °C to +70 °C, 100 mA			8	ohm
Output OFF leakage	-20 °C to +70 °C, 100 V DC			5	nA

Note 1: The minimum voltage for the 4-20 mA output to operate is $V = 7.2 + R \text{ load [ohm]} * 0.020$ [V DC]
For a GFC201 with a load of 250 ohm, the minimum voltage would be 12.2 V DC.

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

3.1. BUTTONS

There are three buttons: **SET** , **UP**  and **RIGHT**  :

- **SET** is used to enter and exit menus and confirm options chosen
 - **UP** is used to change the data
 - **RIGHT** is used to move the cursor (blinking digit or icon) to the right
- Additional button functions:

There are two types of buttons accepted by the GFC201 flow computer / totalizer:

- 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 button will not change the value if the settings are locked.

3.2. INPUTS

GFC201 has two inputs:

- Pulse input from a flow sensor such as wave, logical signal, open drain/collector, npn/pnp, reed switches, dry contact and others. The computer / totalizer has all pull-up/down, current limiting and signal conditioning circuits built-in. The input also provides power for all types of sensors.
- 3 wire RTD input for Pt100 providing signal for the liquid temperature. This signal is precisely measured, converted to temperature and is used to correct the volume measured. The correction can be disabled.

3.3. OUTPUTS

GFC201 has three isolated outputs:

3.3.1. Analog output

The isolated analog output is 4-20 mA, two wire, passive, 12 bit, with reverse polarity and surge protection, high accuracy and reliability. Using the **SET20** menu, it can be programmed to represent the flow rate, net or gross.

SET20 parameter refers to the flow rate at which the output has to be 20.00 mA.

3.3.2. Digital output

The isolated digital output has no polarity, can work with 100V/100mA and can be programmed to be:

- Net or gross flow rate alarm, high or low, with +/- 1% hysteresis.

Example: If the alarm is programmed at 100.00 L/M and to be **high** the output will turn on when the flow rate exceeds 101.00 L/M and will turn off when it drops below 99.00 L/M.

With **low** alarm the action will be reversed.

- Temperature / RTD alarm. The output for this alarm is normally closed and will open when GFC201 detects a wrong condition: broken wire or RTD, shorted RTD, too low or too high temperature.

3.3.3. Pulse output

This output will produce one pulse at every programmed volume that passed through the flow meter. It can be used for remote totalizing, control or to synchronize the flow through the flow meter with another flow meter or equipment.

3.4. DISPLAY

The liquid crystal display (LCD) has 7 digits with 5 decimal places and many icons. It shows rate, total and all the variables and options that can be set or programmed. The rates and the totals have programmable auto, none, 1, 2, 3, 4 or 5 decimal places.

When the display shows rate, a "**RATE**" and "**A**" or "**B**" icon is displayed. If it shows total a "**TOTAL**" icon will be displayed along with "**A**" or "**B**".



“**A**” is for net and “**B**” is for gross volume.
(**Gross** is without the temperature correction, **net** is after the correction has been made).

When input pulses are present, an “**INP**” (input) icon will be displayed.
When the digital output is ON an “**alarm**” icon will be displayed
When the pulse output is producing a pulse, the “**pulse**” icon will be shown.
If the total on the LCD is allowed to be reset, a “**RESET**” icon will be displayed.

3.4.1. Volume and time units

Milliliters (**mL**), liters (**L**), gallons (**G**), cubic feet (**CF**), cubic meters (**M³**) and acre feet (**AF**) per second (**S**), minute (**M**), hour (**H**) and day (**D**) are available.

3.4.2. Normal mode

Automatically after turning the power on or exiting a menu, GFC201 enters the normal mode.
Normal mode displays:

- Rate A (net, corrected) or B (gross, uncorrected)
- Total A (net) or B (gross). Totals reset can be enabled or disabled. Both totals are stored in a non-volatile memory every 50 seconds or immediately when cleared.
If a total is allowed to be reset, the **RESET** icon is shown. Reset a total with long **RIGHT** button.
- Temperature in °C or °F. If GFC201 detects a wrong condition in the RTD measurement circuitry, it will display an error message instead of temperature.

Err 1 – left or middle wire is broken, or RTD is shorted

Err 2 – the right wire or the RTD is broken

Err 3 – temperature is too high (above about 100 °C)

Err 4 – temperature is too low (below about -45 °C)

- To switch between rate A, rate B, total A, total B and temperature use short **UP** button.

3.4.3. Menus

To enter the menus, use long **SET** button in normal mode. About 5 seconds after holding the **SET** button, the first menu will appear on the LCD:

- In the “volume units” (**vU**) menu, use **UP** to choose the volume units among **mL**, **L**, **G**, **CF**, **M³** and **AF**. This will be the volume unit for all flow meter KFACTORS and the pulse output as well.
While in this menu all the settings can be locked/unlocked. Use long **SET**.
 - Use short **UP** to lock/unlock the settings. Then use short **SET** to go back to volume units.
If the settings are locked, they can be viewed, but not changed.

Press short **SET** to move to the “time unit menu.”

- In the “time unit” (**tU**) menu, use **UP** to choose the time units among **S**, **M**, **H** and **D**. Press short **SET** to move to the “degrees” menu.
- There you choose °C or °F.
If you choose °C the reference density for refined products and lubrication oils will be in **kg/m³**. At a



reference temperature of **15 °C**.

If you choose **° F** the reference density for refined products and lubrication oils will be in **normalized units**. At a reference temperature of **60 ° F**.

- Press short **SET** to go to **TEMP. OFFSET** menu. In this menu an offset to the temperature measured can be entered in the range between -9.99 and +9.99 degrees. To change the sign use long **SET** button. Press short **SET** to continue to the next menu.
- **KFACTOR** icon along with a blinking decimal point and the KFACTOR number is shown. The decimal places for all KFACTORS (single KFACTOR and all KFACTORS in the curve) can be programmed using **UP** button. KFACTORS ranging from 0.00001 to 9,999,999 can be entered this way. To move from the blinking decimal point away and start entering the KFACTOR digits use the **RIGHT** button. The main **KFACTOR** for the particular flow meter connected to the GFC201 can be entered. This is how many **pulses** the flow computer will receive **per volume unit**.

From the **KFACTOR** menu use short **SET** to enter the next menu.

NOTE: the computer will not accept zero for the KFACTOR.

In the **CURvE** menu, use short **UP** to change between blinking **CURvE** and blinking **KFACTOR**. The flow computer will use either the single **KFACTOR** or the calibration **CURvE** of up to 10 points for calculations. The points have to be entered before using the calibration curve. The curve is stored in a non-volatile memory, and the points can be entered in any order. The computer will order and validate them.

- Enter the calibration curve mode by using long **SET** in the **CURvE** menu for either a blinking **CURvE** or **KFACTOR**.
- “**CAL Crv**” will appear on the LCD, and “**NO**” icon will be blinking. To continue choose **YES** and press short **SET**. To leave calibration curve data mode and leave the previous calibration data untouched, choose **NO** and press short **SET** to go back to the **CURvE** menu.

This feature is very useful for flow meters that have a calibration sheet provided by the manufacturer or the calibration laboratory. Each point consists of an input frequency and a KFACTOR (in pulses per **volume unit**) for that frequency.

Once you enter the calibration curve data menu, you have to go to the last point (point 9). If you have data for less points enter 0.0 for the frequency for all unused points. GFC201 will not accept 0.0 for any KFACTOR.

If **YES** has been chosen, “**Point 0**” will appear on the LCD. Press short **SET** and enter the input frequency in Hz for point 0. Press short **SET** and then enter the KFACTOR for that input frequency. Press short **SET** to do the same for the next point.

Repeat the above for up to 9 more points. After point 9, the flow computer will automatically return to the **CURvE** menu.

- There is no need to enter the frequency at each point in a special (ascending/descending) order. The computer will automatically sort and validate the data and calculate all the parameters..

In the **CURvE** menu press short **SET** to move to “**Correction**” menu.



- In the **Correction** menu choose among **none**, **GEn Liq** (General Liquid), **rEFinEd**, and **Lub Oil**. Press short **SET**.
 - **none** : no temperature correction will be made, no RTD required, rate A and B will be equal, total A and B will also be equal. Pressing short **SET** will take you to **PO CFG** (pulse output configuration) menu.
 - **GEn Liq** : use it for temperature correction of general liquids. After **SET** enter the volume thermal expansion coefficient **tEC** of the liquid at the reference temperature. The **tEC** has to be in 10^{-6} units. If the volume coefficient is 0.000950 , you need to enter 0950. It also has to be per $^{\circ}\text{C}$ or $^{\circ}\text{F}$, whichever you already chose in the previous menu.
Pressing **SET** will take you to the reference temperature **rt** menu. There you need to enter the reference temperature **rt** (in the right degrees $^{\circ}\text{C}$ or $^{\circ}\text{F}$) at which the liquid has the volume **tCE** you already entered. Use another **SET** to move to **PO CFG** (pulse output configuration) menu.
 - **rEFinEd** or **Lub Oil**: for these products you need to enter the reference density **rd**.
 - If you chose $^{\circ}\text{C}$ the reference density **rd** has to be in kg/m^3 , in the range:
 - **refined** : 611.2 to 1163.8 kg/m^3
 - **lubrication oils** : 810.3 to 1163.8 kg/m^3
 - If you chose $^{\circ}\text{F}$ the reference density **rd** has to be in **normalized units**, in the range:
 - **refined** : 0.6113 to 1.1646
 - **lubrication oils** : 0.8017 to 1.1646

Press **SET** to move to **PO CFG** (pulse output configuration) menu.

- There you choose if the pulse output will represent the total A (net, corrected) or B (gross, uncorrected) Use **SET** to move to **SETP** menu.
- There you enter **SETP**, which is for how many volume units the pulse output will produce 1 pulse. If **SETP** = 7.45 and the volume unit chosen is liters **L**, then GFC201 pulse output will produce one pulse exactly every 7.45 liters. Use **SET** to move to **AO CFG** (analog output configuration) menu.
- There you choose if the analog output will represent the flow rate A (net, corrected) or B (gross, uncorrected). Use **SET** to move to **SET20** menu.
- In the **SET20** menu, set the flow rate in **volume units per time units** at which you want the analog output to be 20.00 mA. Analog output will be 4.00 mA at 0.0 **vU/tU**. If **SET20** = 0.0 the analog output will stay about 3.85 mA and will not change with the rate. Press short **SET** to move to the **do CFG** (digital output configuration) menu.
- There you can program the digital output to be a flow rate (A or B) alarm, or temperature / RTD alarm
 - **flow rate alarm** : Use **SET** to choose if the alarm will be **High** or **Low**. Then use **SET** to move to **ALARM CFG** (alarm configuration) menu, where you choose if the alarm will be for rate A (net, corrected) or B (gross, uncorrected). Use **SET** to move to alarm menu and enter the flow rate for the alarm in **volume units per time units**.
Press short **SET** to move to the **Rate decimal Places**
 - Choosing **temperature / RTD alarm** will take you directly to the **Rate decimal Places** menu.
- Program (using short **UP**) auto, none, 1, 2, 3, 4 or 5 decimal places for the flow rate.



- Press short **SET** to move to the **Total decimal Places** menu where (using short **UP**) auto, none, 1, 2, 3, 4 or 5 decimal places for all totals can be programmed.
If **AUTO** has been chosen GFC201 will use the icons “**x10**” and “**x100**”. When the total reaches 9 999 999 it will not clear but the icon **x10** will be used. When it reaches again 9 999 999, it will not clear but the icon **x100** will be used. This way the total extends to 9 digits and will clear after it reaches 999 999 999 (one billion).
- Press short **SET** to move to the **Total A Reset enable/disable** menu. In this menu using **UP** button the total A reset can be enabled or disabled.
If enabled and GFC201 is in normal mode displaying total A, the **RESET** icon will also be displayed and long **RIGHT** will clear total A.
- Press short **SET** to move to the **Total B Reset enable/disable** menu. In this menu using **UP** button the total B reset can be enabled or disabled.
If enabled and GFC201 is in normal mode displaying total B, the **RESET** icon will also be displayed and long **RIGHT** will clear total B.

Because this is the last menu, pressing long **SET** will move the computer to the **LOCK** menu. Use **UP** to lock the settings and press short **SET** to go back to **Total B Reset enable** menu. General practice would be to unlock the settings at the **vU** (volume units) menu. Settings can be changed and locked again before exiting at the last **Total B Reset enable/disable** menu. Press short **SET** to exit. After a couple of seconds during which all the settings are checked, validated and stored into the non-volatile memory, the computer will return to the normal mode.

NOTE: The software time out feature will reset the computer and force it to the normal mode WITHOUT saving any changes made in any of the menus. The changes will only be saved after exiting the Total B Reset enable menu by pressing short SET.

NOTE: Even in menu mode, the computer always continues to measure and calculate rate and total and control all outputs so no total will be lost. In some circumstances, such as changing the KFACTOR or, the total accumulated will be invalidated. The user must take appropriate actions after changing the settings, such as resetting the total for an instance.

3.5. Checking the LCD

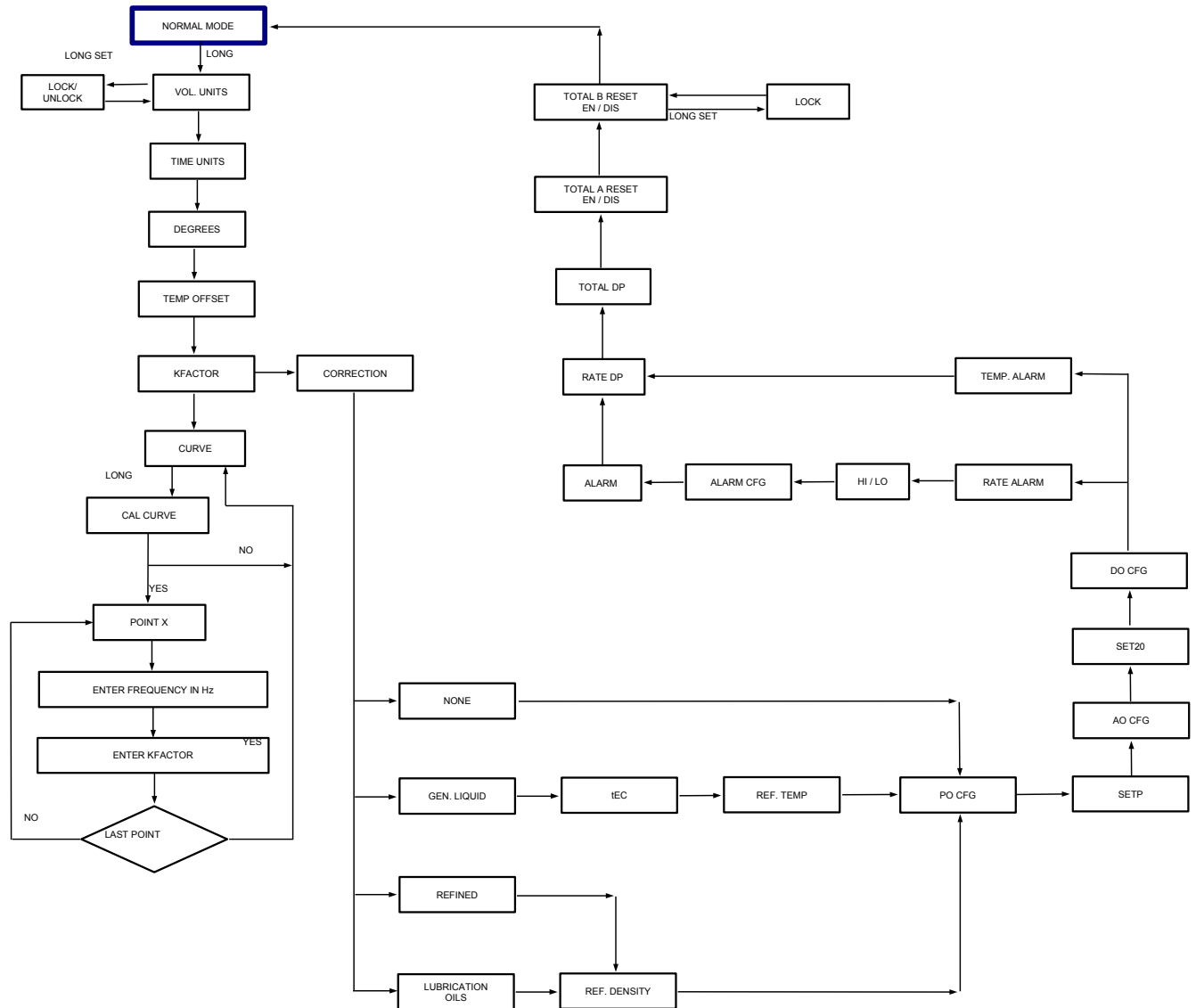
All the icons of the LCD can be checked by pressing and holding the **RIGHT** button while powering on or after exiting the last menu. Releasing the button will return the computer to normal mode.

3.6. Removing the power

Both totals A and B are stored in the non-volatile memory every 50 seconds. Before removing the power make sure that there was no flow for the last minute.

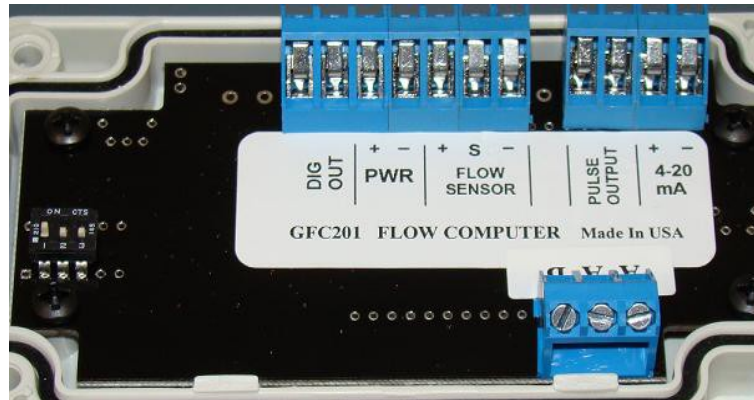
4. MENU DIAGRAM

The menu diagram for GFC201 flow computer / totalizer is shown below.



5. APPLICATION

5.1. ELECTRICAL



NOTE: There is no isolation between the inputs and the power supply. Terminals “-” for the power and the flow sensor are shorted inside the device. It is the user’s responsibility to consider this fact and implement appropriate wiring in the user’s specific application.

Flow sensor:

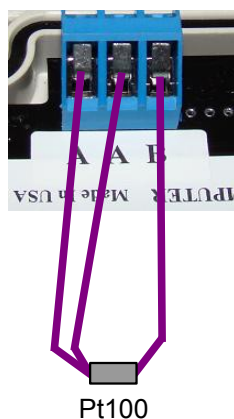
- “+” - Power for the flow sensor, plus. The voltage equals the power supply voltage.
- “S” - Signal
- “-” - Power for the flow sensor, minus

Both the **digital and the pulse output** have no polarity, isolated

The **analog output 4-20 mA** is 2 wire loop power, isolated

- “+” - Analog output plus
- “-” - Analog output minus

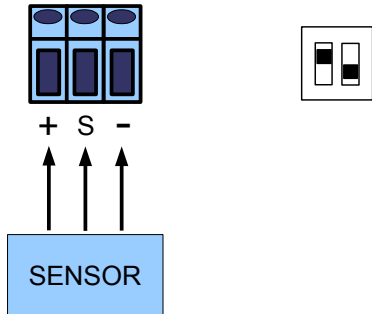
Temperature sensor (Pt100 RTD)



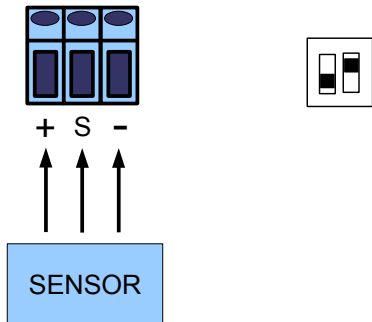
5.1.1. Wiring the flow sensor

GFC201 accepts a variety of flow sensors. See below for wiring specifications and their particular wiring.

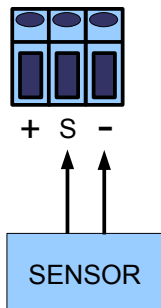
5.1.1.1. NPN Open Drain, Open Collector, Reed Switch, Dry Contact



5.1.1.2. PNP Open Drain, Open Collector



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



5.2. VERSIONS



WALL MOUNT GFC201



WALL MOUNT GFC201E

6. ORDERING

For ordering please use the following G Instruments part numbers:

<i>Description</i>	<i>G Instruments PN</i>
GFC201 flow computer (external isolated 8 – 36 V DC needed)	30170
GFC201 flow computer with GPS115 (115 VAC power supply)	30184
GFC201 flow computer with GPS220 (220 VAC power supply)	30185
GFC201 flow computer with GPS122 (85-264 VAC power supply)	30239
GFC201E flow computer (external isolated 8 – 36 V DC needed)	30174
GFC201E flow computer with GPS115E (115 VAC power supply)	30192
GFC201E flow computer with GPS220E (220 VAC power supply)	30307
GFC201E flow computer with GPS122E (85-264 VAC power supply)	30199



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