



## FEATURES

- SEPARATE VOLUME UNITS FOR FLOW RATE AND TOTAL
- 4.8 YEARS, UP TO 9 YEARS ON A SINGLE AA SIZE BATTERY (COIL)
- "C" SIZE BATTERY OPTION
- UNIVERSAL INPUT, 5 kHz
- NO NEED OF AMPLIFIERS OR LINEARIZERS
- SIMPLIFIED 2 LEVEL MENU
- ISOLATED 4-20mA, 12 BIT ANALOG OUTPUT
- 7 DIGIT RATE AND THREE 7 DIGIT TOTALS WITH PROGRAMMABLE DECIMAL PLACES
- SINGLE KFACTOR OR 10 POINT CALIBRATION CURVE
- KFACTORS FROM 0.001 TO 9,999,999
- MILLILITERS, LITERS, GALLONS, CUBIC FEET, CUBIC METERS, ACRE FEET
- PER SECOND, PER MINUTE, PER HOUR, PER DAY
- 100V/100mA OPEN DRAIN OUTPUT THAT CAN BE PROGRAMMED TO BE:
  - RATE ALARM, HIGH OR LOW
  - BATCH OUTPUT WITH A START INPUT
  - PULSE OUTPUT, UP TO 480 PULSES PER MINUTE (METERING PUMPS)
- PROGRAMMABLE SLEEP MODE FOR THE DISPLAY TO SAVE POWER
- SETTINGS LOCK/UNLOCK FOR SECURITY
- ONE LOCK FOR THE KFACTOR, A SEPARATE LOCK FOR THE REST OF THE SETTINGS
- HIGH CONTRAST IN THE ENTIRE TEMPERATURE RANGE
- BATTERY LOW INDICATOR
- SIMPLE PROGRAMMING, SMALL SIZE

## APPLICATIONS

- FLOW RATE AND TOTAL MEASUREMENT AND CONTROL
- BATCH APPLICATIONS
- METERING PUMPS PRECISE CONTROL FOR DOSING APPLICATIONS



## 1. DESCRIPTION

GFC104 is a micro power battery powered flow computer totalizer with an outstanding combination of excellent features, extremely long battery life, universal input, high input frequency and a variety of outputs. It accepts open drain/collector npn/pnp, reed switch, dry contact, coils, almost any wave and logical signals. GFC104 has an open drain 100V/100mA output that can be programmed to work as a rate alarm, high or low, with +/- 1 % hysteresis, batch or pulse output.

GFC104 has separate volume units so for an instance the flow rate can be in GPM be the totals in acre feet.

The analog output has programmable 4 mA so the output can be shifted, scaled or even reversed.

For better accuracy, GFC104 provides capabilities of using calibration tables for up to 10 points. In seconds the operator can switch between a single KFACTOR and the curve of up to 10 points.

The GFC104 software implements a version of our proprietary predictive/adaptive, self-adjusting digital filtering which provides extremely stable reading at any input frequency, plus very fast response to any change in the flow.

GFC104 is the perfect solution for flow measurement and control applications that require high accuracy and reliability, small size, industrial grade performance and low maintenance.



## 2. ABSOLUTE MAXIMUM RATINGS \*

Operating temperature	-20 °C to +70 °C <b>The electronics system is industrial (-40 °C to +85 °C) and higher grade . The Liquid Crystal Display (LCD) limits the temperature range.</b>
Output current	100 mA DC
Output voltage	100 V
Input voltage ("S" to "-")	5 VDC

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

## 3. CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
<b>Power Supply</b>					
Battery life	25 ° C, LCD sleep enabled, coil, typical values, Fig. 1, Note 3	4.8		9	years
Battery life	25 ° C, LCD sleep enabled, 50 uA, typical values, Fig. 2, Note 3	2.5		4.2	years
<b>Input</b>					
Voltage for the sensor	-20 °C to +70 °C		3	3.7	V DC
Input threshold, high	Rectangular wave 5 V, 50 % duty cycle		1.75		V
Input threshold, low	Rectangular wave 5 V, 50 % duty cycle		1.25		V
Coil voltage	Symmetrical signal from the coil (sine, triangle, saw etc)	20			mVpp
Input frequency	Rectangular wave, 50 % duty cycle	0 - 5	0 - 10		kHz
<b>Analog Output</b>					
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, 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
<b>Digital Output</b>					
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
Pulse duration			62.5		ms
Pause duration		62.5			ms
Pulse rate				480	p/min

**Note 1:** The minimum voltage for the 4-20 mA output to operate is  $V = 9.5 + R_{load} [ohm] * 0.020$  [V DC]  
For a GFC104 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

**Note 3:** The battery life shown is for a "AA" size battery. GFC104 has a "C" size battery option that can provide even longer battery life for sensors that have higher consumption

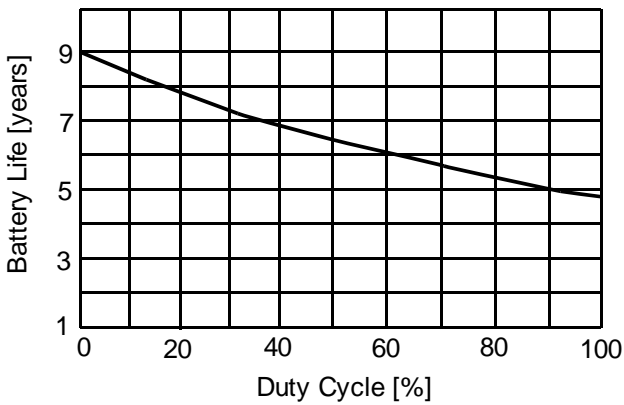


Fig. 1 Battery Life vs. Duty Cycle, coil

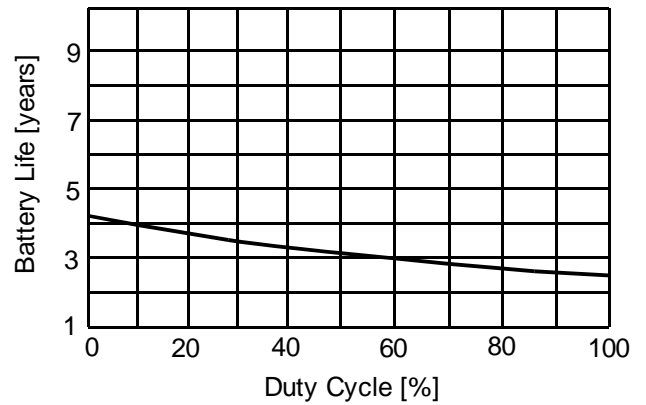


Fig. 2 Battery Life vs. Duty Cycle, 50 uA

**NOTE:** Duty Cycle refers to the percentage of the time the flow computer / totalizer has input pulses.

**Example:** If a coil is connected and there is consistent flow the entire 4.8 years, the battery life of the GFC104 will average 4.8 years. For an average flow of 12 hours each day, the battery life averages 6.4 years.

**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 GFC104 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 button will not change the value if the settings are locked.**

**3.2. INPUTS**

GFC104 has two inputs:

- Pulse input from flow sensors. This input can power micro power sensors. It accepts 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.



- Start/resume/cancel input. This input is used for batch applications with the output of GFC104 programmed as batch. The intended use of this input is to connect to it a normal open push button, dry contact or an open drain output. If the output of the flow computer / totalizer is programmed as alarm or pulse then this input is ignored.

### 3.3. OUTPUT

GFC104 has one digital and one isolated analog output.

#### 3.3.1. Digital output

The digital output is 100VDC/100mA DC open drain (sinking) with reverse polarity protection. It can be programmed to be:

- Rate alarm, high or low, with +/- 1% hysteresis.  
**Example:** If the alarm is programmed at 100.00 GPM and to **high**, the output will turn on (sinking current) when the flow rate exceeds 101.00 GPM and will turn off when it drops below 99.00 GPM. With **low** alarm the action will be reversed.
- Batch total  
**Example:** The batch amount is programmed at 1000.0 G. The **total B** shows the batch amount accumulated and is not resettable. When **total B** reaches or exceeds 1000.0 G, the digital output gets turned ON and the **total B** stops increasing. Pressing the push button for more than 1 second will clear **total B**, turn the digital output OFF and **total B** will start accumulating next batch amount.
- Pulse output. This feature is intended for use with metering/dosing pumps.  
**Example:** You are adding chlorine or fertilizer to the water and have connected the control input of a pump to this pulse output. You program the "**SETP**" factor at 3.762 Gallons per pulse. The pump will produce one pulse every 3.762 gallons and add the chlorine or the fertilizer in an exact proportion to the water.

#### 3.3.2. 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 **SET4** and **SET20** menu, it can be programmed properly shifted, scaled or even reversed.

**Example:** If you program **SET4** = 80.0 GPM and **SET20** = 40.0 GPM the analog output will be 20 mA at 40.0 GPM and will linearly decrease down to 4 mA at 80.0 GPM.

### 3.4. DISPLAY

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

A "**FLOW**" icon will always be displayed.

When the display shows rate, a "**RATE**" icon is displayed. If it shows total, a "**TOTAL**" icon will be displayed along with "**A**", "**B**" or "**C**" (GFC104 has three totals).

When input pulses are present, an "**INP**" (input) icon will be displayed. If the total on the LCD is allowed to be reset, a "**RESET**" icon will be displayed.



### 3.4.1. Volume and time units

- GFC104 flow computer has milliliters (**mL**), liters (**L**), gallons (**G**), cubic feet (**CF**), cubic meters (**M<sup>3</sup>**) and acre feet (**AF**) PER second (**S**), minute (**M**), hour (**H**) and day (**D**).
- There are two separate menus where separate volume units for flow rate and total can be entered.  
**Example:** The flow rate can be in GPM but all totals in acre feet.

### 3.4.2. Normal mode

Automatically after replacing the battery or exiting a menu, GFC104 enters the normal mode. Normal mode displays:

- Rate
- Total A, B or C. Total A reset can be enabled or disabled. It is stored in a non-volatile memory every 50 seconds or immediately when cleared.  
Total B in batch mode for the output is non-resettable, It is the total that is compared against the preprogrammed batch volume.  
If a total is allowed to be reset, the **RESET** icon is shown. Reset a total with long **RIGHT** button.
- To switch between rate and totals on the display, 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:

- **KFACTOR** icon along with **dP 1234** is shown. The decimal places for all KFACTORs (single KFACTOR and all KFACTORs in the calibration table) can be programmed using **UP** button. KFACTORs ranging from 0.001 to 9,999,999 can be entered this way.

While in this menu pressing long **SET** will enter the KFACTOR lock/unlock menu. Using **UP** button the KFACTOR decimal places and the KFACTOR itself can be locked or unlocked. When locked they can only be viewed but not changed. Short **SET** returns back to KFACTOR decimal places menu.

Use short **SET** to move to the next menu.

- **KFACTOR** icon is shown. The main **KFACTOR** for the particular flow meter connected to the GFC104 can be entered using **UP** and **RIGHT**. All KFACTORs must be in **pulses per gallon**.

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

Short **SET** enters the output type menu.

- In the **output type** menu choose between **alarm**, **batch** and **pulse** using the **UP** button. While in this menu using long **SET** the settings lock/unlock menu can be entered where all settings except KFACTOR can be locked or unlocked. This includes the output type as well. When locked the output type, alarm type, alarm setting, the batch volume, **SETP** and **SET20** can be viewed but not changed. Short **SET** returns back to output type menu.

Press short **SET** to move to the next menu.



\* If the alarm output type has just been chosen, the next menu will be the “**alarm type**” menu where using **UP** button **high** or **low** alarm can be chosen. Press short **SET** to move to the **alarm/output value** menu.

\* If the **pulse** output type has been chosen the next menu will be **SETP** (output value menu)

- In the **output value** menu:
  - The value of the **alarm** must be in **G/M (GPM)**
  - The value for **SETP** must be in **GALLONS PER PULSE**
  - The value for the **batch** must be in gallons

**Note that the computer will not accept zero for those settings.**

Press short **SET** to move to the next menu.

- In the **SET20** menu, set the flow rate in G/M at which you want the analog output to be 20.00 mA. The value of the analog output for 4.00 mA can be programmed in the **SET4** menu. If **SET20** = 0.0 or **SET4** = **SET20** the analog output will stay about 3.85 mA and will not change with the rate. Press short **SET**. 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 SET20 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, the total accumulated will be invalidated. The user must take appropriate actions after changing the settings, such as resetting the total for an instance.**

#### 3.4.3.1. The Hidden Menu

This is a second level menu that offers more features and programming flexibility to trained professionals or more advanced users. The setting in the hidden menu are not affected by the lock/unlock of the settings in the first level menu.

To enter the hidden menu while in the **KFACTOR** menu, move the cursor (blinking digit) to the most right and then use long **SET** to enter the curve menu.

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 factory default is 1.0 for the **KFACTOR** of each point. 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 data 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 (in Hz) and a **KFACTOR** (in pulses per gallon) 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. The computer 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 **SET4** menu.

- In the **SET4** menu the icon SET20 will be blinking showing the relation to **SET20** parameter. In this menu the flow rate (in G/M) for 4.00 mA of the analog output can be entered. The factory default is 0.00 [G/M].

Use short **SET** to move to the next menu.

- In the flow rate "volume units" (**vU**) menu, use **UP** to choose the volume units for the flow rate among **mL, L, G, CF, M<sup>3</sup>** and **AF**. 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** (per second), **M** (per minute), **H** (per hour) and **D** (per day). Press short SET to move to "**volume units menu**" for all totals.
- In the total "volume units" (**vU**) menu, use **UP** to choose the volume units for all totals among **mL, L, G, CF, M<sup>3</sup>** and **AF**.
- Press short **SET** to move to the "Rate **decimal Places**" menu where (using short **UP**) auto, none, 1, 2, or 3 decimal places for the flow rate can be programmed.
- Press short **SET** to move to the "Total **decimal Places**" menu where (using short **UP**) auto, none, 1, 2, or 3 decimal places for all totals can be programmed.
- 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 GFC114 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 **SLEEP** menu.  
In the **SLEEP** menu, (using **UP** button) the sleep of the LCD feature can be enabled or disabled. If this feature is enabled the GFC101 computer will turn off the LCD after not having any input pulse or button pressed for one minute, extending the battery life.



**NOTE: Only the LCD is powered down during sleep. The computer is fully functioning and no input pulse or button press will be missed. The computer will turn the LCD on immediately after the first input pulse or button pressed.**

If this feature is disabled, the LCD is always powered but the total consumption of the GFC104 computer will be higher and the battery life will be reduced.

- Press short **SET** to go back the **KFACTOR** menu on the first level.

### 3.5. Checking the LCD

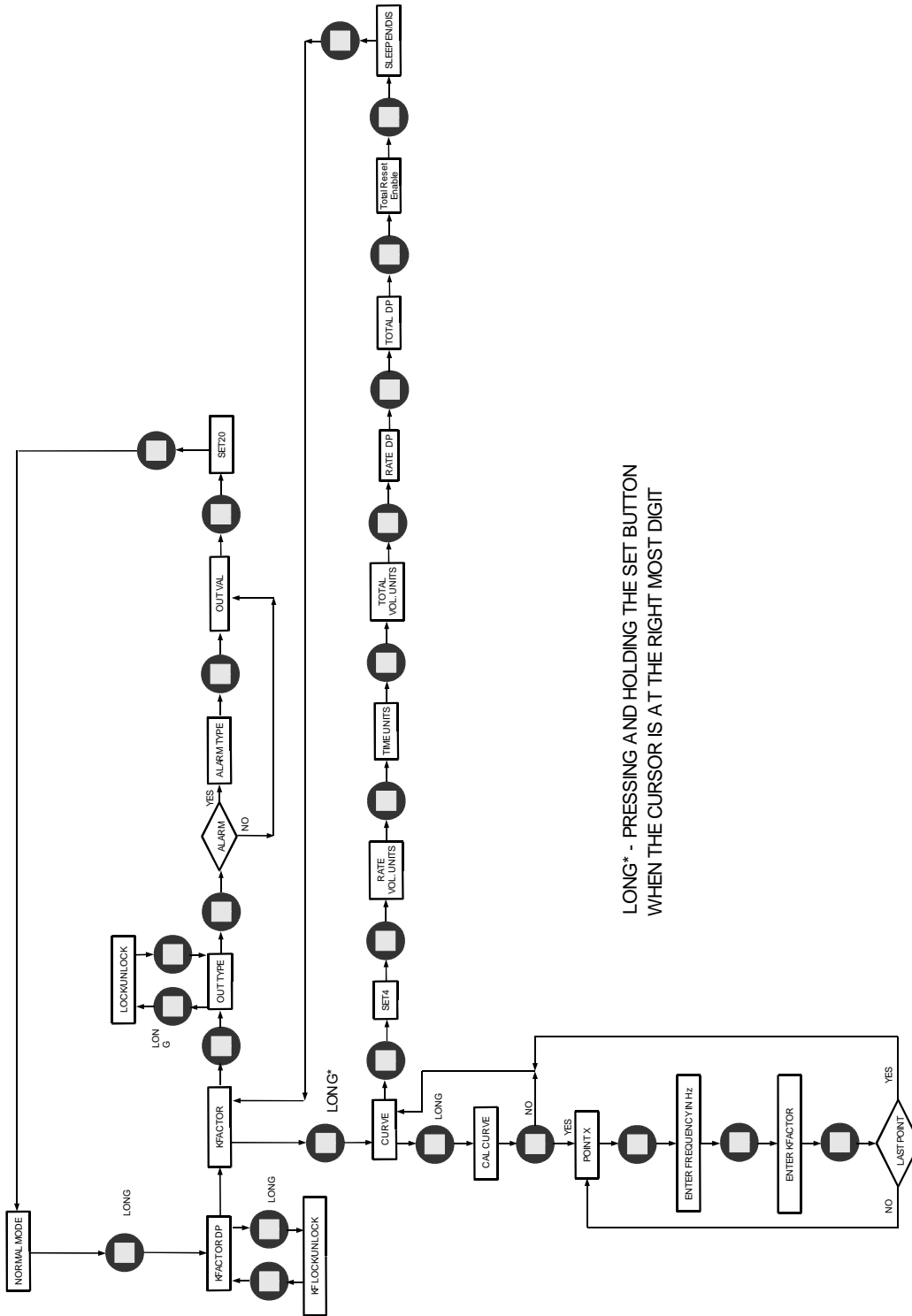
All the icons of the LCD can be checked by pressing and holding the **RIGHT** button while replacing the battery or after exiting the **SLEEP** menu. Releasing the button will allow the computer to return to normal mode.

**NOTE: Removing the battery will clear total B and total C**

**Total A is stored in the non-volatile memory every 50 seconds.**  
**Before removing the battery 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.**

### 4. MENU DIAGRAM

The menu diagram for GFC104 flow computer / totalizer is shown below.



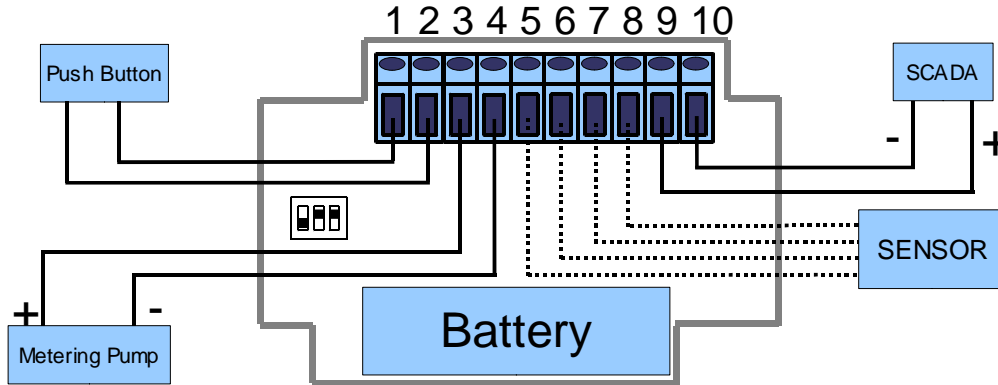
LONG\* - PRESSING AND HOLDING THE SET BUTTON WHEN THE CURSOR IS AT THE RIGHT MOST DIGIT

5. APPLICATION

5.1. ELECTRICAL

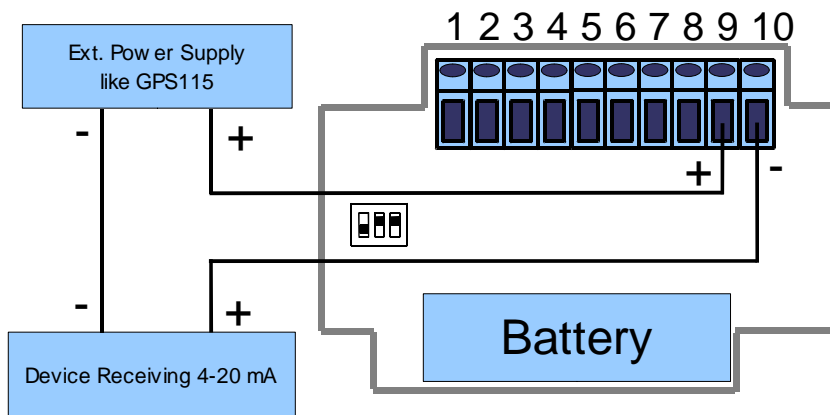
The wiring diagram is shown below.

**NOTE: There is no isolation between any input and the digital output. Terminals 2, 4 and 7 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.**



- 1 – Push button plus
- 2 – Push button minus
- 3 – Digital output plus
- 4 – Digital output minus
- 5 – Power for the sensor, plus
- 6 – Signal / Coil
- 7 – Power for the sensor, minus
- 8 – Coil, only
- 9 – Analog output, plus
- 10 – Analog output, minus

In case the device receiving the 4-20 mA is passive the wiring can be done as on the diagram below:

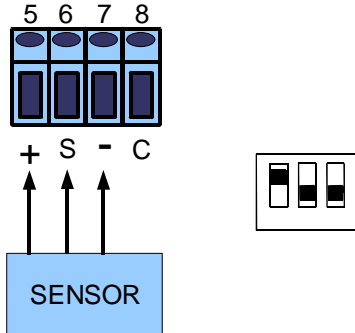


The external power supply i.e. GPS115 provides the power. The three devices have to be connected in series, as on the diagram above.

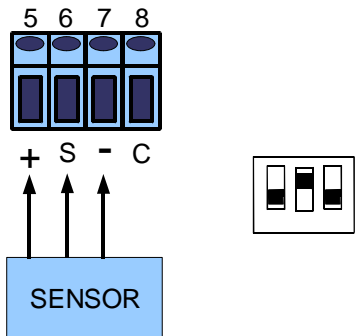
## 5.1.1. Wiring the sensor

GFC104 accepts a variety of sensors. See below for wiring specifications.

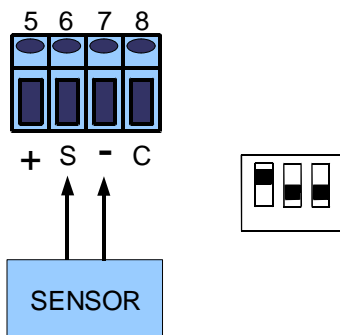
### 5.1.1.1. NPN Open Drain, Open Collector



### 5.1.1.2. PNP Open Drain, Open Collector

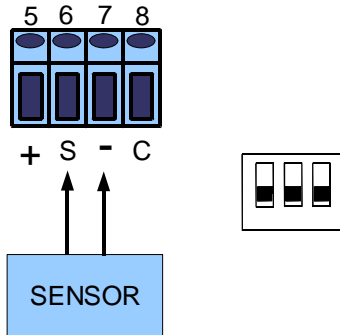


### 5.1.1.3. Reed Switch, Dry Contact

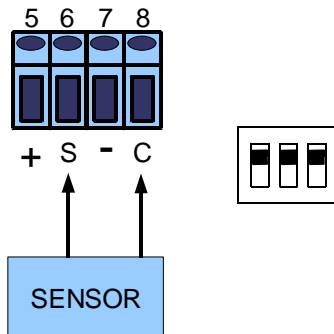


**NOTE: A small capacitor in parallel may be needed. Different reed switches and dry contacts have different bouncing time. Test and evaluate carefully to determine the right capacitor.**

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



#### 5.1.1.5. Coils



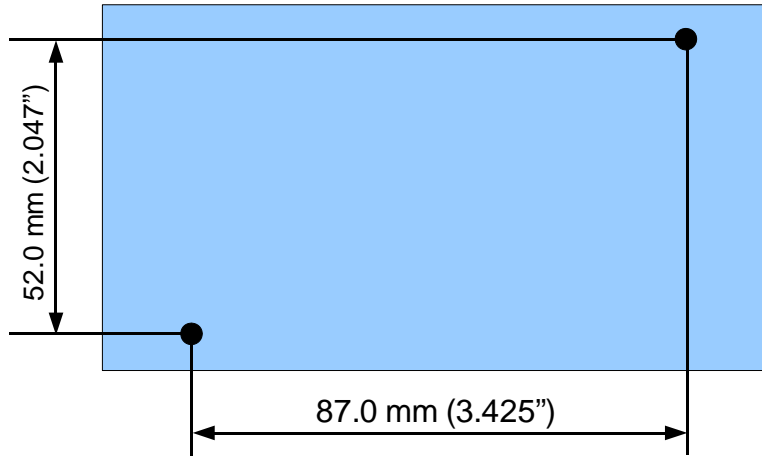
**NOTE: If the cable to the coil is shielded, connect the shield to “-” (terminal 7) ONLY. Do not connect the shield to anything at the other (coil) end of the cable. In order to keep the isolation the shield has to be isolated from earth ground and all other equipment or electrical connections.**

**If the isolation requirements of the application allow, it is recommended terminal 7 (“-”) to be connected to a good earth ground, for a better protection and noise reduction.**

**Carefully evaluate and test the wiring.**

## 5.2. MECHANICAL

Mounting GFC104 on a wall requires an area of 120 x 65 mm (4.73 x 2.56 inches) and only two screws:



NOTE: The cable grips and the cables need additional space

## 6. ORDERING

For ordering please use the following G Instruments part numbers:

<i>Description</i>	<i>G Instruments PN</i>
GFC104 flow computer with a "AA" size battery	30207
GFC104 flow computer with a "C" size battery	30210
GFC104 flow computer with a "AA" battery and GPS115 (115 VAC power supply)	30211
GFC104 flow computer with a "AA" battery and GPS220 (220 VAC power supply)	30212
GFC104 flow computer with a "AA" battery and GPS122 (85-264 VAC power supply)	30227

**Replace the AA size battery with G Instruments part number (PN) 30030 only.**  
**Replace the C size battery with G Instruments part number (PN) 30213 only.**

**If another type of battery has been used, the specifications of the GFC104 flow computer can not be guaranteed and the device can be damaged.**



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