



FEATURES

- 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
- 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
 - TOTAL LIMIT FOR 1 TO 64 DAYS WITH A RESUME INPUT
 - PULSE OUTPUT, UP TO 480 PULSES PER MINUTE (METERING PUMPS)
- 64 DAYS DATALOGGER (TOTAL FOR EACH 24 HOURS)
- PROGRAMMABLE SLEEP MODE FOR THE DISPLAY TO SAVE POWER
- SETTINGS LOCK/UNLOCK FOR SECURITY
- HIGH CONTRAST IN THE ENTIRE TEMPERATURE RANGE
- BATTERY LOW INDICATOR
- SIMPLE PROGRAMMING, SMALL SIZE

APPLICATIONS

- FLOW RATE AND TOTAL MEASUREMENT AND CONTROL
- BATCH APPLICATIONS
- LIMITING THE TOTAL IN ANY ROLLING PERIOD OF 1 TO 64 DAYS
- PROGRAMMABLE METERING PUMPS PRECISE CONTROL FOR DOSING APPLICATIONS



1. DESCRIPTION

GFC101 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 npr/pnp, reed switch, dry contact, coils, almost any wave and logical signals. GFC101 has an open drain 100V/100mA output that can be programmed to work as a rate alarm, high or low, with +/- 1 % hysteresis, batch, limit or pulse output.

Regardless of the type of the output chosen, GFC101 stores up to 64 totals for each 24 hours that can be easily viewed on the liquid crystal display.

For better accuracy, GFC101 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 GFC101 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.

GFC101 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 The electronics system is industrial (-40 °C to +85 °C) and higher grade . The Liquid Crystal Display (LCD) limits the temperature range.
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
Power Supply					
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
Input					
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
Analog Output					
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
Digital Output					
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 GFC101 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. GFC101 has a "C" size battery option that can provide even longer battery life for sensors that have higher consumption

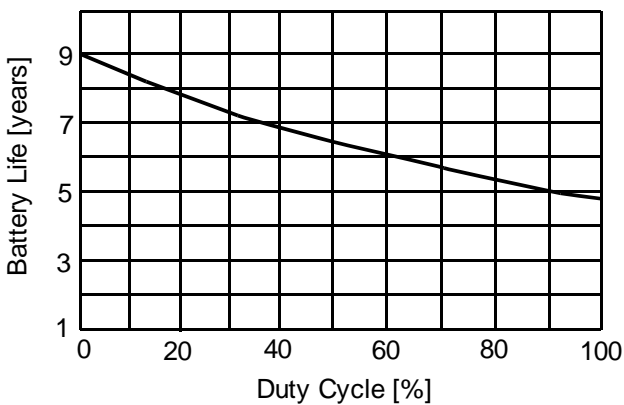


Fig. 1 Battery Life vs. Duty Cycle, coil

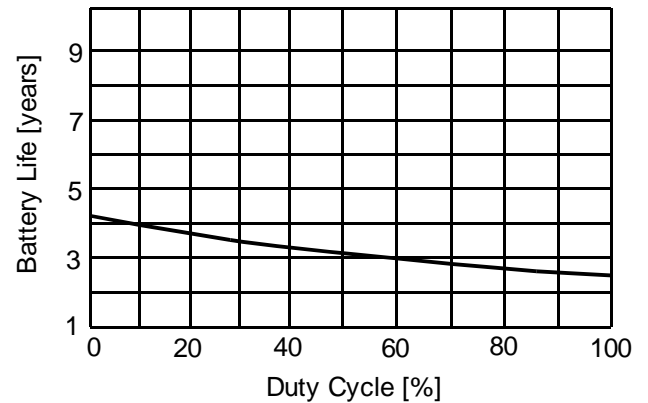


Fig. 2 Battery Life vs. Duty Cycle, 50 uA

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 GFC101 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 GFC101 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

GFC101 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 or linearizers.



- Start/resume/cancel input. This input is used for batch and limit applications with the output of GFC101 programmed as batch or limit. 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

GFC101 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.
- Limit total. This feature can limit the total for any rolling number of days programmed.
Example: To limit the total of water used to 200 gallons a week, program the limit to 200 gallons and the DAYS to 7. If the total in any rolling 7 days exceeds 200 gallons, the output will turn on (sinking current) and can shut off the master valve or perform another function. The output will stay on until the resume input (connected to a push button, switch etc.) is shorted. The total used is checked against the limit once a day, 24 hours after the previous check.
- 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 **SET20** menu, it can be programmed to represent the flow rate.

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**” (GFC101 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

- GFC101 flow computer has 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**).

3.4.2. Normal mode

Automatically after replacing the battery or exiting a menu, GFC101 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 total 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 pressing (and holding pressed) the **SET** button, the first menu will appear on the LCD:

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

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

- **KFACTOR** icon is shown. The main **KFACTOR** for the particular **FLOW** meter connected to the GFC101 can be entered using **UP** and **RIGHT**. This is how many pulses the flow computer will receive for one gallon.
While in this menu all the settings can be locked/unlocked. Use **RIGHT** button to move the cursor to the furthest digit on the right and then use long **SET**.

- Use short **UP** to lock/unlock the settings. Then use short **SET** to go back to **KFACTOR** menu.
- If the settings are locked, they can be viewed, not changed.

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 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 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 GFC101 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 **SET20** menu.

- In the **SET20** menu, set the flow rate in G/M at which you want the analog output to be 20.00 mA. Analog output will be 4.00 mA at 0.0 G/M. 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 “**volume units menu**.”
- In the “**volume units**” (**vU**) menu, use **UP** to choose the volume units among **mL**, **L**, **G**, **CF**, **M³** 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**, **M**, **H** and **D**. Press short **SET** to move to the “**OUT Type**” menu.
- In the output type menu, use **UP** to choose the type of the output among **alarm**, **batch**, **limit** and **pulse**. Press short **SET** to move to the next menu or press long **SET** to enter the **DATALOG** menu.

* If alarm 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 value** menu.

* If the **limit** output has been chosen, the next menu will be **DAYS** menu where the rolling number of days for the limit can be entered.

If another output type has been chosen, the next menu will be **BATCH** or **SETP** value menu.

- In the output value menu:
 - The value of the alarm must be in **G/M**
 - The value of the batch must be in **GALLONS**, and it will compare to the **total B**
 - The value of the limit must be in **GALLONS**



- The value for SETP must be in **GALLONS PER PULSE**

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

- 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 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 GFC101 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 GFC101 computer will be higher and the battery life will be reduced.

Because the **SLEEP** menu is the last one, 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 **SLEEP** menu. General practice would be to unlock the settings at the **KFACTOR** menu. Settings can be changed changed and locked again before exiting at the last menu (**SLEEP** menu). Press short **SET** to exit. After a couple of seconds during which all the setting are checked, validated and stored into the non-volatile memory, the computer will return to 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 SLEEP menu by pressing short SET.

NOTE: Even in menu mode, the computer always continues to measure and calculate rate and total and control the output 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 or returning it to the previous state.

- If long **SET** has been pressed in the **output type** menu, the computer will move to the **DATALOG** menu.

“**DAYS back 00**” will appear on the LCD. Pressing **UP** will display the total after the last full 24 hours. Pressing **RIGHT** will bring back the **DAYS back XX** menu. Pressing **RIGHT** again will increment the **days back** number. The totals for up to 64 previous days are available. This feature can be useful with the limit output, allowing the user to check the total water used per day and to determine when the limit was exceeded.

The 24 hour total begins two ways: upon battery installation/replacement or after a **DATALOG INIT**.



Example: Changing the battery at 11 a.m. will begin the 24 hour clock, which will cycle at 11 a.m. the next day, etc. The **DTALOG INIT** menu can change the clock setting.

- Press short **SET** to move the computer to the **DATALOG RESET** menu. Choose **YES** or **NO** using **UP** button. Choosing **YES** will reset the data log to zero for all the totals (1 to 64 days back).
- Press short **SET** to move to the **DTALOG INIT** menu. Choosing **YES** will initialize the data log – all the totals for all days back will remain untouched, but the time for completing 24 hours total will change to the moment at which the short **SET** after **YES** was pressed. After the short **SET**, the computer will return to the **OUTPUT TYPE** menu.

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, the data log totals and the time elapsed since last 24 hour total was saved.

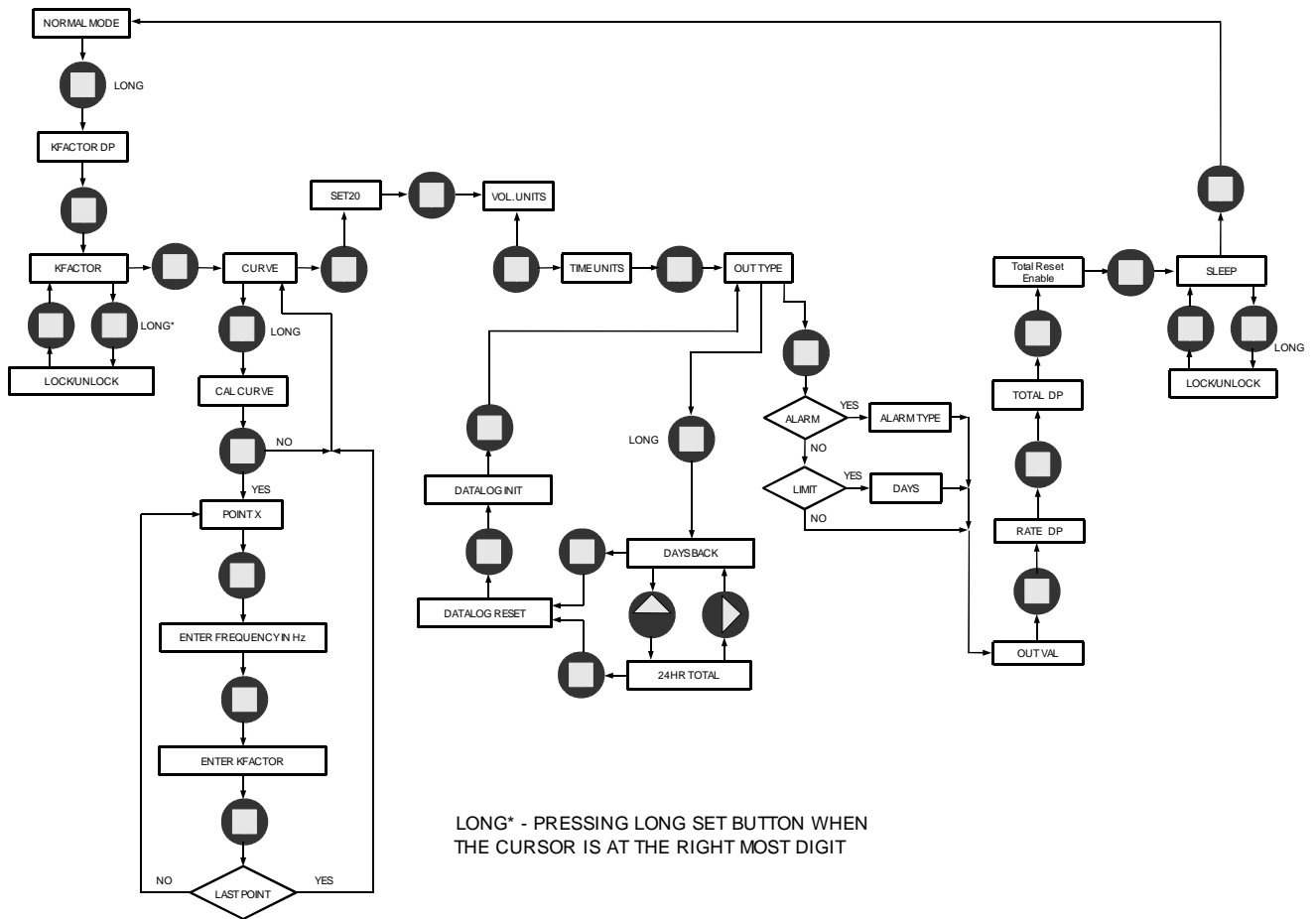
Total A is stored in the non-volatile memory every 50 seconds.

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 GFC101 flow computer / totalizer is shown below.

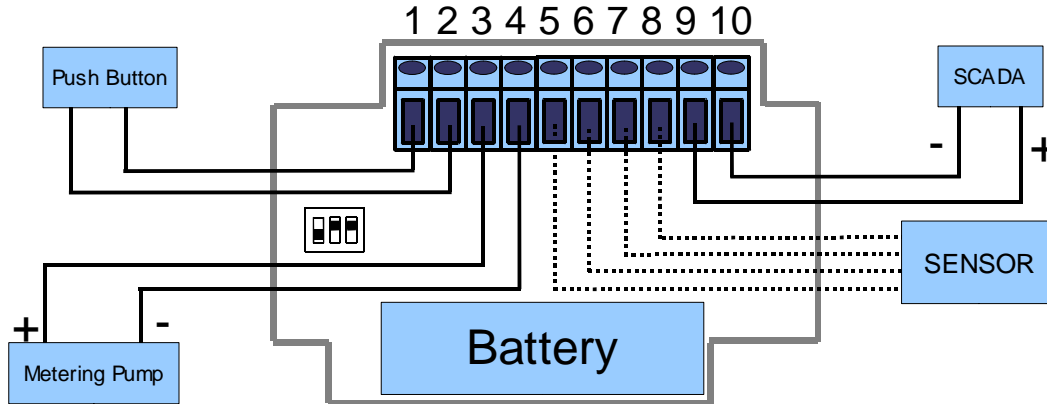


5. APPLICATION

5.1. ELECTRICAL

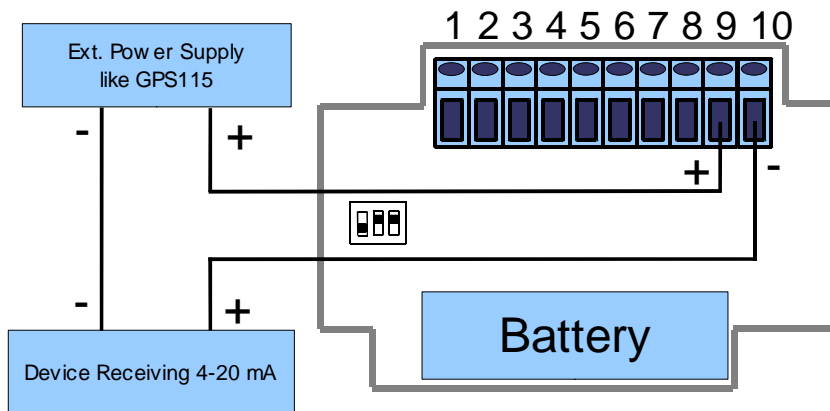
The wiring diagram is shown below.

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:

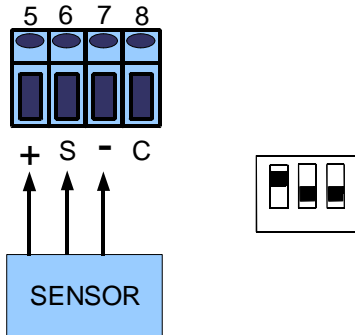


The external power supply i.e. GPS115 provides the power. The three devices have to be connected in series, as on the diagram above.

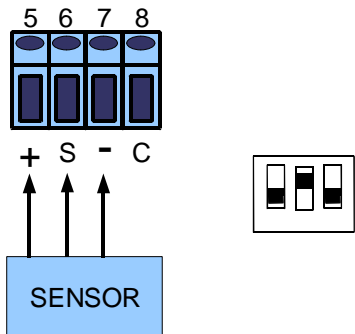
5.1.1. Wiring the sensor

GFC101 accepts a variety of sensors. See below for wiring specifications.

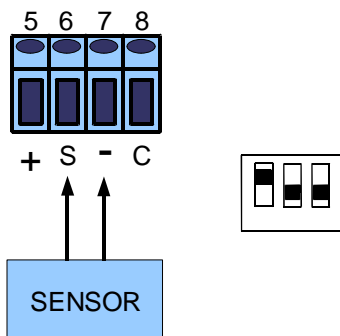
5.1.1.1. NPN Open Drain, Open Collector



5.1.1.2. PNP Open Drain, Open Collector

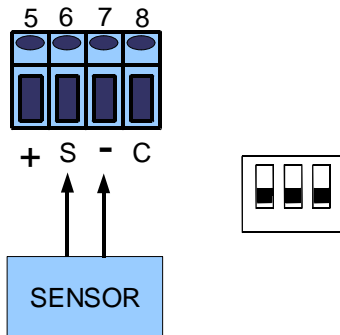


5.1.1.3. Reed Switch, Dry Contact

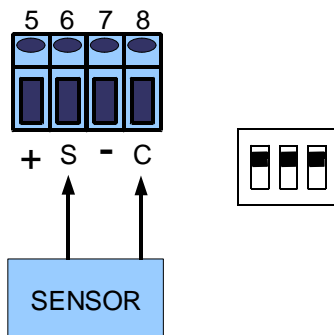


NOTE: A small capacitor in parallel may be needed. Different reed switches and dry contacts have different bouncing time. Test and evaluate carefully to determine the right capacitor.

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



5.1.1.5. Coils



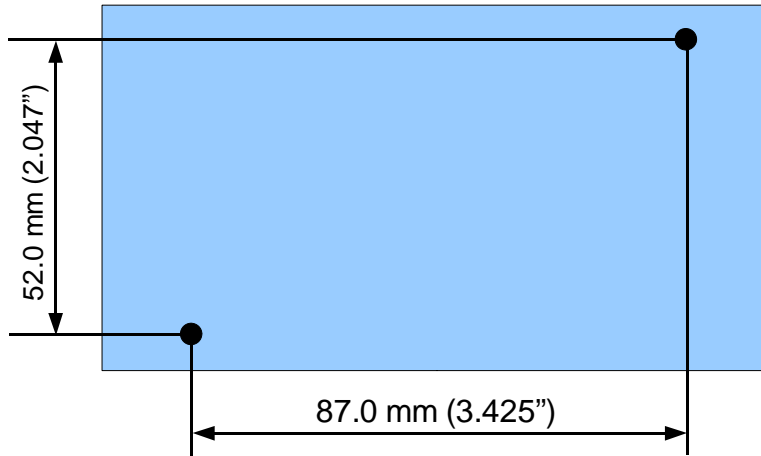
NOTE: If the cable to the coil is shielded, connect the shield to “-” (terminal 7) ONLY. Do not connect the shield to anything at the other (coil) end of the cable. In order to keep the isolation the shield has to be isolated from earth ground and all other equipment or electrical connections.

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 GFC101 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>
GFC101 flow computer with a "AA" size battery	30121
GFC101 flow computer with a "C" size battery	30214
GFC101 flow computer with a "AA" battery and GPS115 (115 VAC power supply)	30123
GFC101 flow computer with a "AA" battery and GPS220 (220 VAC power supply)	30124
GFC101 flow computer with a "AA" battery and GPS122 (85-264 VAC power supply)	30226

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 GFC101 flow computer can not be guaranteed and the device can be damaged.



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