



FEATURES

- UNIVERSAL INPUT, 5 kHz, CAN POWER THE SENSOR
- NO NEED OF AMPLIFIERS OR LINEARIZERS
- SEVEN DIGIT RATE WITH PROGRAMMABLE DECIMAL PLACES
- THREE SEVEN DIGIT TOTALS WITH PROGRAMMABLE DECIMAL PLACES. ONE NON-RESETTABLE, TWO RESETTABLE
- 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
- SEPARATE RATE AND TOTAL UNITS
- ISOLATED 12 BIT ANALOG 4-20 mA LOOP POWER OUTPUT
- ISOLATED NO POLARITY 100V/100mA DC/AC PULSE OUTPUT, UP TO 500 Hz
- 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
- METERING PUMPS PRECISE CONTROL FOR DOSING APPLICATIONS
- SCADA



1. DESCRIPTION

GFC116 is a low power flow computer / totalizer with an universal input which provides power for many types of sensors and accepts their signal to measure flow rate and total. There is no need of using external linearizers or preamplifier for coils. GFC116 pulse input connects directly to the coil, amplifies and conditions its signal.

GFC116 has an isolated no polarity 100V/100mA DC/AC pulse output for up to 500 Hz. It can be used to scale and retransmit the input pulses to another device or system, control metering pumps, or other devices.

It also has an isolated 12 bit analog 4-20 mA loop power output that can be connected to SCADA, PLC or another control device.

For better accuracy GFC116 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.

GFC116 is the perfect solution for flow measurement and control applications that require high accuracy and reliability, high isolation, multi-functionality, 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.
Power supply voltage	40 VDC
Voltage for the analog output	40 VDC
Sensor consumption	10 mA DC
Pulse output current	100 mA DC/AC
Pulse output voltage	100 V DC, 70V AC

* **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	12		36	V DC
Input					
Voltage for the sensor	-20 °C to +70 °C, max 10 mA, Note 1		10		V DC
Threshold, low	Wave or logical signal (CMOS, TTL etc.)		1		V DC
Threshold, high	Wave or logical signal (CMOS, TTL etc.)		1.4		V DC
Coil voltage	Symmetrical signal from the coil (sine, triangle, saw etc)	20			mVpp
NAMUR, low threshold	-20 °C to +70 °C, Powered by GFC116, Note 2		1		mA DC
NAMUR, high threshold	-20 °C to +70 °C, Powered by GFC116, Note 2		2.1		mA DC
Reed switch current	-20 °C to +70 °C, Powered by GFC116, Note 2			3.5	mA DC
Frequency, HF	Note 6		5 000		Hz
Frequency, MF	Note 6		1 000		Hz
Frequency, LF	Note 6		200		Hz
Analog Output					
Power supply	-20 °C to +70 °C, Note 3	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 4			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
Pulse Output					
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
Pulse rate	Note 5			30,000	p/min

Note 1: When powering a 3 wire sensor like open drain/collector pnp/npn sensor. For 2 wire sensors the current is automatically limited when powered by GFC116.

Note 2: If the 2 wire sensor uses external power, the external voltage must be 10 V DC or less.

Note 3: 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 GFC116 with a load of 250 ohm, the minimum voltage would be 14.5 V DC.

Note 4: The parameter includes all errors, non-linearity and noise at constant voltage and temperature.

Note 5: Pulse and pause have equal widths.



Note 6: The values are for reference only. The maximum frequency strongly depends on the duty cycle of the signal and the type of the sensor.

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 GFC116 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

GFC116 has one pulse input from a flow sensor such as wave, logical signal, open drain/collector, npn/pnp, reed switches, dry contact, proximity/NAMUR sensors, Data Industrial 2 wire flow meters, turbine meters, coils 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. There is no need to use external amplifiers for the coils if they provide more than 20 mVpp signal.

3.3. OUTPUTS

GFC116 has two isolated outputs:

3.3.1. Analog output

The isolated analog output is 4-20 mA loop power (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.

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

3.3.2. Pulse output

The isolated pulse output has no polarity, can work with 100V/100mA and can be used to connect to metering / dosing pumps, SCADA, PLCs and other devices. It can provide up to 30,000 pulses per minute (500 Hz) with equal duration of the pulse and the pause.

Example: You are adding chlorine, biocide 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 pulses per Gallon (or other total units). The pump will produce 3.762 pulses per each Gallon (or other total unit) and add the chlorine, the biocide or the fertilizer in an exact proportion to the water.



3.4. DISPLAY

The liquid crystal display (LCD) has 7 digits with 1, 2 or 3 decimal places and many 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**” (GFC116 has three totals).

When input pulses are present, an “**INP**” (input) icon will be displayed.

When the pulse output is ON a “**PULSE**” 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

- GFC106 flow computer has milliliters (**mL**), liters (**L**), gallons (**G**), cubic feet (**CF**), cubic meters (**M³**) and acre feet (**AF**) . Separate volume units can be programmed for flow rate and total.
- The time units are: second (**S**), minute (**M**), hour (**H**) and day (**D**).

3.4.2. Normal mode

Automatically after turning the power on or exiting a menu, GFC116 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 and total C are always resettable. If a total is allowed to be reset, the **RESET** icon is shown. Reset a total with long **RIGHT** button.
- To switch between rate, total A, B or C, 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:

- **Volume Units (vU)** for all totals total can be entered in this first menu. To change the units use the **UP** button. While in this menu all the settings can be locked / unlocked. Use long **SET** to enter the lock menu.
 - Use short **UP** to lock / unlock the settings. Then use short **SET** to go back to the total volume units menu. If the settings are locked, they can be viewed, but not changed.
- 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 GFC106 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 **KFACTOR decimal places** menu.



- **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. Use short **SET** to move to the next menu.
- **KFACTOR** icon is shown. The main **KFACTOR** for the particular flow meter connected to the GFC106 can be entered using **UP** and **RIGHT**. This is how many pulses the flow computer will receive for one total volume unit. While in this menu a calibration table of up to 10 points can be entered
 - Enter the calibration data mode by using long **SET**.
 - “**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 **KFACTOR** 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 total 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. The GFC106 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 **KFACTOR** 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.

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.
- In the **CurvE** menu press short **SET** to move to **flow rate volume unit** menu. Then use **UP** to choose the new unit among **mL**, **L**, **G**, **CF**, **M³** and **AF**.
- Press short **SET** to move to the **flow rate decimal places** menu and then use **UP** to choose among auto, none, 1, 2 and 3 decimal places. Press short **SET** to move to the **time unit** menu
- In the “time unit” (**tU**) menu, use **UP** to choose the time unit units among **S**, **M**, **H** and **D**. Press short **SET** to move to the **SET20** menu.
- In the **SET20** menu, program the flow rate at which you want the analog output to be 20.00 mA. Analog output will be 4.00 mA at 0.0 flow rate. If **SET20** = 0.0 the analog output will be disabled. It will stay



about 3.85 mA and will not change with the flow rate.

- Press short **SET** to move to the **SETP** menu.
The value for **SETP** must be in **pulses per total volume unit**

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 **SETP** menu. General practice would be to unlock the settings at the **total volume unit (the first)** menu. Settings can be changed and locked again before exiting at the last menu (**SETP** 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 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 SETP 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 for an instance.

3.5. Checking the LCD

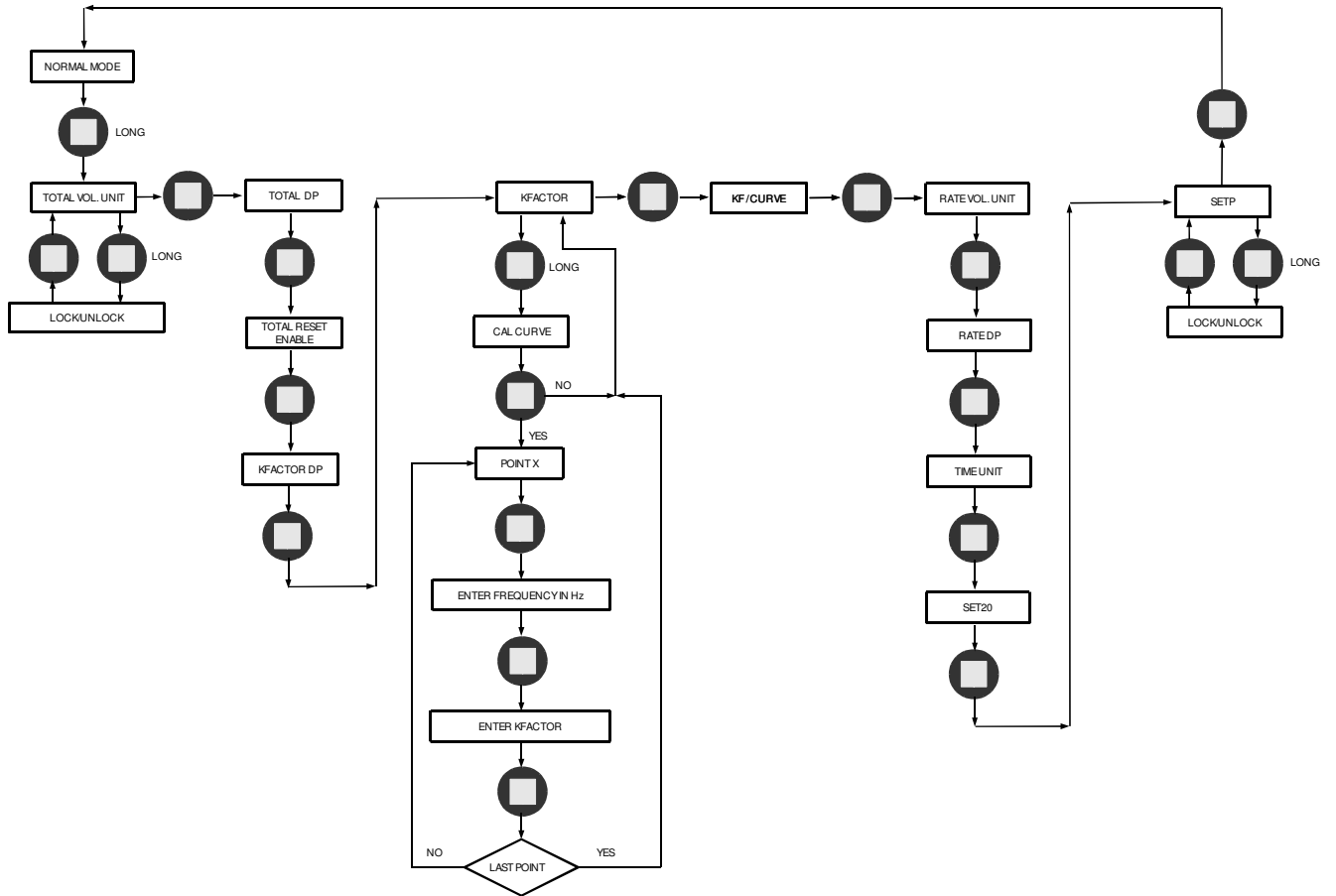
All the icons of the LCD can be checked by pressing and holding the **RIGHT** button while powering on or after exiting the last menu. Releasing the button will return the computer to normal mode.

3.6. Removing the power

Total A is 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 GFC116 flow computer / totalizer is shown below.



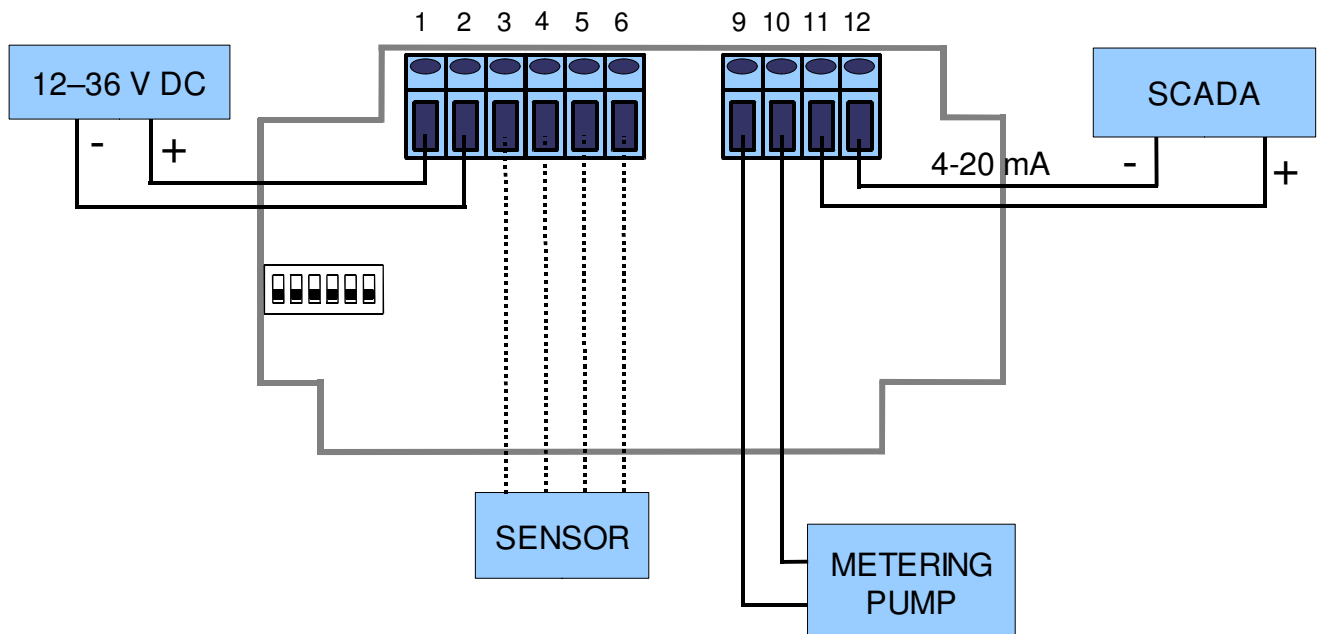
5. APPLICATION

5.1. ELECTRICAL

The wiring diagram is shown below.

NOTE: There is no isolation between the sensor input and the power supply input. Terminals 2 and 5 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.

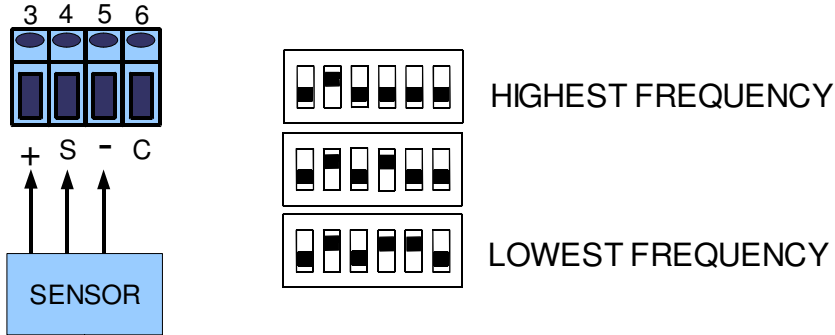
- 1 – Power supply plus
- 2 – Power supply minus
- 3 – Power for the sensor, plus
- 4 – Signal/Coil
- 5 – Power for the sensor, minus
- 6 – Coil, only
- 9, 10 – Pulse output, no polarity
- 11 – Analog output plus
- 12 – Analog output minus



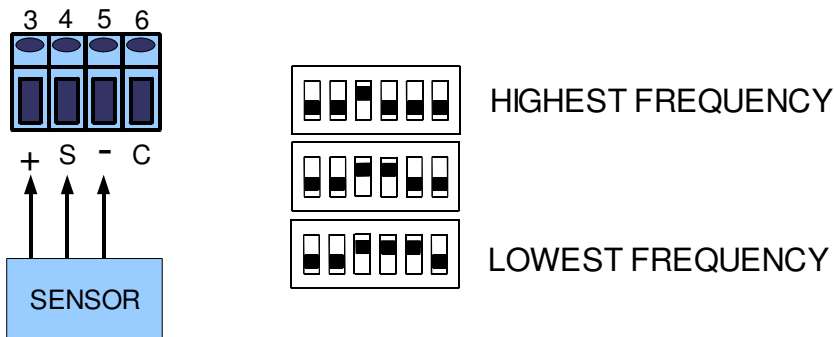
5.1.1. Wiring the sensor

GFC116 accepts a variety of sensors. See below for wiring specifications and their particular wiring is shown below:

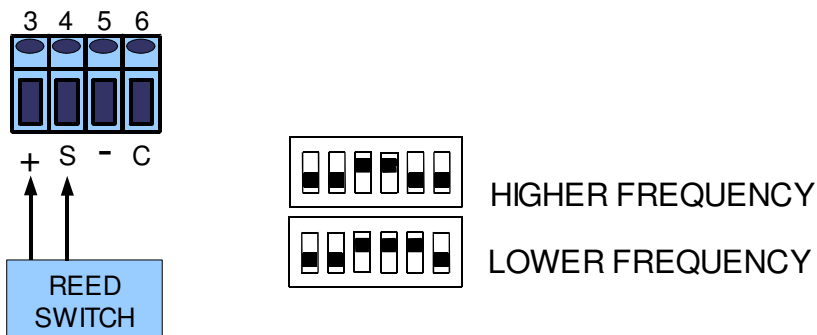
5. NPN Open Drain, Open Collector



5.1.1.2. PNP Open Drain, Open Collector

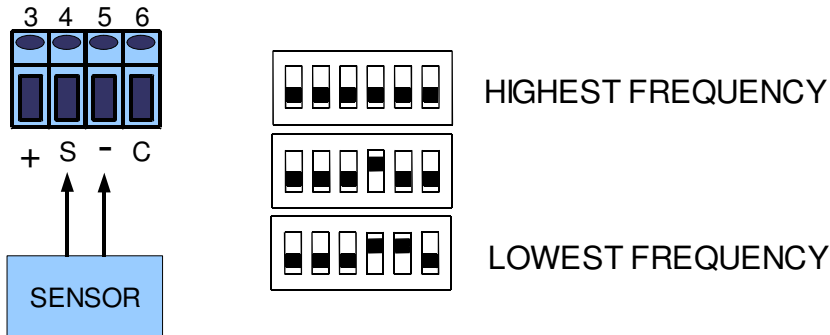


5.1.1.3. Reed Switch, Dry Contact



NOTE: Different reed switches and dry contacts have different bouncing time. Test and evaluate carefully to determine the right DIP switch setting.

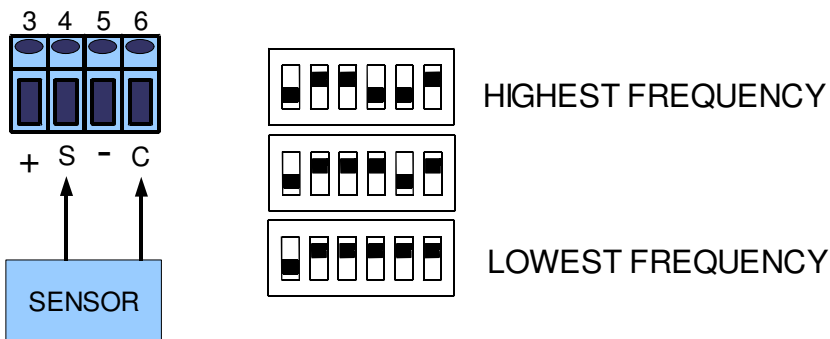
5.1.1.4. Wave (square, sine, triangle, saw etc.), Logical Signal (CMOS, TTL etc.)



5.1.1.5. NAMUR Sensors, Data Industrial Two Wire Flow Meters



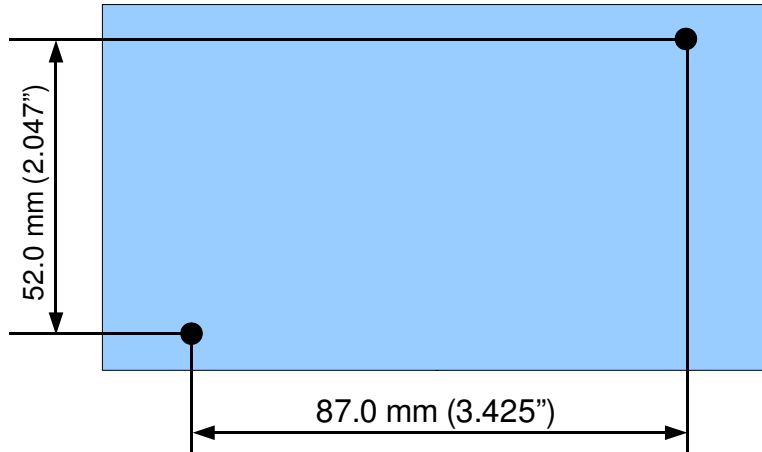
5.1.1.6. Coils



NOTE: If the cable to the coil is shielded, connect the shield to “-” (terminal 5) ONLY. Do not connect the shield to anything at the other (coil) end of the cable. The shield has to be isolated from earth ground and all other equipment or electrical connections.

5.2. MECHANICAL

Mounting GFC116 on a wall requires an area of 120 x 65 mm (4.73 x 2.56 inches) and 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>
GFC116, no power supply (external 12 – 36 V DC needed)	30324
GFC116, no power supply, no cable glands	30325
GFC116 with GPS115	30326
GFC116 with GPS115, no cable glands	30327
GFC116 with GPS220	30328
GFC116 with GPS220, no cable glands	30329
GFC116 with GPS122	30330
GFC116 with GPS122, no cable glands	30331



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