



## FEATURES

- MAX. FLOW RATE 25 L/M (6.6 GPM)
- 0.3 % OF RATE (1:1 TO 100:1)
- 0.5 % OF RATE (100:1 TO 200:1)
- MAX:MIN FLOW - 6600:1 (CUT OFF IS 0.001 GPM)
- FULLY COMPLIANT PROGRAMMABLE RS485 MODBUS RTU PORT
- CAN MEASURE HIGHLY PULSATING FLOW
- MAX PRESSURE 1034 kPa (150 PSI)
- POWER 8.5 – 40 VDC, LESS THAN 2.4 VA, SURGE AND POLARITY PROTECTED
- ISOLATED NO POLARITY PROGRAMMABLE DIGITAL OUTPUT, 100V / 100 mA, FOR
  - PULSE OUTPUT UP TO 1100 Hz.
  - HIGH / LOW ALARM WITH PROGRAMMABLE HYSTERESIS
  - BATCH
- PROGRAMMABLE CUT OFF AND BATCH AMOUNT
- STORES THE TOTAL IN A NON-VOLATILE MEMORY
- TOTAL IS RESETTABLE
- MODBUS MASTER CAN READ FLOW RATE, TOTAL, BATCH TOTAL AND MANY OTHER PARAMETERS MANY TIMES A SECOND
- NO MOVING PARTS
- NO GROUNDING RINGS NEEDED
- EMPTY PIPE DETECTION
- VERY FAST RESPONSE
- BODY FROM KYNAR PVDF
- SELF-CLEANING ELECTRODES FROM 316 SS
- DIE CAST ALUMINUM WATERPROOF ENCLOSURE
- POWDER COATING
- WEIGHT 530 g (18.7 OZ) INCLUDING THE CABLES
- DIMENSIONS 102x98x35 mm (4"x3.85"x1.35")

## APPLICATIONS

- ACCURATE FLOW RATE AND TOTAL MEASUREMENT OF WATER, FERTILIZER, BIOCIDES AND MILD CHEMICALS
- ACCURATE MEASUREMENT THE FLOW RATE AND TOTAL OF METERING PUMPS
- AUTOMATIC BATCHING OF VERY LOW VOLUMES
- VERY ACCURATE PROGRAMMABLE FLOW SWITCH
- FLOW RATE CONTROL
- SCADA
- INDUSTRIAL CONTROL
- IRRIGATION



## 1. DESCRIPTION

GMAG100 is a 1/4" in-line 25 L/M (6.6 GPM) max magmeter (electromagnetic flow meter). It limits the max flow rate to 6.6 GPM when the pulse output is used. The MODBUS port does not limit the flow rate and can be used to read and measure up to 8 GPM. It has no moving parts, wide power supply voltage range, software empty pipe detection, self-cleaning electrodes, an isolated programmable digital output, and an RS485 MODBUS RTU communication port.

Proprietary software algorithms and signal processing techniques ensure its high accuracy, repeatability, linearity and very large turn-down ratio along with very low consumption. The isolated programmable output ensures high functionality, flexibility and compatibility. GMAG100 can work as an accurate flow meter, accurate programmable flow switch or as an accurate batch controller of very low volumes.

Using the MODBUS RTU port the flow rate, the total and many other parameters can be read many times a second remotely, monitored, stored or transmitted to another device or system over a radio link. GMAG100 stores the total in a non-volatile memory, so it can be used without a totalizer.

GMAG100 software uses versions of our proprietary signal recovery and self-adjusting adaptive-predictive algorithms which makes it possible to measure accurately interrupted and highly pulsating flow, and have a very high accuracy in a very large turn down range.



## 2. ABSOLUTE MAXIMUM RATINGS \*

Operating temperature	-20 °C to +85 °C
Fluid Temperature	+80 °C
Power supply voltage	40 VDC
Pulse output current	100 mA DC/AC
Pulse output voltage	100 V DC, 70V AC

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

## 3. CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
<b>Power Supply</b>					
Voltage	25 °C	8.5		36	V DC
Power consumption	25 °C, 8.5 - 36V			2.4	VA
<b>Accuracy</b>					
Error, 1:1 to 100:1	24 V, 25 °C, earth grounded, tap water, NOTE 1		0.3	0.5	% of rate
Error, 100:1 to 200:1	24 V, 25 °C, earth grounded, tap water, NOTE 1		0.5	0.8	% of rate
<b>Liquid Conductivity</b>					
Minimum conductivity	24V, 25 °C		20	30	uS/cm
<b>Digital Output</b>					
Output ON resistance	-20 °C to +85 °C, 100 mA			8	ohm
Output OFF leakage	-20 °C to +85 °C, 100 V DC			7	nA
Max Frequency	6.6 GPM	1100			Hz
<b>KFACTOR</b>					
KFACTOR	2.641721 pulses/mL		10 000		pulses/Gal
<b>Electrodes</b>					
Material			316 SS		
<b>Body</b>					
Material			Kynar PVDF		
<b>Potting</b>					
Material	High grade epoxy and RTV for electronics		Epoxy		
<b>Fittings</b>					
Fittings type			3/8" NPT		
<b>Power Cable</b>					
Type and length	6 wire, stranded, 24 AWG each		6		feet
<b>Grounding wire</b>					
Type and length	16 AWG stranded, yellow-green		10		feet
<b>RS485 port</b>					
Equivalent load	Up to 247 devices can be connected to the same 2-wire network		1/8		

**Note 1:** The error is determined by running a sufficient amount of tap water and precisely weighing it on a scale. The error is the difference between the total measured by the scale and the total measured by the magmeter, divided by the scale total. The same test has been repeated at different flow rates.

**Example:** We ran about 25 000 mL through the magmeter at a flow rate about 0.1 GPM. The scale showed 25 072 mL, the magmeter showed 25 026 mL.

The error:  $(25\ 026 - 25\ 072) / 25\ 072 * 100 = -0.18$  [% of rate]

We state and specify a relative (of rate) error. This means no matter what the flow rate is the error is the percent specified above of it. For a better understanding of errors and accuracy, please read our application note [AN103](#).

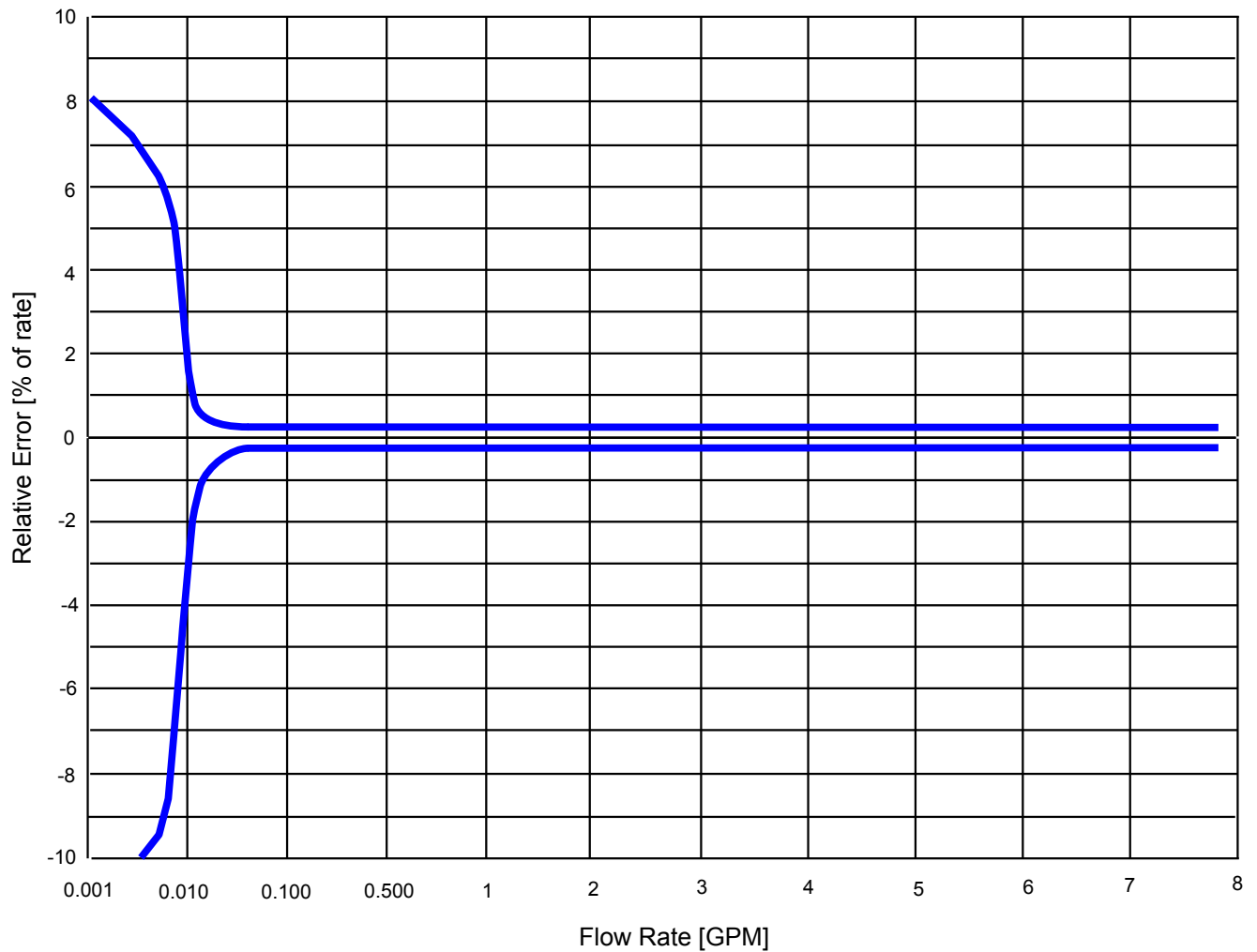


Fig. 1 GMAG100 error vs. Flow Rate, typical

**Note:** G Instruments will be improving the low end of GMAG100 to get even a better accuracy and even larger turn down ratio.

**Note:** The flow rate on Fig. 1 exceeds 6.6 GPM. When MODBUS is used to read flow rate and total, there is no limit. The limit is only by the mechanics of GMAG100 and we do not recommend using it above 8 GPM.



## 4. APPLICATION

### 4.1. ELECTRICAL

GMAG100 has one cable with 6 wires:

**red** - power supply "+" . Reverse polarity protected.

**black** - power supply "-"

**green** - digital output (no polarity)

**white** - digital output (no polarity)

**orange (brown)** - "A" (D+) signal of the RS485 MODBUS port

**blue** - "B" (D-) signal of the RS485 MODBUS port

**NOTE: The black wire (power supply negative) is internally connected to the aluminum enclosure of GMAG100 and to the green / yellow grounding cable.**

GMAG100 has also a green / yellow grounding cable. **This cable must be connected to a good earth ground all the time. It is also recommended to connect the power negative to a good earth ground as well.**

The digital output can be connected to a flow computer, remote display, PLC, SCADA and other devices. It can be programmed to be a pulse output, a high / low alarm with hysteresis or a batch controller output. This way the magmeter can be used as a very precise flow switch, for a flow ON/OFF control, or a precise batch control.

#### 4.1.1. Connecting to our GFC111 flow computers and similar

Connect the green and white wires to "S" and "+" terminal and set the DIP switches to **pnp**.

#### 4.1.2. Connecting to other devices

Because the pulse output is isolated and has no polarity it can also be connected to inputs set for npn, dry contact, reed switch and others that can work with pulses up to 1100 Hz. The recommended pull-up or pull down current through the pulse output is at least 1-2 mA for the standard cable of 6 feet included. If the cable has been extended the current should also increase.

#### 4.1.3. Alarm and batch, connections

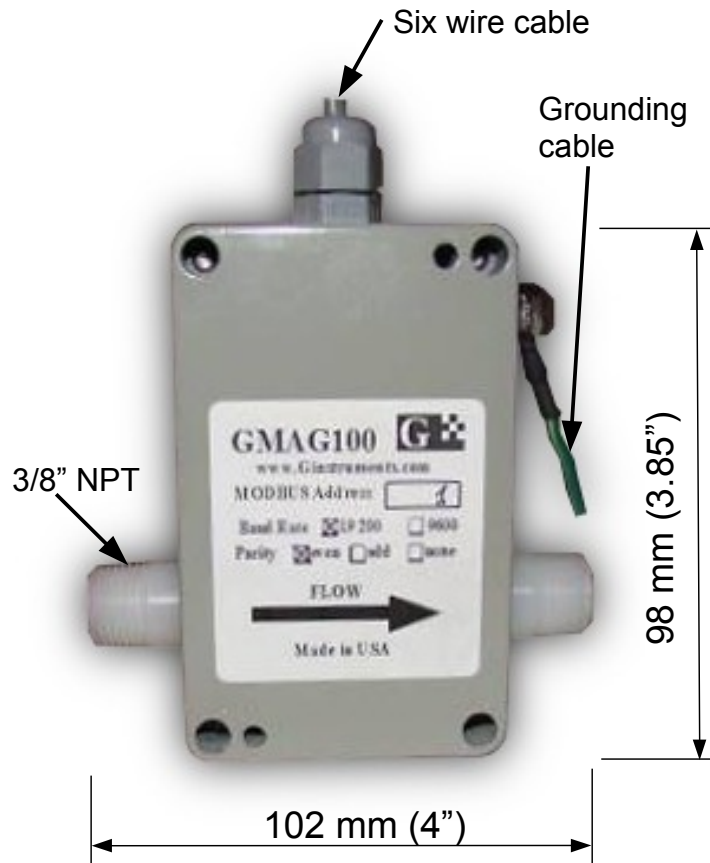
The digital output can work with voltages up to 100 VDC or 70 VAC, providing up to 100 mA current. It can turn on/off a relay, which in turn can open / close a valve, can start / stop a pump or do something else.

**NOTE: If you are not connecting all the wires isolate well the unused ones.**

## 4.2. MECHANICAL

### 4.2.1. Dimensions

The GMAG100 magmeter has the following dimensions:



## 5. COMMUNICATION

Communication is available through the RS485 MODBUS RTU port. If the distance to the master is significant a twisted pair must be used. We strongly recommend a shielded twisted pair (STP) to be used.

The communication protocol is MODBUS RTU. Functions 0x03 (read holding registers), 0x04 (read input registers) and 0x06 (write a single holding register) are implemented. The GMAG100 device handles exceptions 1, 2, 3 and 6.

Here are the registers implemented:

<b><i>Register Address</i></b>	<b><i>Register Type</i></b>	<b><i>Read/Write</i></b>	<b><i>Description</i></b>	<b><i>Format</i></b>
20	Input	R	Flow Rate in GPM x 1000	6600 = 6.600 GPM
36	Input	R	Total in US Gallons x 1000, High, NOTE 1	Long Integer, High



37	Input	R	Total in US Gallons x 1000, Low, NOTE 1	Long Integer, Low
103	Input	R	Batch total accumulated in Gallons x 1000	45 672 = 45.672 Gallons
104	Input	R	Batch state, 0 = reset, 1 = run, 2 = pause	Default is 0 = reset
1000	Holding	W	MODBUS slave address, NOTE 5	1 - 247, default is 1
1002	Holding	R/W	Alarm, 0.000 to 8.000 GPM	0 - 8 000 = 0.000 - 8.000 GPM default is 6000 = 6.000 GPM
1003	Holding	R/W	Alarm type, high or low	0 = high, 1 = low default is 0 = high
1004	Holding	R/W	Alarm hysteresis, 0.0 to 3.000 GPM	0 - 3000 = 0.0 - 3.000 GPM default is 200 = 0.200 GPM
1007	Holding	R/W	Cut off, 0.001 to 0.600 GPM	1 - 600 = 0.001 - 0.600 GPM default is 4 = 0.004 GPM
1008	Holding	R/W	Digital output type, pulse, alarm or batch	0 = pulse, 1 = alarm, 2 = batch default is 0 = pulse
1034	Holding	R/W	Batch in Gallons x 1000. From 0.030 to 65.5 Gallons	Default is 20 000 = 20.000 Gallons
1049	Holding	W	Reset the total, NOTE 2	Write 26 993
1053	Holding	W	RS485 MODBUS RTU Baud Rate. NOTE 5.	0 = 19 200, 1 = 38400, 2 = 57600, 3 = 115200, 4 = 9600 default is 0 = 19 200
1054	Holding	W	RS485 MODBUS RTU parity. NOTE 5.	0 = even, 1 = odd, 2 = none default is 0 = even
1055	Holding	W	Batch button. Writing to this register changes the states of the batch. NOTE 3.	
1056	Holding	W	Batch cancel. NOTE 4.	
1057	Holding	W	Stop Bits. NOTE 5, NOTE 6	0 = 2 stop bits, 1 = 1 stop bit default is 0 = 2 stop bits

**NOTE 1:** Always read both high and low registers, in that order. Merge them to form an unsigned long variable. It will contain the total in steps of 1/1000 Gallons.

**Example:** Reading 377 546 will mean 377.546 Gallons

**NOTE 2:** The total will be reset only by writing exactly 26 993 to register 1049

**NOTE 3:** If the current state is reset, it will change to run. The digital output will turn off (open) and the batch total will start accumulating. If the current state is run, it will change to pause. The digital output will close and the batch total will stop accumulating. If the state is pause, it will change to run again (resume). The digital output will open and the batch total will continue accumulating again. When it reaches the batch setting the digital output will close and the batch total will stop increasing.

**NOTE 4:** Writing to this register will cancel the batch. The digital output will close, the batch state will change to reset and the batch total will be cleared.

**NOTE 5:** When changing the baud rate, the MODBUS address, the parity or the stop bits, GMAG100 will first do the change and then reply to the master with the new setting already in effect.

**NOTE 6:** One stop bit will be automatically used with even and odd parity. The setting for the stop bits will only be used when no parity has been programmed. **Note** that MODBUS standard requires 2 stop bits with no parity.

**TIP:** After changing the MODBUS address, or the baud rate or the parity, write down the new setting on the white label on GMAG100

## 5. ORDERING

For ordering please use G Instruments part number 30177.



## IMPORTANT NOTICE

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