



Oval Gear Positive Displacement Flowmeter

GFM23



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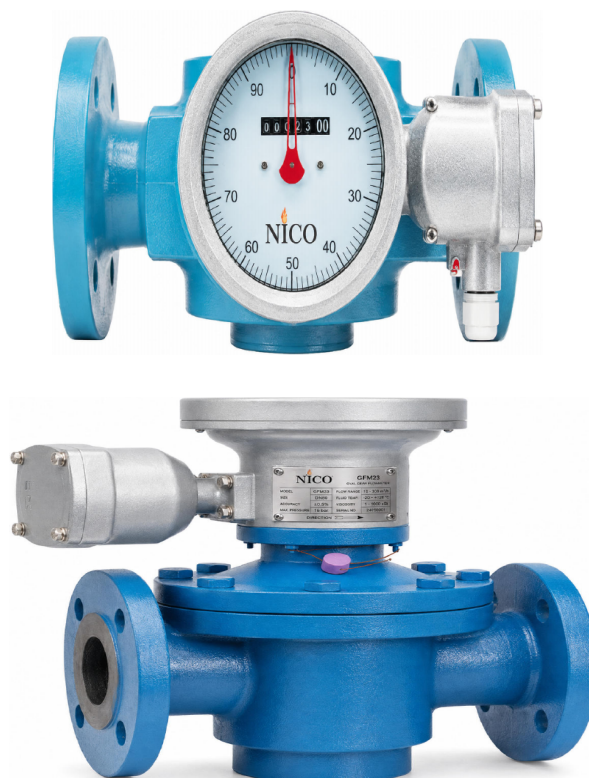


Oval Gear Positive Displacement Flowmeter

GFM23

Nikan Sanat Khavarmiyaneh (NICO) designs and manufactures industrial instrumentation for pressure, temperature, level and flow measurement, together with the accessories that complete an installed measuring point.

GFM23 is the oval gear positive displacement flowmeter within the NICO Flow Measurement line — a direct volumetric meter for viscous and lubricating liquids where velocity-inferring technologies lose accuracy.



DN8-DN200

NOMINAL SIZE COVERAGE

±0.2%

BEST STATED ACCURACY OF READING

9

READOUT / TRANSMITTER CONFIGURATIONS

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01 · PRODUCT OVERVIEW

GFM23 oval gear flowmeter

GFM23 is a positive displacement liquid flowmeter built around a pair of meshing oval gear rotors. Each revolution of the rotor pair transfers a fixed number of measuring-cavity volumes from inlet to outlet, so the meter counts **volume directly** rather than inferring it from velocity.

Because measurement does not depend on the velocity profile, GFM23 does not require the long straight upstream runs that inferential meters need, and its accuracy improves rather than degrades as liquid viscosity rises. This makes it the appropriate technology for fuel oil, petroleum products, lubricating and vegetable oils, and for viscous liquids that a turbine or vortex meter cannot handle.

±0.2% / ±0.5%

ACCURACY OF READING

2-3000 mPa·s

VISCOSITY, BY CONSTRUCTION

−20 ... +250 °C

 MEDIUM TEMPERATURE, BY
CONSTRUCTION

Product family at a glance

Attribute	GFM23
Technology	Positive displacement, oval gear rotor pair
Measured medium	Liquid — fuel oil, petroleum and petroleum products, vegetable oil, food liquids, chemicals
Nominal size	DN8 ... DN200 — not every intermediate DN is available in every construction; see the flow-range and dimension tables
Service constructions	Standard · High Temperature · High Viscosity
Body materials	Cast iron · cast steel · stainless steel
Readout / transmitter	Mechanical zero-return counter · mechanical counter with pulse output · mechanical counter with 4-20 mA output · blind transmitter · multi-function LCD electronic register — high-temperature variants where applicable. Nine configurations, Section 03B
Transmitted output	None · pulse · 4-20 mA
Digital register outputs	Pulse · 4-20 mA · RS-485 · HART — package-dependent, Section 11B
Process connection	Flange (DIN / ANSI / JIS) · thread · tri-clamp
Protection grade	IP65 (stated protection grade)
Ambient temperature	−20 ... +55 °C — LCD electronic register −30 ... +55 °C, Section 11B

Why positive displacement

Viscosity is an advantage

Higher viscosity improves sealing between rotor and chamber, reducing slip. A dedicated High Viscosity construction extends service to 3000 mPa·s.

No velocity profile dependence

Volume is displaced mechanically. Upstream disturbance affects the meter far less than it affects an inferential technology.

Direct mechanical totalising

A no-power mechanical construction totalises without any electrical supply — useful for custody-style transfer points and remote sites.

Digital register available

A multi-function LCD electronic register adds instantaneous flow, batch totalising, multi-unit display, RS-485 and optional HART.

Statement of scope. Application categories above are the media families named for this product. They are **not** a chemical-compatibility approval. Compatibility for a specific medium depends on the wetted-part materials of the selected construction and shall be confirmed by NICO Engineering.

02 · MEASURING PRINCIPLE

Oval gear positive displacement

Two oval gear rotors mesh inside a precisely machined metering chamber. Differential pressure across the meter turns the rotor pair; as they turn, each rotor alternately seals a crescent-shaped cavity between itself and the chamber wall, carries that fixed volume around, and discharges it to the outlet.

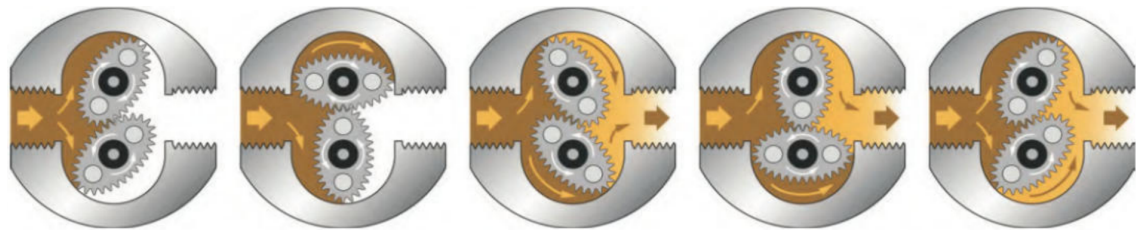


Fig. 1 — Trapped-volume transfer through one revolution of the oval gear pair. Four measuring volumes per revolution. NICO schematic, not to scale.

Volume relationship

One complete revolution of the gear pair displaces **four measuring-cavity volumes**. Total volume is therefore the cavity volume multiplied by the counted revolutions — a purely geometric relationship, independent of density, conductivity, temperature or velocity profile.

Mechanical readout path

Rotor motion is transferred through the coupling to the counter head. Two coupling constructions are used: magnetic coupling and sub-axial coupling. The counter provides accumulated total and a resettable single-batch register with pointer indication. An error-adjustment mechanism (changing-gear adjustment) allows the indicated volume to be trimmed against a calibration reference. On DN50 and larger a precision regulator is fitted.

Electronic readout path

Where a transmitter or electronic register is selected, rotor motion is converted to a pulse train by a sensor mounted on the counter head or, in the blind construction, directly on the body. Two transmitter types are used: a photoelectric pulse transmitter and a 4–20 mA converter. The multi-function LCD electronic register processes the pulse train to give instantaneous flow, accumulated total and batch total with pulse, 4–20 mA, RS-485 and optional HART output.

ENGINEERING NOTE

The coupling type is not a selectable ordering field. Where the application imposes a coupling requirement — for example a magnet temperature limit in high-temperature service — state it in the enquiry and confirm it with NICO Engineering.

Construction

#	Component	Function
1	Counter	Accumulated and single-batch volume indication
2	Signal output	Pulse or analogue transmitter, where fitted
3	Precision regulator	Fitted on DN50 and above
4	Coupling seal	Isolates the counter head from the process
5 / 9	Front and rear cover	Close the metering chamber; the rear cover carries the rotor journals
7	Oval gear rotor pair	The measuring element — defines the displaced volume per revolution
8	Shell	Pressure-containing metering body

03 A · PRODUCT CONFIGURATIONS

Service constructions and body materials

GFM23 is one product family configured along three independent axes: the **service construction**, which fixes the temperature, viscosity and accuracy envelope; the **body material**, which fixes the pressure and corrosion envelope; and the **readout / transmitter package**, which fixes indication, output and communication. This section covers the first two axes; the readout axis is Section 03B.

Standard -20 ... +100 °C	High Temperature +100 ... +250 °C	High Viscosity -10 ... +100 °C
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Fig. 2 — The three service constructions. Each carries its own performance table; the tables are not interchangeable.

Service construction × body material

Service construction	Cast iron	Cast steel	Stainless steel	Envelope
Standard	✓	✓	✓	-20 ... +100 °C · 2-200 mPa·s · ±0.5% and ±0.2%
High Temperature	✓	✓	✓	+100 ... +250 °C · 2-200 mPa·s · ±0.5% and ±0.2%
High Viscosity	✓	✓	✓	-10 ... +100 °C · 200-3000 mPa·s · ±0.5% only

Not offered. There is no combined High Temperature and High Viscosity construction. A high-viscosity medium above +100 °C is outside the published envelope of every construction and shall not be ordered from this catalog. Refer the duty to NICO Engineering.

What each construction changes

Standard

The base construction. Widest accuracy choice, full size coverage, lowest cost. Suits fuel oils, petroleum products and light lubricants at ambient process temperature.

High Temperature

Adds a finned thermal extension between the metering body and the counter head, protecting the readout from process heat. Flow ranges are derated relative to Standard across the mid sizes. A high-temperature readout construction is used — see Section 03B.

High Viscosity

Rotor and clearance geometry adapted for 200-3000 mPa·s. Flow ranges are substantially lower than Standard at the same nominal size, and **only ±0.5% accuracy is offered**.

Body material

Cast iron and stainless steel share one pressure band; cast steel carries the higher band. Body material does not change the temperature or viscosity envelope — that is set by the service construction.

Model designation. GFM23 is a single NICO product family. Size, service construction, body material, readout package and every other choice are expressed through the ordering code in Section 16 — not through separate model numbers.

Pressure options change with the service construction. Cast-steel high-viscosity service does not carry the 4.0 MPa option, and cast-iron high-viscosity service does not carry the 1.0 MPa option. See Section 08.

03 B · PRODUCT CONFIGURATIONS

Readout and transmitter configurations

GFM23 is supplied in nine readout and transmitter configurations. These are **configurations of one product family**, not separate models. Every configuration is selected through field 5 of the ordering code in combination with the service construction — see Section 16.



01 Mechanical Zero-Return

Local indication **Yes**
Output **None**
Temperature construction **Standard / HV**



02 HT Mechanical Zero-Return

Local indication **Yes**
Output **None**
Temperature construction **High Temperature**



03 Mechanical + Pulse Output

Local indication **Yes**
Output **Pulse**
Temperature construction **Standard / HV**



04 HT Mechanical + Pulse Output

Local indication **Yes**
Output **Pulse**
Temperature construction **High Temperature**



05 Mechanical + 4-20 mA

Local indication **Yes**
Output **4-20 mA**
Temperature construction **Standard / HV**



06 HT Mechanical + 4-20 mA

Local indication **Yes**
Output **4-20 mA**
Temperature construction **High Temperature**



07 Blind Transmitter

Local indication **No**
Output **Pulse or 4-20 mA**
Temperature construction **Confirm**



08 Multi-Function LCD Electronic Register

Local indication **Yes**
Output **Pulse / 4-20 mA / RS-485 / HART**
Temperature construction **Standard / HV**



09 HT Multi-Function LCD Electronic Register

Local indication **Yes**
Output **Pulse / 4-20 mA / RS-485 / HART**
Temperature construction **High Temperature**

High-temperature variants. Configurations 02, 04, 06 and 09 carry the finned thermal extension that separates the counter head from the metering body. They are the readout constructions used with the High Temperature service construction. The exact selection rule — whether the HT readout is supplied automatically whenever the service construction is High Temperature, or is separately selectable — is **confirmed with NICO Engineering** and is not fixed by this catalog. State the process and ambient temperature in the enquiry.

03 B · PRODUCT CONFIGURATIONS

Configuration definitions and availability

Each configuration on the previous page corresponds to one readout package code. The package fixes local indication, transmitted output and communication together, because these are not independent choices — a mechanical counter with no supply cannot carry an electrical output, and the digital outputs are supplied as defined packages.

Readout package definitions

Code	Configuration	Local indication	Totaliser	Instantaneous flow	Transmitted output	Communication
M0	Mechanical Zero-Return	Pointer + roller counter	Accumulated + resettable batch	—	None	None
MP	Mechanical + Pulse	Pointer + roller counter	Accumulated + resettable batch	—	Pulse	None
MA	Mechanical + 4-20 mA	Pointer + roller counter	Accumulated + resettable batch	—	4-20 mA	None
BP	Blind Transmitter, pulse	None	—	—	Pulse	None
BA	Blind Transmitter, 4-20 mA	None	—	—	4-20 mA	None
D1	LCD Electronic Register	LCD	Accumulated + resettable single	Yes	Pulse	RS-485
D2	LCD Electronic Register	LCD	Accumulated + resettable single	Yes	Pulse + 4-20 mA	RS-485
D3 OR	LCD Electronic Register	LCD	Accumulated + resettable single	Yes	Pulse + 4-20 mA	RS-485 + HART

Table 12 — Readout package definitions. Codes are NICO-controlled designations used in ordering-code field 5.

Availability against the service construction

Readout package	Standard	High Temperature	High Viscosity	Notes
M0	✓	✓ HT head	✓	No electrical supply of any kind
MP	✓	✓ HT head	✓	Photoelectric pulse transmitter
MA	✓	✓ HT head	✓	4-20 mA converter
BP	Confirm	Confirm	Confirm	Confirm the service construction with NICO Engineering
BA	Confirm	Confirm	Confirm	Confirm the service construction with NICO Engineering
D1	✓	✓ HT head	✓	Digital register — see Section 11B
D2	✓	✓ HT head	✓	Digital register — see Section 11B
D3	OR	OR	OR	HART package — On Request

Table 13 — Readout package availability. ✓ available · Confirm = engineering confirmation required · OR = On Request.

High-temperature readout construction. Configurations 02, 04, 06 and 09 carry the finned thermal extension used with the High Temperature service construction. The readout construction supplied for a given duty is **confirmed with NICO Engineering** against the process and ambient temperature stated in the enquiry; it is not selected as a separate ordering-code field.

Blind transmitter availability. The blind transmitter is offered in cast iron, cast steel and stainless steel bodies with flange or thread connection. Its availability in High Temperature and High Viscosity service is **Confirm with NICO Engineering** and is established for the specific duty at enquiry.

04 · FEATURES AND APPLICATIONS

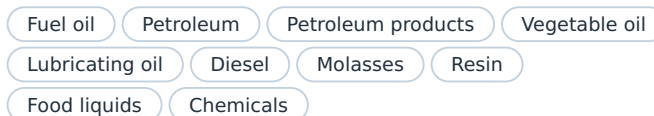
Where GFM23 is the right meter

Key features

- **Direct volumetric measurement.** Four fixed measuring volumes per rotor revolution; no velocity inference.
- **Accuracy to $\pm 0.2\%$ of reading** in Standard and High-Temperature service.
- **Three service constructions** covering $-20 \dots +250 \text{ }^{\circ}\text{C}$ and $2 \dots 3000 \text{ mPa}\cdot\text{s}$.
- **Three body materials** — cast iron, cast steel and stainless steel — across all nine construction cells.
- **Nine readout and transmitter configurations**, from a no-power mechanical totaliser to a multi-function digital register.
- **Mechanical construction available** with no electrical supply of any kind.
- **Digital register** with instantaneous flow, batch totalising, multi-unit display, RS-485 and optional HART.
- **Error adjustment by changing gear**, allowing field trim against a calibration reference.
- **Precision regulator** fitted from DN50 upward.
- **Three connection families** — flange, thread and tri-clamp — each with a defined size scope.

Application areas

The following are the media families stated for this product.



Typical duties

Duty	Recommended construction
Fuel-oil transfer and burner metering	Standard · cast iron or cast steel
Hot fuel oil, bitumen-adjacent service	High Temperature
Lubricating oil, gear oil dispensing	Standard or High Viscosity
Heavy viscous liquid batching	High Viscosity
Edible oil, food liquid	Stainless steel · tri-clamp connection
Remote monitoring / plant network	Any construction with LCD register — RS-485

Compatibility is not implied by the application list. Chemical service covers an unbounded range of media. Material suitability for a specific chemical, concentration and temperature is a wetted-parts question and shall be confirmed by NICO Engineering for the selected construction. No universal chemical compatibility is claimed.

Where GFM23 is not the right meter

Liquids carrying solids

A positive displacement element has close running clearances. Abrasive or particulate-laden liquid requires upstream filtration; unfiltered slurry service is outside the scope of this product.

Gas or two-phase flow

The measured medium is liquid. Entrained gas is displaced and counted as volume, producing over-registration.

Very low viscosity at high flow

Slip past the rotors rises as viscosity falls. Below the stated $2 \text{ mPa}\cdot\text{s}$ lower limit the published accuracy does not apply.

Hot high-viscosity duty

High Temperature and High Viscosity are separate constructions and are not combined. Refer such duties to NICO Engineering.

05 · TECHNICAL SPECIFICATIONS

Consolidated technical data

Parameter	GFM23
Measuring principle	Positive displacement — oval gear rotor pair, four measuring volumes per revolution
Measured medium	Liquid: fuel oil, petroleum, petroleum products, vegetable oil, food liquids, chemicals
Nominal size	DN8 ... DN200 — availability per construction; see Sections 06 and 13
Accuracy	±0.2% or ±0.5% of reading in Standard and High-Temperature service ±0.5% of reading only in High-Viscosity service
Repeatability	— not stated — see note 1
Medium temperature	Standard –20 ... +100 °C · High Temperature +100 ... +250 °C · High Viscosity –10 ... +100 °C
Medium viscosity	Standard and High Temperature 2 ... 200 mPa·s · High Viscosity 200 ... 3000 mPa·s
Nominal pressure	Configuration-dependent — see Section 08. Confirm with NICO Engineering for the selected material, service construction and process connection
Body material	Cast iron · cast steel · stainless steel
Wetted-part materials	— see Section 10 and note 2

Readout, output and supply — by configuration

Parameter	Mechanical constructions	Blind transmitter	LCD electronic register
Readout package	M0 MP MA	BP BA	D1 D2 D3
Local indication	Pointer counter with zero return; accumulated and resettable batch total	None	LCD — instantaneous flow and total shown simultaneously; resettable single total
Transmitted output	None (M0) · pulse (MP) · 4–20 mA (MA)	Pulse or 4–20 mA	Pulse · 4–20 mA (D2, D3)
Communication	None	None	RS-485 · HART (D3 OR)
Supply	None (M0) · 12 VDC or 24 VDC (MP MA)	12 VDC or 24 VDC	8–30 VDC external, or internal battery (dual-power)
Power consumption	—	—	< 1 W at 24 VDC
Ambient temperature	–20 ... +55 °C	–20 ... +55 °C	–30 ... +55 °C
Transmission distance	0 – 1000 m	0 – 1000 m	Per RS-485 / 4–20 mA installation practice
Electrical accuracy	±1 pulse	±1 pulse	Per register configuration

Table 14 — Configuration-based electrical specification. A single supply value does not apply across all readout architectures.

Parameter	GFM23
Error adjustment	Changing-gear adjustment (mechanical) · coefficient K adjustment (electronic register)
Precision regulator	DN50 and above
Coupling	Magnetic coupling or sub-axial coupling — not a selectable field
Protection grade	IP65 — stated protection grade
Hazardous-area approval	— see note 3
Process connection	Flange DN8–DN200 (DIN / ANSI / JIS) · thread DN8–DN150 · tri-clamp DN8–DN80
Flow direction	Unidirectional — install per the body marking
Mounting	Rotor shafts in a horizontal plane — mandatory; see Section 14

Notes to the specification table

Note 1 — repeatability. Not stated for this product; shown as — rather than assumed from the accuracy class. **Note 2 — wetted parts.** The material designation above refers to the meter **body**. Internal wetted components, including the oval gear rotors, are not specified in this catalog. See Section 10.

Note 3 — hazardous area. No hazardous-area certification is claimed by this catalog. Certified execution is available **On Request**; state the zone, gas group, temperature class and equipment category with the enquiry.

Note 4 — parameters not stated. Pressure loss versus flow, weight per size, dimensional tolerances and surface-finish declarations are not stated in this catalog. They are confirmed per project on request.

06 A · FLOW RANGE

Standard service construction

Envelope: medium temperature $-20 \dots +100 \text{ }^{\circ}\text{C}$ · viscosity $2 \dots 200 \text{ mPa}\cdot\text{s}$. Flow in **m³/h**. The measuring range depends on the selected accuracy class: the $\pm 0.2\%$ class starts at a higher minimum flow than the $\pm 0.5\%$ class.

Nominal size	Cast iron		Cast steel		Stainless steel	
	$\pm 0.5\%$	$\pm 0.2\%$	$\pm 0.5\%$	$\pm 0.2\%$	$\pm 0.5\%$	$\pm 0.2\%$
DN8	0.02~0.5	0.024~0.5	0.02~0.5	0.024~0.5	0.02~0.5	0.024~0.5
DN10	0.08~0.4	0.1~0.4	0.08~0.4	0.1~0.4	0.1~0.5	0.1~0.5
DN15	0.25~1.5	0.3~1.5	0.25~1.5	0.3~1.5	0.3~1.5	0.3~1.5
DN20	0.5~3	0.6~3	0.5~3	0.6~3	0.6~3	0.6~3
DN25	1~6	1.2~6	1~6	1.2~6	1.2~6	1.2~6
DN40	2.5~15	3~15	2.5~15	3~15	3~15	3~15
DN50	4~24	4.8~24	4~24	4.8~24	4.8~24	4.8~24
DN80	10~60	12~60	10~60	12~60	12~60	12~60
DN100	16~100	20~100	16~100	20~100	20~100	20~100
DN150	32~190	38~190	32~190	38~190	38~190	38~190
DN200	34~340	68~340	34~340	68~340	68~340	68~340

Table 1 — Standard construction measuring ranges, m³/h.

Size coverage. DN32 and DN65 do not appear in this table. DN65 has published dimensions in the cast-iron and stainless constructions but no published flow range; DN32 appears in no performance or dimension table. Both are **On Request** and shall be confirmed with NICO Engineering before selection.

SIZING TIP

Select the size so that the **normal** duty flow sits in the upper half of the measuring range and the **minimum** duty flow stays above the range minimum for the accuracy class you are buying. A meter sized on maximum flow alone will run below its minimum at turndown and will not hold its accuracy class.

06 B/C · FLOW RANGE

High-temperature and high-viscosity service

B · High Temperature construction

Envelope: medium temperature +100 ... +250 °C · viscosity 2 ... 200 mPa·s. Flow in **m³/h**.

Nominal size	Cast iron		Cast steel		Stainless steel	
	±0.5%	±0.2%	±0.5%	±0.2%	±0.5%	±0.2%
DN8	0.02~0.5	0.024~0.5	0.02~0.5	0.024~0.5	0.02~0.5	0.024~0.5
DN10	0.08~0.4	0.1~0.4	0.08~0.4	0.1~0.4	0.1~0.5	0.1~0.5
DN15	0.24~1.35	0.35~1.35	0.24~1.35	0.35~1.35	0.36~1.35	0.36~1.35
DN20	0.54~2.7	0.72~2.7	0.54~2.7	0.72~2.7	0.72~2.7	0.72~2.7
DN25	1.2~5.4	1.4~5.4	1.2~5.4	1.4~5.4	1.4~5.4	1.4~5.4
DN40	2.7~13.5	3.6~13.5	2.7~13.5	3.6~13.5	3.6~13.5	3.6~13.5
DN50	4.4~21.6	5.75~21.6	4.4~21.6	5.75~21.6	5.75~21.6	5.75~21.6
DN80	10.8~54	14.4~54	10.8~54	14.4~54	14.4~54	14.4~54
DN100	18~90	24~90	18~90	24~90	24~90	24~90
DN150	38~170	45.6~170	38~170	45.6~170	45.6~170	45.6~170
DN200	34~340	68~340	34~340	68~340	68~340	68~340

Table 2 — High Temperature construction measuring ranges, m³/h.

Derating. High-temperature maxima are reduced relative to Standard across DN15–DN150. DN8, DN10 and DN200 carry the same values as the Standard table. Use this table, not Table 1, for any duty above +100 °C.

C · High Viscosity construction

Envelope: medium temperature –10 ... +100 °C · viscosity 200 ... 3000 mPa·s · **accuracy ±0.5% of reading only**. Flow in **m³/h**.

Nominal size	DN10	DN15	DN20	DN25	DN40	DN50	DN80	DN100	DN150	DN200
Flow range	0.04~0.2	0.15~0.75	0.3~1.5	0.6~3	1.5~7.5	2.4~12	6~30	10~50	38~100	34~300

Table 3 — High Viscosity construction measuring ranges, m³/h. One range applies to all three body materials.

±0.2% is not available in High-Viscosity service. The high-viscosity performance data supports ±0.5% of reading only. An order combining the High-Viscosity construction with the ±0.2% accuracy class will be rejected by the ordering code (rule R1).

DN8 in high-viscosity service. The high-viscosity range table begins at DN10. DN8 is **not offered** in this construction and is shown by its absence from the table.

Size coverage. DN65 does not appear in any of the three flow tables and is **On Request**. The High-Viscosity table applies one flow range to all three body materials; the body materials carry different pressure options, which are given in Section 08.

07 · ACCURACY AND PERFORMANCE

Accuracy classes and their scope

GFM23 accuracy is expressed as a percentage **of reading**, not of full scale. The class you can order depends on the service construction, and each class carries its own minimum flow.

Accuracy availability

Service construction	±0.5% of reading	±0.2% of reading	Notes
Standard	✓	✓	Both classes tabulated per size and per body material
High Temperature	✓	✓	Both classes tabulated; ranges derated relative to Standard
High Viscosity	✓	—	±0.2% is not offered in this construction

What the accuracy class changes

Selecting ±0.2% does not change the maximum flow of a given size — it raises the **minimum** flow at which the class is held. The turndown of a ±0.2% meter is therefore narrower than that of the same size at ±0.5%.

Example, Standard cast iron	±0.5%	±0.2%
DN25 measuring range, m³/h	1 ~ 6	1.2 ~ 6
DN50 measuring range, m³/h	4 ~ 24	4.8 ~ 24
DN100 measuring range, m³/h	16 ~ 100	20 ~ 100

SELECTION TIP

Buy the accuracy class you can actually hold across the duty. A ±0.2% meter operated below its own minimum flow performs worse than a ±0.5% meter correctly sized for the same duty.

Conditions of the stated accuracy

The stated class applies within the measuring range of the selected size, within the viscosity and temperature envelope of the selected service construction, on a single-phase liquid free of entrained gas, with the meter full of liquid and installed in the marked flow direction, with the rotor shafts in a horizontal plane.

Field trim

Mechanical constructions carry a changing-gear error-adjustment mechanism. Electronic register constructions are trimmed through the coefficient K parameter against a calibration reference — see Section 11B.

Pressure loss

Pressure loss across the meter rises with flow rate and with medium viscosity. **A pressure-loss characteristic is not published in this catalog.** For pump sizing and for any duty near the range maximum, request the pressure-loss figure for the selected size, construction and viscosity from NICO Engineering.

What to request. State the selected size, service construction, body material and the medium viscosity at operating temperature, and NICO Engineering will confirm the pressure loss at the duty flow. This matters most where the duty runs near the range maximum or where the pump has limited available head.

08 · PRESSURE

Body pressure and connection rating

Pressure capability of a GFM23 assembly is set by **three** independent things: the body material, the service construction, and the process connection actually fitted. The lowest-rated of the three governs the installed assembly.

Controlling statement. Pressure capability is configuration-dependent and shall be confirmed by NICO Engineering for the selected material, service construction and process connection. No single pressure figure applies to the GFM23 family.

Body pressure by material and service construction

Body material	Standard	High Temperature	High Viscosity
Cast iron	1.0 · 1.6 MPa	1.0 · 1.6 MPa	1.6 MPa
Cast steel	2.5 · 4.0 · 6.4 MPa	2.5 · 4.0 · 6.4 MPa	2.5 · 6.4 MPa
Stainless steel	1.0 · 1.6 MPa	1.0 · 1.6 MPa	1.6 MPa

Table 4 — Body pressure statements by material and service construction. These are body statements, not assembly ratings.

High-viscosity service reduces the available pressure options. Cast iron loses the 1.0 MPa option and cast steel loses the 4.0 MPa option in High-Viscosity construction. This is a real reduction in the option set, not a rounding of the table.

Three things the pressure figures do not tell you

1 · The rating basis

Whether a body figure is a maximum allowable working pressure, a design pressure or a nominal designation is not stated. It shall be confirmed for any duty where the distinction matters — which is any duty approaching the figure.

2 · Flange class compatibility

Flange classes up to PN40, ANSI Class 600 and JIS 40K are offered. Which class is intended for which body pressure is **not defined**. An ANSI class number is not a pressure in bar — it depends on flange material group and temperature.

3 · Non-flanged connections

The thread and tri-clamp connections carry no stated pressure limit. A tri-clamp connection in particular is normally the governing element of an assembly and must be rated for the duty independently.

Temperature derating

No pressure–temperature derating curve is published. For High-Temperature service to +250 °C, confirm the allowable pressure at temperature with NICO Engineering.

ORDERING NOTE

Pressure is **not** a field in the GFM23 ordering code. State the operating and design pressure in the enquiry (Section 15) and NICO Engineering will confirm the body and connection combination that satisfies them.

09 · TEMPERATURE AND VISCOSITY

Service envelopes

Medium temperature

Service construction	Medium temperature	Application
Standard	−20 ... +100 °C	Ambient and warm liquid service
High Temperature	+100 ... +250 °C	Hot service; a finned thermal extension separates the counter head from the metering body
High Viscosity	−10 ... +100 °C	Viscous service; note the lower limit is −10 °C, not −20 °C
Ambient — mechanical and blind	−20 ... +55 °C	Enclosure and transmitter ambient
Ambient — LCD electronic register	−30 ... +55 °C	Digital register ambient — see Section 11B

The +100 °C boundary. +100 °C is the upper limit of the Standard construction and the lower limit of the High-Temperature construction. For a duty at or close to +100 °C, state the operating and design temperature in the enquiry and let NICO Engineering assign the construction. Do not assume either construction by default.

Ambient limit versus process temperature. The High-Temperature construction handles medium to +250 °C while the enclosure ambient limit remains +55 °C. Installations with high radiant or confined-space ambient must be assessed; the thermal extension protects the head from the process, not from the room.

Medium viscosity

Service construction	Viscosity range	Accuracy available
Standard	2 ... 200 mPa·s	±0.5% and ±0.2%
High Temperature	2 ... 200 mPa·s	±0.5% and ±0.2%
High Viscosity	200 ... 3000 mPa·s	±0.5% only
Above 3000 mPa·s	—	On Request — no published performance data

Table 5 — Viscosity envelope by service construction. All viscosity values are dynamic viscosity in mPa·s.

SELECTION TIP

Viscosity must be evaluated **at the operating temperature**, not at 20 °C. A fuel oil at 200 mPa·s cold may fall to 20 mPa·s when heated — which moves the duty from the High-Viscosity construction into the Standard construction, and changes both the flow range and the available accuracy class. State both the viscosity and the temperature at which it was measured.

Combined envelope summary

Duty	Construction	Flow-range table	Accuracy
−20 ... +100 °C at 2–200 mPa·s	Standard	Table 1	±0.5% or ±0.2%
+100 ... +250 °C at 2–200 mPa·s	High Temperature	Table 2	±0.5% or ±0.2%
−10 ... +100 °C at 200–3000 mPa·s	High Viscosity	Table 3	±0.5%
Above +100 °C at above 200 mPa·s	Not offered — refer to NICO Engineering	—	—

Readout temperature limits are checked separately from the process envelope. The service construction fixes the process envelope; the readout package fitted to it has its own limits. For a duty above **+200 °C**, and for an LCD electronic register on any duty above **+150 °C**, the readout construction shall be **confirmed with NICO Engineering** in addition to the service construction.

10 · MATERIALS

Body materials and wetted parts

GFM23 is offered in three body materials. The material designation in the ordering code refers to the **meter body**. Internal wetted components are a separate question and are addressed explicitly below.

Body material options

Material	Pressure band	Size coverage	Typical use
Cast iron	1.0 · 1.6 MPa	DN10 ... DN200	Fuel oil, lubricating oil, general petroleum service at moderate pressure
Cast steel	2.5 · 4.0 · 6.4 MPa	DN15 ... DN200	Higher-pressure hydrocarbon service
Stainless steel	1.0 · 1.6 MPa	DN15 ... DN150	Food liquids, edible oils, chemical service, sanitary connections

Table 6 — Body materials. Size coverage is the range for which dimensional data is published in this catalog.

Material grade designations for the cast iron and cast steel bodies, and confirmation of the stainless grade, are supplied with the order documentation. They are not stated in this catalog.

Wetted-part material construction

The table below states, component by component, what this catalog does and does not specify.

Component	Material	Status
Metering body / shell	Per selection	Cast iron, cast steel or stainless steel per the ordering code
Oval gear rotor pair	—	Not stated in this catalog. Confirm with NICO Engineering — this is the measuring element and it is fully wetted
Front cover	—	Not stated — confirm with NICO Engineering
Rear cover	—	Not stated — confirm with NICO Engineering
Rotor shafts / journals	—	Not stated — confirm with NICO Engineering
Bearings	—	Not stated — confirm with NICO Engineering
Static seals / gaskets	—	Not stated — elastomer selection is medium- and temperature-dependent and must be confirmed per duty
Coupling seal	—	Not stated — confirm with NICO Engineering
Magnetic coupling magnets	—	Not stated — relevant to High-Temperature service, where magnet remanence is temperature-limited
Process connection	—	Not stated — confirm with NICO Engineering

Internal wetted-part materials, including the measuring gears and other internal components, require controlled confirmation where they are not stated in this catalog. A wetted-parts list is issued with the order documentation for the specific construction. Do not assume that the body material designation extends to the rotors, shafts, bearings or seals.

Media compatibility. No compatibility matrix is published. Suitability for a specific medium depends on the complete wetted-part set, the concentration and the operating temperature. Submit the medium with the enquiry.

Sanitary and food-contact service. A tri-clamp connection is offered in stainless steel to DN80. Surface-finish specification, food-contact material declaration and sanitary certification are **On Request** and are not claimed by this catalog.

Corrosive service. Where the measured liquid is chemically corrosive, a stainless steel meter shall be selected. Cast iron and cast steel meters shall not be tested with water. Selecting a stainless body does not by itself establish compatibility of the internal wetted components — see the register above.

11 A · ELECTRONICS

Readout and transmitter options

GFM23 is available as a purely mechanical totaliser with no supply, as a mechanical totaliser with a transmitted output, as a blind transmitter with no local indication, or as a multi-function digital register. These are **different constructions, not accessories**, selected as one package in ordering-code field 5.

A · Mechanical zero-return counter — M0

The base construction. A pointer indicates rotor position over a graduated dial; a roller counter accumulates total volume and a second register accumulates the single batch. Two reset controls are fitted — one for the batch counter, one for the pointer.

Mechanical indication provides	Detail
Accumulated total	Non-resettable roller counter — lifetime totalised volume
Resettable batch / single-cycle total	Roller register returned to zero by the counter reset control
Pointer indication	Graduated dial showing the sub-division of the current revolution
Zero-return / reset facility	Counter reset and pointer reset controls
Error adjustment	Changing-gear adjustment; precision regulator fitted DN50 and above
Electrical supply	None. The construction totalises with no supply of any kind

Reset discipline. The return-to-zero operation shall be carried out only after flow has stopped. The detailed procedure is in the GFM23 Instruction Manual, not this catalog.

B · Mechanical counter with pulse output — MP

A photoelectric pulse transmitter is added to the counter head, converting rotor motion into a pulse train for remote totalising while local mechanical indication is retained.

Parameter	Value
Transmitter type	Photoelectric pulse transmitter
Working voltage	12 VDC / 24 VDC
Transmission distance	0 - 1000 m
Electrical performance accuracy	±1 pulse
Wiring	Three-conductor: supply positive, pulse output, ground
Hazardous-area execution	On Request — no hazardous-area certification is claimed by this catalog; see Section 05 note 3

C · Mechanical counter with 4-20 mA output — MA

A converter transmits the flow signal as a 4-20 mA analogue current proportional to instantaneous flow rate, while local mechanical indication is retained.

Parameter	Value
Transmitter type	4-20 mA flow converter
Wiring — standard	Two-wire 4-20 mA, 24 V supply
Wiring — optional	Three-wire 4-20 mA, 24 V supply OR
Working voltage	12 VDC / 24 VDC
Output represents	Instantaneous flow rate

D · Blind transmitter — BP BA

Body and transmitter only, with no local indication. Converts pipeline flow into a pulse or analogue signal for a remote display instrument, control system or recorder.

Parameter	Value
Transmitter type	Pulse (photoelectric) BP or 4-20 mA BA
Body materials	Cast iron, cast steel and stainless steel transmitter bodies
Allowable working voltage	12 VDC / 24 VDC
Pipeline connection	Flange or thread — tri-clamp is not offered with this construction
Transmission distance / accuracy	0 - 1000 m · ±1 pulse — as the mechanical transmitters above

Pulse coefficient. The pulse coefficient is specific to the individual meter and is stated on its nameplate and calibration certificate. State the secondary instrument with the enquiry so the coefficient and output frequency are confirmed for the selected size.

11 B · ELECTRONICS

Multi-function LCD electronic register

The multi-function LCD electronic register is the advanced readout construction for GFM23. It processes the rotor pulse train to display instantaneous flow rate, total accumulated flow and batch (single-cycle) flow simultaneously, and provides configurable pulse, analogue and digital communication outputs.



Display function	Availability
Instantaneous flow rate	Yes
Total accumulated flow	Yes
Single / batch accumulated flow	Yes
Resettable single total	Yes, per configuration
Simultaneous flow and total	Yes
Multiple engineering units	Yes

Fig. 4 — Register display interfaces. The single-cycle total is reset at the instrument.

Display capability

Item	Display digits	Unit
Cumulative	99999.999 ~ 99999999	l / m³ / t / kg / ml / gal
Instantaneous flow	999.99 ~ 99999	l / m³ / t / kg / ml / gal per h or m

Table 15 — Digital display capacity.

Technical data

Parameter	Value
Supply voltage	8 - 30 VDC
Power architecture	Dual-power — automatic switching between internal battery and external supply
Power consumption	< 1 W overall at 24 VDC
Ambient temperature	-30 ... +55 °C
Pulse output interface	Push-pull, active-high and active-low capable
Pulse amplitude	Low level < 1 V; high level > (supply voltage - 3 V)
Communication default	9600 bps, 8 data bits, no parity, 1 stop bit, CRC

Digital output packages

NICO code	Power	Output and communication
D1	Battery or external	Voltage pulse + RS-485
D2	Battery or external	Voltage pulse + RS-485 + 4-20 mA
D3 OR	Battery or external	Voltage pulse + RS-485 + 4-20 mA + HART

Table 16 — Digital register packages.

Current output requires an external supply. Where the 4-20 mA function of **D2** or **D3** is used, the external supply shall be **not less than 15 V**. A battery-only installation does not support the current output. State the supply arrangement in the enquiry.

Multi-unit capability. Flow and total are displayed in volumetric units (l, m³, ml, gal) and mass units (t, kg). A unit not listed here is not available; confirm any special unit requirement with the enquiry.

CONFIGURABLE PARAMETERS

The register is field-configurable for engineering unit, 20 mA corresponding flow rate, damping coefficient, coefficient K, pulse output mode and equivalent, device address, baud rate and protocol type. Parameter access is password protected and restricted to qualified personnel. Menu numbers and the full parameter procedure are given in the GFM23 Electronic Register Instruction Manual and are deliberately not reproduced in this catalog.

Digital register scaling. Digital register scaling is configured from the calibration coefficient supplied with the meter. Refer to the GFM23 Electronic Register Instruction Manual for parameter configuration. **No generic coefficient is published** — the value is specific to the individual meter and appears on its nameplate and calibration certificate.

Supply and ambient are package-specific. The 8-30 VDC supply and the -30 ... +55 °C ambient stated above apply to the LCD electronic register only. The mechanical and blind transmitter constructions are 12 / 24 VDC with a -20 ... +55 °C ambient. Read the row for the package actually selected — Section 05, Table 14.

11 C · ELECTRONICS

Output, communication and wiring

Output and communication by readout package

Readout package	Pulse	4-20 mA	RS-485	HART	Supply
M0	—	—	—	—	None
MP	✓	—	—	—	12 / 24 VDC
MA	—	✓	—	—	12 / 24 VDC
BP	✓	—	—	—	12 / 24 VDC
BA	—	✓	—	—	12 / 24 VDC
D1	✓	—	✓	—	8-30 VDC / battery
D2	✓	✓	✓	—	8-30 VDC (≥15 V for current) / battery
D3	✓	✓	✓	OR	8-30 VDC (≥15 V for current)

Table 17 — Output and communication availability. ✓ supported · — not available in this package · OR = On Request.

Electrical interface — LCD electronic register

Terminal	Function
V+	Power supply positive
P0	Pulse output
V-	Power supply negative
IO+	Current output positive
IO-	Current output negative
A	RS-485 A
B	RS-485 B
GND	Ground

Table 18 — Register terminal functions.

Wiring arrangements available

Arrangement	Terminals used
Three-wire pulse	V+ · PO · V-
RS-485 communication	V+ · V- · A · B
Two-wire current	V+ · IO+
Three-wire current	V+ · V- · IO+
Four-wire current + RS-485	V+ · V- · IO+ · A · B
HART on the current loop	V+ · IO — V- not connected

HART installation. For the two-wire 4-20 mA current loop with the HART communication module, the V- terminal shall **not** be connected. An optional 250 Ω load resistor is used where the loop does not already present sufficient resistance.

Transmitter wiring — mechanical and blind constructions

Construction	Arrangement	Conductors
MP BP	Pulse transmitter	Supply positive · pulse output · ground
MA BA	Two-wire 4-20 mA	Supply positive (24 V+) · current loop return
MA BA	Three-wire 4-20 mA OR	Supply positive · current output positive · common (current negative and supply negative)

RS-485 communication

RS-485 communication is available with the multi-function LCD electronic register (packages D1, D2, D3). The register operates as a polled slave and returns single cumulative total, total cumulative total and instantaneous flow.

Parameter	Default	Configurable range
Baud rate	9600 bps	1200 · 2400 · 4800 · 9600
Data format	8 data bits, no parity, 1 stop bit	Parity none / odd / even
Error checking	CRC over the message contents	—
Device address	1	1 ... 255
Register values returned	Single cumulative, total cumulative, instantaneous flow	—

Protocol detail. Frame structure, register map, data scaling and the reset-to-zero command are given in the GFM23 Electronic Register Instruction Manual supplied with the meter. The complete register map is not reproduced in this product catalog.

HART availability. HART is offered on the D3 digital package only, is carried on the 4-20 mA loop, and requires an external supply. It is supplied **On Request**. Where a host system requires a registered device description file, state this with the enquiry so it can be confirmed before order.

11 D · ELECTRONICS

Readout / output selection matrix

This matrix is the single-glance view of what each readout architecture can do. Use it to fix the readout package before completing the ordering code.

Readout package	Local indication	Totaliser	Instantaneous flow	Pulse	4-20 mA	RS-485	HART	HT version
M0 Mechanical zero-return	Pointer + roller	✓	—	—	—	—	—	✓
MP Mechanical + pulse	Pointer + roller	✓	—	✓	—	—	—	✓
MA Mechanical + 4-20 mA	Pointer + roller	✓	—	—	✓	—	—	✓
BP Blind transmitter, pulse	—	—	—	✓	—	—	—	Confirm
BA Blind transmitter, 4-20 mA	—	—	—	—	✓	—	—	Confirm
D1 LCD register	LCD	✓	✓	✓	—	✓	—	✓
D2 LCD register	LCD	✓	✓	✓	✓	✓	—	✓
D3 LCD register	LCD	✓	✓	✓	✓	✓	OR	✓

Table 19 — Readout / output selection matrix. ✓ available · — not available · OR = On Request · Confirm = engineering confirmation required.

How to choose the package

If the duty needs...	Select
Local reading only, no electrical supply available	M0
Local reading plus remote totalising	MP
Local reading plus a flow-rate signal to a controller	MA
No local reading, signal to a remote display or DCS	BP or BA
Local flow rate and total, plus digital network	D1
Local flow rate and total, plus analogue and digital	D2
The above plus HART on the current loop	D3 OR

Constraints that decide the package

No supply at the point of measurement

Only **M0** totalises without a supply. Every other package requires an electrical supply. A battery-powered digital register is available but does not support the current output.

Instantaneous flow rate is required

Only the digital register packages display instantaneous flow locally. The mechanical constructions totalise; they do not indicate rate.

A mechanical meter cannot carry an electrical output.

Package **M0** is a no-supply construction. If any output or communication is required, a package that includes a transmitter must be selected. This is enforced by ordering-code rules R6 and R7.

Simultaneous outputs. Where a package lists more than one output, those outputs are available together — the **D2** package, for example, provides the pulse, the 4-20 mA signal and the RS-485 link at the same time. Cells marked **Confirm** are established with NICO Engineering for the selected service construction.

12 · PROCESS CONNECTIONS

Connection types and size scopes

Three connection families are available. **Each carries its own nominal-size scope, and the scope is enforced by the ordering code.**

Connection	Size scope	Notes
Flange	DN8 ... DN200	DIN, ANSI or JIS standard — see the class table below
Thread	DN8 ... DN150	Thread standard and size designation to be confirmed with the enquiry
Tri-clamp	DN8 ... DN80	Sanitary connection; clamp size designation to be confirmed with the enquiry

Table 7 — Connection type and nominal-size scope.

The size scopes are hard limits. A tri-clamp connection above DN80, or a threaded connection above DN150, is not available and will be rejected at order entry. Above those sizes, flange is the only connection.

Flange standards and classes

Standard	Classes offered
DIN	PN10 · PN16 · PN25 · PN40
ANSI	Class 150 · Class 300 · Class 600
JIS	10K · 20K · 30K · 40K

Flange class must be confirmed against the body pressure. This catalog does not state which flange class corresponds to which body-pressure configuration, and an ANSI class number is not a pressure in bar. State the design pressure and design temperature in the enquiry; NICO Engineering will confirm the flange class.

Data supplied on request

Item	Status
Thread standard and thread size per DN	On Request
Tri-clamp size designation per DN	On Request
Connection material	On Request — see Section 10
Face-to-face length for thread and tri-clamp	On Request — the published dimension tables are for the flanged version only
Gasket and counter-flange requirement	On Request
Dimensions for ANSI, JIS and non-PN16 classes	On Request — see Section 13

Blind transmitter connection scope. The blind transmitter construction is offered with **flange or thread** connection. A tri-clamp blind transmitter is **On Request**.

SELECTION TIP

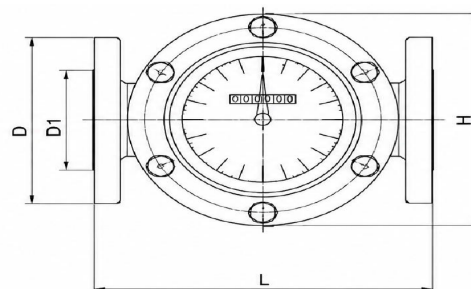
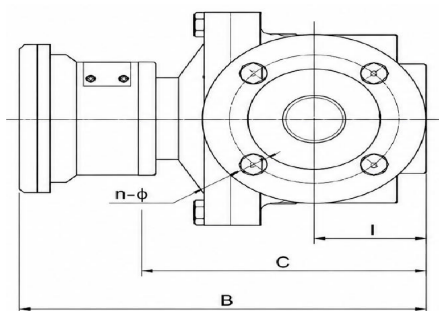
On a viscous or hot duty the connection is frequently the governing element of the assembly, not the meter body. Fix the flange standard, class and facing at enquiry stage — changing it later usually changes the face-to-face length and therefore the pipework.

13 A · DIMENSIONS

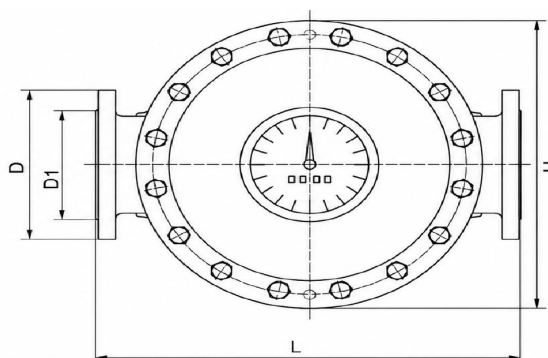
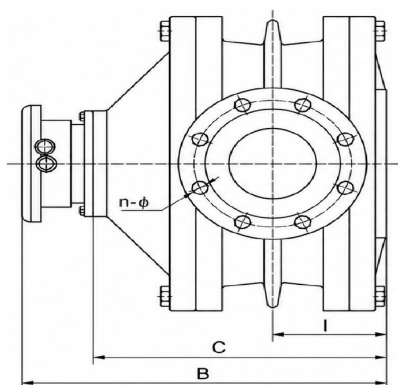
General arrangement — flanged construction

PLAN VIEW

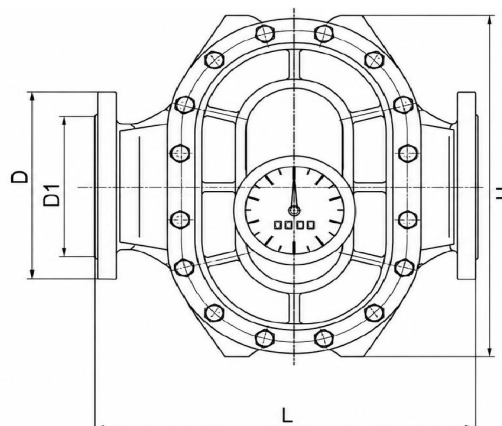
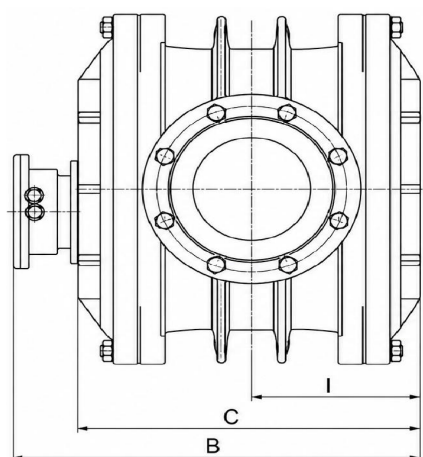
FLANGE FACE



DN10-DN40



DN50~DN100



DN150, DN200

Fig. 3 — GFM23 flanged general arrangement, NICO schematic, not to scale. **All dimension tables in this catalog are for the DIN PN16 flange.** Other standards and classes on request.

High-temperature construction adds a thermal extension. The finned extension increases the overall height of the counter head. The increment is size-band dependent — see the note on page 22.

13 A · DIMENSIONS

Cast iron construction

Cast iron construction

Covers the cast-iron standard, cast-iron high-viscosity and high-temperature cast-iron constructions. Dimensions in mm. DIN PN16 flange.

DN	L	H	A	B	D	D1	N	Φ
DN8	—	—	—	—	—	—	—	—
DN10	150	100	165	210	90	60	4	14
DN15	170	118	172	226	95	65	4	14
DN20	200	150	225	238	105	75	4	14
DN25	260	180	232	246	115	85	4	14
DN40	245	180	249	271	145	110	4	18
DN50	340	250	230	372	160	125	4	18
DN65	420	325	270	386	180	145	4	18
DN80	420	325	315	433	195	160	8	18
DN100	515	418	370	458	215	180	8	18
DN150	540	515	347	557	280	240	8	23
DN200	650	650	476	720	335	295	12	23

Table 8 — Cast iron construction dimensions, mm. L face-to-face · H overall height · D flange outer diameter · D1 bolt circle · N × Φ bolt count and hole diameter.

DN8. Dimensional data is not published for DN8 in any construction and is shown as —. A DN8 meter is **On Request**; confirm dimensions with NICO Engineering before finalising pipework.

High-temperature construction — added elevation. The high-temperature construction adds a cooling-fin thermal extension above the metering body:

- **DN50 and below — add approximately 100 mm** to the counter-head elevation.
- **Above DN50 — add approximately 160 mm** to the counter-head elevation.

All remaining dimensions are unchanged from the table above. The exact elevation for the selected size is confirmed on the certified general-arrangement drawing issued against the order.

INSTALLATION TIP

Order the certified GA drawing before releasing pipework fabrication. The published table is a selection aid; the certified drawing is the fabrication document.

13 B/C · DIMENSIONS

Cast steel and stainless steel constructions

B · Cast steel construction

Covers the cast-steel standard, cast-steel high-viscosity and high-temperature cast-steel constructions. Dimensions in mm. DIN PN16 flange.

DN	L	H	B	A	D	D1	N	Φ
DN15	200	138	232	180	105	75	4	14
DN20	250	164	220	160	125	90	4	18
DN25	300	202	252	185	135	100	4	18
DN40	300	202	293	208	165	125	4	23
DN50	384	262	394	312	175	135	4	23
DN80	450	337	452	332	210	170	8	23
DN100	555	442	478	310	250	200	8	25
DN150	540	510	557	347	300	250	8	26
DN200	650	650	720	476	—	310	12	26

Table 9 — Cast steel construction dimensions, mm. **Note the column order:** B precedes A in this table.

DN200 flange outer diameter is shown as —. The value available for this cell is not consistent with the bolt-circle diameter of the same row and is therefore not published. Confirm with NICO Engineering.

Size coverage. The cast-steel construction is dimensioned from DN15. DN8, DN10 and DN65 are not published in this construction.

C · Stainless steel construction

Dimensions in mm. DIN PN16 flange.

DN	L	H	B	A	D	D1	N	Φ
DN15	208	120	228	172	95	65	4	14
DN20	236	150	238	225	105	75	4	14
DN25	287	195	246	232	115	85	4	14
DN40	265	178	349	265	145	110	4	18
DN50	265	178	349	265	160	125	4	18
DN65	365	260	436	319	180	145	4	18
DN80	420	305	459	324	200	160	8	18
DN100	515	400	554	373	220	180	8	18
DN150	540	515	607	397	280	240	8	23
DN200	—	—	—	—	—	—	—	—

Table 10 — Stainless steel construction dimensions, mm.

Stainless DN200. Flow data exists for a stainless DN200 meter but **no dimensional data is published**. A stainless DN200 is **On Request** and requires dimensional confirmation from NICO Engineering before it can be specified.

Size coverage across the three constructions

DN	8	10	15	20	25	32	40	50	65	80	100	150	200
Cast iron	—	✓	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	✓
Cast steel	—	—	✓	✓	✓	—	✓	✓	—	✓	✓	✓	✓
Stainless	—	—	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	—

Table 11 — Published dimensional coverage. ✓ dimensioned in this catalog · — On Request.

Weights and dimensional tolerances are not stated in this catalog and are supplied On Request.

Body weight variants. DN50 and DN80 are built in a lighter and a heavier body construction. The dimensions tabulated above are the standard supply; where a specific face-to-face length or envelope is required, state it with the enquiry and it will be confirmed on the certified drawing.

14 A · INSTALLATION

Installation requirements

A positive displacement meter has different installation needs from an inferential meter. It does **not** require the long straight upstream runs that a vortex or turbine meter requires — but it is far less tolerant of solids, gas and dry running.

Do not apply inferential-meter straight-run rules to GFM23. Straight-run lengths quoted for vortex or turbine technologies are not applicable to a positive displacement element and shall not be transferred to this product.

Mandatory conditions

Requirement	Reason
Rotor shafts in a horizontal plane	Mandatory in every orientation. Mounting the meter with the rotor shafts out of the horizontal plane places the rotor weight on the thrust bearings. The short-term effect is a loss of accuracy; the long-term effect ranges from reduced service life to rapid mechanical damage. Achieved by mounting the meter so that the counter head or terminal cover faces horizontally
Full pipe at all times	The meter counts displaced volume. A partially filled line produces registration that does not correspond to liquid volume
Correct flow direction	The element is unidirectional. Install per the direction arrow marked on the body
Upstream filtration	Running clearances are close by design. A strainer shall be fitted upstream — see Section 14B for the stated mesh requirement
No gas or air entrainment	Entrained gas is displaced and counted as volume, causing over-registration. Fit an air-eliminator strainer where air or vapour in the liquid cannot be avoided
Clean commissioning	Welding slag in new pipe and rust scale from tanks will block the oval gears. Flush the line before the meter is installed, or install a spool piece during flushing
No dry running	Do not operate the meter without liquid
No hydraulic testing with water on iron and steel bodies	Cast iron and cast steel meters shall not be tested with water

Pipeline arrangement

Horizontal pipeline

Flow may run left to right or right to left; the direction arrow on the body governs. The rotor shafts must remain in the horizontal plane.

Vertical pipeline

Permitted. **Flow direction shall be bottom to top** so that the metering chamber stays full. The meter is best placed in a bypass leg so that impurities do not settle into it.

Bypass line

Provide a bypass with isolation valves so the meter can be removed for service or proving without shutting the process down. Required for continuous duty and used during line flushing.

Counter head orientation

If the meter is installed to the flow arrow and the dial zero finishes at an inconvenient angle, the counter head may be rotated: below DN40 by releasing the four M4 nuts, DN50 and above by releasing the four M6 external hexagon screws.

Commissioning and operation

Action	Requirement
Check free rotation before installation	Remove the flange protection plugs, and gently rotate the gear inward with a flat-blade screwdriver from one end — the pointer should turn. DN80 and above require a little more force. Use a strong screwdriver that will not break
Fill slowly — avoid water hammer	Sudden starting and stopping produces water hammer, which readily damages the meter. On first use open the upstream valve slowly to fill the meter, then open the downstream valve slowly
Operate below maximum	Operate at 70-80% of the maximum flow rate of the selected range. Sustained operation at or above the range maximum accelerates wear and increases pressure loss
Pulsation	Downstream of a positive displacement pump, pulsation can drive the meter beyond its range maximum on each stroke even when the mean flow is within range. Damp the pulsation or size the meter for the peak
Thermal expansion	In High-Temperature service, allow for pipework expansion and avoid imposing pipe stress on the meter body. Support the pipework independently
Enclosure ambient	Keep the counter head within its ambient limit — -20 ... +55 °C for mechanical and blind constructions, -30 ... +55 °C for the LCD register. In hot installations protect the head from radiant heat
Residual calibration fluid	Meters are calibrated with diesel before dispatch and a residual film may be present. Confirm acceptability for food, edible-oil and sensitive chemical duties before installation

Parameters not stated in this catalog. Straight-run lengths · maximum permissible pipe loads · torque values for connection bolting · proving and recalibration intervals. All are duty-specific: **confirm with NICO Engineering** for the selected construction and application.

14 B · INSTALLATION

Filtration and commissioning

Upstream filtration is not optional on a positive displacement meter. The rotating clearances inside the metering chamber are close by design, and solid particles are the principal cause of failure in this product family.

One or more filters shall be installed upstream of the flow meter. The strainer shall be of appropriate pipe size and mesh size, fitted directly on the inlet side of the meter.

Stated filter requirement

Nominal size	Filter mesh	Nominal wire pitch	Status
Below DN50	60 mesh	2.4 / mm	Stated requirement
DN50 and DN65	—	—	Not stated — see the coverage note below
DN80 and above	40 mesh	1.6 / mm	Stated requirement

Table 20 — Upstream filter requirement.

Mesh is not micron. The values above are **mesh counts** with the wire pitch given beside them. They are **not** micron ratings and shall not be converted to, quoted as, or substituted by a micron figure. A micron rating for a specific strainer depends on its wire diameter and weave and is a property of the strainer, not of the mesh number alone. Where a project specification demands a micron rating, request it explicitly and it will be confirmed by NICO Engineering.

DN50 and DN65. The mesh requirement above is stated for sizes *below DN50* and for *DN80 and above*. For DN50 and DN65, **confirm the filter rating with NICO Engineering** rather than interpolating between the two grades. The finer grade is a sound starting point for an enquiry.

Filter installation and maintenance

Position

The strainer is fitted directly on the inlet side of the meter, within the isolatable section so that it can be serviced without draining the line.

Inspection

The filter shall be inspected and cleaned or replaced regularly. A blocked strainer raises the pressure loss of the assembly and can starve the meter.

Bypass

For continuous duty the meter and its strainer shall be installed with a bypass, so that the strainer can be cleaned without interrupting the process.

Commissioning

During initial flushing the meter and filter position may be replaced by a straight spool piece, or the bypass used, so that construction debris never passes through the meter.

INSTALLATION TIP

The single most common cause of premature PD-meter failure is commissioning debris. A temporary fine strainer during the first weeks of operation, removed once the system is clean, costs far less than a rotor set.

Air and vapour. Where air or vapour in the liquid cannot be avoided, an air-eliminator strainer is recommended in addition to the particulate strainer. Entrained gas is counted as liquid volume.

15 · ENQUIRY

Selection information for quotation

Complete this information with the enquiry. Items marked • are required for NICO Engineering to confirm the configuration; the remainder allow the selection to be optimised.

Item	Unit	Value
• Process liquid	—	
• Flow — minimum	m ³ /h	
• Flow — normal	m ³ /h	
• Flow — maximum	m ³ /h	
• Operating pressure	MPa / bar	
• Design pressure	MPa / bar	
• Operating temperature	°C	
• Design temperature	°C	
• Viscosity at operating temperature	mPa·s	
Density at operating temperature	kg/m ³	
Solids content / particle size	—	
• Line size	DN	
• Process connection type	flange / thread / tri-clamp	
• Flange standard and class	DIN / ANSI / JIS	
• Body material requirement	—	
Wetted-material requirement	—	
• Accuracy required	±0.5% / ±0.2%	
• Readout package required	M0 / MP / MA / BP / BA / D1 / D2 / D3	
• Local indication required	yes / no — pointer or LCD	
• Output signal	none / pulse / 4–20 mA	
Communication	none / RS-485 / HART	
• Electrical supply available	none / 12 VDC / 24 VDC / 8–30 VDC / battery	
• Ambient temperature at the meter	°C	
• Hazardous-area requirement	zone / gas group / T class	
Installation arrangement	horizontal / vertical, bypass, filtration	
Upstream strainer fitted	mesh / micron	
Certification / documentation	—	

INQUIRY NOTE

State viscosity **and** the temperature at which it was measured. Viscosity determines the service construction, and the service construction determines the flow range and the available accuracy class — so a viscosity given without its temperature can change the whole selection.

Design pressure and design temperature drive three separate confirmations: the body material, the flange class, and the service construction. Supplying only the operating values will delay the quotation.

The readout package drives the electrical scope. Local indication, output, communication and supply are supplied together as one package (Section 11D). State what the duty needs to *do* — totalise locally, transmit a total, transmit a rate, or join a digital network — and the package follows.

16 · ORDERING CODE

GFM23 model code — structure and fields 1 to 5

The GFM23 model code has **ten fields**, separated by hyphens. Every field must be specified. Codes marked **OR** are supplied On Request following engineering review.

GFM23 — 1SIZE — 2SRV — 3MAT — 4ACC — 5RDO — 6PWR — 7CON — 8FCL — 9EX — 10OPT

Indication, output, communication and supply are one selection. They are supplied as defined readout constructions, not as independent options, and are therefore expressed by a single **readout package** in field 5 together with the **supply** in field 6. Section 11D lists what each package provides.

1 Nominal size

Code	Selection
008	DN8 OR
010	DN10
015	DN15
020	DN20
025	DN25
032	DN32 OR
040	DN40
050	DN50
065	DN65 OR
080	DN80
100	DN100
150	DN150
200	DN200

3 Body material

Code	Selection
CI	Cast iron
CS	Cast steel
S4	Stainless steel

4 Accuracy

Code	Selection
A5	±0.5% of reading
A2	±0.2% of reading — not applicable when field 2 = V

2 Service construction

Code	Selection
S	Standard −20 ... +100 °C · 2–200 mPa·s
T	High Temperature +100 ... +250 °C · 2–200 mPa·s · HT readout construction
V	High Viscosity −10 ... +100 °C · 200–3000 mPa·s · ±0.5% only — rule R1

5 Readout / transmitter package

Code	Selection
M0	Mechanical zero-return — pointer and roller counter, no output
MP	Mechanical + pulse — counter with photoelectric pulse transmitter
MA	Mechanical + 4–20 mA — counter with analogue converter
BP	Blind transmitter, pulse — no local indication
BA	Blind transmitter, 4–20 mA — no local indication
D1	LCD register — pulse + RS-485
D2	LCD register — pulse + RS-485 + 4–20 mA
D3	LCD register — pulse + RS-485 + 4–20 mA + HART OR

ORDERING NOTE

The service construction fixes the temperature **and** the viscosity envelope. There is no separate temperature or viscosity field — specifying them separately would allow combinations that no performance table supports. The high-temperature readout construction follows from field 2 = **T** ; it is not separately coded.

16 · ORDERING CODE

Fields 6 to 10

6 Supply

Code	Selection
NA	No electrical supply — required when field 5 = M0
D12	12 VDC — mechanical transmitter and blind constructions
D24	24 VDC — mechanical transmitter and blind constructions
DE	8–30 VDC external — LCD register packages
BT	Internal battery — LCD register packages OR Does not support the 4–20 mA output — rule R9

7 Process connection

Code	Connection	Size scope
FL	Flange	DN8–DN200
TH	Thread	DN8–DN150
TC	Tri-clamp	DN8–DN80

9 Hazardous area

Code	Selection
NE	No hazardous-area requirement
EX	Explosion-protected execution OR State zone, gas group, temperature class and equipment category with the enquiry. No certificate is held — see Section 05 note 3

8 Flange class

Code	Selection
NA	Not applicable — required when field 7 ≠ FL
D10	DIN PN10
D16	DIN PN16
D25	DIN PN25
D40	DIN PN40
A15	ANSI Class 150
A30	ANSI Class 300
A60	ANSI Class 600
J10	JIS 10K
J20	JIS 20K
J30	JIS 30K
J40	JIS 40K

10 Options

Code	Selection
XX	No special option
OR	Special option — specify with the enquiry

Pressure is not a field in this code. Pressure capability follows from the body material, the service construction and the process connection. State the operating and design pressure with the enquiry (Section 15).

Viscosity, temperature and filtration are not fields in this code. Viscosity and temperature are expressed through the service construction (field 2). The upstream filter is a separate item of supply, not a meter option — see Section 14B.

16 · ORDERING CODE

Mandatory compatibility rules

Every order is validated against the rules below before acceptance. A rule marked **rejected** describes a combination the code will not issue; a rule marked **On Request** describes a combination that requires engineering review before it can be issued.

Rule	Condition	Result
R1	Field 2 = V (High Viscosity)	Field 4 must be A5 . A2 is rejected — the high-viscosity performance data supports $\pm 0.5\%$ only
R2	Field 7 = TC (tri-clamp)	Field 1 must be DN80 or smaller — larger sizes rejected
R3	Field 7 = TH (thread)	Field 1 must be DN150 or smaller — larger sizes rejected
R4	Field 7 $\neq$ FL	Field 8 must be NA
R5	Field 7 = FL	Field 8 must not be NA
R6	Field 5 = M0	Field 6 must be NA — a mechanical meter carries no electrical supply and no output
R7	Field 5 = MP , MA , BP or BA	Field 6 must be D12 or D24
R8	Field 5 = D1 , D2 or D3	Field 6 must be DE or BT
R9	Field 5 = D2 or D3 with the 4–20 mA output in use	External supply ≥ 15 V required. Field 6 = BT alone is On Request — a battery-only register does not support the current output
R10	Field 5 = D3 (HART)	On Request — engineering review; no device-registration evidence is held
R11	Field 5 = BP or BA (blind transmitter)	On Request — service-construction and body-material compatibility confirmed case by case. Field 7 = TC is not offered with this package
R12	Field 2 = T (High Temperature)	The high-temperature readout construction applies. Confirm with NICO Engineering — state the process and ambient temperature with the enquiry
R13	Field 1 = 008 , 032 or 065	On Request — confirm availability, flow range and dimensions
R14	Field 1 = 200 with field 3 = S4	On Request — flow data is published but dimensional data is not; confirm dimensions before specifying
R15	Field 8 flange class selection	Confirmed against the body pressure by NICO Engineering — the class is not fixed by this catalog
R16	Field 9 = EX	On Request — certified execution subject to certificate evidence. No hazardous-area certification is claimed

Rules R6 to R9 keep the electrical selection consistent. The readout package carries its own indication, output and communication as one set, and the supply field is constrained to that package. A combination that the product does not build therefore cannot be written as a code.

17 · HOW TO ORDER

Ordering examples

Example 1 — Standard service with digital register

DN50 fuel-oil transfer, cast steel body, $\pm 0.2\%$ accuracy, LCD register with 4–20 mA and RS-485, external supply, DIN PN16 flange, non-hazardous area.

GFM23-050-S-CS-A2-D2-DE-FL-D16-NE-XX

Field	Code	Selection
1	050	DN50
2	S	Standard construction — $-20\ldots+100\text{ }^{\circ}\text{C}$, 2–200 mPa·s
3	CS	Cast steel body
4	A2	$\pm 0.2\%$ of reading — permitted, construction is not High Viscosity
5	D2	LCD electronic register — pulse + RS-485 + 4–20 mA
6	DE	8–30 VDC external supply — $\geq 15\text{ V}$ required because the current output is used (rule R9)
7	FL	Flange — DN50 within the DN8–DN200 scope
8	D16	DIN PN16 — class confirmed against body pressure at order (rule R15)
9	NE	No hazardous-area requirement
10	XX	No special option

Example 2 — High-temperature service, mechanical, no supply

DN25 hot oil at $+180\text{ }^{\circ}\text{C}$, cast steel body, $\pm 0.5\%$, mechanical counter with no electrical supply, threaded connection.

GFM23-025-T-CS-A5-M0-NA-TH-NA-NE-XX

Field	Code	Selection
1	025	DN25
2	T	High Temperature construction — $+100\ldots+250\text{ }^{\circ}\text{C}$; HT readout construction applies (rule R12)
3	CS	Cast steel body
4	A5	$\pm 0.5\%$ of reading
5	M0	Mechanical zero-return counter — pointer, accumulated total and resettable batch total, no output
6	NA	No electrical supply — mandatory with M0 (rule R6)
7	TH	Thread — DN25 within the DN8–DN150 scope
8	NA	Not applicable — connection is not flanged (rule R4)
9	NE	No hazardous-area requirement
10	XX	No special option

Note on this configuration. The high-temperature construction adds a finned thermal extension; the counter-head elevation increases by 100 mm in this size band (Section 13A). Face-to-face length for the threaded version is supplied On Request — the published dimension tables cover the flanged version.

17 · HOW TO ORDER

Ordering example 3 and rejected configurations

Example 3 — High-viscosity service, blind transmitter

DN80 heavy lubricating oil at 1200 mPa·s, cast iron body, blind pulse transmitter to a remote display, 24 VDC, DIN PN16 flange.

GFM23-080-V-CI-A5-BP-D24-FL-D16-NE-XX

Field	Code	Selection
1	080	DN80
2	V	High Viscosity construction — 200–3000 mPa·s, –10...+100 °C
3	CI	Cast iron body — 1.6 MPa in high-viscosity service
4	A5	±0.5% — mandatory under rule R1; ±0.2% is not available in this construction
5	BP	Blind transmitter, pulse output — no local indication. On Request under rule R11
6	D24	24 VDC
7	FL	Flange
8	D16	DIN PN16
9	NE	No hazardous-area requirement
10	XX	No special option

Why this example is On Request. The blind transmitter is fully specified for body material, voltage, connection and transmission distance, but its availability in High-Viscosity service is confirmed per duty. The configuration is orderable after engineering confirmation; it is not a catalog-standard selection.

Rejected configurations

Configuration	Rule	Why it is rejected
GFM23-100-V-CI-A2-...	R1	High-Viscosity construction with ±0.2% accuracy. The high-viscosity performance data supports ±0.5% only. Select A5 , or select a Standard construction if the medium viscosity permits it
GFM23-050-S-CI-A5-M0-D24-...	R6	Mechanical zero-return package with an electrical supply specified. M0 is a no-supply construction and carries no output. Either select NA for field 6, or select MP / MA if a transmitted output is actually required
GFM23-100-S-CI-A5-D2-DE-TC-NA-...	R2	Tri-clamp connection at DN100. The tri-clamp scope ends at DN80. Select flange or thread
GFM23-050-S-CS-A5-D1-DE-FL-NA-...	R5	Flanged connection with flange class NA . A flange class must be specified when field 7 = FL

A rejected code is not a refusal of the duty. In every case above the duty itself is normally satisfiable by a different valid configuration. Where it is not — for example a high-viscosity medium above +100 °C, which no construction covers — the duty is referred to NICO Engineering rather than forced into a code.

18 · SELECTION

Selection and engineering notes

Selection checklist

✓	Check	What to verify
	Flow range	Minimum duty flow is above the range minimum for the accuracy class ordered ; maximum duty flow, including pump pulsation peaks, is within the range maximum — preferably at 70–80% of it
	Viscosity	Evaluated at the operating temperature, and the resulting value lies inside the envelope of the selected service construction
	Temperature	Operating and design temperature inside the construction envelope; ambient at the counter head within its limit for the selected readout package
	Service construction	One construction covers the duty. High Temperature and High Viscosity are not combined
	Accuracy class	Available in the selected construction — $\pm 0.2\%$ is not offered in High Viscosity
	Body material	Selected against the design pressure and the medium
	Readout package	Indication, output, communication and supply are consistent as one package; the supply actually available at site matches field 6
	Connection	Type within its nominal-size scope; flange standard, class and facing fixed
	Installation	Rotor shafts horizontal, full pipe, correct direction, upstream strainer of the stated mesh, no gas entrainment, bypass provided

Standard configuration

Selectable directly from this catalog:

- DN10 ... DN200 excluding DN32 and DN65
- All three service constructions
- All three body materials
- $\pm 0.5\%$ in all constructions; $\pm 0.2\%$ in Standard and High Temperature
- Readout packages **M0** **MP** **MA** **D1** **D2**
- Supply **NA** **D12** **D24** **DE**
- Pulse, 4–20 mA and RS-485 per package
- Flange, thread or tri-clamp within the stated size scopes
- DIN, ANSI or JIS flange classes

NICO Engineering confirmation required

Available, but confirmed case by case:

- Final pressure capability of the assembly
- Flange class against the body pressure
- Wetted-part materials and media compatibility
- DN8, DN32, DN65 and stainless DN200
- Media above 3000 mPa·s
- Duty at or near the +100 °C construction boundary
- Blind transmitter against service construction (**BP** **BA**)
- HART package **D3**; battery-only supply with current output
- High-temperature readout interlock
- Hazardous-area certified execution
- Filter rating for DN50 and DN65
- Sanitary surface finish and food-contact declaration
- Pressure loss, weights, tolerances

ENGINEERING NOTE

Three of the four most common GFM23 selection errors are the same every time: sizing on maximum flow only, quoting viscosity at 20 °C instead of at operating temperature, and choosing $\pm 0.2\%$ without checking that the duty minimum stays above the $\pm 0.2\%$ range minimum. The fourth is omitting upstream filtration. A fifth now appears with the digital register: specifying a battery-powered register and then requiring the 4–20 mA output, which a battery-only supply does not sustain.

19 · SUMMARY

GFM23 product summary

GFM23

NICO MODEL

DN8-DN200

SIZE COVERAGE

±0.2%

BEST ACCURACY OF READING

Capability summary

Capability	GFM23
Technology	Oval gear positive displacement, four measuring volumes per revolution
Service constructions	Standard · High Temperature · High Viscosity
Temperature	−20 ... +250 °C, by construction
Viscosity	2 ... 3000 mPa·s, by construction
Accuracy	±0.5% of reading; ±0.2% in Standard and High-Temperature service
Body materials	Cast iron · cast steel · stainless steel
Readout configurations	Nine — mechanical zero-return, mechanical with pulse, mechanical with 4–20 mA, blind transmitter, multi-function LCD electronic register, and high-temperature variants
Signals	Pulse · 4–20 mA · RS-485 · HART on request — package-dependent
Supply	None (mechanical) · 12 / 24 VDC (transmitter) · 8–30 VDC or battery (LCD register)
Connections	Flange DN8-DN200 · thread DN8-DN150 · tri-clamp DN8-DN80
Ordering code	Ten fields — Section 16

Technical selection support

NICO Engineering confirms the configuration against the duty before quotation. Submit the enquiry data in Section 15 and the following will be confirmed with the quotation: assembly pressure capability, flange class, wetted-part materials, readout package availability against the selected service construction, dimensional general arrangement and any On Request item in the selected configuration.

Nikan Sanat Khavarmiyaneh (NICO)

Industrial instrumentation for pressure, temperature, level and flow measurement, and related accessories.
www.nikaansanat.com

Related NICO Flow products

GFM24 — Gear Positive Displacement Flowmeter, for small-bore and high-pressure viscous duties.

VMF28 — Vortex Flowmeter, for steam, gas and low-viscosity liquid service.

Document control. GFM23 Product Catalog **REV. 01**. One revision identity applies throughout this document: **REV. 01**. Supersedes REV. 00. Configuration-dependent values shall be confirmed by NICO Engineering for the selected construction.

NICO.

NIKAN SANAT KHAVARMIYANEH

GFM23 · OVAL GEAR POSITIVE DISPLACEMENT FLOWMETER

Oval gear positive displacement flowmeter for viscous and lubricating liquid service. Three service constructions, three body materials, nine readout and transmitter configurations, DN8 to DN200, accuracy to $\pm 0.2\%$ of reading.

TECHNICAL SELECTION SUPPORT

Nikan Sanat Khavarmiyaneh (NICO)

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REV. 01.

Specifications are subject to change without notice. Configuration-dependent values shall be confirmed by NICO Engineering for the selected construction.

