

LT Series

Turbine flow meters with frequency output

Up to

- 1500 lpm, 400 US gpm
- 480 bar, 7000 psi

The LT turbine flow meter with frequency output provides a precision solution to the flow measurement of hydraulic systems on test stands, machine tools and other fixed or mobile applications. The flow meter can be installed anywhere in the hydraulic circuit for production testing, commissioning, development testing and analysis of control systems. The compact design allows the LT series flow meters to be installed where space is limited.

The LT turbine flowmeter has a frequency output and is the ideal tool for monitoring the performance of pumps, motors, valves and hydrostatic transmissions.



Manufacturers of hydraulic components and test equipment
for the Mobile, Industrial and Agricultural industries



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Features

- **FLOW:** 1 - 1500 lpm
0.25 - 400 US gpm
- **PRESSURE:** Up to
480 bar, 7000 psi
- **ACCURACY:** Up to 1% of
indicated reading
- **FREQUENCY OUTPUT**
- **BI-DIRECTIONAL**
operation
- **TEMPERATURE:** sensor
built-in
- **FLUIDS:** Wide range of
hydraulic oil, lubrication oil,
and fuels
- **CALIBRATION:** 21 cSt
as standard. Special
calibration possible



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Specifications

Model Number	Main ports	Top ports	Flow Range	Maximum pressure
LT15-FM-B-B-6	1/2" BSPP	1/4" BSPP*	1 - 15 lpm	420 bar
LT15-FM-S-S-6	3/4" -16UN #8 SAE ORB	7/16" -20UN #4 SAE ORB*	0.25 - 4 US gpm	6000 psi
LT60-FM-B-B-6	3/4" BSPP	1/4" BSPP	3 - 60 lpm	420 bar
LT60-FM-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	0.8 - 16 US gpm	6000 psi
LT150-FM-B-B-6	3/4" BSPP	1/4" BSPP	5 - 150 lpm	420 bar
LT150-FM-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	1.3 - 40 US gpm	6000 psi
LT300-FM-B-B-6	1" BSPP	1/4" BSPP	8 - 300 lpm	420 bar
LT300-FM-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
LT400-FM-B-B-6	1" BSPP	1/4" BSPP	10 - 400 lpm	420 bar
LT400-FM-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2.5 - 100 US gpm	6000 psi
LT600-FM-B-B-5	1 1/4" BSPP	1/4" BSPP	15 - 600 lpm	350 bar
LT600-FM-S-S-5	1-5/8" -12UN #20 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	5000 psi
LT600-FM-F-S-3	1-1/2" #24 SAE Code 61 4-bolt flange	7/16" -20UN #4 SAE ORB	5 - 160 US gpm	3000 psi
LT800-FM-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 800 lpm	480 bar
LT800-FM-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	7000 psi
LT800-FM-F-B-3	1-1/2" #24 SAE Code 61 4-bolt flange	1/4" BSPP	20 - 800 lpm	210 bar
LT800-FM-F-S-3	1-1/2" #24 SAE Code 61 4-bolt flange	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	3000 psi
LT1500-FM-F-S-6	2" #32 SAE Code 62 4-bolt flange	7/16" -20UN #4 SAE ORB	12.5 - 400 US gpm	420 bar

* Only one test port

Functional specification

Ambient temperature: 5 to 40 °C (41 - 104 °F)

Fluid type: Oils, fuels, water glycol, water oil emulsions

Fluid temperature: 5 to 90 °C (41 - 194 °F) continuous use.

Accuracy: 15 to 100% of range - 1% of indicated reading

Below 15% fixed accuracy of 1% of 15% of full scale

To obtain 1% of indicated readings a Webtec DHCR must be used. Accuracy with other readouts 1% of full scale.

LT15 is 1% of full scale over full range.

Output: Frequency - 20 -2000 Hz

Impedance - 3700 Ohm,

Inductance - 1kHz: 1.55H

Construction material

Flow body: 600 / 800 / 1500 High tensile Aluminium 2014A T6

15 / 60 / 150 / 300 / 400 High tensile Aluminium 2011 T6

Internal parts: Aluminium, Steel, Stainless Steel.

Transducer body: Aluminium, Steel - electroless nickel plated, Stainless Steel.

Seals: Viton seals as standard EPDM are available - please consult sales office.

Operation

As fluid is passed through the flow block it rotates a precision turbine. The flow straighteners and turbine design minimise the effects of turbulence and swirl. The turbine blades are detected by the magnetic reluctance transducer which produces a pulse output. The flow block has ports for pressure or temperature sensors which can be supplied as an option.

Reverse Flow

The flow block is capable of measuring flow in either direction.

Calibration

All units are calibrated with 21 cSt oil as standard. Calibration certificates are available on request - this is a chargeable option. Production calibration of LT1500 lpm turbine is confirmed by testing over the range of 50 to 750 lpm and by design only above 750lpm. Other calibration on request - please consult the sales office.

Installation

The flow block has built-in flow straighteners so the normal recommended length of 10 Ø of straight tube can be reduced to 8 Ø where space is limited. Inlet and outlet connections should always be of a similar bore size to that of the flowmeter to prevent venturi or constriction effects.

The range of flow meters can be used for intermittent or continuous testing of flow in either direction. The flow block can be mounted in any orientation. For heavy duty applications where the flow meter will be used constantly with continuous pressure spikes please contact sales to discuss your application.

Filtration

It is recommended that a 25-micron (10 micron for LT15) filter is installed in the circuit prior to the flow block.

Top ports

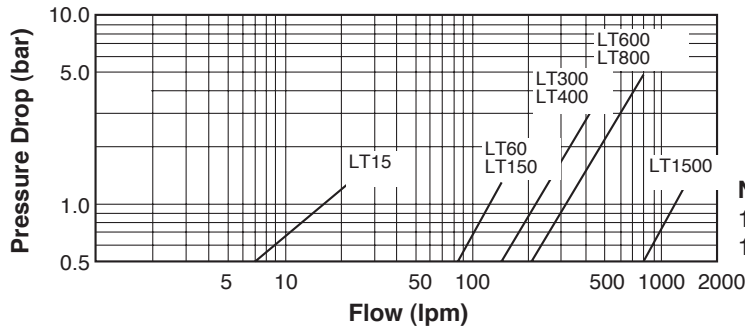
Most flow meters have two additional ports (see table for configuration) in the top face of the flow meter to enable the user to connect both a temperature and pressure sensor. The LT15 has one top port. All flow meters come with one M16 x 2 test point fitted as standard.

Ordering

To order an LT flow meter please quote the model number from the table above. eg: LT15-FM-B-B-6. All LT flow meters (excluding LT15) can have both a temperature sensor and pressure transducer connected simultaneously.

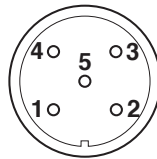
Pressure Drop Chart

Hydraulic Oil Viscosity 21 Centistokes



Note:
 1 UK gallon = 4.546 litres
 1 US gallon = 3.785 litres

Connection Details



Pins

- 1 - Freq +ve
- 2 - Freq -ve
- 3 - Temp
- 4 - Temp
- 5 - N/C

Description

- Connecting cable (5m)
- Connecting cable (10m)
- Connector M12

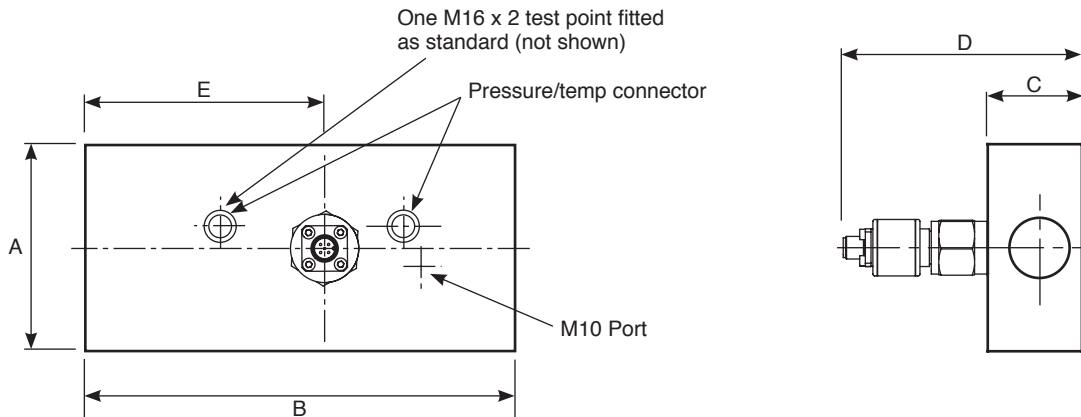
Part number

- FT10228-05
- FT10228-10
- FT9880

Dimensions in mm (inches)

Model No	A	B	C	D	E	Weight kg (lbs)
LT15	37 (1-1/2")	136 (5-3/8")	37 (1-1/2")	115 (4-1/2")	69.5 (2-3/4")	0.7 (1.5)
LT60	62 (2-1/2")	190 (7-1/2")	50 (2")	121 (4-13/16")	103 (4")	1.6 (3.5)
LT150	62 (2-1/2")	190 (7-1/2")	50 (2")	121 (4-13/16")	103 (4")	1.6 (3.5)
LT300	62 (2-1/2")	190 (7-1/2")	50 (2")	122 (4-13/16")	103 (4")	1.7 (3.7)
LT400	62 (2-1/2")	190 (7-1/2")	50 (2")	122 (4-13/16")	103 (4")	1.7 (3.7)
LT600	62 (2-1/2")	212 (8-3/8")	75 (3")	139 (5-1/2")	127 (5")	2.7 (6)
(LT600-FR-F-*-*)	100 (4")	212 (8-3/8")	75 (3")	139 (5-1/2")	126 (5")	5.0 (11)
LT800	100 (4")	212 (8-3/8")	75 (3")	139 (5-1/2")	126 (5")	5.0 (11)
LT1500	140 (5-1/2")	260 (10-1/4")	100 (4")	161 (6-3/8")*	130 (5-1/8")	10.0 (22)

* LT1500 includes 4 feet on base, add 20 mm (3/4") to D for full height.
 LT1500 is fitted with carry handles - not shown on diagram.



Note: LT15 has only one pressure/temp connection

Turbine Flow Meters

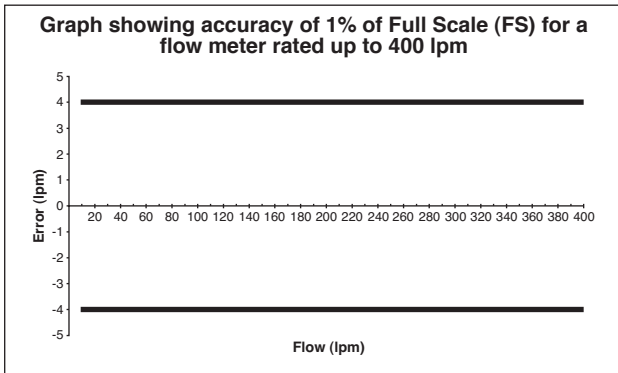
Accuracy

The accuracy is better described as the uncertainty of the flow reading compared to a known reference. Every flow measurement has an error associated with it, caused by the combination of a large number of factors that affect the operation of the flow meter, these include bearing friction, temperature, viscosity, magnetic drag and the signal strength to name but a few.

All our flow meters are calibrated at 10 points over the flow range and its performance measured against a flow reference that is traceable to International standards. Accuracy is typically quoted in one of two ways: as a percentage of full scale (the maximum calibrated flow) or as a percentage of the indicated reading (the actual flow).

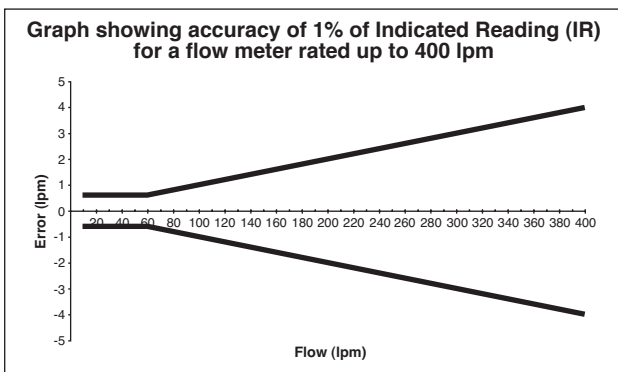
Full scale (FS) or full scale deflection (FSD)

A term that was originally used for analogue displays where a needle pointed to a number on a scale, hence FSD. The flow accuracy is a fixed amount regardless of the actual flow you are measuring. For example 1% FS for a flow meter with a maximum calibrated flow of 400 lpm is ± 4 lpm whether you are measuring 40 lpm, 200 lpm or 400 lpm (see graph below). If you need to measure flows of 40 and 400 lpm with same flow meter then it is important to check the allowable error at all flows.



Indicated reading (IR)

Accuracy is quoted as a percentage of the actual value measured. So if the accuracy of a 400 lpm flow meter is 1% IR then the error at 400 lpm is ± 4 lpm. As the actual flow measured reduces, so does the error in lpm. When measuring a flow of 60 lpm with an accuracy of 1% IR, the possible error is ± 0.6 lpm. At very low flows, the possible errors are no longer proportional to the flow rate, but actually a fixed amount in lpm (see graph below). For example if the accuracy is quoted as 1% IR (>60 lpm) for a flow meter with the range 10 - 400 lpm, then the accuracy is 1% of the actual flow in the range 60 to 400 lpm and a fixed flow error in the range 10 to < 60 lpm.



Repeatability

The repeatability is the variation in the performance of the flow meter when used under the same conditions. Our range of flow meters has excellent repeatability of better than $\pm 0.2\%$. This is just as important as the accuracy since in many applications the flow readings from the same flow meter will be compared at regular intervals to look for any change in performance of the system.

Flow range (Turndown ratio)

A turbine flow meter has a minimum and a maximum calibrated flow which together describe the range of flows that can be accurately measured. Through the addition of signal conditioning either mounted on the flow meter or built into the readout, the flow range of our flow meters has been extended considerably compared to other models on the market; the ratio of the maximum to the minimum calibrated flow (turndown ratio) is between 15 and 40 across all models. Particular effort has been made to extend the flow range by calibrating down to lower flows enabling one flow meter to be used where two may have been required in the past. This makes the flow meter both a more economical and easier to install solution.

Fluid viscosity

The performance of a turbine flow meter can be affected by the viscosity of the fluid measured. Our turbine flow meters are calibrated at between 18 and 26 cSt as standard (a mean viscosity of 21 cSt), which is the typical kinematic viscosity for a hydraulic fluid operating at 50 °C. The kinematic viscosity of all hydraulic fluids is related to the fluid temperature and the table below shows the affect of temperature on the kinematic viscosity of a range of typical grades of hydraulic oil.

The shaded area of the table shows the range of viscosities that can be measured by a flow meter with standard calibration with minimal effect on the accuracy (less than $\pm 1\%$ FS).

Flow meters can be specially calibrated at a different viscosity to the standard or we can advise on the expected error when the flow meter is used at other viscosities, please contact sales for further information.

Table showing kinematic viscosity (cSt) of different mineral oils at specific temperatures

Temp °C	Fluid type					
	ISO15	ISO22	ISO32	ISO37	ISO46	ISO68
0	85.9	165.6	309.3	449.9	527.6	894.3
10	49.0	87.0	150.8	204.7	244.9	393.3
20	30.4	50.5	82.2	105.5	127.9	196.1
30	20.1	31.6	48.8	59.8	73.1	107.7
40	14.0	21.0	31.0	36.6	44.9	63.9
50	10.2	14.7	20.8	23.9	29.4	40.5
60	7.7	10.7	14.7	16.5	20.2	27.2
70	6.0	8.1	10.9	12.0	14.6	19.2
80	4.8	6.4	8.4	9.1	11.1	14.3
90	4.0	5.2	6.6	7.2	8.7	11.1
100	3.3	4.3	5.5	6.0	7.1	8.9

ISO 15, 22, 32, 46 and 68 based on typical figures for the Esso Nuto range of HM oils. ISO 37 based on Shell Tellus HM oil.