

## LT Series

### Turbine flow meters with frequency output

Up to 750 lpm, 480 bar

Frequency output

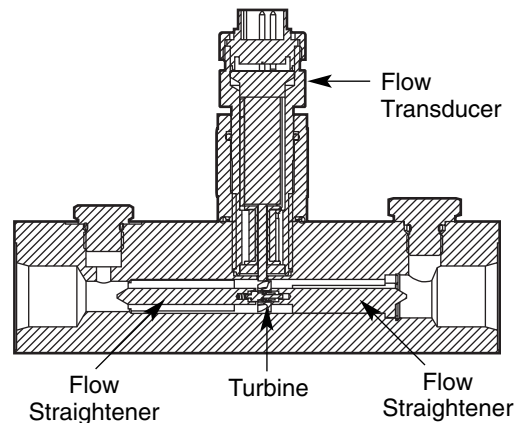


The LT turbine flow meter with frequency output provides a complete solution to the flow measurement of hydraulic systems on test stands, machine tools and other fixed or mobile applications. The flow meter can be installed anywhere in the hydraulic circuit for production testing, commissioning, development 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.

#### Features

- **FLOW:** 1 - 750 lpm
- **PRESSURE:** Up to 480 bar (7000 psi)
- **ACCURACY:**  $\pm 1\%$  of full scale over a wide range (when used with a signal converter)
- **FREQUENCY OUTPUT**
- **BI-DIRECTIONAL** operation
- **FLUIDS:** Wide range of hydraulic oil, lubrication oils, and fuels
- **CALIBRATION:** 21 cSt as standard. Special calibration possible



***Another quality product from the Webster Range***

## Specifications (Frequency Output)

Model number	Calibrated range (lpm)	Accuracy 1 Point Linearization	Accuracy 15 Point Linearization	Max. cont. pressure (bar)	Inlet/outlet ports
LT15-B-B	1 - 15	2% FS	1% FS ( $\pm 0.15$ lpm)	420	1/2" BSPF
LT60-B-B	3 - 60	1% FS	1% IR (> 10 lpm)	420	3/4" BSPF
LT150-B-B	5 - 150	1% FS	1% IR (> 10 lpm)	420	3/4" BSPF
LT300-B-B	10 - 300	1% FS	1% IR (> 20 lpm)	420	1" BSPF
LT400-B-B	10 - 400	1% FS	1% IR (> 20 lpm)	420	1" BSPF
LT600HP-S-B	20 - 600	1% FS	1% IR (> 25 lpm)	480	1-7/8" UN
LT750HP-S-B	20 - 750	1% FS	1% IR (> 25 lpm)	480	1-7/8" UN

**Note:** 1 Point Linearization would be achieved with a DF series readout  
15 Point Linearization would be achieved with a DHCR or Webster Datalogger

## Measurement and Indication

### Flow

Measured by the electronic count of an axial turbine that is designed to minimise the effects of variations in temperature and viscosity. A magnetic transducer monitors the speed of the turbine. Built-in flow straighteners eliminate flow swirl and allow flow measurement in both directions.

### Accuracy

The LT flow meters offer excellent accuracy over a very wide flow range when used with a separate signal converter. Accuracy is shown in the table above and quoted as a percentage of full scale - the maximum flow (% FS) or as a percentage of the indicated reading - the measured flow (% IR).

### Special calibration

The standard flow ranges and accuracies are shown in the table above, all flow meters are calibrated at 21 cSt as standard. Special calibration is available over a custom flow range or at a different viscosity, please contact sales to discuss your application.

### Repeatability

Better than  $\pm 0.2\%$

### Response Time

Depends on signal converter

### Duty cycle

The LT series have been designed for permanent installation and continuous operation under a normal duty cycle. For heavy duty applications where the flow meter will be used constantly with continuous pressure spikes please contact sales to discuss your application in more depth.

### Frequency Output

Frequency: 20 - 2000 Hz  
Impedance: 3700 Ohm +25% - 20%  
Inductance: 1 kHz: 1,55H +25% - 20%

### Operating temperature

Continuous: -20 to 90 °C (Media)  
Intermittent: 90 to 110 °C (Media)  
Ambient: -10 to 50 °C

### Additional top ports

All LT flow meters have two additional ports in the top face of the flow meter to enable the user to connect both a temperature and pressure sensor. As standard both ports are blanked and are 1/4" BSPF. LT15 has 1 x 1/4" BSP and 1 x M10x1.

### Filtration

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

## Construction

### Flow block

High tensile aluminium block houses a six blade turbine rotating on a stainless steel bearing and shaft. The flow straighteners and turbine design minimise the effects of turbulence and swirl. The one piece assembly can be easily removed for cleaning. Optional loading valves and readouts are available.

### Seals

Viton seals compatible with oil, fuels, water glycol and water oil emulsions. EPDM seals for use with phosphate-ester are available. Consult sales office.

## Installation

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

### HP flow meters

The high pressure (HP) range of flow meters (600 and 750 lpm models) have been engineered to withstand high operating pressures of up to 480 bar, as well as heavy duty cycles where there may be frequent pressure pulses or continuous changes in the flow rate. The HP models have a strengthened turbine assembly which incorporates dual bearings and the assembly is held in place with a specially designed threaded insert.

The Webster range of flow meters can be used for intermittent or continuous testing of flow in either direction. Standard transducer output connection is 5 pin DIN Male Amphenol type. See over for connection details.

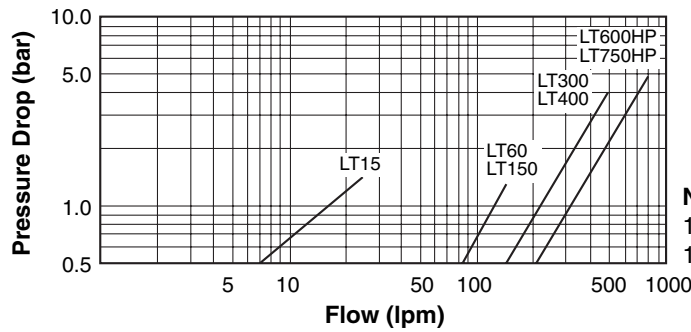
## Ordering

To order an LT flow meter please quote the model number from the table above. eg: LT15-B-B. All LT flow meters can

have both a temperature sensor and pressure transducer connected simultaneously.

# Pressure Drop Chart

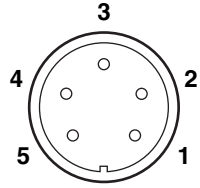
Hydraulic Oil Viscosity 21 Centistokes



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

## Connection Details

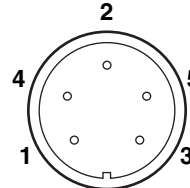
### Frequency (LT15)



**Pins**

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

### Frequency (LT60 - 750)



**Pins**

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

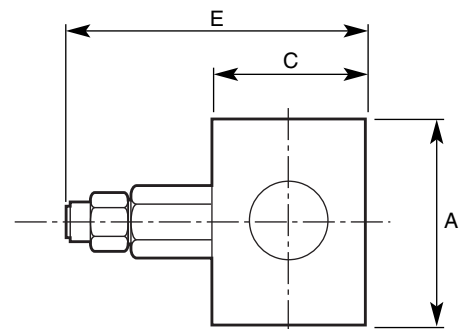
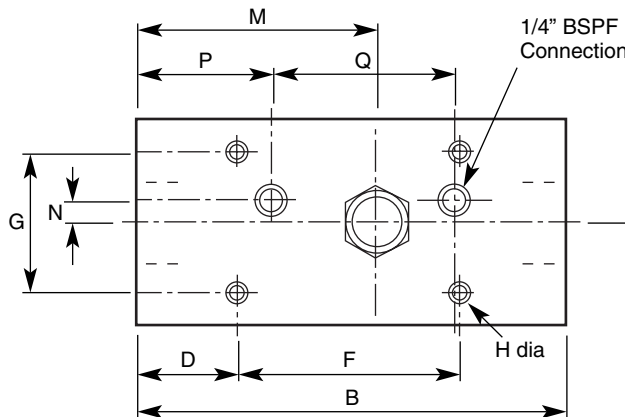
For LT15 use mating screw locking cable connector (female), part number FT9445

For all other models use mating screw locking plug (male), part number FT7884

## LT (Dimensions in Millimetres)

Model No	Port Size	A	B	C	D	E	F	G	H UNC	M	N	P	Q
LT15	1/2" BSPF*	36.9	136	36.9	-	97	-	-	-	69.5	0	25.0	90.0
LT60	3/4" BSPF*	64	191	51	51	110	105	44.5	1/4"	102	9.5	31.8	105
LT150	3/4" BSPF*	64	191	51	51	110	105	44.5	1/4"	102	9.5	31.8	105
LT300	1" BSPF*	64	191	51	51	114	105	44.5	1/4"	102	9.0	35.0	108
LT400	1" BSPF*	64	191	51	51	114	105	44.5	1/4"	102	9.0	35.0	108
LT600HP	1 7/8" UN	102	213	76	-	134	-	-	-	86	19	35.0	116
LT750HP	1 7/8" UN	102	213	76	-	134	-	-	-	86	19	35.0	116

\*UNF ports available



**Note:** LT15 has 1 x 1/4" BSP & 1 x M10x1

## Turbine Flow Meters

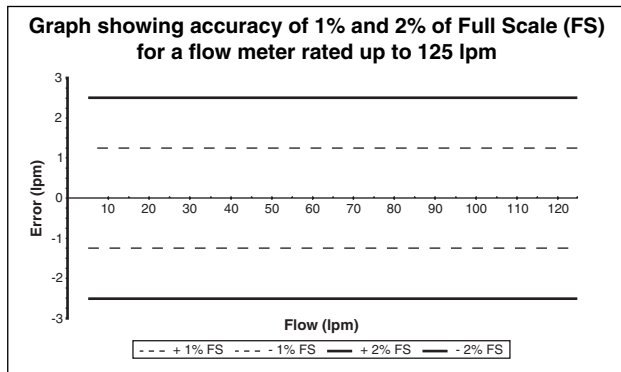
### Accuracy

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.

Every Webster flow meter is 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).

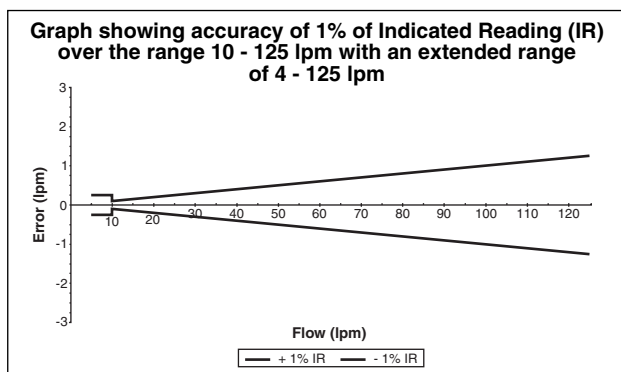
### Full scale (FS) or full scale deflection (FSD)

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 125 lpm is  $\pm 1.25$  lpm whether you are measuring 10 lpm, 50 lpm or 125 lpm (see graph below). If you need to measure flows of 10 and 125 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 125 lpm flow meter is 1% IR then the error at 125 lpm is  $\pm 1.25$  lpm. As the actual flow measured reduces, so does the error in lpm. When measuring a flow of 50 lpm with an accuracy of 1% IR, the possible error is  $\pm 0.5$  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 ( $>10$  lpm) for a flow meter with the range 4 - 125 lpm, then the accuracy is 1% of the actual flow in the range 10 to 125 lpm and a fixed flow error in the range 4 to  $<10$  lpm.



### Repeatability

The repeatability is the variation in the performance of the flow meter when used under the same conditions. The Webster 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 the Webster 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 Webster 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. All Webster 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 Webster flow meter with standard calibration with minimal effect on the accuracy (less than  $\pm 1\%$  FS).

Webster 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.