

J1939 Series

SAE J1939 CAN compatible sensors for hydraulic system monitoring of flow, pressure and temperature on pumps, valves and hydrostatic transmissions

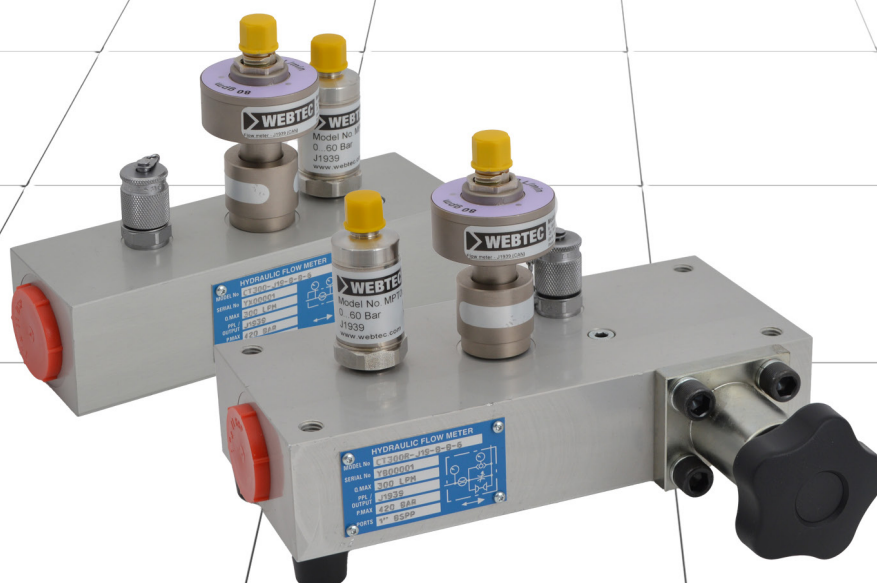
The CT turbine flow meter range with J1939 compatible output provides a convenient solution to measure flow and temperature in hydraulic systems. The flow meter can be installed anywhere in the hydraulic circuit for production testing, commissioning, development testing and analysis of control systems. With the addition of the manual loading valve on the CTR meters further test scenarios can be simulated and monitored such as pump efficiency.

Pressure sensors with J1939 capability are also available to complement the CT Flow meters. With a pressure sensor all the fundamental parameters of a hydraulic system can be monitored in a single, compact unit with one cable supporting the J1939 protocol.

Make it **BLUE**

Features

- Bi-Directional operation.
- Flowmeter SAE J1939 CAN compatible output (configured to customer's specification).
- Optional Built-in loading valve.
- Flowmeters with loading valve have Interpass® safety protection system, bypasses oil internally in the event of the valve being over pressurised in either flow direction.
- Pressure transducer pressure range of 0 to 1000 bar, 0 to 14500 psi.
- Pressure transducer SAE J1939 output.
- Consult sales for our hydraulic sensors with CANOpen, 5 V and mA outputs.



Flowmeters Specifications

Maximum Rated Pressure:	480 bar, 7000 psi
Maximum Flow:	1500 L/min, 400 US gpm
Ambient Temperature Range:	5 to 40 °C, 41 to 104 °F
Fluid Temperature Range:	5 to 90 °C, 41 to 194 °F continuous use
Compatible Fluid:	Mineral oils to ISO 11158. Other fluids consult sales office.
Accuracy/Tolerances:	Reading 15% to 100% of flow range - 1% of indicated reading. Readings below 15% of full scale flow - fixed accuracy of 0.15% of full scale (CT15 is 1% of full scale).
Repeatability:	Better than $\pm 0.2\%$
Porting:	BSPP, SAE
Material:	
Flow Body:	600/750 High tensile Aluminium 2014A T6 60/150/300/400 High tensile Aluminium 2011 T6 15 High tensile Aluminium 6082 T6
Internal Materials:	Aluminium, Steel, Stainless Steel.
Transducer:	Body and nut - steel 212A42 electroless nickel plated Housing and Lid - Aluminium 2011 T3 electroless nickel plated FKM (EPDM seals - CT models only. Consult sales office).
Seal:	IP66 (EN60529) *With cable connected
IP Rating:	IP66 (EN60529) *With cable connected
Power Supply:	8-40 V d.c
Response Time:	50 ms + 1 period (turbine frequency)
Bus Speed:	250 kHz
Current:	5 mA @32 V, 20 mA @8 V
Output:	SAE J1939 compatible (not fully compliant)

Sales Order Code

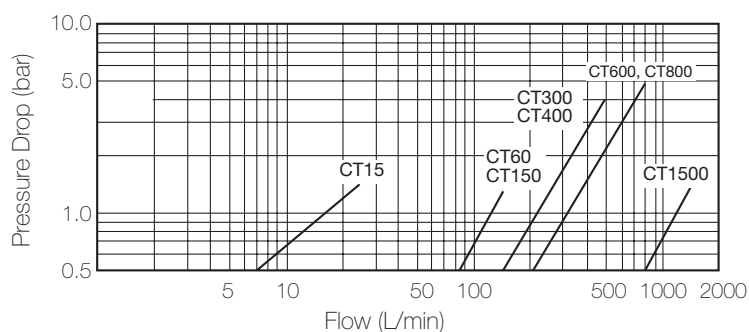
Please contact our technical sales team to discuss any special order requirements.

MODEL NUMBER	MAIN PORTS	TOP PORTS	CALIBRATED FLOW RANGE	MAX RATED PRESSURE	TEMP RANGE	PGN
CT15-J19-B-B-6	1/2" BSPP	1/4" BSPP	1 - 15 L/min	420 bar	0 - 120°C	65295 (0xFF0F)
CT15-J19-S-S-6	3/4" -16UN #8 SAE ORB	7/16" -20UN #4 SAE ORB	0.25 - 4 US gpm	6000 psi	32 - 248°F	65295 (0xFF0F)
CT60-J19-B-B-6	3/4" BSPP	1/4" BSPP	3 - 60 L/min	420 bar	0 - 120°C	65297 (0xFF11)
CT60-J19-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	0.8 - 16 US gpm	6000 psi	32 - 248°F	65297 (0xFF11)
CT150-J19-B-B-6	3/4" BSPP	1/4" BSPP	5 - 150 L/min	420 bar	0 - 120°C	65298 (0xFF12)
CT150-J19-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	1.3 - 40 US gpm	6000 psi	32 - 248°F	65298 (0xFF12)
CT300-J19-B-B-6	1" BSPP	1/4" BSPP	8 - 300 L/min	420 bar	0 - 120°C	65299 (0xFF13)
CT300-J19-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi	32 - 248°F	65299 (0xFF13)
CT400-J19-B-B-6	1" BSPP	1/4" BSPP	10 - 400 L/min	420 bar	0 - 120°C	65300 (0xFF14)
CT400-J19-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2.5 - 100 US gpm	6000 psi	32 - 248°F	65300 (0xFF14)
CT600-J19-B-B-5	1-1/4" BSPP	1/4" BSPP	15 - 600 L/min	350 bar	0 - 120°C	65301 (0xFF15)
CT600-J19-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	32 - 248°F	65301 (0xFF15)
CT600-J19-S-S-5	1-5/8" -12UN #20 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	5000 psi	32 - 248°F	65301 (0xFF15)
CT800-J19-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 800 L/min	480 bar	0 - 120°C	65303 (0xFF17)
CT800-J19-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	7000 psi	32 - 248°F	65303 (0xFF17)
CT800-J19-F-B-3	1-1/2" #24 SAE Code 61 4-bolt flange	1/4" BSPP	20 - 800 L/min	210 bar	0 - 120°C	65303 (0xFF17)
CT800-J19-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	32 - 248°F	65303 (0xFF17)
CT800-J19-F-B-6	1-1/2" #24 SAE Code 62 4-bolt flange	1/4" BSPP	20 - 800 L/min	420 bar	0 - 120°C	65303 (0xFF17)
CT1500-J19-F-S-6	2" #32 SAE Code 62 4-bolt flange	7/16" -20UN #4 SAE ORB	12.5 - 400 US gpm	6000 psi	32 - 248°F	65304 (0xFF18)
CT1500-J19-F-S-6-L	2" #32 SAE Code 62 4-bolt flange	7/16" -20UN #4 SAE ORB	50 - 1500 L/min	420 bar	0 - 120°C	65304 (0xFF18)

Note: The default J1939 Address for all models is 133 (0x85). Please Contact Sales if a different J1939 Address is required.

Flowmeter Pressure Drop Chart

Hydraulic Oil Viscosity 21 Centistokes



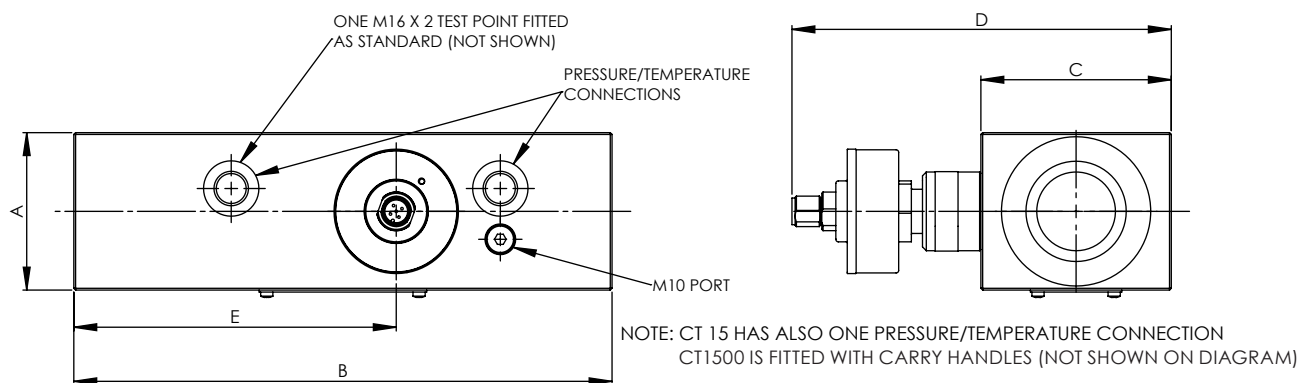
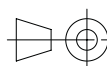
Note:
1 UK gallon = 4.546 litres
1 US gallon = 3.785 litres

Installation Details

Flowmeters Dimension Table

MODEL NUMBER	A		B		C		D		E		WEIGHT	
Units	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
CT15	37	1-1/2	136	5-3/8	37	1-1/2	123	5	69.5	2-3/4	0.7	1.5
CT60	62	2-1/2	190	7-1/2	50	2	136	5-3/8	103	4	1.6	3.5
CT150	62	2-1/2	190	7-1/2	50	2	136	5-3/8	103	4	1.6	3.5
CT300	62	2-1/2	190	7-1/2	50	2	140	5-1/2	103	4	1.7	3.7
CT400	62	2-1/2	190	7-1/2	50	2	140	5-1/2	103	4	1.7	3.7
CT600	62	2-1/2	212	8-3/8	75	3	152	6	127	5	2.7	6
CT600-J19-F	100	4	212	8-3/8	75	3	160	6-1/4	126	5	5	11
CT800	100	4	212	8-3/8	75	3	160	6-1/4	126	5	5	11
CT800 (code 62)	113	4-1/2	212	8-3/8	100	4	165	6-1/2	126	5	6	13.2
CT1500	140	5-1/2	260	10-1/4	100	4	176	7*	130	5-1/8	10	22

*CT1500 includes 4 feet on base, add 20 mm, 3/4" to D for full height



Sales Order Code

Please contact our technical sales team to discuss any special order requirements.

MODEL NUMBER	MAIN PORTS	TOP PORTS	CALIBRATED FLOW RANGE	MAX RATED PRESSURE	TEMP RANGE	PGN
CT300R-J19-B-B-6	1" BSPP	1/4" BSPP	8 - 300 L/min	420 bar	0 - 120°C	65299 (0xFF13)
CT300R-J19-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi	32 - 248°F	65299 (0xFF13)
CT400R-J19-B-B-6	1" BSPP	1/4" BSPP	10 - 400 L/min	420 bar	0 - 120°C	65300 (0xFF14)
CT400R-J19-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2.5 - 100 US gpm	6000 psi	32 - 248°F	65300 (0xFF14)
CT600R-J19-F-B-3	1-1/2" #24 SAE Code 61 4-bolt flange	1/4" BSPP	20 - 600 L/min	210 bar	0 - 120°C	65302 (0xFF16)
CT600R-J19-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	32 - 248°F	65302 (0xFF16)
CT600R-J19-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 600 L/min	480 bar	0 - 120°C	65302 (0xFF16)
CT600R-J19-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 160 US gpm	7000 psi	32 - 248°F	65302 (0xFF16)
CT800R-J19-F-B-3	1-1/2" #24 SAE Code 61 4-bolt flange	1/4" BSPP	20 - 800 L/min	210 bar	0 - 120°C	65303 (0xFF17)
CT800R-J19-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 800 L/min	480 bar	0 - 120°C	65303 (0xFF17)
CT800R-J19-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	32 - 248°F	65303 (0xFF17)
CT800R-J19-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	7000 psi	32 - 248°F	65303 (0xFF17)

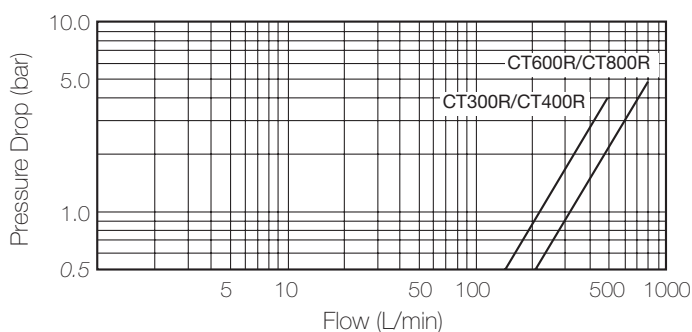
Note: The default J1939 Address for all models is 133 (0x85). Please Contact Sales if a different J1939 Address is required.

CT600R and CT800R has limited pressure control below 86 lpm (23 US gpm).

The maximum controllable pressure in this region is calculated by: max pressure (in bar) = 5 x flow (L/min) +30

Flowmeter with Loading Valve Pressure Drop Chart

Hydraulic Oil Viscosity 21 Centistokes



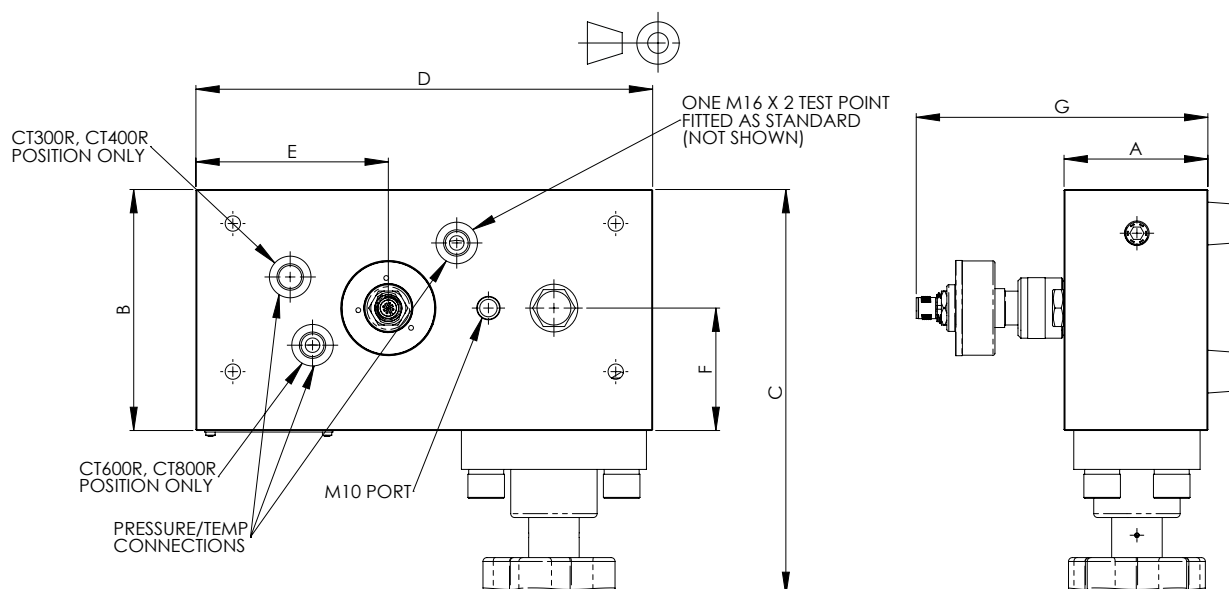
Note
1 UK gallon = 4.546 litres
1 US gallon = 3.785 litres

Installation Details

Flowmeters with Loading Valve Dimension Table

MODEL NUMBER	A		B		C		D		E		F		G		WEIGHT	
Units	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
CT300R	49	2	100	4	182	7-1/8	222	8-3/4	102.5	4	47.6	1-7/8	138	5-1/2	3.7	8.1
CT400R	49	2	100	4	182	7-1/8	222	8-3/4	102.5	4	47.6	1-7/8	138	5-1/2	3.7	8.1
CT600R	75	3	125	5	211	8-3/8	235	9-3/4	99	3-7/8	63	2-1/2	157	6-1/8	7.5	16.5
CT800R	75	3	125	5	211	8-3/8	235	9-3/4	99	3-7/8	63	2-1/2	157	6-1/8	7.5	16.5

Add 20mm, 3/4" to G for full height including feet.



Pressure Sensor Specifications

Accuracy:	$\leq \pm 1\%$ of FSD.
Long term stability:	$\leq \pm 0.2\%$ of FSD per year.
Temperature Drift:	0 - 60 °C: $\leq \pm 0.5\%$ of FSD.
	-20 - 85 °C: $\leq \pm 1\%$ of FSD.
	-40 - 85 °C 0.2% per 10 °C.
Additional Temperature Drift:	
Power Supply:	10 - 30 V d.c
Current:	≤ 40 mA
Measuring Rate:	100 ms
Non-Linearity:	$\leq \pm 0.2\%$ of FSD
Bus Speed:	250 kHz

Sales Order Code

Please contact our technical sales to team to discuss any special order requirements.

MODEL NUMBER	RATED PRESSURE RANGE	MAXIMUM OVER-PRESSURE	PRESSURE CONNECTION	DEFAULT J1939 ADDRESS
MPT060BBJ	0 - 60 bar	120 bar	1/4" BSPP	100
MPT100BBJ	0 - 100 bar	200 bar	1/4" BSPP	101
MPT160BBJ	0 - 160 bar	320 bar	1/4" BSPP	102
MPT250BBJ	0 - 250 bar	500 bar	1/4" BSPP	103
MPT400BBJ	0 - 400 bar	800 bar	1/4" BSPP	104
MPT600BBJ	0 - 600 bar	1200 bar	1/4" BSPP	105
MPT1K0BBJ	0 - 1000 bar	15000 bar	1/4" BSPP	106
MPT1K0PUJ	1000 psi	1740 psi	7/16"-20UN #4 SAE ORB	107
MPT1K5PUJ	1500 psi	2900 psi	7/16"-20UN #4 SAE ORB	108
MPT2K0PUJ	2000 psi	4000 psi	7/16"-20UN #4 SAE ORB	109
MPT3K0PUJ	3000 psi	6000 psi	7/16"-20UN #4 SAE ORB	110
MPT5K0PUJ	5000 psi	10000 psi	7/16"-20UN #4 SAE ORB	111
MPT10KPUJ	10000 psi	17400 psi	7/16"-20UN #4 SAE ORB	112

Please Contact Sales if a different J1939 Address is required.

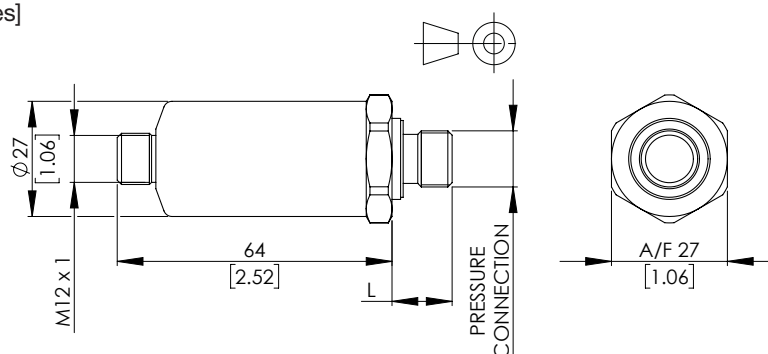
Cables, Splitters and Terminators

MODEL NUMBER	DESCRIPTION
SR-CBL-0.5-MF-CAN	0.5 m
SR-CBL-02-MF-CAN	2 m
SR-CBL-05-MF-CAN	5 m
SR-CBL-10-MF-CAN	10 m
SR-CBL-0.05-Y-CAN	Splitter no cable
SR-CBL-0.3-Y-CAN	CAN Y splitter, including 0.3 m cable
SR-CBL-000-R-CAN	CAN terminating resistor

Installation Details Dimensions in mm [Inches]

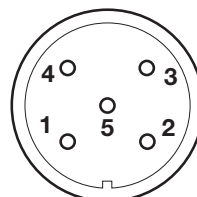
PRESSURE CONNECTION	LENGTH, L	
	mm	Inch
1/4" BSPP**	14	0.55
7/16"-20UN #4 SAE ORB	12	0.47

**G 1/4A DIN EN ISO 1179-2 formerly DIN 3852-E



Connecting Details

	ASSIGNMENT
1	Shield
2	+ In
3	GND
4	CAN H
5	CAN L



Turbine Flow Meters

Operation

As fluid passes through the flow meter it rotates a precision turbine. The flow straighteners and turbine design minimise the effects of turbulence and swirls. The turbine blades are detected by a magnetic reluctance transducer and the frequency is captured by a micro-controller. The micro-controller converts the frequency in to an equivalent flow and corrects for dynamic variances to achieve 1% of indicated flow rate. Temperature is sensed at the tip of the transducer which is in contact with the oil flow. Flow and temperature values are combined by the microcontroller and transmitted in a standard J1939 frame format. The flow block has ports for pressure sensor which can be supplied as an option.

The integrated loading valve gives progressive pressure loading in either direction. Replaceable safety burst discs are part of Interpass® safety protection system and operate if maximum pressure is exceeded, relieving flow to the return line. Replacement safety discs are stored in an internal holder machined in the rear of the flowblock.

Reverse Flow

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

Calibration

All CT turbine flow meter are calibrated at a mean viscosity of 21 cSt using ISO32 hydraulic mineral oil to ISO11158 category HM. Calibration certificates are available on request - this is a chargeable option. Production calibration of CT1500 L/min turbine is confirmed by testing over the range of 50 to 750 L/min and by design only above 750 L/min. 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 8Ø where space is limited. Inlet and outlet connections should always be of a similar bore size to that of the flow block 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 block will be used constantly with continuous pressure spikes please contact sales to discuss your application.

Filtration

Must be better than DIN ISO4406: 21/19/16 or NAS 10 (typically achieved with 20-20u filters).
CT15; must be better than DIN ISO4406: 19/16/13 or NAS 7 (typically achieved with 10u filters).

Top ports

Most flow meters have two additional ports (see table for configuration) in the top face of the flow meter for additional sensors. The CT15 has one top port. A range of J1939 compatible pressure sensors are available to fit these ports. All flow meters come with one M16 x 2 test point fitted as standard.

Accuracy

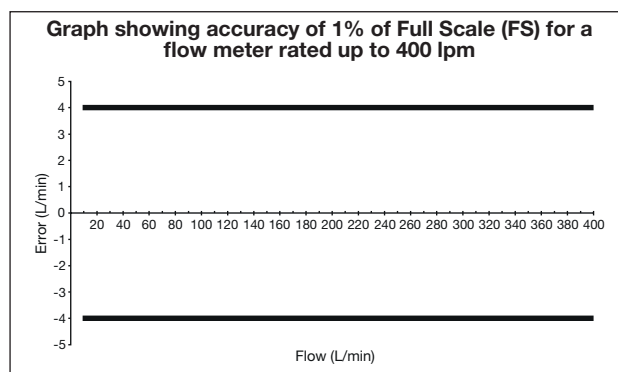
The accuracy is better described as the uncertainty of the flow reading compared to a known reference. Every flow measurement has an error associated with it, caused by the combination of a large number of factors that affect the operation of the flow meter,

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).

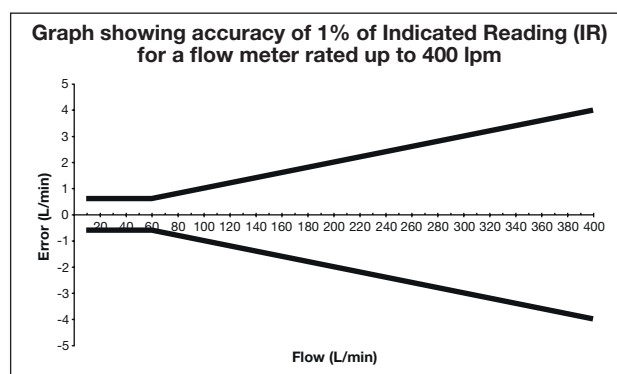
Full scale (FS) or full scale deflection (FSD)

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 L/min is ± 4 L/min whether you are measuring 40 L/min, 200 L/min or 400 L/min (see graph below). If you need to measure flows of 40 and 400 L/min 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 L/min flow meter is 1% IR then the error at 400 L/min is ± 4 L/min. As the actual flow measured reduces, so does the error in L/min. When measuring a flow of 60 L/min with an accuracy of 1% IR, the possible error is ± 0.6 L/min. At very low flows, the possible errors are no longer proportional to the flow rate, but actually a fixed amount in L/min (see graph below). For example if the accuracy is quoted as 1% IR (>60 L/min) for a flow meter with the range 10 - 400 L/min, then the accuracy is 1% of the actual flow in the range 60 to 400 L/min and a fixed flow error in the range 10 to < 60 L/min.



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	449.6	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

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