



Intelligent Digital (CAN-open) sensors and accessories for use with HPM Series meters and in generic CAN bus environments

All Intelligent Digital (ID) sensors use the CAN-open protocol that makes a plugand-play system with the HPM meters. These sensors are compliant with the CAN-open standard and are fully supported for integration in third party systems.

There is a wide range of cables and connectors to suit all applications. The ID sensors are connected in-line with one another, by way of a Y cable, often resulting in shorter cable lengths.

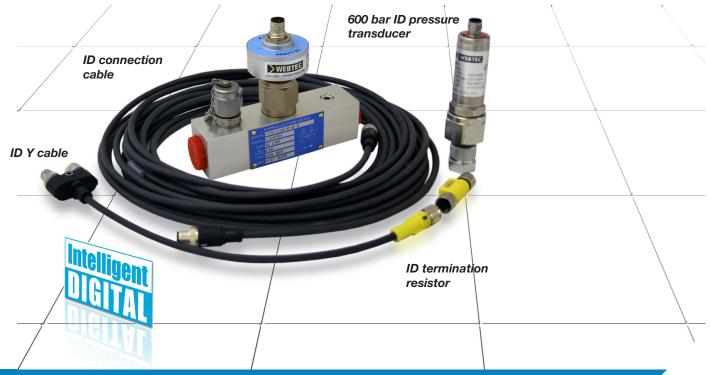
The CT and CTR series of turbine flow meters, provide a complete solution to the flow and temperature measurement of hydraulic systems on test stands, machine tools and other fixed or mobile applications. The flow meter can be installed anywhere in the hydraulic circuit for production testing, commissioning, development testing and control systems. The compact design allows the flow meters to be installed where space is limited.

The integral loading valve built into the CTR series provides smooth progressive pressure control in both flow directions allowing components such as cylinders or motors to be tested without re-plumbing the test connections.



Features

- Bl directional flowmeters operation.
- Flowmeters with loading valve have BI directional operation 'INTERPASS™' safety system, bypasses oil internally in the event of valve being over pressurised.
- Flowmeter temperature range of -20 to 90 °C, -4 to 194 °F.
- Pressure transducer temperature range of -25 to 105 °C, -13 to 221 °F.
- Pressure transducer housed in a stainless-steel body and are available in ranges up to 1000 bar, 14500 psi.





Flowmeters Specifications

Maximum Rated Pressure: 480 bar, 7000 psi **Maximum Flow:** 1500 L/min, 400 US gpm **Ambient Temperature Range:** -10 to 50°C, 14 to 122°F

Fluid Temperature Range: -20 to 90°C, -4 to 194°F continuous use

-25 to +125 °C (-13 to +257 °F). **Temperature display:**

Viscosity range: 10...100 cSt

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).

Temperature ± 2 °C

Repeatability: Better than ± 0.2%

Filtration: Oil cleanliness should be better than DIN ISO4406: 21/19/16 or NAS 10 (typically achieved with

20-20u filters).

CT15; should be better than DIN ISO4406: 19/16/13 or NAS 7 (typically achieved with 10u

filters or less). BSPP, SAE

Porting: Material:

> 600/750 High tensile Aluminium 2014A T6 Flow Body:

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

15 High tensile Aluminium 6082 T6 Aluminium, Steel, Stainless Steel.

Internal Materials: 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:**

Power Supply: 8-40 Vdc **Response Time:** 50 ms

Sales Order Code

Please contact our technical sales team to discuss any special order requirements. **Flowmeters Model Number Table**

MODEL NUMBER	MAIN PORTS	TOP PORTS	FLOW RANGE	MAX. PRESSURE
CT15-CAN-B-B-6	1/2" BSPP	1/4" BSPP	1 - 15 L/min	420 bar
CT15-CAN-S-S-6	3/4" -16UN #8 SAE ORB	7/16" -20UN #4 SAE ORB	0.25 - 4 US gpm	6000 psi
CT60-CAN-B-B-6	3/4" BSPP	1/4" BSPP	3 - 60 L/min	420 bar
CT60-CAN-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	0.8 - 16 US gpm	6000 psi
CT150-CAN-B-B-6	3/4" BSPP	1/4" BSPP	5 - 150 L/min	420 bar
CT150-CAN-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	1.3 - 40 US gpm	6000 psi
CT300-CAN-B-B-6	1" BSPP	1/4" BSPP	8 - 300 L/min	420 bar
CT300-CAN-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
CT600-CAN-B-B-5	1-1/4" BSPP	1/4" BSPP	15 - 600 L/min	350 bar
CT600-CAN-S-S-5	1-5/8" -12UN #20 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	5000 psi
CT750-CAN-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 750 L/min	480 bar
CT750-CAN-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 200 US gpm	7000 psi
CT1500-CAN-F-S-6-L	2" #32 SAE Code 62 4-bolt flange	7/16" -20UN #4 SAE ORB	50 - 1500 L/min	420 bar
CT1500-CAN-F-S-6	2" #32 SAE Code 62 4-bolt flange	7/16" -20UN #4 SAE ORB	12.5 - 400 US gpm	6000 psi

Note: To order please quote the model number from the table above



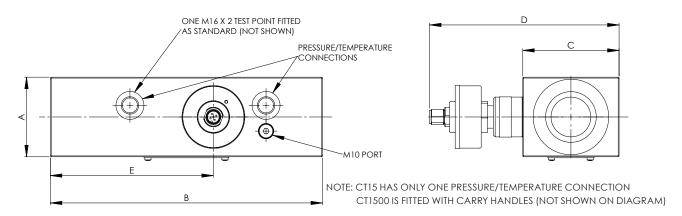
Installation Details

Flowmeters Dimension Table

MODEL NUMBER	1	4		В	(ı			E	WEI	GHT
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
CT600	62	2-1/2	212	8-3/8	75	3	152	6	127	5	2.7	6
CT750	100	4	212	8-3/8	75	3	160	6-1/4	126	5	5	11
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 20mm, 3/4" to D for full height





Sales Order Code

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

Flowmeters with Loading Valve Model Number Table

MODEL NUMBER	MAIN PORTS	TOP PORTS	FLOW RANGE	MAX. PRESSURE
CT300R-CAN-B-B-6	1" BSPP	1/4" BSPP	8 - 300 L/min	420 bar
CT300R-CAN-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
CT750R-CAN-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 750 L/min	480 bar
CT750R-CAN-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 200 US gpm	7000 psi

Note: To order please quote the model number from the table above

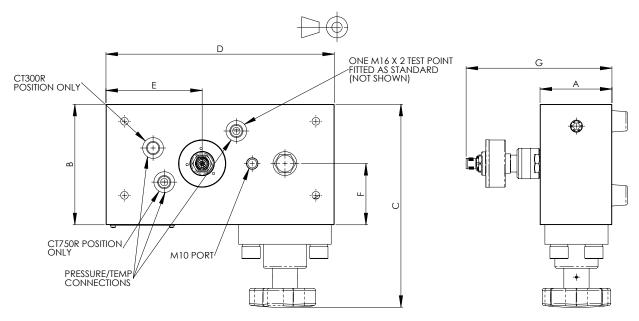
Installation Details

Flowmeters with Loading Valve Dimension Table

MODEL NUMBER	A		E	3	(ı)	E	•		=	(ā .	WEI	GHT
Units	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	kg	ld
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
CT750R	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 Transducer Specifications

Maximum Rated Pressure: 1000 bar, 14,500 psi Ambient Temperature Range: -25 to 85°C, -13 to 185°F

Fluid Temperature Range: -25 to 105°C, -13 to 221°F continuous use

Compatible Fluid: Hydraulic Mineral oils, Other fluids consult sales office

Accuracy/Tolerances:

Pressure: ± 0.5% full scale

Temperature: ± 3 °C, 5.4 °F (SR-PTT-* ONLY)

Porting: Supplied with M16 x 2 test point connector rated to a maximum pressure of 630 bar, 9100 psi

and a 'live' connection pressure of 400 bar, 5800 psi or less.

Material:

Body Materials: Stainless steel 1.4301

Seal: FKM

Weight: 170 g, 0.4 lb

IP Rating: IP66 (EN60529) *With cable connected

Power Supply: 8-40 Vdc Response Time: 1 ms

Sales Order Code

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

CAN (ID) Pressure Transducers Model Number Table

MODEL NUMBER	PRESSURE RANGE BAR	OVERLOAD PRESSURE PMAX BAR
SR-PT*-016-05-0C-CAN	-1 - 16	32
SR-PT*-060-05-0C-CAN	0 - 60	120
SR-PT*-160-05-0C-CAN	0 - 160	320
SR-PT*-400-05-0C-CAN	0 - 400	800
SR-PT*-600-05-0C-CAN	0 - 600	1000
SR-PT*-1K0-05-0C-CAN	0 - 1000	1000**

Note: To order please quote the model number from the table above.

Replace * with 'N' for no temperature and with' T' for unit with temperature.

^{**}When using the 1000 bar sensor above 630 bar we recommend the M16 x 2 test point adapter is not used - connect the sensor directly.



CAN (ID) Connection Cables

MODEL NUMBER	LENGTH
SR-CBL-0.5-MF-CAN	0.5m
SR-CBL-02-MF-CAN	2m
SR-CBL-05-MF-CAN	5m
SR-CBL-10-MF-CAN	10m
SR-CBL-20-MF-CAN	20m
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
SR-CONN-ADPT-M12	Cable adapter M12x1 5pol analog

Accessories/Spares

MODEL NUMBER	DESCRIPTION
SR-USB-HPM6000	USB cable type A to B
SR-HPM-CHG-03-0C	In car charger adaptor
HPM7000-AC-CHG	In car charger adaptor 12V HPM7000
HPM7000-AC-PSU	Power supply HPM7000

Other sensors & accessories

MODEL NUMBER	DESCRIPTION
SR-VADC-710	SR/CAN voltage, current & frequency converter
SR-TTP-190-05-0C-CAN	CAN Temperature transducer -40 to 150 °C 1/4" BSPP
SR-ICM	ICM Contamination Monitor Kit for HPM7000

Installation Details Dimensions in mm [Inches]





CAN-open Functionality

All the CAN sensors listed above are CAN-open compliant and can be used by integrators in CAN bus applications. The sensors digitise the physical quantity and make the value available on the CAN bus. They can sample at various rates, apply filtering and scale the measurements appropriately.

The sensors implement the CAN2.0B standard and can transmit at rates up to 1Mbits/s with 11 or 29 bit identifiers. The physical layer of the 2-wire interface is specified according to ISO 11898. The bus termination resistor is not included in the device.

The CAN protocol complies with the CAN-open specification DS301 and CAN-open device profile DS404. Possible configurations can be set with the object dictionary. Heartbeat and emergency messages can be used to monitor the status of the sensor.

CAN Supply

Voltage: 8-40VDC, protected against reverse polarity

Current: Pressure, temperature <10mA

Flow 25mA

CAN Interface

Physical layer: 2-wire interface, 5 V level according to ISO 11898, protected against short-circuit

Max. Bitrate: 1 Mbit/sec

Bus termination: External (120 Ω) at last node

Protocol: CAN-open DS301, Device Profile DS404



Connecting Details

	ASSIGNMENT						
1	CAN shield, PE						
2	+ UB, +24 VDC						
3	GND, 0V						
4	CAN_H, CAN+						
5	CAN_L, CAN-						



CAN-Open Summary

The measured data can be extracted from the sensor in one of two formats: process value or field value.

Process value is a 32bit floating point number (little endian) to IEEE-754-Format. It is formatted and scaled in the appropriate sensor units, ie. bar, Ipm, usgpm, etc.

Field value is a 16bit integer (±32000) representing the linear gradient of the sensor value. This must be converted to a process value based on the sensor type and range by the user. It has the advantage of producing less bus traffic but must be configured at every power up.

CAN-open type: NMT Slave **Network boot up:** Minimum boot up

COB-ID placing: Pre-defined connection set, SDO

Node id: Object (specific entry)
Bitrate: Object (specific entry)
Number of PDOs: PDO1, PDO5, PDO6 & PDO7

Emergency message: Supported

Heartbeat: Supported
Device profile: CiA DS404
Default settings: Bitrate 500 kbit/s

Node ID 78 hex (may vary)

Process value automatically transmits at the set rate after power on.

Full data sheets are available on request from Webtec sales.

Electronic Data Sheets (EDS) created with the CAN-open Design Tool v2.2.42.0. are also available.

Your supplier:



Aroflex AG | CH-8560 Märstetten www.aroflex.ch | info@aroflex.ch

Webtec reserve the right to make improvements and changes to the specification without notice





SR sensors and accessories for use with HPM Series meters

SR sensors are plug-and-play systems with the HPM meters. SR sensors are compatible with the current range of HPM meters and backwards compatible with previous meters.

There is a wide range of cables and connectors to suit all applications. The CT and CTR series of turbine flow meters, provide a complete solution to the flow and temperature 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 control systems. The compact design allows the flow meters to be installed where space is limited.

The integral loading valve built into the CTR series provides smooth progressive pressure control in both flow directions allowing components such as cylinders or motors to be tested without re-plumbing the test connections.



Features

- Bl directional flowmeters operation.
- Flowmeters with loading valve have BI directional operation 'INTERPASS™' safety system, bypasses oil internally in the event of valve being over pressurised.
- Flowmeter temperature range of -20 to 90 °C, -4 to 194 °F.
- Pressure transducer temperature range of -25 to 105 °C, -13 to 221 °F.
- Pressure transducer housed in a stainless-steel body and are available in ranges up to 1000 bar, 14500 psi.
- CAN sensors for use with HPM series meters available, see CAN series.





Flowmeters Specifications

Maximum Rated Pressure:480 bar, 7,000 psiMaximum Rated Flow:750 L/min, 200 US gpmAmbient Temperature Range:-10 to 50°C, 14 to 122°F

Fluid Temperature Range: -20 to 90°C, -4 to 194°F continuous use

Compatible Fluid: Mineral oils to ISO 11158. Other fluids consult sales office

Viscosity range: 10...100 cSt

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 $\pm 0.2\%$

Filtration: Oil cleanliness should be better than DIN ISO4406: 21/19/16 or NAS 10 (typically achieved with

20-20u filters).

CT15; should be better than DIN ISO4406: 19/16/13 or NAS 7 (typically achieved with 10u

filters or less). BSPP, SAE

Porting: 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 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: FKM (EPDM sea IP Rating: IP54 (EN60529) Power Supply: 7-15 Vdc Response Time: 50 ms

Internal Materials:

Sales Order Code

Please contact our technical sales team to discuss any special order requirements. **Flowmeters Model Number Table**

MODEL NUMBER	MAIN PORTS	TOP PORTS	FLOW RANGE	MAX. PRESSURE
CT15-SR-B-B-6	1/2" BSPP	1/4" BSPP	1 - 15 L/min	420 bar
CT15-SR-S-S-6	3/4" -16UN #8 SAE ORB	7/16" -20UN #4 SAE ORB	0.25 - 4 US gpm	6000 psi
CT60-SR-B-B-6	3/4" BSPP	1/4" BSPP	3 - 60 L/min	420 bar
CT60-SR-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	0.8 - 16 US gpm	6000 psi
CT150-SR-B-B-6	3/4" BSPP	1/4" BSPP	5 - 150 L/min	420 bar
CT150-SR-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	1.3 - 40 US gpm	6000 psi
CT300-SR-B-B-6	1" BSPP	1/4" BSPP	8 - 300 L/min	420 bar
CT300-SR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
CT600-SR-B-B-5	1-1/4" BSPP	1/4" BSPP	15 - 600 L/min	350 bar
CT600-SR-S-S-5	1-5/8" -12UN #20 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	5000 psi
CT750-SR-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 750 L/min	480 bar
CT750-SR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 200 US gpm	7000 psi
CT750-SR-F-B-3	1-1/2" #24 SAE CODE 61 4-BOLT FLANGE	1/4" BSPP	20 - 750 L/min	210 bar
CT750-SR-F-S-3	1-1/2" #24 SAE CODE 61 4-BOLT FLANGE	7/16" -20UN #4 SAE ORB	5 - 200 US gpm	3000 psi

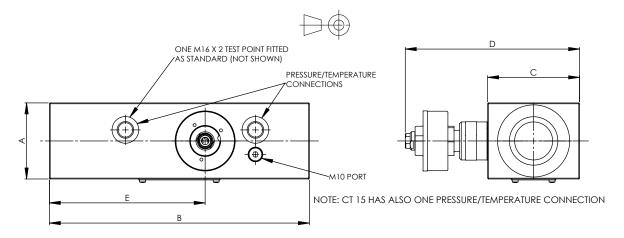
Note: To order please quote the model number from the table above



Installation Details

Flowmeters Dimension Table

MODEL NUMBER		Ą		В	()			WEI	GHT
Units	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	kg	lb
CT15	37	1-1/2	136	5-3/8	37	1-1/2	114	4-5/8	69.5	2-3/4	0.7	1.5
CT60	62	2-1/2	190	7-1/2	50	2	127	5	103	4	1.6	3.5
CT150	62	2-1/2	190	7-1/2	50	2	127	5	103	4	1.6	3.5
CT300	62	2-1/2	190	7-1/2	50	2	131	5-1/8	103	4	1.7	3.7
CT600	62	2-1/2	212	8-3/8	75	3	145	5-5/8	127	5	2.7	6
CT750-SR-F	100	4	212	8-3/8	75	3	151	5-7/8	126	5	5	11
CT750	100	4	212	8-3/8	75	3	151	5-7/8	126	5	5	11



Sales Order Code

Please contact our technical sales team to discuss any special order requirements. **Flowmeters with Loading Valve Model Number Table**

MODEL NUMBER	MAIN PORTS	TOP PORTS	FLOW RANGE	MAX. PRESSURE
CT300R-SR-B-B-6	1" BSPP	1/4" BSPP	8 - 300 L/min	420 bar
CT300R-SR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
CT600R-SR-F-B-3	1-1/2" #24 SAE CODE 61 4-BOLT FLANGE	1/4" BSPP	20 - 600 L/min	210 bar
CT600R-SR-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
CT600R-SR-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 600 L/min	480 bar
CT600R-SR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 160 US gpm	7000 psi
CT750R-SR-S-B-7	1-7/8" -12UN #24 SAE ORB	1/4" BSPP	20 - 750 L/min	480 bar
CT750R-SR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 200 US gpm	7000 psi
CT750R-SR-F-B-3	1-1/2" #24 SAE CODE 61 4-BOLT FLANGE	1/4" BSPP	20 - 750 L/min	210 bar
CT750R-SR-F-S-3	1-1/2" #24 SAE CODE 61 4-BOLT FLANGE	7/16" -20UN #4 SAE ORB	5 - 200 US gpm	3000 psi

Note: To order please quote the model number from the table above

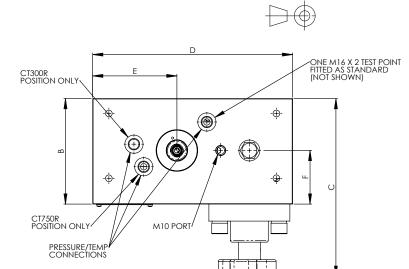


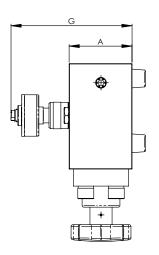
Installation Details

Flowmeters with Loading Valve Dimension Table

MODEL NUMBER	A		В		С		D		E		F		G		WEIGHT	
Units	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	kg	ld
CT300R	49	2	100	4	182	7-1/8	222	8-3/4	102.5	4	47.6	1-7/8	129	5-1/8	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	148	5-3/4	7.5	16.5
CT750R	75	3	125	5	211	8-3/8	235	9-3/4	99	3-7/8	63	2-1/2	148	5-3/4	7.5	16.5

Add 20mm (3/4") to G for full height including feet





Pressure Transducer Specifications

Maximum Rated Pressure: 1000 bar, 14,500 psi Ambient Temperature Range: -25 to 85°C, -13 to 185°F

Fluid Temperature Range: -25 to 105°C, -13 to 221°F continuous use

Compatible Fluid: Mineral oils to ISO 11158. Other fluids consult sales office

Accuracy/Tolerances:

Pressure: ± 0.5% full scale

Temperature: ± 3 °C, 5.4 °F (SR-PTT-* ONLY)

Porting: Supplied with M16 x 2 test point connector rated to a maximum pressure of 630 bar, 9100 psi

and a 'live' connection pressure of 400 bar, 5800 psi or less.

Material:

Body Materials: Stainless steel 1.4301

 Seal:
 FKM

 Weight:
 170 g, 0.4 lb

 IP Rating:
 IP54 (EN60529)

 Power Supply:
 7-15 Vdc

 Response Time:
 1 ms

Response Time:

Sales Order Code

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

SR Pressure Transducers Model Number Table

MODEL NUMBER	PRESSURE RANGE BAR	OVERLOAD PRESSURE PMAX BAR
SR-PT*-015-05-0C	-1 - 15	32
SR-PT*-060-05-0C	0 - 60	120
SR-PT*-150-05-0C	0 - 150	320
SR-PT*-400-05-0C	0 - 400	800
SR-PT*-600-05-0C	0 - 600	1000
SR-PT*-1K0-05-0C	0 - 1000	1000**

Note: To order please quote the model number from the table above.

Replace * with 'N' for no temperature and with' T' for unit with temperature.

^{**}When using the 1000 bar sensor above 630 bar we recommend the M16x2 test point adapter is not used - connect the sensor directly.



SR Cables

MODEL NUMBER	LENGTH	TYPE
SR-CBL-003-55-MM	3m	Connecting
SR-CBL-005-55-MF	5m	Extension

Accessories/Spares

MODEL NUMBER	DESCRIPTION		
SR-USB-HPM6000	USB cable type A to B		
SR-HPM-CHG-03-0C	In car charger adaptor		

Other sensors & accessories

MODEL NUMBER	DESCRIPTION					
SR-RPM-300-05-3C	SR Tach with 5 pin fixed cable					
SR-RPM-WHL-00-0C	Tach contact wheel					
SR-RPM-ADP-00-0C	Focus adaptor					
SR-VADC-710	SR/CAN voltage, current & frequency converter					
SR-TTP-190-05-0C	SR Temperature transducer -40 to 150 °C 1/4" BSPP					

Installation Details Dimensions in mm [Inches]



SR-PTT-***-05-0C



Your supplier:



Aroflex AG | CH-8560 Märstetten www.aroflex.ch | info@aroflex.ch

Webtec reserve the right to make improvements and changes to the specification without notice