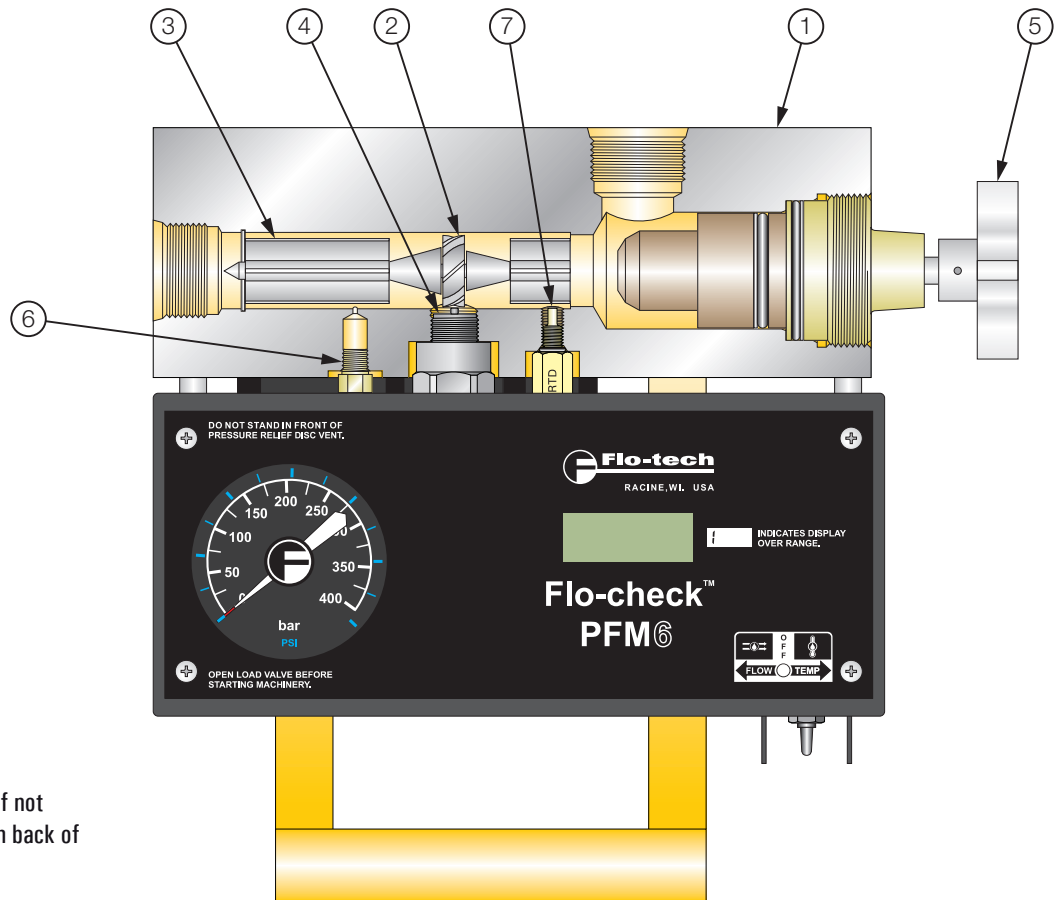


# General design features



1. Housing
2. Turbine rotor
3. Rotor supports
4. Magnetic pick-up
5. Loading valve
6. Pressure sensor
7. Temperature sensor
8. Internal pressure relief not illustrated. Located on back of housing.

## Operating principle

Flo-tech's portable hydraulic testers simultaneously measure the flow rate, temperature, pressure and optionally, power of hydraulic fluid. Designed for testing pumps, valves, cylinders, motors, hydrostatic or power shift transmissions and power steering systems in both mobile and stationary applications, these compact units utilize turbine flow meter technology.

**Flow:** As fluid passes through the tester, it turns the turbine rotor. As each turbine blade passes the magnetic pick-up, an electrical signal is generated. This frequency signal is proportional to the flow rate and is transmitted to the tester's electronics for display on a PC screen or the front panel LCD of the tester's electronic case.

**Temperature:** All testers contain an internal temperature sensor for measuring the temperature of the fluid as it passes through the flow meter body.

**Pressure:** Pressure is provided in either analog or digital format, depending on the model of the tester. PFM6 and PFM6BD testers are equipped with helical type pressure gauges, while the PFM8 tester includes a silicon strain gauge pressure sensor and the Flo-Check® USB tester utilizes a piezoelectric pressure sensor.

**Power:** Power measurements are derived from the product of flow and pressure. The Flo-Check® USB and the PFM8 are designed to calculate this measurement and display the results in either horsepower or kilowatts. When using the PFM6 or PFM6BD, power can be calculated using the following formulas:

$$\text{H.P.} = \frac{\text{gal/min} \times \text{psi}}{1714} \qquad \text{H.P.} = \frac{\text{l/min} \times \text{bar}}{447.4}$$

$$\text{kW} = \frac{\text{l/min} \times \text{bar}}{600}$$

Designed for both ease of operation and safety, all testers feature loading valves with fingertip control and pressure surge protection.

# Flo-Check<sup>®</sup> USB hydraulic system analyzer

Simultaneously measures flow, pressure, temperature



- Flow accuracy  $\pm 1\%$  of reading @ 32 cSt
- Field selectable US or metric readings
- High and low set point alarms for flow, pressure and temperature
- Captures pressure spikes up to 10,000 psi (0.2 milliseconds duration)
- Exports saved data to Microsoft Excel<sup>®</sup> and other spreadsheet programs
- USB powered
- Easy to use, plug and play
- Calculates hydraulic power
- Select continuous monitoring or capture data manually
- Logs up to 12 hours
- Records alarm history

The Flo-Check<sup>®</sup> hydraulic system analyzer can be used as a stationary or portable tester for both industrial and mobile hydraulic system diagnostics, and analysis of the prognostic health of a hydraulic system. It features flow, pressure and temperature sensors that are monitored by a data acquisition module. This module records the operating parameters of the system and transfers them to the user's laptop via the USB port.

The custom software utility is a Windows<sup>®</sup>-based application which is compatible with Windows Vista<sup>®</sup>, Windows XP, Windows 2000, and Windows 7. This intuitive software configures the displayed information into user-selected engineering units and provides real-time graphics with instantaneous readings and trends for all three measurement parameters. The software also permits the data to be saved for export into a spreadsheet program.

The hydraulic system analyzer is powered through the USB port of a PC, making it easy to set up and ideal for portable applications. Interfaced to the PC application, the hydraulic analyzer offers a straightforward method of monitoring system parameters complete with data acquisition.



## SPECIFICATIONS

### Performance

#### Flow:

Accuracy	$\pm 1\%$ of reading @ 32 cSt
Repeatability	$\pm 0.2\%$

#### Pressure:

Accuracy	$< \pm 0.5\%$ BFSL
Stability	$< \pm 0.25\%$ of full scale
Zero offset	$< \pm 2\%$ of full scale
TC zero and TC span	$< \pm 1.5\%$ of full scale
Response time	0.2 milliseconds

#### Temperature:

Calibration error (25 °C)	$\pm 1$ °C
Absolute error (over full range of sensor, 0 to 150 °C)	
Without calibration	$\pm 3$ °C
With calibration	$\pm 1.6$ °C
Nonlinearity	$\pm 0.4$ °C
Repeatability	$\pm 0.1$ °C

#### Data acquisition:

Sample rate	10 kHz
PC screen update/record rate	1 second (average 10K samples)
Flow	1 second (average 10K samples)
Temperature	1 second (min, max, average 10K samples)
Pressure	1 second (min, max, average 10K samples)

#### Power

USB power:	+5 VDC (supplied through USB port of a PC)
USB voltage tolerance:	+4.6 VDC min, +5.25 VDC max
Current:	100 mA, typ

#### Environmental

Pressure rating:	414 bar (6000 psi) maximum with a 3:1 safety factor; capable of 10,000 psi transients
Operating pressure:	414 bar, 41.4 MPA, 420 kg/cm <sup>2</sup> (<6000 psi); capable of 10,000 psi transients
Internal valve by-pass:	7500 psi $\Delta P$
Pressure drop:	See $\Delta P$ charts on page 12
Fluid temperature:	-40 to +150 °C (-40 to +300 °F)
Ambient temperature:	0 to +85 °C (+32 to +185 °F)
Storage temperature:	-40 to +85 °C (-40 to +185 °F)
Humidity:	0-90%, non-condensing

#### Material

Housing:	6013-T351 aluminum; anodized
Turbine rotor:	T416 stainless steel
Rotor supports:	6061-T6 aluminum alloy
Seals:	Viton <sup>®</sup> standard; EPR optional
Ball bearings:	440C stainless steel
Hub cones:	6061-T6 aluminum alloy
Temperature probe:	T303 stainless steel
Valve:	12L14 steel body with 303 SS seat
Spool/Sleeve:	12L14 steel
Magnetic pick-up:	
Body	T303 stainless steel
Nut	T303 stainless steel
Electronic case:	Cold rolled steel; black zinc plate with clear seal
Ports:	SAE straight thread O-ring boss, female J1926/1; ISO1179 (BSPP)

# Flo-Check<sup>®</sup> USB hydraulic system analyzer

Simultaneously measures flow, pressure and temperature

## SOFTWARE

The Flo-tech analyzer software provides a real-time graphical and digital interface for monitoring and/or recording pressure, temperature and flow rate parameters from the hydraulic analyzer. In addition to the graphical and digital displays, the main screen also consists of a menu bar, buttons with common functions and alarm indicators.

The software offers the following options:

- View real time pressure, temperature, flow rate and power measurements
- Record all measurements to a file
- Choice of recording all measurement points or capturing points manually
- Selection of all measurement units, US or metric
- Ability to adjust display of graph data
- High/Low alarm indicators set by the operator



All measurements taken can be saved once per second to a comma separated value (.csv) file for export into a spreadsheet program. For example, recording for 2 minutes would yield 120 points of data. Even though data points are only recorded once per second, pressure spikes and dips are captured by recording the maximum or minimum pressure during each measurement period. Therefore, the precise shape of the pressure spike is not recorded but its amplitude and the time it occurred are both recorded.

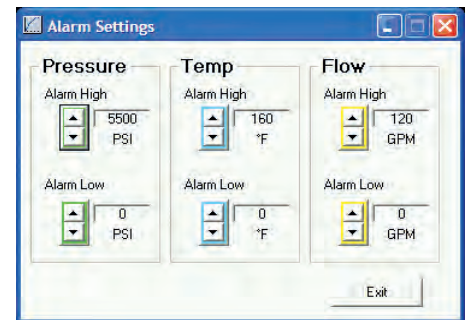
## Graphs

The graph on the main screen contains more than 60 points of data. Previous data points are saved in memory and can be viewed at any time. Adjustments can be made to optimize data that is displayed by hiding individual graph plots, adjusting the scale of each plot or adding horizontal gridlines to the graph.

Measurement (over a 1 second time period)	Color indication	Alarm indication	Digital indication	Graphical display	Record to file
Average pressure	Green	●	●	●	●
Minimum pressure	Dark green			●	●
Maximum pressure	Dark green			●	●
Average temperature	Blue	●	●	●	●
Average flow rate	Yellow	●	●	●	●
Average power	Orange		●		●

## Alarms

There are three sets of high/low alarm indicators on the main screen which monitor pressure, temperature and flow rate. Alarm indicators flash if the current system measurements exceed the alarm limits set by the operator and continue to flash when the current system measurements return to normal to alert the operator that an alarm condition occurred. Alarms must be reset manually to acknowledge the alarm condition.



## ORDERING INFORMATION

Model number <sup>1</sup>	Nominal port size	Flow range
F7160	SAE 16	3 - 85 gal/min
F7161	SAE 24	7 - 199.9 gal/min
F7162	G 1	15 - 321 l/min
F7163	G 1 ½	26 - 757 l/min

<sup>1</sup> Each Flo-Check<sup>®</sup> hydraulic system analyzer includes a 16.4 ft. (5 M) USB, a male to B male (IP 68) connection cable, CD-Rom of the software utility, and complete operating instructions packaged in a protective carrying case.

## ACCESSORIES

Model number	Description
F001109	5-point calibration certificate <sup>2</sup>
F001110	10-point calibration certificate <sup>2</sup>
F1614-7500	Pressure relief disc, 7500 psi (1 per tester)

<sup>2</sup> Certificates are traceable to NIST, ISO 9001.



# PFM 6 digital portable hydraulic tester

Simultaneously measures flow, pressure, temperature



- Five flow ranges
- Large 3 1/2 digit LCD for flow and temperature
- Helical tube pressure gauge
- One toggle switch to control power and select flow and temperature
- Loading valve with fingertip control of pressure
- Platinum resistance temperature sensor
- Pressure surge protection with internal pressure relief
- Turbine flow sensor provides fast response
- Available with SAE or BSPP ports
- Pressures up to 414 bar (6000 psi)
- Temperatures up to 150 °C (300 °F)
- Flow accuracy  $\pm 1\%$  of full scale
- Repeatability  $\pm 0.2\%$

The PFM6 series is a compact, lightweight portable tester designed for fast diagnostic troubleshooting of all types of mobile or stationary hydraulic systems and components. These self-contained testers feature laboratory accuracy and provide flow, pressure and temperature measurements simultaneously from one point.

Simple operation includes a toggle switch to display either flow or temperature readings and a loading valve that operates with fingertip control. The dual scale helical tube pressure gauge offers pulsation dampening and high overpressure capacity. For safe operation, all testers include an internal pressure relief system.

## SPECIFICATIONS

### Performance

Flow accuracy:	$\pm 1\%$ of full scale
Repeatability:	$\pm 0.2\%$
Turbine response:	$\leq 200$ ms
Temperature:	
Fluid	-20 to +150 °C (-4 to +300 °F)
Ambient	-20 to +55 °C (-4 to +131 °F)
Flow readout:	Linearity and zero shift $\pm 1$ digit
Operating pressure:	Up to 414 bar, 41.4 MPA, 420 kg/cm <sup>2</sup> (6000 psi)
Pressure drop:	See $\Delta P$ charts on page 12
Readout accuracy:	$\pm 1$ digit

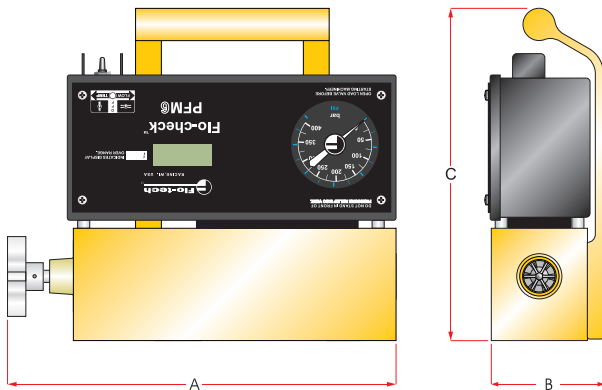
### Material

Housing:	6013-T651 aluminum; anodized
Turbine rotor:	T416 stainless steel
Ball bearings:	440C stainless steel
Rotor shaft:	T303 stainless steel
Rotor supports:	
PFM6-15/30	CA360 brass
PFM6-60/85/200	6061-T6 aluminum alloy
Hub cones:	6061-T6 aluminum alloy
Valve body:	
PFM6-15/30	Cold rolled steel; zinc plate, dichromate finish
PFM6-60/85/200	
Valve stem:	12L14 steel; zinc plate, dichromate finish
Poppet:	T303 stainless steel
Sleeve:	12L14 steel; hardened
PFM6-200 only	D.O.M. steel tube
Temperature probe:	T303 stainless steel
Magnetic pick-up:	
Body	T303 stainless steel
Nut	T303 stainless steel
Seals:	Buna N standard; Viton® and EPR optional
Carrying handle:	Cast aluminum; anodized
Electronic case & cover:	Cold rolled steel; zinc plate with clear seal, epoxy black paint
Battery:	4 AA size alkaline, ~ 50 hours of service
Ports:	SAE straight thread O-ring boss, female J1926/1; ISO1179 (BSPP)

# PFM6 digital portable hydraulic tester

Simultaneously measures flow, pressure and temperature

## DIMENSIONS



Series	A Length mm (inches)	B Depth mm (inches)	C Height mm (inches)	Weight kg (lbs)
PFM6-15	287 (11.3)	92 (3.6)	262 (10.3)	6.3 (13.85)
PFM6-30	287 (11.3)	92 (3.6)	262 (10.3)	6.3 (13.85)
PFM6-60	292 (11.5)	92 (3.6)	262 (10.3)	7.5 (16.50)
PFM6-85	292 (11.5)	92 (3.6)	262 (10.3)	7.5 (16.50)
PFM6-200	311 (12.3)	105 (4.1)	275 (10.8)	9.1 (20.00)

## ORDERING INFORMATION

Series	Nominal port size	Flow range	Model number	STD or CE model	Pressure gauge units of measure
PFM6-15	SAE 12	1 - 15 gal/min	F5080 * - XXX	Leave blank for standard model or <b>CE</b> for CE option	psi bar MPA kg/cm <sup>2</sup>
PFM6-30	SAE 12	2 - 30 gal/min	F5079 * - XXX		
PFM6-60	SAE 16	3 - 60 gal/min	F5078 * - XXX		
PFM6-85	SAE 16	4 - 85 gal/min	F5077 * - XXX		
PFM6-200	SAE 24	7 - 199.9 gal/min	F5076 * - XXX		
PFM6-15	G 3/4	4 - 56 l/min	F5110 * - XXX		
PFM6-30	G 3/4	7.5 - 113.6 l/min	F5111 * - XXX		
PFM6-60	G 1	12 - 227 l/min	F5112 * - XXX		
PFM6-85	G 1	15 - 321 l/min	F5113 * - XXX		
PFM6-200	G 1 1/2	26 - 757 l/min	F5114 * - XXX		

## EXAMPLES:

**F5076-PSI** = PFM6-200  
SAE 24 ports  
7 - 199.9 gal/min flow range  
Standard model  
Psi pressure units

**F5111CE-BAR** = PFM6-30  
G 3/4 ports  
7.5 - 113.6 l/min flow range  
CE certified  
Bar pressure units

## ACCESSORIES

Model number	Description	Series
F4934-1530	Carrying case	PFM6-15 & PFM6-30
F4934-6085	Carrying case	PFM6-60 & PFM6-85
F4934-200	Carrying case	PFM6-200
F1614-7500	Pressure relief disc, 7500 psi (1 per tester)	All PFM6s
F001109	5-point calibration certificate <sup>1</sup>	All PFM6s
F001110	10-point calibration certificate <sup>1</sup>	All PFM6s

<sup>1</sup> Certificates are traceable to NIST, ISO 9001.

# PFM 6BD bi-directional hydraulic tester

Simultaneously measures flow, pressure and temperature



- Bi-directional in-line testing capabilities in three flow ranges
- Large 3 1/2 digit LCD for flow and temperature
- Helical tube pressure gauge
- One toggle switch to control power and select flow and temperature
- Loading valve with fingertip control of pressure
- Platinum resistance temperature sensor
- Pressure surge protection with internal pressure relief
- Turbine flow sensor provides fast response
- SAE ports
- Pressures up to 414 bar (6000 psi)
- Temperatures up to 150 °C (300 °F)
- Flow accuracy  $\pm 1\%$  of full scale
- Repeatability  $\pm 0.2\%$

The PFM6BD series includes all the features of the standard PFM6 series with the added benefit of bi-directional flow measurement. Designed for fast diagnostic troubleshooting of all types of mobile or stationary hydraulic systems and components, these compact testers offer laboratory accuracy and provide flow, pressure and temperature measurements simultaneously from one point.

## SPECIFICATIONS

### Performance

<b>Flow accuracy:</b>	
Forward	$\pm 1\%$ of full scale
Reverse	$\pm 2\%$ of full scale
<b>Repeatability:</b>	$\pm 0.2\%$
<b>Turbine response:</b>	$\leq 200$ ms
<b>Temperature:</b>	
Fluid	-20 to +150 °C (-4 to +300 °F)
Ambient	-20 to +55 °C (-4 to +131 °F)
<b>Flow readout:</b>	Linearity and zero shift $\pm 1$ digit
<b>Operating pressure:</b>	Up to 414 bar (6000 psi, 41.4 MPA, 420 kg/cm <sup>2</sup> )
<b>Pressure drop:</b>	See $\Delta P$ charts on page 12
<b>Readout accuracy:</b>	$\pm 1$ digit

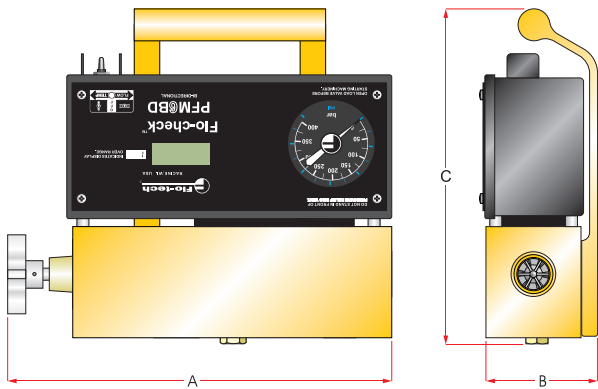
### Material

<b>Housing:</b>	6013-T651 aluminum; anodized
<b>Turbine rotor:</b>	T416 stainless steel
<b>Ball bearings:</b>	440C stainless steel
<b>Rotor shaft:</b>	T303 stainless steel
<b>Rotor supports:</b>	6061-T6 aluminum alloy
<b>Hub cones:</b>	6061-T6 aluminum alloy
<b>Valve body:</b>	12L14 steel; zinc plate, dichromate finish
<b>Valve stem:</b>	T303 stainless steel
<b>Spool/sleeve:</b>	4340 Alloy steel; hardened
<b>Temperature probe:</b>	T303 stainless steel
<b>Magnetic pick-up:</b>	
Body	T303 stainless steel
Nut	T303 stainless steel
<b>Seals:</b>	Buna N standard; Viton® and EPR optional
<b>Carrying handle:</b>	Cast aluminum; anodized
<b>Electronic case &amp; cover:</b>	Cold rolled steel; zinc plate with clear seal, epoxy black paint
<b>Battery:</b>	4 AA size alkaline, ~ 50 hours of service
<b>Ports:</b>	SAE straight thread O-ring boss, female J1926/1

# PFM 6BD bi-directional hydraulic tester

Simultaneously measures flow, pressure and temperature

## DIMENSIONS



Series	A Length mm (inches)	B Depth mm (inches)	C Height mm (inches)	Weight kg (lbs)
PFM6BD-60	287 (11.3)	92 (3.6)	265 (10.4)	7.5 (16.50)
PFM6BD-85	287 (11.3)	92 (3.6)	265 (10.4)	7.5 (16.50)
PFM6BD-200	300 (11.8)	105 (4.1)	277 (10.9)	9.0 (19.50)

## ORDERING INFORMATION

Series	Nominal port size	Flow range	Model number	STD or CE Model	Pressure gauge units of measure
PFM6BD-60	SAE 16	12 - 227 l/min (3 - 60 gal/min)	F5082 * - XXX	Leave blank for standard model or <b>CE</b> for CE option	<b>psi</b> <b>bar</b> <b>MPA</b> <b>kg/cm<sup>2</sup></b>
PFM6BD-85	SAE 16	15 - 321 l/min (4 - 85 gal/min)	F5083 * - XXX		
PFM6BD-200	SAE 24	26 - 757 l/min (7 - 199.9 gal/min)	F5084 * - XXX		

## EXAMPLES:

**F5083-PSI** = PFM6BD-85  
SAE 16 ports  
15 - 321 l/min (4 - 85 gal/min)  
Standard model  
Psi pressure units

**F5082CE-PSI** = PFM6BD-60  
SAE 16 ports  
12 - 227 l/min (3 - 60 gal/min)  
CE certified  
Psi pressure units

## ACCESSORIES

Model number	Description	Series
F4934-6085	Carrying case	PFM6BD-60 & PFM6BD-85
F4934-200	Carrying case	PFM6BD-200
F1614-7500	Pressure relief disc, 7500 psi (2 per tester)	All PFM6BDs
F001109	5-point calibration certificate <sup>1</sup>	All PFM6BDs
F001110	10-point calibration certificate <sup>1</sup>	All PFM6BDs

<sup>1</sup> Certificates are traceable to NIST, ISO 9001.

# PFM8 Digital hydraulic tester & dynamometer

Simultaneously measures flow, pressure, power and temperature



- Five flow ranges
- Front panel selectable US or metric readings
- Dynamometer reads power (HP & kW) directly
- 3 ½ digit LCDs for digital display of flow, temperature, pressure and power
- Large easy-to-use membrane switch
- Loading valve with fingertip control of pressure
- Silicon strain gauge pressure sensor
- Platinum resistance temperature sensor
- Pressure surge protection with internal pressure relief
- Turbine flow sensor provides fast response
- Pressures up to 414 bar (6000 psi)
- Temperatures up to 150 °C (300 °F)
- Flow accuracy  $\pm 1\%$  of full scale
- Repeatability  $\pm 0.2\%$

The all digital PFM8 series combines a compact, lightweight hydraulic tester and a dynamometer in one unit. Designed for fast diagnostic troubleshooting of all types of hydraulic systems and components, including engine-pump combinations. These testers make all flow, temperature, pressure and power measurements from one point. A bonus feature of this series is the capability to switch from US to metric units of measure in the field.

Each tester utilizes two digital displays, one for flow and temperature and a second display for pressure and power. Simple operation includes a large format membrane switch for on/off control and selection of units of measure to be displayed. A loading valve with fingertip control and an internal pressure relief system are standard features.

## SPECIFICATIONS

### Performance

Flow accuracy:	$\pm 1\%$ of full scale
Repeatability:	$\pm 0.2\%$
Turbine response:	$\leq 200$ ms
Temperature:	
Fluid	-20 to +150 °C (-4 to +300 °F)
Ambient	-20 to +55 °C (-4 to +131 °F)
Flow readout:	Linearity and zero shift $\pm 1$ digit
Operating pressure:	Up to 414 bar, 41.4 MPA, 420 kg/cm <sup>2</sup> (6000 psi)
Pressure drop:	See $\Delta P$ charts on page 12
Readout accuracy:	$\pm 1$ digit

### Material

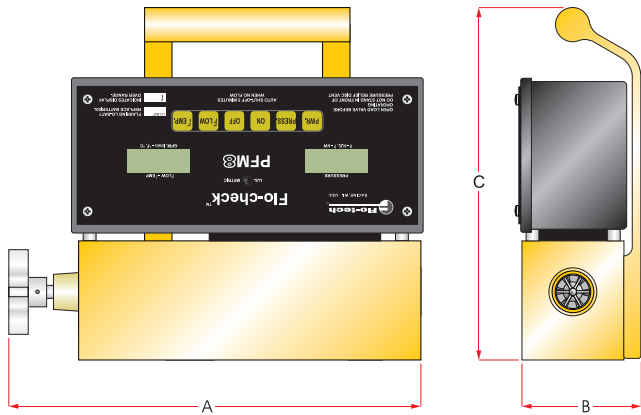
Housing:	6013-T651 aluminum; anodized
Turbine rotor:	T416 stainless steel
Ball bearings:	440C stainless steel
Rotor shaft:	T303 stainless steel
Rotor supports:	
PFM6-15/30	CA360 brass
PFM6-60/85/200	6061-T6 aluminum alloy
Hub cones:	6061-T6 aluminum alloy
Valve body:	
PFM6-15/30	Cold rolled steel; zinc plate, dichromate finish
PFM6-60/85/200	12L14 Steel; zinc plate, dichromate finish
Valve stem:	T303 stainless steel
Poppet:	12L14 steel; hardened
Sleeve:	
PFM6-200 only	D.O.M. steel tube
Temperature probe:	T303 stainless steel
Magnetic pick-up:	
Body	T303 stainless steel
Nut	T303 stainless steel
Seals:	Buna N standard; Viton® and EPR optional
Carrying handle:	Cast aluminum; anodized
Electronic case & cover:	Cold rolled steel; zinc plate with clear seal, epoxy black paint
Battery:	AA size alkaline, ~ 50 hours of service
Ports:	SAE straight thread O-ring boss, female J1926/1



# PFM8 digital hydraulic tester & dynamometer

Simultaneously measures flow, pressure, power and temperature

## DIMENSIONS



Series	A Length mm (inches)	B Depth mm (inches)	C Height mm (inches)	Weight kg (lbs)
PFM8-15	287 (11.3)	92 (3.6)	262 (10.3)	6.3 (13.85)
PFM8-30	287 (11.3)	92 (3.6)	262 (10.3)	6.3 (13.85)
PFM8-60	292 (11.5)	92 (3.6)	265 (10.4)	7.5 (16.50)
PFM8-85	292 (11.5)	92 (3.6)	265 (10.4)	7.5 (16.50)
PFM8-200	311 (12.3)	105 (4.1)	277 (10.9)	9.1 (20.00)

## ORDERING INFORMATION

Series	Nominal port size	Flow range	Power HP (kW)	Model number
PFM8-15	SAE 12	4 - 56 l/min (1 - 15 gal/min)	52.5 (39)	F5061
PFM8-30	SAE 12	7.5 - 113.6 l/min (2 - 30 gal/min)	105 (78)	F5058
PFM8-60	SAE 16	12 - 227 l/min (3 - 60 gal/min)	210 (157)	F5052
PFM8-85	SAE 16	15 - 321 l/min (4 - 85 gal/min)	298 (222)	F5053
PFM8-200	SAE 24	26 - 757 l/min (7 - 199.9 gal/min)	700 (522)	F5054

## EXAMPLES:

**F5061** = PFM8-15  
SAE 12 ports  
4 - 56 l/min (1 - 15 gal/min)

**F5053** = PFM8-85  
SAE 16 ports  
15 - 321 l/min (4 - 85 gal/min)

## ACCESSORIES

Model number	Description	Series
F4934-1530	Carrying case	PFM8-15 & PFM8-30
F4934-6085	Carrying case	PFM8-60 & PFM8-85
F4934-200	Carrying case	PFM8-200
F1614-7500	Pressure relief disc, 7500 psi (1 per tester)	All PFM8s
F001109	5-point calibration certificate <sup>1</sup>	All PFM8s
F001110	10-point calibration certificate <sup>1</sup>	All PFM8s

<sup>1</sup> Certificates are traceable to NIST, ISO 9001.