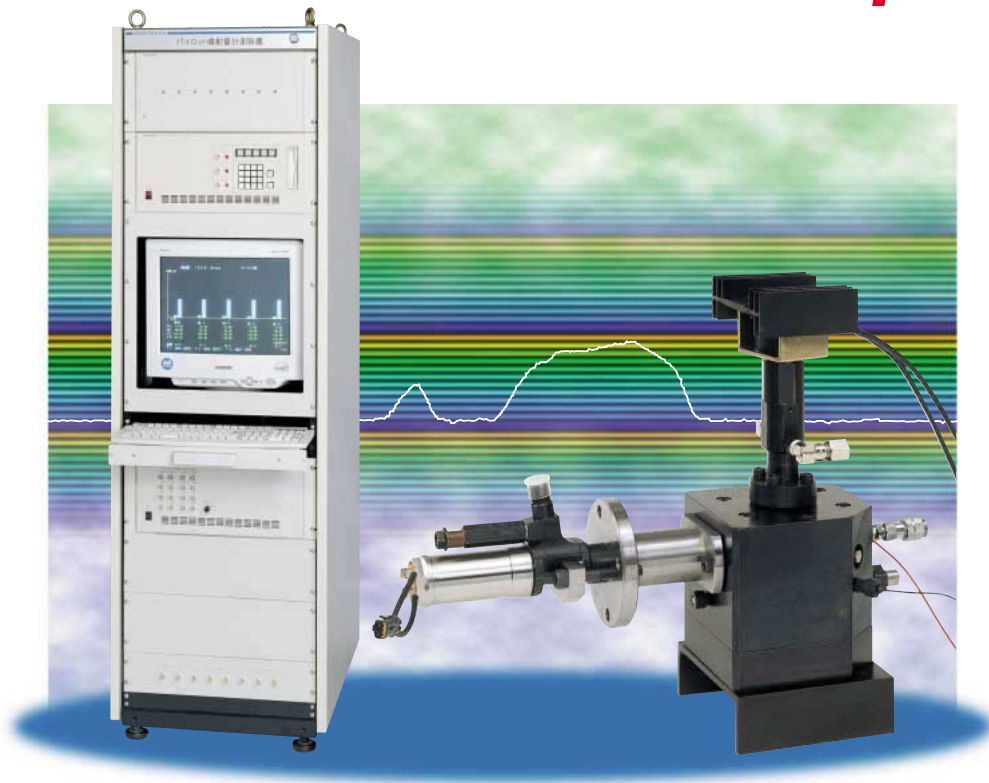


**Discontinued**  
(Reference only)

***New product***



## Pilot Injection Measuring System

# FJ-6000 Series

The FJ-6000 is a precision, multi-functional pilot injection measuring system that can output the continuous signals of the fuel injection rate.

It continuously measures the quantity of each pilot, main and total fuel injection. Results are given for the average, total, maximum and minimum values in tabular format or as bar-graphs.

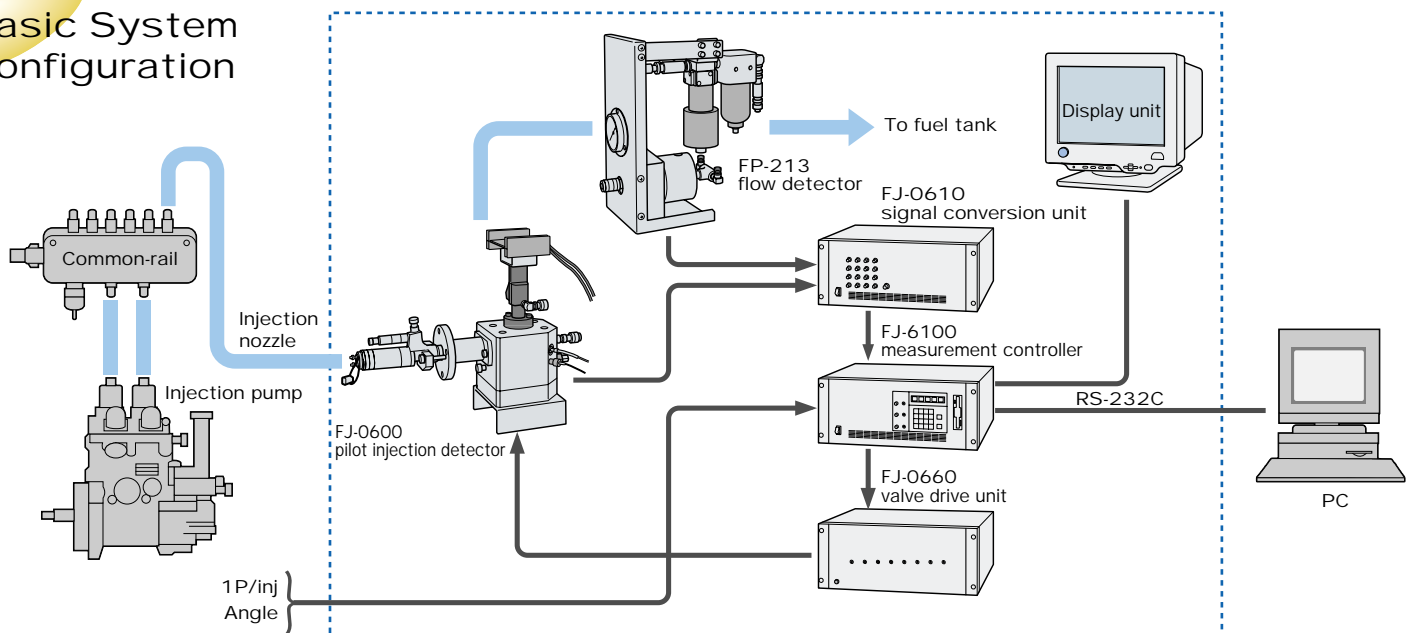
**ONO SOKKI**

# The FJ-6000 series.....advancing pilot injection measuring system more than ever.

## Features:

- Precision pilot injection measurement (within  $\pm 0.5\%$  of reading)
- Wide measuring range (0 to 300 mm<sup>3</sup>/stroke)
- Distortion free injection rate waveform output through digital filtering
- User-defined back pressure setting (1 to 4 MPa)
- Injection-by-injection continuous measurement (0.6 to 50 Hz [36 to 3,000 injections/min])
- Equipped with a measurement controller that can connect to a maximum of eight sensors

## Basic System Configuration



## Specifications

Main function	: Measurement of the fuel injection quantity and rate of a pilot injection system
Measured parameters	: Fuel injection quantity (pilot, main and total injections), fuel injection rate (pilot and main injections), pump revolution (injections/min), fuel temperature, and back pressure
Fuel injection quantity	: Instantaneous value, average, total, standard deviation, maximum, minimum, and cylinder-to-cylinder deviation
System configuration	: ● FJ-0600 pilot injection detector ● FJ-0610 signal conversion unit ● FJ-0660 valve drive unit ● FJ-6100 measurement controller ● External CRT or LCD display unit (optional)

### ● FJ-0600 Pilot Injection Detector

Measuring range	: Pilot injection quantity - 0 to 20 mm <sup>3</sup> /stroke Total injection quantity - 0 to 100 mm <sup>3</sup> /stroke; 0 to 200 mm <sup>3</sup> /stroke; 0 to 300 mm <sup>3</sup> /stroke
Resolution	: 1/1000 of the maximum injection quantity
Accuracy	: Pilot injection quantity - $\pm 0.2$ mm <sup>3</sup> /stroke Main injection quantity - $\pm 0.2$ mm <sup>3</sup> /stroke (for quantities no greater than 40 mm <sup>3</sup> /stroke); $\pm 0.5\%$ of reading (for quantities greater than 40 mm <sup>3</sup> /stroke)
Injection frequency	: 0.6 to 50 Hz (36 to 3,000 injections/min)
Nozzle back pressure	: 1 to 4 MPa
Fuel temperature	: 10 to 80°C (inside the detector)
Pressure detector	: Strain gauge type sensor for back pressure measurement and piezoelectric sensor for pilot and main injection measurement

Temperature detector	: Pt 100 resistance bulb
Others	: Equipped with 12-MPa safety valve

### ● FJ-0610 Signal Conversion Unit

#### [Input Signal]

Pressure	: Pilot and main injections and back pressure Up to 8 input channels for each signal
Temperature	: Inside FJ-0600 and FP-213's inlet (outlet) Up to 8 input channels for each signal
Flow	: From FP-213 Up to 8 input channels for each signal

#### [Voltage Output] <sup>Note 1</sup>

Injection rate	: 0 to 10 V/0 to 100 mm <sup>3</sup> /ms <sup>Note 2</sup> (during calibration)
	<sup>Note 1</sup> The unit outputs the voltage signal for injection rate separately for the pilot injection and main injection pressure detectors.
	<sup>Note 2</sup> This upper limit changes to 200 or 300 mm <sup>3</sup> /stroke, depending on the measuring range applied.

#### [Digital Lowpass Filter]

Bandwidth	: 2, 4, 6, 8 kHz and through
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#### [General Specifications]

Power supply	: 100 V AC $\pm 10\%$ , 50/60 Hz, approx. 100 VA
Outer dimensions	: 420 (W) × 199 (H) × 450 (D) (mm)
Weight	: Approx. 10 kg

### ● FJ-0660 Valve Drive Unit

This unit controls valves (up to 8 channels) by means of a timing signal sent from the FJ-6100 measurement controller.

#### [General Specifications]

# FJ-6100 Measurement Controller Display Examples

# FJ-6000 SERIES

## 《Realtime Injection Quantity》



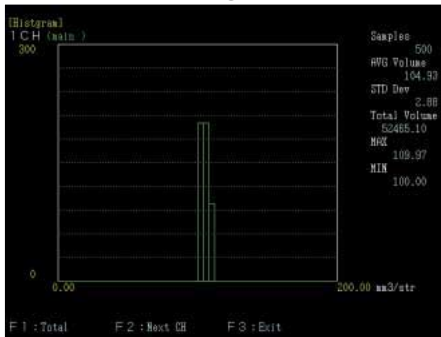
## 《Statistics》

[Statistics Table]						
	AVG Volume (mm <sup>3</sup> /str)	Total Volume (mm <sup>3</sup> )	STD Dev (mm <sup>3</sup> /str)	MRG (mm <sup>3</sup> /str)	MIN (mm <sup>3</sup> /str)	STD Div All (mm <sup>3</sup> /str)
1CH (P)	5.01	2505.23	2.80	9.99	0.00	0.07
(M)	104.94	52485.10	2.88	109.97	100.00	-0.04
(T)	109.94	54970.33	4.20	119.99	100.40	0.03
(FP)	0.00	0.00				
2CH (P)	4.91	2457.18	2.82	9.98	0.00	-0.02
(M)	104.94	52472.20	2.86	109.98	100.00	-0.03
(T)	109.95	54923.33	4.04	119.30	100.31	-0.05
(FP)	0.00	0.00				
3CH (P)	4.91	2457.07	2.88	9.99	0.00	-0.02
(M)	105.13	52584.06	2.85	109.99	100.00	0.15
(T)	110.04	55021.13	3.98	119.07	100.70	0.13
(FP)	0.00	0.00				
4CH (P)	5.08	2530.88	2.88	9.98	0.01	0.12
(M)	104.92	52458.17	2.87	109.96	100.05	-0.05
(T)	109.95	54988.25	4.02	119.42	100.68	0.07
(FP)	0.00	0.00				
AVG(All) CHs(P)	4.95 mm <sup>3</sup> /str	Total Volume All ch(P)	14846.99 mm <sup>3</sup> /str			
(M)	104.98 mm <sup>3</sup> /str	(M)	514923.04 mm <sup>3</sup> /str			
(T)	109.93 mm <sup>3</sup> /str	(T)	529770.00 mm <sup>3</sup> /str			

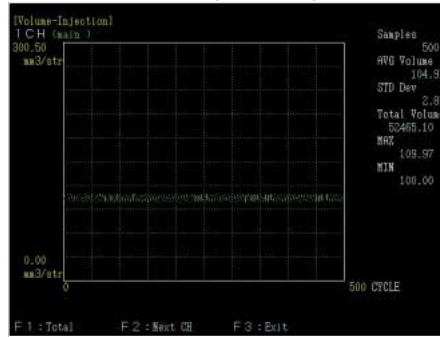
## 《Measured Data》

[Sample Data]							
1 CH	Cycle	Pilot Volume (mm <sup>3</sup> /str)	Main Volume (mm <sup>3</sup> /str)	Total Volume (mm <sup>3</sup> /str)	Temp (°C)	Prse (MPa)	Pump Speed (r/min)
1	1	4.99	105.95	110.91	30.4	1.85	1304.1
2	2	4.48	105.90	111.32	31.3	1.46	1309.0
3	3	1.88	100.74	102.62	29.9	1.75	1302.9
4	4	5.38	109.59	117.92	30.3	1.82	1305.8
5	5	8.81	106.43	115.24	29.1	1.38	1309.9
6	6	2.27	104.27	106.54	27.7	1.18	1303.5
7	7	2.27	104.27	106.54	27.7	1.18	1303.9
8	8	5.74	102.11	107.85	28.2	1.76	1307.9
9	9	7.20	109.86	118.15	27.9	1.21	1301.8
10	10	7.88	107.80	110.45	26.5	1.88	1305.8
11	11	8.13	105.84	111.77	24.0	1.59	1309.8
12	12	8.59	103.49	112.09	24.9	1.24	1303.8
13	13	3.05	101.33	104.38	23.4	1.81	1309.0
14	14	8.52	109.17	115.89	21.9	1.61	1304.0
15	15	8.52	109.17	115.89	21.9	1.61	1304.0
16	16	9.99	107.82	117.00	22.8	1.17	1308.0
17	17	3.44	104.88	108.30	21.3	1.74	1301.9
18	18	8.90	102.70	109.60	20.8	1.53	1305.9
19	19	0.37	100.55	100.92	20.5	1.10	1303.9
20	20	2.83	100.39	112.22	20.2	1.67	1303.8

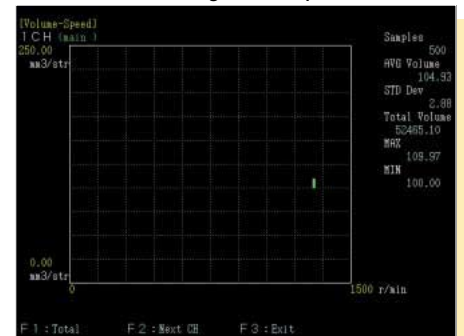
## 《Histogram》



## 《Quantity vs. Cycle》



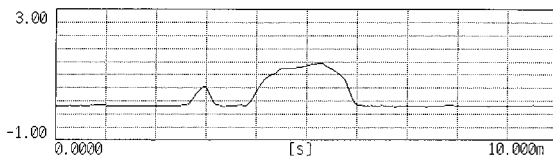
## 《Quantity vs. Speed》



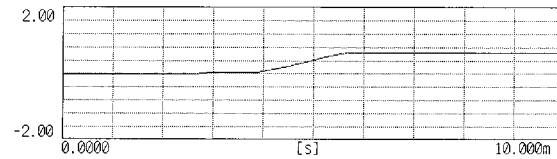
## Injection Rate and Chamber Pressure

Injection pressure: 80 MPa Pilot injection quantity: 5 mm<sup>3</sup>/stroke Main injection quantity: 50 mm<sup>3</sup>/stroke

### 《Injection Rate》



### 《Chamber Pressure》



Power supply <sup>Note 3</sup> : 100 V AC  $\pm$ 10%, 50/60 Hz, approx. 200 VA  
 Outer dimensions : 420 (W)  $\times$  199 (H)  $\times$  450 (D) (mm)  
 Weight : Approx. 18 kg

### ● FJ-6100 Measurement Controller

#### 【Input Section】

Fuel injection quantity input : Up to 8 input channels for each signal  
 (Pilot and main injections) 16-bit A/D converter  
 Fuel temperature input : Up to 8 input channels for each signal  
 (Inside detector and FP-213's inlet (outlet)) 12-bit A/D converter  
 0 to 10 V/0 to 100°C input level  
 Back pressure measurement section : Up to 8 input channels 0 to 10 V/0 to 10 MPa input level  
 (pressure converter equipped as an option)  
 Timing pulse input section : ● 1 P/R and angular signal (either 360, 720, 900, 1800 or 3600 P/R)  
 (detector equipped as an option)  
 ● Injector drive current  
 Input level : 1 P/R 0.3 to 30 Vp-p  
 Angular signal TTL  
 Drive current 0.5 A minimum  
 Adjustable range of trigger level : -7.5 to +7.5 V (for 1 P/R only)

#### 【Display Unit】

Built-in LCD display : Used to confirm settings.  
 External display unit : Either a CRT or LCD display can be connected.  
 Displayable data items formats : ● Bar graph of realtime injection quantity (pilot and main for each channel and

average) and numeric data of realtime injection quantity (pilot, main and total for each channel and average)

- Injection quantity vs. cycle plot (pilot, main and total injections)
- Injection quantity vs. speed plot (pilot, main and total injections)
- Injection quantity histogram (pilot, main and total injections)
- Numeric listing of injection quantities (pilot, main and total injections), temperature and revolution
- All-channel display of the average, total, standard deviation, maximum, minimum and cylinder-to-cylinder deviation of pilot and main injections

#### 【Memory】

Capacity : Maximum of 2,000 cycles' worth of data per channel

#### 【Output Section】

Voltage output : Fuel injection quantity 0 to 3 V/0 to 300 mm<sup>3</sup>/stroke  
 (separately for pilot, main and total injections)  
 Revolution 0 to 3 V/0 to 3000 r/min

#### 【Interface】

Data interface : RS-232C as a standard feature  
 GPIB as an option

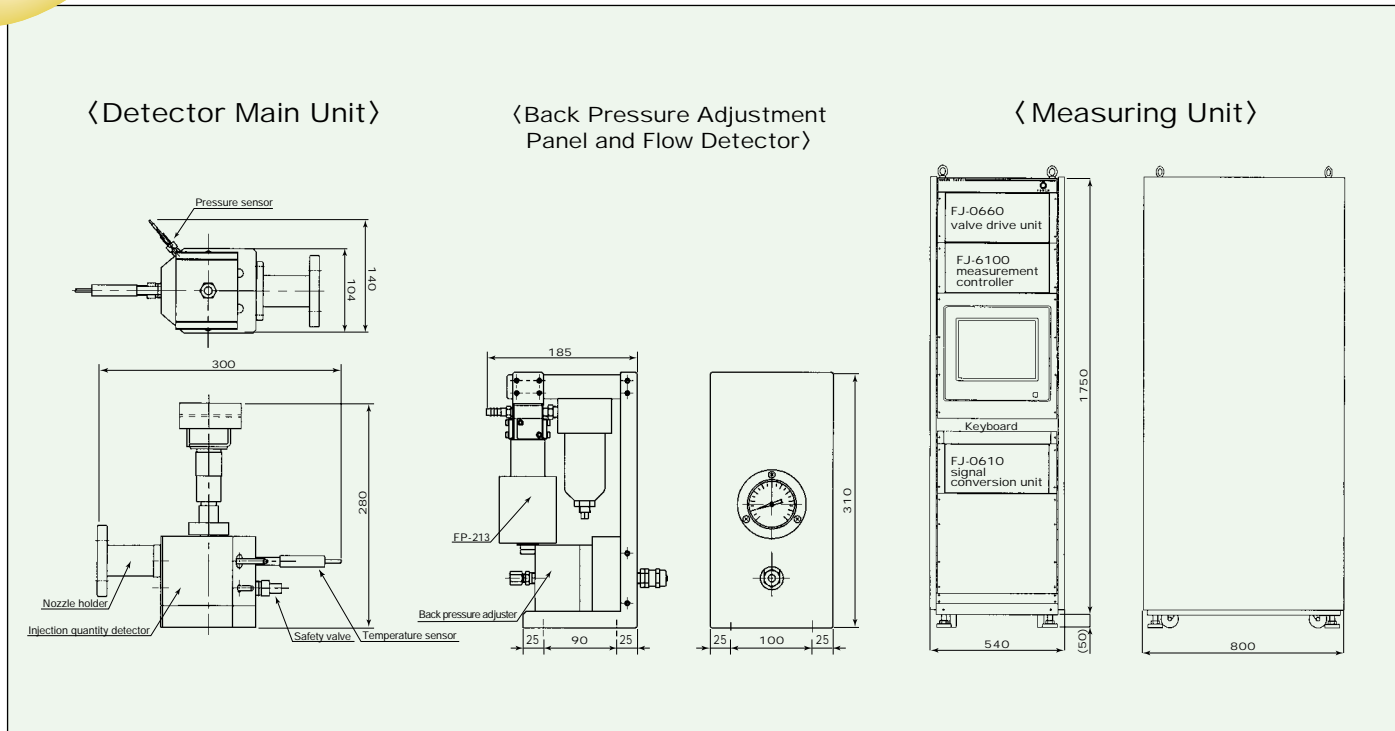
#### 【General Specifications】

Power supply <sup>Note 3</sup> : 100 V AC  $\pm$ 10%, 50/60 Hz, approx. 80 VA  
 Outer dimensions : 420 (W)  $\times$  199 (H)  $\times$  450 (D) (mm)  
 Weight : Approx. 8 kg

Note.3 Power supply requirement of the total system can be adjusted to 100, 120, 220 or 240V.

# Outer Dimensions

(unit:mm)



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\*Outer appearance and specifications are subject to change without prior notice.

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