Z2R-07017A

SAM

Speedy Accuracy Maintainability

Instruction Manual

for

Digital Mass Flow Controller
1480FX/2480FX/1480G/2480G
Series

Hitachi Metals Ltd.

Kuwana Create Co., Ltd.

SAM Research

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1. Preface

Thank you for purchasing one of our SAM Mass Flow Controllers: 1480FX/2480FX/1480G/2480G (also referred to as an "MFC"). In order to use the product correctly, please make sure the supplied product matches the specifications you wanted by referring to the label on the product. Then read this instruction manual.

2. Precautions for use

1) Do not use the MFC in locations exposed to high temperature, high humidity or vibration. The maximum storage temperature of the MFC is 80˚C.
2) Make sure your gas type and flow rate match the specification of this MFC.
   Use of a gas different from the gas specified for the MFC may cause large deviations in the flow rate. The MFC cannot control the flow rate of some gas types.
3) Make sure the installation direction (gas flow direction) is correct. Backward flow may cause the MFC to malfunction.
4) There must not be any gas leaks in the plumbing, especially when using gases at very low concentrations.
5) Use of gas at excessively high pressures may cause faulty operation of the MFC. Observe the specified operating pressure range for the MFC.
   If the MFC is placed under pressure at a level that exceeds its withstand pressure, it may be damaged.
6) Use of the MFC at operating temperatures outside the specified range may cause faulty MFC operation. Use the MFC only within the range of 5 to 50˚C.
7) Do not use contaminated gas. The MFC may become clogged or malfunction.
8) If you need to use highly reactive gas, you must first thoroughly purge the plumbing and the MFC itself.
   Any residual oxygen or moisture left inside due to insufficient purging can cause a chemical reaction, which can damage the MFC.
9) The MFC cannot completely stop the flow of gas itself. If you need to shut off the gas completely, use a separate shut off valve.
10) Note that our standard conditions for calibrated flow rates are 0˚C and 1 atm of pressure (SCCM, SLM).
11) Make sure the ±15 VDC power supply is providing the correct voltage, polarity, and capacity.
    Reversed polarity may damage the unit.
    Supply the positive and negative voltage at the same time (within 1 second).
    The power supply time from zero to full voltage must be 100 ms or less.
    If you want to re-supply power after turning the unit off, wait at least 5 seconds.
    This device is not designed to handle more than 100,000 on and off power cycles.
12) Check that the analog setting input is within the range ±15 VDC.
13) When using the flow rate output, the withstand voltage of the device receiving the output data must be at least ±15 VDC.
14) Make sure the MFC is sufficiently warmed up. The MFC needs at least 30 minutes to warm up and stabilize after turning on the power.

3. Features

1) High-speed response, high accuracy
   The MFC achieves its high-speed response and high accuracy due to the synergistic effect of a layered piezoelectric actuator, a simple valve design, a high-speed, high-precision A/D-D/A conversion, a high-performance microcomputer and a large, non-volatile memory.
2) Clean design
   a) No particle generation — Simple design does not use any sliding parts in gas-contact areas, such as springs.
   b) Metal seal — Simple design does not use any elastomer or rubber parts in the gas-contact areas. All sealing portions consist entirely of 316L SS.
   c) Surface finish — The gas-contact parts are polished using a special electropolishing technique, and the final surface roughness is Ry0.4 μm.
3) The multi gas/multi-range function (MG/MR) - Standard feature on all series -
   After purchase, the MFC gas type, flow rate, and flow rate unit can be changed with dedicated software. (However, there is a limit to the ranges when changing the settings.)
   Guaranteed flow rate accuracy using the actual gas.
4) Pressure insensitive function (PI) - Optional feature (G1/G3/G4 series) -
   Reduce variations in the controlled flow rate when the supply gas pressure varies.
5) Built-in inlet pressure sensor - Optional feature (G1/G3/G4 series) -
   The built-in pressure sensor monitors inlet pressure and the MFC displays the pressure reading on the LCD display.
   This pressure can also be monitored through the digital commands.
6) LCD display - Optional feature (G1/G3/G4 series) -
   The built-in pressure sensor monitors the inlet pressure, and the temperature sensor monitors the ambient temperature near the MFC. These are displayed in LCD display placed on the top of MFC. The display can be used to show the set-point or the flow output using the LCD select switch and digital commands.
7) Flow verification function (FV) - Optional feature (G4 series) -
   Using this function, the MFC can verify its own actual flow rate variations, without disconnecting the MFC from the plumbing.
   This function allows re-calibration of variations in the flow rate.
8) Flow control valve shut-off function - Optional feature (G2/G3/G4 series) -
   By using a built-in metal diaphragm valve, the MFC reduces its internal leakage, which is the leakage through the flow control valve, to an absolute minimum.
9) 2-mode alarm output and LED status display.
10) The following functions can be used with the digital command settings.
    a. Ramping function
    b. Flow integration
    c. SMV mode (piezo valve mode)
11) General-purpose digital interface (RS232C or RS485)

Table of functions and series

MFC series models	Functions included					Remarks
	Standard	Optional functions				
	MG/MR function	PI function	FV function	Valve shut-off function	LCD display	
1480FX / 2480FX	○	-	-	-	-	MG/MR
1480G1 / 2480G1	○	○	-	-	○	MG/MR + PI
1480G2 / 2480G2	○	-	-	○	-	MG/MR + Shut
1480G3 / 2480G3	○	○	-	○	○	MG/MR + PI + Shut
1480G4 / 2480G4	○	○	○	○	○	All-In-One

○: Included -: Not available

4. Specifications

4-1. Functions and operating conditions

1	Model			1480FX / 2480FX / 1480G / 2480G
2	Functions	High-accuracy flow control		Standard
		Multi-gas / Multi-range function (MG/MR)		Standard
		Pressure insensitive function (PI)		Optional (G1/G3/G4 series)
		Built-in pressure sensor		Optional (G1/G3/G4 series)
		Control valve auto close function		Standard
		Digital communication - Write a set-point - Read the flow output - Reset the flow sensor zero		Standard (RS232C or RS485)
		Control valve shut off function		Optional (G2/G3/G4 series)
		Flow verification function (FV)		Optional (G4 series)
3	Standard full scale flow rate *1 (N2 equivalent)		FR-01	2 to 5 SCCM *2
			FR-02	6 to 14 SCCM
			FR-03	15 to 27 SCCM
			FR-04	28 to 38 SCCM
			FR-05	39 to 71 SCCM
			FR-06	72 to 103 SCCM
			FR-07	104 to 192 SCCM
			FR-08	193 to 279 SCCM
			FR-09	280 to 754 SCCM
			FR-10	755 to 2,037 SCCM
			FR-11	2,038 to 5,500 SCCM
			FR-12	5,501 to 11,000 SCCM
			FR-13	11,001 to 30,000 SCCM
			FR-14	30,001 to 50,000 SCCM
4	Valve operation			Normally closed / Normally open
5	Flow control range			2 to 100%FS
6	Operation pressure *3		Differential pressure	0.05 to 0.30 MPa(D): (FR-01 to 12) 0.10 to 0.30 MPa(D): (FR-13) 0.15 to 0.30 MPa(D): (FR-14)
			Outlet pressure	Vacuum to Atmospheric pressure
7	Proof pressure			1.0 MPa(G)
8	Temperature		Operation	5 to 50˚C
			Accuracy guaranteed	15 to 35˚C
			Baking	Max 65˚C
9	Humidity			35 to 80%RH (non condensing)
10	Mounting attitude			Horizontally or vertically (in any position)
11	Set-point input			0.1 to 5 VDC (absolute rating ±15 VDC)
12	Flow signal output			0 to 5 VDC (maximum output ±15 VDC)
13	Power supply		FX, G1 series	+15 VDC ± 4%, max. 140 mA -15 VDC ± 4%, max. 140 mA
			G2, G3, G4 series	+15 VDC ± 4%, max. 200 mA -15 VDC ± 4%, max. 150 mA
14	Warm up time			At least 30 minutes

*1 FR-12, 13 and 14 are available for FX and G1 series only.

*2 SCCM flow rate units represent values converted to mL/min (0˚C, 1 atmospheric pressure), CCM represents values converted to mL/min. (25˚C, 1 atmospheric pressure).
SLM flow rate units represent values converted to L/min (25˚C, 1 atmospheric pressure).

*3 Contact us for the pressure of low differential pressure models.

4-2. Hardware specifications

1	Gas path Materials	Body, Fitting, bypass, valve orifice	316L SS
		Diaphragm	YET101 (Ni-Co alloy)
		Flow sensor	316L SS (FR-01 to 12) Ni (FR-13 and 14)
		Seals	Metal O ring (316L SS)
		Shut valve (G2/G3/G4 series)	316L SS, YET101, PCTFE
		Pressure sensor (G1/G3/G4 series)	316L SS
		Flow verification tank (G4 series)	316L SS
2	Surface finish of gas wetted area		Special electropolishing
3	Fittings *4		W seal, C seal, H1G seal, 1/4"HMJ (UJR) male
4	LCD display		6×4mm, 4 digits display, LED backlight
5	External leak integrity		$<1\times10^{-11}$Pa m^3/s (He)
6	Internal leak integrity	FX, G1 series (Without valve shut off function)	<0.5%FS
		G2, G3, G4 series (With valve shut off function)	$<1\times10^{-8}$Pa m^3/s (He)

*4 H1G seal is available for 1.5" IGS model (14** series) only.

4-3. Flow control performance

1	Accuracy (Does not include zero deviation)	Nitrogen	10 to 100%	±(0.5%SP + 0.15%FS)
			2 to 10%	±0.2%FS
			(Example)	At 5%: ±4.0%SP, At 10%: ±2.0%SP
		Actual gas	10 to 100%	±(1.5%SP + 0.35%FS)
			2 to 10%	±0.5%FS
			(Example)	At 5%: ±10.0%SP, At 10%: ±5.0%SP
2	Linearity	Nitrogen		±0.3%FS
		Actual gas		±1.0%FS
3	Repeatability (included in accuracy)		10 to 100%	±(0.1%SP+0.05%FS)
			2 to 10%	±0.06%FS
4	Zero shift guarantee			Within ±0.5%FS/year
5	Temperature sensitivity		Zero	±0.01%FS/˚C (15 to 35˚C)
			Span	±0.01%SP/˚C (15 to 35˚C)
6	Response time	0 → (20 to100%)		Less than 1.0 sec to within ±2%SP
		0 → (2 to 20%)		Less than 1.5 sec to within ±0.4%FS

4-4. Pressure insensitive function (PI) (G1/G3/G4 series)

1	Pressure transient sensitivity	Pressure gradient < 0.5kPa / 0.12s (Normal flow control mode)		±1.0%SP after transients stop + 1 second
		Pressure gradient: ≥ 0.5kPa/0.12s (PI mode)	Pressure delta < 0.02MPa	±(1.5%SP+1.0%FS) after transients stop + 1 second
			Pressure delta 0.02 to 0.05MPa	±(3.0%SP+1.0%FS) after transients stop + 1 second

4-5. Built-in metal diaphragm valve (Shut-off function) (G2/G3/G4 series)

1	Valve operation pressure	0.4 to 0.7MPa(G)
2	Internal leak integrity	$<1\times10^{-8}$Pa･m^3/s (He)
3	Durability (allowable number of open / close operations)	2 million times (including opening and closing during flow verification)
4	Valve operation	Normally open

4-6. Flow verification function (FV) (G4 series)

1	Verifiable range	Full scale flow range	10 to 5500 SCCM
		Set-point range	2 to 100%FS
2	Verification repeatability (3σ)	10 to 400 SCCM	±1.5%SP
		401 to 5500 SCCM	±2.5%SP
3	Pressure range *5	Inlet pressure	0.05 MPa (G) to 0.3 MPa (G)
		Outlet pressure	-0.08 MPa (G) or less (at 100% flow rate)
4	Verification repeatability guaranteed pressure		Pressure when obtaining the reference data ±0.03MPa
5	Verification time		2 to 4 minutes
6	Re-calibration	Range of span deviation re-calibration	Less than ±20% (cumulative)
		Range of zero deviation re-calibration	Less than ±20% (cumulative)
		Re-calibration time	2 seconds

*5 Contact us for the pressure of low differential pressure models.

4-7. Built-in pressure sensor (G1/G3/G4 series)

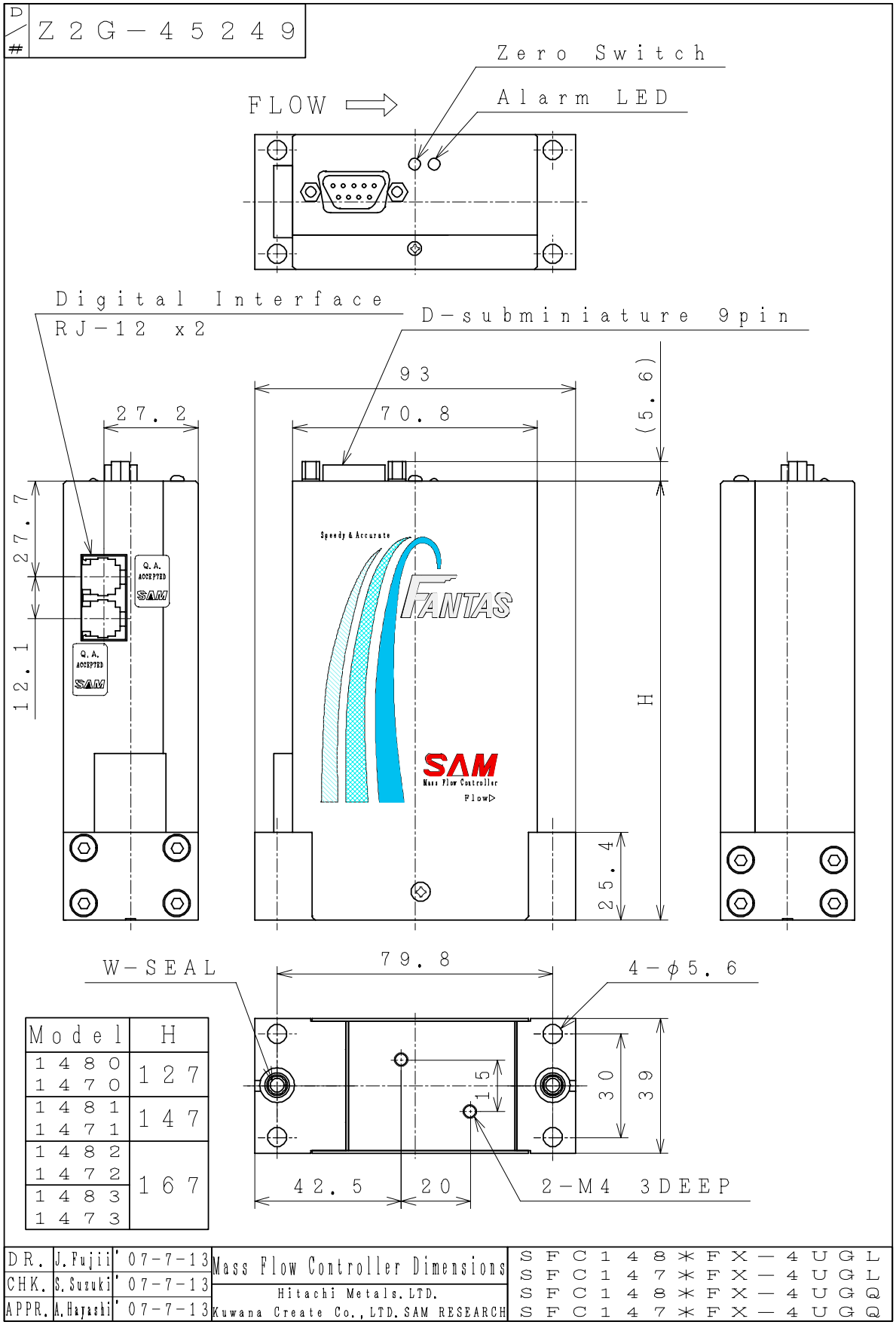
1	Pressure range	-0.1 to 1.0 MPa (G)
2	Accuracy	±0.5%FS
3	Repeatability	±0.01%FS
4	Structure	Diaphragm type
5	Temperature drift	0.05%/˚C
6	Display range	-99.9 to 999.9 kPa
7	Output	Can be read via digital communication (no analog output)

4-8. Temperature sensor (G1/G3/G4 series)

1	Temperature sensor	Platinum resistance temperature detector
2	Measuring range	273.2 to 323.2K
3	Display range	273.2 to 323.2 K

5. Dimensions

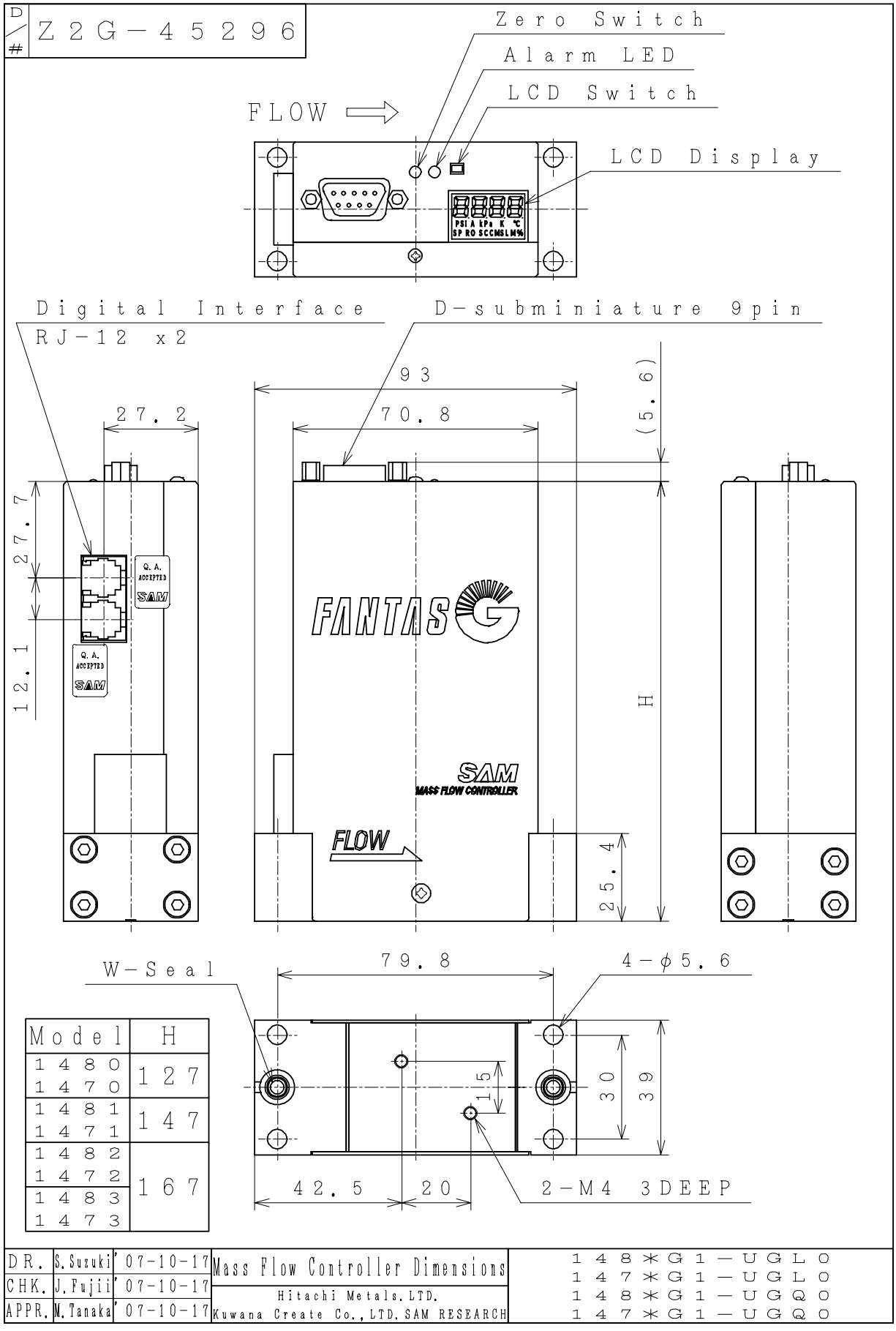
5-1. 1480FX, 1.5" IGS, W-seal



Model	H
1480 1470	127
1481 1471	147
1482 1472	167
1483 1473	

DR.	J.Fujii	'07-7-13	Mass Flow Controller Dimensions	SFC148*FX—4UGL
CHK.	S.Suzuki	'07-7-13	Hitachi Metals.LTD.	SFC147*FX—4UGL
APPR.	A.Hayashi	'07-7-13	Kuwana Create Co.,LTD.SAM RESEARCH	SFC148*FX—4UGQ
				SFC147*FX—4UGQ

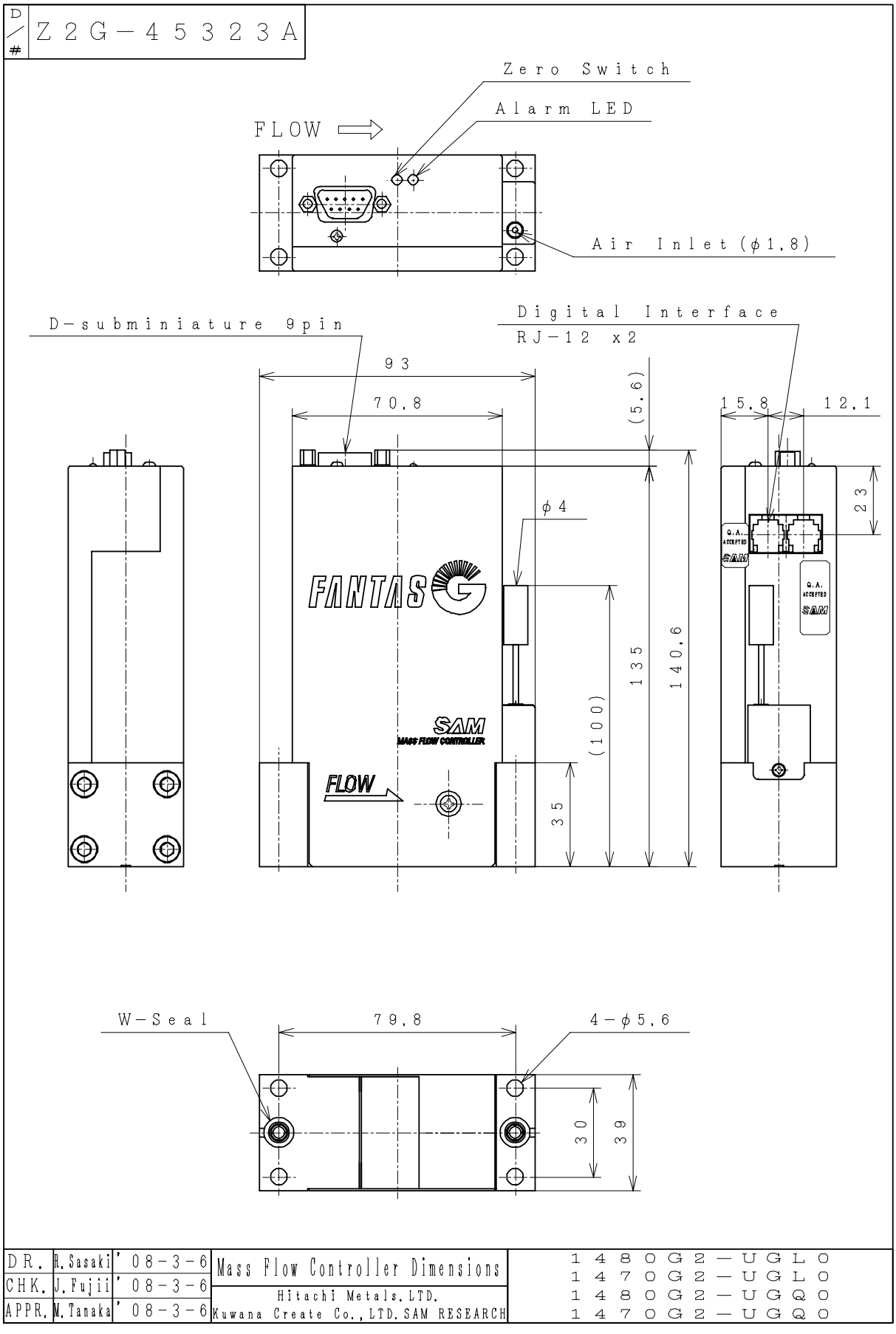
5-2. 1480G1, 1.5" IGS, W-seal



Model	H
1480 1470	127
1481 1471	147
1482 1472	167
1483 1473	

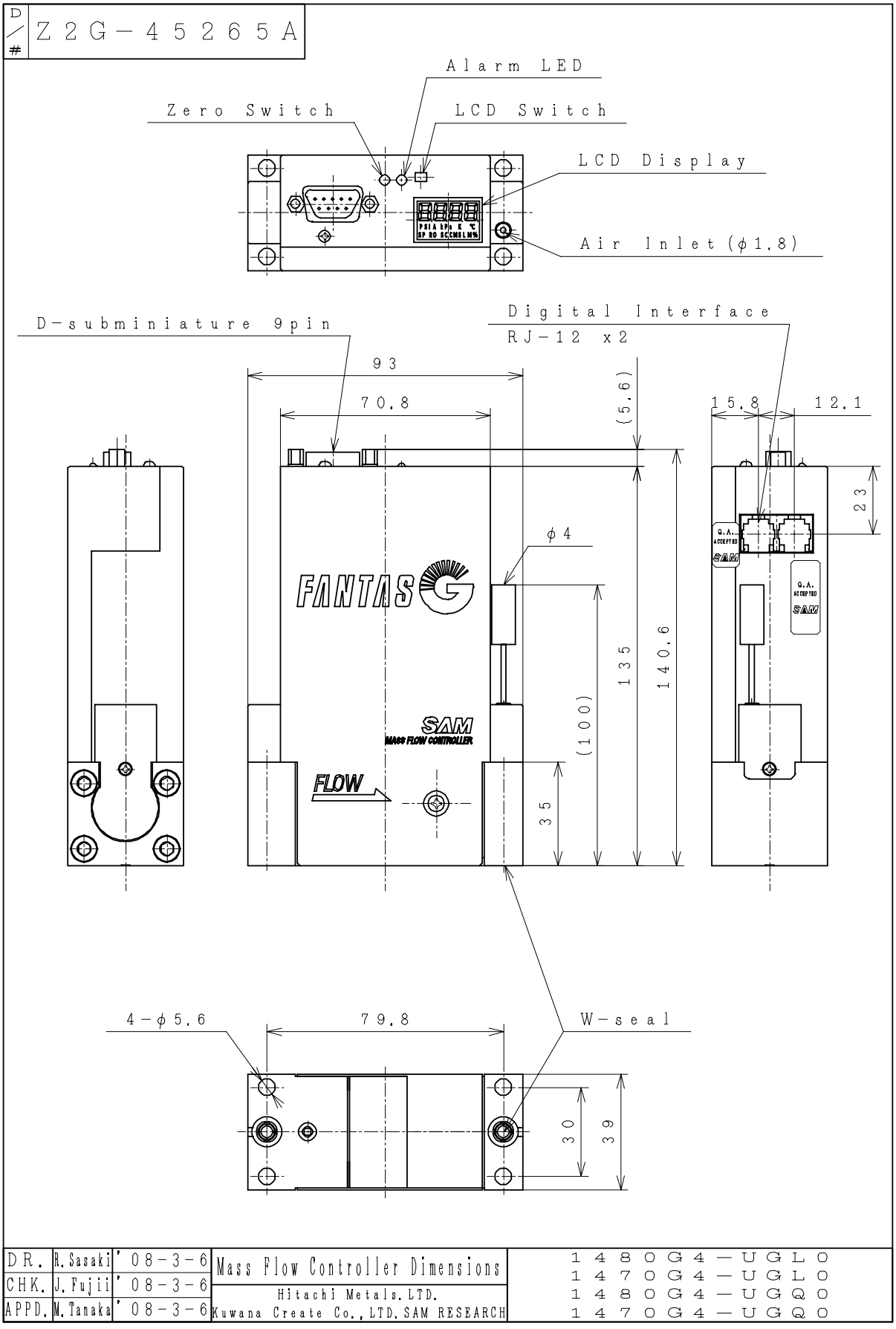
DR.	S.Suzuki	'07-10-17	Mass Flow Controller Dimensions	1480＊G1－UGLO 1470＊G1－UGLO 1480＊G1－UGQO 1470＊G1－UGQO
CHK.	J.Fujii	'07-10-17	Hitachi Metals,LTD.	
APPR.	M.Tanaka	'07-10-17	Kuwana Create Co.,LTD.SAM RESEARCH	

5-3. 1480G2, 1.5" IGS, W-seal



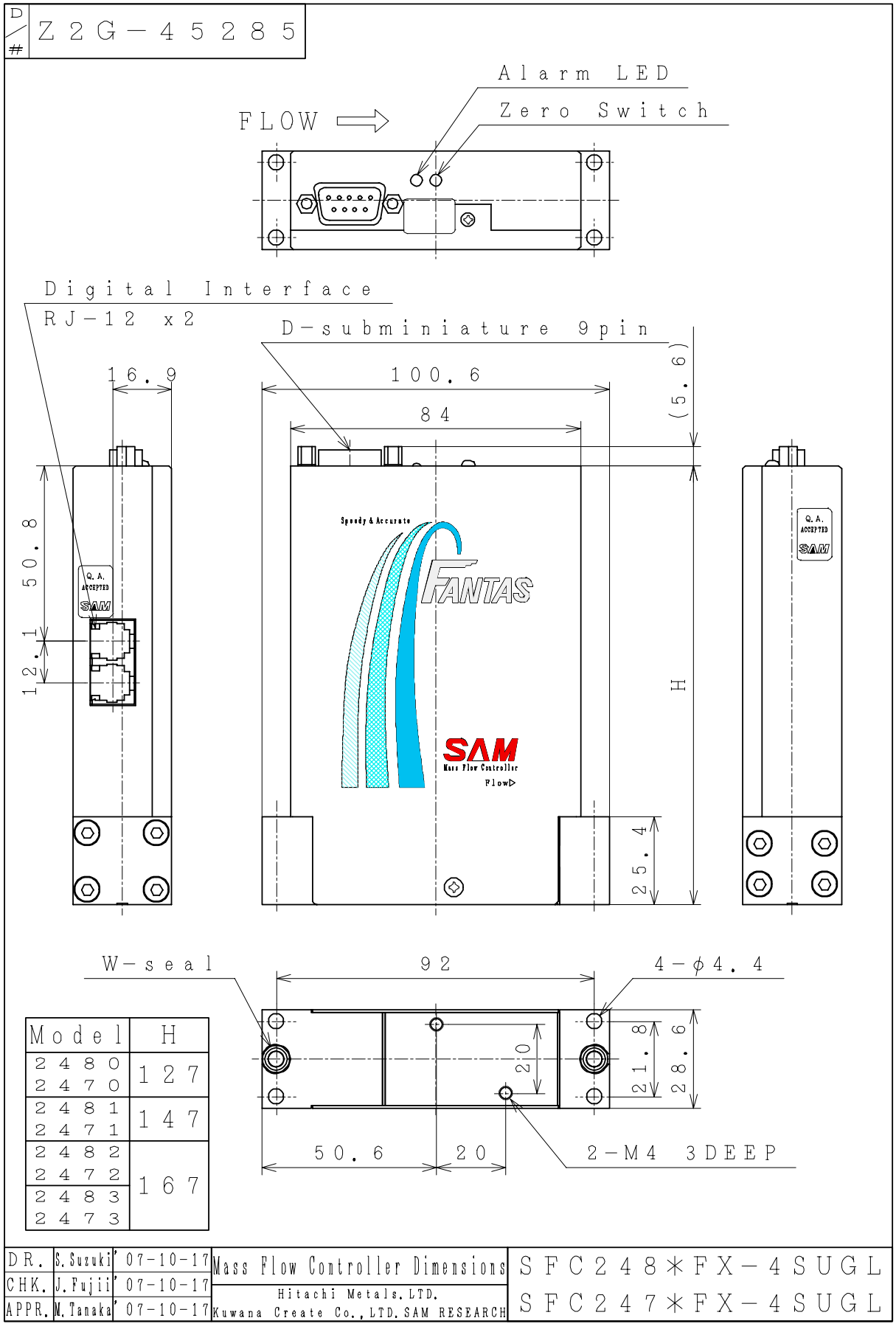
DR.	R.Sasaki	'08-3-6	Mass Flow Controller Dimensions	1480G2-UGLO
CHK.	J.Fujii	'08-3-6		1470G2-UGLO
APPR.	M.Tanaka	'08-3-6	Hitachi Metals.LTD.	1480G2-UGQO
			Kuwana Create Co.,LTD.SAM RESEARCH	1470G2-UGQO

5-4. 1480G4, 1.5" IGS, W-seal



DR.	R.Sasaki	'08-3-6	Mass Flow Controller Dimensions	1480G4-UGLO 1470G4-UGLO 1480G4-UGQO 1470G4-UGQO
CHK.	J.Fujii	'08-3-6	Hitachi Metals.LTD.	
APPD.	M.Tanaka	'08-3-6	Kuwana Create Co.,LTD.SAM RESEARCH	

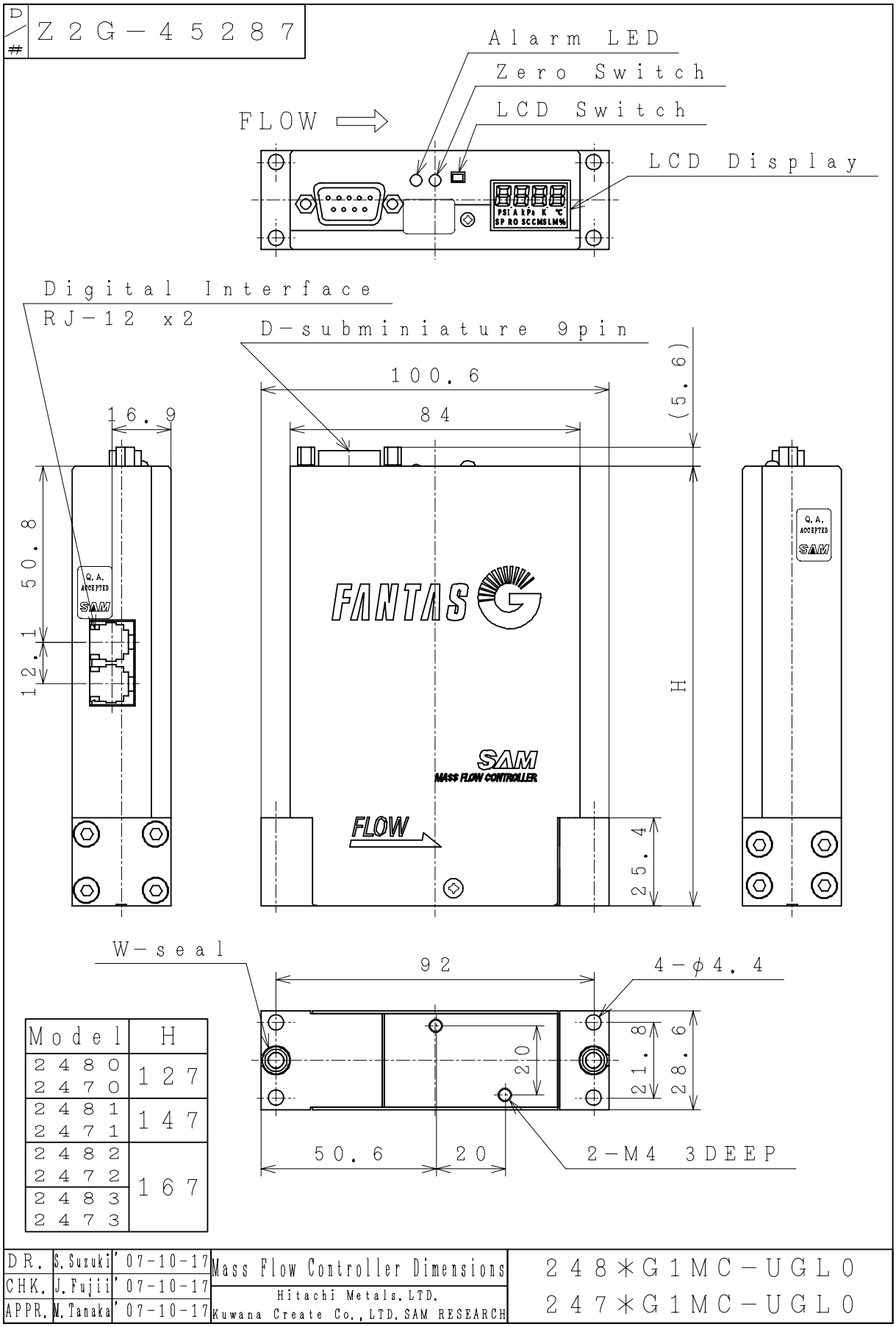
5-5. 2480FX, 1.125" IGS, W-seal



Model	H
2480 2470	127
2481 2471	147
2482 2472	167
2483 2473	

DR.	S.Suzuki	07-10-17	Mass Flow Controller Dimensions	SFC248＊FX－4SUGL
CHK.	J.Fujii	07-10-17	Hitachi Metals.LTD.	SFC247＊FX－4SUGL
APPR.	M.Tanaka	07-10-17	Kuwana Create Co.,LTD. SAM RESEARCH	

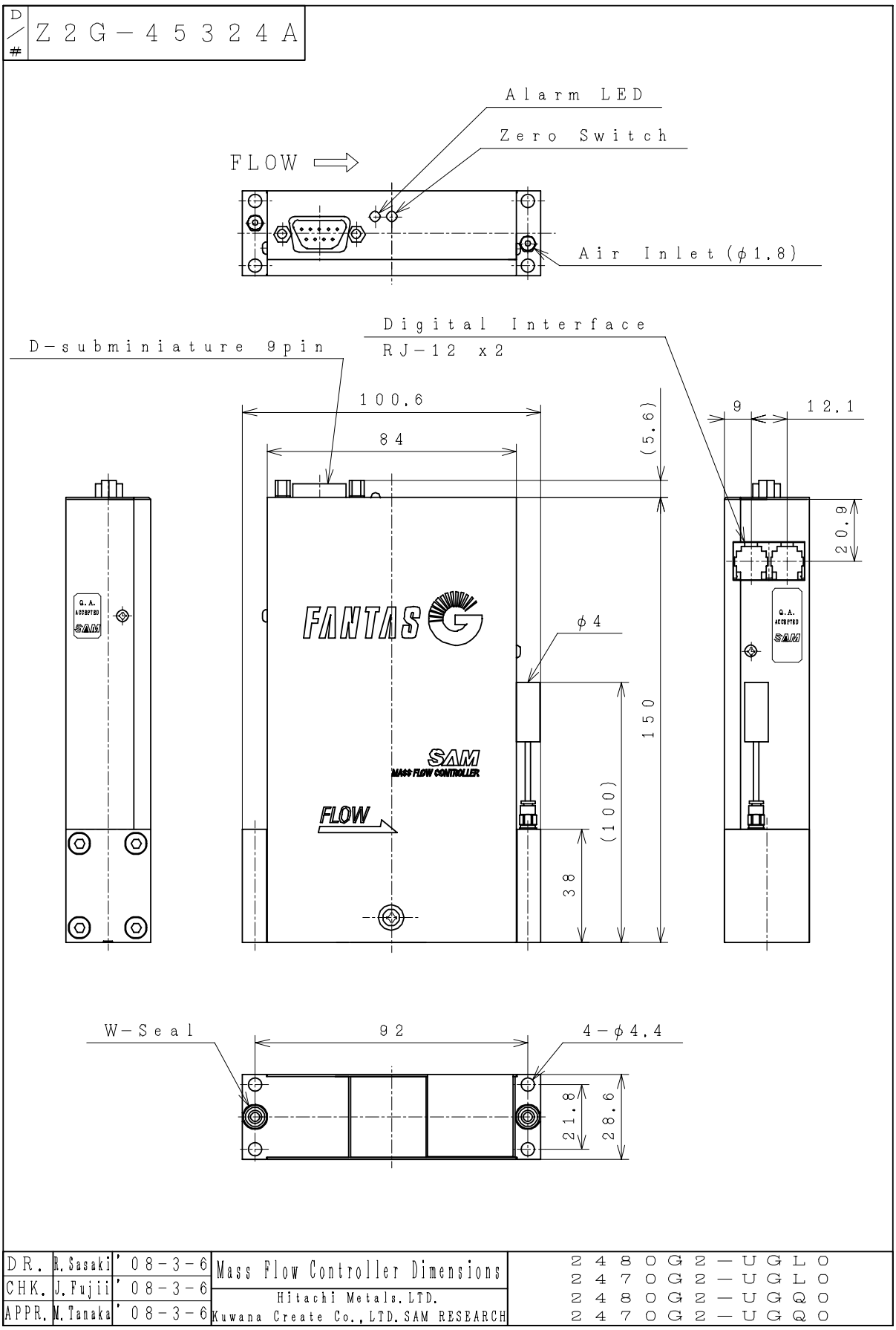
5-6. 2480G1, 1.125" IGS, W-seal



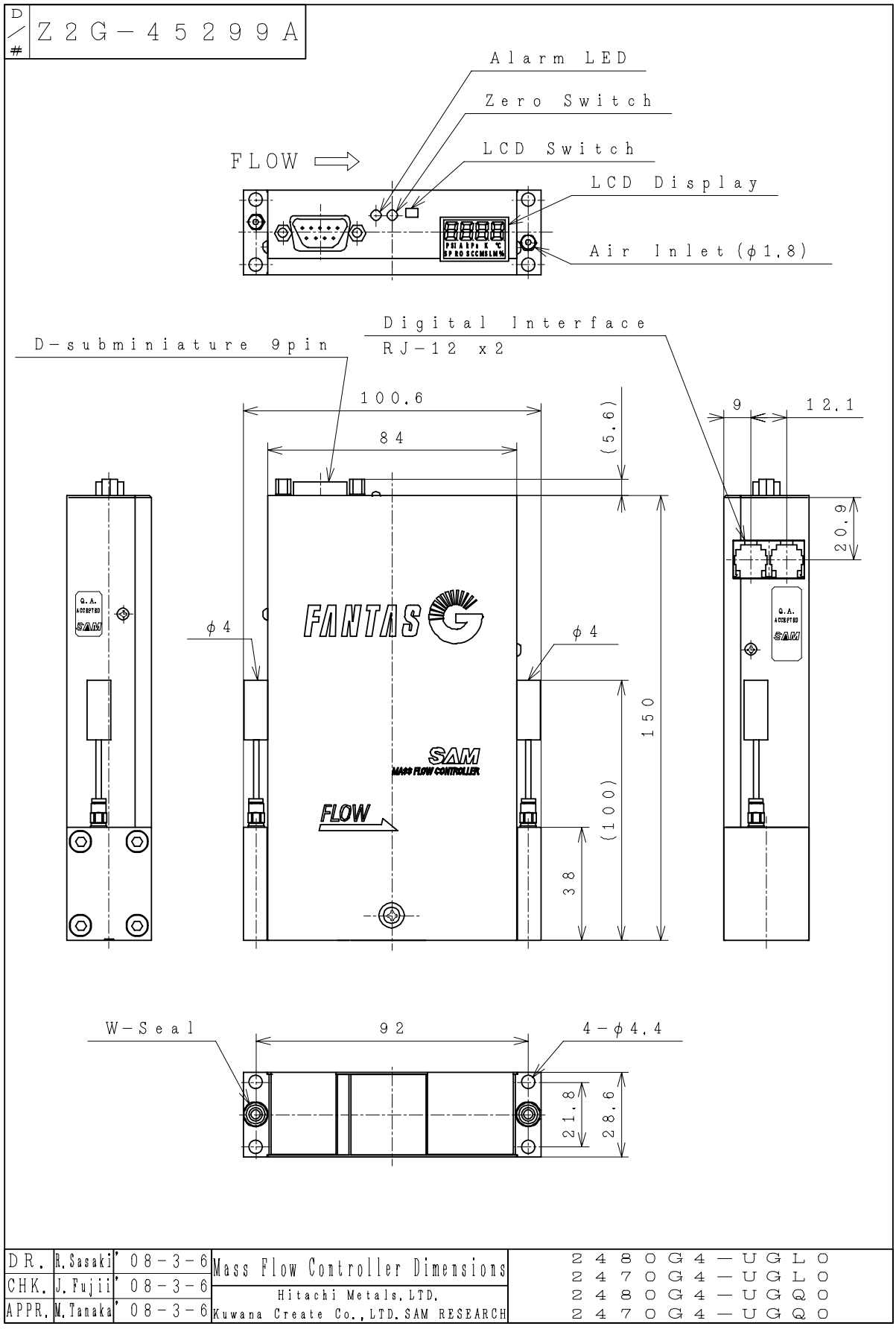
Model	H
2480 2470	127
2481 2471	147
2482 2472	167
2483 2473	

DR.	S.Suzuki	'07-10-17	Mass Flow Controller Dimensions	248＊G1MC－UGL0
CHK.	J.Fujii	'07-10-17	Hitachi Metals.LTD.	247＊G1MC－UGL0
APPR.	M.Tanaka	'07-10-17	Kuwana Create Co.,LTD.SAM RESEARCH	

5-7. 2480G2, 1.125" IGS, W-seal



5-8. 2480G4, 1.125" IGS, W-seal



DR.	R.Sasaki	'08-3-6	Mass Flow Controller Dimensions	2480G4-UGLO
CHK.	J.Fujii	'08-3-6		2470G4-UGLO
APPR.	M.Tanaka	'08-3-6	Hitachi Metals, LTD.	2480G4-UGQO
			Kuwana Create Co., LTD. SAM RESEARCH	2470G4-UGQO

6. Connections

6-1. Analog interface connector

Connector: D-subminiature 9-pin connector (set screw: M3)

Applicable plug: 17JE-13090-02 (D8B) (made by DDK) or equivalent

1) Connector type: "L"

Pin No.	Signal
1	Valve open/close input (+15 VDC: Fully open, -15 VDC: Fully closed.)
2	Flow output (0 to 5 VDC)
3	+15 VDC
4	COM (for ±15 VDC)
5	-15 VDC
6	Set-point input (0.1 to 5 VDC)
7	COM (for the output)
8	COM (for the set-point input)
9	Valve voltage monitor (0 to 5 VDC)

Note 1: Valve open/close input signal

The flow control valve fully opens, when +15VDC is applied to the pin 1.

The flow control valve fully closes, when -15VDC is applied to the pin 1.

Note 2: All of the COM lines are connected to each other.

Note 3: The valve open / close function can be used even when the set-point input signal is input.

Priority of these signals is as follows.

1) Valve open / close signal

2) Set-point input signal.

Note 4: +15VDC, -15VDC, COM (for ±15 VDC)

When supplying power, the positive and negative voltages must be powered up at the same time (within one second of each other). The power supply voltage rise time must be less than 100 ms.

Note 5: The output impedance of the valve voltage monitor terminal is 10 ohm or less. Its output is not protected. Do not short circuit this line to the COM terminal.

2) Connector type: "Q"

Pin No.	Signal
1	Valve forced open (actuate by connecting this pin to the COM terminal)
2	Flow output (0 to 5 VDC)
3	+15 VDC
4	COM (for ±15 VDC)
5	-15 VDC
6	Set-point input (0.1 to 5 VDC)
7	COM (for the output)
8	COM (for the set-point input)
9	Valve forced close (actuate by connecting this pin to the COM terminal)

Note 1: By connecting pin 1 (valve forced open) to COM, and pin 9 (valve forced closed) to COM, the valve will behave as directed.

Note 2: All of the COM lines are connected to each other.

Note 3: The valve open / close function can be used even when the set-point input signal is input.

Priority of these signals is as follows.

1) Valve open / close signal

2) Set-point input signal.

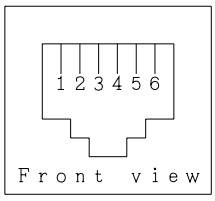
Note 4: +15VDC, -15VDC, COM (for ±15 VDC)

When supplying power, the positive and negative voltages must be powered up at the same time (within one second of each other). The power supply voltage rise time must be less than 100 ms.

6-2. Digital interface connector

Connectors used: 43814-6621 (made by Molex) (RJ-12 * 2)

Pin No.	Signal	
	RS232C	RS485
1	COM (for signals)	
2	No connection	
3	Rxd	RS-
4	Txd	RS+
5	No connection	
6	No connection	



The COM of the digital interface connector is shorted to the COM of the analog connector inside the MFC housing.

Note 1: Rxd, Txd (RS232C); Input/output for theRS232C interface.

Note 2: RS-, RS+ (RS485); Input/output for the RS485 interface.

7. Multi-gas / multi-range function (MG/MR function), standard on all series

This function lets you change the gas type, flow rate, and flow rate units after purchase.

To change the specifications, connect the MFC to a personal computer which has our exclusive software installed on it. Specify the new gas type, flow rate, and flow rate units to use through the digital communication. (However, there are limits to the size of the changes that can be made.)

For recommended gas pressure settings after Multi-gas / Multi-range change, see the separate “Z2R-08015 : MFC RECOMMENDED GAS PRESSURE SETTINGS”.

8. Pressure insensitive function (PI), optional on the G1/G3/G4 series

When the inlet pressure fluctuates, the built-in pressure sensor in the MFC detects the fluctuation. Based on the amount of fluctuation, the MFC controls the valve gap of flow control valve to keep the flow stable.

9. LCD display, optional on the G1/G3/G4 series

The back lit LCD on the top of the MFC will show the following.
Change the item displayed using the select switch on top of the MFC or the digital command (*).

1) Inlet pressure (kPa(G) or PSIA)
2) Ambient temperature (K (Kelvin) or ˚C)
3) Set-point (SCCM / SLM / CCM / LM or %)
4) Flow output (SCCM / SLM / CCM / LM or %)

Each time you press the LCD select switch on the top of the MFC, the units specified will change, in the following order:

Pressure "kPa" → Pressure "PSIA" → Temp. "K" → Temp. "˚C"
→ Set-point "SCCM or SLM or CCM or LM" → "Set-point (%)"
→ Flow output "SCCM or SLM or CCM or LM" → Flow output "%"

10. Flow verification function (FV), optional on the G4 series

This function enables you to verify the flow rate and correct the variation in the flow rate without disconnecting the MFC from the gas piping.
MFC verifies zero deviation and span deviation (deviation of the full scale flow) of its flow sensor by comparing with reference data previously obtained through user's operation.

<Common Procedure of flow verification>

1. Measure the reference data. - Reference data measurement -
   Measure the MFC's condition to be compared with a future condition previously, for example, at the start-up period of a semiconductor equipment.
   5 reference datas can be memorized in the MFC.
2. Use MFC for a certain period of time.
3. Verify the flow rate at the time. – Flow verification -
   Measure the MFC's condition at the time.
   You can compare the result with any of the memorized 5 reference datas and see the deviation.
4. Correct the deviation - Re-calibration -
   You can restore the flow of the MFC to the compared reference data condition.

To use this function, press the zero adjustment switch on the top of the MFC, use our special program for flow rate tests, or use the digital commands.
For details, see the separate "Z2R-08009 : Flow Verification Digital Command" specification.

11. Flow control valve shut-off function, optional on the G2/G3/G4 series

A metal diaphragm valve (MDV) is built into the MFC. When the flow set-point is set to 0%, or the control valve is fully closed, the MFC closes the MDV in conjunction with the flow control valve. This function makes the internal leak integrity improved to 1×10^{-8}Pa m^3/s (He), or less.
This function can be enabled or disabled using the digital command.
For details, see the separate "Z2R-08010 : Instruction Manual for Digital Commands".

12. Alarm functions

The 1480FX/2480FX/1480G/2480G series MFCs have two types of alarms: Alarm A and alarm B. You can set the delay time (alarm timer), alarm threshold (alarm window) and alarm mask by using digital commands. You can also monitor the alarm status.
When an alarm occurs, the lighting pattern of the LED on the top of the MFC will change. Therefore, you can monitor the status of an alarm without using commands.

LED lighting pattern when an alarm occurs

Alarm status		LED
No alarm output (normal operation)		Flashes green, once per second
Alarm A	Supply voltage error	Goes off
	Disagreement between set-point input and flow output	Lights red
	Digital communication error EEPROM access error	
Alarm B	Control status change (from the preset value) (1) Pressure (2) Operation temperature (3) Clogging of valve or sensor in MFC (4) Flow rate change due to other reasons	Flashes red every 0.5 seconds

12-1. Alarm A: Alarm A can be triggered by any of the following five fatal errors.

a) Supply voltage error
This error occurs when the +15 VDC supply voltage drops (to approximately +12 VDC or less). Even if the voltage drop is temporary and the voltage returns to normal, the MFC will latch the alarm output (keeps LED light off as this is normal close contact).
Turn the power off and on again and to clear this alarm.

b) Digital communication error
This error occurs when the MFC receives commands with a different communication format or different communication speed than was specified, when a parity error or checksum error occurs, or if an abnormal length command is received.
When this error occurs, the MFC latches the alarm status. However, if the alarm latch function has been disabled, the MFC will clear this alarm if the next command is normal.

c) EEPROM access error
This error occurs when a faulty software switch setting is made, or when an error occurs while reading or writing an EEPROM (non-volatile memory). The MFC always latches this alarm after it occurs. Although the alarm can be cleared using an alarm clear command, unless a normal value is written, the same alarm may occur again when accessing the same data.

d) Disagreement between set-point input and flow output
This error occurs when the set-point input and the flow output do not match.
You can set the alarm threshold and the unit of threshold as a percentage of the full scale or a percentage of the setting. This alarm only occurs when the valve mode is set to "servo mode (flow control mode)". When the valve mode is set to "open" or "close," this alarm will not occur.

e) Integration Level 2 exceeded
This error occurs when the integrated flow exceeds Integration Level 2.
If you don't clear the integrated flow, you cannot clear this alarm.

12-2. Alarm B: Alarm B can be triggered by any of the following three alarm factors.

a) Excessive zero offset
This error occurs when the zero correction value is larger than 10% of FS (FS: Full Scale).

b) Integration Level 1 exceeded
This error occurs when the integrated flow exceeds the Integration Level 1 setting.
If you don't clear the integrated flow, you cannot clear this alarm.

c) Variation in sensor current, valve voltage, sensor bridge voltage, analog setting, or sensor output
These are factors used to monitor internal changes. You have to enter reference values before using the MFC. The MFC has two modes for setting the reference values.

13. Zero adjusting method for the flow sensor

Although the zero of the flow sensor is thoroughly adjusted before shipment, the zero may deviate during use if byproducts stick to the flow sensor, for example. In this case, adjust the zero as follows, so that you can keep the deterioration of the accuracy to a minimum.

1) Warm up
Wait at least 30 minutes after turning on the power for the unit to warm up.

2) Stop the gas flow
a. Flow the actual gas through the MFC at the correct pressure.
b. Stop the gas completely by closing the stop valves in the upstream and downstream of the MFC.
c. Open the flow control valve in the MFC fully to eliminate any differential pressure between the inlet and outlet of the MFC.

3) Zero adjustment
a. Position of the zero adjustment switch
The zero adjustment switch is located on the top of the MFC.
Please refer to "5. Dimensions" for the position of zero adjustment switch for each model.
b. Adjustment method
Confirm that flow output from the MFC is stabilized, and press the zero adjustment switch approximately 1 second.
Please note that if you press the zero adjustment switch for more than 30 seconds, you may reset all of the settings.
c. Confirm the zero adjustment of the flow sensor
Confirm that the flow output from the MFC is ±0.2%FS.

14. Warranty and after sales service

1) Warranty period
   The warranty period is one year after leaving our site.
2) Warranty coverage
   The warranty is limited to the unit itself. Any incidental or consequential damage or loss caused by the unit, directly or indirectly, is not covered. Within the warranty period, problems due to inappropriate or reckless handling, caused by fire, or natural disaster, or any other act of god or problems, due to repairs or modifications made by the users or other unauthorized personnel, the use of corrosive gas, highly reactive gas, problems from use or storage in inappropriate circumstances, or problems from causes clearly beyond the responsibility of Hitachi Metals, and cases where the cause of the problem is not clear, are up to Hitachi Metals to decide whether the repairs will be performed without charge.
3) After sales service
   If you have any questions or need any clarifications, please contact the shop where you purchased the unit, or contact us directly.

15. Maintenance and checks

If the MFC does not operate normally, first check the following before asking for repairs.

1) Gas does not flow
   a. Incorrect connection.
   b. The source gas valve is not open.
   c. The forced close valve function is activated.
2) Flow rate fluctuates
   a. The pressure variation in the supply gas is too large.
   b. The differential pressure is larger than specified.
3) The zero has deviated
   The MFC will not reach 0 until the temperature balance in the thermal sensor is established, which takes about 30 minutes after turning on the power. Warm up the unit for 30 minutes or longer. After warming up, if the zero is still not correct, use the zero adjustment switch to adjust it.
4) Cannot achieve the appropriate flow or the flow is too large
   a. The valve forced open function is activated.
   b. The control gas pressure is not appropriate.