

Instruction Manual

MT10 Mini Manometer

This User's Manual contains useful information about the functions and operating procedures as well as the handling precautions for the MT10 mini manometer. To ensure correct use of the MT10 mini manometer, please read this manual thoroughly before use.

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YOKOGAWA

IM 265301-01E
5th Edition

When Product Is Delivered to You

Please check the contents of the package. If the wrong instrument or accessories have been delivered, if some accessories are missing, or if they appear abnormal, contact the dealer from whom you purchased them. At that time, please give the dealer the model name, suffix code, and serial number found on the name plate attached at the rear of the product.

1. Safety Precautions

Be sure to follow the instructions and requirements on safety described in this manual when handling the product. If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired. Yokogawa Electric Corporation assumes no liability for the customer's failure to comply with those instructions and requirements.

WARNING Describes precautions that should be observed to prevent the danger of serious injury or death to the user.

CAUTION Describes precautions that should be observed to prevent the danger of minor or moderate injury to the user, or the damage to the property.

<Note> Provides information that is important for proper operation of the instrument.

The following symbols are used on this instrument.



To avoid injury, death of personnel or damage to the instrument, the operator must refer to an explanation in the Instruction Manual.



Direct current

WARNING 1. Precautions Against Explosion

Do not operate the instrument in the presence of flammable or explosive gases or vapors since this instrument is not explosion-proof. Operation of the instrument in such an environment constitutes a safety hazard.

2. High-pressure Gases

- Use a measuring tube and pressure connector rigid enough to withstand the pressure being measured.
- Check the measuring tube, pressure connector and their joints to ensure that there is no leaking of the fluid being measured or separation in the joints. Any such leakage or separation can be hazardous to personnel or equipment near the instrument because of the pressure. Exercise due care since the greater the pressure is, the greater the risk will be.

3. Connection of AC Power

Confirm that the POWER switch is off before plugging in the power cord.

4. Protective Grounding for AC Power Supply

To prevent electrical shock, use only the power cord supplied by YOKOGAWA. Connect the power cord to a grounded AC outlet. Use a power cord whose rated voltage complies to the rated voltage of the instrument. Do not use an extension cord that does not have protective grounding.

5. Do not use any AC power supply other than the power supply kit(model 366969) manufactured by YOKOGAWA.

CAUTION 1. Do not apply a pressure exceeding the specified maximum allowable input. It may damage the instrument. (For the maximum allowable input, see Chapter 7, "Specifications.")

2. Avoid measuring the pressure of a corrosive gas, hot fluid (50 °C or higher), liquid, or mixture of a gas and liquid.

3. Internal condensation may occur if the instrument is moved to another place where both ambient temperature and humidity are higher, or if the room temperature changes rapidly. In such cases acclimatize the instrument to the new environment for at least one hour before starting operation.

4. If exposed to direct sunlight, the instrument heats up to temperatures higher than the surrounding air. Do not use the instrument in a location exposed to direct sunlight.

5. When tightening the connector to the input port, do not place only one spanner on the connector. It may damage the internal piping of the instrument. Use two spanners: one to hold onto the flattened portion of the input port and another to hold the connector. Then, tighten the connector to the input port.

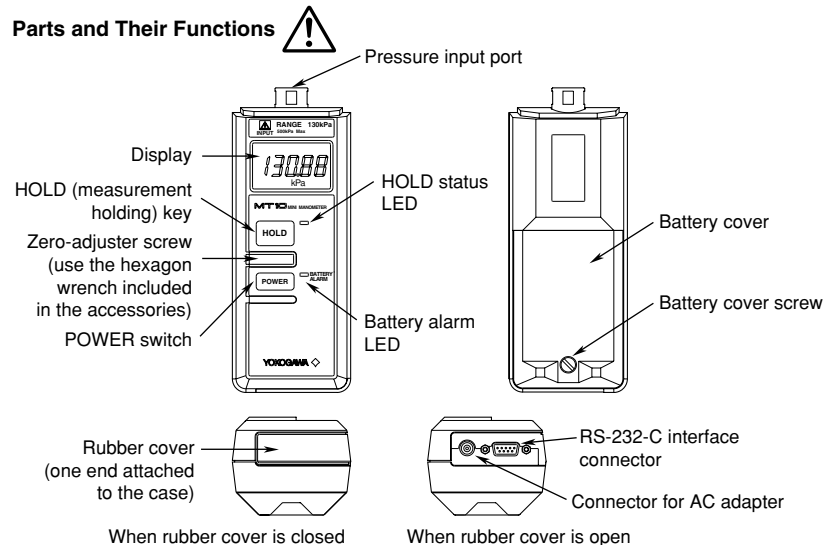
6. Remove the batteries when they have run out or when not using the instrument for a long time. Leaving them installed may result in a failure due to leakage of battery acid.

7. Keep the instrument away from volatile chemicals and do not allow a rubber or vinyl product to come into contact with the case or operation panel. It may result in discoloration.

8. Do not remove the cover from the instrument. When the instrument needs internal inspection or adjustment, contact your dealer or the nearest Yokogawa representative as listed on the back cover of this manual.

9. If you notice smoke or unusual odors coming from the instrument, immediately stop using it. Contact your dealer or the nearest Yokogawa representative.

2. Parts and Their Functions



3. Before Starting Measurement

■ Ambient Temperature and Humidity (See CAUTION 3 and 4)

● The instrument must be used only where the following conditions are met:

- Ambient temperature: 5 to 40 °C
- Ambient humidity: 20 to 80 % RH No condensation is allowed.
- Do NOT use the instrument in the following places:
 - Near heat sources
 - Where an excessive amount of soot, steam, or dust is present
 - Where corrosive gases may be present
 - Near strong magnetic field sources
 - Near high-voltage equipment or power lines

■ Power (See WARNINGS 3 and 4)

This instrument can be driven by either AA-size batteries or AC power through the dedicated AC adapter. When the batteries have nearly run out, the battery alarm LED lights up.

● Installing the batteries

- (1) Turn off the power.
- (2) Use a coin or a tool with a screwdriver-like tip to loosen the screw holding battery cover and detach the cover.
- (3) Replace all four batteries with new ones. Note the polarity of each battery when installing the new ones. Make sure that they are all installed correctly, as shown on the holder.
- (4) Put the cover back in its original position and tighten the screw.

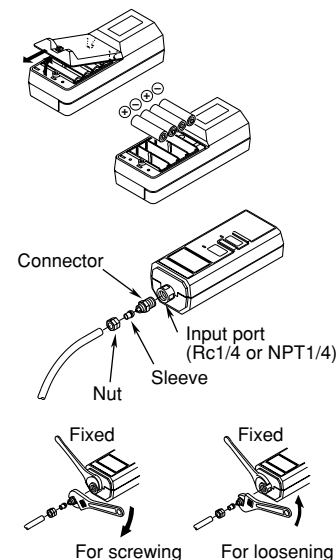
● Connecting the AC adapter (See CAUTION 10)

- (1) Turn off the power.
- (2) Plug the AC adapter cable into the connector of the instrument.
- (3) Plug the power cord into the AC adapter and then plug the other end of the cord into an AC outlet.

■ Input Connection Procedure (See CAUTION 5)

This item takes the optional connector assembly (B9310RR) as an example in explaining how to connect a pressure-leading tube to the input port.

- (1) Wind duct tape tightly around the connector to prevent leakage.
- (2) Tighten the connector firmly to the input port (Rc1/4 female) to prevent leakage.
- (3) Insert the tip of the pressure leading tube through the opening of the nut and then insert the sleeve at the tip of the tube. Firmly fix the sleeve to the tube with the nut. Finally screw the nut into the connector.



4. Measuring the Pressure (See WARNINGS 1 and 2 and CAUTIONS 1 and 2)

■ Power On/Off and Behavior at Power-on

Pressing the POWER key on the front panel turns on the power. Pressing it again turns the power off. Immediately after the power is turned on, all display elements appear on the LCD panel and the instrument is then ready for measurement.

<Note> Sometimes the display may enter the hold mode at power-on. If this occurs, press the HOLD key to cancel the mode before you begin operating the instrument.

■ Zero Calibration (Zero CAL)

Compensation for effects resulting from variations in temperature and/or the installation environment in order to carry out precision pressure measurements is called "zero calibration" (zero CAL). This feature may not be necessary in regular measurements (measurements in a horizontal position). It is advisable, however, that you use the zero-CAL function to measure pressure with better accuracy. Also activate the zero-CAL function, once in a while, if your operating environment is likely to vary during continuous measurement.

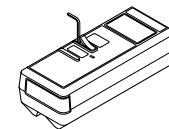
● Implementing Zero Calibration Manually

- 1) Set the input to open atmosphere.
- 2) Lift the left end of the zero-CAL cover.
- 3) Using the supplied Allen wrench, adjust the zero-CAL control so the display reads 0.

The reading increases as you turn the control clockwise, and decreases as you turn it counterclockwise.

● Implementing Zero Calibration Via Communication

- 1) Set the input to open atmosphere.
- 2) Send a zero-calibration command from a personal computer (see "Programming" in Chapter 5, "Communication Functions," for details on commands).



■ Holding a Measurement

Use the HOLD key to hold an indicated measurement. The indication will not be updated until the HOLD mode is released. Pressing the HOLD key stops updating an indicated measurement and the LED beside the HOLD key lights up. Pressing the HOLD key again restarts updating and the LED turns off.

■ Behavior Upon Error

An error code (Er.xx) corresponding to the cause of an error is displayed on the LCD panel. (For error codes, see "Troubleshooting" in Chapter 6, "Maintenance and Calibration.")

5. Communication Function

■ Communication Data

Transmission: measured data
reception: zero calibration

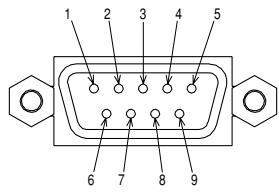
■ RS-232-C Interface Specifications

Electric characteristic : Conforms to EIA RS-232-C
Connection : Point-to-point
Communications : Half-duplex
Synchronization : Start-stop system (asynchronous)
Baud rate : 1200 bps
Start bit : 1 (fixed)
Data length : 8 bits
Parity : No (off)
Stop bit : 1 bit
Connector : DELC-J9PAF-13L6 from JAE (or the equivalent)
Hardware and software handshaking: None
Receive buffer size : 37 bytes

■ Connecting the RS-232-C Interface Cable

When connecting this instrument to a personal computer, see the following descriptions and make sure that the setups (data transmission speed, data format, etc.) between the instrument and computer match. Also, make sure that the correct interface cable meeting the specifications for this instrument is used.

● Connector Pin Assignment

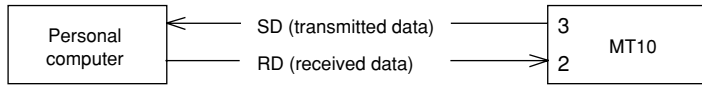


- 2 BB(RXD; Received Data) : Data received from personal computer
Signal direction : Input
- 3 BA(TXD; Transmitted Data) : Data transmitted to personal computer
Signal direction : Output
- 5 AB(GND; Signal Ground) : Ground for signals
Pins 1, 4, and 6 through 9 are not used.

RS-232-C Connector (DELC-J9PAF-13L6)
(D-Sub 9-pin male connector on the instrument)

● Directions of Signals

The figure below shows the directions of the signals used by the RS-232-C interface.



● Table of RS-232-C Standard Signals and Their CCITT and JIS Abbreviations

Pin No. (9-pin connector)	Abbreviation			Signal
	RS-232-C	CCITT	JIS	
5	AB(GND)	102	SG	Signal ground
3	BA(TXD)	103	SD	Transmitted data (output)
2	BB(RXD)	104	RD	Received data (input)

■ Programming

● Commands Corresponding to Functions

Function	Command Data
Zero calibration	0,0,18,12,64,10,10,0,32,32,32,32,48,46,48,160
Measured-data transmission	0,0,18,4,128,1,40,0,191

● Format of Output When Receiving Measured-data Transmission Command

Request to MT10 : Computer converts command data to characters and sends them.

Reply from MT10 : Computer reads measured values sent.

```
***** (8 bytes) (8 bytes) (8 bytes) *
Name Data Aux. data
```

Name : INPUT (The space is filled with blanks.)
Data : Measurement (The space is filled with blanks.)
Aux. data : Pressure unit (The space is filled with blanks.)
Asterisk (*) : Each denotes a one-byte character (which is meaningless to the user-to be ignored).

<Note> The carriage return (CR) or linefeed (LF) code is not output.

● Sample Programs (Quick Basic Version 4.5)

Computer : IBM PC/AT and compatible system with serial port

1. Execute Zero Calibration

```
1000 '*****
1010 ' EXECUTE ZERO CALIBRATION
1020 '
1030 ' SAVE "MT10ZCL2.BAS",A
1040 '*****
1050 INPUT "EXECUTE ZERO CALIBRATION. (Y/N) >> ",Q$
1060 IF Q$="N" OR Q$="n" THEN 1160
1070 IF Q$<>"Y" AND Q$<>"y" THEN 1050
1080 '
1090 TX$=CHR$(0)+CHR$(0)+CHR$(18)+CHR$(12)+CHR$(64)+CHR$(10)+CHR$(10)+CHR$(0)
1100 TX$=TX$+CHR$(32)+CHR$(32)+CHR$(32)+CHR$(32)+CHR$(48)+CHR$(46)+CHR$(160)
1110 '
1120 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
1130 PRINT #1,TX$;
1140 CLOSE #1
1150 PRINT "COMPLETED."
1160 END
```

2. Read Measured Data 100 Times

```
1000 '*****
1010 ' READ MEASURED DATA 100 TIMES
1020 '
1030 ' SAVE "MT10MES2.BAS",A
1040 '*****
1050 INPUT "READ MEASURED DATA 100 TIMES. (Y/N) >> ",Q$
1060 IF Q$="N" OR Q$="n" THEN 1200
1070 IF Q$<>"Y" AND Q$<>"y" THEN 1050
1080 '
1090 TX$=CHR$(0)+CHR$(0)+CHR$(18)+CHR$(4)+CHR$(128)+CHR$(1)+CHR$(40)+CHR$(0)+CHR$(191)
1100 '
1110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
1120 FOR J=1 TO 100
1130 PRINT #1,TX$;
1140 A$=INPUT$(33,#1)
1150 B$=MID$(A$,9,24)
1160 PRINT B$
1170 FOR I=1 TO 10000 : NEXT I
1180 NEXT J
1190 CLOSE #1
1200 END
```

6. Maintenance and Calibration (See CAUTIONS 6 through 9)

■ Storage Conditions

● The following conditions must be met when storing this instrument:

Ambient temperature: -20 to 70 °C; ambient humidity: 5 to 95 % RH or less

● Avoid storing this instrument in any of the following locations:

Damp places; in direct sunlight; near heat sources; where the level of mechanical vibration is high; where an excessive amount of dirt, dust or salinity is present; where corrosive gases may be present

■ Cleaning the Instrument

Cleaning the instrument with a volatile solvent such as a thinner or benzene may cause discoloration. Use a damp cloth moistened with water or alcohol to wipe the instrument carefully.

■ Calibration

The calibration guarantee period of this instrument is one year. Periodic calibration is recommended for correct use of the instrument. For calibration, please contact your nearest Yokogawa representative, listed on the back cover of this manual.

■ Blank Display at Power-on (When Operating on Batteries or AC Power Supply)

Replace all four batteries with new ones at the same time, and then switch the manometer on.

If the problem still persists, contact your nearest Yokogawa representative, listed on the back cover of this manual.

■ Troubleshooting

Error Code	Cause of Error	Countermeasure
Er.01	Sensor failure	Needs repair. Immediately turn off the power and contact your nearest Yokogawa representative, listed on the back cover of this manual.
Er.02	Circuit failure	Needs repair. Immediately turn off the power and contact your nearest Yokogawa representative, listed on the back cover of this manual.
Er.03	Input exceeds measuring range	Check the input value.
Er.07	Input exceeds measurement display range	Turning the wrench clockwise, adjust the display reads 0.
Er.08	Measured value exceeds high/low limits	Check the input value.
Er.12	Zero point shifting widely	Readjust the zero point.

*If the other error codes are displayed, please contact your YOKOGAWA sales representative.

7. Specifications

■ General Specifications

Model	265302	265303	265304
Pressure Type	Gauge pressure		
Measuring Range (with guaranteed accuracy)	0 to 130 kPa	0 to 700 kPa	0 to 3000 kPa
	0 to 1.3256 kgf/cm ²	0 to 7.138 kgf/cm ²	0 to 30.59 kgf/cm ²
	0 to 975.1 mmHg	0 to 5250 mmHg	—
	0 to 521.9 inH ₂ O	0 to 2810 inH ₂ O	0 to 12044 inH ₂ O
	0 to 38.39 inHg	0 to 206.7 inHg	0 to 885.9 inHg
	0 to 18.86 psi	0 to 101.5 psi	0 to 435.1 psi
	0 to 1300 mbar	0 to 7000 mbar	0 to 30 bar
Measurement Display Range	-2.5 to 110% of measuring range		
Accuracy*1	±(0.04% of rdg + 0.03% of FS)		±0.1% of FS
Resolution	0.0kPa	0.1kPa	1kPa
Maximum Allowable Input	500kPa	1000kPa	4500kPa
Internal Capacity	Approx. 2 cm ³		
Temperature Coefficient	Zero drift	±0.02% of FS/10°C	
	Span drift	±0.02% of FS/10°C	
Effect of Mounting Direction	±0.1% of FS	±0.02% of FS	±0.01% of FS
	Gas Leakage 10 ⁻⁵ cm ³ /s max		
	Measurement Fluid Gases only (non-flammable, non-explosive, non-toxic, and non-corrosive gases)		
Measurement Fluid Temperature	5° to 50°C		
Pressure Sensor	Silicon resonant sensor		
Pressure Sensing Element	Diaphragm		
Pressure Display Unit*2	kPa, kgf/cm ² , mmH ₂ O, mmHg, inH ₂ O, inHg, psi or mbar (one specified upon shipment)		
Calibration Interval	1 year		
Input Connection	Rc1/4 female or NPT1/4 female		
Material of measurement section	Japanese Industrial Standard SUS316 stainless steel; Hastelloy C276		

*1: Reference conditions: positioned horizontally, temperature 23±3°C, and immediately after zero calibration.

■ Complying Standard

General Safety EN61010-1: 1993/A2: 1995

SEMKO Certified

EMC: EN55011(1991), EN55022(1994), EN50082-1(1992), EN61000-4-2(1995)

SEMKO Verified

The influence under the immunity environment is +/-30% of FS.

■ Common Specifications

Power Supply: AA-size batteries; four 1.5-V primary batteries or four 1.2-V secondary batteries (will last for approximately 100 continuous hours if alkaline batteries are used), AC adapter (100-120/220-240 V AC, 50/60 Hz, with 15 V/1.33 A output); optional

Communication: RS-232-C

Transmission: half-duplex "brain" protocol

Baud rate: 1200 bps

Display: 4.5 digits, LCD

Display Update Interval: approximately 0.5 second

Response: approximately 4 seconds (before the reading falls within the given accuracy)

Other Functions: Hold function that retains the on-display pressure reading, Zero-point adjustment

Warm-up Time: one minute maximum

Insulation Resistance: 500 V DC, 20 MΩ MIN. (between the AC power line and case), when the dedicated AC adapter is used

Withstanding Voltage: 1500 V AC/one minute (between the AC power line and case), when the dedicated AC adapter is used

Operating Temperature/Humidity Range: 5 to 40 °C, 20 to 80 % RH (non-condensing)

Storage Temperature/Humidity Range: -25 to 70 °C, 5 to 95 % RH

External Dimensions/Weight: approximately 72 (W) x 174 (H) x 60 (D)(mm), excluding the input connection/approximately 700 g

■ Standard Accessories

Accessories	Part or Model No.	Quantity	Specification(s)
1 Carrying case	B9926CZ	1	
2 Alkaline AA-size	A1070EB*	4	1.5 V DC
3 Monkey spanner	B9926CX	1	150 mm
4 Single-ended wrench	B9926CW	1	H19
5 Hexagon wrench	B9926CY	1	H2.5
6 Duct tape	X9910DG	1	-
- User's manual	IM 265301-01E	1	This manual

*: Part no. A1070EB specifies only one AA battery.

■ Optional Accessories

Accessories	Part or Model No.	Quantity	Specification Code
- AC power supply kit	366969	(1)	-D: UL/CSA Standard -F: VDE Standard -R: SAA Standard -Q: BS Standard
7 Connector assembly (for a vinyl tube with inner diameter of 4 mm and outer diameter of 6 mm)	B9310RR	1	
8 Simple connector assembly (for a vinyl tube with inner diameter of 4 mm and outer diameter of 6 mm)	B9310ZH	1	
9 Adapting connector (JIS, R1/4-to-Rc1/8)	G9612BG	1	
10 Adapting connector (ANSI, R1/4-to-1/4NPT female thread)	G9612BJ	1	
11 Adapting connector (ANSI, R1/4-to-1/8NPT female thread)	G9612BW	1	

