MANUAL No. 99MBE021A8
SERIES No. 264

DP-1VR

DIGIMATIC MINIPROCESSOR

User's Manual

Read this User's Manual thoroughly
before using the instrument. After reading,
retain it close at hand for future reference.

Mitutoyo

CONVENTIONS USED IN USER'S MANUAL

The following describes the meaning of the symbols and other conventions used in this user's manual.

Safety Precautions

To operate the instrument correctly and safely, Mitutoyo manuals use various safety signs (Signal Words and Safety Alert Symbols) to identify and warn against hazards and potential accidents.

● The following signs indicate general warnings:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

CONVENTIONS USED IN USER'S MANUAL

- The following signs indicate specific warnings or prohibited actions, or indicate a mandatory action:

Alerts the user to a specific hazardous situation. The given example means “Caution, risk of electric shock”.

Prohibits a specific action. The given example means “Do not disassemble”.

Specifies a required action. The given example means “Ground”.

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CONVENTIONS USED IN USER'S MANUAL

On Various Types of Notes

The following types of notes are provided to help the operator obtain reliable measurement data through correct instrument operation.

IMPORTANT

- An *important* note a type of note that provides information essential to the completion of a task. You cannot disregard this note to complete the task.
- An important note is a type of precaution, which if neglected could result in a loss of data, decreased accuracy or instrument malfunction/failure.

NOTE A *note* emphasizes or supplements important points of the main text. A note supplies information that may only apply in special cases (e.g., Memory limitations, equipment configurations, or details that apply to specific versions of a program).

TIP A tip is a type of note that helps the user apply the techniques and procedures described in the text to their specific needs. It also provides reference information associated with the topic being discussed.

Safety Precautions (Read Before Use)

Please observe the following safety precautions to ensure safe use.

WARNING

- This product is intended for use with general machinery (measuring instruments, machine tools, etc.).
  Do not use this product in applications where operation faults or accidents can cause direct bodily injury or death, such as in medical equipment, aerospace equipment, trains, and atomic power plant equipment. Contact MITUTOYO if you have questions regarding suitable applications for this product.
- If this product starts to emit smoke or strange odors, or if it otherwise fails to operate correctly, turn off the main switch immediately and disconnect the AC adapter from the electrical outlet, then contact your local MITUTOYO representative for repair information. Continued use of this product under the above conditions may cause a fire or an electric shock accident.
- If this product is dropped or otherwise damaged, turn off the main switch and disconnect the AC adapter from the electrical outlet, then contact your local MITUTOYO representative. Continued use of this product under the above conditions may cause a fire or an electric shock accident.
- To avoid risk of fire and electric shock, users should never attempt to repair or modify this product.
- If any foreign object should become trapped inside this product, turn off the main switch and disconnect the AC adapter from the electrical outlet, then contact your local MITUTOYO representative.

Safety Precautions (Read Before Use)

CAUTION

- Be sure to maintain the specified power supply voltage. Use of power supply voltage that is outside the specified range can cause product damage, fire, and electric shock.
- Do not place this product in direct sunlight or in hot environments, which can raise the product's internal temperature and cause a fire or electric shock.
- Do not place this product against a wall (or other solid barrier), which can raise the product's internal temperature and cause accidents. Maintain a gap of at least 10 cm between this product and any adjacent wall, so that its power cord can be easily removed.

EC Directive Compliance

- The DP-1VR is compliant with the following EC directive.
  EMC Directive EN61326-1:1997+A1:1998

Notes on Overseas Transfer

- This product is controlled by the Export Control Regulations. Please contact Mitutoyo before transferring it abroad.

Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and other European countries with separate collection systems)

This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. To reduce the environmental impact of WEEE (Waste Electrical and Electronic Equipment) and minimize the volume of WEEE entering landfills, please reuse and recycle.
For further information, please contact your local dealer or distributors.

Warranty

This equipment has been manufactured under strict quality management, but should it develop problems arising from Mitutoyo's manufacture, shipping, etc., within 1 year of the date of purchase, repair shall be performed free of charge according to the contents of the attached warranty. Contact the distributor where the equipment was purchased or a Mitutoyo Sales Office.

In the following cases, repair will be charged even during the term of the warranty.

- ◆ Failure or damage due to improper usage, modification, or improper repair
- ◆ Failure or damage due to relocating, transportation, dropping, etc., following purchase
- ◆ Failure or damage due to improper maintenance or storage.
- ◆ Failure or damage due to use of abnormal voltage or other-than-prescribed power supply (voltage, frequency)
- ◆ Accidents or damage due to fire, earthquake, water damage, lightning, or other natural disasters, pollution, smoke damage, gas damage (sulfuric gas, etc.)
- ◆ Cases not covered by the warranty
- ◆ Other failures or damages not imputable to Mitutoyo's responsibility

This warranty is not transferable and is only valid within the country of the original purchase.

Contents

Contents

1 OUTLINE

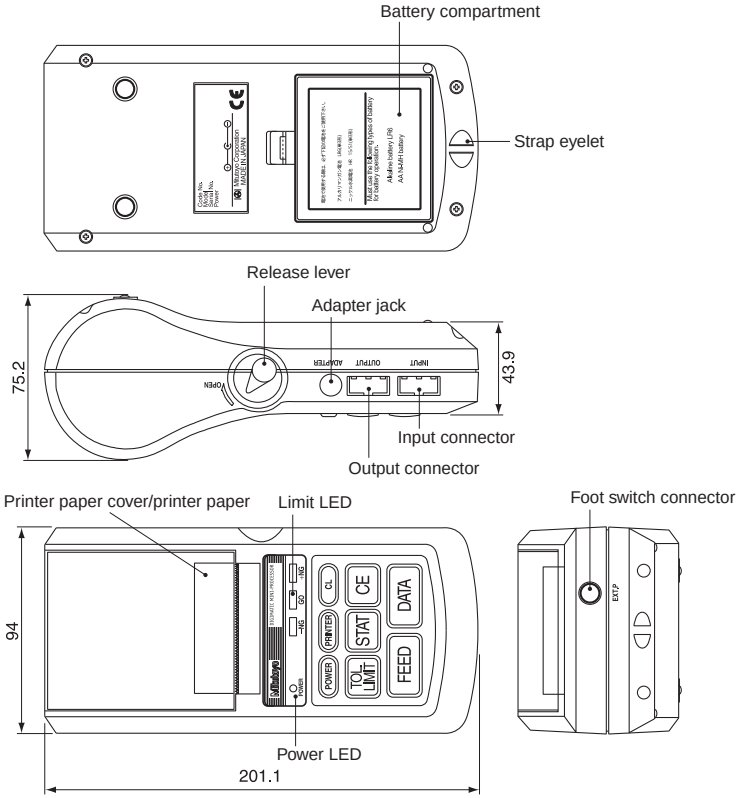
1. Introduction

The DV-1VR is a dedicated data processing unit used connected to a Mitutoyo digimatic gage, that records the data from this gage and performs statistical processing. It is easy to operate and allows data processing on the spot.

2. Features

(1) Wide array of statistical parameters:
Sample count (N), Maximum value (MAX), Minimum value (MIN), Range (R), Average value ($\bar{X}$), Standard deviation (σn, $\sigma n-1$), Process capability index (C_P, C_{PK}), Number of defectives ($\pm$NG), Fraction defective (P)
5 pairs of limit data
(2) Histogram generation
(3) Generation of D (Displacement) chart indicating temporal changes of measurement data
(4) Calculation functions required for X-R control charts
(5) Timer input function
(6) Data output functions:
Measurement data output (RS-232C, TTL level)
GO/NG judgment output (+NG, GO, –NG)
Connectable to Mitutoyo measurement data network system (μ-NET System)
(7) GO/NG judgment display and output through LED/printing
(8) Power supply: AC adapter or four AA nickel-metal-hydride (Ni-MH) batteries or alkaline batteries (LR6)
(9) 48 m high-durability printer paper (5 years guaranteed when stored in cool and dark place)

OUTLINE



Appearance

Product Configuration

Part Name	Q'ty
DP-1 VR (main unit)	1
AC adapter	1
Printer paper	1
Strap	1
Quick Reference	1
User's Manual	1

2 SETUP

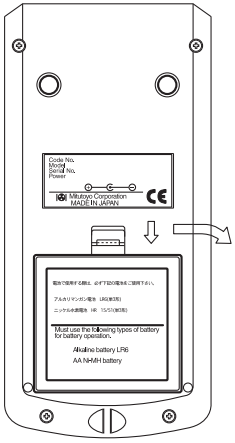
1. Power Supply

- The power is supplied via an AC adapter or four AA nickel-metal-hydride (Ni-MH) batteries or alkaline batteries (LR6).
- If both batteries and an AC adapter are set, power supply from the AC adapter is given priority. (Batteries are not supplied.) Batteries cannot be charged from the AC adapter, so use a dedicated battery charger for battery charging.
- If the voltage drops during battery use or if an AC adapter other than the one that is provided is used, the power LED will blink to indicate an anomaly.

1.1 Setting the batteries

Set the batteries. If using the AC adapter, refer to section 1.2.

<1> Open the battery compartment.

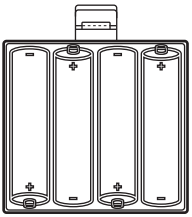


Press the battery compartment by pressing the lock release and pull the compartment lid off.

SETUP

<2> Set the batteries.

Set four AA alkaline batteries (LR6) or nickel-metal-hydride (Ni-MH AA) batteries in the battery compartment, making sure to orient them correctly.



<3> Following the reverse procedure of that described in <1>, press back the battery compartment lid into place until you hear a click.

IMPORTANT

- **Be sure to correctly orient the batteries.**
- **Do not mix different types of batteries.**
- **Use either size AA alkaline batteries (LR6) or size AA nickel-metal-hydride (Ni-MH AA).**
- **Do not use manganese batteries.**
- **If alkaline batteries are used, printouts may look faint due to the characteristics of such batteries.**
- **When using alkaline batteries or Ni-MH batteries, the printing speed may be slower compared to when the AC adapter is used.**
- **If batteries are used, any exfoliation or swelling of the coating on battery terminals may cause bad contact or a short circuit. Make sure that the batteries are free of exfoliation and swelling before using them.**
- **If the DP-1VR will not be used for a long period of time, remove the batteries from the battery compartment. If the batteries are left inside the DP-1VR, battery leaks may render the DP-1VR unusable.**
- **Batteries can be used as the power supply when the temperature is 10°C or higher. At temperatures lower than 10°C, faint printouts and other problems may occur.**

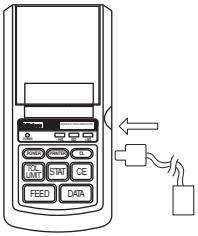
ADDENDA

- **The DP-1VR does not have a charging function. Use a dedicated charger for battery charging.**
- **The battery life of the DP-1VR is approximately 10,000 lines (when printing in large size once every 5 s using 1600 mAh Ni-MH batteries).**
- **The battery life greatly varies according to the customer's use environment.**

1.2 Connecting the AC adapter

Connect the AC adapter to the DP-1VR.

If the DP-1VR is run on batteries, skip this section.



Insert the AC adapter plug securely all the way.

CAUTION

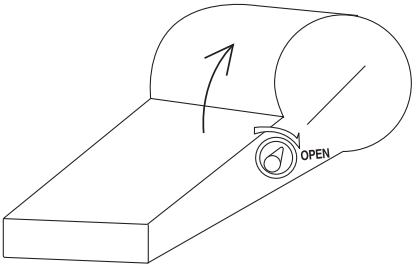
- **Use only one of the following Mitutoyo-specified AC adapters.**

100 V (for Japan)	**09EAA119**
120 V (for North America)	**09EAA119A**
200 V (for China)	**09EAA119DC**
230 V (for Australia)	**09EAA119F**
230 V (for Europe)	**09EAA119D**
230 V (for U.K.)	**09EAA119E**
220 V (for Korea)	**09EAA119K**

- **Use of an AC adapter not included in the above list may result in poor print quality and shorten the life of the DP-1VR.**

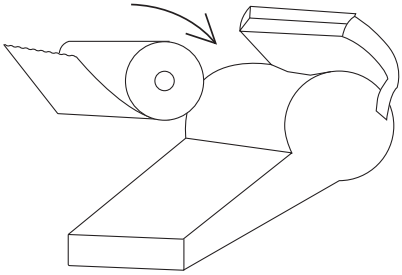
2. Setting the Printer Paper

<1>



- Press down the release lever.
- The printer paper cover rises, so open it.

<2>



- Peel off the tape that holds the end of the printer paper in place, pull out a little the edge of the printer paper, and set the printer paper.
- When setting the printer paper, make sure that the printer paper core securely fits in the printer paper folder.
  Setting the printer paper in a slanted position, this may cause a paper jam during printing, so be sure to set the printer paper so that it is in a straight position.
- Close the printer paper cover with the edge of the printer paper protruding a little.
- Switch on the power of the DP-1VR and press the [FEED] key to feed forward approximately 100 mm (4 inches) of printer paper.

CAUTION

- **When setting the printer paper, be careful not to cut your hands with the paper cutter.**

IMPORTANT

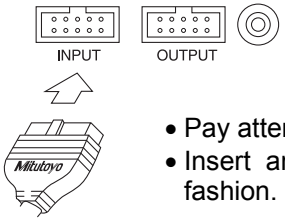
- **Be sure to press the [FEED] button after setting the printer paper. Pressing this button automatically aligns the paper, reducing the likelihood of paper jams.**
- **The printer head is exposed when the printer paper cover is opened. The printer head is very hot immediately after printing and may cause burns if touched.**
- **The printer paper for the DP-1VR is a special type of paper with excellent durability, chemical resistance, and weather resistance. Only use the Mitutoyo-specified paper (Part No. 09EAA082, 10 rolls/set).**
- **If the Mitutoyo-specified paper is not used, the quality cannot be guaranteed.**
- **The printer paper should be stored in a cool and dark place.**

3. Connection to Gage

Before connecting the DP-1VR to the digimatic gage, check that both are switched off.

(1) Connecting the DP-1VR to digimatic gage

Connect one of the connectors of the connection cable to the input connector of the DP-1VR, and connect the other connector to the output connector of the digimatic gage. As the connection cable varies according to the gage, refer to the user's manual of the gage to be used.



- Pay attention to the connector directions.
- Insert and pull out the connectors in a straight fashion.

Input Connector Connection

(2) If connecting the DP-1VR to LSM, EF counter, or KA counter

If the DP-1VR is connected to the following models, change the interface mode to COMPATIBLE.

- Models for which interface mode must be changed to COMPATIBLE

Model	Part No.
Laser scan micro LSM-6000 Series	544-062
LG counter	542-061
EF Series	542-066
Linear scale counter	174-173/174
KA Series	174-175/176
Mu-Wave	957861

Change the interface mode with the following procedure.

- Interface mode switching procedure

Operation	Printout
CE + POWER	*DP-1VR* SELECT SDP INTERFACE PUSHSTAT: MODE CHANGE PUSHDATA: MODE FIX INTERFACE: ADVANCE
STAT	INTERFACE: COMPATIBLE
DATA	Changes to data input mode

STAT key: Mode switch DATA key confirmation, end

(3) Connection using RS-232C

The DP-1VR can be connected to a linear scale counter via the RS-232C interface. In this case, use the Part No. 09EAA094 RS-232C counter cable.

For the connection method, refer to the applicable user's manuals.

The Part No. 09EAA094 RS-232C counter cable is specially designed for connecting Mitutoyo K Series counters, and its operation is not guaranteed in the case of connection to other than a K Series counter.

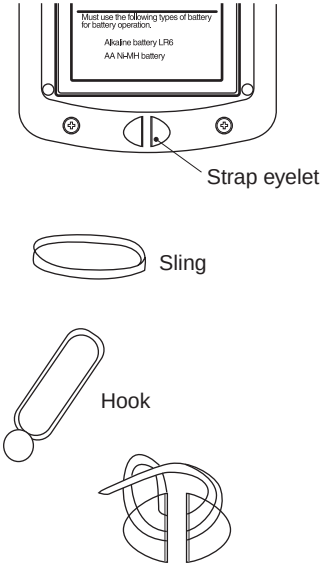
4. Other Connections

4.1 Attaching the strap

Attach the strap to the DP-1VR if needed.

<1> Remove the sling from the hook.

<2> Pass the sling in the DP-1 strap eyelet as shown in the figure.



<3> Attach the hook to the pulled out loop.

4.2 Foot switch

Data input is done via the foot switch.
Connect the foot switch to the foot switch connector.
Part No.: 937179T (special accessory)

4.3 RS-232 conversion cable and GO/±NG judgment cable

<1> RS-232C conversion cable (Part No. 09EAA084)
This cable is used to fetch the output from the DP-1VR. Connect this cable to the output connector of the DP-1VR.

<2> GO/±NG judgment cable (Part No. 965516)
This cable is used to fetch the limit judgment result from the DP-1VR. Connect this cable to the output connector of the DP-1VR.

NOTES

- **The RS-232C cable and GO/±NG judgment cable cannot be used simultaneously.**
- **The RS-232C cable and RS-232C counter cable (Part No. 09EAA094) cannot be used simultaneously.**
- **Connect/disconnect cables while the power is switched off.**

3 PARAMETERS

1. Parameters

Parameters are functions for customizing the operation of the DP-1VR. Set them according to the intended purpose.

Two types of parameters can be set for the measuring tool connected to the DP-1VR. Select the parameter according to the measuring tool that is connected.

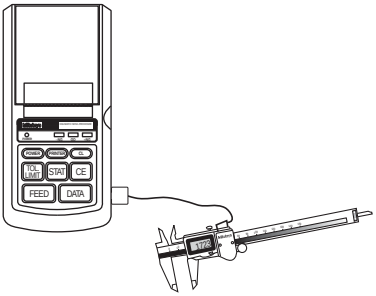
2. When Connecting a Caliper or Micrometer

These parameters are set when connecting a caliper or micrometer to the DP-1VR via the digimatic interface.

The parameter setting mode is entered by pressing the [POWER] key while holding down the [DATA] key to start up the DP-1VR.

When the parameter mode has been entered, the parameters to be set are printed out in sequence. To change a setting, press the [STAT] key. If the setting is fine as is, just press the [DATA] key and that parameter will be set.

A list of the parameters is shown in the following table.



PARAMETERS

Table 1. Parameters in DP-1 Mode

Setting Sequence	Setting Item	Setting Contents	Printout	Default
1	PARAMETER CLEAR	Clear parameter	PARAMETER CLEAR PARAMETER NO CLEAR	Don't clear
2	SYSTEM MODE	DP-1 mode/multi-printer mode	Set to DP-1.	DP-1
3	WORK MODE	MODE0/MODE1 MODE2/MODE3	MODE 0/MODE 1 MODE 2/MODE 3	MODE1
4	BAUD RATE	1200/2400/4800/ 9600/19200	1200/2400/4800 9600/19200	4800
5	PARITY	None/Even/Odd	NON/EVEN/ODD	Even
6	DATA LENGTH	7/8	7/8	7
7	PRINT SIZE	Large/Normal	LARGE/ NORMAL	Large If mode2 has been selected, only normal size is accepted.
8	BACK FEED	Displayed only when "NORMAL" has been selected for "PRINT SIZE".	Use with ON setting.	8
9	POWER SAVE	Power save/Normal	SAVE/ NORMAL	Normal
10	PRINT DENSITY	Normal/Dark	NORMAL/ DARK	Normal
11	BZ MODE	Buzzer On/Off	ON/OFF	Buzzer On
12	TIME PRINT	Use/Don't use time function	ON/OFF	Use
13	DATA FORMAT	Select date display format	YYYY/MM/DD MMM/DD/YYY DD/MMM/YYY	YYYY/MM/D
14	DATA	Set date	Date is printed in the format set in 13, above. Ex: In case of January 2, 2000 2000/1/2 JAN/2/2000 2/JAN/2000	Japanese standard date format
15	TIME	Set time		Japan standard time
16	UNIT	Automatic (mm/inch switch) Millimeter (mm) Inch (inch) No unit Gram (g) Temperature (°C) Ton (t) Ounce (Lb) Newton (N)	mm/inch mm inch g °C t Lb N	Automatic

IMPORTANT

- **Be sure to set the operation mode to DP-1VR.**

NOTES

- **The limit data is cleared when the parameter input mode is entered.**
- **When parameter all clear is executed, the default settings are made except for the date and time. The date and time are cleared to 2001/1/1, 0:0.**
- **If a setting other than "Automatic" has been selected for the unit setting, the unit set by the parameter is printed out regardless of the data unit that was input. In this case, the input data unit information is ignored.**

3. Printing RS-232C Output of Linear Scale

These are the setting parameters when the RS-232C interface is attached to the linear scale and printing is performed using the DP-1VR. The parameter setting mode is entered by pressing the [POWER] key while holding down the [DATA] key to start up the DP-1VR.

When the parameter mode has been entered, the parameters to be set are printed out in sequence. To change a setting, press the [STAT] key. If the setting is fine as is, just press the [DATA] key and that parameter will be set.

A list of the parameters is shown in the following table.

PARAMETERS

Table 2. Parameters When Printing out RS-232C Output of Counter

Setting Sequence	Setting Item	Setting Contents	Printout	Default
1	PARAMETER CLEAR	Clear parameter	PARAMETER CLEAR PARAMETER NO CLEAR	Don't clear
2	SYSTEM MODE	DP-1 mode/multi-printer mode	Set to MP.	DP-1
3	WORK MODE	MODE0/MODE1	MODE 0/MODE 1	MODE1
4	BAUD RATE	1200/2400/4800/ 9600/19200	1200/2400/4800 9600/19200	4800
5	PARITY	None/Even/Odd	NON/EVEN/ODD	Even
6	DATA LENGTH	7/8	7/8	7
7	PRINT SIZE	Large/Normal	LARGE/ NORMAL	Large If mode2 has been selected, only normal size is accepted.
8	BACK FEED	Displayed only when "NORMAL" has been selected for "PRINT SIZE".	Use with ON setting.	–
9	POWER SAVE	Power save/Normal	SAVE/ NORMAL	Normal
10	PRINT DENSITY	Normal/Dark	NORMAL/ DARK	Normal
11	BZ MODE	Buzzer On/Off	ON/OFF	Buzzer On
12	TIME PRINT	Use/Don't use time function	ON/OFF	Use
13	DATA FORMAT	Select date display format	YYYY/MM/DD MMM/DD/YYY DD/MMM/YYY	YYYY/MM/D
14	DATA	Set date	Date is printed in the format set in 13, above. Ex: In case of January 2, 2000 2000/1/2 JAN/2/2000 2/JAN/2000	Japanese standard date format
15	TIME	Set time		Japan standard time
16	UNIT	Millimeter (mm) Inch (inch) No unit Gram (g) Temperature (°C) Ton (t) Ounce (Lb)	mm inch g °C t Lb	No unit
17	INPUT AXIS	Sets data to be input. Multiple settings are possible.	XYZ	Y axis, Y axis, Z axis
18	CUL AXIS	Sets data to be input. Only 1 axis can be set.	XYZ	X axis

IMPORTANT

- **Be sure to set the operation mode to MP.**
- **Be sure to set the data processing axis even if statistical analysis is not performed.**
- **If connecting a counter, use Part No. 09EAA094.**
- **The devices that can be connected using this mode are in case the RS-232C interface of the Mitutoyo K Series counter is used. If a different product is connected, the operation cannot be guaranteed.**

NOTES

- **When parameter clear is executed, the DP-1 mode defaults are set except for the date and time.**
- **When parameter clear is executed, the date and time are cleared to 2001/1/1, 0:0.**
- **Unit information is not transmitted from the linear scale counter. Therefore, the unit is not printed out if the unit setting is not made.**
- **Only a K Series counter can be connected.**
- **After setting 7 PRINT SIZE to NORMAL, the BACK FEED setting item is displayed. Normally, the DP-1VR is used with this item set to ON.**
- **About 18 CUL AXIS**
  When the input data does not include axis data specified with 18, an error message may be printed out.
  Example: 18 CUL AXIS Z axis specified
  If the input data is the X axis,
  NO CUL AX is printed out.
  In such a case, the DP-1VR should be used with 3 WORK MODE set to 0. Statistical processing is not performed, but data printing is possible.
- **Following the parameter settings, power off once both the DP-1 and counter, and then power them on again. Malfunctions may occur if they are not powered on again.**

4. Parameter Setting Example

The parameter setting procedure is described in detail below.

4.1 DP-1 parameter setting procedure

Parameters can be set by entering the parameter mode. In the state in which the parameter setting mode is not powered on, press the [POWER] key while holding down the [DATA] key to enter the parameter mode.

In the parameter input mode, the setting contents can be changed through key operation.

Parameter Setting Keys		Time Settings	
STAT	Setting change	PRINTER	Time increment
DATA	Setting confirmation	CL	Minute increment
		STAT	Time print
		DATA	Time confirmation

Date Settings	
PRINTER	Year increment
CL	Month increment
CE	Day increment
STAT	Date print
DATA	Date confirmation

The following settings are made as an example.

- Parameter clear
- Character size
- Date
- Time

Key Operation	Printout	Comment
[DATA] + [POWER] Startup	PARAMETER SETUP MODE SYSTEM MODE : DP-1 WORK MODE : MODE1 BAUDRATE : 4800 PARITY : EVEN DATA LENGTH : 7 PRINT SIZE : LARGE POWER SAVE : NORMAL PRINT DENSITY : NORMAL BUZZER MODE : ON TIME STAMP : ON DATE FORMAT : YYYY/MM/DD DATE : 2000/ 1/ 1 TIME : 10:10 UNIT : PUSH DATA : DATA FIX & GO PUSH STAT : DATA CHANGE PARAMETER NO CLEAR	The fact that the mode is the parameter setting mode is printed out. All the parameters are printed out. Date display format
STAT	PARAMETER CLEAR	
DATA	PARAMETER CLEAR SYSTEM MODE : DP-1	If Clear is selected, the buzzer sounds four times to call the user's attention.
DATA	MODE : MODE1	
DATA	BAUDRATE : 4800	
DATA	PARITY : EVEN	
DATA	DATA LENGTH : 7	
DATA	PRINT SIZE : LARGE	If Mode 2 is selected, "NORMAL" is selected and this item cannot be input.
STAT	PRINT SIZE : NORMAL	The character size is changed with the [STAT] key.

PARAMETERS

Key Operation	Printout	Comment
DATA	POWER SAVE : NORMAL	Confirm with [DATA] key
DATA	PRINT DENSITY : NORMAL	
DATA	BUZZER MODE : ON	
DATA	TIME PRINT : ON	
DATA	DATE FORMAT : YYYY/MM/DD	Date display format
DATA	CE : DAY CL : MONTH PRINTER : YEAR PUSH EACH KEY TO INCREMENT DATE 2001/1/1	Change last 2 digits of the year
DATA	POWER SAVE : NORMAL	Confirm with [DATA] key
DATA	PRINT DENSTY : NORMAL	
DATA	BUZZER : ON	
DATA	TIME PRINT : ON	
DATA	DATE FORMAT : YYY/MM/DD	Date display format
DATA	CE : DAY CL : MONTH PRINTER : YEAR PUSH EACH KEY TO INCREMENT DATE 01/JAN/2000	Change last 2 digits of the year
CE	Increment the date with the [CE] key 1 to 31 cycle	
CL	Increment month with the [CL] key 1 to 12 cycle	
PRINTER	[PRINTER] key Increments the year 00 to 20 cycle	
STAT	Print out the date during settings by pressing the [STAT] key. Printing cannot be done with the [CE], [CL], and [PRINTER] keys.	
DATA	Complete the settings with the [DATA] key. YYYY/MM/DD : 2001/2/2 CL : MIN PRINTER : HOUR PUSH EACH KEY TO INCREMENT TIME 11:11	
CL	Increment minutes with the [CL] key. 0 to 59 cycle	
PRINTER	Increment the time with the [PRINTER] key. 0 to 23 cycle	
STAT	Print out the time during settings with the [STAT] key. Printing cannot be performed with the [PRINTER] key. HH:MM:SS 11:11: 0	

Key Operation	Printout	Comment
DATA	Complete the settings with the [DATA] key. HH:MM:SS 11:11: 0 UNIT : AUTO	The date and time are confirmed and written by pressing the [DATA] key. The clock starts immediately after the time has been confirmed with the [DATA] key with the seconds setting at "0".
DATA	SYSTEM MODE : DP-1 WORK MODE : MODE1 BAUDRATE : 4800 PARITY : EVEN DATA LENGTH : 7 PRINT SIZE : NORMAL POWER SAVE : NORMAL PRINT DENSITY : NORMAL BUZZER MODE : ON TIME PRINT : ON DATE FORMAT : YYY/MM/DD DATE : 2001/2/2 TIME : 11:11 UNIT : AUTO	The list of set parameters is printed out.

IMPORTANT

- **Since parameter inputs are memorized by performing all the operations to the end, do not stop midway.**
- **The date and time settings are written following time input confirmation.**
- **No validity check is performed for the date and time. Make sure that correct values are input.**
- **Example: February 30 does not exist.**
- **Leap years and the number of days in a month are automatically calculated.**
- **The clock stops while parameters are being set. Set the time when setting parameters other than the time.**
- **Set the time in the 24-hour format.**

NOTE

- **Upon parameter input completion, the mode changes to the data input mode.**

4 FUNCTIONAL OUTLINE

1. Key Function

Key	Function			
			Mode 3	
	Mode 0	Modes 1, 2	Subgroup During Measurement	Subgroup After Measurement
CL **(Clear key)**	● Clears only measurement data (settings remain). ● Be sure to press this key before setting the LIMIT.		● Performs re-input from the No. 1 data.	● Clears the measurement data (settings remain).
CE **(Cancel key)**	● Cancels the measurement data input immediately before.		● Cancels the measurement data input immediately before.	● Deletes the subgroup for which input was ended immediately before.
TOL.LIMIT **(Limit key)**	● Press this button to enter or exit the measuring mode for the upper and lower limits of the standard.		● Stops measurement and cancels the measuring mode.	● Starts the next subgroup measurement.
STAT **(Stat key)**	● Does not operate.	● Statistical processing is performed based on all the input data, the processing results are printed out, and a histogram is generated.	● Subgroup measurement is ended, X and R are calculated, and the results are printed out.	● The control limit values are calculated from all the subgroups for which input has been completed, and the results are printed out.
FEED **(Feed key)**	● Printer paper is fed while this key is pressed.			
DATA **(Data key)**	● Inputs data from the measuring device.			
PRINTER ON/OFF **(Printer On/Off key)**	● Switches printer printing on/off.			
POWER **(Power key)**	● Switches the power on/off.			

NOTE

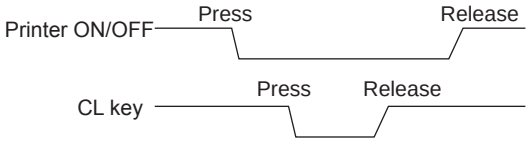
◆ **The sample size is determined by "STAT" of Subgroup 1. "STAT" of Subgroup 2 and later becomes effective only after an amount of data corresponding to the sample size has been input.**

2. Functions of Each Mode

<table>
<tr><th>Mode 0</th><th>Mode 1</th><th>Mode 2</th><th>Mode 3</th></tr>
<tr><td>● Functions
Measurement data printing
Tolerance judgment</td><td>● Functions
Measurement data printing
Tolerance judgment
Statistical processing
Histogram generation</td><td>● Functions
D chart (graph that visually displays measurement data displacement) printing
Statistical processing
Histogram printing</td><td>● Functions
The processing results are printed out to create an $\overline{X}$-R control chart based on data input only.</td></tr>
<tr><td colspan="3">a) Limit settings
<1> To record GO/NG judgments and histograms, press the [TOL.LIMIT] key. If no settings have been made, proceed to measurement.
<2> Up to 5 pairs of limit data can be saved. The limit data No. is switched by pressing the [STAT] key.
<3> Display either the upper or lower limit on the measuring device and press the [DATA] key.
<4> Display the other limit value on the measuring device and press the [DATA] key.
<5> After completing the settings, press the [TOL.LIMIT] key.</td><td>a) Subgroup measurement
Subgroup measurement is executed by pressing the [TOL.LIMIT] key.
Up to 9999 subgroups can be input.
The sample size of a subgroup ranges from 2 to 10.</td></tr>
<tr><td colspan="2">b) Measurement
The measurement data can be recorded with the [DATA] key, timer input, a data request command from the RS-232C input, foot switch, or the data output switch of the measuring device.
GO/NG judgment is performed at the same time, and the judgment result is displayed and output as follows.
▲… Upper limit exceeded
▼… Lower limit exceeded</td><td>b) Measurement
The measurement values and D chart can be recorded with the [DATA] key, timer input, a data request command from the RS-232C input, foot switch, or the data output switch of the measuring device.
GO/NG judgment is performed at the same time, and the judgment result is displayed and output as follows.
▶… Upper limit exceeded
◀… Lower limit exceeded</td><td>b) Measurement
The measurement data can be recorded with the [DATA] key, timer input, a data request command from the RS-232C input, foot switch, or the data output switch of the measuring device.</td></tr>
<tr><td>c) Statistical processing</td><td colspan="2">c) Statistical processing
Statistical processing is performed for the measurement data up to that point with the [STAT] key, and the statistical processing result and histogram are saved.</td><td>c) Statistical processing
<1> Press the [STAT] key once to print out the $\overline{X}$ and R processing for that group.
<2> Press the [STAT] key again to calculate and print out the control limits values from the data up to that point.</td></tr>
</table>

3. Timer Input Function

This function is used to automatically fetch data from the measuring device at given intervals. This function is activated by pressing the [FEED] key while the [PRINTER ON/OFF] key is held down, and the interval time can be set by then pressing a key. To disable this function, press the [CL] key while holding down the [PRINTER ON/OFF] key.



NOTES

1. **If 0.25 s or 1 s has been set with the interval timer, do not use the [CL], [CE] and [STAT] keys, as this may cause malfunction.**
2. **If, when the interval timer operation is switched off, data still remains in the buffer, this data is printed out in some cases.**
3. **If wishing to change the interval time during data fetching through the interval timer, exit the mode once to clear the data, and then set the new interval time.**

- The various keys and interval times are listed below.

Key	Interval time
STAT	0.25 s
TOL.LIMIT	1 s
CE	5 s
CL	30 s
DATA	1 min
FEED	30 min
PRINTER ON/OFF	60 min

NOTE

- **If 0.25 s or 1 s has been set, the measurement data cannot be printed out. Also, if 0.25 s has been set, the data input buzzer does not sound.**

5 OPERATION

1. Power On/Off

The power is switched on/off as described in the following table.

Operation	Key	Printout
Power on	POWER	Mitutoyo * DP-1VR * * MODE-1 * DATE 2000/2/2 TIME 13:36
Power off	POWER Hold down the [POWER] key for 2 or more seconds.	

ADDENDA

- **To prevent powering off of the DP-1VR by mistake, the power is switched off when the [POWER] key is released after being pressed for 2 or more seconds. If the [POWER] is pressed for less than 2 seconds, the power does not switch off.**
- **The printout contents are for when the large printing size is selected. In the case of the normal printing size, the printout contents differ slightly.**

2. Basic Operations 1

The basic operations when the limit settings are not performed are described below. The operations are the same for Mode 0, Mode 1, and Mode 2.

2.1 Data input, cancel, clear

Function	Operation	Printout
● Power ON	POWER	Mitutoyo * DP-1VR * * MODE-1 * DATE 2000/2/2 TIME 13:35
● Data input Other than [DATA] key Foot switch operation Data is fetched through interval timer	 Data Data	Fetches and prints out the data fetched from the measuring device. 1 12.23 mm 2 26.25 mm
● Data cancel Cancels the data input immediately before.	CE	* CANCEL *
● Data all clear Clears all the input data.	CL	* CLEAR *
● Time print Prints out the date and time.	PRINTER ON/ OFF+DATA	DATE 2000/ 2/ 2 TIME 13:36
● Statistical processing Performs statistical processing using the input data. (This function does not work in Mode 0.)	STAT	PART NO. DATE 2000/ 2/ 2 TIME 13:35 NAME: * RESULT * N 56 MAX 81.26 mm MIN 25.66 mm R 55.60 mm X 54.23 mm sn 12.5635 mm sn-1 13.5897 mm

IMPORTANT

- **DP-1 printer paper offers excellent durability and chemical resistance. However, as thermosensitive paper, it has its limits. In the case of extended storage (5 years or longer) or use for official documents, printed records should be copied.**
- **If cutting fluid or other substances get on the printer paper, make a copy for storage purposes.**
- **In Mode 0**
- **Statistical processing is not performed.**
- **The maximum number of data that can be handled is 100,000.**
- **In Mode 1**
- **The maximum number of data that can be handled is 9,999.**
- **Once 9999 data have been input, statistical processing is automatically performed.**
- **In Mode 2**
- **The maximum number of data that can be handled is 9,999.**
- **Once 9999 data have been input, statistical processing is automatically performed.**
- **The data printing format is the same as that in Mode 1.**
- **When the parameter time print is set to off, the date and time are not printed out.**

3. Basic Operations 2

The operations when the limit settings have been performed are described below. The operations are the same for Mode 0, Mode 1, and Mode 2. These operations are performed when connecting digimatic tools such as calipers and micrometers.

3.1 Limit data input

The following operations are performed for limit data input. Data is input with a measuring device connected to the DP-1VR.

● Power ON	POWER	Mitutoyo * DP-1VR * * MODE 1 * DATE 2000/2/2 TIME 13:35 *LIMIT DATA 1* LSL 12.56 mm USL 25.89 mm TOL 13.33 mm
● Limit input mode The limit data mode is entered with the [TOL.LIMIT] key. The limit number is switched with the [STAT] key. The limit data can be selected from 5 sets of data.	TOL.LIMIT STAT	*LIMIT MODE* *LIMIT DATA 1* *NO LIMIT DATA* *LIMIT DATA 2* LSL 12.56 mm USL 25.89 mm TOL 13.33 mm
● Limit data input Using a caliper, etc., display the upper and lower limits and press the [DATA] key. Either the upper value or the lower value can be input first. The data is saved with the [TOL.LIMIT] key.	DATA DATA TOL.LIMIT Limit setting end	LMT1 15.12 mm LMT2 16.36 mm *NEW LIMIT DATA* *LIMIT DATA 2* DATE 2000/ 2/ 2 TIME 13: 35 LSL 15.12 mm USL 16.36 mm TOL 12.4 mm

NOTES

- **To enter the limit input mode, the DP-1VR must be in one of the following two states: <1> Data immediately following power on not input, or <2> all the data cleared with the [CL] key.**
- **In the limit input mode, limit data is switched using the [STAT] key. Up to 5 sets of limit data can be saved. Switch the limit data as needed.**
- **When a number corresponding to already set limit data is selected and limit data is then newly input, the new data is overwritten on the old data and the old data ceases to exist.**
- **Limit data remains saved even after the power is switched off.**
- **Immediately after the power is switched on, the limit data that was being used at the time the power was switched off is selected.**
- **If no limit data is required (if limit judgment is not required), either select a limit number for which no limit data has been input (refer to 3.2), or delete the limit data (refer to 3.3.)**

3.2 Limit data check/switch

The following operations are performed to check the five sets of limit data and switch the limit data to be used.

● Limit check and switch This operation is possible only if data has not been input, or after data clear using the [CL] key.	TOL.LIMIT	LIMIT MODE* *LIMIT DATA 2* LSL 12.36 mm USL 25.67 mm TOL 13.31 mm
The limit data is switched using the [STAT] key.	STAT	*LIMIT DATA 3* LSL 12.56 mm USL 25.89 mm TOL 13.33 mm
	STAT	*LIMIT DATA 4* * NO LIMIT DATA *
Press the [TOL.LIMIT] key for the number of the limit data to be used. The new limit data will be switched to as a result.	STAT	*LIMIT DATA 5* LSL 12.36 mm USL 25.67 mm TOL 13.31 mm
	TOL.LIMIT	*NEW LIMIT DATA* *LIMIT DATA 5* DATE 2000/ 2/ 2 TIME 13: 35 LSL 12.36 mm USL 25.67 mm TOL 13.31 mm

3.3 Limit data cancellation

The following operation is performed to delete limit data. It is performed when limit data becomes unnecessary.

● Limit cancellation Press the [CL] key for the limit data to be deleted. The selected limit data will be deleted as a result.	TOL.LIMIT	*LIMIT DATA 1* LSL 12.36 mm USL 25.67 mm TOL 13.31 mm
	CL	*LIMIT CLEARED* DATE 2000/ 2/ 2 TIME 13: 35 *LIMIT DATA 1* *NO LIMIT DATA*

3.4 Data input, cancel, clear

Table 2. DP1 Mode 1 Operation Example 2

Function	Operation	Printout
● Power ON	POWER	Mitutoyo * DP-1VR * * MODE 1* DATE 2000/ 2/ 2 TIME 13: 35 *LIMIT DATA 1* LSL 12.36 mm USL 25.67 mm TOL 13.31 mm
● Time printing	PRINTER ON/OFF + DATA	DATE 2000/ 2/ 2 TIME 13: 35
● Data cancellation Cancels the data input immediately before.	CE	* CANCEL *
● Data all clear Clears all the input data.	CL	* CLEAR *
● Data input Performs limit judgment for the input data and displays and prints out the judgment result.	DATA DATA DATA	▼1 12.00 mm 2 26.25 mm ▲3 32.56 mm

Input Data, Display, and Printout

Input	Input data < Lower limit value	Lower limit value ≤ Input data ≤ Upper limit value	Upper limit value < Input data
Display	–NG GO +NG	–NG GO +NG	–NG GO +NG
Print	▼		▲

Data input

Function	Operation	Printout
Statistical processing • Statistical processing is automatically performed once 9,999 data have been input. (Statistical processing is not performed in Mode 0.)	STAT	PART NO. DATE 2000/ 2/ 2 TIME 13: 35 NAME *RESULT* N 56 MAX 81.26 mm MIN 25.66 mm R 55.60 mm X̄ 54.23 mm σn 12.5635 mm σn-1 13.5897 mm –NG 2 +NG 4 P 18.56% Cp 0.45670 Cpk 0.30000 *HISTOGRAM* LSL 12.36 mm USL 25.67 mm TOL 13.31 mm DIV 10 –NG 2|□ LSL |·•••••• A 2|□ B 4|□□ C 5|□□ D 8|□□□□ E 9|□□□□ F 11|□□□□□□ G 4|□□ H 9|□□□□ I 5|□□ J 4|□□ USL |·•••••• +NG 4|□□

Function	Operation	Printout
		□ = 2 A 12.3600~ B 13.6910~ C 15.0220~ D 16.3530~ E 17.6840~ F 19.0150~ G 20.3460~ H 21.6770~ I 23.0080~ J 24.3390~ 25.6700~

IMPORTANT

- **DP-1 printer paper offers excellent durability and chemical resistance. However, as thermosensitive paper, it has its limits. In the case of extended storage (5 years or longer) or use for official documents, printed records should be copied.**
- **If cutting fluid or other substances get on the printer paper, make a copy for storage purposes.**
- **In Mode 0**
  Statistical processing is not performed.
  The maximum number of data that can be handled is 100,000.
- **In Mode 1**
  The maximum number of data that can be handled is 9,999.
  Once 9999 data have been input, statistical processing is automatically performed.
- **In Mode 2**
  The maximum number of data that can be handled is 9,999.
  Once 9999 data have been input, statistical processing is automatically performed.
  The data printing format is the D chart (analog variations printout).
- **When the parameter timestamp is off, the date and time are not printed out.**

4. Mode 3

Mode 3 Operation Example

Function	Operation	Printout
Power ON	POWER	Mitutoyo * DP-1VR * * MODE 3* DATE 2000/ 2/ 2 TIME 13: 35
Subgroup measurement start Transition to subgroup measurement mode	TOL.LIMIT	SUB GR. NO.1
Data fetching (subgroup measurement mode)	 DATA DATA DATA	Data is fetched from the measuring device and printed out. 1 12.00 mm 2 26.25 mm 3 32.56 mm
Data cancellation Cancels the data input immediately before. ([CL] key operation before subgroup measurement)	CE	* CANCEL *
Subgroup data all clear Clears all the data in the subgroup and performs measurement again from No. 1 data ([CL] key operation during subgroup measurement)	CL	* CLEAR SUB DATA*
Time print	PRINTER ON/OFF + DATA	DATE 2000/ 2/ 2 TIME 13: 35
Ends subgroup measurement and performs $\bar{X}$-R calculation for subgroup. (Subgroup measurement mode normal end)	STAT	$\bar{X}$ 0.92335 mm R 2.77568 mm PART NO. DATE 2000/ 2/ 2 TIME 13: 35 NAME
Stops subgroup measurement and cancels the subgroup measurement mode. (Subgroup measurement mode forced end)	TOL.LIMIT	* EXIT SUB GR. *
Performs next subgroup measurement.	TOL.LIMIT	SUB GR. 2

Function	Operation	Printout
Data fetch	DATA DATA DATA	Data is fetched from the measuring device and is printed out. 1 12.00 mm 2 26.25 mm 3 32.56 mm
Ends subgroup measurement and performs $\bar{X}$-R calculation for subgroup.	STAT	$\bar{X}$ 0.92335 mm R 2.77568 mm PART NO. _____ DATE 2000/ 2/ 2 TIME 13: 35 _____ NAME
Calculates the control limits from the data of all groups input up to that point and prints out the results.	STAT	*CONTROL LIMIT* DATE 2000/ 2/ 2 TIME 13: 35 NO.OF SUB GR. 5 SAMPLE SIZE 8 $\bar{\bar{X}}$ 4.1999 mm $\bar{X}$-UCL 6.9057 mm $\bar{X}$-LCL 1.4970 mm $\bar{R}$ 2.6458 mm R-UCL 6.8082 mm R-LCL 6.8082 mm
Time stamp	PRINTER ON/OFF + DATA	DATE 2000/ 2/ 2 TIME 13: 35
Cancels the immediately preceding subgroup data. [CE] key operation following subgroup measurement end	CE	*CLEAR SUB GR.*
Measurement data clear [CL] key operation following subgroup measurement end	CL	*CLEAR ALL DATA *

5. Counter RS-232C Printing

Function	Operation	Printout
● Power ON When the parameter timestamp is off, the date and time are not printed out.	POWER	Mitutoyo * DP-1VR * * MODE 1* DATE 2000/ 2/ 2 TIME 13: 35 *LIMIT DATA 1* LSL 12.365 mm USL 25.675 mm TOL 13.310 mm
● Time stamp	PRINTER ON/OFF + DATA	DATE 2000/ 2/ 2 TIME 13: 35
● Data cancellation Cancels the data input immediately before.	CE	* CANCEL *
● Data all clear Clears all the input data.	CL	* CLEAR *
● Data input Performs limit judgment for the input data and displays and prints out the judgment result. The meanings of the symbols are as follows. ▼: Data < Lower limit value : Lower limit value ≤ DATA ≤ Upper limit value ▲: Upper limit value < DATA DATA: Data that was input	DATA DATA DATA	▼1 X 12.000 Y 23.565 2 X 24.254 Y 23.896 ▲3 X 32.566 Y 23.896
Statistical processing • Statistical processing is automatically performed once 9,999 data have been input.	STAT	*RESULT* PART NO. DATE 2000/ 2/ 2 TIME 13: 35 NAME N 56 MAX 81.26 MIN 25.66 R 55.60 $\overline{X}$ 54.23

Function	Operation	Printout
		σn 12.5635 σn-1 13.5897 –NG 2 +NG 4 P 18.56% Cp 0.45670 Cpk 0.30000 *HISTOGRAM* LSL 12.36 USL 25.67 TOL 13.31 DIV 10 –NG 2|□ LSL |·•••••• A 2|□ B 4|□□ C 5|□□ D 8|□□□□ E 9|□□□□ F 11|□□□□□□ G 4|□□ H 9|□□□□ I 5|□□ J 4|□□ USL |·•••••• +NG 4|□□ □ = 2 A 12.3600~ B 13.6910~ C 15.0220~ D 16.3530~ E 17.6840~ F 19.0150~ G 20.3460~ H 21.6770~ I 23.0080~ J 24.3390~ 25.6700~

MEMO

6 MAINTENANCE

This chapter describes the daily maintenance of the DP-1VR.

1. Cleaning the Printer Head

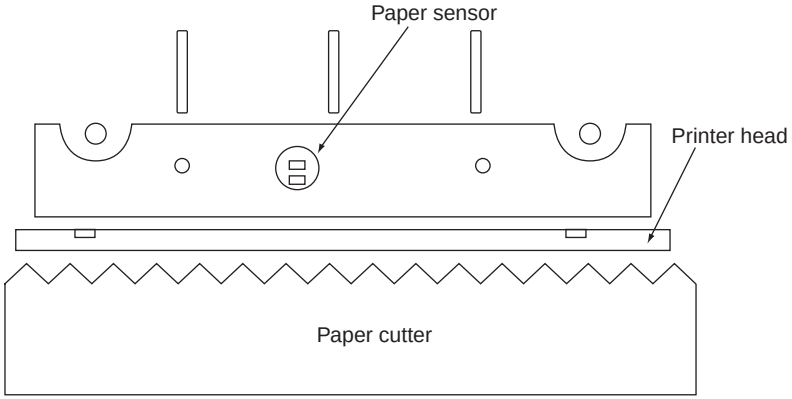
Dirt adhering to the printer head may result in poor printing quality and damage the printer head, making printing altogether impossible. It is therefore recommended to clean the printer head on a regular basis.
Cleaning method:
Open the printer cover and gently wipe the printer head with a cotton swab moistened with a little alcohol. Then wipe off any alcohol remaining on the printer head with a dry cotton swab.

2. Cleaning the Paper Sensor

A dirty paper sensor may render printer paper detection impossible and prevent normal operation. It is thus recommended to clean the paper sensor on a regular basis.
Cleaning method:
Open the printer cover and gently wipe the paper sensor with a cotton swab moistened with a little alcohol. Then wipe off any alcohol remaining on the printer head with a dry cotton swab to make sure it is fully dry.

CAUTION

- **Never perform cleaning immediately after printing, because the printer head will still be very hot and may cause burns. This also presents the risk of the alcohol igniting.**
- **Thoroughly wipe off any alcohol that remains on the printer head. Powering on the DP-1VR while the printer head is not completely dry may cause a fire.**
- **Handle the alcohol used for cleaning with care.**
- **Never use thinner, benzene, or some other substance instead of alcohol.**


Paper sensor
Printer head
Paper cutter

7 ERROR MESSAGES

1. Power Supply Alarms

Table 1. Power Supply-Related Alarms

Status	Power LED Blinking Pattern	Data Input	Cancellation Conditions
Abnormally high voltage	Alternately 0.6 s on, 0.6 s off	Not possible	Turn on again the DP-1VR
Normal	Always on	Possible	
Voltage drop alarm When the voltage drops and the remaining battery power is low	Alternately 1.5 s off, 0.3 s on 0.3 s off, 0.3 on	Possible	Recovery when the voltage returns to normal range
Abnormally low voltage When voltage drops and operation becomes impossible.	Alternately 0.6 s on, 0.6 s off	Not possible	Turn on again the DP-1VR

CAUTIONS

- **When the DP-1VR is turned off, all the saved data is deleted. Also note that if the AC adapter is disconnected while the DP-1VR is being used (regardless of whether or not the DP-1VR is powered via the AC adapter), all the data saved until then is lost.**
- **When operating the DP-1VR on batteries, if the room temperature drops below 10°C, the battery life becomes considerably shorter. Use an AC adapter when the room temperature drops below 10°C.**
- **When the batteries are used up, the voltage drops below the operating voltage, so that the alarm lamp may not function properly. If the alarm lamp blinks, change the batteries as promptly as possible or switch to the AC adapter.**

2. Other Alarms

Table. DP-1VR Errors and Alarms

Alarm Type	Symptoms	Causes	Cancellation Conditions
● System error	● Immediately after power on, all the LEDs blink and the buzzer sounds.	● A fatal error occurred in the DP-1VR. ● The service temperature is either too high or too low.	● Turn off the DP-1VR and then turn it on again. If this does not solve the problem, call the nearest Sales Office or Service Center. ● Use the DP-1VR in the temperature range of 0°C to 45°C.
● Overflow	● OVER FLOW* is printed out.	● The processable range has been exceeded.	● Clear the data with the [CL] key.
● Out of paper	● The −NG and +NG LEDs blink. ● A red line appears on the printer paper.	● There is no printer paper.	● Set printer paper in the DP-1VR.
● Cover open (head up)	● The −NG and +NG LEDs blink.	● The printer paper cover is open.	● Close the cover.
● No measuring device connected	● NO GAGE* is printed out.	● No measuring device is connected. ● The connecting cable is damaged. ● Poor contact of the connecting cable	● Connect a measuring device. ● Replace the connecting cable. ● Check the connector of the connecting cable.
● Incorrect format	● *FORMAT ERROR*	● The format of the input data is incorrect.	● Replace the connecting cable. ● Check the connector of the connecting cable.
● Incorrect unit	● *UNIT ERROR*	● The unit of the input data is incorrect.	● This message is printed out when the unit differs from that of the data that was first input. Input data of the same unit as that of the data that was first input. ● A unit that differs from that of the set limit data has been input. Input data of the same unit as that of the limit data.

ERROR MESSAGES

Alarm Type	Symptoms	Causes	Cancellation Conditions
● Decimal point position error	● *POINT ERROR*	● The position of the decimal point of the input data is incorrect.	● The position of the decimal point differs from that of the data that was first input. Input data with the same decimal point position as that of the data that was first input. ● A decimal point position that differs from that of the set limit data has been input. Input data with the same decimal point position as that of the limit data.
● Overflow caution	● The buzzer sounds twice each time data is input.	● Overflow is about to happen.	● Stop measurement as soon as possible and perform the statistical processing. Then press the [CL] key to clear the data.

8 PROCESSING SPECIFICATIONS

1. Valid Number of Digits

The valid numbers of digits for processing are as follows.
The valid number of digits using A to describe the valid number of digits of the input data (number of digits after the decimal point) is indicated in the following table.

Valid Number of Digits

Symbol	Meaning	Valid Number of Digits (After Decimal Point)	Tolerance
Data	Input data	A	–
N	Number of data	0	–
MAX	Max. value	A	–
MIN	Min. value	A	–
R	Range	A	–
X	Average	A + 2	Lowermost digit ±1
σn	Standard deviation	A + 2	Lowermost digit ±1
σn-1	Standard deviation	A + 2	Lowermost digit ±1
P	Fraction defective	3 (**.***%)	Lowermost digit ±1
Cp	Process capability index	3	Lowermost digit ±1
Cpk	Process capability index	3	Lowermost digit ±1
LSL	Lower limit value	A	Lowermost digit ±1
USL	Upper limit value	A	Lowermost digit ±1
DIV	Number of divisions in histogram	Fixed to 10	–
	Histogram range display	A + 2	Lowermost digit ±1
$\overline{X}$	Center ($\overline{X}$ control)	A + 2	Lowermost digit ±1
$\overline{X}$-UCL	Upper control limit ($\overline{X}$ control)	A + 2	Lowermost digit ±1
$\overline{X}$-LCL	Lower control limit ($\overline{X}$ control)	A + 2	Lowermost digit ±1
$\overline{R}$	Center (R control)	A + 2	Lowermost digit ±1
$\overline{R}$-UCL	Upper control limit (R control)	A + 2	Lowermost digit ±1
$\overline{R}$-LCL	Lower control limit (R control)	A + 2	Lowermost digit ±1

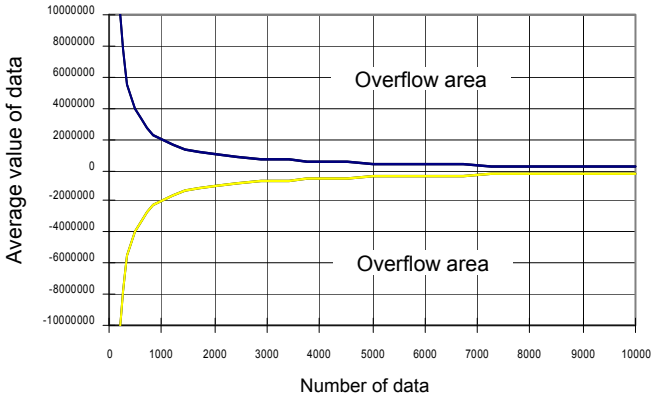
IMPORTANT

- **For the processing error application range, refer to Processing Error Details.**

2. Overflow and Processing Errors

- Overflow and processing errors
  DP-1VR overflow conditions and processing errors are described below.
  DP-1VR overflow varies according to the average value of data and the number of data. This is illustrated in the Overflow Conditions graph below.
- Graph explanation
  Assuming that an average value of 10 m is measured (with a caliper, etc.) with two or more digits after the decimal point, let us see approximately how many data can be measured.
  <1> Data 10000.00 is expressed as 1000000 when expressed as data without a decimal point.
  <2> Horizontally extending the vertical axis on the graph yields the horizontal axis of the graph.
  <3> 2000 is obtained as the number of data.
  <4> When data with an average value of 10 m is measured approximately 2000 times, overflow is observed.

Overflow Conditions



IMPORTANT

- **When using a caliper, micrometer, etc., overflow almost never occurs.**
- **When using the DP-1VR as a linear scale counter printer, overflow may occur. Therefore, referring to the overflow occurrence conditions graph and appropriate caution are required.**

NOTE

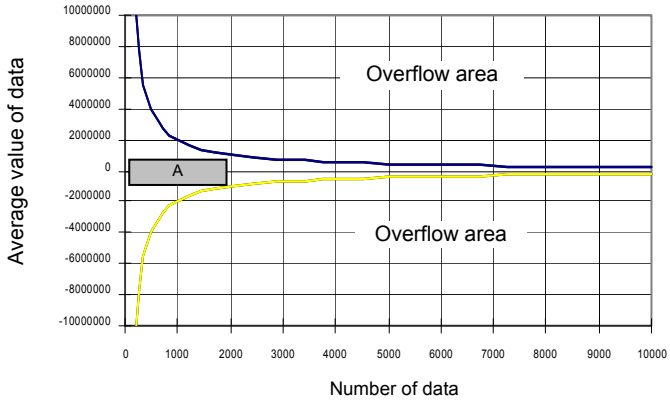
- **The notation format for average data values does not use a decimal point.**
  Example: Read 10.00 as 1000.

3. Processing Error Details

The DP-1VR processing error is described below.
The DP-1VR processing error is defined as follows.

1. Lowermost digit ±1 is counted but the value is on the inside of the overflow limit indicated by the processing precision.
   Data variation at this time is approximately ±5% of the average value.
2. The processing error when the average value variation greatly exceeds the above variation is counted as lowermost digit ±5.
3. However, regarding area A (±1000000, number of data 2000 or lower), in all cases the processing error is counted as lowermost digit ±1.

Processing Accuracy



NOTE

- **The notation format for average data values does not use a decimal point.**
  Example: Read 10.00 as 1000.

4. Formulas

4.1 Mode 1 and 2 Processing

Table 2. Formula 1

Printout	Meaning	Calculation Formula
N	Number of data	
MAX	Maximum data value	
MIN	Minimum data value	
R	Data range	MAX − MIN
$\bar{X}$	Average data value	ΣXi/N
σn	Standard deviation	σn = $((N\cdot\Sigma ESXi^2 - (\Sigma Xi)^2)/N^2)^{1/2}$
σn-1	Sample standard deviation	σn − 1= $((N\cdot\Sigma ESXi^2 - (\Sigma Xi)^2)/N\cdot E(N-1))^{1/2}$
−NG	Number of data smaller than lower limit	Number of data for which LSI > Xi
+NG	Number of data larger than upper limit	Number of data for which USL < Xi
P	Fraction defective	P = ((−NG) + (+NG))/N
C_P	Process capability index	C_P = TOL/(6σn − 1) TOL:USL − LSL
C_{PK}	When process capability index bias is considered	C_{PK} = Zmin/3 Zmin: Smaller of ZUSL and ZLSL ZUSL = (USL − $\bar{X}$)/σn − 1 ZLSL = ($\bar{X}$ − LSL)/σn − 1

4.2 Mode 3 Processing

N: Number of data
MAX: Maximum data value
MIN: Minimum data value
n: Number of subgroups
A2: Refer to Table 3
D3: Refer to Table 3
D4: Refer to Table 3
The maximum number of data of a subgroup is 10.

Table 3. Mode 3 Variable Table

Sample Size n	A2	D3	D4
2	1.880		3.267
3	1.023		2.574
4	0.729		2.282
5	0.577		2.114
6	0.483		2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

Symbol	Meaning	Calculation Formula
$\overline{X}$	Average subgroup value	$\overline{X} = \Sigma Xi/N$
R	Subgroup range	$R = Xmax - Xmin$
$\overline{\overline{X}}$	Mean value	$\overline{\overline{X}} = \Sigma \overline{X}i/n$
$\overline{X}$-UCL	Upper control limit	$\overline{X}$ - UCL = $\overline{\overline{X}} - A2 \bullet \overline{R}$
$\overline{X}$-LCL	Lower control limit	$\overline{X}$ - LCL = $\overline{\overline{X}} - A2 \bullet \overline{R}$
$\overline{R}$	Center (R control)	$\overline{R} = \Sigma Ri/n$
$\overline{R}$-UCL	Upper control limit (R control)	$\overline{R} - UCL = D4 \bullet \overline{R}$
$\overline{R}$-LCL *1	Lower control limit (R control)	$\overline{R} - UCL = D3 \bullet \overline{R} \times 1$

ADDENDUM

***1: If the number of samples is 6 or less, $\overline{R}$-LCL is not printed out.**

9 OUTPUT

By connecting a dedicated cable (part No. 965464, option) to the OUTPUT connector on the side panel, input data GO/NG judgment or measurement data output via RS-232C can be performed.

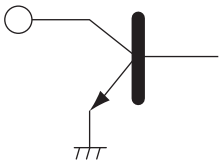
1. GO/±NG Judgment Output

When a GO/±NG judgment cable (part No. 965516, option) is connected, and the limit values are set in Mode 0, Mode 1, or Mode 2, output is done through an open collector.

2SC4047 or equivalent

V_{CEO} (max) = 50 V

IC (max) = 100 mA



2. RS-232C Compliant Output

This output is performed as an RS-232C compliant signal from the [DATA] key, timer input, a command from the RS-232C input, foot switch, or the data output key of the measuring device. However, data output such as the results of the processing performed in the DP-1VR, is not performed. Note that an RS-232C conversion cable (part No. 09EAA084) is required when this output is used.

2.1 Communication specifications

Output signal level:	TTL level (An RS-232C compliant signal level is obtained when an RS-232C conversion cable is used.)
Communication method:	Half-duplex method
Communication speed:	1200, 2400, 4800, 9600, 19200
Bit configuration:	Start bit: 1 bit Data length: 7/8 bits Parity: Even/odd/none Stop bit: 2 bits

2.2 Data format

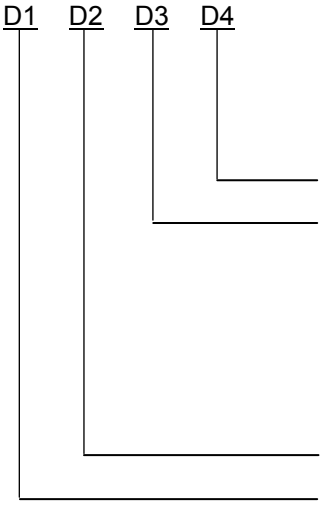
- Normal data consists of 13 bytes.

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Data	0	1	A	Signed data	Most significant data	Data	Data	Data	Data	Data	Data	Least significant data	CR
Code HEX	30h	31h	41h	2Bh 2Dh									0Dh

Output when the data is −12.345 mm: 01A-0012.345 CR

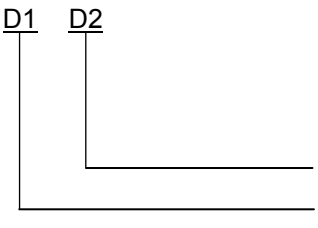
- ASCII code is output.

2.3 Error code



Number	1	2	3	1
Data code	9	1	Error code	CR
Hex	39h	31h	0Dh	

2.4 Data request command



Number	1	2
Data code	1 or A	CR
Hex	31h, 41h	0Dh

Point to be checked when in doubt (before judging that a failure has occurred!)

10 TROUBLESHOOTING

When a problem occurs in the DP-1VR, perform a check based on the table on the next page before jumping to the conclusion that a failure has occurred.

If the problem cannot be solved even through troubleshooting, request repair from the Mitutoyo dealer where the unit was purchased or the nearest Mitutoyo Sales Office. (See the list of addresses printed at the end of this manual.)

The warranty for the DP-1VR is good for a period of one year from the purchase date. However, some types of repairs may be available only on a billable basis.

TROUBLESHOOTING

DP-1VR Symptoms	Causes	Handling
The state of the DP-1VR changes to that immediately after power-on during printing **The printing looks faint.**	● Manganese batteries are used. ● Exfoliation or swelling of the battery terminals ● An AC adapter other than the one specified is used. ● Power is supplied from the DP-1VR to the connected measuring device. ● If the AC adapter input voltage (AC power supply line) is low, when the actual voltage is lower than the prescribed voltage by 5% or more ● The AC adapter input is simultaneously used for a high-voltage, large-current device. ● The printer head is dirty.	● Use charged AA-size nickel-hydride batteries or AA-size alkaline batteries. ● Remove exfoliation or swelling from the battery terminals. ● Use only one of the dedicated AC adapters listed on page 54. ● Power cannot be supplied from the DP-1VR to a measuring device that uses an external power supply. ● Measure the voltage of the power supply line and check if the voltage is appropriate. ● Connect the AC adapter to a different power supply line. ● Clean the printer head with a cotton swab, etc.
The printer does not work.	● The [PRINTER ON/OFF] switch is set to OFF. ● A foreign object has gotten inside the printer or a paper jam has occurred. ● The mode is the timer input mode and the interval time setting is either 0.25 s or 1 s.	● Press the switch once more to turn the DP-1VR on. ● Remove the foreign object or paper jam with tweezers. ● When the interval time is set to 0.25 s or 1 s, the printer is automatically switched off.
Miscounting by the measuring device	● The AC adapter input is simultaneously used for a high-voltage, large-current device.	● Connect the AC adapter to a different power supply line.

11 SPECIFICATIONS

Item	Description	Remarks
Code No.	264-504	100 V
Printing method	Line thermal, 384 dots	
Character specifications	36 × 24 dots (large), 24 × 16 (normal)	
Printing speed	0.5 s per line	When using AC adapter
Number of print lines	7,000 lines/roll (large) 10,000 lines/roll (normal)	
Power supply	AC adapter (6 V, 1000 mA) Four AA-size alkaline batteries (LR6) or four AA-size Ni-MH batteries	Dual power supply
Service temperature	0 to 45°C (AC adapter) 10 to 45°C (batteries)	
Storage temperature	−10 to 50°C	Using Mitutoyo-specified packaging
Clock error	±2 m max./month	
Clock battery life	Approx. 10 yrs	This is a reference value only.
Battery life	10,000 lines using 1600 mAh Ni-MH batteries, printing once every 5 s at 20°C	The battery life greatly varies according to the usage conditions. This is a reference value only.
Size	201.1 × 94 × 75.2 (D × W × H)	
Weight	390 g	Main unit only
Print capacity	Measurement values, GO/NG judgment	Mode 0
	Measurement values, GO/NG judgment, number of data, max. value, min. value, range, average value, standard deviation (σn, σn-1), number of defectives, fraction defective, process capability index (Cp, Cpk), histogram	Mode 1
	Same as above + D chart	Mode 2
	Calculation function for center line and control limit data required for control chart creation	Mode 3
Processing capacity	100000	Mode 0
	9999	Mode 1, Mode 2
	Sample size Subgroup Total number of data 10 × 9999 = 99990	Mode 3
	5 pairs of limit data	
Output function	Measurement data output (RS-232C, TTL level)	
	GO/NG judgment output (+NG, GO, -NG)	
Timer input	0.25 s, 1 s, 5 s, 30 s, 1 m, 30 m, 60 m	

SPECIFICATIONS

Item	Description	Remark
Standard accessories and options	AC adapter (for Japan)100 V	09EAA119
	AC adapter (for North America) 120 V	09EAA119A
	AC adapter (for China) 220 V	09EAA119DC
	AC adapter (for Australia) 230 V	09EAA119F
	AC adapter (for Europe) 230 V	09EAA119D
	AC adapter (for U.K.) 230 V	09EAA119E
	AC adapter (for Korea) 220 V	09EAA119K
	Printer paper, 1 roll (width: 58 mm, length: 48 mm)	Part No. 09EAA082 when ordering (10-roll pack)
	Strap	09EAA079
	Quick Reference	09EAA090
	User's Manual	99MBE021

Optional accessories

Product Name	Part No.	Remark
9-pin RS-232C conversion cable for AT compatible machine	No. 09EAA084	Outputs data from DP-1VR to PC via RS-232C.
RS-232C counter cable	No. 09EAA094	Used when printing output of KA counter.
GO/±NG judgment cable	No. 965516	Outputs the OK/NG judgment result. Cable termination processing done by customer.
Foot switch	No. 937179T	

Consumables

Product Name	Part No.	Remark
Printer paper (10-roll pack)	No. 09EAA082 *1	TP55KJ-H (Nippon Paper Industries Co., Ltd.) 58 mm (W) × 40 mm (L)

***1:** High-durability paper