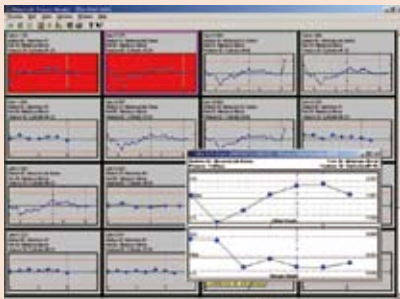
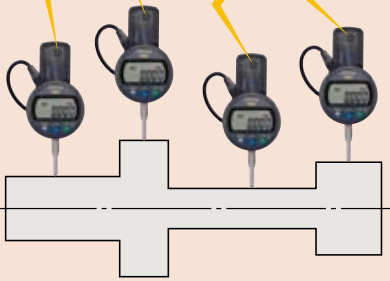


New Products

	A	B	C	D	G
1	Displacement (1)	Displacement (2)	Displacement (3)	Displacement (4)	Measurement date and time
2	0.281	0.162	0.121	0.051	2013/4/1 7:30:00
3	0.279	0.152	0.133	0.064	2013/4/1 7:30:05
4	0.265	0.149	0.142	0.089	2013/4/1 7:30:10
5					
6					



Measurement Data Management

USB-ITPAK V2.0

Refer to pages A-10–A-12 for details.

Digimatic Gage / PC Data Input Device

USB Input Tool IT-016U

Refer to page A-6 for details.

Measurement Data Wireless Communication System

U-WAVE

Refer to pages A-7–A-9 for details.

Measurement Data Network System

MeasurLink

Refer to pages A-15–A-19 for details.

A

Measurement Data Management

Measurement Data Management

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入力待ち

次: Mitutoyo Block, Cylinder #4 ID

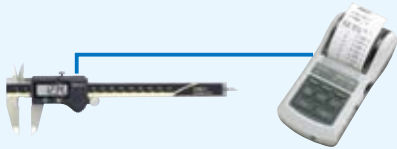
Example of Measurement Data Management System

A system for recording and analyzing measurement results from various Mitutoyo measuring instruments for quality assurance purposes.

Implementation Step 1

Recording measurement results

No more transcribing



DP-1VR A-13

Measurement data can be easily printed. Data can be output to a PC for statistics calculations.

Direct data input to a PC

Connecting cable-integrated USB-ITN



USB Input Tool Series A-5

Lineup of three models with different output specifications IT-012U/IT-016U/IT-007R



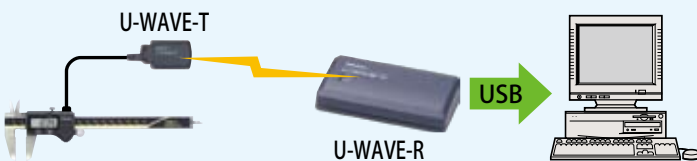
Input Tool Series A-6

Connect to a RS-232C interface PC with 4 channels and a sequencer



Multiplexer MUX-10F A-14

Wireless

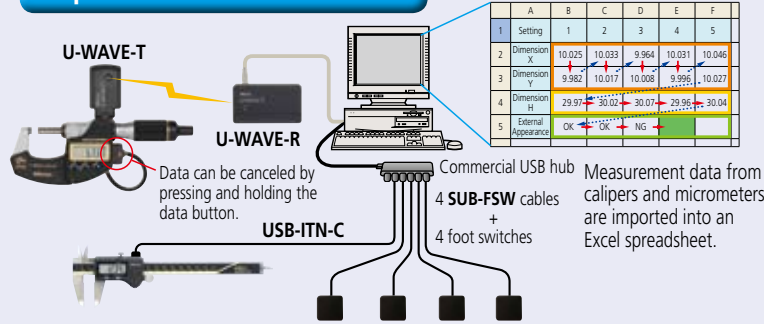


U-WAVE A-7

Implementation Step 2

Software dedicated to inspection and quality control

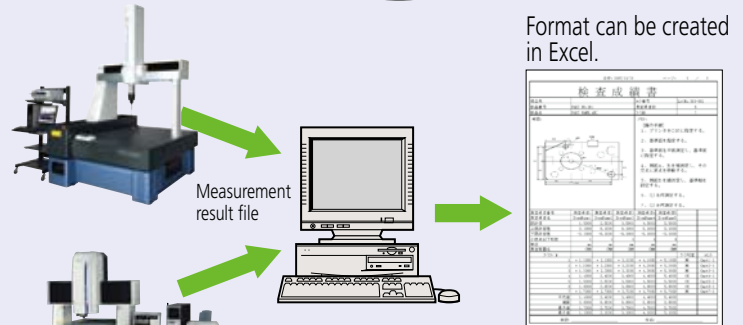
Inspection certificate creation



Data can be canceled by pressing and holding the data button.

Commercial USB hub
4 SUB-FSW cables + 4 foot switches
Measurement data from calipers and micrometers are imported into an Excel spreadsheet.

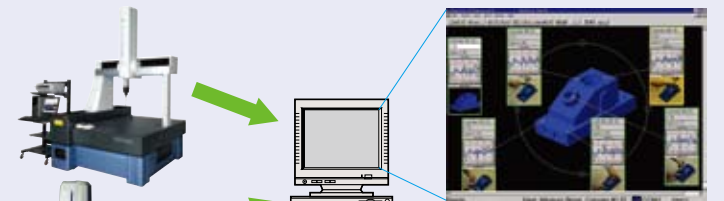
USB-ITPAK A-10



Format can be created in Excel.

MeasureReport A-22

Statistical Process Control



Go/ no go judgment, process capability and control charts are displayed in real time.

U-WAVE-R

U-WAVE-T

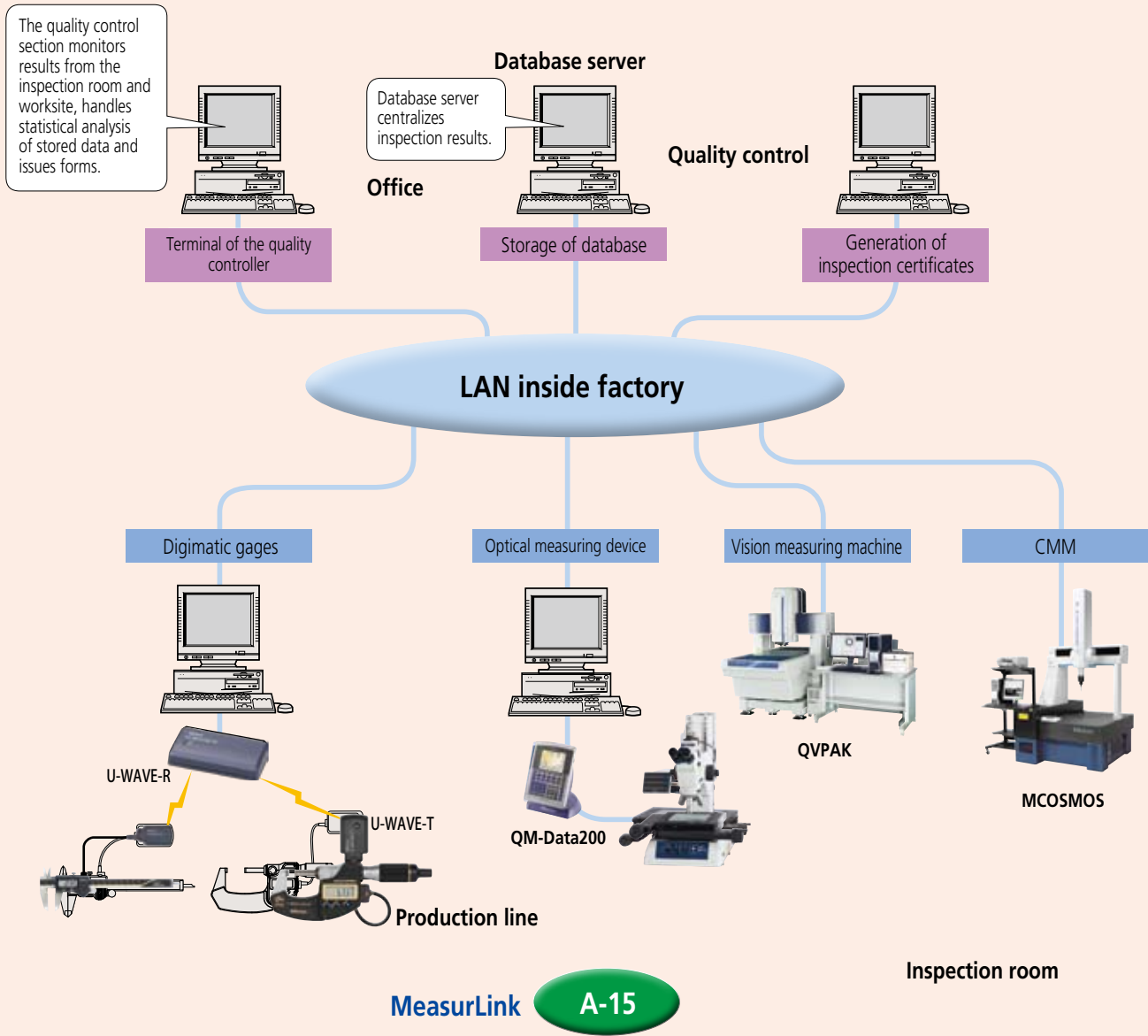
Digimatic gages

MeasurLink A-15

Implementation Step 3

Creating a quality control network covering a wide area within the factory

Unify management of the quality test using the network in the factory



Measurement Data Management

Convenient data collection tool and quality control software

Digimatic Gage / PC Data Input Device SERIES 264 — USB Input Tool Direct

A data collection tool that offers simple and popular operability (HID connection) and optional software to input data to Microsoft Excel at a reasonable price. A more sophisticated way to improve operational efficiency.

Use USB-ITN standalone as a dedicated interface for digimatic indicators compatible with HID keyboard devices.

In common with the popular model IT-012U, this device is capable of entering measurement data to Microsoft Excel or a memo pad. Application example: using USB-ITN standalone to input data while selecting the data entry point flexibly during a measurement whose procedures cannot be determined in advance (such as the inspection of items or trial products with few measurements or without repeated procedures).

Using USB-ITN in combination with dedicated options

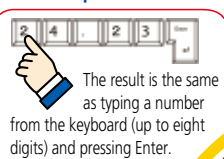
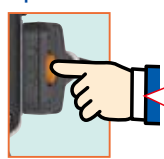
Refer to pages A-10 to A-12 for details.

If you need more than just the ability to load the measurement data to Excel, the optional software USB-ITPAK can create a data input procedure to an Excel sheet to improve the operational efficiency of repeated inspections. Application example: using USB-ITN in combination with USB-ITPAK V2.0 to improve the operational efficiency of daily inspections such as sampling tests or complete inspections of mass-produced product.



USB-ITN

Input data to the PC with the push of a button.



The result is the same as typing a number from the keyboard (up to eight digits) and pressing Enter.

Just press the data button to send the displayed value to the PC.

Can be connected directly to a USB port on a PC with 1 cable.

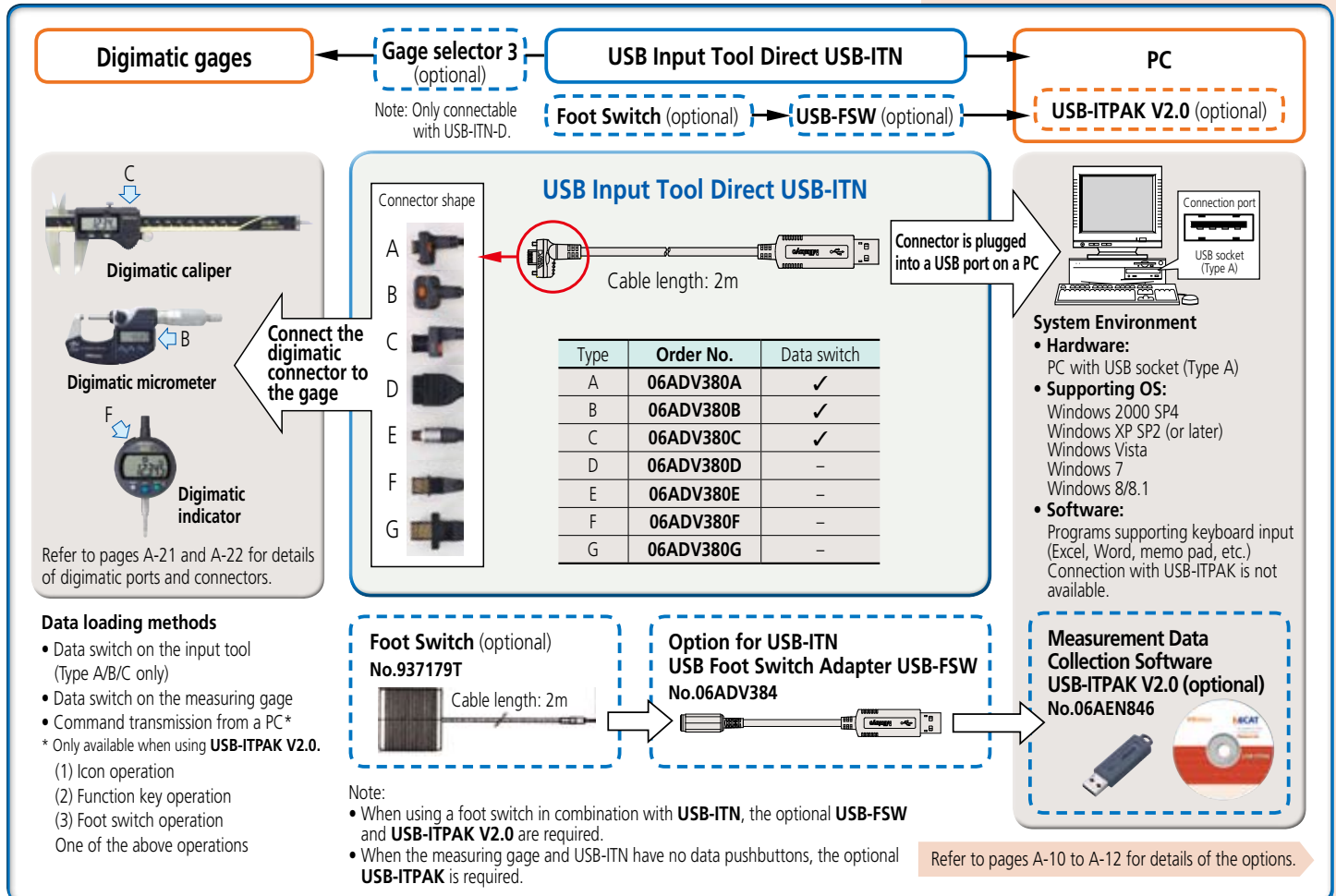
USB Input Tool Direct

USB Input Tool Direct is automatically recognized as a HID* keyboard device (standard driver of Windows) by connecting it to a USB port.
* Human Interface Device

Main specification

- Output compatibility: USB1.1 and USB2.0
 - Supporting driver software: Switchable between 2 items below
 - (1) When using standalone: HID keyboard device*
 - (2) When using with USB-ITPAK V2.0: Virtual COM port (VCP)
 - Communication speed: 12Mbps (Full Speed)
 - Power supply: USB bus power
 - Mass: 59g
 - USB2.0 certificate
 - Conforms to EMC Directives.
- *Since this device is compatible with Windows standard driver software, dedicated driver software is not required.

System Configuration

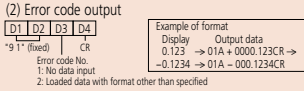
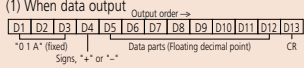


Specifications of IT-007R RS-232C Communication

- Output specification: RS-232C compliant
- Communication method: Full duplex
- Communication speed: 2400bps (fixed)
- Bit configuration: Start bit 1
Data length 8
(Most significant bit, 0 (fixed))
Parity, None
Stop bit 1

Flow control: None
Home position: DCE (modem definition)

• Data format



• Data request signal

Data can be output by transmitting a character from the PC.

• Connector specification and power supply from the PC

This product operates while accumulating the power supplied from the PC. A second or more input interval is required.

Pin No.	Symbol	in/out	Description of functions
1	(N.C.)	—	No connection
2	RXD	OUT	Data output from this product to the PC
3	TXD	IN	Data input from the PC to this product
4	DTR	IN	+12 V power supply from the PC*
5	GND	—	Ground
6	DSR	OUT	Not used
7	RTS	IN	+12 V power supply from the PC*
8	CTS	OUT	Not used
9	(N.C.)	—	No connection

* "4" and "6", "7" and "8" are short-circuited with each other inside this product.

* When connecting to a sequencer, a power supply is required.

Input voltage: Supplied in the range 6 V - 16 V

Power supply terminal: Supplied to pins 4 and 7

Measurement Data Input Unit Input Tool SERIES IT-016U / IT-007R

USB Keyboard Signal Conversion Type IT-016U / IT-007R

The IT-012U, a popular USB input tool that enables easy data recording, has been upgraded. For the same price, usability is improved with extended functionality to help you do inspection work more efficiently.

The IT-016U is equipped with a connector socket for a push-button or switch-foot operation.

Functional improvements include:

- A bigger, easy-to-press data switch. Size increased from ø4mm to ø18mm. Durability of the push button increases from 1 million to 10 million operations.
- May be used with optional software USB-ITPAK V2.0. Enables efficient routine inspection work, for example, in mass production.

RS-232C Communication Conversion Type IT-007R

Input tool for RS-232C communication best suited for communication control of the software!

Control is available by transmitting data request commands via RS-232C communication.

For example, production engineers can create communication programs to load the measurement data by transmitting a command from the PC.

This product is a compact and low-cost RS-232C communication interface, which is convenient when it is installed in a machine tool or dedicated device to feed back measurement data.

Main Specifications of IT-016U

Supported driver software: Changeable between two types

Output specification: USB2.0 or USB1.0

(1) Stand-alone: HID keyboard device*

(2) Using USB-ITPAK V2.0: Virtual COM port (VCP)

Communication speed: 12Mbps (Full Speed)

Power supply: USB bus power

USB2.0 certificate

Conforms to EMC Directives

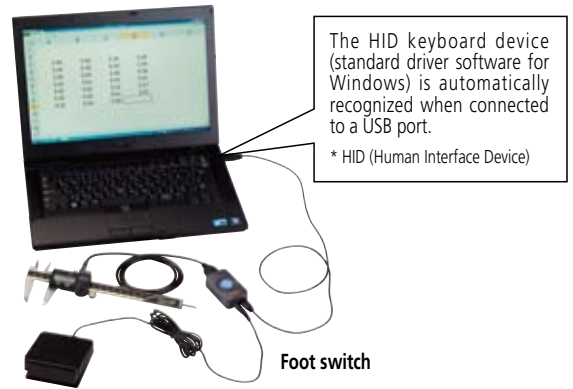
* This product is compatible with the standard driver software for Windows. No dedicated driver software is required.



IT-016U



IT-007R

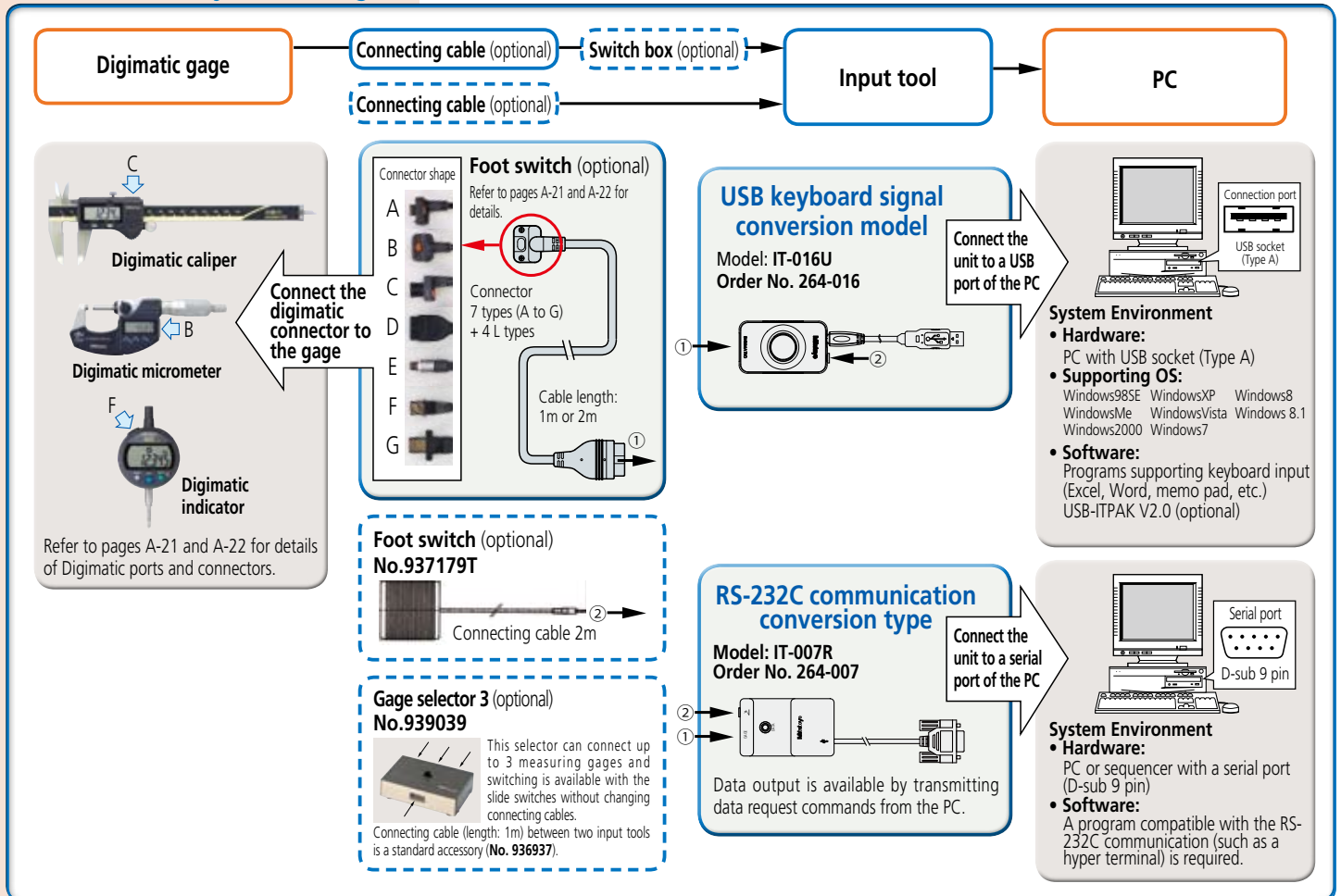


The HID keyboard device (standard driver software for Windows) is automatically recognized when connected to a USB port.

* HID (Human Interface Device)

Foot switch

IT-016U/IT-007R System Configuration



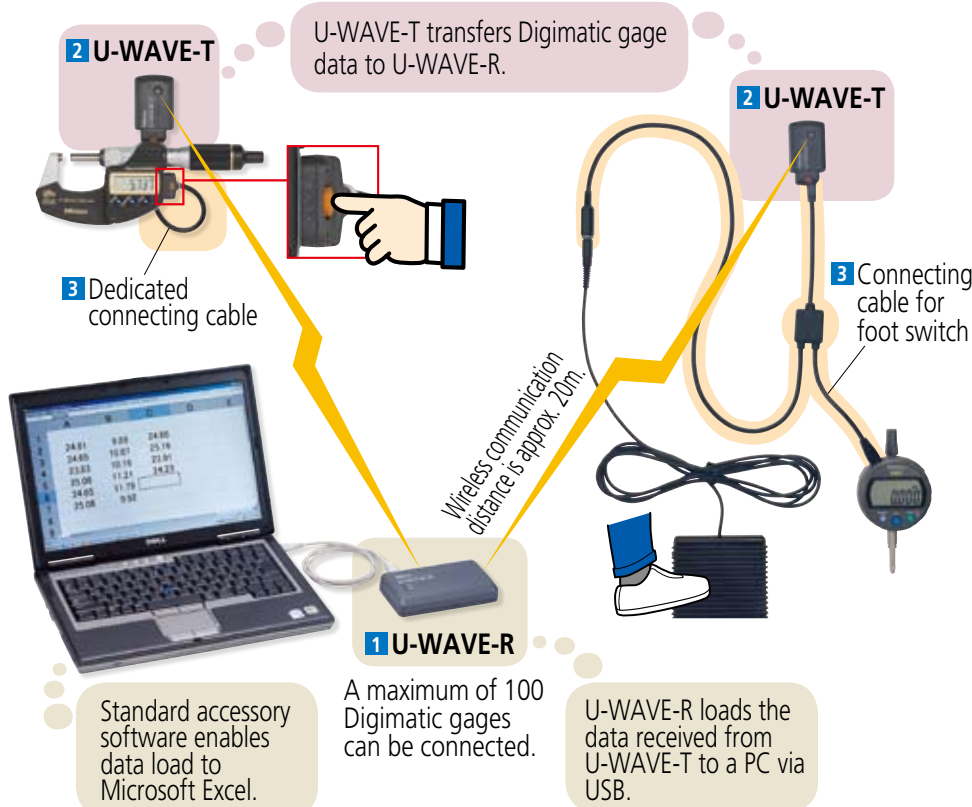
Measurement Data Management

Convenient data collection tool and quality control software

Measurement data wireless communication system U-WAVE

- Data from Digimatic gages can be loaded to a PC easily.
 - Wireless communication eliminates cabling, improving measuring operability.
 - The Data Interface Function of the U-WAVE-R standard accessory software enables data input to commonly available software by keyboard input (Microsoft Excel*, Notepad, etc.).
 - USB-ITPAK V2.0 supports U-WAVE
- Loading multiple measurement data into separate Excel sheets, or simultaneous measurement using the special event drive is now available without the need for macro programming. (Automatic loading in a certain interval is available with the timer function.)

U-WAVE system configuration



Data from Digimatic gages can be loaded to a PC easily by using items **1** to **3** below.

1 U-WAVE-R

Receives data from U-WAVE-T and loads to a PC via USB.

Model	U-WAVE-R
Order No.	02AZD810D
Power supply	USB bus power system
Number of U-WAVE-R units that can be connected to one PC	Up to 16
Number of U-WAVE-T units that can be connected	Up to 100
External dimensions	140×80×31.6mm
Mass	130g

U-WAVEPAK software (standard accessory)

System Environment: Compatible OS

Windows 2000 Professional (SP4 or later)*
Windows XP Home Edition (SP2 or later)*
Windows XP Professional (SP2 or later)*
Windows Vista*, Windows 7*, Windows 8/8.1*

* Revision history (U-WAVEPAK)

Ver1.010 or later is compatible with 32/64-bit OS.
Ver1.020 or later is compatible with Windows 8.
Ver1.021 or later is compatible with Windows 8.1.

Main specifications

- Setup of dedicated driver software (USB and virtual COM port)
- Initial setting of ID number and frequency selection (required only once for first time)
- Load data to Microsoft Excel or Notepad through data interface function
- Note: Cannot be connected to a device other than a PC (such as DP-1VR, PDA, or controller).

U-WAVE-R main unit



USB2.0 cable (1m) attached

U-WAVEPAK



U-WAVE system communication specifications

• Wireless communication

Conformity standards	ARIB STD-T66 (Japan)*
Wireless standards	Conform to IEEE802.15.4
Wireless communication distance	Approx. 20m (within visible range)
Wireless communication speed	250 kbps
Transmission output	1mW (0dBm) or less
Modulation method	DS-SS (Direct Sequence - Spread Spectrum) Resistant to interfering signals and noise
Communication frequency	2.4GHz band (ISM band: Universal frequency)
Used band	15 channels (2.405 to 2.475GHz at intervals of 5MHz) The noise search function avoids interference with other communication devices.

* According to the Radio Regulations, the use of this product is permitted in the countries listed below. This product must not be used in other countries or areas.

Use of U-WAVE is allowed in the following countries:

This product is a radio equipment classified in the 2.4GHz Band Wide-band Low Power Data Communication System. To use this product, conformity to the radio law of each country is required. The use of U-WAVE sold in Japan is permitted in the countries listed below.

Applicable models	• 02AZD810D • 02AZD880D • 02AZD730D
Area	Country
Asia	Japan, Indonesia, Thailand, Vietnam, Malaysia, Philippines, India
North America	US, Canada
Europe	27 EU member nations (UK, France, Germany, Italy, Netherlands, Belgium, Luxembourg, Spain, Portugal, Austria, Sweden, Finland, Denmark, Bulgaria, Cyprus, Czech, Slovakia, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Malta, Poland, Romania, Slovenia) 4 EFTA member nations (Norway, Switzerland, Iceland, Liechtenstein) Turkey

Countries, which permit the use of U-WAVE purchased from Mitutoyo Overseas Operations or Agents/Distributors in the intended use destination are listed below.

Area	Country
Asia	Singapore, South Korea
Central and South America	Mexico, Costa Rica, Brazil

U-WAVE cannot be used in countries other than the above.

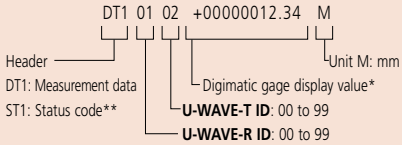


Refer to the Measurement Data Wireless Communication System leaflet (E12000) for more details.

Measurement data wireless communication system U-WAVE

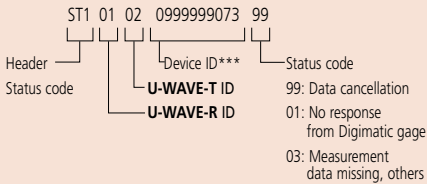
• Data format

Example of format when the Digimatic gage displays 12.34



* Data interface function is switchable to "Measurement value only" e.g.) +00000012.34

** Example of status code format



*** Unique number assigned to U-WAVE at shipment

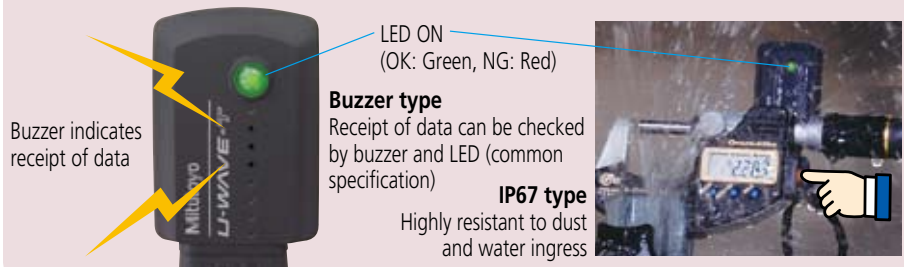
Notes on identification of measurement data and multiple systems operation

Following the above format, the U-WAVE data format starts with a 4-digit code where the first two digits represent receiver channels and the last two are transmitter channels. The large number of transmitter/receiver combinations possible with this scheme ensures that the receivers in a factory measurement system only accept data from the intended transmitters, even when several receivers are all within communication range of different transmitters using the same channel. Different frequency bands (up to 15 available) may also be used to further ensure that there are no communication problems between adjacent U-WAVE-R units.

2 U-WAVE-T

Transmits measurement data to U-WAVE-R. Select IP67 or buzzer model, according to your application. U-WAVE-R can be connected to Digimatic gages by dedicated cable for U-WAVE-T (option).

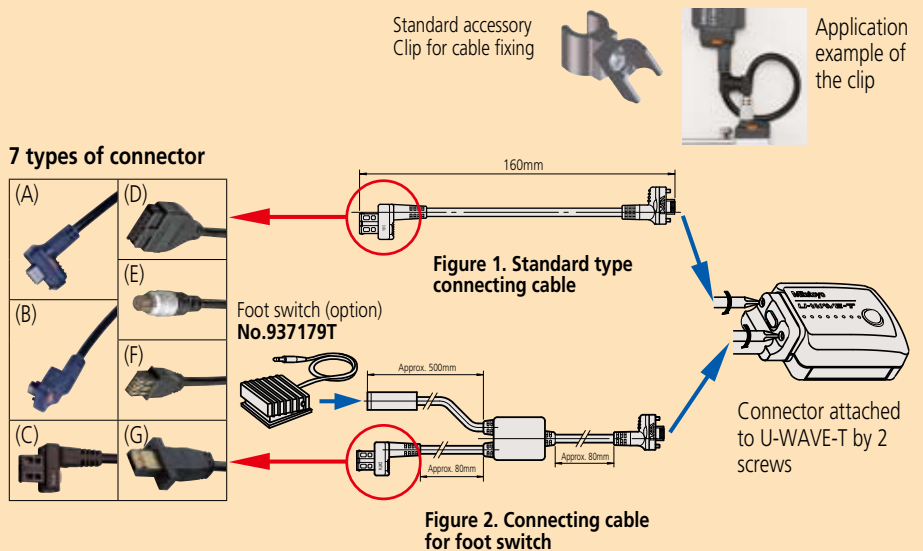
Model	U-WAVE-T (IP67 type)	U-WAVE-T (buzzer type)
Order No.	02AZD730D	02AZD880D
Protection Rating	IP67	None
Data reception indication	LEDs	Buzzer and LEDs
Power supply	Lithium battery CR2032x1	
Battery life	Approx. 400,000 transmissions	
Dimensions	44x29.6x18.5 mm	
Mass	23 g	



3 U-WAVE-T dedicated connection cable

A dedicated cable connects a Digimatic gage to U-WAVE-T. Check the connector (A to G; refer to pages A-21 and A-22 for details) compatible with the Digimatic gage to be used and select either standard type (figure 1) or foot switch type (figure 2) according to your application.

Type	Standard connecting cable	Connecting cable for foot switch
	Part Nos.	Part Nos.
(A) Water-proof model with output button	02AZD790A	02AZE140A
(B) Water-proof model with output button	02AZD790B	02AZE140B
(C) With data-out button	02AZD790C	02AZE140C
(D) 10-pin plain type	02AZD790D	02AZE140D
(E) 6-pin round type	02AZD790E	02AZE140E
(F) Plain type straight	02AZD790F	02AZE140F
(G) Plain type straight water-proof model	02AZD790G	02AZE140G



Measurement Data Management

Convenient data collection tool and quality control software

Measurement Data Management U-WAVE

Optional Accessories for U-WAVE-T

U-WAVE-T mounting plate

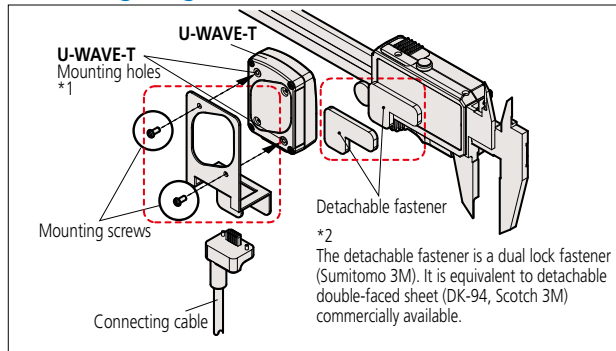
Since the standard cable clip is not sufficient to support the U-WAVE-T on a Digimatic gage, a mounting plate is provided. The mounting plate can be fixed to the gage by the easily detachable hook-and-eye type fasteners provided. Batteries can be replaced without needing to detach the U-WAVE-T from the gage.



U-WAVE-T mounting plate
Part No.02AZE200

- Standard accessories
- Detachable fasteners: 1 set
 - Mounting screw 2pcs.

Mounting diagram (No.02AZE200)



- *1 To avoid damaging the threaded holes in the plastic body of the U-WAVE-T unit, the mounting screws should be tightened only just sufficiently to grip. Repeated removal of these screws should also be avoided for the same reason.
- *2 In order to avoid loss of adhesion, do not allow oil or coolant to come into contact with the bonding surfaces of the detachable fasteners.

Application examples of the mounting plate

Super Caliper CD67-S15PM



Front view Rear view

QuantuMike MDE-25MJ



Front view Rear view

Digimatic Indicator ID-C112XB



Front view Rear view

Application example of the 'event drive' mode

Data request support from PC. Special order U-WAVEPAK (Event drive)

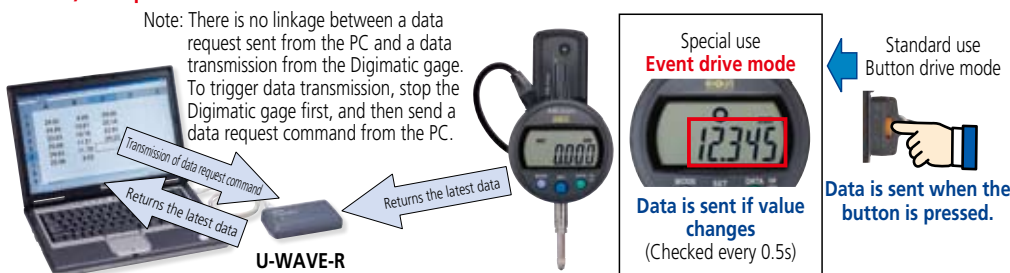
For standard type U-WAVE, the currently displayed data can be sent by pressing the data switch. This is called "button drive mode".

In the "event drive mode", the measurement value is checked every 0.5 seconds and measurement data is automatically sent if there is a change. At this time, the data switch is disabled. The sent data is written in the U-WAVE-R memory, and only the latest data is kept, it is not output to the PC. The data is loaded to the PC from the U-WAVE-R memory when the data request command is sent. The mode switching between "button drive" and "event drive" is enabled by the special order U-WAVEPAK (Event drive).

In the event drive mode, pressing the data switch on the Digimatic gage is not necessary. PC operation enables loading data from multiple gages at once.

To perform simultaneous measurement using USB-ITPAK V2.0, a special order U-WAVEPAK (Event drive) is required.

Note: There is no linkage between a data request sent from the PC and a data transmission from the Digimatic gage. To trigger data transmission, stop the Digimatic gage first, and then send a data request command from the PC.



When using the event drive please note:

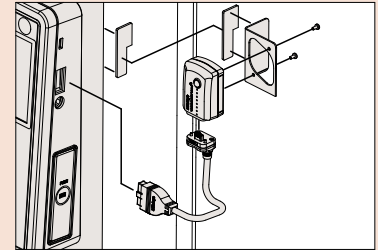
- The battery life is shorter than in normal mode. The battery lasts approximately 20 days with continuous use. Switching to the button mode when the battery is not in use extends the battery life.
- When using several Digimatic gages (U-WAVE-T), communication errors may occur because of radio interference in simultaneous measuring. Therefore, it is required to add U-WAVE-R and set different frequencies (15ch) to avoid radio wave interference.

U-WAVE-T mounting plate for QM-Height Order No.02AZE990

Standard accessories

- Detachable fasteners: 1 set
- Mounting screw: 2 pcs

Mounting diagram for QM-Height (02AZE990)



Refer to the Measurement Data Wireless Communication System leaflet (E12000) for more details.

Special order U-WAVEPAK (Event drive)

This is a special order product. For the latest pricing, please contact your dealer or the nearest Mitutoyo Service Center.

Product configuration: Program on CD



For **U-WAVE-R** and **U-WAVE-T**, please purchase the standard model.

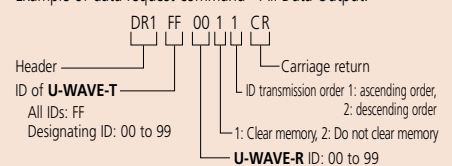
Install this special order **U-WAVEPAK** (Event drive) and gain the ability to perform setups without using the standard accessory **U-WAVEPAK**.

A program to send a data request command is separately required to load data to a PC.

Event drive supporting software:

- **USB-ITPAK V2.0** (timer input enabled)
- **MeasureReport** (function key operation)

Example of data request command - All Data Output:



Order No.

Model No.	USB-ITPAK V2.0
Order No.	06AEN846

Upgrade pricing from V1.0 is not available. Please purchase V2.0.

USB-ITPAK V2.0 USB dongle



A USB dongle must be connected to the PC running the software.

Operating environment

Compatible OS *1	Windows 2000 SP4 Windows XP SP2 or later Windows Vista Windows 7 Windows 8 Windows 8.1
Supported Excel versions *2	Excel 2000 Excel 2002 Excel 2003 Excel 2007 Excel 2010 Excel 2013
Hard disk	Free space of more than 10MB
CD-ROM drive	For program installation
USB port *3	2 ports or more
Monitor resolution	800x600, 256 colors or more

*1: 32-bit, 64-bit OS supported

*2: Operation with Excel for MAC OS is not guaranteed.

*3: A commercially available hub can be used.
(USB certified product is recommended)

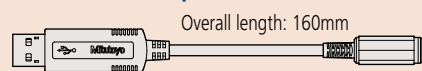
Language support

- Operation language (15 languages)
Japanese, English, German, French, Spanish, Italian, Czech, Swedish, Turkish, Polish, Hungarian, Russian, Korean, Chinese (traditional/simplified), and Simplified Chinese
- Operation manual (PDF file)
Japanese, English, German

Order No. Price

Model No.	USB-FSW
Order No.	06ADV384

Foot Switch Adapter USB-FSW



Overall length: 160mm

Common optional software IT-016U/USB-ITN and U-WAVE

Measurement data collection software **USB-ITPAK V2.0** (IT-007R are not supported)

Upgraded USB-ITPAK now supports U-WAVE, a wireless communication system.
Both wired connection (IT-016U/USB-ITN) and wireless system (U-WAVE) are supported.

New functions of USB-ITPAK V2.0

- Supports the U-WAVE wireless communication system
- Timer input function
- Measurement date/time display
- Others: Compatible with Windows 8, 64-bit OS, and Russian included in the operating language selection

USB-ITPAK V2.0 creates a procedure to input data from gages equipped with Digimatic output to Excel sheets via USB-ITN or U-WAVE. This optional software facilitates the daily inspection work for mass-produced products.

The combined use with USB-ITPAK V2.0 will improve the operational efficiency of repetition inspection work. Best suited for keeping track of inspection data of mass-produced products.

- Automatically calls Excel sheet.
- Cursor moves can be specified.
- Input range can be specified per Digimatic gage, which reduces improper input.
- The last data input can be canceled by a single operation (foot switch, function key etc.)
- Data input or cancellation can be performed at once in multiple-point simultaneous measurement.

Main features of USB-ITPAK V2.0

- **Setting of Microsoft Excel input:**
Designation of where to input (workbook, worksheet, cell range), cursor move (right, down), and others.
- **Selection of measuring method (3 modes available)**
(1) Sequential measurement (2) Simultaneous measurement (3) Individual measurement (refer to page A-12 for details).
- **Control item and instruction at data input** (Note 1: Not available during individual measurement, Note 2: Not available during simultaneous measurement in the event drive mode)

Control item	Mouse operation	Function key	Foot switch + USB-FSW	Data switch when using U-WAVE	Data switch other than U-WAVE
Data output request	✓ (Note 1)	✓ (Note 1)	✓	✓ (Note 2)	✓
Data cancel	✓ (Note 1)	✓ (Note 1)	✓	✓ Press and hold (Note 2)	—
Data skip	✓ (Note 1)	✓ (Note 1)	✓	—	—
Character input (example: OK or NG etc.)	—	—	✓ Pre-registered character strings	—	—

- **Number of connectable gages** (Note 3: The actual number can be less depending on the system configuration.)

Available devices	Maximum number of connection (total of (1), (2), and (3))	Others
(1) IT-016U/USB-ITN	For Windows 2000/XP Up to 100 units (Note 3) For Windows Vista/7/8 Up to 20 units (Note 3) (For U-WAVE-R , plus 100 per unit in terms of available gages.)	• Maximum registration (total of (1), (2), and (3)) 400 units • Control/identification of connecting gage VCP (Virtual COM port) Switch from HID to VCP for (1) and (2). The VCP driver software is supplied with USB-ITPAK .
(2) USB-FSW		
(3) U-WAVE-R (Up to 100 gages can be per one unit of U-WAVE . U-WAVE-T ID: 00 to 99)		

- **Data loading time:** when using **USB-ITN**, 0.2s to 0.3s per gage unit
U-WAVE event drive mode: 0.5s data refresh interval
- **Timer input function** (only in simultaneous measurement)
Input interval (time): 0.1s (Note 4) to 24 hours at maximum
(Note 4: If a shorter time is set, a priority is given to the longer time compared with the actual communication time.)
- **Measurement date/time display function** (available in sequential and simultaneous measurements)
The display format is subject to the setting of the Excel sheet.

USB Foot Switch Adapter USB-FSW

This USB adapter for connecting a PC is required when using the Foot Switch (**No. 937179T**) in **USB-ITN**. A dedicated VCP driver* for this adapter is included in **USB-ITPAK**.

Main specification

- With **USB-ITPAK**, application of the foot switch can be set.
- Data control: "Data request", "Data cancel", "Data skip"
- Character string input (e.g. GO/NG, etc.)

*USB-FSW is used for installation of the VCP driver.



Foot switch (**No.937179T**)

USB-FSW

Measurement Data Management

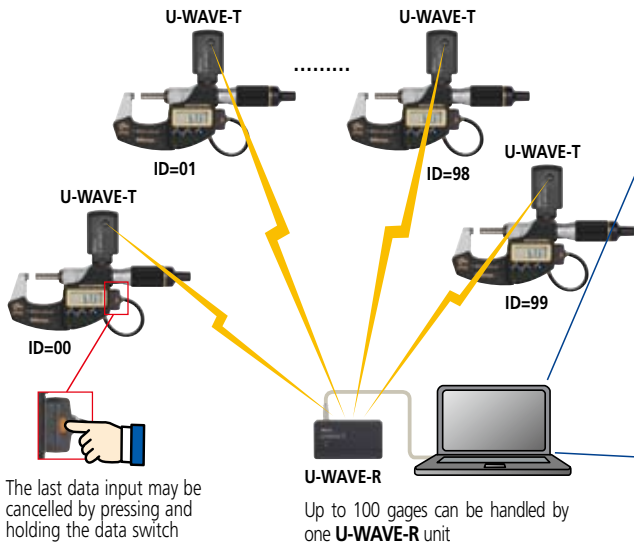
Convenient data collection tool and quality control software

Measurement Data Management USB-ITPAK V2.0

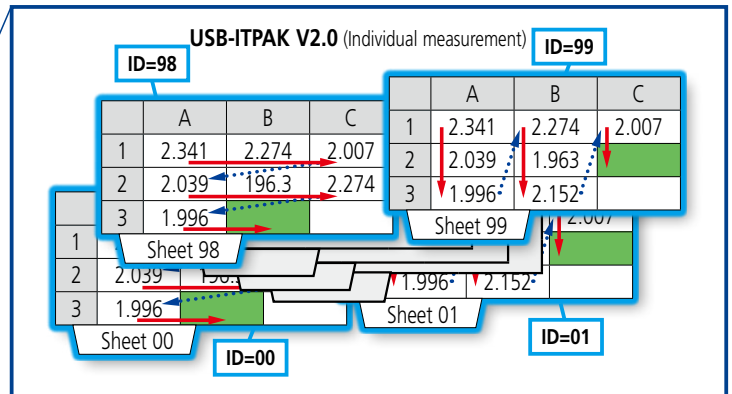
USB-ITPAK V2.0 (Not available for IT-007R)

More applications can be handled due to new features (Wireless (U-WAVE) support, Timer input, Measurement date/time display)
Example of measurement using the U-WAVE wireless communication system — data sorting of individual measurements

Data from multiple Digimatic gages sent to separate Excel sheets



Loading data from multiple Digimatic gages (U-WAVE-T) into separate Excel sheets is now available without the need for macro programming.

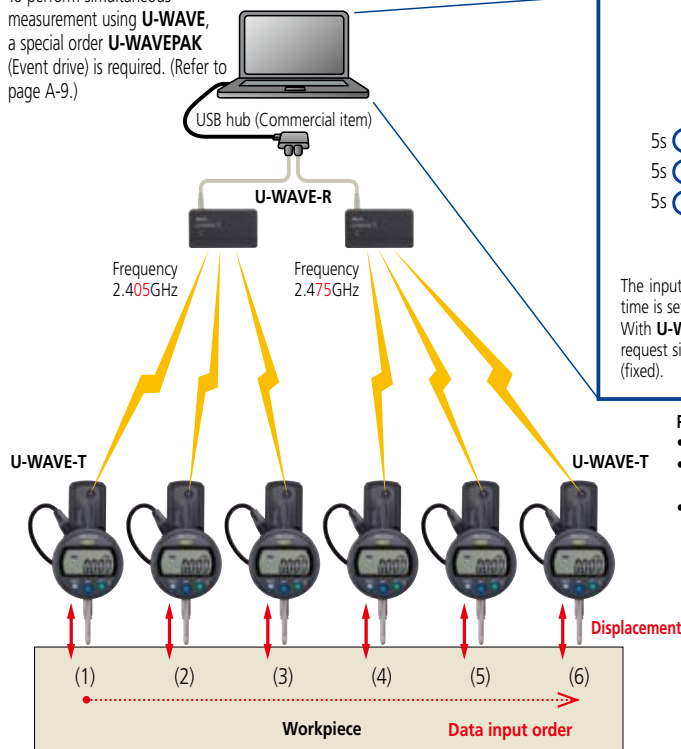


- Entry point can be specified per gage (by U-WAVE-T ID).
- Specifying an Excel file: Excel Book (full path) + sheet name
 - Specifying data input cells (example: A1:C3)
 - Specifying cursor move (right or down)

Example of measurement using the U-WAVE wireless communication system — timer input + measurement date/time display during simultaneous measurement

Automatically obtains displacement data in a certain input interval

To perform simultaneous measurement using U-WAVE, a special order U-WAVEPAK (Event drive) is required. (Refer to page A-9.)



If using USB-ITPAK V2.0 supporting U-WAVE event drive, arbitrary timer input is allowed without the need for macro programming.

USB-ITPAK V2.0 simultaneous measurement + timer input (example: 5s interval)

	A	B	C	D	E	F	G
1	Displacement (1)	Displacement (2)	Displacement (3)	Displacement (4)	Displacement (5)	Displacement (6)	Measurement date/time
2	0.281	0.162	0.121	0.051	0.011	-0.001	2013/4/1 7 30 00
3	0.279	0.152	0.133	0.064	0.018	-0.003	2013/4/1 7 30 05
4	0.265	0.149	0.142	0.089	0.021	-0.007	2013/4/1 7 30 10
5							
6							

The input interval can be arbitrarily set by 0.1s intervals up to 24 hours. If a smaller value than the data loading time is set, the actual measurement time will be the input interval.
With U-WAVE, an error (no data) may occur if less than 0.5s is set for the input interval. This is because the data request signal is issued before the data comes in, based on the event drive data refresh interval that is set to 0.5s (fixed).

Points to note when performing simultaneous measurement using U-WAVE and USB-ITPAK V2.0

- Besides U-WAVE, a special order U-WAVEPAK (Event drive) is required.
 - The battery life of U-WAVE-T becomes shorter in the event mode, reducing to approximately 20 days for continuous measurement.
 - When using several Digimatic gages, communication errors may occur because simultaneous transmission from all gages may cause radio interference.
With U-WAVE, radio wave interference can be mostly avoided if data is transmitted after making sure there is no other radio communication.
CSMA/CA method: this avoids radio interference and enables successful simultaneous data transmission of three U-WAVE-T units per U-WAVE-R.
- To perform simultaneous measurement with more than three units of U-WAVE-T, add U-WAVE-R and set different frequencies (15 ch) to avoid radio interference.

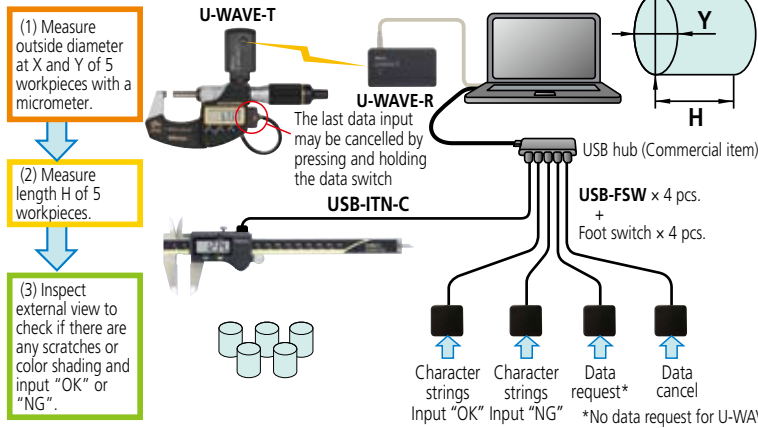
Create Microsoft Excel input procedures with USB-ITPAK V2.0 to handle data from U-WAVE or the USB Input Tool Direct

Measurement applications of USB-ITPAK V2.0 (Three examples of how USB-ITPAK V2.0 can be deployed are shown below)

Sequential measurement

Measurement values are input one by one according to a procedure previously defined by using one or more Digimatic gages (via UIT-016U/USB-ITN or U-WAVE).

(Measurement example – see figure at right)



When a measuring procedure is executed, a window (as below) is displayed. "Data request*", "Data cancel*", "Data skip*", "Aborting", "Complete" can be specified. * These operations can be allocated to the function key or foot switch (via USB-FSW).

Cell movement direction after inputting data (down and right)

Carriage return (Low, column)

Microsoft Excel sheet previously specified

	A	B	C	D	E	F
1	Setting	1	2	3	4	5
2	Dimension X	10.025	10.033	9.964	10.031	10.046
3	Dimension Y	9.982	10.017	10.008	9.996	10.027
4	Dimension H	29.97	30.02	30.07	29.96	30.04
5	External Appearance	OK	OK	NG		

Input range of micrometer (B2 to F3)

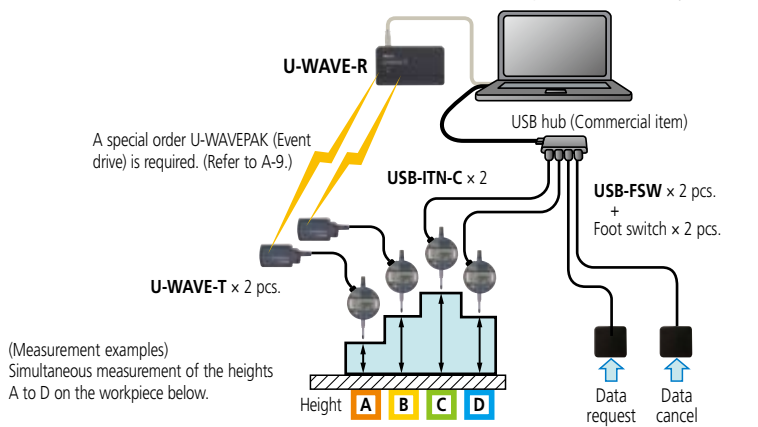
Input range of caliper (B4 to F4)

Input range of visual judgment (B5 to F5)

Cell that will receive next input is highlighted in green

Simultaneous measurement

Measurement values are input simultaneously from several Digimatic gages (via IT-016U/USB-ITN, U-WAVE)



	A	B	C	D	E
1		Height A	Height B	Height C	Height D
2	1	5.02	8.03	9.96	6.03
3	2	4.98	8.02	10.01	5.99
4	3	4.97	8.04	10.07	5.96
5	4				
6	5				

First measurement (finished)

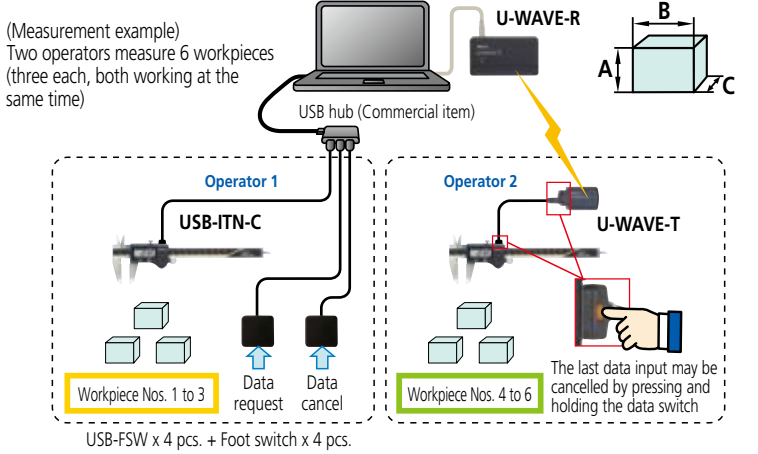
Second measurement (finished)

Third measurement (finished)

Fourth measurement (Wait for next input)

Individual measurement

Several operators input measurement data asynchronously according to individually defined procedures (where to input, move direction, etc.) from each Digimatic gage via IT-016U/USB-ITN or U-WAVE.



Since several individual operators perform measurement simultaneously, an operation key and a function key in the window below cannot be used at the same time. The only effective input device in this case is the foot switch (via USB-FSW).

	A	B	C	D	E	F	G
1	Setting	1	2	3	4	5	6
2	Dimension A	10.02	10.03	9.96	10.15	10.23	10.04
3	Dimension B	9.98	10.01	10.07	9.99	9.78	
4	Dimension C	10.15	10.14		9.96	10.27	

Operator 1

Operator 2

Cell that will receive next input

Cell that will receive next input

Notes on using USB-ITPAK:

Do not merge the cells in the specified range as a measurement data input. During measurement, the Microsoft Excel worksheet cannot be modified in any way apart from entering data. If you need to modify the sheet, it is necessary to abort or finish the measurement.

Measurement Data Management

Convenient data collection tool and quality control software

Data processing printer for quality control SERIES 264 — Digimatic Mini-Processor DP-1VR

- This is a palm-sized printer used to print measurement data from Digimatic gages or to perform statistical analysis.
- The versatile DP-1VR printer not only prints measurement data, but performs a variety of statistical analyses, draws histograms and D-charts and also performs complex operations on X-bar R control charts.
- Equipped with RS-232C output and GO/NG judgment output as standard functions, this processor delivers the high reliability expected from an advanced quality inspection machine.
- This line thermal printer enables fast and quiet printing.



264-504
DP-1VR



Examples of printout

```

Mitutoyo
* DP-1VR *
* MODE 1 *

DATE 2002/ 2/27
TIME 10:43

*LIMIT DATA 1*
LSL 26.44 mm
USL 27.00 mm
TOL 0.56 mm

▲ 1 27.02 mm
▼ 2 26.43 mm
3 26.42 mm
4 26.56 mm
5 26.56 mm
6 26.63 mm
7 26.62 mm
8 26.46 mm
9 26.46 mm
10 26.70 mm

PART NO.:
DATE 2002/ 2/27
TIME 10:43
NAME:
* RESULT *
N 10
MAX 27.02 mm
MIN 26.42 mm
R 0.60 mm
x̄ 26.5900 mm
σn 0.1673 mm
σn-1 0.1764 mm

-NG 2
+NG 1
P 30.000 %
Cp 0.529
Cpk 0.283

* HISTOGRAM *
LSL 26.44 mm
USL 27.00 mm
TOL 0.56 mm

DIV 10
-NG 2 00
LSL A 00
A B C D E F G H I J 00000000
USL 00
+NG 1 00

D= 1
A 28.4400 mm ~
B 28.4960 mm ~
C 28.5520 mm ~
D 28.6079 mm ~
E 28.6639 mm ~
F 28.7199 mm ~
G 28.7759 mm ~
H 28.8319 mm ~
I 28.8879 mm ~
J 26.8439 mm ~
27.0000 mm ~
    
```

```

Mitutoyo
* DP-1VR *
* MODE 2 *

DATE 2002/ 2/27
TIME 10:44

*LIMIT DATA 1*
*LIMIT DATA 1*
*NO LIMIT DATA*
LIMIT1 26.86 mm

LIMIT2 27.44 mm

*NEW LIMIT DATA*
*LIMIT DATA 1*
DATE 2002/ 2/27
TIME 10:44

LSL 26.86 mm
USL 27.44 mm
TOL 0.58 mm

L C U
27.41mm | | |
27.31mm | | |
27.51mm | | |
27.35mm | | |
27.07mm | | |
27.09mm | | |
27.14mm | | |
27.14mm | | |
27.35mm | | |
27.42mm | | |
27.47mm | | |
27.49mm | | |
27.49mm | | |

PART NO.:
DATE 2002/ 2/27
TIME 10:44
NAME:
* RESULT *
    
```

```

Mitutoyo
* DP-1VR *
* MODE 3 *

DATE 2002/ 2/27
TIME 10:45

SUB GR. NO. 1
1 27.54 mm
2 28.30 mm
3 27.71 mm
4 28.55 mm
5 27.43 mm
6 27.94 mm
7 27.27 mm

x̄ 27.7914 mm
R 1.08 mm
PART NO.:
DATE 2002/ 2/27
TIME 10:45
NAME:

SUB GR. NO. 2
1 28.23 mm
2 28.07 mm
3 28.66 mm
4 29.20 mm
5 29.59 mm
6 30.11 mm
7 30.78 mm

x̄ 29.2343 mm
R 2.71 mm
PART NO.:
DATE 2002/ 2/27
TIME 10:45
NAME:

*CONTROL LIMIT*
DATE 2002/ 2/27
TIME 10:45

NO. OF SUB GR. 2
SAMPLE SIZE 7
x̄ 28.5129 mm
x̄-UCL 28.3069 mm
x̄-LCL 27.7189 mm
R 1.8950 mm
R-UCL 3.6450 mm
    
```

Statistical calculations

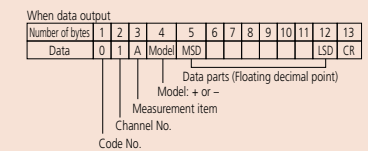
- | | | |
|---|--|---|
| <p>Mode 0</p> <p>GO/±NG judgment</p> | <p>Modes 1,2</p> <p>N: Number of data
MAX: Maximum value
MIN: Minimum value
R: Range
x̄: Average value
σn: Standard deviation of the sample (N)
σn-1: Sample standard deviation (N-1)
-NG: Number of data smaller than lower limit value
+NG: Number of data larger than upper limit value
P: Fraction defective
Cp: Process capability index
Cpk: Process capability index (process target centered)</p> | <p>Mode 3</p> <p>N: Number of data
MAX: Maximum value
MIN: Minimum value
n: Number of subgroup (Max. 10)
x̄: Average value of subgroup
R: Range of subgroup
x̄: Mean value
x̄-UCL: Upper control limit
R: Mean (R control)
R-UCL: Upper control limit (R control)
R-LCL: Lower control limit (R control)</p> |
|---|--|---|

Specifications

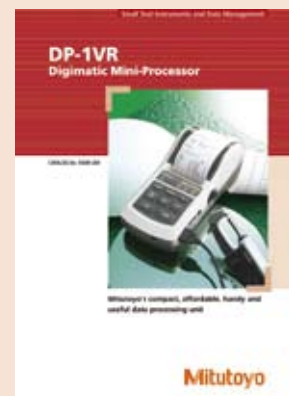
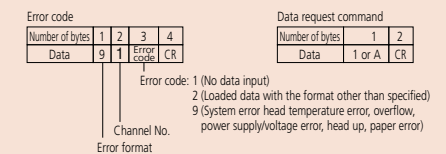
- Order No.: 264-504
- Model: DP-1VR
- Data processing capacity:
 - Mode 0: 10000 data items
 - Modes 1,2: 9999 data items
 - Mode 3: Sample size (10 x subgroup 9999=99990 data)
- Upper/lower limit value 5 pairs can be held in memory
- Output : (1) RS-232C output level (TTL) function (2) GO/±NG judgment output (+NG, GO, -NG)
- Input timer: Input intervals 0.25s, 1s, 5s, 30s, 1min, 30min, 60min
- Printing method: Thermal line printer 384 dots/char
- Character specification: Normal character 24 x 16 dots / Large character 36 x 24 dots
- Printing speed: 0.5s per line (using AC adapter)
- Printing line: 10000 lines of normal characters per roll 7000 lines of large characters per roll
- Printing paper: High durability thermo-sensitive paper Width 58mm x length 48m
 - Note: Printed characters do not fade if a printout is stored in a cool dark place, but if it is to be used for official documents, or stored more than 5 years, it is recommended that a copy be made.
- Power supply: 2 power methods
 - (1) AC adapter 100V (6VDC, 1000mA) supplied as a standard accessory.
 - (2) 4pcs. of LR6/AA size (alkaline or Ni-Mh)
- Battery life: 10000 lines (5s/line using a 1600mAh Ni-Mh battery)
 - Note: This is a typical value and is not guaranteed.
- External dimensions: 94 (W) x 201 (D) x 75.2 (H) mm
- Mass: 390g (main unit)
- Optional Accessories:
 - (1) RS-232C changing cable
 - For connection with a PC
 - Cable length 1m, D-sub 9 pin
 - (2) RS-232C counter cable
 - For connection with KA counter
 - Cable length 1m, D-sub 25 pin
 - (3) GO/±NG judgment cable
 - Cable length 2m, D-sub 10 pin terminal/separate wires
 - (4) Foot switch
- Consumable items:
 - Printing paper (10 rolls)

RS-232C communication specification (Output specification)

- Output signal level: TTL
- Communication method: Half-duplex
- Communication speed: 1200/2400/4800/9600/19200
- Bit configuration: Start bit 1 bit
- Data length: 7/8 bit
- Parity check: Even/odd/none
- Stop bit: 2 bit
- Data format



Example of format
Display of a Digimatic gage Output data
0.123 01A+0000.123CR



Refer to the DP-1VR leaflet (E4209) for more details.

Specifications

- Order No.: 264-002
- Model: MUX-10F
- Data input port: 4 channels for Digimatic gages
- Output: (RS-232C)
- Data output Via RS-232C interface:
Data transmission method: Half-duplex
Data transmission code: ASCII/JIS
Data length: 8 bits
Parity check: None
Stop bit: 1
Data transmission speed: 300/600/1200/2400/9600/19200bps
- Connector specification:

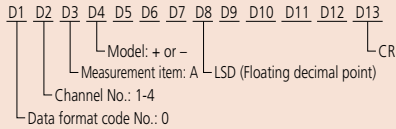


Pin No.	Signal	Function	in/out
1	CD		out
2	RD	Received data	out
3	TD	Communication data	in
4			
5	GND	Ground	
6	DR		out
7			
8	CS		out
9			

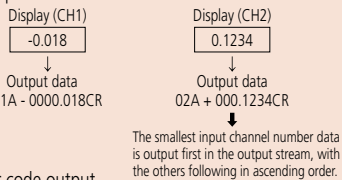
* For connection with a PC, use a commercially available RS-232C straight cable.

Data format

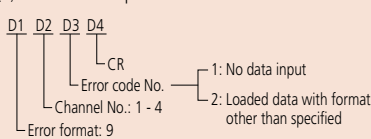
(1) When data output



(2) Example of format



(3) Error code output



- Power supply: AC adapter (9V, 500mA)
- External dimensions: 91.4 (W) x 92.5 (D) x 50.4 (H) mm
- Note: Communication software is not attached.

Digimatic/RS-232C Interface Unit Multiplexer MUX-10F

- Multiplexer MUX 10F is a measurement data transfer device that converts incoming Digimatic output measurement data to RS-232C and outputs it to an external device such as a PC.
Up to four measuring instruments with Digimatic output can be connected.



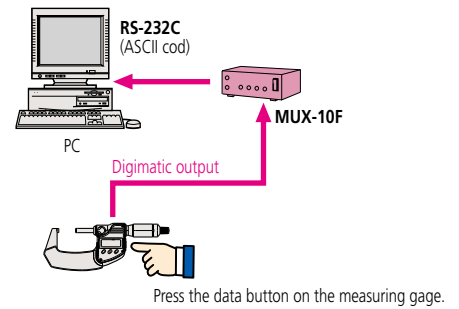
264-002
MUX-10F



Usage Example

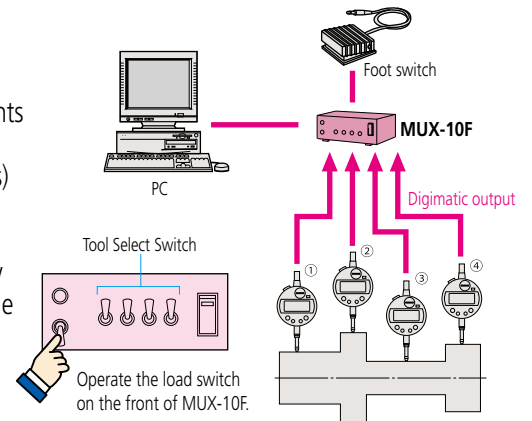
Data input using the data button on the Digimatic gage

- If the Digimatic gage has a data button, data is sent to the MUX-10 from the gage, converted to RS-232C and sent out.



Data input using the load switch

- If the Digimatic gage does not have a data button, or when simultaneous measurements are performed, the MUX-10 load switch is used to poll data from the measuring gage(s) selected by the tool selection switch(es), converted to RS-232C, and sent out.
- If multiple measuring gages are selected by the tool selection switch, data is input in the order of channels 1 through 4.
- Optional foot switch (937179T) is available for quick data entry.

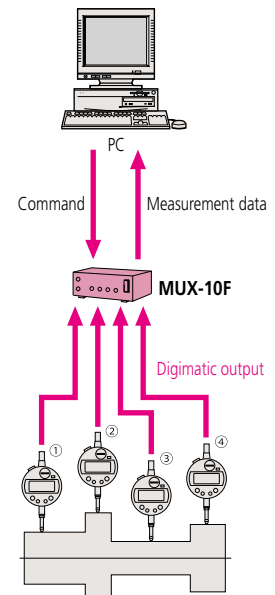


Data input using the external commands

- Data from a specified measuring gage connected to MUX-10F can be polled (ch 1- 4) by inputting a command from the PC.

Commands (ASCII)	Transfer channels
1 (ASCII code31) CR	1
2 (ASCII code32) CR	2
3 (ASCII code33) CR	3
4 (ASCII code34) CR	4
*A (ASCII code41) CR	1, 2, 3, 4
*B (ASCII code42) CR	1, 2, 4
*C (ASCII code43) CR	1, 3, 4
*D (ASCII code44) CR	2, 3, 4
E (ASCII code45) CR	1, 2, 3
F (ASCII code46) CR	1, 2
G (ASCII code47) CR	1, 3
H (ASCII code48) CR	1, 4
I (ASCII code49) CR	2, 3
J (ASCII code50) CR	2, 4
K (ASCII code51) CR	3, 4

* Command will operate the same as previous MUX-10 when 4-channel mode is turned off.



Measurement Data Management

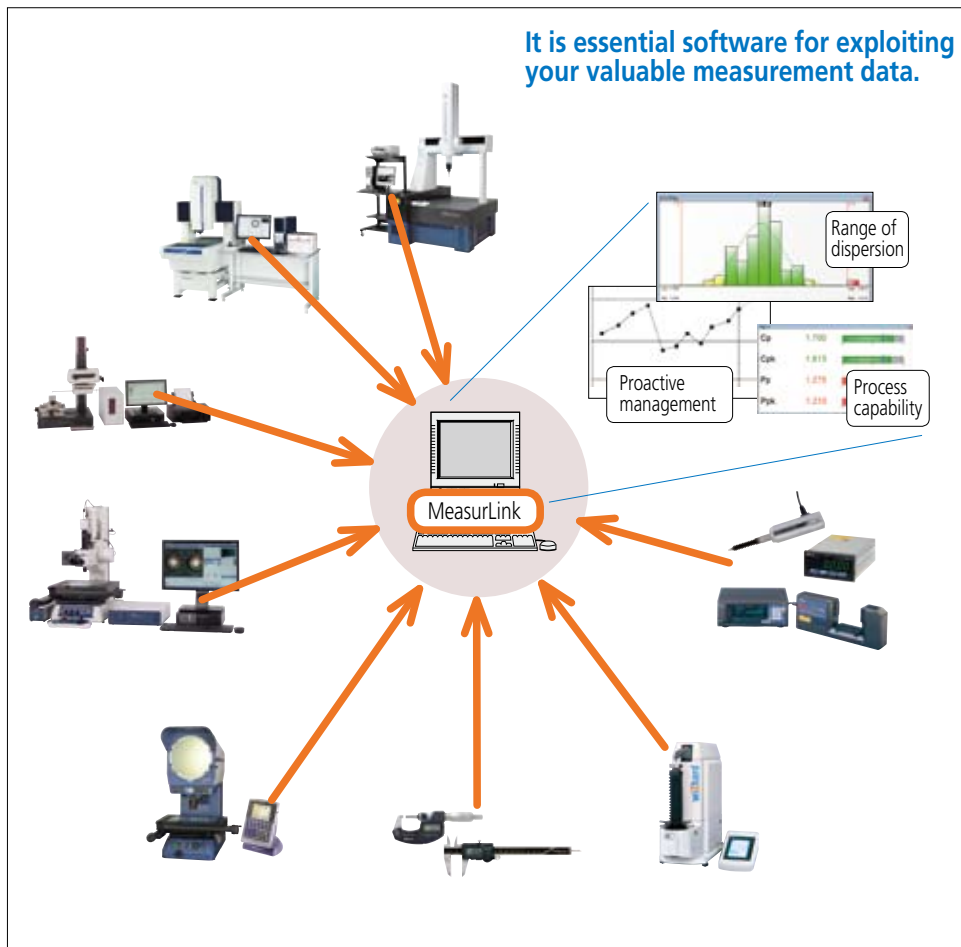
Convenient data collection tool and quality control software

Measurement Data Network System MeasurLink

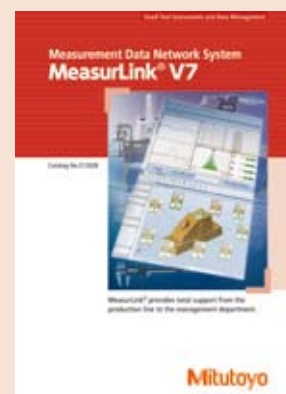
- MeasurLink is a data management modular software system that enables collecting data from a wide range of Mitutoyo measuring tools and systems including Coordinate Measuring Machines.

Measurement data storage can be centralized by implementing a network system using a company LAN. Quality information such as checking, monitoring, analysis of the measurement results and creating inspection reports can be shared among separate offices to maximize efficiency.

Data from Mitutoyo measuring instruments are visually displayed in real-time in the inspection room or line side



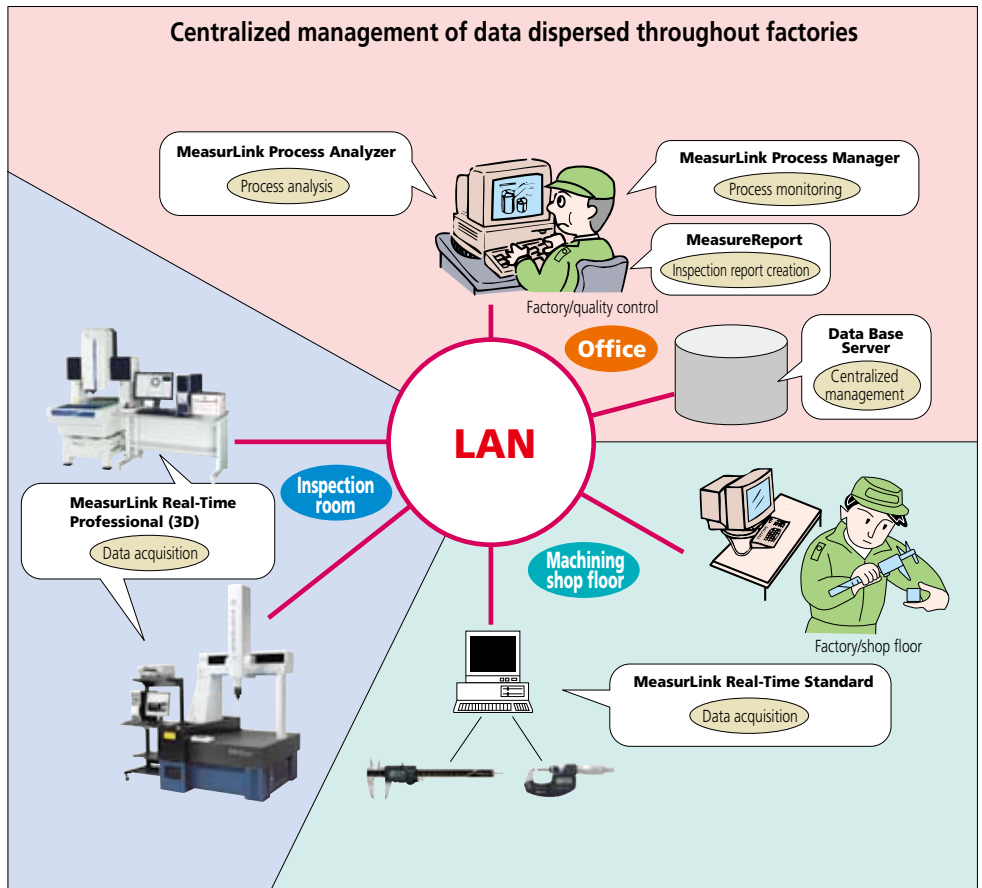
MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world
metrology software
MeasurLink



Refer to the MeasurLink leaflet (E12028) for more details.

- MeasurLink supports anything from stand-alone, small-scale systems to large-scale systems utilizing a PC network environment. Expansion from a stand-alone installation to a network system can easily be performed, allowing a gradual upgrade from a single-test operation in one section to a full-scale operation.

Centralized measurement data management by networking



Measurement Data Management

Convenient data collection tool and quality control software

MeasurLink V7 Data Collection/Analysis Software

Real-Time Standard (RT Std)

Real-Time Professional (RT Pro)

Real-Time Professional 3D (RT Pro 3D)

MeasurLink Real-time is the Statistical Process Control (SPC) MeasurLink module that collects data from Mitutoyo and third-party measuring devices and systems to provide analysis functionality in real-time by displaying control charts or process capability indexes. Three versions are offered so that a customer can choose the version that best suits the requirements, from a standard version providing basic functionality through to the full-spec version offering data handling using Hoops 3D graphics. (Refer to Table 1 on the next page.)

MeasurLink Real-Time common functions

• Various data views

The measurement results are displayed in various views, including statistical analysis result, data list, and work process imaging. The display can be switched instantly according to the needs of the operator.

[Data sheet] NEW
Individual data can be displayed in the list per measurement item.

[2D view]
A word balloon function is available having a picture or a diagram of the workpiece on the back. It can be used as work process instructions.

[Classic SPC view]
Graphs and lists can be freely selected to display data of single measurement item. It is useful to check detailed information such as date and time of the acquired data.

Click the tab to switch the display.

• Adding traceability information

Traceability information for each workpiece can be added, for example, serial no., rod no., inspector name, machine no., or cause of problems and remedies.

This information can be used as search criteria when extracting data using the filtering function (RT Pro/ RT Pro 3D) when a problem occurred.

• Alarm function

The operator is notified when "Out of Tolerance" or "Out of Control Limit" occurs.

The method of notification can be selected from a pop-up window, e-mail (Fig.1), or log file recording.

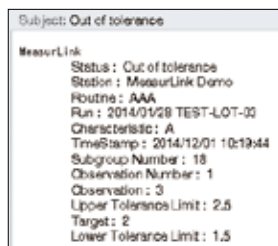


Fig.1 Alarm notification by E-mail

• Exporting data to an Excel file

Measurement data can be exported to an Excel file. This function is useful if the data needs to be used in a department that does not have MeasurLink.

(Fig.2)

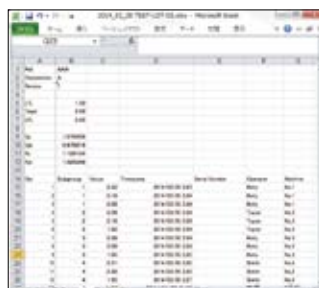


Fig.2 Export to Excel

RT Std/Pro/Pro 3D common functions

- Connectable measuring instruments
 - Measuring tool with digimatic output (equipped with PC data processing unit)
- [Supported interfaces]
 - Wireless (USB) U-WAVE (VCP)
 - Wired (USB) IT-016/USB-ITN VCP or HID IT-012U (HID)
 - Wireless (D-sub 9 pin) IT-007R MUX-10F, DP-1VR, and others
- Screen display mode when collecting data
 - Classic SPC view
 - Data sheet
 - 2D view
 - Parts data sheet, etc.
- Statistical Analysis result [Chart]
 - Xbar-R, Xbar-S, X-Rs control charts, Histogram, Run chart, Pre-control chart, Tear chart, Meta chart, Indicator bar, multivariate data control chart, etc.
- [Statistics]
 - Maximum value, Minimum value, Standard deviation, Average $\pm 3/4/6$, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio
- Alarm function [Target items]
 - Out of tolerance
 - 1 point exceeds control limit line (following are related to management chart)
 - Consecutive 9 points in one side from center line
 - 6 points successively increasing or decreasing
 - Others including 8 judgment criteria for Shewhart control chart
- Adding traceability information
 - Measurement date (automatically added)
 - Serial No. (Keyboard entry)
 - Special causes and remedies
 - Selection from comment list registered as an option
 - Enter from keyboard when measuring classified title registered as an option (e.g. Lot No. LOT 001)
- Report print out function
 - Measurement values, analysis calculation results and various charts can be arranged to output according to requirements.
- Export function of measuring result
 - Excel format
 - CSV format
- Security function
 - Once the access authorization is set, it requires "User name" and "Password" input before the program will start. Data editing actions such as reference, entry and changes require authorization according to the user's role in order to preserve data reliability.
- Operation languages
 - 10 languages are supported.
 - Japanese, English, French, German, Dutch, Spanish, Swedish, Polish, Italian, Turkish- Japanese, English, French, German, Dutch, Spanish, Swedish, Polish, Italian, Turkish

MeasurLink V7 common functions

- Operating environments
[Operating System]
 - Windows7 (32bit/64bit)
- [Data base]
 - Microsoft SQL Server 2005
Standard / Workgroup Edition
 - Microsoft SQL Server 2008
Standard / Enterprise Edition
 - Sybase and Oracle are not supported.

RT Pro/Pro 3D Common functions

- Connectable measuring instrument
 - Mitutoyo Measurement Data Management System
(equipped with PC data processing unit)
- [Supported data processing software]
 - CMM: MCOSMOS V3.2 or later
 - Vision System: QVPAK V10.0 or later/QSPAK V10.2 or later/
QSPAK MSE V3.1 or later/QIPAK V4.1 or later
 - Vision Unit: QSPAK VUE V4.1 or later
 - Surface Roughness / Contour instruments:
Formtracepak V5.3 or later
 - Roundness instruments: ROUNDPAK V5.6 or later
- Filter function
 - Keyword items for data extraction
 - Measurement data (year, month, day, time, week, etc.)
 - Serial No.
 - Traceability information
(e.g. Inspectors, Machine No., etc.)
 - Alarm item
 - Import function for text data
 - Default format files (mbf, dfq, etc.)
 - Customize function
A template can be created according to ASCII file to be imported.

RT Pro 3D Common functions

- Screen display mode when collecting data
- 3D view

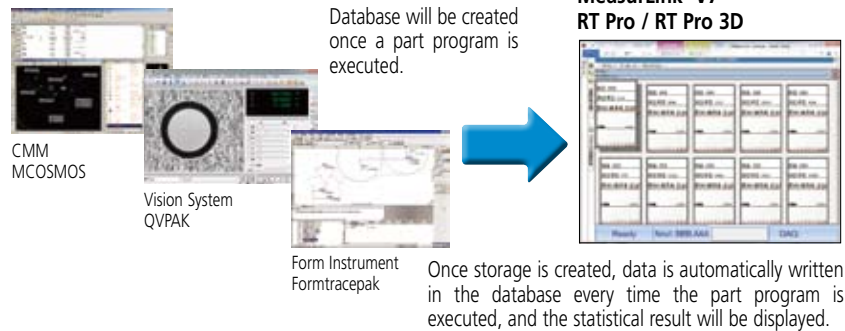
Table 1 Data collection/analysis software Real-Time functional comparison

Functions		Data collection software		
		Real-Time Standard	Real-Time Professional	Real-Time Professional 3D
Collected data display	Classic SPC view	●	●	●
	Data sheet	●	●	●
	2D view	●	●	●
	3D view (HOOPS)			●
Data extract	Filter		●	●
Input from tools and devices	Measuring tools (RS-232C, USB)	●	●	●
	Measuring instruments (DDE)		●	●
Text input	Import (ASCII)		●	●

- Real-time Professional 3D is a full-spec package. The feature to be measured can be displayed in detail using 3D CAD data.

• Automatic linking with part programs

Linking with part programs created in CMM or Vision Measuring Systems, data such as part no.; measurement item; nominal size; tolerance value and more can be loaded from a part program. A database to store all of the data is automatically configured when a part program is run.



• Filtering function

Required data can be easily extracted based on the date and time of the measurement, added comments, or alarms.

• Import function

Measurement data saved in ASCII files can be loaded. Also, a feature to customize a template for loading according to the format is provided.

MeasurLink Real-Time Professional 3D functions

• Real-time Professional 3D is a full-spec package

The feature to be measured can be displayed in detail using 3D CAD data.



[3D view]

3D graphics library HOOPS displays real view of the workpiece using an hsf file created from 3D CAD data. The displayed workpiece image can be freely turned, translated, or scaled so that you can get a clear view of the feature to be measured.

The word balloons and lead lines that display the measurement result and measured feature will move following the CAD data translation.

Measurement Data Management

Convenient data collection tool and quality control software

MeasurLink V7 Optional Process Analysis Software for Administrators

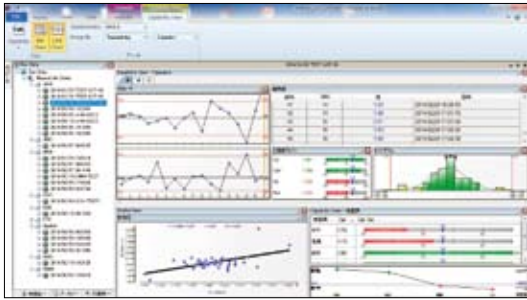
Process Analyzer Lite (PA Lite)

Process Analyzer Professional (PA Pro)

Process Analyzer is an optional software package provided for administrators who are authorized to access the database created by MeasurLink Real-time for the purpose of checking and analyzing measurement results. Two types of packages are made available: Process Analyzer Lite, the basic version; and the full-spec Process Analyzer Professional version. (see Table 1)

- **PA Lite is base version for viewing the measurement database.**

Data stored in the MeasurLink database can be checked from a selected list.



The same data displayable by data collection software can be displayed, including measurement results, charts, and statistical calculation results with the look and feel of the Windows Explorer.

- **PA Pro is a full-spec package that provides additional data check and analysis capability.**

Can also perform various analyses by filtering, data processing, etc., in addition to data checking.

- **Filtering function that allows data extraction and grouping**

Data can be extracted or grouped by selecting the date and time and other traceability information as keywords.

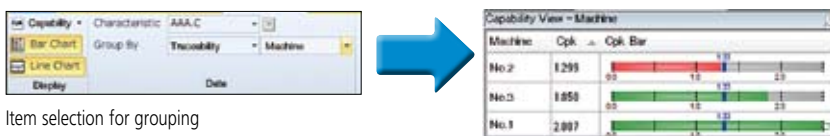
Example) Filtering data by an operator name Displays statistical analysis result in charts (Xbar-R, for example).



Filtering item selection menu

Result of filtering in the chart

Example) Grouping by Machine No. Cp, Cpk comparison



Item selection for grouping

Cpk value and bar graph per machine

Table 1 Process Analyzer functional comparison (an option available for administrators)

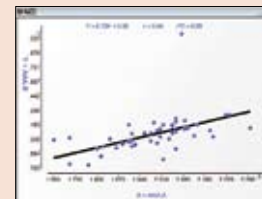
Function	Process analysis software	
	Process Analyzer Lite	Process Analyzer Professional
Result display	Classic SPC view	●
	Data sheet	●
	2D view	●
Data extract	Filter	●
Data processing	Data file merging, Copying, Editing	●
Masking	Archive data	●

PA Lite/PA Pro common functions

- Statistical Analysis result [Chart]
 - Xbar-R, Xbar-S, X-Rs control charts, Histogram, Run chart, Pre-control chart, Tear chart, Meta chart, Indicator bar, multivariate data control chart, etc.
- [Statistics]
 - Maximum value, Minimum value, Standard deviation, Average $\pm 3/4/6$, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio
- Reporting print out function
 - Measurement values, analysis calculation results and various charts can be arranged to output according to requirements.
- Exporting function of measurement result
 - Excel format
 - CSV format

PA Pro functions

- Statistical analysis result [Chart]
 - Scatter plots: The relationship between two items can be plotted.



- Data processing capability
 - Files can be managed by merging, copying, and editing. Also, the data archive function allows inclusion of the archived data in the Real-Time list.

Main specifications of MeasureReport

- Document creation:
 - Automatic creation of template sample style (Number of items x number of workpieces specified)
- GO/±NG Judgment:
 - Tolerance judgment (marked in NG value)
 - Workpiece judgment (OK or NG in judgment column)
- Statistical analysis: mean, maximum, minimum, range, standard deviation, Cp, Cpk, fraction defective, number of defectives, etc. 15 items in total.
- Capacity:
 - (1) Measurement result file conversion
Max. 200 items x Max. 2,000 workpieces
 - (2) On-line data input
Max. 200 items x Max. 2,000 workpieces
 - (3) MeasurLink database import
Max. 200 items x Max. 2,000 workpieces or
Max. 2,000 items x Max. 200 workpieces
- File combined:
 - A maximum of 10 measurement files can be specified and both measurement items and workpieces can be combined respectively.
- Printing and saving of inspection table:
 - Automatic printing and saving in Excel format
- Function of comment output to the inspection table:
 - 30 items including part number and lot number can be input.
- Function of workpiece drawing output to the inspection table:
 - Image files (bmp, jpg) can be displayed in arbitrary position.
- Others:
 - Decimal point digit justification, error display, automatic page break
- File conversion: Supported file formats
 - <CMM>
 - (1) MCOSMOS ASCII file (Geopak-3)
 - (2) MPK2700 statistic file (Binary format)
 - (3) MPK2700 ASCII file (Text format)
 - <Vision Measuring Systems>
 - (1) QUICK VISION QVPAK-QV Report
 - (2) QUICK SCOPE QSPAK measurement result file
 - (3) QUICK IMAGE QIPAK measurement result file
 - <Optical Instruments>
 - (1) Vision Unit QSPAK measurement result file
- Up to MeasurLink Version 6.2 can be exported.

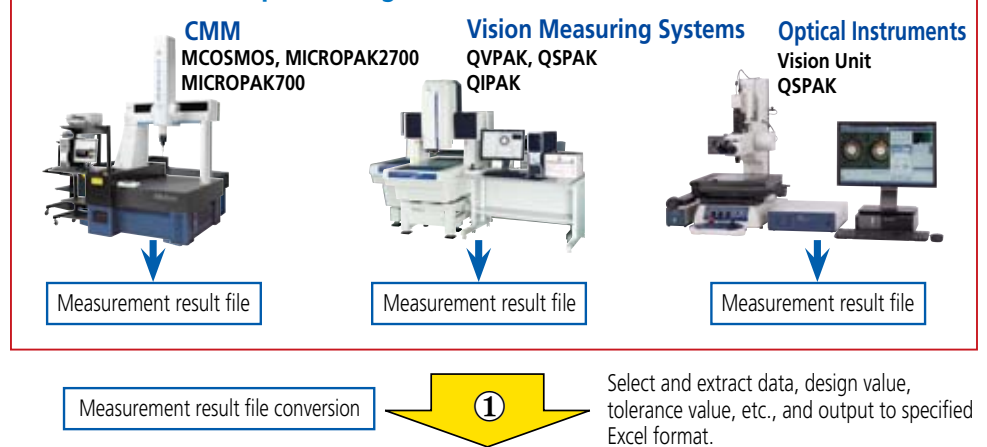
Measure Report operation environment (recommended)

- OS: Windows 2000 SP3 or later / Windows XP SP2 or later / Windows Vista / Windows 7
- Spreadsheet software:
 - Excel 2000/2002/2003/2007/2010/2013
- CPU: 500MB or more
- Memory: 500MB or more
- Hard disk: 2GB or more free space
- Display: 1024 x 576 or larger
- Media drive: CD-ROM drive*
- Communication port: RS-232C port D-sub 9 pin
- Others: Keyboard and mouse supported by OS
- * Uses when installing

Data Conversion Program into Inspection Certificates in Excel Format MeasureReport

- Data from a measurement result file generated with a CMM, vision measuring machine or other machine can be output to an inspection table generated with Excel. Data from multiple measuring machines can be combined into a single inspection table (up to 200 measurement items).
- An inspection table can be generated by inputting data from a Digimatic measuring gage via the interface. Calculation results of optical measuring machine, QM-Data 200 and the counter values for the X-axis and Y-axis output through RS-232C can be processed in the same way.
- An original Excel form can be generated by using an attached sample form as a template and making simple edits (such as copy and paste).
- The computation function is available for tolerance judgment, workpiece judgment, statistical calculation and other types of processing at inspection table generation time.

Create inspection table from measurement result file of each measuring machine (PC data processing)



Example of inspection table created.




Excel inspection table creation macro program

- Measurement result file, data loaded from on-line communication, or data specified from database file of MeasurLink can be output to an Excel table.
- Original format can be created by simple editing with sample style as a template.
- Desired template style can be automatically created by specifying required number of items and workpieces.
- Tolerance judgment (*marked in NG data), workpiece judgment (OK or NG is indicated in judgment column), statistical analysis, page break are automatically processed.
- Data from several measurement machines can be combined in 1 inspection table.





Measurement Data Management




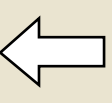
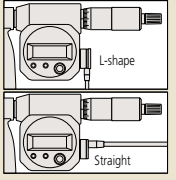
Convenient data collection tool and quality control software

Digimatic Data Cable Selector (including USB Input Tool Direct)

USB Input Tool Direct USB-ITN 	Connector type		(A) Water-proof type with output button	(B) Water-proof type with output button	(C) Straight type with output button	(CR) L type with output switch (cable outlet is right)
	Model No. Order No.		USB-ITN-A 06ADV380A	USB-ITN-B 06ADV380B	USB-ITN-C 06ADV380C	No applicable models USB-ITN-C is available Refer to the following figure.
IT-016U/IT-007R/DP-1VR/MUX-10F/ EC Counter 	Connector type		(A) Water-proof type with output button	(B) Water-proof type with output button	(C) Straight type with output button	(CR) L type with output switch (cable outlet is right)
	Order No.	1m	05CZA624	05CZA662	959149	04AZB512
		2m	05CZA625	05CZA663	959150	04AZB513
U-WAVE-T 	Connector type		(A) Water-proof type with output button	(B) Water-proof type with output button	(C) Straight type with output button	(CR) L type with output switch (cable outlet is right)
	Standard		02AZD790A	02AZD790B	02AZD790C	No applicable models Type C connectors are available, but take care of the cable when using thimbles Refer to the following figure.
	For foot switch		02AZE140A	02AZE140B	02AZE140C	

Select a cable (A to G) whose gage connector fits the digimatic port on your gage (check the red dotted frame in the above pictures).

Gage connectors on data cable The connector dimensions are given on page A-23.	Connector type	(A) Water-proof type with output button	(B) Water-proof type with output button	(C) Straight type with output button	(CR) L type with output switch (cable outlet is right)
	Picture of gage connector				
	Data switch	Available	Available	Available	Available

Digimatic ports on gage Please note that some high-precision Digimatic gages are capable of displaying the measurement result to more than 6 digits. However, according to the Digimatic output specification, the result may be output in 6 digits only. Digimatic gages whose display may exceed 6 digits <ul style="list-style-type: none"> • Laser Scan Micrometers • Litematic • Linear gage counter (EH) • High-Accuracy Digimatic Micrometer (293-100/293-130) 	Picture of Digimatic port				
	Applicable models	<ul style="list-style-type: none"> • Digimatic caliper 500-776/500-777, etc. 500-712-20/500-713-20, etc. 500-712 etc. 550-301-10/550-331-10, etc. 551-301-10/551-331-10, etc. 552-302-10/552-303-10, etc. 552-150-10/552-151-10, etc. 552-155-10/552-156-10, etc. 552-181-10/552-182-10, etc. • Digimatic special application caliper 573-601/573-602, etc. • Digimatic depth gage 571-251-10/571-252-10, etc. • Digimatic scale unit 572-600, 572-601, etc. 	<ul style="list-style-type: none"> • Digimatic micrometer 293-100/293-130 293-140-30/293-141-30, etc. 293-230-30 etc. 340-251-30/340-252-30 • Dedicated micrometers for Digimatic 422-230-30/422-231-30, etc. 406-250-30/406-251-30, etc. 343-250-30/343-251-30, etc. 369-250-30/369-251-30, etc. 345-250-30/345-251-30, etc. 314-251-30/314-252-30, etc. • Digimatic micrometer head 350-251-30/350-261-30, etc. • Digimatic holtest 468-161/468-162, etc. • Digimatic depth gage 329-250-30/329-251-30, etc. 	<ul style="list-style-type: none"> • Digimatic caliper 500-150-30/500-151-30, etc. 500-500-10/500-501-10, etc. 500-443 etc. • Digimatic special application caliper 573-118-10/573-119-10, etc. 573-116-10/573-117-10, etc. 573-191-30/573-291-30 573-181-30/573-182-30, etc. • Digimatic depth gage 571-201-30/571-202-30, etc. • Digimatic micrometer head 164-163/164-164 • Digimatic scale unit 572-203-10/572-213-10 572-300-10/572-301-10, etc. • Digital height master 515-374/515-376, etc. 	<ul style="list-style-type: none"> • Digimatic micrometer 293-582/293-583, etc. 389-514/389-714  <p>Type C straight connectors are available, but may interfere with thimble operation.</p>

(D) Flat 10-pin type	(E) Round 6-pin type	(F) Flat straight type	(FB) Flat L-shape (cable outlet is back)	(FR) Flat L-shape (cable outlet is right)	(FL) Flat L-shape (cable outlet is left)	(G) Flat straight waterproof type
USB-ITN-D 06ADV380D	USB-ITN-E 06ADV380E	USB-ITN-F 06ADV380F	No applicable models USB-ITN-F is available			USB-ITN-G 06ADV380G
(D) Flat 10-pin type	(E) Round 6-pin type	(F) Flat straight type	(FB) Flat L-shape (cable outlet is back)	(FR) Flat L-shape (cable outlet is right)	(FL) Flat L-shape (cable outlet is left)	(G) Flat straight waterproof type
936937	937387	905338	905689	905691	905693	21EAA194
965014	965013	905409	905690	905692	905694	21EAA190
(D) Flat 10-pin type	(E) Round 6-pin type	(F) Flat straight type	(FB) Flat L-shape (cable outlet is back)	(FR) Flat L-shape (cable outlet is right)	(FL) Flat L-shape (cable outlet is left)	(G) Flat straight waterproof type
02AZD790D	02AZD790E	02AZD790F	No applicable models Use 02AZD790F or 02AZD140F .			02AZD790G
02AZE140D	02AZE140E	02AZE140F				02AZE140G



(Note 1) ID-F, EB, EC-101D, ID-U, ID-SS, ID-SX are required to use with the USB-ITN.
 (Note 2) USB-ITN, IT-016U, and U-EAVE cannot be used with EF/EH, VL-50-B/50S-B, and SJ-500/SV-2100.

(D) Flat 10-pin type	(E) Round 6-pin type	(F) Flat straight type	(FB) Flat L-shape (cable outlet is back)	(FR) Flat L-shape (cable outlet is right)	(FL) Flat L-shape (cable outlet is left)	(G) Flat straight waterproof type
N/A	N/A	N/A	N/A	N/A	N/A	N/A

<ul style="list-style-type: none"> • Digimatic indicator ID-H • ID-F (Note1) • High-precision height gage QM-Height • Mu-checker Digital Mu-checker (using a foot switch) • Laser scan micrometer LSM-9506 • Linear gage counter EF/EH (Note 2) • EB (Note 1), EC-101D (Note 1) • Litematic VL-50-B/50S-B (Note 2) • Contour measuring system SJ-210/310/410 • SJ-500/SV-2100 (Note 2) • Hardness testing machines HM-210/220 	<ul style="list-style-type: none"> • Digimatic micrometer 293-666/293-667, etc. • 227-201 etc. • 369-411/369-412, etc.. • Hardness testing machines HM-100 • HM-200 • HV-100 • HR-300/400/500 • HH-411 	<ul style="list-style-type: none"> • Digimatic indicator ID-CX, ID-C (Peak-Value Hold Type) (Note1), ID-C (Calculation type), ID-C (Bore Gage Type), ID-U (Note2), ID-SS (Note1), ID-SX (Note1) • Digimatic height gage 192-663-10/192-613-10/570-322/570-227, etc. (Flat L-shape, cable outlet is right) • ABS borematic 568-361/568-362, etc. • Scale unit 572-460/572-560/572-480-10/572-580-10, etc. • Digimatic bore gage 511-501/511-502, etc. • Hardness testing machines HH-300 • Digimatic depth gage Digimatic type (ID-CX) 				<ul style="list-style-type: none"> • Digimatic indicator ID-N • ID-B

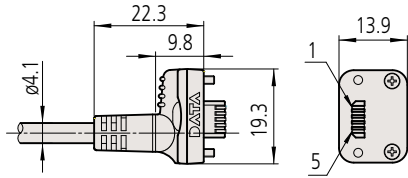
Measurement Data Management

Convenient data collection tool and quality control software

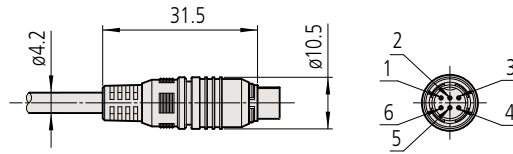
Digimatic data cable specifications (Dimensions)

Gage connector dimensions

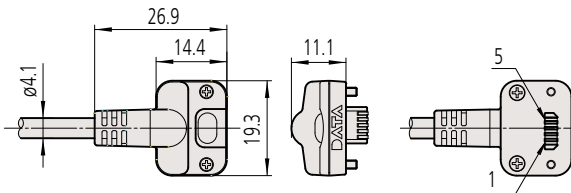
(A) (1) No.06ADV380A (2) No.05CZA624 (1m) (3) No.02AZD790A (Standard)
No.05CZA625 (2m) No.02AZE140A (FSW)



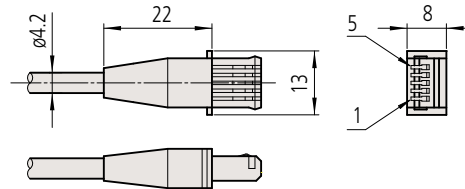
(E) (1) No.06ADV380E (2) No.937387 (1m) (3) No.02AZD790E (Standard)
No.965013 (2m) No.02AZE140E (FSW)



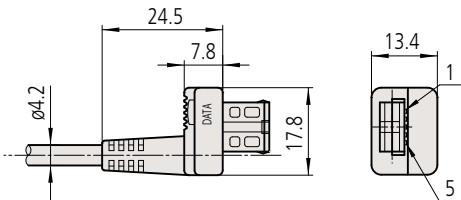
(B) (1) No.06ADV380B (2) No.05CZA662 (1m) (3) No.02AZD790B (Standard)
No.05CZA663 (2m) No.02AZE140B (FSW)



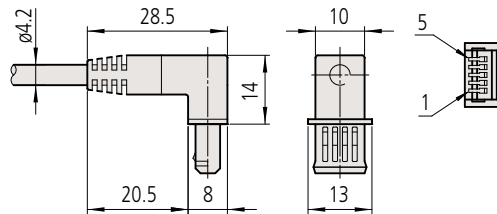
(F) (1) No.06ADV380F (2) No.905338 (1m) (3) No.02AZD790F (Standard)
No.905409 (2m) No.02AZE140F (FSW)



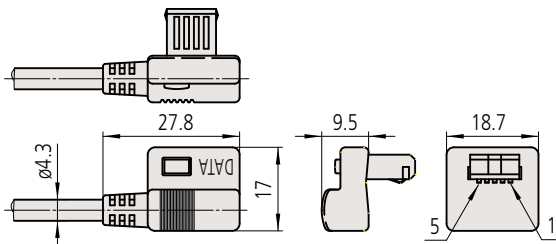
(C) (1) No.06ADV380C (2) No.959149 (1m) (3) No.02AZD790C (Standard)
No.959150 (2m) No.02AZE140C (FSW)



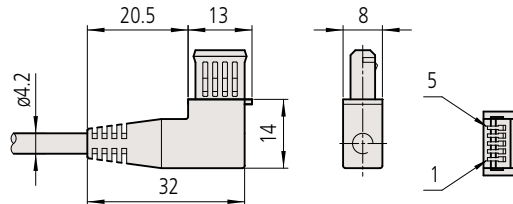
(FB) (1) No applicable models (2) No.905689 (1m) (3) No applicable models
No.905690 (2m)



(CR) (1) No applicable models (2) No.04AZB512 (1m) (3) No applicable models
No.04AZB513 (2m)

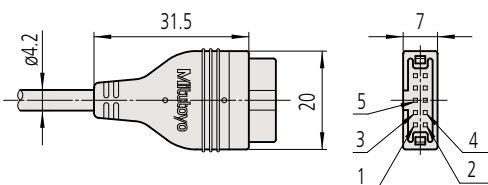


(FR) (1) No applicable models (2) No.905691 (1m) (3) No applicable models
No.905692 (2m)

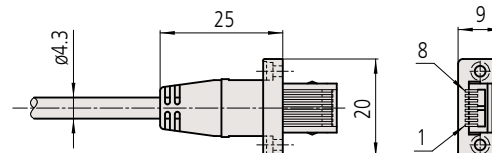


(FL) and (FR) is symmetrical and the same size.

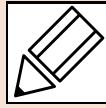
(D) (1) No.06ADV380D (2) No.936937 (1m) (3) No.02AZD790D (Standard)
No.965014 (2m) No.02AZE140D (FSW)



(G) (1) No.06ADV380G (2) No.21EAA194 (1m) (3) No.02AZD790G (Standard)
No.21EAA190 (2m) No.02AZE140G (FSW)



Quick Guide to Precision Measuring Instruments



Quality Control

Quality control (QC)

A system for economically producing products or services of a quality that meets customer requirements.

Process quality control

Activities to reduce variation in product output by a process and keep this variation low. Process improvement and standardization as well as technology accumulation are promoted through these activities.

Statistical process control (SPC)

Process quality control through statistical methods.

Population

A group of all items that have characteristics to be considered for improving and controlling processes and quality of product. A group which is treated based on samples is usually the population represented by the samples.

Lot

Collection of product produced under the same conditions.

Sample

An item of product (or items) taken out of the population to investigate its characteristics.

Sample size

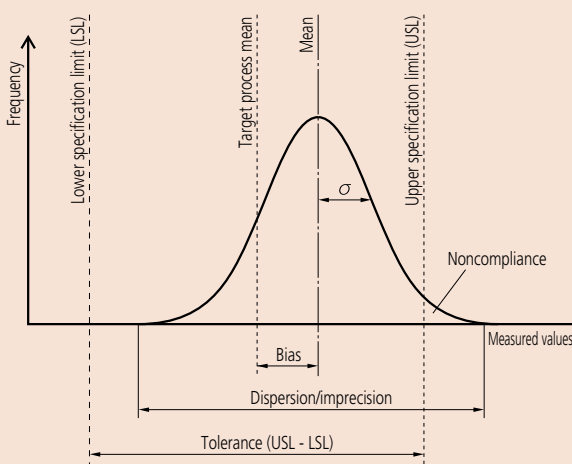
Number of product items in the sample.

Bias

Value calculated by subtracting the true value from the mean of measured values when multiple measurements are performed.

Dispersion

Variation in the values of a target characteristic in relation to the mean value. Standard deviation is usually used to represent the dispersion of values around the mean.



Histogram

A diagram that divides the range between the maximum and the minimum measured values into several divisions and shows the number of values (appearance frequency) in each division in the form of a bar graph. This makes it easier to understand the rough average or the approximate extent of dispersion. A bell-shaped symmetric distribution is called the normal distribution and is much used in theoretical examples on account of its easily calculable characteristics. However, caution should be observed because many real processes do not conform to the normal distribution, and error will result if it is assumed that they do.

Process capability

Process-specific performance demonstrated when the process is sufficiently standardized, any causes of malfunctions are eliminated, and the process is in a state of statistical control. The process capability is represented by mean $\pm 3\sigma$ or 6σ when the quality characteristic output from the process shows normal distribution. σ (sigma) indicates standard deviation.

Process capability index (PCI or Cp)

A measure of how well the process can operate within the tolerance limits of the target characteristic. It should always be significantly greater than one. The index value is calculated by dividing the tolerance of a target characteristic by the process capability (6σ). The value calculated by dividing the difference between the mean (\bar{X}) and the standard value by 3σ may be used to represent this index in cases of a unilateral tolerance. The process capability index assumes that a characteristic follows the normal distribution.

Notes: If a characteristic follows the normal distribution, 99.74% data is within the range $\pm 3\sigma$ from the mean.

Bilateral tolerance

$$C_p = \frac{USL - LSL}{6\sigma}$$

USL: Upper specification limit
LSL: Lower specification limit

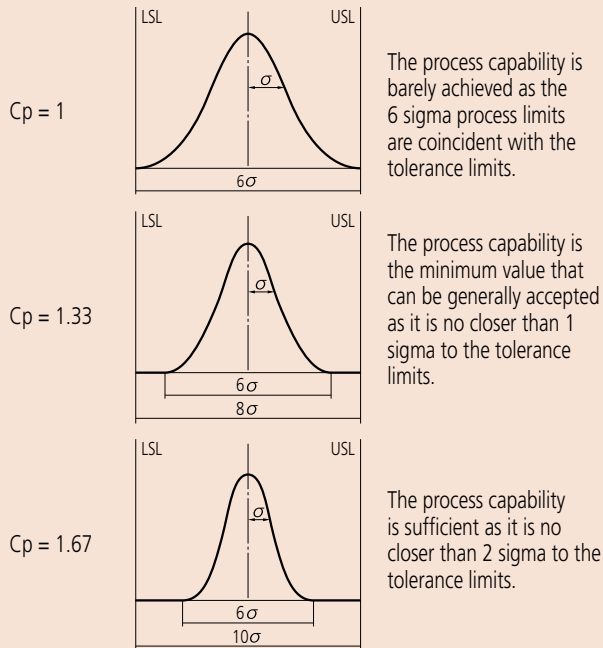
Unilateral tolerance ... If only the upper limit is stipulated

$$C_p = \frac{USL - \bar{X}}{3\sigma}$$

Unilateral tolerance ... If only the lower limit is stipulated

$$C_p = \frac{\bar{X} - LSL}{3\sigma}$$

Specific examples of a process capability index (Cp) (bilateral tolerance)

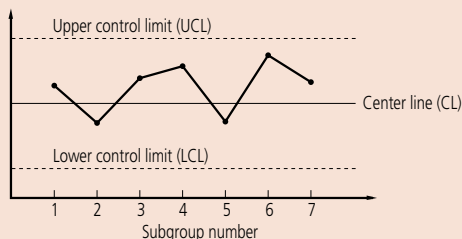


Note that Cp only represents the relationship between the tolerance limits and the process dispersion and does not consider the position of the process mean.

Notes: A process capability index that takes the difference between the process mean from the target process mean into consideration is generally called Cpk, which is the upper tolerance (USL minus the mean) divided by 3σ (half of process capability) or the lower tolerance (the mean value minus LSL) divided by 3σ , whichever is smaller.

Control chart

Used to control the process by separating the process variation into that due to chance causes and that due to a malfunction. The control chart consists of one center line (CL) and the control limit lines rationally determined above and below it (UCL and LCL). It can be said that the process is in a state of statistical control if all points are within the upper and lower control limit lines without notable trends when the characteristic values that represent the process output are plotted. The control chart is a useful tool for controlling process output, and therefore quality.



Chance causes

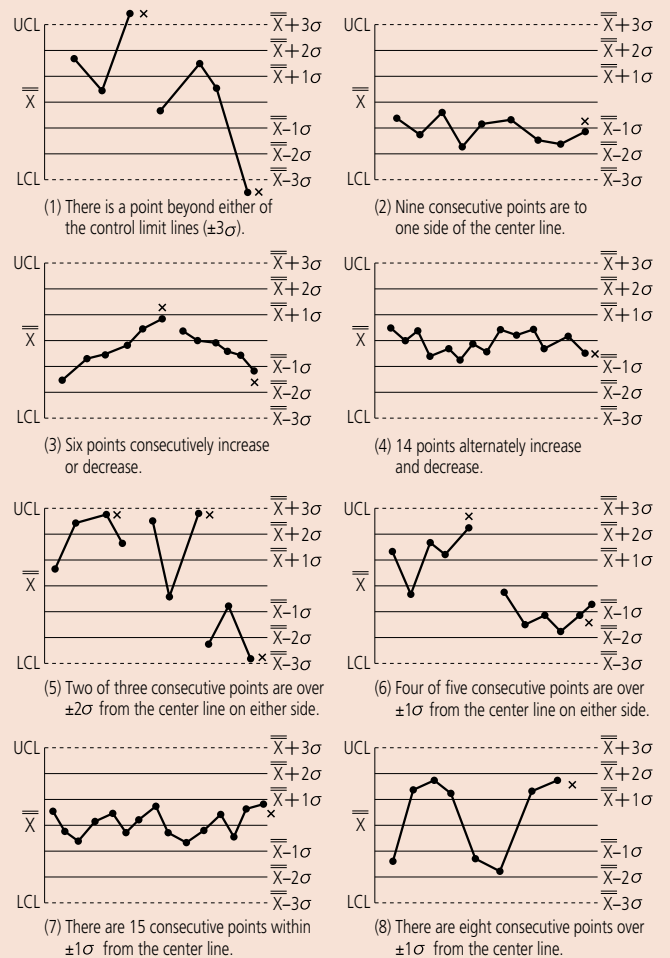
These causes of variation are of relatively low importance. Chance causes are technologically or economically impossible to eliminate even if they can be identified.

\bar{X} -R control chart

A control chart used for process control that provides the most information on the process. The \bar{X} -R control chart consists of the \bar{X} control chart that uses the mean of each subgroup for control to monitor abnormal bias of the process mean and the R control chart that uses the range for control to monitor abnormal variation. Usually, both charts are used together.

How to read the control chart

Typical trends of successive point position in the control chart that are considered undesirable are shown below. These trends are taken to mean that a 'special cause' is affecting the process output and that action from the process operator is required to remedy the situation. These determination rules only provide a guideline. Take the process-specific variation into consideration when actually making determination rules. Assuming that the upper and the lower control limits are 3σ away from the center line, divide the control chart into six regions at intervals of 1σ to apply the following rules. These rules are applicable to the \bar{X} control chart and the \bar{X} control chart. Note that these 'trend rules for action' were formulated assuming a normal distribution. Rules can be formulated to suit any other distribution.



Note: This part of 'Quick Guide to Precision Measuring Instruments' (A-25 to A-26) has been written by Mitutoyo based on its own interpretation of the JIS Quality Control Handbook published by the Japanese Standards Association.

References

- JIS Quality Control Handbook (Japanese Standards Association)

- Z 8101: 1981
- Z 8101-1: 1999
- Z 8101-2: 1999
- Z 9020: 1999
- Z 9021: 1998