

Digimatic Gage/PC Data Input Device USB Input Tool IT-020U/IT-007R

Refer to page A-6 for details.



Mini-Printer Equipped with Data Logging Function DP-1VA LOGGER

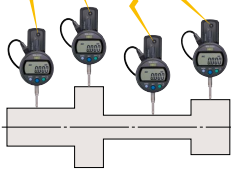
Refer to page A-19 for details.



Measurement Data Wireless Communication System U-WAVE Series

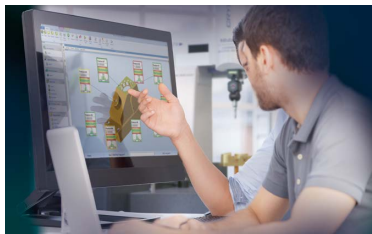
Refer to pages A-9 to A-14 for details.

	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 V2.1/V3.0

Refer to pages A-15 to A-17 for details.



Measurement Data Network System MeasurLink®

Refer to pages A-25 to A-30 for details.

A

Measurement Data Management

MeasurLink® ENABLED

Data Management Software by Mitutoyo

Measurement Data Network System

MeasurLink® is a measurement data management system based on databases (SQL Server). You can build a network to manage the measurement results and measuring machines by simply combining the functions necessary for your purpose.

MeasurLink® is a registered trademark of Mitutoyo Corporation in Japan and Mitutoyo America Corporation in the United States.

MICAT

Mitutoyo Metrology Computer Aided Technology
the standard in world
metrology software
MeasurLink

Measurement Program

"MICAT Planner" automatic measurement program generation software is supported.

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Measurement Data Management

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Example of Measurement Data Management

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

Step 1

Recording measurement results

No more transcribing



DP-1VA LOGGER

A-19

Equipped with the data logger function, it allows batch transfer of stored data to a PC with a USB cable.

Direct data input to a PC

Connecting cable-integrated USB-ITN



USB Input Tool Direct

A-5

Lineup of two models with different output specifications IT-020U/IT-007R



Input Tool Series

A-6

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



Multiplexer MUX-10F

A-20

Wireless

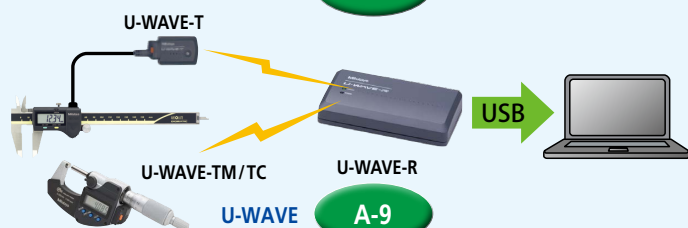


For Digimatic micrometers
U-WAVE-TMB



For Digimatic calipers
U-WAVE-TCB

A-8



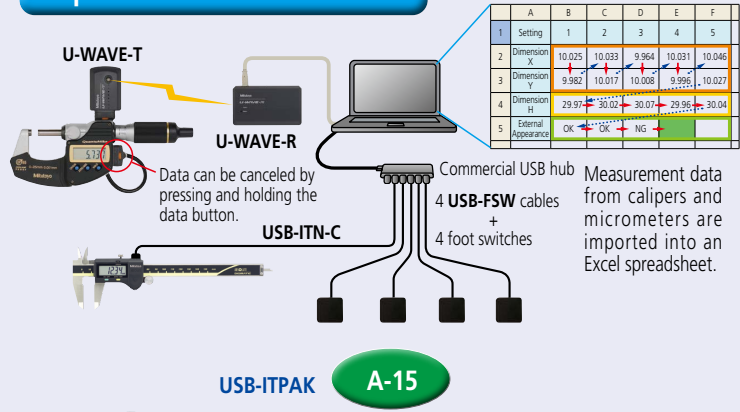
U-WAVE-TM/TC
U-WAVE

A-9

Step 2

Software dedicated to inspection and quality control

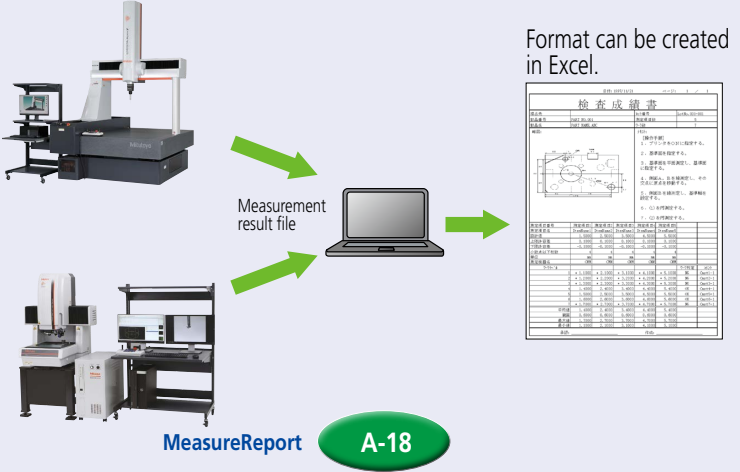
Inspection certificate creation



USB-ITPAK

A-15

Measurement data from calipers and micrometers are imported into an Excel spreadsheet.

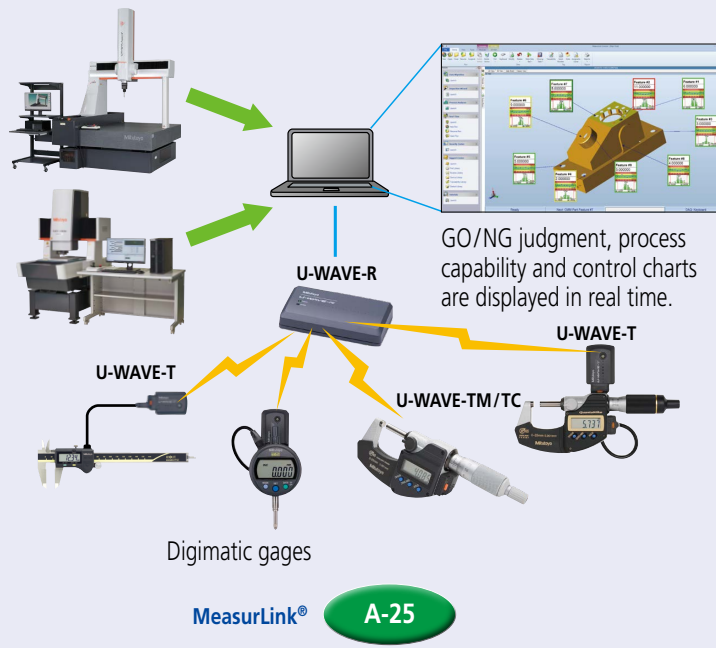


MeasureReport

A-18

Format can be created in Excel.

Statistical Process Control



MeasurLink®

A-25

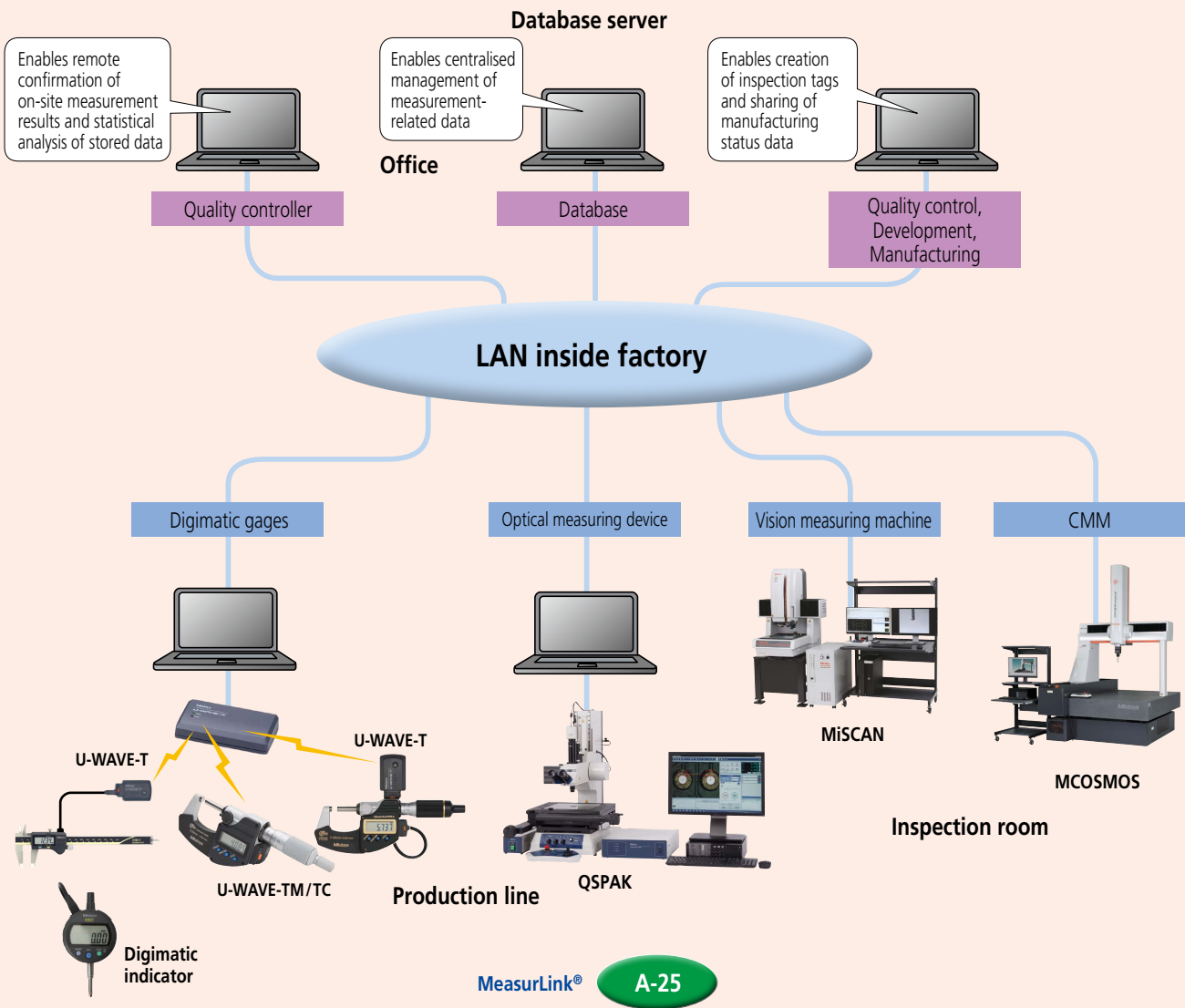
GO/NG judgment, process capability and control charts are displayed in real time.

System Design

Step 3

Network the quality control information of whole the factory

Unify and control the measurement results through the network



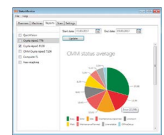
Condition Monitor

Conduct preventive maintenance through CMM status monitoring



Status Monitor

Can remotely monitor measuring machines

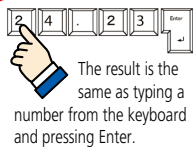


Measurement Data Management

Digimatic Gage/PC Data Input Device USB Input Tool Direct USB-ITN

- Converts measurement data to keyboard signals and directly inputs them to spreadsheet software such as Excel and memo pad.
- Measurement data collection software (optional) is also available (refer to page A-15).

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



The result is the same as typing a number from the keyboard 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-ITN-B

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

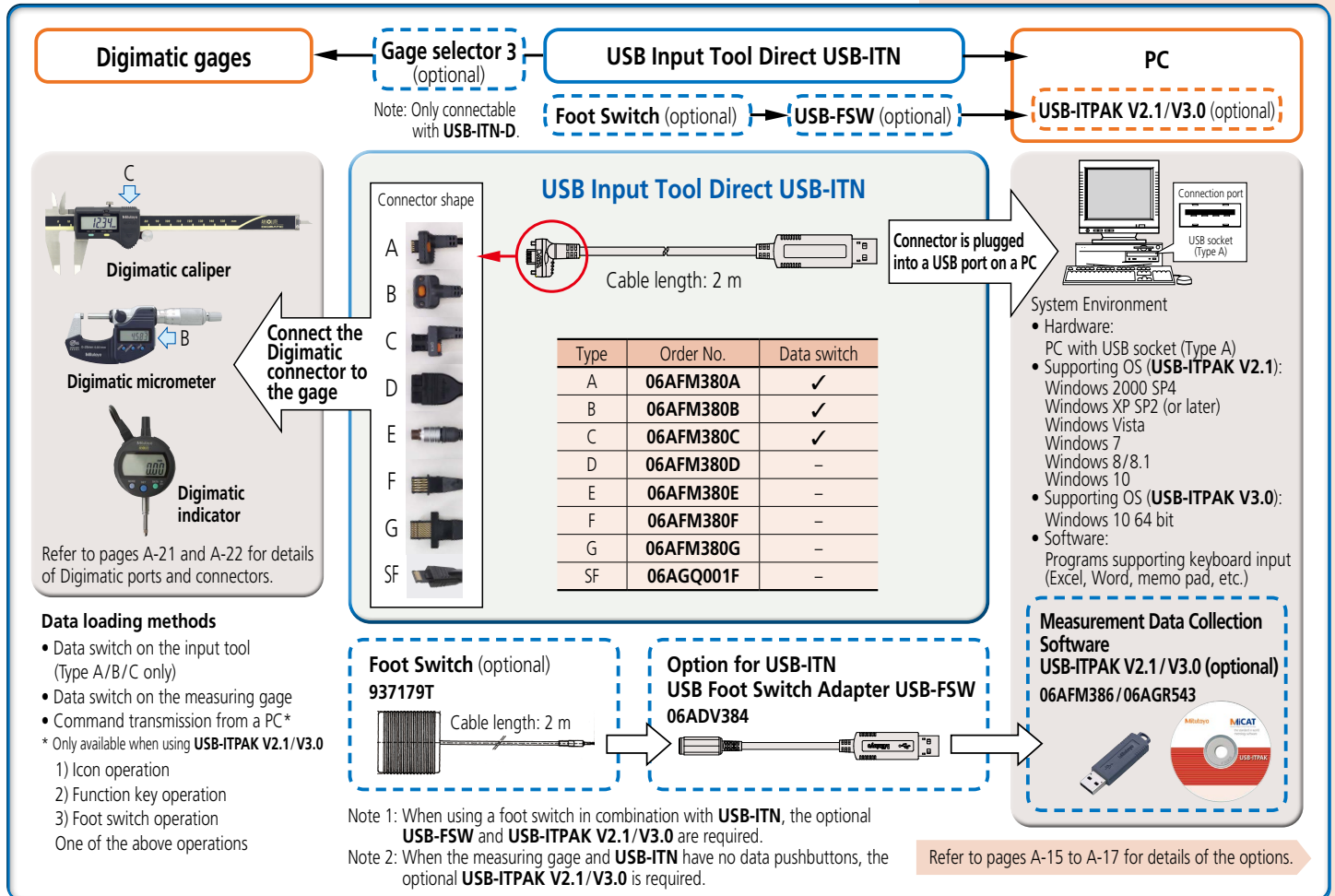


USB-ITN

Main specification

- Output compatibility: USB1.0 or USB2.0
 - Supporting driver software: Switchable between 2 items below
 - 1) When using standalone: HID keyboard device*
 - 2) When using with **USB-ITPAK V2.1/V3.0**: Virtual COM port (VCP)
 - Communication speed: 12 Mbps (Full Speed)
 - Power supply: USB bus power
 - Mass: 59 g
 - USB2.0 certificate
 - Conforms to EU EMC Directive.
- * Since this device is compatible with Windows standard driver software, dedicated driver software is not required.
Note: Information regarding **USB-ITPAK V3.0** can be downloaded from our website.

USB-ITN System Configuration

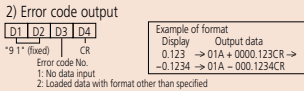
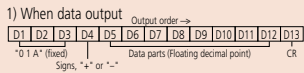


Specifications of IT-007R RS-232C Communication

- Output specification: RS-232C compliant
- Communication method: Full duplex
- Communication speed: 2400 bps (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

* When connecting to a sequencer, a power supply is required.
Input voltage: Supplied in the range 6 V to 16 V
Power supply terminal: Supplied to pins 4 and 7
Note: *4* and *6*, *7* and *8* are connected with each other inside this product.

**Measurement Data Input Unit
Input Tool SERIES IT-020U/IT-007R**

USB Keyboard Signal Conversion Type IT-020U

The IT-020U, a popular USB input tool that enables easy data recording. Allows you to perform inspection work more efficiently.

USB-connected input tool housed in a dedicated box with a large data switch and a foot switch connector socket. When combined with the optional software **USB-ITPAK V2.1/V3.0**, it allows you to improve inspection work efficiency.

Main Specifications of IT-020U

Supported driver software: Changeable between two types
Output specification: USB2.0 or USB1.0

- 1) Stand-alone: HID keyboard device*
- 2) Using **USB-ITPAK V2.1/V3.0**: Virtual COM port (VCP)

Communication speed: 12 Mbps (Full Speed)

Power supply: USB bus power

USB2.0 certificate

Conforms to EMC Directive

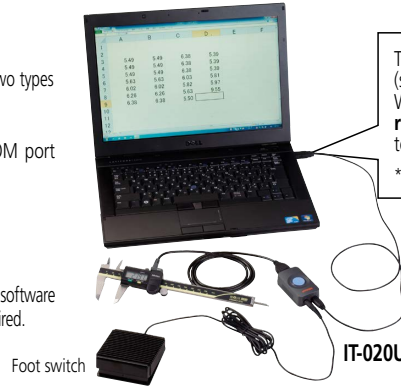
* This product is compatible with the standard driver software for Windows. No dedicated driver software is required.



IT-020U

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-020U

RS-232C Communication Conversion Type IT-007R

Input tool for RS-232C communication

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

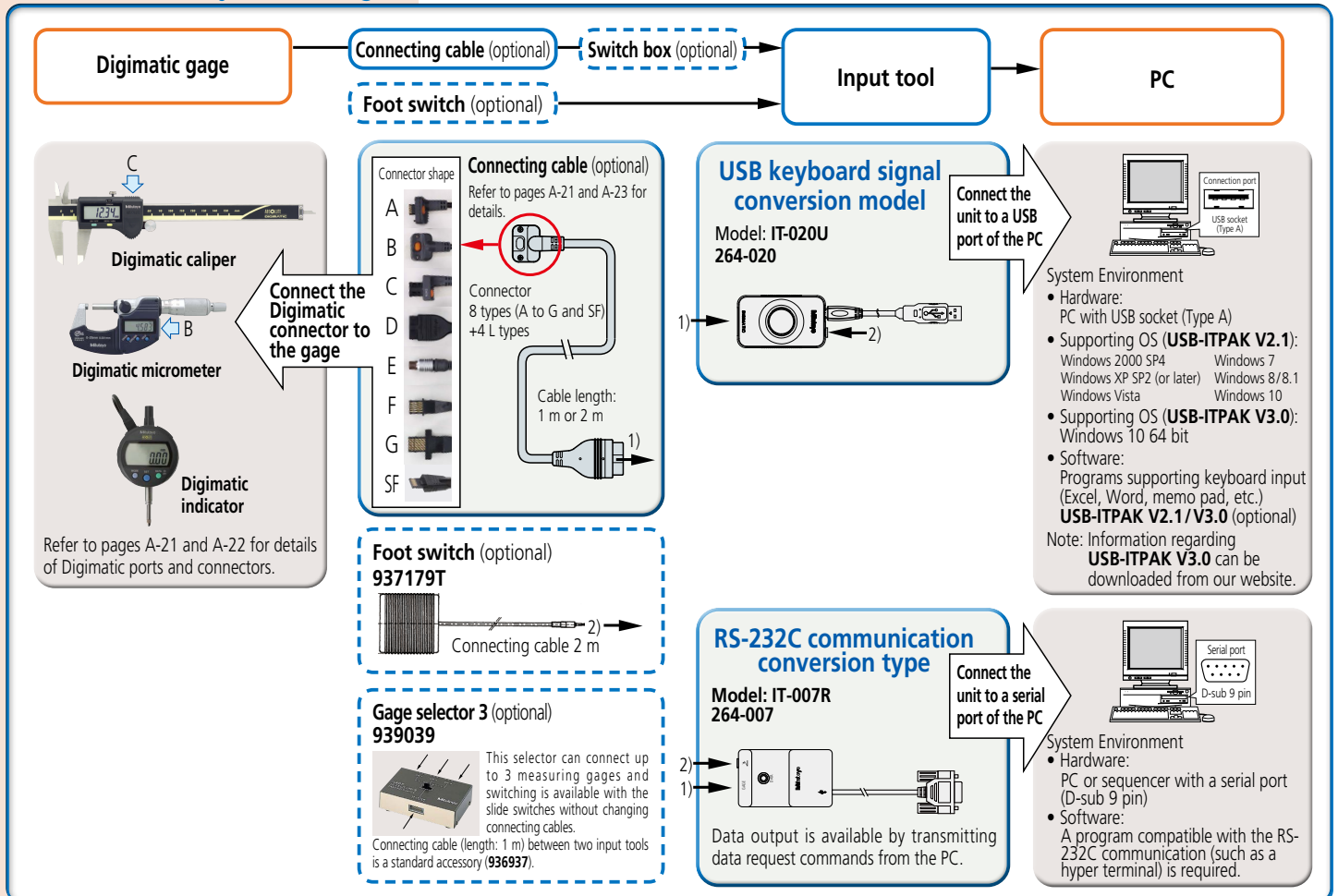
For example, production engineers can create communication programs to load the measurement data by transmitting a command from the PC.

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.



IT-007R

IT-020U/IT-007R System Configuration



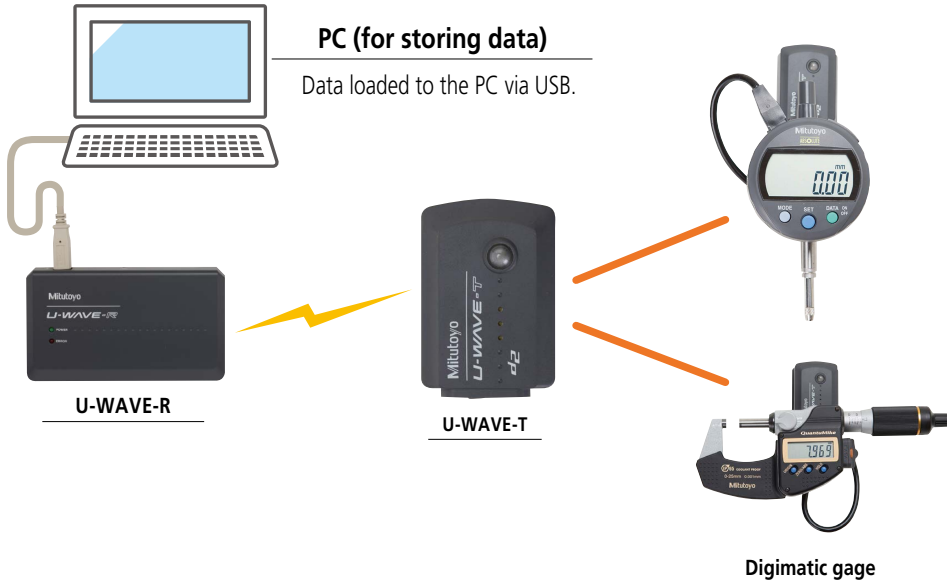
Measurement Data Management

What is the U-WAVE Series?

- A "Measurement Data Wireless Communication System" that, with simple operations, allows you to send data from Digimatic gages to a PC, etc. via wireless communication. The following three types are currently available.

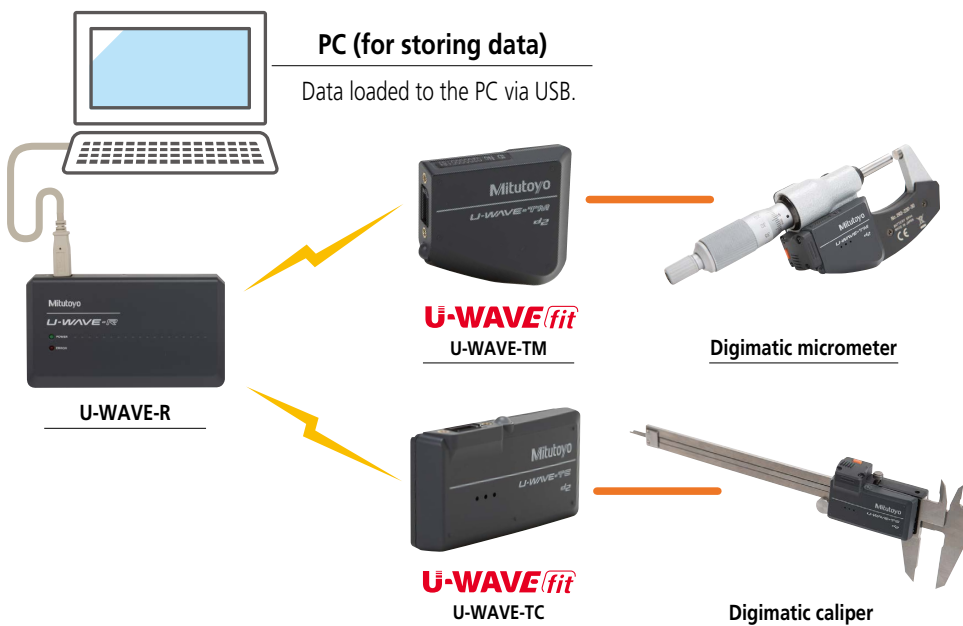
1) U-WAVE

Comprises of a receiver (**U-WAVE-R**) that connects to a PC and a transmitter (**U-WAVE-T**) that connects to a Digimatic gage.



2) U-WAVE fit

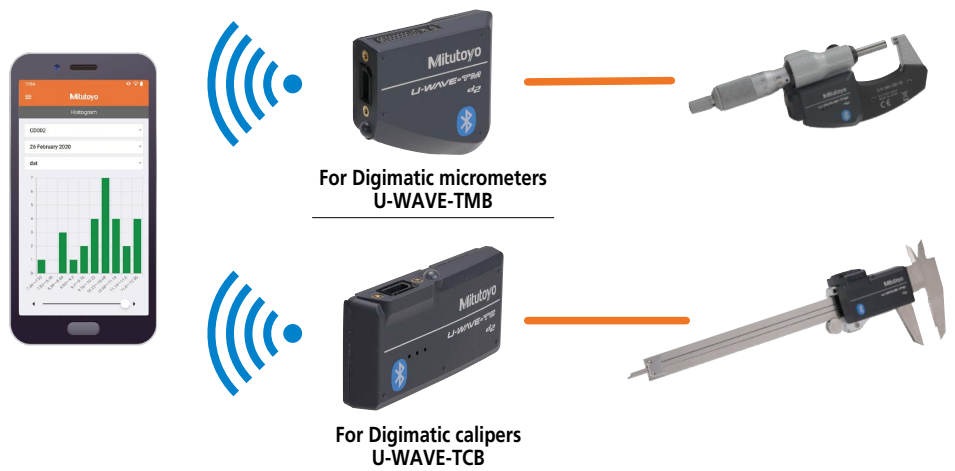
Dedicated for Digimatic calipers and Digimatic micrometers, it inherits the functions and performance of **U-WAVE** but is more compact, thinner, and with improved operability.



Refer to the Measurement Data Wireless Communication System **U-WAVE** Brochure (**E12000**) for more details.

3) Mitutoyo Bluetooth® U-WAVE

U-WAVE fit with **Bluetooth®** capability. It can not only connect to a PC, but also other devices that support Bluetooth®, such as a smartphone or tablet without the need for an external receiver unit.
 Note: Connectivity of the dedicated **Mitutoyo Bluetooth® U-WAVE** application and **U-WAVE-TMB/TCB** to every single Bluetooth® device is not guaranteed.



Function comparison table

	U-WAVE	U-WAVE fit* ¹	Mitutoyo Bluetooth® U-WAVE* ¹
Transmission method	Original <based on IEEE802.15.4 (2.4 GHz)>		Bluetooth®
Communication distance	Approx. 20 m (line of sight)		Approx. 16 m (line of sight)
Connectible model	Digimatic gages	Digimatic calipers and micrometers	
Dedicated application/ software	U-WAVEPAK (included with U-WAVE receiver) USB-ITPAK* ²		U-WAVEPAK-BW U-WAVEPAK-BM U-WAVE Navi USB-ITPAK* ²

*1 Please check the list of compatible models since the unit may not be attachable to some models.

*2 Please note that **USB-ITPAK** may not be recognized if your computer's OS build is old.



Refer to the Measurement Data Wireless Communication System **U-WAVE** Brochure (E12000) for more details.

Measurement Data Management

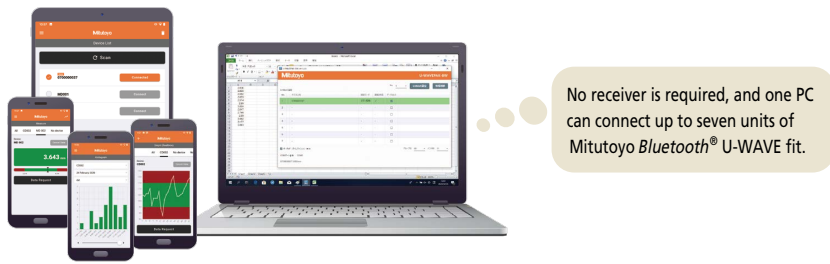
Measurement Data Wireless Communication System U-WAVE-TMB/TCB (Mitutoyo Bluetooth® U-WAVE)

- Bluetooth® communication allows for wireless transmission of measurement data from digimatic micrometers and calipers to PCs, smartphones, tablets and other such terminals.
- Bluetooth® communication not only allows cost reduction, as it does not require the conventional dedicated receiver unit (U-WAVE-R), but it also improves operability.
- **U-WAVEPAK-BM** (free), the measurement support application software for smartphones is available for download from app stores (Google Play, Apple Store).



- **U-WAVEPAK-BW** (free), the communication software for transferring measurement data to optional computer software (**USB-ITPAK**, **MeasurLink®**) is available for download from our company's website.
<https://www.mitutoyo.co.jp/eng/contact/products/u-wave/>

Mitutoyo Bluetooth® U-WAVE fit system configuration



For Digimatic micrometers
U-WAVE-TMB



For Digimatic calipers
U-WAVE-TCB





Measurement Navigation Application Mitutoyo U-WAVE Navi

A new application tool for **Mitutoyo Bluetooth® U-WAVE** is now available. It allows to set measuring points, methods (which tool to use), cautions in each measuring process. By allowing the insertion of image files into procedures, it enables anyone to measure in the same way and correctly. Since it also allows for entering the inspectors' names, it can be used to keep records of "when, where, who" performed the measurement. Workpiece information, procedures, as well as measurement results can be managed on the application. It can also output data in CSV format.



Mitutoyo U-WAVE Navi is available for free download from Google Play.

Master how to use both applications according to your purpose.

	 Mitutoyo U-WAVE Navi	 U-WAVEPAK-BM
Purpose	Using the application, create a measurement procedure, display and navigate the measurement, and manage the measurement results	Measure a workpiece continuously to perform a simple trend management
Possible actions (Functions)	Create/perform a measurement procedure (including GO/NG judgement) Navigate a measurement procedure Manage/transfer a measurement procedure Display a list of measurement results Transfer a measurement result	Judgment Data logging Graphical display of measurement result Display the histogram of measurement results Transfer a measurement result (log data)
Display language	Japanese/English (Depends on the OS settings)	English
Compatible OS	Android 7.0 or later (iOS not supported)	Android 7.0 or later/iOS 10.0 or later

U-WAVE-TMB/TCB (Mitutoyo Bluetooth® U-WAVE) System Communication Specifications

• Wireless Communication Specifications

Wireless communication	Bluetooth® 4.2 Low Energy
Wireless communication distance	Approx. 16 m (line of sight) Approx. 10 m (in a factory environment)
Transmission output	3.2 mW (5 dBm) or less (Class2)
Modulation method	FH-SS (Frequency-hopping spread spectrum)
Communication frequency	2.4 GHz band

- Note 1: To use **U-WAVE-TMB/TCB**, conformity to the radio law of each country is required. Please contact your dealer or nearest Mitutoyo sales office.
- Note 2: **U-WAVE-TMB/TCB** is not compatible with **U-WAVE fit**, for which communication specifications are different.
- Note 3: Connectivity of **U-WAVE-TMB/TCB** to every single Bluetooth® device is not guaranteed.

Optional Accessories

Model No.	USB-ITPAK V2.1/V3.0
Order No.	06AFM386/06AGR543
Compatible OS (Windows)	USB-ITPAK V2.1: Windows 2000 SP4 to Windows 10 USB-ITPAK V3.0: Windows 10 64 bit only
Compatible Excel version	USB-ITPAK V2.1: Excel 2002, 2003, 2007, 2010, 2013, 2016, Microsoft 365 USB-ITPAK V3.0: Excel 2010, 2013, 2016, Microsoft 365

Note: Applicable only when **U-WAVEPAK-BW** is used.

USB-ITPAK V2.1/V3.0



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

Note: Google Play and the Google Play logo are trademarks of Google LLC. Apple and the Apple logo are trademarks of Apple Inc.



Refer to the Measurement Data Wireless Communication System **U-WAVE** Brochure (**E12000**) for more details.

Measurement Data Wireless Communication System
U-WAVE-TMB/TCB (Mitutoyo Bluetooth® U-WAVE)

Transmitter / Receiver



SPECIFICATIONS

	For Digimatic micrometers		For Digimatic calipers	
Order No.	264-626*	264-627*	264-624*	264-625*
Model	U-WAVE-TMB (IP67 type)	U-WAVE-TMB (buzzer type)	U-WAVE-TCB (IP67 type)	U-WAVE-TCB (buzzer type)
Protection level	IP67	N/A	IP67	N/A
Data reception indication	LED	LED, buzzer	LED	LED, buzzer
Power supply	Lithium battery CR2032x1			
Battery life	Approx. 1 year under normal conditions of use, but varies according to usage.			
Mass (g)	18			

* Order No. differs depending on the destination country. Add the following suffix to the order No.: K for Korea, B for Brazil and Argentina.



02AZF310



02AZF300

Choose a connecting unit compatible with your gage.

Order No.	02AZF310	02AZF300
Protection level	IP67	N/A
Mass (g)	6	
Connectable transmission unit	U-WAVE-TMB/TCB (for dust/water-proof type)	U-WAVE-TCB (for standard type)

Note: Water-proof performance is ensured only when attached to measuring instruments of IP67 type.

For model compatibility information, refer to a separate sheet provided with **Catalog No. E12000**: Measurement Data Wireless Communication System U-WAVE.

Compatibility of measuring tool and unit

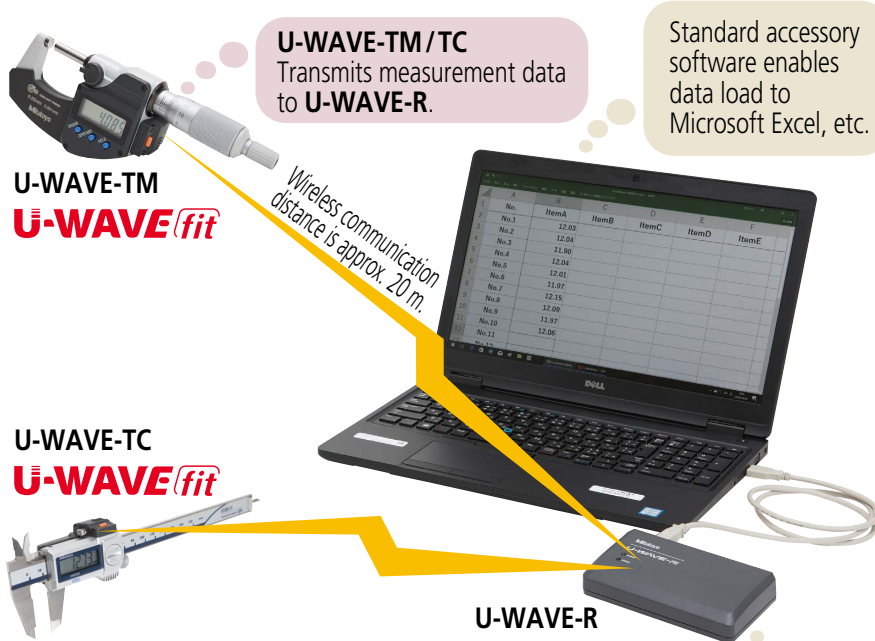
	Assembled appearance	Connecting unit	Transmitter
For micrometers	Standard	02AZF310	264-627 U-WAVE-TMB (buzzer type)
	QuantuMike	02AZF310	264-626 U-WAVE-TMB (IP67 type)
For calipers	Standard	02AZF300	264-625 U-WAVE-TCB (buzzer type)
	Coolant-proof type	02AZF310	264-624 U-WAVE-TCB (IP67 type)

Measurement Data Management

Measurement data wireless communication system U-WAVE-TM/TC (U-WAVE fit)

- The transmitter is designed to fit in the space behind the display, and the connecting cable has been replaced by a rigid connector.
- Data from digimatic tools can be sent to a PC via wireless communication.
- Connecting the **U-WAVE-R** to the PC and starting **U-WAVEPAK** (software), enables data input to spreadsheet such as Excel, memo pad, etc.
- Optional software **USB-ITPAK** is available. (refer to page A-15)

U-WAVE fit system configuration



A maximum of 100 Digimatic gages can be connected.
Loads the data received from **U-WAVE-TM/TC** to a PC via USB.

U-WAVE-R

Model	U-WAVE-R
Order No.*	02AZD810D/02AZD810E/02AZD810F
Power supply	USB bus power system
Number of U-WAVE-R units that can be connected to one PC	Up to 15
Number of U-WAVE-T units that can be connected	Up to 100
External dimensions	140×80×31.6 mm
Mass (g)	130

* Order No. differs depending on the destination country.

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*
Windows 10*

* 32-bit, 64-bit OS supported
<Versions confirmed operational on Windows 10>
• **U-WAVEPAK Version1.020** or later

Connectability confirmed for tablet PC

- Microsoft Surface Pro 6 (the version whose operation on Windows 10 Professional is confirmed)
- Required environment: DVD drive (required for installation), USB port ×2 ports or more

Note 1: Cannot be connected to a device other than a PC (such as **DP-1VA LOGGER**, sequencer etc.).

Note 2: Also available for download (free) from our company's website.

U-WAVE-R main unit



USB2.0 cable (1 m) attached

U-WAVEPAK



U-WAVE-TM/TC (U-WAVE fit) System Communication Specifications

• Wireless communication

Wireless specifications	Original <based on IEEE802.15.4 (2.4 GHz)>
Wireless communication distance	Approx. 20 m (line of sight)
Wireless communication speed	250 kbps
Transmission output	2.5 mW (4 dBm) or less
Modulation method	DS-SS (Direct Sequence - Spread Spectrum) Resistant to interfering signals and noise
Communication frequency	2.405-GHz band (ISM band: Universal frequency)
Used band	15 channels (2.405 to 2.475 GHz at intervals of 5 MHz) The noise search function avoids interference with other communication devices.

Note: To use **U-WAVE-TM/TC**, the conformity to the radio law of each country is required. If you use this product outside the country of purchase, please contact your dealer or nearest Mitutoyo sales office.



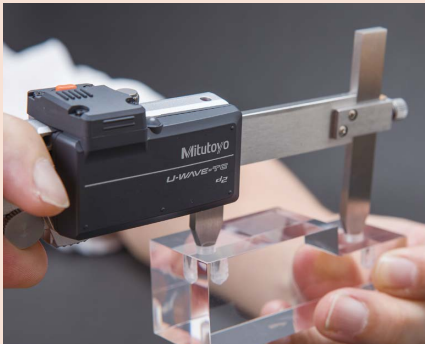
Refer to the Measurement Data Wireless Communication System **U-WAVE** Brochure (**E12000**) for more details.

Main specifications of U-WAVEPAK

- Setup of dedicated driver software (USB and virtual COM port)
- Initial setting of ID number and frequency selection (required only once for the first time)
- Load data to Microsoft Excel or Notepad through the data interface function

**Measurement data wireless communication system
U-WAVE-TM/TC (U-WAVE fit)**

Type of transmission unit



264-622



264-621

SPECIFICATIONS

IP67 type is resistant to water and dust ingress. Buzzer type notifies data reception by buzzer sound and LED.

Connectable measuring instruments	Micrometer		Caliper		
	Order No.	264-622*	264-623*	264-620*	264-621*
Model		U-WAVE-TM (IP67 type)	U-WAVE-TM (Buzzer type)	U-WAVE-TC (IP67 type)	U-WAVE-TC (Buzzer type)
Protection Rating		IP67	N/A	IP67	N/A
Data reception indication		LEDs	Buzzer and LEDs	LEDs	Buzzer and LEDs
Power supply	Lithium battery CR2032x1				
Battery life	Approx. 400,000 times continuous data transmission				
External dimensions (mm)	41.9x12.9x38.8			56x11.45x30.4	
Mass (g)	18				

* Order No. differs depending on the destination country. Add the following suffix to the order No.: K for Korea, B for Brazil and Argentina.



02AZF310



02AZF300

Fixed to transmission unit and inserted into output connector of Digimatic gage.

Order No.	02AZF310	02AZF300
Protection level	IP67	N/A
Mass (g)	6	
Connectable transmission unit	U-WAVE-TM/TC (for dust/water-proof type)	U-WAVE-TC (for standard type)

Note 1: **02AZF310** ensures water-proof performance only when attached to measuring instruments of IP67 type.

For information on supported connecting units, please contact your local Mitutoyo sales office.

Note 2: Water-proof performance is ensured only when attached to measuring instruments of IP67 type.

Compatibility of measuring tool and unit

Digimatic gage		Assembled appearance (Front/Back)	Connecting unit	Transmission unit
Micrometer	Standard		02AZF310	264-623* U-WAVE-TM (buzzer type) U-WAVE fit
	QuantuMike			264-622* U-WAVE-TM (IP67 type) U-WAVE fit
Caliper	Standard		02AZF300	264-621* U-WAVE-TC (buzzer type) U-WAVE fit
	Coolant-proof type		02AZF310	264-620* U-WAVE-TC (IP67 type) U-WAVE fit

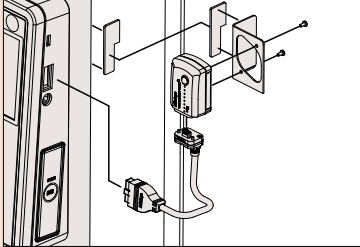
* Order No. differs depending on the destination country. Add the following suffix to the order No.: K for Korea, B for Brazil and Argentina.

U-WAVE-T mounting plate for QM-Height 02AZE990

Standard accessories

- Detachable fastener, 2 pcs. (mirror-imaged)
- Mounting screw: 2 pcs.

Mounting Diagram for QM-Height (02AZE990)



Refer to the Measurement Data Wireless Communication System **U-WAVE** Brochure (E12000) for more details.

Measurement Data Wireless Communication System U-WAVE

Optional Accessories for U-WAVE

U-WAVE-T mounting plate

Supports the **U-WAVE-T** on a Digimatic gage by detachable fastener. Batteries can be replaced without needing to detach the **U-WAVE-T** from the gage.

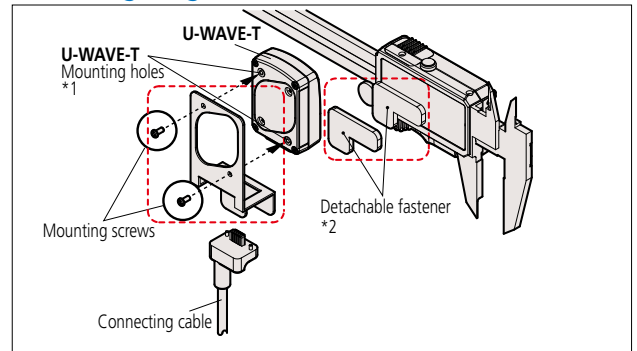


U-WAVE-T mounting plate 02AZE200

Standard accessories

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

Mounting diagram (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.

Typical applications of the mounting plate

QuantuMike MDE-25MX



Front view

Rear view

Digimatic Indicator ID-C112XB



Front view

Rear view

Measurement Data Management

Measurement Data Collection Software

USB-ITPAK V2.1/V3.0 (IT-016U/IT-020U/USB-ITN/U-WAVE/DP-1VA LOGGER connectable)

- **USB-ITPAK V2.1/V3.0** 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 Input Tool or U-WAVE 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 V2.1/V3.0

- **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-17 for details).
- **Control item and instruction at data input**

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	✓*1	✓*1	✓	✓*2	✓
Data cancel	✓*1	✓*1	✓	✓ Press and hold*2	
Data skip	✓*1	✓*1	✓		
Character input (example: OK or NG etc.)			✓ Pre-registered character strings		

- *1 Not available during individual measurement.
- *2 Not available during simultaneous measurement in the event driven mode.

• Number of connectable gages

Available devices	Maximum number of connection (total of (1), (2), and (3))	Others
1) IT-020U/USB-ITN	For Windows 2000/XP Up to 100 units*3 For Windows Vista/7/8/8.1/10 Up to 20 units*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 connectable to each U-WAVE-R . U-WAVE-T ID: 00 to 99)		

- **Data loading time:** when using **IT-020U/USB-ITN**, 0.2 s to 0.3 s per gage unit
U-WAVE event driven mode: 0.5 s data refresh interval
- **Timer input function** (only in simultaneous measurement)
Input interval (time): 0.1 s*4 to 24 hours at maximum
- **Measurement date/time display function** (available in sequential and simultaneous measurements)
The display format is subject to the setting of the Excel sheet.
- *3 The actual number can be less depending on the system configuration.
- *4 If a shorter time is set, a priority is given to the longer time compared with the actual communication time.

Optional Accessories for USB-ITPAK

USB Foot Switch Adapter USB-FSW

This USB adapter for connecting a PC is required when using the Foot Switch (**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.)
- Note: **USB-FSW** is used for installation of the VCP driver.



Order No.

Model No.	USB-ITPAK V2.1/V3.0
Order No.	06AFM386/06AGR543

Upgrading from V1.0/V2.0 is not supported.

USB-ITPAK V2.1/V3.0 USB dongle



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

Operating environment

Compatible OS*1	USB-ITPAK V2.1: Windows 2000 SP4 Windows XP SP2 or later Windows Vista Windows 7 Windows 8 Windows 8.1 Windows 10 USB-ITPAK V3.0: Windows 10 (64 bit only)
Supported Excel versions*2	USB-ITPAK V2.1: 2002, 2003, 2007, 2010, 2013, 2016 Microsoft 365 USB-ITPAK V3.0: 2010, 2013, 2016 Microsoft 365
Hard disk	USB-ITPAK V2.1: Free space of more than 10 MB USB-ITPAK V3.0: Free space of more than 15 MB
CD-ROM drive	For program installation
USB port*3	2 ports or more
Monitor resolution	USB-ITPAK V2.1: 800×600, 256 colors or more USB-ITPAK V3.0: 1024×768, 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)

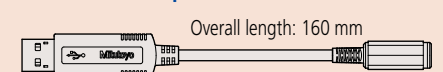
Language support

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

Order No.

Model No.	USB-FSW
Order No.	06ADV384

Foot Switch Adapter USB-FSW



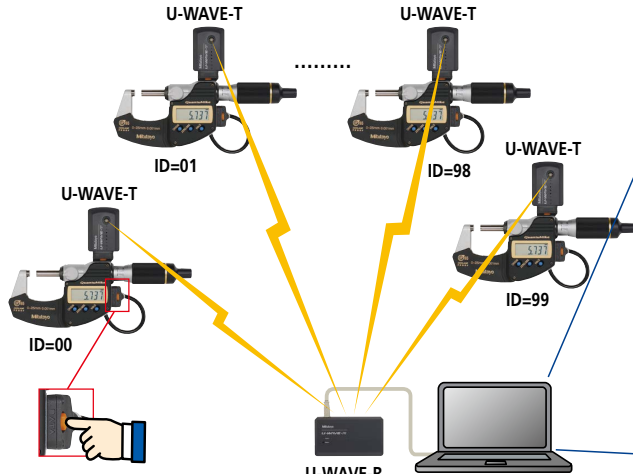
Measurement Data Management

USB-ITPAK V2.1/V3.0 (IT-016U/IT-020U/USB-ITN/U-WAVE/DP-1VA LOGGER connectable)

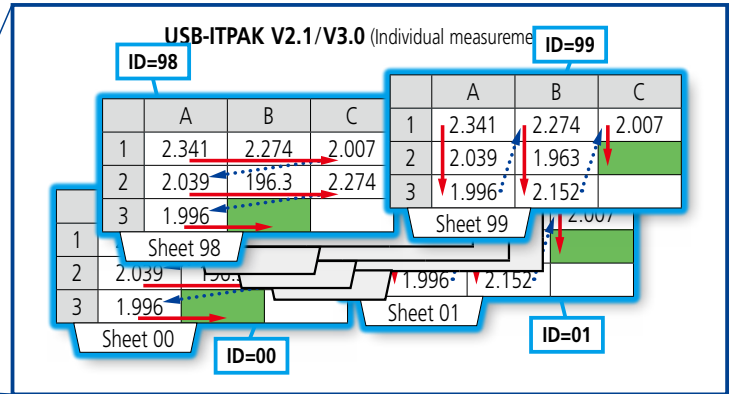
Example of measurement using the U-WAVE Series wireless communication system

<Data sorting of individual measurements>

Data from multiple Digimatic gages (U-WAVE-T, U-WAVE-TM/TC) 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.



The last data input may be canceled by pressing and holding the data switch

Up to 100 gages can be handled by one U-WAVE-R unit

Note: U-WAVE-TM/TC can also applicable.

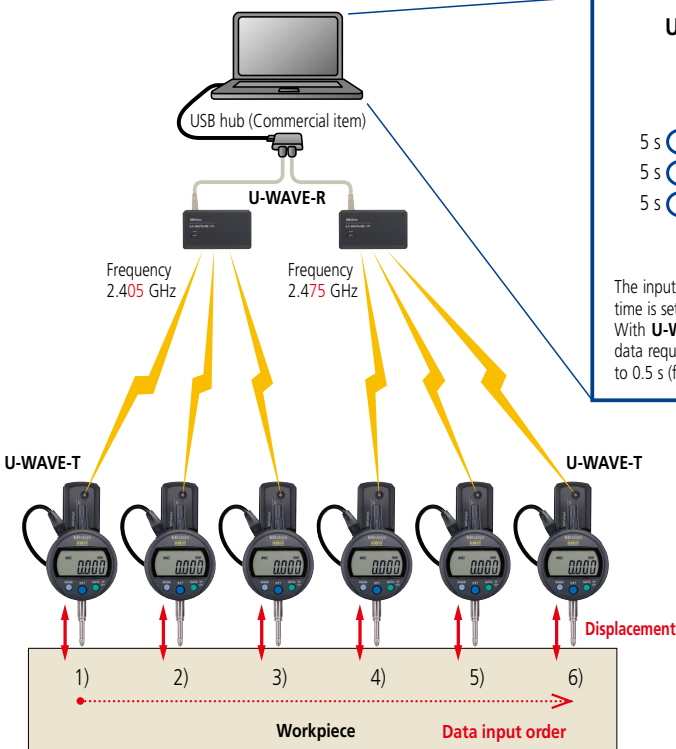
Entry point can be specified per gage (by U-WAVE-T ID).

- 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

If using USB-ITPAK V2.1/V3.0 supporting U-WAVE event driven, arbitrary timer input is allowed without the need for macro programming.



USB-ITPAK V2.1/V3.0 simultaneous measurement + timer input (example: 5 s 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 0.1 s 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 0.5 s is set for the input interval. This is because the data request signal is issued before the data comes in, based on the event driven data refresh interval that is set to 0.5 s (fixed).

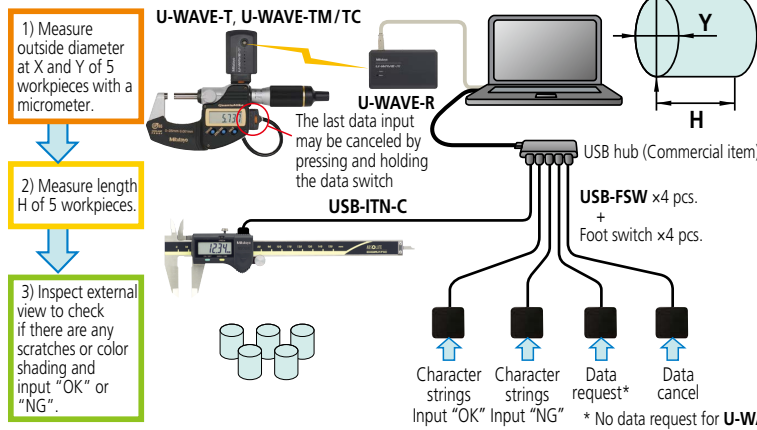
Measurement Data Management

You can set up the procedure to input the measurement data to the Excel sheet in combination with **USB-ITPAK V2.1/V3.0** and **IT-016U/IT-020U/USB-ITN/U-WAVE**

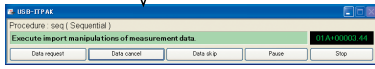
Measurement applications of USB-ITPAK V2.1/V3.0 (Three examples of how **USB-ITPAK V2.1/V3.0** can be deployed are shown below)

Sequential measurement Measurement values are input one by one according to a procedure previously defined by using one or more Digimatic gages (via **IT-016U/IT-020U/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**).



	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		

Cell movement direction after inputting data (down and right)

Carriage return (Low, column)

Microsoft Excel sheet previously specified

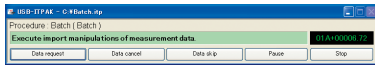
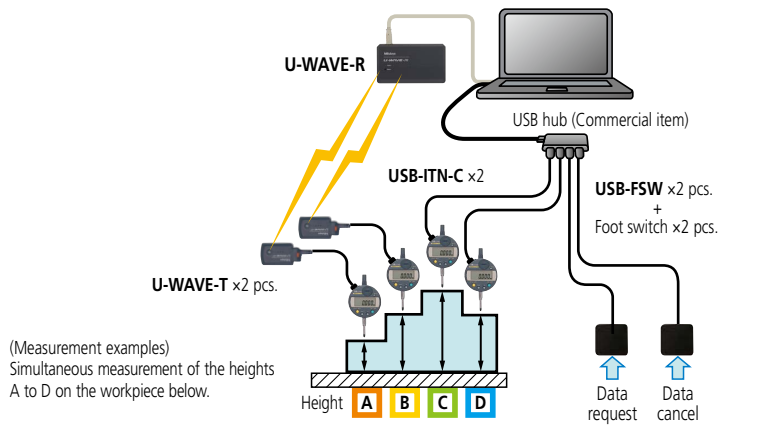
Input range of micrometer (B2 to F3)

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/IT-020U/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)

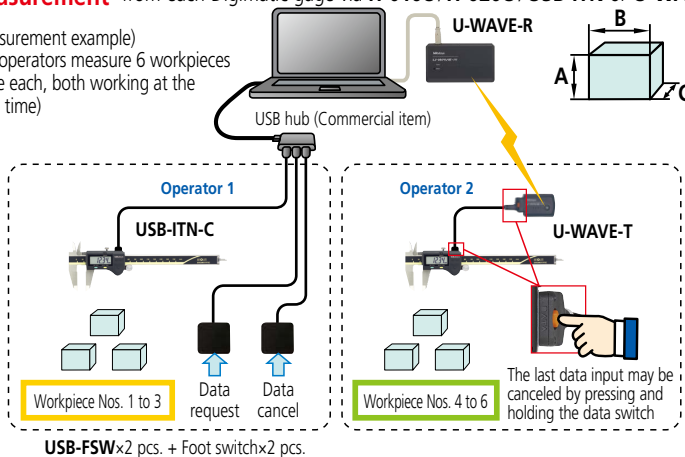
Third measurement (finished)

Fourth measurement (Wait for next input)

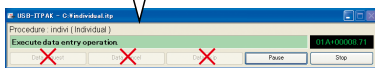
Individual measurement Several operators input measurement data asynchronously according to individually defined procedures (where to input, move direction, etc.) from each Digimatic gage via **IT-016U/IT-020U/USB-ITN** or **U-WAVE**.

(Measurement example)

Two operators measure 6 workpieces (three each, both working at the same time)



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 Cell that will receive next input

Operator 2 Cell that will receive next input

Notes on using USB-ITPAK V2.1/V3.0:

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.

Mitutoyo Bluetooth® U-WAVE and U-WAVE ZigBee cannot be used together.

Main specifications of MeasureReport

- Document creation:
 - Automatic creation of template sample style (Number of items × 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
 - 2) On-line data input
 - Max. 200 items × Max. 2,000 workpieces
 - 3) MeasurLink® database import
 - Max. 200 items × Max. 2,000 workpieces or
 - Max. 2,000 items × 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
 - Comment output to the inspection table:
 - 30 items including part number and lot number can be input.
 - Workpiece drawing output to the inspection table:
 - Image files (bmp, jpg) can be displayed in arbitrary positions.
 - 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

Measure Report operation environment (recommended)

- OS: Windows 2000
 - Windows XP
 - Windows Vista (32-bit)
 - Windows 7 (32-bit/64-bit)
 - Windows 10 (64-bit)
 - Microsoft Excel: 2000/2002/2003/2007/2010/2013/2016/2019
- (Only 32-bit edition is available regardless of Windows version. It doesn't work on 64-bit Windows.)
- CPU: Processor of 1 GHz or more
 - Memory: 2 GB or more
 - Hard disk: 3 GB or more free space
 - Display: 1024×768 or larger
 - Drive: CD-ROM or DVD drive (required for installation)

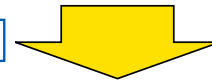
Data Conversion Program into Inspection Certificates in Excel Format MeasureReport

- 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).
- A customized format can be created for an inspection sheet using simple editing (copy & paste, etc.) by using a sample format as the template.
- 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 for each measuring machine (PC data processing)



Measurement result file conversion



Select and extract data, design value, tolerance value, etc., and output in specified Excel format.

Example of inspection table.

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 measuring machines can be combined in one inspection table.

Measurement Data Management

Mini-Printer Equipped with Data Logging Function SERIES 264 — Digimatic Mini-Processor DP-1VA LOGGER

In addition to the conventional (DP-1VR) printing and statistical calculation functions, data logger and USB output functions are added and enhanced.

- This is a palm-sized printer used to print measurement data from Digimatic gages or to perform statistical analysis.
- The versatile **DP-1VA LOGGER** printer not only prints measurement data, but performs a variety of statistical analyses, draws histograms and D-charts and also performs complex operations on Xbar-R control charts.
- The data logger function allows storage of up to 1,000 pieces of data in memory, and batch transfer of stored data to an Excel-format inspection certificate, etc., by connecting to a PC with a USB cable (optional).



Example of printout

MODE1

Various statistical calculations are executed using all input data. If the tolerance limits have been set, GO/±NG judgment and histogram creation are also enabled.

```

*LIMIT DATA 1*
LSL 19.11 mm
USL 21.00 mm
TOL 1.89 mm

1 20.14 mm
2 22.18 mm
3 19.66 mm
4 20.77 mm
5 20.27 mm
6 20.26 mm
7 19.31 mm
8 19.64 mm
9 19.93 mm
10 19.30 mm
11 19.56 mm
12 18.95 mm
13 20.82 mm

PART NO.:
DATE 2018/ 2/15
TIME 12: 5

NAME:
* RESULT *
MAX 21.30 mm
MIN 18.99 mm
R 2.07 mm
X 19.9550 mm
σn 0.4501 mm
σn-1 0.4578 mm

-NG 1
P 8.867 %
Cp 0.815
Cpk 0.815

* HISTOGRAM *
LSL 19.11 mm
USL 21.00 mm
TOL 1.89 mm

DIV 1 10
  
```

MODE2

In addition to the MODE1 function, measurements within the tolerance limits are printed out as a D chart*. This chart allows you to identify the trend of variations in measurement data.
* D chart stands for Displacement chart.

```

*LIMIT MODE2*
*LIMIT DATA 1*
*NO LIMIT DATA*
LIM1T1 27.22 mm
LIM1T2 28.27 mm

*NEW LIMIT DATA*
*LIMIT DATA 1*
DATE 2018/ 2/17
TIME 14:37

LSL 27.22 mm
USL 28.27 mm
TOL 1.05 mm

L C U
28.08mm | | |
27.67mm | | |
28.14mm | | |
28.01mm | | |
27.72mm | | |
27.41mm | | |
28.97mm | | |
27.12mm | | |
27.72mm | | |
27.58mm | | |
10 28.14mm | | |
28.22mm | | |
28.45mm | | |
28.45mm | | |
28.00mm | | |

PART NO.:
DATE 2018/ 2/17
TIME 14:38

NAME:
* RESULT *
N 10
MAX 28.45 mm
MIN 26.99 mm
R 1.48 mm
X 27.8563 mm
σn 0.4194 mm
σn-1 0.4270 mm
  
```

MODE3

Only input of data automatically enables calculation processing of complex control limit values as well as calculation for creating an Xbar-R control chart.

```

SUB GR. NO. 1
1 26.39 mm
2 26.77 mm
3 28.82 mm
4 29.70 mm
5 27.41 mm
6 28.84 mm
7 28.97 mm

X 26.9486 mm
R 4.88 mm

DATE 2018/ 2/17
TIME 14:40

NAME:
SUB GR. NO. 2
1 27.77 mm
2 27.13 mm
3 27.86 mm
4 27.84 mm
5 27.90 mm
6 28.65 mm
7 28.85 mm

X 27.7329 mm
R 1.99 mm

PART NO.:
DATE 2018/ 2/17
TIME 14:40

NAME:
*CONTROL LIMIT*
DATE 2018/ 2/17
TIME 14:40
NO. OF SUB GR. 2
SAMPLE SIZE 7
X-UCL 27.6007 mm
X-LCL 26.8609 mm
R-UCL 3.4850 mm
R-LCL 0.2849 mm
  
```

Example of batch printing log data

In OUTLOG Setting 1

```

* OUT LOG START *
* LOG = 10

DATE 2018/ 2/15

10:18:32 37.20 mm
10:18:44 39.84 mm
10:17:58 37.22 mm
10:17:58 37.27 mm
10:18:16 38.88 mm
10:18:41 37.68 mm
10:18:17 37.70 mm
10:18:47 37.80 mm
10:20:17 37.58 mm
10:20:43 37.04 mm

* OUT LOG END *
  
```

This setting allows printout of measurement time, measurement value, and GO/±NG judgment result.

In OUTLOG Setting 2

```

* OUT LOG START *
* LOG = 10

DATE 2018/ 2/15

1 20.41 mm
2 20.37 mm
3 22.05 mm
4 22.31 mm
5 20.68 mm
6 22.19 mm
7 21.29 mm
8 22.03 mm
  
```

This setting allows printout of data number, measurement value, and GO/±NG judgment result.

In OUTLOG Setting 3

```

* OUT LOG START *
* LOG = 10

1 2018/ 2/15 10:28:28
21.00 mm
2 2018/ 2/15 10:28:31
20.10 mm
3 2018/ 2/15 10:28:33
18.00 mm
4 2018/ 2/15 10:28:37
18.03 mm
5 2018/ 2/15 10:29:29
20.85 mm
  
```

This setting allows printout of data number, measurement date and time, and GO/±NG judgment result.

Specifications

- **264-505**
 - Model: **DP-1VA LOGGER**
 - Data input: Digimatic input, RS-232C input (specific to Mitutoyo **KA** counter)
 - Data processing capacity:
 - Mode 0: 100,000 pcs. of data
 - Modes 1,2: 9,999 pcs. of data
 - Mode 3: Sample size 10×9,999 subgroups=99,990 pcs. of data
 - GO/±NG judgment (five sets can be defined)
 - Output: 1) USB output
2) RS-232C data output at TTL levels
3) GO/±NG judgment result output (+NG, GO, -NG)
 - Input timer: Input intervals
 - 0.25 s, 1 s, 5 s, 30 s, 1 min, 30 min, 60 min
 - Printing method: Thermal line printer
 - Printing speed: 0.8 s per line (6.5 mm/s) (using AC adapter)
 - Printing line: 10,000 lines of normal characters per roll
7,000 lines of large characters per roll
 - Printing paper: High durability thermo-sensitive paper
Width 58 mm × length 48 mm
- Note: If it is to be used for official documents, or stored more than 5 years, it is recommended to make a more durable copy.
- Power supply: 2 power methods
 - 1) AC adapter 100 to 240 V 50/60 Hz AC adapter (6 V, 2 A) as a standard accessory.
 - 2) 4 pcs. of LR6/AA size (alkaline or Ni-Mh)
- Note: Manganese dioxide batteries are not usable.
- Battery life: About 10,000 lines* (if data is printed once every 5 seconds using 1,600 mA NiMH batteries at 20 °C)
- * This is a typical value and is not guaranteed.
- External dimensions: 94 (W) ×201 (D) ×75.2 (H) mm
 - Mass: 390 g (main unit)

Optional Accessories

- 1) USB cable (A-microB) : **06AFZ050** (1 m)
- 2) RS-232C output cable: **09EAA084** (1 m, D-SUB 9-pin)
- 3) RS-232C counter cable: **09EAA094**
Cable for **KA** counter (1 m, D-SUB 25-pin)
- 4) GO/±NG judgment cable: **965516**
(2 m, 10 pin terminal/separate)
- 5) Foot switch: **937179T**

Consumable Items

Printing paper (10 rolls): **09EAA082**

Statistical calculation data

MODE0

GO/±NG judgment

MODE1, 2

- N: Number of pieces of data
- MAX: Maximum value
- MIN: Minimum value
- R: Range
- X: Mean value
- σn: Standard deviation of a population (N)
- σn-1: Sample standard deviation (N-1)
- NG: For the number of pieces of data smaller than the lower limit
- +NG: For the number of pieces of data larger than the upper limit
- P: Percentage of rejects
- Cp: Maximum process capability potential
- Cpk: Actual process capability achieved

MODE3

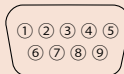
- N: Number of pieces of data
- MAX: Maximum value
- MIN: Minimum value
- n: Number of subgroups (up to 10)
- X: Mean value in a subgroup
- R: Range of a subgroup
- X: Mean value
- X-UCL: Upper control limit
- X-LCL: Lower control limit
- R: Center (R control)
- R-UCL: Upper control limit (R control)
- R-LCL: Lower control limit (R control)



Refer to the **DP-1VA LOGGER Brochure (E12041)** for more details.

Specifications

- **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/
19200 bps
- Connector specification:

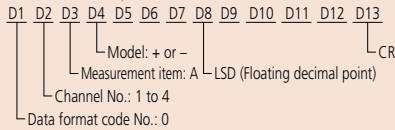


Pin No.	Signal	Function	in/out
1	CD		out
2	RD	Received data	out
3	TD	Communication data	in
4			
5	GND	Ground	
6	DR		out
7			
8	CS		out
9			

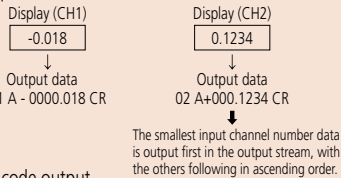
Note: For connection with a PC, use a commercially available RS-232C straight cable.

- Data format

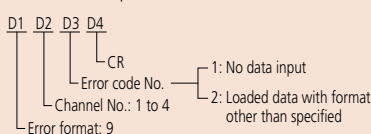
1) When data output



2) Example of format



3) Error code output



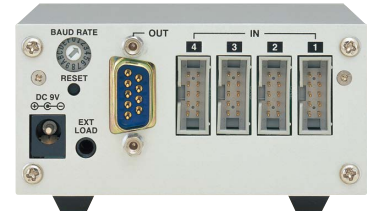
- Power supply: AC adapter (9 V, 500 mA)
- External dimensions: 91.4 (W) x92.5 (D) x50.4 (H) mm
- Note 1: Communication software is not included.
- Note 2: Separately purchase the cables. Refer to pages A-21 and A-22 for cable types.

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 other devices such as a PC and sequencer.
- Up to four measuring instruments with Digimatic output can be connected.



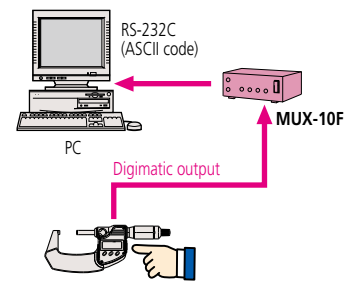
264-002
MUX-10F



Typical Application

Data input using the data button on the Digimatic gage

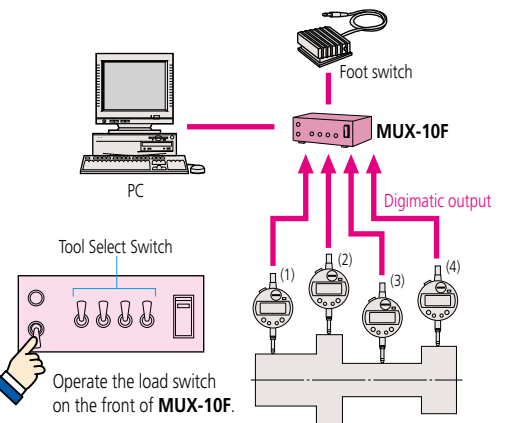
- If the Digimatic gage has a data button, data is sent to the **MUX-10F** from the gage, converted to RS-232C and sent out.



Press the data button on the measuring gage.

Data input using the load switch

- If the Digimatic gage does not have a data button, or when simultaneous measurements are performed, the **MUX-10F** 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.

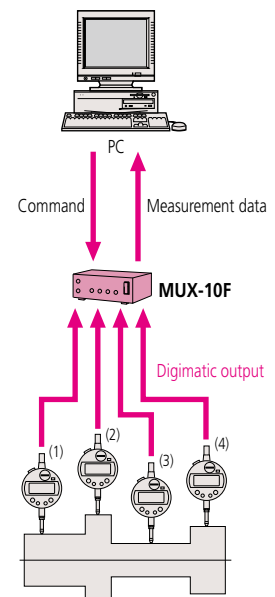


Data input using the external commands

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



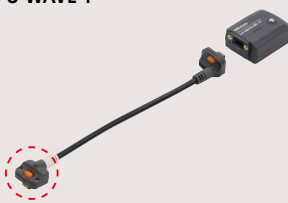
Commands (ASCII)	Transfer channels
1 (ASCII code31) CR	1
2 (ASCII code32) CR	2
3 (ASCII code33) CR	3
4 (ASCII code34) CR	4
*A (ASCII code41) CR	1, 2, 3, 4
*B (ASCII code42) CR	1, 2, 4
*C (ASCII code43) CR	1, 3, 4
*D (ASCII code44) CR	2, 3, 4
E (ASCII code45) CR	1, 2, 3
F (ASCII code46) CR	1, 2
G (ASCII 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.











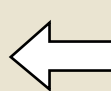

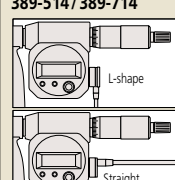
Measurement Data Management

Digimatic Data Cable Selector (including USB Input Tool Direct)

1) 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)	D) Flat 10-pin type	
	Model No. Order No.	USB-ITN-A 06AFM380A	USB-ITN-B 06AFM380B	USB-ITN-C 06AFM380C	No applicable models USB-ITN-C is available Refer to the following figure.	USB-ITN-D 06AFM380D	
2) IT-020U/IT-007R/DP-1VA LOGGER/ MUX-10F/EC Counter  Connector (12 types, A to G and SF) Type D on the other end for all models	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)	D) Flat 10-pin type	
	Order No.	1 m	05CZA624	05CZA662	959149	04AZB512	936937
		2 m	05CZA625	05CZA663	959150	04AZB513	965014
3) 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)	D) Flat 10-pin type	
	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.	02AZD790D	
	For foot switch	02AZE140A	02AZE140B	02AZE140C		02AZE140D	








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


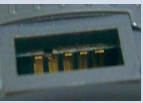
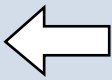
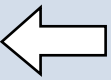
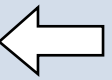


Gage connectors on data cable The connector dimensions are given on page A-23.	Connector type	A) Water-proof type with output button	B) Water-proof type with output button	C) Straight type with output button	CR) L type with output switch (cable outlet is right)	D) Flat 10-pin type
	Picture of gage connector					
	Data switch	Available	Available	Available	Available	N/A

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) 	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. • Digimatic special application caliper 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 293-140-30 / 293-141-30, etc. 293-230-30 etc. • 340-251-30 / 340-252-30 293-666-20 / 293-667-20, etc. 227-201-20 / 227-203-20, etc. 227-205-20 / 227-206-20, etc. 227-221-20 etc. 227-223-20 etc. • 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. 	<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>	<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 HV-110 / 120 HR-530 HR-600

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 water-proof type	SF) Straight standard type
USB-ITN-E 06AFM380E	USB-ITN-F 06AFM380F	No applicable models USB-ITN-F is available.			USB-ITN-G 06AFM380G	USB-ITN-SF 06AGQ001F
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 water-proof type	SF) Straight standard type
937387	905338	905689	905691	905693	21EAA194	06AGL011
965013	905409	905690	905692	905694	21EAA190	06AGL021
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 water-proof type	SF) Straight standard type
02AZD790E	02AZD790F	No applicable models Use 02AZD790F or 02AZD140F .			02AZD790G	02AZG011
02AZE140E	02AZE140F				02AZE140G	02AZG021

! 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-020U,** and **U-WAVE** cannot be used with **EF/EH, VL-50-B/50S-B,** and **SJ-500/SV-2100**.

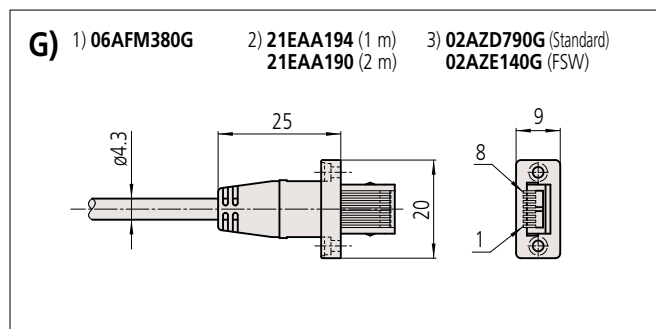
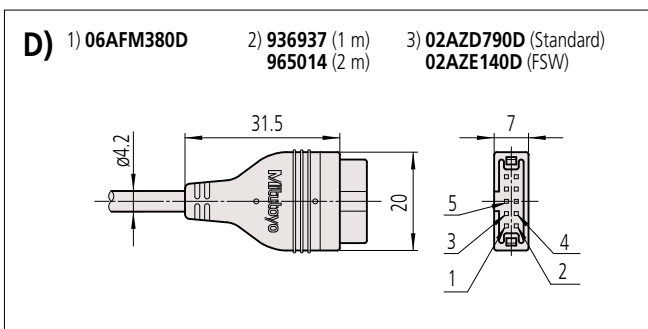
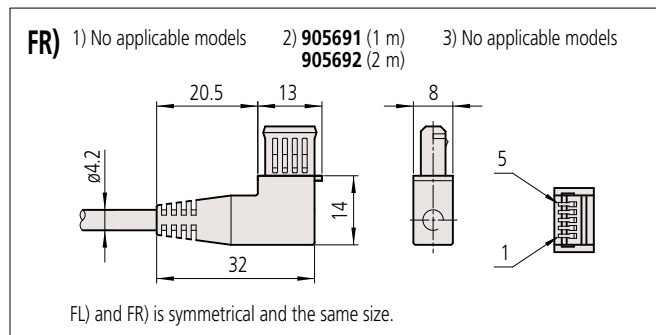
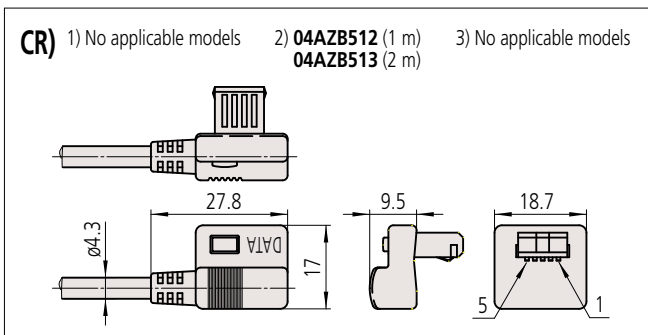
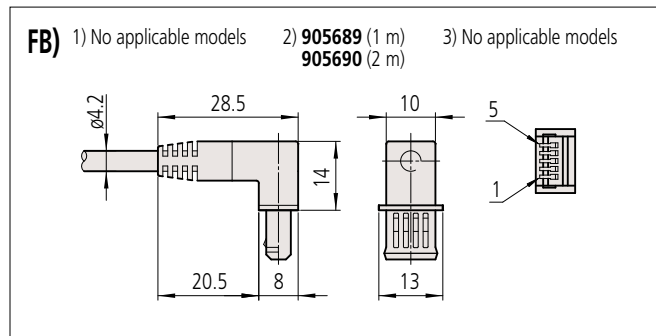
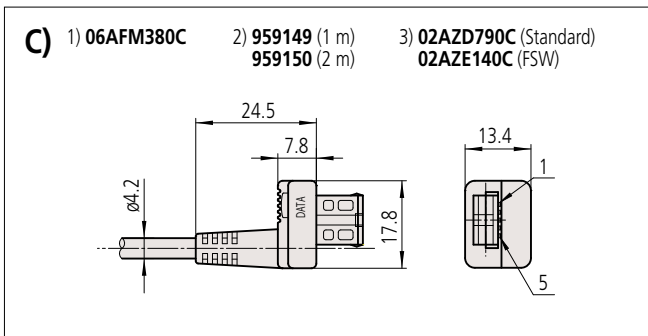
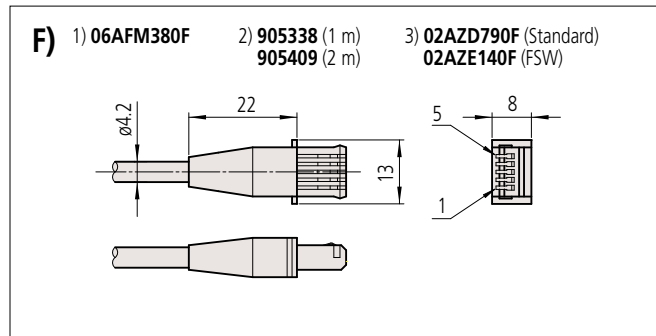
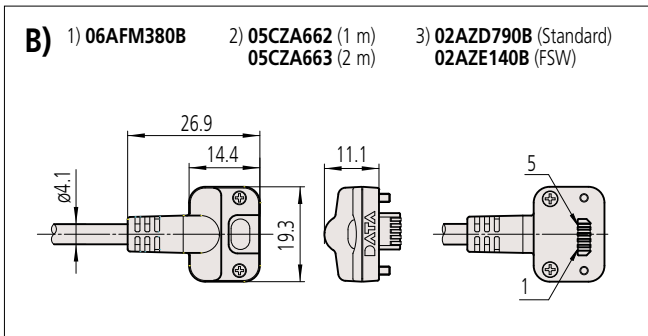
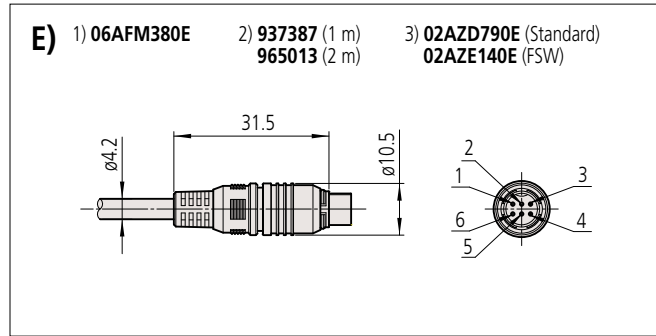
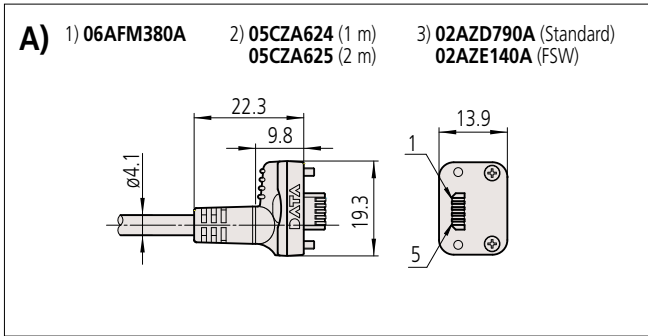
E) Round 6-pin type	F) Flat straight type	FB) Flat L-shape (cable outlet is back)	FR) Flat L-shape (cable outlet is right)	FL) Flat L-shape (cable outlet is left)	G) Flat straight water-proof type	SF) Straight standard type
						
N/A	N/A	N/A	N/A	N/A	N/A	N/A

						
<ul style="list-style-type: none"> • Hardness testing machines HM-102 HM-103 HM-320 HM-430 HM-411 	<ul style="list-style-type: none"> • Digimatic indicator ID-CX, ID-C (Peak-Value Hold Type), ID-C (Calculation type), ID-C (Bore Gage Type), ID-U (Note 1), ID-SS (Note 1), ID-SX (Note 1) • Digimatic height gage 192-663-10/192-613-10/570-322/570-227 • ABS borematic 568-361/568-362, etc. • Scale unit 572-460/572-560/572-480-10/572-580-10, etc. 	<ul style="list-style-type: none"> • Digimatic bore gage 511-501/511-502, etc. 	<ul style="list-style-type: none"> • Hardness testing machines HH-300 	<ul style="list-style-type: none"> • Digimatic depth gage Digimatic type (ID-CX) 	<ul style="list-style-type: none"> • Digimatic indicator ID-N ID-B 	<ul style="list-style-type: none"> • Digimatic indicator ID-CNXX ID-FNX

Measurement Data Management

Digimatic data cable specifications (Dimensions)

Gage connector dimensions (Unit: mm)



Measurement Data Management

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. It supports the “visualization of quality” by showing quality information important for judging the status of processes, such as control charts and process capability indexes, in an easy-to-understand way.



Note: MeasurLink® is a registered trademark of Mitutoyo Corporation in Japan and Mitutoyo America Corporation in the United States.

Is the inspection record data utilized to solve quality-related problems?

Measurement results printed out in the inspection room

Measurement results manually entered in a check sheet on the machining line

Hard to identify problems with only numerical data

Current problem

- Data scattered in various locations in the plant
- Numerical data not effectively utilized
- Lack of knowledge about statistical calculations
- Management using spreadsheet software
- Problems need to be tackled by the on-site person in charge

Hard to respond quickly since it takes time to enter and analyze data. Unsure about reliability of analysis.

Isn't there any quicker, simpler and more reliable management method?

SPC management can be easily done by combining Mitutoyo measuring instruments and MeasurLink®.

The SPC management can be done with MeasurLink® with a surprisingly simple procedure

MeasurLink® Real-Time

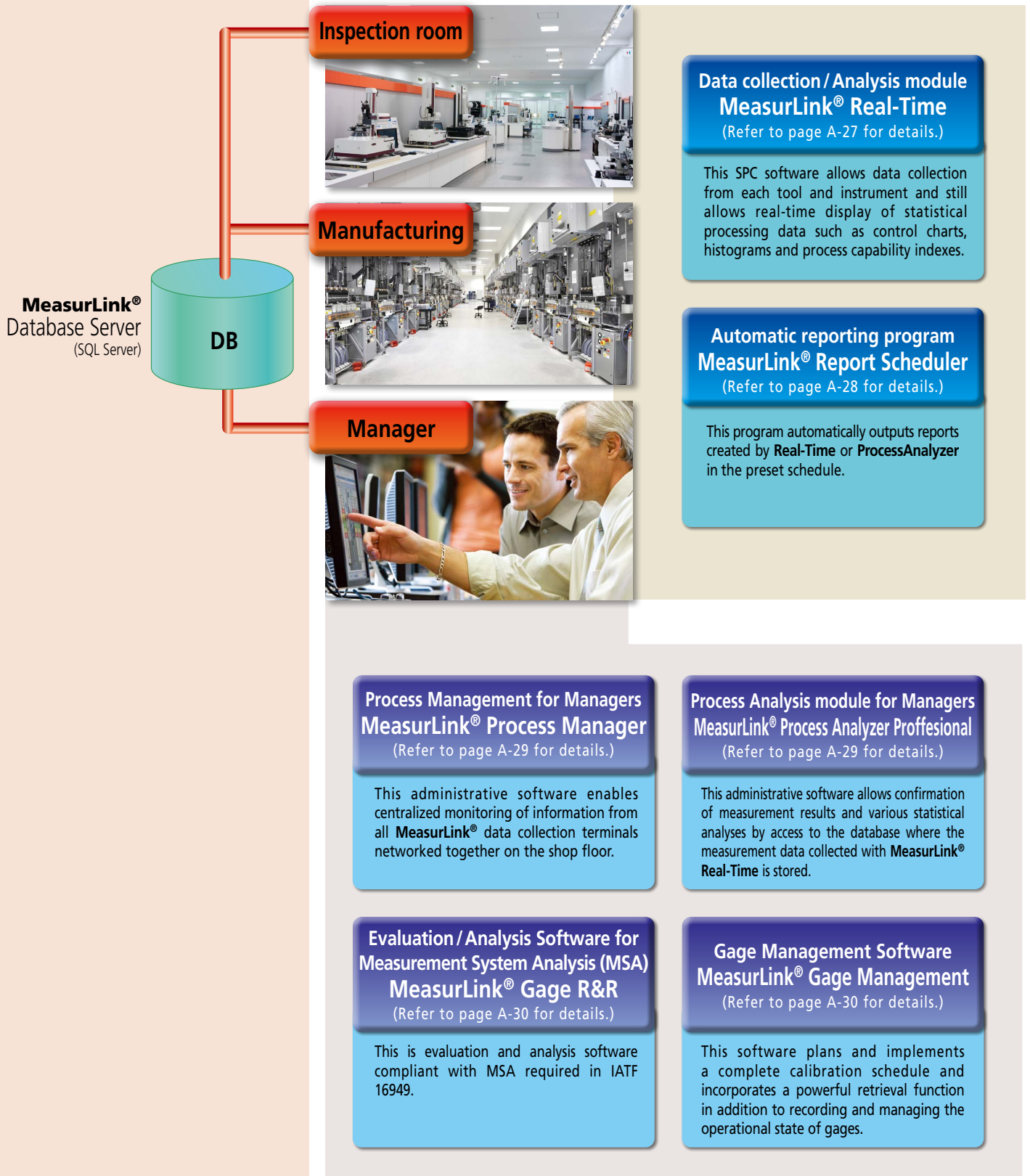
MeasurLink® is an IoT platform for quality management that realizes “Visualization of quality”.



Refer to the **MeasurLink® Brochure (E12028)** for more details.

• **Centralized monitoring from all MeasurLink® data collection terminals networked together on the shop floor**

Enables easy networking through the Database Server (SQL Server). It comprises the six software packages shown in the figure below, and allows for choosing/combining functions necessary for the purpose, such as “data collection” in the inspection room or on the shop floor, or “process monitoring/analysis” by the manager.



Measurement Data Management

MeasurLink® Data Collection/Analysis Software

Real-Time Standard (RT Std)

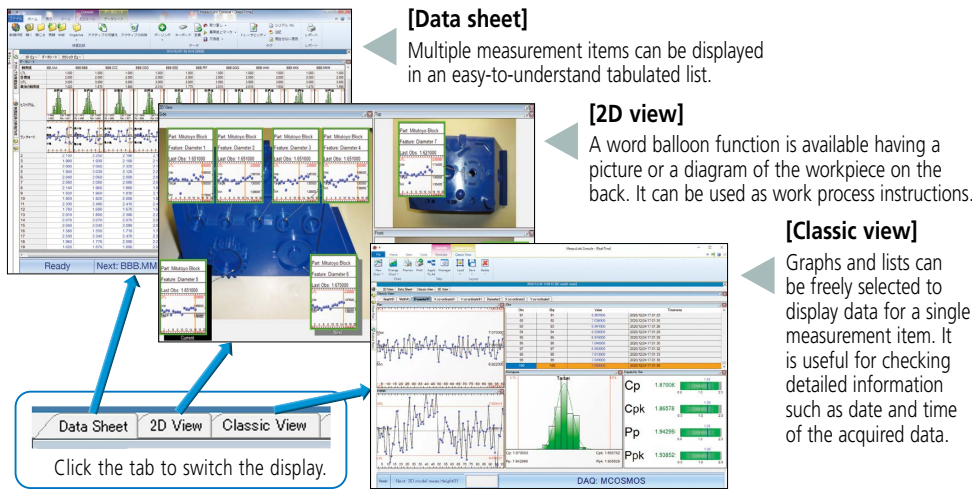
Real-Time Professional (RT Pro)

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

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.

• Various data views

Collected data can be displayed in various views, such as data lists, work instruction images, statistical analysis results, etc. The views can be switched easily according to the needs of the operator.



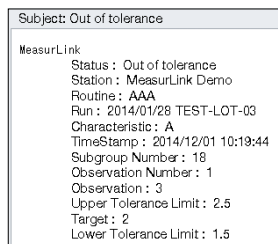
• Adding traceability information

Traceability information for each workpiece can be added, for example, serial no., lot no., inspector name, machine no., or cause of problems and remedies. Traceability will also support Barcode scanners for easy error free entry. This information can be used as search criteria when extracting data using the filtering function (RT Pro/RT Pro 3D) when a problem occurs.

• Alarm function

The operator and management are notified when an "Out of Tolerance" or other events occur.

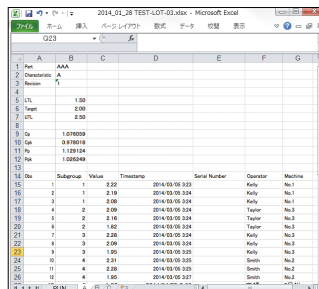
The method of notification can be selected from a pop-up window, E-mail (Fig. 1), audible alarm or log file.



(Fig. 1) Alarm notification by E-mail

• Exporting data to an Excel file

Measurement data can output 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/RT Pro/RT 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-020U/USB-ITN** (VCP or HID)
 - Wireless (D-sub 9 pin) **IT-007R, MUX-10F, DP-1VA LOGGER**, and others
 - Various RS-232C devices (partially restricted)

- Screen display mode when collecting data
 - Classic view
 - Data sheet
 - 2D view
 - Part data sheet, etc.
- Statistical Analysis result [Chart]
 - Xbar-R, Xbar-S, X-Rs control charts, Histogram, Run chart, Pre-control chart, Tier chart, Box plot chart, Meter chart, Indicator bar, Multivariate data control chart, etc.

[Statistics]
Maximum value, Minimum value, Standard deviation, Average $\pm 3\sigma/4\sigma/6\sigma$, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio, etc.

- Alarm function
- [Target items]
 - Out of tolerance
 - 1 point exceeds control limit line (following are related to management chart)
 - Consecutive 9 points on one side of 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 measurement results
 - Excel
 - Text
 - QIF
 - AQDEF
- 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 integrity.
- Operation languages
 - 19 languages are supported:
 - English, Japanese, French, German, Dutch, Spanish, Swedish, Polish, Italian, Turkish, Korean, Chinese (simplified/traditional), Thai, Hungarian, Czech, Finnish, Portuguese, Russian

Events possible to be logged

- Measurement data
- Retake/modify data
- Failed data tests
- Assignable Cause and Corrective Action

MeasurLink® System Requirements

- Operating environments
[Operating System]
Microsoft Windows 7 (32-bit/64-bit)
Microsoft Windows 7 SP1
Microsoft Windows 8.1 (32-bit/64-bit)
(Microsoft Windows 8.1 RT is not supported)
Windows 10 (32-bit/64-bit)
(Windows 10 Mobile and IoT editions are not supported)
[Database]
Microsoft SQL Server 2017 Standard/Enterprise Edition
Microsoft SQL Server 2016 Standard/Enterprise Edition
Microsoft SQL Server 2014 Standard/Business Intelligence/Enterprise Edition
SQL 2019 Standard/Enterprise

RT Pro/RT 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: **QVPAK VUE V4.1** or later
· Surface Roughness/contour instruments:
FORMTRACEPAK V5.311 or later
· Roundness instruments: **ROUNDPAK V7.0** or later
· Hardness testing machines: **AVPAK V2.0** 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
A custom import template can be built to collect data in **Real-Time Pro/Pro 3D**. MeasurLink® supports ASCII file types such as CSV and TXT with minimum required information (e.g. part name, characteristic name and measurement values, etc.) In addition, MeasurLink® supports QIF, AQDEF, and QMD file types.

RT Pro 3D functions

- Screen display mode when collecting data
- 3D view

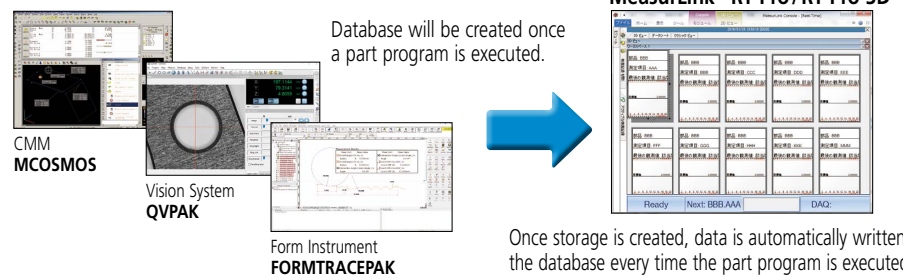
Functions		Data collection software		
		Real-Time Standard	Real-Time Professional	Real-Time Professional 3D
Collected data display	Classic view	✓	✓	✓
	Data sheet	✓	✓	✓
	2D view	✓	✓	✓
	3D view (Hoops)			✓
Data extract	Filter		✓	✓
Input from tools and devices	Measuring tools (RS-232C, USB)	✓	✓	✓
	Measuring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

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

- **RT Pro/RT Pro 3D** enables customers to connect and acquire data from Mitutoyo coordinate measuring machines, vision and form measuring systems via native integration (DDE).

• Automatic linking with part programs

To automate the process of linking the CMM, Vision or Form system with MeasurLink®, some easy setup is needed on the device and in MeasurLink®. Then, when the part program is executed, the measurement system will send the part and measurement information to MeasurLink®, along with any tagged data related to the measurement. A new run can be created in **Real-Time Pro/Pro 3D**, or the data can be added to an existing run. The charts and statistics will continuously update and be displayed in the view.



• Filtering function

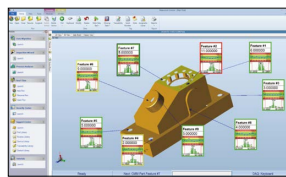
Required data can be easily extracted based on the date and time of the measurement, added comments, or alarms.

• 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.

• RT Pro 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.

MeasurLink® Automatic Report Generation Program MeasurLink® Report Scheduler

Automatically generates a report created by the **Real-Time (RT Std/RT Pro/RT Pro 3D)** or **Process Analyzer Professional** modules, each of which is connected to the network according to a specified schedule.

The Use of MeasurLink® Report Scheduler

• Typical applications

- Automatic generation of a weekly report specified from among last week's data.
- Automatic report generation by extracting only data with tag information about "tool replacement" (due to wear, breakage, etc.)
- Automatic generation of a daily report for each shift by filtering inspection record data on the basis of a shift



MeasurLink® Report Scheduler common functions

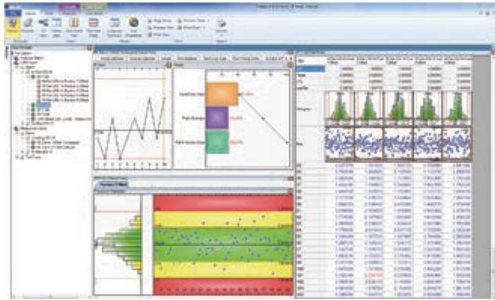
• Report output destinations

- Printer, file, E-mail (as an attached document)

Measurement Data Management

MeasurLink® Optional Process Analysis Software for Managers Process Analyzer Professional

Analyze data collected on all networked Real-Time stations to identify problem areas, take corrective action, and improve the quality of your product. Inspection data can be merged, filtered, charted and printed to identify long-term trends and identify root causes for process improvement.

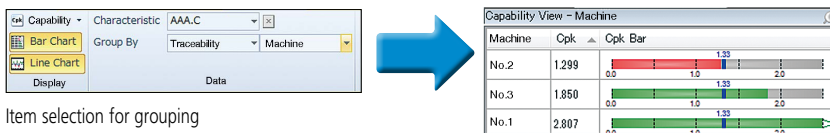


The same data displayable by data collection software can be displayed, including measurement results, charts, and statistical calculation results with the look and feel of Windows Explorer.

- 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) Grouping by Machine No. Cp, Cpk comparison



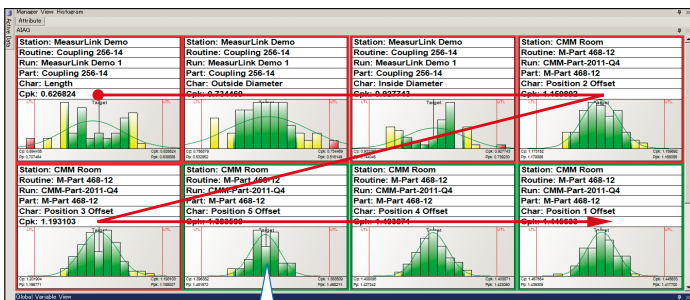
Cpk value and bar graph per machine

MeasurLink® Process Management for Managers Process Manager

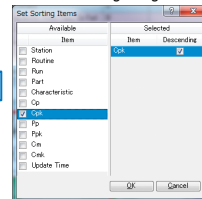
Monitor data as it is collected in Real-Time. **Process Manager** provides managers with the perfect tool to organize and maintain a shop-wide quality program at a glance. Display snapshot windows of characteristics that are currently being collected in MeasurLink® Real-Time. The data can be sorted by inspection station, capability or timestamp. Easily see process information without walking from one inspection area to another by viewing current production across all machines. Show clients your quality operation for the entire facility.

- **Manager View**

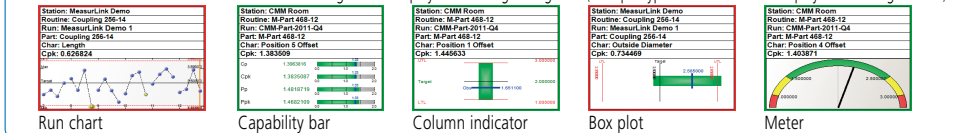
Displays various types of charts as an at-a-glance guide. The manager can narrow down all items of data currently being measured into a specific monitoring range of those of critical importance or sort those data (in ascending or descending order) on the basis of process capability index.



Possible to sort charts in the view and narrow down the monitoring range.



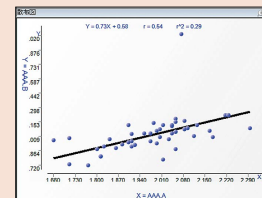
Selects various charts such as run charts and histograms to display as an at-a-glance guide. (Multiple types of charts can be displayed in Manager View.)



PA Pro Functions

- Result display
 - Classic view
 - Data sheet
 - 2D view
 - Part data sheet, etc.
- Statistical Analysis result [Chart]
 - Xbar-R, Xbar-S, X-Rs control charts, Histogram, Run chart, Pre-control chart, Tear chart, Box plot chart, Meter chart, Indicator bar, multivariate data control chart, etc.
- [Statistics]
 - Maximum value, Minimum value, Standard deviation, Average $\pm 3\sigma/4\sigma/6\sigma$, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio, etc.
- Report 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

Scatter plots: The relationship between two items can be plotted.



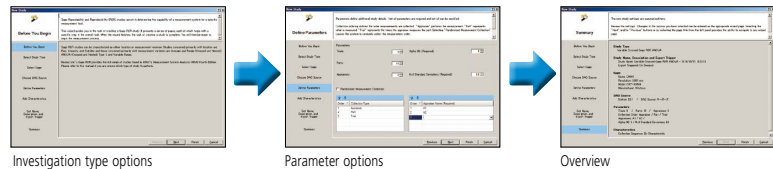
- Filter function
 - Keyword items for data extraction
 - Measurement data (year, month, day, time, week, etc.)
 - Serial No.
 - Traceability information (e.g. Inspectors, Machine No., etc.)
 - Alarm item
- Data processing
 - Data file merging, Copying
 - Editing
- Data processing capability
 - Old runs can be archived so they are not available for collection in Real-Time.
- Electronic signature function
 - Provides support for medical and pharmaceutical manufacturers electronic records, including audit trails, e-signatures and advanced security.
 - Conforms to FDA 21CFR Part 11

MeasurLink® Evaluation/Analysis Software for Measurement System Analysis (MSA) Gage R&R

Gage R&R is a collection of techniques whose purpose is to measure the capability of a measurement system for a measurement task. Gage R&R techniques provide information about a measurement system's reproducibility, R&R, location or stability. Graphical tools allow for isolation of gaging problems including inconsistencies in technique between operators or inspectors.

• Automatic calculation of MSA evaluation results

This allows the operator to simply input an evaluation method/evaluation condition and measurement data with the Wizard function. The operator can implement MSA evaluation simply by selecting an "investigation type option", "Measuring instrument option", "data input source option", "parameter option", etc.



• Evaluation method compliant with MSA (fourth edition)

The software can implement evaluation using the following methods compliant with MSA (Measurement System Analysis).

- 1) Measurement value tolerance Gage R&R variance analysis method
- 2) Measurement value tolerance Gage R&R range & average method
- 3) Measurement value branching Gage R&R variance analysis method
- 4) Measurement value branching Gage R&R average & range method
- 5) Measurement value range method
- 6) Measurement value simplified method
- 7) Measurement value MSA4
- 8) Deviation
- 9) Linearity
- 10) Stability

• Registration of gage-specific information

1. Registration of information on gages within the system

This allows registration of gage information on the following items and association with evaluated results.

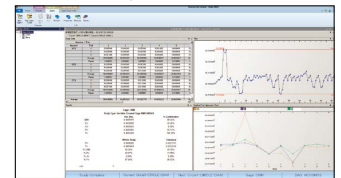
Registration items: Gage name, maker, model, resolution, unit, measuring range, etc.

2. Information link between MeasurLink® Gage Management and this software

This software can use measuring instruments information that has been registered in **Gage Management** directly as options. Additionally, since Gage R&R evaluation results are also linked with measuring instruments information, the schedule of Gage R&R expiry dates can be managed by **Gage Management**.

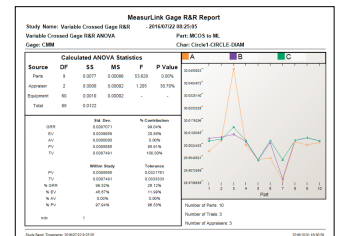
• Analysis chart view

Various charts such as the control chart are effective for analysis/judgment on variations due to operator, the adequacy of gage accuracy, etc., and remedies for problems.



• Output of results as a report

Evaluated results and charts can be printed as a report.

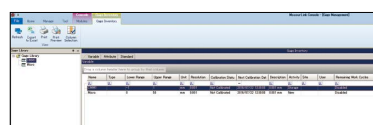


MeasurLink® Gage Management Software Gage Management

This software can help you plan and implement a reliable calibration schedule with a powerful retrieval function in addition to recording and controlling the status of measuring instruments. It enables simple recording of measuring instruments usage state (operation, storage, calibration, Gage R&R, repair and out-of-service) to speedily understand the current location and status of all measuring instruments. Measuring instrument information can be viewed from any networked terminal on which **Gage Management** is installed since the information is centrally managed in a database. Measuring instruments information can be shared between software packages linked to **Gage R&R**.

• Creation of a list of calibration-targeted gages from the gage management table

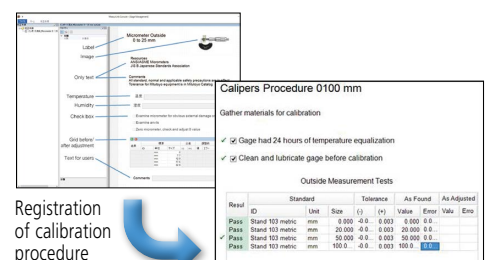
The target gages are retrieved from a variety of search items such as gage ID, gage type, model, maker, distributor, calibration date, current usage state and location to create the list.



Gage management table

• Registration and running a calibration procedure

Allows simple registration of the calibration procedure for each measuring instruments and implementation of the calibration.

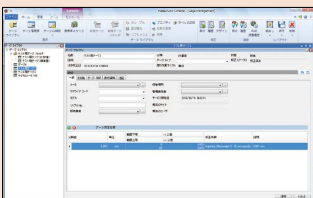


Registration of calibration procedure

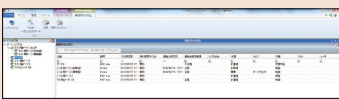
Calibration run

• Confirmation of detailed gage information

Allows confirmation of detailed information on individual gages. The software allows you to display a list of gages depending on "Calibration Overdue", "Next Month Due", etc., by setting a calibration date and confirm detailed information on the calibration history of gages.



Display of detailed gage information

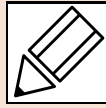


Display of gages listed depending on calibration date



Display of calibration history

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

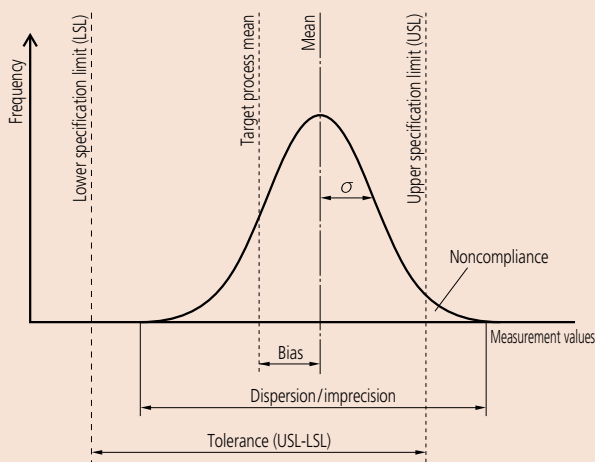
Number of product items in the sample.

Bias

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

Dispersion, Imprecision

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 measurement 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)

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.

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

Bilateral tolerance

$$C_p = \frac{USL - LSL}{6\sigma} \quad \begin{array}{l} USL: \text{Upper specification limit} \\ LSL: \text{Lower specification limit} \end{array}$$

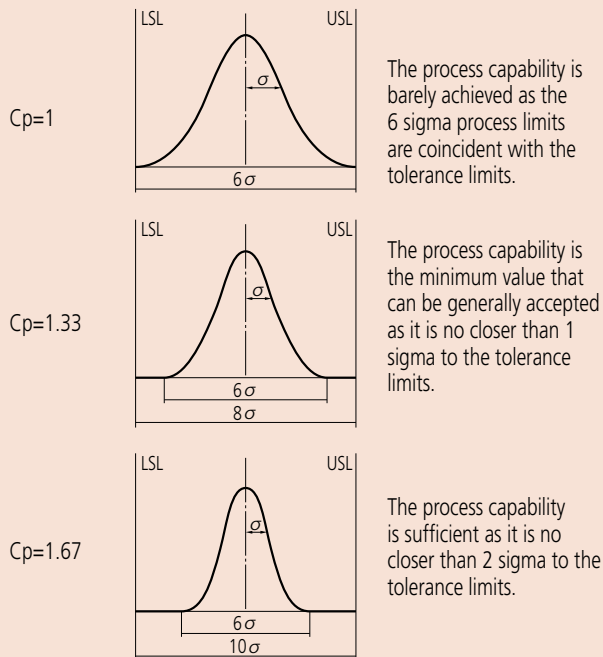
Unilateral tolerance ... If only the upper limit is stipulated

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

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)

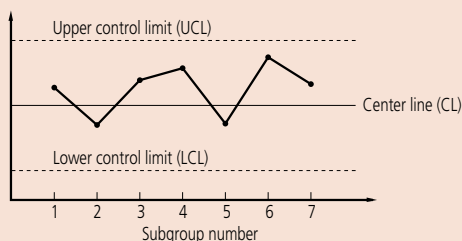


Note that Cp only represents the relationship between the tolerance limits and the process dispersion and does not consider the position of the process mean.

Note: 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

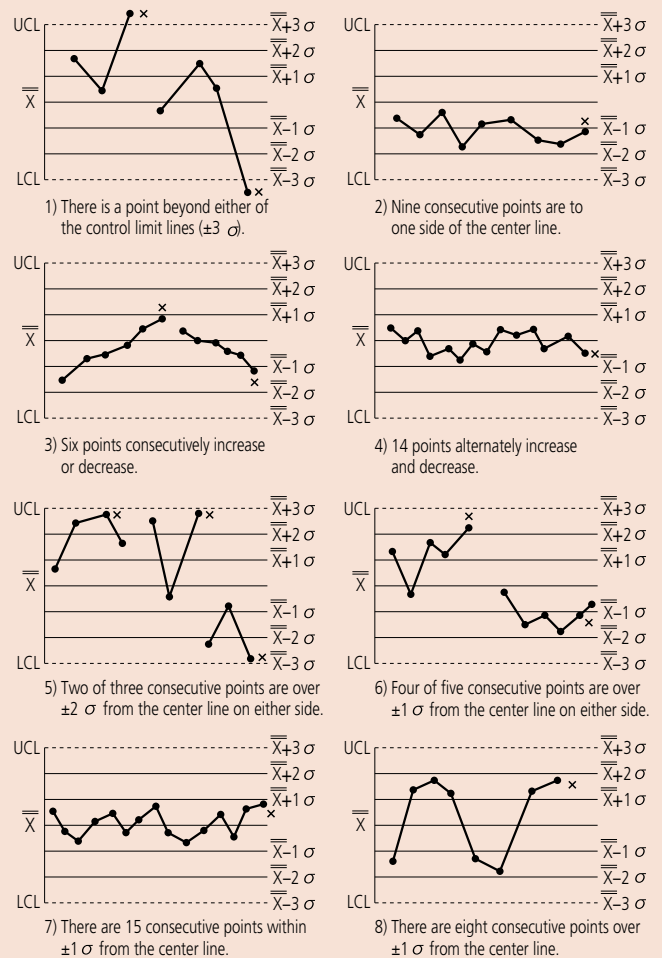
These causes of variation are of relatively low importance. Chance causes are technologically or economically impossible to eliminate even if they can be identified.

\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-31 to A-32) 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