No. STD-005

# TECHNICAL INFORMATION

## Design Specifications of Digimatic Data Output Interface

Mitutoyo

## CONTENTS

## PREFACE

Your present measuring instruments or data processing units, which have specific data I/O formats, can have a wider range of measurement data control by connecting them to a Mitutoyo Digimatic measuring instrument or data processor (e.g. Digimatic Mini-processor, etc.).
This manual provides information that is essential for designing such systems and describes the Digimatic I/O specifications of the Mitutoyo measuring instruments and data processors. The basic concept of the system configuration is as follows.

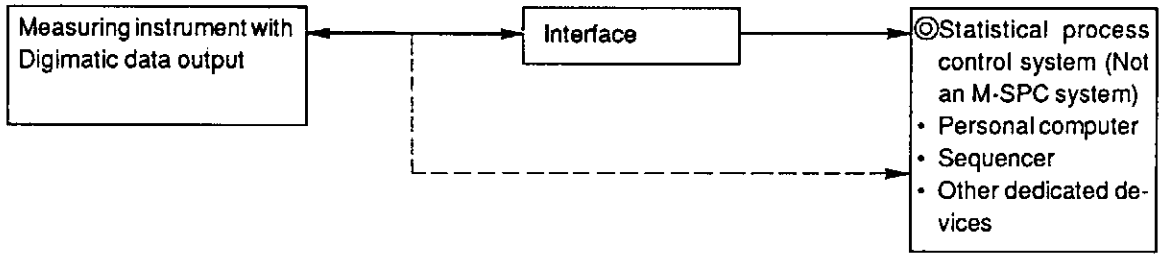



**Fig. (1) Connecting the measuring instrument with Digimatic data output to the External device**

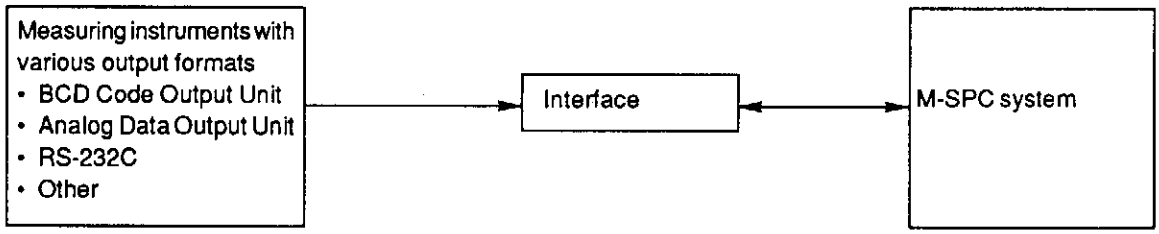



**Fig. (2) Connecting the measuring instruments with various data output formats to the M-SPC system**

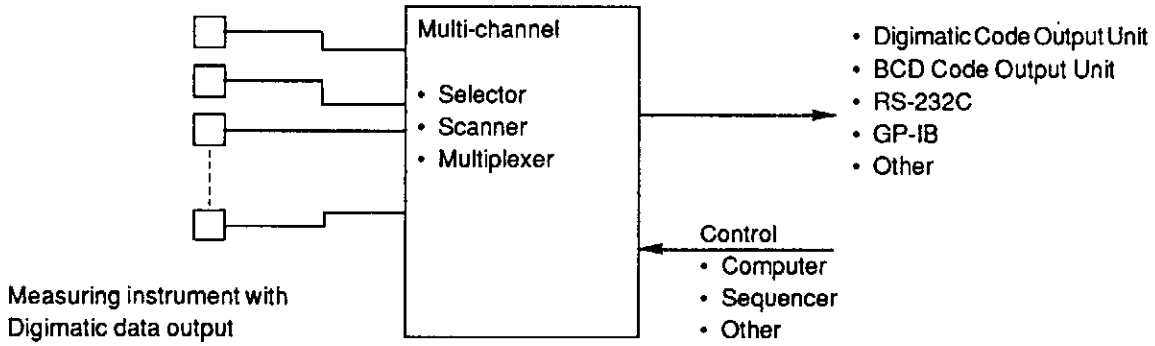



**Fig. (3) Application aiming for system integration and automated measurement**

# PART 1 DIGIMATIC DATA OUTPUT SPECIFICATIONS

## 1. List of Digimatic Data Output

| Gage Name | Same spec. | OUTPUTS | INPUTS | Remarks |
|---|---|---|---|---|
| Digimatic Caliper (CD-15AM SERIES)*1 | Digimatic Height Gage HDM<br>Digimatic Height Gage HDS-M<br>Digimatic Scale Unit SD-M | DATA, CK., RDY | REQ. | * DATA and CK have positive logic.<br>* REQ, RD, DATA2, and ENTRY have negative logic.<br>* For the minimum access time, refer to each operation manual.<br>* For the timing chart and information on data formatting, refer to section 1.6. |
| Digimatic Caliper CD-15 | Digimatic Indicator IDU, Solar CD | DATA, CK., RDY | REQ. | |
| Digimatic Micrometer MDC-25M Series | Digimatic Holetest HTP<br>MIKEMATIC | DATA, CK., | REQ. | |
| Digimatic Indicator ID ID-130M Series | Linear Gage LG-D<br>Digimatic Indicator IDA, IDF<br>Mu-CHECKER ...etc. | DATA, CK., RDY | REQ.<br>DATA2, ENTRY | |
| Digimatic Indicator IDC IDC-112M Series | Digimatic Indicator IDC<br>IDC-1012M | DATA, CK., | REQ. | |
| Digimatic Code Out Unit | PG, PM, GM, F Counter | DATA, CK., RDY | REQ. | |

*1 Not currently produced

| Gage Name | OUTPUT SPECIFICATIONS | INPUT SPECIFICATIONS | CABLE No. | POWER SUPPLY |
|---|---|---|---|---|
| Digimatic Caliper (CD-15AM SERIES)*1 | Open drain :<br>- 0.3 to + 7.0V, 400 µAmax | C-MOS :<br>Pull up to VDD (1.55V) | 937243 | battery SR-44 ×1 |
| Digimatic Caliper CD-15 | Open drain :<br>- 0.3 to + 7.0V, 400 µAmax | C-MOS :<br>Pull up to VDD (1.55V) | 905338 | battery SR-44 ×1 |
| Digimatic Micrometer MDC-25M | Open drain :<br>- 0.3 to + 7.0V, 400 µAmax | C-MOS :<br>Pull up to VDD (1.55V) | 937387 | battery SR-44 ×1 |
| Digimatic Indicator ID | Open collector :<br>10L = 100 mAmax | C-MOS :<br>Pull up to VDD (5.0V) | 936937 | AC adaptor DC9V |
| Digimatic Indicator IDC IDC-112M Series | Open drain :<br>- 0.3 to + 7.0V, 400 µAmax | C-MOS :<br>Pull up to VDD (1.55V) | 937387 | battery SR-44 ×2 |
| Digimatic Code Out Unit | Open collector :<br>10L = 100 mAmax | C-MOS :<br>Pull up to VDD (5.0V) | 936937 | 100V AC |

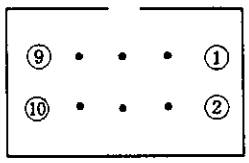
*1 Not currently produced

## 2. Connector Specifications

### • Connector type and pin assignment of the Digimatic measuring instrument

Connector type and pin assignment vary depending on the model of the Digimatic measuring instrument. The following shows connector types and pin assignments of the various models. The dedicated communication cables have the following specifications:

### 2.1 Interface-side connector for dedicate cable




Manufacturer: T&B (Thomas & Betts)
→No. 609-1007

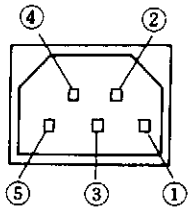
| Pin No. | Name | Function |
|---|---|---|
| 1 | GND | Signal ground |
| 2 | DATA 1 | Outlet data |
| 3 | CLOCK | Clock |
| 4 | $\overline{\text{RDY}}$ ($\overline{\text{READY}}$) | Data transmission ready |
| 5 | $\overline{\text{REQUEST}}$ | Data output request from external device |
| 6 | $\overline{\text{ENTRY}}$* | Data inputrequest from external device |
| 7 | $\overline{\text{DATA2}}$* | Input data |
| 8 | +9V* | 9V input terminal |
| 9 | +9V* | 9V input terminal |
| 10 | GND | Frame ground |

*: Depending on the model
Refer to the I/O specifications of the Digimatic Indicator ID-M and Linear Gage LG-D

### 2.2 Gage-side connector for dedicated cable

(1) Digimatic Caliper CD-M, Digimatic Caliper CD-AM, Digimatic Scale Unit SD-M, Digimatic Height Gage HDS-M, and other Digimatic Calipers.

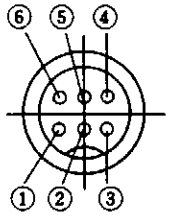
Connector pin assignment
Mitutoyo MQ 65-5P




| Pin No. | Name | Function |
|---|---|---|
| 1 | GND* | Ground |
| 2 | DATA* | Data is output in the folloing format |
| 3 | CK* | Clock |
| 4 | GND* | Ground |
| 5 | $\overline{\text{REQ}}$** | Data output request from external device |

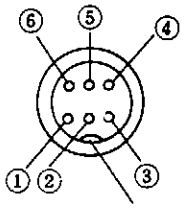
*: Open drain - 0.3 to + 7 V (400μA max.)
**: Pull up to $V_{DD}$ (1.55V) externally.

(2) Digimatic Micrometer MDC-M, Digimatic Holetest HTD, Digimatic Indicator IDC, and other special purpose Digimatic Micrometers and Heads (with data output)



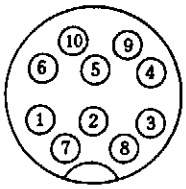

| Pin No. | Signal name | Function |
|---|---|---|
| 1 | GND | Signal GND |
| 2 | DATA | Measured data |
| 3 | CK | Clock |
| 4 | NC | Unassigned |
| 5 | $\overline{\text{REQ}}$ | Data output request from external device |
| 6 | NC | Unassigned |

(3) MIKEMATIC




| Pin No. | Signal name | Function |
|---|---|---|
| 1 | GND | Signal GND |
| 2 | DATA | Measured data |
| 3 | CK | Clock |
| 4 | $\overline{\text{READY}}$ | REQ receiving request from this unit |
| 5 | $\overline{\text{REQ}}$ | Data output request from external device |
| 6 | NC | Unassigned |

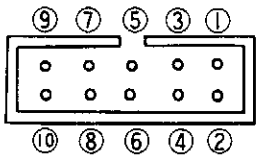
(4) Digimatic Indicator IDB, Digimatic Snap Holetest




| Pin No. | Signal | I/O | Function |
|---|---|---|---|
| 1 | GND | — | GND |
| 2 | DATA | Out | Measured data |
| 3 | CLOCK | Out | Data transmission clock |
| 4 | $\overline{\text{READY}}$ | Out | Data transmission ready |
| 5 | $\overline{\text{REQUEST}}$ | In | Data output request from external device |
| 6 | NC | — | ——— |
| 7 | NC | — | ——— |
| 8 | CHARGE | In | Power supply from main unit (DCI + 4.3V) |
| 9 | +9V | In | Power supply from data processor |
| 10 | NC | — | ——— |

(5) Digimatic indicator, Linear Gage LG-D, Digimatic indicator IDA, A/D PACK-1 Digimatic codeout, DIGITAL Mu-CHECKER, RUNOUT CHECKER, A/D PACK-1 DIGIMATIC CODEOUT UNIT For GM, F, PM COUNTER & LASER SCAN MICROMETER.

Connector (T&B 609-1007)




*Pins to be used differ depending on the model.

①-⑩ : Digimatic Indicater
Linear Gage LG
④Unassigned

①-⑤, ⑧, ⑨, ⑩ : A/D PACK-1
RUNOUT CHECKER

①-⑤, ⑩ : Other models

Pin assignment

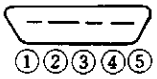
| Pin No. | Name | I/O | Function |
|---|---|---|---|
| 1 | GND | — | ——— |
| 2 | DATA1 | Out | Output data |
| 3 | CLOCK | Out | Clock |
| 4 | $\overline{\text{RDY}}$ | Out | Data transmission ready |
| 5 | $\overline{\text{REQUEST}}$ | In | Data output request from external device |
| 6 | $\overline{\text{ENTRY}}$ | — | Data input request from external device |
| 7 | $\overline{\text{DATA2}}$ | — | Input data from external device |
| 8 | +9V | In | 9V input terminal |
| 9 | +9V | In | 9V input terminal |
| 10 | GND | — | ——— |

Transistor output (pull up with a resistor of 10K)

(6) Digimatic Micrometer (old-type Digimatic Micrometer, old-type special purpose Digimatic Micrometer), Digimatic Micrometer Head (Series 164)

Connector specifications:

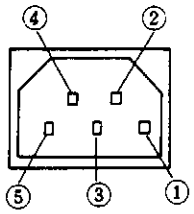
ECID-SPG-2.SDS: (Manufacturer: Hirose)




| Pin No. | Name | Function | Remark |
|---|---|---|---|
| 1 | GND | ———— | •C-MOS<br>•Open drain<br>•Absolute maximum rating<br>(- 0.3 to +10.0V, 0.4mA) |
| 2 | DATA | Output data | |
| 3 | CK | Clock | |
| 4 | $\overline{\text{READY}}$ | Data transmission ready | |
| 5 | $\overline{\text{REQ}}$ | Data output request from external device | ———— |

(7) Old-type Digimatic Caliper CD-M

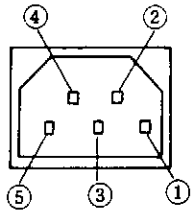
Mitutoyo MQ 65-5P




| Pin No. | Name | Function | Remark |
|---|---|---|---|
| 1 | GND | Ground | C-MOS open drain<br>- 0.3 to +7V, 45mA, max. |
| 2 | DATA | Output data | |
| 3 | CK | Clock | |
| 4 | $\overline{\text{READY}}$ | Data transmission ready | Pull up to $V_{DD}$ (+2.7 to +3.1V) externally. |
| 5 | $\overline{\text{REQ}}$ | Data output request from external device | |

(8) Digimatic Height Gage

Mitutoyo MQ-65-5P




| Pin No. | Signal | Function |
|---|---|---|
| 1 | GND | Signal GND |
| 2 | DATA | Measured data |
| 3 | CK | Clock |
| 4 | $\overline{\text{READY}}$ | REQ receiving request from this unit |
| 5 | $\overline{\text{REQ}}$ | Data output request from external device |

Note

- As the connector type and pin assignment of each measuring instrument is subject to change without notice, the user should confirm the specifications of your instrument before configuring a system.

## 3. List of Available Cables (TYPE A to F)

### • Connection with Digimatic measuring instruments

The output connector type differs, depending on the model of the Digimatic measuring instrument. Therefore, cables are discriminated as follows:

| Connecting cable No. | Applicable models |
|---|---|
| **Type A**<br>937243 (1m)<br>937244 (2m) | Digimatic Caliper, Digimatic Caliper CD-AM, Digimatic Height Gage, Digimatic Height Gage, Digimatic Scale Unit, and other Digimatic Calipers (with data output) |
| **Type B**<br>937387 (1m)<br>965013 (2m) | Digimatic Micrometer, Digimatic Holetest, Digimatic Indicator IDC, MIKEMATIC, and other Digimatic Micrometers and Heads (with data output) |
| **Type C**<br>937386 (1m)<br>965012 (2m) | IDB, Digimatic Snap Holtest*1, and other type-B instruments |
| **Type D**<br>936937 (1m)<br>965014 (2m) | Digimatic Indicator, Linear Gage LG-D, Digimatic Indicator IDA, A/D PACK-1, RUNOUT CHECKER, DIGITAL Mu-CHECKER, DIGIMATIC CODEOUT UNIT for GM, F, PMCOUNTER & LASERSCAN MICROMETER |
| **Type E**<br>936289 (1m)<br>965015 (2m) | MD-M (old-type Digimatic Micrometer, old-type special purpose Digimatic micrometer), Digimatic Micrometer Head. |
| **Type F**<br>905338 (1m)<br>905409 (2m) | Digimatic Indicator IDU, CD-15/20 (instruments manufactured after 21 May 1987) |

• The design and pin assignments of the connectors are described in the following pages.

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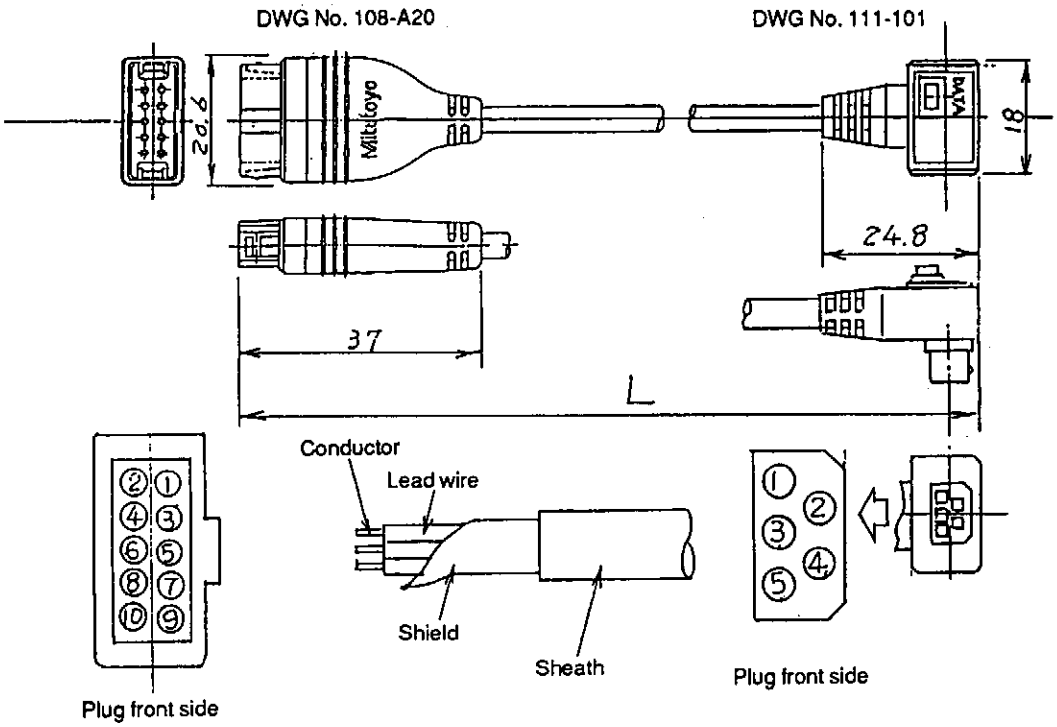
## 4. Cable Specifications

### 4.1 TYPE A

| Part No. | Dimension L |
|---|---|
| 937243 | 1m |
| 937244 | 2m |

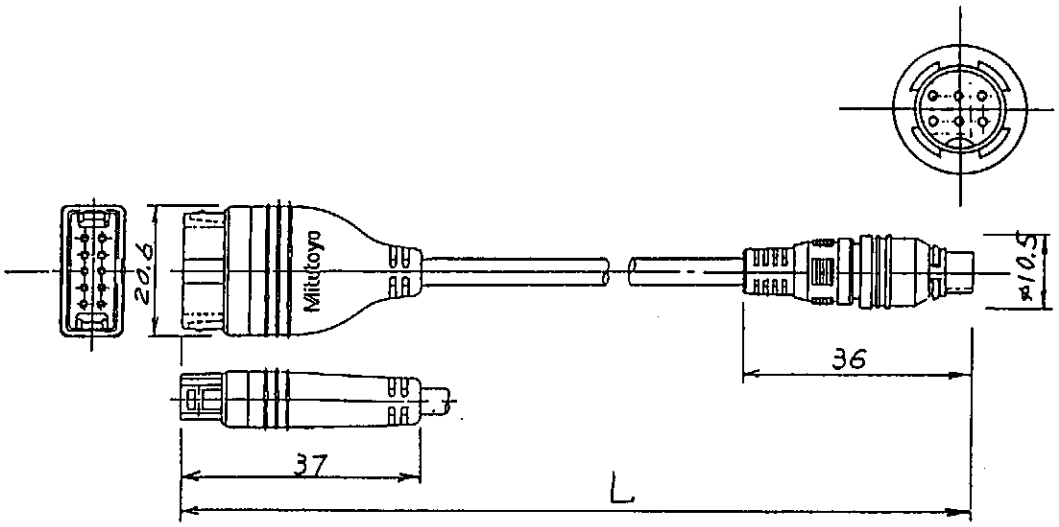


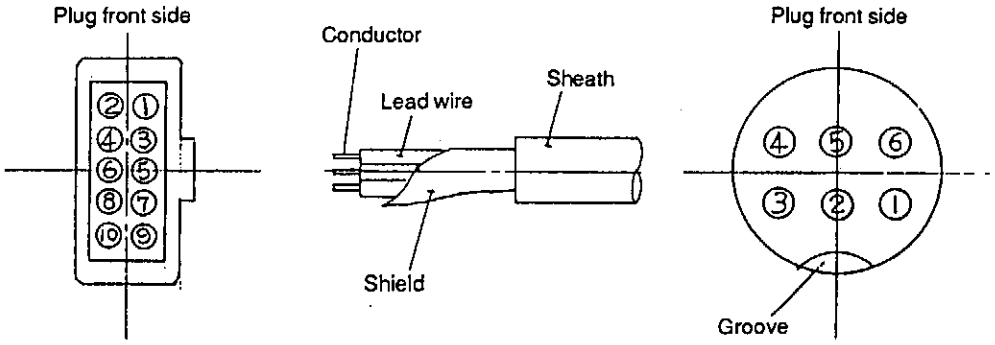

| Left plug | | Right plug | | Cable | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pin No. | Connection | Pin No. | SW wiring | Lead wire color | Conductor configuration | Core wire cover | Shield | Sheath | Overrall diameter |
| 1 | ⟷ | 1 | | Blue | 16 x ø0.08 strands | Heat resistant PVC | Shielded by the entire wire-net, 60 x ø0.12 strands wound counter clock-wise | Oil-proofed | ø4.3 |
| 2 | ⟷ | 2 | | Black | " | " | | | |
| 3 | ⟷ | 3 | | Red | " | " | | | |
| 4 | ⟷ | 4 | | Green | " | " | | | |
| 5 | ⟷ | 5 | | White | " | " | | | |
| | | | | | | | | | |

*Connect the shield to pin No. 1.

## 4.2 TYPE B

| Part No. | Dimension L |
|---|---|
| 937387 | 1m |
| 965013 | 2m |



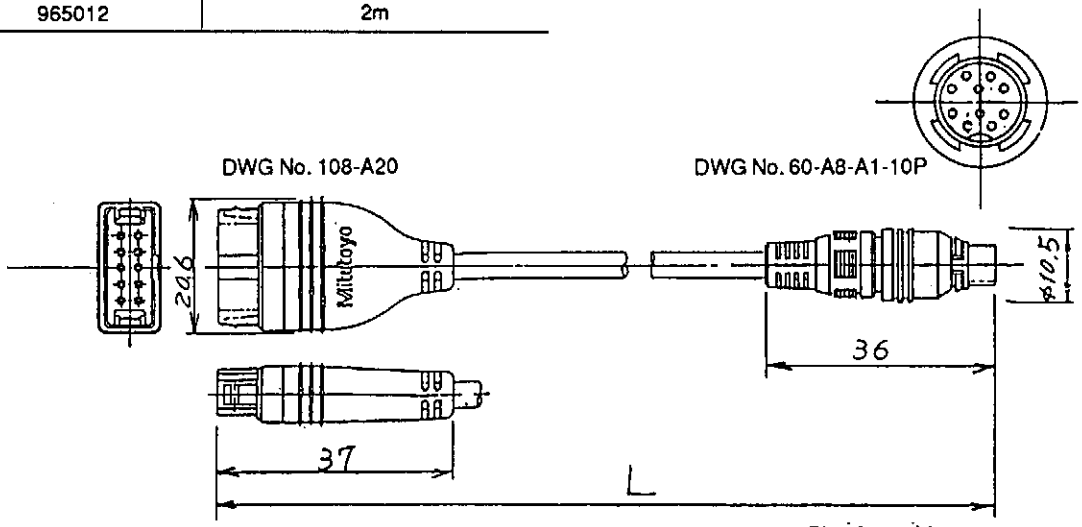



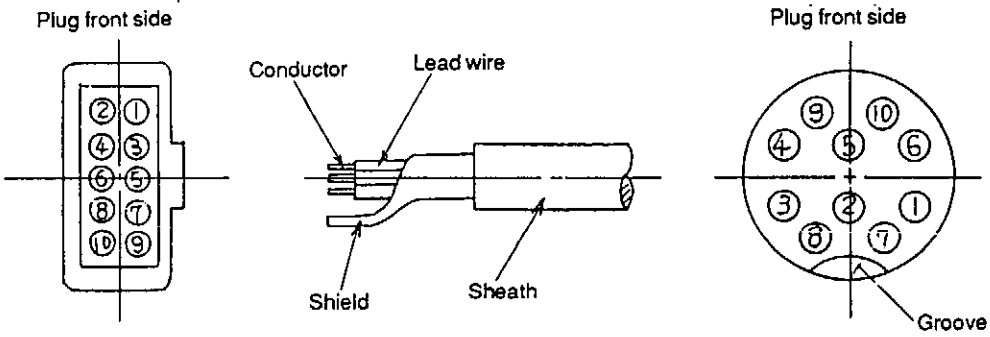

| Left plug | | Right plug | Cable | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pin No. | Con-nection | Pin No. | Lead wire color | Conductor configuration | Core wire cover | Shield | Sheath | Overall diameter |
| 1 | ⟷ | 1 | Blue | 16 x ø0.08 strands | Heat resistant PVC | Shielded by the entire wire-net, 60 x ø0.12 strands wound counter clock-wise | Oil-proofed | ø4.3 |
| 2 | ⟷ | 2 | Black | " | " | | | |
| 3 | ⟷ | 3 | Red | " | " | | | |
| 4 | ⟷ | 4 | Green | " | " | | | |
| 5 | ⟷ | 5 | White | " | " | | | |
| | | | | | | | | |

* Connect the shield to pin No.1.

## 4.3 TYPE C

| Part No. | Dimension L |
|---|---|
| 937386 | 1m |
| 965012 | 2m |



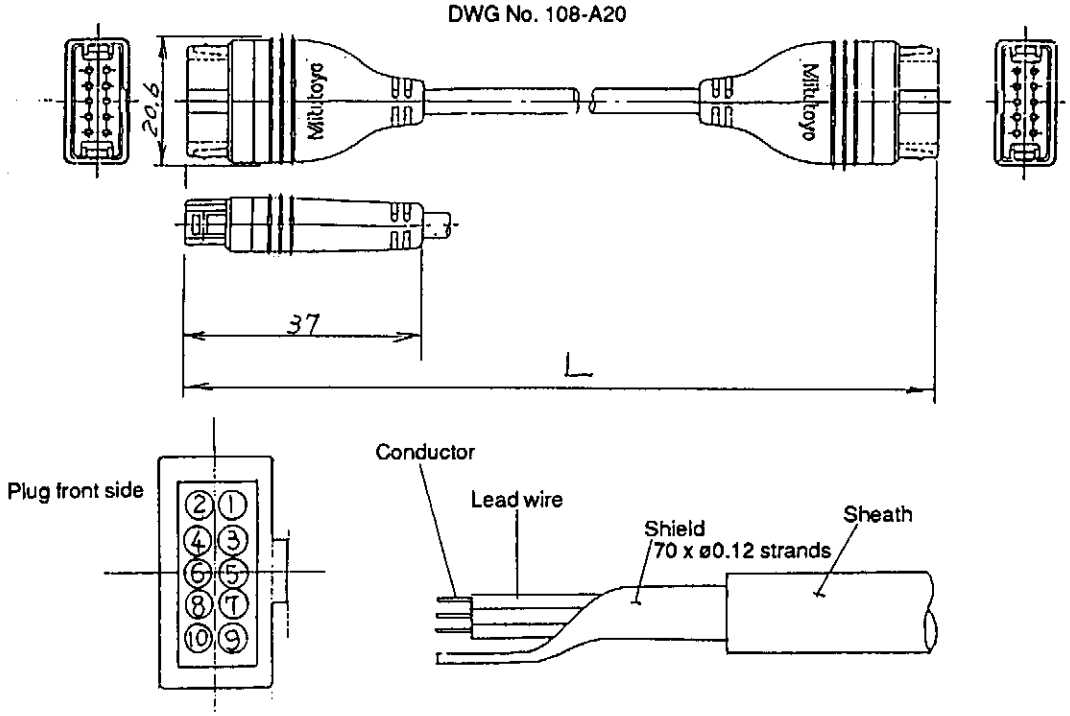




| Left plug | | Right plug | Cable | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pin No. | Connection | Pin No. | Lead wire color | Conductor configuration | Core wire cover | Shield | Sheath | Overrall diameter |
| 1 | ⟷ | 1 | Shield ⟵ | | | Shielded by the entire wire-net, 60 x ø0.12 stands wound counter clock-wise | Oil-proofed | ø4.3 |
| 2 | ⟷ | 2 | Black | 7 x ø0.1 strands | Viemex VF | | | |
| 3 | ⟷ | 3 | Red | " | " | | | |
| 4 | ⟷ | 4 | Green | " | " | | | |
| 5 | ⟷ | 5 | White | " | " | | | |
| 6 | ⟷ | 6 | Gray | " | " | | | |
| 7 | ⟷ | 7 | Yellow | " | " | | | |
| 8 | ⟷ | 8 | Brown | " | " | | | |
| 9 | ⟷ | 9 | Orange | " | " | | | |
| 10 | ⟷ | 10 | Blue | " | " | | | |

## 4.4 TYPE D

| Part No. | Dimension L |
|---|---|
| 936937 | 1m |
| 965014 | 2m |

DWG No. 108-A20

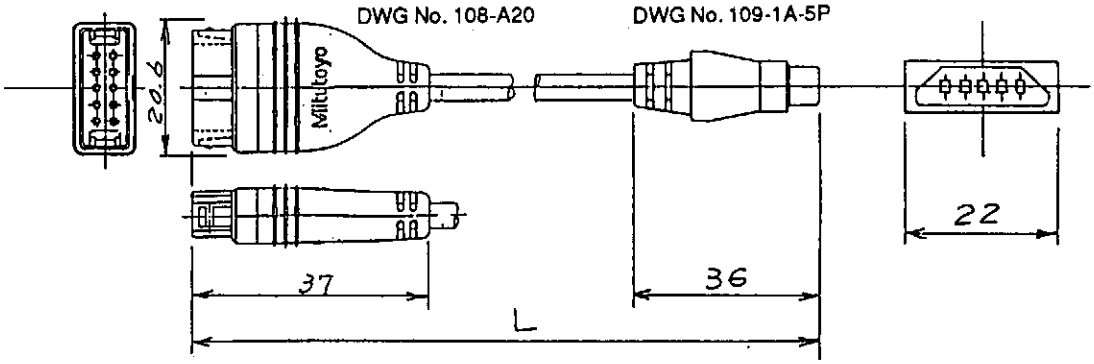



| Left plug | | Right plug | Cable | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pin No. | Con-nection | Pin No. | Lead wire color | Conductor configuration | Core wire cover | Shield | Sheath | Overrall diameter |
| 1 | ⟷ | 1 | Blue | 16 x ø0.08 strands | Heat resistant PVC | Shielded by the entire wire-net, 60 x ø0.12 strands wound counter clock-wise | Oil-proofed | ø4.3 |
| 2 | ⟷ | 2 | Black | " | " | | | |
| 3 | ⟷ | 3 | Red | " | " | | | |
| 4 | ⟷ | 4 | Green | " | " | | | |
| 5 | ⟷ | 5 | White | " | " | | | |

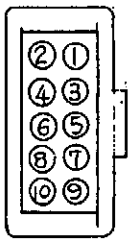
*Connect the shield to pin No. 1

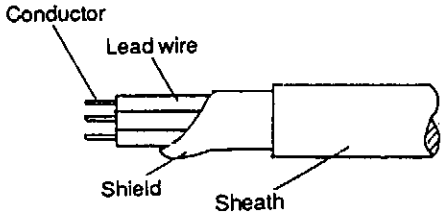
## 4.5 TYPE E

| Part No. | Dimension L |
|---|---|
| 936289 | 1m |
| 965015 | 2m |

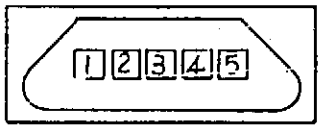



Plug front side




Plug front side

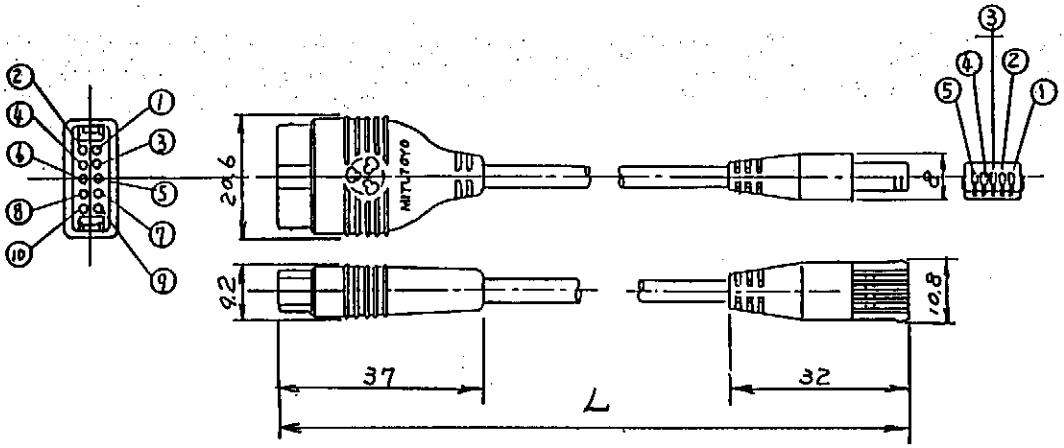



| Left plug | | Right plug | Cable | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pin No. | Con-nection | Pin No. | Lead wire color | Conductor configuration | Core wire cover | *Shield | Sheath | Overall diameter |
| 1 | ⟷ | 1 | Shield | | | Shielded by the entire wire-net, 60 x ø0.12 strands wound counter clock-wise | Oil-proofed | ø4.3 |
| 2 | ⟷ | 2 | Black | 7 x ø0.1 strands | Viemex VF | | | |
| 3 | ⟷ | 3 | Red | " | " | | | |
| 4 | ⟷ | 4 | Green | " | " | | | |
| 5 | ⟷ | 5 | White | " | " | | | |
| 6 | ⟷ | 6 | Gray | " | " | | | |
| 7 | ⟷ | 7 | Yellow | " | " | | | |
| 8 | ⟷ | 8 | Brown | " | " | | | |
| 9 | ⟷ | 9 | Orange | " | " | | | |
| 10 | ⟷ | 10 | Blue | " | " | | | |

* Connect the shield to pin No.1.

## 4.6 TYPE F TYPE 1

| Part No. | Dimension L |
|---|---|
| 905338 | 1m |
| 905409 | 2m |




| Left plug | | Right plug | Cable | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pin No. | Connection | Pin No. | Lead wire color | Conductor configuration | Core wire cover | Shield | Sheath | Overall diameter |
| 1 | ⟷ | 1 | Blue | 16 x ø0.08 strands | Heat resistant PVC | Shielded by the entire wire-net, 60 x ø0.12 stands wound counter clock-wise | PVC | ø4.3 |
| 2 | ⟷ | 2 | Black | " | " | | | |
| 3 | ⟷ | 3 | Red | " | " | | | |
| 4 | ⟷ | 4 | Green | " | " | | | |
| 5 | ⟷ | 5 | White | " | " | | | |

*Connect the shield to pin No. 1

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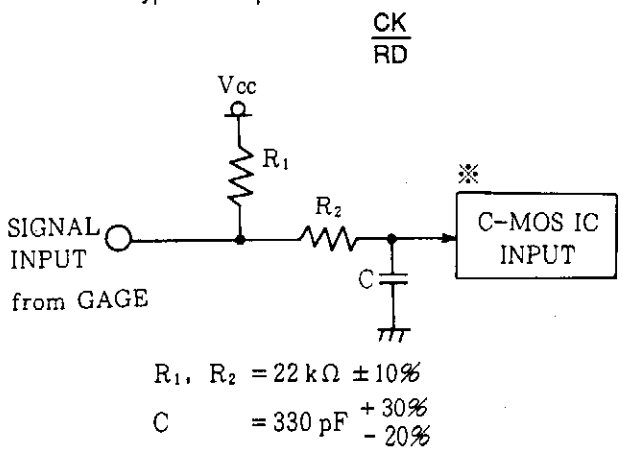
## 5. Electrical Specifications

### 5.1 I/O specification

| Pin No. | Signal | I/O<br>I/F — Gage | Circuitry type | Function |
|---|---|---|---|---|
| 1 | GND | ——— | ——— | Signal GND |
| 2 | DATA | ←——— | A | Data |
| 3 | CK | ←——— | A | Data input timing clock |
| 4 | $\overline{\text{RDY}}$ | ←——— | A | Data transmission ready from gage ($\overline{\text{READY}}$) |
| 5 | $\overline{\text{REQ}}$ | ———→ | B | Data output request for gage ($\overline{\text{REQUEST}}$) |

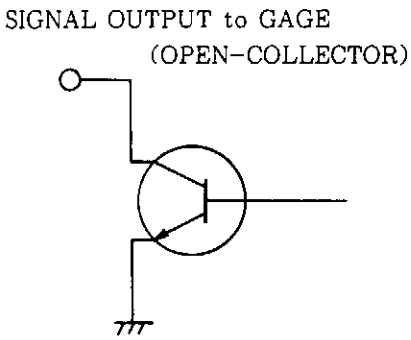
• Example I/O circuitry

Type A – Input circuit: DATA

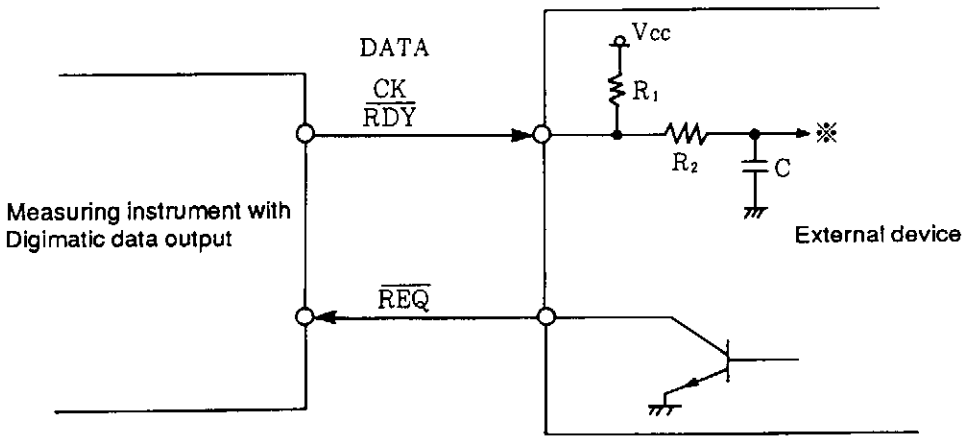



$R_1$, $R_2$ = 22 kΩ ±10%
C = 330 pF $^{+30\%}_{-20\%}$

Type B – Output circuit: $\overline{\text{REQ}}$




NPN-type transistor 2SC2855 (or equivalent)
or TTL IC (with open-collector type)




*Use a C-MOS IC.

## 5.2 Electrical characteristics

Maximum rating

| Item | Symbol | Rating | Unit |
|---|---|---|---|
| Power supply | $V_{CC}$ | 4.75 to 5.25 | V |
| Input voltage | $V_{IM}$ | 5.25 | V |
| Output voltage | $V_{CUT}$ | 7 | V |

DC characteristics

| TYPE | Item | Symbol | Condition | min | max | Unit |
|---|---|---|---|---|---|---|
| A | Low-level input voltage | $V_{IL}$ | — | 0 | 0.8 | V |
| | High-level input voltage | $V_{IH}$ | — | 4.2 | 5.25 | V |
| | Low-level input current | $I_{IL}$ | $V_{IL}$ = 0.8V | — | 250 | μA |
| B | Low-level output voltage | $V_{\overline{OL}}$ | $I_{\overline{OL}}$ = 10mA | — | 0.1 | V |
| | Allowable current leak in high-level output | $I_{L\overline{OH}}$ | $V_{\overline{OH}}$ = 5.5V | — | -1 | μA |

AC characteristics

| Symbol | Condition | min | max | Unit |
|---|---|---|---|---|
| $t_1$ | Fig. 1-1 | 0 | 2 | s |
| $t_2$ | Fig. 1-1 | 15 | | μs |
| $t_3$ | Fig. 1-1 | 100 | | μs |
| $t_4$ | Fig. 1-1 | 100 | | μs |
| $t_5$ | Fig. 1-1 | 0 | — | μs |
| $t_7$ | Fig. 1-2 | — | 80 | ms |

*1: The external device must be ready to receive an $\overline{RDY}$ signal.
If the external device is busy for processing data from a previous input, then the period of inaccessibility must be defined beforehand to prohibit $\overline{RDY}$ reception.

## 6. Timing Chart

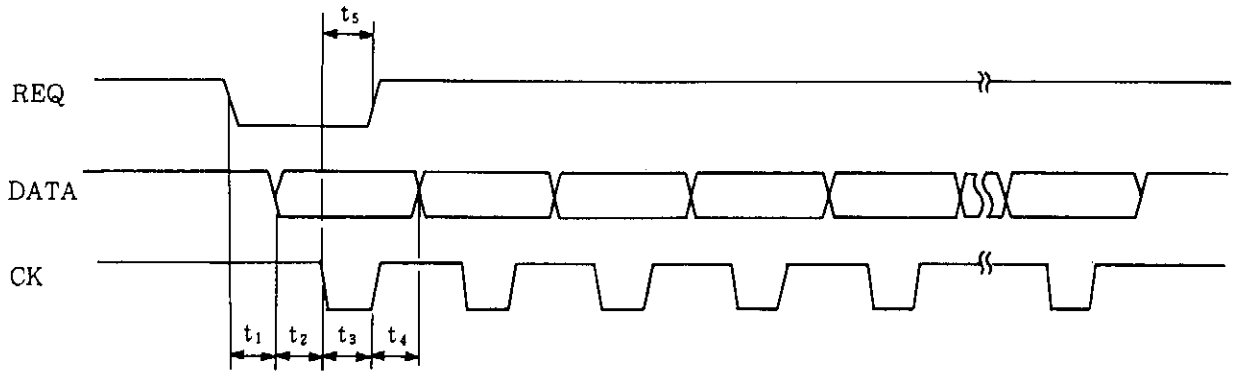



Fig. 1-1

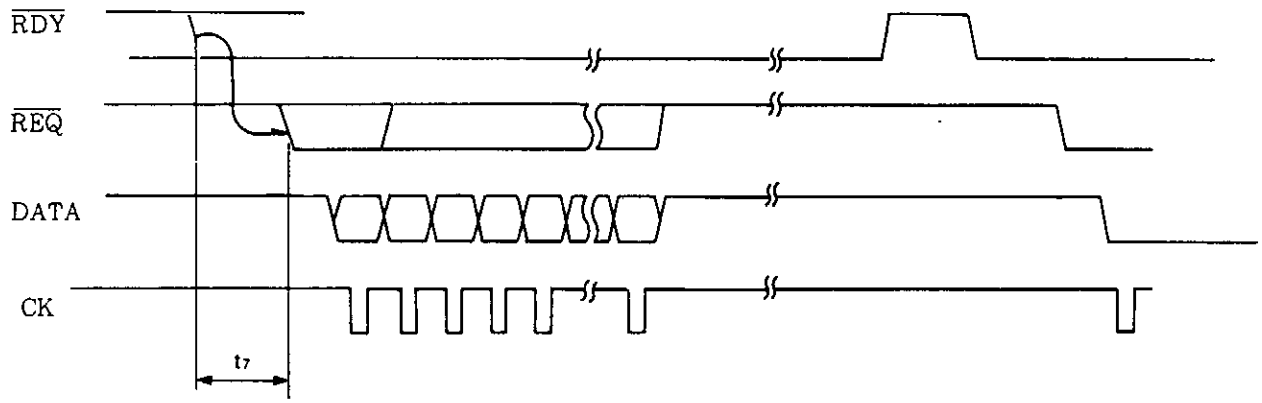


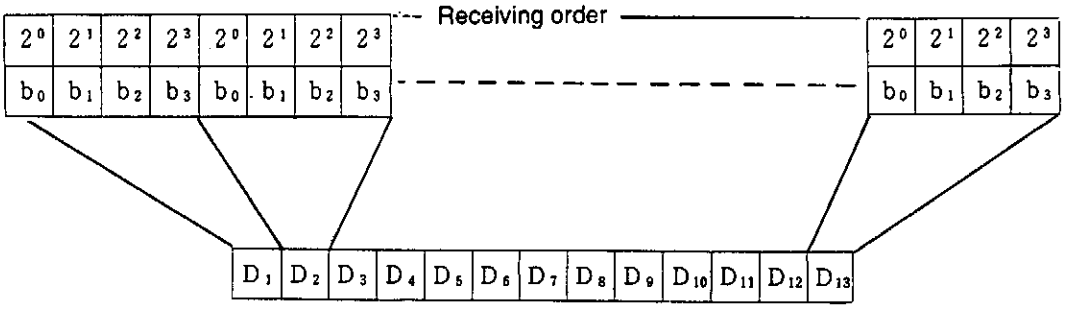

Fig. 1-2

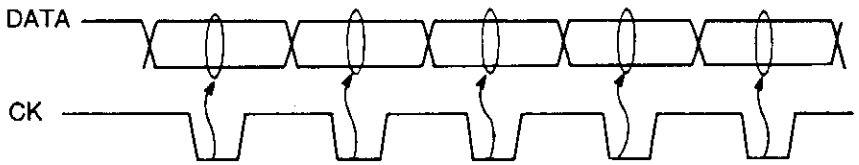
**Fig. 1-1** shows a timing chart where each device outputs a $\overline{\text{REQ}}$ signal and then receives DATA and CK signals, disregarding the $\overline{\text{RDY}}$. **Fig. 1-2** shows a timing chart where Digimatic Interface logs data after a $\overline{\text{REQ}}$ signal is output in response to a data receive request ($\overline{\text{RDY}}$ signal) from a measuring instrument with a data output button (e.g. MIKEMATIC, etc.). It is also possible for the interface to input data after it issues a $\overline{\text{REQ}}$ signal for the measuring instrument.

## 7. Data Input Order

When the $\overline{REQ}$ is active (low level), data is serially output from the Digimatic measuring instrument. The measurement data is comprised of 13 digits (fixed length), numbered $D_1$ to $D_{13}$, each of which is 4 bits wide. Each digit is transmitted and received in the order of LSB to MSB (data format is described later). Each bit of data is received while the CK is active (low level), in accordance with positive logic ( 0 = low level, 1 = high level).

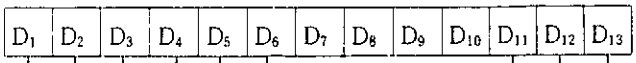
When $\overline{RDY}$ signal becomes active (low level), data input will be performed. However, an $\overline{RDY}$ signal can be often controlled simply by a switch contacting. Take appropriate measures to prevent malfunctions caused by a chattering switch.



## 8. Data Format

### 8.1 Data configuration




**Data type**

0 ; Entry data : Digimatic Micrometer MD-M only
1 ; Number of samples : "
2 ; MAX data : "
3 ; MIN data : "
4 ; X data : "
5 ; σ data : "
6 ; MAX. HOLD data : Digimatic Indicator ID-M, Linear Gage LG-D only
7 ; MIN. HOLD data : "
8 to E; Undefined
F ; NORMAL data : Types other than the ones listed above

**Entry number**

3-digit BCD, MSD = D2, LSD = D4 (D1=0)
ALL F (D1 0)

**Sign**

0 ; "+"
8 ; "–"

**Numerical data**

6-digit BCD, MSD = D6, LSD = D11 (D1≠ 1)
D6 to 8 = F, D9 to 11 = 3-digit BCD (D1=1)

**Decimal point position**

0 ; D6 D7 D8 D9 D10 D11
1 ; D6 D7 D8 D9 D10 , D11
2 ; D6 D7 D8 D9 , D10 D11
3 ; D6 D7 D8 , D10 D11
4 ; D6 D7 , D8 D9 D10 D11
5 ; D6 , D7 D8 D9 D10 D11

**Unit and tolerance judgment result (8 to F shows no unit)***

0 ; M M = mm
1 ; I I = inch
2 ; M (+NG)
3 ; M (GO)
4 ; M (-NG)
5 ; I (+NG)
6 ; I (GO)
7 ; I (-NG)

* Digimatic Mini-processor DP-2 does not accept 8 to F. It causes a data error.

## 8.2 Data format

a) Entry data

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O | n | | | +/- | Xn | | | | | | . | M/I |

Example

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Content |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 2 | 0 | X1 = 123.45 M |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 3 | 1 | X10 = 12.345 I |
| 0 | 1 | 0 | 0 | 8 | 0 | 1 | 2 | 3 | 4 | 5 | 4 | 2 | X100 = -1.2345 M (+NG) |

b) Number of samples

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | N | | | | |

D2 to 8, D12, D13 = F

Example

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Content |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | F | F | F | F | F | F | F | 0 | 0 | 1 | F | F | N = 1 |
| 1 | F | F | F | F | F | F | F | 0 | 1 | 0 | F | F | N = 10 |
| 1 | F | F | F | F | F | F | F | 1 | 0 | 0 | F | F | N = 100 |

c) MAX data, MIN data, $\overline{X}$ data, σ data

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | | | +/- | MAX | | | | | | . | M/I |
| 3 | | | | +/- | MIN | | | | | | . | M/I |
| 4 | | | | +/- | $\overline{X}$ | | | | | | . | M/I |
| 5 | | | | +/- | σ | | | | | | . | M/I |

D2 to 4 = F

Example

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Content |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | F | F | F | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 3 | 0 | MAX = 12.345 M |
| 3 | F | F | F | 3 | 0 | 1 | 2 | 3 | 4 | 5 | 3 | 0 | MIN = -12.345 M |
| 4 | F | F | F | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 3 | 0 | $\overline{X}$ = 12.345 M |
| 5 | F | F | F | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 3 | 0 | σ = 12.345 M |

d) MAX. HOLD data, MIN. HOLD data

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | | | | +/- | MAX. H | | | | | | . | M/I |
| 7 | | | | +/- | MIN. H | | | | | | . | M/I |

D2 to 4 = F

Example

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Content |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | F | F | F | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 4 | 1 | MAX H. X = 1.2345 I |
| 7 | F | F | F | 8 | 0 | 1 | 2 | 3 | 4 | 5 | 4 | 1 | MIN H. X = 1.2345 I |

e) NORMAL data

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F | | | | +/- | X | | | | | | . | M/I |

D2 to 4 = F

Example

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Content |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F | F | F | F | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 2 | 0 | X = 123.45 M |
| F | F | F | F | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 3 | 1 | X = 12.345 I |
| F | F | F | F | 8 | 0 | 1 | 2 | 3 | 4 | 5 | 4 | 2 | X = 1.2345 M (+NG) |

Note) The data items from a) to d) in the above data formats will be output only when the $\overline{RDY}$ signal is issued from the Digimatic measuring instrument. It is always the NORMAL DATA that is output in response to the $\overline{REQ}$ signal from the external device where the $\overline{RDY}$ signal is not issued. The NORMAL DATA is also output in response to the $\overline{RDY}$ signal issued from a Digimatic measuring instrument.

SDP → Digimatic measuring instrument

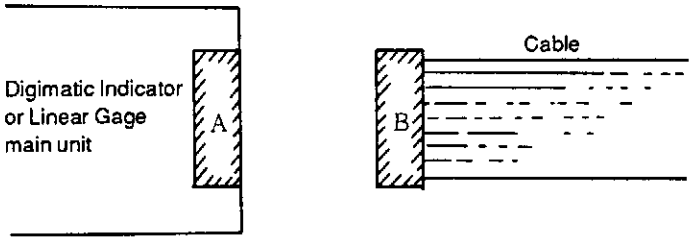
## PART 2 DIGIMATIC INDICATOR ID, IDF & LINEAR GAGE LG-D I/O SIGNAL SPECIFICATIONS

Application: These specifications apply to the output signals issued by an ID or LG-D with one of the following code numbers.

| | |
|---|---|
| ID | 543-431, 441<br>543-433, 443<br>543-435, 445<br>543-411, 421<br>543-413, 423<br>543-415, 425 |
| IDF | 543-511, 531<br>543-521, 541<br>543-513, 533<br>543-523, 543<br>543-515, 535<br>543-525, 545 |
| LG-D | 542-001, 002 |

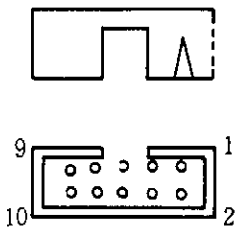
## 1. I/O Signal Specifications for Digimatic Indicator ID, IDF and Linear Gage LG-D.

### 1.1 Applicable connectors




| | |
|---|---|
| A: main unit side | 609-1007<br>PCB male connector with positioning groove, right-angle type (Manufacturer: T&B) or equivalent |
| B: tape cable side | 609-1080M<br>Female connector with strain relief (Manufacturer: T&B) or equivalent |

### 1.2 Connector pin assignment




| I/D<br>ID–I/F | PIN | Signal name | Function |
|---|---|---|---|
| ——— | 1 | GND | |
| ——→ | 2 | DATA 1 | Data is output in the following format*1 |
| ——→ | 3 | CLOCK | Data transmission clock |
| ——— | 4 | NC | Unassigned |
| ←—— | 5 | REQUEST | Data output request from external device |
| ←—— | 6 | ENTRY | Data input request from external device |
| ←—— | 7 | DATA 2 | Input data from the external device*2 |
| ←—— | 8 | +9V | Input terminal for 9V power supply |
| ←—— | 9 | +9V | 9V : 500mA |
| ——— | 10 | GND | |

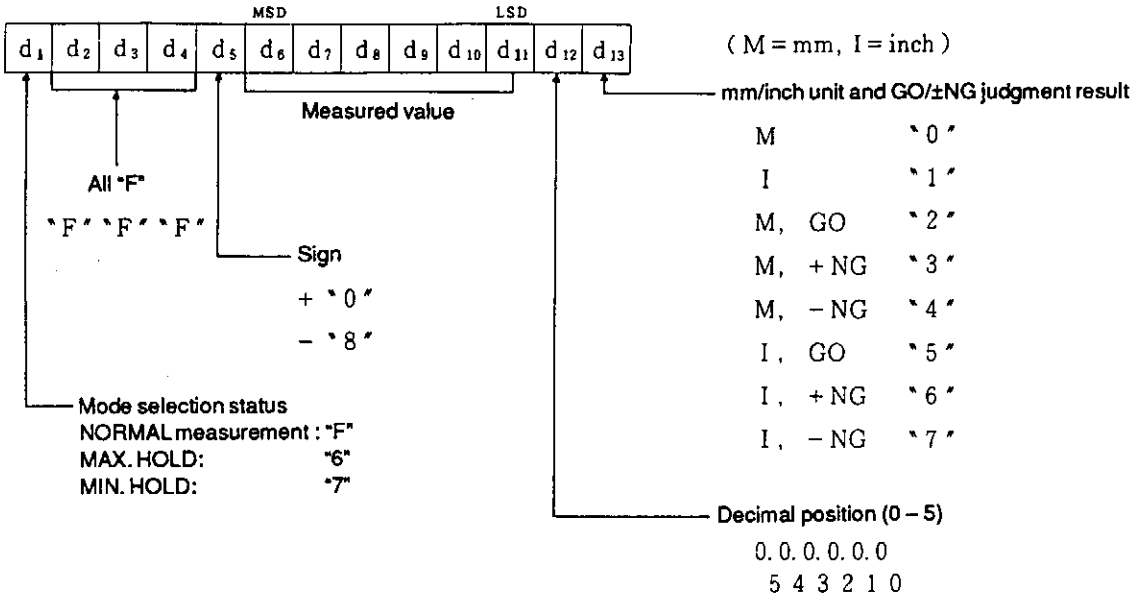
*1 DATA1 : Positive logic
Output of measured data

*2 $\overline{\text{DATA2}}$ : Negative logic

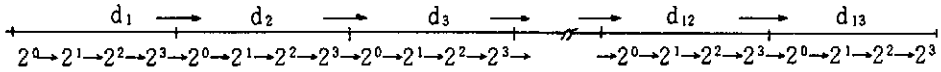
Input of — preset value
upper tolerance limit
lower tolerance limit

## 1.3 Data format

### 1.3.1 Output data (DATA1)




A single measurement is comprised of 13 digits. Each digit is 4 bits wide. The order of digit transmission is:

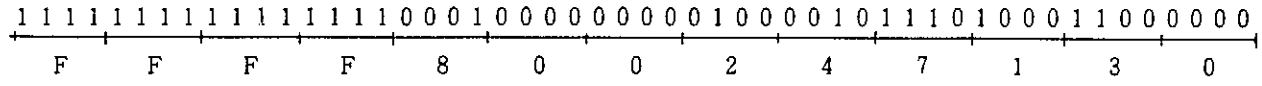



The digits are transmitted serially from d1 to d13, and the bits of each digit are also transmitted serially from LSB ($2^0$) to MSB ($2^3$).

Ex.1

• NORMAL measurement −2.471 M

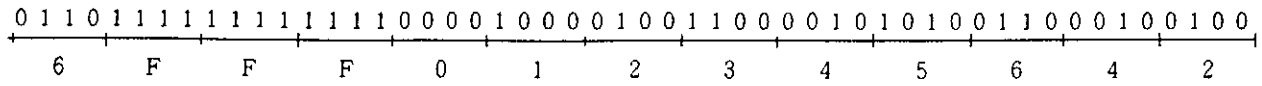
→ output order



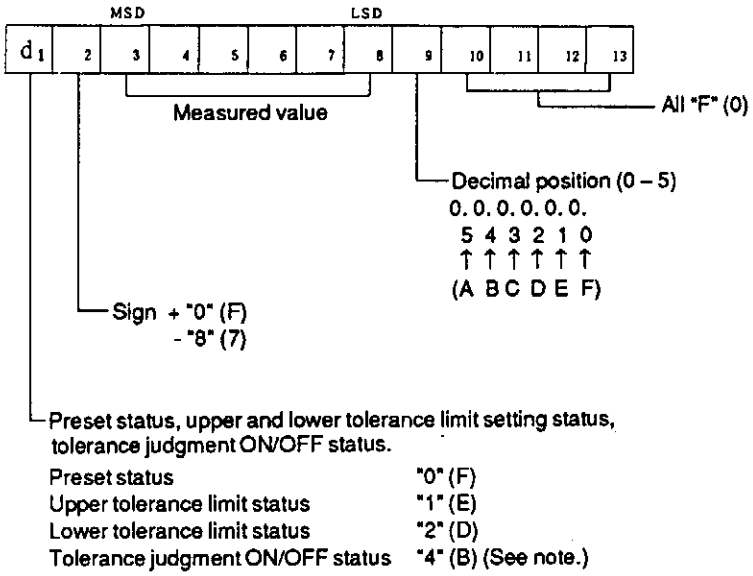

Ex.2

• MAX.HOLD 12.3456 I

→ output order



### 1.3.2 Input data ($\overline{\text{DATA2}}$)




The order of data input is the same as the order of the data output.

[Terminology]

(1) Preset:
The counter can be set to a desired value from which the counting starts.

(2) Upper and lower tolerance limits:
Upper and lower tolerance limits can be set so that a GO/±NG judgment is applied to a measurement and the result displayed.

(3) Tolerance judgment OFF:
The tolerance judgment function as well as the tolerance result display can be turned off with the external control.

Example 1

• Preset –15.000

→ Input order

1 1 1 1 1 1 1 0 1 1 1 1 0 1 0 0 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

0 8 0 1 5 0 0 0 3 F F F F

Example 2

• Upper tolerance limit +12.00

0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

1 0 0 0 1 2 0 0 2 F F F F

Example 3

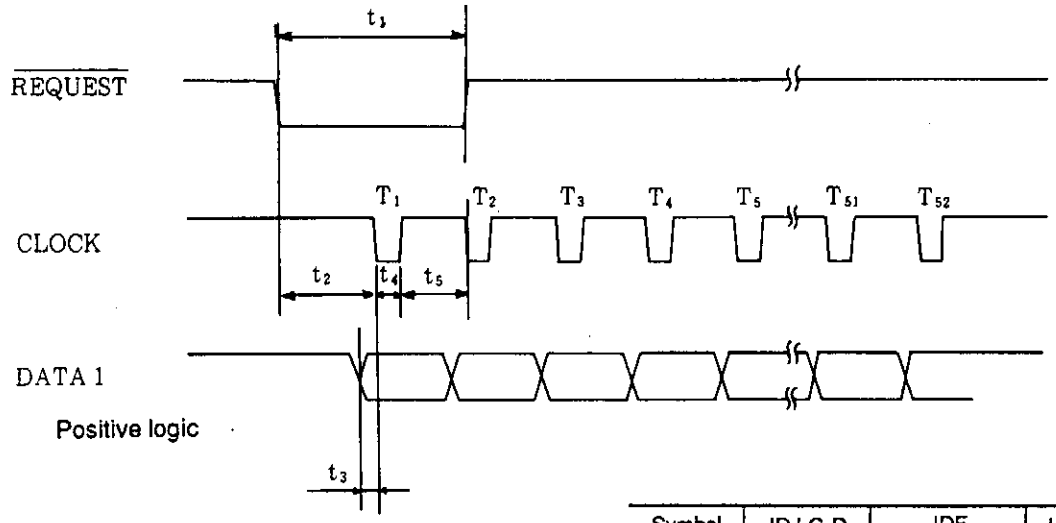
• Tolerance judgment OFF

1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

4 F F E F F F F E F F F F

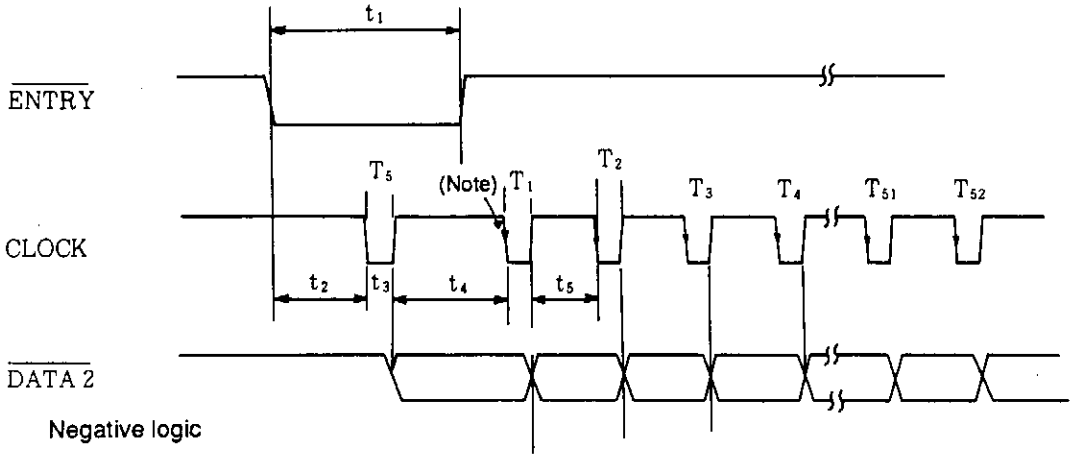
## 1.4 Timing chart

### 1.4.1 Output data




| Symbol | ID·LG-D | IDF | Unit |
|---|---|---|---|
| $t_1$ | 12-20 | 12-55 | ms |
| $t_2$ | 12 | 12 (max) | ms |
| $t_3$ | 16 | 15μ | μs |
| $t_4$ | 136 | 100μs (min) | μs |
| $t_5$ | 280-300 | 200-1000 | μs |

### 1.4.2 Input data




$t_3 \fallingdotseq 136\ \mu s$

$t_4 \fallingdotseq 1.0\,ms$

$t_5 \fallingdotseq 232-220\ \mu s$

$12\,ms \leq t_1 \leq 20\,ms$

$t_2 \leq 12\,ms$

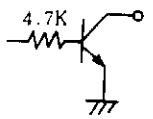
(Note) The Digimatic Indicator or Linear Gage logs data at the fall-off edge of CLOCK signal.

## 2. IC Specifications of I/O Section

| Signal name | Specification |
|---|---|
| DATA 1<br>CLOCK | Transistor<br>Open-collector output<br>ROHM DTC |
| $\overline{\text{REQUEST}}$<br>$\overline{\text{ENTRY}}$<br>$\overline{\text{DATA}}$ 2 | CMOS input<br>Pull up through 20k resistor. |

Absolute maximum rating

Ior=100mA




• Precautions when connecting

(1) Supply power to the Digimatic Indicator ID, IDF, or Linear Gage LG-D using the dedicated AC-adaptor.

(2) Electrical interference through the connecting cables
(If a system malfunction occurs because of electrical interference in the connecting cables, the Digimatic Indicator ID or Linear Gage LG-D will indicate that such an error has occurred by displaying "– – – – – –").

(3) Enter the upper and lower tolerance limits in this order.

(4) Tolerance judgments can commence only when both the upper and lower tolerance limits are correctly entered.

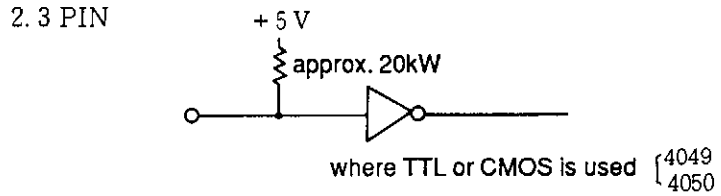
(5) When the lower tolerance limit is larger than the upper tolerance limit, the display shows "$E^{UL}_{ERROR}$"

(6) If the decimal point position set for the Digimatic Indicator ID, IDF or Linear Gage LG-D is different from that set for the counter, "E.r.r.o.r" will be displayed.

(7) Error displays can be cleared with the [ZERO] switch.

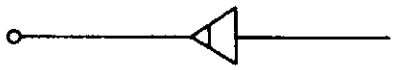
(8) If the external device is not designed to supply power to a Digimatic indicator, build an I/O circuitry at the external device side as shown in the diagram below.

(Input circuitry)



(Output circuitry)

5. 6. 7 PIN



Open-collector or open-drain

(9) About the preset function

(a) For preset data, pin Nos. 3 (CLOCK), 6, ($\overline{\text{ENTRY}}$), and 7 ($\overline{\text{DATA2}}$) are used.

(b) Design the external device so that the $\overline{\text{ENTRY}}$ signal will restore an "H" state when a CK signal is received, or synchronize it to another signal as previously described.
If the line still remains in an "L" state after $T_{s2}$ (refer to 1.4.2) is transmitted, the Digimatic interface will re-start the presetting operation.

(c) A data check for $\overline{\text{DATA2}}$ is carried out for each digit (4-bit).
When an error is detected by this data check the clock count will stop.

(d) Error display enabled by presetting
The following error indication is displayed if the line through pin No.7 ($\overline{\text{DATA2}}$) of the Digimatic Indicator ID, IDF or Linear Gage LG-D1 connector is set to "H" or "L".

Pin No.7

"H" → There is no pulse issued for d12 and d13 when an error is detected at d11, therefore the clock will pulse 45 times.

"L" → Clock pulses will be issued for 0.6 sec. If the line is still in the "L" state, an error indication, as shown on the right, will be displayed because the system determines that no data was entered.

Error display