NITTO KOHKI

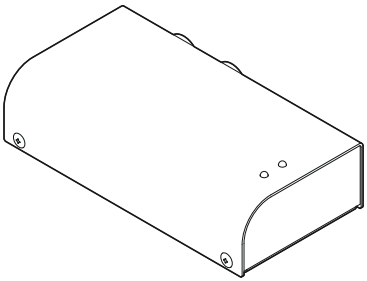
# INSTRUCTION MANUAL

Professional tool

delvo

## Screw Fastening Monitor

**Model: DTM10/DTM45**



**Indoor Use Only**

EN This instruction manual is written in English.
Instruction manuals in other languages can be downloaded from the URL below.

FR Ce manuel d'instructions est rédigé en anglais.
Les manuels d'instructions dans d'autres langues peuvent être téléchargés à partir de l'URL ci-dessous.

DE Diese Bedienungsanleitung ist auf Englisch verfasst.
Bedienungsanleitungen in anderen Sprachen können von der unten genannten URL heruntergeladen werden.

IT Il presente manuale di istruzioni è redatto in lingua inglese.
I manuali di istruzioni in altre lingue possono essere scaricati dal seguente URL.

ES Este manual de instrucciones está escrito en inglés.
En la dirección URL indicada abajo se pueden descargar los manuales de instrucciones en otros idiomas.

PT Este manual de instruções está escrito em inglês.
Pode descarregar os manuais de instruções nos outros idiomas a partir do URL indicado abaixo.

SC 本说明手册的语言是英文。
其他语言的说明手册可从以下 URL 下载。

http://www.nitto-kohki.co.jp/e/

[Specifications]

| Model | DTM10 | DTM45 |
|---|---|---|
| Communication method | RS-232C | |
| Mass (kg) | 0.26 (0.57) | 0.28 (0.62) |
| Connectable electric screwdriver/ controller models | DLV04C10L-A#[1]<br>DLV10C10L-A#[1]<br>DCC0101X-AZ | DLV45C12#[2]-A#[1]<br>DCC0241X-AZ |

#[1]: X, Y, Z  #[2]: P, L

■ Refer to p. 4 for details.

■ For operation of the electric screwdriver, refer to the instruction manual that is provided with the electric screwdriver.

- Please read the manual carefully before you attempt to use your tool so that you may use it properly and safely.
- Keep the manual handy - so you can use it whenever necessary.

• Due to continuous product development/improvement, the specifications and configurations in this document are subject to change without prior notice.

Manufactured by.
**NITTO KOHKI CO., LTD.** 9-4, Nakaikegami 2-chome, Ohta-ku, Tokyo, 146-8555, Japan
Tel : +81-3-3755-1111 Fax : +81-3-3753-8791

(Original Instructions)
TV08150-1 01/2020

## Instructions

Thank you very much for your purchase of this NITTO KOHKI product.
Before using your tool, please read this manual carefully so that you may use it properly to get the most out of it.
Please keep this manual handy - so you can use it whenever necessary.
The following safety notations are used throughout the manual to highlight safety precautions for the user and for the tool.

| | |
|---|---|
| ⚠**WARNING:** | Indicates a potentially hazardous situation which, if not avoided by following the instructions given, could result in death or serious injury. |
| ⚠**CAUTION:** | Indicates a potentially hazardous situation which, if not avoided by following the instructions given, could result in injury or material damage. |

* Please note, however, that failure to observe safety precautions under the "⚠**CAUTION**" category could result in a serious occurrence depending on the situation.
Please observe all safety precautions in the manual.

**CAUTION:** Important precautions for tool setup, operation and maintenance.

About pictograms

⚠ **WARNING:** Failure to follow the instructions for handling could cause danger when using the tool.

Using this tool improperly could result in serious injury. Read this instruction manual before using the tool.

## Contents

## Precautions on Use (Make sure to follow the instructions given)

### ⚠ WARNING

- **Be sure to check the connectable electric screwdriver with this instruction manual.**
  If the model of your electric screwdriver is not mentioned in this manual or it is not an electric screwdriver, or it is not our product, do not connect it.
  Doing so could cause a fire or accident.
- **Use the tool indoors.**
  This tool does not have dust proof or water proof structure. Exposure to dust, sand, or rain while using it outdoors could cause a failure.
- **If the tool is accidentally dropped or hit, check to ensure there is no breakage, cracking or deformation.**
  Breakage, cracking or deformation could cause electric shock or injury.
- **When the tool becomes overheated, or you notice anything abnormal during usage, switch it OFF immediately and request that the tool be repaired.**
- **Make sure that there is nothing combustible near the tool before starting work.**
  If there is anything combustible near the tool, it could cause a fire or accident.
- **There is an error difference in time measurement of the controller and screw fastening monitor because of a communication lag in DTM10.**
- **The numerical data transmitted by this tool is the converted value of motor current.**
  It is not the value of the fastening torque.
- **Control the torque properly.**
  Be sure to test more than once based on actual screw fastening conditions (screw, workpiece and other conditions). Perform the test periodically.
  **Operating Procedure**
  (1)Under actual screw fastening conditions, use the screwdriver to fasten the screw.
  (2)Using a torque wrench, etc., make sure the screw is fastened at the target torque. (Check using the loosening torque method or refastening torque method.)
  (3)If the screw is not fastened at the correct torque, adjust the torque of the electric screwdriver and fasten the screw again.
  (4)When the screw is fastened at the correct torque, use a torque checker (torque sensor) to maintain the torque of the electric screwdriver.

### About Unit Notation

This instruction manual is written using both SI units and the imperial measurement method (yards, pounds). Numeric values outside the ( ) are the value in SI units, while those inside the ( ) are the imperial measurement value.

Notation Example: Length 25.4 (1") → in / mm
Weight: 0.45 (1) → lbs / kg
Torque: 1.13 (10) → Lb·in / Nm

### About FCC/ISEDC

- NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.
  These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
  This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
  (1) this device may not cause harmful interference, and
  (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

# 1. Product Overview

## Application

This monitor is a peripheral device that transmits the numerical data of the current control type screwdriver during screw fastening to the PC and Programmable Logic Controller (PLC).
It transmits the following data to the PC or PLC by RS-232C communication.

| | |
|---|---|
| Operation channel | A unit with which fastening is performed continuously under the same conditions, such as the screw fastening torque, rotational speed, and number of fastening screws<br>● For details, refer to the instruction manual for the current control type electric screwdriver. |
| Converted current value | Motor current value at torque up converted to a value between 0 to 4095 |
| Time | Time from the start of the electric screwdriver rotation until torque up (0 to 9990 msec) |
| Rotation signal (DTM45 only) | Signal from the start of the electric screwdriver rotation until torque up (0 to 60000) |

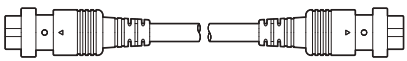
DTM45 outputs time or rotation signal. You can select to output either of the two in "Measurement method" (MEASURE) of the common settings of the controller (DCC0241X-AZ). For controller settings, check the instruction manual of DCC0241X-AZ.

## Checking inside the package

When you open the package box, check the contents of the package and also check for any damage caused by incidents during transportation.
If a problem is found, consult with your dealer where you purchased the product.

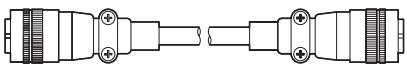
| Screw fastening monitor | DTM10 | DTM45 |
|---|---|---|
| Package content and accessories | Quantity | Quantity |
| Screw fastening monitor (main unit) | 1 | 1 |
| Connection cord | 1 | 1 |
| Rubber feet | 4 | 4 |
| Instruction Manual (this document, Japanese) | 2 | 2 |

DTM10



Connection cord LW9075 (2 m long)

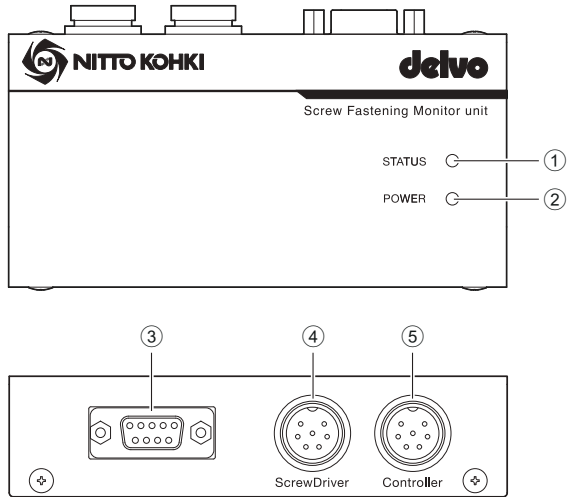
DTM45



Connection cord DLW9078 (2 m long)

Rubber feet

## Part names




| Name | Function |
|---|---|
| ① [STATUS] LED | Lights in blue when data is transmitted. |
| ② [POWER] LED | Lights in green when current is applied. |
| ③ RS-232C connector | Used for connection to the PC or sequencer with the RS-232C communication cable. |
| ④ [ScrewDriver] receptacle | Used for connection to the electric screwdriver with the connection cord. |
| ⑤ [Controller] receptacle | Used for connection to the controller with the connection cord. |

# 2. Specifications

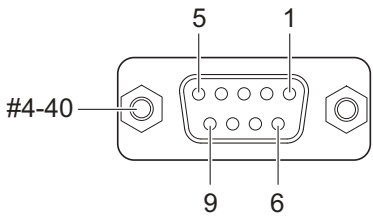
| Model | | DTM10 | DTM45 |
|---|---|---|---|
| Communication method | Transmission method | Asynchronous (asynchronous communication) | |
| | Communication line | Full duplex | |
| | Transmission speed | 38400 bps | 19200 bps |
| | Number of data | 8 bits | |
| | Parity | None | |
| | Stop bit | 1 bit | |
| | Handshake | None | |
| Voltage level | HIGH | 3 to 15 V | |
| | LOW | -15 to -3 V | |
| Mass (weight) (kg) | | 0.26 (0.57) | 0.28 (0.62) |
| External dimensions | | W 124 (4.88) × H 30 (1.18) × D 63 (2.48) | |
| Compatible models | | DLV04C10L-A#[1]<br>DLV10C10L-A#[1]<br>DCC0101X-AZ | DLV45C12#[2]-A#[1]<br>DCC0241X-AZ |

#[1]: X, Y, Z #[2]: P, L

## RS-232C connector

| | |
|---|---|
| Specifications | D-SUB 9 pin (female) |
| Screw | Inch female screw (#4-40) |

| Pin No. | Name | Input/output direction | Description |
|---|---|---|---|
| 2 | RxD | Output<br>(Signal output from the monitor) | Transmission data |
| 5 | GND | | Signal ground |




- Other pins are not used

## Transmission data

### ⚠ CAUTION

- **SUM value is the sum (including ",") of each character data from the first byte to the last byte of the transmission data.**
- **There is an error difference in time measurement of the controller and screw fastening monitor in DTM10.**

The following data is transmitted to the PC or PLC.
DTM45 outputs time or rotation signal. You can select to output either of the two in "Measurement method" (MEASURE) of the common settings of the controller (DCC0241X-AZ). For controller settings, check the instruction manual of DCC0241X-AZ.

| | |
|---|---|
| Operation channel | A unit with which fastening is performed continuously under the same conditions, such as the screw fastening torque, rotational speed, and number of fastening screws<br>● For details, refer to the instruction manual for the current control type electric screwdriver. |
| Converted current value | Motor current value at torque up converted to a value between 0 to 4095 |
| Time | Time from the start of the electric screwdriver rotation until torque up (0 to 9990 msec) |
| Rotation signal (DTM45 only) | Signal from the start of the electric screwdriver rotation until torque up (0 to 60000) |

| | |
|---|---|
| Data format | UTF-8 |
| Data length | 11 bytes minimum<br>19 bytes maximum (variable length) |
| Delimiter (separator character) | CR + LF (\r\n) |
| Output timing | When screw fastening is complete |

## Send command

| CH number (3 to 4 bytes) | | | | : | Converted current value (1 to 4 bytes) | | | |
|---|---|---|---|---|---|---|---|---|
| CHp (character data) (p = 1 to 30) | | | | | 0 to 4095 (character data) | | | |
| 0x43 | 0x48 | 0x30 to 0x39<br>Tens place*1 | 0x30 to 0x39 | 0x3a | 0x30 to 0x39<br>Thousands place*1 | 0x30 to 0x39<br>Hundreds place*1 | 0x30 to 0x39<br>Tens place*1 | 0x30 to 0x39 |

| - | Time (msec) (1 to 4 bytes) | | | | | , | SUM value (1 byte) | CR character (1 byte) | LF character (1 byte) |
|---|---|---|---|---|---|---|---|---|---|
| | 0 to 9990 (character data) | | | | | | | | |
| 0x2d | | 0x30 to 0x39<br>Thousands place*1 | 0x30 to 0x39<br>Hundreds place*1 | 0x30 to 0x39<br>Tens place*1 | 0x30 to 0x39 | 0x2c | 0x00 to 0xFF | 0x0d | 0x0a |
| | Rotation signal (1 to 5 bytes) | | | | | | | | |
| | 0 to 60000 (character data) | | | | | | | | |
| | 0x30 to 0x36<br>Ten thousands place*1 | 0x30 to 0x39<br>Thousands place*1 | 0x30 to 0x39<br>Hundreds place*1 | 0x30 to 0x39<br>Tens place*1 | 0x30 to 0x39 | | | | |

*1 Omitted if the first digit of the CH number, converted current value or rotation signal is 0. The respective places below are omitted in the following examples.
Operation channel: Tens place
Converted current value and time: Thousands place
Rotation signal: Ten thousands place

E.g.) Operation channel: 1, converted current value: 100, screw fastening time: 400 (msec)

| byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Operation channel | | | : | Converted current value | | | - | Time | | | , | SUM value | CR character | LF character |
| UTF-8 HEX | 0x43 | 0x48 | 0x31 | 0x3a | 0x31 | 0x30 | 0x30 | 0x2d | 0x34 | 0x30 | 0x30 | 0x2c, | 0x74 | 0x0d | 0x0a |
| DATA | C | H | 1 | : | 1 | 0 | 0 | - | 4 | 0 | 0 | , | t | \r | \n |

- Calculation of SUM value: 0 × 43 + 0 × 48 + 0 × 31... + 0 × 30 + 0 × 2c = 0 × 274

E.g.) Operation channel: 3, converted current value: 310, rotation signal: 3000

| byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Operation channel | | | : | Converted current value | | | - | Rotation signal | | | | , | SUM value | CR character | LF character |
| UTF-8 HEX | 0x43 | 0x48 | 0x33 | 0x3a | 0x33 | 0x31 | 0x30 | 0x2d | 0x33 | 0x30 | 0x30 | 0x30 | 0x2c | 0xa8 | 0x0d | 0x0a |
| DATA | C | H | 3 | : | 3 | 1 | 0 | - | 3 | 0 | 0 | 0 | , | | \r | \n |

- Calculation of SUM value: 0 × 43 + 0 × 48 + 0 × 31... + 0 × 30 + 0 × 2c = 0 × 2a8
- There is no corresponding character for SUM value "0xa8".

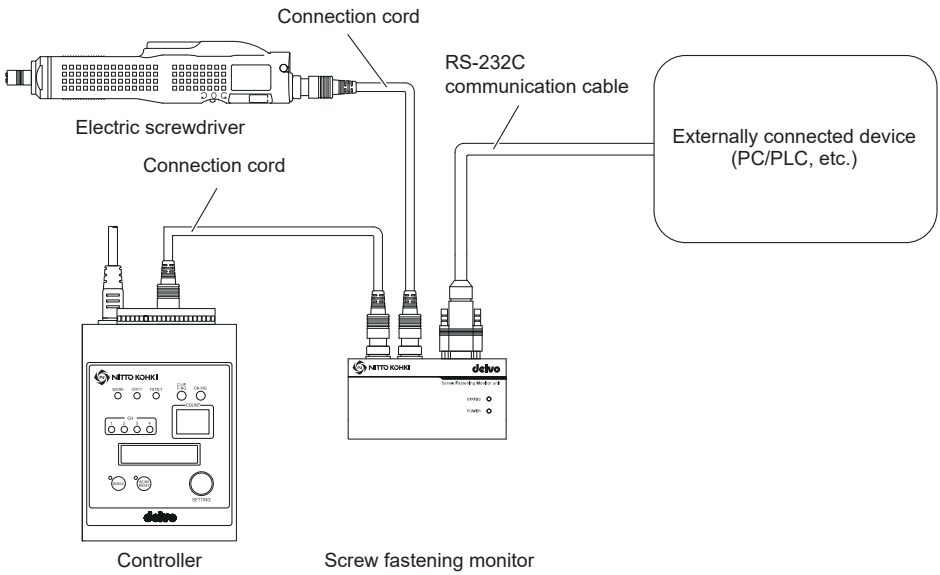
# 3. Connection Diagram

This is explained with DTM10 as an example.

## ⚠ CAUTION

- **Make sure to properly connect the connection cord.**
- **If the PC to be connected does not have an RS-232C connector, use a device that converts the D-Sub9 pin to USB, etc.**
  Nitto Kohki has confirmed connectivity with the following product. (We do not provide support.)
  BSUSRC0610BS made by BUFFALO

DTM10



# 4. How to Use

Calculate the output torque (converted value) from the numerical data (converted current value) sent by the monitor.
You can calculate the output torque (converted value) by sending the current value of the electric screwdriver motor to the PC or PLC.
To convert the converted current value to the output torque, it is necessary to calculate the torque conversion factor first.
You can calculate the output torque (converted value) from the torque conversion factor by using the following formula.

**Output torque (converted value) = Converted current value × Torque conversion factor**

Here it is explained with DTM10 as an example.

## ⚠ CAUTION

- **The calculated torque value is the output torque. It is not the fastening torque.**
  Using a torque wrench, etc., make sure the screw is fastened at the target fastening torque by the loosening torque method or refastening torque method.
- **After confirming that the screw is fastened at the target torque using a suitable method, calculate the torque conversion factor.**
- **Be sure to test more than once based on actual screw fastening conditions (screw, workpiece and other conditions).**
  Perform the test periodically.
- **When the torque or rotational speed of a current control type electric screwdriver is changed, measure the conversion factor in each case.**
  Conversion factor will be different for each setting. Measure the conversion factor several times.

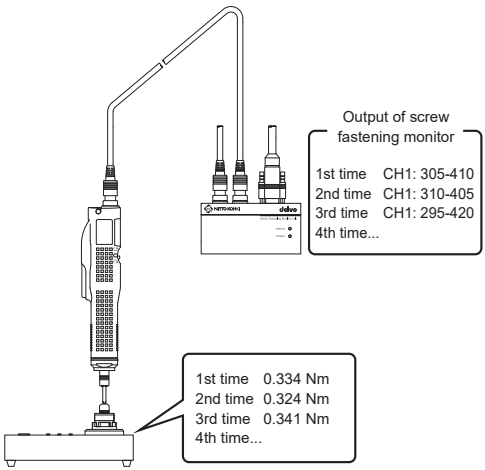
### *1* Fasten the screw with a torque checker (torque sensor) or workpiece.

Fasten the screw several times while making sure the screw is fastened at the target torque.

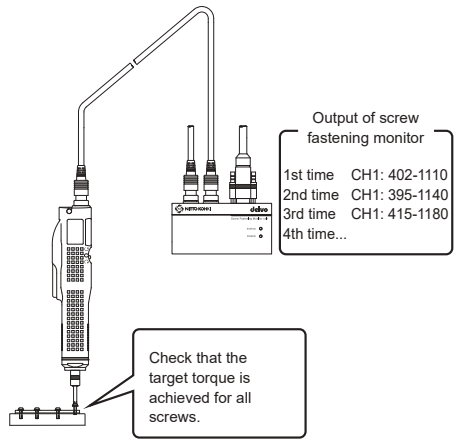
### *2* Record the converted current value.

If you are using a torque checker (torque sensor), record the fastening torque.

Torque checker (torque sensor)




Workpiece




### *3* Calculate the torque conversion factor.

$$\text{Torque conversion factor} = \frac{\text{Output torque average (target value)}}{\text{Average of converted current value of screw fastening monitor}}$$

E.g.: Calculation with a torque checker (torque sensor) (screw fastened 3 times)

$$\frac{(0.334 + 0.324 + 0.341) \div 3}{(305 + 310 + 295) \div 3} = 0.0010978022$$

(1st time, 2nd time, 3rd time: numerator; Screw fastening frequency: denominator; 0.0010978022 = Torque conversion factor)

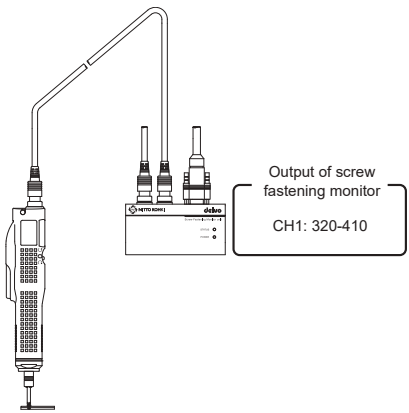
E.g.: Calculation with the target torque (target torque 1 Nm)

$$\frac{1\ \text{Nm}}{(402 + 395 + 415) \div 3} = 0.0024752475$$

(Target torque: numerator; Torque conversion factor = 0.0024752475; 1st time, 2nd time, 3rd time, Screw fastening frequency: denominator)

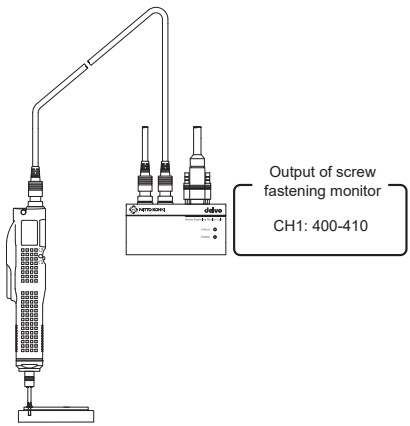
**4 Based on the torque conversion factor, calculate the output torque from the converted current value at the time of actual screw fastening.**

When calculating the conversion factor with the torque checker (torque sensor)




320 Converted current value × 0.0010978022 Torque conversion factor = 0.351 Nm Output torque

When calculating the conversion factor with the target torque




400 Converted current value × 0.0024752475 Torque conversion factor = 0.99 Nm Output torque

## Using time and rotation signal

### ⚠ CAUTION

- **Rotation signal is output only by DTM45.**
- **DTM45 outputs time or rotation signal.**
  You can select to output either of the two in "Measurement method" (MEASURE) of the common settings of the controller (DCC0241X-AZ). For controller settings, check the instruction manual of DCC0241X-AZ.

You can check whether the numerical values of time and rotation signal to be sent by the monitor are within the maximum/minimum values of screw fastening to determine that the screw is fastened correctly.

### ⚠ CAUTION

- **To fix the output numerical value, use the same operations method to perform the screw fastening.**
- **Periodically measure the time and rotation signal.**
- **The screw length or electric screwdriver speed may show individual differences. Also it changes due to the effects of heating or mechanical loss, etc.**
  Measure several times.
- **Consider the screw length tolerance, workpiece individual differences, and operations scattering while setting the electric screwdriver operation.**
  Examples of setting the time are given below. Do the same for the rotation signal. (For example -10%/+10%)
  Screw fastening time lower limit value: -10% from minimum measured value
  E.g.) Minimum measured value 0.6 s → Set the screw fastening time lower limit value to 0.54 s
  Screw fastening time upper limit value: +10% from maximum measured value
  E.g.) Maximum measured value 0.7 s → Set the screw fastening time upper limit value to 0.77 s
- **There is an error difference in time measurement of the controller and screw fastening monitor in DTM10.**

***1*** **Perform screw fastening several times using the electric screwdriver and record the maximum and minimum values of time and rotation signal sent by the monitor.**
The numerical data of time and rotation signal is sent by the monitor to a PC/PLC.
Data is not sent if stoppage occurs before torque up or at reverse rotation.
Calculate the upper and lower limit values of time and rotation signal from the minimum and maximum values.

***2*** **Check on the PC or PLC whether the time and rotation signal sent by the monitor are within the maximum/minimum values of actual screw fastening.**
In the following conditions, screw fastening is considered as not done appropriately.

| Relation between the output data from the monitor and the actual values | Causes |
|---|---|
| Lower limit value of time/rotation signal > Actual value | Short screw, refastening, screw galling, etc. |
| Upper limit value of time/rotation signal < Actual value | Long screw fastened mistakenly, etc. |

## Software for confirmation of output torque

Nitto Kohki provides a software for PCs which can be used to confirm the output torque and save history. For details, see our website.

**http://www.nitto-kohki.co.jp/e/**

# 5. Appendix

## When an abnormality has occurred (Troubleshooting)

| Symptoms | Location to investigate | Solution |
|---|---|---|
| Unable to receive data | Is there a mistake, error, or a disconnection in the RS-232C cable? | Select an appropriate cable (cross or straight) and check the connection. |
| | Is the communication setting done appropriately? | Review the communication setting on the PC or PLC. |
| The electric screwdriver does not operate | Is the connection cord connected to the proper place? | Check the connection of the connection cord. |

## Maintenance and inspection

### ⚠ WARNING

- **Always perform inspection before using the tool.**
- **Do not disassemble or alter the tool.**
- **Use genuine parts.**

### ⚠ CAUTION

- **For repair or part replacement, contact your dealer where you purchased the tool.**
  Repairing requires special knowledge and skills. If repair is performed at a place other than a specialty store, the tool may not demonstrate its full performance or it could lead to an accident or injury.
- **Request repair with the failed status kept intact.**
  When requesting a repair, do not throw away damaged parts. It could be important information for investigating the cause of the failure so do not change the status.

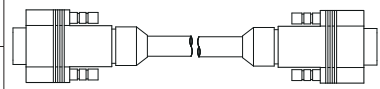
| Inspection locations | Caution |
|---|---|
| Cord | Failure to perform inspection could result in fire or electric shock.<br>● Check if the cord is damaged and if found stop using the tool.<br>● Do not store the cord by wrapping it around the main unit. If it has been stored with the cable wrapped around the main unit, immediately change the storage method. |
| Main unit | ● Check for damage, cracks or breaks on the main unit. |
| Transmission data | ● Check that the operation channel, converted current value and screw fastening time have not changed. |
| Maintenance | ● If the main unit is stained, use a cloth soaked in soapy water and wrung out well to wipe off the stains. The tool does not have a waterproof structure and if water enters inside it could fail. |

## Disposal

- Separate power tools, accessories, and packing materials for environmentally-friendly recycling.
- Do not dispose of the power tool as household garbage.
- When disposing of electric tools, hand them over to Nitto Kohki or your dealer.

## Separately-sold products

The following products are sold separately. To purchase these items, contact your dealer where you purchased your electric screwdriver.

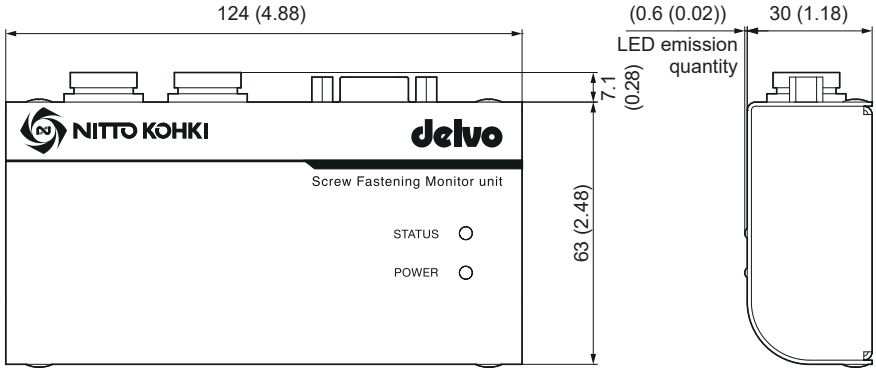
| Product name (model) | Appearance | Specifications, etc. |
|---|---|---|
| Communication cable (straight)<br>DLW9092 |  | Used for connection to PC/PLC<br>(p. 6) |
| Communication cable (cross)<br>DLW9093 | | |

## Glossary

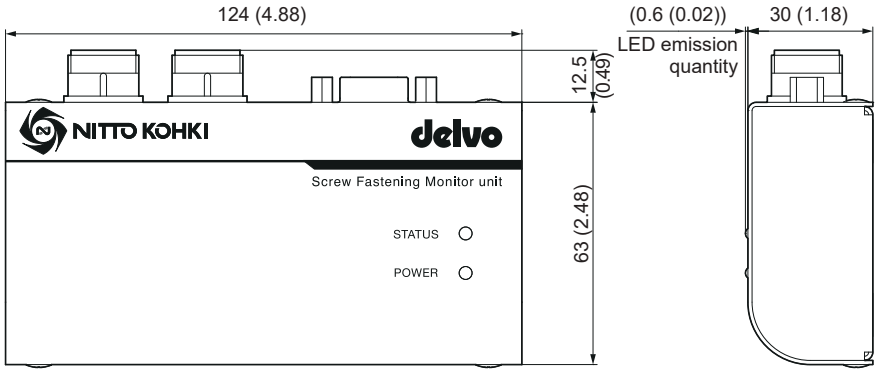
| Term | Description |
|---|---|
| C | |
| Converted current value | Motor current value at torque up (the torque reaches the set torque and the electric screwdriver stops automatically) converted to a value between 0 to 4095 |
| L | |
| Loosening torque method | Torque measurement method for measurement of torque value when the fastened screw is loosened with a torque wrench, and the screw starts rotating |
| O | |
| Operation channel | Channel during operations (while settings are valid) |
| P | |
| PLC | (Programmable Logic Controller)<br>Electronic device performing sequential control according to a program |
| R | |
| Receptacle | Connector for connecting the connection cord |
| Refastening torque method | Torque measurement method for measurement of torque value when the fastened screw is further fastened with a torque wrench and the screw starts rotating again |
| T | |
| Torque up | The torque reaches the set torque and the screwdriver stops automatically |
| Torque conversion factor | Factor for calculating the output torque (converted value) from the converted current value |
| Torque checker | Torque measuring instrument |

## External dimensions

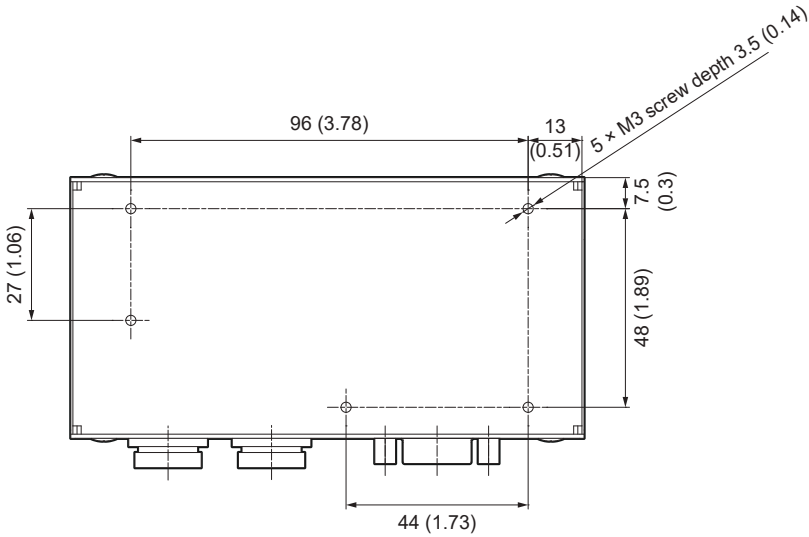
DTM10




DTM45



Back (common)



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