



Sonic Belt Tension Meter

BDTM201 Operation Manual

This manual describes operation procedure of BDTM201.
Please read this manual thoroughly before for full use of functions.

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1. Precautions

- Please read this precautions carefully. And Keep this manual safe for future reference.
- These precautions are written to defend the user to keep other people from harm, and to prevent other damages. Please pay attention to these precautions.
- These signs indicate the level of danger which can be expected by improper use.

 Danger	 Warning	 Caution
Imminently dangerous situation, such as death or severe injury	Can cause break down, injury, and electric shock	Injury or physical damages

	Things the user must NOT do.
	Things the user must do.

 Warning

	Do not make strong impact or throw. ● Can cause breakdown and fire		Do not break down or change. ● Can cause injury
	Do not use this in a flammable environment. ● Can cause an explosion or the fire when using this near propane gas or gasoline		Do not put liquids such as water or solvents on the meter. Do not use the sensor in a wet or oily environment.



Please measure the tensile force after confirming the machine has been turned off.



Please turn off the power, immediately right after you hear a thunder noise and move to a safety place.

● Can cause an electric shock



Caution



Avoid keeping at the place where much humidity, dust and high temperature are present.

● Can cause the break down



Do not use solvents (thinner and benzene, etc.) for maintenance.



Do not put on an unstable place like a sloping table.

● Can cause injury or breakdown



Even though the arm part of the flexible arm sensor (standard) is a flexible pipe, do not bend it at an acute angle. Please do not bend it close to the head of the sensor (within 20mm from the sensor), and also do not bend it at the bottom of the sensor. For a cord sensor, do not grab or twirl the sensor or cord parts strongly.



Do not leave or use this sensor in the direct sunlight or high temperature place.

2. Brief summary, caution & check points for failure

■ Brief summary

The sonic belt tension meter (BDTM201) is the handy equipment which enables to measure the tension accurately by analyzing sonic wave without touching.

A sensor catches the produced eruption of sound wave by pick the belt span. After that, the high processing computer analyzes it and shows the result on the screen digitally.

■ Check points for the immeasurable state

[Failed to measure or the results were fluctuated significantly.]

ITEM	PRESUMED	PRESUMED CAUSE	CONFIRMATION PONT
"Error" shows up or the measure mode can not be engaged or the red light on.	Nothing shows up or only measuring processing sign shows up from the third time of measurin (Frequency mode)	● "0" is entered to the unit mass, width & span ● Input the wrong frequency range ● Measured frequency exceeds 5000Hz or below 10Hz ● Battery drain	● Check the entered data (Input the correct number) ● The frequency displays, but the tension does not measure ● Change the measurement frequency range (LOW (V) ⇔ STANDARD ⇔ HIGH) ● Check whether the measurement frequency exceeds 5000Hz or not ● Battery drain
The unevenness of the output level is large.	● The measured value changes every time greatly ● The sensor responds to the background noise keenly	● The sensor attaches to a belt for a moment ● Automatic gain adjustment is not enough	● Measure again keeping enough distance so that the sensor does not attach to a belt ● Turn off a power once at the measurement place, then turn it on (Turn on a power with connected the sensor, then push "MEASURE" button after one second)

*Please inquire to us or the dealer where you purchased if the BDTM201 does not work after checking the points above.

3. Measurement principle of BDTM201

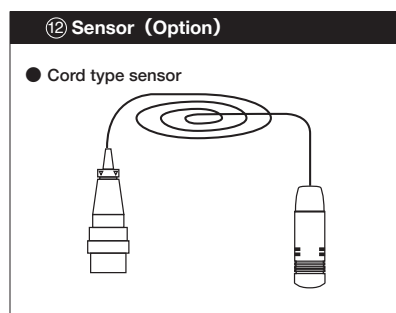
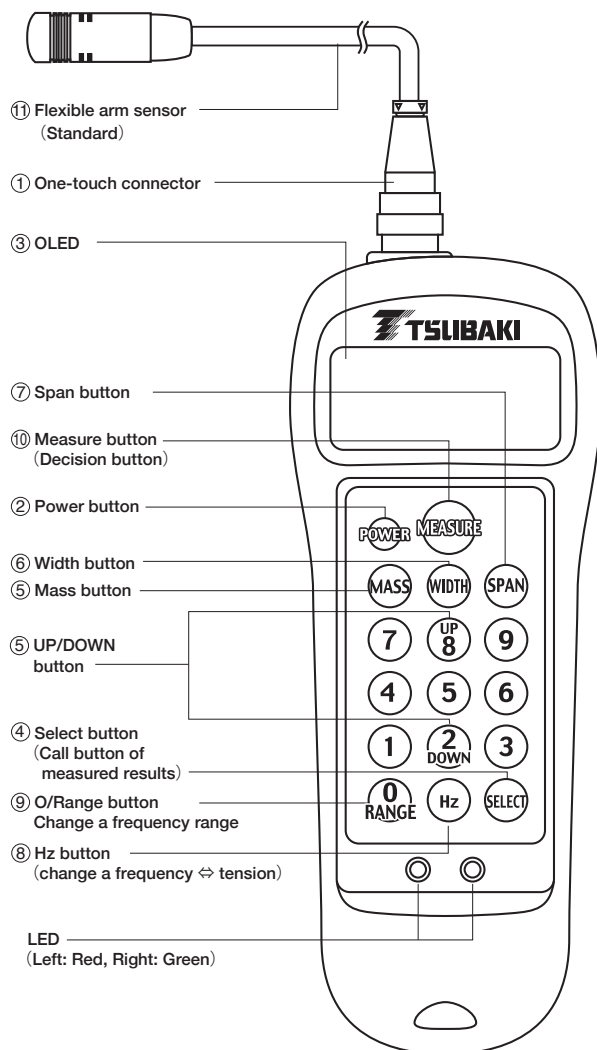
When we make an impact on a belt between belt sprockets, it starts to oscillate irregularly. The belt gradually oscillates with its inherent regular waveform, but this basic waveform will be attenuated in a short while. Though we did not have any simple devices for picking up a period of such a waveform, we can now do so fairly easily thanks to the development of unique data processing methods. A measured oscillation frequency can be converted into a belt tension with the formula on the right.

Thus, BDTM201 can display a more accurate tension by incorporating a correction factor obtained in calibration testing into data to be input, though it may display a higher tension than in actuality due to the rigidity of the belt under specific conditions.

Calculation " $T_o = 4 \times M \times W \times S^2 \times f^2 \times 10^{-9}$ "

To: Tension	(N)
M: Unit mass	(g/mm width × m length)
W: Belt width or number of ribs (wires)	(mm/R)
S: Measured span length	(mm)
f : Horizontal characteristic frequenc	(Hz)

4. Explanation of the parts of BDTM201 main body

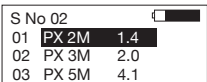


Power supply: Triple A type x 2 pieces

① One-touch connector	There is the hollow of a dent, insert a convex connector at the top. To remove a connector, slide the joint part and pull out.
② Power button	Press the power button to turn BDTM201 on. It will automatically turn off five minutes after the last measure.
③ OLED This displays tension value	● Tension numerical number is shown by three digits from 0.01 ~ 99,900. ● Frequency numerical number is shown by three digits from 10.0 ~ 5,000 Hz. ● The red light and ERROR will be shown on the screen when the result of the measure is out of the standard range. NOTE: If the standard range over occurs after the result is shown, it beeps twice until the second measure. ● A battery type signature at the time of the battery consumption is shown. LOW BATT blinks on and off when the battery is low. ● OLED will turn off after no operation for 1 minute. [Overview of OLED showing pattern] Measurement frequency level H : HIGH S : STANDARD L : LOW (V) Memory No. In measurement of belt type Note: This will be shown pre-installation. ⑤ (No 00) (PX 2M) [Battery residual quantity] TENSION 99900 N [The measured result] Unit mass belt width span indication example S No 00 [Battery residual quantity] M 999.9 g/m W 999.9 mm/R S 9999 mm

④ Select button	● [Memory of measuring condition] Press SELECT button to choose any desired input number displayed in power-on. 40 memory functions selectable from No. 0 to 39 *To pass on, press SELECT button back to back, to jump in the number, press the wished number directly on it. Please press the number continuously to call out larger than the number ten.														
⑤ MASS button	● [To show the preinstalled mass] The belt type is shown by pressing and holding the MASS button for one second or more. And choose by UP or DOWN button and push MEASURE button for confirmation. *Showing unit : g/m. *CAT(rough standard), tension and frequency won't be shown without selecting belt type. <table> <tr><td>S No 02</td><td></td></tr> <tr><td>01 PX 2M</td><td>1.4</td></tr> <tr><td>02 PX 3M</td><td>2.0</td></tr> <tr><td>03 PX 5M</td><td>4.1</td></tr> </table>	S No 02		01 PX 2M	1.4	02 PX 3M	2.0	03 PX 5M	4.1						
S No 02															
01 PX 2M	1.4														
02 PX 3M	2.0														
03 PX 5M	4.1														
⑥ WIDTH button	● Press WIDTH button for putting the width of the belt with numeric key. *Enter capacity: 000.1 - 999.9 mm/R														
⑦ SPAN button	● Press SPAN button for putting the width of the belt span numeric key.														
⑧ Hz button (switching frequency and tension)	● Press Hz button for selecting frequency or tension. *The mode changes every time this button is pressed. ● Press Hz button more than one second to show both records with tension and frequency.														
⑨ 0/RANGE button (switch frequency range)	Press 0/RANGE button more than one second to change measurement frequency range. <table border="0"> <tr> <td>HIGH...900~5000Hz</td> <td>By UP or DOWN button to choose the range, and press</td> </tr> <tr> <td>STANDARD...10~1000Hz</td> <td>MEASURE button for confirmation.</td> </tr> <tr> <td>LOW (V) ...10~50Hz</td> <td></td> </tr> </table> *Change to HIGH for measuring over 1000Hz <table> <tr><td>S No 01</td><td></td></tr> <tr><td>HIGH</td><td></td></tr> <tr><td>STANDARD</td><td></td></tr> <tr><td>LOW (V)</td><td></td></tr> </table>	HIGH...900~5000Hz	By UP or DOWN button to choose the range, and press	STANDARD...10~1000Hz	MEASURE button for confirmation.	LOW (V) ...10~50Hz		S No 01		HIGH		STANDARD		LOW (V)	
HIGH...900~5000Hz	By UP or DOWN button to choose the range, and press														
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STANDARD															
LOW (V)															
⑩ MEASURE	1.Press MEASURE button to set up auto trigger mode. *Initially is shown. *During measurement is shown. The measurement starts after receiving a signal from a sensor 2.It will start measuring after selecting belt type and press MEASURE button. 3.After changing measuring frequency range, press MEASURE button for measuring changed frequency range.														
⑪ Flexible arm sensor	This sensor has narrow path of ϕ 12.5mm and action-pipe which can set a sensor position handily. It is best used when one cannot put the main body on the floor.														
⑫ Sensor (Option)	Cord type Because the size of this sensor is a narrow path of ϕ 12.5mm, it is measurable by every places.														

5. Operation procedure of BDTM201

Procedure	Description	Operation	Display screen
1	Set up the sensor.	Choose an optimum sensor and fix in the main body with one-touch connector.	
2	Turn on power.	"POWER" button — PUSH	No ☐
3	Input No. by numerical keypad or select button. EX: Select from 00 to No.02	"SELECT"button — PUSH [Number is forwarded sequentially every time "SELECT"button is pressed. 00→0 1 →· ·→38→39 00→01→02→In addition, you can jump to any designated number by pressing a number with numeric key.] ①Selecting procedure "SELECT"button — PUSH (1st time) "SELECT"button — PUSH (2nd time) ②electing procedure "2"button — PUSH When "SELECT" button is pressed during the following procedure (during display of unit mass, belt width, span length input, and measured value), the number being chosen is displayed.	No ☐ No 00→No 01 No 01→No 02 No 00→No 02
4-1	Case of inputting a unit mass manually. EX: Put 2.5g/mm wide x meter long [See page 9 for input data.]	"MASS"button — PUSH [Input the unit mass (g/mm W x m L) in the order of blinking position on display screen by use of numeric key. If you input wrong number, press "MASS" button again to return the cursor to the first.] "0"button — PUSH "0"button — PUSH "2"button — PUSH "5"button — PUSH	M= g/m 『Allowable input capacity: 0.1~999.9g/mm×m』 M=0 g/m M=00 g/m M=002. g/m M=002.5g/m
4-2	Case of inputting the unit mass from belt type. EX: Select P5M.	● "MASS" button — PUSH (holding down more than one second) Belt type is shown on screen by pressing "MASS" button more than one second. By using "UP" or "DOWN" button to select the belt type. ● "DOWN" button — PUSH Place highlighted portion on P5M. ● "MEASURE" — PUSH PX5M is displayed on screen.	
5	Input the belt width. EX: Put 25mm. [See page 9 for input data.]	"WIDTH"button — PUSH [Do the same step as the above 4-2. When data above allowable capacity is input, the cursor returns to the first, and input of data is requested again.] "0"button — PUSH "2"button — PUSH "5"button — PUSH "0"button — PUSH	W= mm/R 『Allowable input capacity: 000.1~999.9mm』 W=0 mm/R W=02 mm/R W=025. mm/R W=025.0mm/R
6	Input the span length. [See page 9 for input date.]	"SPAN"button — PUSH [Do the same step as the above 4-1.]	S= mm 『Allowable input capacity: 0001~9999mm』

7	Start measurement.	① Get sensor in central span of the measure object without touching it. ② "MEASURE" button — PUSH: LED (green) blinks, shows . ③ To vibrate the wire, flip the belt span with a finger etc.: shows . The following measurement is performed by the sensor receiving sound without use of measure button from the second time. Since measurement is started by the sensor receiving sound, it is started as well even by a noise if it has a relatively stable sound pressure. Result is shown as well as beep sound emitted and LED (green) turns on in 0.2 second after reception of belt vibration sound.	. [After the second measurement, please notice that the screen shows the data previously measured. And you hear the beep, the new data will be displayed on the screen.]
8-1	Shows tension.	"Hz" button — PUSH [Shows frequency corresponding to the measured tension. * When "Hz" button is pressed once again, the display returns to tension mode.]	
8-2	Shows frequency after measurement of tension.	"Hz" button — PUSH [Shows frequency corresponding to the measured tension. When "Hz" button is pressed once again, the display returns to tension mode.]	

6. How to input the data

6-1. How to input the unit mass (Refer to the unit mass tables on next page)

- Synchronous belt & (Reference) Flat timing belt
To input the unit mass is width (mm) × length (m) in g/mm width × m Length.
1.Data capacity is 000.1~999.9g/mm width × m Length
2.Able to input with four significant digit figures of three columns of integers and decimal one column
- Synchronous belt from the pre-install data
Push "MASS" bottom more than one second, belt type shows up on the screen. With using "UP" or "DOWN" button to select and push "MEASURE" to set.
- (Reference) V belt, V-Ribbed belt, and Wire
Input the mass per meter of length in "g/m length" for unit mass.
Able to input by four significant digits, i.e. three digits of integer and one digit below decimal point from 000.1 up to 999.9 g/m L. Unit mass corresponds to one piece for V-belt and wire, and one rib for V-ribbed belt.

	MASS	WIDTH	SPAN
Synchronous belt Flat timing belt	g/mm W ×mL	mm	mm
V-Ribbed belt	g/Ribbed ×mL	Number of Ribbed	mm
V belt	g/one belt ×mL	1	mm
Wire	g/one belt ×mL	1	mm

6-2. How to input the belt width or the number of belts (ribs)

- Synchronous belt & (Reference) Flat timing belt
To put the date is for belt width is 000.1mm~999.9mm, three digits of integer and one digit below decimal point in mm.
- (Reference) V belt, V-Ribbed belt, and Wire
For V belt and Wire, put one piece. For V ribbed belt, put the number of ribs of V-ribbed belt.

6-3. How to in put the value of span length

Span length is a distance between contacts with belt sprocket, and can be calculated by the following calculating formula.

Alternatively, measure the distance between belt sprocket contacts with a tape measure and put.

$$L = \sqrt{C^2 - \frac{(Dp - dp)^2}{4}}$$

L : Span length (mm)

C : Distance between axes (mm)

Dp : Large belt sprocket pitch outer diameter (mm)

dp : Small belt sprocket pitch outer diameter (mm)

7. Unit mass table of the preinstalled belt

■Table1: Unit mass list of synchronous belts

Refer to the explanation of "MASS" button at page 6.

Unit mass : g/mm width×m length

PX Belt		PX Belt RC type		PX Belt water proof type		Ultra PX belt HC type		Ultra PX belt oil proof		Ultra PX belt HY type	
Type	Unit mass	Type	Unit mass	Type	Unit mass	Type	Unit mass	Type	Unit mass	Type	Unit mass
PX 2M	1.4	RC 2M	1.4	W 5M	3.5	HC 3M	2.2	HA 5M	3.4	HY 3M	2.6
PX 3M	2.0	RC 3M	2.0	W 8M	5.6	HC 5M	4.1	HA 8M	4.7	HY 5M	3.5
PX 5M	4.1	RC 5M	3.8			HC 8M	5.1	HA 14M	7.9	HY 8M	4.5
PX 8M	5.6	RC 8M	5.1			HC 14M	8.4			HY 14M	8.1
PX 14M	9.8	RC 14M	8.6								

8. Unit mass table of TSUBAKI synchronous belt

■Table2: For BDTM201 unit mass table

Data of unit mass can be input by four significant digits, i.e. three digits of integer and one digit below decimal point in g/mm W x m L from 0.1 to 999.9 g/mm W x m L.

① PX Belt

Type	P2M	P3M	P5M	P8M	P14M
Pitch (mm)	2.000	3.000	5.000	8.000	14.000
Unit mass (g/mm width×m length)	1.4	2.0	4.1	5.6	9.8

② PX Belt RC type

Type	P2M-RC	P3M-RC	P5M-RC	P8M-RC	P14M-RC
Pitch (mm)	2.000	3.000	5.000	8.000	14.000
Unit mass (g/mm width×m length)	1.4	2.0	3.8	5.1	8.6

③ PX Belt water proof type

Type	P5M-W	P8M-W
Pitch (mm)	5.000	8.000
Unit mass (g/mm width×m length)	3.5	5.6

④ Ultra PX belt HC type

Type	UP3M-HC	UP5M-HC	UP8M-HC	UP14M-HC
Pitch (mm)	3.000	5.000	8.000	14.000
Unit mass (g/mm width×m length)	2.2	4.1	5.1	8.4

⑤ Ultra PX belt oil proof type

Type	UP5M-HA	UP8M-HA	UP14M-HA
Pitch (mm)	5.000	8.000	14.000
Unit mass (g/mm width×m length)	3.4	4.7	7.9

⑥ Ultra PX belt HY type

Type	UP3M-HY	UP5M-HY	UP8M-HY	UP14M-HY
Pitch (mm)	3.000	5.000	8.000	14.000
Unit mass (g/mm width×m length)	2.6	3.5	4.5	8.1

Note: These unit masses are different from those used in BDTM101 (kg/m).

9.The installation tension table of TSUBAKI synchronous belts

① PX belt

Unit : N

Type	P2M			P3M			P5M				P8M					P14M				
Belt width mm	4	6	10	6	10	15	10	15	20	25	15	20	25	40	60	40	60	80	100	120
Recommended	5.9	9.4	17	20	36	57	108	171	238	307	225	311	403	686	1091	990	1564	2178	2812	3455
Max.	7.8	12	22	26	47	74	147	232	323	418	294	406	526	897	1426	1310	2070	2882	3720	4572

② PX belt RC type

Unit : N

Type	P2M-RC			P3M-RC			P5M-RC				P8M-RC					P14M-RC				
Belt width mm	4	6	10	6	10	15	10	15	20	25	15	20	25	40	60	40	60	80	100	120
Recommended	5.9	9.4	17	20	36	57	97	154	214	276	203	280	363	617	982	990	1564	2178	2812	3455
Max.	7.8	12	22	26	47	74	132	209	291	376	265	365	473	807	1283	1310	2070	2882	3720	4572

③ PX belt water proof type

Unit : N

Type	P5M-W			P8M-W			
Belt width mm	10	15	25	15	25	40	60
Recommended	108	171	307	225	403	686	1091
Max.	147	232	418	294	526	897	1426

④ Ultra PX belt HC type

Unit : N

Type	UP3M-HC			UP5M-HC				UP8M-HC					UP14M-HC				
Belt width mm	6	10	15	10	15	20	25	15	20	25	40	60	40	60	80	100	120
Recommended	29	52	82	108	171	238	307	177	244	317	540	859	794	1255	1747	2255	2771
Max.	40	72	114	147	232	323	418	235	324	421	717	1140	1050	1659	2310	2982	3665

⑤ Ultra PX belt oil proof type

Unit : N

Type	UP5M-HA				UP8M-HA					UP14M-HA				
Belt width mm	10	15	20	25	15	20	25	40	60	40	60	80	100	120
Recommended	108	171	238	307	177	244	317	540	859	794	1255	1747	2255	2771
Max.	147	232	323	418	235	324	421	717	1140	1050	1659	2310	2982	3665

⑥ Ultra PX belt HY type

Unit : N

Type	UP3M-HY			UP5M-HY				UP8M-HY					UP14M-HY				
Belt width mm	6	10	15	10	15	20	25	15	20	25	40	60	40	60	80	100	120
Recommended	39	68	105	125	194	265	338	255	347	444	740	1150	1020	1581	2162	2754	3366
Max.	47	82	127	165	256	350	446	290	394	505	841	1308	1225	1899	2597	3308	4043

About the installation tension level of our synchronous belt, the gap will not occur between BDTM201 measurement and true tension in the range of Note1 and Note2. So it is not necessary to set a tension compensating rate.

Note1) As for the measuring installation tension, set the belt on the machine first and measure the average tension of stretch and loose side of the belt after spinning several times to make the machine run smoothly. If both spans have the difference of more than 30%, please adjust them and measure again.

Note2) Measure with a span having the length more than 20 times the tooth pitch.

(Because a higher value than actual is showed at the short range to be affected by the rigidity of the belt itself.)

As for experienced machines install the belt following the procedure provided for a corresponding machine, it is capable of managing tension by setting cycle numerical value which approved by BDTM201 afterward.

10. Specification of BDTM201

■ Main Body

- Power Supply: Two triple A batteries. Alkaline battery is recommended.
- Overall Size: 160 (H) × 59 (W) × 26 (D)
- Mass: 120g
- Temperature and humidity range for use and storage: -10~-50°C, 80% (free from condensation)

■ Accessories

● BDTM201

- 1) Flexible type sensor
 - Sensor outer diameter: 12.5mm
 - Total length: 170mm
 - Measurable frequency band: 10Hz~5000Hz
- 2) Soft case for carrying
 - Capable of containing the body of tension meter, flexible type sensor etc.
- 3) Two triple A batteries
- 4) Operation manual of BDTM201
- 5) Operating procedure sheet for carrying
- 6) Inspection acceptance certificate
- 7) Warranty

● Option

Cord type sensor

- Sensor outer diameter: 12.5mm
- Total length: 1m
- Measurable frequency band: 10Hz~5000Hz

11. Guarantee & Repair Guidelines

Thank you for choosing our sonic tension meter (BDTM201).

We guarantee for one year for the main body and six months for the sensor.

If our sonic tension meter (BDTM201) fails due to a manufacturing or workmanship defect during the period, we repair it free of charge.

Please contact our distributor from which you purchased for the repair.

(See the enclosed warranty.)

When the official approval is required, direct the sensor to a communicator which emits stable frequency sound from 10 to 5000 Hz, and measure the same way as measuring tension. The calibration is enabled easily.

In addition, we will calibrate your device for a fee, so please contact us or our sales agents if needed.



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