Continuously Evolving TAWERS!
The Arc Welding Robot System
TAWERS

NEW

Panasonic BUSINESS

6 Axis Articulated Arc Welding Robots TAWERS Series
January 2018
Robot Systems with Integrated Welding Power Source Technology

**Torch type selectable to fit your application!**

**TM series**

- **Separate Type**
  - Superior wire feedability and reduced cable interference
- **Through-Arm Type**
  - Focused on reducing cable interference
- **External Type**
  - Focused on wire feedability

**Space saving & high payload!**

**TS series**

- **TS-950**
  - External Type
  - Through-Arm Type

**WGIII/WGHIII**

- **Payload**
  - 8 kg

**Long-arm & high payload!**

**TL series**

- **External Type**

**Manipulator Lineup (as of January 2018)**

<table>
<thead>
<tr>
<th></th>
<th>TS series</th>
<th>TM series</th>
<th>TL series</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>800 950</td>
<td>1100 1400</td>
<td>1800 2000</td>
</tr>
<tr>
<td><strong>Separate</strong></td>
<td>– –</td>
<td>○ ○ ○ ○</td>
<td>– –</td>
</tr>
<tr>
<td><strong>Through-Arm</strong></td>
<td>○ ○ ○ ○</td>
<td>○ ○ ○ ○</td>
<td>– –</td>
</tr>
<tr>
<td><strong>External</strong></td>
<td>○ ○ ○ –</td>
<td>– – – ○</td>
<td>○ ○</td>
</tr>
<tr>
<td><strong>Payload</strong></td>
<td>8 kg</td>
<td>6 kg</td>
<td>6 kg</td>
</tr>
</tbody>
</table>

Rated Welding Output:

- **WGIII**: 350 A @ 80 % duty cycle (CV), 350 A @ 60 % duty cycle (pulse).
- **WGIII**: 450 A @ 100 % duty cycle (CV/pulse)
A variety of features specialized for arc welding

**Feature 1 (TM/TL) Enhanced Basic Performance**

**Increased Motion Speed**
TM-1400: Speed of main 3 axes increased by 22% on average.
(approx. 42% more than TA type)

**Extended Reach**
TM-1400: 1437 mm (63 mm more than TA type)

**Feature 2 (TS/TMD) Arm Specialized for Welding**

**Cantilever Structure**
makes arm compact and improves accessibility to workpieces.

In addition to Through-Arm Type and External Type, an additional choice—Separate Type (TM series)

Revolutionary new type of arc welding robot with advantages of both Through-Arm Type and External Type.

**Feature 1** **External Flexible Conduit**

[Conventional Type]

Torch cable

R=small

[Separate Type]

Flexible conduit

R=large

Torch cable

**Feature 2** **Through-Arm Power Cable**

[Conventional Type]

Power cable interference can occur depending on the welding position.

[Separate Type]

Through-arm power cable reduces cable interference.

**Feature 3 (TM/TL) Structure Specialized for Welding**

**Clean Cable Management!**

[Option] Internal Flexible Conduit (for wire feed)**

Manipulator-Controller cable (control)

Manipulator-Controller cable (motor power)

Welding power cable

Gas hose (with valve)

**For use with drum packing wire only.**

An example of circumferential welding

**High Wire Feedability**

Less Cable Interference

**Suppresses twist of wire!**

Reduces target position error at weld start and end points!

New type welding robot achieves even higher quality welds.
"Weld Navigation" allows easy parameter setting (Standard)

Easy setting with Teach Pendant

Note: Screens are subject to change without notice.

Rich welding parameter database developed through our long experience

"Weld Navigation" reduces parameter setting time.

Notes:  "Parameters by Weld Navigation are guideline only and do not guarantee welding result.
Consult us for material and processes available with Weld Navigation.

Two Easy Steps:
1. Select weld joint. The figure changes according to the joint.
2. Select plate thicknesses. That’s all!

The right parameters automatically
Leg length and weld speed are also adjustable.
Weld Navigation recalculates weld current and voltage according to the changes.

WGIII controller with high performance

• Compared to the conventional model, 6 times faster main CPU and 4 times more memory capacity reduce start-up time by 50% to about 30 seconds.

Improved maintainability

• Swivel rack in the case makes maintenance easy and saves space.
• Cables with connectors on both ends reduce Cable exchange time.
**TAWERS Technology—Various Welding Processes**

- **SP-MAG II** for short-circuit mixed gas welding on thin plates
- **HD-Pulse** for high-speed and low-spatter in high-current pulsed mixed gas welding
- **MTS-CO₂** for CO₂ welding

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**TAWERS Welding Process Guide**

### MAG welding

- **Super Active MAG**
- **Active MAG**
- **SP-MAG II**
- **HD-Pulse**
- **Normal-Pulse**

#### candle:
- **SP-MAG II**
  - Secondary switching and SP-HS control achieve stable arc and low spatter welding.
- **HD-Pulse**
  - Short-circuit transfer (1 pulse-1 dip) minimizes undercuts in high speed welding.
- **Normal-Pulse**
  - Droplet transfer (1 pulse-1 drop) achieves low spatter.

#### notes:
- **Note:** 1.2 mm mild steel wire used for this guide.
- **Weld speed (cm/min)**
- **Weld current (A)**
- **Short-circuit transfer range (Dip transfer range)**

### CO₂ welding

- **Super Active CO₂**
- **Active CO₂**
- **MTS-CO₂**
- **Normal CO₂**

#### candle:
- **MTS-CO₂**
  - MTS control added to SP-MAG technology reduces spatter of CO₂ welding.

#### notes:
- **Note:** 1.2 mm mild steel wire used for this guide.
- **Weld speed (cm/min)**
- **Weld current (A)**

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**APPLICATION TYPE**

**Super Active Wire Feed Process**

Achieves even lower spatter with high-precision control of wire feed speed.

**Super Active MAG**

**Super Active CO₂**

See the page of "Super Active TAWERS" for details.
**SP-MAG II**

(Super-imposition Control)

Greatly reduces spatter in mixed gas (MAG) welding on thin plates

Welding waveform control achieves low spatter in short-circuit transfer range.

- **Spatter comparison (1 minute at 200 A)**
  - Conventional welder (350GB2)
  - TAWERS (SP-MAG II)

![Spatter reduction](image)

**SP-MAG II current waveform**

1. **Initial short-circuit control**
   - Detects initial short-circuit and then the secondary switching* circuit reduces weld current rapidly to prevent micro-short circuit that causes spatter.

2. **Neck control**
   - Detects a neck of the droplet and then the secondary switching* circuit reduces weld current rapidly to prevent fuse effect that causes spatter.

3. **HS control**
   - Suppresses weld pool oscillation and prevents micro-short circuit that causes spatter.

4. **SP control**
   - Superimposes the current immediately after a short-circuit release and allows for higher wire-melting speed. This makes the next short circuit smooth and also makes the short-circuit cycle shorter.

*Secondary switching is the spatter reduction process that rapidly reduces weld current immediately before and after shot-circuit and allows for smooth transitions between arc and short circuit.

**MTS-CO₂**

(Metal Transfer Stabilization Control)

Reduces spatter by up to 75% using inexpensive CO₂ gas

MTS control added to SP-MAG technology reduces spatter of CO₂ welding.

![MTS-CO₂](image)

**CO₂ welding delivers uniform pan-bottom shaped penetration.**

- **Penetration comparison**
  - 0.9 mm Conventional CO₂
  - 0.9 mm MTS-CO₂

- **Joint**: Fillet  • **Base metal**: 2.3 mm mild steel SPCC  • **Weld current**: 120 A  • **Weld speed**: 0.3 m/min  • **Wire**: YGW12 (1.2 mm)  • **Shielding gas**: CO₂
**HD-Pulse**

(－Hyper Dip-Pulse Control)

**Achieves high-speed pulsed welding**

Short and narrow arc prevents undercuts during high-speed welding.

**HD-Pulse advantages:**

- Preventing undercuts during high speed welding.
- Dip (Short circuit) transfer enabling lower heat input with better gap handling capability.
- Precisely controlled dip timing reducing spatter.

**High speed welding**

- **HD Pulse**
  - Gap: 0.4 mm
  - Undercut

- **Normal Pulse**
  - Gap: 1.5 mm
  - Undercut

- Base metal thickness: 2.3 mm  
- Weld current: 300 A  
- Weld speed: 1.1 m/min

**Preventing undercuts with ideal penetration!**

**Type of the droplet transfer**

- **HD Pulse**
  - 1 dip by 1 pulse (Short-circuit transfer)
  - Short
  - Narrow
  - Concentrated arc

- **Normal Pulse**
  - 1 drop by 1 pulse (Drop transfer)
  - Long
  - Wide
  - Drop

**Spray transfer range: 280 A or more**

<table>
<thead>
<tr>
<th>Weld process</th>
<th>SP-MAG II</th>
<th>Normal-Pulse</th>
<th>HD-Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weld speed</td>
<td>good</td>
<td>good</td>
<td>excellent</td>
</tr>
<tr>
<td>Spatter</td>
<td>good-fair</td>
<td>excellent</td>
<td>good</td>
</tr>
<tr>
<td>Penetration pattern</td>
<td>fair</td>
<td>good-fair</td>
<td>excellent</td>
</tr>
<tr>
<td>Undercut</td>
<td>fair</td>
<td>fair</td>
<td>good</td>
</tr>
<tr>
<td>Heat input</td>
<td>fair</td>
<td>fair</td>
<td>good</td>
</tr>
<tr>
<td>Gap handling</td>
<td>fair</td>
<td>fair</td>
<td>good</td>
</tr>
<tr>
<td>Overall</td>
<td>fair</td>
<td>fair</td>
<td>excellent</td>
</tr>
</tbody>
</table>

- **SP-MAG II disadvantage:**
  - Spatter in high-current range.
- **Normal-pulse disadvantage:**
  - Undercuts in high-speed welding.

**HD-Pulse process is ideal for high-current and high-speed welding.**
External Communication (Ethernet)
Production and Quality Control on LAN
The LAN connection allows you to share welding data with other robots and improve production and quality control.

Flying Start
Executes arc-on/off programs a little before the torch reaches the weld start/end point to reduce cycle times.

Standard Arc Start
Weld start point → Wire feed start → Arc start

Flying Start
Wire feed start → Weld start point → Arc start

Cycle Time Reduction
Arc is struck the moment torch reaches weld start point.

Wire Auto Retract
As the robot moves to weld start points, the wire is retracted automatically; thereby, improving arc start.

End of a weld → Wire retraction → Next weld point

Moving toward next weld point → Moving toward next weld point

Wire Stick Auto Release (for CO₂/MAG)
Automatically detects a wire stuck at the end of a weld and re-ignites the arc to release the wire.

Pitch Movement ("Jog settings")
This function enables robot movement at a pre-set distance by every click of the jog dial. This is useful when working in narrow, constricted spaces or in fine-tuning robot position.

Lift Start / Lift End
Quality Weld Starts and Ends, Spatter and Cycle Time Reduction.
The robot lifts up the welding torch quickly at the start and end of the weld. By coordinating the robot motion with the welding waveform and wire feed control, quality and cycle time are improved. (Much quicker than wire retraction.)

Lift Start
Contact → Lifting up

Lift End
Lifting up → Cycle time reduction

Arc Start Retry (for CO₂/MAG)
Detecting a failure of arc start, the robot automatically starts arc ignition again.

Torch Angle Display (Teach Pendant)
Torch angle is displayed on the screen, making it possible to reduce teaching time and obtain consistent bead appearance.

Program Test
In Teach mode, operator can safely verify taught program including welding without switching to Auto mode.
Weld Data Management

Big progress toward ideal production and quality control. Samples weld data with a interval of up to 50 micro seconds, allowing high-precision monitoring and status/error output. The data can be stored and used for quality control.

- **Weld Monitor**
  - Standard
  - Monitors data such as weld current, voltage and wire feed speed constantly and warns when abnormality is detected.

- **Weld Data Management**
  - Optional Software
  - • Weld Monitoring (Expanded function)
    - Up to 50 weld monitoring conditions can be defined.
  - • Weld Data Logging/Recording
    - Data such as weld current, voltage and wire feed speed can be logged according to the preset triggers. The log data can be graphed on the teach pendant and recorded on SD memory card.

- **Welding Data Log**
  - Optional Software
  - Logs data of weld sections. The log data can be saved for analysis.

More advanced welding system available

- **Auto Extension Control**
  - Optional Software
  - Compensates heat distortion or teaching error of odd-shaped work.
  - Robots detects changes in wire extension and compensates automatically.

- **Synchronous Weaving Low Pulse (Spiral Weaving Included)**
  - • Synchronizes weld current, wire feed speed and weaving completely.
  - • Alternates condition A/B during weaving, which is ideal for welding of different thickness plates. (One for thin plate, the other for thick plate)

- **Cooperative Multi-Robot Control**
  - Allows cooperative control between two robots.
**Small Type Arc Welding Robots**

**TS Series**

**NEW**

**Payload: 8 kg**

**TS-800/950**

**Dimensions & Work Envelope**

For working envelope of point O, consult us.

(Unit: mm)

**Short Type**

**TS-800**

**TS-950**

**Manipulator General Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>TS-800</th>
<th>TS-950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Short arm</td>
<td>Short arm</td>
</tr>
<tr>
<td>Structure</td>
<td>6 axis articulated</td>
<td>Short arm</td>
</tr>
<tr>
<td>Payload</td>
<td>8 kg</td>
<td>8 kg</td>
</tr>
<tr>
<td>Maximum Reach</td>
<td>841 mm</td>
<td>971 mm</td>
</tr>
<tr>
<td>Minimum Reach</td>
<td>159 mm</td>
<td>190 mm</td>
</tr>
<tr>
<td>Working Range</td>
<td>682 mm</td>
<td>781 mm</td>
</tr>
<tr>
<td>Max. Motion Speed</td>
<td>RT (Rotating Trunk): 326°/s</td>
<td>RW (Rotating Wrist): 518°/s</td>
</tr>
<tr>
<td></td>
<td>UA (Upper Arm): 326°/s</td>
<td>TW (Twisting Wrist): 1,040°/s</td>
</tr>
<tr>
<td></td>
<td>FA (Forearm): 510°/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BW (Bending Wrist): 518°/s</td>
<td></td>
</tr>
<tr>
<td>Position Repeatability</td>
<td>±0.05 mm</td>
<td></td>
</tr>
<tr>
<td>Motor</td>
<td>Total Power: 2,100 W</td>
<td>All axes</td>
</tr>
<tr>
<td>Mounting</td>
<td>Floor/Ceiling<em>1/Wall</em>2</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>55 kg</td>
<td>56 kg</td>
</tr>
</tbody>
</table>

*1: Ceiling mount type is factory optional.
*2: Setting by service personnel is necessary. *Working range of RT axis is limited.
### Dimensions & Work Envelope

- **Short Type**
  - **TM-1100**

- **Standard Type**
  - **TM-1400**

- **Middle Type**
  - **TM-1600**

- **Long Type**
  - **TM-1800**

#### Manipulator General Specifications

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Type</td>
<td>Short arm</td>
<td>Standard arm</td>
<td>Middle arm</td>
<td>Long arm</td>
<td>Long arm</td>
<td>Long arm</td>
<td>Long arm</td>
</tr>
<tr>
<td>Structure</td>
<td></td>
<td></td>
<td></td>
<td>6 axis articulated</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Payload</td>
<td>6 kg</td>
<td>4 kg</td>
<td>6 kg</td>
<td>8 kg</td>
<td>8 kg</td>
<td>6 kg</td>
<td>6 kg</td>
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<tr>
<td>Maximum Reach</td>
<td>1163 mm</td>
<td>1437 mm</td>
<td>1639 mm</td>
<td>1809 mm</td>
<td>2011 mm</td>
<td>1801 mm</td>
<td>1999 mm</td>
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<tr>
<td>Minimum Reach</td>
<td>418 mm</td>
<td>404 mm</td>
<td>513 mm</td>
<td>430 mm</td>
<td>550 mm</td>
<td>383 mm</td>
<td>491 mm</td>
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<tr>
<td>Working Range</td>
<td>745 mm</td>
<td>1033 mm</td>
<td>1126 mm</td>
<td>1379 mm</td>
<td>1461 mm</td>
<td>1418 mm</td>
<td>1508 mm</td>
</tr>
<tr>
<td>Max Speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT (Rotating trunk)</td>
<td>225°/s</td>
<td>210°/s</td>
<td>195°/s</td>
<td>195°/s</td>
<td>197°/s</td>
<td>197°/s</td>
<td>197°/s</td>
</tr>
<tr>
<td>UA (Upper arm)</td>
<td>225°/s</td>
<td>210°/s</td>
<td>195°/s</td>
<td>197°/s</td>
<td>197°/s</td>
<td>197°/s</td>
<td>197°/s</td>
</tr>
<tr>
<td>FA (Forearm)</td>
<td>225°/s</td>
<td>215°/s</td>
<td>205°/s</td>
<td>205°/s</td>
<td>205°/s</td>
<td>205°/s</td>
<td>205°/s</td>
</tr>
<tr>
<td>RW (Rotating wrist)</td>
<td>425°/s</td>
<td>425°/s</td>
<td>425°/s</td>
<td>425°/s</td>
<td>385°/s</td>
<td>385°/s</td>
<td>385°/s</td>
</tr>
<tr>
<td>BW (Bending wrist)</td>
<td>425°/s</td>
<td>425°/s</td>
<td>425°/s</td>
<td>425°/s</td>
<td>375°/s</td>
<td>375°/s</td>
<td>375°/s</td>
</tr>
<tr>
<td>TW (Twisting wrist)</td>
<td>629°/s</td>
<td>629°/s</td>
<td>629°/s</td>
<td>629°/s</td>
<td>624°/s</td>
<td>624°/s</td>
<td>624°/s</td>
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<tr>
<td>Position Repeatability</td>
<td>±0.08 mm</td>
<td>±0.10 mm</td>
<td>±0.08 mm</td>
<td>±0.15 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Power</td>
<td>3 400 W</td>
<td>4 700 W</td>
<td>5 050 W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brakes</td>
<td>All axes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>Floor / Ceiling*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>156 kg</td>
<td>170 kg</td>
<td>180 kg</td>
<td>215 kg</td>
<td>217 kg</td>
<td>215 kg</td>
<td>216 kg</td>
</tr>
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*Ceiling mount type is factory optional.
Dimensions & Work Envelope

Long Type
TM-2000

Long Type
TL-1800

Long Type
TL-2000

Controller / Welder Technical Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>WGIII</th>
<th>WGHIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions*</td>
<td>W 553 mm x D 550 mm x H 1181 mm</td>
<td>W 553 mm x D 550 mm x H 1407 mm</td>
</tr>
<tr>
<td>Weight**</td>
<td>135 kg</td>
<td>171 kg</td>
</tr>
<tr>
<td>Memory Capacity</td>
<td>40 000 points</td>
<td>171 kg</td>
</tr>
<tr>
<td>Position Control</td>
<td>Software servo control</td>
<td></td>
</tr>
<tr>
<td>External Memory</td>
<td>Teach Pendant: one SD memory card slot, two USB 2.0 ports (USB 2.0: Hi-Speed not supported)</td>
<td></td>
</tr>
<tr>
<td>Control Axes</td>
<td>6 axes simultaneously (Max. 27 axes)</td>
<td></td>
</tr>
<tr>
<td>Input and Output</td>
<td>Input: 40 points (Optionally expandable up to 2048 points) Output: 40 points (Optionally expandable up to 2048 points)</td>
<td></td>
</tr>
<tr>
<td>Input Power</td>
<td>3 phase, 200 V AC±20 V AC, 22 kVA, 50/60 Hz</td>
<td>3 phase, 200 V AC±20 V AC, 30.5 kVA, 50/60 Hz</td>
</tr>
<tr>
<td>Welding Process</td>
<td>CO₂ / MAG / Stainless steel MIG / Pulse MAG / Stainless pulse MIG</td>
<td></td>
</tr>
<tr>
<td>Output Current Range</td>
<td>30 to 350 A DC</td>
<td>30 to 450 A DC</td>
</tr>
<tr>
<td>Output Voltage Range</td>
<td>12 to 36 V DC</td>
<td>12 to 42 V DC</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>CV: 80 % @ 350 A Pulse: 60 % @ 350 A</td>
<td>100 %</td>
</tr>
</tbody>
</table>

Teach Pendant

Controller (with power unit)

Note: For details on the power connection, refer to “Connecting primary power source” in the arc welding robot controller manual.
Great material handling capability!

Coordinated multi-robot movement for flexible system without jig.

- **Coordinated movement with WGIII/GIII robot(s)**
  Allows to build flexible system without jig.
  Maximum configuration:
  - Arc welding robot x 2
  - Large robot x 1

- **GIII controller for large robots**
  Same operation, maintenance and options as conventional robots

### Manipulator General Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>YS-080GIII</th>
<th>HS-220GIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>6 axis articulated robot</td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>80 kg</td>
<td>220 kg</td>
</tr>
<tr>
<td>Working Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT (Rotating trunk)</td>
<td>±180°</td>
<td>±178°</td>
</tr>
<tr>
<td>UA (Upper arm)</td>
<td>-80° ~ +155°</td>
<td>-65° ~ +80°</td>
</tr>
<tr>
<td>FA (Forearm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RW (Rotating wrist)</td>
<td>±360°</td>
<td>±360°</td>
</tr>
<tr>
<td>BW (Bending wrist)</td>
<td>±125°</td>
<td>±125°</td>
</tr>
<tr>
<td>TW (Twisting wrist)</td>
<td>±360°</td>
<td>±360°</td>
</tr>
<tr>
<td>Max Motion Speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT (Rotating trunk)</td>
<td>170°/s</td>
<td>120°/s</td>
</tr>
<tr>
<td>UA (Upper arm)</td>
<td>140°/s</td>
<td>105°/s</td>
</tr>
<tr>
<td>FA (Forearm)</td>
<td>160°/s</td>
<td>110°/s</td>
</tr>
<tr>
<td>RW (Rotating wrist)</td>
<td>230°/s</td>
<td>145°/s</td>
</tr>
<tr>
<td>BW (Bending wrist)</td>
<td>230°/s</td>
<td>145°/s</td>
</tr>
<tr>
<td>TW (Twisting wrist)</td>
<td>350°/s</td>
<td>220°/s</td>
</tr>
<tr>
<td>Position Repeatability</td>
<td>±0.15 mm</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>645 kg</td>
<td>955 kg</td>
</tr>
</tbody>
</table>