POWER GAP

Applications for Power Gap Systems

Inductive Power Supply & Signal Transmissions

www.trelectronic.com/powergap
Ideal Applications for Power Gap

Power Gap can provide a unique solution for problems with motion applications.

- **Cable**
  - Stress damage
  - Limitation of physical movement
  - Additional space requirements

- **Connector**
  - Wear and tear (maintenance is necessary)
  - Human error when connecting
  - Protection requirement for exposed connectors

- **Slip Ring**
  - Limited life cycle (maintenance is necessary)
  - Vulnerable to dust and liquids
  - Increased size of rotary mechanism

Power Gap can transmit power and signal over a gap simultaneously.

**POWERGAP is the answer!**

**Rotary Unit**
- No stress on cable
- Instant Changeout
- No cable movement
- No limitation of turning radius

**Interchangeable Unit**
- Dust & Contamination OK
- No connection labor
- No wear and tear
- No human error

**Moving Unit**
- Requires only one transmitter
- No cable movement
- No physical connection
- Protection class IP67
Wiring Through Air Gap

Common Hardwired System

Device (Sensors)  Controller

Power and signal transmission

Power Gap Concept

Inductive Transmission

Device (Sensors)  Controller

Possible transmission through partition

Power and signal transmission limited to non-metallic partitions.

Advantages of Power Gap

Power and signal transmission

The multiple signal transmission is possible by one system.

Possible transmission through partition

Direct connection of Output signal to PLC I/O

Protection class IP67 (Most models)

Signals
Switch signal parallel
Analog signal 4...20mA or 0...10V
Data RS232C, CC-Link and other
Power Gap Principle

Power Gap consists of the Remote mounted on the movable side and the Base Sensor installed on the fixed side. When the Remote comes into the transmittable field of the Base Sensor, inductive power is supplied to the Remote, and the signals are transmitted across the gap.

Remote
Receives power and command from the Output head supporting connected devices and sends signals to the Base head simultaneously.

Base
Hardwired to power supply and controller. Inductively supplies power to the Remote head as well as 2-way communication with the Remote head simultaneously.
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Applications for Power Gap Systems

Multi Surface Process Turning Jig, Workpiece Mount Verification

Applications
Machining 2 faces of the workpiece on the pallet which turns 90 degree.
Power Gap supplies power to 12 proximity switches and transmits their switching state.

Machining Center Pallet

Solution
Power Gap System
- Cable breakage from stress
- Eliminate stress points and cable breakage problems.
- Contribute to space saving inside of the machine.

After Improvement
- Eliminate stress points and cable breakage problems.
- Contribute to space saving inside of the machine.

Applications
- Machining 2 faces of the workpiece on the pallet which turns 90 degree.
- Power Gap supplies power to 12 proximity switches and transmits their switching state.

Detecting workpiece and jig

Mount Confirmation And Machining Upper Surface

Pallet Turns To Machine The Side Surface

Inductive Power Supply & Signal Transmission

Proximity Switch

Remote Head

Base Head

Inductive Power Supply & Signal Transmission

Proximity Switch for workpiece

Proximity switch for jig

Proximity switch for jig

Proximity switch for jig

Proximity switch for jig

Proximity switch for jig

Proximity switch for jig

Proximity switch for jig

Inductive Power Supply & Signal Transmission

Remote terminal

Remote terminal

Base Sensor

Remote terminal

Base Sensor

Remote terminal

Base Sensor

Inductive Power Supply & Signal Transmission

Workpiece
Prox. Switch X 4
Jig
Prox. Switch X 8
Terminal
Remote Remote
Power Signal

Base Sensor

PLC

Power 24V DC
**Workpiece Detection on a Turntable**

Application

Machining and loading/unloading are performed continuously by turning the turntable which has two jigs. Power Gap supplies power to proximity switched and transmits the switching state of the sensor.

**Machine Work Turntable**

**Previous Problems**
- Cable breakage from stress

**Solution**
- Power Gap System

**After Improvement**
- Eliminate stress points and cable breakage problems.
- Free from limitation of cable movement, no need to return to the home position.

**Construction of Devices**

**Movable Side Pallet**
- Detector
- Remote

**Fixed Side**
- Base Sensor
- Power 24V DC
- PLC

**Unloading and Machining**

< Loading >

180° Turn

< Machining >

Remote

Remote

Inductive Power Supply & Signal Transmission

Inductive Power Supply & Signal Transmission

Base Sensor

PLC
Applications for Power Gap Systems

**Confirming Presence of Workpiece on a Two Sided Jig**

*Previous Problems*
- Cable breakages due to turning stress

*Solution*
- Power Gap System

*After Improvement*
- Eliminate stress points and cable breakage problems.
- Contributed to space saving inside of the machine.

**Application**
Two sided jig is used to accept different profile of workpiece. Power Gap supplies power to proximity switch for detection and transmits the switching state of sensor.

**Jig Rotated to Match Workpiece Profile**

**Load New Workpiece**

**Welding After Detecting the Workpiece**

**Construction of Devices**

Movable Side Pallet
- Detector
- Power 24V DC
- Remote

Fixed Side
- Detector
- Base Sensor
- Power
- Remote
- Signal
- PLC
Applications for Power Gap Systems

Identifying and Verifying Workpiece on a Turntable

**Application**
Continuous cycle of loading, welding and unloading. By using 3 jigs mounted on a turntable turning 120 degree at a time.
Power Gap supplies power to 8 proximity switches and transmits their switching state.

**Welding Process Turntable**

**Previous Problems**
- Cable breakage from stress
- Time loss from home positioning due to physical limitation of the cable.

**Solution**
- Eliminate stress points and cable breakage problems.
- Turntable can turn continuously, without homing. Improved efficiently.

**After Improvement**

**Construction of Devices**

**Movable Side Pallet**

- Identifying: 4 Prox. Switch
- Positioning: 4 Prox. Switch

**Fixed Side**

- Base Sensor
- 24V DC Power
- PLC
**Confirming Pressure of Hydraulic Unit on Turntable**

**Previous Problems**
- No productive method to check pressure of the fluid on turntable.
- Lack of fluid pressure causing defective products.

**Solution**
- Power Gap System

**After Improvement**
- Productively confirming fluid pressure on turntable.
- Confirming the fluid pressure of workpiece right before machining, eliminated defective products due to the leakage of pressure.

**Application**
Confirming pressure sensor signal before machining each workpiece on the turntable. Power Gap RGP provides power to the pressure sensor.

**Loading and Pressurizing the Workpiece**

**Turntable Turn to Machining Position, After Pressure Confirmation**

**Unloading, Machined Workpiece**

**Construction of Devices**

**Movable Side Turntable**
- Power
- Remote
- Pressure Sensor
- Signal

**Fixed Side**
- Power
- Remote
- Base Sensor
- Signal
- Display
- Power 24V DC
Applications for Power Gap Systems

**Confirming Presence of Workpiece on a Turntable**
*(Transmitting Continuous Revolutions)*

**Previous Problems**
- No productive method to install sensors on a turntable available.
- Seating of workpieces visually confirmed by operator every time.

**Solution**
- Successfully install 16 functional sensors.
- Eliminate visual confirmation enabled full automation. Continuous use of all sensors possible by heads installed in the center.

**After Improvement**
- Successfully install 16 functional sensors.
- Eliminate visual confirmation enabled full automation. Continuous use of all sensors possible by heads installed in the center.

**Application**
Load, assembly and unload process, by using 4 jigs on a turntable. Turning 90 degree at a time. Power Gap is installed on the center. Providing power to 16 sensors and transmits their signals simultaneously.

**Construction of Devices**

**Movable Side Turntable**
- Prox. Switch 4 x 4
- Remote Unit
- Remote

**Fixed Side**
- Power
- Base Sensor
- 24V DC
- PLC

**Revolution of the Turntable**
- Rotate 90°

**Unloading of the Workpieces**
- Unloading

**Confirming Seating of Workpiece and Assembly**
- Prox. Switch

**Inductive Power Supply & Signal Transmission**
- Remote Base Sensor

**Remote Unit**
- PLC
- Power 24V DC
- Base Sensor

**Proximity Switch**
- Prox. Switch 4 x 4
Applications for Power Gap Systems

Positioning of Workpiece on Pipe-Cut Machine

Application

Positioning unit is swiveled 90 degrees after positioning, and cut pipes are pushed out for continuous processing.

Power Gap transmits trigger signal from the positioning unit.

Previous Problems

- Each cut-pipe is pulled out from the feeder side, after cutting. Causing time-loss.

Solution

Power Gap System

After Improvement

- Continuous feed of the pipe in one direction is possible. Simpler and faster process.

Pipe Cutter Positioning Unit

Positioning Confirming Position and Cutting. Swiveling and Ejection of the Cut Pipe

Construction of Devices

Movable Side Positioning Unit

- Prox. switch
- Remote
- Power
- Signal
- Base Sensor
- PLC

Fixed Side

- Power
- 24V DC
Initiating Motors for Print Positioning Adjustment

Previous Problems
- Impossible to adjust the alignment without stopping the rollers. Time loss from stopping the machine for adjustment.

Solution
- Power Gap System

After Improvement
- Adjustment of the alignment in motion made possible, due to power and signal being sent to motor inside of the rotating drums.
- Improved efficiency.

Application
Adjust the positioning while the drums are in motion. Power Gap sends power and signal to motors installed inside of the drum.

Test Print
Alignment Adjustment
Start Printing

Construction of Devices
- Movable Side Drum
  - Motor
  - Remote
- Fixed Side
  - Power 100V AC
  - PLC
  - Base
  - Signal
Confirming Workpiece on a Removable Robot Hand

**Application**
Confirming presence of workpiece in a robot hand picking up workpieces from a die. The robot hand rotates and replaced for the shapes of the workpiece. Power Gap sends power to photoelectric sensors and transmits their signal.

**Previous Problems**
- Manual exchange of the hands by operator is required.
- Coiled cables used were breaking from motion stress.

**Solution**
Power Gap System

**After Improvement**
- Eliminate manual exchange process by an operator.
- Eliminate coiled cable and cable breakage problem.

**Construct of Devices**

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**Movable Side Hand**

- Photoelectric Switch x 2
- Remote

**Fixed Side**

- Power
- 24V DC
- PLC

**Base Sensor**

- Inductive Power Supply & Signal Transmission
- Remote

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Applications for Power Gap Systems

TR ELECTRONIC

POWER GAP

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TR ELECTRONIC

Passionate about Sensors
Replacing Pallet Per Shape of Workpiece

Placement of the Jig and Activation of Sensors at the Same Time

Confirming the Seating of Workpiece and Start Welding.

Construction of Devices

Movable Side Pallet

<table>
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<th>Prox. Switch</th>
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Fixed Side

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**Applications for Power Gap Systems**

**Confirming Workpiece on a Removable Jig**

**Application**

Replace welding jig according to the shape of the workpiece. Confirm the seating of the workpiece, and weld. Power Gap sends power to proximity switches and transmits their switching state.

**Welding Process Jig**

**Previous Problems**

- Manual disconnection and connection of the connectors required for every jig replacement.

**Solution**

Power Gap System

**After Improvement**

- Eliminate connection process.
- Faster change out time.
- Eliminate wear and tear components.

**Inductive Power Supply & Signal Transmission**

Remote Base

Sensor

Pallet

Workpiece

Remote

Base Sensor

Prox. Switch

**Movable Side Pallet**

**Fixed Side**

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<th>Prox. Switch</th>
<th>Remote</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Base Sensor</th>
<th>Power 24V DC</th>
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</table>
Confirming Workpiece on Stamping Die

**Previous Problems**
- Connector connection at Die change-outs are difficult. Also time consuming.
- Wear and tear on connectors and cable.

**Solution**
Power Gap System

**After Improvement**
- Eliminated manual wire connection at die change-outs. The process has been simplified.

**Application**
Detecting workpiece on the die to prevent empty shot or double sheets. Power Gap sends power to 8 proximity switches and transmits their switching state.

**Construction of Devices**

---

**Press Machine Die Base**

**Previous Problems**

**Solution**
Power Gap System

**After Improvement**

- Eliminated manual wire connection at die change-outs. The process has been simplified.

---

**Applications for Power Gap Systems**
Detection of Misalignment of Workpiece on Pallet

Machining Center Pallet

**Previous Problems**
- Cable breakage problems from stress.
- Difficult to use multiple styles of pallets.

**Solution**
Power Gap System

**After Improvement**
- Eliminate cable breakage problems
- No limitation to increase numbers of pallets, easy change-outs.

**Application**
Change pallet to match workpiece.
Detect workpiece misalignment during machining with touch sensors.
Power Gap sends power to sensors and transmits their signals.

**Construction of Devices**

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Applications for Power Gap Systems

Workpiece Confirmation on a Conveyor Shuttle

Transfer Line Shuttle

Previous Problems
- Cable breakages from stress.
- Visual confirmation required for places impossible to hardwire.

Solution
Power Gap System

After Improvement
- Eliminate stress points and cable breakage problems.
- Full automation made possible.

Application
The conveyor shuttle motion triggered by confirming loading or unloading of the workpiece. Power Gap sends power to proximity switches and transmits their signals.

Loading and Confirming Workpiece

Shuttle Conveyor in Motion

Unloading Workpiece

Construction of Devices

Movable Side Shuttle

Fixed Side

Proximity Switch x 8
Remote
Power
Base Sensor
24V DC
PLC

Remote Sensor
Inductive Power Supply & Signal Transmission

Moving

Proximity Switch
Inductive Power Supply & Signal Transmission

Unloading

Proximity Switch
Inductive Power Supply & Signal Transmission
Applications for Power Gap Systems

Workpiece Confirmation on Pallets

Application
Confirming workpiece on circulating pallets through assembly process. Power Gap sends power to proximity switches and transmits their signals.

Assembly Line Pallet

Previous Problems
- Countless disconnect and connection causes need for frequent maintenances. Designed area and time needed for connection and disconnection of pallets.

Solution
Power Gap System

After Improvement
- Eliminating connectors simplified the process.
- Eliminate waiting time for connection and disconnection.
- Pallets can be used efficiently.

Loading and Confirming Workpiece Seating

Moving on to Assembly Process After Confirmation

Pallet Goes Down to Return After Unloading Confirmation

Construction of Devices

Movable Side Pallet

Fixed Side

Prox. Switch x 4
Remote
Power
Base Sensor
Signal

Power 24V DC
PLC
Applications for Power Gap Systems

**Workpiece Identification, Solenoid Valve Actuation and Clamp Confirmation on Pallet**

**Assembly Line Pallet**

**Previous Problems**
- Change-out of large pallets are time consuming and labor intensive.

**Solution**
Power Gap System

**After Improvement**
- Identification, mount and seating confirmation of the workpieces are automated, preparation time is reduced drastically.

**Application**
Automatically identify and mount the workpiece from its shape. Power Gap sends power to 32 proximity switches and 4 points solenoid valves also transmits their signals.

**Construction of Devices**

**Movable Side Pallet**
- Proximity Switch x 24
- Cylinder Switch x 8
- Solenoid Valve x 4

**Fixed Side**
- Base Head
- Base Amplifier
- 24V DC
- PLC

**Remote Head**
- Output Unit
- Remote Amplifier

**Base Head**
- Solenoid Valve
- Cylinder Switch
Applications for Power Gap Systems

Jig Adjustment and Clamp Confirmation on Pallet

Application
Control a Motor, an encoder, a solenoid valve and a sensor installed on the pallet. Utilizing Field BUS CC-Link. Power Gap sends power to CC-Link remote I/O on a pallet and transmits CC-Link data.

Assembly Line Pallet

Previous Problems
- Desire to manage whole assembly line with CC-Link.
- Mount adjustment manually done by operators.

Solution
Power Gap System

After Improvement
- Sending of power and data communication of CC-Link are performed simultaneously without hardwiring.
- Automated adjustment of the jig improves loading efficiency.

Loading A Workpiece

Workpiece Mount Adjustment

Moving To Assembly Process

Construction of Devices

Movable Side Pallet

Fixed Side

- Power
- Base
- Sensor
- CC-Link

- Power 24V DC

- Remote
- Signal

- Cylinder Switch
- Solenoid Valve
- Encoder
- Motor

Inductive Power Supply & Signal Transmission
**Application**
Confirm and mount workpiece by utilizing sensors and solenoid valves, also workpiece recognition on robot hand transmitted through pallet. 2 airgap transmission.

**Confiming Workpiece On Pallet**
Supplying Power & Transmitting Signal Inductively 1st

**Confiming Workpiece On Robot Hand**
Supplying Power & Transmitting Signal Inductively 2nd

**Feeding Workpiece To Following Process**
Supplying Power & Transmitting Signal Inductively 1st
Supplying Power & Transmitting Signal Inductively 2nd

**Construction of Devices**

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<td>Remote Head</td>
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<td>PLC</td>
<td>Power</td>
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**Previous Problems**
- Desire to eliminate connection leadtime of sensors and solenoid valves on the pallet.
- Also have desire to eliminate connection time for robot hand change-outs.

**Solution**
Power Gap System

**After Improvement**
- Eliminate connection labor on the pallet and time loss. Also eliminate connection labor on robot hand change-outs.
- Production line is fully automated.
Non-Contact Charging of Batteries

Automatic Transport AGV

### Previous Problems
- Desire to eliminate battery change-outs during operation hours.
- Desire to extend interval of the battery charges.

### Solution
Power Gap System

### After Improvement
- Eliminate the need for battery change-outs.
- Extend interval of full charging, improved efficiency.
- No exposed terminals, no risk to operators.

### Application
The battery of AGV units are partly charged during the waiting time at stops.

### Construction of Devices

- **AGV**
  - Battery (24V DC)
  - 28V DC
  - Remote

- **Fixed Side**
  - Base
  - Power 100V AC
Applications for Power Gap Systems

Confirmation of Workpiece on Removable Jig Placed on Pallet. (2 Air Gaps Transmission)

Application
Jigs are replaced according to shape of workpieces, reducing preparation time. Power Gap sends power to proximity switches on the jig and transmits their signals through 2 steps of <fixed side>-<pallet>-<jig>.

Previous Problems
- Desire to share same pallets for multiple designs of workpieces by changing jigs.
- Desire to confirm seating signals from jigs.

Solution
Power Gap System

After Improvement
- Cost saving by sharing same pallets.
- Simple no hardwired and fast change-outs of jigs.

Transmission Line Jig & Pallet

Removable Jig on Pallet

Common Pallet for Different Jigs

2 Stage Transmission of Workpiece Seating Signal

Construction of Devices

<table>
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<td>Power Signal</td>
<td>Power Signal</td>
<td>PLC</td>
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After Improvement

- Cost saving by sharing same pallets.
- Simple no hardwired and fast change-outs of jigs.
Power Gap
Sensor System

Inductive Power Supply & Signal Transmission

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Since 1989, TR Electronic North America has become an industry leader in manufacturing and supporting position feedback, drive technology and sensor solutions world-wide. Through its complete line of absolute encoders, linear measurement systems and industrial sensors, TR Electronic is able to deliver exceptional results every time.

From automotive, to material handling to metal fabrication, TR's flexible product manufacturing process allows for custom product design with the highest quality and precision you demand.

TR Electronic provides local service and support with North American factory trained technicians who are ready to assist you.

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Refer to the Power Gap Brochure for Product Part Information
Power Gap Sensor System

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