

PCBA to Fluidic Machine with BeiJer X2pro System Controller.

Components of PCBA to Fluidic Machine with BeiJer X2pro System Controller.

PCBA and Fluidic Load Assemblies

Printed Circuit Board Assemblies (PCBAs) and Fluidic Load Assemblies are distinct but sometimes interconnected components in the manufacturing of various devices, particularly in fields like electronics, medicine, and industrial automation.

PCBA (Printed Circuit Board Assembly):

A PCBA is a printed circuit board (PCB) with electronic components soldered or assembled onto it.

- PCB: A flat, non-conductive board, usually made of fiberglass or similar materials, with conductive pathways (traces) printed on it, acting as the foundation for electrical connections.
- PCBA: The PCB with components like resistors, capacitors, integrated circuits (ICs), and connectors attached, making it a functional electronic circuit.

Key Aspects of PCBA:

- Assembly Process: PCBA involves mounting components using technologies like Surface Mount Technology (SMT) and Through-Hole Technology (THT), followed by soldering, testing, and inspection.
- Applications: PCBAs are vital in a wide range of devices, including consumer electronics (smartphones, laptops), automotive systems (engine management, navigation), aerospace and defense applications (avionics, radar), and medical devices (monitoring equipment, imaging systems).
- Importance: PCBA plays a crucial role in enabling the miniaturization, functionality, and reliability of modern electronic devices.

Fluidic Load Assemblies:

While the term "Fluidic Load Assembly" might not be as common as PCBA, it generally refers to systems or components that deal with manipulating or managing fluids within a device or system.

- Potential Functions: These assemblies can be found in various applications, especially where precise fluid control is needed. This could involve:
- Fluid Handling: Moving, dispensing, or controlling fluids in a controlled manner.
- Fluid Measurement: Using sensors, potentially integrated into a PCBA, to monitor fluid parameters like volume or flow rate.
- Fluidic Self-Assembly: A technique where tiny devices are assembled by manipulating them with fluids.

Relationship between PCBA and Fluidic Load Assemblies:

- Integration: In many applications, particularly in fields like medical devices or industrial automation, PCBAs are used to control and monitor Fluidic Load Assemblies.
- Sensors and Control: PCBAs can contain microprocessors, sensors, and control circuitry that interface with components within a Fluidic Load Assembly.
- Communication: PCBAs might also include communication modules that transmit data from Fluidic Load Assemblies to other parts of the device or system.

<https://www.pcbcart.com/article/content/PCBA-introduction.html>

<https://www.festo.com/gr/en/search/?text=PCBA+to+Fluidic+Machine+with+BeiJer+X2pro+System+Controller>

TWO (2) Tape Assemblies with Denso HM-40602M-W 4-Axis 600mm SCARA Industrial Robots

The DENSO HM-40602M-W is a 4-axis SCARA robot well-suited for automated tape assembly tasks in manufacturing environments.

Capabilities:

- High Speed and Repeatability: HM-Series SCARA robots offer outstanding speed and repeatability, with minimum location repeatability accuracy of ± 0.02 mm. This precision is crucial for accurate and consistent tape placement.
- Compact Design: The HM series features a space-saving design, making it suitable for integrating into existing production lines or new work cells.
- Payload Capacity: The HM-4A602M model, a similar variant with 600mm reach, boasts a maximum payload capacity of 4 kg. The HM series can handle up to 20kg payloads.
- Dust and Mist-Proof Options: HM-series robots are available in standard and IP65 dust- and mist-proof configurations, enabling deployment in various industrial settings.
- End-Effector Flexibility: The HM series' maximum allowable moment of inertia (0.45 kgm^2) is six times larger than conventional robots, allowing a wider variety of end-effectors, including those for tape application.
- Ease of Integration: The HM-series' compact design and internal wire/air piping facilitate integration into larger work cells, [according to DENSO Robotics](#).

Automated Tape Application:

- Taping End-Effectors: Robots like the DENSO HM-40602M-W can be equipped with specialized end-effectors (tools) designed to handle and apply adhesive tapes.
- Precision Placement: Using detailed path programming, the robot arm with the tape applicator moves over the workpiece and applies the tape with precision and accuracy.

- **Handling Diverse Tapes:** Systems like the RoboTape, designed for robotic tape application, can handle different types of adhesive-backed foams, felts, and attachment tapes. These systems can be integrated with various industrial robot brands.
- **Increased Efficiency and Quality:** Automating tape application with robots like the DENSO HM-40602M-W offers benefits such as reduced manual labor, increased production speed, consistent and reliable tape application, and minimized material waste.

Examples of Robotic Tape Applications:

- **Masking in Surface Treatments:** Robots can be used to apply masking tape for surface treatment processes like plasma spraying or spray painting.
- **Electronic Assembly:** SCARA robots are widely used in electronics manufacturing for tasks demanding speed and precision, such as applying sealants and adhesives in circuit board assembly.
- **Applying Adhesive Tapes to Curved Surfaces:** Robotic tape application systems can apply pressure-sensitive tapes to curved surfaces more efficiently than manual methods.

In Conclusion:

The DENSO HM-40602M-W SCARA robot, with its combination of speed, precision, payload capacity, and adaptability, is a viable choice for automating various tape assembly applications, leading to increased efficiency and improved product quality. When combined with specialized tape application end-effectors and systems, it can handle complex taping tasks and significantly enhance manufacturing processes.

<https://www.denso-wave.com/en/>

TWO (2) Roll Assemblies; Offload - Reject Assembly

It refers to a system component involved in rejecting faulty Printed Circuit Boards (PCBs) from a roll-to-roll assembly line, where the rejected boards are then handled by a fluidic machine and controlled by a BeiJer X2pro Human-Machine Interface (HMI) system controller.

Here's a breakdown of the potential system components and their roles:

- **Roll Assemblies:** This suggests the PCBs are processed in a continuous roll form, implying a roll-to-roll assembly line for efficiency.
- **Offload - Reject Assembly:** This describes the process of identifying defective or non-conforming PCB assemblies and removing them from the production line. Reject conveyors, often utilizing pneumatic channels or mechanisms like flippers, are common for this purpose, allowing for rejection without halting the entire process.
- **PCB to Fluidic Machine:** Rejected PCBs are transferred to a fluidic machine. This machine likely handles a process involving fluids, possibly for cleaning, testing, or further processing of the rejected boards. Fluid handling systems are crucial in manufacturing, involving interconnected machines to channel fluid power for various tasks, potentially including specialized processing of rejected goods.

- BeiJer X2pro System Controller: The BeiJer X2pro is a high-performance Human-Machine Interface (HMI) panel designed for industrial automation. It serves as the control interface for the system, allowing operators to monitor and control the entire rejection and fluidic machine process. It features:
- Powerful ARM Cortex-A9 processors for fast operation.
- Intuitive user interface for easy configuration and control.
- Integration capabilities with various automation equipment like PLCs.
- Potential for fault diagnosis and data acquisition for process monitoring.

In summary, the system likely functions as follows:

1. PCBs are processed in a roll-to-roll assembly line.
2. Faulty PCBs are identified (possibly through automated inspection systems like AOI).
3. A reject mechanism, possibly a pneumatically-controlled conveyor or flipper system, offloads the rejected PCBs from the line without interrupting the overall production flow.
4. The rejected PCBs are transported to a fluidic machine for further handling or processing.
5. The entire process, including identifying faulty boards, controlling the reject mechanism, and managing the fluidic machine, is controlled and monitored by the BeiJer X2pro HMI system controller.

This type of automated rejection system is essential in maintaining high-quality PCB production, ensuring that only good assemblies proceed through the manufacturing process.

EIGHT (8) Cognex Digital Cameras

A setup involving 8 Cognex Digital Cameras for a PCB to Fluidic Machine with a BeiJer X2pro System Controller suggests an automated system designed for handling and potentially processing PCBs in a fluidic environment, likely with inspection or vision-guided robotics.

Here's a breakdown of the components and their potential roles in such a system:

1. Cognex Digital Cameras (8 Units):

- **Function:** These cameras provide the "eyes" of the system, capturing images of the PCBs for various tasks. Cognex In-Sight series cameras, like the In-Sight 7000, are suitable for PCB inspection and assembly verification.
- **Purpose:** The 8 cameras could be used for:
 - **High-Resolution Inspection:** Each camera could be focused on a different section of the PCB for detailed defect detection (e.g., solder paste inspection, component placement verification).
 - **Multi-view 3D Inspection:** Multiple cameras could be combined for full 3D inspection of the PCB or components.
 - **Vision Guided Robotics:** Used to guide robotic arms for precise pick-and-place operations of PCBs or components within the fluidic machine.

- Tracking and Recognition: Detecting, counting, and tracking PCBs or components throughout the process.
- Cognex In-Sight 7000 as an example: This series offers features like high-resolution imaging, various lens options, and internal lighting choices, making it suitable for demanding industrial applications.

2. Fluidic Machine:

- Function: This machine likely involves the use or processing of fluids in relation to PCBs. Examples could include fluid dispensing, washing, or applying coatings.
- Integration with cameras: The cameras would likely be positioned to monitor and inspect the fluidic process, ensuring correct application, flow, and quality within the machine.

3. Beijer X2pro System Controller:

- Function: This acts as the Human Machine Interface (HMI) for the system, providing a control and visualization platform.
- Integration with Cameras: The X2pro can interface with the Cognex cameras (likely via Ethernet) to display camera data, control camera functions, and manage the overall automation process.
- Features: The X2pro boasts a powerful processor, connectivity options, robust design, and compatibility with iX Developer software for configuration and control.

Connecting the Components:

- Communication: Cognex cameras support industrial communication protocols like EtherNet/IP, enabling seamless data exchange with the Beijer X2pro controller.
- Software: Cognex In-Sight Explorer or VisionView software would be used to set up and configure the cameras and integrate them with the X2pro.

Potential Applications:

- Automated PCB Assembly and Inspection: The system could automate the process of placing components onto PCBs, applying fluidic processes, and inspecting for quality, potentially in high-speed or challenging environments.
- Fluid Dispensing Control and Verification: Cameras could monitor and verify accurate fluid dispensing onto PCBs.
- Vision-Guided PCB Handling in Fluidic Processes: Robotic arms equipped with Cognex cameras could be guided to handle PCBs within a fluidic system.

Considerations:

- Specific camera models: The exact Cognex camera models would depend on the required resolution, speed, and environmental conditions of the application.
- Software integration: Ensuring seamless communication and data exchange between the Cognex software and the Beijer iX Developer software is crucial.
- Lighting and Optics: Proper lighting and lens selection are essential for optimal image quality and accurate vision performance in potentially demanding environments.

<https://www.cognex.com/products/machine-vision>

Multiple Festo Stepper Motors / Handlers / Actuators

When building a PCBA (Printed Circuit Board Assembly) to fluidic machine using Festo components and a Beijer X2pro system controller, you'll be looking for specific types of motors, handlers, and actuators, along with compatible motion controllers.

1. Motors:

- **Stepper Motors:** Festo offers the EMMS-ST series, a Core Range product, suitable for simple, precise positioning applications. They feature hybrid technology for high torque at low speeds and come in different sizes.
- **Servo Motors:** For more dynamic and demanding applications requiring high precision and speed, Festo provides servo motors like the EMMT-AS and EMMB-AS. They offer features like low cogging torque, quick installation with a one-cable solution, and automatic parameter setting with servo drives.

2. Handlers and Actuators:

- **Handling Modules:** Festo offers electric handling modules, including a complete rotary/linear handling unit for combined rotary and linear movements, and a rotary gripper module for gripping and rotating small objects. They also have multi-axis handling solutions for precise positioning, like those using electric tooth belt and ball screw axes.
- **Actuators:**
 - **Pneumatic Actuators:** Festo has a wide range of pneumatic actuators, including linear actuators (piston rod and rodless cylinders), rotary cylinders, and servo-pneumatic systems for controlled positioning.
 - **Electric Actuators:** These include electric linear actuators like the ESBF-BS-63-300-10P, rotary drives, and handling modules.
 - **Dispense Heads:** For fluid dispensing, Festo offers specialized dispense heads like the VTOE and VTOI, designed for precise dosing of small liquid quantities.

3. Controller Compatibility (Beijer X2pro):

- **Festo Motion Controllers:** Festo's upcoming series of motion controllers, set to launch in 2025, will integrate Beijer Electronics' WebIQ software for enhanced user experience and operational efficiency.
- **Multiprotocol Servo Drives:** Festo's CMMT-AS and CMMT-ST servo drives are compatible with various industrial Ethernet protocols, including EtherNet/IP, EtherCAT, PROFINET, and Modbus TCP, allowing for integration with diverse systems.

4. Additional Considerations:

- **Engineering Tools:** Festo provides online tools like "Electric Motion Sizing" for single axes and "Handling Guide Online" for multi-axis systems to assist with system specification.
- **Festo Motion Control Package (FMCP):** Festo offers custom control cabinets with function block software to reduce multi-axis system startup time.
- **Distributed I/O and Valve Systems:** Festo's CPX-AP-A and CPX-AP-I systems offer flexible automation solutions with support for various fieldbuses.

The optimal Festo stepper motors, handlers, and actuators can be selected to build a strong and efficient PCBA to fluidic machine with a Beijer X2pro controller by carefully considering the application's requirements for precision, speed, load capacity, and control system compatibility

<https://www.festo.com/in/en/>

SMC Pneumatics

When using SMC pneumatics with a Beijer X2 pro HMI controller for a PCB to fluidic machine, you're looking at a solution that combines robust automation components for precise handling and control.

Here's a breakdown of the key elements and considerations:

1. SMC Pneumatics for PCB Handling:

- SMC offers a wide range of pneumatic components suitable for delicate PCB handling and integration into fluidic systems.
- Pick and Place Machines: These machines are crucial for accurately placing surface mount components (SMCs) on PCBs, often utilizing pneumatic lines for gripping and precise placement.
- Actuators and Grippers: SMC provides various actuators (linear and rotary) and grippers designed for tasks like pressing, lifting, transferring, positioning, clamping, and sorting PCBs and components.
- Fluid Control Equipment: If your fluidic system involves controlled fluid flow, SMC offers valves (like directional control valves and process valves) and flow control equipment to manage this aspect.

2. Beijer X2 pro HMI Controller:

- The Beijer X2 pro HMI controller provides a powerful and versatile interface for controlling automated systems.
- High Performance: It features powerful ARM Cortex-A9 processors for demanding applications.
- Connectivity: It offers a wide range of connectivity options, including Ethernet and potentially optional bus modules like CANopen, Profibus or MPI for interfacing with different equipment.
- iX Software: The iX software provides smart communication tools and features for HMI development and integration.

3. Integration and Interfacing:

- Communication: You can connect the Beijer X2 pro HMI to controllers (potentially including the ones driving the SMC pneumatic components) via Ethernet or other supported communication protocols like RS485.
- Control Logic: The X2 pro, especially models like the X2 control, can integrate HMI and PLC functionality, enabling you to develop the control logic for your fluidic machine within the same platform.
- User Interface: The HMI provides a visual interface for operators to monitor and control the pneumatic system and the overall fluidic machine.

Considerations:

- **Specific SMC Components:** The exact SMC components needed will depend on the specific requirements of your PCB to fluidic machine (e.g., type of actuators, grippers, valves).
- **Communication Protocols:** Ensure compatibility between the Beijer X2 pro and the communication protocols used by the chosen SMC components (e.g., if you're using valve manifolds with serial communication capabilities).
- **Software Development:** You will need to use the iX software to design the HMI interface and potentially program the control logic if you're using a model with integrated PLC functionality.
- **Environmental Considerations:** Consider the operating environment when selecting components, especially for fluidic applications (e.g., using corrosion-resistant materials for high-purity chemical transfer).

<https://spada.in/blog/f/smc-pneumatics---leading-the-way-in-automation-solutions#:~:text=With%20a%20focus%20on%20energy,environmental%20impact%20and%20operational%20costs>.

<https://www.festo.com/in/en>

Balluff Photoelectric Sensors

Balluff photoelectric sensors are well-suited for automation tasks involving the movement of printed circuit board assemblies (PCBAs) to a fluidic machine, especially when integrated with a Beijer X2pro system controller.

Why choose Balluff photoelectric sensors for this application?

- **Diverse range:** Balluff offers a wide range of photoelectric sensors, including models with various sensing ranges, different light types (red light, infrared, blue light, or laser technology), and options for background suppression.
- **Precision detection:** These sensors can reliably detect the presence, shape, color, distance, or thickness of objects like PCBAs, which is crucial for accurate handling and positioning in automated assembly processes.
- **Optimized for automation:** Balluff photoelectric sensors are specifically designed and optimized for use in robotics, automation, assembly, and handling applications.
- **Specialized options for demanding applications:** Balluff also provides specialized sensors such as Micromote sensors for miniature applications and color sensors for precise color recognition, which can be useful in PCBA handling for tasks like sorting or quality inspection.

Interfacing with the Beijer X2pro system controller:

The Beijer X2pro system controller, with its powerful ARM Cortex-A9 processor and the iX software, offers excellent connectivity and integration capabilities. The extensive driver list in iX Developer ensures compatibility with various automation equipment, including Balluff sensors.

Key features of Beijer X2pro for sensor integration:

- Extensive driver list: The iX software provides drivers for seamless communication with a wide range of automation devices, including Balluff sensors.
- Robust connectivity: X2 pro panels offer various connectivity options, such as Ethernet and serial ports, to connect sensors and other components.
- Integrated control: Some X2 pro models, like the X2 control, feature integrated CODESYS-based PLC functionality, allowing for powerful control and data processing from sensor inputs.

In summary:

Balluff photoelectric sensors offer the necessary features and performance for reliable detection of PCBAs in an automated fluidic machine application. The Beijer X2pro system controller, with its advanced capabilities and extensive driver support, provides a suitable platform for seamless integration and control of these sensors.

To determine the most appropriate Balluff photoelectric sensor model and configuration for a specific PCBA to fluidic machine application with a Beijer X2pro system controller, it's recommended to consult the technical documentation for both Balluff sensors and the specific X2pro model being used. Additionally, seeking advice from Balluff or a local distributor like Power Motion can help in selecting the optimal sensor solution and ensuring proper integration.

<https://www.balluff.com/>

Modular Enclosure with Omron D4JL-2NFA-C5 Basic / Snap Action Lock Switches

An Omron D4JL-2NFA-C5 safety door switch with a Beijer X2pro system controller within a modular enclosure, likely as part of a safety system for a fluidic machine.

Here's a breakdown of the components and considerations:

1. Omron D4JL-2NFA-C5 Safety Door Switch:

- Function: This is a guard lock safety door switch, designed to monitor and interlock protective covers or doors on machinery.
- Key Features:
- Lock Strength: 3,000 N, making it suitable for large, heavy doors.
- Contacts: 2 circuits + 2 contacts in the safety circuit (with the 'N' switch configuration). These use gold clad contacts, suitable for both general and micro loads.
- Door Lock/Release: Mechanical lock with a 24 VDC solenoid release.
- Trapped Key Type: Available option to prevent accidental locking of personnel within hazardous areas.
- Rear Release Button: Allows unlocking from the inside in emergencies.
- Protection Degree: IP67, indicating dust-tightness and water resistance.

- Mounting: Various mounting options are available, including horizontal, vertical, and adjustable mounting.

2. BeiJer X2pro System Controller:

- Function: A human-machine interface (HMI) panel, potentially serving as the control system for your fluidic machine.
- Key Features (specific to different X2 pro models):
 - Display: Available in various sizes (e.g., 7", 12", 21") with different resolutions and touch technologies.
 - Processor: Powerful ARM Cortex-A9 processor.
 - Connectivity: Ethernet ports, serial ports (RS232, RS422/485), USB, SD card.
 - Housing: Robust aluminum housing with IP65 front rating.
 - Operating Temperature: Wide operating temperature range (-10°C to +60°C or 0°C to +50°C, depending on the model).

3. Modular Enclosure:

- Function: Provides physical protection and mounting space for the Omron D4JL switch, the BeiJer X2pro controller, any associated electronics (like a PCBA), and wiring.
- Considerations:
 - IP Rating: Ensure the enclosure provides a sufficient level of ingress protection (IP rating) to match the environment and the components' requirements (e.g., IP67 for the Omron switch).
 - Space: Select an enclosure with enough internal space for all components, their wiring, and any necessary ventilation or heat dissipation.
 - Mounting Options: Consider how the enclosure will be mounted to the fluidic machine and how the Omron switch and BeiJer X2pro will be mounted within the enclosure.
 - PCBA Safety: If including a PCBA, consider best practices for handling and safety, such as proper isolation of high voltage circuits, appropriate component selection (e.g., using off-board power supplies), and potentially conformal coating or potting for protection against environmental factors.

4. Interfacing:

- Wiring: Connect the Omron D4JL switch to the BeiJer X2pro controller, likely through the X2pro's serial ports or expansion interface. Refer to the datasheets for the specific wiring diagrams and terminal assignments.
- Logic: Program the BeiJer X2pro to monitor the state of the Omron safety switch and implement appropriate safety functions (e.g., machine shutdown if the door is opened).

Important Notes:

- Risk Assessment: Always perform a risk assessment to determine the appropriate safety level for your application and ensure that the chosen components and their integration meet those requirements.
- Installation and Maintenance: Follow the installation and maintenance instructions provided in the datasheets and manuals for both the Omron switch and the BeiJer X2pro.

- Defeating Safety Functions: Never defeat, tamper, or bypass any safety functions, as this can result in death or serious injury.

<https://www.festo.com/in/en>