



Product Engineering & Industrial HMI

Standardizing Industrial Automation: GUI Home Screen Architecture

Client: A leading industrial robotics integrator and automation solution provider -
Touch-Enabled Panel PC Systems



At a Glance

60%

reduction in program
changeover time

70%

faster fault isolation via
visual alarm locate

100%

OS access secured behind
L1/L2 governance



The Client

A leading industrial robotics integrator and automation solution provider, operating multi-controller robotic cells across its automated lines. This engagement covers the latest version of the client's touch-enabled Panel PC operator interface, standardizing how operators monitor and control robots, vision systems, and ancillary tooling on the shop floor.



The Business Challenge

Manufacturing operations were hindered by fragmented control systems, requiring operators to manage robots, vision systems, and auxiliary equipment through separate interfaces. Fault diagnosis was slow and heavily dependent on manual PLC checks and

on-site inspections, increasing downtime and repair times. Production changeovers required specialised engineering support and complex parameter updates, while unrestricted access to industrial Panel PC operating systems created cybersecurity and operational risks that threatened overall efficiency and reliability.



Our Approach

We developed a unified operator platform that centralised cell control, programming, monitoring, and support while improving security and ease of use.

- **Modular Tile Architecture:** Responsive tile grid supporting single-tile closed states and expanded overlay views.
- **Persistent Banner & Control Panel:** Persistent header displays for connection/telemetry and color-coded push-button controls.
- **Visual Block Programming:** Structured sequence builder using Part, Motion, Utility, and Change blocks with real-time validation.
- **Integrated Peripheral Management:** Embedded live 2-camera feeds (with 7-day playback) and integrated Twilio chat/video remote support.
- **Governance & OS Locking:** Dual-tier security (L1 Admin / L2 Customer) and password-restricted OS minimization.



Solution Overview & UI Navigation Architecture

In business terms, the Home Screen gives operators one touch-enabled surface to monitor and control an entire cell, replacing separate controller interfaces and the teach-pendant with a single, persistent, tile-based view.

UI Component	Functional Scope & Responsibilities	Boundary / Display Rule
Banner Tile	Displays client logo, real-time date/time, Wi-Fi signal, and HMI-Robot connectivity status.	Persistent header; single fixed view; non-expandable.
Status Tile	Monitors cell readiness, shows color-coded borders (Green/Yellow/ Red), active alarms, and 100-entry history.	Borders reflect live state; overlay open view highlights active error positions.
Robot Tile	Read-only monitoring of joint positions (W,P,R), operational modes (T1, T2, Auto), speed %, and I/O status.	Open view occupies space above Operator Panel; read-only parameters.
Program Tile	Manages active program, part number, block sequence creation, setup configuration, and reactivation states.	Open view expands across grid; highlights modified active programs in orange.
Operator Panel	Provides physical push-button controls mapped to digital inputs with dynamic flag color animations.	Persistent lower panel; remains visible during tile open views.



Technology Stack

- **Platform:** Windows-based application deployed on industrial touchscreen Panel PCs.
- **Protocols:** Implicit messaging for fast PLC/Robot digital I/O sync; explicit messaging for register data.
- **Remote Support:** Twilio SDK integration for live text chat, video calls, and screen sharing.

Widget Specifications

- **Banner Widget:** Persistent header displaying connection status (Green=On / Red=Off), signal bar, and system clock.
- **Status Widget:** Dynamic borders: Green (Cycle OK), Yellow (Idle), Red (Fault/E-Stop). Top 2 active alarms in closed view; 100-record historical log in open view.
- **Robot Widget:** Read-only joint coordinates (W, P, R). Open view exposes T1/T2/Auto modes, speed %, and illuminated state indicators (Run, Busy, Step, Hold, Fault, Prod).
- **Vision Widget:** Displays 2 live camera feeds (CAM-1, CAM-2) in closed view. Open view supports selection across up to 8 active cameras with 7-day archived video retrieval.
- **Program Widget:** Drag-and-drop sequence builder: Part Data → Gripper Data → Infeed/Outfeed → Machine Fixture → Utility/Vision/Change → End Block. Mandatory L2 password for Save/Delete.
- **Trip Computer Widget:** Tracks cycle performance across Trip A, Trip B, and Lifetime counters (Last cycle time, Avg cycle time, Total/Good/Non-good part count).
- **Helpdesk Widget:** Enables direct Twilio-powered chat and video support with DiFACTO technicians while keeping Operator Panel and Robot/Status tiles accessible.
- **My Docs Widget:** Integrated viewer for Electrical/Pneumatic PDFs, Mechanical Assembly BOMs, DWG files, and manufacturer manuals with keyword search.
- **Operator Panel:** Persistent 10-button strip with 5 flag-driven visual states (0=Dark/Gray, 1=Bright, 10=Medium, 11=Light, 12=Blinking) mapped directly to PLC registers.

Security Governance

- **L1 Administrator (DiFACTO):** Exclusive access to Robot IP config, Vision Base URL, Motion Profile uploads, Camera management, and Operator Panel button mapping.
- **L2 Customer Operator:** Access to password changes, program creation/saving, My Docs browsing, and operational settings. OS minimization restricted behind password confirmation.



Business Outcomes & Impact

Dimension	Before (Status Quo)	DiFACTO V3 Result	Business Impact
Control Consolidation	3 separate controller interfaces	1 touch Panel PC Home Screen	Unified monitoring; eliminated hardware clutter.
Fault Isolation Time	15–20 min manual register checks	< 2 min visual alarm locate	70%+ reduction in diagnostic downtime (MTTR).
Program Changeover	Requires teach-pendant expert	Drag-and-drop block creation	Accelerated line changeovers by 60%.
Remote Support MTTR	Hours waiting for field engineer	Instant Twilio video/chat support	Drastic reduction in field dispatch expenses.
OS Security Compliance	Unrestricted Windows desktop access	Locked shell with L1/L2 control	100% protection against unauthorized OS tampering.



Why It Matters

This solution demonstrates how modern industrial interfaces can simplify operations while maintaining strict control over security and governance. By replacing complex teach-pendant programming with intuitive visual workflows, manufacturers can reduce training requirements, accelerate changeovers, and improve operator productivity. At the same time, role-based security and OS lockdown measures help protect critical systems from unauthorised access, reducing cybersecurity risks and supporting more reliable plant operations.

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