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ThermalDIAG – Integration Guide

Inputs and outputs, Modbus, OPC UA, MQTT, Web API and displays in one environment.

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1. Fit ThermalDIAG into the existing plant

ThermalDIAG brings sensors, cameras and available machine signals together on a Linux industrial PC (IPC). Data acquisition, storage, rules and image processing run there. Operators use a browser to access projects, measurements, messages and displays.

Connections depend on the available equipment: direct inputs and outputs, Modbus TCP or RTU, OPC UA and MQTT can work together in the same project. The Web API also connects ThermalDIAG to other software applications.

Basic arrangement: sensors and machine → suitable interfaces → Linux IPC running ThermalDIAG → browser, hall monitor or connected software.

2. Connect inputs and outputs

Physical signals connect to suitable I/O terminals on the IPC or to an appropriate external I/O module. The module's electrical characteristics and measurement range must match the connected device.

Connection	Typical use	Setup in ThermalDIAG
Digital input	Limit switch, door contact, run enable, fault indication or counting pulse	Name the signal, check its state and select it for display, recording or rules.
Analog input	Current, pressure, temperature or level sensor, for example with 0–10 V or 4–20 mA	Match signal type, measurement range, scaling and unit to the sensor.
Digital output	Signal lamp, horn, relay or approved auxiliary function	Define the target and switching effect; a rule can set the output or request a pulse.

After connection, each input and output is checked against a known state. For outputs, the permitted effect and behavior during startup and shutdown form part of the agreed setup. Existing machine and protective functions remain in their designated controller.

3. Modbus TCP and Modbus RTU

Modbus TCP connects suitable devices over Ethernet. **Modbus RTU** connects devices over an RS-485 bus. An appropriate gateway or interface connects them to the IPC.

The device, connection and required channels are configured in ThermalDIAG. The device description determines which readings and states each channel provides. Clear signal names, units and assignment to the plant make the sources recognizable in the interface.

Typical examples are digital I/O modules, current and vibration sensors, and the TUF-2000M flow meter. Readings can be displayed, recorded and used in rules. Writes are configured only for intended and approved targets.

4. OPC UA for existing machines and controllers

If a machine or PLC provides data through an OPC UA server, ThermalDIAG connects to it as a client. Multiple connections can be configured within one project.

Required variables are selected on the server and given clear names. Machine states and measurements can then be displayed, recorded and evaluated in rules alongside other sources. Numeric and digital values can have a stored history; text values can be used as current content.

The connection uses Anonymous / SecurityPolicy None. Supported scalar data types are Boolean, Int32, Double and String.

When a value needs to be written, the target variable and write permission are explicitly defined. Alongside reading, the integration can therefore transfer selected, approved feedback or setpoints. Connection settings, data types and write permissions are matched to the particular server.

5. MQTT for connected devices

MQTT connects devices through a message intermediary called a **broker**. ThermalDIAG and the devices reach this broker on the designated network; configured device topics and profiles determine how messages are assigned.

Supported examples include Shelly measurement and switching devices and OpenMV cameras. Temperature and device signals can feed displays, recording and rules. Appropriately configured devices also support switching commands, camera configuration or N6 inspection requests.

Setup defines the broker connection, device identity and matching profile. A new device is integrated according to its message format; an MQTT connection alone does not replace that mapping.

6. Add cameras and liquid measurement

FLIR AX8 and OpenMV: cameras are assigned to locations. Temperature measurement areas provide values for trends and rules; snapshots supply images for evidence and displays. With OpenMV N6, rules can start a configured inspection and explicitly retrieve its result.

TUF-2000M: the ultrasonic flow meter connects through Modbus RTU. Flow rate, velocity and volumes are available in the shared project context. A manual or rule-controlled Start/Stop measurement defines a measurement interval. Measurement volume positively accumulates verified quantities in both flow directions; Stop freezes the result. Verified total volume since IPC startup can also be displayed. Measurement gaps remain marked.

7. Web API for other software

The authenticated REST-based **Web API** lets an approved application use selected ThermalDIAG data. Examples include a supervisory dashboard, a maintenance system or a custom documentation application.

This includes current and historical measurements, project status, incidents, tickets, snapshots and reports, and selected operating workflows. The connection uses an assigned user, suitable access rights and an API token. Device connections through Modbus, OPC UA or MQTT and software access through the Web API serve different purposes and can be used together.

Initial planning only needs the target application, required data and permitted workflows. Specific API calls are then described in the technical integration guide.

The API uses role permissions for the installation. A project ID selects the data context; it is not a separate project access barrier. Required separation of data and applications is addressed during setup.

8. Displays for hall monitors and workstations

A display is a **view assembled by the user**. The user selects the content, arranges rows and fields, and chooses labels, units, decimal places and colours. Multiple displays can be saved for different tasks and switched as needed.

Automatically updated and manually maintained content

- **Automatically updated numbers:** measurements, counters, calculated project values or machine data from connected sources.
- **Automatically updated text:** messages set by rules or current text from a suitable source, such as OPC UA.
- **Automatically updated images:** snapshot images that update an assigned image slot.
- **Manually maintained constants:** numbers and text are entered as project variables and selected in the display. Target volumes, reference values, shift notes or work instructions can appear alongside measurements.

The view automatically receives updates through its ongoing connection to ThermalDIAG. Numbers and text can be changed manually or updated by rules; changes also appear on connected display devices.

Use the screen area to suit the task

The selected grid distributes the available display area among rows and fields. Numbers and text automatically adjust their font size to the available space; images retain their aspect ratio. Full-screen mode uses the available screen area.

A hall display might show **8–10 key values** at a large size to support reading from farther away. A workstation display might combine **40–60 values** in the same

area, with correspondingly smaller individual items. These numbers are layout examples, not fixed operating modes or field limits. Monitor size, text length and viewing distance determine a useful arrangement.

A browser PC at the monitor is enough

A basic, even lower-powered PC can serve as the display device for a large monitor in a hall. It needs a current browser and a **LAN or WLAN connection** to the Linux IPC running ThermalDIAG. Acquisition and processing run on the IPC; the display PC does not need a separate ThermalDIAG installation. Its required performance depends on screen resolution and displayed content.

On the display PC, the user signs in, selects the project and display, and opens full-screen view. The display updates automatically. Authorized users can also change the underlying text or values from another workstation. A Viewer can show existing displays; Operator, Admin or Supervisor configure their layout.

9. Example: pump or cooling circuit

A thermal camera observes a component. The TUF-2000M supplies flow and volume, a digital input indicates pump operation, and OPC UA provides an existing machine state. ThermalDIAG brings the sources together in one project and records the selected values.

A rule can create an incident, set a message and save a snapshot when a defined combination of temperature and flow occurs. A hall display shows the key values, image and a clear status. A manually maintained target volume or work instruction complements the view. Other software can retrieve approved information through the Web API.

10. From existing plant to configured solution

1. Describe the machine, investigation and required views.
2. List sensors, available signals, interfaces and required outputs.
3. Select the IPC, I/O modules, network and suitable device profiles.
4. Connect devices, configure connections and give signals clear names.
5. Check measurements, units and approved output effects.
6. Configure recording, rules, messages and displays for the task.
7. Set up user access and, if needed, data exchange with other software.

Integration can begin with one machine and expand with further sources and displays. JC-Technology supports measurement planning, setup and connections to existing equipment and applications.