Dynamox

USER MANUAL

Trigger for DynaGateway

IoT-S LTE-S



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1 Getting Started and Product Overview

This chapter introduces what **Trigger for DynaGateway** is, the improvements it delivers, and why this feature is important for maintenance and reliability routines.

The goal is to provide **field technicians, maintenance teams, engineers, and coordinators** with a clear understanding of the functionality before proceeding with installation and configuration.

1.1 Purpose of the Trigger for DynaGateway feature

Trigger for DynaGateway enables **waveform** data collection from Dynamox sensors **under specific operational conditions**, rather than at fixed time intervals or through manual activation.

In practice, it allows DynaGateway to wait for an event signal (e.g., a digital signal from equipment or a PLC) and then:

- Prepare communication with configured sensors;
- Request waveform collection at the desired moment;
- Send data to the **Dynamox Platform** for analysis.

This ensures data collection is no longer "generic" but tied to well-defined operating conditions, such as:

- Machine in steady-state operation;
- Specific load cycle;
- Process maneuver or event (e.g., tipping, start-up, braking).

1.2 Benefits of condition-based data collection

Using Trigger for DynaGateway provides more representative and comparable data.
Key benefits include:

- **Measurement repeatability:** collections occur under similar operating conditions (same load point, same cycle, same maneuver), reducing variability and improving comparison across measurement campaigns.
- **Higher diagnostic reliability:** with less operational "noise", vibration trends and spectra more accurately reflect asset condition, supporting safer maintenance decisions.
- **Focus on critical events:** captures waveforms during specific events – often the most critical for equipment (start-ups, stops, impacts, load maneuvers) – which time-based collection rarely captures.
- **Resource optimization:** condition-based data collection avoids unnecessary measurements (e.g., machine stopped or outside relevant regime), optimizing:
  - DynaGateway communication usage;
  - Analysis time for the team;
  - Sensor battery life.
- **Improved cross-department communication:** since collection conditions are defined collaboratively (maintenance, operations, engineering), Trigger for DynaGateway creates a common language for **when** and **why** data is collected, facilitating technical discussions and action prioritization.

1.3 Time-based vs condition-based collection

To understand the value of Trigger for DynaGateway, distinguish two concepts:

1. **Time-based collection:** Traditional model where data is scheduled:

- Every X minutes, hours, or days; or
- In fixed campaign routines.

Characteristics:

- Simple to configure and understand;
- Does not guarantee consistent operating conditions;
- May record data with machine stopped, in transition, or under irrelevant regimes.

2. **Condition-based collection (event-based):** DynaGateway only collects when a predefined condition is met, such as:

- A digital signal indicating the asset reached a specific operating point;
- A combination of PLC signals representing a process cycle;
- A command event (maneuver, engagement, mechanism activation).

Characteristics:

- Ensures collection at the right moment under desired conditions;
- Improves repeatability and statistical quality;
- Especially useful for assets with short, transient, or highly variable cycles.

SUMMARY	
Time-based collection answers the question:	"What was happening at this time?"
Condition-based collection answers the question:	"How does the asset behave when this specific condition occurs?"

The **Trigger for DynaGateway** was specifically developed to enable condition-based data collection in a configurable, safe, and fully integrated manner with DynaGateway and Dynamox sensors.

In the following chapters, you will find detailed information on the system architecture, installation requirements, step-by-step assembly, and practical configuration of this functionality.

2 Product description

This chapter introduces the **Trigger for DynaGateway**, its main components, the interaction with the PLC STG-800, and the overall system architecture.

The goal is to provide a clear understanding of how the solution fits into the context of condition monitoring using Dynamox sensors.

2.1 What is Trigger for DynaGateway?

The **Trigger for DynaGateway** is a feature that enables DynaGateway to perform **condition-based waveform collections** based on digital signals originating from the process or a PLC.

Instead of collecting data only at fixed intervals, DynaGateway will:

- Wait for a user-defined **trigger event** (e.g., maneuver, load cycle, operation command);
- Interpret the event via its **digital input**;
- Activate associated Dynamox sensors to collect waveform data at the exact configured moment;

> ⓘ The time between the trigger event and the start of data collection depends on the Bluetooth connection.

- Send data automatically to the **Dynamox Platform** for visualization and analysis.

Effectively, Trigger for DynaGateway turns DynaGateway into an **interface between process automation and vibration monitoring**, aligning data collection with real operating conditions.

2.2 Role of PLC STG-800

The **PLC STG-800 organizes and combines digital process signals**, enhancing flexibility for Trigger for DynaGateway.

Typical roles include:

- Receive signals from multiple asset points (limit switches, position sensors, contactor states, command signals);
- Apply **control logic** (e.g., "pre-trigger when condition A is active, final trigger when condition B occurs");
- Provide consolidated digital outputs to DynaGateway's input.

Thus:

- In simple applications, the DynaGateway can receive a single direct signal from the equipment;
- In more complex applications, the PLC STG-800 allows the creation of logical combinations, sequences (pre-trigger + trigger), and filtering, ensuring that the DynaGateway is only activated under well-defined conditions.

The result is a solution that is more **adaptable to different processes**, while respecting the existing logic of the plant's automation.

2.3 System architecture

A solução Trigger for DynaGateway é composta, em linhas gerais, pelos seguintes elementos:

- **Dynamox Sensors:** Responsible for accurate online monitoring of vibration and temperature in industrial assets.
- **DynaGateway:** A device that communicates with the sensors, coordinates data collection, and transmits the information to the Dynamox Platform.
- **PLC STG-800 (when applicable):** Centralizes and processes process signals, generating digital outputs that represent pre-trigger conditions and the final trigger.
- **Monitored asset and process signals:** Equipment and systems (motors, gearboxes, locomotives, off-road trucks, conveyors, among others) that generate electrical signals representing operating states.
- **Dynamox Platform:** The environment where data is received, stored, visualized, and analyzed.

In simplified terms, the architecture can be understood as follows:

1. The **asset** enters a specific operating state (for example, a load cycle or maneuver).
2. This state is detected by process sensors or automation logic and sent to the **PLC STG-800**.
3. The PLC applies the configured logic (pre-trigger, final trigger, sequences, combinations) and activates a **digital output** dedicated to DynaGateway.
4. **DynaGateway** interprets the signal through its digital input and, according to the configuration, executes the communication routine with Dynamox sensors and performs waveform collection.
5. The collected data is sent to the **Dynamox Platform**, where it becomes available for monitoring, trend analysis, and reporting.

In applications where the logic is simple, the PLC can be omitted, and the digital signal can come directly from the asset or a dedicated contact. In scenarios with multiple conditions, using the PLC STG-800 provides greater control and robustness.

2.4 Accepted voltage and electrical precautions

The digital input used by Trigger for DynaGateway on DynaGateway was designed to operate with **direct current (DC)** signals within a safe voltage range.

Key electrical characteristics:

- **Accepted voltage range:** 5 VDC to 24 VDC. Within this range, the signal is correctly interpreted as active or inactive logic level, according to configuration.
- **Signals below 3 VDC:** may not be recognized or may cause undefined behavior.

> ⓘ **Signals above 24 VDC:** may cause **permanent damage** to DynaGateway's digital input.

For this reason, the following precautions must be observed:

- Ensure that the signal provided by the **PLC STG-800** (or any other device) to DynaGateway's digital input is **always within the 3–24 VDC range**.
- In assets or panels that use higher voltages (for example, 48 VDC, 70 VDC, or typical locomotive control levels), **signal conditioning** is mandatory before connecting to DynaGateway. This conditioning may include:

– Use of interface relays or optocouplers;
– Auxiliary 24 VDC power supplies for PLC output logic;
– Specific level conversion modules, when applicable.

- Use only **direct current (DC)** signals as specified;
- Check wire **polarity** before connection;
- Ensure DynaGateway is **de-energized** during assembly and wiring, following plant safety procedures.

Responsibility for ensuring signal compliance lies with the team responsible for the panel and PLC integration. The DynaGateway installation manual and the plant's internal electrical safety standards must always be followed.

2.5 Functional overview

In summary, Trigger for DynaGateway can be understood as:

- A **bridge** between the automation world (digital signals, PLC, process logic) and the **condition monitoring** world (sensors, waveforms, vibration analysis);
- A feature that directs DynaGateway to **collect data only when it makes sense**, aligning measurements with specific asset states;
- A resource that integrates naturally with existing **PLC STG-800** logic, without interfering with process control, simply "reading" conditions via dedicated digital signals.

The next chapters will detail **pre-installation requirements**, **step-by-step assembly**, and **practical configuration** of the feature on the Dynamox Platform and in the field.

3 Pre-installation

This chapter presents the precautions and checks required **before physically installing** Trigger for DynaGateway in the field. The goal is to ensure the environment, electrical signals, and materials are suitable, minimizing rework and risks to equipment and personnel.

3.1 Pre-assembly checklist

Before starting any installation activity, follow the checklist below:

3.1.1 System documentation and information

- Confirm the equipment model: **DynaGateway** compatible with digital input for Trigger for DynaGateway;
- Verify if the **PLC STG-800** (or other PLC) is installed and operational, when applicable;
- Have on hand:
  - Electrical diagram of the panel where DynaGateway will be integrated;
  - List of PLC **digital inputs and outputs** related to the Trigger;
  - Identification of the trigger point in the process (e.g., limit switch, running signal, tipping command);
  - Specification of control voltages involved.

3.1.2 Required materials and components

- DynaGateway unit to be installed;
- PLC STG-800 (when the application requires additional pre-trigger/trigger logic, without embedded technology to activate the trigger, etc.);
- Digital signal cables (twisted pair or equivalent, per plant standard);
- Connectors, terminals, terminations, and any cable glands suitable for the required protection rating.
- Signal conditioning devices, when needed:
  - Interface relays;
  - Optocoupler modules;
  - Level converters for 12/24 VDC;
- Power supply (**12/24 VDC**) for command logic and interface modules;
- Mounting hardware (screws, clamps, DIN rail, supports, etc).

3.1.3 Recommended tools

- Screwdrivers compatible with DynaGateway and panel connectors;
- Wire cutters and strippers;
- Crimping tools (if terminals are used);
- **Multimeter** for voltage and continuity checks;
- Labels or markers for cable and connection identification.

3.1.4 Installation site checks

- Confirm **physical location** for DynaGateway:
  - Secure mechanical mounting;
  - No mechanical interference;
  - Adequate proximity to monitored area and communication network.
- Verify environmental **protection level** (e.g., IP67) and, if needed, plan for:
  - Proper cable glands and seals;
  - Protection against dust, moisture, and splashes;
  - Minimum distance from heat sources.
- Plan **cable routing** to avoid:
  - Prolonged parallel runs with power cables;
  - Areas with strong electromagnetic interference;
  - Crushing points or excessive bending.

3.2 Signal conditioning (when required)

The Trigger for DynaGateway uses the DynaGateway's **digital input**, designed to operate within a specific DC voltage range. Before installation, it is essential to ensure that the process signals are adequate.

3.2.1 Expected operating range

- Digital input accepts signals between **3 VDC and 24 VDC**;
- Signals below **3 VDC** may not be recognized correctly;
- Signals above **24 VDC** may permanently damage the input.

3.2.2 Common scenarios requiring conditioning

- Panels or assets operating with control logic **above 24 VDC** (e.g., 48 VDC, 70 VDC, traction systems);
- Equipment without dedicated 24 VDC output for external interface.

In such cases, it is recommended to:

- Use **interface relays** or dedicated output modules in the PLC, powered by 24 VDC, so that the relay contact switches the appropriate voltage for the DynaGateway;
- Employ **optocouplers** or isolation modules when galvanic separation between the process circuit and the DynaGateway circuit is required;
- Verify in the electrical design that the current and voltage supplied to the DynaGateway are within the specified limits.

3.2.3 Best practices for cabling and grounding

- Use appropriate control signal cables, preferably twisted pairs;
- Follow plant **grounding and shielding** practices:
  - Shielded cables grounded at a single point, if standard;
  - Avoid ground loops that introduce signal noise.
- Maintain physical segregation between signal and power cables whenever possible.

3.2.4 Signal pre-check

Before connecting the signal to the DynaGateway digital input, you should:

- Measure voltage with a **multimeter**, simulating trigger condition (active/inactive);
- Confirm values are within **3–24 VDC** range;
- Verify signal **polarity** (positive/negative) and common reference (0 VDC) shared between DynaGateway and control circuit.

3.3 Electrical safety and installation preparation

Installation activities for the Trigger for DynaGateway involve accessing electrical panels and field equipment. Therefore, it is essential to follow the plant's safety procedures and applicable standards:

3.3.1 Power isolation and lockout

- Ensure that the panel where the DynaGateway will be installed is **de-energized** before any intervention;
- Apply **lockout/tagout (LOTO)** procedures when available at the plant;
- Verify the **absence of voltage** using appropriate instruments before touching cables or terminals.

3.3.2 Personal Protective Equipment (PPE)

- Use PPE required by local safety policy, such as:
  - Insulating and mechanical protection gloves;
  - Safety glasses;
  - Helmet, safety footwear, and clothing suitable for industrial environments.

3.3.3 Responsibilities and qualifications

- Installation must be performed by qualified professionals familiar with:
  - Electrical diagram reading;
  - Panel assembly practices;
  - Internal safety and energy isolation standards.
- The technical lead must validate the integration design of Trigger for DynaGateway with the PLC and process before assembly begins.

3.3.4 Additional precautions for DynaGateway

- Do not connect or disconnect signal cables with DynaGateway energized, unless specifically instructed by the manufacturer.
- Avoid exposing the device to:
  - Excessive moisture during assembly;
  - Dirt, dust, or conductive particles inside the panel;
  - Mechanical stress during tightening of screws or connections.

4 Installation

This chapter describes **the structure of the Trigger for DynaGateway installation kit**, **step-by-step assembly** of the PLC STG-800 and Wago connector set, and important notes to ensure a safe and organized installation.

4.1 Installation kit structure

The installation kit for Trigger for DynaGateway was designed to simplify field assembly and allow the PLC + connector set to be prepared in advance when necessary. It typically includes:

- **3M VHB 4960 Double-Sided Tape (19 mm):**
  - Cut section (approx. 13 cm) used to fix the PLC to the base or kit mask.
- **Flexible signal and power cables:**
- **Black** flexible cable, 0.32 mm² (22 AWG) – approx. 33 cm;
- **Red** flexible cable, 0.32 mm² (22 AWG) – approx. 21 cm;
- **White** flexible cable, 0.5 mm² (20 AWG) – approx. 6 cm.
- **Tubular terminals (ferrules):**
  - 6 units of pre-insulated single tubular terminals for 0.5 mm² conductor (black), used on cable ends connected to the PLC and Wago connector.
- **Inline Wago connector:**
  - 1 unit of 5-way inline splice connector, model 221-415 or equivalent (0.14–4 mm²), for organizing and branching power and return cables.
- **Nylon cable ties:**
  - 2 units of nylon ties, 100 x 2.5 mm (or per specification), for securing and organizing the cable harness.
- **PLC STG-800:**
  - 1 unit of PLC STG-800 (Barth Elektronik model 0850-0800), supplied with firmware corresponding to the customer's application profile.

QUANTITY	DESCRIPTION
13 cm	3M VHB 4960 DOUBLE-SIDED TAPE 19MMX33M
33 cm	FLEXIBLE CABLE SECTION 0.32MM SQUARE - 22AWG - 100M - BLACK
21 cm	FLEXIBLE CABLE SECTION 0.32MM SQUARE - 22AWG - 100M - RED
6 cm	FLEXIBLE CABLE SECTION 0.5MM SQUARE - 20AWG - WHITE
6 pcs.	SIMPLE TUBULAR TERMINAL (EYELETS) PRE-INSULATED 0.5MM2 BLACK
1 pc.	5P INLINE CONNECTOR 41A 0.14-4MM 221-415 - WAGO
2 pcs.	NYLON TIE 100 x 2.5mm - PACKAGE OF 100 pcs.
1 pc.	PLC - PROGRAMMABLE LOGIC CONTROLLER - 0850-0800 - BARTH-ELEKTRONIK

The kit structure is organized into **two main stages**:

- **Material preparation:** assembling the wiring harness and securing the components (PLC and Wago connector) to the kit's base/mask;
- **Final assembly:** integrating the kit with the DynaGateway and connecting it to the power supply and signal points on the customer's panel.

This division allows the kit to be prepared in a controlled environment and shipped to the customer ready for installation, especially when the DynaGateway is already in operation and will only be complemented with the Trigger for DynaGateway functionality.

4.2 Material preparation

Material preparation consists of **mechanically securing** the PLC and the Wago connector to the kit base, followed by **assembling the wiring harness**.

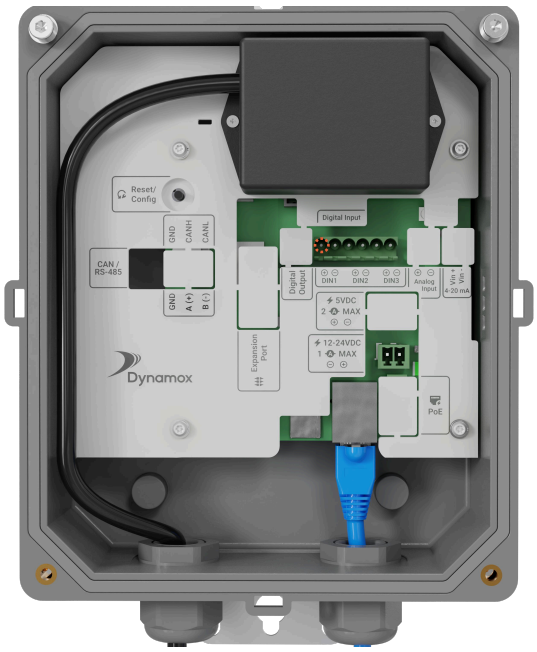
Follow the steps below:

1. Cleaning the mounting surface:

- Clean the surface of the base/mask where the PLC STG-800 and the Wago connector will be installed, using a clean cloth and alcohol;
- Ensure the area is dry and free of dust, oil, or debris to guarantee proper adhesion of the double-sided tape.

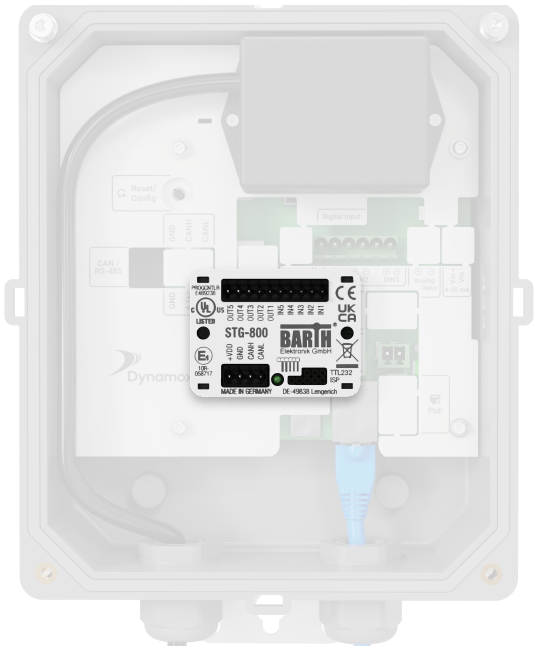
2. Direct connection of the operational signal:

- If your machine has embedded logic and does not require a PLC, or if the operational signal for the Trigger is a single step, you can insert this signal directly into the DynaGateway, as shown in the image on the side (first terminal from left to right). If not, proceed with the following steps.



3. Applying the double-sided tape for the PLC:

- Apply the 3M VHB double-sided tape to the designated area for the PLC (as marked on the kit's mask/base);
- Remove the protective film from the tape.

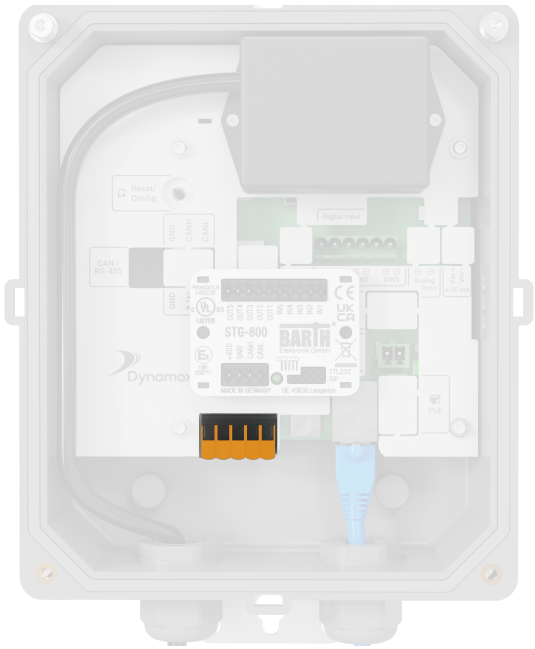


4. Securing the PLC STG-800:

- Position the PLC on the double-sided tape, aligning it with the marking (dashed line or outline) so that the PLC body fully covers the mark;
- Press firmly for a few seconds to ensure proper adhesion.

5. Positioning the Wago connector:

- Place the 5-way Wago connector in the designated area on the kit base, with the **cable entries facing the cable glands** (or cable exit route) to facilitate harness organization;
- Secure the connector using the method provided in the kit (adhesive, snap-fit, or other).

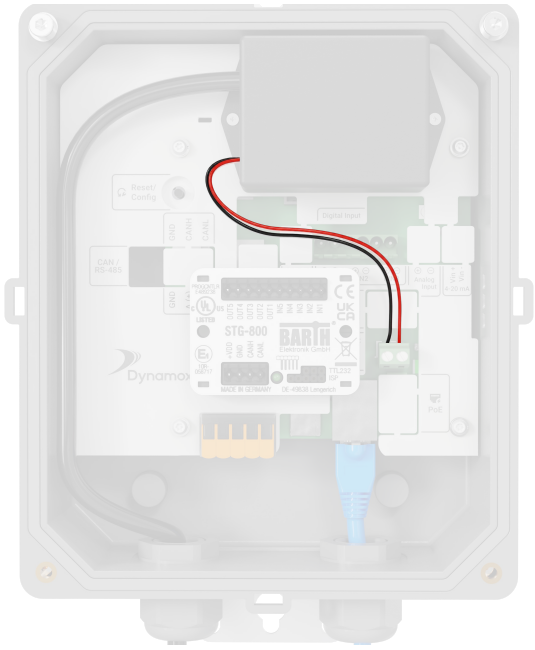


6. Preparing the power supply cables:

- Separate the **red** and **black** cable sections corresponding to the power supply (length as specified in the kit);
- Strip the ends that will be connected to the power source and, when applicable, crimp tubular terminals on the ends that will connect to the PLC and the Wago connector.

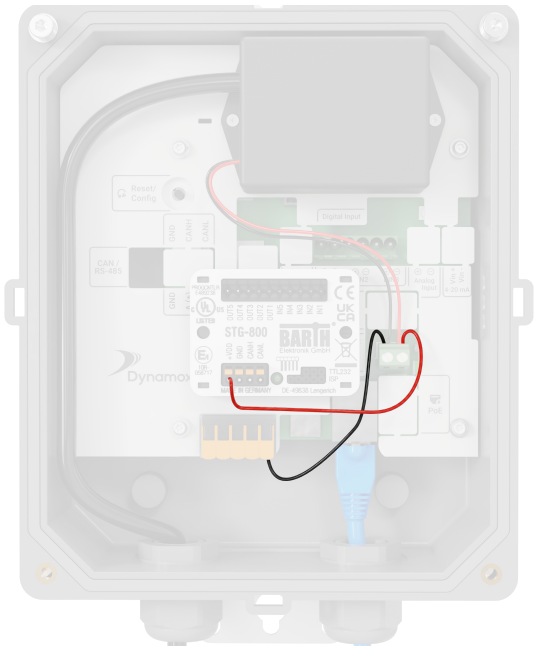
7. Connecting to the power source:

- Join the **non-crimped** ends of the red and black cables to the respective output cables of the system's power supply (positive and negative), following the panel's standard color coding;
- Secure these connections to the **green connector** or designated power terminal, according to the kit's electrical diagram and the customer's panel.



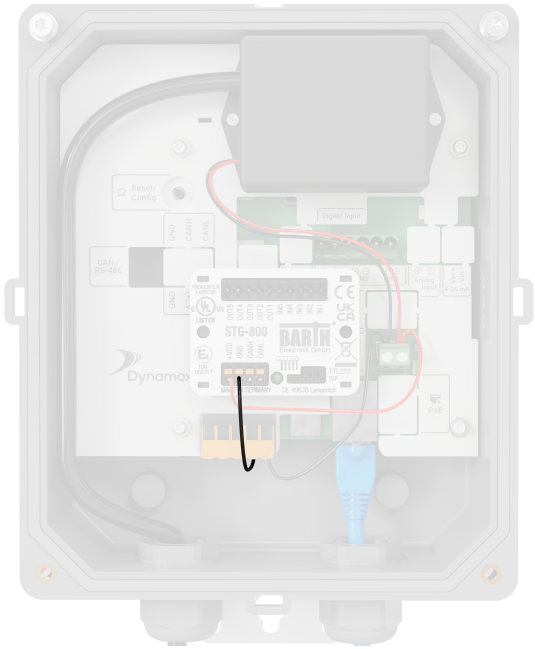
8. Connecting the cables to the PLC and Wago connector:

- Connect the **crimped** end of the red cable to the positive power terminal of the PLC STG-800 (12/24 VDC or as specified for the PLC);
- Connect the **crimped** end of the black cable corresponding to the common return (0 VDC) to the Wago connector, which will serve as the distribution point for this potential.



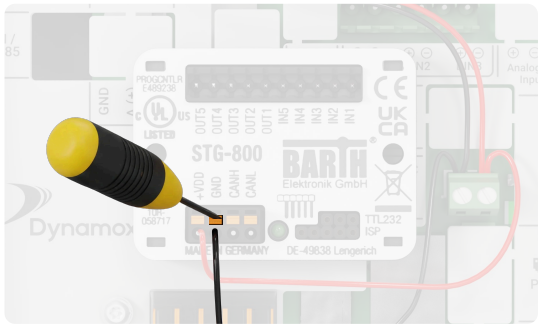
9. Interconnecting the return between PLC and Wago:

- Connect the **black** cable section (common return) between the 0 VDC terminal of the PLC STG-800 and one of the Wago connector terminals, as shown in the kit illustration;
- This connection ensures that the PLC and the DynaGateway share the same 0 VDC reference, provided that the Gateway return is also derived from this point.



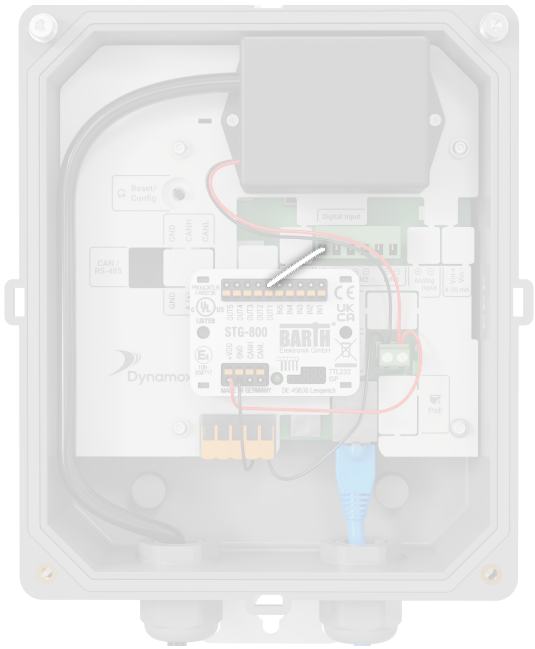
Wago connector:

To insert the cable into the Wago connector, use a **small screwdriver** to press the orange pin/actuator, fully insert the conductor into the housing, and then release the pin to lock the cable.



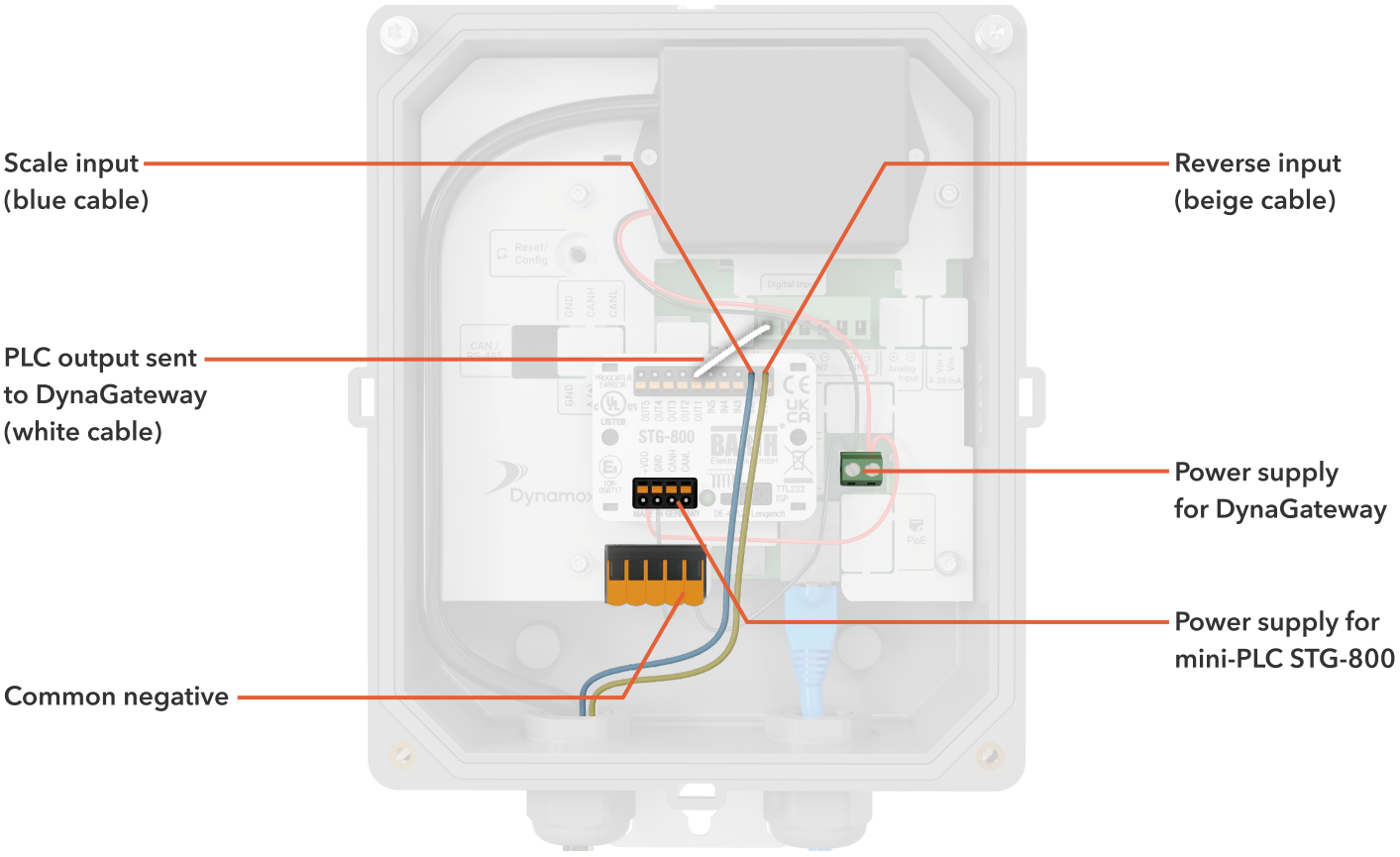
10. Preparation of the trigger output cable

- Prepare the **white** cable that will be used as the trigger output from the PLC to the DynaGateway;
- Crimp a tubular terminal on the end that will be connected to the **OUT1** output (or another designated PLC output);
- Prepare the other end for connection to the 7-pin connector of the DynaGateway (or equivalent connector defined for the digital input).



11. Connecting the white cable to the PLC output

- Connect the white cable to the digital output configured as the trigger (e.g., **OUT1**), observing the polarity and the function defined in the PLC logic.



4.3 Final assembly and cable organization

After preparing the materials, proceed with the final harness organization and integration with the DynaGateway:

1. Harness organization and fastening:

- Group the cables (power supply, return, trigger output) and secure them with the provided **nylon cable ties**;
- Ensure the cables are neatly arranged, without excessive mechanical stress and without risk of being pinched by covers or panel doors;
- Trim excess cable tie ends after tightening to avoid sharp edges.

2. Connecting the trigger to the DynaGateway

- Connect the free end of the **white** cable to the corresponding pin of the DynaGateway **digital input** (e.g., right pin of the 7-pin connector, according to the Gateway's electrical layout);
- Ensure that the return (0 VDC) used by the DynaGateway is properly interconnected to the same **common reference point** used by the PLC (via Wago connector or panel return terminal).

3. Verifying PLC input connections

- Confirm that the PLC input points (e.g., IN4 and IN5) are connected according to the application logic:
  - One input for the pre-trigger (when applicable);
  - Another input for the collection trigger.
- Check in the application diagrams which process signals feed these inputs (switches, sensors, machine PLC contacts, etc.).

4. General wiring review

- Verify that all cables are correctly identified according to plant standards;
- Ensure there are no loose conductors, poorly crimped terminals, or partially inserted wires in terminals and connectors;
- Check the tightness of all terminals, including those on the power supply and panel terminals.

4.4 Important installation notes

To ensure mechanical and electrical robustness of the installation, observe the following points:

- **Use of proper tools:**
  - Use a fine-tip screwdriver to operate the Wago connector locking mechanism, inserting the cable only with the pin pressed and ensuring the conductor is fully inserted before releasing.
- **Integrity of the double-sided tape:**
  - Securing the PLC with 3M VHB double-sided tape requires a clean surface and uniform pressure during application;
  - Avoid repeated repositioning, which may reduce adhesion strength.
- **Cable routing and strain relief:**
  - Ensure the cable harness is not under tension or bent at sharp angles;
  - Whenever possible, provide a small “slack loop” to absorb vibrations and panel movements.
- **Electrical safety:**
  - All installation must be performed with the panel de-energized, following the plant’s lockout tagout (LOTO) procedures;
  - Any subsequent wiring changes must be followed by a new check of the voltages applied to the DynaGateway and PLC.

4.5 Post-installation verification

Once the physical installation of the kit is complete, it is recommended to perform a basic functional check before final logic configuration:

1. Power check:

- Energize the panel in a controlled manner and verify that the PLC STG-800 and the DynaGateway power up correctly, according to their visual indicators.

2. Testing PLC inputs and outputs:

- Manually or via the system, activate the conditions that should trigger the pre-trigger and the trigger;
- Confirm that the corresponding PLC inputs are activated and that the trigger output (OUT1 or similar) correctly switches the voltage (3–24 VDC) at the DynaGateway digital input.

3. Validating the signal on the DynaGateway:

- Using a multimeter, measure the voltage at the DynaGateway digital input point, verifying that the active level is within the specified range (3–24 VDC);
- Ensure there is no residual voltage when the signal is inactive.

4. Configuration record:

- Record which PLC inputs were used (e.g., IN4 = collection trigger, IN5 = pre-trigger) and which output is connected to the DynaGateway digital input;
- This information will be used in the next step for **logic and parameter configuration** of the Trigger for DynaGateway, detailed in the following chapter.

5 Configuration

This chapter describes how the **Trigger for DynaGateway** should be configured, from the operating logic (pre-trigger and final trigger) to operating modes and timing parameters, and configuration via the platform for LTE/IoT devices. The goal is to ensure that technicians, engineers, and coordinators understand **how the system decides when to collect and how to transform the operating condition into a collection rule**.

5.1 Configuration overview

Configuring the Trigger for DynaGateway involves three main aspects:

- **Process / PLC side:**
  - Define which signals represent the operational condition of interest (pre-trigger, final trigger, or single event).
  - Program the logic in the **PLC STG-800** (or another plant PLC), generating one or more digital outputs dedicated to the DynaGateway.
- **DynaGateway side (digital input):**
  - Physically connect the trigger signal to the DynaGateway digital input;
  - Define the **type of logic level** (active high or active low);
  - Ensure the signal is within the **3–24 VDC** range.
- **Dynamox Platform side (trigger profile):**
  - Associate the sensors that will be collected under condition;
  - Choose the operating mode (single step, two steps, event per sensor, single event for multiple sensors);
  - Configure timing parameters (minimum condition time, interval between collections, timeout, maximum number of events per day).

5.2 Pre-trigger and final trigger logic

The pre-trigger and final trigger logic is used in applications where **the event of interest is short** or when the machine does **not remain stable long enough** for the entire connection and data collection process to occur in a single step.

1. **Pre-trigger:**

- It is the system preparation signal;
- When the pre-trigger is activated, the DynaGateway:
  - Starts or intensifies the attempt to communicate with the associated sensors;
  - "Keeps the connection alive" within a configured time window;
  - Remains in standby mode to receive the final trigger.
- It usually comes from a condition that anticipates the main event, such as:
  - Start of a maneuver;
  - Gear engagement;
  - Preliminary positioning of equipment.

2. **Final trigger:**

- It is **the signal that authorizes waveform collection**;
- Must occur **within the window** opened by the pre-trigger;
- When the final trigger is received, the DynaGateway:
  - Validates whether the pre-trigger is active (or if the condition was met within the expected time);
  - Initiates the collection routine for the configured sensors;
  - Logs the event as a condition-based collection.

Operating logic:

1. The pre-trigger is activated (dedicated PLC input and corresponding output to the DynaGateway).
2. The DynaGateway enters preparation mode within a configured **response time**.
3. If, within this time, the final trigger is activated:
   - The condition is considered valid;
   - The DynaGateway initiates sensor data collection.
4. If the final trigger does **not** occur within the response time:
   - The event is canceled;
   - The system returns to standby mode;
   - Cancellation is governed by the **timeout** parameter.

This logic ensures reliable recording of events that, on their own, would be faster than the necessary connection and collection window between the DynaGateway and sensors.

5.3 Operating modes

The Trigger for DynaGateway can operate in different modes, adapting to the asset's behavior and the type of event to be monitored.

1. Single-step mode (one signal):

- A single digital signal represents the complete collection condition.
- When this signal reaches the configured state (e.g., active high level), the DynaGateway:
  - Validates the **minimum dwell time**;
  - Initiates waveform collection from the associated sensors.
- Recommended for:
  - Machines with stable operating conditions, where the condition of interest lasts longer than the time required for connection and collection;
  - Applications where it is sufficient to know "how the asset behaves when this signal is active."
- Example: A locomotive configured to collect only at **speed notch 8**, using a single digital signal indicating when this point is reached.

2. Two-step mode (pre-trigger + final trigger):

- Uses two distinct signals, organized in the PLC:
  - One for the pre-trigger;
  - Another for the final trigger.
- Pre-trigger opens the preparation window (communication and readiness);
- Final trigger, within this window, authorizes collection.

Recommended for:

- Assets with **short or transient cycles**, where the main event is very fast;
- Situations where the desired operating condition occurs only for a few seconds;
- Logic obtained from distinct activation signals with sequential steps.

3. **Event-per-sensor mode:**

- Each sensor associated with the profile is triggered for each signal (or set of combined signals) from the **trigger event** to perform the data collection
- The DynaGateway interprets these signals individually, triggering collection only for the corresponding sensor, according to the waveform collection queue configuration.

Recommended for:

- When each sensor is associated with a subsystem with very fast events;
- When the event is too short to perform all collections for sensors associated with **Trigger for DynaGateway**.

4. **Single-event mode for multiple sensors:**

- A single signal (or combined set of signals) **triggers collection for all sensors associated** with the trigger profile.
- After receiving a valid event, the DynaGateway:
  - Iterates through the list of configured sensors;
  - Performs collections **sequentially**, **one sensor at a time**, respecting its communication architecture.

Recommended for:

- When the event is long enough for the configured sensor profile collection to be triggered by a single event.

5.4 Timing and prioritization parameters

In addition to operating modes, proper functioning of Trigger for DynaGateway depends on configuring some **key parameters** in the trigger profile.

1. **Condition dwell time (minimum time):**

- Defines how long the trigger signal (or set of signals) must remain active to be considered **valid**.
- Serves as a filter against:
  - Electrical noise;
  - Acceleration ramps;
  - Very fast irrelevant pulses;
  - Contact oscillations.
- Must be compatible with process dynamics:
  - For stable events, it can be longer;
  - For fast events, it should be sufficient to filter noise without preventing detection.

2. Timeout (maximum waiting time for the condition):

- Determines how long the DynaGateway will wait for **condition confirmation** after the event starts (especially relevant in pre-trigger + final trigger).
- If the condition is not met within this interval:
  - The event is **canceled**;
  - No collection occurs;
  - The system returns to standby mode.
- Prevents the DynaGateway from remaining indefinitely "locked" in an attempt to collect that never materializes.

3. Interval between collections and maximum number of events per day:

- The trigger profile defines:
  - The maximum number of daily collections under trigger;
  - The minimum interval between collections for the same profile.
- These parameters protect:
  - DynaGateway processing capacity;
  - Sensor battery life;
  - Data quality, avoiding excessive redundant data.

Typically adopted:

- **One collection per day** per trigger, depending on asset criticality;
- A minimum interval of several hours between successive collections for the same profile, to respect the DynaGateway charging cycle and trend analysis purpose.

4. Event priority and coexistence with scheduled collections:

- The DynaGateway can operate with:
  - Time-based scheduled collections; and
  - Condition-based collections via Trigger for DynaGateway.
- Schedules are independent but coexist. When defining the trigger profile, it's important to:
  - Avoid trigger windows during periods of high scheduled collection volume;
  - Adjust the number of daily collections to avoid overloading communication and analysis.

In terms of prioritization:

- It is recommended to treat the trigger as a high-interest event, to be respected within configured quantity and interval limits;
- If the process generates trigger events very frequently, it is essential to:
  - Review the logic with the automation team;
  - Adjust the minimum condition time and maximum number of events per day.

5.5 Practical configuration example

Below is a generic example of a configuration sequence for an asset using **pre-trigger and final trigger**:

1. **Define the operational condition of interest:**

- **Example:** tipping of an off-road truck while in reverse gear.

2. **Map signals in the process / PLC:**

- **PLC Digital Input 1:** reverse gear signal (pre-trigger);
- **PLC Digital Input 2:** tipping signal activated (final trigger);
- **PLC Digital Output 1:** logical combination to be sent to the DynaGateway (pre-trigger);
- **PLC Digital Output 2:** final trigger for the DynaGateway.

3. **Program the logic in the PLC:**

- Pre-trigger active when reverse gear is engaged;
- Final trigger active when the tipping mechanism is activated with reverse gear engaged.

4. **Connect PLC outputs to the DynaGateway:**

- **Pre-trigger digital output:** dedicated digital input (when architecture uses two channels or accessory);
- **Final trigger digital output:** DynaGateway digital input used by the trigger profile;
- Ensure voltages are within the 3–24 VDC range and that the 0 VDC reference is shared.

5. **Configure the trigger profile in the Dynamox Platform:**

- Associate the sensors installed on the truck with the trigger profile;
- Select **two-step mode (pre-trigger + final trigger)**;
- Define:
  - Minimum condition dwell time (e.g., 10 s);
  - Timeout between pre-trigger and final trigger (e.g., 30 s);
  - Maximum number of collections per day (e.g., 2 collections via trigger);
  - Minimum interval between collections (e.g., 4 hours).

6. **Validate operation in the field:**

- Manually force the condition (reverse gear + tipping) in a controlled environment;
- Verify that the DynaGateway logs the event and triggers sensor collection;
- Confirm in the Dynamox Platform that data arrives under the corresponding trigger profile.

6 Platform setup

6.1 Prerequisites

Before starting configuration in the Dynamox Platform, check that:

- It is a DynaGateway LTE/LTE-S or IoT/IoT-S (only);
- The DynaGateway is installed, powered, and connected to the network (Wi-Fi, Ethernet, or mobile network);
- The DynaGateway has already been adopted in a Workspace on the Dynamox Platform;
- The Spots and Dynamox sensors to be used with the Trigger are registered and associated with the same Workspace as the Gateway;
- The DynaGateway digital input is correctly connected to the asset or PLC outputs, with a signal between 3 and 24 VDC;
- The user has permission on the Platform to edit Gateway settings.

6.2 Accessing DynaGateway on the Platform

1. Access the Dynamox Platform via browser;
2. Select the Workspace where the DynaGateway is adopted;
3. In the side menu, go to **Gateways**;
4. Locate the desired DynaGateway in the list and click on it to open the settings screen.

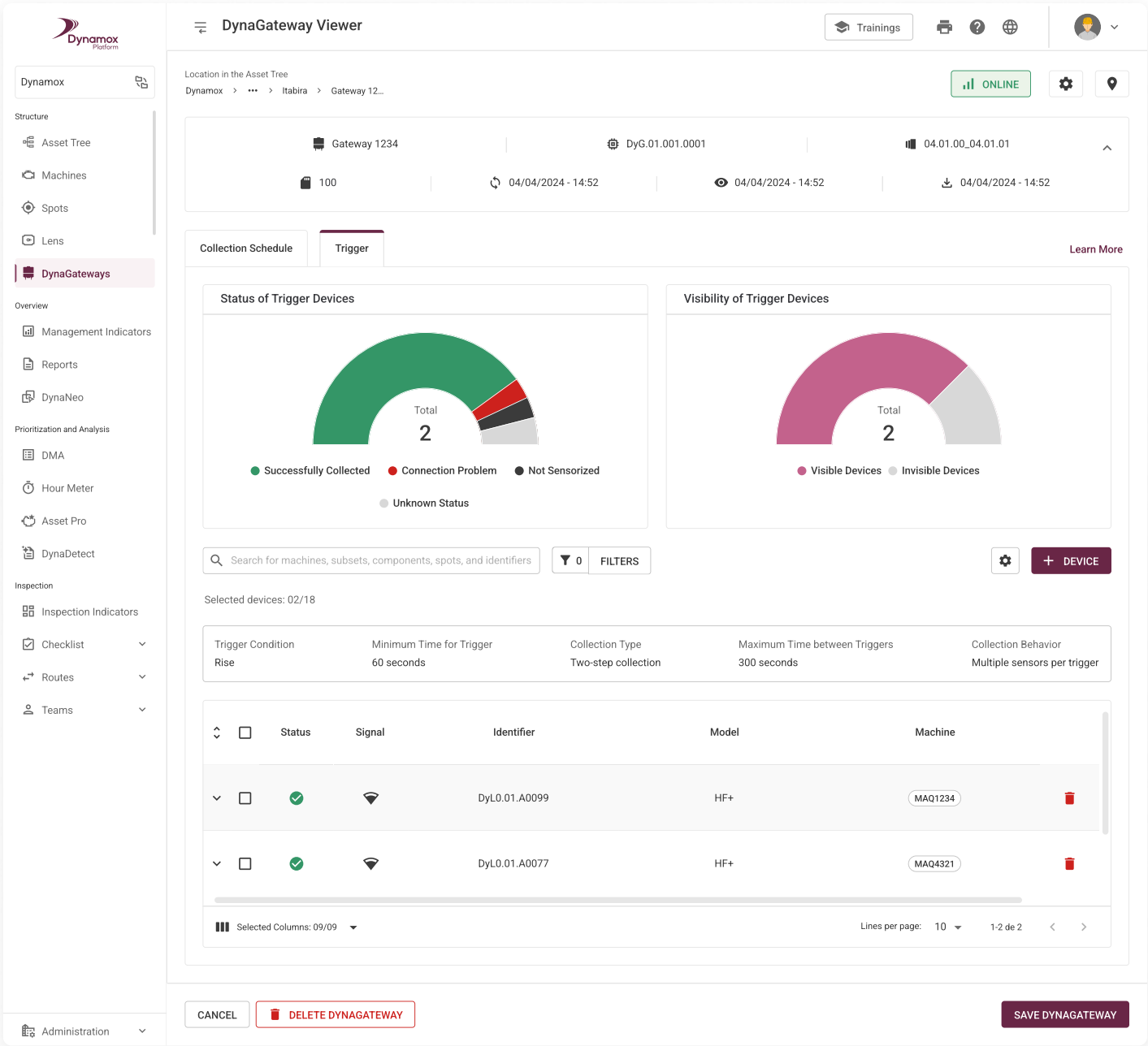
On the Gateway screen, general device information is displayed, and below, the list of associated and visible Spots.

6.3 Trigger for DynaGateway section

On the Gateway settings screen, locate the section for Trigger.

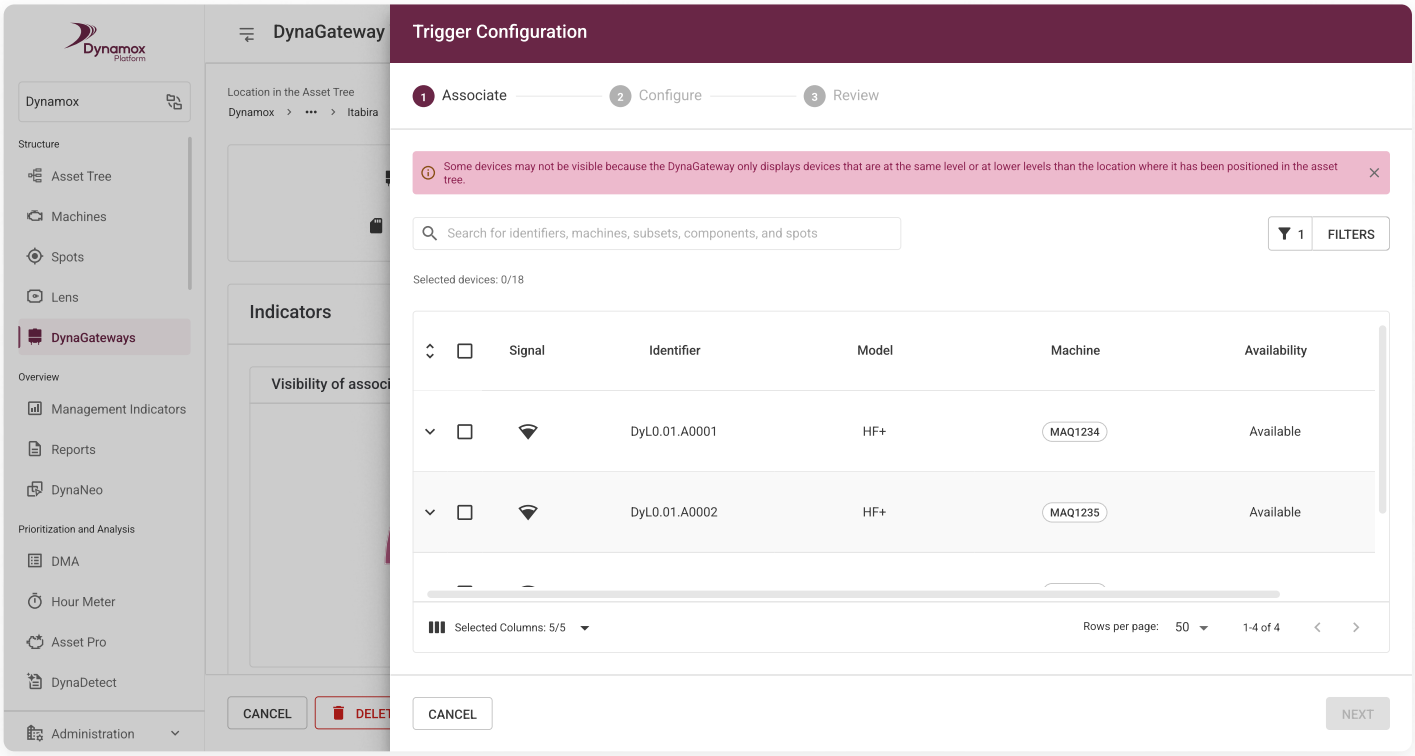
In this section, the following are configured:

- Sensors to be triggered under condition;
- Trigger operating mode;
- Digital input parameters;
- Dwell times, condition response time, and timeout.



6.4 Associating sensors with Trigger

1. Check the Spots associated with the Gateway at the bottom of the screen (click the gear icon in the Trigger tab);
2. Select the Spots (sensors) that will be part of the Trigger for DynaGateway logic;
3. Respect the maximum sensor limit per Gateway defined for the feature (e.g., up to 16 sensors).



6.5 Selecting operating mode

Define the Trigger operating mode according to the application:

- **Single-step (single trigger):**
  - Collection initiated by a single digital signal;
  - Recommended for machines with stable operating conditions, where the condition of interest lasts long enough for connection and collection.

- **Two-step (pre-trigger + final trigger):**
  - One signal acts as pre-trigger (communication preparation);
  - Another signal acts as final trigger (collection authorization);
  - Recommended for short or transient cycles where the main event is fast.

- **Event-per-sensor:**
  - Each sensor has its own trigger event;
  - Suitable for assets where different points are associated with distinct events.

- **Single event for multiple sensors:**
  - A single event triggers all sensors associated with the Trigger profile;
  - Collections are executed sequentially, one sensor at a time.

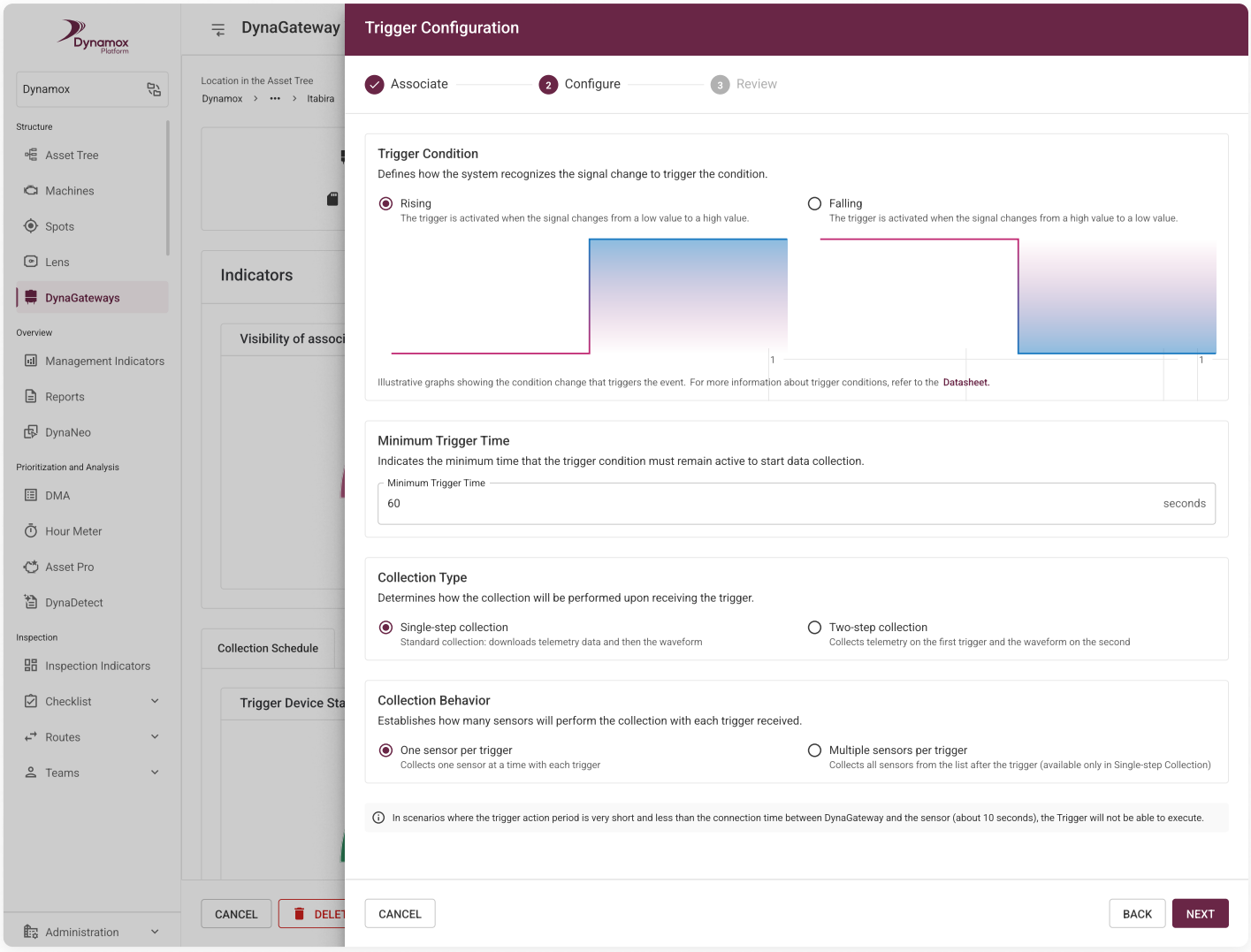
6.6 Trigger parameters

Configure the parameters that define digital input behavior and Trigger logic:

- **Logic level (signal priority):**
  - Define whether the signal will be considered active at high level (energized) or active at low level (de-energized), according to PLC or asset logic.
- **Minimum condition dwell time:**
  - Minimum time the signal must remain active to be accepted as valid;
  - Used to filter electrical noise, very fast pulses, and contact oscillations.
- **Condition response window:**
  - Time window during which the DynaGateway waits for operational condition confirmation after detecting the trigger or pre-trigger event;
  - If the condition is not met within this window, the attempt is terminated.
- **Timeout (Default):**
  - Maximum waiting time for the condition or pre-trigger + final trigger sequence (300 s);
  - When timeout is reached, the DynaGateway cancels the collection attempt and returns to standby mode.
- **Signal association to steps (Two-step mode):**
  - Define which signal will be used as pre-trigger and which as final trigger;
  - Adjust the maximum allowed time window between pre-trigger and final trigger for the sequence to be considered valid.

- **Maximum number of events and interval between collections (Default):**

– Define the maximum number of collections per day generated by the Trigger (1x per day);
– Define the minimum interval between collections for the same profile, avoiding communication overload and redundant data (24 hours).



6.7 Saving and applying configuration

1. Check selected sensors, operating mode, and defined parameters;
2. Select the collection sequence using the arrows;
3. Click **Save** in the Trigger section;
4. Save the Gateway settings.

The Platform sends the new Trigger profile to the DynaGateway, which starts operating with the updated rules from the next detected trigger event.

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