



AI-powered surveying

Introduction

The TS20 debuts as the first robotic total station equipped with on-device (edge) AI, taking automation to the next level by accelerating measurements, reducing mistakes, and enabling performance in the most challenging conditions.

But what exactly does AI bring to a total station and how does it advance the TS20's capabilities?

This guide will help you understand the TS20's AI-powered features and how they add value to your daily work as a surveyor.

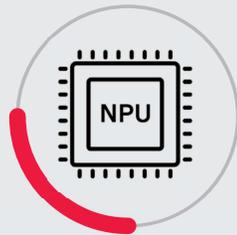
This guide:

- Introduces the processing chip enabling on-device (edge) AI in the TS20
- Describes the capabilities and benefits of the TS20's AI-powered features
- Delivers insights from TS20 development experts

The foundation for AI in the TS20: The NPU

Before we look at the TS20's AI-powered features, it is important to understand the hardware making this all possible. This is where the Neural Processing Unit (NPU) comes in.

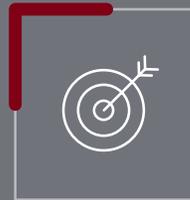
The TS20 is equipped with an NPU, a chip specifically designed for AI and machine learning tasks. The NPU efficiently processes vast amounts of data in neural networks. Additionally, all processing happens right on the total station. This is known as on-device AI, or edge AI, and this has many benefits for the TS20, including immediate and powerful performance, energy savings, and data security.



Key NPU benefits



The NPU can handle large volumes of data and perform trillions of operations per second, optimising processing speed while lowering power consumption. This means the total station can handle even more complex tasks and it doesn't drain the battery.



AI algorithms and models run directly on the TS20 where the data is generated, ensuring efficient real-time processing for AI-powered automation. Therefore, even the most sophisticated automation tasks happen immediately with no downtime for processing, keeping efficiency high.



Edge AI means data remains on the TS20, enhancing security. On-device AI empowers automation, but it doesn't learn from your data and doesn't need to transfer anything to function. This means your data is secure and you stay in complete control of when, how, and with whom it's transferred.

At its core, the NPU powers AI-driven functionalities and makes it possible to process data in the field – all in the most energy efficient configuration. This also enables the TS20 to handle increasingly complex tasks and refine existing capabilities.

Excitingly, the NPU also means that as we understand your needs in the future, we can create entirely new features and enable them on the TS20 through software updates. Altogether, this ensures that the TS20 is the right total station for you today and ready to grow with you into the future.

A new phase



The TS20 initiates a new phase for robotic total stations - taking automation to new levels with AI, enhancing robustness and performance through challenging conditions, and with a range of unprecedented connectivity, and much more. Perhaps best of all, it is a future-ready total station. So as impressive as the capabilities are today, we're already working to expand what it can do, all of which can be implemented with software updates as they come. This makes it a great investment today for access to tomorrow's capabilities.

- Hans-Martin Zogg,
Business Director
Total Stations

AI meets surveying

Equipping the TS20 with powerful processing capabilities opens a wide array of possibilities for new features. While AI is now becoming common across a variety of office applications, bringing it onto the device to make field work easier is unique. We focused this potential on automation that will have the greatest impact on the surveyor's daily tasks and challenges.

The TS20's AI-powered automation provides a way to address this through new features and enhancements to existing total station capabilities. With AI-automation we:

- Ensure surveyors can measure faster and work uninterrupted, whether on busy, dynamic construction sites, in challenging environments, or facing bad weather.
- Minimise common manual measuring mistakes that undermine efficiency and productivity.

We'll explore how the TS20's AI-driven innovations - AI-Detect, AI-Follow, and AI-powered ATR and PowerSearch - are transforming the way surveyors work, helping them save time, reduce rework, and achieve consistent results, even in the most demanding conditions.

AI-powered features overview

1

AI-Detect automatically checks that the prism type in the software matches the one you're measuring to, removing errors from measuring to an incorrectly selected target type.

2

AI-Follow predicts where the AP20 is during line-of-sight interruptions, relocking fast to continue measuring.

3

AI-enhanced ATR and PowerSearch ensure efficient and continuous measuring even in challenging conditions, like misty rain or with partially covered prisms.

4

With improved ATR and PowerSearch, the TS20 can also now measure automatically to reflective tapes, saving time and money.



AI-Detect

When surveyors measure with the incorrect prism type selected in the software, the positions are calculated with the wrong offsets, making the measurement inaccurate. Typically, the surveyor might notice this early and quickly apply corrections, but if not, the consequences can quickly escalate to time-intensive post processing, remeasuring, or costly rework if something has already been built on inaccurate data.

To combat this source of mistakes, AI-Detect automatically checks if the prism type selected in Leica Captivate is different than the one seen by the TS20 using the camera and laser signal receiver. If the two don't match, a pop-up in Captivate alerts you that the wrong prism type is selected, giving guidance to change the entry, but ultimately leaving the choice with you for assurance.

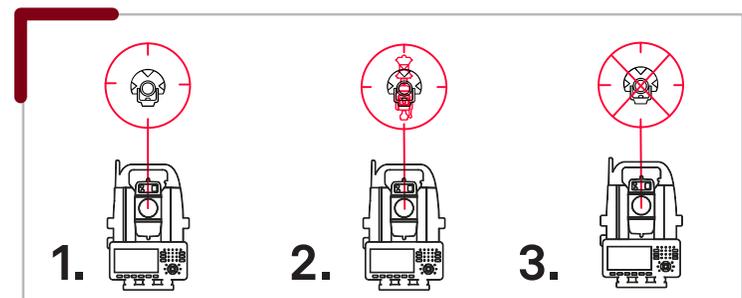
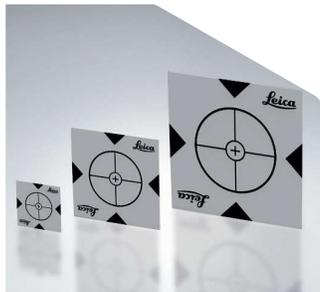


Trained on the full range of Leica Geosystems prisms, AI-Detect recognises and classifies the prism the total station is aimed to, instantly analysing images captured by the camera. This robust data set enables AI-Detect to correctly identify prism types in a range of conditions and at long distances. AI-Detect is never trained on the user's data. Instead, Leica Geosystems developers and engineers train it offline, so that all improvements are delivered through software updates and never based on customer data.

By catching mistakes before they occur with AI-Detect, surveyors save time, avoid rework, and ensure data integrity.



Quick takeaway: By ensuring you always have the right prism type selected with AI-Detect, you remove manual mistakes, increasing efficiency and reducing rework.



Impact

You see the impact of AI in various shapes and forms. Some are subtle and just let you do your work better, more comfortably, without noticing. With others, you are doing things that haven't been possible in the past and are very visible within the workflow, like detecting the right prism types so you don't need to redo work. We plan to continue developing both so you can be assured that what you do is right.



- Johannes Maunz,
VP, Artificial Intelligence

AI-Follow

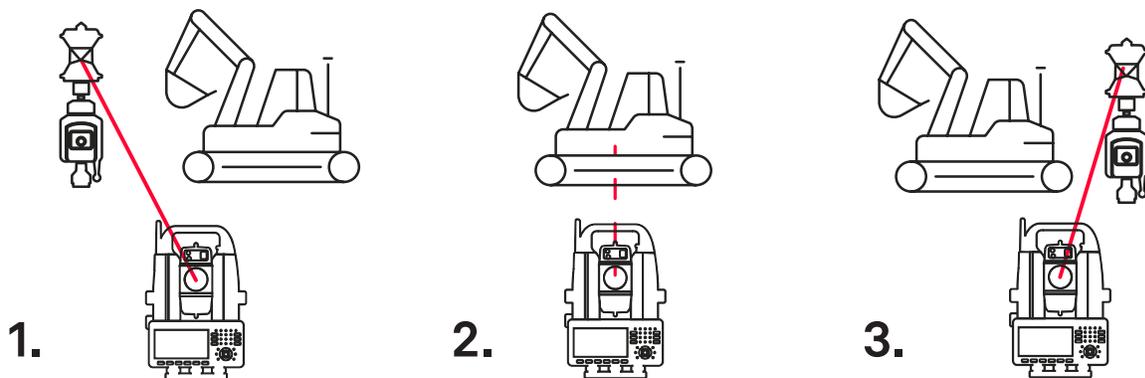
Surveyors working in one-person operations often find themselves in situations where the line of sight between the total station and the AP20 is interrupted, resulting in a loss of lock. This could include moving behind vegetation, vehicles or pedestrians passing by, laying down the pole to mark a point, and many more. Re-lock takes time, interrupting and breaking focus on work.

AI-Follow (release in 2026) provides lightning fast relock to your prism after the TS20 sees the AP20 again, enhancing productivity by reducing downtime and ensuring continuous operation in dynamic environments.

The AP20 is trained on a range of situations and movements, from obstructions to setting down and picking up the pole. The AP20 uses AI to continuously estimate prism positions and steers the TS20 to the right anticipated direction. This makes it possible for the TS20 to relock to the AP20 super-fast once line of sight is restored.



Quick takeaway: For surveyors in one-person operations using the AP20, AI-Follow means less waiting and more measuring no matter the site conditions.





Quick takeaway: With the TS20, surveyors can search and aim to prisms and reflective tapes with remarkable speed and consistency across conditions. AI-enhanced ATR and PowerSearch empower surveyors to measure and stake out more points per day with fewer interruptions to the work that needs their focus.

AI-powered ATR and PowerSearch

Automatic target searching, aiming, and locking have long delivered benefits for robotic total station users, but these features often struggled in certain weather conditions, like misty rain, and didn't work with reflective tapes. AI-enhanced ATR and PowerSearch on the TS20 deliver improved target aiming and stable prism lock in challenging environments, even when measuring to tapes.

We used AI to improve ATR for automatic target aiming and stable prism lock in challenging environments. Trained to recognise more targets in more conditions improves performance in difficult weather or when prisms are partially obstructed.

For example, our engineers went to Wales to capture data in the worst misty rain conditions to train the AI:

Step 1: Go out in the middle of nowhere and wait for terrible weather.

Step 2: Take lots of measurements of prisms and other targets in bad atmospheric conditions.

Step 3: Train the AI on the data so the TS20 can recognise prisms in all kinds of challenging environments.

The combination of AI-automation with the TS20's new hardware, including fast and accurate EDM and advanced motors, and IP66 protection make it virtually unstoppable across conditions.

Additionally, trained on prism-reflected laser signals, PowerSearch provides more robust prism identification and ensures the TS20 does not search and find other reflective spots.

AI-enhanced ATR and PowerSearch now also work with reflective tapes, allowing faster setup on sites when tapes are used as control targets.

Just the beginning

What we set here with the TS20 is the foundation for improvements going forward. We will continue to build on Hexagon's legacy with AI, maximising the capabilities of the NPU by staying close to our customers to understand their needs into the future. This means the TS20 today is really just the beginning.



- Johannes Maunz,
VP, Artificial Intelligence

Looking forward

As you've learned, on-device AI enables features like AI-Detect, AI-Follow, and enhanced ATR and PowerSearch to set the standard for productivity and performance in even the most challenging conditions. More than that, you've discovered how the NPU ensures the TS20's capabilities will evolve with your needs, making it the right instrument now and as your business and the industry develops. Finally, we encourage you to share your experiences with us so we can continue to shape this expansive future together.

Learn more about
the Leica TS20

