AT1032S Datasheet and user manual

www.ikalogic.com | support@ikalogic.com

Version 1.0, 2026-03-14

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AT1032S Overview

AT1032S is a comprehensive automated test equipment solution designed for functional PCBA testing, system validation, and firmware verification. Part of the **AT1000 series**, AT1032S eliminates the need for building custom test fixtures from scratch.

With 32 programmable analog/digital I/Os, 8 dry contact relays, programmable power supply, and extensive communication interfaces (USB, CAN, Ethernet, RS232, RS485, I2C, SPI, UART), AT1032S provides everything needed for comprehensive automated testing. It connects to a computer (Windows, Linux, MacOS) via USB or Ethernet and is controlled through comprehensive APIs supporting Python , C and NodeJS.

Figure 1. AT1032S Test Sequencer

AT1032S features **SYNC IN** and **SYNC OUT** ports that allow multiple units to be ***daisy-chained*** together, expanding your test system as your requirements grow. The API handles multiple devices, making it easy to control hundreds of I/Os from a single test script. Synchronization latency between devices is less than 0.1 µs.

Stand-alone or Remote Operation

AT1032S can store hundreds test sequences in its internal memory, allowing the operator to select the appropriate test program adapted to the device under test. The device can operate in stand-alone mode without a PC connection, or be remotely controlled from a host computer for more integrated test systems.

Warning

Read ***Safety Information*** serction carefully before using this instrument.

Typical applications and key benefits

AT1032S test sequencer is perfectly adapted to electronics design and manufacturing houses needing to automate the testing and quality assurance of electronics systems. Typical applications are:

Typical applications	Key benefits
• Functional PCB Testing • Semiconductor Validation • Communication Protocol Validation • Power Supply Testing • System Integration Validation • Firmware functional testing • Bed of nails based test systems • Stress-testing of equipment	• All-in-One Solution: Combines multiple test functions in a single device • Easy integration with APIs • Flexible Analog/Digital I/O Configuration • Daisy-chain multiple units for expanded capabilities • Production Ready: Back panel DB37/DB25 connectors for test fixture integration

Product highlights

Hardware capabilities	Software & control
• **32 Programmable I/Os** (±25V input, 0-24V output) • **8 Dry Contact Relays** (up to 60V, 2A) - solid state for unlimited lifetime • **Programmable Power Supply** (0-13V, 2A) with current measurement • **2 USB 3.0 Ports** with power cycling and current measurement (up to 1A each) • **3 Ethernet Ports** (100BASE-T) • **Communication Interfaces**: CAN 2.0A/B, RS232 (2 ports), RS485 (2 ports), I2C, SPI, UART • **Built-in HMI**: Color OLED display (160x80), rotary encoder with push button, speaker	• Python, NodeJS and C APIs for test automation • Stand-alone mode - runs test sequences without PC connection • Remote mode - controlled from your computer via USB or Ethernet • Synchronization via SYNC IN/OUT for multi-device setups (< 0.1 µs output latency) • Current measurement on power supply, USB ports, and relay number 4 (1 µA resolution) • Cross-platform support: Windows, Linux, MacOS • Linux-based system with Docker containers for test sequences

Getting Started

AT1032S is ready to use out of the box. It's delivered with USB and Ethernet cables, a 24V DC power adapter, and spring terminal connectors for all front panel connections. To start using AT1032S, you need to install the appropriate API package for your programming language of choice. Below are instructions for setting up NodeJS and Python projects:

NodeJS project

```
mkdir my_test_project
cd my_test_project
npm init -y
npm install @ikalogic/at1000
```

Python project

```
mkdir my_test_project
cd my_test_project
python -m venv my_test_env
source my_test_env/bin/activate
pip install ikalogic-at1000
```

If using python on Windows, use `my_test_env\Scripts\activate` to activate the virtual environment.

Example code

Example NodeJS script to send a voltage on one output and measure the voltage on another input:

```
import AT1000 from '@ikalogic/at1000';

// Find and connect to the device
let devices = await AT1000.findDevices(500);
const tester = devices[0];

// Configure I/O pins
const output_pin = tester.gpio.analog(1);
const input_pin = tester.gpio.analog(2);

output_pin.configure_output();
input_pin.configure_input();

// Set output voltage and read input
output_pin.write(2.5);  // Set IO 1 to 2.5V
await new Promise(resolve => setTimeout(resolve, 200));  // Wait 200ms
let voltage = input_pin.read();
console.log(`Measured voltage: ${voltage}V`);
```

And the same example script in Python:

```python
from ikalogic_at1000 import AT1000
import time

# Find and connect to the device
devices = AT1000.find_devices(timeout=500)
tester = devices[0]

# Configure I/O pins
output_pin = tester.gpio.analog(1)
input_pin = tester.gpio.analog(2)

output_pin.configure_output()
input_pin.configure_input()

# Set output voltage and read input
output_pin.write(2.5)  # Set IO 1 to 2.5V
time.sleep(0.2)  # Wait 200ms
voltage = input_pin.read()
print(f"Measured voltage: {voltage}V")
```

More code examples, tutorials and detailed API documentation can be found on ***Ikalogic website: https://ikalogic.com/kb/at1000-api/at1000_home/***.

AT1032S system architecture

The diagram below shows the main components of AT1032S device.

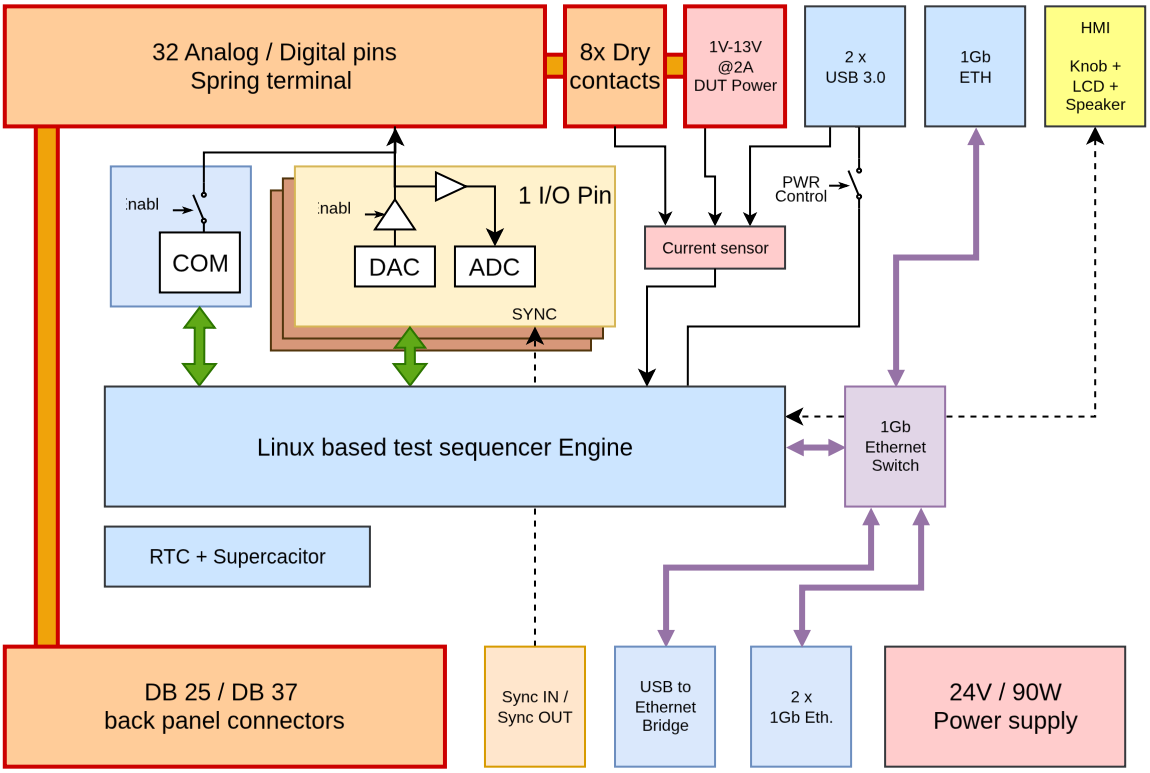


Figure 2. AT1032S system architecture

A functional AT1032S test system is composed of two main sub-systems:

The D.U.T. Interface

This allows for interfacing the with Device Under Test (D.U.T.) and accommodates to a wide range of voltage levels and signal types (digital, analog, communication protocols, power supply, etc.). All DUT interface signals are either accessible via screw-less terminal blocks on the front panel of the device, or via standard DB connectors on the back panel of the device (DB37 and DB25 connectors). DB connectors allow for easy integration with bed of nails test fixtures.

Sequencer engine

This is the core of the test system, that generates the test sequence, verify the results, and generates outputs such as tests reports (user defined), audible feedback (via the built-in speaker), visual feedback (via the built-in OLED display), etc. The sequencer engine can either run test sequences stored in the embedded memory of the device (stand-alone mode), or it can be remotely controlled from a host computer via USB or Ethernet connection.

AT1032S detailed interfaces description

Front panel: DUT interfaces and HMI

The figure below shows the front panel of the AT1032S device with all the available interfaces.

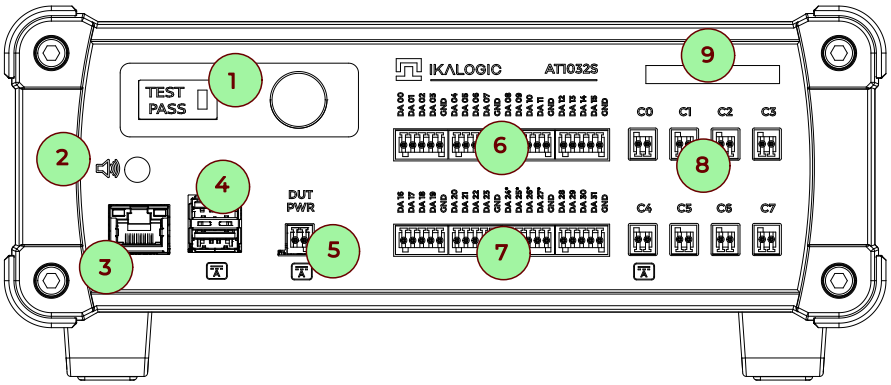


Figure 3. AT1032S Front view with legs retracted

The front panel is composed of the following main items:

1. ***HMI*** (LCD display, rotary encoder)
2. Speaker (also part of the ***HMI***)
3. DUT Ethernet interfaces (RJ45 port)
4. Dual USB 3.0 Type-A ports for DUT connection, with current measurement and power cycling capabilities
5. Programmable Power Supply output (0-13V, 2A) for DUT powering, with current measurement capabilities
6. General purpose I/Os, analog or digital, upper row (from DA0 to DA15)
7. General purpose I/Os + communication interfaces, analog or digital, lower row (from DA16 to DA31)
8. Dry contact relays (up to 60V, 2A), with current measurement capabilities on relay number 4
9. Ventilation holes

16 general purpose I/Os on lower row (DA16 to DA31) can be used for various communication protocols (I2C, SPI, UART, RS232, RS485, CAN) in addition to standard digital/analog I/Os.

AT1032S is shipped with all compatible spring terminal connectors for the front panel. In case you need additional connectors, they can be ordered from any distributor supplying Wurth Elektronik products, using the following part numbers: 691381000005 (5p connectors) and 691381000002 (2p connectors).

Alternative I/Os functions

The table below summarizes the alternative functions available on general purpose I/Os from DA16 to DA31.

I/O	Alternative functions
DA16	SPI1.MOSI, UART1.UART TX, I2C1.SDA
DA17	SPI1.MISO, UART1.UART RX
DA18	SPI1.SCK, I2C1.SCL
DA19	TMS (JTAG1)
DA20	SPI2.MOSI, UART2.UART TX, I2C1.SDA
DA21	SPI2.MISO, UART2.UART RX
DA22	SPI2.SCK, I2C1.SCL
DA23	TMS (JTAG2)
DA24	CAN.H, RS4851.A
DA25	CAN.L, RS4851.B
DA26	RS485.A
DA27	RS485.B
DA28	RS232.TX
DA29	RS232.RX

Maximum voltage levers on I/Os when using alternative functions

While all I/O are designed to support ±25V input voltage range, when an alternative function is used, the voltage levels must comply with the specifications of the corresponding protocol. For example, when using DA28 and DA29 as RS232.TX and RS232.RX, the voltage levels must be within the RS232 standard (typically ±12V). Similarly, when using DA16 and DA18 as I2C1.SDA and I2C1.SCL, the voltage levels must be within the I2C standard (typically 0V to 5V or 0V to 3.3V). The table below summarizes the maximum voltage levels allowed on I/Os when using alternative functions.

Alternative functions	Maximum voltage levels on enabled I/Os
I2C, UART, SPI, JTAG	0V to V_TARGET (V_TARGET is software configurable from 1.6V to 3.6V)
CAN	±16V
RS485	±16V
RS232 RX	±25V
RS232 TX	±15V

Back panel: Power, control and bed of nails interfaces

The back panel of the AT1032S device is shown in the figure below.

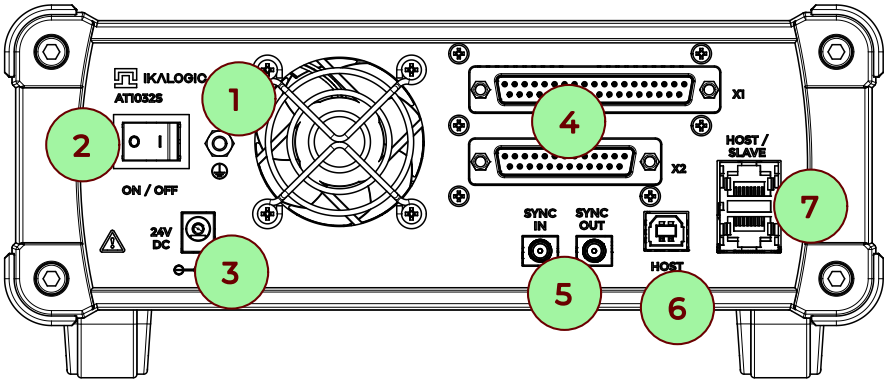


Figure 4. AT1032S back view with legs retracted.

The back panel is composed of the following main items:

1. Earth ground connection (screw terminal connected to the device chassis)
2. ON/OFF power switch
3. Power supply input (24V DC, barrel jack 5.5/2.1)
4. DB37 / DB25 connectors (X1/X2) for test fixture connection
5. SYNC IN / SYNC OUT connectors for synchronizing daisy-chained AT1032S devices
6. USB Type-B port for PC connection
7. Dual Ethernet port for PC connection and daisy-chaining (100BASE-T)

DB37 / DB25 connectors pinout

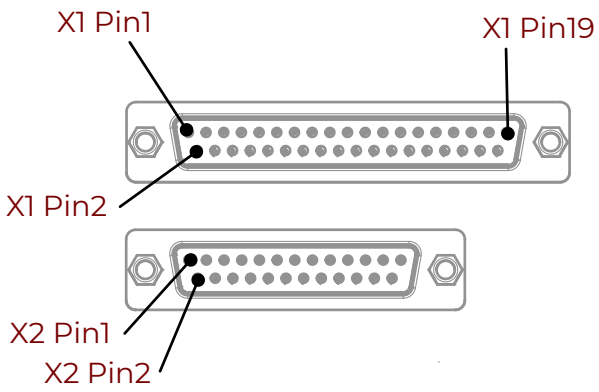


Figure 5. Detailed view of X1/X2 connectors

Pin	Signal	Notes
1	DA0	
2	DA1	
3	DA2	
4	DA3	
5	DA4	
6	DA5	
7	DA6	
8	DA7	
9	GND	Ground
10	DA8	
11	DA9	
12	DA10	
13	DA11	
14	DA12	
15	DA13	
16	DA14	
17	DA15	
18	GND	
19	DUT PWR	DUT power output
20	DA16	Alt functions: SPI1.MOSI, UART1.UART TX, I2C1.SDA
21	DA17	Alt functions: SPI1.MISO, UART1.UART RX,
22	DA18	Alt functions: SPI1.SCK, I2C1.SCL

Pin	Signal	Notes
23	DA19	Alt functions: TMS (JTAG1)
24	DA20	Alt functions: SPI2.MOSI, UART2.UART TX, I2C1.SDA
25	DA21	Alt functions: SPI2.MISO, UART2.UART RX
26	DA22	Alt functions: SPI2.SCK, I2C1.SCL
27	DA23	Alt functions: TMS (JTAG2)
28	GND	
29	DA24	Alt functions: CAN.H, RS4851.A
30	DA25	Alt functions: CAN.L, RS4851.B
31	DA26	Alt functions: RS485.A
32	DA27	Alt functions: RS485.B
33	DA28	Alt function : RS232.TX
34	DA29	Alt function : RS232.RX
35	DA30	
36	DA31	
37	GND	

Table 1. X1 (DB37) connector pinout

All DAn pins can be used a general purpose, analog or digital I/Os, independently of its alternative function capability. In other words, once disabled, the alternative function does not add any specific constraints to its pin.

User interface (HMI)

AT1032S features a simple Human Machine Interface (HMI) composed of a color OLED display, a rotary encoder with push button, and a speaker for audible feedback, all fully configurable from the API.

Figure 6. AT1032S Human Machine Interface (HMI)

The HMI can be used in stand-alone mode to select and run test sequences stored in the internal memory of the device, or it can be used in either remote or stand-alone modes to display real-time information about the test being executed.

Available HMI commands

The HMI can be fully controlled from the API using a set of dedicated commands. The exact syntax is different for each language (Python, C, NodeJS), but the available functions are the same across all languages.

HMI element	Available commands
Screen	• Clear screen • Set screen background and foreground colors • Draw text on the screen • Draw / update a progress bar
Rotary encoder (Knob)	• Wait for a knob event • Get a knob event (rotation direction, button press/release)
Speaker	• Play a predefined sound ("Success", "Failure", "Alert") with a given volume from 0 to 100%.

More advanced graphics functions (drawing lines, rectangles, circles, bitmaps, etc.) are planned for future firmware updates.

Main specifications

Power Supply Requirements

Parameter	Value
Power supply voltage	24V DC ± 0.5V
Power supply current	3.75A max
Connector type	Barrel jack (5.5/2.1mm)

Table 2. Power Supply Requirements

A suitable 24V DC power adapter (with international connectors) is included with the AT1032S device.

Operating conditions

Parameter	Conditions
Temperature	0°C to 50°C
Relative humidity	< 85% non-condensing
Altitude	< 1000 m

Table 3. Operating conditions

General Purpose I/O Specifications

Digital Input / Output

Parameter	Value
Number of I/Os	32 programmable channels
Input voltage range	-25V to +25V (12 mV steps)
Output voltage range	0V to +24V (23 mV steps)
Configurable logic thresholds	VIH and VIL programmable per channel (50 mV steps)
Output levels	VOH and VOL programmable per channel (25 mV steps)
Input impedance	1 MΩ typical
Output current	25 mA max per channel

Analog Input / Output

Parameter	Value
Input Resolution	12-bit ADC
Input voltage range	-25V to +25V
Input Accuracy	±25 mV typical
Output Resolution	10-bit DAC
Output voltage range	0V to +24V
Output Accuracy	±25 mV typical

Supported Protocols on Select I/Os

- **I2C:** Master mode, up to 400 kHz (slave mode currently not supported)
- **SPI:** Master mode, up to 10 MHz (slave mode currently not supported)
- **UART:** Baud rates from 300 bps to 1 Mbps
- **RS232:** 1 ports, baud rates from 300 bps to 1 Mbps
- **RS485:** 2 ports, baud rates from 300 bps to 10 Mbps
- **CAN Bus:** 1 channel, CAN 2.0A/B, bit rates from 10 kbps to 1 Mbps

Dry contacts specifications

Parameter	Value
Number of relays	8 dry contact relays
Maximum voltage	60V DC/AC
Maximum current	2A per contact
On-resistance	< 0.2 Ω typical
Relay lifetime	Unlimited (solid state relay)
Special feature (Relay 4)	Bidirectional high-precision current measurement (1 µA resolution)

DUT Power specifications

Parameter	Value
Output voltage range	0 to 13V, programmable
Output current	2A max
Voltage accuracy	±100 mV
Current measurement range	0 to 2A
Current measurement resolution	1.5 mA
Current measurement accuracy	±3 mA typical
Over-current protection	Yes, fixed 2A limit

DUT USB ports specifications

Parameter	Value
Number of USB ports	2 x USB 3.0 Type-A
Power per port	5V, up to 1A
Power control	Individual on/off control per port
Current measurement resolution	3 mA per port
Current measurement range	0 to 1A per port

Communication Interfaces

Ethernet

Parameter	Value
Number of ports	3
Interface type	100BASE-T
Connector	RJ45
Protocols supported	TCP/IP, UDP

CAN Bus

Parameter	Value
Number of channels	1
CAN standard	CAN 2.0A/B
Bit rates	10 kbps to 1 Mbps
Termination	Software-configurable 120Ω

RS232

Parameter	Value
Number of ports	2
Connector type	DB9 female
Baud rates	300 bps to 1 Mbps
Voltage levels	±12V typical

RS485

Parameter	Value
Number of ports	2
Connector type	Terminal block
Baud rates	300 bps to 1 Mbps
Termination	Software-configurable 120Ω
Multi-drop support	Up to 32 nodes

Current measurements

Measurement Point	Type	Resolution	Range	Accuracy
Power Supply output	Unidirectional	3 mA	0 to 2A	±5 mA typical
USB Port 1	Unidirectional	3 mA	0 to 1A	±5 mA typical
USB Port 2	Unidirectional	3 mA	0 to 1A	±5 mA typical
Relay 4 (special)	Bidirectional	1 µA	±2A	±1 µA typical

Synchronization

Parameter	Value
SYNC IN	TTL compatible input for triggering
SYNC OUT	TTL compatible output for daisy-chaining
Synchronization latency	< 0.1 µs between devices

Mechanical Specifications

Parameter	Value
Enclosure	Black anodized aluminum
Dimensions (WxDxH)	250 x 180 x 90 mm (with legs retracted)
Weight	1.2 kg (preliminary)
I/O Connectors	Spring terminal blocks
Relay Connectors	Spring terminal blocks
Back panel connectors	DB37 + DB25
Mounting	Desktop or rack-mount (optional)

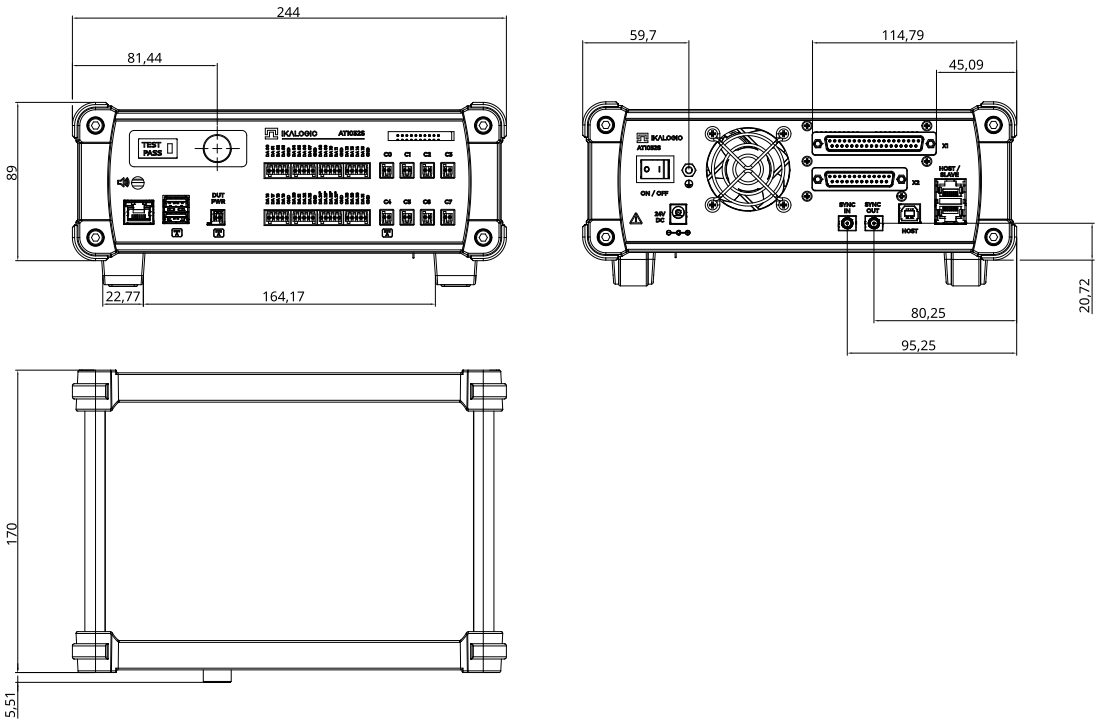


Figure 7. AT1032S Mechanical drawing (all dimensions in mm)

Daisy chaining

From a network architecture perspective, daisy-chained AT1032S devices are considered independent devices connected to the same TCP/IP network. They may or may not be interconnected with the SYNC IN/OUT SMA ports depending on the timing precision required.

On the API script side, multiple AT1032S devices are handled as independent objects, each with its own IP address or USB identifier. The user can create as many device objects as needed and control them independently or in a synchronized manner.

In case of SYNC IN/OUT connected devices, the first device in the chain (the one generating the SYNC OUT signal) is considered the master device, while all other devices are considered slave devices. Slave devices will execute their test sequences in perfect synchronization with the master device, ensuring precise timing across all devices in the chain. It's the user's responsibility to ensure that the master device is indeed the first one in the SYNC chain.

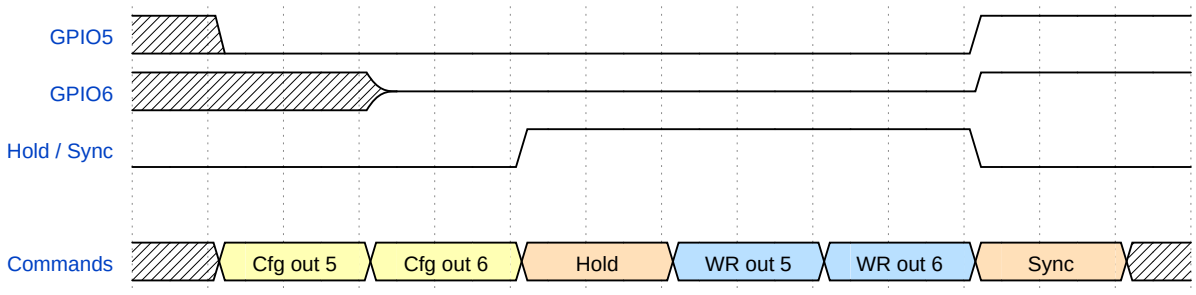
Output synchronization mechanism

Since AT1032S devices are connected via standard TCP/IP network (Ethernet or USB), there is no inherent timing synchronization between multiple devices. To address this, AT1032S devices include dedicated SYNC IN and SYNC OUT ports that allow for precise synchronization of outputs across multiple daisy-chained devices.

When multiple AT1032S devices are daisy-chained using the SYNC IN/OUT ports, their outputs can be synchronized with a latency of less than 0.1 µs. This is particularly useful for applications requiring precise output timing across multiple test channels. This synchronization is not only valid for digital outputs, but also analog outputs.

When HOLD is enabled, output are held from being applied to output buffer. They are stored in a latch-like system until a SYNC IN signal is received. Upon receiving the SYNC IN signal, all outputs from all daisy-chained devices are updated simultaneously, ensuring perfect synchronization.

The following example explains achieved through the following mechanism:



1. GPIO 5 is updated (and updated on the physical output) immediately
2. GPIO 6 is updated (and updated on the physical output) immediately
3. HOLD is enabled: subsequent output updates are stored in a latch and not applied to the physical outputs

4. GPIO 5 is updated (but not applied to the physical output due to HOLD)
5. GPIO 6 is updated (but not applied to the physical output due to HOLD)
6. A SYNC IN signal is received from the SYNC IN port and all outputs (from all daisy-chained devices) are updated simultaneously, applying the lat

GPIO5 and GPIO6 in the example above can span multiple daisy-chained AT1032S devices or can be on the same physical device.

What's in the box

- AT1032S Test Sequencer unit
- Screw-less terminal connectors (spring clamp type) for all front panel connections (8 5-pin connectors for I/Os, 1 2-pin connector for power supply, 8 2-pin connector for relays)
- 24V DC power adapter (with international plugs)
- USB cable (Type-A to Type-B)
- Ethernet cable

Warranty & Support

Manufacturer Warranty

AT1032S comes with a **1-year manufacturer warranty** covering defects in materials and workmanship. The warranty includes:

- Free repair or replacement of defective units
- Return shipping costs covered (within warranty period)

Calibration Services

Optional calibration services available:

- Factory calibration certificate (included with purchase)
- Re-calibration service (recommended annually)

Certifications and Regulations

AT1032S complies with the following applicable European Directives: Electromagnetic Compatibility (EMC) Directive 2004/108/EC, Low-Voltage Directive 2006/95/EC, IEC 61326-2.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CAN ICES-3 (B) / NMB-3 (B)

RoHS Compliant 2011/65/EC. This device does not contain any of the substances in excess of the maximum concentration values ("MCVs") defined in the EU RoHS Directive.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CE Logo

ROHS Logo

WEEE Logo

Safety information

This product complies with safety standards IEC NF/EN 61010-1: 2010, IEC NF/EN 61010-2-030 and UL 61010-1: 2015 To prevent possible electrical shock, fire, personal injury, or damage to the product, read all safety information before you use the product. The following international symbols are used on the product and in this manual.

Important safety notes

Warning, to avoid electrical shock or fire :

- Carefully read all instructions.
- Use the product only as specified, otherwise the protection supplied by the product can be compromised.
- Do not use the product if it operates incorrectly.
- Before use, inspect device casing, probes, test leads and accessories for mechanical damage and replace if damaged.
- Never attempt to repair a defective device. Contact after-sale service.
- Do not use the product or its accessories in case of any damage.
- Remove all probes, test leads and accessories that are not in use.
- Never use the device for measuring mains circuits.
- Never use the device for measuring circuits which are not isolated from mains.
- Do not touch electrical wires with bare hands.
- Keep away from children’s sight or from animals.
- Do not expose to water, heat or moisture.
- The device’s ground connection through the USB cable is for measurement purposes only. The logic analyzer does not have a protective safety ground.
- Ensure there is no significant voltage between device ground and the point to which you intend to connect it.
- Do not apply more than the rated voltage, between the terminals or between each terminal and ground.
- Do not apply input voltages above the rating of the instrument.
- Measure a known voltage first to make sure that the product operates correctly.
- Do not work alone.
- Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame resistant clothes) to prevent shock.
- Do not use the device in wet or damp conditions, or around explosive gas or vapor.
- Do not operate the product with covers removed or the case open. Hazardous voltage exposure is possible.
- Do not use in a system in which the failure of the product might result in personal injury.