



PLC Simulator

User Guide · LearnSCADA · October 2026

The LearnSCADA PLC Simulator is a live Modbus TCP practice plant that runs in the cloud. You can do three things with it:

- **watch and operate it** from your browser;
- **connect your own HMI, SCADA or PLC software** to it over Modbus TCP;
- **build your own plant** by uploading a workbook (an Excel file) that defines the register map.

You get your **own private simulator** with its own Modbus port. Nobody else can see it or change it.

1. Getting access

Free trial

- 1 Go to learnscada.com/sim and click **Try it free for 2 hours**.
- 2 If you don't have an account yet, enter your email. The link in the email creates your free account and brings you back. No card and no password needed.
- 3 Click **Try it free for 2 hours** again. Your simulator opens.

The trial is **2 hours of run time in total, once per account**, over as many sessions as you like. Only time while your simulator is running counts. A trial simulator stops after **10 minutes** with no dashboard open and no Modbus connection, so an idle trial doesn't use up your time. When the 2 hours are used, **/sim** offers **Buy**.

Buying

- 1 Sign in at learnscada.com, go to **/sim** and click **Buy, \$97 one-time**.
- 2 Pay through Stripe. Sales tax is added where it applies.

It's a one-time purchase, not a subscription: **founding-member lifetime access**, offered for a limited time. Later the simulator moves to an annual subscription, and founding members keep their lifetime access.

Lifetime access means for as long as the simulator service runs. Buying the simulator **includes Pro Library membership for life**; Pro membership on its own doesn't include the simulator.

If you used the free trial first, **your simulator and its workbooks become yours**. Its next start moves it to your permanent Modbus port.

Refunds: a refunded purchase ends your access. Your simulator is stopped and disabled, and its data is deleted 30 days later. If you buy again within those 30 days, it comes back as it was.

2. Opening your simulator

- 1 Go to learnscada.com/sim or [/account](https://learnscada.com/account), and click **Open my simulator** (or **Continue your free trial**). You're signed in to the simulator automatically, with no second password.



- If your simulator is stopped, you land on **Your PLC simulator**, at `sim.learnscada.com/m/`. It shows your Modbus port and whether the simulator is running. Click **Start my sim**; your dashboard opens a few seconds later.

If all slots are in use you'll see *"All 5 simulators are in use. Try again shortly."* with a live count. A limited number of simulators can run at once across the site (free trials have their own, smaller pool). Try again in a few minutes.

Your **Modbus port** is assigned the first time you start your simulator. An owner's port is **permanent**. A trial keeps its port between runs.

When your simulator stops on its own

What happens	Owners	Free trial
Idle stop: no dashboard open and no Modbus connection	after 30 minutes	after 10 minutes
Run limit	12 hours after each start	when the 2 hours of trial time are used

Start it again whenever a slot is free. **Stopping never loses anything**. Your workbooks and blocked IPs are kept.

To stop it yourself, click **Stop** on **Your PLC simulator** (`sim.learnscada.com/m/`).

Simulator sign-ins last up to 4 hours. After that, open it again from `learnscada.com/sim`.

3. The dashboard

Your dashboard is at `https://sim.learnscada.com/s/<your id>/`. The top bar shows:

- **live**: the dashboard is receiving updates;
- **Modbus**: your address, for example `sim.learnscada.com:20000`, and **read/write**;
- **Clients**: how many Modbus connections are open right now;
- **Scan**: how often the simulator updates;
- **Up**: how long it has been running;
- **Owner**: your badge;
- **User guide**: downloads this guide.

Tags

Every point in your plant is listed with its Modbus reference (for example `400002` for holding register 1), its type and scale, its live value and raw register contents, its behavior (static, sine, expr and so on) and its description.

To filter, use the chips (Coils, Discrete, Input, Holding) or the search box.

To change a value:

- **Numbers**: click the value, type a new one, and press **Enter**. **Esc** cancels.
- **On/off tags**: click **ON/OFF**.

Only tags the simulator doesn't calculate can be set. **Reset sim** reloads the active workbook and returns every tag to its starting value.



Plant

When one of the **built-in** water plant workbooks is active (the water tank, or fill, hold, feed), the **Plant** panel shows it as a live graphic: the tank level and setpoint, the high and low alarm limits, the inlet valve, the pump and the drain (green when open or running, with flow moving through the pipes), outflow, temperature, pump current, AUTO or MANUAL mode, and the HI and LO alarm lamps. Pointers on the tank's % scale mark the **SP** setpoint (orange) and the **HI** and **LO** alarm limits (red); with the fill, hold, feed workbook they also mark **FILL** (fill_to, blue) and **FEED** (dump_to, green). Hover a pointer for its exact value. Write to the plant from your own HMI or Modbus client and watch it respond.

Three **Step** indicators show what the plant is doing: **FILL** (blue) while the inlet is open, **HOLD** (amber) while it waits, and **FEED** (green) while the pump sends water to distribution. With the fill, hold, feed sample in auto they follow its cycle and show the hold countdown.

The graphic is drawn for the built-in water plant's register map only. A workbook you upload may follow that map or do something entirely different, so while one of your own workbooks is active there's no Plant panel, just its registers in the Tags list. This holds even for an uploaded copy of the template. To get the water plant and its graphic back, **Activate** a built-in workbook (Water tank, or Fill, hold, feed) in the Workbooks list.

Below the graphic are the operator controls:

Control	What it does
Mode: AUTO / MANUAL	Writes mode. In AUTO the workbook's logic runs the pump and inlet.
Pump: START / STOP	MANUAL only. Writes pump_cmd. The pump won't run dry (below 1%).
Inlet valve: OPEN / CLOSE	MANUAL only. Writes inlet_cmd. Watch the level: it fills past the high alarm if you leave it open.
Drain valve: OPEN / CLOSE	Either mode. Writes drain_cmd.

In AUTO the pump and inlet buttons are greyed out. When you switch back to AUTO, the logic takes over from wherever the plant is. Your HMI can do the same by writing the same tags; the buttons always show the current state, whoever changed it.

Connected clients

For each connection you see its IP address and port, the last request type and unit ID, how long it has been connected, and its request count and rate. Two controls:

- **Drop** closes that connection. The client can reconnect.
- **Block** refuses every connection from that IP until you unblock it.

Blocked addresses are listed under **Blocked IPs**, each with an **Unblock** button. **Recent disconnects** lists recent sessions.

Workbooks

The **Workbooks** panel holds your plant definitions:

- **Download template:** the water tank sample, a good starting point.
- **Fill / hold / feed template:** the water tank as a batch cycle (see section 4).



- Both samples are always in the list as built-in workbooks, so you can **Activate** either one without uploading anything.
- **Upload a workbook:** drop an `.xlsx` file on the box or click it. The whole workbook is checked before it's saved. If anything is wrong, nothing is saved, and you get a list of every problem with its row number.
- **Activate** loads a stored workbook into your running simulator. Connected Modbus clients stay connected and switch to the new register map.
- **Download** and **Delete** a stored workbook. The active workbook and the built-in sample can't be deleted.

Event log

The event log shows connects, disconnects, every write (with the tag name), changes you make on the dashboard, and workbook changes.

4. Connecting your HMI or software

Setting	Value
Host	<code>sim.learnskada.com</code>
Port	your port, shown on your dashboard and at <code>sim.learnskada.com/m/</code> (for example 20000)
Protocol	Modbus TCP
Unit ID	any (1 is fine)
Addressing	zero-based: holding register 0 = 400001, input register 0 = 300001, coil 0 = 000001, discrete input 0 = 100001
Writes	allowed (coils and holding registers)
Connections	up to 50 at once

32-bit values (int32, uint32, float32) use two registers. The word order is set in the workbook: **big** means high word first (ABCD), **little** means low word first (CDAB).

Your simulator only accepts Modbus connections **while it's running**. Start it first.

The water tank sample

New simulators start with a 1000-gallon water tank: an inlet valve (60 gpm), a drain valve (25 gpm) and a transfer pump (50 gpm), with high and low level alarms.

Table	Address	Reference	Tag	Notes
holding	0	400001	mode	0 = manual, 1 = auto
holding	1	400002	level_sp	level setpoint, % x10
holding	2	400003	hi_limit	high alarm limit, % x10
holding	3	400004	lo_limit	low alarm limit, % x10
coil	0	000001	pump_cmd	auto drives it; in manual you do



Table	Address	Reference	Tag	Notes
coil	1	000002	inlet_cmd	auto drives it; in manual you do
coil	2	000003	drain_cmd	you open and close it
coil	3	000004	alarm_reset	write 1 to clear latched alarms
discrete	0-4	100001-100005	pump_running, inlet_open, drain_open, hi_alarm, lo_alarm	feedback and alarms
input	0-5	300001-300006	level, flow_in, flow_out, temperature, motor_amps, heartbeat	% x10, gpm x10, degF x10, A x10, counter

In **auto** (mode = 1) the simulator holds the level near `level_sp`. In **manual** (mode = 0) you drive `pump_cmd` and `inlet_cmd` yourself. Scaled values are stored times 10: a register value of 500 means 50.0%.

The fill, hold, feed sample

The second built-in workbook runs the same tank as a batch cycle in auto: **fill** to `fill_to`, **hold** for `hold_s` seconds, **feed** (pump out to distribution) down to `dump_to`, then fill again. Coils, discretes and the first six input registers are the same as the standard sample. These holding registers set the pace, and you can change them while it runs:

Reference	Tag	Default	What it does
400002	fill_to	80% (x10)	fill up to this level
400005	dump_to	20% (x10)	feed (pump out) down to this level; 2% or more
400006	hold_s	5 s	how long to hold when full, 0-999 s (0 = feed right away)
400007	tank_gal	300 gal	tank size: smaller fills and feeds faster

Three input registers show the cycle, all in whole seconds or plain numbers:

Reference	Tag	What it shows
300007	phase	0 = fill, 1 = hold, 2 = feed
300008	hold_t	seconds held so far
300009	hold_left	the hold countdown: seconds left while holding (0 otherwise)

In the Plant panel, the **Hold timer** under the step indicators counts the hold down from `hold_s` to 000 (orange while holding); between holds it shows the preset, greyed out.

5. Workbook format

A workbook has a **Registers** sheet, and optionally a **Settings** sheet. The template includes an **Instructions** sheet too.

Registers sheet

Each tag is one row. The header row names the columns, in any order:

Column	Required	Meaning
Tag	yes	Name: letters, digits, <code>_</code> ; starts with a letter; up to 40 characters
Table	yes	coil, discrete, input or holding (also <code>co/0x</code> , <code>di/1x</code> , <code>ir/3x</code> , <code>hr/4x</code>)
Address	yes	Zero-based (unless Settings <code>address_base</code> = 1)
Type		<code>bool</code> (coils and discretes only), <code>int16</code> , <code>uint16</code> , <code>int32</code> , <code>uint32</code> , <code>float32</code>
Scale		The register holds value x Scale. 10 gives 0.1 resolution. Default 1.
Initial		Starting value
Behavior		<code>static</code> (default), <code>random</code> , <code>walk</code> , <code>sine</code> , <code>ramp</code> , <code>counter</code> , <code>toggle</code> , <code>expr</code>
Min, Max		Limits (values are clamped), and the range for random, walk, sine and ramp
Period_s		Seconds per cycle for sine, ramp and toggle
Expression		The formula when Behavior is <code>expr</code>
Units, Description		Shown on the dashboard

Behaviors

Behavior	What it does
static	Holds its value. Clients and the dashboard can set it.
random	A new random value between Min and Max each scan (on/off for bool)
walk	Drifts randomly between Min and Max
sine	A smooth wave between Min and Max, one cycle every Period_s
ramp	Climbs from Min to Max over Period_s, then starts again
counter	Adds 1 each scan; wraps from Max back to Min
toggle	Flips every Period_s
expr	Calculated from the Expression each scan

Expressions

You can use	Details
Tag names and numbers	
Arithmetic	<code>+</code> <code>-</code> <code>*</code> <code>/</code> <code>//</code> <code>%</code>
Comparisons	<code>==</code> <code>!=</code> <code><</code> <code><=</code> <code>></code> <code>>=</code>
Logic	<code>and</code> , <code>or</code> , <code>not</code> , <code>a if condition else b</code>
Special names	<code>prev</code> (this tag before this scan), <code>t</code> (seconds since start), <code>dt</code> (seconds since the last scan), <code>scan</code> , <code>pi</code>



You can use	Details
Functions	<code>clamp(v, lo, hi)</code> , <code>min</code> , <code>max</code> , <code>abs</code> , <code>round</code> , <code>sqrt</code> , <code>sin</code> , <code>cos</code> , <code>exp</code> , <code>log</code> , <code>noise(a)</code> , <code>random(a, b)</code> , <code>int</code> , <code>float</code> , <code>bool</code>

Rows calculate top to bottom. An expression sees rows **above** it from this scan, and rows **below** it from the last scan.

Useful patterns:

- **Integrate a flow:** `prev + rate * dt`
- **Latch until reset:** `condition or (prev and not reset_tag)`
- **Hysteresis:** `level > sp + 2 or (prev and level > sp - 0.5)`

For safety, expressions can't use anything else: no `**`, no strings, no attributes or indexing, no imports. Expressions are limited to 500 characters.

Settings sheet

Key	Value
name	Shown on the dashboard
description	Shown on hover
scan_ms	100 to 5000 (default 500)
word_order	big or little
address_base	0 or 1

Limits

Limit	Value
File size	2 MB
Tags	2,000
Addresses	0 to 9999 per table

6. Troubleshooting

Problem	Try
My HMI can't connect	Is your simulator running ? Check the port on your dashboard. Is your own IP under Blocked IPs ?
Writes fail	Make sure you're on your port. Calculated tags (<code>expr</code> , <code>sine</code> and so on) are overwritten every scan.
"All simulators are in use"	Try again in a few minutes. A slot frees when another simulator stops.
My simulator stopped	Idle stop or run limit. Start it again; nothing was lost.

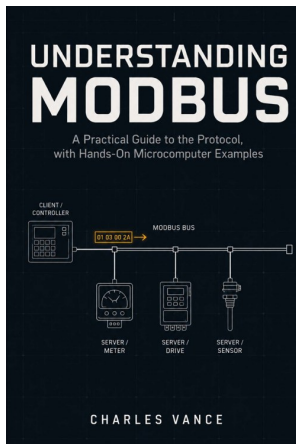


Problem	Try
My free trial won't start	Its 2 hours are used. /sim offers Buy , and your simulator comes with it.
Upload rejected	Read the list: each line names the row. Fix those cells and upload again.
The dashboard says "Log in"	Open it again from learncada.com/sim .

Questions: admin@learncada.com

Learn Modbus: read it, take the course, practice live

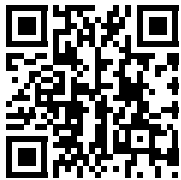
This guide is for the LearnSCADA PLC Simulator. Here's the rest of the set, all at learnscada.com.



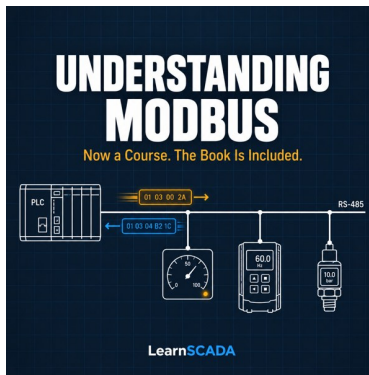
Understanding Modbus

The book, by Charles Vance

A practical guide to the protocol, with hands-on microcomputer examples: the data model, RTU, ASCII and TCP frames, addressing, data types, troubleshooting, and a pump-station project in Python.



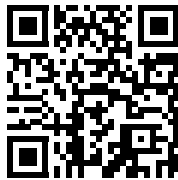
Scan or visit
learnscada.com/books/understanding-modbus



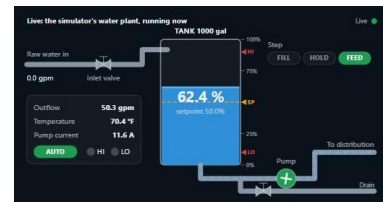
Understanding Modbus course

The book comes with it

The book chapter by chapter, all 19, with interactive figures and tools and a short check at the end of each chapter. The complete book PDF is included. Part I is free to preview.



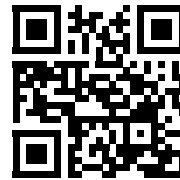
Scan or visit
learnscada.com/courses/understanding-modbus



PLC Simulator

Practice on a live Modbus TCP plant

Your own private water plant on the internet. Read and write it from any HMI, SCADA or Modbus client and watch it respond. **Free 2-hour trial** (free account, no card). **Founding-member lifetime access, \$97 one-time** for a limited time (it later becomes an annual subscription): a permanent port, runs of up to 12 hours, your own register maps, and **Pro Library membership for life** included.



Scan or visit
learnscada.com/sim

Try it right now: point any Modbus TCP client at `sim.learnscada.com` port 502. That's the live plant on the store's simulator page, read-only and open to everyone.