



Datasheet: Amper digital aggregator



Overview

The digital aggregator is a data collection device used to monitor changes in 24V digital control signals.

It is the primary way to automatically count machine cycles with the Amper system.

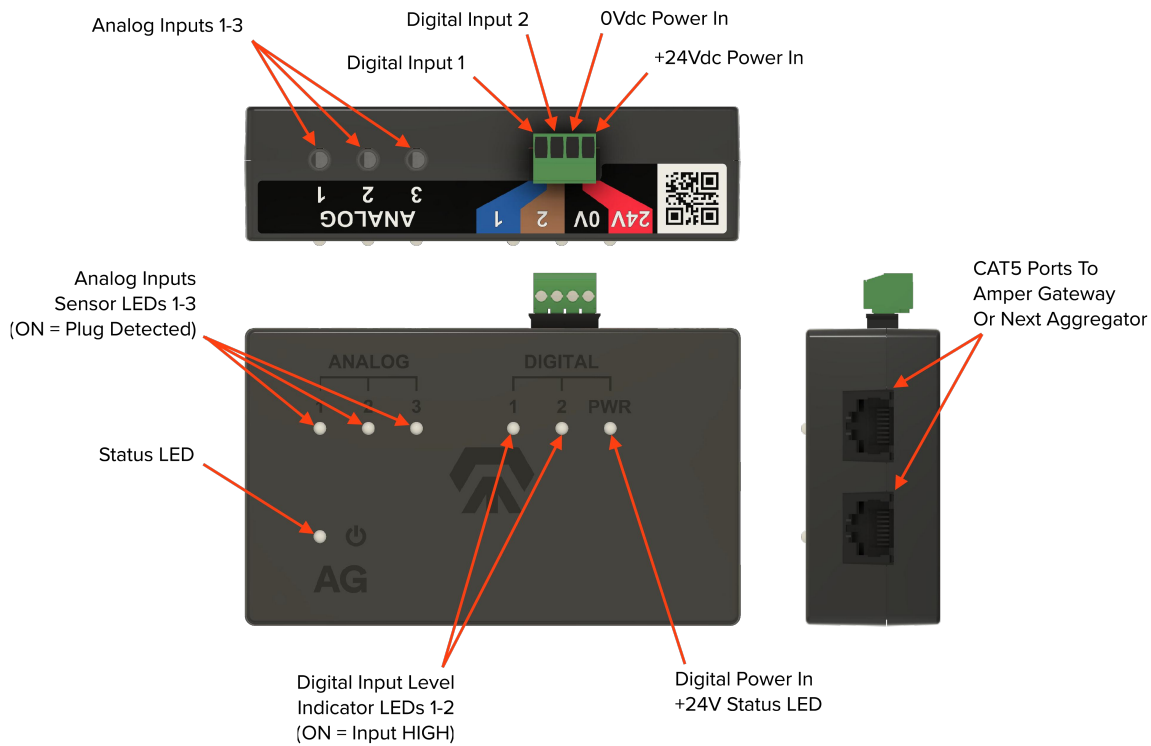
Also used for monitoring machine uptime on machines like those that use pneumatics or hydraulics.

The device also has proprietary analog inputs for Amper's standard electrical current sensor which can be used to monitor machine uptime on machines that primarily use motors for their production process.

The digital aggregator enables you to automatically get OEE data and track your machine performance when using the automated cycle count add-on. Like our analog aggregator, the device must be paired with an Amper gateway in order to send the collected data.

GETTING STARTED

Device connection & indicator diagram



Technical specifications

⚠ All voltages specified are relative to voltage at the power supply reference “0V” input.

Digital power supply reference inputs

24V supply input absolute maximum voltage	Max: +40Vdc
24V supply input recommended voltage range	Min: +9Vdc, Max: +24Vdc
24V supply input current consumption	Nominal: 15mA (at 24Vdc), max: 50mA (at 24Vdc)
Reverse polarity shut-off voltage	Shut-off at $(V_{0V}) - (V_{24V}) > +8V$

Digital signal inputs #1 and #2

Input absolute maximum voltage	Max: +60Vdc
Input recommended voltage range (high level)	Min: +9Vdc, Max: +24Vdc
Input minimum voltage	Min: 0Vdc
Input impedance	Min: 100k ohm, nominal: >500k ohm
Input current consumption	Nominal: 68uA (at 24V), max: 380uA (at 60V)

GETTING STARTED

Installation requirements & checklist



You must already have installed and connected your Amper gateway prior to installation.

Generally, most installs will take 30-60 minutes to complete. Older or very complex equipment may sometimes take longer.

Machines

The machine must contain or be able to output an applicable **digital control signal that alternates between an on and off** state per our electrical requirements and installation recommendations.

Skills

To install, someone must be able to:

- Open up power and/or control panels on the machine
- Read machine schematics and identify where signals are in the machine panel
- Understand machine operation enough to understand how and when machine signals are triggered during production

Roles

Usually you will need at least one person from the following list in order to successfully install the product:

- ☑ Maintenance manager and/or technician
- ☑ Engineering manager
- ☑ Controls engineer

Tools and resources

- Amper hardware kit (shipped to you)
 - Digital aggregator
 - CAT5 cable
 - Install accessories (wire, wire strippers, small screwdriver)
- Optional external load resistor
- Tools to open machine panels and to open terminal blocks to insert new wires
- Machine schematic/wiring diagram

INSTALLATION STEP 1:

Connecting to the Amper system

- 1** Mount the gateway (either Wi-Fi or cellular) as high as possible on the outside of the machine. The gateway's 110V power supply powers both the gateway and any connected aggregators.
- 2** Place each aggregator inside the machine panel and connect to the gateway via CAT5 cable.
- 3** Use the two CAT5 ports (available on both analog and digital aggregators) to extend the system in either direction.
- 4** If existing analog aggregator is installed: Connect the digital aggregator to the available CAT5 port on the existing device.
If not: Connect digital aggregator to the gateway's CAT5 port.
- 5** Check for a solid blue LED status light in the lower left corner of the digital aggregator. This indicates power and successful gateway connection.

INSTALLATION STEP 2:

Connecting to your machine

Signal selection

Signals for utilization only

When installing to capture machine up and downtime, there are generally two approaches.

1. The first is a signal that remains in the on state for the entire approximate duration of the cycle. For example, this could include a “chuck clamp closed” signal or a part presence sensor output. In these cases, Amper can interpret “on” as production directly.
2. The second is a signal that changes states once or more times during production. This could include the control signal for a solenoid on a machine with pneumatic or hydraulic components that fire multiple times per cycle. In these cases, Amper can interpret the presence of multiple changes on and off as production, blending the moments in between into a continuous representation of your production cycles.

Signals for cycle counting

When capturing a signal in order to count cycles, it is critical that the signal changes back and forth exactly once per cycle. If the signal triggers outside of machine cycles or doesn't trigger consistently, then the resulting count data will be inaccurate.

When available, the best option is usually to use a spare M-Code output. If available, you can program that M-Code into your end-of-program macro (such as an M30 on many systems) to momentarily turn the output on when the count should be registered. This option gives you the most control over the signal and guarantees the highest accuracy.

Other high-accuracy options include existing signals in your machine, including:

- Part presence or proximity sensor output
- Bar feeder control
- Chuck clamp closed
- Solenoid control (for pneumatic or hydraulic actions that happen once per cycle)
- Control for any other discrete operations that happen once per cycle

Finding the signal in your machine

Once the ideal signal has been determined, you must **find where the signal or output is located** within your machine panel.

Begin with your machine schematic or wiring diagram (in most cases).

Locate the table that lists the Machine I/O or “Outputs” in the table of contents.

In that table, find the name corresponding to the intended signal. (Usually, that table should indicate a page number where you can find more detail.)

Go to the detailed page and look for two pieces of information: output or wire label code **and** module label code.

Look for the module within your machine panel using your knowledge of the machine and the label code from the schematic.

Find the output and/or existing signal wire. Note this location.

Finding 24V and 0V power

The power reference inputs must be on the same circuit as the intended signal. Usually, it is best to find existing 24V and 0V/ground outputs on the same module as the intended signal.

Labeling conventions may differ, but refer to the same page on the schematic along with the page for the machine DC power supply in order to confirm which outputs are appropriate if you are not sure.

Now that we’ve identified all the outputs we need, determine where you will mount or place the digital aggregator within the machine panel and mount it if you haven’t already done so.

You can now wire in the 24V and 0V power reference connections to the device. The 24V wire should be in the outermost screw post of the four-pin connector. The 0V wire goes adjacent to it in the next screw post down.

If in doubt, please reference the text on the plastic above the connector. The 24V and 0V text are on the intended sides.

Connecting the signal

The signal will be connected with only a single wire. Because the inputs do not source or sink current, a return wire is not used.



If capturing an existing signal, simply slip the new wire into the output alongside the existing one.



If it is tight, you may need to remove the existing wire, twist the new one around it, and then reinsert it.



If using an empty output, insert the new wire as normal. The wire can then be screwed into the digital aggregator's input.

If you are using a dedicated external sensor with an NPN-only output, we recommend adding a load resistor between the signal wire and +24V. If no load is added, the signal may not successfully return to the off state. You can easily do so with a standard resistor by inserting it alongside those wires in the aggregator's screw posts. See Appendix A for examples.

Troubleshooting recommendations

The digital aggregator is only as accurate as the signal it is capturing. It is important to make sure the signal is triggered once per cycle.

It can be helpful to test to make sure the output is doing what you are expecting. You can often attach a multimeter to the output and have an operator either run the machine, or have an engineer trigger the specific M-Code. You should see the multimeter show the change in voltage. If the signal is momentary and very fast (such as an M-Code that returns immediately), you may only see the multimeter flash briefly.

Once you are set up and the device is configured, you can check the signal changes and any associated counts in real time in the app. Go to Settings > Hardware Page and click the "INPUT DETAILS" button below the machine's name.

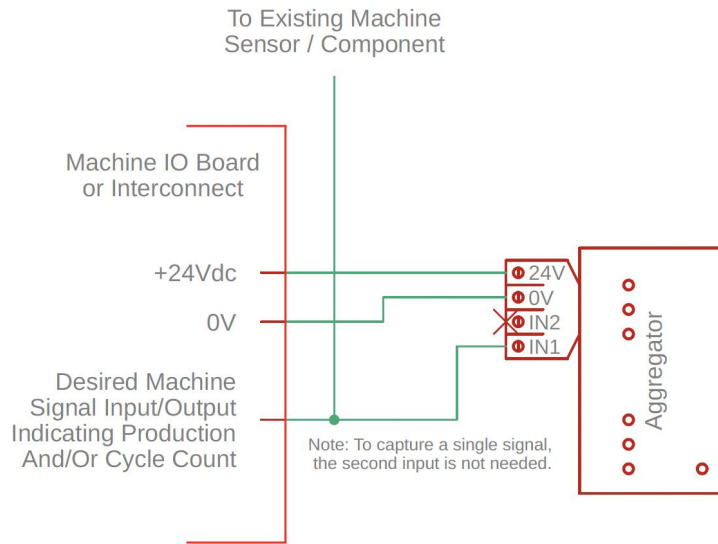
If you see counts that are different than expected, check the Part History list to see whether the signal is changing the way you expected. In some cases, Amper may be able to filter out extraneous counts. Otherwise, a signal adjustment or change of signal choice may be required.

If you have more detailed questions, please reach out to Amper Support or your customer success representative so that we can get you the technical support you need.

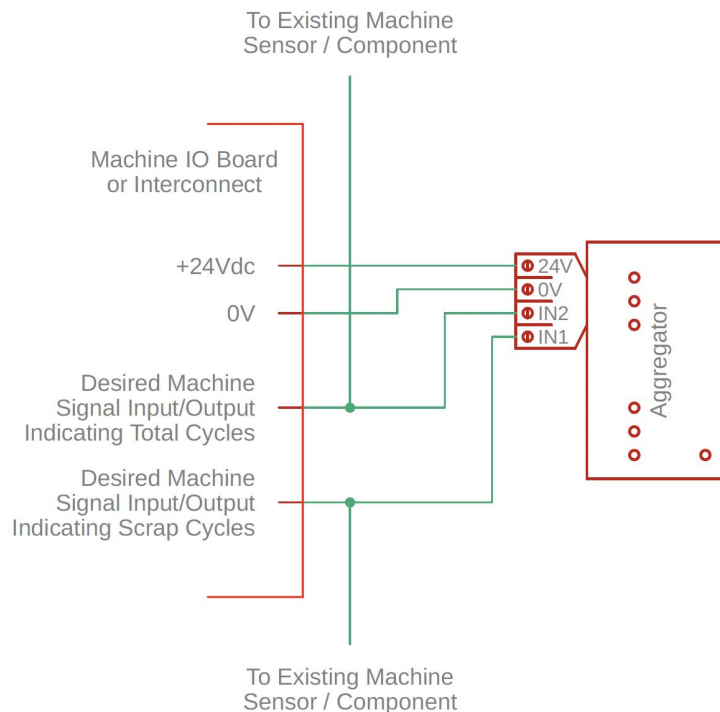
APPENDIX A

Schematic wiring diagrams

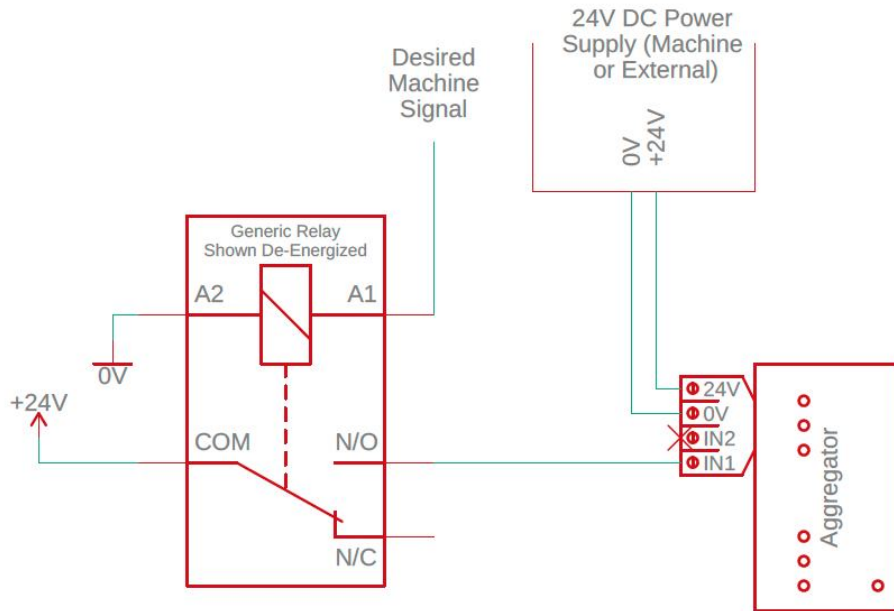
Direct to machine digital I/O (singular signal)



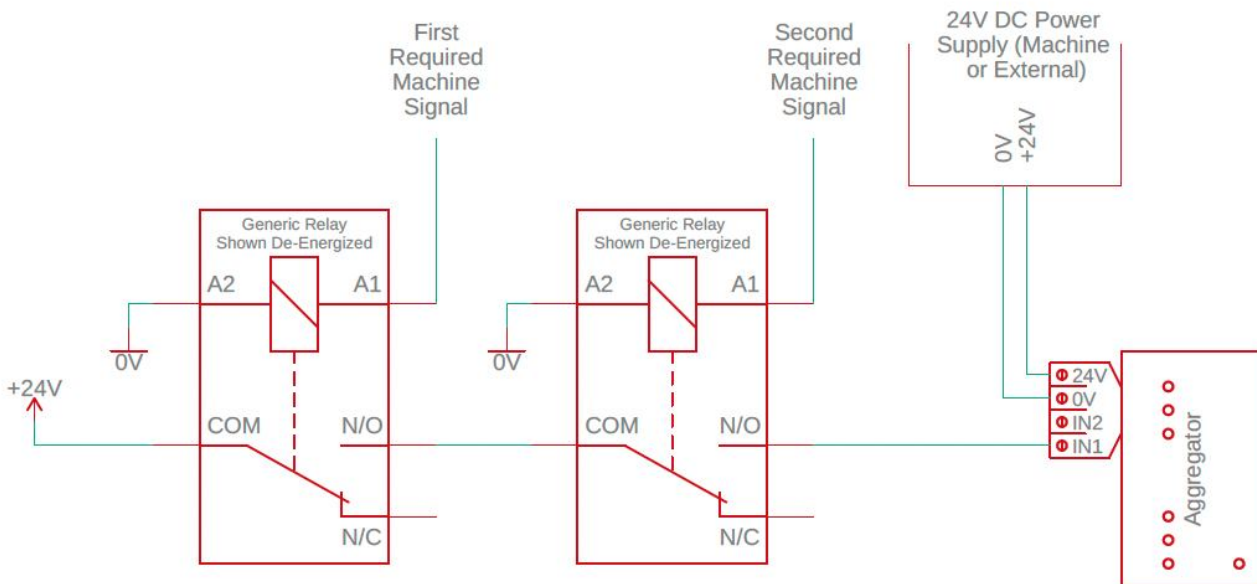
Direct to machine digital I/O (two signals)



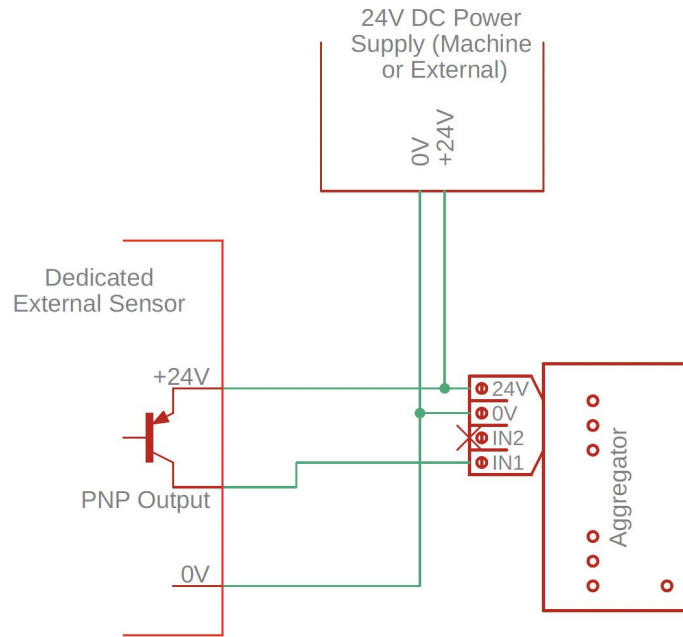
Using relay output



Using multiple relays to combine two machine signals (logical AND)



External/dedicated sensor directly to aggregator (PNP)



External/dedicated sensor directly to aggregator (NPN with load resistor)

