TECHNICAL RESOURCE · SUMMARY

Synergic Is Not Automatic

The quarter turn, and what the curve cannot see. A four minute read.

> Synergic control is not the machine setting everything, it is not pulse, and it is not controlling your arc. It is a library of settings held in the machine's memory: a relationship between amps and volts, built from three inputs, wire type, wire size and shielding gas, that somebody measured once. You set the amps and you trim the volts. Trim is the quarter turn you give it when the job in front of you is not the job the curve was measured on.

Four people, four different wrong answers

Four different people misunderstand synergic welding in four different ways, and I have had all four conversations this year. The welder thinks the dial sets amps. The supervisor thinks trim is a heat knob. The salesperson thinks the machine sets everything, because that is what the brochure said. And the fab shop owner thinks the money bought a productivity gain. Every one of those came out of the way the machines are sold and the way the manuals are written. It matters, because this is part of competence.

What a synergic line actually is

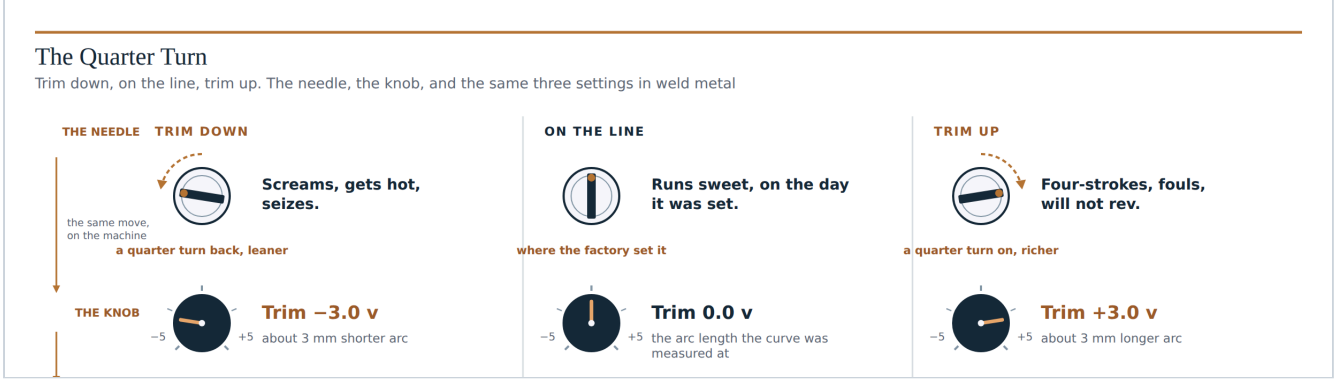
A relationship between amps and volts, built from three inputs: wire type, wire size, gas type. Somebody established what the volts should be for the amps across every combination of those three, and the machine holds the answer. A Migatronic synergic program is three curves of four calibration points each, with straight lines interpolated in between. Four points. Nothing between them was ever measured.

And on a plain synergic CV machine, **nothing in there is controlling your arc**. The arc is held by ordinary constant voltage self regulation, the same physics that held it before synergic control was invented. The synergic layer only saves the operator from guessing the voltage. It provides a starting point.

Trim is not a heat knob

Trim is a bias on the settings table's output, roughly plus or minus 5 volts, which at about a volt per millimetre of arc column is about 5 mm of arc length. It does not touch the commanded wire feed speed, so deposition does not change and the current barely moves. It changes arc length. Cigweld calls it Heat Control on the Transmig 355i, and that name has done real damage, because call it heat and you send a welder chasing a fusion problem with the wrong knob.

The numbers do not travel either. Nine makers, nine names, and the European brands express it in volts while the American brands use a dimensionless index. Write plus 2 v on a WPS and it only means something on a machine that expresses trim in volts, in the same mode.



Trim down, on the line, trim up. The needle and the trim knob turned by the same amount. The full figure in the article carries the weld underneath.

The four things the curve cannot see

The machine reads its own output terminals. That is the entire extent of its awareness. Four things sit outside it, and all four move the arc away from the number on the display.

1. Your stick-out, the expensive one. About 7 amps per millimetre. Lincoln publishes 200 a at 21 v for 1.2 mm solid wire in CO2 at a nominal 16 mm. Reach into a joint, stick-out out to 25 mm, and the arc receives about 174 a. Thirteen per cent of your current, gone, with nothing on the machine touched. Wire feed speed has not changed, so the bead is the same size. Fusion is not.

2. The leads and the work return. The voltmeter reads at the machine's own terminals, so it always reads high. A documented case put 4 v across the leads and connections on a 31 v arc, a 13 per cent error. The machine sent what it was asked for. The arc never got it.

3. The gas in the bottle. 80 argon 20 CO2 and 82/18 are both M21 under ISO 14175, and the standard lets any component above 5 per cent arrive within plus or minus 10 per cent of nominal. So a nominal 20 turns up anywhere from 18 to 22 and is fully compliant.

4. The wire actually loaded. AWS A5.18 allows manganese from 1.40 to 1.85 per cent and silicon from 0.80 to 1.15. Two compliant spools of ER70S-6 do not run the same. Change to a cored wire and it stops being a small difference at all.

For the person signing the purchase order

The honest case for synergic control is variability reduction and faster changeover. That is worth the money. What it is not is a productivity gain on its own. TWI surveyed its members on weld repair rates, and the three dominant factors are welder skill level, weld location and accessibility, and poor fit-up before welding. **Synergic control addresses none of the three.** There is no independent quantification of what the curve itself contributes on manual GMAW either. Every figure in circulation is manufacturer sourced. Budget for the change, not just the hardware.

What to do with it on Monday

- **Welder.** The primary knob picks a point on the curve, trim is the quarter turn, and stick-out is the one thing on the sheet you can control without a meter. So control it.
- **Supervisor.** Record the trim next to the current across the fleet, and check the program against what is physically loaded before you check anything else. Anything on the stops, or past about plus or minus 3 volts, is telling you something, and it is a five minute check.
- **Owner.** Buy at changeover time and resource the setup. Do not buy it expecting it to fix fusion, access or fit-up, because those are the three things that drive your repair rate and none of them are in the curve.

The curve is a promise made in perfect conditions. Understanding what causes the variation, and what makes the displayed values inaccurate, is what lets you repeat the weld.

The rest of it, free

- The full technical article. Thirteen pages, four figures, twenty four sourced footnotes.
- An interactive version. Pick a wire, a gas and a diameter, load the wrong program on purpose, and watch what it costs you.
- A shop floor guide to print and post up, in A2, A3 or A4.

grahamfry.com.au/technical-resources/synergic-mig-welding