TECHNICAL ANNEXE

Everything CARI-Gold does, in one place.

The reference behind the CARI-Gold brochure: every capability, what you load and what you get back, each of the fifteen machine kinds with the findings it can return and the readings it needs.

Preparing a job file: page 3 · Preparing machine records: pages 4 and 9 · Looking up a finding: pages 5 to 8

Capabilities, by area page 2

The weighings file and the gram account page 3

Machine records and the floor page page 4

Melting, stock and investment page 5

Casting, rolling and heat page 6

Engraving and lasers page 7

Finishing, plating and refining page 8

Column guide page 9

Words on the screen, sectors and deployment page 10

CAPABILITIES

What CARI-Gold does, by area.

Two pages of results from the records a gold floor already keeps, and one line that joins them.

The gram account

- Grams not accounted for at each of three steps of every cast job: melt and pour, cutting, finishing.
- A usual range for melt and pour and for finishing, for the job's own charge and recipe.
- A band and a dot for those two steps: green inside the band, red above, amber below. Cutting is shown in grams only.
- A banner on every job with a step above its range.
- A step not weighed is shown as not weighed and is never guessed.
- Weighings that do not add up are marked as entries to check and kept out of the money total.
- A total per job, over the steps that were weighed.
- Totals per month when the jobs carry a date.
- Value per step, job and month, at the rate per gram you type.
- Two spreadsheet files for the accounts desk: per job step, and per month.

Fault next to grams

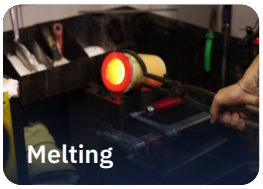
- A job's step above its range shown beside the fault named on the machine on its job card.
- Shown only for the machine kinds linked to that step; a record link, not a statement of cause.
- A plain note when a job names no machine, so nothing is paired by guesswork.

The machine floor

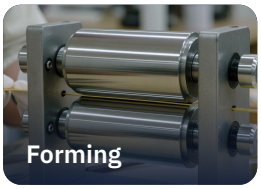
- Fifteen machine kinds in one table, one row per machine.
- Two record sets from the same machine: a good run and the run to review.
- One of four answers for every machine, in the same words.
- A possible fault named in plain words, with where to look.
- An urgency grade beside each fault or change, for maintenance planning.
- Faults first, then changes, then could not judge, then machines with nothing raised.
- As many machines of each kind as you run, under your own names.
- Machines added one at a time, each from its own file, and merged into one table.
- A plant figure typed where a machine needs one.
- A reading that cannot be real is named and the machine is shown as could not judge.

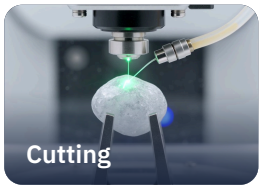
How you use it

- Paste from a spreadsheet, or choose a file; comma, tab and semicolon files are read.
- Example data built in for a first look, for the weighings, a two-machine floor and two furnaces.
- A column guide for every machine kind, with a template file.
- Plain refusals that say what to fix: an unreadable file, a duplicate job name, a decimal comma, a wrong unit.
- Results print from the browser, without the entry boxes.
- Light and dark display, on a laptop or a phone.
- Runs on your own PC in a web browser; your records are processed there.
- Reads records only; it never writes to a machine.











Scope. The gram account follows a cast job from charge to finished pieces. The floor page covers the fifteen machine kinds of this annexe; any of them can be loaded without the others.

THE WEIGHINGS FILE AND THE GRAM ACCOUNT

One line per job, as the job card has it.

The gram account needs only the weighings the floor already takes. Any weighing may be left empty.

Columns of the weighings file

COLUMN	WHAT IT HOLDS
Job	A name for the job. Each name once.
Machine	Optional. The machine that worked on the job, by the name you use on the floor page.
Date	Optional. Year-month-day, or day-month-year. Jobs are then totalled by month.
Charge	Metal into the crucible: fresh metal, and button and sprues from earlier casts. Grams.
Cast tree	The whole cleaned tree after the investment is removed: pieces, button and sprues, before cutting. Grams.
Cut pieces	The pieces cut off the tree. Grams.
Returned button and sprues	Button and sprues cut off and returned to stock. Grams.
Finished pieces	The pieces after finishing. Grams.
Recovered gold	Metal recovered from filings, dust and sweeps and returned for this job. Enter the weight of metal, not the gross weight of the sweeps. Grams.
Gold rate	Optional. Rupees per gram of the metal weighed; no price is built in.

Recipe columns, optional

COLUMN	WHAT IT HOLDS
Zinc share	The zinc in the alloy, as a fraction.
Melt temperature	The temperature the melt is taken to. Degrees Celsius.
Atmosphere	Cast in air or under cover gas.
Investment weight	The investment in the flask. Kilograms.

How the three steps are made

STEP	WEIGHINGS IT USES
Melt and pour	From the charge to the cast tree.
Cutting	From the cast tree to the cut pieces and the returned button and sprues.
Finishing	From the cut pieces to the finished pieces and recovered gold.

What a step can show

ON THE SCREEN	MEANING
Inside its usual range	Inside the band (green).
Outside its usual range	Above the band (red). The job gets a banner naming the step.
Below its usual range	Below the band (amber). Check the entry.
Weighed	Cutting is shown in grams. It has no usual range.
Not weighed	A weighing the step needs was left empty. The page says which.
Weighings do not add up	An entry to check. The step is kept out of the money total.

The band and the dot



Dot: grams not accounted for. Green: inside the band. Red: above. Amber: below. Cutting is shown in grams only.

PER JOB

The grams not accounted for over the steps that were weighed, and their value when a rate is given.

PER MONTH

Jobs, jobs with a step above its range, grams not accounted for and their value, for each month in the file.

FILES FOR ACCOUNTS

One file with a line per job step, and one with a line per month. Both open in a spreadsheet.

MACHINE RECORDS AND THE FLOOR PAGE

Each machine's own records, good days and the days to look at.

For every machine you load two sets of its own records: a set from a good run, and the set you want looked at. No two machines need be alike.

Two ways to load a machine

HOW	WHAT IT HOLDS
As a table	One line per record: the machine's name, its kind, the set it belongs to, then its readings. Used for: continuous caster, vacuum caster, rolling mill, annealing furnace, laser marker, diamond laser cutter, electro-polisher, mass finisher, plating bath, gold refining.
As a data file	For machines whose records are logs of a whole firing, heat, mix or job: induction melter, investment mixer, burnout furnace, enamel kiln, CNC engraving.

One machine, one file. Type the machine's name, pick its kind, choose its file. It joins the floor table beside the rest and can be removed again.

Plant figures. Typed on the page where a machine needs one: mass finisher: the weight of media in the bowl; annealing furnace: the thermocouple drift per day your plant allows.

The order of the table

1. Machines with a fault named.
2. Machines where a change was seen.
3. Machines that could not be judged, with the record problem named.
4. Machines with nothing raised.

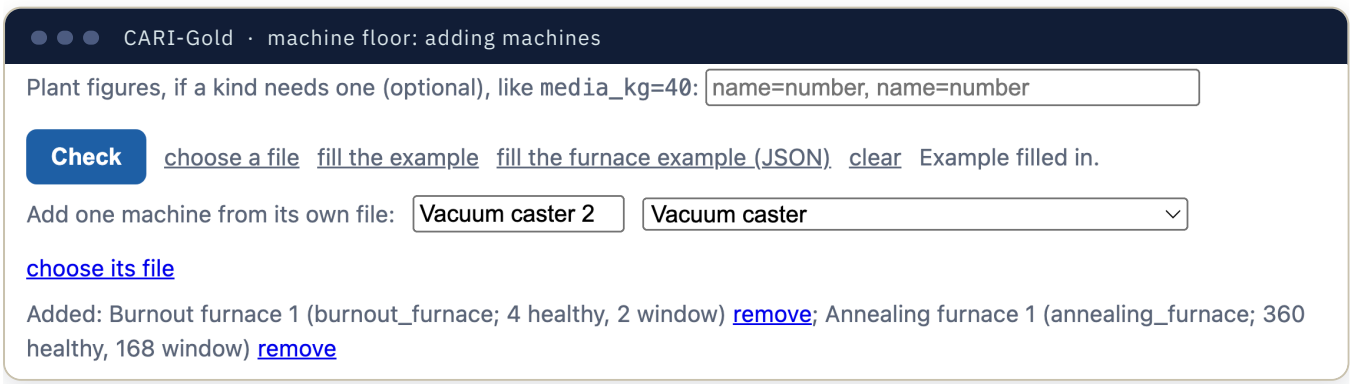
The four answers

ANSWER	MEANING
A reason to look	A possible fault is named. Urgency grade on the screen: **Fix at next stop**.
Change seen	A change from the machine's own normal is reported; no fault is named. Urgency grade on the screen: **Keep watching**.
Could not judge	The page identifies a missing or invalid reading, or a problem with the records.
Nothing raised	No fault or change was flagged in these records.

Fault next to grams: machine kinds linked to a step

STEP	MACHINE KINDS
Melt and pour	Induction melter, vacuum caster, continuous caster, burnout furnace, investment mixer.
Finishing	Electro-polisher, mass finisher, plating bath.

A job's flagged step and a machine's fault are shown together only when the job card names that machine and its kind is linked to the step. Every other machine kind is read on the floor page on its own.



Machines are added by name and kind, each from its own file. Example records for a two-machine floor and two furnaces are built in for a first look.

MELTING, STOCK AND INVESTMENT

From the melt to the fired flask.

Four machine kinds. Each finding is the wording shown on the floor page.

1 Induction melter

FINDING	WHAT TO CHECK
Lining worn	Inspect the refractory lining.
Capacitor bank fault	Check the capacitor bank.
Coil cooling water flow low	Check the coil cooling circuit.
Ground leak current high	Check the lining, and the coil for damp.
Melt taken hotter than its target	Review the melt temperature of the heat.
Dip probe reading low	Check the dip probe; replace it if faulty.

Reads: The power-supply panel, the cooling-water log and the melt book of each heat. **Loaded as:** a data file.

2 Continuous caster

FINDING	WHAT TO CHECK
Cooling-water flow low	Check the die cooling-water supply.
Die worn	Inspect the die.
Die cooling impaired	Check the die cooling surfaces and cooler contact.
Withdrawal force up	Check the die for damage or metal pick-up.
Protective gas low	Check the cover gas supply.
Melt held hot / held cold	Check the melt temperature against its set point.
Strand slipping in the drive	Check the drive rolls.
Melt level low	Check the crucible level against the recipe.
Withdrawal programme differs from the recipe	Check the programme loaded for the job.

Reads: Die temperature, cooling-water inlet temperature and flow, drive motor current, melt temperature, gas flow and pull stroke, beside the recipe of the job. **Loaded as:** a table.

3 Investment mixer

FINDING	WHAT TO CHECK
Vacuum pump weak	Check the vacuum pump.
Vacuum leak	Check the bowl seal and the vacuum line.

Reads: The vacuum gauge and the timing of each mix. **Loaded as:** a data file.

4 Burnout furnace

FINDING	WHAT TO CHECK
Heat loss high	Check the insulation and the door seal.
Heating power low	Check the elements and the supply voltage.
Thermocouple failed	Check the thermocouple and its connections; replace it if faulty.
Firing did not follow the approved programme	Check the programme that was run.
Control fault	Check the power switch and the control loop.
Heavier load than usual	Check the load against the furnace's normal charge.
Less heat needed than usual (change seen)	Check the load, the vent and the thermocouple.

Reads: The controller log of each firing. **Loaded as:** a data file.





Every machine also returns change seen, could not judge, or nothing raised, when no fault is named. A named fault points to an inspection; your team confirms it at the machine.

CASTING, ROLLING AND HEAT

The caster, the mill and the furnaces.

Four machine kinds. For the annealing furnace, the floor page can flag the work thermocouple for inspection.

5 Vacuum caster

FINDING	WHAT TO CHECK
Pump slow	Check the vacuum pump for wear.
Slow pump-down	Check the pump, the seals and the flask.
Leak	Check the chamber seals.
Damp flask	Check the burnout and the flask handling.
Flask colder than the recipe	Check the flask temperature at the caster.
Argon below the recipe	Check the argon supply and regulator.
Melt poured colder than the recipe	Check the pour temperature.

Reads: Vacuum readings of the cycle, argon pressure, flask and melt temperatures, with the recipe set points. Optional: the caster's leak test. **Loaded as:** a table.

6 Rolling mill

FINDING	WHAT TO CHECK
Roll eccentricity	Check the rolls for run-out.
Stand less stiff	Check the neck bearings and the stand bolts.
Roll gap opened	Check the gap setting and roll wear.

Reads: Roll force, thickness error and thickness ripple of each pass, with the pass schedule. **Loaded as:** a table.

7 Annealing furnace

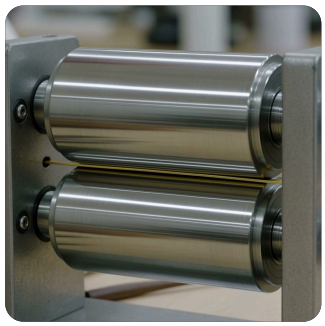
FINDING	WHAT TO CHECK
Work thermocouple drifting from the reference	Check the work thermocouple against the reference; replace it if faulty.

Reads: The work and reference thermocouples, with the drift per day your plant allows. **Loaded as:** a table.

8 Enamel kiln

FINDING	WHAT TO CHECK
Thermocouple failed	Check the thermocouple and its connections; replace it if faulty.
Thermocouple slow	Check the sheath, the position and the junction.
More heat lost	Check the insulation and the door seal.
Heating power low	Check the elements and the supply voltage.
Heater switch stuck	Check the heater switch.
Programme run is not the approved one	Check the programme that was run.

Reads: One day of the controller log. **Loaded as:** a data file.





> **Every machine also returns** change seen, could not judge, or nothing raised, when no fault is named. A named fault points to an inspection; your team confirms it at the machine.

ENGRAVING AND LASERS

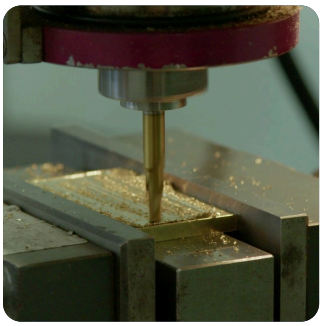
The spindle and the beam.

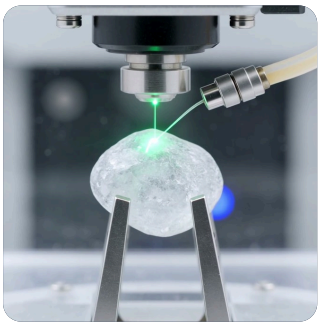
Three machine kinds. Required and optional readings are listed below each machine.

9 CNC engraving

FINDING	WHAT TO CHECK
Chatter	Review the cut and the tool for the job.
Loose workholding	Check the fixture and the clamping.
Front spindle bearing worn	Inspect the front spindle bearing.
Ball-screw backlash	Check the ball screw and its nut.
Axis position loop poorly tuned	Check the axis drive tuning.
Chipped tool	Inspect the cutting edge.
Worn tool still cutting	Inspect the cutting edge; change the tool if worn.
Tools wearing out fast	Check the material and the coolant.
Spindle or holder out of balance	Check the spindle, holder and tool for imbalance.
Tool run-out	Check the tool and clean the holder.

Reads: The machine's own log of each engraving job. **Loaded as:** a data file.





10 Laser marker

FINDING	WHAT TO CHECK
Laser source weak	Check the laser source.
Laser output above its setting	Check the power setting and the source.
Scanner drifting	Check scanner alignment and calibration.
Work height wrong	Check the focus height.
Window or lens dirty	Clean the window and the lens.
Mark not legible	Inspect the finished mark.

Reads: Source power and the position offset of each mark. Optional: the line width from the vision system. **Loaded as:** a table.

11 Diamond laser cutter

FINDING	WHAT TO CHECK
Pump diodes ageing	Check the laser source.
Laser cannot reach its setting	Check the diodes and the supply.
Chiller flow low	Check the chiller and its flow.
Stage error	Check the motion stage.
Fume extraction low	Check the extraction filter and fan.
Q-switch unstable	Check the Q-switch.
Optics dirty	Clean the optics.
Beam quality or focus to check	Run a beam and focus check.

Reads: Pump current, output power, chiller flow, diode temperature, stage following error, extraction flow, cut time and depth. Optional: power at the work. **Loaded as:** a table.

Every machine also returns change seen, could not judge, or nothing raised, when no fault is named. A named fault points to an inspection; your team confirms it at the machine.

FINISHING, PLATING AND REFINING

The finish, the plate and the refinery.

Four machine kinds, read load by load and batch by batch. Required and optional readings are listed below each machine.

12 Electro-polisher

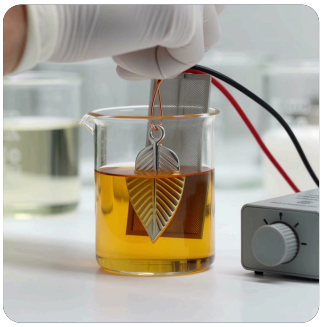
FINDING	WHAT TO CHECK
Voltage set low	Check the voltage setting: etching risk.
Voltage set high	Check the voltage setting: pitting risk.
Bath hotter than usual	Check the bath temperature.
Bath cold	Check the bath heating.
Bath metal-loaded, or a poor contact	Check the bath condition and the rack contact.

Reads: Cell voltage, current and the weight removed from each batch, weighed before and after. Optional: the bath temperature. **Loaded as:** a table.

13 Mass finisher

FINDING	WHAT TO CHECK
Media worn	Inspect the media; renew it if worn.
Rinse water blocked	Check the rinse line and clear the sludge.
Drive weak	Check the eccentric weight and its setting.
Drive set high	Check the eccentric setting.
Bowl overloaded	Check the load against the media in the bowl.

Reads: Bowl acceleration, the weight removed from each load, weighed before and after, and the parts loaded, with the weight of media in the bowl. Optional: a sludge reading. **Loaded as:** a table.





14 Plating bath

FINDING	WHAT TO CHECK
Contact resistance up at the rack or busbar	Clean and tighten the contacts.
Anode passivation	Inspect the anode.
Bath hotter / colder than its set point	Check the bath heating and its setting.
Filter loop flow low	Check the filter and the pump.
Bath level low	Check the level against the operating procedure.
Free acid high	Check the bath assay.

Reads: Cell voltage, current, bath temperature, filter flow, level and the acid assay of each load. **Loaded as:** a table.

15 Gold refining

FINDING	WHAT TO CHECK
Scrubber performance down	Check the fan, the caustic and the pump.
Slow or incomplete dissolving	Check the batch for incomplete dissolution.
Scrubber fan pressure low	Check the fan and the gas path.
Scrubber pH low	Check the scrubber liquor and the caustic supply.
Scrubber liquid flow low	Check the scrubber circulation.
Too little nitric acid in the mix	Check the acid dosing.
Vessel colder than its set point	Check the vessel heating.
Agitator current low	Check the agitator.

Reads: The fume reading at the stack, fan pressure, acid flows, vessel temperature, agitator current, scrubber pH and flow, with the karat and weight of each batch. **Loaded as:** a table.

Every machine also returns change seen, could not judge, or nothing raised, when no fault is named. A named fault points to an inspection; your team confirms it at the machine.

COLUMN GUIDE

The readings each machine needs, from the application itself.

The column guide is built into the floor page: the word to type for each machine kind, the reading columns of its table, and a template file.

CARI-Gold · machine floor: column guide

machine	type this in the kind column	reading columns	
Vacuum caster	`vacuum_caster`	gauge_30s_mbar, gauge_pour_mbar, argon_bar, flask_c, melt_c, flask_set_c, argon_set_bar, pour_set_c, wire_mm	template
Plating bath	`plating_bath`	cell_v, current_a, bath_c, flow_l_min, level_frac, assay_acid_g_l, area_dm2	template
Gold refining	`gold_refining`	nox_stack_ppm, fan_dp_pa, hcl_flow, hno3_flow, vessel_temp_c, agitator_current_a, scrubber_ph, scrubber_flow_l_min, karat, batch_kg	template
Rolling mill	`rolling_mill`	alloy, width_m, h_entry_m, reduction, roll_radius_m, mu, roll_force_kn, thickness_error_um, thickness_ripple_um	template
Continuous caster	`continuous_caster`	alloy, diameter_mm, stroke_mm, pull_s, dwell_s, melt_setpoint_c, level, water_l_min, die_c, water_in_c, water_flow_l_min, motor_current_a, melt_c, gas_flow_l_min, encoder_stroke_mm optional: strand_wheel_mm, melt_level	template
Burnout furnace	`burnout_furnace`	logs and lists: give as a JSON file (see the furnace example)	
Enamel kiln	`enamel_kiln`	logs and lists: give as a JSON file (see the furnace example)	
CNC engraving	`cnc_engraving`	logs and lists: give as a JSON file (see the furnace example)	
Induction melter	`induction_melter`	logs and lists: give as a JSON file (see the furnace example)	
Investment mixer	`investment_mixer`	logs and lists: give as a JSON file (see the furnace example)	
Electro-polisher	`electropolish`	v, a, removed_g	template
Mass finisher	`mass_finishing`	accel, removed_g, parts_kg optional: sludge	template
Laser marker	`laser_marking`	power_w, offset_um optional: width_um	template
Diamond laser cutter	`laser_cutting`	recipe, pump_current_a, output_power_w, chiller_flow_l_min, diode_temp_c, following_error_um, extraction_flow, pulse_energy_scatter, cut_time_min, cut_depth_mm optional: power_at_work_w	template
Annealing furnace	`annealing_furnace`	t_s, FURN1.Zone.WorkTC, FURN1.Zone.ReferenceTC, FURN1.State, FURN1.Survey.Flag	template

How to use it. Find your machine kind. For a table, start with its template. For a log file, check the records listed for your machine on pages 5 to 8. The application includes a furnace log example.

WORDS ON THE SCREEN, SECTORS AND DEPLOYMENT

The same words, on every floor.

CARI-Gold uses a small set of plain terms and keeps to them on every screen and every printed page.

Words you will read

TERM	MEANING
Usual range	The band shown for melt and pour or for finishing, for a charge and recipe like the job's.
Good records	Records of a machine from a good run.
Records to look at	Records from the run you want reviewed.
Recorded for the same machine as	The words that link a job's flagged step to a machine's fault. A record link for you to look at both; not a statement of cause.
Fix at next stop	The grade beside a named fault. On the screen: plan the repair for the next planned stop.
Keep watching	The grade beside a change seen. On the screen: look again at the next routine round.

Capacity of one run

ITEM	CAPACITY
Jobs in one weighings file	Up to five hundred.
Size of one file	Up to 20 MB.
Machines on the floor page	As many as your file names.

What it runs on

Your own PC, in a web browser. No connection to a machine or a controller is needed, and your records are processed on your own PC and stay with you. It reads records only.

Where it works

SECTOR	WHAT IS READ
Jewellery workshops and factories	The gram account for every cast job; casting, engraving, laser, finishing and plating machines on the floor page.
Casting houses	The gram account job by job for each customer's work; melter, investment mixer, burnout furnace and vacuum caster.
Refineries	The floor page: gold refining with its fume scrubber, batch by batch, and the induction melter for the refined metal.
Bullion and mints	The floor page: induction melter, continuous caster, rolling mill, annealing furnace and laser marker.
Chain makers	The floor page: continuous caster, rolling mill and annealing furnace before the chain machine; plating, electro-polishing and mass finishing after it.


Workshops


Casting houses


Refineries


Bullion and mints


Chain makers

START WITH A WALKTHROUGH ON YOUR OWN PC

Bring cast-job weighings, or a good run and a run to review for each machine you choose. We set CARI-Gold up with your team and read the page for the records you bring. Your records stay with you.

WRITE TO US

contact@carimo.tech
carimotech.com