TECHNICAL ANNEXE

What goes in, what comes out, unit by unit.

For the facility, BMS or HVAC engineer at a commercial building, mall, data centre, hospital, hotel, airport, IT park or process plant: the points each part of the plant needs, the form of the file, what every finding means, and the records the application keeps.

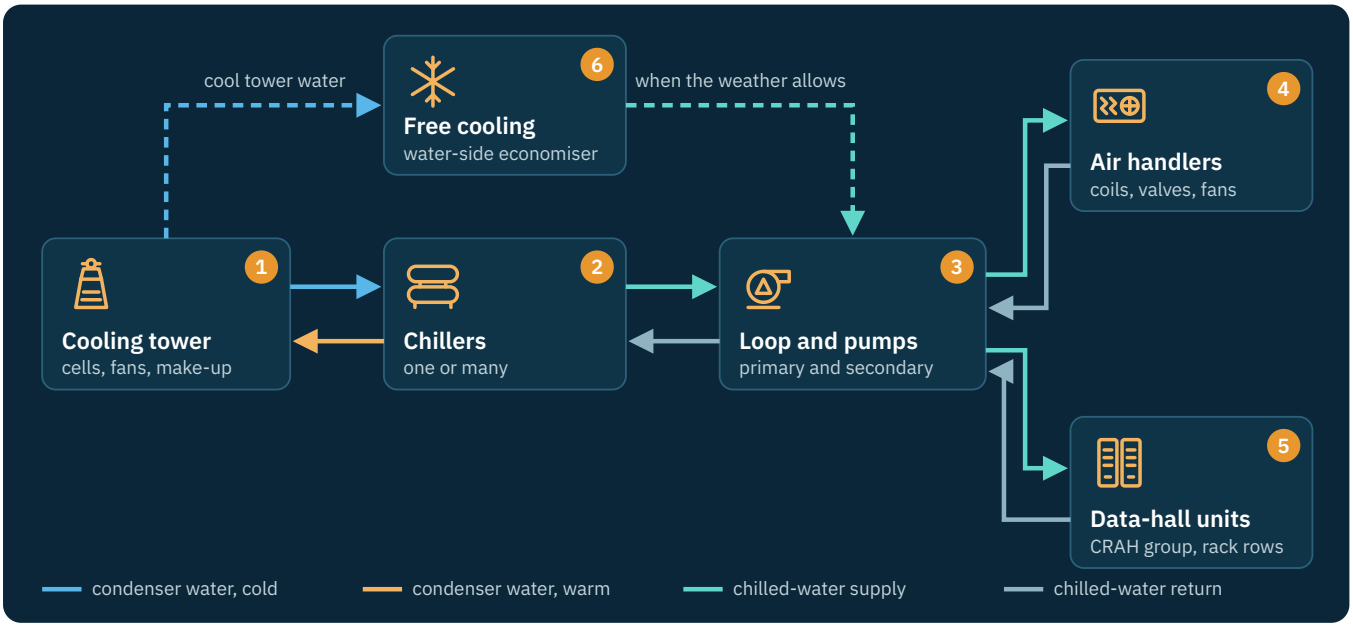
- Capabilities at a glance — page 2
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- Chillers: points and screens — page 4
- Chillers: alerts, cleaning time, energy — page 5
- Cooling tower and condenser-water loop — page 6
- Primary-secondary loop and chilled-water pumps — page 7
- Air handlers and their fans — page 8
- Data-hall cooling units and free cooling — page 9
- Records: history, work orders, report, projects — page 10

CAPABILITIES AT A GLANCE

Everything the application does, on one page.

CARI-Chiller reads a building-management or historian export on your own PC. It returns chiller alerts with urgency grades and named plant-unit findings with dates, together with a printable report. Each line below is a working part of it.

CAPABILITY	WHAT IT GIVES
Chiller health	Each chiller against its own normal running; four readings, actual against expected, with daily trends.
Chiller alerts	The readings that moved, the size of the move, how long it lasted, and whether it still shows in the latest records.
Urgency grade	Keep watching, or Fix at next stop, on every open chiller alert.
Check against normal weeks	What the alerts would have raised in the weeks your team selected as normal.
Energy	Compressor power per ton of cooling, normal against the last week; extra energy while a chiller alert was open.
Cost	Extra energy priced with your electricity price and currency; open chiller alerts ranked by cost.
Cleaning time	A band of days to your chiller maker's condenser cleaning limit.
Plant-unit findings	Named findings with dates for the cooling tower and condenser-water loop, primary-secondary loop, chilled-water pumps, air handlers and their fans, data-hall cooling units and free cooling.
Alert history	Acknowledge, close and reopen chiller alerts, by name, in a sealed log; closure by a second person.
Work orders	One spreadsheet file, one row per chiller alert, for maintenance planning.
Report	A printable report: plant summary, then a sheet per chiller and per plant unit.
Saved projects	Point choices, units, dates, electricity price, cleaning limit and alert history kept per plant, with a timeline of runs.
Units and dates	Common temperature, flow and power units converted; day-first or month-first dates settled before anything is read.
Deployment	Runs on your own PC and opens in a web browser. Reads records only.



DATA NEEDS

One file, as your system already writes it.

CARI-Chiller reads a CSV export from a building management system or a historian: one row per time step, one column per point, with a time column, covering both the normal period and the later days to check. A file may be up to 50 MB.

The file

ITEM	WHAT IS EXPECTED
Form	CSV, one header row, one time column
Chillers in one file	Columns that begin with a chiller name, such as CH1 or Chiller_2, are grouped by chiller
Plant units in one file	Columns that begin with a unit name and a dot, such as Tower1.supply; the unit name is yours to choose, and a plant may have as many named units as it needs
Time	Day-first or month-first is settled from the file, or asked
Gaps and error codes	Left out and counted; the file is never repaired

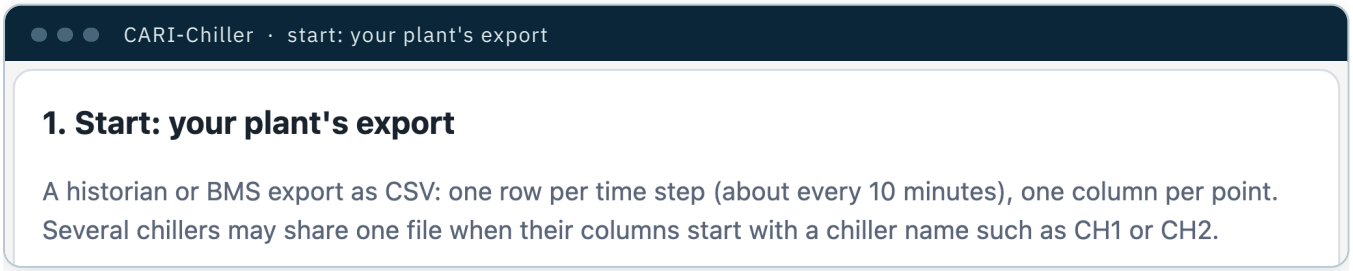
Units for the chiller points

QUANTITY	UNITS ACCEPTED
Temperature	°C, °F, K
Temperature difference	K, °C, °F
Flow	kg/s, kg/h, L/s, L/min, m³/h, gpm
Power	kW, W, MW, hp, BTU/h

The unit of each chiller column is read from its name, or chosen on the points screen (gpm is US gallons per minute). A reading that cannot be right for its unit stops the run with a plain sentence. Plant-unit columns are exported in the units shown in their tables on pages 6 to 9; speeds and valve positions are a fraction from 0 to 1 or per cent, as each table shows. For water, 1 kg/s is about 1 L/s or 3.6 m³/h.

Record length and spacing

EQUIPMENT	ROW SPACING	NORMAL-OPERATION RECORD	LATER RECORD TO CHECK
Chillers	about every 10 minutes	about four weeks, with hot days and mild days	a week of steady running after the normal period
Cooling tower and condenser-water loop	closer than hourly	two days or more	two days
Primary-secondary loop	closer than hourly	a day or more of steady running	a few hours of steady running
Chilled-water pumps	closer than hourly	a day or more of steady running	a few hours of steady running
Air handlers	about every 5 minutes	not needed	a day with the supply fan running
Data-hall cooling units	closer than hourly	a day or more	half a day or more
Free cooling	every 5 minutes, unbroken	a day or more	half a day or more



The start screen. Drop the export here, or open a saved project so that last month's choices are already filled in.

CHILLERS · POINTS AND SCREENS

Chillers: the points to export and the screens you read.

For water-cooled chillers with the compressor motor power metered. One chiller or many may share a file; each is judged on its own, and one that cannot be judged says why while the others still run.

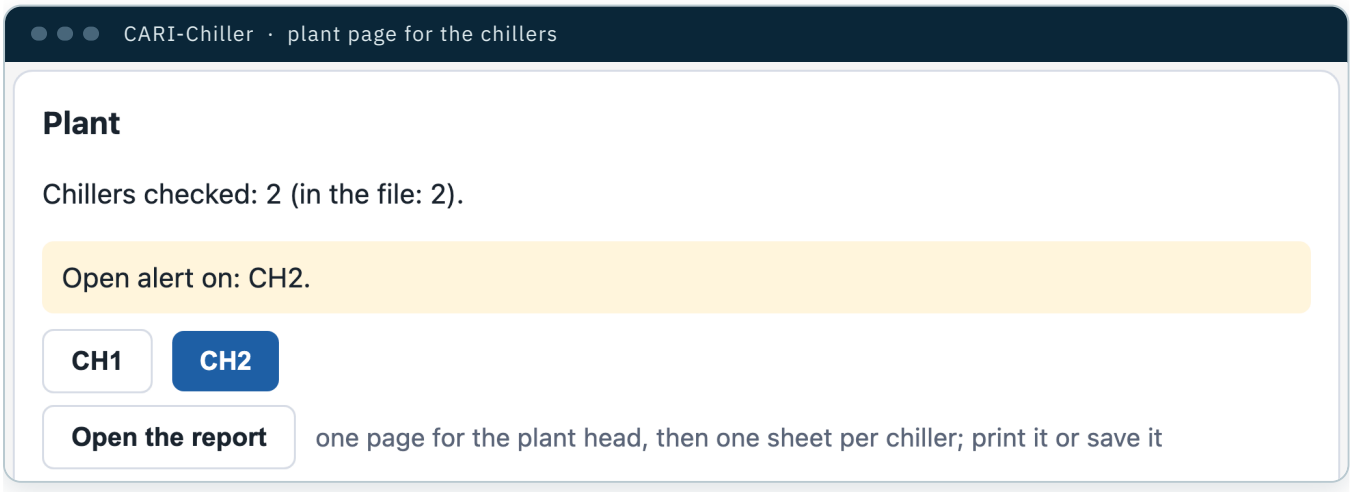
Points, per chiller

POINT	KIND
chilled water entering (return)	temperature
chilled water leaving (supply)	temperature
condenser water entering	temperature
chilled-water flow	flow
condenser-water flow	flow
suction superheat	temperature difference
condenser subcooling	temperature difference
evaporating temperature	temperature
condensing temperature	temperature
condenser water leaving	temperature
compressor motor power	power

Water temperatures, flows and power come from the BMS or its meters; evaporating and condensing temperature, superheat and subcooling come from the chiller's own controller over its BMS link. If a point is missing from the file, the points screen names it and shows which screen needs it.

Screens

SCREEN	WHAT IT GIVES
Start	Drop the export, load a sample plant, or open a saved project.
Points	Which column is which point, and its unit.
Normal period	The dates the team calls normal, and the cleaning limit with its source.
Plant	Every chiller and plant unit with its status; report, electricity price and work orders.
Health view	Actual against expected for evaporator temperature, condenser temperature, leaving condenser water and motor power, with daily trends.
Alerts	Each lasting change with the readings that moved and the urgency grade.
Check against normal weeks	What the normal weeks themselves would have raised.
Energy	Compressor power per ton of cooling and the extra energy of each alert.
Time to the cleaning limit	The band of days and the limit it rests on.
History and approvals	Acknowledge, close and reopen, with the sealed log.



The plant page for a two-chiller file: the chiller that carries an open alert, a button for each chiller, and the printable report.

CHILLERS · WHAT EACH RESULT MEANS

Alerts, cleaning time and energy, line by line.

A chiller alert states what was seen: which readings moved away from that chiller's normal running, by how much, for how long. It is a reason to look, with a grade that says how soon.

Words on an alert

ON SCREEN	MEANING
Still showing in the readings	The change is present in the latest records of the file.
Cleared in the readings	The readings have returned to normal; the alert keeps its dates and hours.
Provisional alert	The normal period was shorter than about four weeks; confirm with a longer record.
Largest change	The readings that moved furthest, out of the four on the health view.
Not judged for some hours	The chiller ran outside the loads and weather its normal weeks covered; the screen says which.

Urgency grade

GRADE	MEANING
Keep watching	Look again at the next routine round.
Fix at next stop	Plan the repair for the next planned stop.

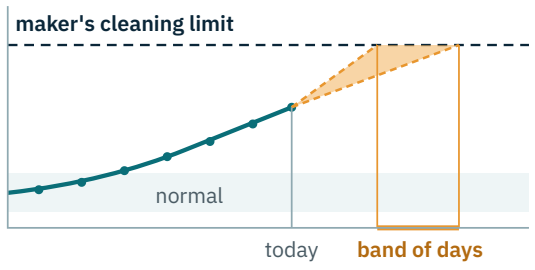
Time to the cleaning limit

ITEM	WHAT IT IS
What is followed	The condenser approach of each chiller (condensing temperature minus leaving condenser water, K), day by day.
The limit	Your chiller maker's printed cleaning point for the approach, typed with where it is printed; shown beside the result.
The answer	A band of days to the limit, redrawn with each new file. At the limit, the screen says the cleaning point is reached.
No clear rise	When the reading is not rising, the screen says so and gives no time.

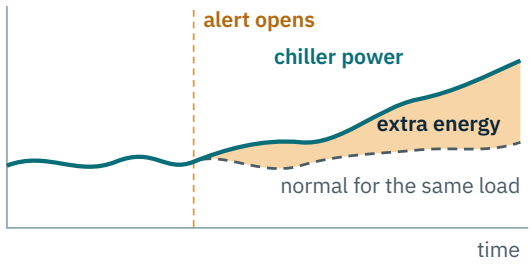
Energy and cost

ITEM	WHAT IT IS
Power per ton of cooling	Compressor motor power per ton of cooling, in the normal period and in the last week judged.
Extra energy	The energy drawn above normal while an alert was open.
Cost	Extra energy priced with the electricity price and currency you type; shown with every alert and in the work-order file.
Ranking	Open chiller alerts, largest extra-energy cost first.

Days to the cleaning limit



Extra energy while an alert is open



Check the weeks you called normal. Beside the alerts the application shows which alerts would have appeared in those weeks.

COOLING TOWER AND CONDENSER-WATER LOOP

The tower, cell by cell.

Each tower group is two tower cells and the condenser side of the two chillers they serve. Give each group its own name in the export.

What each finding reports

FINDING ON SCREEN	WHAT WAS SEEN
Tower cell weak (fill or spray nozzles)	One cell cools less than the other; the cell is named.
Fan belt slip	The named cell's fan draws less power than expected for its speed command.
Chiller condenser fouled	A chiller's condenser passes heat less well than in its normal period; the chiller is named.
Water treatment upset: blowdown not flowing	Dissolved solids in the circulating water are building up.
Make-up valve shut or stuck open	Tower make-up flow or a cell's basin level is away from normal; where one basin is affected, the cell is named.
Extra water loss: drift eliminator or leak	The tower is taking more make-up water than its duty explains.
Changed, not a fault pattern	The readings have moved away from normal in a way that matches none of the named faults. Worth a look on the next round.



Points needed

POINT TO EXPORT	UNIT TO EXPORT
outdoor wet-bulb temperature	°C
heat load on the chillers (cooling duty)	kW
chiller compressor power, both chillers together	kW
tower supply (cold) water temperature	°C
tower return (hot) water temperature	°C
cell 1 cold-water temperature	°C
cell 1 fan speed command	fraction 0 to 1
cell 1 fan power	kW
cell 1 basin level	%
cell 2 cold-water temperature	°C
cell 2 fan speed command	fraction 0 to 1

POINT TO EXPORT	UNIT TO EXPORT
cell 2 fan power	kW
cell 2 basin level	%
second cell running	0 or 1
tower make-up water flow	kg/s
circulating-water conductivity	µS/cm
chiller 1 cooling duty (heat taken)	kW
chiller 1 compressor power	kW
chiller 1 condensing temperature	°C
chiller 2 cooling duty (heat taken)	kW
chiller 2 compressor power	kW
chiller 2 condensing temperature	°C

Cooling duty and group totals. Where the BMS does not trend cooling duty, add a calculated column: for water, duty in kW is about 4.18 × chilled-water flow in kg/s × the return-minus-supply difference in K, for each chiller. The heat load of the group is the sum of the two cooling duties; the compressor power of the group is the sum of the two compressor powers.

PRIMARY-SECONDARY LOOP AND CHILLED-WATER PUMPS

The loop and its pumps, from one set of points.

One set of ten points serves two unit types. The loop reports on the chiller side and the bypass; the pumps report on the secondary pumps.

Primary-secondary water loop

FINDING ON SCREEN	WHAT WAS SEEN
Deficit flow through the decoupler	The building side draws more water than the chiller side supplies, so return water runs back through the bypass and warms the supply.
Primary side weak: pump, plant unit or strainer	The chiller side delivers less flow than normal for the pumps and chillers running.
Changed, not a fault pattern	The readings have moved away from normal in a way that matches none of the named faults. Worth a look on the next round.

Chilled-water pumps

FINDING ON SCREEN	WHAT WAS SEEN
Secondary pump worn	The pumps hold less pressure at the far load than normal for their speed and flow.
Secondary pump efficiency loss (motor or bearings)	The pumps draw more power than normal for the water they move.
Changed, not a fault pattern	The readings have moved away from normal in a way that matches none of the named faults. Worth a look on the next round.

Points needed

POINT TO EXPORT	UNIT TO EXPORT
primary-side flow	one flow unit for all three
secondary-side flow	same flow unit
flow through the decoupler (bypass)	same flow unit
differential pressure at the remote load	as recorded
secondary pump speed	fraction 0 to 1
number of primary pumps running	count
number of secondary pumps running	count
number of chillers running	count
primary pumps power	kW
secondary pumps power	kW





One flow unit throughout. The primary, secondary and bypass flows may be in any flow unit, as long as all three use the same one. Bypass flow is positive from supply to return, that is, when primary flow is above secondary flow.

AIR HANDLERS AND THEIR FANS

The air handler: valves, sensors and the supply fan.

For an air-handling unit with heating and cooling coils, a mixing box and a supply fan. Rows about every five minutes; no normal period is needed for this unit.

What each finding reports

FINDING ON SCREEN	WHAT WAS SEEN
Heating and cooling fight: leaking valve or sequence fault	The heating and cooling valves are open together for much of the time the fan runs.
Duct static pressure below set point with the supply fan at full speed	The supply fan is at full speed while duct pressure stays below set point. Usual causes: a slipping belt, a blocked filter, a closed damper or a duct leak.
Mixed air outside the span of return and outside air	A mixed-air, return-air or outdoor-air sensor reads wrong, or sits where the air is not mixed.



Points needed

POINT TO EXPORT	UNIT TO EXPORT
supply-air temperature	°C
supply-air temperature set point	°C
mixed-air temperature	°C
return-air temperature	°C
outdoor-air temperature	°C
cooling valve position	% open

POINT TO EXPORT	UNIT TO EXPORT
heating valve position	% open
supply fan status	0 or 1
supply fan speed	%
duct static pressure	Pa
duct static pressure set point	Pa
occupied (optional)	0 or 1

FANS ACROSS THE PLANT

Fans are read as part of the machine they serve. **Tower fans:** speed command and power for each cell, for belt slip. **Air-handler supply fan:** status, speed and the duct pressure it should hold. **Data-hall unit fans:** the speed of each unit against the others in the room.

CARI-Chiller · plant page: an air handler

AHU Level 5: Air-handling unit. **Finding.**

- **heating and cooling fight: leaking valve or sequence fault**, from 2026-05-08 00:00 to 2026-05-09 00:00
- **heating and cooling fight: leaking valve or sequence fault**, from 2026-05-11 00:00 to 2026-05-13 00:00 (still showing)

An air handler on the plant page, with its finding and the days it was seen.

DATA-HALL COOLING UNITS AND FREE COOLING

The data hall, unit by unit and row by row.

Each data-hall group is three computer-room air-handling units (CRAHs) serving four rack rows. Give each group its own name in the export. Free cooling is a water-side economiser on the chilled-water plant.

Data-hall cooling units

FINDING ON SCREEN	WHAT WAS SEEN
Unit departs from its peers	One unit reads differently from the others; the unit and the reading are named.
Valve hunting	A unit's chilled-water valve moves back and forth more than the others; the unit is named.
Hot spot	Names the rack row whose inlet temperature runs higher than the other rows.
Changed, not a fault pattern	The readings have moved away from normal in a way that matches none of the named faults. Worth a look on the next round.

Points for each CRAH (all three)

POINT TO EXPORT	UNIT TO EXPORT
return air temperature	°C
supply air temperature	°C
return air humidity	%
chilled-water valve position	% open
fan speed	%
unit power	kW
humidifier output	kg/h
chilled-water return temperature of the unit	°C

Shared points for the group

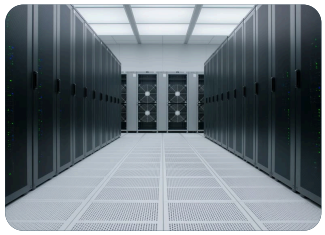
POINT TO EXPORT	UNIT TO EXPORT
rack inlet temperature, each of four rows	°C
chilled-water supply temperature	°C
total chilled-water flow of the units	kg/s
IT load	kW

Free cooling

FINDING ON SCREEN	WHAT WAS SEEN
Economiser valve held part-open	The valve sits between open and shut for hours.
Economiser valve open when the tower water is too warm	The valve is open in a period unsuited to free cooling.
Economiser valve shut when free cooling is available	The valve is shut in a period suited to free cooling.
Economiser exchanger losing effectiveness	Free cooling gives less than in its normal period for the same conditions.
Changed, not a fault pattern	The readings have moved away from normal in a way that matches none of the named faults. Worth a look on the next round.

Points needed

POINT TO EXPORT	UNIT TO EXPORT
outdoor wet-bulb temperature	°C
chilled-water supply temperature	°C
water temperature rise across the data hall	K
IT load	kW
economiser valve position	fraction 0 to 1
cooling-plant power	kW





RECORDS

History, work orders, report and projects, kept for you.

Keep the team's steps on chiller alerts, print one report for the plant, and export chiller-alert rows for maintenance planning. Saved projects keep each plant's setup and history.

Steps on a chiller alert

STEP	WHAT IS RECORDED
Acknowledged	Someone has seen the alert and will look. Name and time; a note is optional.
Closed	The inspection or repair is complete. The reason is required, and the person closing is not the one who acknowledged.
Reopened	A closed alert is opened again. The reason is required.

The log records each alert step in order. A changed, deleted or reordered entry is detected.

The printable report

PART	WHAT IT HOLDS
Plant summary	One page for the plant head: every chiller and plant unit with its status.
Sheet per chiller	Health view, alerts with the team's steps, energy and cleaning time.
Sheet per plant unit	Its findings with their dates.
About this result	One page stating what the report covers.

Saved projects

ITEM	WHAT IT HOLDS
Kept per plant	Point choices, units, date order, normal dates, electricity price, cleaning limit and its source.
Alert history	One sealed log for the plant; a step recorded on an alert stays with it across runs.
Timeline	One line per run: for each chiller, its open alerts and its power per ton of cooling.
Rename and remove	A project can be renamed. A removed project is set aside with its log and can be put back.

Work-order file: columns

work order ref · plant · chiller · alert from · alert to · still showing in the readings · hours · urgency grade · grade meaning · readings that moved · largest change · what was found · cause · plant team · last step · extra energy · extra energy cost from your tariff · currency · evidence · check after the repair

A spreadsheet with one row per chiller alert, ordered by extra-energy cost. It carries the dates, urgency grade, readings that moved, the team's last step and the check after the repair.

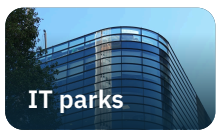
Where it works

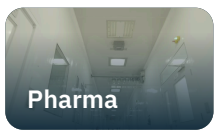












Also hotels, airports and district cooling plants. The equipment in the plant decides the points to export and the findings returned.

DEPLOYMENT

Runs on your own PC and opens in your web browser. It reads records only and never writes to a chiller or its controls. Your plant records stay on your own computer.

WRITE TO US

contact@carimo.tech
carimotech.com