

MedGasCAD Operating Manual

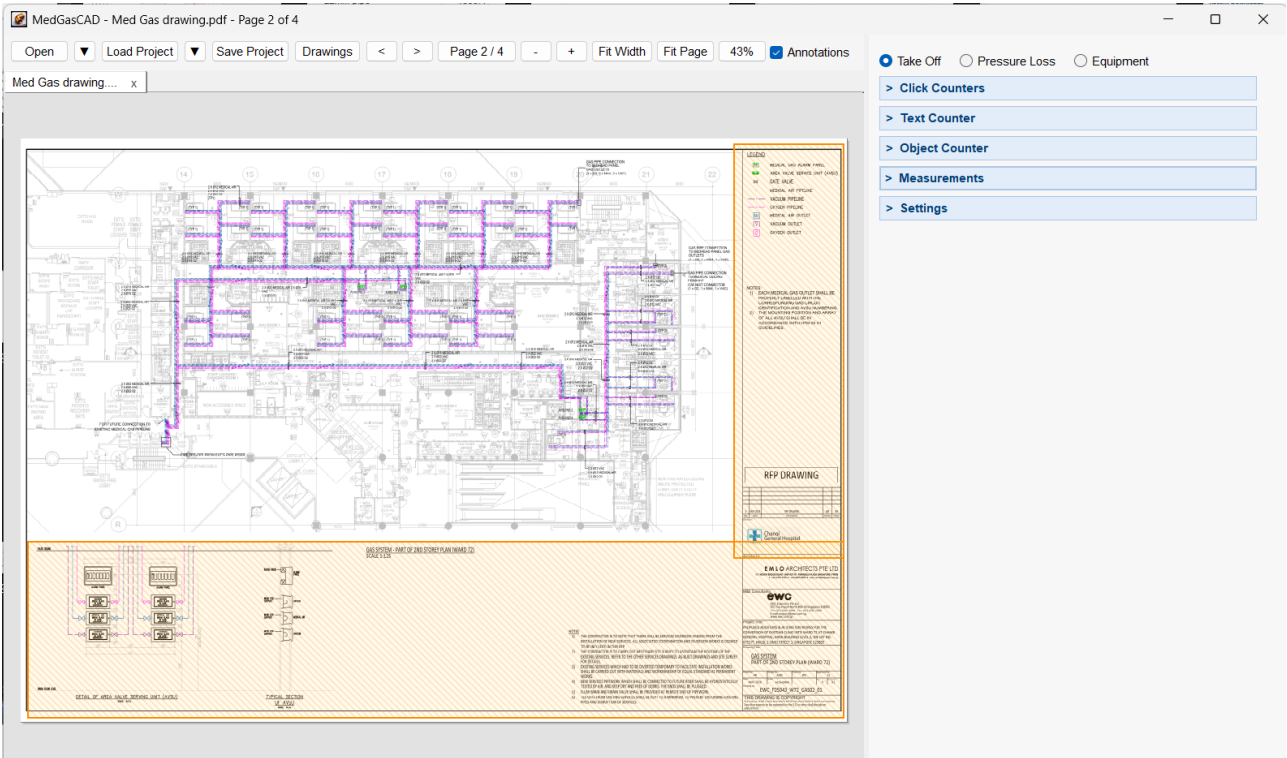
Version 2.7 - current released WinForms interface, OCR text counting, Auto Trace measurements, counter clone/import workflows, clone workflows, Insert Node, pressure-loss Auto From/To workflow, hotkeys, reports, print preview, equipment, and project workflow.

Item	Details
Application	MedGasCAD
Manual version	2.7
Release date	2026-07-25
Scope	PDF take-off, measurements, Auto Trace measurements, click/text/object counters, OCR-assisted text counting, counter cloning/import, measurement/pressure-loss cloning, pressure loss, automatic From/To naming, branch routing, pipe-size optimization, equipment, reports, display controls, hotkeys, and project workflow.

This manual describes the normal user workflows for MedGasCAD. The pressure-loss naming guidance has been updated for the current Auto workflow, where branch junction labels are handled by the app and users normally work with simple running endpoint names such as A1, A2, and A3.

1. App Layout and Toolbar

MedGasCAD opens PDF drawings in document tabs. The drawing viewport is on the left and the working panels are on the right. The main toolbar contains file, project, navigation, zoom, rotation, display, hotkey, and annotation controls.



Toolbar area	Purpose
Open / Load Project / Save Project	Open PDF files, load an existing project, or save the current project file.
Drawing tabs	Switch between opened PDFs. A project can contain multiple drawings and multiple pages.
Page and zoom controls	Move between pages, zoom in/out, fit page, zoom to selection, and use Ctrl + mouse wheel for zooming.
Rotate left / right	Rotate the current drawing view. Drawing rotation is saved with the project.
Display toggles	Use toolbar icons for annotations, Boost preview, thin lines, greyscale, and related display options.
Right-side panels	Choose Take Off, Pressure Loss, or Equipment. Panels can be opened only when needed.

2. Opening PDFs and Projects

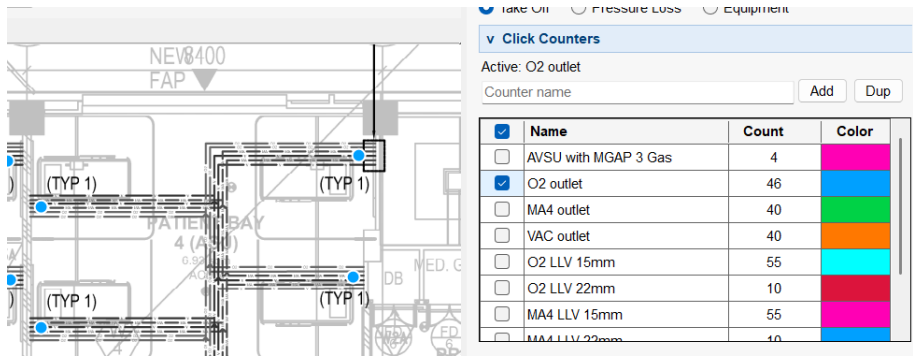
Action	How it works
Open PDF	Click Open and select one or more PDF files. Shift-click or Ctrl-click in the file dialog can open multiple PDFs at once.
Load Project	Load a .mgcadproj project file to restore drawings, counters, pressure-loss segments, equipment inputs, exclusions, rotations, and saved panel states.
Save Project	Save take-off data, text and object counters, measurements, pressure-loss data, optimization changes, equipment inputs, label settings, and panel states.
Recent dropdowns	The small triangle beside Open and Load Project opens recent file/project choices.

For large or complex PDFs, the first render can take longer. The app keeps the interface responsive where possible and displays rendering feedback while the drawing or preview page is being prepared.

3. Take Off Workflow

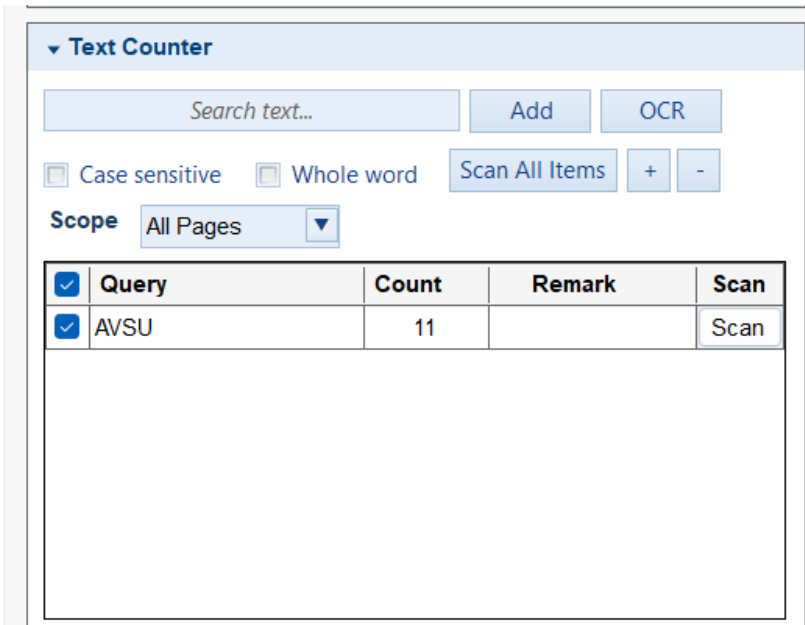
The Take Off workspace contains Click Counters, Text Counter, Object Counter, Measurements, and Settings.

Click Counters



Control	Purpose
Add / Dupe / Delete	Create, duplicate, or remove counter rows.
Linked dupes	Duplicated click counters can stay linked so changing any linked item updates the count for the linked chain. Linked rows share the same count and color.
Color	Set the display color for counter dots on the PDF. When adding new rows, MedGasCAD checks colors already in use and chooses the next available default color.
Show / hide	Toggle individual rows or all rows so the drawing can be inspected clearly.
Rename	Edit item names directly in the counter table.
Ctrl + click	Add to an existing selection when selecting counter points.

Text Counter

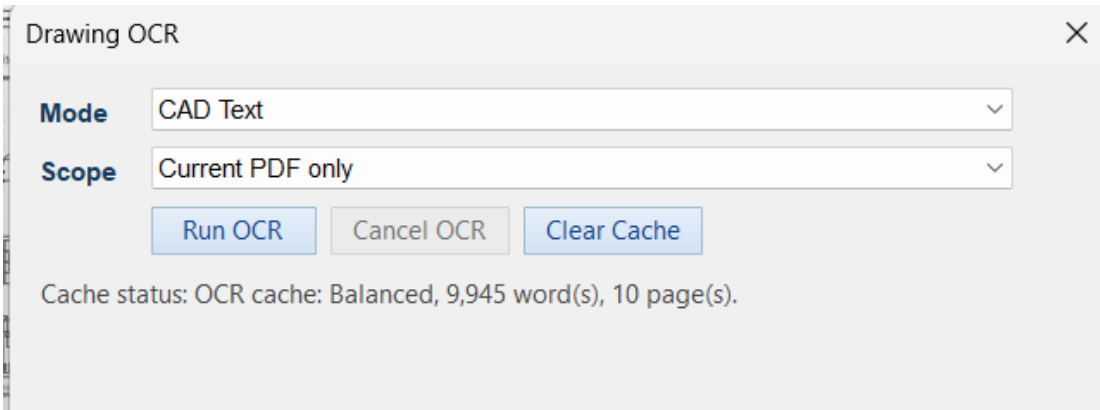


Control	Purpose
Search text	Enter a query and add it to the table.
OCR	Open Drawing OCR to create or update the searchable OCR cache used by Text Counter for scanned, rotated, or CAD-style text.
Case sensitive / Whole word	Refine how matches are counted. Hyphenated text is treated as one search item.
Scan All Items	Rescan every text-counter row using the current scope.

Control	Purpose
Scope	For multi-page PDFs, choose Current Page or All Pages. Single-page PDFs use current page behavior.
Scrollbar markers	Text matches on other pages are indicated on the page scrollbar so matches are easier to locate.

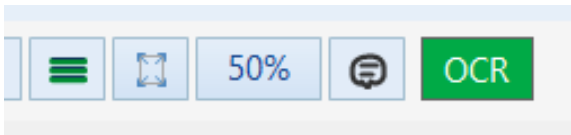
Drawing OCR

Drawing OCR adds an OCR cache to the project workflow instead of creating a separate searchable PDF. Text Counter uses this cache together with any native PDF text, so the normal Scan buttons and match overlays continue to work from the Text Counter table.

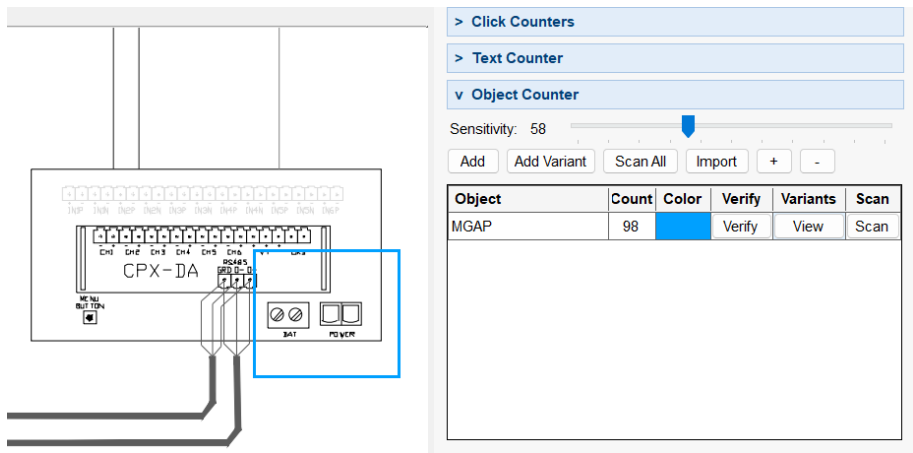


Control	Purpose
Mode	Choose CAD Text for normal CAD drawings. Fast is quicker for simple horizontal text. Balanced and Robust add more OCR passes for difficult or rotated text.
Scope	Choose Current Page only, Current PDF only, or All Open PDF depending on how much OCR cache should be prepared.
Run OCR	Starts OCR. The OCR window is modeless, so it can be moved aside while work continues on the drawing.
Cancel OCR	Stops the active OCR job. Completed pages remain saved in the cache and can be reused later.
Clear Cache	Clears the OCR cache for the current PDF so the next run processes pages again from scratch.
Cache status	Shows the OCR mode, word count, cached page count, progress percentage, completed pages, active workers, and elapsed time while OCR is running.

- OCR cache is saved as pages complete, so a cancelled or interrupted multi-page run can resume instead of starting over.
- If a PDF changes, MedGasCAD checks page-level cache signatures and reprocesses changed pages while reusing unchanged cached pages.
- For multi-page PDFs, OCR can process multiple pages concurrently. The toolbar OCR indicator turns red and shows the overall percentage while OCR is busy, then returns to green OCR when idle.
- Text Counter can use partial OCR cache results while OCR is still running, so completed pages are searchable before the whole job finishes.



Object Counter



Control	Purpose
Add / Add Variant	Create an object template and add variants for similar symbols.
Sensitivity	Adjust matching sensitivity for object recognition.
Scan All Items	Rescan all object rows using the selected scope.
Import	Import object templates from another project. Imported objects start with zero count and can be scanned in the current project.
Verify	Review detected thumbnails. Unchecked thumbnails remain visible and the verify state is saved in the project.
Scope	Choose Current Page or All Pages when the PDF has more than one page.

Measurements and Settings



Area	Purpose
Measurements	Draw line or polyline measurements, duplicate to target, clone a system, update selected, and undo. Labels can show distance, size, and other selected information.
Auto Trace	Pick a colored pipe/line from the PDF, isolate that color, preview detected candidates in the visible drawing area, then trace them into normal measurement segments using the current system and pipe size.
Calibration	Set drawing scale manually or with dropdown values. Scale changes update measurement and pressure-loss distances.
Exclusion zones	Create All Pages or Single Page exclusion zones. Shift + left-click an exclusion hatch to remove only that zone.
Clone Counters	Open the Clone Counters dialog to copy click, text, and object counter definitions from the active drawing tab to selected open PDF tabs.
Import Counters	Open the Import Counters dialog to import counter definitions from an existing saved project file.
Greyscale PDF	Render the PDF in greyscale to improve contrast with take-off overlays. Current rendering keeps pan, zoom, and drawing performance close to normal color mode.

Auto Trace Measurements

Control	Purpose
Color	Click Color, then click the pipe/line color directly on the PDF. The swatch shows the picked color used by Preview and Trace.
Tol	Color tolerance. Increase it when the isolated pipe breaks into small pieces because the PDF uses anti-aliasing or slightly different shades. Lower it when nearby colors are being included.
Preview	Shows temporary cyan candidate measurement lines in the visible drawing area. Preview is safe to use repeatedly because it does not add measurements.
Trace	Adds detected candidates as normal measurement segments. Trace uses the active System, Pipesize, color, calibration, and display settings, and skips areas already covered by matching existing measurements where possible.
Isolate	Turns non-matching PDF colors greyscale, leaving the picked color visible. Use this to confirm that the line you want can be seen clearly before tracing.
Merge	Controls how aggressively close parallel detections are merged into one centerline. Lower values preserve real parallel pipes; higher values remove double-edge detections from thick colored strokes.
Current PDF only / Current Page only	Limit the measurement tree and displayed measurement list to the active PDF tab or active page. These filters are useful after tracing multi-page drawings.

- Choose the measurement System and Pipesize before tracing; traced segments use the current values and become normal editable measurements.

- Use Isolate first. If the colored pipe is not clear, adjust Tol or pick the color again from the PDF.
- Use Preview before Trace so you can see which candidates will be added without changing the project.
- Zoom or pan so the area you want to trace is visible. Auto Trace works from the visible area and renders it internally at higher trace resolution, so closer views can help difficult drawings.
- If the PDF has real parallel pipe lines, lower Merge. If it creates double lines on one thick stroke, increase Merge.
- Auto Trace follows the selected color and is best for mostly straight pipe runs. Review the result after tracing and manually draw or edit any missed unusual geometry.
- Exclusion zones are respected, so use them to keep legends, notes, or repeated symbols from being traced as measurement segments.

Measurement Clone button

The clone icon beside Undo opens Clone Measurements. Use it when another system follows the same measured route geometry but uses different pipe sizes.

Measurements

Line Polyline Clear

Duplicate to Target Update Selected Undo

System: O2 Pipesize: 22mm

Measured Distance: Measured Distance Manual Distance: Manual Distance

Ortho Snap Show lines in PDF

Labels: Distance Size Current PDF only

Segments: 32

- Show All
- O2 (Total: 376.0 m)
- 15mm (Total: 358.8 m)
- 22mm (Total: 17.2 m)
- 15.2 m
- 1.0 m
- 1.0 m

Settings

Clone Counters

Clone Counters is available from Take Off > Settings. It copies counter definitions from the active source PDF tab to selected target PDF tabs so repeated drawings do not require rebuilding the same click, text, or object counter list.

Clone Counters

Source: T-WN1649_MG06_3006.pdf

Click Counters (0)

Include click dots/counts

Text Counters (0)

Object Counters (0)

Target PDF tabs

Med Gas drawing.pdf

Replace matching names/queries

Cancel Clone

Option	Purpose
Click Counters	Clone selected click-counter definitions. Enable Include click dots/counts when a typical floor or repeated drawing should carry over the clicked locations as well as the counter names.
Text Counters	Clone text-counter queries and options to selected target tabs.
Object Counters	Clone object-counter names, colors, variants, and templates to selected target tabs.
Target PDF tabs	Choose the open PDF tabs that should receive the cloned counters. Use All and None for fast selection.
Replace matching names/queries	When checked, matching click names and text queries in the target are replaced by the source definition. When unchecked, existing matching target rows are kept.
Clone	Creates the selected counter definitions in the target tabs. Counts start from the cloned data when click dots/counts are included; otherwise they start from 0 until clicked or scanned.

Import Counters

Import Counters is available from Take Off > Settings. It imports counter definitions from an existing saved .mgcadproj project file into the current project. This is useful when standard counter names, text queries, or object templates are reused across projects.

Import Counters

Select counters to import. Imported counts start at 0 until clicked or scanned.

☒ Click (10) ☒ Text (2) ☒ Object (2)

☐ Include click dots Click dots page: Current page

	Type	Name / Query	Drawing	Detail
☒	Click	LLV 22 - O2	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	LLV 15 - O2	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	LLV 22 - MA4	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	LLV 15 - MA4	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	LLV 35 - VAC	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	LLV 22 - VAC	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	AVSU 3G O2 MA VAC	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	Outlet O2	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	Outlet MA4	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Click	Outlet VAC	T-WN1649_MG06_3006.pdf	0 click(s)
☒	Text	AVSU	T-WN1649_MG06_3006.pdf	

Undo Last Select All Clear Cancel Import

Option	Purpose
Click / Text / Object	Filter which counter types are shown and imported.
Include click dots	For click counters, optionally import the saved clicked points and counts. Leave unchecked when only the counter names are needed.
Click dots page	When importing click dots into a multi-page PDF, choose the destination page. Current page is the default.
Selection table	Review the imported Type, Name/Query, Drawing, and Detail. Uncheck rows that should not be imported.
Smart duplicate handling	Click names and text queries that already exist in the current counters are ignored. Repeated same-name items from multi-page source projects are imported only once.
Object variants	Object counters with the same name are imported separately only when their variants/templates are different. Matching existing object definitions are skipped.
Undo Last	Reverts the most recent successful import operation when available.

4. Pressure Loss Workflow

The Pressure Loss panel is used to draw pipe segments, assign systems, define flow and endpoint names, calculate pressure loss, inspect reports, and optimize pipe sizes. The current recommended workflow is to leave Auto enabled for From/To naming and only edit names manually when a special label is needed.

Control	Purpose
Line / Polyline	Draw pressure-loss pipe segments. F1 activates Line and F2 activates Polyline when Measurement or Pressure Loss is active.
System / Pipesize	Assign the gas system and pipe size for new or selected segments.
Department / Beds/Qty	Select the department or calculation basis and enter the relevant bed or quantity count. System mapping controls how design flow is calculated.
Flow / Force flow	When multiple selected segments have different flows, Flow shows (multiple). Enable Force flow to key one value and apply it to all selected segments, including rows based on a selected department.
Measured Distance	Shows the measured drawing distance for the selected segment.
Manual Distance	Overrides the measured distance when needed. After using Update Selected, the manual distance box clears so the next segment is not accidentally overwritten.
From / To / Auto / step	Name segment endpoints. Auto is the recommended mode. The step button and F9 advance the From/To values when Auto is off or when you want to prepare the next pair manually.
Branch Off / Insert Node	Branch from an existing route or insert a numbered suffix node into an existing pressure-loss segment.
Calc	Calculate and highlight the selected route.
Report / Batch / Log / Tables	Open detailed route report, batch report, issue log, and pressure-loss reference tables.
Optimize	Open the Pressure Loss Optimize window for route sizing review and applying recommended pipe sizes.
Clone icon	Open Clone System to copy pressure-loss route geometry from one system to another with pipe-size and flow/department mapping.
Labels	Toggle drawing labels such as distance, index, flow rate, and pipe size. Label checkbox states are saved with the project.

Duplicate logical segment names are checked and reported in the Pressure Loss Log when values are inconsistent. Warning highlights use a distinct display color so they are not confused with normal selection highlighting.

5. Auto From/To Naming

Auto is the normal pressure-loss naming mode. It reduces manual typing by reading the route you are drawing and preparing the next From/To pair automatically.

Auto mode behavior	How to use it
Default start	For a fresh route, start with From = Source and To = A1. Draw the first segment and apply it.
After each segment	Auto moves the previous To into From and creates the next running To. Example: Source -> A1 becomes A1 -> A2, then A2 -> A3.
Connecting to an existing endpoint	If the start point connects to an existing route endpoint, Auto uses that endpoint as From and prepares the next unused endpoint name as To.
Connecting into the middle of a segment	If the start point connects into the middle of an existing segment, MedGasCAD splits the route and creates an internal branch junction label. Continue drawing normally from that split point.
Branch junction labels	Generated branch junction labels use the BR1, BR2, BR3 pattern. These are internal helper junctions and are not intended as normal user endpoint labels.
Deleted or edited segments	Auto recalculates the used endpoint names after segment changes so the next generated name avoids duplicates.
Multi-page and multi-PDF projects	Auto checks pressure-loss segments across the current project context, so it can continue naming routes that span pages or drawing tabs.

Recommended Auto workflow

- Leave Auto checked for normal pressure-loss drawing.
- Use simple endpoint names such as A1, A2, A3, or another project-specific prefix if needed.
- Draw the first source segment, then keep drawing connected segments. Auto will advance the names.
- When branching from an existing route, use Branch Off or start the next segment from an existing endpoint or segment. The app will create any required internal branch junction.
- Review the tree and Log after a route is built. Duplicate or disconnected names should be corrected before reporting.

When Auto is off

Turn Auto off only when you want full manual control of From and To names. In this mode MedGasCAD will not automatically repair or advance names for you.

- Type From and To before drawing each segment.
- Make sure the From value exactly matches the previous segment's To value when continuing a route.
- Use the step button or F9 to move the current To into From and increment the next To value.
- Use custom names only when they help you read the route. Avoid reusing the same endpoint name for different physical points.
- Run Log or Calc after manual edits to catch disconnected routes, duplicates, or inconsistent segment data.

6. Branch Off and Insert Node

Branch Off is for the common case where an existing pressure-loss route needs a new branch from a point on a previously drawn route, including the middle of a segment or polyline leg.

Step	How it works
1. Select the branch point	Select the pressure-loss segment or polyline leg where the new branch should start.
2. Click Branch Off	The app creates a safe internal branch junction label and splits the existing route at the selected branch point if needed.
3. Continue drawing	The new branch starts from the branch point. With Auto enabled, the next To value is filled with the next available running endpoint label.
4. Review route data	Route fields, From/To names, distances, and pressure-loss values are recalculated. Manual distances on split pieces are preserved proportionally where possible.

While drawing a pressure-loss Line or Polyline, the status text can show the last detected running index, for example: Line: pick start and end. Last A3. This helps prevent repeated endpoint names when building several branches.

Insert Node

Insert Node is for splitting an existing pressure-loss segment when you need a deliberate intermediate node on a route. It is separate from Auto From/To and Branch Off.

Step	How it works
1. Select the system	Choose the pressure-loss system that contains the segment you want to split. Insert Node only targets visible segments in the selected system.
2. Click Insert Node	Move over the pressure-loss segment and click the intended insertion point. Press Esc to cancel before placing the node.
3. Pick away from endpoints	The click must be on the segment body, not on an existing endpoint. The app projects the click onto the nearest matching segment.
4. Review the split	The original segment becomes two segments. Distances and pressure-loss values are recalculated, and manual distance overrides are split proportionally where possible.
Inserted node behavior	Details
Suffix label	The inserted node uses the upstream numbered label plus a lowercase suffix, such as A3a. If A3a already exists, the next available suffix is used.
No route renumbering	Downstream node names are preserved. Insert Node does not renumber the rest of the route.
No BR labels	BR1, BR2, and similar labels remain reserved for branch junctions created by Branch Off or Auto branch splitting.
Undo	Use Undo to revert the insertion if the split point or node label is not what you intended.

7. Clone Measurements and Clone System

Clone workflows reduce repeated drawing when another system, page, or open drawing follows the same route geometry. Use Same location when the target drawing lines up with the source, or Basepoint when the same geometry needs to be shifted to a matching point on another page or drawing.

Clone Measurements

Use Clone Measurements from the Take Off Measurements panel when you need to copy measured routes from one system to another. The dialog maps source pipe sizes to target pipe sizes. It does not include flow or department mapping because take-off measurements are length/quantity based.

Clone Measurements

From

O2

To

VAC

Pipe size mapping

Current pipe size	New pipe size
15mm	15mm
22mm	22mm

Cancel

Clone

Field	Purpose
From / To	Choose the source measurement system and the target measurement system. Same-system cloning is allowed only when the target drawing or page is different from the source.
Scope	Current Page clones only the active page. Target Page clones the current page to a chosen open drawing page. Open PDFs clones to the matching page number in another open drawing.
Drawing / Page	For Target Page, choose the open drawing and target page number. The source is intentionally the current page only.
Location	Same location preserves source coordinates. Basepoint closes the dialog, asks for a source basepoint, jumps to the target page, then asks for the target basepoint and applies that offset.
Pipe size mapping	For every pipe size found in the source measurements, choose the pipe size to use in the cloned target system.
Clone / Undo clone	Clone creates matching measurement geometry under the target system using the mapped pipe sizes. Undo clone reverts the most recent clone operation.

Clone System for Pressure Loss

Use Clone System from the Pressure Loss panel when another gas system follows the same route layout. The dialog maps pipe sizes and maps each source flow/department to an appropriate target flow/department.

Pressure Loss

Line

Polyline

Clear

Branch Off

Duplicate to Target

Update Selected

Undo

System

VAC

Mapping

Pipesize

22mm

Manual flow

Flow

40

Force flow

Beds/Qty

1

Measured Distance

Manual Distance

From

Source

To

A1

Auto

Route

Source-A21

Calc

Report

Batch

Log

Tables

Optimize

Ortho

Snap

Show lines in PDF

Labels

Distance

Index

Flow rate

Pipesize

Current PDF only

Combine same pipesize flow

Segments: 22

Mode: idle

Show A1

VAC (Total: 191.2 m)

22mm (Total: 178.3 m)

35mm (Total: 14.9 m)

14.9 m [Source-A1] | 40 L/min | Loss: 0.0142 kPa

Clone System

From: O2 To: VAC

Scope: Target Page Drawing: Alvernia Combined.pdf Page: 7

Location: Same location

Pipe size mapping

Current pipe size	New pipe size
15mm	22mm
22mm	28mm

Flow / department mapping

Current flow / department	New flow / department
Manual flow	Manual flow
O2 Maternity mother	VAC Maternity LDRP mother
O2 Maternity nursery	VAC Maternity nursery

Cancel Clone

Field	Purpose
From / To	Choose the source pressure-loss system and target system. Same-system cloning is allowed only when the target drawing or page is different from the source.
Scope	Current Page clones only the active page. Target Page clones the current page to a chosen open drawing page. Open PDFs clones to the matching page number in another open drawing.
Drawing / Page	For Target Page, choose the open drawing and target page number. The source is intentionally the current page only.
Location	Same location preserves source coordinates. Basepoint closes the dialog, asks for a source basepoint, jumps to the target page, then asks for the target basepoint and applies that offset.
Pipe size mapping	Map every pipe size used by the source system to the pipe size to use for the cloned target system.
Flow / department mapping	Map each source department or flow basis to the target system's department list.
Manual flow	If the source row is Manual flow, the cloned row remains Manual flow and its design flow is set to 0 so you can key in the correct flow manually.
Route labels	When cloning to the same system on another page or drawing, fresh endpoint labels are generated so Source, numbered endpoints, and BR labels do not repeat in the target context.
Preserved data	Geometry, manual distance, route labels where valid, and quantity are preserved, then pressure loss is recalculated for the target mapping.
Clone / Undo clone	Clone creates matching pressure-loss geometry with the selected mappings. Undo clone reverts the most recent clone operation.

8. Pressure Loss Optimize

Pressure Loss Optimize checks the current route or batch routes against a selected pressure-loss criterion. It does not change the drawing until recommendations are applied.

Control / Column	Purpose
Criteria	Select the target percentage for route pressure-loss budget.
Analyze	Analyze the currently selected route.
Batch Analyze	Analyze qualifying routes and show results in the same table.
Minimum	Choose the minimum allowed recommended pipe size, such as 15mm or 22mm.
Calc Selected	Calculate the route using recommended sizes for checked rows and current sizes for unchecked rows.
Apply Selected	Apply recommendations for checked rows only. Rows already matching the recommendation are ignored.
Red up Apply / Green down Apply	Apply only upsize recommendations or only downsize recommendations.
Undo Apply	Undo the most recent Optimize apply action.
Diff	Current Loss minus Recommended Loss. If all changes are in one direction, only the largest relevant value is highlighted. If both increase and decrease values exist, the largest positive and largest negative values are highlighted.

9. Reports, Logs, Tables, and Print Preview

Window	Purpose
Route Report	Detailed route calculation with route length, pressure loss, mapped system pressure, and pass/fail summary. Selecting rows highlights the segment and switches to the correct PDF page or drawing tab.
Batch Report	Summarizes multiple routes and reports failures, maximum pressure loss, and route totals.
Calculation Log	Shows pressure-loss warnings such as inconsistent duplicate logical segment values or route issues.
HTM 02-01 Tables / Curves	Reference table and curve views for the mapped pressure-loss family.
Print Preview / Export PDF	Create drawing-oriented previews and export report tables and route maps. Preview pages display rendering feedback while complex pages are being prepared.

Route Report Window

The Route Report window lists each segment in the selected route, tabulated pressure-loss values, total route length, total pressure loss, mapped system pressure percentage, and pass/fail result.

Print Preview

Print Preview table pages are formatted for sharing or printing. Route map pages show the highlighted route over the drawing background, with numbered markers corresponding to the report table. True endpoint labels are shown, while internal branch junction labels are suppressed on printed drawings.

10. Equipment

Area	Purpose
Oxygen Source	Enter design flow, number of beds, Appendix M basis, refilling period, cylinder fill pressure, supply distance, and telemetry selection.
Medical Air / Surgical Air / Vacuum	Enter system demand and equipment assumptions to calculate recommended source equipment.
Equipment Detail	Review calculated duties, standby arrangements, receiver sizing, and selected equipment data.
Equipment Summary	Generate simplified source-equipment reports for review.

Simplified Equipment Source Report

MedGasCAD Source Equipment Summary

HTM 02-01 based preliminary selection

OXYGEN SOURCE EQUIPMENT

Oxygen - Recommended Equipment

Primary supply

1 x Taylor-Wharton SCS 3400, 3,230 L net LOX

Secondary supply

1 x Taylor-Wharton SCS 3400, 3,230 L net LOX

VE control panels

2 x CPX VE-1000-DIGITAL, 1 panel(s) per VE in parallel

Control panel capacity

1 x 1000 ± 1,000 L/min per VE

Vaporisers

4 x Cryoquip MV100, 2 per VE, duty/standby

Reserve supply (third source)

1 nos of 2 x 25 J-size cylinders, CPX MANFOLD-AUTO-GAS-650

Emergency reserve basis

25 J-size cylinders for 4 hours at average demand

Spare cylinders

25 J-size cylinders, replacing one bank of the reserve manifold

Cylinder guide basis

150 bar J cylinder = 7,400 L

Usable cylinder basis

6,413 L after 20 bar changeover allowance

MEDICAL AIR SOURCE EQUIPMENT

Medical Air - Recommended Equipment

Proposed CPX plant

MA-420-T, 400 L/min, Triplex (2 duty + 1 standby)

Primary supply

2 duty compressors of Triplex plant, each 210 L/min

Secondary supply

1 standby compressor(s) of Triplex plant, each 210 L/min

Air treatment

Duplex dryers, filters, regulators and bacterial filters

Receivers

Receiver set sized to HTM arrangement

Reserve supply (third source)

1 nos of 2 x 10 J-size cylinders, CPX MANFOLD-AUTO-GAS-650

Spare cylinders

10 J-size cylinders

Cylinder basis

150 bar J cylinder = 6,800 L, usable 6,800 L

VACUUM SOURCE EQUIPMENT

Vacuum - Recommended Equipment

Proposed CPX plant

MV-675-T, 675 L/min, Triplex (2 duty + 1 standby)

Primary supply

2 duty pumps of Triplex plant, each 338 L/min

Secondary supply

1 standby pump(s) of Triplex plant, each 338 L/min

Reserve supply (third source)

Portable suction equipment

Reservoir

450 L water capacity with bypass facilities

Bacterial filters

Duplex bacterial filters with drainage flasks

Notes: Source equipment follows HTM 02-01 source principles and MedGasCAD catalogue selections. Final configuration remains subject to HTM commissioning, supplier agreement and site constraints.

11. Display and Performance Controls

Control	Purpose
Annotations toggle	Show or hide PDF annotations when reviewing drawings.
Boost preview toggle (F6)	Toggle boosted bitmap preview mode for faster browsing on complex drawings while retaining drawing overlays.
Thin Lines toggle (F7)	Display heavy vector strokes with thinner on-screen line weight for easier high-zoom review.
Fit Page / Zoom	Fit the current page, zoom in/out, or zoom to the selected area.
Dynamic tile learning	MedGasCAD starts with a default tile size and learns better tile choices while you pan and zoom each drawing.
Greyscale PDF	Use greyscale when it improves overlay visibility. The current renderer is optimized so greyscale does not significantly slow drawing interaction.
Rendering feedback	Large or complex PDFs may show Loading PDF or Rendering, please wait while the base drawing or print preview page is prepared.

12. Hotkeys

Command	Hotkey
Line tool	F1
Polyline tool	F2
Snap mode	F3
Show lines in PDF	F4
Fit Page	F5
Boost preview	F6
Thin Lines	F7
Ortho Mode	F8
Pressure Loss From/To step	F9
Repeat last drawing command	Space
Finish polyline	Enter or right-click
Cancel current command	Esc
Zoom	Ctrl + mouse wheel
Pan	Middle mouse drag or pan gesture
Remove exclusion zone	Shift + left-click on exclusion hatch

13. Recommended Project Workflow

Step	Recommended practice
1. Open drawings	Open all required PDFs or load the existing project. Confirm page, rotation, and scale.
2. Set display	Choose greyscale, thin lines, Boost preview, annotations, and zoom settings that make the drawing readable.
3. Take off quantities	Use click, text, object counters, and measurements for take-off quantities.
4. Build or clone routes	Leave Auto enabled, draw from Source to A1 for the first route segment, then continue drawing connected segments. Use Branch Off for branches from existing routes. Use Clone Measurements or Clone System when another system follows the same geometry.
5. Calculate and review	Use Calc, Report, Batch, Log, and Tables to verify routes and resolve warnings.
6. Optimize pipe sizes	Open Optimize, choose criteria and minimum size, review recommendations, test with Calc Selected, then apply selected changes.
7. Print preview and export	Use Print Preview to check formatted report pages and route maps before exporting PDF.
8. Save project	Save regularly so drawings, counters, pressure-loss data, optimize changes, equipment data, exclusions, rotations, label settings, and panel states are preserved.

Manual complete.