



## White paper: Combined Operation (CO) pressurisation automats.

*Purpose: To give services and installers a basic explanation of Combined Operation in which the possibilities offered are made clear.*

### General explanation:

Flamco expansion automats for application in closed central heating systems and closed cooling and air-conditioning installations have an application area relating to system size. To be able to operate larger systems, the standard products can be provided in duplicate (1 automat) or coupled (2-4 automats). The Failure Change-over (FC) and Load-Dependent (LD) working principles are possible for both. With Failure Change-over automats can replace each other with a defect and split working hours. Load-Dependent works as power supplementation or sharing.

### A pressurised automat (MK or Flamcomat) single or double version:

A single operation version (SO) is standard.	1 pump/compressor,	1 valve.
A Flamcomat as double version is standard.	2 pumps,	2 valves.
An M-K/U in double version must be ordered as special.	2 compressors,	1 valve.

With a double version of an M-K/U or Flamcomat, FC or LD principle of operation can be set for the operation of the pumps/compressors in this one automat. (LD is default setting)

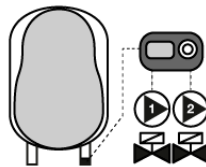


Figure 1-2; Double version diagram:



**Coupled automats in Combined Operation Failure Change-over (CO-FC):**

- When two automats are connected to the modules for Combined Operation (CO), one automat always works as FC and the other one as FC or FR (Failure Reserve).
  - FC: The automats including control units can replace each other if one of them fails. So this is a fully redundant pressurised system. With proper functioning, there is alternation between the automats to keep operating hours equal.
  - FR: The second automat is only activated when the first one has a failure. This is maintained by a periodic maintenance cycle (once every fortnight) because it can remain stopped for a protracted period.
- For each automat, one can still select between FC and LD for the operation of the pumps/compressors within the automat.

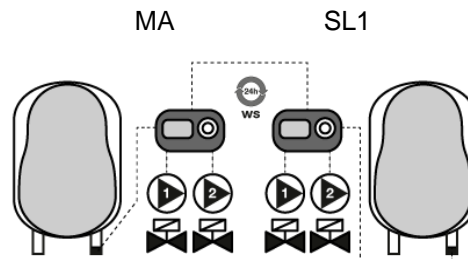
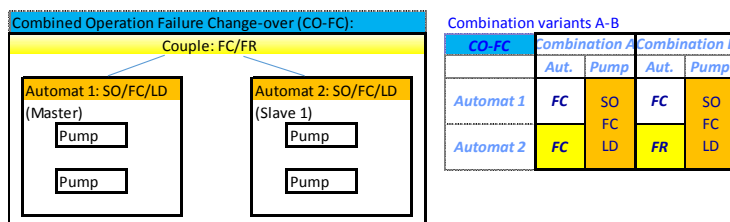


Fig 3-4; CO-FC with automats in FC:

- A maximum of two automats to be coupled.
- Automats and vessels must be completely identical including any auxiliary vessels.
- No height difference possible between automat/vessel/pump unit.

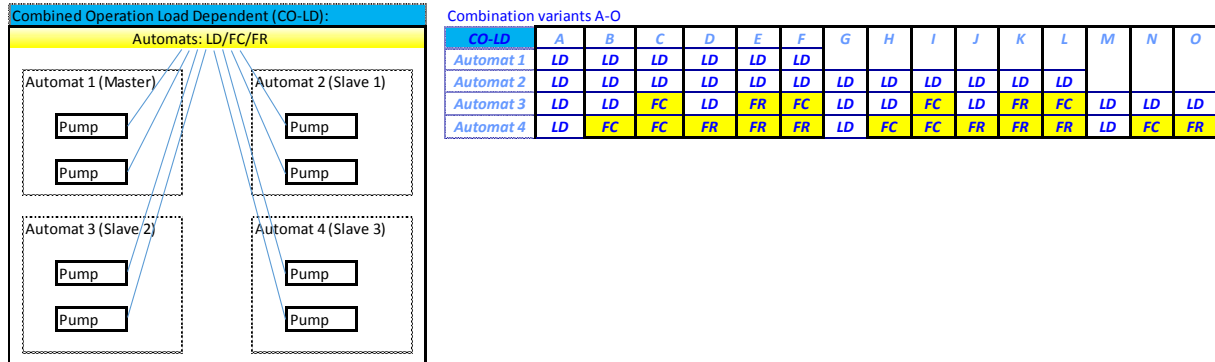
Fig 5; Possible combination variants CO-FC (2 x 3 combination variants):





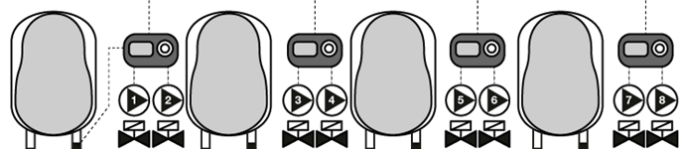
## Coupled automats in Combined Operation Load-Dependent (CO-LD):

Fig 6; Possible combination variants CO-LD (15 combination variants):



- Minimal the Master control is set as LD with CO-LD. Combined operation is always set on the automat with master module. Every coupled Slave (max. 3) is with CO-LD controlled by the master.
- The control unit of the master automat controls at component level (sees pumps/compressors/valves instead of automats). A maximum of 8 pumps/compressors and 8 valves can be controlled. They are grouped in max. 4 automats, because these components are controlled through the Slave control units.

Fig 7; Maximum number of components with CO-LD: : MA SL1 SL2 SL3



- With CO-LD, the control unit chosen as Master must always work. If the Master control is switched off, the whole combination of automats stops working. If a Slave control unit is switched off, only the actuators of this control unit no longer count.
- Under CO-LD, it is possible to select per automat how it must work in the total combination:
  - LD: Components also activate, when this is needed.
  - FC: All of the coupled automats run in turn. When there is for example 1 automat in FC and 3 automats in LD, than there are maximum 3 automats working. If one has a failure, it is changed-over. Working hours are kept equal over the complete set of automats.
  - FR: These automats are available as reserve capacity in case of a failure. The FR automat is normally not working and is maintained with a periodic maintenance cycle (once every fortnight).



- The standard version is identical automats and vessels without height difference.
- As height difference between automats one floor is standard acceptable.
- Maximum height difference is to be calculated for each situation. For example, another Flamcomat model can be used higher in the building (lower pressure). It must, however, be able to achieve the same heating capacity.
- Within the combination, there is 1 measure difference (larger or smaller) in vessel size possible. Main and auxiliary vessel must be equal per automat. Also see cross table below.

Fig 8; Cross table; difference in vessel size:

		Vessel automat 1															
		FG 200	FG 300	FG 400	FG 500	FG 600	FG 800	FG 1000	FG 1200	FG 1600	FG 2000	FG 2800	FG 3500	FG 5000	FG 6500	FG 8000	FG 10000
Vessel automat 2	FG 200	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	FG 300	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-
	FG 400	-	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-
	FG 500	-	-	x	x	x	-	-	-	-	-	-	-	-	-	-	-
	FG 600	-	-	-	x	x	x	-	-	-	-	-	-	-	-	-	-
	FG 800	-	-	-	-	x	x	x	-	-	-	-	-	-	-	-	-
	FG 1000	-	-	-	-	-	x	x	x	-	-	-	-	-	-	-	-
	FG 1200	-	-	-	-	-	-	x	x	x	-	-	-	-	-	-	-
	FG 1600	-	-	-	-	-	-	-	x	x	x	-	-	-	-	-	-
	FG 2000	-	-	-	-	-	-	-	-	x	x	x	-	-	-	-	-
	FG 2800	-	-	-	-	-	-	-	-	-	x	x	x	-	-	-	-
	FG 3500	-	-	-	-	-	-	-	-	-	-	x	x	x	-	-	-
	FG 5000	-	-	-	-	-	-	-	-	-	-	-	x	x	x	-	-
	FG 6500	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	-
	FG 8000	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x
	FG 10000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x

### Technical characteristics:

- A maximum of 500 metres cable length is possible between automats to be combined.
- Application area and combinations are equal to the standard Flamcomat or M-K/U.
- Cable between automats is supplied with a fixed length of 10 metres with both the master and the slave module set.
- Specifications if longer cable required: 2 core, shielded. This is not supplied by Flamco.
- Use hose sets as available as standard with Flamcomat or M-K/U. Always connect multiple automats side by side / parallel to the system. Parallel connection to a collecting main that is directly connected to the system is also possible. Examples are diagrammatically shown in the user manual.



## Options:

- *Refill*: Can be used unchanged. (Is controlled per automat by the automat itself.)
- *Gas sensor*: Useable with CO-FC, not supported with CO-LD.
- *SPC extension Analogue signal output*: Is for use with CO-FC and CO-LD. Note that with CO-LD the pressure sensor of the set master is the pressure reference point.
- *RS485, Data protocol (Easy contact)*: Can be used unchanged.
- *Signal doubler*: With application of 2 x SPC control on 1 vessel. Usable with CO-FC and CO-LD.

Not recommended due to the following disadvantages:

- Automatic degassing function is not possible here.
  - No backup vessel present. When there is a failure or membrane to change out, both automats must be switched off.
- *Minimum pressure limiter*: Can be used unchanged. (Is controlled per automat by the automat itself.)
  - *Temperature limiter*: Can be used unchanged. (Is controlled per automat by the automat itself.)
  - *Diaphragm rupture sensor*: This must be ordered separately and is assembled by the customer using the manual supplied. Can be used unchanged. (Is controlled per automat by the automat itself.)