

**BETACAP60X100 TO DILUTE A FIRST MIXTURE UP TO 12,000:1
AND A SECOND MIXTURE UP TO 120:1 IN A DILUTING GAS**

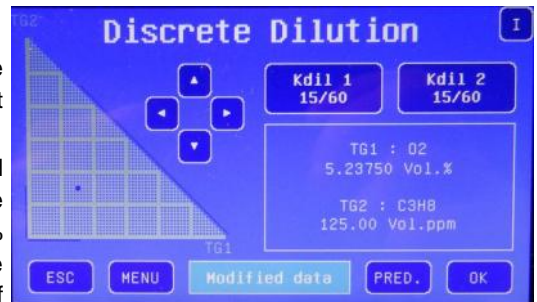


FUNCTIONS OF THE DILUTER

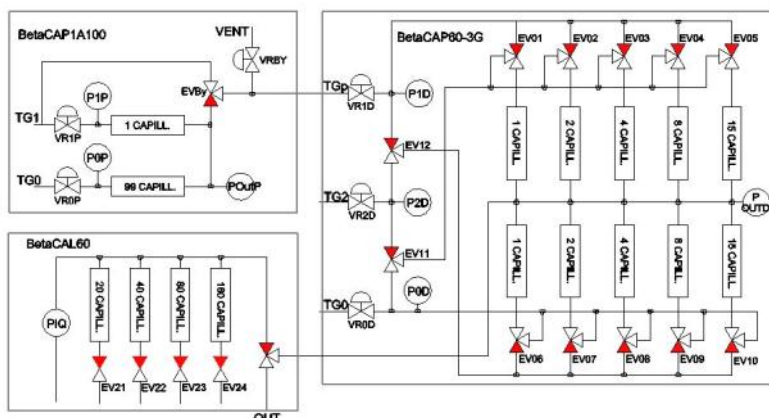
BetaCAP60100 is characterized by the possibility of operating dilutions between three gases or mixtures: generally two active gases and a neutral gas (diluting gas) are used. Each of the two active gases (or mixtures) is at the same time to be diluted and diluting; to be diluted for the measurement of itself and diluting for the measurement of the other. One of the three inputs (TG1) can be pre-diluted 100:1 or not pre-diluted at all (pre-diluter bypassed). The possibility of diluting two mixtures with different dilution factors is mainly applied to measuring the cross sensitivities: in this case, at the user's choice, the component to be measured can be contained in TG1 while TG2 contains the cross interfering component (or vice versa). TGO always contains the diluent gas.

The User may request two dilution ratios or two concentration values, one referred to a component present in the cylinder that feeds the TG1 input and the other present in the tank that feeds TG2.

- Dilution ratios request (with discrete steps): both inputs can be diluted on 60 steps between 1.667% and 100%, while for the TG1 input are available another 60 steps for boosted dilutions, between 0.01667% and 1.0 %, in addition to zero. The menu on the side represents the area of possible dilutions for the final diluter only : the three sides of the triangle represent possible dilutions with only two components, while the internal area represents all the combinations of the three input gases.
- Concentration values request (in continuous mode) in the range between 0.833% and 99.1666% of the test gas concentration (in addition to 0 and 100%) for each component present in TG1 or TG2, while for the components of TG1 the dilution can reach 0.00833 %



In the diagram shown here, the final 60-ratio diluter is visible on the right, the pre-diluter CAP1A100 on the left and the CAL60 flow meter on the left (capillary laminators and measure of pressure drop at their ends): this meter, normally bypassed, it is inserted only during self-referring test, presented below.



The interfacing of the two modules of the diluter and pre-diluter is managed through a bypass regulating valve, which vents the excess flow of the pre-diluted gas with respect to the flow request at the input TGp of the diluter.

The two solenoid valves EV11 and EV12 distribute the gases (TG1, TG2 and TGO) to the two sides of each of the two modules in the diluter (each with 30 capillaries) so that each of the three inputs can cross from 0 to 60 capillaries according to the required dilutions couple.

MAIN CHARACTERISTICS

- Dilutions realized both in "60 discrete steps" with 1,667% spacing and in continuous mode, with free setting of the diluted gas concentration value, both for TG1 and TG2.
- Pre-dilution 100:1 available for one of the two inlets to be diluted
- PID electronic regulation of the differential pressures applied to the capillary heads for both modules (pre-diluter and final diluter)
- Detection of the 7 pressure measurements (required for adjustments) and acquisition of up to 4 measurement signals from the analyzer under test, with 16-bit resolution
- Calculation and automatic compensation of the effects due to the different viscosities of the gases or mixtures entering and correcting the errors indicated in the metrology certificate
- Internal circuits resistant to most strongly aggressive and / or solvent gases
- User interface with color graphic display and touch screen

DESCRIPTION

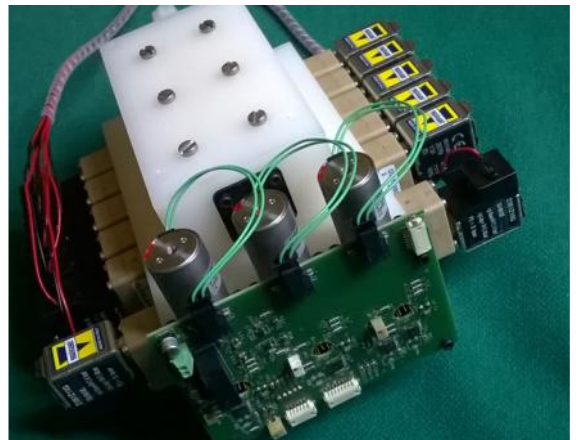
The BetaCAP60X100 tool consists of two modules:

- the pre-diluter CAP1A100 with fixed ratio 100: 1 is equipped with its automatic pressure settings and is inserted / bypassed according to the dilutions required for the components of TG1
- The final 60-capillary diluter receives the pre-diluted gas on one input, on a second input it receives a second gas to be diluted (if any) and on a third input it receives the diluting gas (the same used also by the pre-diluter).

The construction of both modules respects the rules already applied for the consolidated predecessor BetaCAP30: all the gas ways between the pneumatic components are obtained inside or in contact on the surface of a PVDF manifold. Only the entry / exit routes are made with compression pipes and fittings. The result is a compact, very rugged construction with reduced dead volumes, isothermal and with very limited leakage opportunities.

The materials in touch with the gases to be treated (PVDF, PTFE, PEEK, AISI 316L, Glass, Kalrez, Viton) are resistant to most of the gaseous components in the usual concentrations (optionally it is possible to replace the Viton with the Kalrez and the details in PVDF and PTFE with steel AISI316L).

The menu on the side represents the area of possible dilutions for the final diluter only: the three sides of the triangle represent possible dilutions with only two components, while the internal area represents all the combinations of the three input gases.



The availability of two virtually equal diluters and the 2^n progression of the number of capillaries for each group, has also allowed the development of an interesting procedure for the self-verification of the quality of the diluter, for the determination of errors (minimal differences of flow caused by the uncertainties during the capillary selection process) and for the automatic compensation of the same. The function is available both as a local function and as a software package for PCs with Windows OS: in the latter case, the report with the calculated error table is also produced. The test is obtained as a sequence of flow measurements, made with an CAL60 meter supplied as an option, and has the characteristic of providing as a result the errors due to the non perfect flow matching in the capillary groups with the theoretical progression (2^N). The real peculiarity of the test is not to require any external reference, but to use as reference only one of the two groups from 1 capillary: all the other groups are qualified in relation to the only internal reference. The test consists of five independent phases and each phase is divided into two or three "measures". Also the flow meter supplied as an option is not necessarily traceable but this only brings advantages, unless the probable lack of recognition in an accredited environment.

A detailed clarification of this information which, not better specified, may appear risky is available at the link <https://www.beta-strumentazione.it/wp-content/uploads/2019/09/CAP60.3G-SelfTest.pdf>

The advantage of the aforementioned procedure is that flow deviations are calculated by comparing two or three very close flows (identical flows indicate zero deviation) and therefore are not affected by the non-linearity error of the meter.

Since the phases 1 ... 5 are independent of each other, it's possible using different meters in each phase (with the advantage of increasing the resolution and reducing the measuring drift): we use (and provide as an option) an internal module with 5 different flow laminators and only one differential pressure meter that communicates with the diluter. Any non linearity in the proportions of the 5 laminators does not influence the results of the test.

OPERATION OF THE GAS DIVIDER

For the purpose of use, the operator is faced with a simple interface: color graphic display and touch screen, with which he selects the desired menu and sets the few parameters necessary to operate through the virtual keypad.

The menus are organized with a hierarchical structure having at higher level the choice : Factory parameters, Calibrations, User parameters, Operating functions.

To perform accredited tests, the User will activate the corrections based on the results of the metrological certificate (if performed), while for non-accredited tests or verification of good functioning, it is possible to activate the calibration based on the results of the self-referential test application of a gas at the TG1 input and few hour for automatic and unattended run.

The main application of the self-referring test in an accredited environment is getting the reason for delaying the metrological calibration time: this do increase the gas divider availability and reduces the operating costs.

TECHNICAL SPECIFICATIONS

Dilution ratios: two independent dilutions can be carried out "in discrete steps" or continuously

- in discrete steps up to 60 steps spaced 1,667%
- continuously in the range 0.8333% ... 99.1667%, including zero and span
- Dilution uncertainty: (before calibration) better than 0.4% rel. + 0.005% of the incoming concentration:
- (after calibration **) better than 0.2% rel. + 0.002% of the incoming concentration
- Dilution repeatability: $\leq \pm 0.2\%$ rel.
- Working pressure: between 200 and 2000 hPa rel. (up to 6 Bar inlet to the PID pressure regulators)
- Diluted gas flow: depends on the settable pressure applied (0.4 ... 4 L / min.)
- Inlet gas connections: two gases to be diluted (typical measuring and interfering) and a diluting gas
- Output connections: diluted gas and overflow for pre-diluted gas
- Connection type: 4 x 6 mm compression fittings PVDF (AISI316L on request)
- Metrological certificate: optional, from a DAkkS accredited European laboratory
- Materials in touch with gas: AISI 316, borosilicate glass, PVDF, PPS, PEEK, Kalrez.
- As an option, only AISI316L, PEEK and Kalrez
- Analogue measurem. : 4 relative pressures for diluter (indication in hPa with 5 digits) 16 bit resolution
- 3 more relative pressures for pre-diluter
- Other measures: barometric pressure and temperature of the diluter
- Acquired. measures : 4 measurement signals from the analyzer (group isolated inputs) with 16-bit resolution
- Communic. interfaces : RS485 (including converter for USB) with open protocol type AK
- Power supply: from 100 to 240 Vac - 0.8 A max.
- Dimensions and weights: 19 "std. h 3UT depth. 250 mm or compact case (430 x 244 x 341 mm)

** with self-referring calibration

MECHANICAL CONSTRUCTION

The BetaCAP60-3G diluter, the BetaCAP1A100 pre-diluter and possibly the CAL60 flow meter can be accommodated indifferently in a 19 "rack or in a compact plastic case.

The compact case is more suitable for field use, but also the rack container can be in turn inserted into a protective container equipped with carrying handles.

