

maPlex – 4-CHANNEL GAS MULTIPLEXER

User guide

Version: 1.01
07/2021

madur
E L E C T R O N I C S

- 1. Introduction 3
- 2. Construction 4
 - 2.1. Dimensions 4
 - 2.2. maPlex – outside 5
 - 2.3. maPlex – inside 6
- 3. Pneumatic diagram 7
- 4. Installation 8
 - 4.1. Installation example 9
- 5. maPlex setup in moSys software 10
 - 5.1. Cyclic measurements 10
 - 5.2. Measurement according to scheduler 11
 - 5.3. Measurements triggered by digital inputs 12
 - 5.4. Flip-flop mode 13
 - 5.5. Other work modes 13

1. INTRODUCTION

maPlex gas multiplexer is one of many accessories for madur's Mamos gas analyser. It allows to perform measurements from up to four different gas sources, using only one gas analyser. Thanks to the additional gas pump installed inside maPlex, the gas sample from the next sampling source is being prepared during measurement from the previous point – transition between sampling sources is minimal ("seamless roaming").

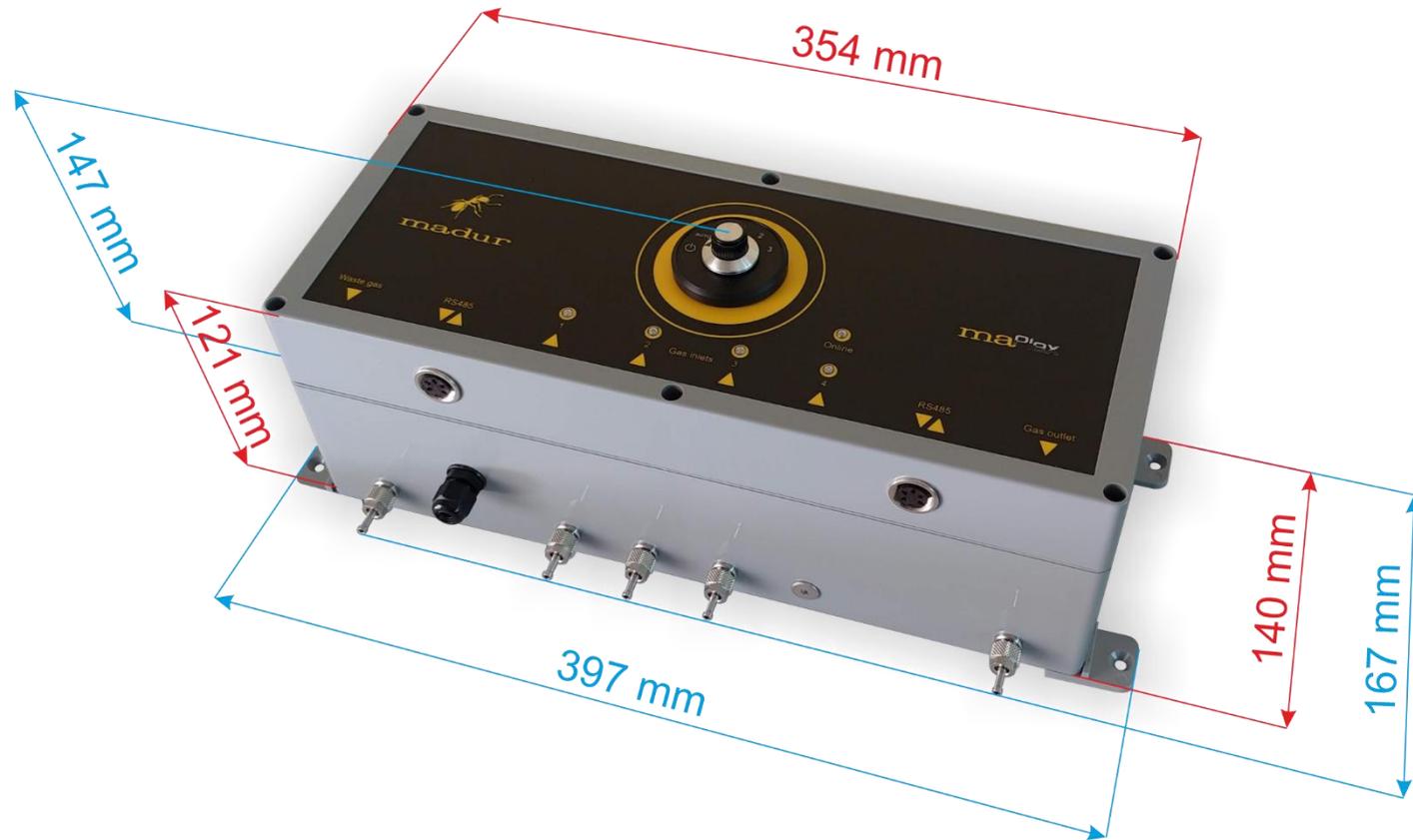
maPlex can utilise one of its channels for ventilation and/or calibration purposes.

Configuration of maPlex multiplexer is integrated into mamos PC program, and basically focuses on setting of the appropriate work mode.

2. CONSTRUCTION

2.1. Dimensions

maPlex weighs approximately 2,3 kg (depends on the actual number of channels) and its dimensions are (WxHxD) 354x121x140mm (box) and 397x147x167mm (including gas ports, work knob, mounting feet).



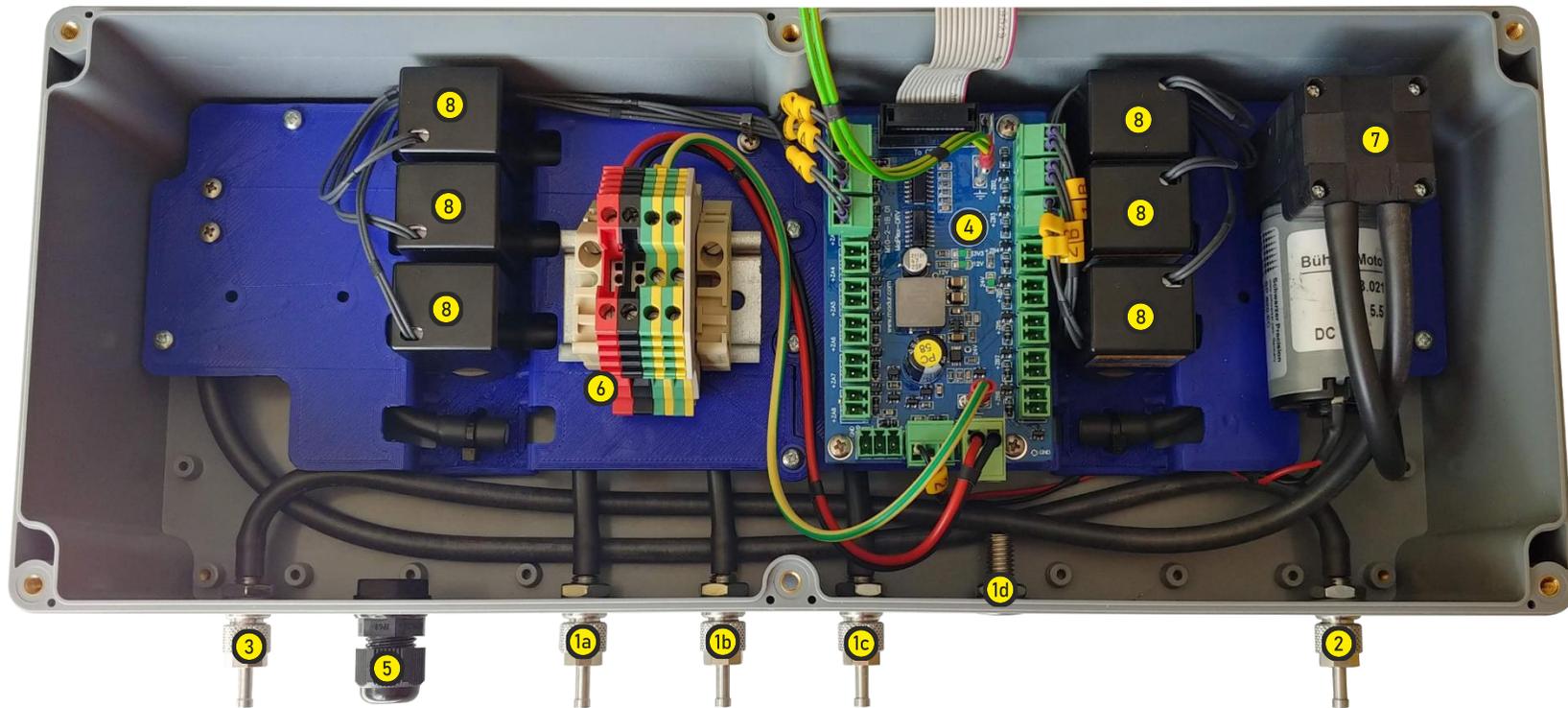
2.2. maPlex – outside



1. Gas inlets from sampling points.
1d. – This version of maPlex is 3-channels one, therefore one gas channel is blanked
2. Gas outlet from multiplexer – to gas analyser
3. Waste gas – when maPlex prepares the next sampling point, internal pump draws the gas and channels it to waste (before channel are actually switched)
4. RS485 communication connectors
5. Cable pass for 24VDC supply cable
6. Work knob – allows manual selection of gas channel

7. Status diode:
 - - connected to mamos analyser (regular short flashes)
 - . . . ●●●● - mamos has not been found (two short flashes, pause)
8. Channel diode:
 - - measuring from this channel (RED diode is lit on)
 - - preparing selected channel (GREEN diode is lit on)
 - - measuring from this channel. Channel is selected manually with work knob!

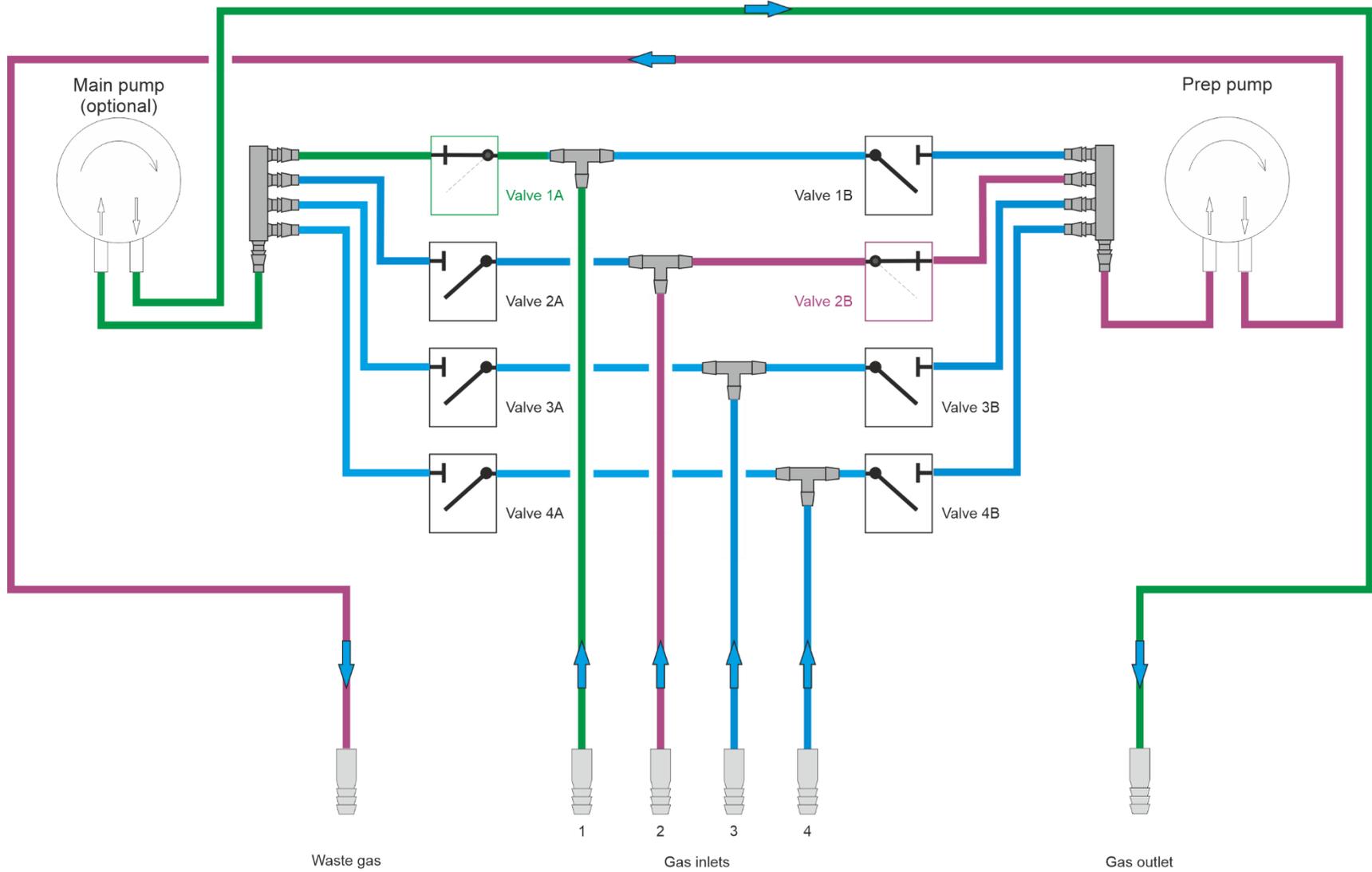
2.3. maPlex – inside



1. 1a-1c: Gas inlets from sampling points (gas dryers).
- 1d. – This version of maPlex is 3-channels one, therefore one gas channel is blanked
2. Gas outlet from multiplexer – to gas analyser
3. Waste gas – when maPlex prepares the next sampling point, internal pump draws the gas and channels it to waste (before channels are actually switched)
4. maPlex main CPU
5. Cable pass for 24VDC supply cable
6. 24VDC supply terminal
7. Gas pump that prepares sample from the next sampling point. Pump is being enabled 60 sec. (time is adjustable) prior the next channel is about to be enabled – infusion phase is “shifted” from mamos to multiplexer . This way the gas sample is available at the analyser almost instantly after the switch.
8. 2-way solenoid valves. Each channel utilises 2 valves.

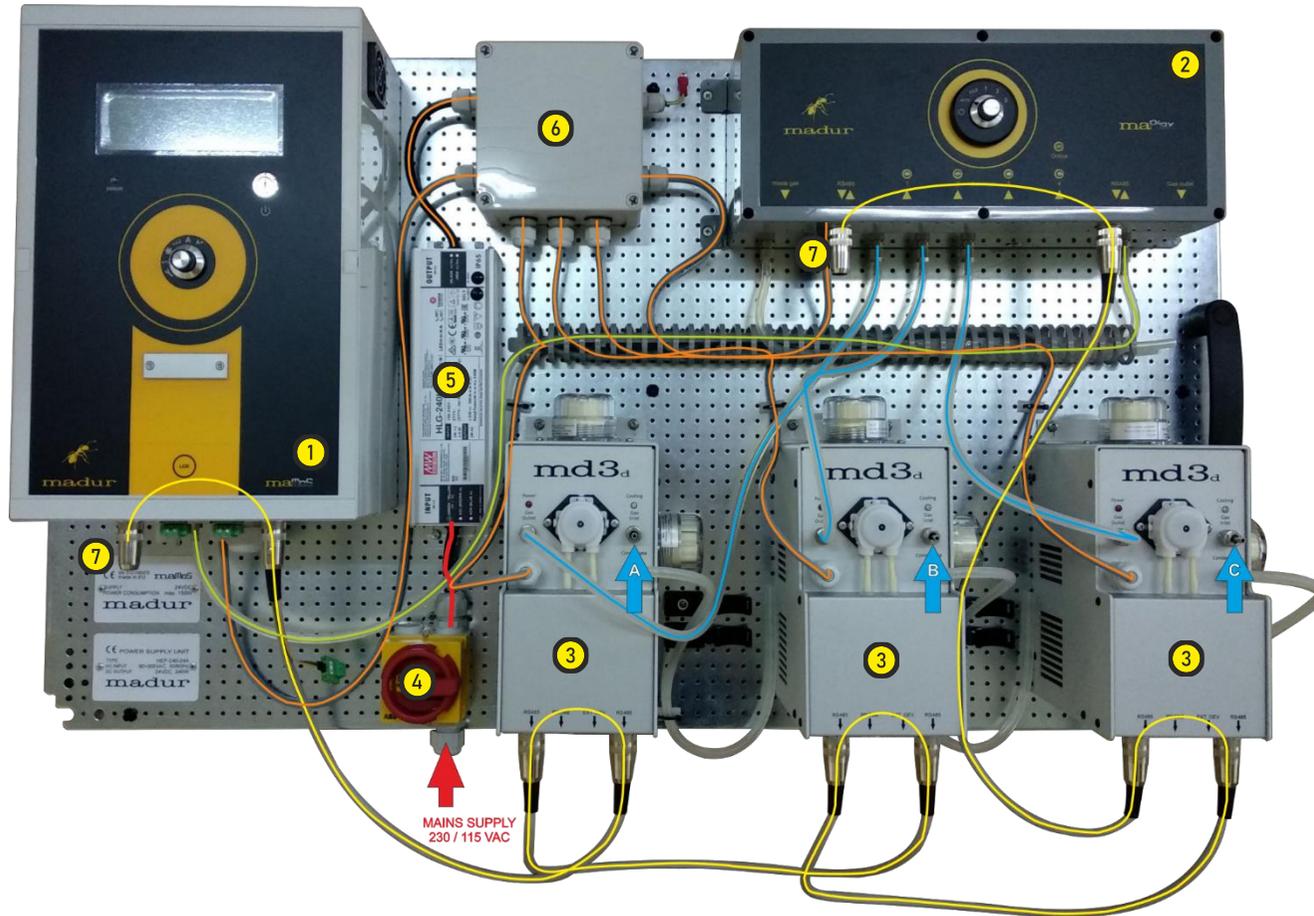
3. PNEUMATIC DIAGRAM

Diagram explains how maPlex delivers sample (green line) to the analyser – Valve 1A closed and how it prepare sample prior measurement (purple line) – Valve 2B closed:



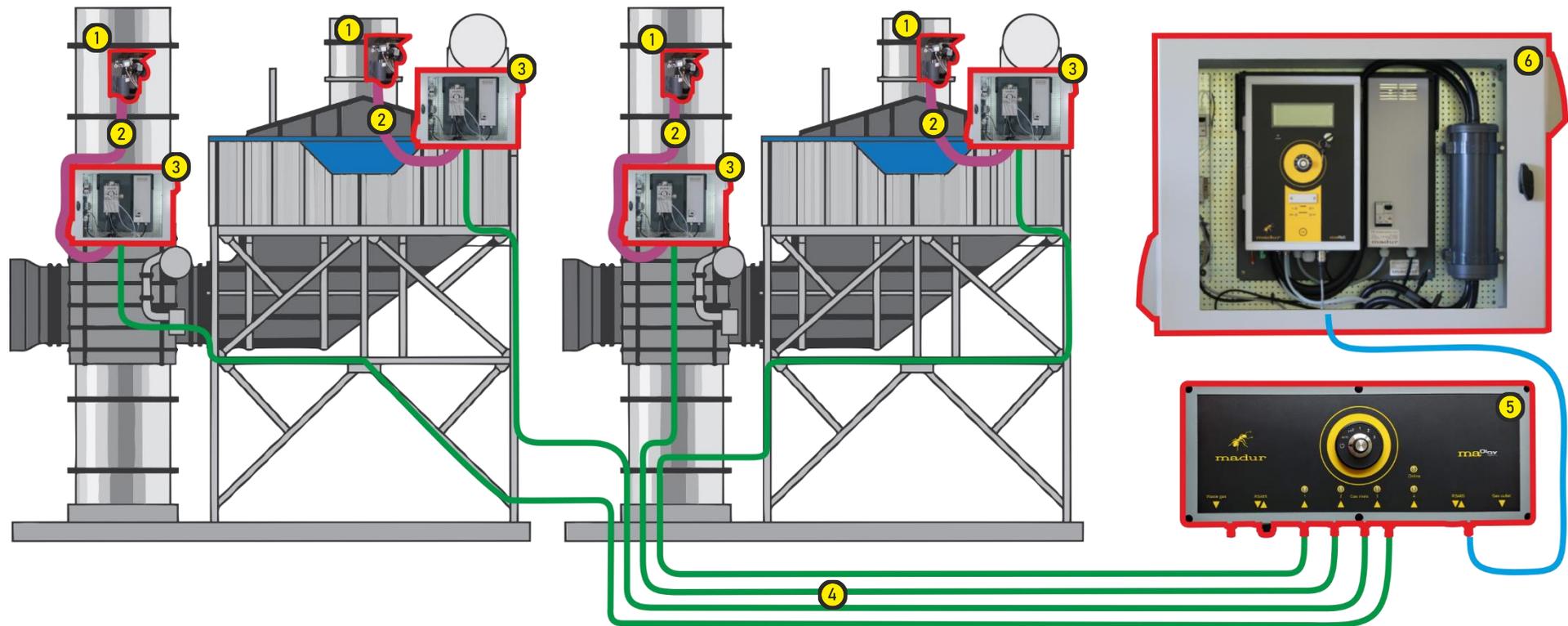
4. INSTALLATION

In this example (3-channel installation) all elements of equipment are installed on one plate and in a direct proximity: gas analyser, multiplexer and 3x MD3 gas dryers. In real life conditions, analyser and multiplexer would be installed together and would be separated from gas dryers, which would be installed closer to sampling points.



1. Gas analyser
2. Multiplexer, collects samples from each source (gas dryer) – light blue lines, and delivers currently selected sampling source to the analyser – light green line.
3. Gas dryers. To each dryer connect the gas source -blue arrows.
4. Mains supply connector and main power switch
5. 230/115VAC (red line) to 24VDC power supply
6. 24VDC crossing box – from here 24VDC is delivered to each device (orange lines)
7. Each device in mamos ecosystem communicates with each other using RS485 interface (yellow line). Each device has two RS485 ports to link with another devices. Border nodes are connected only with one link and the free ports are ended with RS485 terminator - to avoid communication interferences in long communication lines.

4.1. Installation example



Usually, sampling points are in remote distances from the gas analyser, often at high, difficult to access, locations (e.g. up on the stack). In such case, gas dryers should be installed close to sampling point (stationary gas probe) from where gas is delivered using cold lines. Cold lines can be even dozens of meters long – such distances introduce delay when switching between gas sources.

To avoid that, maPlex gas multiplexer is equipped with own gas pump. This pump is activated moments before source switching, so the gas “inflates” the entire volume of cold line and provides instant (seamless) “roaming” between sampling points.

- | | |
|---|---|
| 1. Stationary gas probe | 4. Long cold lines, feeds dry gas from dryers to analyser via multiplexer |
| 2. (If required) Heated line – can be short to minimise the cost of entire installation | 5. maPlex – 4-channel gas multiplexer |
| 3. MD3 gas dryer (recommended in IP55 cabinet and air conditioning module) | 6. mamos gas analyser (in IP55 cabinet and air conditioning module) |

5. MAPLEX SETUP IN MOSYS SOFTWARE

maPlex multiplexer is under full control of mamos gas analyser, and all the setting is performed via moSYS software (via connected mamos analyser).

To be able to work with multiple gas sources a new features has been added to WORK MODES menu in moSys software – only those new features will be described.

5.1. Cyclic measurements

1. Time table – graphical representation of the current work cycle. Each gas source (sampling point) is represented by its unique colour.
2. Legend – shows which colour represent each source. User can define its own coloures (by double clicking on a selected channel):

3. New action for the digital inputs: “Go to the next sampling point”.
When mamos receives signal on its digital input, it will switch to the next sampling source. New cycle will start with “AfterGasSwitch” phase
4. It is possible to manually restart the measurement cycle and go to the specific gas source:

5.2. Measurement according to scheduler

Work mode

Duration of cycle's phases hh:mm:ss

Phase: 'Ventilation' 00:05:00

Phase: 'Infusion' 00:01:00

Phase: 'First zeroing' 00:02:00

Phase: 'Measurement' 01:00:00

Phase: 'Warm-up' 00:00:10

AUX channel 00:02:00

Autocalibration1 00:02:00

Autocalibration2 00:02:00

Ends in

Work mode

Measurements according to scheduler

Scheduler

1. <input checked="" type="checkbox"/> 00:30:00	9. <input type="checkbox"/> 00:00:00	17. <input type="checkbox"/> 00:00:00
Ch:A Measure.	Off	Off
2. <input checked="" type="checkbox"/> 02:00:00	10. <input type="checkbox"/> 00:00:00	18. <input type="checkbox"/> 00:00:00
Ch:C Measure.	Off	Off
3. <input checked="" type="checkbox"/> 07:15:00	11. <input type="checkbox"/> 00:00:00	19. <input type="checkbox"/> 00:00:00
Ch:D Measure.	Off	Off
4. <input checked="" type="checkbox"/> 13:00:00	12. <input type="checkbox"/> 00:00:00	20. <input type="checkbox"/> 00:00:00
Ch:B Measure.	Off	Off
5. <input type="checkbox"/> 00:00:00	13. <input type="checkbox"/> 00:00:00	21. <input type="checkbox"/> 00:00:00
Off	Off	Off
6. <input type="checkbox"/> 00:00:00	14. <input type="checkbox"/> 00:00:00	22. <input type="checkbox"/> 00:00:00
Off	Off	Off
7. <input type="checkbox"/> 00:00:00	15. <input type="checkbox"/> 00:00:00	23. <input type="checkbox"/> 00:00:00
Off	Off	Off
8. <input type="checkbox"/> 00:00:00	16. <input type="checkbox"/> 00:00:00	24. <input type="checkbox"/> 00:00:00
Off	Off	Off

Input IN1

Input IN2

No action

Restart a cycle with "Ventilation" phase

Restart a cycle with "Measurements" phase

Terminate measurements and go to "Standby"

Go to the next sampling point

The analyser shifts (starting with "AfterGasSwitch" phase) to the next sampling point A-B-C...A. For Compact and split configs (single measurement channel) action is ignored.

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0

1 2 3 4

Legend

Stand-by Warm-up Ventilation Measurement A Measurement B AUX channel

Restart measurement cycle - force start from:

Preview Save Default Ventilation Measurement Pre stand-by Gas source Close

In "scheduler" mode, it is possible to select when and which gas source will have been measuring. It is possible to enable up to 24 cycles per day. Each phase must be activated, and gas source must be assigned:

Cycle parameters

Cycle No: 9

Active

Measurement channel:

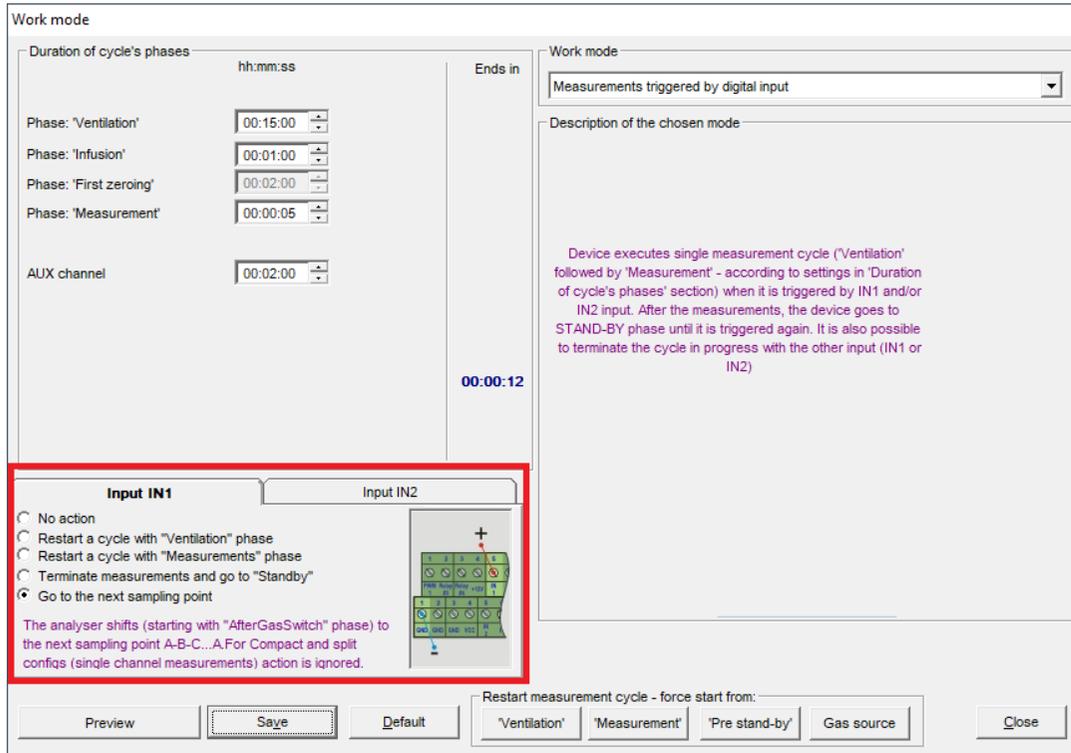
Gas channel number: A

AutoCalibration

Save Close

Start of each phase can be freely adjusted; phases should not overlap.

5.3. Measurements triggered by digital inputs



In mode "triggered by digital inputs", analyser is administered by external devices:
If phase "Measurements" is set to 00:00:00, analyser will measure from selected source until it receives signal to terminate / restart or to switch to another source.
New cycle (after receiving input signal) will start with ventilation phase.
If Measurements is > 00:00:00, analyser will perform measurements for this time and then will go to standby mode and will wait for the next signal from one of digital inputs.

5.4. Flip-flop mode

Work mode

Duration of cycle's phases

Full cycle time: 04:00:00

Phase: 'Ventilation': 00:05:00

Phase: 'Infusion': 00:01:00

Phase: 'First zeroing': 00:02:00

Phase: 'Measurement': 00:15:00

Phase: 'Warm-up': 00:00:10

AUX channel: 00:02:00

Ends in: 00:01:47

Work mode: Flip-flop for Multi Split configuration

Description of the chosen mode: 01:00:00 Time of the first zeroing

Available only for Multi-Split configuration. Similar to the Cyclic mode but ventilation occurs every N-measurements (depending on the set times). Ventilation > Measurement A > Measurement B > Measurement A > Measurement B > ... > Ventilation.

Input IN1: No action, Restart a cycle with "Ventilation" phase, Restart a cycle with "Measurements" phase, Terminate measurements and go to "Standby", Go to the next sampling point

The analyser shifts (starting with "AfterGasSwitch" phase) to the next sampling point A-B-C...A. For Compact and split configs (single channel measurements) action is ignored.

Input IN2

Timeline: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0

Legend: Stand-by, Warm-up, Ventilation, AUX channel

Restart measurement cycle - force start from: Ventilation, Measurement, Pre stand-by, Gas source

Flip-flop work mode is similar to mode "cyclic measurements". The main difference is the less frequent ventilation.

In cyclic mode, ventilation phase occurs after each measurements: Source A → Ventilation → Source B → Ventilation → Source C → Ventilation...

In case of flip-flop mode, depending on the times set to each phase, ventilation occurs less frequent, allowing to switch between gas sources without ventilation, e.g.:

Source A → Source B → Source C → Source D → Ventilation...

In the picture ventilation phases are shown with red arrows.

5.5. Other work modes

- In theory, multiplexer can work in Long-term modes, but due extremely long measurement phases, multiplexed measurements are senseless.
- Overlapping mode is, by design, dedicated to work with just two analysers in master-slave dependence - multiplexer mode does not apply here.