

# Instructions Software GMS\_3CH\_HP gas mixing system

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### Software control program GMS\_3CH

The software is used from 7 tabs.



The buttons :

*HELP* – *software* opens this software manual.

*HELP* – *hardware* opens the instruction manual : installation, maintenance, calibration.

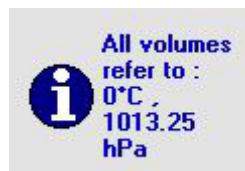
*Exit program* : the GMS\_3CH **must** be shut down by clicking this button - DO NOT finish the program in another way !



After finishing the operation close all valves at the gas containers !



The standard condition for all gas volumes – unit : Ncm<sup>3</sup>/minute - is 0°C and 1013.25 hPa.




## Settings - Gas consumption

*COM-Ports on this PC* : lists all serial ports ( COM – Ports ) available on the PC.

*COM-Port GMS\_3CH* : shows the COM - port connected to GMS\_3CH flow controllers. This value is read from the WINDOWS registry.



At the first time when the software is started an error message is displayed and this field is empty. In this case the user has to key in the COM port number. By clicking on the blue *INFO* button the WINDOWS device manager is opened where all COM ports are listed under Ports ( COM & LPT ). The GMS\_3CH port is listed as USB Serial Port COM x. The number x has to be entered in the

program.  USB Serial Port (COM10)

*Save data here* : these entries stipulate the parameters for data storage. By clicking the button  next to *Save data here ...* : a dialog is opened to enter the path for data storage. The complete path is displayed as *Path for data storage*.

*Denotation* : this field sets a prefix for the data. The data are stored as MS EXCEL worksheet ***Denotation\_year\_month\_day\_hour\_minute.xlsx***. The filename is combined from this prefix and the actual date and time automatically.

*Save data automatically as .. (at STOP)* : by activation of this check box the data are stored automatically at STOP.

*Save data automatically .. after XXX minutes* : when this check box is activated the data are stored after xxx minutes.

*Gas consumption for channel 1... :* shows the gas consumption for channel 1 ... 3. So the user can see if it is necessary to exchange the gas container to prevent an empty gas bottle. If the gas container is exchanged the *arrow button* should be clicked to set the consumption to zero.





If the configuration has been changed it is necessary to click the button *Save configuration in WIN registry*.

## START / STOP - select gases

For manual operation mode it is necessary to enter data in the frame *Inputs* :

1. *Select gases* : for channel 1 to 3 the type of gas has to be selected from the drop-down list

 boxes. After changing gas type it is necessary to **click the check box for confirmation**. A green check mark shows the change of gas type. The descriptions change automatically.

 **Min / Max** indicate the flow range for each channel. Each channel can be operated only in the indicated ranges. **The ranges depend on the selected gases.**

2. *Setpoint for total flow* : this is for input of the total flow in standard cm<sup>3</sup>.
3. *Setpoints for concentration 2.. 3* : here the gas concentrations for each channel must be set in the unit percent volume.
4. *Automatic STOP after ... minutes* : if the check box is activated ( check mark ) the gas dosing is stopped after XXX minutes automatically.


For start of operation the *START* button has to be clicked. During operation the setpoints for concentrations and total gas flow can be changed, if the button *New setpoints ... set* is clicked.




*Setpoints Flow* : shows the flow setpoints for MFC 1 ... 3.  
-> not editable.

*Actual values* : shows the ( calculated ) values for

**ACTUAL values :**

Concentration 2 : **12,01** Vol% O2-oxygen 

Concentration 3 : **1,24** Vol% CO2-carbon dioxide 

TOTAL flow : **199,9** NmL/Min

Flow MFC 1 :  Ncm3/M N2-nitrogen

Flow MFC 2 :  Ncm3/M O2-oxygen

Flow MFC 3 :  Ncm3/M CO2-carbon dioxide

- Concentrations 2 and 3 with gas description / formula
- total gas flow
- actual flow for each channel and gas notation.

*Set NEW setpoints* : a click on this button adopts the values from the INPUT frame.

*STOP* : a click on this button stops operation ( gas flow ).

*Start time and Running time* : show a) date and time of start and b) expired time in minutes from start.

Start time :  Run time :  minutes

## Profile table - automatic operation

The screenshot shows the GMS\_3CH software interface. The main window is titled 'GMS\_3CH version 5.2' and 'running ...'. The menu bar includes 'Settings - Gas consumption', 'Data', 'Graph 24h', 'START / STOP - select gases', 'Profile table', 'INFO + Maintenance', and 'Leak alarm and pressure settings'. The toolbar contains 'Help' and 'Exit Program'. The 'Profile table' is a table with columns: 'Conc2 Vol%', 'Conc3 Vol%', 'Time/min', and 'Vtotal / NmL/min'. The table contains three rows: (10, 20, 5, 50), (20, 10, 5, 50), and (30, 0, 5, 50). The second and third rows are highlighted in yellow. Below the table, there are dropdown menus for 'CO2-carbon dioxide', 'H2-hydrogen', 'Timeinterval/Min', and 'Total Flow / NL/Min'. The 'Total time' is set to 15.0 minutes. The status 'Profile running ...' is displayed. To the right, there are buttons for 'Start Profile', 'Stop Profile', and 'Open MS EXCEL table'. Below these are input fields for 'Start time', 'Running time', and 'Remaining time'. There are also input fields for 'Gas 1', 'Gas 2', and 'Gas 3'. The 'ACTUAL values' section shows 'Total flow', 'Concentration 2', and 'Concentration 3'. A status bar at the bottom indicates 'reading MFC 3'. An information icon on the right states: 'All volumes refer to : 0°C, 1013.25 hPa'.

This function allows to run a concentration – time – profile automatically. The gas for each channel is indicated at the footer of the table.

This profile is a MS EXCEL worksheet - profile - in the GMS\_3CH.xlsx file. It can be changed by opening the EXCEL table ( **editable are only the yellow cells** ).



For this operation mode the flow limits for each MFC have to be observed, they can be taken from the **profile** table :

I	J	K
Flow1/lcm <sup>3</sup> /m	Flow2/lcm <sup>3</sup> /m	Flow3/lcm <sup>3</sup> /m
198	0	2
196	0	4
199	0	1
190	10	0
180	20	0
170	30	0



The inputs are not checked automatically - they have to be checked when editing the profile table !



Only yellow fields can be edited - the others are locked.

Empty rows in the table are defined as end of the table and the profile.

*Open MS EXCEL file* : opens the file GMS\_3CH.xlsx. The profile worksheet can be changed



After changing the profile worksheet the EXCEL file must be saved and closed. By clicking **IMPORTANT - Read EXCEL file** the changes are read in by the GMS\_3CH program.



The program does not read the table automatically.

Start profile starts operation. Operation is finished

- when the last record in the EXCEL table is finished ( followed by an empty row ) or
- when Stop profile is clicked by the user.

The actual record set is marked in blue.

Conc2 Vol%	Conc3 Vol%	Time/min	Vtotal / NmL/min
10	20	5	50
20	10	5	50
30	0	5	50

Start Profile ↑

Stop Profile ↓

Start time : 31.01.2021 16:15:54

Open MS EXCEL table

IMPORTANT : Read table

Gas 1 ... 3 : show the actual gas description for each channel.

Actual values : shows the concentrations and total flow.

Total time, Start time, Run time, Remaining time : show the corresponding times.

### Data table and data storage

Date	Time	RunTime...	Vol% O2-oxyg...	Vol% CO2-car...	Vtotal/NmL/...	Flow1 N2-nitr...	Flow2 O2-oxy...	Flow3 CO2-c...	Err	StepP	2_SETP	2_f
27.08.2021	14:30:23	0,0	10,08	0,22	190,510	170,900	19,200	0,410		0	12	10,
27.08.2021	14:30:24	0,0	11,20	0,71	195,580	172,300	21,900	1,380	D#_CONC	0	12	11,
27.08.2021	14:30:25	0,1	11,63	1,06	197,790	172,700	23,000	2,090		0	12	11,
27.08.2021	14:30:26	0,1	11,78	1,13	198,650	173,000	23,400	2,250		0	12	11,
27.08.2021	14:30:27	0,1	11,82	1,16	198,810	173,000	23,500	2,310		0	12	11,
27.08.2021	14:30:28	0,1	11,86	1,19	199,060	173,100	23,600	2,360		0	12	11,
27.08.2021	14:30:29	0,1	11,89	1,19	199,280	173,200	23,700	2,380		0	12	11,
27.08.2021	14:30:30	0,1	11,89	1,20	199,400	173,300	23,700	2,400		0	12	11,
27.08.2021	14:30:31	0,1	11,93	1,21	199,520	173,300	23,800	2,420		0	12	11,
27.08.2021	14:30:32	0,2	11,93	1,21	199,520	173,300	23,800	2,420		0	12	11,

min %Vol %Vol NmL/Min NmL/Min NmL/Min NmL/Min %Vol %V

All volumes refer to : 0°C , 1013.25 hPa

This table shows all data - measured and calculated data during operation.

StepP : If the profile mode is used, the values show the number of the step in the profile. When manual START / STOP mode is used : StepProfile = 0.

Setpoint , Mean value, and Standard deviation for concentrations from the last 100 values ( for each step ) are also stored in the data table.



This table can be stored by clicking : save NOW as MS Excel \*.xls. The program stores the data as \*.xlsx file ( storage as \*.xls for older MS EXCEL versions is also available on request ):

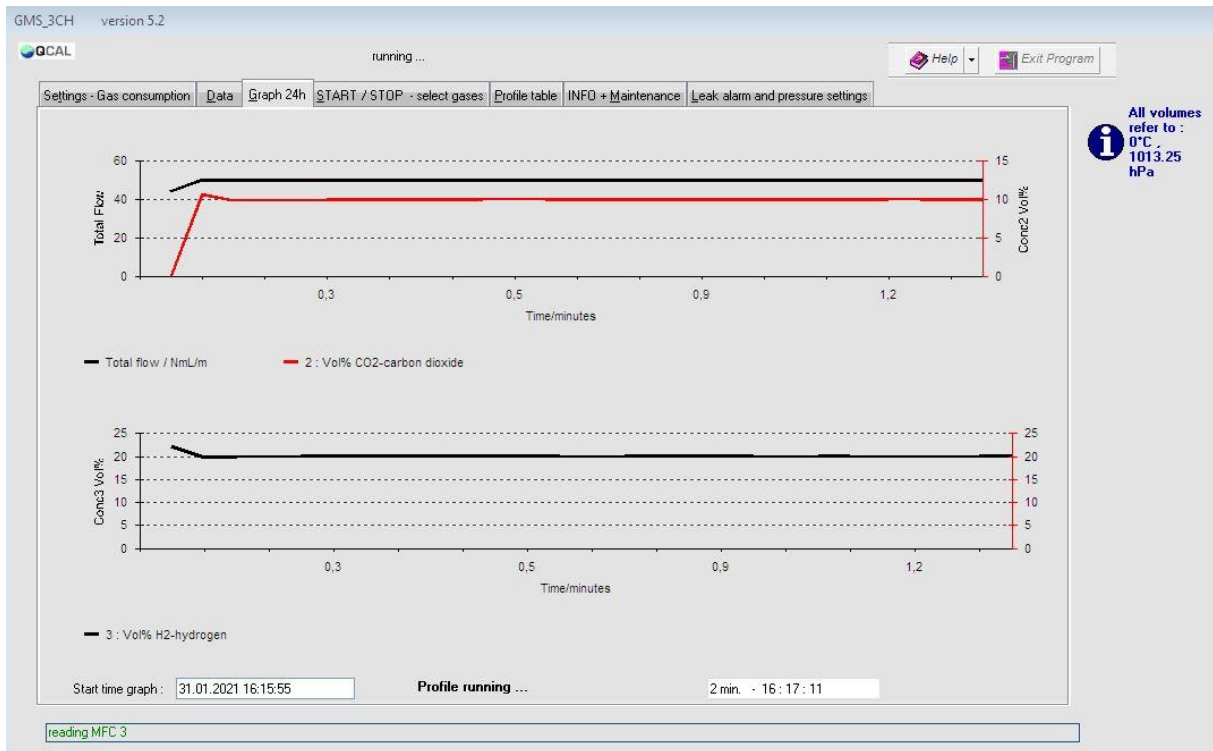


This table can be deleted by Delete Data after confirmation.

Total volume 1 ... 3 : show the gas consumption for each gas ( channel ), referred to 0°C and 1013,25 hPa.

### Graph 24h

This tab shows the concentration for gas 2 and 3 and the total flow graph as graphs. The graphs renew every 24 hours automatically.




**Info**


This tab shows informations for the GMS\_3CH and the gases it is calibrated for ( Safety Data Sheets = SDS ), it also provides a purging tool for maintenance purposes.


Settings - Gas consumption | Data | Graph 24h | START / STOP - select gases | Profile table | INFO | TCP server


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**Informations - ( click button ) :**

 Safety DataSheet N2

 Safety DataSheet air

 Safety DataSheet O2

 Safety DataSheet CO2



## TCP server

With the functions of this menu item it is possible to operate the GMS\_3CH via a TCP internet server and to exchange data. The GMS\_3CH computer is the client, name, IP address of this PC are indicated in the corresponding fields.

The ( local ) port of the client is defined by the input in the field ' port '. It should be different from the remote port

- 1.) The remote IP address and the remote port of the Remote Server must be entered by the user :
- 2.) By clicking ' Connect with TCP server -> ' the PCs are connected :

The screenshot shows a software interface for configuring a TCP server. At the top, there is a menu bar with options: Settings - Gas consumption, Data, Graph 24h, START / STOP - select gases, Profile table, INFO, and TCP server. Below the menu bar, there is a 'TCP protocol' label with a question mark icon and a 'Connect with TCP server ->' button. The interface is divided into two main sections: 'GMS PC Client' and 'Remote Server'. The 'GMS PC Client' section has fields for 'Name' (MiniPC-PC), 'IP address' (192.168.178.27), and 'Port' (0). The 'Remote Server' section has fields for 'Remote Host' (192.168.178.33), 'IP address remote' (192.168.178.33), and 'Port remote' (333). Below these sections, there is a checkbox for 'Send data - interval' which is checked, with a value of '10' and the text 's - activate by CheckBox!'. At the bottom left, there is a 'State / Error / Data' field containing the text 'closed'. At the bottom right, there are two buttons: 'Disconnect server' and 'Save settings for TCP'.

3.) By clicking 'Disconnect server' the connection is closed.

4.) By clicking 'Save settings for TCP' the connection settings are stored and set the next time.

## Protocol :

Data sent by the client :

1. At Start / Start profile / New setpoints :  
"QC\_Year\_Month\_Day\_Hour\_Minute\_Second\_Flow(1)\_ Flow(2)\_ Flow(3).  
Flow(1, 2, 3) : values for setpoints for flow on channel 1, 2, 3 in NmL/minute
2. At Stop : "QC\_STOPPED\_Year\_Month\_Day\_Hour\_Minute\_Second"
3. At error messages : "QC\_STOPPED\_ERROR NO  
GAS\_Year\_Month\_Day\_Hour\_Minute\_Second"
4. If Send data – Interval is activated the client sends data at the specified time interval.

Format :

For manual start :

"QC\_Data\_actual date and time\_total flow\_concentration 2\_ concentration 3\_ error messages ( if applicable )"

For profile start :

"QC\_Data\_P\_actual date and time\_total flow\_concentration 2\_ concentration 3\_ error messages ( if applicable )"

Instructions sent by the server :

1. To start the operation with actual indicated setpoints : "QC\_START"
2. To start the operation with the profile from the profile table : "QC\_STARTprof"
3. To stop the operation : "QC\_STOP"

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