Smart Service Software
for use with Brooks® Smart Mass Flow
Meter/Controller Series
Essential Instructions
Read this page before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining Brooks Products.

- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, please see back cover for local sales office contact information. Save this instruction manual for future reference.
- If you do not understand any of the instructions, contact your Brooks Instrument representative for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Brooks Instrument. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

CAUTION

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedure must be observed during the removal, installation or other handling of circuit boards or devices.

Handling Procedure:
1. Power to unit must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit cards must be transported in a conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

Comments
This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, SMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.
Dear Customer,

We appreciate this opportunity to service your flow measurement and control requirements with a Brooks Instrument device. Every day, flow customers all over the world turn to Brooks Instrument for solutions to their gas and liquid low-flow applications. Brooks provides an array of flow measurement and control products for various industries from biopharmaceuticals, oil and gas, fuel cell research and chemicals, to medical devices, analytical instrumentation, semiconductor manufacturing, and more.

The Brooks product you have just received is of the highest quality available, offering superior performance, reliability and value to the user. It is designed with the ever changing process conditions, accuracy requirements and hostile process environments in mind to provide you with a lifetime of dependable service.

We recommend that you read this manual in its entirety. Should you require any additional information concerning Brooks products and services, please contact your local Brooks Sales and Service Office listed on the back cover of this manual or visit www.BrooksInstrument.com

Yours sincerely,

Brooks Instrument
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1. Introduction to Smart Service

1.1 GENERAL INFORMATION

Brooks Smart Service software for Microsoft® Windows™ is a calibration and service tool for performing calibrations and/or service on the Brooks Smart Mass Flow Meter models and the Brooks Smart Mass Flow Controller models.

Smart Service is designed to give access to all the configuration parameters, and perform a complete calibration in conjunction with the Brooks Vol-U-Meter series or other flow reference equipment. The Smart Service program runs only if the Smart DDE software is installed on your PC. This manual explains how to use the Smart Service software under the Microsoft Windows environment for Personal Computers in conjunction with the Brooks Smart Mass Flow products. The manual does not cover the functionality of the Smart Mass Flow Meters and Controllers itself. These products are described in detail in a different document; please refer to document 541-C-051-AAG. For detailed protocol message structure, we refer to our Communication Instruction manual; document 541-C-053-AAG.

NOTE: The reader is assumed to have knowledge on how to use the Microsoft Windows environment for Personal Computers.

1.2 THE BROOKS SMART MASS FLOW PRODUCTS

The Brooks Smart Mass Flow Meters models measure gas flows accurately. The heart of the systems is the thermal mass flow sensor which produces an electrical output signal as a function of flowrate.

In addition the Brooks Smart Mass Flow Controllers measure and control gas flows. The flow ranges per model are listed in table .1

Table 1 Brooks Smart Mass Flow Meters and Controllers

<table>
<thead>
<tr>
<th>Brooks Smart Mass Flow Products</th>
<th>Flow Ranges (N₂ equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass Flow Controller Model</td>
<td>Mass Flow Meter Model</td>
</tr>
<tr>
<td>5850S/MF50S</td>
<td>5860S/MF</td>
</tr>
<tr>
<td>5851S/MF51S</td>
<td>5861S/MF</td>
</tr>
<tr>
<td>5853S/MF53S</td>
<td>5863S/MF</td>
</tr>
<tr>
<td>5850SM/5964S</td>
<td>5864S/MF</td>
</tr>
<tr>
<td>5851SM/5965S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Brooks Smart Mass Flow products are equipped with analogue I/O, representing the mass flow and —in case of a controller— the setpoint. The information on these I/O ports are represented as a voltage signal ranging from 0 (1) to 5 Volt or as a current signal ranging from 0 (4) to 20 mA.

In addition, all models can be equipped with a communication piggy back board, providing access to the flow and setpoint information, either in a range from 0% to 100%, or in selectable engineering units. You also have access to the configuration parameters of the device.
NOTE: Further on in this manual the abbreviation DMFC is frequently used and is referring to both the Smart Mass Flow Meter and the Smart Mass Flow Controller products.

1.3 USES OF SMART SERVICE

Smart Service is a software package designed for calibration and service on the Smart Mass Flow products. At the office or in the field, the Smart Mass Flow products can only be calibrated, serviced and repaired with the use of Smart Service.

Using Smart Service enables you to perform the following tasks:

- Complete calibration of the Smart Mass Flow products.
- Inspect or change any parameters inside the Smart Mass Flow products.
- Inspect or change of configuration data.
- Configuring operational settings.
- Optimize the control parameters of the device for your process application.
- Fine tune response time settings.
- Print a full report for the calibrated device, including the parameter settings and a calibration curve. (Microsoft® Excel software needs to be installed on your PC).
2 Installation

2.1 GENERAL

This section describes the installation of the Smart Service software and setting up your system in order to establish communication with the Brooks Smart Mass Flow products. The system requirements will be discussed as well as the hardware connections, which must be made between the device(s) and the host computer.

2.2 RECEIPT OF EQUIPMENT

When the equipment is received, the outside packing case should be checked for damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding his liability. A report should be submitted to your nearest Product Service Department.

Brooks Instrument
407 W. Vine Street
P.O. Box 903
Hatfield, PA 19440 USA
Toll Free (888) 554-FLOW (3569)
Tel (215) 362-3700
Fax (215) 362-3745
E-mail: BrooksAm@BrooksInstrument.com
http://www.brooksinstrument.com

Brooks Instrument
Neonstraat 3
6718 WX Ede, Netherlands
Tel 31-318-549-300
Fax 31-318-549-309
E-mail: BrooksEu@BrooksInstrument.com

Brooks Instrument
1-4-4 Kitasuna Koto-Ku
Tokyo, 136-0073 Japan
Tel 011-81-3-5633-7100
Fax 011-81-3-5633-7101
E-mail: BrooksAs@BrooksInstrument.com

Remove the envelope containing the packing list. Carefully remove the instrument from the packing case. Make sure spare parts are not discarded with the packing materials. Inspect for damaged or missing parts.
2.3 RECOMMENDED STORAGE PRACTICE

Equipment supplied by Brooks Instrument is to be placed in intermediate or long-term storage, it is recommended that it be:

a. Stored within the original shipping container.
b. Stored in a sheltered area, under the following conditions:
   1) Optimum ambient temperature 21°C (70 °F), maximum 32 °C (90 °F), minimum 7 °C (45 °F).
   2) Optimum relative humidity 45% (maximum 60%/minimum 25%).
c. Subjected to a visual inspection upon removal from storage, to verify that the condition of the equipment is ‘as received’. If the equipment has been in storage for more than ten months or if it has not been stored under the recommended conditions, all pressure containing seals should be replaced. In addition, the device should be subjected to a pneumatic pressure test in accordance with the applicable vessel codes.

2.4 RETURN SHIPMENT

Prior to returning any instrument to the factory, contact your nearest Brooks location for a Return Materials Authorization Number (RMA#). This can be obtained from one of the following locations:

Brooks Instrument
407 W. Vine Street
P.O. Box 903
Hatfield, PA 19440 USA
Toll Free (888) 554-FLOW (3569)
Tel (215) 362-3700
Fax (215) 362-3745
E-mail: BrooksAm@BrooksInstrument.com
http://www.brooksinstrument.com

Brooks Instrument Brooks Instrument
Neonstraat 3 1-4-4 Kitasuna Koto-Ku
6718 WX Ede, Netherlands Tokyo, 136-0073 Japan
P.O. Box 428 Tel 011-81-3-5633-7100
6710 BK Ede, Netherlands Fax 011-81-3-5633-7101
Tel 31-318-549-300 E-mail: BrooksAs@BrooksInstrument.com
Fax 31-318-549-309
E-mail: BrooksEu@BrooksInstrument.com

Any instrument returned to Brooks requires completion of Form RPR003-1, Brooks Instrument Decontamination Statement, as well as, a Material Safety Data Sheet (MSDS) for the fluid(s) used in the instrument. This is required before any Brooks Personnel can begin processing. Copies of the form can be obtained from any Brooks Instrument location listed above.
2.5 SYSTEM REQUIREMENTS

In order to be able to run Smart Service, the following hardware and software is required:

- IBM compatible personal computer with an 80586, or higher revision microprocessor
- Microsoft Windows 3.1 or higher
- Hard Disk Drive with at least 8 Mbytes (excluding Smart DDE) available for storage
- 3.5" Floppy Disk Drive for High Density Diskettes
- At least 32Mbytes (more recommended) Random Access Memory (RAM)
- 9-pin or 25-pin serial port for RS-232 communication
- At least one printer port

IMPORTANT NOTE:
When using Smart Service with RS-485, an additional RS-232 to RS-485 converter or RS-485 interface board is required. To support a wide range of RS-232 to RS-485 converters and RS-485 interface boards, Smart Service allows the selection of both the direction control line (i.e. RTS or DTR) and the read and write buffer logical levels (i.e. logical ‘1’ activating the write buffer and logical ‘0’ activating the read buffer, or logical ‘0’ activating the write buffer and logical ‘1’ activating the read buffer). Contact Brooks Instrument for available converters and interface boards.

2.6 HARDWARE SETTINGS AND CONNECTIONS

See the Smart DDE manual section 2.3 and 2.4 for Hardware settings and connections.

2.7 SMART SERVICE SOFTWARE PACKAGE

The Smart Service software package consists of:

1. Two 3.5" floppy disks (labeled ‘Smart Service 1 of 2’ and ‘Smart Service 2 of 2’).
2. Two 3.5" floppy disks (labeled ‘Smart DDE software’ and ‘Demo Smart DDE’).
3. The Smart DDE installation and operation manual.
4. The Smart Service calibration procedure.
5. This Smart Service installation and operation manual.
6. Execution control key (dongal).

NOTE:
The Smart DDE software should be installed before installing Smart Service (please refer to the Smart DDE installation and operation manual).
2.7 INSTALLATION PROCEDURE

Perform the following tasks for installing the Smart Service software on your hard disk:

1. Connect the 'Execution control key' to the printer port
2. Start up Windows.
3. Insert the 'Smart Service 1 of 2' disk into drive a: or b:
4. For Windows 3.xx
   Select File | Run from the program manager menu and type a:\setup or b:\setup, followed by pressing the Enter-key.
   For Windows 95 or 98
   Select Start | Run from the taskbar and type a:\setup or b:\setup, followed by pressing the Enter-key.

The install program will start copying the files into the directory specified as the install directory. The installation program will ask you to insert the second disk labeled 'Smart Service 2 of 2' disk, the installation continues after pressing the Enter-key. Next the install program will produce a Smart Service group file in the windows directory. This file is added to the program manager which creates a Smart Service group with the Smart Service and Tooldata icon in the Program Manager desktop. The install program also appends some program specific settings to the WIN.INI file. The installation is now completed.

NOTE:
The following changes have to be made to the windows environment on the PC.
For Windows 3.xx; under "Main", "Control panel", "International".
Change the number format to:
1000 Separator : ",", (comma).
Decimal Separator : ".", (point).
For Windows 95 or 98; under "Start", "Settings", "Control panel", "Regional settings", "Number".
Change the number format to:
Decimal symbol : ".", (point).
Digit grouping symbol : ",", (comma).
Under "Date":
"Short date style", "d-MM-yy"
3 Running Smart Service

3.1 STARTING SMART SERVICE

By double clicking on the Smart Service icon you can start the Smart Service program. At start up Smart Service will show a dialog box, asking you to enter the password of the DMFC.

Figure 1 Password dialog box

NOTE:
It is advisable, not to have any other application running, while using Smart Service.

After entering the password (default DMFC password is “BROOKS”), click the “OK” button to continue. Hereafter the Smart Service main screen will pop up.

Figure 2 Main screen
Observing the main screen you will find the settings for the Smart communication between Smart Service and the DMFC. The screen settings must match the settings selected on the optional Smart piggy back board on the DMFC. If the communication settings match, you can click the “Setup DMFC communication” button in order to start communication with the DMFC. The tagnumber does not have to be filled in(correctly) provided that the "Derive Tagnumber automatically" checkbox is checked(default). After initialization, the serial number of the connected DMFC is shown in the top of the main screen (“Order # not entered” is shown in case of a not calibrated DMFC). You are now able to access the separate screens, corresponding to the screen names on the left side of the main screen, by clicking the square box before the screen name.

**NOTE:** In case a DMFC tagname is less than eight digits, Smart Service will change the tagname by adding one or more " * " behind the old tagname until the total of eight digits is reached.

The changed tagname will be saved in the DMFC. (i.e. old tagname 75012, will be saved as 75012***)

**NOTE:** In most of the separate screens (e.g. Device Data, Configuration and others) three buttons will appear, with the following function:

1) **Read data from DMFC**

   This button refreshes the screen information with the saved DMFC settings.

   **NOTE:** When the checkbox “Read data on open module” in the main screen is checked, the action “Read data from DMFC” will be automatically performed when opening one of the separate screens.

2) **Send data to DMFC**

   Pressing the “Send data to DMFC” button sends the changes to the working memory of the DMFC. (the changes will be lost when powering down the DMFC)

3) **Backup**

   When pressing the “backup” button the information inside the working memory of the DMFC will be saved in the non-volatile memory of the DMFC.

   (this prevents the DMFC from loosing data after switching off power)

   **NOTE:** Refer to the Calibration procedure (J-834-P-088-AAG) for more information on how to handle the separate screens.

**3.2 AUTOMATIC CALIBRATIONS**

Smart Service rev.D. or higher, also supports automatic calibrations. For automatic calibrations, the following extra hardware is needed:
- Brooks Instrument 0154 read-out unit, with RS232 communication possibility;

This hardware is respectively needed for automatic input and output adjustment, automatic linearization and linearization check.
Both units require an additional communication port on the PC.
3.3 ADDITIONAL FEATURES

The Additional features screen is not mentioned in the calibration procedure because it is not part of the standard calibration.

Figure 3  Additional features screen

The additional features screen contains the following items:

1) ‘DMFC database; Restore DMFC.
   This restores the data in the non-volatile memory of the DMFC to the working memory of the DMFC.

2) ‘Gas parameters; Re-scale factor.
   This factor is used to change the range of the DMFC between 0.8 and 1.2 times the original flowrate (e.g. if the original full-scale flow is 100 l/m you can change it between 80 and 120 l/m).

3) ‘Operational gas #; Select gas.
   When using a Smart MFC/M with more then one (maximum is 10) calibration curves, the desired operational gas can be selected here.
4) ‘Flow totalizer’; Start, Stop and Reset.
   Totalizer functions to Enable, Disable and Reset the DMFC totalizer with the corresponding buttons.

5) ‘Additional status’; Enable/Disable....
   You can activate the individual alarms by clicking the corresponding box.

Figure 4  Additional status screen

6) ‘Write protection’; Change password...
   This option allows you to change the password in the connected DMFC.

Figure 5  Write protection screen

Note: Changing the DMFC’s password means;
The operator needs to use this new password next time he connects this DMFC to Smart Service. (see section 3.1 of this manual)

7) ‘Actual parameters & data’; Actual data ....
   Here, all the actual data needed for servicing the DMFC can be monitored and changed.
8) ‘All data to/from file’; Up/Down load ....
All the stored data in the DMFC can be uploaded to, or downloaded from a “DDA” file.

9) ‘Default settings’;
‘Enable digital barometer’
If there is a digital barometer available, and this checkbox is checked, Smart Service will look for it automatically while linearizing. This setting will be stored in the WIN.INI file and set as default everytime Smart Service is started.
‘Default S-software revision’
This is the software revision(S-firmware) that will be printed on the calibration sheet. In case of another firmware revision this value can be changed here. This setting will be stored in the WIN.INI file and set as default everytime Smart Service is started. Changing this value in the ‘Calibration sheet printing screen’ (Figure 8), will only change the value on the calibration sheet, and not in the WIN.INI file.

3.4 DMFC STATUS
For additional information on the DMFC status press “F1” button on the keyboard. The DMFC Status screen will pop up. The screen will provide the information on “Communication”, “Status” and “Additional” issues.
3.5 PRINT CALIBRATION SHEET

For generating a complete calibration report press the print “calibration sheet...” button in the main screen. The “Calibration sheet printing screen” will pop up.

**NOTE:** For the printing option, Microsoft Excel software needs to be installed on your PC.

In this screen all relevant data can be added and DMFC settings can be chosen to be printed on the calibration sheet. When all data is filled in press the “Print...” button.
in order to start Excel. Excel will automatically generate the calibration sheet. After processing of the data a dialog box “Cal sheet” will pop up.

*Figure 9 Cal sheet screen*

In the “Cal sheet” screen the options are “printing” and/or “editing” calibration sheet.

**NOTE:** Before pressing “Ok”, to print the calibration sheet, make sure the printer is connected and on-line.
4 Tooldata

4.1 INTRODUCTION TO TOOLDATA

Smart Service uses the Brooks Vol-U-Meter calibration equipment for verifying the DMFC’s (see Product Data Sheet 1060 for Vol-U-Meter products). Tooldata is an additional program for entering Vol-U-Meter relevant information; i.e. volumes, toolnumber and piston pressure. Smart Service uses the tooldata file during linearization of the DMFC. Depending on the full scale flowrate of the DMFC, a Vol-U-Meter size has to be chosen. Vol-U-Meter information for several Vol-U-Meters can be saved and edited in this program.

4.2 TOOLDATA PROCEDURE

Start Tooldata by double clicking the Tooldata icon.

Creating a new Tooldata file:

1) Click on the file button to open the “Open tooldata file” dialog box.
2) Under “file name” enter a name for the Vol-U-Meter data file (for example 3500cc.tda) and click on the OK button. A new dialog box will pop up.

3) Confirm to create this file.
4) Fill in all relevant information like “toolnumber”, “Piston pressure” (in mbar) and “calibrated volumes” (in ml, determined by an authorized calibration institute).
5) Click the “Save” button and close the program by clicking the “Close” button.
LIMITED WARRANTY
Seller warrants that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and service and that the Software will execute the programming instructions provided by Seller until the expiration of the earlier of twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller. Products purchased by Seller from a third party for resale to Buyer (“Resale Products”) shall carry only the warranty extended by the original manufacturer.
All replacements or repairs necessitated by inadequate preventive maintenance, or by normal wear and usage, or by fault of Buyer, or by unsuitable power sources or by attack or deterioration under unsuitable environmental conditions, or by abuse, accident, alteration, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer’s expense.
Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller.

BROOKS SERVICE AND SUPPORT
Brooks is committed to assuring all of our customers receive the ideal flow solution for their application, along with outstanding service and support to back it up. We operate first class repair facilities located around the world to provide rapid response and support. Each location utilizes primary standard calibration equipment to ensure accuracy and reliability for repairs and recalibration. The primary standard calibration equipment to calibrate our flow products is certified by our local Weights and Measures Authorities and traceable to the relevant International Standards.
Visit www.BrooksInstrument.com to locate the service location nearest to you.

START-UP SERVICE AND IN-SITU CALIBRATION
Brooks Instrument can provide start-up service prior to operation when required. For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

CUSTOMER SEMINARS AND TRAINING
Brooks Instrument can provide customer seminars and dedicated training to engineers, end users and maintenance persons. Please contact your nearest sales representative for more details.

HELP DESK
In case you need technical assistance:
| Americas | +1-888-554-FLOW |
| Europe | +31-318 549 290 |
| Asia | +011-3-5633-7100 |

Due to Brooks Instrument’s commitment to continuous improvement of our products, all specifications are subject to change without notice.

TRADEMARKS
Brooks ........................................ Brooks Instrument, LLC
Buna .............................................. DuPont Dow Elastomers
Kalrez ........................................ DuPont Dow Elastomers
Teflon ........................................... E.I. DuPont de Nemours & Co.
Viton .......................................... DuPont Performance Elastomers