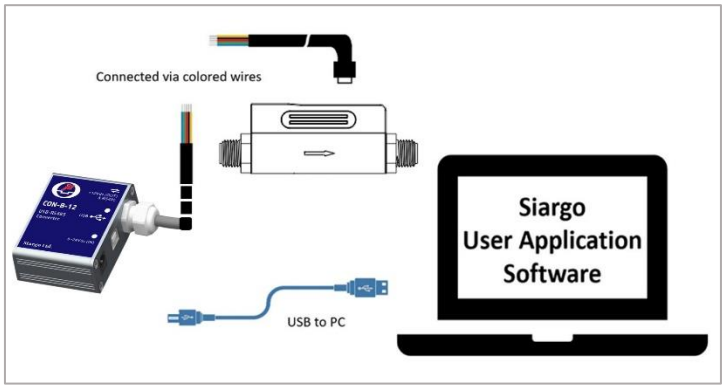
Siargo Ltd.

User Guide for Product Evaluation Kit

VA.1.0



Production Evaluation Kit

All Siargo Sensing Products

User Guide

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Attention!

- Please carefully read this manual prior to operating this product.
- Do not open or modify any hardware which may lead to irrecoverable damage.
- Do not use this product if you suspect any malfunctions or defection.
- Do not use this product with corrosive media or in a strong vibration environment.
- Use this product according to the specified parameters.
- Only the trained or qualified personnel shall be allowed to perform product services.

Use with caution!

- Be cautious for the electrical safety, even it operates at a low voltage, any electrical shock might lead to some unexpected damages.
- The gas to be measured should be clean and free of particles. Do not apply this meter for liquid medium.
- Do not apply for any unknown or non-specified gases that may damage the product.
- For remote data, please be sure the meter is properly configured.

Table of Contents

1. Overview

CON series are designed for user evaluation of Siargo's current off-the-shelf products for basic performances. It has hardware that converts the digital output (I2C, RS485, RS232, and RS232-TTL) output of Siargo's current products into the format that can be directly read by a Microsoft Windows-based personal computer via the USB. For demonstration purposes, Siargo also offers free downloadable software that allows the user to access the basic digital functions of the products and enables the user to evaluate the basic performance of the specific product without additional work. For some simple applications, this Kit provides a plug-and-play option. It can read from up to 128 sensors with the RS485 interface in serial.

This series of Kits are matching to the complete product family.

The current version of the software is 1.2.0.0.

Features

- For an easy evaluation of the product's basic performance and functions
- Plug-and-play for simple applications
- Free downloadable Microsoft Windows-based software
- All cables are included
- Work with multiple devices
- Limited customization optional

2. Receipt / unpack of the products

2.1. Hardware/converter

Upon receipt of the products, please check the packing box before the dismantlement of the packing materials. Ensure no damages during shipping. If any abnormality is observed, please contact and notify the carrier who shipped the product and inform the distributors or sales representatives if the order is not placed directly with the manufacturer, otherwise, the manufacturer should be informed as well. For any further actions, please refer to the return and repair section in this manual.

If the packing box is intact, proceed to open the packing box, and you shall find the product. The power and data USB cable as shown below can also be found in the same packing materials.

Figure 2.1: Digital data reader

Figure 2.2: power and data USB cable

Please check immediately for the model and integrity of the product as well as the power and data USB cable, if any abnormal is identified, please notify the distributor/sales representative or manufacturer as soon as you can. If any defects are confirmed, an exchange shall be arranged immediately via the original sales channel. This user manual shall also either be included in the packing box or via an online request for an electronic version. In most cases, this manual shall be made available to the customer before the actual order.

Please be sure that the digital data reader matches the product interface that you ordered.

The standard cable is a USB cable with one end to be USB-A and another end to be USB-B. As the USB can also power the product, the power adapter will be an option only and will not be supplied unless specially ordered.

2.2 User application software

The user application software is Microsoft Windows 10 compatible, and it offers digital access to the products. It allows the user to read, display, and save the flowrate, accumulated flowrate, pressure, and other parameters that apply to the products that the user ordered. It also allows the user to perform certain actions such as reading the product serial number, Modbus address and changing the standard/reference conditions, change gas medium parameters (if applicable). For some products it also allows the user to perform on-site re-calibration.

The software is free for the customers and may be updated from time to time without further notice.

To download the software, please email aslink@siargo.com to receive a download link. Please write the product name in the subject of the email request.

3 Knowing the products

3.1. Product description

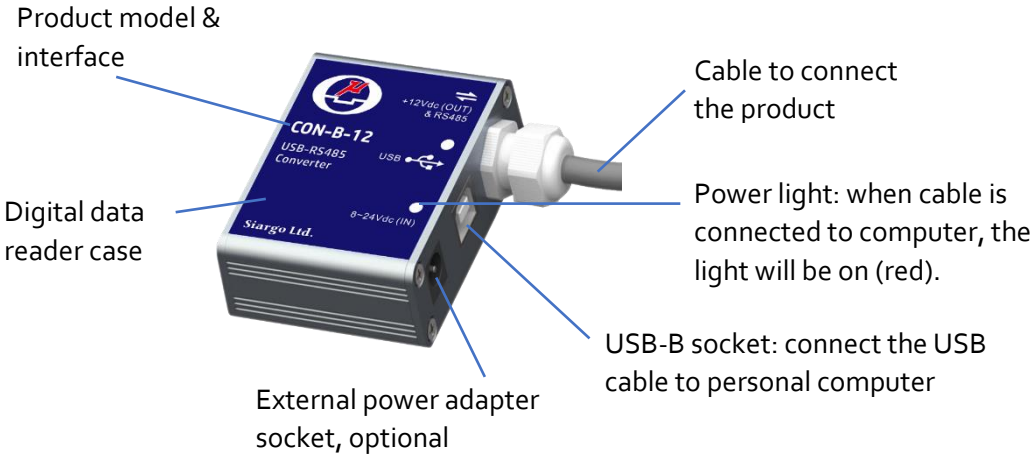


Figure 3.1: Product description

3.2. Power and data cable description

The cable is a standard USB cable with one end having USB-A for connection to a personal computer and another end having USB-B for connection to the product (digital data reader). For most of the products, an external power adapter is not required. Please contact your sales for the detailed information.

3.3. Mechanical dimensions

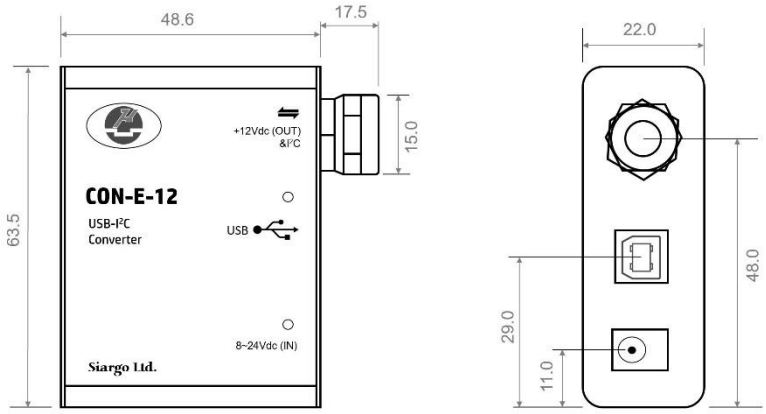


Figure 3.3: The dimensions of the digital data reader.

4 Installation

4.1. Software installation

The downloadable "Siargo User Application" software is a zipped file. After download, please unzip the file and place all files in the zipped file into a single directory.

SiargoUserApplication

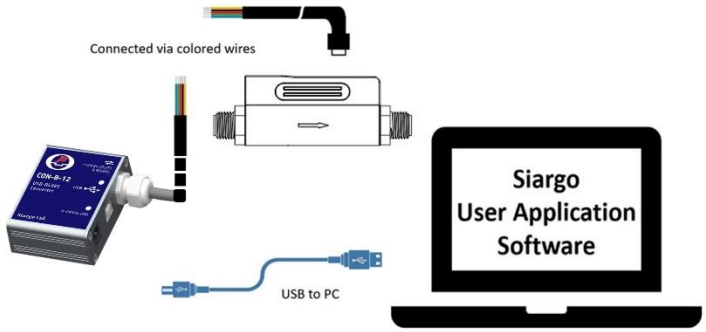
This concludes the installation. No other steps are needed for the installation. To run the software, simply click on the executable "SiargoUserApplication" icon that is inside the above directory on your storage media where you put the unzipped files:

SiargoUserApplication

The application will then start to run. It is recommended that before you start the software, connect the hardware first. In case the digital data reader is unplugged while the software is running, the software may require to restart (exit and run again) to make the communication effective.

4.2. Hardware connection

Refer to the following graph to connect the hardware:



1) Plug the cable attached to the digital data reader into the product. In most cases, the cable will have a plug that matches the product's electrical interface. In case the cable has a colored multiple wire end, please refer to the product user manual for the detailed connection requirements.
2) Plug the USB cable into the digital data reader and the personal computer USB-A socket.
3) Connect the product to a flow media line (optional) or any other devices.

Note: 1. Once the USB cable is plugged into both the digital data reader and the computer, the light on the reader will turn red (power on) which indicates the product is properly powered.

2. Please follow the instruction of the product user manual for product mechanical connections.

Cautions

a) Don't alter any parts of the product.
b) Ensure the cable connection with the digital data reader is properly engaged.
c) Make sure no mechanical stresses in the connections.
d) The strong electromagnetic interference sources close by or any mechanical shocks at the pipeline may also create malfunctioning of the product.
e) Slowly open/close valves at the gas supply piping to prevent abrupt pulse flow impact.

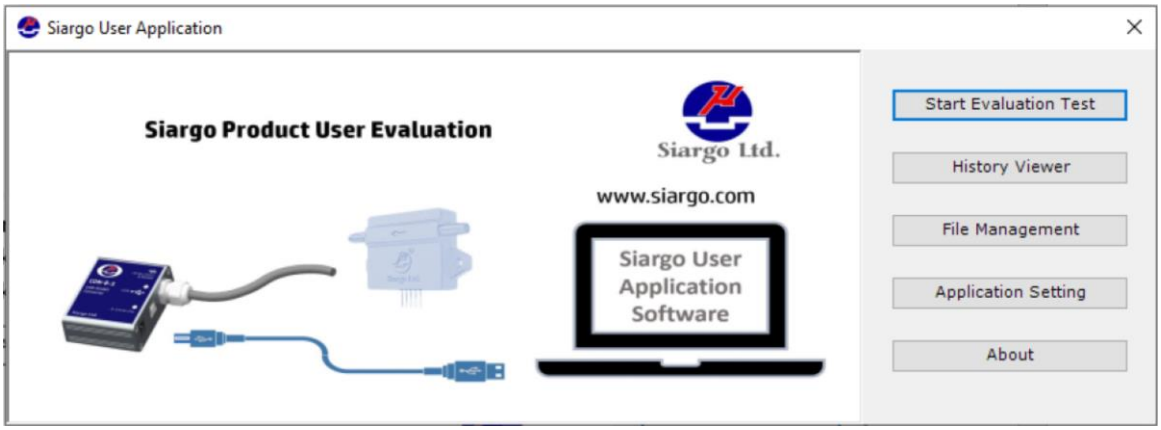
5 User application software

5.1 Check the product specifications

Note: not all functions in the software are applicable for specific products. Contact your sales for more information.

5.2 Basic applications of the software

By clicking on the "SiargoUserApplication" icon in the software directory, the software will start and the Opening Window will appear:



There are 5 executable buttons on the above window:

Start Evaluation Test – This will bring you to the functional windows.

History Viewer – This will allow you to look at the saved data.

File Management – This will enable you to manipulate the files that you saved.

Application Setting – This will open the product selection and parameter windows.

About – This software version and other information.

⚠ **Note:** For the first time use, you need to select and confirm (Save) the product to establish the communication between the product and your computer. You can also set the basic communication parameters that you desire.

Please click on "Application Setting", and perform the following as shown in the following graph:

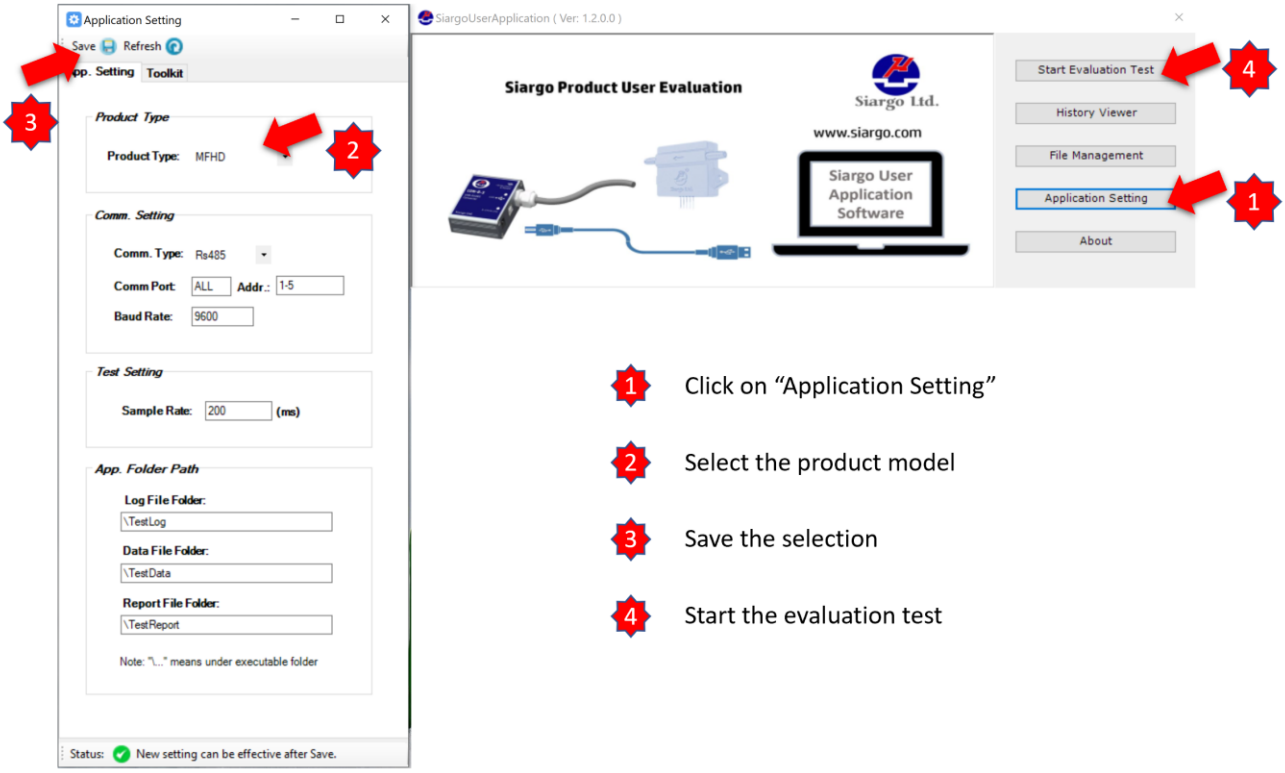


Figure 5.2-1. Establish the digital communication

Note: The product at the time of shipping may have set the default Modbus address to 255. To speed the connection, and no time-out, please set the address to be 1 through 5.

Once you select the product, the other default communication parameters would automatically be set. If you have any doubt, you can also double-check each of the parameters.

If you know the product address, you can input it, with which the first time establishment of the communication between the product and your computer could be faster.

In addition, you can also set the location where you want to save the data files by changing the default destination at the lower left of the above graph.

Before you start the product evaluation test, this "Application setting" window also allows you to change the product default address. Select the "Toolkit" tab on the Application Setting window, and it will bring you the digital address window. At the time of shipping, the default value of the address (either I^2C or RS485) will be "2" or "1". The I^2C address must be an even number.

This software allows you to change the default address to your desired I^2C or RS485 Modbus address, up to 128 different ones.

See the first graph on the next page for additional information. (Figure 5.2-2).

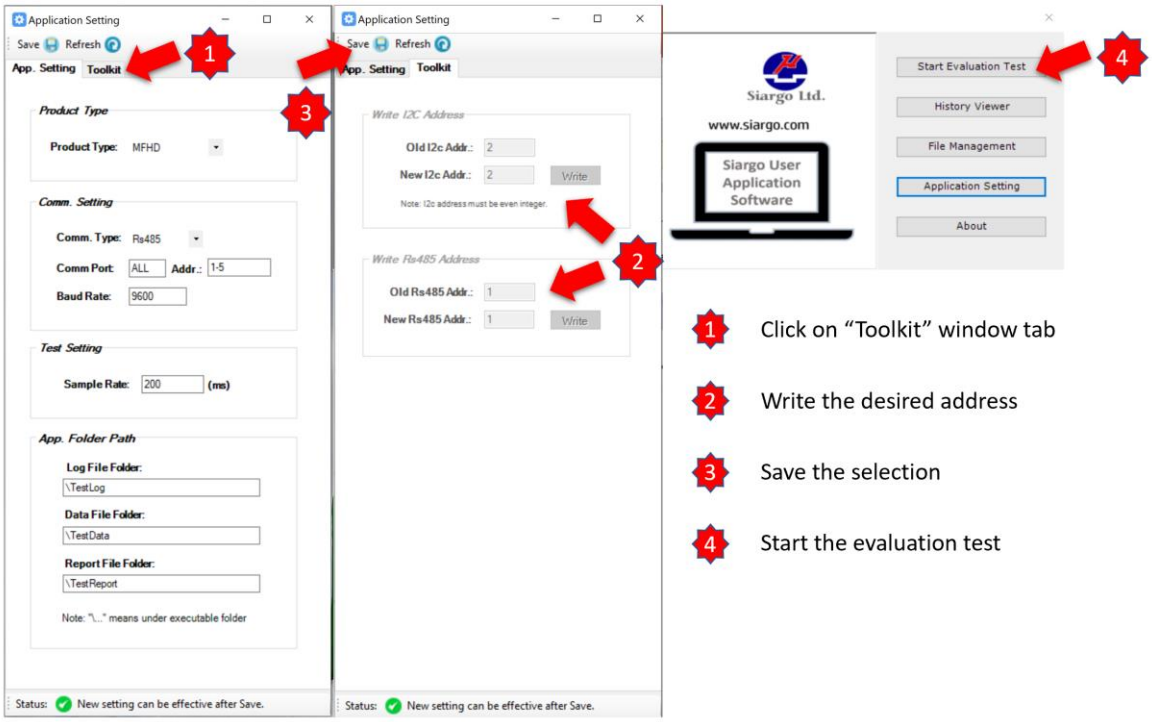


Figure 5.2-2. Change the default digital address

Once the program starts, wait for up to 40 sec for the meter to establish the communication with the computer. The waiting time depends on the computer's USB port speed and other parameters. Once the communication is established. The product name and serial number (if available, otherwise it will use a dummy one) will be displayed in the "Test Control" window.

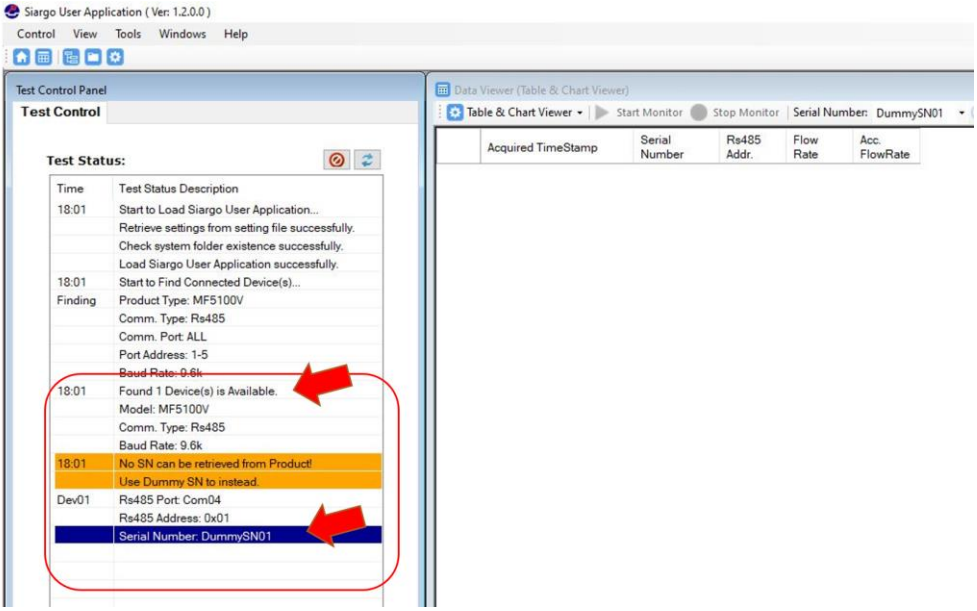


Figure 5.2-3 Establish the digital communication

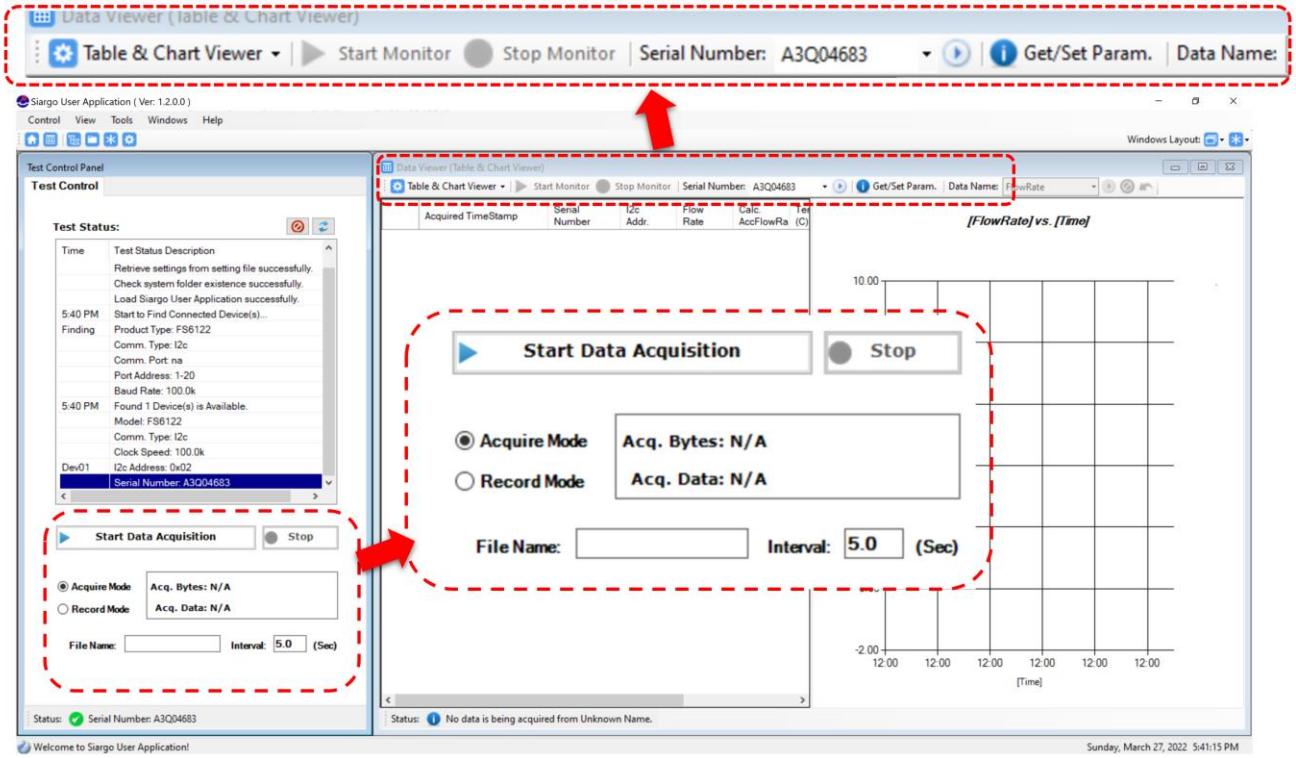
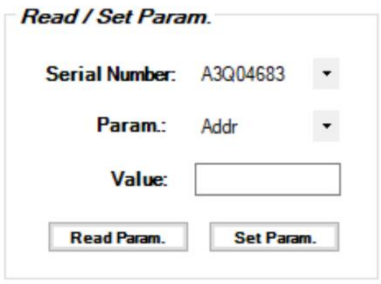


Figure 5.2-4. Main windows of the software during tests

After you click on the "Start Evaluation Test", it will bring you to the main windows of the software, for which there are two windows. One is the "Test Control" window in which you have the "Test Status" which will show you the results of the product communication establishment process, and any other results after you execute a command during the tests. At the bottom of the "Test Control" window, see the inset expansion in Figure 5.2-4, two options can be selected. One is the "Acquire Mode" for which only data acquisition will show on the screen, and the second one is "Record Mode" for which you can record/save the acquired data. The interval is the time that data will be saved. The default time is 5 sec. Once you are ready, you can then click on the "Start Data Acquisition", then the data and the corresponding graph will be shown in the "Table and Chart Viewer" window.

In the "Table and Chart Viewer" window, several tool options can be accessed via the toolbar, see the top expansion in Figure 5.2-4. The default view of the window shows both the data and graph of a specific output parameter (default is mass flow rate). You can use the pull-down menu of "Table & Chart Viewer" to select data only, the graph only, or both. The toolbar also offers the start and stop of the data acquisition, and it will show the serial number of the product. When you have connected to multiple products, this tool will be a pull-down menu that lists all product serial numbers in tests. You can select any of them to show the particular product data on the Viewer window.

Refer to the graph on the top left on the next page, the "Get/Set Param." on the "Tabel and Chart Viewer" window is a tool that you can use to read and set some basic functions of the products. Double click on this button, the "Read/Set Parameter" window will be hidden.



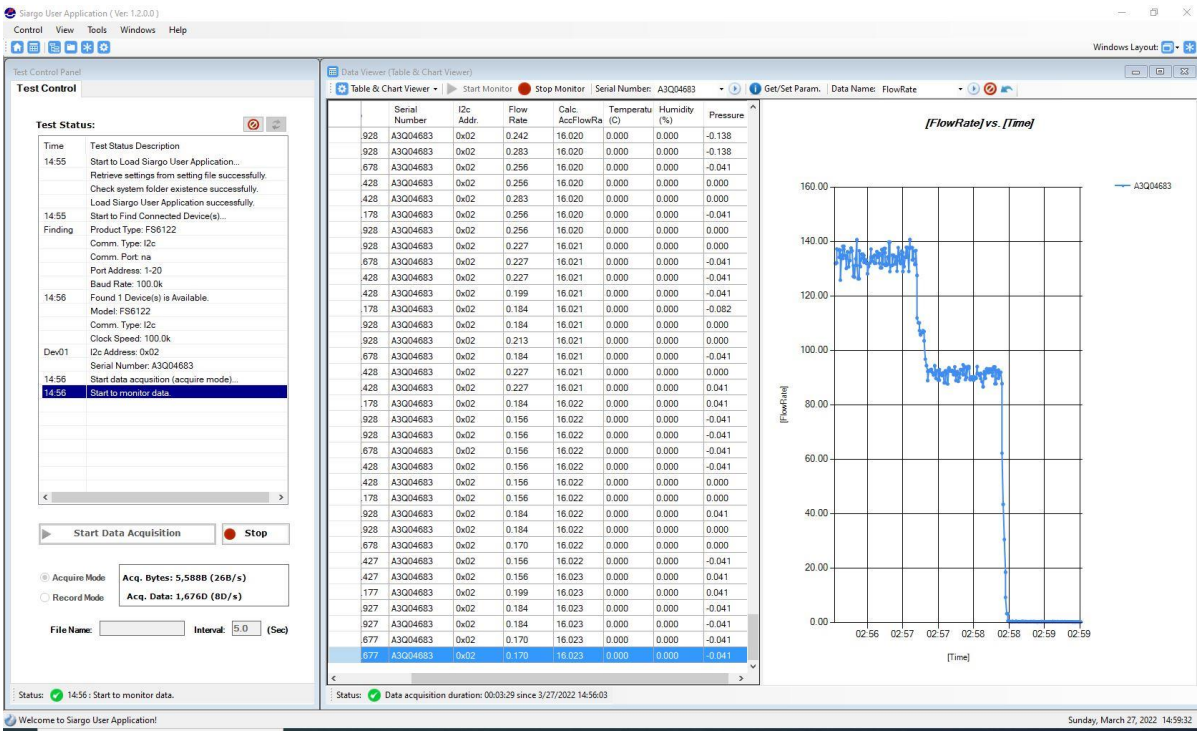
Depending on a specific product and available options, you can set the flow and pressure offset. If you have multiple products connected, use the serial number pull-down menu to select the product that you like to reset the offsets.

The parameter pull-down menu allows you to read and write parameters into the products. When a new value is inputted, click on the "Set Param." Button to confirm the input. If the input is successful, then you can also find the message from the "Test Control" window on the left of the screen.

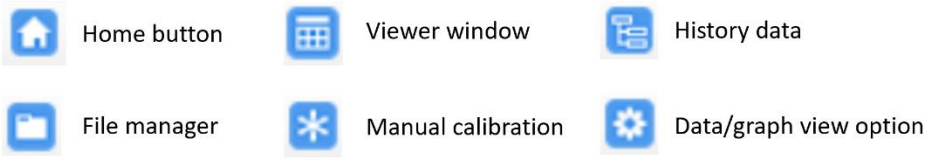
Using these parameter options, you can read/change the address for products having I²C or RS485 Modbus interface. Also, you can change the "Gas conversion factor" or "GCF" if the option is available. The GCF can be used to change reference conditions, correct system deviation, and change calibration gas type. For detailed information, please refer to Sec. 8 of this user guide. Again, you can use the serial number pull-down menu in case multiple products are connected.

The default graphic view is mass flow rate. If you like to see the plot of pressure or temperature or other parameters, if available for some products, use the "Data Name" option on the toolbar to select the data type you like to plot.

A typical example of a mini-blower flow rate measurement is shown below:



There are 6 icon buttons on the main toolbar which offer easier access to the above-mentioned functions.



5.3 Manual calibration

It is also possible to use this software to perform limited re-calibration by manually inputting the data read from your reference meter and the data read from the product. It is recommended that this should be done only by experienced users. Please contact the manufacturer for further information.

5.3.1 The basic requirement for calibration

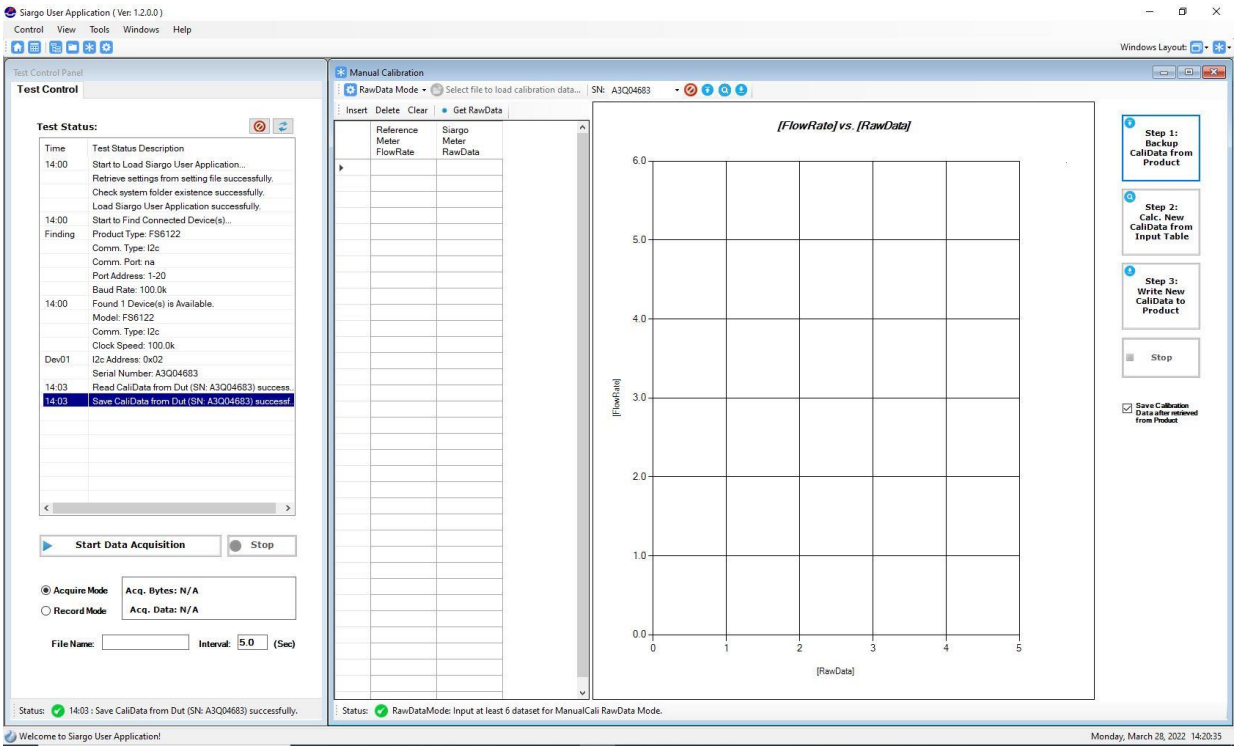
Calibration of the gas flow meter can be tedious. Many articles can be found on the internet for attention during the calibration of a gas flow meter. Briefly, one will need an accurate reference meter with an accuracy of at least 3 times better than the meter to be calibrated. In other words, the meter to be calibrated with your reference meter will likely have 3 times worse accuracy. Secondly, the reference should work in a close possible working principle of the meter to be calibrated. For example, Siargo's products are measuring the mass flow via flow speed. When one tries to use a volumetric flow meter standard to calibrate a speed based mass flow meter, the volume driver should be able to run at a constant speed for a certain period within which the meters to be calibrated can have a stable metering time that needs to be sufficient compared to that of the meters' set response time.

All connections of the flow calibration setup should avoid abrupt changes in pipe diameter, and avoid using excessive valves, and connections. Refer to Sec.8.2.2. One needs to ensure the complete setup can provide a stable flow condition, with environmental conditions as close as possible compared to the original calibration conditions (20°C, 101.325kPa, and relative humidity at about 30 to 80%RH). The calibration gas medium should be dry and clean with any impurities less than 1%.

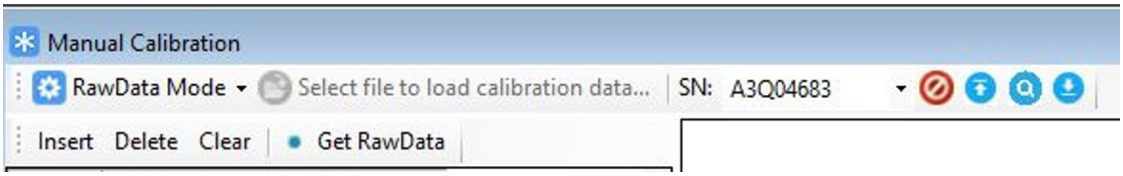
5.3.2 Brief description of the manual calibration process

The current software by no means replaces the calibration software used in the manufacture of the products, but it can offer a quick on-site correction of the errors that could come from the bent piping, some instability yet repeatable circumstances. The best use of this manual calibration shall be for a limited flow range (not for the full dynamic range).

Click on the manual calibration icon on the main window's toolbar, it will open the manual calibration window:



The expanded manual calibration window toolbar is as follows,



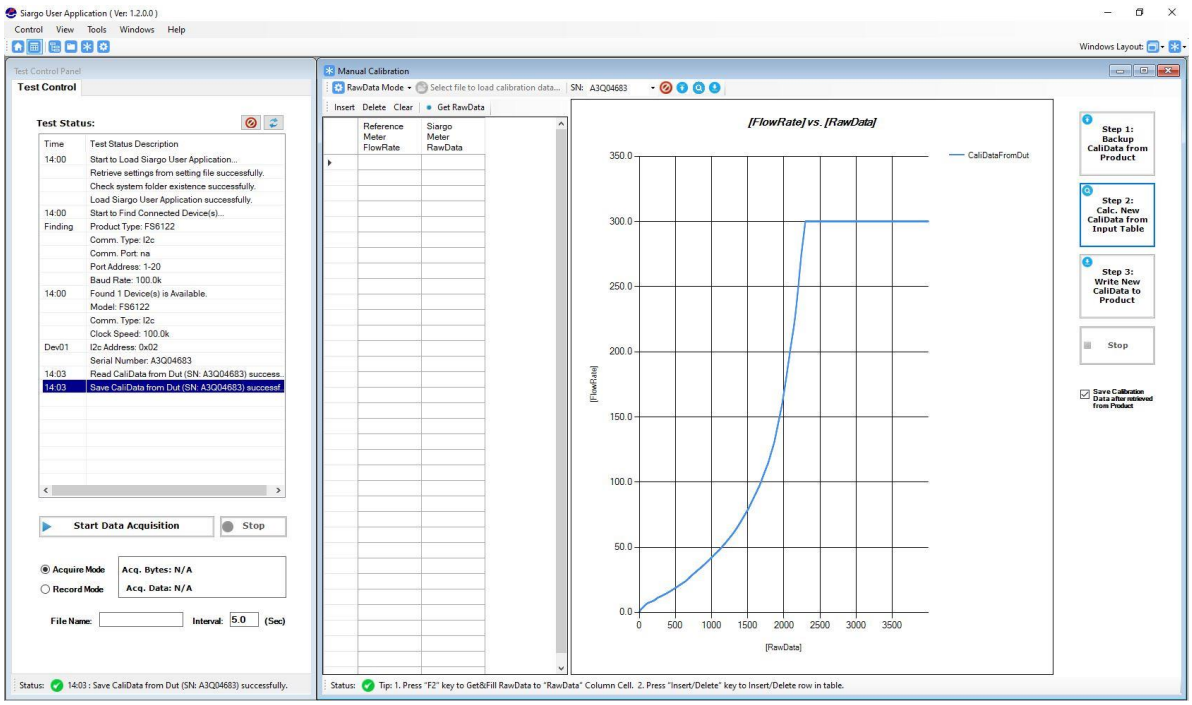
The functions of the icons on the top right:

Stop; Backup the meter original calibration;

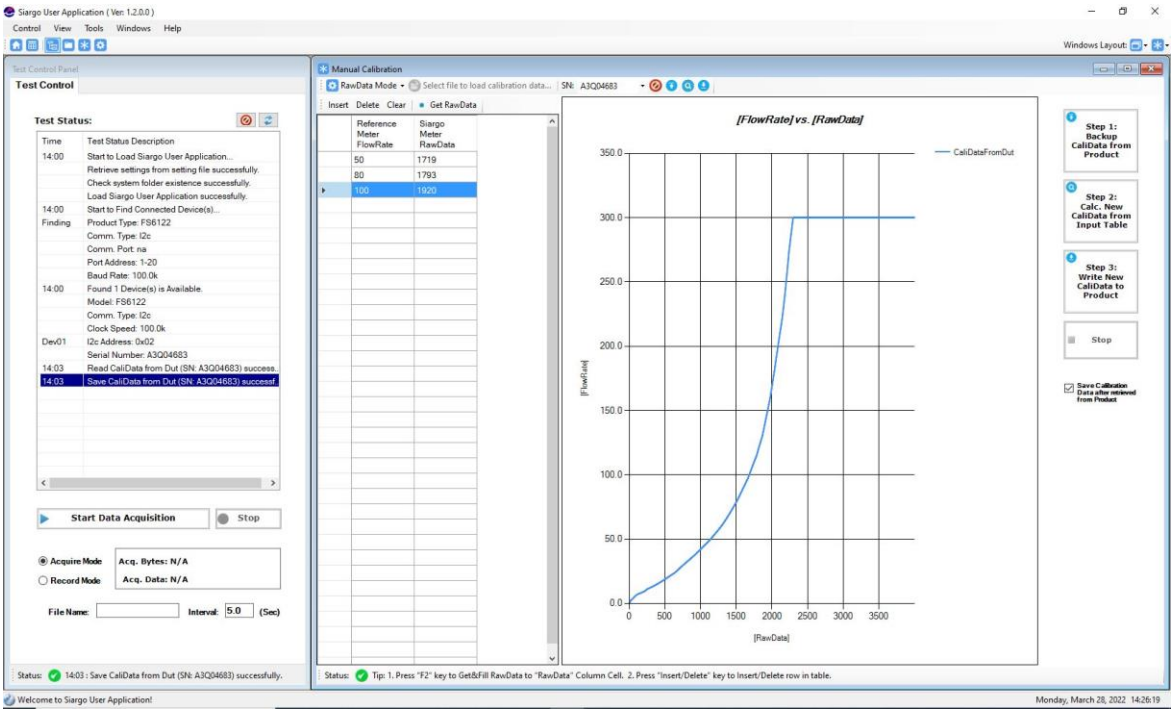
Curve fitting based on the manual calibration data; Write the manual calibration data.

You can use this software to test the flow stability of your calibration system by looking at both the output of your reference meter and the output curve of the product at the calibration range that you intend to perform. Look at the SN shown on the toolbar to ensure that you have the correct product for calibration. Select the "RawData Mode" from the pull-down menu on the toolbar.

Before you start the manual calibration, it is advised that you back up the original meter calibration data in case you need to reload them. After the data are backup, the original calibration curve will be shown in the graphic window as below:



Then, you can start the calibration process by tuning your reference meter to the desired flowrate that you like to calibrate. After you have stable readings from both your reference meter, you can then manually enter the first flow rate you like to calibrate at the first row under the "Reference Meter Flowrate" column. And click on the "Get RawData" button above the data window. The data from the meter to be calibrated will show in the "Siargo Meter RawData" column. Repeat this process until all flow rates are measured.



Then click on the curve fitting icon, to start the curve fitting that will include the data you take and the original manufacturer data to obtain the new calibration curve. While doing this, the mouse cursor will be in a busy status. Wait until the process is finished that shall be depending on the number of data points added and the computer you have. When the fitting process is done, you can then write the curve into the product by clicking on the "data write" icon.

This shall conclude the manual calibration process.

Note: it is recommended to use this option only for limited correction of the original calibration curve or the meter does not deviate significantly from the original calibration. In case you want to do a completely new calibration. You may want not to back up the original data but directly take all-new calibration data points. It is recommended to have at least 11 data points for the complete range depending on your system stability and the dynamic range that you need to have.

For further questions, please contact the manufacturer.

6 Product selection and order information

6.1 Product selection

Model	Applicable product(s)
CON-B-5	MF5000 (with hazardous rating)
CON-B-12	FS4000 (RS485); AM1000 (RS485); FS6100 (RS485); MF4000 (RS485); MF4600 (RS485); MF5100V; MF5000; MF5100; MF5600; MF5700; MF5709; MF5806-G; MF5806; MFGD; MFHD; CS3001 (RS485); HMF2000 (RS485)
CON-C-12	FS4001 (RS232); FS4000 (RS232); MF4000 (RS232); MF4600 (RS232)
CON-E-3	FSP1000; FSP2000
CON-E-5	FS6122; FSP2000
CON-E-12	FS4001 (I^2C); FS5001L; FS8001; AM1000 (I^2C); FS6100 (I^2C); FS5200; LF6000 (I^2C); CS3001 (I^2C); HMF2000 (I^2C)

Note: Please make sure your product's configuration, and select the correct model for your order.

6.2 Order contact and customer support

The sales offices and the sales distributors/representatives are listed at the end of this document. For small quantities, the order can be placed either through the Siargo website: www.siargo.com or the sales office. For large quantities, please contact the sales office, distributors, or sales representatives.

Siargo is making every effort to ensure the quality of the products. In case of questions and/or product support, please contact the customer service listed at the end of the document.

7 Technical specifications

Input	I²C / RS485 / RS232 / RS232-TTL
Output	USB-A
Power supply	PC USB or external 8~24Vdc
Software	Microsoft Windows 8.0 and above compatible, downloadable
USB cable for data	Included, 1.5m.
Cable for product	Included, 0.5 ~ 2 m, depending on the product cable
Power adapter	110~240 Vac to 8~24Vdc included.

8 Technical notes for use of the evaluation kit

8.1 Use with caution

This evaluation kit is designed for assisting the customer who wants to have a quick evaluation of the product performance. Although it can be used for some simple applications such as recording the digital output, changing the reference conditions, correcting system deviation, and changing the measurement gas media from that at the calibration. It also offers an option for using on-site calibration. However, It has no intention to replace the necessary customer programming and other application tasks. Some of the product parameters or functions cannot be accessed via this simple evaluation kit.

Please refer to the corresponding product user manual for additional information.

8.2 Use the "Gas conversion factor, GCF"

8.2.1 Change the reference calibration conditions

For each mass flow sensing product, it requires calibration at specific or standard conditions that normally contain a gas medium, a temperature, and a pressure. Often it happens that the nomenclature of the "standard conditions" could be different in different regions of the world. At the time of shipping, Siargo's products are calibrated with clean air at 20°C, 101.325 kPa.

While the pressure value of the reference/standard conditions is the same 101.325kPa, the standard temperature value can vary. The commonly used ones are 0°C, 15°C, 20°C, and 25°C. With this

evaluation kit, the user can change these reference temperatures by utilizing the "Gas conversion factor" option.

The calculation of the GCF is based on the ideal gas equation:

$$\frac{PV}{T} = Constant$$

For example, if you like to change the reference/standard temperature from the one calibrated at 20°C, 101.325kPa to a reference meter calibrated at 15°C, 101.325kPa, the factor can be calculated as follows (assume the pressure value is the same as 101.325kPa):

$$GCF_{15} = \frac{V_{15}}{V_{20}} = \frac{T_{15}}{T_{20}} = \frac{273.15 + 15}{273.15 + 20} = 0.9829$$

In the program, the GCF is equal to the calculated value of x1000. Therefore, you can input a value of 983 and save it to complete the change of the reference conditions.

8.2.2 Correct a system deviation

It is very common that a user may compare the data from the product with a third-party reference meter, and in many cases, there could be some discrepancies.

When performing such a comparison, please note that the reference meter should have a better-specified accuracy (about 1/3 of the product), and pay special attention to the differences in the reading accuracy and full-scale accuracy.

A full scale accuracy = reading accuracy x (full scale flow rate/ set point (current) flow rate)

Another key point to comparing the different flow meters is that as long as the fluidic flow is a continuous flow without pulsation, then the fluidic dynamic will have the system following the Bernoulli equation:

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

where ρ is the fluid density; g is the acceleration due to gravity; P1 is the pressure of the reference meter; P2 is the pressure at the test meter; v1 is the velocity of the reference meter, and v2 is the velocity of the test meter. h1 and h2 are the corresponding height for the meters which in most cases is the same in the system. Therefore, it would be very critical to have the system not have a pressure variation. (This explains our recommendations for the installations in Section 4). Also, the meter measurement principle is often very important for the understanding of any discrepancies.

Please note for comparison with a rotameter, the reading could have large deviations due to the different measurement principles, in particular as a rotameter is sensitive to pressure and temperature variations.

However, if the system is properly set, such a deviation should be a constant one. In this case, you can use the GCF to correct the system deviation by measuring at least 3 data points using your reference meter and applying the least square fitting to get the deviation constant and then apply this constant to the GCF (your constant x 1000).

8.2.3 Apply to a different gas medium

The product is calibrated with a high precision NIST traceable metrological standard with clean and dry air. Thanks to the unique thermal sensing technology, the sensor can be applied to meter the other clean and dry gas with similar thermal diffusivities without losing accuracy. It effectively solves the nonlinearity issues of applying a gas conversion factor in calorimetric sensing, making the measurement highly accurate in a large dynamic range. Gases that can be applied include air, N_2, O_2, Ar, CO_2, and many others.

This innovative product operates also follows the basic sensing principle described in the international standard for thermal mass flow meters (ISO 14511:2001 - Measurement of fluid flow in closed conduits — Thermal mass flowmeters). For gases with different diffusivities, a gas conversion factor could be applied. But due to the meter assembled procedure, the head loss value from the meter to the meter would not be 100% identical, and at the large dynamic measurement range, the thermal response would also have some deviations and nonlinearity from gas to gas. Therefore, measurement by the sensor for a gas medium with substantially different diffusivities compared to that of the calibration gas would bear larger measurement errors, particularly at the low Reynold number range where the laminar flow has a sensitive flow profile.

Please note, unlike the change of standard/reference conditions, a change of the gas medium may lead to a change in the measurable dynamic range. Siargo offers limited gas conversion factors for different gases, please contact the manufacturer for detailed information.

8.3. Customer calibration

The software also offers customer calibration options in the limited dynamic range. This is because the dynamic range is limited by the hardware amplification at the time of shipping. For further information, please contact the manufacturer.

9 Troubleshooting

Phenomena	Possible causes	Actions
No communication	Power not connected or not sufficient	Connect the power, check the cable
	Cable connection incorrect	Check cable
		Check the reader power indicator
		Check PC USB port
		Check the digital reader interface type
	Incorrect product selection	Check product name on software, make sure to save after selection
	Incorrect baud rate selection	Try start with 9600
	Digital reader failure	Return to factory
The data file cannot be found	Incorrect file location	Check software setting
Large errors or unexpected flow rate	Particles, fluid type	Check system
	Mechanical connection	Check system
	Product error	Check the product user manual
Erroneous or large noise	Vibration, unstable flow	Check system
Offset unstable	Circuitry instability	Check system, power off

10 Warranty and Liability

(Effective January 2018)

Siargo warrants the products sold hereunder, properly used, and properly installed under normal circumstances and service. As described in this user manual, it shall be free from faulty materials or workmanship for 180 days for OEM products and 365 days for non-OEM products from the date of shipment. This warranty period is inclusive of any statutory warranty. Any repair or replacement serviced product shall bear the same terms in this warranty.

Siargo makes no warranty, representation, or guarantee and shall not assume any liability regarding the suitability of the products described in this manual for any purposes that are not specified in this manual. The users shall be held full responsibility for validating the performance and suitability of the products for their particular design and applications. For any misusage of the products out of the scope described herein, the user shall indemnify and hold Siargo and its officers, employees, subsidiaries, affiliates, and sales channels harmless against all claims, costs, damages, and expenses or reasonable attorney fees from direct or indirect sources.

Siargo makes no other warranty, express or implied, and assumes no liability for any special or incidental damage or charges, including but not limited to any damages or charges due to installation, dismantling, reinstallation, etc. other consequential or indirect damages of any kind. To the extent permitted by law, the exclusive remedy of the user or purchaser, and the limit of Siargo's liability for any and all losses, injuries, or damages concerning the products, including claims based on contract, negligence, tort, strict liability, or otherwise shall be the return of products to Siargo, and upon verification of Siargo to prove to be defective, at its sole option, to refund, repair or replacement of the products. Regardless of form, no action may be brought against Siargo more than 365 days after a cause of action has accrued. The products returned under warranty to Siargo shall be at the user or purchaser's risk of loss and will be returned, if at all, at Siargo's risk of loss. Purchasers or users are deemed to have accepted this limitation of warranty and liability, which contains the complete and exclusive limited warranty of Siargo. It shall not be amended, modified, or its terms waived except by Siargo's sole action.

This manual's product information is believed to be accurate and reliable at the time of release or made available to the users. However, Siargo shall assume no responsibility for any inaccuracies and/or errors and reserves the right to make changes without further notice for the relevant information herein.

This warranty is subject to the following exclusions:

(1) Products that have been altered, modified, or have been subject to unusual physical or electrical circumstances indicated but not limited to those stated in this document or any other actions which cannot be deemed as proper use of the products;

(2) Products that have been subject to chemical attacks, including exposure to corrosive substances or contaminants. In the case of battery usage, long term discharge or leakage induced damages;
(3) Products that have been opened or dismantled for whatever reasons;
(4) Products that have been subject to working conditions beyond the technical specification as described by this manual or related datasheet published by the manufacturer;
(5) Any damages incurred by the incorrect usage of the products;
(6) Siargo does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies;
(7) Products that are re-sold by unauthorized dealers or any third parties.

11 Service contact

Siargo Ltd. is making every effort to ensure the quality of the products. In case of questions, and or product support, please contact customer service at the address listed below. We will respond to your request in a timely fashion and will work with you toward your complete satisfaction.

Customer service and all orders should be addressed to

Siargo Ltd.
3100 De La Cruz Boulevard, Suite 210,
Santa Clara, California 95054, USA
Phone: +01(408)969-0368
Email: info@Siargo.com

For orders, please provide an accurate and full postal address. Siargo will not ship to P.O. Boxes or via a third party.

For further information and updates, please visit www.Siargo.com.

Appendix I: Document history

Revision A.0.1 (March 2022)

First release.

Software Version 1.2.0.0.

Revision A 1.0 (April 2022)

Add manual calibration option description for Software Version 1.2.0.0.

Add solution to default Modbus address time-out issue.