Siargo Ltd.

Smart Gas Monitor Device VA.6

Enabled with CAT-M LTE

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CF5800

User Manual

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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 in a strong vibrational and electromagnetic environment.
- Do not use this product with HF surgical equipment.
- 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 oxygen. Do not apply this smart gas monitor for any other purpose.
- Training of the operator should be performed before use .
- CAT-M wireless is a local network, excellent for data safety and reliability. Some knowledge of the system is required for the communication.

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1. Brief Introduction

This product can be applied for metering, monitoring gases, and transmitting the data to a designated cloud data center. The applications include monitoring oxygen concentrator usage for home care and managing oxygen cylinders for individual oxygen supply. It aims to assist the supplier in the practical and remote management of the usage of an oxygen concentrator, cylinder, or other sources. The data will enable better customer service, prevent supply shortages, reduce inventory, and improve manufacturing efficiency.

The data acquisition can be fully customized. For a typical home care oxygen therapy, an oxygen concentrator is used as a therapy source. This product can be directly connected to the oxygen concentrator, medical oxygen cylinders, or other sources. The total consumed oxygen, instant oxygen flow rate, time, and oxygen temperature during therapy can be recorded and transmitted to the data center via the CAT-M module (a local SIM card will be required). These data will assist in analyzing and understanding therapy's effectiveness.

The product can also be used for other clean, dry, non-corrosive, non-flammable, and non-explosive gas management.

The product is powered by a C-cell lithium-ion battery with a supercapacitor for IoT applications. The battery could not be shipped together with the product due to freight restrictions, but it can be easily purchased from battery suppliers, such as SAFT.

Applications

Home care, nursing homes, rehabilitation centers, etc.

- Medical oxygen (gas) cylinder;
- Liquid oxygen vessel;
- Portable oxygen system (liquid or concentrator);
- Possibly oxygen concentrator compliance monitoring and metering.

USE

CF35800 is intended for use in a Controlled or Pollution Degree 2 environment, for use in indoor, dry locations.

EU Conformity Statement

Hereby, Siargo declares that the radio equipment type CF3580o Smart Gas Monitor Device complies with Directive 2014/53/EU.

RF Exposure Information

This device has been tested and meets applicable limits for Radio Frequency (RF) exposure.

Frequency Bands (UL: CAT-M1):

- Band20: 832~862 MHz;
- Band28: 703~748 MHz.

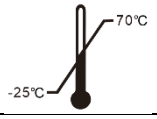
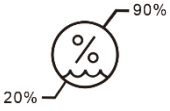
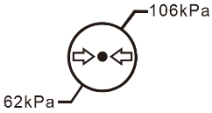
Transmit Power Ranges (CAT-M1):

- Band20: 20.18dBm;
- Band28: 19.67dBm.

Symbols Description

Table 1.1: Symbols description of the package and label

	Caution in USE.
	The product complies with Directive 2014/53/EU.
	The product should be disposed of under the Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC).
	Refer to the instruction manual.
IP41	IP stands for "Ingress Protection". An IP41 rating means the equipment is protected against solid objects larger than 1 mm (such as tools, wires, etc.), and it can also protect against vertically falling water drops. When the equipment is tilted up to 15 degrees from vertical, dripping water will not cause harmful effects to it.

	Indicates the product manufacturer's name and address.
	Indicates the authorized representative in the European Union.
	Indicates the date when the product was manufactured.
UDI	A Unique Device Identifier (UDI) is a distinctive code assigned to a medical device. It's used to identify and track the device throughout its lifecycle.
	Correct the upper-right position of the package.
	The contents of the package are fragile; therefore, it shall be handled with care.
	The package shall be kept away from rain.
	Maximum 8 identical packages, which may be stacked on one another.
	The temperature limits are between -25 °C and 70 °C, within which the transport package shall be stored and handled.
	The humidity limits are between 20%RH and 90%RH, within which the transport package shall be stored and handled.
	The atmospheric pressure limits are within 62 kPa ~ 106 kPa, within which the transport package shall be stored and handled.

List of Accessories

There are no cables, transducers, or other accessories.

Warning on Stacking

Do not stack the products on top of one another. Stacking can cause damage to the components,

including delicate pressure gauges, valves, and tubing. This may lead to inaccurate oxygen flow regulation or even gas leakage, posing significant safety risks.

Additionally, when stacked, it becomes difficult to access and operate each unit properly. Maintenance and inspection tasks also become more challenging, potentially leading to overlooked issues.

Warning on the location close to other equipment

Keep the products at a safe distance from other equipment that may generate heat, sparks, or electromagnetic interference. Heat-producing devices like heaters or high-power electrical equipment can increase the risk of fire when in proximity to oxygen, as oxygen supports combustion.

Equipment that emits electromagnetic fields, such as some types of industrial machinery or large electrical transformers, can interfere with the proper functioning of the product's electronic components (if applicable), leading to incorrect readings or malfunctioning of the device.

Avoid placing the products near equipment that could cause physical damage through vibration or impact. For example, machinery with moving parts that cause significant vibrations may loosen the connections of the product over time.

Warning on the portable RF communications equipment

Portable RF (Radio Frequency) communications equipment, such as mobile phones, walkie-talkies, and Wi-Fi-enabled devices, can potentially interfere with the proper operation of the products.

The RF signals emitted by these communication devices can disrupt the sensitive electronic components within the product. This interference may lead to inaccurate readings of oxygen flow rates, malfunction of control systems, or even complete failure of the device.

To ensure the safe and reliable operation of the products, it is recommended to keep portable RF communications equipment at a minimum distance of 30 cm from the product.

Protection of the public mains network

The product is battery-powered and has no relation to the public mains network. Whether it's the considerations regarding the public mains network or any other non-battery-related power-supply scenarios, they do not apply to this battery-powered product. Its operation and performance are mainly determined by the capacity and characteristics of the batteries it uses.

2. Knowing the Products

2.1 Product Description

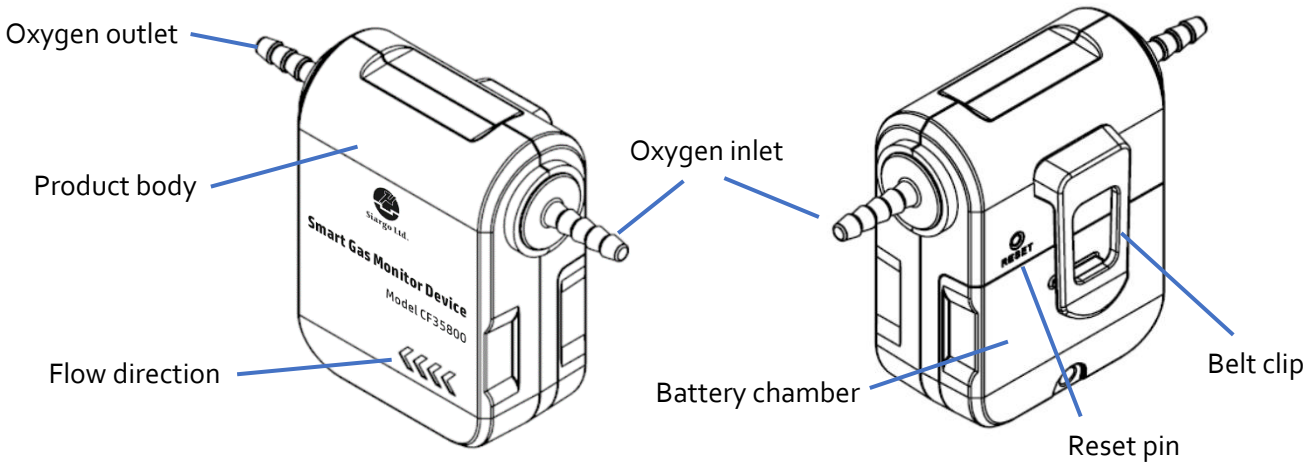


Figure 1.1: CF35800 parts description

2.2 Mechanical Dimensions

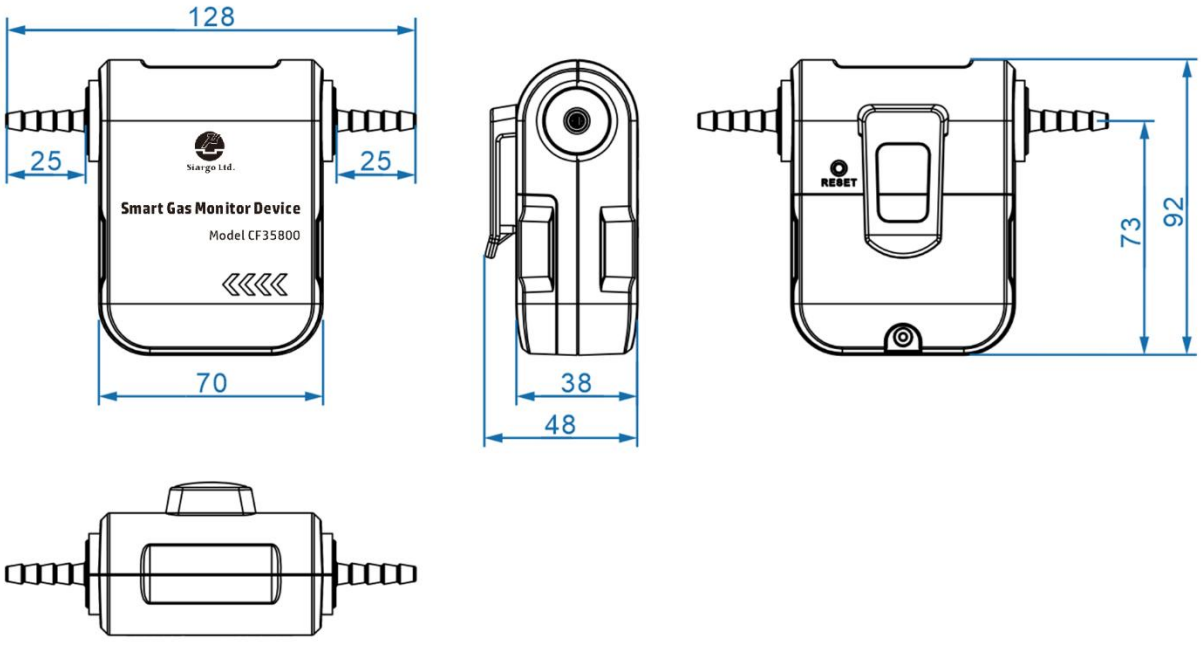


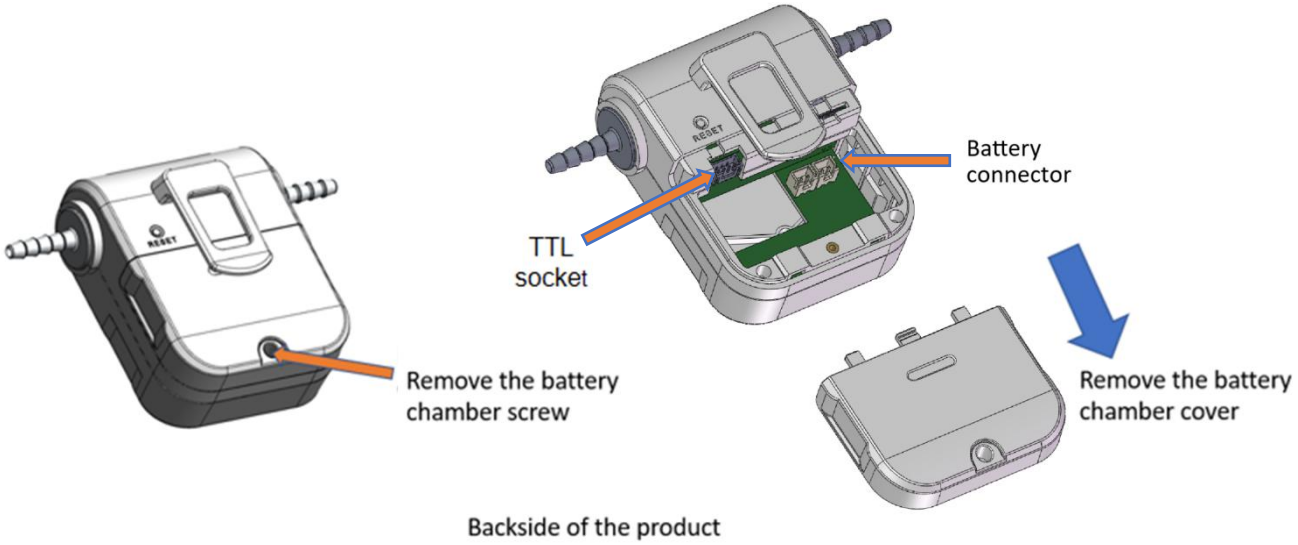
Figure 1.2: CF35800 mechanical dimensions

2.3 Battery Installation or Replacement

The product is powered by a C-size Lithium-ion battery (3.6Vdc) with an 8.5 ~ 9Ah capacity, complemented by a supercapacitor for enhanced performance in IoT applications. Due to the air freight restriction, the battery is not included in the shipment. The local supplier may provide the battery before shipment. If not, please get in touch with your local supplier or distributor.

Caution: The batteries must have a safety certification (IEC 62133).

The battery should offer a lifetime of over 1 year under normal operating conditions. If you need to change the battery or purchase one yourself, ensure it is safety-approved for use with this type of product. If you are not sure, please contact the suppliers for recommendations.



Typical battery for IoT applications:

SAFT LS 26500-20F hybrid primary Li-SOCl2 battery (3.6Vdc C-size bobbin cell fitted with a 20F LIC)

Cautions

a) The batteries should be installed, removed, and replaced by the service personnel designated by the manufacturer, because the replacement of the battery by untrained personnel may lead to dangerous situations.

b) If the product is unlikely to be used for a period of time, the batteries need to be removed.

3. Product Performance

	Value	Unit
Flow range, full scale	0 ~ 20	l/min (SLPM)
Dynamic range	100:1	
Accuracy	±(1.5%rd + 0.15%FS)	%
Working temperature	5 ~ 40	°C
Working pressure	1.0	MPa
Working humidity	0 ~ 95 (no condensation)	%RH
Working altitude	-400 ~ +4000 (62 ~ 106)	m (kPa)
Warmup time	500	msec
Power supply*	Lithium-ion, C-cell, 8.5~9Ah	
Battery life	Minimal 1 year, extended 2 years.	
Output	Serial number, time/date, Instant flow rate, accumulated flow rate/totalizer.	
Data transmission	CAT-M LTE (EU band)	
Data rate	Once per hour	
Manual reset	Totalizer, press for 5 sec, with confirmation (LED) or beep	
Internal data port	TTL	
Storage temperature	-25 ~ +70	°C
Storage humidity	20 ~ 90	%RH
Storage pressure	62 ~ 106	kPa
Weight (without batteries)	180	gram
Protection class	IP41	
Product lifetime	5	years
Compliance	RoHS, REACH, CE: IEC 61000-4-2;4;8	
Gas compatible	Medical oxygen	
Wetted materials	ISO 18562	

*Note: the battery must be the one IoT application, with a super-capacitor to allow the current for data transmission.

4. Operation

4.1 Clear the Totalizer or Accumulated Flow Rate

Press the RESET key to clear the totalizer or accumulated flow rate. The buzzer will ring when the task is clear and successful.

4.2 Communication Parameter Configuration

Connect the converter, and set communication parameters as follows:

Baud rate (Bits per second)	115200 bps
Start bits	1
Data bits	8
Stop bits	1
Even/Odd parity	None

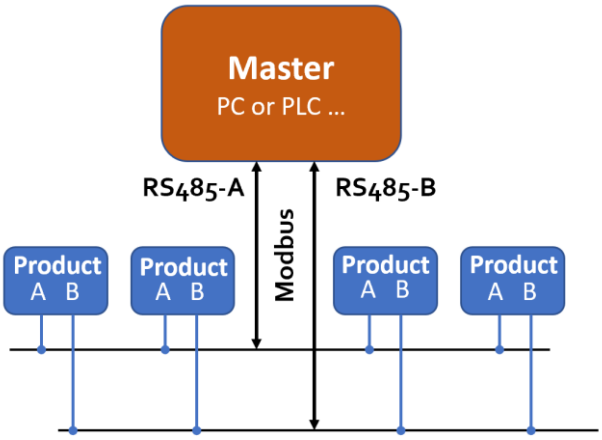
Use the manufacturer-supplied converter to set the URI and URL, see the protocol described below.

4.3 RS485 Modbus Communication Protocol

The digital communication protocol is based on standard Modbus RTU Half-plex mode. A master (PC or PLC) can communicate with multiple slaves (the current product) for data exchange and configuration of communication parameters.

4.3.1 Hardware Connection

The hardware layer is TIA/EIA-485-A, as illustrated below. In this configuration, the product (CF35800) is a slave.



4.3.2 Communication Parameters

The PC UART communication parameters are listed in the following table.

Parameters	Protocol
	RTU
Baud rate (Bits per second)	115200 bps
Start bits	1
Data bits	8
Stop bits	1
Even/Odd parity	None
Bits period	104.2 µsec
Bytes period	1.1458 msec
Maximum data length	20
Maximum nodes	247

4.3.3 Frame

The frame function is based on the standard Modbus RTU framing:

Start_bits	Address	Function codes	Data	CRC	Stop_bits
T1-T2-T3-T4	8 bit	8 bit	N 8 bit (20≥n≥0)	16 bit	T1-T2-T3-T4

Start_bits: 4 periods bit time, for a new frame.

Address: The address can be set from 1 to 247 except for 157 (0x9d). 0 is the broadcast address.

Function codes: Define the product (CF35800)'s functions/actions (slaves), either execution or response.

Data: The address of the register, the length of data, and the data themselves.

CRC: CRC verification code. The low byte is followed by the high byte. For example, a 16-bit CRC is divided into BYTE_H and BYTE_L. In the framing, the BYTE_L will come first, followed by the BYTE_H. The last one is the STOP signal.

Stop_bits: 4 periods of bit time, for ending the current frame.

4.3.4 Function Codes

The Modbus function codes applied for the product are a subclass of the standard Modbus function codes. These codes are used to set or read the registers of the product:

Code	Name	Functions
0x03	Read register	Read register(s)
0x06	Set a single register	Write one single 16-bit register
0x10	Set multiple registers	Write multiple registers

4.3.5 Registers

Functions	Description	Register	Modbus reference
Firmware	Current firmware version(R)	0x007F	40128 (0x007F)
Address	Product address (R/W)	0x0081	40130 (0x0081)
Serial number	Serial number of the product	0x0030 ~ 0x0035	40049 (0x0030)
Flow rate	Current flow rate (R)	0x003A ~ 0x003B	40059 (0x003A)
Accumulated flow	Accumulated or totalized flow rate (R)	0x003C ~ 0x003E	40061 (0x003C)
Battery level	Battery level (R)	0x0048	40071 (0x0048)
Battery voltage	Battery voltage (R)	0x0049	40072 (0x0049)
Time interval *	Timed transmission time(R/W)	0x00A8	40169 (0x00A8)
Flow threshold *	Send traffic threshold(R/W)	0x00D8	40217 (0x00D8)
Heartbeat *	Confirm device online time(R/W)	0x00D9	40218 (0x00D9)
Write protection	Write protection of selected parameters (W)	0x00FF	40256 (0x00FF)
URI	Data receiving platform URI(R/W)	0x8520 ~ 0x8540	74081(0x8520)
URL	Data receiving platform URL(R/W)	0x8560 ~ 0x8580	74145 (0x8560)

Notes: 1, R – Read-only, W – Write only, R/W – Read and write.

2. For the * marked functions, please disable the write protection before executing the command.

The product (CF5800) has multiple registers available for the assignment of the various functions. With these functions, the user can obtain data from products, such as product addresses and flow rates from the registers, or set product functions by writing the corresponding parameters.

The currently available registers are listed in the following table, and the registers may be customized upon contacting the manufacturer. Where R: read; W: write-only; W/R: read and write.

Note: At the time of shipping, the write protection function is enabled except for the address and baud rate. Once the user completes the register value change, the write protection will be automatically re-enabled to prevent incidental data loss.

The detailed information of each register is described below: Y: enabled; N: disabled.

Firmware	**0x007F**	**Write**	N
		Read	Y
Description	Current firmware version		
Value type	Character		
Notes	**e.g.,** Value(0x007F) = 0x3014, current firmware version is 3.0.1.4.		

Monitor device address	**0x0081**	**Write**	Y
		Read	Y
Description	Address of the product		
Value type	UINT 16		
Notes	Values range from 1 to 247, excluding 157 (0x9d). Broadcast address 0 is not enabled.		

SN, Serial number	**0x0030 ~ 0x0035**	**Write**	N
		Read	Y
Description	Series Number of the product, SN		
Value type	ASCII		
Notes	SN= value(0x0030), value(0x0031),….,value (0x0035); **e.g.,** Receiving 12 bits as: 0x2A47, 0x3741, 0x4549, 0x3032, 0x3035, 0x382A, the corresponding Serial Number is **G7AEl02058**.		

Current flow rate	**0x003A ~ 0x003B**	**Write**	N
		Read	Y
Description	Current flow rate		
Value type	UINT 32		
Notes	Flow rate = [Value (0x003A)*65536 + value (0x003B)]/1000 **For example, when the flow rate is 1.234 l/min (SLPM), the user should** read "0 (0x0000)" from register 0x003A and "1234 (0x04D2)" from register 0x003B. Then, current flow rate = (0*65536+1234)/1000 = 1.234 l/min (SLPM).		

Accumulated flow rate	0x003C ~ 0x003E	Write	N
		Read	Y
Description	Accumulated or totalized flow rate		
Value type	UINT 32 + UNIT 16		
Notes	Accumulated flow rate = Value (0x003C) * 65536 + Value (0x003D) + Value (0x003E)/1000 **e.g.,** For an accumulated flow rate of 3452.245 m^3, the user will read "0 (0x0000)" from register 0x003C; "3452 (0x0D7C)" from register 0x003D, and "245 (0x00F5)" from register 0x003E. Then, accumulated flow rate = 0 + 3425 + 245/1000 = 3425.245 m^3.		

Battery level	0x0048	Write	N
		Read	Y
Description	Read the battery level in percentage (%)		
Value type	UINT 16		
Notes	Available value: 0 ~ 100.		

Battery voltage	0x0049	Write	N
		Read	Y
Description	Read the battery voltage in Vdc.		
Value type	UINT 16		
Notes	Battery voltage = Value (0x0049) / 100 Available value: 300 ~ 370. **e.g.,** for a voltage of 3.60 Vdc, the user will read "360 (0x0168)" from register 0x0049; therefore, battery voltage = 360/100 = 3.60 Vdc		

Time interval *	0x00A8	Write	Y
		Read	Y
Description	The time interval for sending data is in seconds.		
Value type	UINT 16		
Notes	When the flow rate is larger than or equal to the flow threshold, the monitor device sends data to the platform at time intervals. Available value: 180 ~ 60000. The default value is 3600.		

Heartbeat *	0x00D9	Write	Y
		Read	Y
Description	Confirm the device's online time; the unit is an hour.		
Value type	UINT 16		
Notes	When the flow rate is smaller than the flow threshold, the monitor device sends data to the platform with a heartbeat value. Available value: 1 ~ 24.. The default value is 24.		

Flow threshold *	0x00D8	Write	Y
		Read	Y
Description	Send traffic threshold		
Value type	UINT 16		
Notes	When the flow rate is smaller than the flow threshold, the monitor device sends data to the Platform with a heartbeat value. The value is X 1000, with an available range of 0 ~ 10000, corresponding to 0 ~ 10 l/min (SLPM). The default value is 500, corresponding to 0.5 l/min (SLPM).		

Write protection	0x00FF	Write	Y
		Read	N
Description	Write protection disabler for a set value to a specific register.		
Value type	UINT 16, Fixed value 0xAA55		
Notes	This function is enabled at the time of product shipment. To enable the write function of a specific parameter, such as GCF, the user needs to send 0xAA55 to the register 0x00FF, and then the write function will be enabled (write protection is disabled). After the write execution is completed, the firmware will automatically re-enable the write protection.		

URI	0x8520 ~ 0x8540	Write	Y
		Read	Y
Description	Data receiving platform URL		
Value type	Character		
Notes	Value =/149793c7-01b7-4d79-91c6-f212dd6bbdfd		

URL	0x8560 ~ 0x8580	Write	Y
		Read	Y
Description	Data receiving platform URL		
Value type	Character		
Notes	Value = https://webhook.site		

4.4 CAT-M Configuration

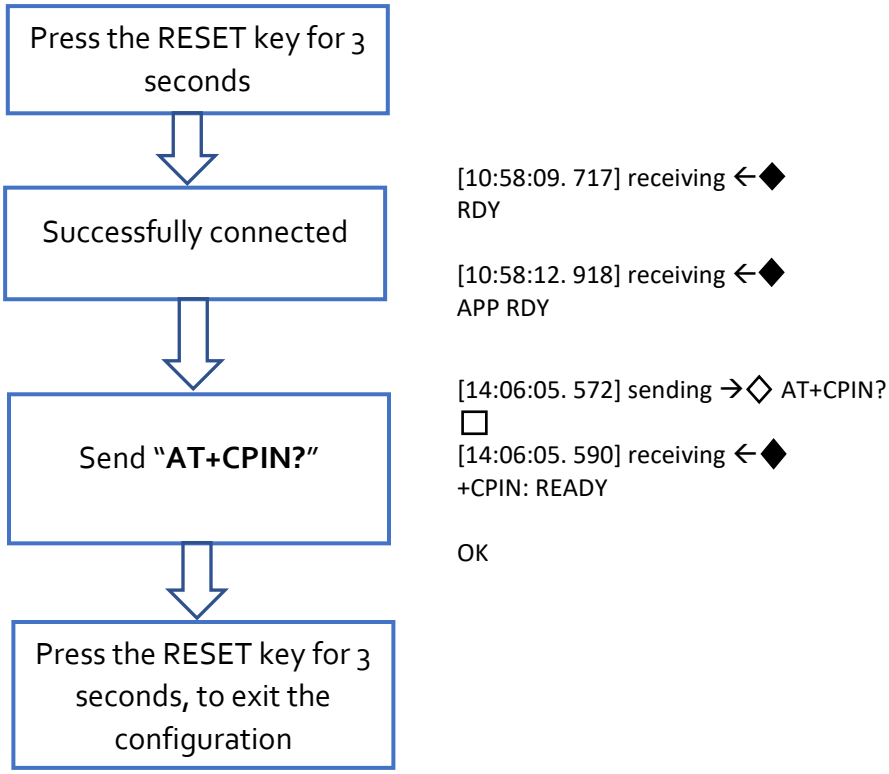
- **Start connection:**
  Press the RESET key for 5 seconds. The buzzer will ring twice, and you will receive the information below:

  RDY
  +CFUN: 1
  +CPIN: READY
  DST: 0
  **PSUTTZ: 23/11/28,05:48:12","+32",0*

  If the "above information" is not received, please check the converter, connection, etc.
  If only lines 1~3 are received, please confirm the network status.

- **Confirm the SIM card is installed**
  Send "**AT+CPIN?**" and enter the carriage return character;
  Receive "**+CPIN: READY OK**".

- **Exit the configuration:**
  Press the RESET key for 5 seconds, the buzzer will ring 3 times, to exit the configuration.
  CF35800 will send data to the URL once per hour.



4.5 Notes before Use

Before using the product, the following precautions should be taken:

a) Check the product for any damage, such as cracks or leaks in the flow channel, body, or other components.

b) Confirm that there is an adequate supply of oxygen. For oxygen cylinders, check the pressure gauge to ensure there is sufficient oxygen pressure.

c) Choose the appropriate nasal cannula according to the user's needs, and make sure it is clean and in good condition.

d) The oxygen inlet is connected to an oxygen concentrator or oxygen supply equipment, and the oxygen outlet supplies oxygen to the patient through the nasal cannula. Ensure no leakage for the connections. Please do not confuse the oxygen inlet and oxygen outlet.

e) If the product is stored at the maximum storage temperature or minimal storage temperature, it needs to be cooled or warmed for> 30 minutes.

4.6 Suggestion in Foreseeable Conditions

When the product is exposed to reasonably foreseeable environmental conditions, the following measures can be taken:

a) Regularly inspect and maintain the equipment to ensure its performance and safety. Check for any signs of wear, damage, or malfunction caused by environmental factors such as humidity, temperature changes, or dust.

b) Seal or cover the equipment adequately when it's not in use to protect it from dust, moisture, and other contaminants.

c) Install environmental monitoring systems in the storage and operation areas of the product to keep track of temperature, humidity, and other relevant environmental parameters. This helps to identify any abnormal conditions promptly.

d) Set up alarm systems that will notify the staff when the environmental conditions exceed the acceptable range so that immediate action can be taken to protect the equipment.

e) Train the medical staff on how to handle the product properly under different environmental conditions. They should know how to respond to emergencies such as power outages, floods, or extreme temperature changes to minimize the damage to the equipment. Educate them about the importance of reporting any environmental incidents or equipment malfunctions promptly.

4.7 EMC Guidance & Declaration

4.7.1 Guidance and Manufacturer's declaration - electromagnetic emissions

The product is intended for use in the electromagnetic environment specified below. The customer or user of the product should ensure it is used in an appropriate environment.

Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The Smart Gas Monitor Device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The Smart Gas Monitor Device is suitable for use in domestic establishments and in establishments directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Not applicable	
Voltage fluctuations / flicker emissions IEC 61000-3-3	Not applicable	

4.7.2 Guidance & Declaration - Electromagnetic Immunity

The smart gas monitor is intended for use in the electromagnetic environment specified below. The customer or user of the smart gas monitor should ensure it is used in an appropriate environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±2 kV, ±4 kV, ±8 kV,±15 kV air	±8 kV contact ±2 kV, ±4 kV, ±8 kV, ±15 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	±2kV for power supply lines	Not applicable	Mains power quality should be that of a typical commercial or hospital environment.
Surge lEC 61000-4-5	±0.5 kV, ±1 kV line to line	Not applicable	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage	<5 % UT (>95% dip in UT.) for 0.5 cycle	Not applicable	Mains power quality should be that of a typical commercial or hospital environment. Suppose the user of the Smart Gas Monitor Device

variations on the power supply input lines IEC 61000-4-11	<5 % UT (>95% dip in UT) for 1 cycle 70% UT (30% dip in UT) for 25/30 cycles <5% UT (>95 % dip in UT) for 5/6 sec		requires continued operation during power mains interruptions. In that case, it is recommended that the Smart Gas Monitor Device be powered from an uninterruptible power supply or a battery.
Power frequency magnetic field lEC 61000-4-8	30 A/m	30 A/m	Power frequency magnetic fields/ Proximity magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Proximity magnetic fields IEC 61000-4-39	CW 8A/m for 30KHz Pluse modulation 2.1KHz, 65A/m for 134.2KHz Pluse modulation 50KHz,7.5A/m for 13.56MHz	CW 8A/m for 30KHz Pluse modulation 2.1KHz, 65A/m for 134.2KHz Pluse modulation 50KHz,7.5A/m for 13.56MHz	

4.7.3 Guidance & Declaration - electromagnetic immunity (Conducted RF & Radiated RF)

The smart gas monitor is intended for use in the electromagnetic environment specified below. The customer or user of the smart gas monitor should ensure that it is used in such an environment.

Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Conducted RF lEC 61000-4-6	3 Vrms 150 kHz to 80 MHz 6 Vrms in ISM bands and amateur radio bands	Not applicable	Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the Smart Gas Monitor Device, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment, due to radiated RF, could result.
Radiated RF lEC 61000-4-3	10 V/m 80 MHz to 2.7 GHz 385MHz-5785MHz Test specifications for ENCLOSURE	10 V/m 80 MHz to 2.7 GHz 385MHz-5785MHz Test specifications for ENCLOSURE	

	PORT IMMUNITY to RF wireless communication equipment (Refer to table 9 of IEC 60601-1-2:2014+A1:2020)	PORT IMMUNITY to RF wireless communication equipment (Refer to table 9 of IEC 60601-1-2:2014+A1:2020)	

4.7.4 Suggestions to Avoid EMC

a) Avoid areas with sources of strong electromagnetic fields such as large transformers, high-power radio transmitters, and microwave ovens.

b) Avoid areas with dense wireless signal transmissions, such as near multiple Wi-Fi routers or large numbers of mobile devices.

c) Keep a certain distance between the product and other electronic devices that may generate electromagnetic interference. For example, do not place mobile phones or tablets too close to the medical equipment.

d) Regularly check and maintain the product to ensure that its electromagnetic shielding function is in good condition.

e) Educate users to be aware of potential sources of electromagnetic interference and take preventive measures.

4.8 Notes after Use

When ending the use of the product, the following precautions should be noted:

a) Turn off the oxygen supply valve on the oxygen source to stop the supply of oxygen. Make sure the valve is closed tightly to prevent any leakage.

b) Disconnect the product: Gently disconnect the oxygen tube from the product and the oxygen source. Handle the product carefully to avoid damage.

c) Remove the nasal cannula gently to avoid any discomfort or irritation to the user. Dispose of the used nasal cannula properly if it is a disposable one.

d) Clean the surface of the product with a clean, dry cloth. Store the product in a clean, dry, and well-ventilated place, away from heat sources, flammable substances, and children.

e) Regularly check the product for any signs of damage or malfunction. If there are any problems, have it repaired or replaced promptly to ensure its performance and safety for future use.

4.9 Possible Adverse Effects

The product is only serving to monitor oxygen or other applicable gas consumption. The wetted materials of the product are compatible with oxygen. There would be no known adverse effects for oxygen flowing through the product. The oxygen administration is not controlled by this product but by other sources.

a) Allergic reactions: Some people may be allergic to the materials of the oxygen inhaler, such as the tubing, resulting in skin rashes, itching, redness, and other allergic symptoms. It may not have any relation to the product, but additional cautions may apply.

b) Infection: If the oxygen inhaler is not adequately cleaned and maintained, it may become a breeding ground for bacteria and viruses, increasing the risk of respiratory infections. Since the product is connected to such sources, one should also be cautious about any such effects.

5. Cleaning and Sterilization

In case the product is required to be sterilized, it is recommended that the sterilization be performed with the standard dry EtO sterilization process.

The outer surface can be cleaned with ethyl alcohol (75%). Be careful that this product does not have a liquid-proof design. Avoid the liquid attack on the electronic compartment.

6. Troubleshooting

Phenomena	Possible causes	Actions
No signal/display	The battery is empty	Check the cable
	No flow or clogging	Check flow and contamination.
	Sensor failure	Return to the factory.
Significant errors or unexpected flow rate	Particles, fluid type	Check the system
Erroneous or large noise	Vibration, unstable flow	Check the system
Offset unstable	Circuitry instability	Check the system
No digital interface	Wrong address, software	Check commands, connection
No wireless	Wrong model, data jam	Check model, power off/on

7. Maintenance

State-of-the-art product maintenance includes corrective, preventive, and predictive maintenance. This section will only address corrective and preventive maintenance, as well as recommendations for checklists before use and periodic services. The other maintenance tasks are irrelevant to this product, and this product is not for tariff or custody transfer. Therefore, metrology maintenance will not be addressed as well.

The correct maintenance of a smart gas monitor is essential for its performance. For the specific applications of this product, the application environment is very friendly, as medical oxygen is usually dry and clean. The product is designed for reliability and robustness, with minimal maintenance requirements throughout its lifetime. This includes precautions for expected mechanical degradation, such as the connectors.

Corrective maintenance

Corrective maintenance must be performed by personnel with basic training in the product and who have essential knowledge of a smart gas monitor. Refer to the troubleshooting and actions listed in Section 6 for the corrective maintenance. The manufacturer will provide circuit schematic diagrams, BOM, maintenance instructions, and calibration instructions to the service personnel for repairing components.

For any doubt, please get in touch with the sales representative or the factory directly to avoid further damage to the product.

Preventive maintenance

Since the application of this product is for medical oxygen monitoring, precautionary or preventive maintenance is essential to ensure the product is working correctly at the time of usage. The following recommendations are the primary preventive maintenance of this product. It should be performed periodically and whenever deemed necessary. The frequency is dependent on the usage.

a) Cleanness maintenance: keeping the smart gas monitor in a clean and contamination-free container after each use is recommended. Use a clean, damp cloth with mild solutions to clean the outside of the product. Do not use pungent hydrocarbons.

b) Never submerge the product in any liquid that may cause irrecoverable damage.

c) Inspect the flow channel connectors, and make sure no foreign materials or particles.

d) Check the battery status before use, and make sure the battery life is sufficient. Use only batteries with safety precautions and batteries with an expiration date. If external power is used while the batteries or rechargeable batteries are installed, periodically check the battery status to ensure it is clean and has no abnormal appearance.

e) Please refer to the troubleshooting section or consult the manufacturer for any other abnormal observations.

f) It is recommended to check the essential smart gas monitor functions, including the metrology performance and wireless data rate, every twelve (12) months.

g) Considering the current smart gas monitor lifetime regulatory observation, send the smart gas monitor back to the factory for service or complete functional and metrological verification.

8. Waste /Residues and End-of-Life Disposal

The handling methods of waste and residues during the use of medical equipment are as follows:

a) Medical waste and residues should be classified and collected according to relevant regulations. Different types of waste, such as infectious waste, sharp objects, and general waste, need to be placed in separate containers.

b) Special attention should be paid to the handling of infectious waste to prevent the spread of diseases. It is usually required to be sterilized or disinfected before disposal.

c) Chemical residues should be dealt with in compliance with environmental protection standards to avoid pollution.

For the disposal of medical equipment and its accessories at the end of their service life:

a) They should be dismantled appropriately and separated based on the types of materials.

b) Components that can be recycled should be sent for recycling.

c) Equipment that cannot be recycled should be disposed of in an environmentally friendly manner, according to local regulations and standards.

9. Warranty and Liability

(Effective January 2018)

Siargo warrants that the products sold hereunder will be used appropriately and 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 of a 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 fully responsible for validating the performance and suitability of the products for their particular design and applications. For any misuse 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., or any 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 when 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, as 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 damage;
(3) Products that have been opened or dismantled for whatever reason;
(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 unauthorized dealers or any third parties resell.

10. Service/order Contact and Other Information

Siargo Ltd. is making every effort to ensure the quality of its products. For questions or product support, please get in touch with the authorized representative. If you need additional assistance, please get in touch with customer service at the address listed below. We will respond to your request in a timely fashion and work with you toward your complete satisfaction.

Manufacturer

Company: Siargo (Chengdu) Ltd.
Address: B09 Chip and Display Industrial Park,
388 Fujia Street, Chengdu 610299, China
Phone: +86 (28) 8513-9315
Email: info@Siargo.com.cn

For sales or product orders, please get in touch with the authorized representative.

Authorized Representative:

Company: Aritium Technologies
Address: S.L.C/ Jove y Valdés 20, C.1.E. "La Cardosa"
Offices 9 and 10, Grado (33820-Asturias), Spain
Phone: +34 984 54 29 61
Email: angel.colao@aritium.com

For any returns, please get in touch with the authorized representative to obtain an RMA. If you require further assistance, please contact info@siargo.com for additional information or a Return Materials Authorization (RMA) before returning the product to the factory for servicing, including calibration. Please specify in your email message that you intend to return the product to the factory and include your shipping address. Be sure to write the RMA on the returned package or include a letter with the RMA information.

Direct customer service request(s) should be addressed to

Siargo Ltd.
4677 Old Ironsides Drive, Suite 310,
Santa Clara, California 95054-1857, USA
Phone: +01(408)969-0368
Email: info@Siargo.com

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

Appendix I: Digital Interface Converter

AI-1. Connect the Monitor Device to a PC

The manufacturer-supplied RS485 Modbus digital interface can assist the user with the configuration process. Siargo offers user application software and a digital converter that can be used to connect the product to a Microsoft Windows-compatible computer for the process.

AI-2. Software Description

The software is Microsoft Windows 8+ compatible. It allows for configuring the URI and URL, and may also have simple data reading and other parameter settings.

- Digital data interface via RS485 Modbus
- Read and record the data
- Set parameters

Appendix II: Firmware History

Revision V3.0.1.6 (January 2025)

- Added the battery level and battery voltage in the RS485 Modbus communication protocol.

Revision V3.0.1.5 (August 2024)

- Added the heartbeat (device online time) setting in the RS485 Modbus communication protocol.

Revision V3.0.1.3 (December 2023)

- Added flow threshold in the RS485 Modbus communication protocol.

Revision V3.0.1.2 (October 2023)

- Revised the communication baud rate to 115200.

Appendix III: Document History

Revision VA.6 (November 2024)

- Removed the Bluetooth LE communication.
- Corrections.

Revision VA.5 (August 2024)

- Corrections.

Revision VA.4 (April 2024)

- Revised the product name to Smart Gas Monitor Device.
- Added the RS485 Modbus communication protocol.
- Added the Bluetooth LE communication.

Revision VA.3.02 (December 2023)

- Revised the registers.

Revision VA.3.01 (October 2023)

- Revised the communication baud rate to 115200.

Revision VA.3 (September 2023)

- Revised the part number to CF35800;
- Minor corrections.

Revision VA.2 (May 2023)

- Final dimension updates.

Revision VA.1 (February 2023)

- Corrections.

Revision VA.0 (September 2022)

- Preliminary release.