GASTRACK – Gas Analyser Probe (GAP) RS485 (Modbus RTU) Register Set

This document details the Modbus register set developed to control and analyse data from the GAP oxygen analyser.

NOTE: Register set valid for product configuration **GAP-B0**.

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Contents

1 DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS, ACTIONS and NOTES used throughout this manual.

WARNING:

The warning symbol is used to indicate instructions that, if they are not followed, can result in minor, serious or even fatal injuries to personnel.

CAUTION:

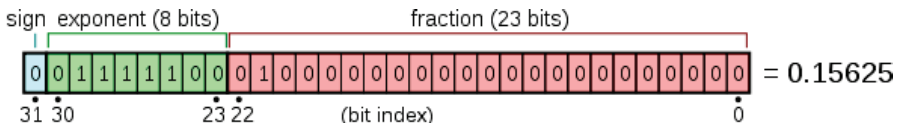
The caution symbol is used to indicate instructions that, if they are not followed, can result in damage to the equipment (hardware and/or software), or a system failure occurring.

ACTION: How data from the device should be used during normal operation.

NOTE: Operating conditions or statements pertaining to the recommended action.

The following terminology and acronyms are used throughout this manual:

- **Input registers** – are read only 16-bit registers. Valid address range starts at 30001.
- **Holding registers** – are read / write 16-bit registers. Valid address range starts at 40001.
- **MSB** – Most Significant Bits.
- **LSB** – Least Significant Bits.
- **EEPROM** - Electrically Erasable Programmable Read-Only Memory.
- **32-bit Integers** – Unsigned 32-bit integers are split over two 16-bit registers where the MSB and LSB are identified.
- **Floating point numbers** – are digitally represented using the IEEE–754 format. Single precision floating point numbers are used throughout and they require 32-bits of data. Since a Modbus register holds 16-bits, it takes two registers to represent a floating point number. The IEEE 754 standard specifies a binary32 as having:
  - Sign bit: 1 bit
  - Exponent width: 8 bits
  - Significand precision: 24 bits (23 explicitly stored)



For example, 20.7 in IEEE 754 format is: 0 10000011 01001011001100110011010

2 MODBUS SETUP

The half-duplex RS485 interface allows multiple sensors or systems to be connected on a single bus and individually addressed following the Modbus RTU protocol.

NOTE: Background reading is strongly recommended if there is no prior knowledge of Modbus. A good place to start is www.modbus.org, where the specification and resources can be obtained in the technical resources page.

The Modbus interface is configured using the following setup:

- **Modbus mode:** RTU
- **Address:** One
- **Baudrate:** 9600
- **Parity:** None
- **Stopbits:** Two

3 MODBUS REGISTERS

NOTE: Default values are shown in **bold**.

NOTE: Values shown in grey are reserved, not applicable or indicate that they should not be changed.

3.1 System Information and Communication Registers

3.1.1 System Information Registers

Table 3-1 –System Information - Input Registers

Name	Register Address	Description	Actions / Notes
Modbus Register Set Revision	0x7531 (30001)	32-bit Integer (MSB 16-bits)	**ACTION:** For reference **NOTE:** Used for diagnostic purposes
	0x7532 (30002)	32-bit Integer (LSB 16-bits)	
Software Revision	0x7533 (30003)	32-bit Integer (MSB 16-bits)	
	0x7534 (30004)	32-bit Integer (LSB 16-bits)	

3.1.2 System Information File Registers

Table 3-2 - System Information - File Records

Name	File Number	Record Number	Actions / Notes
Part Number	0x000 (0x000)	0	**ACTION:** For reference **NOTE:** Read only – Used for system identification
Serial number	0x000 (0x000)	1	
Date Code	0x000 (0x000)	2	

3.1.3 Serial Registers

Table 3-3 – Serial - Input Registers

Name	Register Address	Description	Actions / Notes
Serial Status	0x7535 (30005)	0 = Unavailable Serial parameters are fixed 1 = Not Ready Serial changes are currently not permitted **2 = Ready** Serial changes are permitted 3 = Busy Serial changes in process 4 = Complete Serial changes committed to memory, system will restart in 1s with the new communication settings 5 = Error Error committing serial changes to memory	**ACTION:** Monitor in system **NOTE:** Used in Section 3.1.4 on page 3-2.

Table 3-4 – Serial - Holding Registers

Name	Register Address	Description / Valid Values	Actions / Notes
Serial Address	0x9C41 (40001)	**1**-247	**ACTION:** Set/Monitor in system **NOTES:** Any committed changes are saved in EEPROM and retained on power loss. Any invalid requests are ignored. Used in Section 3.1.4 on below.
Serial Baudrate	0x9C42 (40002)	0 = 2400 1 = 4800 **2 = 9600** 3 = 19200 4 = 38400 5 = 57600 6 = 115200	
Serial Parity	0x9C43 (40003)	**0 = None** 1 = Even 2 = Odd	
Serial Control	0x9C44 (40004)	**0 = Idle** 1 = Save and reset	

3.1.4 Changing Communication Settings

1. Confirm *Serial Status* = *Ready* (30005 = 2).
2. Set *Serial Address* (40001), *Baudrate* (40002) and/or *Parity* (40003) as required.
3. Set *Serial Control* to *Save and Reset* (40004 = 1).
4. Monitor *Serial Status* input register which will change to *Busy* momentarily then *Complete* for 1s before the system resets and communication to the master is lost.
   (30005 = 3 → 4 → 1s delay → reset).

To restore communications, the master should now be configured to the new communication settings.

3.2 Sensor Registers

In addition to the zirconia dioxide oxygen sensor, the GAP has a pressure sensor and Pt-100 temperature sensor fitted.

3.2.1 O_2 Sensor Registers

Table 3-5 – O_2 Sensor - Input Registers

Name	Register Address	Description	Actions / Notes
O_2 ID	0x7536 (30006)	-	**ACTION:** For reference **NOTE:** Unique sensor identifier
O_2 Warning	0x7537 (30007)	16-bit bitmask Each bit represents an individual warning state	**ACTION:** Monitor in system **NOTES:** Warnings are not retained on power loss. Refer to list of Warnings given in *UG-003, GAP User's Guide*.
O_2 Error	0x7538 (30008)	16-bit bitmask Each bit represents an individual error state	**ACTION:** Monitor in system **NOTES:** Errors are not retained on power loss. Refer to list of Errors given in *UG-003, GAP User's Guide*.
O_2 Uncalibrated Value	0x7539 (30009)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2	**ACTION:** Monitor in system **NOTES:** This value can be greater than or less than the 0 – 25% O_2 sensor range and is used to determine measurement stability during the calibration process. Used in Section 3.2.2 on page 3-8.
	0x753A (30010)	Floating point IEEE 754 (LSB 16-bits) Unit = % O_2	
O_2 Calibrated Value	0x753B (30011)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2 Valid Range = 0.00 to 25.00	**ACTION:** Monitor in system **NOTE:** Used in Section 3.2.2 on page 3-8.
	0x753C (30012)	Floating point IEEE 754 (LSB 16-bits) Unit = % O_2 Valid Range = 0.00 to 25.00	

Name	Register Address	Description	Actions / Notes
O_2 Status	0x753D (30013)	0 = Loading System initialising, no O_2 measurements, sensor heater off 1 = OFF No O_2 measurements, sensor heater off 2 = Standby No O_2 measurements, sensor heater on at half power 3 = Warm-up No O_2 measurements, sensor heater on at full power Warm-up time = 60s coming from *OFF* Warm-up time = 20s coming from *Standby* **4 = ON** Valid O_2 measurements, sensor heater on at full power 5 = Cool-down No O_2 measurements, sensor heater on at full power 6 = Calibration Invalid O_2 measurements, calibration in process, sensor heater on at full power	**ACTION:** Monitor in system **NOTE:** Used in Section 3.2.2 on page 3-8.
O_2 Calibration Status	0x753E (30014)	0 = Reserved 1 = Not Ready Calibration is currently disabled **2 = Ready** Calibration enabled 3 = Busy Calibration in progress 4 = Complete Calibration complete 5 = Error Error during the calibration process	**ACTION:** Monitor in system **NOTES:** Calibration is only enabled when *O_2 Control* = *ON* (40005 = 2) for greater than 5 minutes. This delay is required to allow the sensor to stabilise at the correct operating temperature. Used in Section 3.2.2 on page 3-8.
O_2 Configuration Value Type	0x753F (30015)	0 = Invalid **1 = Floating point IEEE 754** 2 = 32-bit integer	**ACTION:** For reference **NOTES:** *O_2 Configuration Value* data format (40015 and 40016) Used in Section 3.2.3 on page 3-8.
O_2 Configuration Status	0x7540 (30016)	0 = Reserved 1 = Not Ready Configuration is currently disabled **2 = Ready** Configuration enabled 3 = Busy Configuration in progress 4 = Complete Configuration complete 5 = Error Error during the configuration process	**ACTION:** Monitor in system **NOTE:** Used in Section 3.2.3 on page 3-8.

Name	Register Address	Description / Valid Values	Actions / Notes
O_2 Diagnostic Value Type	0x7541 (30017)	0 = Invalid **1 = Floating point IEEE 754** 2 = 32-bit integer	**ACTION:** For reference **NOTES:** *O_2 Diagnostic Value* data format (30018 and 30019) Used in Section 3.2.4 on page 3-9.
O_2 Diagnostic Value	0x7542 (30018)	MSB 16-bits	**ACTION:** Monitor in system **NOTES:** Returned diagnostic value of currently selected *O_2 Diagnostic Index* (40016). See *O_2 Diagnostic Value Type* (30017) for data format. Used in Section 3.2.4 on page 3-9.
	0x7543 (30019)	LSB 16-bits	
O_2 Diagnostic Status	0x7544 (30020)	0 = Reserved 1 = Not Ready Diagnostic values are currently disabled **2 = Ready** Diagnostic values enabled 3 = Busy Diagnostic index change in progress 4 = Complete Diagnostic index change complete 5 = Error Error during the diagnostic index change process	**ACTION:** Monitor in system **NOTES:** After a successful diagnostic index change the updated value will be available in *O_2 Diagnostic Value* (30018 and 30019). Used in Section 3.2.4 on page 3-9.

Table 3-6 – O_2 Sensor - Holding Registers

Name	Register Address	Description / Valid Values	Actions / Notes
O_2 Control	0x9C45 (40005)	0 = OFF Turns the O_2 measurement off and then the sensor heater off after the set cool-down delay 1 = Standby Turns the O_2 measurement off and reduces the heater voltage to half power **2 = ON** Turns the O_2 measurement on and increases the heater voltage to full power Warm-up time = 60s coming from *OFF* Warm-up time = 20s coming from *Standby*	**ACTION:** Set/Monitor in system **NOTES:** Standby protects the sensor from condensation. It is recommended that this state should be used when no O_2 measurements are required. If this register is forced to *OFF* by the device then it is due to a system error. This can be confirmed by reading the *O_2 error* (30008).
Clear O_2 Warning	0x9C46 (40006)	**0 = Idle** 1 = Reserved	**ACTION:** None **NOTE:** Any warning present in *O_2 Warning* (30007) will auto clear if the condition that caused the warning is removed.
Clear O_2 Error	0x9C47 (40007)	**0 = Idle** 1 = Clear Error	**ACTION:** Set in system **NOTE:** If an error present in *O_2 Error* (30008) has forced *O_2 Status* to *OFF* (30015 = 1) the error may be cleared using this register and an attempt made to restart the sensor by setting the *O_2 Control* to *ON* (40005 = 2). If the error persists, contact technical@sstsensing.com for guidance.
O_2 Calibration Type	0x9C48 (40008)	**0 = Gain**	**ACTION:** None **NOTE:** Due to the O_2 sensor technology, no "zero" calibration is required and only a "Gain" (or span) calibration needs to be performed.

Name	Register Address	Description / Valid Values	Actions / Notes
O_2 Calibration Value	0x9C49 (40009)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2 Valid Range = 0.00 to 25.00 Recommended Range = 5.00 to 25.00	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. Default = **20.70%** for fresh air. Used in Section 3.2.2 on page 3-8.
	0x9C4A (40010)	Floating point IEEE 754 (LSB 16-bits) Unit = % O_2 Valid Range = 0.00 to 25.00 Recommended Range = 5.00 to 25.00	
O_2 Calibration Control	0x9C4B (40011)	**0 = Idle** 1 = Reserved 2 = Apply Calibration 3 = Reset Status	**ACTION:** Set in system **NOTE:** Used in Section 3.2.2 on page 3-8.
O_2 Configuration Index	0x9C4C (40012)	**0 = Cool-down Delay**	**ACTION:** None **NOTE:** Cool-down is the only configurable option available.
O_2 Configuration Value	0x9C4D (40013)	MSB 16-bits Unit = seconds Valid Range = 0 to 43200 (12hrs)	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. See *O_2 Configuration Value Type* (30015) for data format. Default = **0s** Used in Section 3.2.3 on page 3-8.
	0x9C4E (40014)	LSB 16-bits Unit = seconds Valid Range = 0 to 43200 (12hrs)	
O_2 Configuration Control	0x9C4F (40015)	**0 = Idle** 1 = Reserved 2 = Apply Configuration 3 = Reset Status	**ACTION:** Set in system **NOTE:** Used in Section 3.2.3 on page 3-8.
O_2 Diagnostic Index	0x9C50 (40016)	**0 = TD** 1 = Asymmetry 2 = TP 3 = T1 4 = T2 5 = T4 6 = T5 7 = Heater Voltage	**ACTION:** Set/Monitor in system **NOTES:** Sensor diagnostics are read only; they are available to assist in fault-finding if there is a warning condition present. Contact technical@sstsensing.com for assistance when using this feature. Used in Section 3.2.4 on page 3-9.
O_2 Diagnostic Control	0x9C51 (40017)	**0 = Idle** 1 = Change Index 2 = Reset Status	**ACTION:** Set in system **NOTE:** Used in Section 3.2.4 on page 3-9.

3.2.2 Calibrating the O_2 Sensor

1. Confirm *O_2 Calibration Status* = *Ready* (30014 = 2).
2. Apply the calibration gas for a minimum of 5 minutes. The calibration gas used must be within the 0 – 25% O_2 sensor range and gain calibrations below 5% O_2 are not recommended. When calibrating in fresh air it is assumed that the O_2 concentration is 20.7%.
3. Monitor *O_2 Uncalibrated Value* (30009 and 30010) and wait until the value has been stable to ±0.1% O_2 for a minimum of 30s.
4. Input the O_2% of the calibration gas into *O_2 Calibration Value* (40009 and 40010).
5. Set *O_2 Calibration Control* to *Apply Calibration* (40011 = 2).
6. During the calibration routine *O_2 Calibration Status* will change to *Busy* (30014 = 3) and *O_2 Status* will change to *Calibration* (30013 = 6). O_2 measurements are not valid during this phase.
7. When the calibration routine is complete *O_2 Calibration Status* will change to *Complete* (30014 = 4) and *O_2 Status* will return to *ON* (30013 = 4).
8. Set *O_2 Calibration Control* to *Reset Status* (40011 = 3) to return *O_2 Calibration Status* to *Ready* (30014 = 2).
9. Confirm the *O_2 Calibrated Value* (30011 and 30012) is within ±0.1% O_2 of the calibration gas applied. If not, repeat Steps 3 to 8 and allow the *O_2 Uncalibrated Value* (30009 and 30010) to stabilise for a longer period. If multiple calibration attempts do not result in an accurate calibration, contact technical@sstsensing.com for guidance.

3.2.3 Configuring the O_2 Sensor – Cooldown Delay

When operating in warm, humid environments it is important the sensor remains at a higher temperature than its surroundings, especially if there are corrosive components in the measurement gas. During operation this is not an issue as the heater operates at 700°C, however this means when the sensor or application is being powered down the sensor heater must be the last thing to be turned off after the temperature of the surroundings have suitably cooled.

1. Confirm *O_2 Configuration Status* = *Ready* (30016= 2).
2. Change *O_2 Configuration Value* (40013 and 40014) to the new cool-down delay, see *O_2 Configuration Value Type* (30015) for the required data format.
3. Set *O_2 Configuration Control* to *Apply Configuration* to commit the change (40015 = 2).
4. Monitor *O_2 Configuration Status* which will change to *Busy* momentarily then *Complete* (30016 = 3 → 4).
5. Set *O_2 Configuration Control* to Reset Status (40015 = 3) to return *O_2 Configuration Status* to Ready (30016= 2).

   The newly saved cool-down delay will be applied the next time the *O_2 Control* is set to *OFF* (40005 = 0) when the current state of *O_2 Status* = *ON* (30013 = 4).

3.2.4 Changing the O_2 Sensor Diagnostic Value

1. Confirm *O_2 Diagnostic Status* = *Ready* (30020 = 2).
2. Change *O_2 Diagnostic Index* (40016) to the new diagnostic value you would like to view
3. Set *O_2 Diagnostic Control* to *Change Index* to commit the change (40017 = 1).
4. Monitor *O_2 Diagnostic Status* which will change to *Busy* momentarily then *Complete* (30020 = 3 → 4).
5. Set *O_2 Diagnostic Control* to *Reset Status* (40017 = 2) to return *O_2 Diagnostic Status* to *Ready* (30020 = 2).
6. Read the new value in *O_2 Diagnostic Value* (30018 and 30019). See *O_2 Diagnostic Value Type* (30017) for the data format.

3.2.5 Temperature Sensor Registers

Table 3-7 – Temperature Sensor - Input Register

Name	Register Address	Description	Actions / Notes
Temperature ID	0x7545 (30021)	-	**ACTION:** For reference **NOTE:** Unique sensor identifier
Temperature Warning	0x7546 (30022)	16-bit bitmask Each bit represents an individual warning state	**ACTION:** Monitor in system **NOTES:** Warnings are not retained on power loss. Refer to list of Warnings given in *UG-003, GAP User's Guide*.
Temperature Error	0x7547 (30023)	16-bit bitmask Each bit represents an individual error state	**ACTION:** Monitor in system **NOTES:** Errors are not retained on power loss. Refer to list of Errors given in *UG-003, GAP User's Guide*.
Temperature Uncalibrated Value	0x7548 (30024)	Reserved	**ACTION:** None
	0x7549 (30025)	Reserved	
Temperature Calibrated Value	0x754A (30026)	Floating point IEEE 754 (MSB 16-bits) Unit = °C Valid Range = -50 to 600	**ACTION:** Monitor in system
	0x754B (30027)	Floating point IEEE 754 (LSB 16-bits) Unit = °C Valid Range = -50 to 600	
Temperature Status	0x754C (30028)	0 = Loading System initialising, no temperature measurements 1 = OFF No temperature measurements 2 = Reserved 3 = Reserved **4 = ON** Valid temperature measurements 5 = Reserved 6 = Reserved	**ACTION:** Monitor in system

Name	Register Address	Description	Actions / Notes
Temperature Calibration Status	0x754D (30029)	**0 = Unavailable** Not applicable to this sensor 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None
Temperature Configuration Value Type	0x754E (30030)	**0 = Invalid** 1 = Reserved 2 = Reserved	**ACTION:** None
Temperature Configuration Status	0x754F (30031)	**0 = Unavailable** Not applicable to this sensor 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None
Temperature Diagnostic Value Type	0x7550 (30032)	0 = Invalid **1 = Floating point IEEE 754** 2 = 32-bit integer	**ACTION:** For reference **NOTES:** *Temperature Diagnostic Value* data format (30033 and 30034).
Temperature Diagnostic Value	0x7551 (30033)	MSB 16-bits Unit = Ω	**ACTION:** Monitor in system **NOTES:** Pt100 resistance measurement. See *Temperature Diagnostic Value Type* (30032) for data format.
	0x7552 (30034)	LSB 16-bits Unit = Ω	
Temperature Diagnostic Status	0x7553 (30035)	0 = Reserved 1 = Not Ready Diagnostic value is currently disabled **2 = Ready** Diagnostic value enabled 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** Monitor in system

Table 3-8 – Temperature Sensor - Holding Registers

Name	Register Address	Description / Valid Values	Actions / Notes
Temperature Control	0x9C52 (40018)	0 = Reserved	**ACTION:** Monitor in system **NOTE:** The temperature measurement cannot be switched off.
Clear Temperature Warning	0x9C53 (40019)	**0 = Idle** 1 = Reserved	**ACTION:** None **NOTE:** Any warning present in *Temperature Warning* (30022) will auto clear if the condition that caused the warning is removed.
Clear Temperature Error	0x9C54 (40020)	**0 = Idle** 1 = Reserved	**ACTION:** None **NOTE:** If an error is present in *Temperature Error* (30023) contact technical@sstsensing.com for guidance.
Temperature Calibration Type	0x9C55 (40021)	Reserved	**ACTION:** None
Temperature Calibration Value	0x9C56 (40022)	Reserved	**ACTION:** None
	0x9C57 (40023)	Reserved	
Temperature Calibration Control	0x9C58 (40024)	Reserved	**ACTION:** None **NOTE:** Calibration of the temperature sensor is not allowed.
Temperature Configuration Index	0x9C59 (40025)	Reserved	**ACTION:** None
Temperature Configuration Value	0x9C5A (40026)	Reserved	**ACTION:** None
	0x9C5B (40027)	Reserved	
Temperature Configuration Control	0x9C5C (40028)	Reserved	**ACTION:** None
Temperature Diagnostic Index	0x9C5D (40029)	**0 =** Pt100 Resistance	**ACTION:** None
Temperature Diagnostic Control	0x9C5E (40030)	Reserved	**ACTION:** None

3.2.6 Pressure Sensor Registers

Table 3-9 – Pressure Sensor - Input Registers

Name	Register Address	Description	Actions / Notes
Pressure ID	0x7554 (30036)	-	**ACTION:** For reference **NOTE:** Unique sensor identifier
Pressure Warning	0x7555 (30037)	16-bit bitmask Each bit represents an individual warning state	**ACTION:** Monitor in system **NOTES:** Warnings are not retained on power loss. Refer to list of Warnings given in *UG-003, GAP User's Guide*.
Pressure Error	0x7556 (30038)	16-bit bitmask Each bit represents an individual error state	**ACTION:** Monitor in system **NOTES:** Errors are not retained on power loss. Refer to list of Errors given in *UG-003, GAP User's Guide*.
Pressure Uncalibrated Value	0x7557 (30039)	Reserved	**ACTION:** None
	0x7558 (30040)	Reserved	
Pressure Calibrated Value	0x7559 (30041)	Floating point IEEE 754 (MSB 16-bits) Unit = mbar Valid Range = 260 to 1260	**ACTION:** Monitor in system
	0x755A (30042)	Floating point IEEE 754 (LSB 16-bits) Unit = mbar Valid Range = 260 to 1260	
Pressure Status	0x755B (30043)	0 = Loading System initialising, no pressure measurements 1 = OFF No pressure measurements 2 = Reserved 3 = Reserved **4 = ON** Valid pressure measurements 5 = Reserved 6 = Reserved	**ACTION:** Monitor in system
Pressure Calibration Status	0x755C (30044)	**0 = Unavailable** Not applicable to this sensor 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None

Name	Register Address	Description	Actions / Notes
Pressure Configuration Value Type	0x755D (30045)	**0 = Invalid** 1 = Reserved 2 = Reserved	**ACTION:** None
Pressure Configuration Status	0x755E (30046)	**0 = Unavailable** Not applicable to this sensor 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None
Pressure Diagnostic Value Type	0x755F (30047)	Reserved	**ACTION:** None
Pressure Diagnostic Value	0x7560 (30048)	Reserved	**ACTION:** None
	0x7561 (30049)	Reserved	
Pressure Diagnostic Status	0x7562 (30050)	**0 = Unavailable** Not applicable to this sensor 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None

Table 3-10 – Pressure Sensor - Holding Registers

Name	Register Address	Description / Valid Values	Actions / Notes
Pressure Control	0x9C5F (40031)	0 = Reserved	**ACTION:** Monitor in system **NOTE:** The pressure measurement cannot be switched off.
Clear Pressure Warning	0x9C60 (40032)	**0 = Idle** 1 = Reserved	**ACTION:** None **NOTE:** Any warning present in *Pressure Warning* (30037) will auto clear if the condition that caused the warning is removed.
Clear Pressure Error	0x9C61 (40033)	**0 = Idle** 1 = Reserved	**ACTION:** None **NOTE:** If an error is present in *Pressure Error* (30038) contact technical@sstsensing.com for guidance.
Pressure Calibration Type	0x9C62 (40034)	Reserved	**ACTION:** None
Pressure Calibration Value	0x9C63 (40035)	Reserved	**ACTION:** None
	0x9C64 (40036)	Reserved	
Pressure Calibration Control	0x9C65 (40037)	Reserved	**ACTION:** None **NOTE:** Calibration of the pressure sensor is not allowed.
Pressure Configuration Index	0x9C66 (40038)	Reserved	**ACTION:** None
Pressure Configuration Value	0x9C67 (40039)	Reserved	**ACTION:** None
	0x9C68 (40040)	Reserved	
Pressure Configuration Control	0x9C69 (40041)	Reserved	**ACTION:** None
Pressure Diagnostic Index	0x9C6A (40042)	Reserved	**ACTION:** None
Pressure Diagnostic Control	0x9C6B (40043)	Reserved	**ACTION:** None

3.3 Relay and 4-20mA Registers

3.3.1 Relay Registers

Relays provide Single Pole Single Throw (SPST) contact outputs; unless otherwise specified, relays are normally open as standard.

- Relay 1 – User configurable O_2 measurement alarm
- Relay 2 – O_2 sensor fault indication

Table 3-11 – Relay 1 – Input Registers

Name	Register Address	Description	Actions / Notes
Relay 1 ID	0x7563 (30051)	-	**ACTION:** For reference **NOTE:** Unique output identifier
Relay 1 Warning	0x7564 (30052)	Reserved	**ACTION:** None
Relay 1 Error	0x7565 (30053)	Reserved	**ACTION:** None
Relay 1 Value	0x7566 (30054)	32-bit integer (MSB 16-bits)	**ACTION:** Monitor in system
	0x7567 (30055)	32-bit integer (LSB 16-bits) 0 = Open 1 = Closed	
Relay 1 Status	0x7568 (30056)	0 = Loading System initialising, Relay 1 in start-up state 1 = Reserved 2 = Standby O_2 sensor measurements off, Relay 1 in standby state **3 = ON** O_2 sensor measurements on, Relay 1 state depends the O_2 measurement and the set switch points	**ACTION:** Monitor in system **NOTE:** *Relay 1 Mode* = *Override* (40046 =1) allows the relay state in *Standby* and *ON* to be overridden for test purposes.
Relay 1 Switch Points Status	0x7569 (30057)	0 = Reserved 1 = Not Ready Modification of the switch points is currently disabled **2 = Ready** Modification of the switch points enabled 3 = Busy Modification of the switch points in progress 4 = Complete Modification of the switch points complete 5 = Error Error during the modification of the switch points	**ACTION:** Monitor in system **NOTE:** Used in Section 3.3.2 on page 3-20.

Name	Register Address	Description / Valid Values	Actions / Notes
Relay 1 Configuration Value Type	0x756A (30058)	0 = Invalid **1 = Floating point IEEE 754** 2 = 32-bit integer	**ACTION:** For reference **NOTES:** *Relay 1 Configuration Value* data format (40059 and 40060). Used in Section 3.3.3 on page 3-21.
Relay 1 Configuration Status	0x756B (30059)	0 = Reserved 1 = Not Ready Configuration is currently disabled **2 = Ready** Configuration enabled 3 = Busy Configuration in progress 4 = Complete Configuration complete 5 = Error Error during the configuration process	**ACTION:** Monitor in system **NOTE:** Used in Section 3.3.3 on page 3-21.
Relay 1 Diagnostic Value Type	0x756C (30060)	Reserved	**ACTION:** None
Relay 1 Diagnostic Value	0x756D (30061)	Reserved	**ACTION:** None
	0x756E (30062)	Reserved	
Relay 1 Diagnostic Status	0x756F (30063)	**0 = Unavailable** Not applicable to this sensor 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None

Table 3-12 – Relay 1 - Holding Registers

Name	Register Address	Description / Valid Values	Actions / Notes
Relay 1 Warning	0x9C6C (40044)	Reserved	**ACTION:** None
Relay 1 Error	0x9C6D (40045)	Reserved	**ACTION:** None
Relay 1 Mode	0x9C6E (40046)	**0 = Normal** Relay state depends on O2 sensor value 1 = Override User controls the relay state for test purposes	**ACTION:** Set in system **NOTE:** When *Override* is selected, the relay state is set by changing the value in *Relay 1 Override Value* (40047 and 40048).
Relay 1 Override Value	0x9C6F (40047)	32-bit integer (MSB 16-bits) **0**	**ACTION:** Set/Monitor in system
	0x9C70 (40048)	32-bit integer (LSB 16-bits) 0 = Open 1 = Closed	
Relay 1 Switch Points Type	0x9C71 (40049)	**0 = Window** The relay will switch from the set normal state to the opposite state within the window	**ACTION:** None **NOTE:** Window function is the only option available.
Relay 1 Switch Points - Input Sensor ID	0x9C72 (40050)	-	**ACTION:** For reference **NOTE:** O_2 sensor unique identifier that Relay 1 function is linked to.
Relay 1 Lower Switch Point	0x9C73 (40051)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2 Valid Range = 0.00 to (*Relay 1 Upper Switch Point* – 2*(*Relay 1 Switch Points Hysteresis*)	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. This value must be less than *Relay 1 Upper Switch Point* (40053 and 40054) minus 2 *x Relay 1 Switch Points Hysteresis* (40055 and 40056). Used in Section 3.3.2 on page 3-20.
	0x9C74 (40052)	Floating point IEEE 754 (LSB 16-bits) Unit = % O_2 Valid Range = 0.00 to (*Relay 1 Upper Switch Point* – 2*(*Relay 1 Switch Points Hysteresis*)	

Name	Register Address	Description / Valid Values	Actions / Notes
Relay 1 Upper Switch Point	0x9C75 (40053)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2 Valid Range = 0.00 to (*Relay 1 Lower Switch Point* + 2*(*Relay 1 Switch Points Hysteresis*)	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. This value must be greater than *Relay 1 Lower Switch Point* (40051 and 40052) plus 2 *x Relay 1 Switch Points Hysteresis* (40055 and 40056). Used in Section 3.3.2 on page 3-20.
	0x9C76 (40054)	Floating point IEEE 754 (LSB 16-bits) Unit = % O_2 Valid Range = 0.00 to (*Relay 1 Lower Switch Point* + 2*(*Relay 1 Switch Points Hysteresis*)	
Relay 1 Switch Points Hysteresis	0x9C77 (40055)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2 Valid Range = 0.00 to 25.00 Recommended Range = 0.00 to 1.00	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. Used in Section 3.3.2 on page 3-20.
	0x9C78 (40056)	Floating point IEEE 754 (LSB 16-bits) Unit = % O_2 Valid Range = 0.00 to 25.00 Recommended Range = 0.00 to 1.00	
Relay 1 Switch Points Control	0x9C79 (40057)	**0 = Nothing** 1 = Reserved 2 = Apply Switch Points 3 = Reset Status	**ACTION:** Set in system **NOTE:** Used in Section 3.3.2 on page 3-20.
Relay 1 Configuration Index	0x9C7A (40058)	**0 = Start-up** State of the relay when the system is initialising 1 = Standby State of the relay when O_2 measurements are off 2 = Error State of the relay during an error condition 3 = Normal Normal state of the relay when O_2 sensor measurement is outside the set switch points window and the O_2 sensor is not in an error state	**ACTION:** Set/Monitor in system **NOTE:** Used in Section 3.3.3 on page 3-21.
Relay 1 Configuration Value	0x9C7B (40059)	MSB 16-bits **0**	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. See *Relay 1 Configuration Value Type* (30057) for data format. Used in Section 3.3.3 on page 3-21.
	0x9C7C (40060)	LSB 16-bits 0 = Open 1 = Closed	

Name	Register Address	Description / Valid Values	Actions / Notes
Relay 1 Configuration Control	0x9C7D (40061)	**0 = Nothing** 1 = Change Index 2 = Apply Configuration 3 = Reset Status	**ACTION:** Set in system **NOTE:** Used in Section 3.3.3 on page 3-21.
Relay 1 Diagnostic Index	0x9C7E (40062)	Reserved	**ACTION:** None
Relay 1 Diagnostic Control	0x9C7F (40063)	Reserved	**ACTION:** None

3.3.2 Configuring Relay 1 Switch Points and Hysteresis

The relay switch points set where the relay will change state depending on the current O_2 sensor measurement. When the O_2 measurement is within the set window (between the upper and lower switch points) the relay will switch to the opposite state from the configured normal state. For example, if the relay is configured as normally open it will be open above and below the set window and closed within the set window. If only one switch point is required set the upper or lower switch point to the maximum or minimum of the sensor measurement range respectively.

Hysteresis may be added to the upper and lower switch points to avoid relay jitter when the measured O_2 value is fluctuating around one of the switch points. This value is also a function of the sensor measurement range, for example, if the hysteresis was set to 0.5 the relay switch points would have ±0.5% O_2 hysteresis.

1. Confirm *Relay 1 Switch Points Status* = *Ready* (30056 = 2).
2. Change *Relay 1 Lower Switch Point* (40051 and 40052), *Relay 1 Upper Switch Point* (40053 and 40054) and *Relay 1 Switch Points Hysteresis* (40055 and 40056) as required.
3. Set *Relay 1 Switch Points Control* to *Apply Switch Points* to commit the change/s (40057 = 2).
4. Monitor *Relay 1 Switch Points Status* which will change to *Busy* momentarily then *Complete* (30056 = 3 → 4).
5. Set *Relay 1 Switch Points Control* to *Reset Status* (40057 = 3) to return *Relay 1 Switch Points Status* to *Ready* (30056 = 2).

The example given on page 3-21 demonstrates the relay opening and closing as the O_2 measurement changes; the relay is configured to be normally open, the lower switch point has been set to 8% O_2 and the upper to 13% O_2 with 1% O_2 hysteresis.

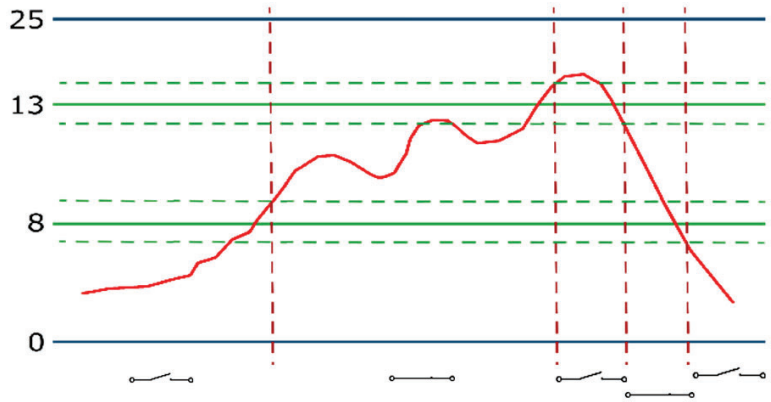


Figure 3-1

1. To begin with the sensor measurement is <7% O_2 so the relay is open.
2. When the measurement exceeds 9% O_2 (8% + 1% hysteresis) the relay will close.
3. The relay will remain closed until the O_2 measurement increases to above 14% (13% +1% hysteresis) at which point it will open again.
4. The relay will remain open until the O_2 reading falls below 12% (13% - 1% hysteresis) at which point it will close again.
5. The relay will remain closed until the O_2 reading falls below 7% (8% - 1% hysteresis) at which point it will open again.

3.3.3 Configuring Relay 1 System States

Configure the relay state during each of the system conditions:

1. Confirm *Relay 1 Configuration Status* = *Ready* (30058 = 2).
2. Change *Relay 1 Configuration Index* (40058) to the system state to be configured
3. Set *Relay 1 Configuration Control* to *Change Index* to load the selected system state (40061 = 1).
4. Change *Relay 1 Configuration Value* to the desired relay state.
5. Set *Relay 1 Configuration Control* to *Apply Configuration* to save the change (40061 = 2).
6. Monitor *Relay 1 Configuration Status* which will change to *Busy* momentarily then *Complete* (30058 = 3 → 4).
7. Set *Relay 1 Configuration Control* to *Reset Status* (40061 = 3) to return *Relay 1 Configuration Status* to *Ready* (30058 = 2).
8. Repeat Steps 1 to 7 for each system state as required.

Table 3-13 - Relay 2 - Input Registers

Name	Register Address	Description	Actions / Notes
Relay 2 ID	0x7570 (30064)	-	**ACTION:** For reference **NOTE:** Unique output identifier.
Relay 2 Warning	0x7571 (30065)	Reserved	**ACTION:** None
Relay 2 Error	0x7572 (300656)	Reserved	**ACTION:** None
Relay 2 Value	0x7573 (30067)	32-bit integer (MSB 16-bits)	**ACTION:** Monitor in system
	0x75734 (30068)	32-bit integer (LSB 16-bits) 0 = Open 1 = Closed	
Relay 2 Status	0x7575 (30069)	0 = Loading System initialising, Relay 2 in start-up state 1 = Reserved 2 = Standby O_2 sensor measurements off, Relay 2 in standby state **3 = ON** O_2 sensor measurements on, Relay 2 state depends the O_2 error state	**ACTION:** Monitor in system **NOTE:** *Relay 2 Mode* = *Override* (40066 =1) allows the relay state in *Standby* and *ON* to be overridden for test purposes.
Relay 2 Switch Points Status	0x7576 (30070)	**0 = Unavailable** Not applicable to this output 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None
Relay 2 Configuration Value Type	0x7577 (30071)	0 = Invalid **1 = Floating point IEEE 754** 2 = 32-bit integer	**ACTION:** For reference **NOTES:** *Relay 2 Configuration Value* data format (40079 and 40080). Used in Section 3.3.4 on page 3-25.
Relay 2 Configuration Status	0x7578 (30072)	0 = Reserved 1 = Not Ready Configuration is currently disabled **2 = Ready** Configuration enabled 3 = Busy Configuration in progress 4 = Complete Configuration complete 5 = Error Error during the configuration process	**ACTION:** Monitor in system **NOTE:** Used in Section 3.3.4 on page 3-25.

Name	Register Address	Description	Actions / Notes
Relay 2 Diagnostic Value Type	0x7579 (30073)	Reserved	**ACTION:** None
Relay 2 Diagnostic Value	0x757A (30074)	Reserved	**ACTION:** None
	0x757B (30075)	Reserved	
Relay 2 Diagnostic Status	0x757C (30076)	**0 = Unavailable** Not applicable to this sensor 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None

Table 3-14 - Relay 2 - Holding Registers

Name	Register Address	Description / Valid Values	Actions / Notes
Relay 2 Warning	0x9C80 (40064)	Reserved	**ACTION:** None
Relay 2 Error	0x9C81 (40065)	Reserved	**ACTION:** None
Relay 2 Mode	0x9C82 (40066)	**0 = Normal** Relay state depends on O2 sensor error state 1 = Override User controls the relay state for test purposes	**ACTION:** Set in system **NOTE:** When *Override* is selected the relay state is set by changing the value in *Relay 2 Override Value* (40067 and 40068).
Relay 2 Override Value	0x9C83 (40067)	32-bit integer (MSB 16-bits) **0**	**ACTION:** Set/Monitor in system
	0x9C84 (40068)	32-bit integer (LSB 16-bits) 0 = Open 1 = Closed	
Relay 2 Switch Points Type	0x9C85 (40069)	Reserved	**ACTION:** None
Relay 2 Switch Points - Input Sensor ID	0x9C86 (40070)	-	**ACTION:** For reference **NOTE:** O_2 sensor unique identifier that Relay 2 function is linked to.
Relay 2 Lower Switch Point	0x9C87 (40071)	Reserved	**ACTION:** None
	0x9C88 (40072)	Reserved	
Relay 2 Upper Switch Point	0x9C89 (40073)	Reserved	**ACTION:** None
	0x9C8A (40074)	Reserved	
Relay 2 Switch Points Hysteresis	0x9C8B (40075)	Reserved	**ACTION:** None
	0x9C8C (40076)	Reserved	
Relay 2 Switch Points Control	0x9C8D (40077)	Reserved	**ACTION:** None

Name	Register Address	Description	Actions / Notes
Relay 2 Configuration Index	0x9C8E (40078)	**0 = Start-up** State of the relay when the system is initialising 1 = Standby State of the relay when O_2 measurements are off 2 = Error State of the relay during an error condition 3 = Normal Normal state of the relay when O_2 sensor measurement is outside the set switch points window and the O_2 sensor is not in an error state	**ACTION:** Set/Monitor in system **NOTE:** Used in Section 3.3.4 on page 3-25.
Relay 2 Configuration Value	0x9C8F (40079)	MSB 16-bits **0**	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. See *Relay 2 Configuration Value Type* (30070) for data format. Used in Section 3.3.4 on page 3-25.
	0x9C90 (40080)	LSB 16-bits 0 = Open 1 = Closed	
Relay 2 Configuration Control	0x9C91 (40081)	**0 = Nothing** 1 = Change Index 2 = Apply Configuration 3 = Reset Status	**ACTION:** Set in system **NOTE:** Used in Section 3.3.4 on page 3-25.
Relay 2 Diagnostic Index	0x9C92 (40082)	Reserved	**ACTION:** None
Relay 2 Diagnostic Control	0x9C93 (40083)	Reserved	**ACTION:** None

3.3.4 Configuring Relay 2 System States

Configure the relay state during each of the system conditions:

1. Confirm *Relay 2 Configuration Status* = *Ready* (30071 = 2).
2. Change *Relay 2 Configuration Index* (40078) to the system state to be configured.
3. Set *Relay 2 Configuration Control* to *Change Index* to load the selected system state (40081 = 1).
4. Change *Relay 2 Configuration Value* to the desired relay state.
5. Set *Relay 2 Configuration Control* to *Apply Configuration* to save the change (40081 = 2).
6. Monitor *Relay 2 Configuration Status* which will change to *Busy* momentarily then *Complete* (30071 = 3 → 4).
7. Set *Relay 2 Configuration Control* to *Reset Status* (40081 = 3) to return *Relay 2 Configuration Status* to *Ready* (30071 = 2).
8. Repeat Steps 1 to 7 for each system state as required.

3.3.5 4 – 20mA Registers

The device is factory set to output a range of 0 – 25% O_2 via the 4 – 20mA analogue output (Analogue Out1).

Table 3-15 – 4-20mA - Input Registers

Name	Register Address	Description	Actions / Notes
4-20mA ID	0x757D (30077)	-	**ACTION:** For reference **NOTE:** Unique output identifier.
4-20mA Warning	0x757E (30078)	Reserved	**ACTION:** None
4-20mA Error	0x757F (30079)	Reserved	**ACTION:** None
4-20mA Value	0x7580 (30080)	Floating point IEEE 754 (MSB 16-bits) Unit = mA Valid Range = 2.00 to 20.00	**ACTION:** Monitor in system
	0x7581 (30081)	Floating point IEEE 754 (LSB 16-bits) Unit = mA Valid Range = 2.00 to 20.00	
4-20mA Status	0x7582 (30082)	0 = Loading System initialising, 4-20mA in start-up state 1 = Reserved 2 = Standby O_2 sensor measurements off, 4-20mA in standby state **3 = ON** O_2 sensor measurements on, 4-20mA value depends the O_2 measurement and the set sensor range	**ACTION:** Monitor in system **NOTE:** *4-20mA Mode* = *Override* (40086 =1) allows the Current value in *Standby* and *ON* to be overridden for test purposes.
4-20mA Sensor Range Status	0x7583 (30083)	0 = Reserved 1 = Not Ready Modification of the sensor range is currently disabled **2 = Ready** Modification of the sensor range enabled 3 = Busy Modification of the sensor range in progress 4 = Complete Modification of the sensor range complete 5 = Error Error during the modification of the sensor range	**ACTION:** Monitor in system **NOTE:** Used in Section 3.3.6 on page 3-30.
4-20mA Configuration Value Type	0x7584 (30084)	0 = Invalid 1 = Floating point IEEE 754 **2 = 32-bit integer**	**ACTION:** For reference **NOTES:** *4-20mA Configuration Value* data format (40099 and 40100). Used in Section 3.3.7 on page 3-30.

Name	Register Address	Description	Actions / Notes
4-20mA Configuration Status	0x7585 (30085)	0 = Reserved 1 = Not Ready Configuration is currently disabled **2 = Ready** Configuration enabled 3 = Busy Configuration in progress 4 = Complete Configuration complete 5 = Error Error during the configuration process	**ACTION:** Monitor in system **NOTE:** Used in Section 3.3.7 on page 3-30.
4-20mA Diagnostic Value Type	0x7586 (30086)	Reserved	**ACTION:** None
4-20mA Diagnostic Value	0x7587 (30087)	Reserved	**ACTION:** None
	0x7588 (30088)	Reserved	
4-20mA Diagnostic Status	0x7589 (30089)	**0 = Unavailable** Not applicable to this sensor 1 = Reserved 2 = Reserved 3 = Reserved 4 = Reserved 5 = Reserved	**ACTION:** None

Table 3-16 – 4-20mA – Holding Registers

Name	Register Address	Description / Valid Values	Actions / Notes
4-20mA Warning	0x9C94 (40084)	Reserved	**ACTION:** None
4-20mA Error	0x9C95 (40085)	Reserved	**ACTION:** None
4-20mA Mode	0x9C96 (40086)	**0 = Normal** 4-20mA value depends on O_2 sensor value 1 = Override User controls the 4-20mA value for test purposes	**ACTION:** Set in system **NOTE:** When *Override* is selected the 4-20mA state is set by changing the value in *4-20mA Override Value* (40087 and 40088).
4-20mA Override Value	0x9C97 (40087)	Floating point IEEE 754 (MSB 16-bits) Unit = mA Valid Range = 2.00 to 20.00	**ACTION:** Set/Monitor in system
	0x9C98 (40088)	Floating point IEEE 754 (LSB 16-bits) Unit = mA Valid Range = 2.00 to 20.00	
4-20mA Sensor Range Type	0x9C99 (40089)	**0 = Sensor Range** The 4-20mA value will vary linearly between the minimum and maximum set sensor range	**ACTION:** None **NOTE:** Sensor range is the only option available.
4-20mA Sensor Range - Input Sensor ID	0x9C9A (40090)	-	**ACTION:** For reference **NOTE:** O_2 sensor unique identifier that the 4-20mA function is linked to.
4-20mA Lower Sensor Range	0x9C9B (40091)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2 Valid Range = 0.00 to (*4-20mA Upper Sensor Range* – 0.01) Recommended Range = 0.00 to (*4-20mA Upper Sensor Range* – 1.00)	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. This value must be less than *4-20mA Upper Sensor Range* (40093 and 40094). Used in Section 3.3.6 on page 3-30.
	0x9C9C (40092)	Floating point IEEE 754 (LSB 16-bits) Unit = % O_2 Valid Range = 0.00 to (*4-20mA Upper Sensor Range* – 0.01) Recommended Range = 0.00 to (*4-20mA Upper Sensor Range* – 1.00)	

Name	Register Address	Description / Valid Values	Actions / Notes
4-20mA Upper Sensor Range	0x9C9D (40093)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2 Valid Range = (*4-20mA Lower Sensor Range* + 0.01) to 25.00 Recommended Range = (*4-20mA Lower Sensor Range* + 1.00) to 25.00	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. This value must be less than *4-20mA Lower Sensor Range* (40091 and 40092). Used in Section 3.3.6 on page 3-30.
	0x9C9E (40094)	Floating point IEEE 754 (MSB 16-bits) Unit = % O_2 Valid Range = (*4-20mA Lower Sensor Range* + 0.01) to 25.00 Recommended Range = (*4-20mA Lower Sensor Range* + 1.00) to 25.00	
4-20mA Sensor Range Hysteresis	0x9C9F (40095)	Reserved	**ACTION:** None
	0x9CA0 (40096)	Reserved	
4-20mA Sensor Range Control	0x9CA1 (40097)	**0 = Nothing** 1 = Reserved 2 = Apply Sensor Range 3 = Reset Status	**ACTION:** Set in system **NOTE:** Used in Section 3.3.6 on page 3-30.
4-20mA Configuration Index	0x9CA2 (40098)	**0 = Start-up** 4-20mA value when the system is initialising 1 = Standby 4-20mA value when O_2 measurements are off 2 = Error 4-20mA value during an error condition	**ACTION:** Set/Monitor in system **NOTE:** Used in Section 3.3.7 on page 3-30.
4-20mA Configuration Value	0x9CA3 (40099)	MSB 16-bits Unit = mA Valid Range = 2.00 to 20.00	**ACTION:** Set/Monitor in system **NOTES:** Any changes are saved in EEPROM and retained on power loss. See *4-20mA Configuration Value Type* (30083) for data format. Used in Section 3.3.7 on page 3-30.
	0x9CA4 (40100)	LSB 16-bits Unit = mA Valid Range = 2.00 to 20.00	
4-20mA Configuration Control	0x9CA5 (40101)	**0 = Nothing** 1 = Change Index 2 = Apply Configuration 3 = Reset Status	**ACTION:** Set in system **NOTE:** Used in Section 3.3.7 on page 3-30.
4-20mA Diagnostic Index	0x9CA6 (40102)	Reserved	**ACTION:** None
4-20mA Diagnostic Control	0x9CA7 (40103)	Reserved	**ACTION:** None

3.3.6 Configuring the Sensor Range Applied to the 4-20mA Output

The 4-20mA output is factory set to represent a sensor range of 0 – 25% O_2; where 0% O_2 is equal to 4mA and 25% O_2 is equal to 20mA.

This applied sensor range is configurable; an example of changing the lower and upper sensor ranges would be in a combustion atmosphere where the O_2 range is between 5 – 21%. The user could set the lower output range to 4% and the upper output range to 22% and the 4-20mA output would vary linearly in between.

NOTE: The lower and upper ranges lock out the output at the set limits so in the example above, 4% O_2 or below would clamp the output to 4mA and 22% O_2 or above would clamp the output to 20mA.

1. Confirm *4-20mA Sensor Range Status* = *Ready* (30082= 2).
2. Change *4-20mA Lower Sensor Range* (40091 and 40092) and *4-20mA Upper Sensor Range* (40093 and 40094) as required.
3. Set *4-20mA Sensor Range Control* to *Apply Sensor Range* to commit the change/s (40097 = 2).
4. Monitor *4-20mA Sensor Range Status* which will change to *Busy* momentarily then *Complete* (30082 = 3 → 4).
5. Set *4-20mA Sensor Range Control* to *Reset Status* (40097 = 3) to *4-20mA Sensor Range Status* to *Ready* (30082= 2).

3.3.7 Configuring the 4-20mA Output Value During Other System States

Configure the 4-20mA output during each of the other system conditions when the output is not proportional to the O_2 sensor output.

1. Confirm *4-20mA Configuration Status* = *Ready* (30084 = 2).
2. Change *4-20mA Configuration Index* (40098) to the system state to be configured.
3. Set *4-20mA Configuration Control* to *Change Index* to load the selected system state (40101 = 1).
4. Change *4-20mA Configuration Value* to the desired 4-20mA output.
5. Set *4-20mA Configuration Control* to *Apply Configuration* to save the change (40101 = 2).
6. Monitor *4-20mA Configuration Status* which will change to *Busy* momentarily then *Complete* (30084 = 3 → 4).
7. Set *4-20mA Configuration Control* to *Reset Status* (40101 = 3) to return *4-20mA Configuration Status* to *Ready* (30084 = 2).
8. Repeat Steps 1 to 7 for each system state as required.

REFERENCE DOCUMENTS

Reference documents are listed below. The SST documentation list is not exhaustive, always refer to the SST website for the latest information.

NOTE: Any industry standards referenced, always refer to the appropriate website to ensure the most up-to-date version is used.

Part Number	Title
UG-003	Gastrack Gas Analyser Probe (GAP) – Installation, Operation and Maintenance Guide
QS-004	Gastrack Gas Analyser Probe (GAP) – Quick Start Guide
DS-0137	Gastrack Gas Analyser Probe (GAP) – Datasheet

INFORMATION

As customer applications are outside of SST Sensing Limited's control, the information provided is given without legal responsibility. Customers should test under their own conditions to ensure that the equipment is suitable for their intended application.

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