Modbus Protocol Guide
TotalSense Series

Senva Sensors
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TotalSense™ Series

154-0044-0F

Rev.	Release Date	By	Description of Change	ECR
0A		NAK	Initial Release	---
0B	9/23/2021	NJS	Adding system config points	---
0C	6/7/2022	NJS	Updates for engineering CI release	---
0D	9/20/2022	NJS	Updates for CO and O3 release	---
0E	3/8/2023	NJS	Adding PB over comms	---
0F	1/8/2024	NJS	Updates for new feature release	---

Contents

See Also:

152-0401   TotalSense Installation Instructions

154-0042   TotalSense Display Navigation Guide

154-0043   TotalSense BACnet Protocol Guide

Configuration

Congratulations on installing your new Senva Modbus TotalSense Series indoor air quality monitor! The *Modbus Protocol Guide* assumes the first stage of installation is complete, with the TotalSense connected to your local RS485 network and powered.

See "TotalSense Installation Manual" for setup.

The TotalSense supports the following functions of the Modbus Application Protocol Specification, v1.1b3.:
The TotalSense supports the following Modbus functions:
- 0x03 *Read Input Register*
- *0x04 Read Holding Registers*
- 0x06 *Write Single Register*
- 0x10 *Write Multiple Registers*

Protocol
   TotalSense device supports Modbus RTU encoding only (not ASCII).

Scale:
   Values must be divided by this scale factor to be read correctly.

Store:
   All registers 100 or greater will be stored in non-volatile memory.

R/W:
R = Read Only
R/W = Read and Write

Type, Min, Max:
INT8   8-bit integer; -128 to 128, unless otherwise noted
INT16   16-bit integer; -32768 to 32767, unless otherwise noted
Float   Number that contains a decimal point

ENUM = UINT16 16-bit unsigned integer that maps to a defined list of values

Readings

Register	Description	Min/Max	Units	Read	Modbus Scale	Functionality
1	*Temperature*	-400 / 1220	°F/C	R	10	Read current temperature. Units depend on setting in 102.
2	*Relative humidity*	00 / 1000	%RH	R	10	Read current relative humidity in %.
3	*CO2*	0 / 10000	PPM	R	1	Read current CO_2 concentration in PPM.
4	*TVOC ug/m3*	0 / 10000	µg/m^3	R	1	Read current TVOC reading in µg/m^3. This value is compensated for ambient temperature and barometric pressure.
5	*TVOC PPB*	0 / 10000	PPB	R	1	Read current TVOC reading in PPB. This value is compensated for ambient temperature and barometric pressure and assumes an average molecular weight of 46.069 g/mol for conversion, which is based on Ethanol. To adjust this value, see register 108 to adjust scaling factor.
6	*PM 1.0 ug/m3*	0 / 1000.0	µg/m^3	R	10	Read current concentration of particles sized 0.3-1.0 µg/m^3.
7	*PM 2.5 ug/m3*	0 / 1000.0	µg/m^3	R	10	Read current concentration of particles sized 0.3-2.5 µg/m^3.
8	*PM 4.0 ug/m3*	0 / 1000.0	µg/m^3	R	10	Read current concentration of particles sized 0.3-4.0 µg/m^3.
9	*PM 10.0 ug/m3*	0 / 1000.0	µg/m^3	R	10	Read current concentration of particles sized 0.3-10.0 µg/m^3.
10	*Air quality*	0 = Good 1 = Fair 2 = Poor	no units	R	1	Read current air quality status. See "Air Quality Thresholds" section for more information.
11	*Slider display*	-400 / 1220	°F/C	R	10	Read current setpoint slider position. Minimum and maximum values for scaling can be set in 109 and 110 respectively. Units depend on setting in 102.

Register	Description	Min/Max	Units	Read	Modbus Scale	Functionality
12	*Occupancy*	0 = Unoccupied 1 = Occupied	no units	R	1	Read current status of PIR occupancy sensor. This value will stay in the occupied state after a motion event for the period specified in 112.
13	*Ambient light*	0 / 100	foot candles	R	1	Read current ambient light value in foot candles.
14	*Relay contacts state*	0 = OPEN 1 = CLOSED	no units	R	1	Read current state of setpoint relay. Relay settings can be adjusted in 115-120.
15	*Dewpoint*	-400 / 1220	°F/C	R	10	Read current dew point temperature. Units depend on setting in 102.
16	*Pressure*	000 / 3544	inHg	R	100	Read current barometric pressure in inHg. This reading is only available on units that include either CO_2 or VOC sensors.
27	*PM0.5 Particle Count*	0/10000	#/cm^3	R	10	Read Current counts for particles size 0.3 to 0.5.
28	*PM1.0 Particle Count*	0/10000	#/cm^3	R	10	Read Current counts for particles size 0.3 to 1.0.
29	*PM2.5 Particle Count*	0/10000	#/cm^3	R	10	Read Current counts for particles size 0.3 to 2.5.
30	*PM4.0 Particle Count*	0/10000	#/cm^3	R	10	Read Current counts for particles size 0.3 to 4.0.
31	*PM10.0 Particle Count*	0/10000	#/cm^3	R	10	Read Current counts for particles size 0.3 to 10.0.
32	*PM Avg Particle Size*	0/1000	um	R	100	Read Current average size of particle that the device has measured.
33	*CO Reading*	0/2000	ppm	R	10	Read the Current CO readings
35	*O3 Reading*	0/5000	ppb	R	10	Read the Current O3(ozone) readings
37	*User BTN Active State*	0/1	No units	R	1	0 = No button activity since timeout period. 1= Button was pressed within the timeout period.

Diagnostics

Register	Description	Min/Max	Read	Modbus Scale	Functionality
17	*System status*	0 / 255	R	1	0x01 = EEPROM hardware fault (Consult factory) 0x02 = EEPROM data corruption (Consult factory) 0x04 = EEPROM write error (Consult factory) 0x08 = Device is currently using factory defaults (Consult factory) 0x10 = Sensor error (see individual sensor status to more info). **Bolded** statuses will trigger this error.
18	*Temp sensor status*	0 / 255	R	1	**0x01** = Sensor hardware fault (Consult factory) **0x02** = Sensor Data error (Consult factory)
19	*RH sensor status*	0 / 255	R	1	**0x01** = Sensor hardware fault (Consult factory) **0x02** = Sensor Data error (Consult factory)
20	*CO2 sensor status*	0 / 255	R	1	**0x01** = Sensor hardware fault (Consult factory) **0x02** = Sensor Data error (Consult factory) 0x04 = Sensor not ready (Consult factory) 0x40 = Temperature compensation not applied (No action necessary. Default value 25°C is used for temp compensation). 0x80 = Pressure compensation not applied (No action necessary. Default value 25°C is used for pressure compensation.
21	*TVOC sensor status*	0 / 255	R	1	**0x01** = Sensor hardware (I2C) fault (Consult factory) **0x02** = Sensor data error **0x04** = Sensor other hardware error **0x08** = Sensor not ready (training) 0x10 = Temperature compensation not applied 0x20 = Humidity compensation not applied
22	*PM sensor status*	0 / 255	R	1	**0x01** = Sensor communication error (Consult factory) **0x02** = Sensor Data Error (Consult factory) 0x04 = Sensor not ready (Consult factory) 0x08 = Sensor fan speed warning (Consult factory) 0x10 = Sensor fan failure (Consult factory) 0x20 = Sensor laser failure (Consult factory)
23	*Pressure sensor status*	0 / 255	R	1	**0x01** = Sensor hardware fault (Consult factory) **0x02** = Sensor Data error (Consult factory) 0x04 = Sensor not ready (Consult factory)
24	*PID Output Power*	0.0/100.0%	R	10	Read current output percentage of the PID output.
34	*CO Status*	0/255	R	1	**0x01** = Sensor communication error (Consult factory) **0x02** = Sensor Data Error (Consult factory) 0x04 = Sensor Error 0x08 = Sensor not ready (Consult factory) 0x10 = Sensor End of Life 0x20 = Calibration Expired 0x40 = Temperature compensation not applied

Register	Description	Min/Max	Read	Modbus Scale	Functionality
36	*O3 Status*	0/255	R	1	**0x01** = Sensor communication error (Consult factory) **0x02** = Sensor Data Error (Consult factory) 0x04 = Sensor Error 0x08 = Sensor not ready (Consult factory) 0x10 = Temperature compensation not applied 0x02 = Humidity compensation not applied

Settings

Register	Description	Min/Max	Units	Default Value	R/W	Modbus Scale	Functionality
101	*Temp Offset*	-90/90	°F	0	R/W	10	Adjust T reading by up to 9°F (or 5°C).
102	*Temp Unit*	0=F 1=C	No units	0	R/W	1	Select whether display shows degrees Fahrenheit or Celsius. This will also determine the scale of the reading in Register 1.
103	*RH Offset*	-50/50	%RH	0	R/W	10	Adjust RH reading by up to 5%.
104	*CO2 Offset*	-250/250	PPM	0	R/W	1	Offset CO_2 reading by ±250 PPM.
105	*CO2 autocal enable*	0=disabled 1=enabled	None	1	R/W	1	Enable or disable ABC function for CO_2 sensor calibration. It is not recommended to disable this unless you are using a dual channel CO_2 element.
106	*CO2 Autocal Baseline*	400 / 1499	PPM	400	R/W	1	This sets the baseline value for the automatic baseline calibration. This should correspond to expected "unoccupied" levels of CO_2.
107	*CO2 Autocal Period*	1 / 15	Days	14	R/W	1	This sets the period for which ABC will calculate its unoccupied level and calibrate.
108	*TVOC scale*	0000 / 10000	No units	1000	R/W	1000	This value can be used to adjust the TVOC reading. The standard readings are based on an Ethanol equivalent. See "TVOC Molecular Weights" section for more information.
109	*Slider display min*	-400 / 1220	°F/C	50	R/W	1	Value shown when slider is at lowest position for display purposes only. This will not affect the slider resistive output. This will also set the minimum value for the Register 11 reading.
110	*Slider display max*	-40.0 / 122.0	°F/C	95	R/W	1	Value shown when slider is at highest position for display purposes only. This will not affect the slider resistive output. This will also set the minimum value for the Register 11 reading.

Register	Description	Min/Max	Units	Default Value	R/W	Modbus Scale	Functionality
111	*PIR Motion event sensitivity*	10 / 100	No units	80	R/W	1	Sensor sensitivity can be adjusted from 0-100. The default of 80 achieves the specified distance and degree. If nuisance triggers occur or a further sensing distance is required, this value can be decreased and increased accordingly. See TotalSense Installation Manual for a visual representation of this sensitivity value.
112	*PIR Occupied delay*	1 / 120	Minutes	10	R/W	1	This is the number of minutes the occupancy state will remain active after each motion event is detected. This applies to the "occupancy" BACnet and Modbus point as well as the output relay state, if set to PIR in 115.
113	*PM clean interval*	0 / 8760	hours	168	R/W	1	Timed automatic clean cycle of PM element. To disable auto-clean, set to 0.
114	*PM command*	0 / 2	no units	0	R/W	1	Write 1 to execute fan manual clean operation Write 2 to execute PM sensor reset
115	*Relay source*	0=None 1=CO2 2=Humidity 3=Temp 4=TVOC µg/m^3 5=PM 6=Occupancy 7=Air Quality 8 = CO 9 = Ozone	no units	0	R/W	1	Which measurement will activate setpoint relay
116	*Relay polarity*	0 = N.O. 1 = N.C.	no units	0	R/W	1	A N.O. (normally open) relay will be in the open state until it is activated, i.e., turn-on threshold is met, at which time it will close. A N.C. (normally closed) relay will be in the closed state until it is activated, at which time it will open.

Register	Description	Min/Max	Units	Default Value	Read	Modbus Scale	Functionality
117	*Relay on threshold*	000 / 10000	percent	varies	R/W	10	Based on full scale range of the selected sensor, set the value above which the relay will activate. For example, if CO_2 is selected, its full available range is 0-10,000 PPM, so a setpoint of 800 PPM would correspond to an 8.00% threshold setting. For temperature, the full range is -40 to 122°F, so a setpoint of 70°F would correspond to a threshold value of 68%. Use this equation to determine threshold setting for temp in °F: (T+40)/162*100. This setting is ignored for PIR and G/F source selections. Display will show the calculated value as you adjust this setting. The below shows the values that are set by default when each source is selected as well as the calculated value for each.
118	*Relay off threshold*	000 / 10000	percent	Varies	R/W	10	Based on full scale range of the selected sensor, set the value below which the relay will de-activate. For example, to deactivate relay when CO_2 setting reaches 790, set this threshold value to 7.90%. This value must be set lower than the relay on threshold.
119	*Relay min on time*	1 / 240	seconds	60	R/W	1	When relay activates, it will not deactivate until this time has lapsed, regardless of the turn-off setting. The relay will deactivate only when this time has expired AND the turn-off threshold is met.

Table within register 117 Functionality cell:

Source Selection	Range	Default Turn-on Threshold	Calculated Turn-on value	Default Turn-off Threshold	Calculated Turn-off value
CO2	0-10,000 PPM	8.0%	800 PPM	7.0%	700 PPM
RH	0-100% RH	60%	60% RH	55%	55% RH
Temp*	-40 - 122°F	74%	80°F	73%	78°F
TVOC	0-10000 µg/m³	4.0%	400 µg/m³	3.5%	350 µg/m³
CO	0-200 PPM	50%	100PPM	40%	80PPM
Ozone	0-500 PPM	20%	100PPM	16%	80PPM

Register	Description	Min/Max	Units	Default Value	Read	Modbus Scale	Functionality
120	*Relay min off time*	1 / 240	seconds	60	R/W	1	When relay de-activates, it will not activate again until this time has lapsed, regardless of the turn-on setting. The relay will re-activate only when this time has expired AND the turn-on threshold is met.
121	*Display PM size*	0 = 0.3-1.0 1 = 0.3-2.5 2 = 0.3-4.0 3 = 0.3-10.0	Micro-meters	1	R/W	1	Select which particulate size to show on display units.
122	*Display center*	0 = None 1 = Temperature 2 = Humidity 3 = CO2 4 = Air Quality 5 = TVOC µg/m^3 6 = TVOC ppb 7 = PM 8 = Temp Setpoint 9 = CO 10 = O3	None	4	R/W	1	Choose the value to show in the center of the OLED display (Display models only). The below is an example of the Air Quality" setting. If PM is selected, the particle size displayed will depend on the setting in 121.
123	*Display upper left*	0 = None 1 = Relay Icon	None	0	R/W	1	Choose whether to show the relay state icon on the top left of the OLED display (Display models only).
124	*Display upper right*	0 = None 1 = Temperature 2 = Humidity 3 = CO2 5 = TVOC µg/m^3 6 = TVOC ppb 7 = PM 8 = Temp Setpoint 9 = CO 10 = O3	None	1 or 0	R/W	1	Choose the value to show in the upper right of the OLED display (Display models only). Default depends on whether temperature element is included.
125	*Display lower left*	0 = None 1 = Temperature 2 = Humidity 3 = CO2 5 = TVOC µg/m^3 6 = TVOC ppb 7 = PM 8 = Temp Setpoint 9 = CO 10 = O3	None	2 or 0	R/W	1	Choose the value to show in the lower left of the OLED display (Display models only). Default depends on whether humidity element is included.

Register	Description	Min/Max	Units	Default Value	Read	Modbus Scale	Functionality
126	*Display lower right*	0 = None 1 = Temperature 2 = Humidity 3 = CO2 5 = TVOC µg/m^3 6 = TVOC ppb 7 = PM 8 = Temp Setpoint 9 = CO 10 = O3	None	3 or 0	R/W	1	Choose the value to show in the lower right of the OLED display (Display models only). Default depends on whether CO2 element is included.
127	*AQ Ring brightness*	0 / 100	no units	100	R/W	1	Adjust value to increase or decrease brightness of AQ Ring (on AQ Ring devices only).
128	*Good-Fair*	0 / 100	no units	70	R/W	1	Adjust this value to change the threshold below which the display or AQ Ring will show a "fair" rating.
129	*Fair-Poor*	0 / 100	no units	40	R/W	1	Adjust this value to change the threshold at or below which the display or AQ Ring will show a "Poor" rating.
130	*VOC Mode*	0/1	No units	0	R/W	1	0 = Normal operation mode 1 = Training mode (48 hours)
131	*Factory reset*	1234 *	no units	0	R/W	1	Write value 1234 to this register to set all customer accessible values to factory defaults. Device will reboot after factory restore has completed.
132	*Protocol*	0 = Modbus 1 = BACnet	no units		R	1	Read from device DIP switches. See installation Manual for details.
133	*MAC address*	0 / 127	no units		R	1	Read from device DIP switches. See installation Manual for details.
134	*Baud rate*	0 = 9600 1 = 19200 2 = 38400 3 = 57600 4 = 76800 5 = 115200	no units		R	1	Read from device DIP switches. See installation Manual for details.
135	*Data/Parity/Stop*	0 = 8N1 1 = 8N2 2 = 8O1 3 = 8E1	no units		R	1	Read from device DIP switches. See installation Manual for details.

Register	Description	Min/Max	Units	Default Value	Read	Modbus Scale	Functionality
155	*Display Lock*	0 = Disabled 1 = Enabled	No units	0	R/W	1	Choose to lock the settings Menu. This will override the menu lock setting in the device GUI display settings and the device will remain locked until this setting is changed through comms.
156	*PIR Display Wake-Up*	0 = Disabled 1 = Enabled	No Units	0	R/W	1	Will use the PIR motion sensor to wake up the device display when a motion event is detected
157	*Screensaver Timeout*	1/120	Min	1	R/W	1	Sets the time in minutes the screen will stay active until the screensaver turns on.
160	*CO Calibration Expiration*	0/365	days	365	Read Only	1	A count down in days until the CO sensor needs calibration.
161	*CO Sensor End of Life*	0/1825	days	1825	Read Only	1	A count down in days of the CO sensors total lifetime.
162	*Ozone Calibration expiration*	0/365	days	0	Read only	1	Shows number of days left on the Ozone calibration.
163	*BTN State Hold Time*	1/600	Seconds	10	R/W	1	Number of seconds that the button state is active after button is pressed.
164	*Ozone Sensor end of life*	0/1825	days	1825	Read only	1	Number of days until the Ozone sensor is end of life.
165	*Temp setpoint*	-400/1220	F/C	720	Read only	10	Setpoint used when slider is not equipped.

Analog Output

Register	Description	Min/Max	Units	Read	Modbus Scale	Functionality
136	Analog Source	0 = None 1 = CO2 2 = Humidity 3 = Temperature 4=VOC 5 = PM 6 = Slider Temp 7 = PID-Temp 8 = PID-CO2 9 = PID-Slider Temp 10 = CO 11 = Ozone	None	R/W	1	Sets the source of the analog output channel.
137	Analog V min	0/100	Volts	R/W	10	This value corresponds to the lowest point on an analog scale. For a 0-10V signal, set to 0V. For a 2-10V signal, set to 2V.
138	Analog V max	0/100	Volts	R/W	10	This value corresponds to the highest point on an analog scale. For a 0-10V signal, set to 10V. For a 0-5V signal, set to 5V.
139	Analog mA min	0/200	mA	R/W	10	This value corresponds to the lowest point on an analog scale. For a 4-20mA signal, set to 4mA. For a 0-20mA signal, set to 0mA.
140	Analog mA max	0/200	mA	R/W	10	This value corresponds to the highest point on an analog scale. For a 0-20mA or 4-20mA signal, set to 20mA.

PID Settings

Register	Description	Min/Max	Units	Read	Modbus Scale	Functionality
141	PID CO2 setpoint	0/10000	ppm	R/W	1	Sets the CO2 setpoint for the PID controlled analog output.
142	PID Temp Setpoint	-400/1220	F/C	R/W	10	Sets the Temperature set point for the PID controlled analog output.
143/144	PID Kp	-1000000 /1000000	None	R/W	1000	Sets the Proportional gain PID coefficient.
145/146	PID Ki	0/100000	None	R/W	1000	Sets the Integral gain PID coefficient.
147/148	PID Kd	0/100000	None	R/W	1000	Sets the Derivative gain PID coefficient.
149	PID Invert	0 = Not Inverted 1 = Inverted	None	R/W	1	This setting will invert the overall error signal (R - SP instead of (SP - R).
166	AQI PID Setpoint	0/10000	%	R/W	100	Can use this to control a PID loop based on the calculated air quality index.

Air Quality Thresholds

If Air Quality is selected Settings, the device will monitor each CO2, TVOC, PM, RH, and Temp sensor present and will display accordingly. The device will calculate an average air quality based on up to 5 sensors and display good, fair, or poor accordingly.

Register	Description	Min/Max	Units	Default Values	Read	Modbus Scale	Functionality
167	AQI CO2 Poor quality	0/10000	PPM	2000	R/W	1	Threshold where CO2 quality becomes Poor
168	AQI CO2 Good quality	0/10000	PPM	800	R/W	1	Threshold where CO2 quality becomes Good
169	AQI VOC Poor quality	0/32000	Ug/m3	3000	R/W	1	Threshold where VOC quality becomes Poor
170	AQI VOC Good quality	0/32000	Ug/m3	300	R/W	1	Threshold where VOC quality becomes Good
171	AQI PM Poor quality	0/1000	Ug/m3	55	R/W	1	Threshold where PM quality becomes Poor
172	AQI PM Good quality	0/1000	Ug/m3	12	R/W	1	Threshold where PM quality becomes Good
173	AQI CO Poor quality	0/200	PPM	25	R/W	1	Threshold where CO quality becomes Poor
174	AQI CO Good quality	0/200	PPM	0	R/W	1	Threshold where CO quality becomes Good
175	AQI O3 Poor quality	0/5000	PPB	100	R/W	1	Threshold where Ozone quality becomes Poor
176	AQI O3 Good quality	0/5000	PPB	0	R/W	1	Threshold where Ozone quality becomes Good

177	AQI Temp Range Low	-400/1220	F/C	640	R/W	10	Low window threshold for good temperature quality
178	AQI CO Good quality	-400/1220	F/C	790	R/W	10	High window threshold for good temperature quality
179	AQI Temp Range Low	0/100	%RH	30	R/W	1	Low window threshold for good humidity quality
180	AQI CO Good quality	0/100	%RH	60	R/W	1	High window threshold for good humidity quality

The average air quality is calculated as follows for the sensors that have been enabled (see table on page 17 to enable and disable each senor):

1. Each reading is rated according to the above thresholds and given an air quality rating. For each sensor, a good rating is given 90%, fair is given 60% and poor is given 0% air quality.

2. The average of all sensors' air quality is calculated.

3. The average air quality is assigned based on the following thresholds. These thresholds can be adjusted in 128 Good-fair and 129 fair-poor.

    a. Good ≥ 75

    b. 55 < Fair < 75

    c. Poor ≤ 55

Register	Description	Min/Max	Units	Read/Type	Modbus Scale	Functionality
150	AQ Enable Temp	0 = Disabled 1 = Enabled	None	R/W Enum	1	These settings are used to enable or disable a sensor being used for the Air Quality calculation. For a sensor to be enabled it must be installed on the device.

All sensors will be shipped with present elements enabled in the Air Quality calculation. |
151	AQ Enable Humidity	0 = Disabled 1 = Enabled	None	R/W Enum	1	
152	AQ Enable CO2	0 = Disabled 1 = Enabled	None	R/W Enum	1	
153	AQ Enable PM	0 = Disabled 1 = Enabled	None	R/W Enum	1	
154	AQ Enable VOC	0 = Disabled 1 = Enabled	None	R/W Enum	1	
158	AQ Enable CO	0 = Disabled 1 = Enabled	None	R/W Enum	1	
159	AQ Enable Ozone	0 = Disabled 1 = Enabled	None	R/W Enum	1	

TVOC Molecular Weights

Senva's TVOC sensor uses an Ethanol reading to determine a raw TVOC value. Additionally, conversion from µg/m^3 uses the molecular weight of Ethanol. To scale based on a different gas baseline, choose the appropriate gas from the list below and enter the scale factor in 108.

Please note that the sensor is measuring TOTAL VOCs, so adjusting the scale factor will not necessarily result in a gas-specific reading unless, in special cases, that is the only expected VOC present in the area. It is recommended to use the 1.0 scale factor in most cases. The RESET standard suggests calculating TVOC based on the molecular weight of Isobutelyne (scale factor: 1.218).

Data Source: http://aqt-vru.com/emissions/complete-list-of-vocs/

Contamination	Name	Molecular Weight	Scale factor
ACETYLENE	ACETYLEN	26.04	0.565
FORMALDEHYDE	FORMALD	30.03	0.652
METHANOL	MEOH	32.04	0.695
PROPANE	PROPANE	44.1	0.957
ETHANOL	ETOH	46.07	1.000
DIMETHYL ETHER	ME-O-ME	46.07	1.000
METHYL CHLORIDE	CH3-CL	50.49	1.096
1,3-BUTADIENE	13-BUTDE	54.09	1.174
ISOBUTENE	ISOBUTEN	56.11	1.218
N-BUTANE	N-C4	58.12	1.262
ISOBUTANE	2-ME-C3	58.12	1.262
ACETIC ACID	ACETACID	60.05	1.303
ISOPROPYL ALCOHOL	I-C3-OH	60.1	1.305
ETHYLENE GLYCOL	ET-GLYCL	62.07	1.347
ISOPRENE	ISOPRENE	68.12	1.479
BUTANAL	1C4RCHO	72.11	1.565
N-PENTANE	N-C5	72.15	1.566
ISOPENTANE	2-ME-C4	72.15	1.566
HYDROXY ACETONE	HOACET	74.08	1.608
ISOBUTYL ALCOHOL	I-C4-OH	74.12	1.609
BENZENE	BENZENE	78.11	1.695
TOLUENE	TOLUENE	92.14	2.000
M-XYLENE	M-XYLENE	106.17	2.305
O-XYLENE	O-XYLENE	106.17	2.305
P-XYLENE	P-XYLENE	106.17	2.305
TERPENE	TERPENE	136.24	2.957