AMETEK®

PROCESS INSTRUMENTS

MANUAL SUPPLEMENT

9900RM/WM Analyzer
Customer Modbus® Data Communication

PN 903-8818, Rev A

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Overview

> *These Modbus data communication descriptions are intended for 9900RM (Rack Mount) and WM (Wall Mount) versions of this analyzer.*

NOTE

> *Refer to Chapters 2 and 3 in the 9900RM/WM Analyzer* User Manual *for instructions on enabling, disabling, and configuring the customer facing Modbus data communication interface.*

NOTE

Typical 9900RM/WM Analyzer default settings include:

Modbus Node Address:101

RS-485 Communication Settings:	Baud Rate:	38.4 kbps
	Data Bits:	8
	Stop Bit:	1
	Parity:	none

Standard Analyzer

The primary data communication interface between the customer's data acquisition equipment (e.g., DCS, PLC, DAS, SCADA, etc.), and a standard 9900RM/WM Analyzer is Modbus-RTU protocol over RS-485, 2-wire or 4-wire. The connection is made to **TB1** on the **Customer I/O** board as shown in Figure 1. The Modbus-RTU/RS-485 data communication interface provides full read and write access to Modbus registers in Table 1. The analyzer result registers through this interface are updated once per second.

A standard 9900RM/WM Analyzer has a secondary data communication interface using Modbus-TCP protocol over Ethernet. The connection is made to the **RJ-45** port at the analyzer Rear Panel, as shown in Figure 2. The secondary Modbus-TCP/Ethernet data communication interface uses the HMI's **IP Address** (192.168.127.253 shown in Figures 1 and 2 is the default) and provides access to all read-only registers and three (3) command registers (**#82**, **#320**, and **#667**), in Table 1. It allows monitoring of analyzer results and status and initiating routine actions but prohibits modification of analyzer settings. The analyzer result registers through this interface are updated once every 2–4 seconds.

Analyzer With Modbus Gateway Option

When the optional Modbus Gateway is installed in a 9900RM/WM Analyzer, Modbus-TCP/Ethernet at the **RJ-45** port becomes the primary data communication interface (see Figure 2). The primary data communication interface uses the gateway's **IP Address** (192.168.127.253 shown in Figures 1 and 2 is the default) and provides full read- and write-access to Modbus registers in Table 1. The Modbus-RTU/RS-485 connection at **TB1** on **Customer I/O** board is no longer available because it is used internally by the gateway.

If an alternate data communication connection is needed, an adaptor (AMETEK Part No. 301-5462) can be installed at **P2** port of the gateway to provide a secondary Modbus-RTU/RS-485 data communication interface. The interface provides full read- and write-access to the Modbus registers in Table 1.

Analyzer With NDIR Sensor Option

When the NDIR Sensor option is installed in a 9900RM/WM analyzer, Modbus registers in Table 2 becomes available for full read- and write-access. Modbus registers in Table 2 can only be accessed through the Modbus-TCP/Ethernet data communication interface using the **IP Address** of the HMI, regardless of the Modbus Gateway option is installed or not.

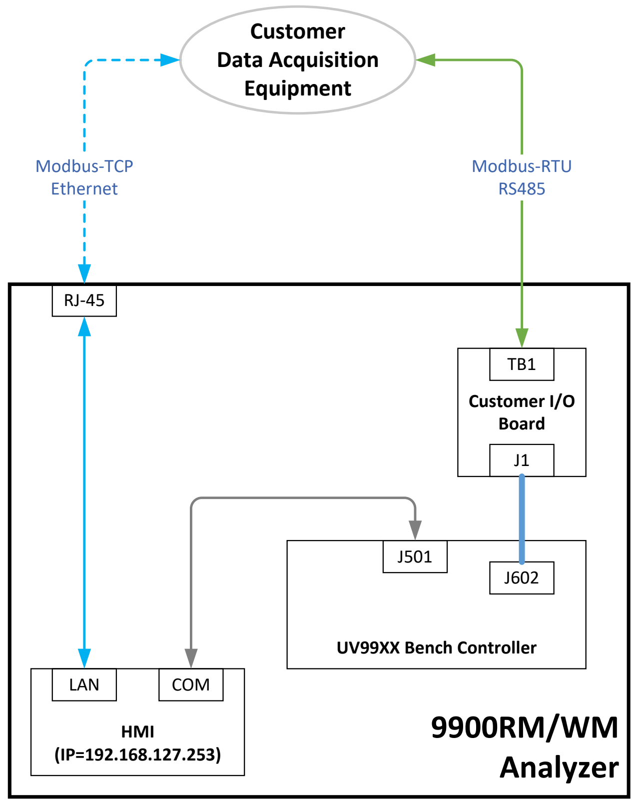

Figure 1.
Customer Data Acquisition Equipment-to-9900 Analyzer, connection to TB1 on Customer I/O board.

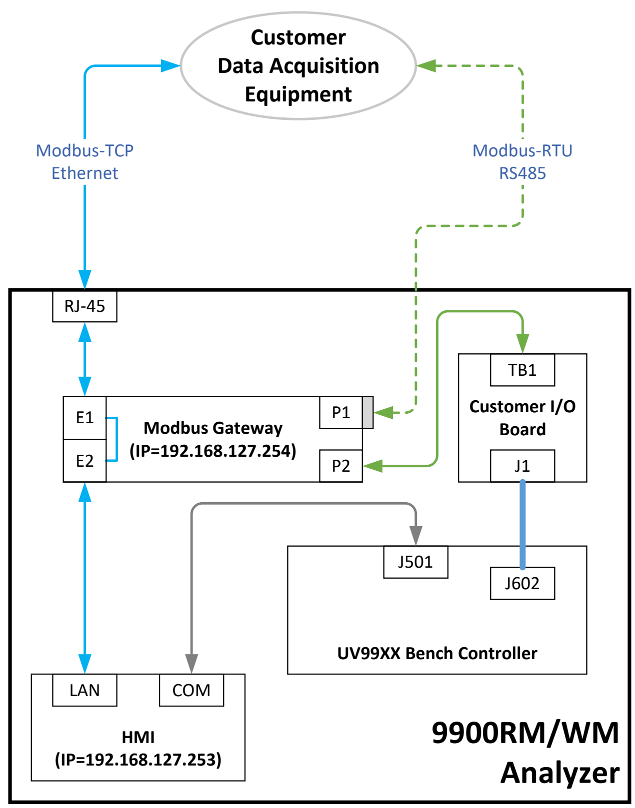

Figure 2.
Customer Data Acquisition Equipment-to-9900 Analyzer, connection to RJ-45 on analyzer Rear Panel.

Changing Communication Settings

The **Baud Rate**, number of **Stop Bits**, and **Parity** of the customer Modbus-RTU/RS-485 interface in standard analyzer configuration can be changed from the HMI. The **Modbus Node Address**, common to both RS-485 ports, can also be changed from the HMI. If the **Modbus Node Address** is changed, the **Slave Address** setting within HMI's **Offline** menu must be changed to match it.

For 9900 Analyzers, the **Modbus Node Address** on the **UV Bench Modbus Communication** screen is a critical setting. If it is changed, the **Modbus Node Address** setting in the HMI's **Offline** menu must be changed to match it. The other settings changeable from the HMI (**Baud Rate**, **Parity**, **Stop Bits**) are applicable to external customer communication interface, and are not applicable to HMI-Bench Controller communication.

To make the change to the communication settings to take effect, the changes must be saved to the UV9000's on-board non-volatile memory and the UV9000 subsystem must be reset.

To change **Modbus Node Address** that the HMI uses to communicate with the UV Bench:

1. Tap the top-right corner of the display screen area, followed by the bottom-left corner of the screen (within one second). The system menu bar will appear at the bottom of the screen.
2. Press the **Offline** button.
3. Press the **Peripheral** button at the top of the menu bar.
4. Press the **Device/PLC Settings** button.
5. Press the **MODBUS SIO MASTER COM1** button.
6. Press the **Device** button.
7. Tap the **Slave Address** numeric field and enter the same **Modbus Node Address** as seen on the **UV Bench Modbus Communication** screen.
8. After changing DCS Port (Modbus serial) settings, press the **Back** button twice to return to the **Peripheral Settings** menu.
9. Press the **Save** button to save the new settings.
10. Press the **Exit** button to exit the HMI's **Offline** menu and reboot the HMI unit.

Modbus Registers

Refer to the section "Analyzer Modbus Register Map" for the definitions and descriptions of the Modbus registers available on the UV9000 analysis subsystem. There are 439 data items that are grouped into categories:

- Analysis data (live UV concentration results)
- Photometric measurement data (absorbances and transmittances)
- Sensor measurement data (temperature, pressure, flow rate, and O2 measurement results)
- Calibration status, command, configuration, and results
- UV bench setup status, command, configuration, and results
- UV bench operations configuration and diagnostic
- System identification and operations command and status
- Communication configuration
- Temperature control status and configuration
- Sensor measurement configuration
- Customer input/output state and configuration
- Analysis operations and configuration
- Track-hold analysis data (concentration results) and configuration

Result and status registers have read-only access; configuration and most command registers are read-write accessible. Result and status register values are updated once per second.

Floating point values in IEEE single-precision format and 32-bit integer values occupy two (2) standard 16-bit Modbus registers. Modicon convention is used in formatting floating point and 32-bit integer values (i.e., the first register holds the lower 16 bits and the second register holds the upper 16 bits).

Analyzer Modbus Register Map

The Modbus register map defined below applies to both Modbus communication interfaces (RTU on RS-485 and TCP on Ethernet) on the analyzer.

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
1	UV Species1 concentration Note: Standard UV species is low-range SO2.	*	FLOAT	RO
3	UV Species2 concentration Note: Standard UV species is NO2.	*	FLOAT	RO
5	UV Species3 concentration Note: Standard UV species is NO.	*	FLOAT	RO
7	UV Species4 concentration Note: Standard UV species is high-range SO2.	*	FLOAT	RO
9	UV Species5 concentration Note: Standard UV species is extended-range SO2.	*	FLOAT	RO
11	UV Species6 concentration Note: Standard UV species is H2S.	*	FLOAT	RO
13	UV Species7 concentration Note: Standard UV species is NDr2.	*	FLOAT	RO
15	UV Species8 concentration Note: Standard UV species is NDr1.	*	FLOAT	RO
17	Aggregated UV species concentration Notes: 1) When NOx measurement is enabled in the Algorithm bitmask (REG#321.b3), the aggregated UV species is NOx, which is the sum of UV Species2 (NO2) and Species3 (NO) concentrations.	*	FLOAT	RO
19	Lamp1-Filter1 absorbance	-	FLOAT	RO
21	Lamp1-Filter2 absorbance	-	FLOAT	RO
23	Lamp1-Filter3 absorbance	-	FLOAT	RO
25	Lamp1-Filter4 absorbance	-	FLOAT	RO
27	Lamp1-Filter5 absorbance	-	FLOAT	RO
29	Lamp1-Filter6 absorbance	-	FLOAT	RO
31	Lamp2-Filter1 absorbance	-	FLOAT	RO
33	Lamp2-Filter2 absorbance	-	FLOAT	RO
35	Lamp2-Filter3 absorbance	-	FLOAT	RO
37	Lamp2-Filter4 absorbance	-	FLOAT	RO
39	Lamp2-Filter5 absorbance	-	FLOAT	RO
41	Lamp2-Filter6 absorbance	-	FLOAT	RO
43	Lamp1-Filter1 transmittance Note: Normalized to Lamp1-Filter1 zero-transmittance.	-	FLOAT	RO
45	Lamp1-Filter2 transmittance Note: Normalized to Lamp1-Filter2 zero-transmittance.	-	FLOAT	RO
47	Lamp1-Filter3 transmittance Note: Normalized to Lamp1-Filter3 zero-transmittance.	-	FLOAT	RO
49	Lamp1-Filter4 transmittance Note: Normalized to Lamp1-Filter4 zero-transmittance.	-	FLOAT	RO
51	Lamp1-Filter5 transmittance Note: Normalized to Lamp1-Filter5 zero-transmittance.	-	FLOAT	RO
53	Lamp1-Filter6 transmittance Note: Normalized to Lamp1-Filter6 zero-transmittance.	-	FLOAT	RO

Table 1.
Analyzer Modbus register map.

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
55	Lamp2-Filter1 transmittance Note: Normalized to Lamp2-Filter1 zero-transmittance.	-	FLOAT	RO
57	Lamp2-Filter2 transmittance Note: Normalized to Lamp2-Filter2 zero-transmittance.	-	FLOAT	RO
59	Lamp2-Filter3 transmittance Note: Normalized to Lamp2-Filter3 zero-transmittance.	-	FLOAT	RO
61	Lamp2-Filter4 transmittance Note: Normalized to Lamp2-Filter4 zero-transmittance.	-	FLOAT	RO
63	Lamp2-Filter5 transmittance Note: Normalized to Lamp2-Filter5 zero-transmittance.	-	FLOAT	RO
65	Lamp2-Filter6 transmittance Note: Normalized to Lamp2-Filter6 zero-transmittance.	-	FLOAT	RO
67	Bench controller board temperature	°C	FLOAT	RO
69	Bench temperature	°C	FLOAT	RO
71	Cell temperature	°C	FLOAT	RO
73	Cell pressure Note: Valid if AMETEK ACT or DCT sample cell pressure transducer is installed and enabled.	mmHg	FLOAT	RO
75	Flow rate Note: Valid if Omron MEM gas flow sensor is installed and enabled.	L/min	FLOAT	RO
77	O2 concentration Note: Valid if a dry application O2 sensor (i.e., paramagnetic Hummingbird Pm1158, Figaro KE-25, or Hummingbird Paracube-Delta) is installed and enabled.	%	FLOAT	RO
79	O2 sensor temperature Note: Valid if Hummingbird Pm1158 O2 sensor installed and enabled.	°C	FLOAT	RO
81	Calibration completion countdown	sec	UINT16	RO
82	Calibration action initiation and current state 0 = abort \ idle 10 = manual zero UV 11 = manual span UV Species1 12 = manual span UV Species2 13 = manual span UV Species3 14 = manual span UV Species4 15 = manual span UV Species5 16 = manual span UV Species6 17 = manual span UV Species7 18 = reserved 19 = manual span Aggregated UV species (NOx only) 20 = manual zero O2 21 = manual span O2 30 = manual zero UV and O2 40 = auto-CAL0 41 = auto-CAL1 42 = auto-CAL2 43 = auto-CAL3 44 = auto-CAL4 45 = full auto-CAL sequence 49 = sample return\flush delay (state indication only) Notes: - When zero-calibrating both the UV species and the O2 sensor at the same time, a zero-calibration gas with no oxygen content (e.g., N2) must be used. - Auto-CAL action commands are not applicable through the Modbus-RTU/ RS-485 interface.	-	UINT16	RW
83	Calibration data averaging duration	sec	UINT16	RW
84	UV Species1 span concentration	*	FLOAT	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
86	UV Species2 span concentration	*	FLOAT	RW
88	UV Species3 span concentration	*	FLOAT	RW
90	UV Species4 span concentration	*	FLOAT	RW
92	UV Species5 span concentration	*	FLOAT	RW
94	UV Species6 span concentration	*	FLOAT	RW
96	UV Species7 span concentration	*	FLOAT	RW
98	Reserved	*	FLOAT	RW
100	Aggregated UV species span concentration Note: Applicable to NOx measurement only.	*	FLOAT	RW
102	UV Species1 span factor	-	FLOAT	RW
104	UV Species2 span factor	-	FLOAT	RW
106	UV Species3 span factor	-	FLOAT	RW
108	UV Species4 span factor	-	FLOAT	RW
110	UV Species5 span factor	-	FLOAT	RW
112	UV Species6 span factor	-	FLOAT	RW
114	UV Species7 span factor	-	FLOAT	RW
116	Reserved	-	FLOAT	RW
118	Lamp1-Filter1 zero-transmittance	-	FLOAT	RW
120	Lamp1-Filter2 zero-transmittance	-	FLOAT	RW
122	Lamp1-Filter3 zero-transmittance	-	FLOAT	RW
124	Lamp1-Filter4 zero-transmittance	-	FLOAT	RW
126	Lamp1-Filter5 zero-transmittance	-	FLOAT	RW
128	Lamp1-Filter6 zero-transmittance	-	FLOAT	RW
130	Lamp2-Filter1 zero-transmittance	-	FLOAT	RW
132	Lamp2-Filter2 zero-transmittance	-	FLOAT	RW
134	Lamp2-Filter3 zero-transmittance	-	FLOAT	RW
136	Lamp2-Filter4 zero-transmittance	-	FLOAT	RW
138	Lamp2-Filter5 zero-transmittance	-	FLOAT	RW
140	Lamp2-Filter6 zero-transmittance	-	FLOAT	RW
142	O2 span concentration	%	FLOAT	RW
144	O2 zero offset	%	FLOAT	RW
146	O2 span factor	-	FLOAT	RW
148	Bench auto setup progress 0 = idle 1…8 = step1…8 65535 (0xFFFF) = aborting	-	UINT16	RO
149	Bench auto setup command 0 = abort 1 = start Note: Once started, repeated start commands are ignored and do not restart the process.	-	UINT16	WO
150	Bench auto setup target PMT signal level Note: As observed at TP2 and TP5 on PMT Signal Board. Range = 0–10000 corresponding to 0.000V–10.000V.	mV	UINT16	RW
151	Bench auto setup maximum lamp pulse current Note: Range = 0–14000 corresponding to 0.000mA–14.000mA.	mA x1000	UINT16	RW
152	Lamp1 base current setpoint (see Note in REG#151)	mA x1000	UINT16	RW
153	Lamp2 base current setpoint (see Note in REG#151)	mA x1000	UINT16	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
154	Lamp1-Filter1 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
155	Lamp1-Filter2 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
156	Lamp1-Filter3 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
157	Lamp1-Filter4 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
158	Lamp1-Filter5 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
159	Lamp1-Filter6 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
160	Lamp2-Filter1 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
161	Lamp2-Filter2 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
162	Lamp2-Filter3 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
163	Lamp2-Filter4 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
164	Lamp2-Filter5 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
165	Lamp2-Filter6 pulse current (see Note in REG#151)	mA x1000	UINT16	RW
166	Measure-PMT HV Note: Range = 3000–8000 corresponding to 300.0V–800.0V.	V x10	UINT16	RW
167	Reference-PMT HV Note: Range = 3000–8000 corresponding to 300.0V–800.0V.	V x10	UINT16	RW
168	Bench auto-level control (ALC) 0 = disable 1 = enable	-	UINT16	RW
169	Lamp1-Filter1 measure-PMT signal level Note: Range = 0–10000 corresponding to 0.000V–10.000V as observed at TP2 and TP5 on PMT Signal Board.	mV	UINT16	RO
170	Lamp1-Filter2 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
171	Lamp1-Filter3 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
172	Lamp1-Filter4 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
173	Lamp1-Filter5 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
174	Lamp1-Filter6 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
175	Lamp2-Filter1 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
176	Lamp2-Filter2 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
177	Lamp2-Filter3 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
178	Lamp2-Filter4 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
179	Lamp2-Filter5 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
180	Lamp2-Filter6 measure-PMT signal level (see Note in REG#169)	mV	UINT16	RO
181	Lamp1-Filter1 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
182	Lamp1-Filter2 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
183	Lamp1-Filter3 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
184	Lamp1-Filter4 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
185	Lamp1-Filter5 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
186	Lamp1-Filter6 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
187	Lamp2-Filter1 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
188	Lamp2-Filter2 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
189	Lamp2-Filter3 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
190	Lamp2-Filter4 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
191	Lamp2-Filter5 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO
192	Lamp2-Filter6 reference-PMT signal level (see Note in REG#169)	mV	UINT16	RO

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
193	Measure-PMT HV measurement Note: Range = 3000–8000 corresponding to 300.0V–800.0V as observed at -HV1 and -HV2 on PMT Supply Board.	V x10	UINT16	RO
194	Reference-PMT HV measurement (see Note in REG#193)	V x10	UINT16	RO
195	Lamp1 base HV measurement Note: Range = 0–5500 corresponding to 0.0V–550.0V.	V x10	UINT16	RO
196	Lamp2 base HV measurement (see Note in REG#195)	V x10	UINT16	RO
197	Lamp1-Filter1 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
198	Lamp1-Filter2 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
199	Lamp1-Filter3 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
200	Lamp1-Filter4 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
201	Lamp1-Filter5 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
202	Lamp1-Filter6 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
203	Lamp2-Filter1 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
204	Lamp2-Filter2 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
205	Lamp2-Filter3 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
206	Lamp2-Filter4 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
207	Lamp2-Filter5 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
208	Lamp2-Filter6 pulse HV measurement (see Note in REG#195)	V x10	UINT16	RO
209	Lamp1 base current measurement Note: Range = 0–14000 corresponding to 0.000mA–14.000mA.	mA x1000	UINT16	RO
210	Lamp2 base current measurement (see Note in REG#209)	mA x1000	UINT16	RO
211	Lamp1-Filter1 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
212	Lamp1-Filter2 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
213	Lamp1-Filter3 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
214	Lamp1-Filter4 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
215	Lamp1-Filter5 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
216	Lamp1-Filter6 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
217	Lamp2-Filter1 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
218	Lamp2-Filter2 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
219	Lamp2-Filter3 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
220	Lamp2-Filter4 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
221	Lamp2-Filter5 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
222	Lamp2-Filter6 pulse current measurement (see Note in REG#209)	mA x1000	UINT16	RO
223	Motor speed Note: Valid if bench type (REG#229) is motorized.	RPM x10	UINT16	RO
224	Filter wheel speed (see Note in REG#23)	RPM x10	UINT16	RO
225	Analysis subsystem model ID Note: UV9900 model ID is 101.	-	UINT16	RO
226	Firmware version – major	-	UINT16	RO
227	Firmware version – minor	-	UINT16	RO
228	Firmware version – build	-	UINT16	RO
229	Bench type 0 = motorized 1 = motorless	-	UINT16	RO

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
230	Wavelength valid bitmask (0 = valid; 1 = invalid) b0...b5 = Lamp1-Filter1…Lamp1-Filter6 b6…b11 = Lamp2-Filter1…Lamp2-Filter6 b12…b15 = reserved Note: Wavelength valid bitmask is derived from the analysis matrix.	-	UINT16	RO
231	UV Species valid bitmask (0 = valid; 1 = invalid) b0...b7 = UV Species1…8 b8 = Aggregated UV result (Species2+Species3) b9…b15 = reserved Note: UV species valid bitmask is derived from the analysis matrix and the algorithm bitmask.	-	UINT16	RO
232	Serial number text[1...2] Notes: 1) Layout of ASCII character registers: high byte = 1st character low byte = 2nd character 2) Serial number text registers are normally RO but can be changed to RW using the "enable change to factory system settings" system operations command.	-	CHAR	RO \ RW
233	Serial number text[3...4] (see Notes in REG#232)	-	CHAR	RO \ RW
234	Serial number text[5...6] (see Notes in REG#232)	-	CHAR	RO \ RW
235	Serial number text[7...8] (see Notes in REG#232)	-	CHAR	RO \ RW
236	Serial number text[9...10] (see Notes in REG#232)	-	CHAR	RO \ RW
237	Serial number text[11...12] (see Notes in REG#232)	-	CHAR	RO \ RW
238	Serial number text[13...14] (see Notes in REG#232)	-	CHAR	RO \ RW
239	Serial number text[15...16] (see Notes in REG#232)	-	CHAR	RO \ RW
240	Serial number text[17...18] (see Notes in REG#232)	-	CHAR	RO \ RW
241	Serial number text[19…20] (see Notes in REG#232)	-	CHAR	RO \ RW
242	System command and state 0 = normal state \ command completed 1 = save current configuration to nonvolatile memory 2 = restore saved configuration from nonvolatile memory 3 = enable change to factory settings 666 = initiate soft-reset Notes: 1) Only one command can be requested at a time. 2) While a command is in progress, further command requests are ignored. 3) Once an action command starts, it cannot be stopped. 4) Factory settings include serial number (REG#232-241) and system hardware presence bitmask (REG#248.b8-b15).	-	UINT16	RW
243	System runtime	sec	UINT32	RO

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
245	System StatusCode1 bitmask (0=false; 1=true) b0 = motor speed out of range b1 = filter wheel speed out of range b2 = motor pulse not detected b3 = filter wheel timing mark not detected b4…b7 = reserved b8 = lamp1 HV error b9 = lamp2 HV error b10 = lamp1 current error b11 = lamp2 current error b12 = PMT HV range error b13 = PMT data range error b14 = PMT data reception error b15 = PMT data not received	-	UINT16	RO
246	System StatusCode2 bitmask (0=false; 1=true) b0 = ALC high error b1 = ALC low error b2 = ALC setpoint error b3 = bench setup error b4…b6 = reserved b7 = unstable reference PMT signal b8 = analog output channel-A out of range or invalid assignment b9 = analog output channel-B out of range or invalid assignment b10 = analog output channel-C out of range or invalid assignment b11 = analog output channel-D out of range or invalid assignment b12 = analog output initialization failure b13 = reserved b14 = excessive span-drift b15 = excessive zero-drift	-	UINT16	RO
247	System Status Code3 bitmask (0=false; 1=true) b0 = bench controller board temperature sensor error b1 = bench temperature sensor error b2 = cell temperature sensor error b3 = bench controller board temperature high b4 = bench temperature high b5 = cell temperature high b6 = bench controller board temperature low b7 = bench temperature low b8 = cell temperature low b9 = cell pressure range error b10 = flow rate range error b11 = O2 sensor error b12 = over heater temperature sensor error b13..b14 = reserved b15‡ = HMI-bench communication failure ‡ b15 indicates HMI-bench communication failure only when ModbusTCP communication with the analyzer is made to the HMI's Ethernet port. When the status bit is raised, all other status bits in StatusCode1 (REG#245), StatusCode2 (REG#246) and StatusCode3 (REG#247) are undertermined.	-	UINT16	RO

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
248	System hardware presence bitmask b0: cell temperature sensor type 0 = PNP sensor selected; 1 = RTD probe selected b1: customer IO board 0 = board not detected; 1 = board detected b2: sample system interface board 0 = board not detected; 1 = board detected b3: UV light source 0 = hollow-cathode lamp (HCL); 1 = reserved b4…b7 = reserved b8: sample conditioning columns 0 = not installed; 1 = installed b9: oven heater RTD 0 = not installed; 1 = installed b10...b11: O2 sensor type 0 = Hummingbird Pm1158 1 = Figaro KE-25 2 = Hummingbird Paracube-Delta 3 = reserved b12…b13 = reserved b14 = cooling fan b15: without UV bench 0 = false; 1 = true Notes: 1) Lower 8 bits are read-only as the presence of the corresponding hardware is detectable by the analyzer firmware. 2) Upper 8 bits are read-\write-able to inform the analyzer firmware of the corresponding hardware being installed. 3) Only O2 sensor types '0' and '1' are currently available. 4) Bits 8-9 and 12-14 are not applicable.	-	UINT16	RO/RW
249	Modbus slave node address Note: Default for node address for UV9900 is 101.	-	UINT8	RW
250	DCS Modbus port baud rate 0 = 38400 (default setting) 1 = 19200 2 = 9600 3 = 4800 Note: Change to DCS Modbus port baud rate, parity or stop bits takes effect on next reset. (DCS Modbus port is J502 of Bench Controller board or TB1 of Customer I/O board.)	-	UINT8	RW
251	DCS Modbus port parity 0 = none (default setting) 1 = odd 2 = even	-	UINT8	RW
252	DCS Modbus port stop bits 1 = 1 stop bit (default setting) 2 = 2 stop bits	-	UINT8	RW
253	Bench heater duty cycle Note: Valid if bench temperature control enabled.	%	UINT16	RO
254	Cell or, if enabled, column heater duty cycle Note: Valid if cell temperature control enabled.	%	UINT16	RO
255	Bench temperature control setpoint Note: Setting the setpoint to 0°C disables the temperature control.	°C	FLOAT	RW
257	Cell temperature control setpoint	°C	FLOAT	RW
259	Bench temperature control proportional band – Kp	°C	FLOAT	RW
261	Cell temperature control proportional band – Kp	°C	FLOAT	RW
263	Bench temperature control integral time constant – Ti	sec	FLOAT	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
265	Cell temperature control integral time constant – Ti	sec	FLOAT	RW
267	Cell pressure transducer measurement low-scale Note: Setting high-scale to '0' disables cell pressure measurement.	mmHg	FLOAT	RW
269	Cell pressure transducer measurement high-scale Note: Setting high-scale to '0' disables cell pressure measurement.	mmHg	FLOAT	RW
271	Flow sensor measurement low-scale Note: Setting high-scale to '0' disables flow sensor measurement.	L/min	FLOAT	RW
273	Flow sensor measurement high-scale Note: Setting high-scale to '0' disables flow sensor measurement.	L/min	FLOAT	RW
275	O2 sensor measurement low-scale Note: Setting high-scale to '0' disables O2 sensor measurement.	%	FLOAT	RW
277	O2 sensor measurement high-scale Note: Setting high-scale to '0' disables O2 sensor measurement.	%	FLOAT	RW
279	Current operation state bitmask of system contact input (0 = open; 1 = closed) b0 = contact input 1 b1 = contact input 2 b2 = contact input 3 b3 = contact input 4 b4...b15 = reserved Notes: 1) Applicable if the 100-2481 Customer IO board is installed. 2) Use of contact inputs 1 and 2 is user configurable. 3) Contact input 4 is used to select the activation direction of relay 2 (REG#280). a) Contact 4 is open, relay 2 de-energizes for CAL. b) Contact 4 is closed, relay 2 energizes for CAL. 4) Use of contact input 3 is reserved.	-	UINT16	RO
280	Current operation state bitmask of system relay output and general fault/warning status b0 = relay 1 (0 = de-energized; 1 = energized) b1 = relay 2 (0 = de-energized; 1 = energized) b2 = relay 3 (0 = de-energized; 1 = energized) b3 = relay 4 (0 = de-energized; 1 = energized) b4 = relay 5 (0 = de-energized; 1 = energized) b5...b13 = reserved b14 = warning status detected (0 = none detected; 1 = at least one warning detected) b15 = fault status detected (0 = none detected; 1 = at least one fault detected) Note: 1) Each relay bit always indicates its current state. 2) Trigger conditions of relay 1 is user configurable. Refer to REG#283. 3) Relay 2 is dedicated to indicate CAL-In-Progress. It can operate as de-energized to indicate CAL or energized to indicate CAL based on the state of contact input 4 (REG#279). 4) Relay 3 is dedicated to indicate Warning. 5) Relays 1 and 3 operate in fail-safe manner, i.e. energized to indicate Normal and de-energized to indicate Fault and Warning, respectively. 6) Use of relays 4 and 5 are reserved.	-	UINT16	RO

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
281	Assignment of action initiated or state indicated by system contact input 1 0 = none \ not used 10 = manual zero UV 11 = manual span UV Species1 12 = manual span UV Species2 13 = manual span UV Species3 14 = manual span UV Species4 15 = manual span UV Species5 16 = manual span UV Species6 17 = manual span UV Species7 18 = reserved 19 = manual span Aggregated UV species (NOx only) 20 = manual zero O2 21 = manual span O2 30 = manual zero UV and O2 40 = auto-CAL0 41 = auto-CAL1 42 = auto-CAL2 43 = auto-CAL3 44 = auto-CAL4 45 = full auto-CAL sequence 50 = bench setup 60 = CEM probe blowback 100 = sample source for analysis [refer to REG#320] 101 = T-H operation [refer to REG#667] 102 = clear all latched relays: 1000...1999 = SEN99xx calibration contact-1 action [integrated mode] Note: Auto-CAL actions [40-45], CEM probe blowback action [60], and SEN99xx actions [1000-1999] are not applicable.	-	UINT16	RW
282	Assignment of action initiated or state indicated by system contact input 2 0 = none \ not used 10 = manual zero UV 11 = manual span UV Species1 12 = manual span UV Species2 13 = manual span UV Species3 14 = manual span UV Species4 15 = manual span UV Species5 16 = manual span UV Species6 17 = manual span UV Species7 18 = reserved 19 = manual span Aggregated UV species (NOx only) 20 = manual zero O2 21 = manual span O2 30 = manual zero UV and O2 40 = auto-CAL0 41 = auto-CAL1 42 = auto-CAL2 43 = auto-CAL3 44 = auto-CAL4 45 = full auto-CAL sequence 50 = bench setup 60 = CEM probe blowback 100 = sample source for analysis [refer to REG#320] 101 = T-H operation [refer to REG#667] 102 = clear all latched relays 1000...1999 = SEN99xx calibration contact-2 action [integrated mode] Note: Auto-CAL actions [40-45], CEM probe blowback action [60], and SEN99xx actions [1000-1999] are not applicable.	-	UINT16	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
283	Bitmask of trigger conditions of system status relay 1 and actions when triggered b0 = fault (0 = exclude; 1 = include) b1 = warning (0 = exclude; 1 = include) b2 = calibration in progress (0 = exclude; 1 = include) b3 = bench setup in progress (0 = exclude; 1 = include) b4 = process alarms invalid (0 = exclude; 1 = include) b5 = process alarm1 (0 = exclude; 1 = include) b6 = process alarm2 (0 = exclude; 1 = include) b7 = process alarm3 (0 = exclude; 1 = include) b8 = process alarm4 (0 = exclude; 1 = include) b9...b13 = reserved b14 = activation (0 = de-energize when triggered; 1 = energize when triggered) b15 = latching (0 = non-latching when triggered; 1 = latching when triggered) Note: Only b0 to b3 are applicable.	-	UINT16	RW
284	Bitmask to include StatusCode1 conditions in system status relay trigger (0 = exclude; 1 = include)	-	UINT16	RW
285	Bitmask to include StatusCode2 conditions in system status relay trigger (0 = exclude; 1 = include)	-	UINT16	RW
286	Bitmask to include StatusCode3 conditions in system status relay trigger (0 = exclude; 1 = include)	-	UINT16	RW
287	Bitmask for designating StatusCode1 conditions as warning or fault (0 = warning; 1 = fault)	-	UINT16	RW
288	Bitmask for designating StatusCode2 conditions as warning or fault (0 = warning; 1 = fault)	-	UINT16	RW
289	Bitmask for designating StatusCode3 conditions as warning or fault (0 = warning; 1 = fault)	-	UINT16	RW
290	Analog output calibration command and operation state 0 = normal operation \ stop calibration 1 = zero calibration 2 = span calibration 3 = 25%-span check 4 = 50%-span check 5 = 75%-span check Note: Applicable if the 100-2481 Customer IO board is installed.	-	UINT16	RW
291	Analog output option bitmask (see Note in REG#290) b0..b1: 0 = 0–5 V output 1 = 1–5 V output 2 = 0–20 mA output 3 = 4–20 mA output b2: channel-A output clamping 0 = no clamping 1 = clamp to min\max output values b3: reserved b4..b5: channel-B output type b6: channel-B output clamping b7: reserved b8..b9: channel-C output type b10: channel-C output clamping b11: reserved b12..b13: channel-D output type b14: channel-D output clamping b15: reserved	-	UINT16	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
292	Analog output channel-A assignment (see Notes in REG#192) 0 = none 1,3,…,77,79 = Modbus REG# of analysis and measurement results 169,170,…,223,224 = Modbus REG# of bench diagnostic measurements 647,649,…,663,665 = Modbus REG# of T-H results 897,899,901,903 = Modbus REG# of sample system signal measurements 981,983,985,987 = Modbus REG# of SEN99xx result-deposits [integrated mode] Notes: 1) Applicable if the 100-2481 Customer IO board is installed. 2) Sample system signals are not applicable. 3) SEN99xx measurement results are not applicable.	-	UINT16	RW
293	Analog output channel-B assignment (see Notes in REG#291 and REG#292) 0 = none 1,3,…,77,79 = Modbus REG# of analysis and measurement results 169,170,…,223,224 = Modbus REG# of bench diagnostic measurements 647,649,…,663,665 = Modbus REG# of T-H results 897,899,901,903 = Modbus REG# of sample system signal measurements 981,983,985,987 = Modbus REG# of SEN99xx result-deposits [integrated mode]	-	UINT16	RW
294	Analog output channel-C assignment (see Notes in REG#291 and REG#292) 0 = none 1,3,…,77,79 = Modbus REG# of analysis and measurement results 169,170,…,223,224 = Modbus REG# of bench diagnostic measurements 647,649,…,663,665 = Modbus REG# of T-H results 897,899,901,903 = Modbus REG# of sample system signal measurements 981,983,985,987 = Modbus REG# of SEN99xx result-deposits [integrated mode]	-	UINT16	RW
295	Analog output channel-D assignment (see Notes in REG#291 and REG#292) 0 = none 1,3,…,77,79 = Modbus REG# of analysis and measurement results 169,170,…,223,224 = Modbus REG# of bench diagnostic measurements 647,649,…,663,665 = Modbus REG# of T-H results 897,899,901,903 = Modbus REG# of sample system signal measurements 981,983,985,987 = Modbus REG# of SEN99xx result-deposits [integrated mode]	-	UINT16	RW
296	Analog output channel-A low-scale (see Note in REG#290)	*	FLOAT	RW
298	Analog output channel-A high-scale (see Note in REG#290)	*	FLOAT	RW
300	Analog output channel-B low-scale (see Note in REG#290)	*	FLOAT	RW
302	Analog output channel-B high-scale (see Note in REG#290)	*	FLOAT	RW
304	Analog output channel-C low-scale (see Note in REG#290)	*	FLOAT	RW
306	Analog output channel-C high-scale (see Note in REG#290)	*	FLOAT	RW
308	Analog output channel-D low-scale (see Note in REG#290)	*	FLOAT	RW
310	Analog output channel-D high-scale (see Note in REG#290)	*	FLOAT	RW
312	Analog output channel-A zero calibration reading (see Note in REG#290)	mV \ mA x1000	UINT16	RW
313	Analog output channel-A full-span calibration reading (see Note in REG#290)	mV \ mA x1000	UINT16	RW
314	Analog output channel-B zero calibration reading (see Note in REG#290)	mV \ mA x1000	UINT16	RW
315	Analog output channel-B full-span calibration reading (see Note in REG#290)	mV \ mA x1000	UINT16	RW
316	Analog output channel-C zero calibration reading (see Note in REG#290)	mV \ mA x1000	UINT16	RW
317	Analog output channel-C full-span calibration reading (see Note in REG#290)	mV \ mA x1000	UINT16	RW
318	Analog output channel-D zero calibration reading (see Note in REG#290)	mV \ mA x1000	UINT16	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
319	Analog output channel-D full-span calibration reading (see Note in REG#290)	mV \ mA x1000	UINT16	RW
320	Analysis sample source 0 = non-process stream or algorithm not affected by sample source 1 = process stream Note: As certain compensation steps in the analysis algorithm (e.g., absorbance offset and compressibility) are valid and applicable only if the gas sample in the analysis cell comes from the process stream, this register allows the Modbus master to inform the UV9900 system the source of the sample (i.e., from the process stream, or from non-process stream such as backpurge air, or calibration cylinder, or non-sampling condition such as isolated sample line or isolated sample probe).	-	UINT16	RW
321	Analysis algorithm bitmask (0 = disable; 1 = enable) b0 = neutral drift compensation b1 = linearization1 b2 = linearization2 b3 = NOx measurement b4 = SO2 dual-range blending b5 = SO2 triple-range extension b6 = SO2 crosstalk adjustment b7 = MeSH correction b8 = hot application b9 = liquid measurement b10...b14= reserved b15 = zero ABS at every peak analysis cycle Note: b15 is only applicable to analyzer firmware version with absorbance peak analysis algorithm.	-	UINT16	RW
322	Cell T&P compensation bitmask b0 = cell temperature compensation 0: static or pseudo-dynamic via Modbus master update 1: dynamic using integrated measurement b1 = cell pressure compensation 0: static or pseudo-dynamic via Modbus master update 1: dynamic using integrated measurement b2...b15= reserved	-	UINT16	RW
323	Nominal cell temperature Note: The nominal value is used in cell temperature static compensation and to trigger cell temperature low/high status conditions when the cell temperature sensor is not installed.	°C	FLOAT	RW
325	Nominal cell pressure Note: The nominal value is used in cell pressure static compensation and to trigger cell pressure range status condition when the pressure sensor is not installed.	mmHg	FLOAT	RW
327	Cell length	cm	FLOAT	RW
329	Linearization or interference compensation coefficient 1	-	FLOAT	RW
331	Linearization or interference compensation coefficient 1	-	FLOAT	RW
333	Linearization or interference compensation coefficient 1	-	FLOAT	RW
335	Linearization or interference compensation coefficient 1	-	FLOAT	RW
337	Linearization or interference compensation coefficient 1	-	FLOAT	RW
339	Linearization or interference compensation coefficient 1	-	FLOAT	RW
341	Linearization or interference compensation coefficient 1	-	FLOAT	RW
343	Absorbance offset for Lamp1-Filter1	-	FLOAT	RW
345	Absorbance offset for Lamp1-Filter2	-	FLOAT	RW
347	Absorbance offset for Lamp1-Filter3	-	FLOAT	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
349	Absorbance offset for Lamp1-Filter4	-	FLOAT	RW
351	Absorbance offset for Lamp1-Filter5	-	FLOAT	RW
353	Absorbance offset for Lamp1-Filter6	-	FLOAT	RW
355	Absorbance offset for Lamp2-Filter1	-	FLOAT	RW
357	Absorbance offset for Lamp2-Filter2	-	FLOAT	RW
359	Absorbance offset for Lamp2-Filter3	-	FLOAT	RW
361	Absorbance offset for Lamp2-Filter4	-	FLOAT	RW
363	Absorbance offset for Lamp2-Filter5	-	FLOAT	RW
365	Absorbance offset for Lamp2-Filter6	-	FLOAT	RW
367	Compressibility correction factor	-	FLOAT	RW
369	Dual-range SO2 blending alpha factor	-	FLOAT	RW
371	Absorbance adaptive filter sigma value	-	FLOAT	RW
373	Absorbance adaptive filter minimum gain value	-	FLOAT	RW
375	Neutral drift adaptive filter sigma value	-	FLOAT	RW
377	Neutral drift adaptive filter minimum gain value	-	FLOAT	RW
379	Reserved	-	FLOAT	RW
381	Reserved	-	FLOAT	RW
383	UV Species1 matrix element 1	-	FLOAT	RW
385	UV Species1 matrix element 2	-	FLOAT	RW
387	UV Species1 matrix element 3	-	FLOAT	RW
389	UV Species1 matrix element 4	-	FLOAT	RW
391	UV Species1 matrix element 5	-	FLOAT	RW
393	UV Species1 matrix element 6	-	FLOAT	RW
395	UV Species1 matrix element 7	-	FLOAT	RW
397	UV Species1 matrix element 8	-	FLOAT	RW
399	UV Species1 matrix element 9	-	FLOAT	RW
401	UV Species1 matrix element 10	-	FLOAT	RW
403	UV Species1 matrix element 11	-	FLOAT	RW
405	UV Species1 matrix element 12	-	FLOAT	RW
407	UV Species2 matrix element 1	-	FLOAT	RW
409	UV Species2 matrix element 2	-	FLOAT	RW
411	UV Species2 matrix element 3	-	FLOAT	RW
413	UV Species2 matrix element 4	-	FLOAT	RW
415	UV Species2 matrix element 5	-	FLOAT	RW
417	UV Species2 matrix element 6	-	FLOAT	RW
419	UV Species2 matrix element 7	-	FLOAT	RW
421	UV Species2 matrix element 8	-	FLOAT	RW
423	UV Species2 matrix element 9	-	FLOAT	RW
425	UV Species2 matrix element 10	-	FLOAT	RW
427	UV Species2 matrix element 11	-	FLOAT	RW
429	UV Species2 matrix element 12	-	FLOAT	RW
431	UV Species3 matrix element 1	-	FLOAT	RW
433	UV Species3 matrix element 2	-	FLOAT	RW
435	UV Species3 matrix element 3	-	FLOAT	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
437	UV Species3 matrix element 4	-	FLOAT	RW
439	UV Species3 matrix element 5	-	FLOAT	RW
441	UV Species3 matrix element 6	-	FLOAT	RW
443	UV Species3 matrix element 7	-	FLOAT	RW
445	UV Species3 matrix element 8	-	FLOAT	RW
447	UV Species3 matrix element 9	-	FLOAT	RW
449	UV Species3 matrix element 10	-	FLOAT	RW
451	UV Species3 matrix element 11	-	FLOAT	RW
453	UV Species3 matrix element 12	-	FLOAT	RW
455	UV Species4 matrix element 1	-	FLOAT	RW
457	UV Species4 matrix element 2	-	FLOAT	RW
459	UV Species4 matrix element 3	-	FLOAT	RW
461	UV Species4 matrix element 4	-	FLOAT	RW
463	UV Species4 matrix element 5	-	FLOAT	RW
465	UV Species4 matrix element 6	-	FLOAT	RW
467	UV Species4 matrix element 7	-	FLOAT	RW
469	UV Species4 matrix element 8	-	FLOAT	RW
471	UV Species4 matrix element 9	-	FLOAT	RW
473	UV Species4 matrix element 10	-	FLOAT	RW
475	UV Species4 matrix element 11	-	FLOAT	RW
477	UV Species4 matrix element 12	-	FLOAT	RW
479	UV Species5 matrix element 1	-	FLOAT	RW
481	UV Species5 matrix element 2	-	FLOAT	RW
483	UV Species5 matrix element 3	-	FLOAT	RW
485	UV Species5 matrix element 4	-	FLOAT	RW
487	UV Species5 matrix element 5	-	FLOAT	RW
489	UV Species5 matrix element 6	-	FLOAT	RW
491	UV Species5 matrix element 7	-	FLOAT	RW
493	UV Species5 matrix element 8	-	FLOAT	RW
495	UV Species5 matrix element 9	-	FLOAT	RW
497	UV Species5 matrix element 10	-	FLOAT	RW
499	UV Species5 matrix element 11	-	FLOAT	RW
501	UV Species5 matrix element 12	-	FLOAT	RW
503	UV Species6 matrix element 1	-	FLOAT	RW
505	UV Species6 matrix element 2	-	FLOAT	RW
507	UV Species6 matrix element 3	-	FLOAT	RW
509	UV Species6 matrix element 4	-	FLOAT	RW
511	UV Species6 matrix element 5	-	FLOAT	RW
513	UV Species6 matrix element 6	-	FLOAT	RW
515	UV Species6 matrix element 7	-	FLOAT	RW
517	UV Species6 matrix element 8	-	FLOAT	RW
519	UV Species6 matrix element 9	-	FLOAT	RW
521	UV Species6 matrix element 10	-	FLOAT	RW
523	UV Species6 matrix element 11	-	FLOAT	RW
525	UV Species6 matrix element 12	-	FLOAT	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
527	UV Species7 matrix element 1	-	FLOAT	RW
529	UV Species7 matrix element 2	-	FLOAT	RW
531	UV Species7 matrix element 3	-	FLOAT	RW
533	UV Species7 matrix element 4	-	FLOAT	RW
535	UV Species7 matrix element 5	-	FLOAT	RW
537	UV Species7 matrix element 6	-	FLOAT	RW
539	UV Species7 matrix element 7	-	FLOAT	RW
541	UV Species7 matrix element 8	-	FLOAT	RW
543	UV Species7 matrix element 9	-	FLOAT	RW
545	UV Species7 matrix element 10	-	FLOAT	RW
547	UV Species7 matrix element 11	-	FLOAT	RW
549	UV Species7 matrix element 12	-	FLOAT	RW
551	UV Species8 matrix element 1	-	FLOAT	RW
553	UV Species8 matrix element 2	-	FLOAT	RW
555	UV Species8 matrix element 3	-	FLOAT	RW
557	UV Species8 matrix element 4	-	FLOAT	RW
559	UV Species8 matrix element 5	-	FLOAT	RW
561	UV Species8 matrix element 6	-	FLOAT	RW
563	UV Species8 matrix element 7	-	FLOAT	RW
565	UV Species8 matrix element 8	-	FLOAT	RW
567	UV Species8 matrix element 9	-	FLOAT	RW
569	UV Species8 matrix element 10	-	FLOAT	RW
571	UV Species8 matrix element 11	-	FLOAT	RW
573	UV Species8 matrix element 12	-	FLOAT	RW
575	UV Species1 unit conversion factor	-	FLOAT	RW
577	UV Species2 unit conversion factor	-	FLOAT	RW
579	UV Species3 unit conversion factor	-	FLOAT	RW
581	UV Species4 unit conversion factor	-	FLOAT	RW
583	UV Species5 unit conversion factor	-	FLOAT	RW
585	UV Species6 unit conversion factor	-	FLOAT	RW
587	UV Species8 unit conversion factor	-	FLOAT	RW
589	Reserved	-	FLOAT	RW
591	Aggregated UV result unit conversion factor	-	FLOAT	RW
593	UV Species1 name[1...2] Note: Layout of ASCII character registers: high byte = 1st character low byte = 2nd character	-	CHAR	RW
594	UV Species1 name[3...4] (see Note in REG#593)	-	CHAR	RW
595	UV Species1 name[5...6] (see Note in REG#593)	-	CHAR	RW
596	UV Species2 name[1...2] (see Note in REG#593)	-	CHAR	RW
597	UV Species2 name[3...4] (see Note in REG#593)	-	CHAR	RW
598	UV Species2 name[5...6] (see Note in REG#593)	-	CHAR	RW
599	UV Species3 name[1...2] (see Note in REG#593)	-	CHAR	RW
600	UV Species3 name[3...4] (see Note in REG#593)	-	CHAR	RW
601	UV Species3 name[5...6] (see Note in REG#593)	-	CHAR	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
602	UV Species4 name[1...2] (see Note in REG#593)	-	CHAR	RW
603	UV Species4 name[3...4] (see Note in REG#593)	-	CHAR	RW
604	UV Species4 name[5...6] (see Note in REG#593)	-	CHAR	RW
605	UV Species5 name[1...2] (see Note in REG#593)	-	CHAR	RW
606	UV Species5 name[3...4] (see Note in REG#593)	-	CHAR	RW
607	UV Species5 name[5...6] (see Note in REG#593)	-	CHAR	RW
608	UV Species6 name[1...2] (see Note in REG#593)	-	CHAR	RW
609	UV Species6 name[3...4] (see Note in REG#593)	-	CHAR	RW
610	UV Species6 name[5...6] (see Note in REG#593)	-	CHAR	RW
611	UV Species7 name[1...2] (see Note in REG#593)	-	CHAR	RW
612	UV Species7 name[3...4] (see Note in REG#593)	-	CHAR	RW
613	UV Species7 name[5...6] (see Note in REG#593)	-	CHAR	RW
614	UV Species8 name[1...2] (see Note in REG#593)	-	CHAR	RW
615	UV Species8 name[3...4] (see Note in REG#593)	-	CHAR	RW
616	UV Species8 name[5...6] (see Note in REG#593)	-	CHAR	RW
617	Aggregated UV result name[1...2] (see Note in REG#593)	-	CHAR	RW
618	Aggregated UV result name[3...4] (see Note in REG#593)	-	CHAR	RW
619	Aggregated UV result name[5...6] (see Note in REG#593)	-	CHAR	RW
620	UV Species1 unit[1...2] (see Note in REG#593)	-	CHAR	RW
621	UV Species1 unit[3...4] (see Note in REG#593)	-	CHAR	RW
622	UV Species1 unit[5...6] (see Note in REG#593)	-	CHAR	RW
623	UV Species2 unit[1...2] (see Note in REG#593)	-	CHAR	RW
624	UV Species2 unit[3...4] (see Note in REG#593)	-	CHAR	RW
625	UV Species2 unit[5...6] (see Note in REG#593)	-	CHAR	RW
626	UV Species3 unit[1...2] (see Note in REG#593)	-	CHAR	RW
627	UV Species3 unit[3...4] (see Note in REG#593)	-	CHAR	RW
628	UV Species3 unit[5...6] (see Note in REG#593)	-	CHAR	RW
629	UV Species4 unit[1...2] (see Note in REG#593)	-	CHAR	RW
630	UV Species4 unit[3...4] (see Note in REG#593)	-	CHAR	RW
631	UV Species4 unit[5...6] (see Note in REG#593)	-	CHAR	RW
632	UV Species5 unit[1...2] (see Note in REG#593)	-	CHAR	RW
633	UV Species5 unit[3...4] (see Note in REG#593)	-	CHAR	RW
634	UV Species5 unit[5...6] (see Note in REG#593)	-	CHAR	RW
635	UV Species6 unit[1...2] (see Note in REG#593)	-	CHAR	RW
636	UV Species6 unit[3...4] (see Note in REG#593)	-	CHAR	RW
637	UV Species6 unit[5...6] (see Note in REG#593)	-	CHAR	RW
638	UV Species7 unit[1...2] (see Note in REG#593)	-	CHAR	RW
639	UV Species7 unit[3...4] (see Note in REG#593)	-	CHAR	RW
640	UV Species7 unit[5...6] (see Note in REG#593)	-	CHAR	RW
641	UV Species8 unit[1...2] (see Note in REG#593)	-	CHAR	RW
642	UV Species8 unit[3...4] (see Note in REG#593)	-	CHAR	RW
643	UV Species8 unit[5...6] (see Note in REG#593)	-	CHAR	RW
644	Aggregated UV result unit[1...2] (see Note in REG#593)	-	CHAR	RW
645	Aggregated UV result unit[3...4] (see Note in REG#593)	-	CHAR	RW

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
646	Aggregated UV result unit[5...6] (see Note in REG#593)	-	CHAR	RW
647	T-H UV Species1 concentration	*	FLOAT	RO
649	T-H UV Species2 concentration	*	FLOAT	RO
651	T-H UV Species3 concentration	*	FLOAT	RO
653	T-H UV Species4 concentration	*	FLOAT	RO
655	T-H UV Species5 concentration	*	FLOAT	RO
657	T-H UV Species6 concentration	*	FLOAT	RO
659	T-H UV Species7 concentration	*	FLOAT	RO
661	T-H UV Species8 concentration	*	FLOAT	RO
663	T-H UV Aggregated UV result	*	FLOAT	RO
665	T-H O2 concentration	%	FLOAT	RO
667	T-H operation command 0 --> 1 = start holding 1 --> 0 = stop holding Notes: 1) The "0 --> 1" command transition initiates the holding of concentration results. 2) If the hold time for a species is "0", the corresponding concentration result is held until the "1 --> 0" command transition. 3) If the hold time for a species has a positive value, the result is held for the time specified and returns to tracking when the time expires, unless at the end of the specified hold time, the command is still "1". In that case, the hold continues until the "1 --> 0" command transition.	-	UINT16	RW
668	Hold time for UV Species1 concentration	sec	UINT16	RW
669	Hold time for UV Species2 concentration	sec	UINT16	RW
670	Hold time for UV Species3 concentration	sec	UINT16	RW
671	Hold time for UV Species4 concentration	sec	UINT16	RW
672	Hold time for UV Species5 concentration	sec	UINT16	RW
673	Hold time for UV Species6 concentration	sec	UINT16	RW
674	Hold time for UV Species7 concentration	sec	UINT16	RW
675	Hold time for UV Species8 concentration	sec	UINT16	RW
676	Hold time for Aggregated UV result	sec	UINT16	RW
677	Hold time for O2 concentration	sec	UINT16	RW

For 9900RM/WM Analyzers that have the optional NDIR Sensor installed, refer to Table 2 for additional Modbus registers.

If an NDIR Sensor option is installed in a 9900RM/WM Analyzer, the Modbus registers in Table 2 are also available.

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
1501	EVO1 concentration result (live)	*	FLOAT	RO
1503	EVO1 concentration result (T-H)	*	FLOAT	RO
1505	EVO1 pressure corrected concentration	*	UINT16	RO
1506	EVO1 raw concentration	*	UINT16	RO
1507	EVO1 pressure	kPa x10	UINT16	RO
1508	EVO1 temperature	C x10	UINT16	RO
1509	EVO1 status code	–	UINT16	RO
1510	EVO1 signal level	–	UINT16	RO
1511	EVO1 zero offset	–	UINT16	RO
1512	EVO1 span gain	x10000	UINT16	RO
1513	EVO1 reserved	–	UINT16	RO
1514	EVO1 reserved	–	UINT16	RO
1521	EVO1 unit code	–	UINT16	RO
1522	EVO1 sensor full scale	–	UINT16	RO
1523	EVO1 sensor type[0..1]	–	UINT16	RO
1524	EVO1 sensor type[2..3]	–	UINT16	RO
1525	EVO1 sensor type[4..5]	–	UINT16	RO
1526	EVO1 sensor type[6..7]	–	UINT16	RO
1527	EVO1 sensor software version [0..1]	–	UINT16	RO
1528	EVO1 sensor software version [2..3]	–	UINT16	RO
1529	EVO1 sensor serial number [0..1]	–	UINT16	RO
1530	EVO1 sensor serial number [2..3]	–	UINT16	RO
1531	EVO1 sensor serial number [4..5]	–	UINT16	RO
1532	EVO1 sensor serial number [6..7]	–	UINT16	RO
1533	EVO1 sensor connect software version [0..1]	–	UINT16	RO
1534	EVO1 sensor connect software version [2..3]	–	UINT16	RO
1535	EVO1 Modbus address	–	UINT16	RO
1601	EVO2 concentration result (live)	*	FLOAT	RO
1603	EVO2 concentration result (T-H)	*	FLOAT	RO
1605	EVO2 pressure corrected concentration	*	UINT16	RO
1606	EVO2 raw concentration	*	UINT16	RO
1607	EVO2 pressure	kPa x10	UINT16	RO
1608	EVO2 temperature	C x10	UINT16	RO
1609	EVO2 status code	–	UINT16	RO
1610	EVO2 signal level	–	UINT16	RO
1611	EVO2 zero offset	–	UINT16	RO
1612	EVO2 span gain	x10000	UINT16	RO
1613	EVO2 reserved	–	UINT16	RO
1614	EVO2 reserved	–	UINT16	RO

Table 2.
Modbus register map, analyzers with optional NDIR Sensor installed.

REG# (40nnn)	Description \ Definition	Unit	Data Type	Access
1621	EVO2 unit code	–	UINT16	RO
1622	EVO2 sensor full scale	–	UINT16	RO
1623	EVO2 sensor type[0..1]	–	UINT16	RO
1624	EVO2 sensor type[2..3]	–	UINT16	RO
1625	EVO2 sensor type[4..5]	–	UINT16	RO
1626	EVO2 sensor type[6..7]	–	UINT16	RO
1627	EVO2 sensor software version [0..1]	–	UINT16	RO
1628	EVO2 sensor software version [2..3]	–	UINT16	RO
1629	EVO2 sensor serial number [0..1]	–	UINT16	RO
1630	EVO2 sensor serial number [2..3]	–	UINT16	RO
1631	EVO2 sensor serial number [4..5]	–	UINT16	RO
1632	EVO2 sensor serial number [6..7]	–	UINT16	RO
1633	EVO2 sensor connect software version [0..1]	–	UINT16	RO
1634	EVO2 sensor connect software version [2..3]	–	UINT16	RO
1635	EVO2 Modbus address	–	UINT16	RO
1641	EVO2 xtalk coefficient1	–	UINT16	RO
1643	EVO2 xtalk coefficient2	–	UINT16	RO
1645	EVO2 xtalk coefficient3	–	UINT16	RO
1647	EVO2 xtalk coefficient4	–	UINT16	RO

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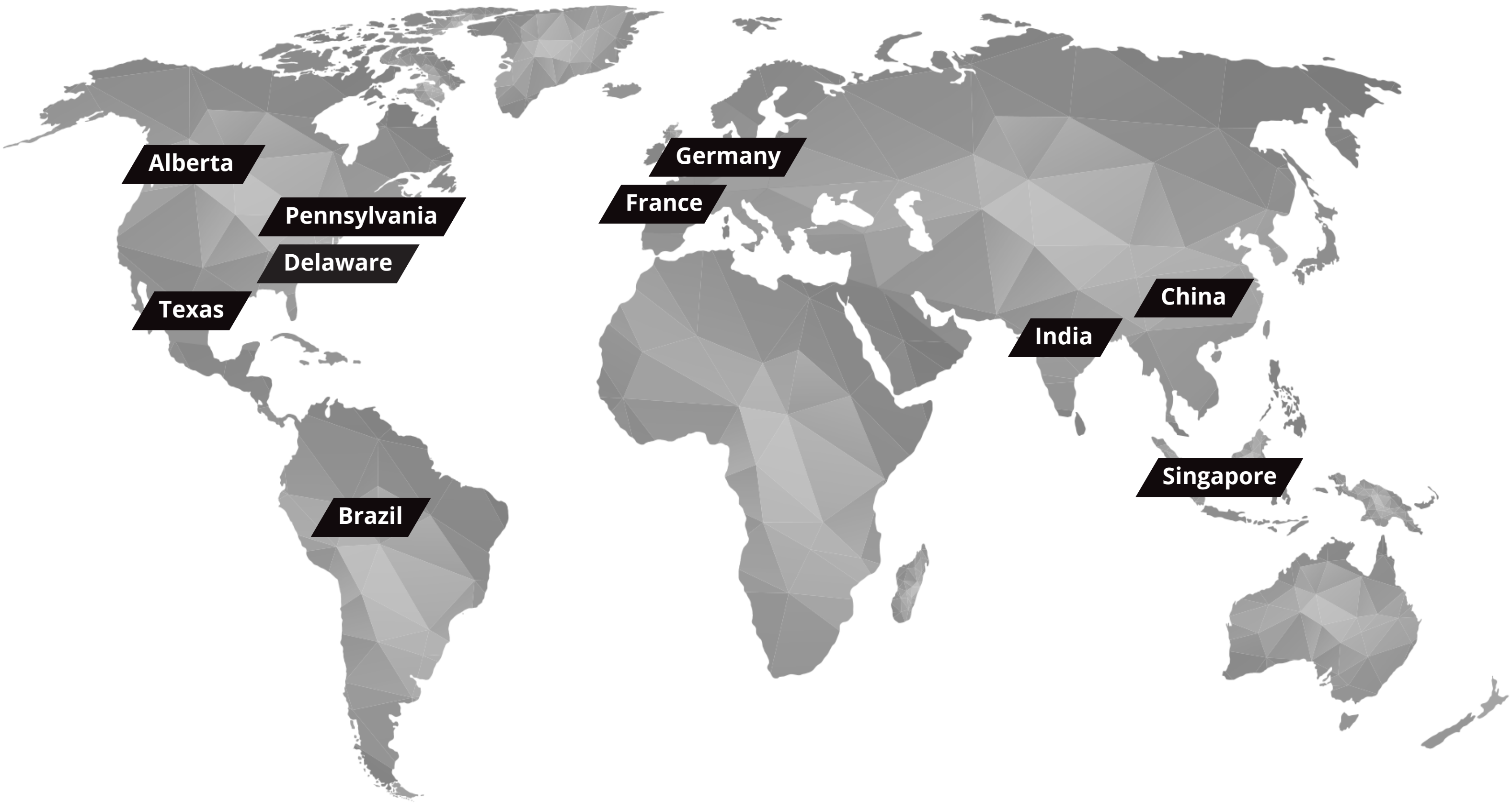

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