RAYCHEM
TraceTek

TT-TS12 and TT-TS12-E Modbus/ Modbus TCP System

Integration Guide

INTRODUCTION

nVent RAYCHEM TT-TS12 and TT-TS12-E are alarm panels and user interfaces for TraceTek leak detection systems. The TT-TS12 panels are built to the UL-508 standards while the TT-TS12-E are constructed to meet the European CE requirements. Both use the Windows PC type platforms running Win CE 6.0 and are powerful platforms with the capability to manage a network of external sensor interface devices, maintain a local data base, support a detailed graphical user interface and provide access to virtually any internal data element on demand from a host system.

In addition to the graphical display of system status and the location of any detected leaks, the TT-TS12 can operate up to several hundred alarm relays assignable to various roles by the user level programming. Data is collected from up to 255 external sensor interface modules (SIMs) on a continuous polling basis. All of the collected data and a variety of internal status flags and setup parameters are stored in a database continuously updated by the TT-TS12.

This document applies to both systems and discusses strategies to selectively collect data from the TT-TS12 data base for use in a Building Management System, Factory Automation System, Pipeline Monitoring System or similar host applications.

THESE INSTRUCTIONS APPLY TO THE FOLLOWING PARTS

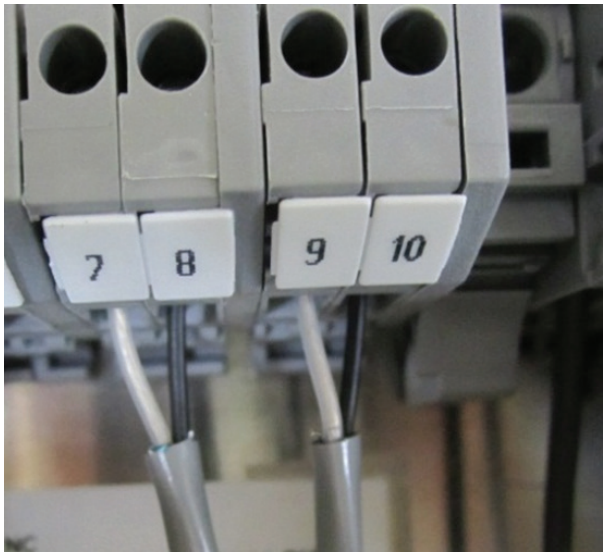
Catalog Number	Part Number	Description
TT-TS12-Panel-0	P000001486	Enclosure mounted TT-TS12 with no SIMs
TT-TS12-Panel-S1-1	P000001487	Enclosure mounted TT-TS12 with 1 TTSIM-1
TT-TS12-Panel-S1-2	P000001488	Enclosure mounted TT-TS12 with 2 TTSIM-1
TT-TS12-Panel-S1-3	P000001489	Enclosure mounted TT-TS12 with 3 TTSIM-1
TT-TS12-Panel-S1-4	P000001490	Enclosure mounted TT-TS12 with 4 TTSIM-1
TT-TS12-Panel-S1A-1	P000001491	Enclosure mounted TT-TS12 with 1 TTSIM-1A
TT-TS12-Panel-S1A-2	P000001492	Enclosure mounted TT-TS12 with 2 TTSIM-1A
TT-TS12-Panel-S1A-3	P000001493	Enclosure mounted TT-TS12 with 3 TTSIM-1A
TT-TS12-Panel-S1A-4	P000001494	Enclosure mounted TT-TS12 with 4 TTSIM-1A
TT-TS12	P000000777	Touchscreen panel

Catalog Number	Part Number	
TT-TS12-Panel-0-E	1244-015331	Enclosure mounted TT-TS12 with no SIMs
TT-TS12-Panel-S1-1-E	1244-015332	Enclosure mounted TT-TS12 with 1 TTSIM-1
TT-TS12-Panel-S1-2-E	1244-015333	Enclosure mounted TT-TS12 with 2 TTSIM-1
TT-TS12-Panel-S1-3-E	1244-015334	Enclosure mounted TT-TS12 with 3 TTSIM-1
TT-TS12-Panel-S1-4-E	1244-015335	Enclosure mounted TT-TS12 with 4 TTSIM-1
TT-TS12-Panel-S1A-1-E	1244-015336	Enclosure mounted TT-TS12 with 1 TTSIM-1A
TT-TS12-Panel-S1A-2-E	1244-015337	Enclosure mounted TT-TS12 with 2 TTSIM-1A
TT-TS12-Panel-S1A-3-E	1244-015338	Enclosure mounted TT-TS12 with 3 TTSIM-1A
TT-TS12-Panel-S1A-4-E	1244-015339	Enclosure mounted TT-TS12 with 4 TTSIM-1A

PHYSICAL CONNECTION:

There are two built-in connection options: RS485 (twisted pair) or Ethernet. Conventional Modbus RTU is supported via the RS485 connection, while Modbus TCP is supported via the Ethernet connection.

1) RS485 connection



Two wire RS485 connection to host system at terminal blocks 9 (+) and 10 (-) in the TT-TS12-PANEL-xx versions

2) Ethernet connections

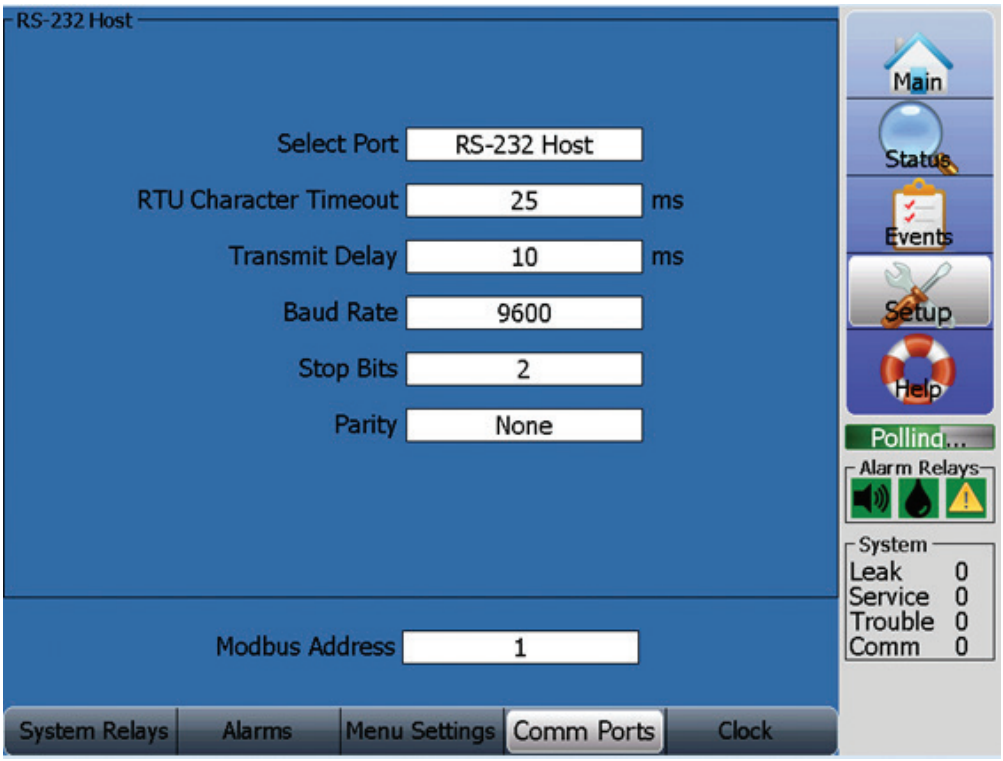
Ethernet connections to the TT-TS12 are made with a standard RJ-45 connector to either of two network ports on the rear side of the touch screen computer at the base

Special Note: If just the touch screen has been purchased (Part Number P000000777), the installer has the option of using the host port connection directly on the back of the touchscreen computer marked “RS232” (on the left of the bottom edge). This is a 9-pin D-sub-miniature connector with conventional RS232 serial port wiring. Connection to the host’s serial port can be made directly to this connector or an external RS232/RS485 port converter can be installed.

In the pre-built panel versions, an ADAM-4522 port converter has been pre-installed so that terminal blocks 9 and 10 are already converted to RS485.

RS232 PORT SET-UP:

2 wire serial port for Modbus RTU: To access the port setting for the serial port, push “Setup” on the right side of any screen. Use the default password value of 10, then select “System” and the “Comm Ports” Tab. The default Comm Port values are shown in this screen:



Note that although the value in the “Select Port” field is “RS232 Host” the values on the screen apply to the built-in RS232 port on the back of the TT-TS12 or to the RS485 connection terminals (9 and 10) present in the PANEL versions.

RTU Character Timeout: 25 ms is customary but smaller values can be tried to speedup polling or larger values can be used to improve communications if comm percentage is unsatisfactory

Transmit Delay 10 ms is customary, can be increased to give the host more time to switch to receive mode or reduced to speed up system response.

Baud rate setting: 2400 to 128000 at all customary rates

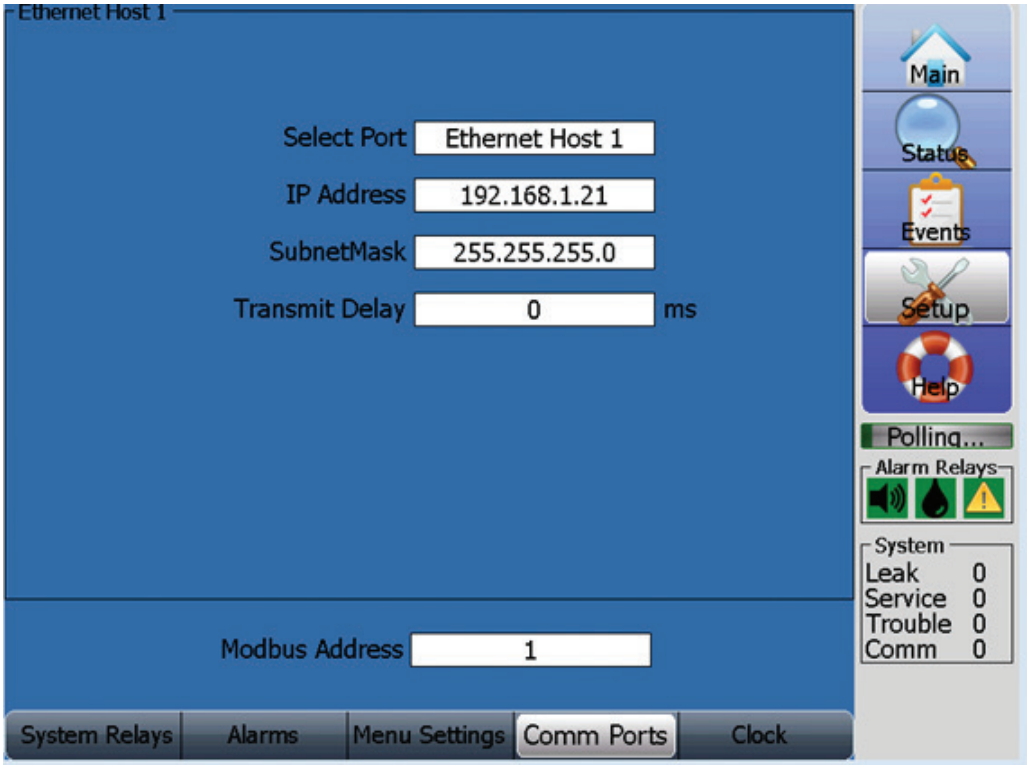
Stop Bits: Set to match host requirements

Parity: Set to match host requirements

Modbus Address: Address used by the host system to identify this TT-TS12 unit. Range is 1 – 249.

ETHERNET PORT SET-UP:

There are two Ethernet ports and either one can be used for Modbus TCP. The default setting for both Ethernet ports is DHCP, so simply plugging the TT-TS12 into an active LAN equipped with a DHCP server will automatically assign an IP address (192.168.1.21 in the screen shot below) and Subnet Mask. Use this IP address for identifying the TT-TS12 for Modbus TCP communications.
If required a static IP address can be assigned. Click or tap on the IP address field and the TT-TS12 will switch to a Windows port configuration screen. There are two icons (corresponding to the two physical Ethernet connectors and each can be configured with its own static IP address). Although it is possible to perform all of the setup using the touch screen mode, it is more convenient to plug a mouse into the USB port when working with the smaller fields on the conventional Windows popup screens.



Modbus Strategy:

The primary use for Modbus RTU or Modbus/TCP is to obtain current system status. Although virtually every set-up parameter, event history and tag is accessible via Modbus, it is usually far more efficient to use the TT-TS12 panel itself for set-up. The USB port is far more convenient for downloading databases of mapping references, event history, SIM set-up strings, etc. The complete Modbus register map is attached to this document. However, the focus of the remaining discussion in this document is how to extract current status information including leak locations for the purpose of supplying real time system status information to a host BMS or other monitoring system.

SIM STATUS FLAGS- (SEE APPENDIX TABLE PAGE 12)

All system status data is organized by the channel number of the Sensor Interface Modules (SIMs) or Mesh Node. Each circuit of TraceTek sensor cable or probes is associated with its own unique SIM or Mesh Node. The range of possible addresses for the SIMs or Mesh Nodes is 1 to 255.

The possible status values that each SIM or Mesh Node can obtain are:

Normal	=	0x0000
Leak Alarm	=	0x0001
Service Alarm	=	0x0002
Cable Break	=	0x0004
Loop Imbalance	=	0x0008
YB Loop Break	=	0x0010
RG Loop Break	=	0x0020
Hardware Error	=	0x0040
Node Low Battery	=	0x0100
Node Battery Fail	=	0x0200
Node Device Fail	=	0x0400
Node Offline	=	0x0800
Leak ReAlarm	=	0x1000
New Leak	=	0x2000
Comm Alarm	=	0x8000

The current status value is stored in a block of 510 registers starting at Input Register 40001.

There are two status registers associated with each SIM or Mesh Node channel. (The second register for each channel relates to the status of discrete alarm inputs assigned to that channel and are used when interfacing an ADAM-4051 digital input module)

It is rare for a system to have all possible SIM/Mesh Node channels in operation and more typically the SIM count will be a much smaller number than 255. For instance, if there are 7 SIMs in the complete system (and they have been addressed with channel numbers 1 through 7), then the status of SIMs # 1 through # 7 can be obtained by polling the values in registers:

SIM number	**SIM Status Flag register number**
SIM#1	40001
SIM#2	40003
SIM#3	40005
SIM#4	40007
SIM#5	40009
SIM#6	40011
SIM#7	40013
…	…
SIM#255	40509

If the value of each of these registers is 0x0000 then all SIMs/Mesh Nodes are normal and the host system process can continue with other tasks.

If any of the returned values are 0x0001, 0x1000 or 0x2000 then a leak has been detected. An alarm message should be displayed on the host system user interface panel and logged into the host system's active alarm page and event history.

SIM STATUS - (SEE APPENDIX TABLES PAGE 15)

The section of the Modbus register map titled SIM Status shows all of the information that is available from each SIM. The block size per SIM is 100 registers. Most of the information is low level detail that is used to pre-determine the SIM Status Flags. Although the SIM Status details are freely available, most system integration objectives will be satisfied by simply reading the current SIM Status Flag for each SIM and branching to a leak location routine only when a LEAK, SERVICE NEEDED, LEAK REALARM or NEW LEAK is indicated by the Status Flag registers.

It is important to realize that the value stored in the leak location registers is not defined until the SIM is in one of the following states: LEAK, SERVICE NEEDED, LEAK REALARM or NEW LEAK. The value in the leak location registers is 61439 (0xEFFF) and not meaningful until the SIM has detected sufficient leakage current to make an accurate leak location estimate as flagged by one of these four states. In other words, polling the leak location register for SIM#1 (156) would generate a response, but the response would be not be useful until SIM#1 was in one of the LEAK or SERVICE NEEDED or LEAK REALARM or NEW LEAK states.

Locating any detected leak requires access to a different set of registers starting at Input Register 156 for SIM#1, 256 for SIM#2; 356 for SIM#3, etc. - up to Input Register 25556 for a leak detected on SIM #255.

SIM number	SIM 'Location Resistance' Register
SIM#1	156
SIM#2	256
SIM#3	356
SIM#4	456
SIM#5	556
SIM#6	656
SIM#7	756
…	…
SIM#255	25556

For instance if a leak is detected on SIM #5 (initially indicated by a return value of 0x0001 in SIM Status Flag register 40009 as discussed above), then the value in Input Register 556 can be queried to determine the location of the detected leak. The returned value is in ohms.

For TraceTek TT7000-HUV sensor cable the scaling value is 0.40 for location in feet or 0.122 for meters.

For all other TraceTek sensor cable the scaling value is 0.256 for location in feet or.078 for meters.

For instance, if the leak on SIM#5 is reported by register 556 to be located at 500 ohms, then the location can be converted to 125 feet (500 x.25) or 39 meters (500 x.078).

If the TT-TS12 system is set to only report in feet or meters for all SIMs, then the next sequential register location (557 in the case of SIM#5) will report the leak location in the unit of measure selected.

For this example with a leak at 500 ohms, register 557 would return a value of 125 if the SIM was set-up with feet as the unit of measure, but the same register would return a value of 39 if the SIM had been set-up to report location in meters.

APPENDIX- MODBUS MAP REGISTER

General Information			
Modbus Function Code: 1,5,15			
Modbus Start Address: 1			
Modbus Block Size: 5			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments**
1	1,5,15	Offline Config	Write 1 = Do not validate device addresses, set to a zero on any future coil read
2	1,5,15	Network sensor device scan	Write 1 = Perform network sensor scan, write 0 = no action Read 1 = scan is in progress, read 0 scan complete
3	1,5,15	Acknowledge Alarm	Write 1 = Acknowledge event/alarm, write 0 = no action
4	1,5,15	Spare	-
5	1,5,15	Spare	-

Device Status Change List			
Modbus Function Code: 1,5,15			
Modbus Start Address: 101			
Modbus Block Size: 255			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments: write a 1 to clear flag**
101	1,5,15	Device 1 Status Change Flag	-
102	1,5,15	Device 2 Status Change Flag	-
103	1,5,15	Device 3 Status Change Flag	-
104	1,5,15	Device 4 Status Change Flag	-
105	1,5,15	Device 5 Status Change Flag	-
....	1,5,15	Device... Status Change Flag	-
352	1,5,15	Device 252 Status Change Flag	-
353	1,5,15	Device 253 Status Change Flag	-
354	1,5,15	Device 254 Status Change Flag	-
355	1,5,15	Device 255 Status Change Flag	-

SIM Database Change Flags			
Modbus Function Code: 1,5,15			
Modbus Start Address: 1001			
Modbus Block Size: 255			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments: write a 1 to clear flag**
1001	1,5,15	SIM 1 DataBase Change Flag	-
1002	1,5,15	SIM 2 DataBase Change Flag	-
1003	1,5,15	SIM 3 DataBase Change Flag	-
1004	1,5,15	SIM 4 DataBase Change Flag	-
1005	1,5,15	SIM 5 DataBase Change Flag	-
....	1,5,15	SIM xx DataBase Change Flag	-
1251	1,5,15	SIM 251 DataBase Change Flag	-
1252	1,5,15	SIM 252 DataBase Change Flag	-
1253	1,5,15	SIM 253 DataBase Change Flag	-
1254	1,5,15	SIM 254 DataBase Change Flag	-
1255	1,5,15	SIM 255 DataBase Change Flag	-

SIM Alarm Status Change Flags			
Modbus Function Code: 1,5,15			
Modbus Start Address: 2001			
Modbus Block Size: 255			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments: write a 1 to clear flag**
2001	1,5,15	SIM 1 Alarm Status Change Flag	-
2002	1,5,15	SIM 2 Alarm Status Change Flag	-
2003	1,5,15	SIM 3 Alarm Status Change Flag	-
2004	1,5,15	SIM 4 Alarm Status Change Flag	-
2005	1,5,15	SIM 5 Alarm Status Change Flag	-
....	1,5,15	SIM xx Alarm Status Change Flag	-
2251	1,5,15	SIM 251 Alarm Status Change Flag	-
2252	1,5,15	SIM 252 Alarm Status Change Flag	-
2253	1,5,15	SIM 253 Alarm Status Change Flag	-
2254	1,5,15	SIM 254 Alarm Status Change Flag	-
2255	1,5,15	SIM 255 Alarm Status Change Flag	-

SIM Leak Alarm Reset Flags			
Modbus Function Code: 1,5,15			
Modbus Start Address: 3001			
Modbus Block Size: 255			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments: write a 1 to clear flag. This flag is set when a leak alarm can be reset on a SIM.**
3001	1,5,15	SIM 1 Latched Alarm Reset Flag	-
3002	1,5,15	SIM 2 Latched Alarm Reset Flag	-
3003	1,5,15	SIM 3 Latched Alarm Reset Flag	-
3004	1,5,15	SIM 4 Latched Alarm Reset Flag	-
3005	1,5,15	SIM 5 Latched Alarm Reset Flag	-
....	1,5,15	SIM xx Latched Alarm Reset Flag	-
3251	1,5,15	SIM 251 Latched Alarm Reset Flag	-
3252	1,5,15	SIM 252 Latched Alarm Reset Flag	-
3253	1,5,15	SIM 253 Latched Alarm Reset Flag	-
3254	1,5,15	SIM 254 Latched Alarm Reset Flag	-
3255	1,5,15	SIM 255 Latched Alarm Reset Flag	-

General Information			
Modbus Function Code: 2			
Modbus Start Address: 1			
Modbus Block Size: 10			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments**
1	2	TraceTek Alarm Relay #1 status	0 = Off, 1 = On
2	2	TraceTek Alarm Relay #2 status	0 = Off, 1 = On
3	2	TraceTek Alarm Relay #3 status	0 = Off, 1 = On
4	2	Spare	-
5	2	Spare	-
6	2	Spare	-
7	2	Spare	-
8	2	Spare	-
9	2	Spare	-
10	2	Spare	-

General Information			
Modbus Function Code: 4			
Modbus Start Address: 1			
Modbus Block Size: 100			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments**
1	4	TraceTek Device Type	0x400
2	4	TraceTek Firmware Version Major	0-255
3	4	TraceTek Firmware Version Minor	0-255
4	4	TraceTek Firmware Build Minor	0-255
5	4	TraceTek Firmware Revision Minor	0-999
6	4	TraceTek OS Version Major	0-255
7	4	TraceTek OS Version Minor	0-255
8	4	TraceTek OS Version Build	0-255
9	4	TraceTek OS Version Revision	0-999
100	4	Spare	-

Device List			
Modbus Function Code: 4			
Modbus Start Address: 52001			
Modbus Block Size: 10			
Number of Blocks: 255			
Modbus Address	**Function Code**	**Description**	**Comments (1 entry for all 255 devices) Computed Devices address = 1001 + (Device Address -1) * 10**
52001	4	Device 1 Type	None = 0, NRM = 1, SIM = 2, ADAM = 3
52002	4	Device 1 Sub Type	None = 0, SIM1 = 1, SIM1A = 2, SIM2 = 3, SIM3 = 4, NODE = 5
52003	4	Device 1 Resources - #Relays	NRM(0-40),ADAM Always 8 Relays
52004	4	Spare	reserve for furture resources
52005	4	Device 1 Status	Bit 13 = 1 Device Updated via Comm.(local use only), Bit 14=1 Device Status Change, Bit 15=1 Comm Alarm
52006	4	Device Firmware Version Major	0-255
52007	4	Device Firmware Version Minor	0-255
52008	4	Device Build Number	0-999 - not used yet
52009	4	Comm Rate	-
52010	4	Spare	-
...	4	…	-
54541	4	Device 255 Type	None = 0, NRM = 1, SIM = 2, ADAM = 3
54542	4	Device 255 Sub Type	None = 0, SIM1 = 1, SIM1A = 2, SIM2 = 3, SIM3 = 4, NODE = 5
54543	4	Device 255 Resources - #Relays	NRM(0-40),ADAM Always 8 Relays
54544	4	Spare	reserve for furture resources
54545	4	Device 255 Status	Bit 13 = 1 Device Updated via Comm.(local use only), Bit 14=1 Device Status Change, Bit 15=1 Comm Alarm
54546	4	Device Firmware Version Major	0-255
54547	4	Device Firmware Version Minor	0-255
54548	4	Device Build Number	0-999 - not used yet
54549	4	Comm Rate	-
54550	4	Spare	-

Device Status Flags			
Modbus Function Code: 4			
Modbus Start Address: 57001			
Modbus Block Size: 4			
Number of Blocks: 255			
Modbus Address	**Function Code**	**Description**	**Comments (1 entry for all 255 Devices) Computed Devices address = 57001 + (SIM # -1) * 4**
57001	4	Device 1 Status	Bit 13 = 1 Device Updated via Comm.(local use only), Bit 14=1 Device Status Change, Bit 15=1 Comm Alarm
57002	4	Spare - possible NRN/Adam Relay States	-
57003	4	Spare - possible NRN/Adam Relay States	-
57004	4	Spare - possible NRN/Adam Relay States	-
57005	4	Device 2 Status	Bit 13 = 1 Device Updated via Comm.(local use only), Bit 14=1 Device Status Change, Bit 15=1 Comm Alarm
57006	4	Spare - possible NRN/Adam Relay States	-
57007	4	Spare - possible NRN/Adam Relay States	-
57008	4	Spare - possible NRN/Adam Relay States	-
….	4	….	
58013	4	Device 254 Status	Bit 13 = 1 Device Updated via Comm.(local use only), Bit 14=1 Device Status Change, Bit 15=1 Comm Alarm
58014	4	Spare - possible NRN/Adam Relay States	-
58015	4	Spare - possible NRN/Adam Relay States	-
58016	4	Spare - possible NRN/Adam Relay States	-
58017	4	Device 255 Status	Bit 13 = 1 Device Updated via Comm.(local use only), Bit 14=1 Device Status Change, Bit 15=1 Comm Alarm
58018	4	Spare - possible NRN/Adam Relay States	-
58019	4	Spare - possible NRN/Adam Relay States	-
58020	4	Spare - possible NRN/Adam Relay States	-

System Status Flags					
Modbus Function Code: 4					
Modbus Start Address: 51001					
Modbus Block Size: 2					
Number of Blocks: 1					
Modbus Address	**Function Code**	**Description**			
51001	4	System Status1	Normal = 0x0001 Service Alarm = 0x0004 Loop Imbalance YB Loop Break RG Loop Break Hardware Error Node Low Battery Node Battery Fail Node Device Fail Node Offline = 0x1000 New Leak = 0x8000	= = = = = = = = = = = 	0x0000 Leak Alarm 0x0002 Cable Break 0x0008 0x0010 0x0020 0x0040 0x0100 0x0200 0x0400 0x0800 Leak ReAlarm 0x2000 Comm Alarm
51002	4	System Status2	Zone 1 Alarm = 0x0002 Zone 3 Alarm Zone 4 Alarm Zone 5 Alarm Zone 6 Alarm Zone 7 Alarm Zone 8 Alarm Leak Summary Alarm Trouble Summary Alarm	= = = = = = = = =	0x0001 Zone 2 Alarm 0x0004 0x0008 0x0010 0x0020 0x0040 0x0080 0x0100 0x0200

SIM Status Flags					
Modbus Function Code: 4					
Modbus Start Address: 40001					
Modbus Block Size: 2					
Number of Blocks: 255					
Modbus Address	**Function Code**	**Description**	**Comments (1 entry for all 255 SIMs) Computed Devices address = 40001 + (SIM # -1) * 4**		
40001	4	SIM 1 Status1	Normal = 0x0001 Service Alarm = 0x0004 Loop Imbalance YB Loop Break RG Loop Break Hardware Error Node Low Battery Node Battery Fail Node Device Fail Node Offline = 0x1000 New Leak = 0x8000	= = = = = = = = = = = 	0x0000 Leak Alarm 0x0002 Cable Break 0x0008 0x0010 0x0020 0x0040 0x0100 0x0200 0x0400 0x0800 Leak ReAlarm 0x2000 Comm Alarm

Modbus Address	Function Code	Description	Comments (1 entry for all 255 SIMs) Computed Devices address = 40001 + (SIM # -1) * 4		
40002	4	SIM 1 Status 2	Zone 1 Alarm = 0x0002 Zone 3 Alarm Zone 4 Alarm Zone 5 Alarm Zone 6 Alarm Zone 7 Alarm Zone 8 Alarm Leak Summary Alarm Trouble Summary Alarm	= = = = = = = = =	0x0001 Zone 2 Alarm 0x0004 0x0008 0x0010 0x0020 0x0040 0x0080 0x0100 0x0200
40003	4	SIM 2 Status 1	see above		
40004	4	SIM 2 Status 2	Reserved		
40005	4	SIM 3 Status 1	see above		
40006	4	SIM 3 Status 2	Reserved		
...	4		-		
40508	4		-		
40509	4	SIM 255 Status 1	see above		
40510	4	SIM 255 Status 2	Reserved		

SIM Resources			
Modbus Function Code: 4			
Modbus Start Address: 42001			
Modbus Block Size: 15			
Number of Blocks: 255			
Modbus Address	**Function Code**	**Description**	**Comments (1 entry for all 255 SIMs) Computed Devices address = 42001 + (SIM # -1) * 8**
42001	4	SIM 1 Service Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42002	4	SIM 1 Trouble Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42003	4	SIM 1 Region 1 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42004	4	SIM 1 Region 2 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42005	4	SIM 1 Region 3 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42006	4	SIM 1 Region 4 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42007	4	SIM 1 Region 5 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42008	4	SIM 1 Region 6 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42009	4	SIM 1 Region 7 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42010	4	SIM 1 Region 8 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42011	4	SIM 1 Region 9 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
42012	4	SIM 1 Region 10 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)

Modbus Address	Function Code	Description	Comments (1 entry for all 255 SIMs) Computed Devices address = 42001 + (SIM # -1) * 8
42013	4	Spare	-
42014	4	Spare	-
42015	4	Spare	-
…	4	…	-
45811	4	SIM 255 Service Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45812	4	SIM 255 Trouble Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45813	4	SIM 255 Region 1 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45814	4	SIM 255 Region 2 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45815	4	SIM 255 Region 3 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45816	4	SIM 255 Region 4 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45817	4	SIM 255 Region 5 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45818	4	SIM 255 Region 6 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45819	4	SIM 255 Region 7 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45820	4	SIM 255 Region 8 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45821	4	SIM 255 Region 9 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45822	4	SIM 255 Region 10 Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
45823	4	Spare	-
45824	4	Spare	-
45825	4	5	-

SIM Status			
Modbus Function Code: 4			
Modbus Start Address: 101			
Modbus Block Size: 100			
Number of Blocks: 255			
Modbus Address	**Function Code**	**Description**	**Comments (1 entry for all 255 SIMs) Computed Devices address = 101 + (SIM No-1) * 100**
101	4	SIM 1 Event Text 0	SIM Event Text (Unicode 50 chars)
102	4	SIM 1 Event Text 1	SIM Event Text
103	4	SIM 1 Event Text 2	SIM Event Text
104	4	SIM 1 Event Text 3	SIM Event Text
105	4	SIM 1 Event Text 4	SIM Event Text
106	4	SIM 1 Event Text 5	SIM Event Text
107	4	SIM 1 Event Text 6	SIM Event Text
108	4	SIM 1 Event Text 7	SIM Event Text
109	4	SIM 1 Event Text 8	SIM Event Text
110	4	SIM 1 Event Text 9	SIM Event Text
111	4	SIM 1 Event Text 10	SIM Event Text
112	4	SIM 1 Event Text 11	SIM Event Text
113	4	SIM 1 Event Text 12	SIM Event Text
114	4	SIM 1 Event Text 13	SIM Event Text
115	4	SIM 1 Event Text 14	SIM Event Text
116	4	SIM 1 Event Text 15	SIM Event Text
117	4	SIM 1 Event Text 16	SIM Event Text
118	4	SIM 1 Event Text 17	SIM Event Text
119	4	SIM 1 Event Text 18	SIM Event Text
120	4	SIM 1 Event Text 19	SIM Event Text
121	4	SIM 1 Event Text 20	SIM Event Text
122	4	SIM 1 Event Text 21	SIM Event Text
123	4	SIM 1 Event Text 22	SIM Event Text
124	4	SIM 1 Event Text 23	SIM Event Text
125	4	SIM 1 Event Text 24	SIM Event Text
126	4	SIM 1 Event Text 25	SIM Event Text
127	4	SIM 1 Event Text 26	SIM Event Text
128	4	SIM 1 Event Text 27	SIM Event Text
129	4	SIM 1 Event Text 28	SIM Event Text
130	4	SIM 1 Event Text 29	SIM Event Text
131	4	SIM 1 Event Text 30	SIM Event Text
132	4	SIM 1 Event Text 31	SIM Event Text
133	4	SIM 1 Event Text 32	SIM Event Text
134	4	SIM 1 Event Text 33	SIM Event Text
135	4	SIM 1 Event Text 34	SIM Event Text
136	4	SIM 1 Event Text 35	SIM Event Text
137	4	SIM 1 Event Text 36	SIM Event Text
138	4	SIM 1 Event Text 37	SIM Event Text
139	4	SIM 1 Event Text 38	SIM Event Text

Modbus Address	Function Code	Description	Comments (1 entry for all 255 SIMs) Computed Devices address = 101 + (SIM No-1) * 100
140	4	SIM 1 Event Text 39	SIM Event Text
141	4	SIM 1 Event Text 30	SIM Event Text
142	4	SIM 1 Event Text 41	SIM Event Text
143	4	SIM 1 Event Text 42	SIM Event Text
144	4	SIM 1 Event Text 43	SIM Event Text
145	4	SIM 1 Event Text 44	SIM Event Text
146	4	SIM 1 Event Text 45	SIM Event Text
147	4	SIM 1 Event Text 46	SIM Event Text
148	4	SIM 1 Event Text 47	SIM Event Text
149	4	SIM 1 Event Text 48	SIM Event Text
150	4	SIM 1 Event Text 49	SIM Event Text
151	4	SIM Status 1	Normal = 0x0000 Leak Alarm = 0x0001 Service Alarm = 0x0002 Cable Break = 0x0004 Loop Imbalance = 0x0008 YB Loop Break = 0x0010 RG Loop Break = 0x0020 Hardware Error = 0x0040 Node Low Battery = 0x0100 Node Battery Fail = 0x0200 Node Device Fail = 0x0400 Node Offline = 0x0800 Leak ReAlarm = 0x1000 New Leak = 0x2000 Comm Alarm = 0x8000
152	4	Reserved	Zone 1 Alarm = 0x0001 Zone 2 Alarm = 0x0002 Zone 3 Alarm = 0x0004 Zone 4 Alarm = 0x0008 Zone 5 Alarm = 0x0010 Zone 6 Alarm = 0x0020 Zone 7 Alarm = 0x0040 Zone 8 Alarm = 0x0080 Leak Summary Alarm = 0x0100 Trouble Summary Alarm = 0x0200
153	4	Sim Hardware Status	See A0 below
154	4	Sense Current	micro amps
155	4	Sense Resistance	k0hms
156	4	Location Resistance	Ohms
157	4	Location	In SIM Units feet/meters/zone
158	4	YB Resistance	Ohms
159	4	RG Resistance	Ohms
160	4	Test Length	In SIM Units feet/meters/zone
161	4	Prev Sense Current	micro amps
162	4	Prev Sense Resistance	k0hms
163	4	Prev Location Resistance	Ohms
164	4	Prev Location	In SIM Units feet/meters/zone
165	4	Prev YB Resistance	Ohms
166	4	Prev RG Resistance	Ohms

Modbus Address	Function Code	Description	Comments (1 entry for all 255 SIMs) Computed Devices address = 101 + (SIM No-1) * 100
167	4	New Leak Threshold Resistance	-
168	4	Node Status	Wireless node
169	4	Last Event	Event Code
170	4	Comm Rate	%
171	4	Sim Version	High Byte Major/Low Byte Minor
172	4	Product ID	-
173	4	Spare	-
174	4	Spare	-
175	4	Spare	-
176	4	Spare	-
177	4	Spare	-
178	4	Spare	-
179	4	Spare	-
180	4	Spare	-
		Raw SIM Analog Input Data	**Raw SIM data as it comes directly from device see individual SIM spec for register format**
181	4	AI - 0 Hardware Status	See individual SIM interface spec for details
182	4	AI - 1 Location Resistance	Ohms, Location of leak or contamination, in resistance, when Detection Current is above Current Threshold.
183	4	AI - 2 Detection Resistance	kOhms, Voltage between cable loops divided by current
184	4	AI - 3 Detection Current	.1 micro Amps, Voltage of Reference resistor divided by Rref
185	4	AI - 4 RG Resistance	Ohms, Length, in resistance, of Red-Green loop
186	4	AI - 5 YB Resistance	Ohms, Length, in resistance, of Yellow-Black loop
187	4	AI - 6 ADC Counts 1	-
188	4	AI - 7 ADC Counts 2	-
189	4	AI - 8 ADC Counts 3	-
190	4	AI - 9 Firmware Version	-
191	4	AI - 10 Product ID	-
192	4	AI - 11 EEPROM Checksum	-
193	4	AI - 12 Leak Detection DAC output value	Value sent to DAC for Leak Detection
194	4	AI - 13 Low Voltage DAC value	Low voltage value used for leak detection. For Leak detection value is: Low Voltage + ((High Voltage – Low Voltage)* (Cable Length/20000)) See Registers for Sensitivity High/Low Voltages (40021 – 40025)
195	4	AI - 14 High Voltage DAC value	High voltage value used for leak detection and determining Loop Lengths.
196	4	AI - 15 Status Word	-
197	4	Spare	-
198	4	Spare	-
199	4	Spare	-
200	4	Spare	-
201	4	SIM 2 status (see record above)	-
301	4	SIM 3 status (see record above)	-
401	4	SIM 4 status (see record above)	-

Modbus Address	Function Code	Description	Comments (1 entry for all 255 SIMs) Computed Devices address = 101 + (SIM No-1) * 100
501	4	SIM 5 status (see record above)	-
601	4	SIM 6 status (see record above)	-
701	4	SIM 7 status (see record above)	-
801	4	SIM 8 status (see record above)	-
...	4	SIM.. status (see record above)	-
25501	4	SIM 255 status (see record above)	-
25600	4	End of SIM 255	-

General Information			
Modbus Function Code: 3,6,16			
Modbus Start Address: 1			
Modbus Block Size: 99			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments**
1	3,6,16	TraceTek Tag 0	TraceTek Tag
2	3,6,16	TraceTek Tag 1	TraceTek Tag
3	3,6,16	TraceTek Tag 2	TraceTek Tag
4	3,6,16	TraceTek Tag 3	TraceTek Tag
5	3,6,16	TraceTek Tag 4	TraceTek Tag
6	3,6,16	TraceTek Tag 5	TraceTek Tag
7	3,6,16	TraceTek Tag 6	TraceTek Tag
8	3,6,16	TraceTek Tag 7	TraceTek Tag
9	3,6,16	TraceTek Tag 8	TraceTek Tag
10	3,6,16	TraceTek Tag 9	TraceTek Tag
11	3,6,16	TraceTek Tag 10	TraceTek Tag
12	3,6,16	TraceTek Tag 11	TraceTek Tag
13	3,6,16	TraceTek Tag 12	TraceTek Tag
14	3,6,16	TraceTek Tag 13	TraceTek Tag
15	3,6,16	TraceTek Tag 14	TraceTek Tag
16	3,6,16	TraceTek Tag 15	TraceTek Tag
17	3,6,16	TraceTek Tag 16	TraceTek Tag
18	3,6,16	TraceTek Tag 17	TraceTek Tag
19	3,6,16	TraceTek Tag 18	TraceTek Tag
20	3,6,16	TraceTek Tag 19	TraceTek Tag
21	3,6,16	TraceTek Tag 20	TraceTek Tag
22	3,6,16	TraceTek Tag 21	TraceTek Tag
23	3,6,16	TraceTek Tag 22	TraceTek Tag
24	3,6,16	TraceTek Tag 23	TraceTek Tag
25	3,6,16	TraceTek Tag 24	TraceTek Tag
26	3,6,16	TraceTek Tag 25	TraceTek Tag
27	3,6,16	TraceTek Tag 26	TraceTek Tag
28	3,6,16	TraceTek Tag 27	TraceTek Tag
29	3,6,16	TraceTek Tag 28	TraceTek Tag

Modbus Address	Function Code	Description	Comments
30	3,6,16	TraceTek Tag 29	TraceTek Tag
31	3,6,16	TraceTek Tag 30	TraceTek Tag
32	3,6,16	TraceTek Tag 31	TraceTek Tag
33	3,6,16	TraceTek Tag 32	TraceTek Tag
34	3,6,16	TraceTek Tag 33	TraceTek Tag
35	3,6,16	TraceTek Tag 34	TraceTek Tag
36	3,6,16	TraceTek Tag 35	TraceTek Tag
37	3,6,16	TraceTek Tag 36	TraceTek Tag
38	3,6,16	TraceTek Tag 37	TraceTek Tag
39	3,6,16	TraceTek Tag 38	TraceTek Tag
40	3,6,16	TraceTek Tag 39	TraceTek Tag
41	3,6,16	Date YYYY	Date - YYYY
42	3,6,16	Date MM	Date - MM = 1 - 12
43	3,6,16	Date DD	Date - DD = 1 - 31
44	3,6,16	Time HH	Time - HH = 0 - 23
45	3,6,16	Time MM	Time - MM = 0 - 59
46	3,6,16	Spare	-
47	3,6,16	Spare	-
48	3,6,16	Spare	-
49	3,6,16	Spare	-
50	3,6,16	TraceTek Relay 1 Alarm Mask	bit 0=Audible Alarm (this bit can only be set by itself), bit 1=Leak Alarm, bit 2=Service Alarm, bit 3=Trouble Alarm, bit 4= Comm Alarm, bit 5=Latch (all but audible alarm)
51	3,6,16	TraceTek Relay 2 Alarm Mask	bit 0=Audible Alarm (this bit can only be set by itself), bit 1=Leak Alarm, bit 2=Service Alarm, bit 3=Trouble Alarm, bit 4= Comm Alarm, bit 5=Latch (all but audible alarm)
52	3,6,16	TraceTek Relay 3 Alarm Mask	bit 0=Audible Alarm (this bit can only be set by itself), bit 1=Leak Alarm, bit 2=Service Alarm, bit 3=Trouble Alarm, bit 4= Comm Alarm, bit 5=Latch (all but audible alarm)
53	3,6,16	Units	Display Units 0=Feet, 1=Meters, 2=Zones (this changed units for all SIMS)
54	3,6,16	Screen Saver Timeout	Min=1 minute, Max=300 minutes
55	3,6,16	Main Menu Timeout	Min=1 minute, Max=100 minutes
56	3,6,16	Language	0=English, 1=French, 2-German, 3=Spanish, 4=Italian, 5=Japanese, 6=Korean
57	3,6,16	Mouse Enable/Disable	0=Disable, 1=Enable
58	3,6,16	Leak Alarm Timeout	0=5 Secs, 1=15 Secs, 2=1 Min, 3=5 Min, 4=15 Min, 5=30 Min, 6=60 Min
59	3,6,16	Service Alarm Timeout	0=5 Secs, 1=15 Secs, 2=1 Min, 3=5 Min, 4=15 Min, 5=30 Min, 6=60 Min
60	3,6,16	Trouble Alarm Timeout	0=5 Secs, 1=15 Secs, 2=1 Min, 3=5 Min, 4=15 Min, 5=30 Min, 6=60 Min
61	3,6,16	Comm. Alarm Timeout	0=5 Secs, 1=15 Secs, 2=1 Min, 3=5 Min, 4=15 Min, 5=30 Min, 6=60 Min
62	3,6,16	Re-Alarm Interval	0-24 Hours, 0=Disable
63	3,6,16	Alarm Re-Flash	0=Disable, 1=Enable
64	3,6,16	Remote Display	0=Disable, 1=Enable
65	3,6,16	Spare	-

Modbus Address	Function Code	Description	Comments
66	3,6,16	Spare	-
67	3,6,16	Spare	-
68	3,6,16	Spare	-
69	3,6,16	Spare	-
70	3,6,16	reserved	-
...	...		-
93	3,6,16	Device bus Number retrys	1-10 (default 2)
94	3,6,16	Device bus Transmit Delay	0-1000 milliseconds (default 0)
95	3,6,16	Device Bus Receive Msg Timeout	0-10000 milliseconds (default 500) Total Time for a receive message timeout. If the complete message is not received by this timeout, then the message is terminated. This is added to the minimum values already hardcoded in the UIT. This is included to extend delays for a radio modem.
96	3,6,16	Device Bus Receive Msg Char Timeout	0-1000 milliseconds (default 25) Receive Message inter character gap timeout. When a character gap exceeds this time, then the message is terminated. This is added to the minimum values already hardcoded in the UIT. This is included to extend delays for a radio modem.
97	3,6,16	Devcie Bus Baud Rate	0=2400, 1=4800, 2=9600, 3=19200, 4=38400, 5=57600, 6=115200, 7=128000
98	3,6,16	Device Bus Stop Bits	1 or 2
99	3,6,16	Device Bus Parity	0=None, 1=Odd, 2=Even

Database Synchronization / Global Alarm Status			
Modbus Function Code: 3,6,16			
Modbus Start Address: 100			
Modbus Block Size: 1			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments**
100	3,6,16	Database Synchronization/Alarm Status Flags	0x0001 = General Information Change Flag 0x0002 = SIM Database Change Flag 0x0004 = SIM Alarm Status Change Flag 0x0008 = SIM Alarm Reset Change Flag 0x0010 = Device Alarm Status Flag (comm errors or embed this in device list) 0x0020 = Device List Change Flag (after a scan) 0x0040 = Spare 0x0080 = Spare Write 1 to bit position to clear flag
100			

SIM Control Data			
Modbus Function Code: 3, 6, 16			
Modbus Start Address: 101			
Modbus Block Size: 100			
Number of Blocks: 255			
Modbus Address	**Function Code**	**Description**	**Comments (1 entry for all 255 SIMs) Contains both Read only and Read/Write data**
101	3,6,16	SIM 1 Tag 0	SIM Tag (Unicode 39 chars + null)
102	3,6,16	SIM 1 Tag 1	SIM Tag
103	3,6,16	SIM 1 Tag 2	SIM Tag
104	3,6,16	SIM 1 Tag 3	SIM Tag
105	3,6,16	SIM 1 Tag 4	SIM Tag
106	3,6,16	SIM 1 Tag 5	SIM Tag
107	3,6,16	SIM 1 Tag 6	SIM Tag
108	3,6,16	SIM 1 Tag 7	SIM Tag
109	3,6,16	SIM 1 Tag 8	SIM Tag
110	3,6,16	SIM 1 Tag 9	SIM Tag
111	3,6,16	SIM 1 Tag 10	SIM Tag
112	3,6,16	SIM 1 Tag 11	SIM Tag
113	3,6,16	SIM 1 Tag 12	SIM Tag
114	3,6,16	SIM 1 Tag 13	SIM Tag
115	3,6,16	SIM 1 Tag 14	SIM Tag
116	3,6,16	SIM 1 Tag 15	SIM Tag
117	3,6,16	SIM 1 Tag 16	SIM Tag
118	3,6,16	SIM 1 Tag 17	SIM Tag
119	3,6,16	SIM 1 Tag 18	SIM Tag
120	3,6,16	SIM 1 Tag 19	SIM Tag
121	3,6,16	SIM 1 Tag 20	SIM Tag
122	3,6,16	SIM 1 Tag 21	SIM Tag
123	3,6,16	SIM 1 Tag 22	SIM Tag
124	3,6,16	SIM 1 Tag 23	SIM Tag
125	3,6,16	SIM 1 Tag 24	SIM Tag
126	3,6,16	SIM 1 Tag 25	SIM Tag
127	3,6,16	SIM 1 Tag 26	SIM Tag
128	3,6,16	SIM 1 Tag 27	SIM Tag
129	3,6,16	SIM 1 Tag 28	SIM Tag
130	3,6,16	SIM 1 Tag 29	SIM Tag
131	3,6,16	SIM 1 Tag 30	SIM Tag
132	3,6,16	SIM 1 Tag 31	SIM Tag
133	3,6,16	SIM 1 Tag 32	SIM Tag
134	3,6,16	SIM 1 Tag 33	SIM Tag
135	3,6,16	SIM 1 Tag 34	SIM Tag
136	3,6,16	SIM 1 Tag 35	SIM Tag
137	3,6,16	SIM 1 Tag 36	SIM Tag
138	3,6,16	SIM 1 Tag 37	SIM Tag
139	3,6,16	SIM 1 Tag 38	SIM Tag

Modbus Address	Function Code	Description	Comments (1 entry for all 255 SIMs) Contains both Read only and Read/Write data
140	3,6,16	SIM 1 Tag 39	SIM Tag
141	3,6,16	Units	0=Feet, 1=Meters, 2=Zones
142	3,6,16	Leak Sensitivity	0=Normal, 1=High, 2=Low, 3=TT500x, 4=TT5DB, 5=TT7000, 6=Custom (write “custom” when changing the resistance threshold below during a block write, then it basically ignores it)
143	3,6,16	Service Sensitivity	0=Normal, 1=High, 2=Low, 3=TT500x, 4=TT5DB, 5=TT7000, 6=Never, 7=Custom (write “custom” when changing the current threshold below during a block write, then it basically ignores it)
144	3,6,16	Barrier Resistance	0-1000
145	3,6,16	ReAlarm Distance	depends on units
146	3,6,16	Zone Resistance	180-300
147	3,6,16	Service Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
148	3,6,16	Trouble Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
149	3,6,16	Spare	-
150	3,6,16	Spare	-
151	3,6,16	Spare	-
152	3,6,16	Spare	-
153	3,6,16	Spare	-
154	3,6,16	Spare	-
155	3,6,16	Relay Alarm Mode (TTSIM1A/2 Only)	0=Leak, 1=Leak/Break, 2=Leak/Break/Service, 3=Force On, 4-Force Off
156	3,6,16	Relay Alarm State (TTSIM1A/2 Only)	0=Off, 1=On
157	3,6,16	Relay Reset Mode (TTSIM1A/2 Only)	0=Auto, 1=Manual, 2=Safe
158	3,6,16	Spare	-
159	3,6,16	Spare	-
160	3,6,16	Current Threshold	-
161	3,6,16	Resistance Threshold	-
162	3,6,16	Spare	-
163	3,6,16	Spare	-
164	3,6,16	Spare	-
165	3,6,16	Spare	-
166	3,6,16	Spare	-
167	3,6,16	Spare	-
168	3,6,16	Spare	-
169	3,6,16	Spare	-
170	3,6	AO Output Write Password	**Raw SIM data. This has to be set to this unique password to prohibit erroneous writes to the data that follows. This is a pass through register set. The data is sent to the device as is. You must reference the individual SIM spec for data formats. We are not allowing block writes for the following registers. This password register has to be set to 13579 to write to the following registers.**
		Raw SIM Analog Output Data	**Register 171-197 are dependent on the specific device. The following is the actual registers for a SIM1. SIM1A and SIM2 actual registers are different.**
171	3,6	AO0: SI Operational Mode:	-

Modbus Address	Function Code	Description	Comments (1 entry for all 255 SIMs) Contains both Read only and Read/Write data
172	3,6	AO1: Leak Resistance Threshold.	Leak Resistance Threshold when Detection Resistance is below Low Resistance Detected flag DI0 is set.
173	3,6	AO2:Locating Current Threshold.	Locating Current Threshold when Detection Current is above a location is measured and Locating Current Detected Flag (DI1) is set
174	3,6	AO3: Sensor Delta Thres.	Percent, Maximum difference allowed in resistance between two loops of cable before an error condition is flagged
175	3,6	AO4: Rref (Ref. Resist.)	Ohms
176	3,6	AO5: K (Scale Factor)	-
177	3,6	AO6: Vref	mVolts
178	3,6	AO7: Settling Time	10 ms increments
179	3,6	AO8: Cycle Time	seconds
180	3,6	AO9: Cycles per Polarity	cycles
181	3,6	AO10: Unit Address	-
182	3,6	AO11: High VoltageThres.	.1 Ohms
183	3,6	AO12: Misc. Settings (need to reset for offset changes to take effect)	-
184	3,6	AO13: Gain 1	0.001
185	3,6	AO14: Gain 2	0.001
186	3,6	AO15: Offset	vAINTP/ vAOUTTP x 1000
187	3,6	High Sensitivity Min	k0hms
188	3,6	Normal Sensitivity Min	k0hms
189	3,6	Low Sensitivity Min	k0hms
190	3,6	Hydro Carbon Sensitivity Min	k0hms(anything below this value is considered Direct Bury Sensitivity)
191	3,6	High Sensitivity Hi / Low Voltage	(these levels selected when Leak Resistance Threshold above High Sensitivity Min) High (0-255 high byte) Low (0-255 low byte)
192	3,6	Normal Sensitivity Hi / Low Voltage	(these levels selected when Leak Resistance Threshold above Low Sensitivity Min and below High Sensitivity Min) High (0-255 high byte) Low (0-255 low byte)
193	3,6	Low Sensitivity Hi / Low Voltage	(these levels selected when Leak Resistance Threshold above Hydro Carbon Sensitivity Min and below Normal Sensitivity Min) High (0-255 high byte), used to determine Loop Lengths, Low (0-255 low byte)
194	3,6	Hydro Carbon Sensitivity Hi / Low Voltage	(these levels selected when Leak Resistance Threshold above Direct Bury Sensitivity Min and below Low Sensitivity Min) High (0-255 high byte), used to determine Loop Lengths for both Hydro Carbons and Direct Bury Low (0-255 low byte)
195	3,6	Direct Bury Sensitivity Hi / Low Voltage	(these levels selected when Leak Resistance Threshold Below Hydro Carbon Sensitivity Min) High (0-255 high byte) Low (0-255 low byte)
196	3,6	Address Mask 1	For testing only, If config jumper on, one bit for each SIM address 0-15. Bit set means that this SIM will respond to queries if that address. Use for stress testing, demos.
197	3,6	Address Mask 2	For testing only, If config jumper on, one bit for each SIM address 16-31. Bit set means that this SIM will respond to queries if that address. Use for stress testing, demos.
198	3,6	Spare	-
199	3,6	Spare	-
200	3,6	Spare	-

Modbus Address	Function Code	Description	Comments (1 entry for all 255 SIMs) Contains both Read only and Read/Write data
201	3,6,16	SIM 2 Data (see above format)	-
301	3,6,16	SIM 3 Data (see above format)	-
401	3,6,16	SIM 4 Data (see above format)	-
501	3,6,16	SIM 5 Data (see above format)	-
601	3,6,16	SIM 6 Data (see above format)	-
701	3,6,16	SIM 7 Data (see above format)	-
801	3,6,16	SIM 8 Data (see above format)	-
901	3,6,16	SIM 9 Data (see above format)	-
1001	3,6,16	SIM 10 Data (see above format)	-
1101	3,6,16	SIM 11 Data (see above format)	-
1201	3,6,16	SIM 12 Data (see above format)	-
1301	3,6,16	SIM 13 Data (see above format)	-
1401	3,6,16	SIM 14 Data (see above format)	-
1501	3,6,16	SIM 15 Data (see above format)	-
1601	3,6,16	SIM 16 Data (see above format)	-
1701	3,6,16	SIM 17 Data (see above format)	-
1801	3,6,16	SIM 18 Data (see above format)	-
1876	3,6,16	SIM 19 Data (see above format)	-
	...	...	-
25501	3,6,16	SIM 255 Data (see above format)	-
25600	3,6,16	End SIM 255 Data (see above format)	-

SIM Mapped Region Data			
Modbus Function Code: 3,6,16			
Modbus Start Address: 60001			
Modbus Block Size: 45			
Number of Blocks: 1			
Modbus Address	**Function Code**	**Description**	**Comments:**
60001	3,6,16	SIM Number	1-255
60002	3,6,16	Region Number	1-10
60003	3,6,16	Region Start	0-5500
60004	3,6,16	Region End	0-5500
60005	3,6,16	Region Relay	High Byte Device Address(1 thru 255), Low Byte Relay Number(1-40 for NRM, 1-8 for ADAM)
60006	3,6,16	Region Relay Latch	0=No Latch, 1=Latch
60007	3,6,16	Region Tag 0	Region Tag
60008	3,6,16	Region Tag 1	Region Tag
60009	3,6,16	Region Tag 2	Region Tag
60010	3,6,16	Region Tag 3	Region Tag
60011	3,6,16	Region Tag 4	Region Tag
60012	3,6,16	Region Tag 5	Region Tag
60013	3,6,16	Region Tag 6	Region Tag
60014	3,6,16	Region Tag 7	Region Tag
60015	3,6,16	Region Tag 8	Region Tag

Modbus Address	Function Code	Description	Comments:
60016	3,6,16	Region Tag 9	Region Tag
60017	3,6,16	Region Tag 10	Region Tag
60018	3,6,16	Region Tag 11	Region Tag
60019	3,6,16	Region Tag 12	Region Tag
60020	3,6,16	Region Tag 13	Region Tag
60021	3,6,16	Region Tag 14	Region Tag
60022	3,6,16	Region Tag 15	Region Tag
60023	3,6,16	Region Tag 16	Region Tag
60024	3,6,16	Region Tag 17	Region Tag
60025	3,6,16	Region Tag 18	Region Tag
60026	3,6,16	Region Tag 19	Region Tag
60027	3,6,16	Region Tag 20	Region Tag
60028	3,6,16	Region Tag 21	Region Tag
60029	3,6,16	Region Tag 22	Region Tag
60030	3,6,16	Region Tag 23	Region Tag
60031	3,6,16	Region Tag 24	Region Tag
60032	3,6,16	Region Tag 25	Region Tag
60033	3,6,16	Region Tag 26	Region Tag
60034	3,6,16	Region Tag 27	Region Tag
60035	3,6,16	Region Tag 28	Region Tag
60036	3,6,16	Region Tag 29	Region Tag
60037	3,6,16	Region Tag 30	Region Tag
60038	3,6,16	Region Tag 31	Region Tag
60039	3,6,16	Region Tag 32	Region Tag
60040	3,6,16	Region Tag 33	Region Tag
60041	3,6,16	Region Tag 34	Region Tag
60042	3,6,16	Region Tag 35	Region Tag
60043	3,6,16	Region Tag 36	Region Tag
60044	3,6,16	Region Tag 37	Region Tag
60045	3,6,16	Region Tag 38	Region Tag
60046	3,6,16	Region Tag 39	Region Tag

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