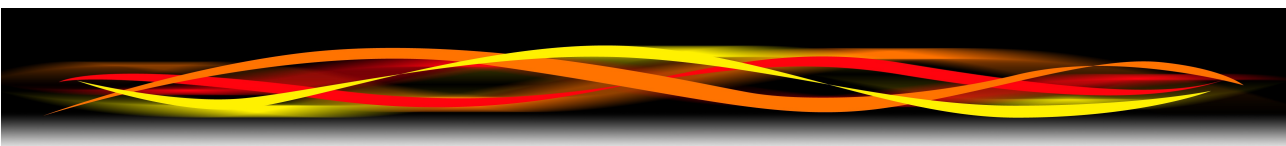# Newflow

NÅNO

LACT-Pro Modbus Manual

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3					
4					

Table of Contents

1   Introduction

The NÅNO LACT Controller one of a range of applications designed specifically to automate and regulate the movements of crude oil from small scale production area to crude gathering and pipeline injection points.

By recording flow at the gathering point, and making the information immediately available in an electronic form, disputes can be readily resolved, and transportation losses minimised, adding significant transparency to the process.

Only live data can be exchanged using the Modbus format, for reports and archived data, the more sophisticated and future-proofed XML communications should be utilised.

2   Modbus Protocol

2.1 TCP/IP INTERFACE

The Modbus/TCP interface is attached to the TCP/IP stack. This will listen to all communications that come in on the configured Modbus/TCP port, for example port 502.

Up to 10 connections are possible per port at one time. If there are 10 active connections, any attempt at any more connections is ignored.

Once a connection has been established, it will be closed after 1 minute of inactivity.

2.2 DATA REFRESH

The Modbus/TCP link has the most recent data available as it accesses the database on each poll. Refreshing of the database is performed every heartbeat, currently this set to 500 milliseconds. The client application should not request data more frequently than once every heartbeat as the data will not have changed quicker than that.

2.3 DATA ENCODING

Modbus uses a 'big-endian' representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the MOST significant byte is sent first.

The following sub-topics describe the different types of encoding and show how the data is encoded within the Modbus/TCP packet. Most client drivers will extract the data from the packet in the correct format for use/display within the client environment.

2.3.1 BIT – 1-Bit Digit (Bit)

Binary data is used for digital input or alarm states that can be represented as a 1 or a 0.

2.3.2 SHORT10 – 16-Bit (Short)

A 16-bit word item transmitted with the MOST significant byte first, for example:-

Value	Register #1	
	Byte #1	Byte #2
0x1234	0x12	0x34

FC3 reads 16-bit items at a time; therefore, only a single register is required to read each Short item.

2.3.3 INT3210 – 32-Bit (Integer)

Integer data is used for encoding status messages, input or output states and permissive modes.

A 32-bit word item is transmitted with the MOST significant byte first, then the next MOST significant, until all bytes are transmitted.

FC3 reads 16-bit items at a time; therefore, two registers are required to read each Integer item.

Value	Register #1		Register #2	
	Byte #1	Byte #2	Byte #3	Byte #4
0x12345678	0x12	0x34	0x56	0x78

2.3.4 FLOAT3210 – 32-Bit (Float)

Float data is used to represent sensor dynamic data. A float is 32-bits; therefore is transmitted just as a 32-bit integer item is.

FC3 reads 16-bit items at a time; therefore, two registers are required to read each Float item.

Example: 5,000.00 decimal is 0x459C4000 hexadecimal float.

Value	Register #1		Register #2	
	Byte #1	Byte #2	Byte #3	Byte #4
0x459C4000	0x45	0x9C	0x40	0x00

2.4 COMMUNICATION PROTOCOL MODBUS-TCP

2.4.1 Supported Function Codes

Function Codes that are supported by the Modbus/TCP Interface on the LACT-Pro application are as follows;

Function Code	Meaning
01	Reading of Coils
03	Reading of Registers
16	Writing of Registers

2.4.2 Reading of Coils (Function Code 01)

Query (example polling device 1, for address 1528, for 18 bits)

MBAP Header (Modbus Application Protocol)										Modbus/TCP PDU (Protocol Data Unit)				
Transaction ID		Protocol ID		Length		Unit ID / Slave ID	Function Code	Start Address		Number of Bits	
Hi	Lo	Hi	Lo	Hi	Lo			Hi	Lo	Hi	Lo
00	01	00	00	00	06	01	01	05	F8	00	12
Modbus/TCP ADU (Application Data Unit)											

Transaction ID	Used for transaction pairing. Value set by the Master.
Protocol ID	Used for Intra-system multiplexing. Modbus value is always 0.
Length	Byte count of the following fields, therefore fixed to 6.
Unit ID / Slave ID	Device Address (1 to 247, 01_{Hex} to $F7_{Hex}$)
Function Code	Function Code (01_{Hex}).
Start Address	First register address to be read.
Number of Bits	Number of bits to be read, max 2000, $7D_{Hex}$

In this example, the returned values are as follows;

Address	Bit Value	Address	Bit Value
1528	0	1537	0
1529	0	1538	0
1530	1	1539	0
1531	0	1540	1
1532	0	1541	0
1533	0	1542	0
1534	0	1543	1
1535	0	1544	1
1536	0	1545	1

Note:

It is only possible to read more than one item at the same time if their addresses are consecutive.

Reply

MBAP Header (Modbus Application Protocol)									Modbus/TCP PDU (Protocol Data Unit)																	
Transaction ID		Protocol ID		Length		Unit ID / Slave ID	Function Code	Byte Count																		
									1535	1534	1533	1532	1531	1530	1529	1528	1543	1542	1541	1540	1539	1538	1537	1536	1545	1544
Hi	Lo	Hi	Lo	Hi	Lo				B7	B6	B5	B4	B3	B2	B1	B0	B7	B6	B5	B4	B3	B2	B1	B0	B1	B0
									0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	1
00	01	00	00	00	06	01	01	03	04								90								03	
Modbus/TCP ADU (Application Data Unit)																										

Transaction ID	As per query. Value set by the Master.
Protocol ID	As per query. Modbus value is always 0
Length	Byte count of the following fields, therefore set to result of (3 + (number of registers x 2). In this case 13 = $0D_{Hex}$
Unit ID / Slave ID	As per query
Function Code	As per query, in this case 03_{Hex}
Byte Count	Byte count of the data, therefore set to result of (number of registers polled for x 2). In this case 10 = $0A_{Hex}$
Values	2 bytes represent each value returned

2.4.3 Reading of Registers (Function Code 03) – SHORT10

Query (example polling device 1, for address 3000, for 5 registers)

MBAP Header (Modbus Application Protocol)							Modbus/TCP PDU (Protocol Data Unit)				
Transaction ID		**Protocol ID**		**Length**		**Unit ID / Slave ID**	**Function Code**	**Start Address**		**Number of Registers**	
Hi	Lo	Hi	Lo	Hi	Lo			Hi	Lo	Hi	Lo
00	01	00	00	00	06	01	03	0B	B8	00	05
Modbus/TCP ADU (Application Data Unit)											

Transaction ID	Used for transaction pairing. Value set by the Master.
Protocol ID	Used for Intra-system multiplexing. Modbus value is always 0.
Length	Byte count of the following fields, therefore fixed to 6.
Unit ID / Slave ID	Device Address (1 to 247, 01_{Hex} to $F7_{Hex}$)
Function Code	Function Code (03_{Hex}).
Start Address	First register address to be read.
Number of Registers	Number of registers to be read, max 125, $7D_{Hex}$

In this example, the returned values are as follows;

Address	Hex Value	Decimal Value
3000	00 03	3
3001	00 03	3
3002	00 02	2
3003	00 01	1
3004	00 01	1

Note:

It is only possible to read more than one item at the same time if their addresses are consecutive.

Reply (SHORT10)

MBAP Header (Modbus Application Protocol)									Modbus/TCP PDU (Protocol Data Unit)										
Transaction ID		Protocol ID		Length		Unit ID / Slave ID	Function Code	Byte Count	Address 3000 Value		Address 3001 Value		Address 3002 Value		Address 3003 Value		Address 3004 Value			
Hi	Lo	Hi	Lo	Hi	Lo				Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo
00	01	00	00	00	0D	01	03	0A	00	03	00	03	00	02	00	01	00	01
Modbus/TCP ADU (Application Data Unit)																		

Transaction ID	As per query. Value set by the Master.
Protocol ID	As per query. Modbus value is always 0
Length	Byte count of the following fields, therefore set to result of (3 + (number of registers x 2). In this case 13 = 0D$_{Hex}$
Unit ID / Slave ID	As per query
Function Code	As per query, in this case 03$_{Hex}$
Byte Count	Byte count of the data, therefore set to result of (number of registers polled for x 2). In this case 10 = 0A$_{Hex}$
Values	2 bytes represent each value returned

2.4.4 Reading of Registers (Function Code 03) – INT3210 or FLOAT3210

Query (example polling device 1, for address 7000, for 5 registers)

MBAP Header (Modbus Application Protocol)							Modbus/TCP PDU (Protocol Data Unit)				
Transaction ID		**Protocol ID**		**Length**		**Unit ID / Slave ID**	**Function Code**	**Start Address**		**Number of Registers**	
Hi	Lo	Hi	Lo	Hi	Lo			Hi	Lo	Hi	Lo
00	01	00	00	00	06	01	03	1B	58	00	05
Modbus/TCP ADU (Application Data Unit)											

Transaction ID	Used for transaction pairing. Value set by the Master.
Protocol ID	Used for Intra-system multiplexing. Modbus value is always 0.
Length	Byte count of the following fields, therefore fixed to 6.
Unit ID / Slave ID	Device Address (1 to 247, 01_{Hex} to $F7_{Hex}$)
Function Code	Function Code (03_{Hex}).
Start Address	First register address to be read.
Number of Registers	Number of registers to be read, max 125, $7D_{Hex}$

In this example, the returned values are as follows;

Address	Hex Representation	Decimal Value
7000	00 00 00 00	0
7001	00 00 00 00	0
7002	42 F0 00 00	120
7003	42 B4 00 00	90
7004	40 0C CC CD	2.2

Note:

It is only possible to read more than one item at the same time if their addresses are consecutive.

Reply (INT3210, FLOAT3210)

MBAP Header (Modbus Application Protocol)									Modbus/TCP PDU (Protocol Data Unit)																			
Transaction ID		Protocol ID		Length		Unit ID / Slave ID	Function Code	Byte Count	Address 7000 Value				Address 7001 Value				Address 7002 Value				Address 7003 Value				Address 7004 Value			
Hi	Lo	Hi	Lo	Hi	Lo				HH	H	L	LL	HH	H	L	LL	HH	H	L	LL	HH	H	L	LL	HH	H	L	LL
00	01	00	00	00	17	01	03	14	00	00	00	00	00	00	00	00	42	F0	00	00	42	B4	00	00	40	0C	CC	CD
Modbus/TCP ADU (Application Data Unit)																												

Transaction ID	As per query. Value set by the Master.
Protocol ID	As per query. Modbus value is always 0
Length	Byte count of the following fields, therefore set to result of (3 + (number of registers x 4). In this case 23 = 17_{Hex}
Unit ID / Slave ID	As per query
Function Code	As per query, in this case 03_{Hex}
Byte Count	Byte count of the data, therefore set to result of (number of registers polled for x 4). In this case 20 = 14_{Hex}
Values	4 bytes represent each value returned

2.4.5 Writing of Registers (Function Code 16) – SHORT10

In this example, the following values are sent;

Address	Hex Value	Decimal Value	Representing Symbol
3008	00 01	1	F
3009	00 04	4	g/cc
3010	00 03	3	psig

Query (example writing to device 1, address 3008, with 3 registers)

MBAP Header (Modbus Application Protocol)								Modbus/TCP PDU (Protocol Data Unit)											
Transaction ID		Protocol ID		Length		Unit ID / Slave ID	Function Code	Start Address		Number of Registers		Byte Count	Address 3008 Value		Address 3009 Value		Address 3010 Value		
Hi	Lo	Hi	Lo	Hi	Lo			Hi	Lo	Hi	Lo		Hi	Lo	Hi	Lo	Hi	Lo	
00	01	00	00	00	0D	01	10	0B	C0	00	03	06	00	01	00	04	00	03	
Modbus/TCP ADU (Application Data Unit)																			

Transaction ID	Used for transaction pairing. Value set by the Master.
Protocol ID	Used for Intra-system multiplexing. Modbus value is always 0.
Length	Byte count of the following fields, in this example calculated as 13 ($0D_{Hex}$)
Unit ID / Slave ID	Device Address (1 to 247, 01_{Hex} to $F7_{Hex}$)
Function Code	Function Code (10_{Hex}).
Start Address	First register address to be written.
Number of Registers	Number of registers to be written, maximum 60
Byte Count	Byte count of the data, therefore set to result of (number of registers to write x 2). In this case 06 = 06_{Hex}
Values	2 bytes represent each value written

Note:
It is only possible to read more than one item at the same time if their addresses are consecutive.

Reply (SHORT10)

MBAP Header (Modbus Application Protocol)							Modbus/TCP PDU (Protocol Data Unit)				
Transaction ID		Protocol ID		Length		Unit ID / Slave ID	Function Code	Start Address		Register Count	
Hi	Lo	Hi	Lo	Hi	Lo			Hi	Lo	Hi	Lo
00	01	00	00	00	06	01	10	0B	C0	00	03
Modbus/TCP ADU (Application Data Unit)											

Transaction ID	As per query. Value set by the Master.
Protocol ID	As per query. Modbus value is always 0
Length	Byte count of the following fields, therefore fixed to 6_{Hex}
Unit ID / Slave ID	As per query
Function Code	As per query, in this case 10_{Hex}
Start Address	First register address that was written.
Register Count	Register count of the data. In this case $03 = 03_{Hex}$

2.4.6 Writing of Registers (Function Code 16) – INT3210 or FLOAT3210

In this example, the following values are sent;

Address	Hex Representation	Decimal Value
5080	00 00 00 02	2
5081	00 00 00 01	1
5082	00 00 00 03	3

Query (example writing to device 1, address 5080, with 3 registers)

MBAP Header (Modbus Application Protocol)								Modbus/TCP PDU (Protocol Data Unit)														
Transaction ID		Protocol ID		Length		Unit ID / Slave ID	Function Code	Start Address		Number of Registers		Byte Count	Address 5080 Value				Address 5081 Value				Address 5082 Value			
Hi	Lo	Hi	Lo	Hi	Lo			Hi	Lo	Hi	Lo		HH	H	L	LL	HH	H	L	LL	HH	H	L	LL
00	01	00	00	00	13	01	10	13	D8	00	03	0C	00	00	00	02	00	00	00	01	00	00	00	03
Modbus/TCP ADU (Application Data Unit)																								

Transaction ID	Used for transaction pairing. Value set by the Master.
Protocol ID	Used for Intra-system multiplexing. Modbus value is always 0.
Length	Byte count of the following fields, in this example calculated as 19 (13_{Hex})
Unit ID / Slave ID	Device Address (1 to 247, 01_{Hex} to $F7_{Hex}$)
Function Code	Function Code (10_{Hex}).
Start Address	First register address to be written.
Number of Registers	Number of registers to be written, maximum 60
Byte Count	Byte count of the data, therefore set to result of (number of registers to write x 4). In this case 12 = $0C_{Hex}$
Values	4 bytes represent each value written

Note:
It is only possible to read more than one item at the same time if their addresses are consecutive.

Reply (INT3210, FLOAT3210)

MBAP Header (Modbus Application Protocol)							Modbus/TCP PDU (Protocol Data Unit)				
Transaction ID		Protocol ID		Length		Unit ID / Slave ID	Function Code	Start Address		Register Count	
Hi	Lo	Hi	Lo	Hi	Lo			Hi	Lo	Hi	Lo
00	01	00	00	00	06	01	10	13	D8	00	03
Modbus/TCP ADU (Application Data Unit)											

Transaction ID	As per query. Value set by the Master.
Protocol ID	As per query. Modbus value is always 0
Length	Byte count of the following fields, therefore fixed to 6_{Hex}
Unit ID / Slave ID	As per query
Function Code	As per query, in this case 10_{Hex}
Start Address	First register address that was written.
Register Count	Register count of the data. In this case $03 = 03_{Hex}$

3   Modbus Links

Two links are provided, theses are;

- Legacy Modbus/TCP Link – mainly giving points in the same location as those from other manufacturers, however this means that data is scattered across a wide range of addresses, making it poor to poll for in 'chunks'.

- Generic Modbus/TCP Link – populating live information and grouped tightly so that very few polls are required to get live data.

The preferred method of receiving all data (archived and live) is via XML comms. This is documented separately but allows a lot of data to be polled for in single polls

3.1 Generic Modbus/TCP Link

Modbus/TCP Port # 593

Address	I/O Point	Index	Format	Description
1000	Computer Alarm		SHORT10	Alarms
1001	Strainer Blocked		SHORT10	
1002	Unallocated Flow Detected		SHORT10	
1003	Totals_Fail_Status		SHORT10	
1004	Pulse Out 1 Set-up Fault		SHORT10	
1005	Pulse Out 1 Fault		SHORT10	
1006	S&W High		SHORT10	
1007	S&W Low		SHORT10	
1008	S&W Transmitter Fail		SHORT10	
1009	System Restart		SHORT10	
1010	Oil Pressure High		SHORT10	
1011	Oil Pressure Low		SHORT10	
1012	Oil Pressure Transmitter Fail		SHORT10	
1013	Oil Temperature High		SHORT10	
1014	Oil Temperature Low		SHORT10	
1015	Oil Temperature Transmitter Fail		SHORT10	
1016	Water Temperature High		SHORT10	
1017	Water Temperature Low		SHORT10	
1018	Water Temperature Transmitter Fail		SHORT10	
1100	Oil Meter Factor has Changed Since Last Sampler Reset		SHORT10	Meter Factor Changed?
1101	Oil Meter Factor has Changed In the Last Month		SHORT10	
1102	Oil Meter Factor has Changed In the Last Day		SHORT10	
1103	Oil Meter Factor has Changed In the Last Active Load		SHORT10	
1110	Unallocated IV Detected - Sampler		SHORT10	Unallocated Flow Detected
1111	Unallocated IV Detected - Monthly		SHORT10	
1112	Unallocated IV Detected - Daily		SHORT10	
3000	Volume Unit		SHORT10	Units
3001	Mass Unit		SHORT10	
3002	Flow Rate Time Unit		SHORT10	
3003	Temperature Unit		SHORT10	
3004	Pressure Unit		SHORT10	
3005	Absolute Pressure Unit		SHORT10	
3006	Gravity Unit		SHORT10	
3007	K Factor Unit		SHORT10	
3008	Auxiliary Input 1 - Unit		SHORT10	
3009	Auxiliary Input 2 - Unit		SHORT10	
3010	Auxiliary Input 3 - Unit		SHORT10	
3011	Auxiliary Input 4 - Unit		SHORT10	
3012	Auxiliary Input 5 - Unit		SHORT10	
3013	Auxiliary Input 6 - Unit		SHORT10	

3021	Current Day		SHORT10	
3022	Current Month		SHORT10	
3023	Current Year		SHORT10	
3024	Current Hour		SHORT10	
3025	Current Minute		SHORT10	
3026	Current Second		SHORT10	
5000	Oil Cumulative Total Integer Modbus Formatted	IV	INT3210	Integer Totals
5001	Oil Cumulative Total Integer Modbus Formatted	GOV	INT3210	
5002	Oil Current Load Total Integer Modbus Formatted	IV	INT3210	
5003	Oil Current Load Total Integer Modbus Formatted	GOV	INT3210	
5004	Oil Current Day Total Integer Modbus Formatted	IV	INT3210	
5005	Oil Current Day Total Integer Modbus Formatted	GOV	INT3210	
5006	Oil Current Month Total Integer Modbus Formatted	IV	INT3210	
5007	Oil Current Month Total Integer Modbus Formatted	GOV	INT3210	
5008	Oil Current Sampler Can Pull Total Integer Modbus Formatted	IV	INT3210	
5009	Oil Current Sampler Can Pull Total Integer Modbus Formatted	GOV	INT3210	
5010	Oil Current Day Unalloc Total Integer Modbus Formatted	IV	INT3210	
5011	Oil Current Day Unalloc Total Integer Modbus Formatted	GOV	INT3210	
5012	Oil Current Month UnallocTotal Integer Modbus Formatted	IV	INT3210	
5013	Oil Current Month UnallocTotal Integer Modbus Formatted	GOV	INT3210	
5014	Oil Current SCP UnallocTotal Integer Modbus Formatted	IV	INT3210	
5015	Oil Current SCP UnallocTotal Integer Modbus Formatted	GOV	INT3210	
5020	Oil Cumulative Total Integer Modbus Formatted	GSV	INT3210	
5021	Oil Current Load Total Integer Modbus Formatted	GSV	INT3210	
5022	Oil Current Day Total Integer Modbus Formatted	GSV	INT3210	
5023	Oil Current Month Total Integer Modbus Formatted	GSV	INT3210	
5024	Oil Current Sampler Can Pull Total Integer Modbus Formatted	GSV	INT3210	
5025	Oil Current Day Unalloc Total Integer Modbus Formatted	GSV	INT3210	
5026	Oil Current Month UnallocTotal Integer Modbus Formatted	GSV	INT3210	
5027	Oil Current SCP UnallocTotal Integer Modbus Formatted	GSV	INT3210	
5030	Oil Cumulative Total Integer Modbus Formatted	NSV	INT3210	TBC
5031	Oil Current Load Total Integer Modbus Formatted	NSV	INT3210	
5032	Oil Current Day Total Integer Modbus Formatted	NSV	INT3210	
5033	Oil Current Month Total Integer Modbus Formatted	NSV	INT3210	
5034	Oil Current Sampler Can Pull Total Integer Modbus Formatted	NSV	INT3210	
5035	Oil Current Day Unalloc Total Integer Modbus Formatted	NSV	INT3210	
5036	Oil Current Month UnallocTotal Integer Modbus Formatted	NSV	INT3210	
5037	Oil Current SCP UnallocTotal Integer Modbus	NSV	INT3210	

	Formatted			
5050	Measured Pressure Present?		INT3210	Is an Input Configured
5051	Measured Temperature Present?		INT3210	
5052	Measured S&W Present?		INT3210	
5053	Auxiliary Input 1 Present		INT3210	
5054	Auxiliary Input 2 Present		INT3210	
5055	Auxiliary Input 3 Present		INT3210	
5056	Auxiliary Input 4 Present		INT3210	
5057	Auxiliary Input 5 Present		INT3210	
5058	Auxiliary Input 6 Present		INT3210	
5060	Oil Pressure Operating Status		INT3210	Input Mode Status
5061	Oil Temperature Operating Status		INT3210	
5062	S&W Operating Status		INT3210	
5063	Water Temperature Operating Status		INT3210	
5070	Pressure Mode Setting		INT3210	Input Mode Settings
5071	Oil Temperature Mode Setting		INT3210	
5072	S&W Mode Setting		INT3210	
5073	Water Temperature Mode Setting		INT3210	
5080	# DPs - Pressure		INT3210	# of Decimal Places
5081	# DPs - Temperature		INT3210	
5082	# DPs - S&W		INT3210	
5090	Batch Sequence #		INT3210	
5091	Truck Ticket #		INT3210	
5200	Water Cumulative Total Integer Modbus Formatted	IV	INT3210	
5201	Water Cumulative Total Integer Modbus Formatted	GOV	INT3210	
5202	Water Cumulative Total Integer Modbus Formatted	NSV	INT3210	
5203	Current Day Water Total Integer Modbus Formatted	IV	INT3210	
5204	Current Day Water Total Integer Modbus Formatted	GOV	INT3210	
5205	Current Day Water Total Integer Modbus Formatted	NSV	INT3210	
5206	Current Month Water Total Integer Modbus Formatted	IV	INT3210	
5207	Current Month Water Total Integer Modbus Formatted	GOV	INT3210	
5208	Current Month Water Total Integer Modbus Formatted	NSV	INT3210	
5300	Oil Previous Load Total Integer Modbus Formatted	IV	INT3210	
5301	Oil Previous Day Total Integer Modbus Formatted	IV	INT3210	
5302	Oil Previous Month Total Integer Modbus Formatted	IV	INT3210	
5303	Oil Previous Sampler Can Pull Total Integer Modbus Formatted	IV	INT3210	
5304	Oil Previous Day Unalloc Total Integer Modbus Formatted	IV	INT3210	
5305	Oil Previous Month UnallocTotal Integer Modbus Formatted	IV	INT3210	
5306	Oil Previous SCP UnallocTotal Integer Modbus Formatted	IV	INT3210	
5307			INT3210	

5308			INT3210	
5309			INT3210	
5310	Oil Previous Load Total Integer Modbus Formatted	GOV	INT3210	
5311	Oil Previous Day Total Integer Modbus Formatted	GOV	INT3210	
5312	Oil Previous Month Total Integer Modbus Formatted	GOV	INT3210	
5313	Oil Previous Sampler Can Pull Total Integer Modbus Formatted	GOV	INT3210	
5314	Oil Previous Day Unalloc Total Integer Modbus Formatted	GOV	INT3210	
5315	Oil Previous Month UnallocTotal Integer Modbus Formatted	GOV	INT3210	
5316	Oil Previous SCP UnallocTotal Integer Modbus Formatted	GOV	INT3210	
5317			INT3210	
5318			INT3210	
5319			INT3210	
5320	Oil Previous Load Total Integer Modbus Formatted	GSV	INT3210	
5321	Oil Previous Day Total Integer Modbus Formatted	GSV	INT3210	
5322	Oil Previous Month Total Integer Modbus Formatted	GSV	INT3210	
5323	Oil Previous Sampler Can Pull Total Integer Modbus Formatted	GSV	INT3210	
5324	Oil Previous Day Unalloc Total Integer Modbus Formatted	GSV	INT3210	
5325	Oil Previous Month UnallocTotal Integer Modbus Formatted	GSV	INT3210	
5326	Oil Previous SCP UnallocTotal Integer Modbus Formatted	GSV	INT3210	
5327			INT3210	
5328			INT3210	
5329			INT3210	
5330	Oil Previous Load Total Integer Modbus Formatted	NSV	INT3210	
5331	Oil Previous Day Total Integer Modbus Formatted	NSV	INT3210	
5332	Oil Previous Month Total Integer Modbus Formatted	NSV	INT3210	
5333	Oil Previous Sampler Can Pull Total Integer Modbus Formatted	NSV	INT3210	
5334	Oil Previous Day Unalloc Total Integer Modbus Formatted	NSV	INT3210	
5335	Oil Previous Month UnallocTotal Integer Modbus Formatted	NSV	INT3210	
5336	Oil Previous SCP UnallocTotal Integer Modbus Formatted	NSV	INT3210	
5337			INT3210	
5338			INT3210	
5339			INT3210	
5340	Previous Day Water Total Integer Modbus Formatted	IV	INT3210	
5341	Previous Month Water Total Integer Modbus Formatted	IV	INT3210	
5342			INT3210	
5343			INT3210	
5344			INT3210	
5345			INT3210	
5346			INT3210	
5347			INT3210	
5348			INT3210	

5349			INT3210	
5350	Previous Day Water Total Integer Modbus Formatted	GOV	INT3210	
5351	Previous Month Water Total Integer Modbus Formatted	GOV	INT3210	
5352			INT3210	
5353			INT3210	
5354			INT3210	
5355			INT3210	
5356			INT3210	
5357			INT3210	
5358			INT3210	
5359			INT3210	
5360	Previous Day Water Total Integer Modbus Formatted	NSV	INT3210	
5361	Previous Month Water Total Integer Modbus Formatted	NSV	INT3210	
5362			INT3210	
5363			INT3210	
5364			INT3210	
5365			INT3210	
5366			INT3210	
5367			INT3210	
5368			INT3210	
5369			INT3210	
7000	Oil Indicated Volume Flow Rate		FLOAT3210	Live Values
7001	Gross Observed Volume Flow Rate		FLOAT3210	
7002	Oil Pressure In Use		FLOAT3210	
7003	Oil Temperature In Use		FLOAT3210	
7004	S&W In Use		FLOAT3210	
7005	Oil Meter Factor		FLOAT3210	
7006	Oil Flow Meter K Factor		FLOAT3210	
7007	Water Indicated Volume Flow Rate		FLOAT3210	
7008	Water Gross Observed Volume Flow Rate		FLOAT3210	
7009	Water Net Standard Volume Flow Rate		FLOAT3210	
7010	Water Meter Factor		FLOAT3210	
7011	Water Flow Meter K Factor		FLOAT3210	
7012	Water Temperature In Use		FLOAT3210	
7020	Auxiliary Input 1 - In Use		FLOAT3210	
7021	Auxiliary Input 2 - In Use		FLOAT3210	
7022	Auxiliary Input 3 - In Use		FLOAT3210	
7023	Auxiliary Input 4 - In Use		FLOAT3210	
7024	Auxiliary Input 5 - In Use		FLOAT3210	
7025	Auxiliary Input 6 - In Use		FLOAT3210	
7050	Cumulative Oil Total	IV	FLOAT3210	32 bit Totals
7051	Cumulative Oil Total	GOV	FLOAT3210	
7052	Local Totalizer	IV	FLOAT3210	
7053	Local Totalizer	GOV	FLOAT3210	
7054	Current Day Total	IV	FLOAT3210	
7055	Current Day Total	GOV	FLOAT3210	

7056	Current Month Total	IV	FLOAT3210	
7057	Current Month Total	GOV	FLOAT3210	
7058	Current Sampler Can Pull Total	IV	FLOAT3210	
7059	Current Sampler Can Pull Total	GOV	FLOAT3210	
7060	Current Daily Unallocated Total	IV	FLOAT3210	
7061	Current Daily Unallocated Total	GOV	FLOAT3210	
7062	Current Monthly Unallocated Total	IV	FLOAT3210	
7063	Current Monthly Unallocated Total	GOV	FLOAT3210	
7064	Current Sampler Can Pull Unallocated Total	IV	FLOAT3210	
7065	Current Sampler Can Pull Unallocated Total	GOV	FLOAT3210	
7070	Cumulative Oil Total	GSV	FLOAT3210	
7071	Local Totalizer	GSV	FLOAT3210	
7072	Current Day Total	GSV	FLOAT3210	
7073	Current Month Total	GSV	FLOAT3210	
7074	Current Sampler Can Pull Total	GSV	FLOAT3210	
7075	Current Daily Unallocated Total	GSV	FLOAT3210	
7076	Current Monthly Unallocated Total	GSV	FLOAT3210	
7077	Current Sampler Can Pull Unallocated Total	GSV	FLOAT3210	
7080	Cumulative Oil Total	NSV	FLOAT3210	TBC
7081	Local Totalizer	NSV	FLOAT3210	
7082	Current Day Total	NSV	FLOAT3210	
7083	Current Month Total	NSV	FLOAT3210	
7084	Current Sampler Can Pull Total	NSV	FLOAT3210	
7085	Current Daily Unallocated Total	NSV	FLOAT3210	
7086	Current Monthly Unallocated Total	NSV	FLOAT3210	
7087	Current Sampler Can Pull Unallocated Total	NSV	FLOAT3210	
7200	Cumulative Water Total	IV	FLOAT3210	
7201	Cumulative Water Total	GOV	FLOAT3210	
7202	Cumulative Water Total	NSV	FLOAT3210	
7203	Current Water Day Total	IV	FLOAT3210	
7204	Current Water Day Total	GOV	FLOAT3210	
7205	Current Water Day Total	NSV	FLOAT3210	
7206	Current Water Month Total	IV	FLOAT3210	
7207	Current Water Month Total	GOV	FLOAT3210	
7208	Current Water Month Total	NSV	FLOAT3210	
7300	Previous Load Total	IV	FLOAT3210	
7301	Previous Day Total	IV	FLOAT3210	
7302	Previous Monthly Total	IV	FLOAT3210	
7303	Previous Sampler Can Pull Total	IV	FLOAT3210	
7304	Previous Day Unallocated Total	IV	FLOAT3210	
7305	Previous Month Unallocated Total	IV	FLOAT3210	
7306	Previous Sampler Can Pull Unallocated Total	IV	FLOAT3210	
7307			FLOAT3210	
7308			FLOAT3210	
7309			FLOAT3210	
7310	Previous Load Total	GOV	FLOAT3210	
7311	Previous Day Total	GOV	FLOAT3210	
7312	Previous Monthly Total	GOV	FLOAT3210	

7313	Previous Sampler Can Pull Total	GOV	FLOAT3210	
7314	Previous Day Unallocated Total	GOV	FLOAT3210	
7315	Previous Month Unallocated Total	GOV	FLOAT3210	
7316	Previous Sampler Can Pull Unallocated Total	GOV	FLOAT3210	
7317			FLOAT3210	
7318			FLOAT3210	
7319			FLOAT3210	
7320	Previous Load Total	GSV	FLOAT3210	
7321	Previous Day Total	GSV	FLOAT3210	
7322	Previous Monthly Total	GSV	FLOAT3210	
7323	Previous Sampler Can Pull Total	GSV	FLOAT3210	
7324	Previous Day Unallocated Total	GSV	FLOAT3210	
7325	Previous Month Unallocated Total	GSV	FLOAT3210	
7326	Previous Sampler Can Pull Unallocated Total	GSV	FLOAT3210	
7327			FLOAT3210	
7328			FLOAT3210	
7329			FLOAT3210	
7330	Previous Load Total	NSV	FLOAT3210	
7331	Previous Day Total	NSV	FLOAT3210	
7332	Previous Monthly Total	NSV	FLOAT3210	
7333	Previous Sampler Can Pull Total	NSV	FLOAT3210	
7334	Previous Day Unallocated Total	NSV	FLOAT3210	
7335	Previous Month Unallocated Total	NSV	FLOAT3210	
7336	Previous Sampler Can Pull Unallocated Total	NSV	FLOAT3210	
7337			FLOAT3210	
7338			FLOAT3210	
7339			FLOAT3210	
7340	Previous Water Day Total	IV	FLOAT3210	
7341	Previous Water Month Total	IV	FLOAT3210	
7342			FLOAT3210	
7343			FLOAT3210	
7344			FLOAT3210	
7345			FLOAT3210	
7346			FLOAT3210	
7347			FLOAT3210	
7348			FLOAT3210	
7349			FLOAT3210	
7350	Previous Water Day Total	GOV	FLOAT3210	
7351	Previous Water Month Total	GOV	FLOAT3210	
7352			FLOAT3210	
7353			FLOAT3210	
7354			FLOAT3210	
7355			FLOAT3210	
7356			FLOAT3210	
7357			FLOAT3210	
7358			FLOAT3210	
7359			FLOAT3210	
7360	Previous Water Day Total	NSV	FLOAT3210	
7361	Previous Water Month Total	NSV	FLOAT3210	
7362			FLOAT3210	
7363			FLOAT3210	
7364			FLOAT3210	

7365			FLOAT3210	
7366			FLOAT3210	
7367			FLOAT3210	
7368			FLOAT3210	
7369			FLOAT3210	
8000	Oil Pressure Override Value		FLOAT3210	Override Values
8001	Oil Pressure Default Value		FLOAT3210	Default Values
8002	Oil Temperature Override Value		FLOAT3210	
8003	Oil Temperature Default Value		FLOAT3210	
8004	S&W Override Value		FLOAT3210	
8005	S&W Default Value		FLOAT3210	
8006	Water Temperature Override Value		FLOAT3210	
8007	Water Temperature Default Value		FLOAT3210	
8020	Oil Pressure 4mA Scale Value		FLOAT3210	ADC Scaling Values
8021	Oil Pressure 20mA Scale Value		FLOAT3210	
8022	Oil Temperature 4mA Scale Value		FLOAT3210	
8023	Oil Temperature 20mA Scale Value		FLOAT3210	
8024	S&W 4mA Scale Value		FLOAT3210	
8025	S&W 20mA Scale Value		FLOAT3210	
8026	Water Temperature 4mA Scale Value		FLOAT3210	
8027	Water Temperature 20mA Scale Value		FLOAT3210	
8028	Auxiliary Input 1 - 4mA Scale		FLOAT3210	
8029	Auxiliary Input 1 - 20mA Scale		FLOAT3210	
8030	Auxiliary Input 2 - 4mA Scale		FLOAT3210	
8031	Auxiliary Input 2 - 20mA Scale		FLOAT3210	
8032	Auxiliary Input 3 - 4mA Scale		FLOAT3210	
8033	Auxiliary Input 3 - 20mA Scale		FLOAT3210	
8034	Auxiliary Input 4 - 4mA Scale		FLOAT3210	
8035	Auxiliary Input 4 - 20mA Scale		FLOAT3210	
8036	Auxiliary Input 5 - 4mA Scale		FLOAT3210	
8037	Auxiliary Input 5 - 20mA Scale		FLOAT3210	
8038	Auxiliary Input 6 - 4mA Scale		FLOAT3210	
8039	Auxiliary Input 6 - 20mA Scale		FLOAT3210	
8040	Oil Pressure Low Alarm Limit		FLOAT3210	Alarm Limits
8041	Oil Pressure High Alarm Limit		FLOAT3210	
8042	Oil Temperature Low Alarm Limit		FLOAT3210	
8043	Oil Temperature High Alarm Limit		FLOAT3210	
8044	S&W Low Alarm Limit		FLOAT3210	
8045	S&W High Alarm Limit		FLOAT3210	
8046	Water Temperature Low Alarm Limit		FLOAT3210	
8047	Water Temperature High Alarm Limit		FLOAT3210	
8060	Oil Pressure Recover After Fail		FLOAT3210	Recovery Modes
8061	Oil Temperature Recover After Fail		FLOAT3210	
8062	S&W Recover After Fail		FLOAT3210	
8063	Water Temperature Recover After Fail		FLOAT3210	

3.2 Legacy Modbus/TCP Link

Modbus/TCP Port # 592

Address	I/O Point	Index	Format	Description
1107	Computer Alarm		BIT	Meter #1 New Alarm Flag
1124	Oil Temperature Transmitter Fail		BIT	Meter #1 Temperature Transducer Fail Low
1125	Oil Temperature Low		BIT	Meter #1 Temperature Low Alarm
1126	Oil Temperature High		BIT	Meter #1 Temperature High Alarm
1128	Oil Pressure Transmitter Fail		BIT	Meter #1 Pressure Transducer Fail Low
1129	Oil Pressure Low		BIT	Meter #1 Pressure Low Alarm
1130	Oil Pressure High		BIT	Meter #1 Pressure High Alarm
1529	Strainer Blocked		BIT	
1530	Unallocated Flow Detected		BIT	
1531	Totals Fault		BIT	
1532	Pulse Out 1 Set-up Fault		BIT	
1533	Pulse Out 1 Fault		BIT	
1534	S&W High		BIT	
1535	S&W Low		BIT	
1536	S&W Transmitter Fail		BIT	
1537	System Restart		BIT	
1538	Simulation Mode Enabled		BIT	
1539	Meter Factor has Changed Since Last Sampler Reset		BIT	TBC
1540	Oil Meter Factor has Changed In the Last Month		BIT	
1541	Oil Meter Factor has Changed In the Last Day		BIT	
1542	Oil Meter Factor has Changed In the Last Active Load		BIT	
1543	Unallocated IV Detected - Sampler		BIT	
1544	Unallocated IV Detected - Monthly		BIT	
1545	Unallocated IV Detected - Daily		BIT	
5101	Oil Current Load Total Integer Modbus Formatted	IV	INT3210	Meter #1 Batch in Progress - IV Total
5102	Oil Current Load Total Integer Modbus Formatted	GOV	INT3210	Meter #1 Batch in Progress - GOV Total
5105	Oil Cumulative Total Integer Modbus Formatted	IV	INT3210	Meter #1 Cumulative - IV Total
5106	Oil Cumulative Total Integer Modbus Formatted	GOV	INT3210	Meter #1 Cumulative - GOV Total
5109	Oil Current Day Total Integer Modbus Formatted	IV	INT3210	Meter #1 Daily - IV Total
5110	Oil Current Day Total Integer Modbus Formatted	GOV	INT3210	Meter #1 Daily - GOV Total
5513	Oil Current Month Total Integer Modbus Formatted	IV	INT3210	
5514	Oil Current Month Total Integer Modbus Formatted	GOV	INT3210	
5515	Oil Current Sampler Can Pull Total Integer Modbus Formatted	IV	INT3210	

5516	Oil Current Sampler Can Pull Total Integer Modbus Formatted	GOV	INT3210	
5517	Oil Oil Current Day Unalloc Total Integer Modbus Formatted	IV	INT3210	
5518	Oil Current Day Unalloc Total Integer Modbus Formatted	GOV	INT3210	
5519	Oil Current Month UnallocTotal Integer Modbus Formatted	IV	INT3210	
5520	Oil Current Month UnallocTotal Integer Modbus Formatted	GOV	INT3210	
5521	Oil Current Sampler Can Pull UnallocTotal Integer Modbus Formatted	IV	INT3210	
5522	Oil Current Sampler Can Pull UnallocTotal Integer Modbus Formatted	GOV	INT3210	
5523	Measured Oil Pressure Present?		INT3210	
5524	Measured Oil Temperature Present?		INT3210	
5525	Measured S&W Present?		INT3210	
5526	Oil Pressure Operating Status		INT3210	
5527	Oil Temperature Operating Status		INT3210	
5528	S&W Operating Status		INT3210	
5529	Oil Pressure Mode Setting		INT3210	
5530	Oil Temperature Mode Setting		INT3210	
5531	S&W Mode Setting		INT3210	
5532	# DP's - Pressure		INT3210	
5533	# DP's - Temperature		INT3210	
5534	# DP's - S&W		INT3210	
5535	Batch Sequence #		INT3210	* Sampler Can Pull Report Number
5536	Truck Ticket #		INT3210	
7101	Oil Indicated Volume Flow Rate		FLOAT3210	Meter #1 IV Flow Rate
7102	Oil Gross Observed Volume Flow Rate		FLOAT3210	Meter #1 GOV Flow Rate
7105	Oil Temperature In Use		FLOAT3210	Meter #1 Temperature
7106	Oil Pressure In Use		FLOAT3210	Meter #1 Pressure
7140	Oil Flow Meter K Factor		FLOAT3210	Meter #1 Current K Factor
7516	Cumulative Oil Total	IV	FLOAT3210	
7517	Cumulative Oil Total	GOV	FLOAT3210	
7518	Local Totalizer	IV	FLOAT3210	* Current Load Total IV
7519	Local Totalizer	GOV	FLOAT3210	* Current Load Total GOV
7520	Current Oil Day Total	IV	FLOAT3210	
7521	Current Oil Day Total	GOV	FLOAT3210	
7522	Current Oil Month Total	IV	FLOAT3210	
7523	Current Oil Month Total	GOV	FLOAT3210	
7524	Current Oil Sampler Can Pull Total	IV	FLOAT3210	
7525	Current Oil Sampler Can Pull Total	GOV	FLOAT3210	
7526	Current Oil Daily Unallocated Total	IV	FLOAT3210	
7527	Current Oil Daily Unallocated Total	GOV	FLOAT3210	
7528	Current Oil Monthly Unallocated Total	IV	FLOAT3210	
7529	Current Oil Monthly Unallocated Total	GOV	FLOAT3210	
7530	Current Oil Sampler Can Pull Unallocated Total	IV	FLOAT3210	
7531	Current Oil Sampler Can Pull Unallocated Total	GOV	FLOAT3210	
7532	Oil Pressure Override Value		FLOAT3210	
7533	Oil Pressure Default Value		FLOAT3210	
7534	Oil Temperature Override Value		FLOAT3210	

7535	Oil Temperature Default Value		FLOAT3210	
7536	S&W Override Value		FLOAT3210	
7537	S&W Default Value		FLOAT3210	
7538	Oil Pressure 4mA Scale Value		FLOAT3210	
7539	Oil Pressure 20mA Scale Value		FLOAT3210	
7540	Oil Temperature 4mA Scale Value		FLOAT3210	
7541	Oil Temperature 20mA Scale Value		FLOAT3210	
7542	S&W 4mA Scale Value		FLOAT3210	
7543	S&W 20mA Scale Value		FLOAT3210	
7544	Oil Pressure Low Alarm Limit		FLOAT3210	
7545	Oil Pressure High Alarm Limit		FLOAT3210	
7546	Oil Temperature Low Alarm Limit		FLOAT3210	
7547	Oil Temperature High Alarm Limit		FLOAT3210	
7548	S&W Low Alarm Limit		FLOAT3210	
7549	S&W High Alarm Limit		FLOAT3210	
7550	Oil Pressure Recover After Fail		FLOAT3210	
7551	Oil Temperature Recover After Fail		FLOAT3210	
7552	S&W Recover After Fail		FLOAT3210	
7796	Oil Meter Factor		FLOAT3210	Meter #1 Meter Factor
8597	S&W In Use		FLOAT3210	Meter #1 Current % S&W
13386	# DP's - Volume Totals		SHORT10	Decimal Places for Gross Totalizer