Model Q46

Modbus TCP/IP Communications Manual

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PRODUCT WARRANTY

Analytical Technology, Inc. (Manufacturer) warrants to the Customer that if any part(s) of the Manufacturer's equipment proves to be defective in materials or workmanship within the earlier of 18 months of the date of shipment or 12 months of the date of start-up, such defective parts will be repaired or replaced free of charge. Inspection and repairs to products thought to be defective within the warranty period will be completed at the Manufacturer's facilities in Collegeville, PA. Products on which warranty repairs are required shall be shipped freight prepaid to the Manufacturer. The product(s) will be returned freight prepaid and allowed if it is determined by the manufacturer that the part(s) failed due to defective materials or workmanship.

This warranty does not cover consumable items, batteries, or wear items subject to periodic replacement including lamps and fuses.

Gas sensors carry a 12 months from date of shipment warranty and are subject to inspection for evidence of misuse, abuse, alteration, improper storage, or extended exposure to excessive gas concentrations. Should inspection indicate that sensors have failed due to any of the above, the warranty shall not apply.

The Manufacturer assumes no liability for consequential damages of any kind, and the buyer by acceptance of this equipment will assume all liability for the consequences of its use or misuse by the Customer, his employees, or others. A defect within the meaning of this warranty is any part of any piece of a Manufacturer's product which shall, when such part is capable of being renewed, repaired, or replaced, operate to condemn such piece of equipment.

This warranty is in lieu of all other warranties (including without limiting the generality of the foregoing warranties of merchantability and fitness for a particular purpose), guarantees, obligations or liabilities expressed or implied by the Manufacturer or its representatives and by statute or rule of law.

This warranty is void if the Manufacturer's product(s) has been subject to misuse or abuse, or has not been operated or stored in accordance with instructions, or if the serial number has been removed.

Analytical Technology, Inc. makes no other warranty expressed or implied except as stated above

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Part 1 – Modbus TCP/IP Description

1.1 General

Q46 Analyzers are available with four digital communication options. Profibus-DP, Modbus-RTU, Modbus-TCP/IP, or Ethernet-IP. This manual applies only to instruments supplied with the Modbus TCP/IP communication option.

It is important critical to note that Modbus TCP/IP devices only communicate with other systems running that application protocol on Ethernet. You cannot plug a Q46 into your office Ethernet and expect to have the Q46 talk to your computer, unless you have a Modbus protocol application on that computer.

The discussion of standard Modbus and Ethernet are vast, and well beyond the ability to discuss here in great detail. The documentation for this option assumes working network knowledge by the user.

1.2 Modbus TCP/IP Communication

It should be understood that Modbus TCP/IP is simply an application layer protocol that is transferred over an Ethernet hardware link. The word "Ethernet" simply refers to the common physical cable, perhaps running to an office PC.

Per the ***Modbus Messaging on TCP/IP Implementation Guide V1.0b***, authored by Modbus.org, a 5-layer Internet model is used for Modbus TCP instead of the familiar three layer model for RTU/ASCII over serial line. This new standard encapsulates standard Modbus function code and data contents into a higher level TCP protocol. The physical layer is not specifically mentioned in the guide, therefore, the wiring infrastructure generally just follows standard Ethernet wiring practices.

The Modbus “bus” structure in this case is an IP bus, and slave addresses become IP addresses. Also, the master/slave relationship in RTU/ASCII becomes more of a client/server relationship in Modbus TCP/IP – where multiple clients (masters) initiate requests to servers (slaves) for information. So, unlike the serial implementation of bussed RTU/ASCII, the TCP implementation becomes more “multi-master” in nature. However, even with all these variations, Modbus TCP data looks exactly like Modbus RTU/ASCII data in format and structure.

In the OSI model, "Ethernet" is the lower part of the model, the physical transfer method or the hardware. It says nothing about the way information is transferred, which is specified near the top of the OSI model. In the common office network, many different standard communication protocols are operating during normal office use, like IP, TCP, etc. None of these are designed to handle the industrial protocol formats, so that interface must be handled by a specific program that recognizes the format. Because of this, a Modbus TCP/IP device cannot be directly connected to your office network for transferring information.

The Q46 utilizes a gateway device inside the analyzer that maps an internal Modbus data structure into the required Modbus TCP/IP data object. This is done to maintain plug-and-play compatibility to all Q46 digital communication options. Any communication option can be plugged into any Q46 for immediate conversion to a new protocol. Because this gateway device is part of the Q46 interface, the ID and device type show up on the interface as the gateway device. However, the Q46 variation type is mapped into the application data object as the last byte.

1.3 Modbus TCP/IP Transmission Details

The data for the protocol is constructed into a specific structure inside a standard TCP Packet. A user application program simply decodes the structure inside the received TCP or UDP packet. To create the Modbus TCP frame, the standard Modbus data frame PDU (Protocol Data Unit) is appended by a new MBAP header (Modbus Application Protocol) to make a larger transmission frame called the ADU (Application Data Unit.) In order to send the new ADU over TCP, the registered port number 502 is used by Modbus.org.

MODBUS PDU

Modbus protocol is a messaging structure, widely used to establish master-slave communication between intelligent devices. In serial format, a message sent from a master to a slave contains a one-byte slave address, a one-byte command, data bytes (depending on command), and a two byte CRC. The protocol is independent of the underlying physical layer and is traditionally implemented using RS232, RS422, or RS485 over a variety of media (e.g. fiber, radio, cellular, etc.) The TCP format strips out the slave address and CRC and just uses the function code and data. So, the basic structure of the PDU frame section is simply:

|<- Modbus PDU ->|
[FUNCTION][DATA]

The function code field of a message frame contains an eight-bit code in the range of 1 ... 255 decimal. When a query message is sent from the master, the function code field tells the slave device what kind of action to perform. Examples include reading the contents of a group of registers, writing to a single register, writing to a group of registers, and reading the exception status.

When the slave device responds to the master, it uses the function code field to indicate either a normal (error-free) response or that some kind of error occurred (called an exception response). For a normal response, the slave simply echoes the original function code. For an exception response, the slave returns a code that is equivalent to the original function code with its most significant bit set to logic 1.

The data field is constructed of one or more bytes and contains additional information, which the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field. If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken.

The data field can be nonexistent (of zero length) in certain kinds of messages. For example, in a request from a master device for a slave to respond with its communications event log (function code 0B hexadecimal), the slave does not require any additional information. The function code alone specifies the action.

MODBUS ADU

Modbus TCP adds a header to the PDU to get the full ADU transmission frame –

|← MBAP HEADER ->| |← Modbus PDU ->|
[TRANS ID] [PROT ID] [LENGTH] [UNIT ID] [FUNCTION][DATA]
|← MODBUS TCP ADU ->|

Where:
Transaction ID = 2 bytes set by client to uniquely identify the request
Protocol ID = 2 bytes set by client (always 00 00)
Length = 2 bytes indentifying the the number of bytes in the message
Unit ID = 1 byte set by client to ID a slave connected on a remote serial line

MODBUS REGISTERS AND COILS

The PDU data portion of the Modbus TCP follows the exact same register format as the serial form of the protocol. Modbus protocol was originally designed to transfer data to and from PLCs (Programmable Logic Controllers), which organize data into groups of registers and coils. PLC registers containing i/o information are called input registers and are numbered 30001 to 39999, while registers containing data or the results of calculations are known as holding registers and are numbered from 40001 to 49999. The term coils, on the other hand, refers to discrete (0 or 1) inputs and outputs. Traditionally, these are inputs from such things as switch closures and outputs to the coils of relays, which are under the control of the PLC.

All registers are 16 bit values, which may be read or written to individually, or in blocks by using specific functions. Likewise for coils, which are one bit values. Since register functions transfer 16 bits and discrete (coil) functions transfer only one, it is usually more efficient to use register functions, which reduces the number of messages required to transfer data. For this reason, the Q46 Series transmitter organizes all of its data into input registers only, or more specifically, data is organized into the holding registers starting at 30001.

The protocol specifies which registers to access by the value of the function code embedded into the message. For example, to read one or more holding registers in a slave device, the master must use function 3 – "Read Holding Register". Similarly, the master must use function 4 – "Read Input Register" to read one or more of the input registers. The Q46 only responds to request for reading input registers (Function 4).

For more information on the protocol, please refer to the "Modicon Modbus Protocol Reference Guide" at http://www.modicon.com/techpubs/toc7.html or, "Modbus Protocol Specification", available for download at http://www.modbus-ida.org/specs.php. Deviations from this guide are noted in the appropriate section. More information regarding Modbus, in general, may be viewed at: http://www.modbus-ida.org/

1.4 Modbus TCP/IP Card Installation Instructions

Use the following instructions to install the Modbus TCP/IP Communications Option into an existing Q46 Analyzer. Monitors ordered with the Ethernet option will be supplied with the board already installed.

1. Disconnect power to the Q46 prior to installation of the board.
2. Remove the connector cover on the power supply circuit board located next to the fuse.
3. Carefully plug the Modbus TCP/IP circuit board into the connector on the power supply board.
4. Align the cover board holes with the holes in the circuit board and use the screws supplied to secure the assembly. Refer to Figure 1 below for the proper assembly.

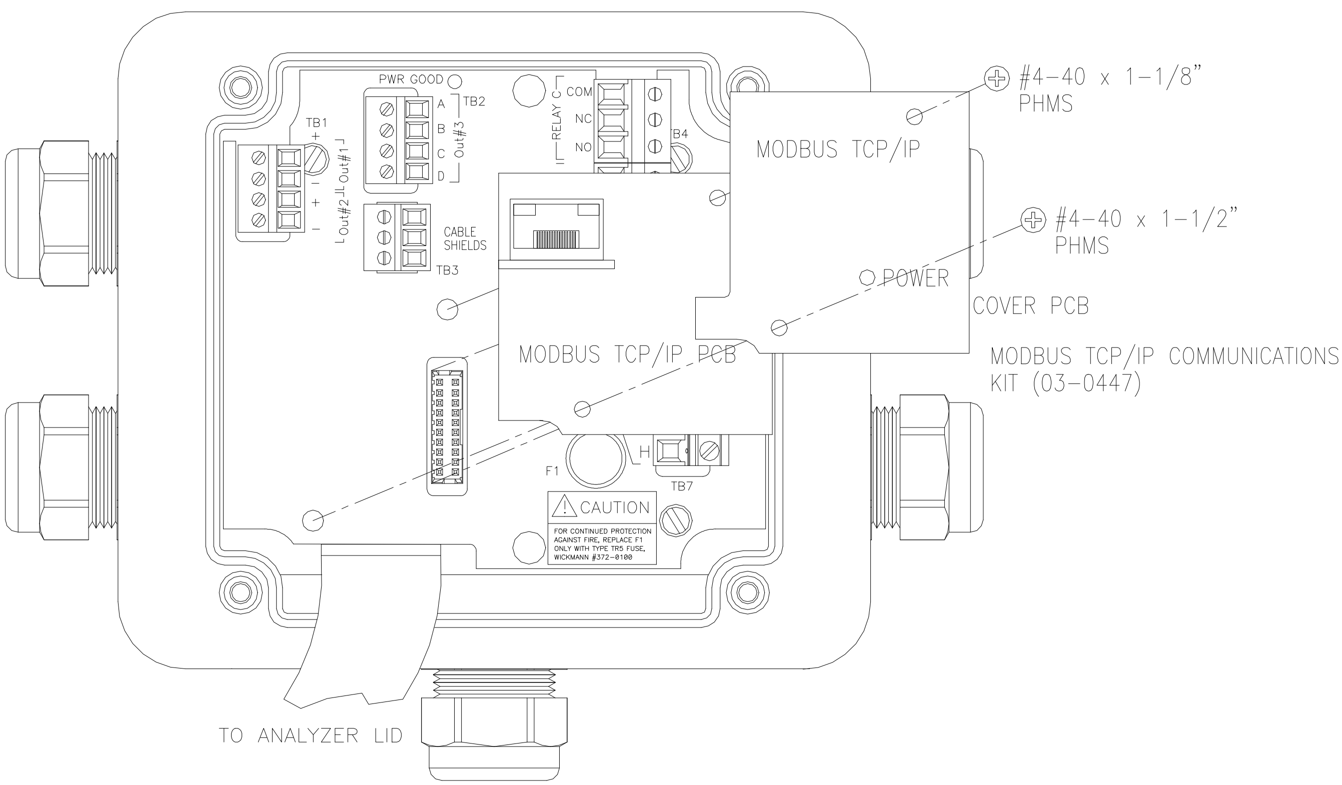

Figure 1 – Modbus TCP/IP Card Installation

1.5 Cable Connection

The cable used for Modbus TCP/IP communication should meet the CAT5 standard defined by the Electronic Industries Association and Telecommunications Industry Association. It is readily available in lengths up to 100 ft. (30 m) with plugs on each end.

To install an Ethernet cable in the Q46, pass the unterminated cable through the cable gland nearest the location of the RJ45 connector on the Modbus TCP/IP option board. Termination of Cat5/5e/6 cables is very easy and can be completed quickly with the commonly available RJ45 crimp tool.

Figure 2 - RJ45 Crimp Tool

While professional results are optimized with the use of the termination tool and custom cable lengths, patch cord style connection can be completed in some cases by passing the finished RJ45 connectors through the Q46 cable gland. The connector will fit through the plastic part of the cable gland, and the rubber grommet can be slit (some RJ45s may be too big for this.) Once the connector is inside the enclosure, simply plug it into the jack provided on the Modbus TCP/IP communication board. Be sure to adjust the rubber insert in the cable gland so that the slit is on the bottom and then tighten the gland to seal around the wire.

1.6 Interface Operation

On power-up, the Q46 looks for a DHCP server to assign an IP address on the network. Once the IP is set, Modbus RTU data can be transferred across the network just like a standard Modbus RTU bus system.

As an example of the data structure, a completed Q46 data set is displayed below in a common diagnostic PC software tool - ***Simply Modbus TCP.*** The user simply enters the IP address established by the client PC, and sets up the standard Modbus PDU data set details.

To run this tool on a PC for check-out of the Q46 interface, the user must first be sure to set the IP address of the PC Ethernet port to the proper number - and so the user must be able to see the interface on the network first. There are various tools available for viewing that defined IP address, but it should be noted that the name which will be "***X-PORT***."

Simple Modbus TCP Client test software can be found at - http://www.simplymodbus.ca/TCPclient.htm

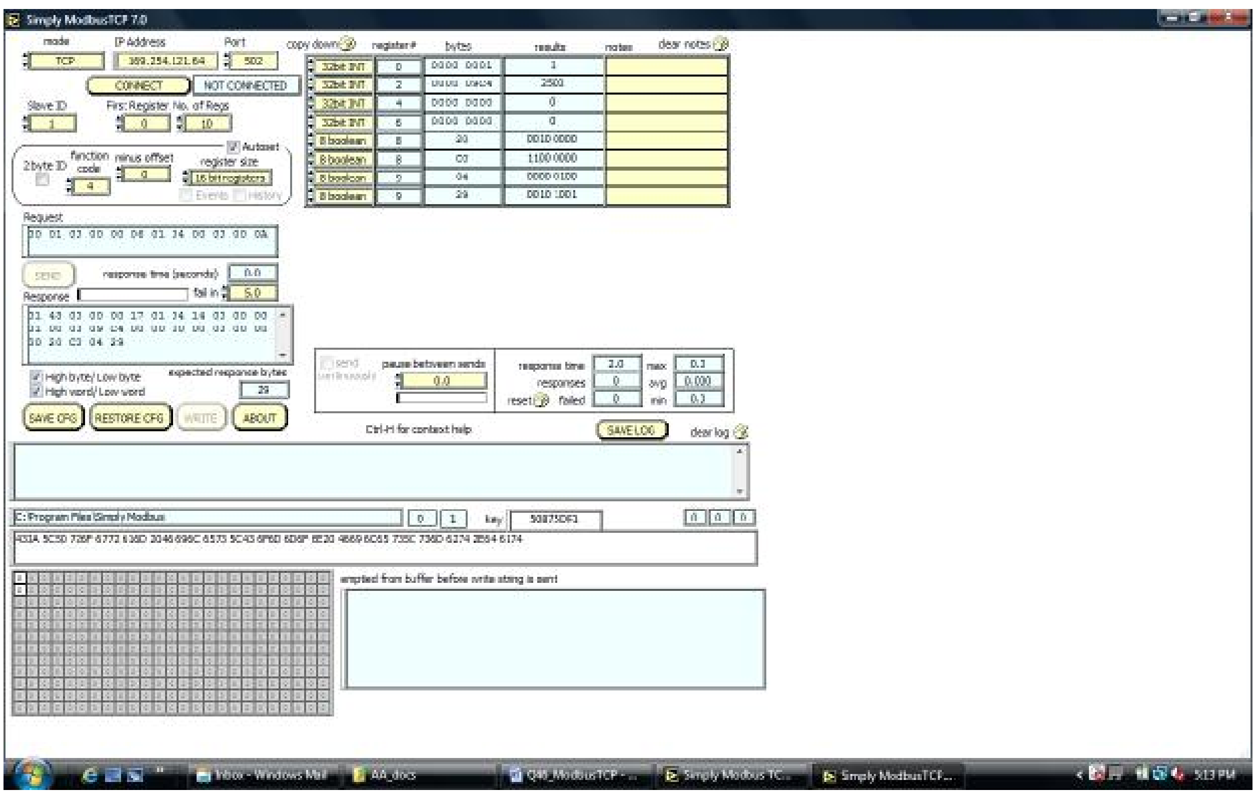

Figure 3 – Simply Modbus TCP 7.0 Tool Example

1.7 Q46 Data Files/Register Assignment

The following table summarizes the registers used for the Modbus TCP data in the Q46 communication board using the Q46D as an example. Tables for all other Q46 series monitors follow. As mentioned previously, the Q46 only supports the "04 – Read Input Register" function.

Register	Data Type	Sensor	Description	Data Format
30001 (HI) 30002 (LO)	long(32)	D.O.	Dissolved Oxygen	8.40 PPM = 840
30003 (HI) 3004 (LO)	long(32)	D.O.	Measured Temperature	25.00° C = 2500
30005 (HI) 30006 (LO)	long(32)	D.O.	Measured % Saturation	98.0% sat = 980
30007 (HI) 30008 (LO)	long(32)	NA	PID value	17.0% = 170
30009	Char(8)	NA	System Status 1	(binary) 00000000
	Char(8)	NA	System Status 2	(binary) 00000000
30010	Char(8)	NA	Alarm Status	(binary) 00000000
	Char(8)	NA	Instrument ID	49 = 49

(Long = Long Integer, requires 4 bytes; Char = Character, requires 1 byte)

Detailed status data from registers 30009 and 30010 are detailed in Figure 3 below.

Register	Bitfield	Description
30009	0 (lsb)	mV Hi
	1	mV Lo
	2	D.O. Hi
	3	D.O. Lo
	4	Temp Hi
	5	Temp Lo
	6	NU
	7	NU
	0	EE Fail
	1	NU
	2	LCD Controller Fail
	3	Cal D.O. Fail
	4	PID Controller Fail
	5	Cal TC Fail
	6	TC Error
	7	Acknowledge Fail (global)
30010	0	Alarm 1, Relay A
	1	Alarm 2, Relay B
	2	Alarm 3, Relay C
	3	Alarm 4, Relay D (optional)
	4	Alarm 5, Relay E (optional)
	5	Alarm 6, Relay F (optional)
	6	NU
	7	NU

Q46H/62 or Q45H/63 Residual Chlorine Tables

Q46H/62/63 Input Register Detail

Register	Byte	Data Type	Sensor	Description	Data Format
30001 (HI) 30002 (LO)	1 to 4	long(32)	Chorine	Measured Chlorine	1.4920 PPM = 14920
30003 (HI) 3004 (LO)	5 to 8	long(32)	Chlorine	Measured Temperature	25.00° C = 2500
30005 (HI) 30006 (LO)	9 to 12	long(32)	pH	Measured pH	7.00 pH = 700
30007 (HI) 30008 (LO)	13 to 16	long(32)	NA	PID value	17.0% = 170
30009	17	Char(8)	NA	System Status 1	(binary) 00000000
	18	Char(8)	NA	System Status 2	(binary) 00000000
30010	19	Char(8)	NA	Alarm Status	(binary) 00000000
	20	Char(8)	NA	Instrument ID	41 = 41

(Long = Long Integer, requires 4 bytes; Char = Character, requires 1 byte)

Q46H/62/63 Status/Alarm Bit Detail

Register	Byte	Bitfield	Description
30009	17	0 (lsb)	NU
	17	1	Cal pH Fail
	17	2	Chlor Hi
	17	3	Chlor Low
	17	4	Temp Hi
	17	5	Temp Lo
	17	6	pH Hi
	17	7	pH Low
	18	0	EE Fail
	18	1	pH Auto-comp Fail
	18	2	LCD Controller Fail
	18	3	Cal Chlor Fail
	18	4	PID Controller Fail
	18	5	Cal TC Fail
	18	6	TC Error
	18	7	Acknowledge Fail (global)
30010	19	0	Alarm 1, Relay A
	19	1	Alarm 2, Relay B
	19	2	Alarm 3, Relay C
	19	3	Alarm 4, Relay D (optional)
	19	4	Alarm 5, Relay E (optional)
	19	5	Alarm 6, Relay F (optional)
	19	6	NU
	19	7	NU

Q46H/64 Dissolved Ozone Tables

Q46H/64 Input Register Detail

Register	Byte	Data Type	Sensor	Description	Data Format
30001 (HI) 30002 (LO)	1 to 4	long(32)	Ozone	Measured Ozone	1.4920 PPM = 14920
30003 (HI) 3004 (LO)	5 to 8	long(32)	Ozone	Measured Temperature	25.00° C = 2500
30005 (HI) 30006 (LO)	9 to 12	long(32)	pH	Measured pH	7.00 pH = 700
30007 (HI) 30008 (LO)	13 to 16	long(32)	NA	PID value	17.0% = 170
30009	17	Char(8)	NA	System Status 1	(binary) 00000000
	18	Char(8)	NA	System Status 2	(binary) 00000000
30010	19	Char(8)	NA	Alarm Status	(binary) 00000000
	20	Char(8)	NA	Instrument ID	41 = 41

(Long = Long Integer, requires 4 bytes; Char = Character, requires 1 byte)

Q46H/64 Status/Alarm Bit Detail

Register	Byte	Bitfield	Description
30009	17	0 (lsb)	NU
	17	1	Cal pH Fail
	17	2	Ozone Hi
	17	3	Ozone Low
	17	4	Temp Hi
	17	5	Temp Lo
	17	6	pH Hi
	17	7	pH Low
	18	0	EE Fail
	18	1	NU
	18	2	LCD Controller Fail
	18	3	Cal Ozone Fail
	18	4	PID Controller Fail
	18	5	Cal TC Fail
	18	6	TC Error
	18	7	Acknowledge Fail (global)
30010	19	0	Alarm 1, Relay A
	19	1	Alarm 2, Relay B
	19	2	Alarm 3, Relay C
	19	3	Alarm 4, Relay D (optional)
	19	4	Alarm 5, Relay E (optional)
	19	5	Alarm 6, Relay F (optional)
	19	6	NU
	19	7	NU

Q46H/65 Dissolved Chlorine Dioxide Tables

Q46H/65 Input Register Detail

Register	Byte	Data Type	Sensor	Description	Data Format
30001 (HI) 30002 (LO)	1 to 4	long(32)	Chorine	Measured Chlorine Dioxide	1.4920 PPM = 14920
30003 (HI) 3004 (LO)	5 to 8	long(32)	Chlorine	Measured Temperature	25.00° C = 2500
30005 (HI) 30006 (LO)	9 to 12	long(32)	pH	Measured pH	7.00 pH = 700
30007 (HI) 30008 (LO)	13 to 16	long(32)	NA	PID value	17.0% = 170
30009	17	Char(8)	NA	System Status 1	(binary) 00000000
	18	Char(8)	NA	System Status 2	(binary) 00000000
30010	19	Char(8)	NA	Alarm Status	(binary) 00000000
	20	Char(8)	NA	Instrument ID	41 = 41

(Long = Long Integer, requires 4 bytes; Char = Character, requires 1 byte)

Q46H/65 Status/Alarm Bit Detail

Register	Byte	Bitfield	Description
30009	17	0 (lsb)	NU
	17	1	Cal pH Fail
	17	2	ClO_2 Hi
	17	3	ClO_2 Low
	17	4	Temp Hi
	17	5	Temp Lo
	17	6	pH Hi
	17	7	pH Low
	18	0	EE Fail
	18	1	NU
	18	2	LCD Controller Fail
	18	3	Cal ClO_2 Fail
	18	4	PID Controller Fail
	18	5	Cal TC Fail
	18	6	TC Error
	18	7	Acknowledge Fail (global)
30010	19	0	Alarm 1, Relay A
	19	1	Alarm 2, Relay B
	19	2	Alarm 3, Relay C
	19	3	Alarm 4, Relay D (optional)
	19	4	Alarm 5, Relay E (optional)
	19	5	Alarm 6, Relay F (optional)
	19	6	NU
	19	7	NU

Q46P & Q46R pH and ORP Tables

Q46P or Q46R Input Register Detail

Register	Byte	Data Type	Sensor	Description	Data Format
30001 (HI) 30002 (LO)	1 to 4	long(32)	pH	Measured pH Measured ORP	7.00 pH = 700 -137 mv = -137
30003 (HI) 3004 (LO)	5 to 8	long(32)	pH	Measured Temperature	25.00° C = 2500
30005 (HI) 30006 (LO)	9 to 12	long(32)	pH	NU	0
30007 (HI) 30008 (LO)	13 to 16	long(32)	pH	PID value	47.5% = 475
30009	17	Char(8)	NA	System Status 1	(binary) 00000000
	18	Char(8)	NA	System Status 2	(binary) 00000000
30010	19	Char(8)	NA	Alarm Status	(binary) 00000000
	20	Char(8)	NA	Instrument ID	53 (Q46P) 57 (Q46R)

(Long = Long Integer, requires 4 bytes; Char = Character, requires 1 byte)

Q46P or Q46R Status/Alarm Bit Detail

Register	Byte	Bitfield	Description
30009	17	0 (lsb)	mv High
	17	1	mv Low
	17	2	pH High
	17	3	pH Low
	17	4	Temp High
	17	5	Temp Low
	17	6	pH Glass Break – Not Used for ORP
	17	7	Reference Fail
	18	0	EE Fail
	18	1	Checksum Fail
	18	2	LCD Controller Fail
	18	3	Cal pH or ORP Fail
	18	4	PID Controller Fail
	18	5	Cal TC Fail
	18	6	TC Error
	18	7	Acknowledge Fail (global)
30010	19	0	Alarm 1, Relay A
	19	1	Alarm 2, Relay B
	19	2	Alarm 3, Relay C
	19	3	Alarm 4, Relay D (optional)
	19	4	Alarm 5, Relay E (optional)
	19	5	Alarm 6, Relay F (optional)
	19	6	NU
	19	7	NU

Q46N Total and Free Ammonia Tables

Q46N & Q46FN Input Register Detail

Register	Byte	Data Type	Sensor	Description	Data Format
30001 (HI) 30002 (LO)	1 to 4	long(32)	Ammonia	Measured Total Ammonia	1.00 PPM = 100
30003 (HI) 3004 (LO)	5 to 8	long(32)	Ammonia	Measured Temperature	25.00°C = 2500
30005 (HI) 30006 (LO)	9 to 12	long(32)	Monochlor	Measured Monochloramine	0.51 PPM = 51
30007 (HI) 30008 (LO)	13 to 16	long(32)	Amm/Mono	Measured Free Ammonia	3.21 PPM = 321
30009	17	Char(8)	NA	System Status 1	(binary) 00000000
	18	Char(8)	NA	System Status 2	(binary) 00000000
30010	19	Char(8)	NA	Alarm Status	(binary) 00000000
	20	Char(8)	NA	Instrument ID	45 = 45

(Long = Long Integer, requires 4 bytes; Char = Character, requires 1 byte)

Q46N & Q46FN Status/Alarm Bit Detail

Register	Bitfield	Description
30009	0 (lsb)	NU
	1	NU
	2	Ammonia Hi
	3	Ammonia Low
	4	Temp Hi
	5	Temp Lo
	6	MonoChlor Hi
	7	MonoChlor Low
	0	Cal Monochlor Fail
	1	NU
	2	LCD Controller Fail
	3	Cal Ammonia Fail
	4	PID Controller Fail
	5	Cal TC Fail
	6	TC Error
	7	Acknowledge Fail (global)
30010	0	Alarm 1, Relay A
	1	Alarm 2, Relay B
	2	Alarm 3, Relay C
	3	Alarm 4, Relay D (optional)
	4	Alarm 5, Relay E (optional)
	5	Alarm 6, Relay F (optional)
	6	NU
	7	NU

Q46C4 or Q46CT Conductivity Tables

Q46C4 & Q46CT Input Register Detail

Register	Byte	Data Type	Sensor	Description	Data Format
30001 (HI) 30002 (LO)	1 to 4	long(32)	Conductivity	Measured Conductivity	2.238 mS = 2238
30003 (HI) 3004 (LO)	5 to 8	long(32)	Conductivity	Measured Temperature	25.00° C = 2500
30005 (HI) 30006 (LO)	9 to 12	long(32)	Conductivity	*Measured Concentration	1.3 % = 13
30007 (HI) 30008 (LO)	13 to 16	long(32)	NA	**Calculated TDS Value	223.5 mg/l = 2235
30009	17	Char(8)	NA	System Status 1	(binary) 00000000
	18	Char(8)	NA	System Status 2	(binary) 00000000
30010	19	Char(8)	NA	Alarm Status	(binary) 00000000
	20	Char(8)	NA	Instrument ID	65 (Q46C4) 61 (Q46CT)

* For concentration versions only ** For conductivity versions only
(Long = Long Integer, requires 4 bytes; Char = Character, requires 1 byte)

Q46C4 or Q46CT Status/Alarm Bit Detail

Register	Byte	Bitfield	Description
30009	17	0 (lsb)	Concentration High
	17	1	Concentration Low
	17	2	Conductivity High
	17	3	Conductivity Low
	17	4	Temp Hi
	17	5	Temp Lo
	17	6	NU
	17	7	NU
	18	0	EE Fail
	18	1	Checksum Fail
	18	2	LCD Controller Fail
	18	3	Cal Conductivity Fail
	18	4	PID Controller Fail
	18	5	Cal TC Fail
	18	6	TC Error
	18	7	Acknowledge Fail (global)
30010	19	0	Alarm 1, Relay A
	19	1	Alarm 2, Relay B
	19	2	Alarm 3, Relay C
	19	3	Alarm 4, Relay D (optional)
	19	4	Alarm 5, Relay E (optional)
	19	5	Alarm 6, Relay F (optional)
	19	6	NU
	19	7	NU

Q46F Fluoride Tables

Q46F Input Register Detail

Register	Byte	Data Type	Sensor	Description	Data Format
30001 (HI) 30002 (LO)	1 to 4	long(32)	Fluoride	Measured Fluoride	1.000 PPM = 1000
30003 (HI) 3004 (LO)	5 to 8	long(32)	RTD	Measured Temperature	25.00° C = 2500
30005 (HI) 30006 (LO)	9 to 12	long(32)		NU	0
30007 (HI) 30008 (LO)	13 to 16	long(32)	Fluoride	PID value	47.5% = 475
30009	17	Char(8)	NA	System Status 1	(binary) 00000000
	18	Char(8)	NA	System Status 2	(binary) 00000000
30010	19	Char(8)	NA	Alarm Status	(binary) 00000000
	20	Char(8)	NA	Instrument ID	73

(Long = Long Integer, requires 4 bytes; Char = Character, requires 1 byte)

Q46F Status/Alarm Bit Detail

Register	Byte	Bitfield	Description
30009	17	0 (lsb)	mv High
	17	1	mv Low
	17	2	Fluoride High
	17	3	Fluoride Low
	17	4	Temp High
	17	5	Temp Low
	17	6	NU
	17	7	Reference Fail
	18	0	EE Fail
	18	1	Checksum Fail
	18	2	LCD Controller Fail
	18	3	Cal Fluoride Fail
	18	4	PID Controller Fail
	18	5	Cal TC Fail
	18	6	TC Error
	18	7	Acknowledge Fail (global)
30010	19	0	Alarm 1, Relay A
	19	1	Alarm 2, Relay B
	19	2	Alarm 3, Relay C
	19	3	Alarm 4, Relay D (optional)
	19	4	Alarm 5, Relay E (optional)
	19	5	Alarm 6, Relay F (optional)
	19	6	NU
	19	7	NU