Model Q46
Ethernet/IP Communications Manual

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

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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 – Ethernet/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 Ethernet/IP communication option. It is critical to note that Ethernet/IP devices only communicate with other systems running the Industrial Protocol of Ethernet. You cannot plug a Q46 into your office Ethernet and expect to have the Q46 talk to your computer.

The discussion of standard Ethernet and Ethernet/IP is 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 Ethernet/IP Communication

Ethernet/IP was first introduced in 2001, and is a highly developed and complete protocol for an industrial Ethernet network solution. Intended for automation applications, EtherNet/IP is a member of a family of networks that implement the Common Industrial Protocol (CIP) at its upper layers of the standard ISO/OSI 7-layer model. CIP defines the object structure, specifies the message transfer, provides users with a unified communication architecture, and encompasses a comprehensive suite of services for a variety of manufacturing automation applications which include data, control, safety, and configuration.

In the CIP Protocol, every network device represents itself as a series of objects. Each object is simply a grouping of the related data values in a device. The identity object contains related identity data values called attributes. Attributes for the identity object include the vendor ID, date of manufacture, device serial number and other identity data.

The Q46 utilizes a gateway device inside the analyzer that maps an internal Modbus data structure into the required Ethernet/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 Ethernet/IP Transmission Details

It should be understood that Ethernet/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.

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 CIP industrial format, so that interface must be handled by a specific program that recognizes the format. Because of this, an Ethernet/IP device cannot be directly connected to your office network for transferring information.

The data for the protocol is constructed into a specific structure inside a standard TCP/IP Packet. A user application program simply decodes the structure inside the received TCP or UDP packet. The data structure consists of a grouping of data values called Attributes inside other sets of containment data called Objects. There are Ethernet/IP required Objects and application Objects. Required objects are typically - Identity, TCP, and Router. Application objects consist of some defined data types, like a Motor Object, and some user specific data types.

1.4 Ethernet/IP Card Installation Instructions

Use the following instructions to install the Ethernet/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 Ethernet/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 on the next page for the proper assembly.

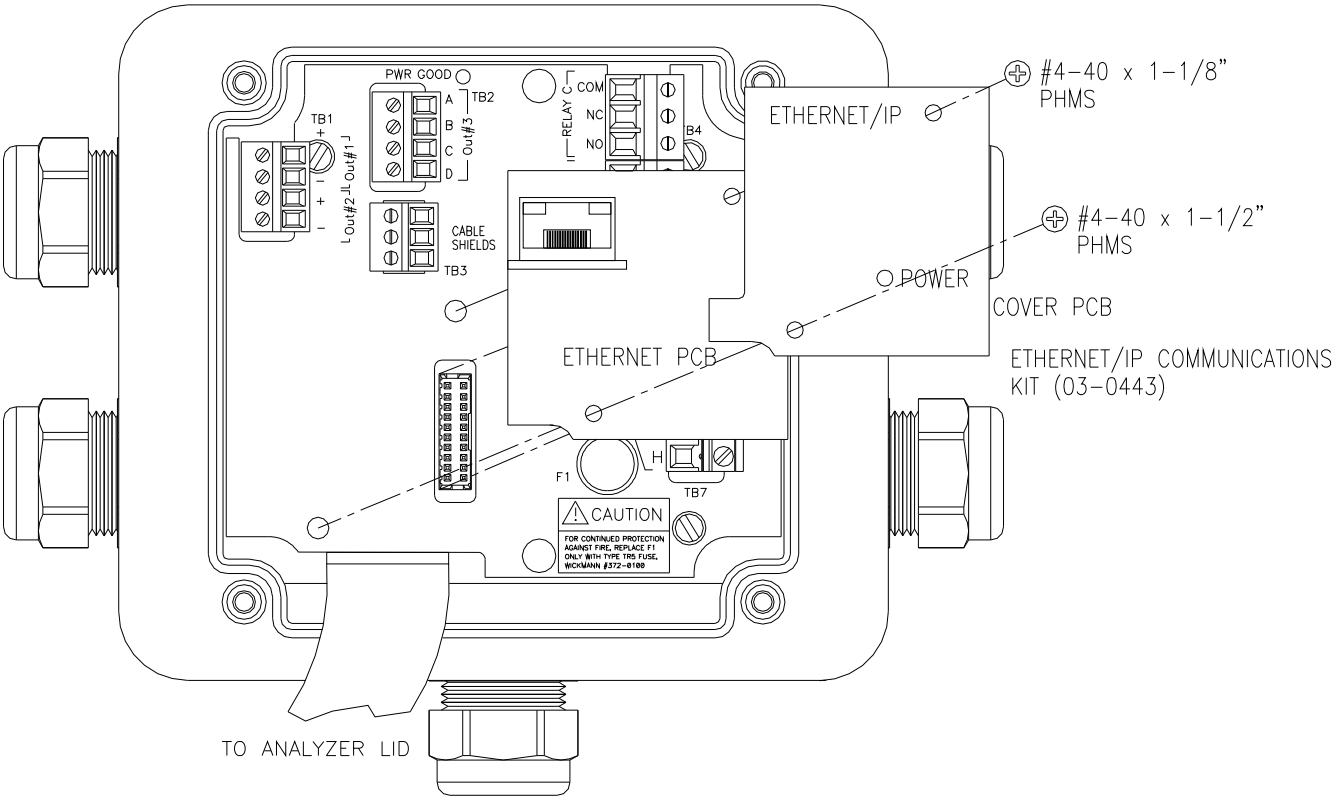

Figure 1 – Ethernet/IP Card Installation

1.5 Cable Connection

The cable used for Ethernet/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 Ethernet/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 Ethernet/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 BOOTP server to assign an IP address. Standard PLC networks (like Rockwell-RSLinx) include this server as part of the system. If no response from BOOTP occurs after about 60 seconds, the Q46 system defaults to an IP address at 192.168.0.254. The data is stored in an object with the attributes shown below, and can be acquired with an Ethernet/IP PC test program using the explicit message format as follows –

Service: 14 **(0x0E hex, Get_Attribute_Single)**
Class: 4 **(0x04 hex, Assembly Object)**
Instance: 101 **(0x65 hex, Input Instance)**
Attribute: 3 **(0x03 hex, Data Attributes)**

As an example, this call is shown in the Molex Ethernet/IP software tool screen shot below, run on the default IP address of a Q46D. This free Molex PC tool can be used to test explicit messages on the Q46 interface. To run this on a PC for check-out, the user must first be sure to set the IP address of the PC Ethernet port to the 192.168.0 subnet range, like 192.168.0.20 (or, manually run a BOOTP server):

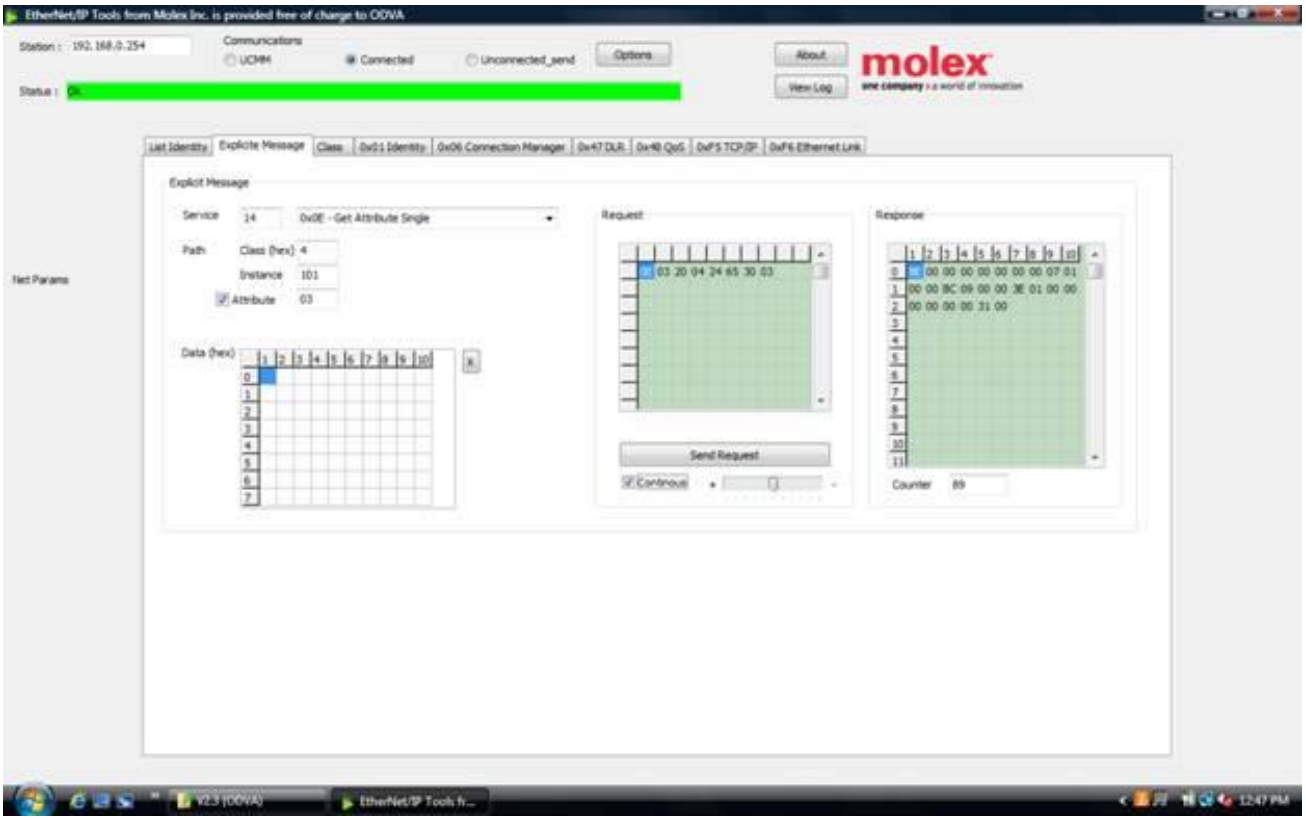

Figure 3 - Molex Ethernet/IP Explicit Message Tool Example

In the Molex example, the explicit message sent to the Q46D is (all hex) –
14, 03, 20, 04, 24, 65, 30, 03

This "Get Attribute Single" call requests the EIP data object at
Class = 4
Instance = 101
Attribute = 3

The raw response shown above from the Q46 is shown below -
8E, 00, 00, 00, 00, 00, 00, 00, 07, 01,
00, 00, BC, 09, 00, 00, 3E, 01, 00, 00,
00, 00, 00, 00, 31, 00

Since Ethernet/IP is a Little Endian protocol, the raw response format above is byte-swapped. To more easily see the data, flip every odd byte to Big Endian fomat. Then, underline our Q46 defined data sets –
<u>00, 8E, 00, 00</u>, <u>00, 00</u>, <u>00, 00, 01, 07</u>
<u>00, 00, 09, BC</u>, <u>00, 00, 01, 3E</u>, <u>00, 00,</u>
<u>00, 00</u>, <u>00</u>, <u>00</u>, <u>00</u>, <u>31</u>

Breaking up the groups, here is how the response corresponds to the Q46D instrument data set. The first 4 bytes are header info for the interface. Two bytes for status will appear in the data object and then 20 data bytes start after those status bytes -

0x008E0000 =	**4 bytes (32 bits) of header (not visible to PLC)**		
Data object starts next…			
0x0000 =	**2 bytes (16 bits) of internal status info (ignore)**		
0x00000107 =	**32-bit value = 263 =**	**2.63 ppm**	**Dissolved Ox**
0x000009BC =	**32-bit value = 2492 =**	**24.92 C**	**Temperature**
0x0000013E =	**32-bit value = 318 =**	**31.8 %**	**Saturation**
0x00000000 =	**32-bit value =**	**0**	**PID**
0x00 =	**8-bit binary value =**	**0x00000000**	**Status 1 flags**
0x00 =	**8-bit binary value =**	**0x00000000**	**Status 2 flags**
0x00 =	**8-bit binary value =**	**0x00000000**	**Alarm flags**
0x31 =	**8-bit value =**	**49**	**ID**

In most PLC's, the 4-byte header will not show in the data object, but the 2-byte internal status header will. You can just ignore that status register when parsing data that starts at the 7th byte.

Note that in the section **1.9 Data File** tables below, we count the first table byte as the first data byte – starting after the 6 byte header/status info So, the first 32-bit data value is listed as bytes 1-4, the second data value is at bytes 5-8, and so on.

1.7 PLC Settings

PLCs handle this exchange in a wide variety of configurations, and the configuration of a class 1 connection in every PLCs software is different, but there should be a place to enter the following information. If this doesn't seem to make sense, follow the explicit info above.

Data Type: "INT" or "16-Bit"
Input T->O Assembly Instance: 0x65 or 101 decimal
Input T->O Size: 11 words (16-bit)
Output O->T Assembly Instance: 0x66 or 102 decimal
Output O->T Size: 1 word (16-bit)
Configuration Assembly Instance: 0x80 or 128 decimal
Configuration Size: 0

*Note that there may be a byte swap occurring on each set of registers as Ethernet/IP is Little Endian (see parse above in section 1.6). So you may have to byte swap each 16-bit register to recombine the data.

**Note that section 1.6 shows that first raw 4 header bytes as being ignored, as the raw bytes are all shown with a Molex PC tool. The 2 raw bytes will show on the PLC, and are simply an internal status register. So, actual data shows right after those 6 bytes.

Note that some Ethernet/IP Master simulators such as EIP Scan do not have data type settings, everything is in bytes. In that case, the input above would be 22 instead of 11. Make sure to double check whether entry values are in hex or decimal.

1.8 Configuring fixed IP with BOOTP

The method below simply uses the BOOTP=DHCP 2.3.2 server application running on a PC with the NIC set to a fixed IP. This is only for those unfamiliar with the BOOTP manual setup.

1) Turn off Q46. Connect Q46 to laptop with direct cable. Set laptop NIC port on a locked IP and subnet to stop DHCP (Q46 interface looks for that by default.) In IPV4 properties on your PC's ethernet connection port, select "Use the following IP Address" and set -
   IP Address = 192.168.0.20
   Subnet Mask = 255.255.255.0

2) Save and close out. This gets the PC on the same subnet as the raw Q46 IP out of the box. It is the same thing we describe in our manual for the Molex tool. If you ever need your PC to work "normally" again, you must de-select this fixed address and let one be assigned automatically.

3) With Q46 off, start the BOOTP server program on the PC. Top and bottom screen will be blank. Now turn on Q46. The BOOTP server will see the connection and you will see a few lines all pop up at the top. You are only looking for the MAC ID. Double click on one of the BOOTP records, and copy the MAC address by selecting with mouse. In the relation lists, hit new, and enter a new IP creation record by putting in the MAC address and the IP 192.168.0.22 (different than your PC.) Click FILE then SAVE AS, and save the file under a name like Q46.BPC.

4) To load it into the Q46, clear history, turn off power on Q46, then turn Q46 back on. The new IP will be sent to the Q46 (you will see that message on bottom line of BOOTP app), and the new IP should now show in the top window at the end of the record. Now, that IP is locked in the Q46. Every time BOOTP application is open and that Q46 powers up on that port, the new IP address is sent to it. Shut off BOOTP tool.

Rockwell's reference -
https://rockwellautomation.custhelp.com/ci/redirect/enduser/enduser/fattach_get.php?p_sid=sk5FYnkj&p_li=&p_accessibility=&p_redirect=&p_file_id=8311&p_tbl=10&p_id=35279&p_created=1164808462&p_olh=0

1.9 Data Files

The data organization shown in section 1.6 corresponds to the same mapping as all the other communication interfaces on the Q46. All Q46 instruments provide 20 bytes of input data to the master, and the meaning of the bytes changes slightly depending on which Q46 instrument is used. The details of these exact bytes for the Q46D are shown below. Tables for other parameters are provided at the end of this manual.

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	D.O.	Dissolved Oxygen	8.40 PPM = 840
5 to 8	long(32)	D.O.	Measured Temperature	25.00° C = 2500
9 to 12	long(32)	D.O.	Measured % Saturation	98.0% sat = 980
13 to 16	long(32)	NA	PID value	17.0% = 170
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
19	Char(8)	NA	Alarm Status	(binary) 00000000
20	Char(8)	NA	Instrument ID	49 = 49

Figure 4 - Q46D Data File, I/O Format Detail

Byte	Bitfield	Description
17	0 (lsb)	mV Hi
17	1	mV Lo
17	2	D.O. Hi
17	3	D.O. Lo
17	4	Temp Hi
17	5	Temp Lo
17	6	NU
17	7	NU
18	0	EE Fail
18	1	NU
18	2	LCD Controller Fail
18	3	Cal D.O. Fail
18	4	PID Controller Fail
18	5	Cal TC Fail
18	6	TC Error
18	7	Acknowledge Fail (global)
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

Figure 5 - Q46D Data File, Status/Alarm Bit Detail

*Note-
Long = Long Integer, requires 4 bytes
Char = Character, requires 1 byte

Q46H/62, Q45H/63 or Q46H/79PR Residual Chlorine Tables

Q46H/62/63/79PR Data File I/O Format Detail

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	Chorine	Measured Chlorine	1.4920 PPM = 14920
5 to 8	long(32)	Chlorine	Measured Temperature	25.00° C = 2500
9 to 12	long(32)	pH	Measured pH	7.00 pH = 700
13 to 16	long(32)	NA	PID value	17.0% = 170
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
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 Data File Status/Alarm Bit Detail

Byte	Bitfield	Description
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)
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 Data File I/O Format Detail

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	Ozone	Measured Ozone	1.4920 PPM = 14920
5 to 8	long(32)	Ozone	Measured Temperature	25.00° C = 2500
9 to 12	long(32)	pH	Measured pH	7.00 pH = 700
13 to 16	long(32)	NA	PID value	17.0% = 170
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
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 Data File Status/Alarm Bit Detail

Byte	Bitfield	Description
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)
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 Data File I/O Format Detail

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	Chorine	Measured Chlorine Dioxide	1.4920 PPM = 14920
5 to 8	long(32)	Chlorine	Measured Temperature	25.00° C = 2500
9 to 12	long(32)	pH	Measured pH	7.00 pH = 700
13 to 16	long(32)	NA	PID value	17.0% = 170
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
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 Data File Status/Alarm Bit Detail

Byte	Bitfield	Description
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	pH Auto-comp Fail
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)
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 Data File I/O Format Detail

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	pH	Measured pH Measured ORP	7.00 pH = 700 -137 mv = -137
5 to 8	long(32)	pH	Measured Temperature	25.00° C = 2500
9 to 12	long(32)	pH	NU	0
13 to 16	long(32)	pH	PID value	47.5% = 475
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
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 Data File Status/Alarm Bit Detail

Byte	Bitfield	Description
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)
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 Data File I/O Format Detail

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	Ammonia	Measured Total Ammonia	1.00 PPM = 100
5 to 8	long(32)	Ammonia	Measured Temperature	25.00°C = 2500
9 to 12	long(32)	Monochlor	Measured Monochloramine	0.51 PPM = 51
13 to 16	long(32)	Amm/Mono	Measured Free Ammonia	3.21 PPM = 321
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
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 Data File Status/Alarm Bit Detail

Byte	Bitfield	Description
17	0 (lsb)	NU
17	1	NU
17	2	Ammonia Hi
17	3	Ammonia Low
17	4	Temp Hi
17	5	Temp Lo
17	6	MonoChlor Hi
17	7	MonoChlor Low
18	0	Cal Monochlor Fail
18	1	NU
18	2	LCD Controller Fail
18	3	Cal Ammonia Fail
18	4	PID Controller Fail
18	5	Cal TC Fail
18	6	TC Error
18	7	Acknowledge Fail (global)
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

Q46C4 or Q46CT Conductivity Tables

Q46C4 & Q46CT Data File I/O Format Detail

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	Conductivity	Measured Conductivity	2.238 mS = 2238
5 to 8	long(32)	Conductivity	Measured Temperature	25.00° C = 2500
9 to 12	long(32)	Conductivity	*Measured Concentration	1.3 % = 13
13 to 16	long(32)	NA	**Calculated TDS Value	223.5 mg/l = 2235
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
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 Data Status/Alarm Bit Detail

Byte	Bitfield	Description
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)
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 Data File I/O Format Detail

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	pH	Measured Fluoride	1.00 PPM = 1000
5 to 8	long(32)	pH	Measured Temperature	25.00° C = 2500
9 to 12	long(32)	pH	NU	0
13 to 16	long(32)	pH	PID value	47.5% = 475
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
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 Data Status/Alarm Bit Detail

Byte	Bitfield	Description
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 pH or ORP Fail
18	4	PID Controller Fail
18	5	Cal TC Fail
18	6	TC Error
18	7	Acknowledge Fail (global)
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

Q46T Turbidity Tables

Q46T Data File I/O Format Detail

Byte	Data Type	Sensor	Description	Data Format
1 to 4	long(32)	Turbidity	Measured Turbidity	0.16 NTU = 16
5 to 8	long(32)	Turbidity	Measured Temperature	25.00° C = 2500
9 to 12	long(32)	Turbidity	NU	NU
13 to 16	long(32)	NA	PID value	17.0% = 170
17	Char(8)	NA	System Status 1	(binary) 00000000
18	Char(8)	NA	System Status 2	(binary) 00000000
19	Char(8)	NA	Alarm Status	(binary) 00000000
20	Char(8)	NA	Instrument ID	85 = 85

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

Q46T Data Status/Alarm Bit Detail

Byte	Bitfield	Description
17	0 (lsb)	NU
17	1	NU
17	2	Turbidity High
17	3	Turbidity Low
17	4	Temp High
17	5	Temp Low
17	6	NU
17	7	NU
18	0	EE Fail
18	1	NU
18	2	LCD Controller Fail
18	3	Cal Turbidity Fail
18	4	PID Controller Fail
18	5	Cal TC Fail
18	6	TC Error
18	7	Acknowledge Fail (global)
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