XPosition

User Manual

A-XGPS

Document No. D108-009
11/2023
Revision 1.17

aparian

CONTENTS

Revision History

Revision	Date	Comment
1.0	13 Apr 2015	Initial document
1.1	25 August 2015	Add UL Listed mark
1.2	26 June 2016	Updated temperature range
1.3	11 August 2016	Added RoHS2 compliant to certifications
1.4	23 May 2017	Add support for two additional interface modes. Add RCM Conformance mark.
1.5	9 June 2017	Modification to Output Assembly and Reference Position format
1.6	5 October 2017	Added UL Class 1 Division 2
1.7	13 February 2018	Added support for Modbus TCP
1.8	23 October 2020	Added new NMEA individual packet statistics
1.9	6 January 2021	Added option for DIP Switch 4 – Fixed IP Address
1.10	14 September 2021	Fixed the module status bits in Logix and Modbus
1.11	20 September 2021	Added GPS quality for the calculated attitude vector when using EtherNet/IP and Modbus.
1.12	4 November 2021	Added Connection Timeout parameter to External GPS configuration tab.
1.13	8 November 2021	Added Communication statistics.
1.14	4 August 2022	Added information required for UL regarding open type device enclosures.
1.15	17 Jan 2023	Update support contact details
1.16	28 August 2023	Indicate the NMEA protocol being used (NMEA 0183).
1.17	13 November 2023	Added UKCA Conformance Mark

1. PREFACE

1.1. INTRODUCTION TO THE XPOSITION

This manual describes the installation, operation, and diagnostics of the Aparian XPosition Module. The XPosition Module provides an interface to high accuracy positioning equipment which can be used across a range of position sensitive applications.

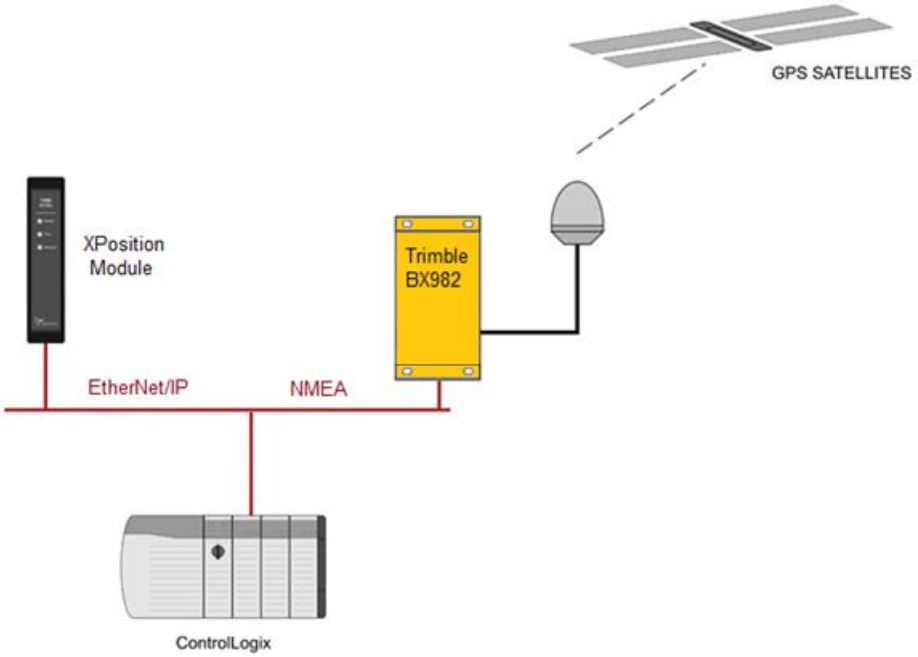


Figure 1.1. – Typical architecture using the Trimble BX982

1.2. FEATURES

The XPosition module provides a method for connecting high precision GPS and inertial navigation devices to Rockwell Automation's Logix (ControlLogix and CompactLogix) family of controllers. Any third party Device can be interfaced to, provided it supports NMEA 0183 communications over Ethernet.

The XPosition module is configured using the Aparian Slate application. This program can be downloaded from www.aparian.com free of charge. Slate offers various configuration methods.

Hereafter the XPosition module will be referred to as the **XPosition**.

The XPosition operates in a Logix "owned" mode. With a Logix connection the input and output assemblies will provide position and diagnostics information which will be available in the Logix controller environment.

The XPosition also supports Modbus Holding registers allowing the user to access the XPosition with Modbus TCP.

The XPosition uses an external GPS receiver to provide accurate position information. The external GPS or inertial navigation device provides various accuracy estimates allowing the user to make informed decisions for high precision position and velocity applications.

The XPosition can also be interfaced with dual antenna receivers and in so doing provide the additional Yaw, Tilt and Heading data.

A built-in webserver provides detailed diagnostics of system configuration and operation, including the display of GPS time, position, and velocity without the need for any additional software.

1.3. ARCHITECTURE

The figure below provides an example of the typical network setup.

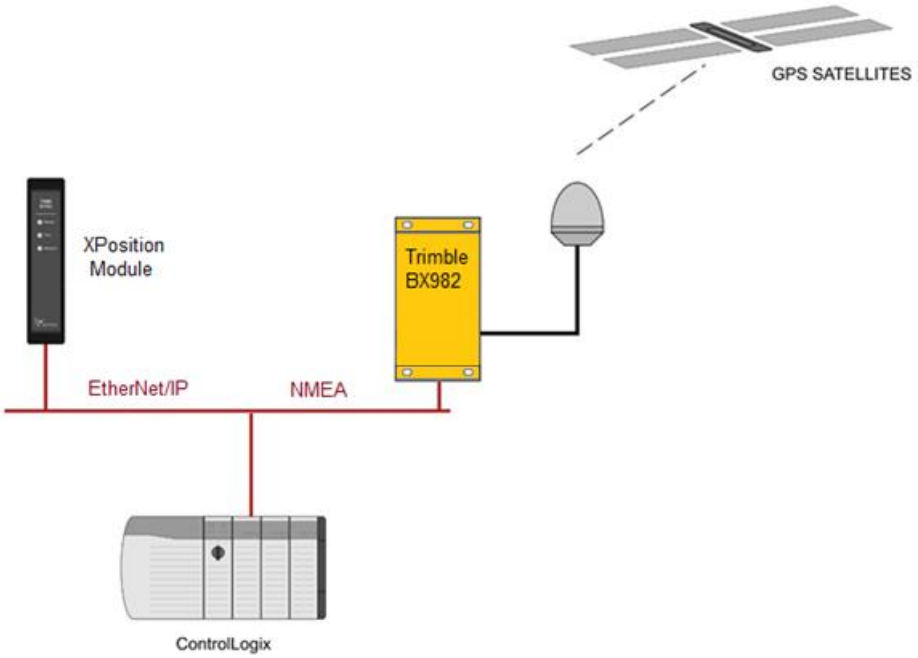


Figure 1.2. - Example of a typical network setup

The XPosition module will convert the data received from the high precision device (e.g. Trimble BX982) in order for the Logix controller to use it. The XPosition can also connect to the Logix controller or Precision GPS / Inertial navigation device over wireless networks allowing the user to accurately measure position of mobile applications (e.g. Cranes, Stackers, etc.).

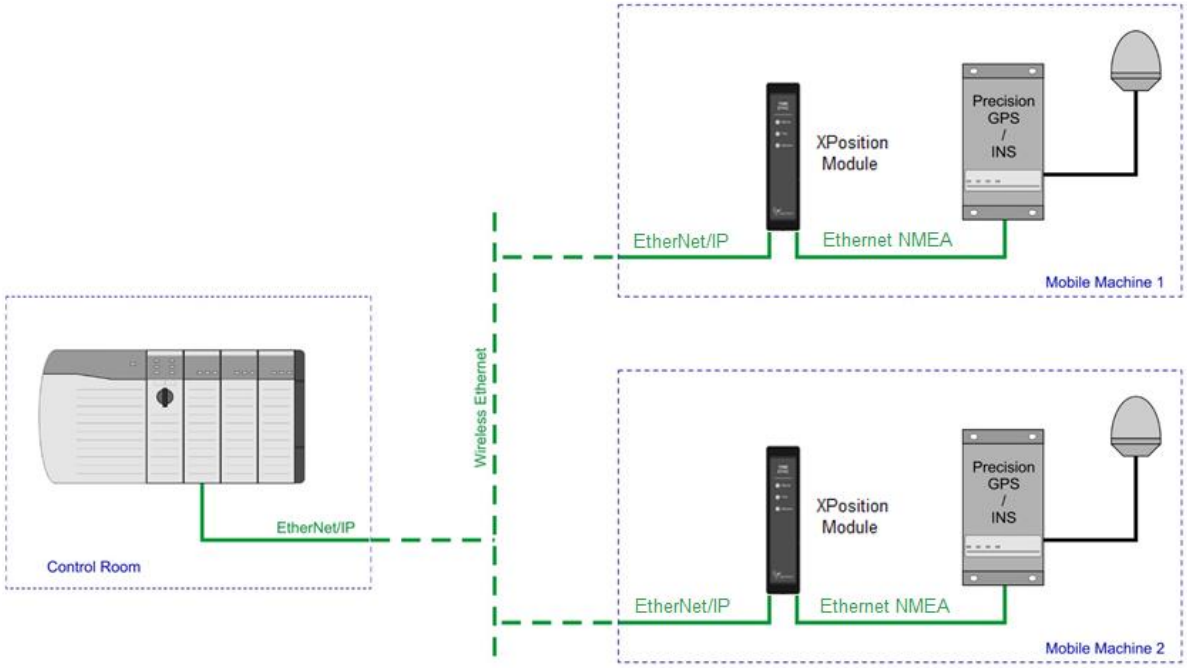


Figure 1.3. - Example of a wireless network setup

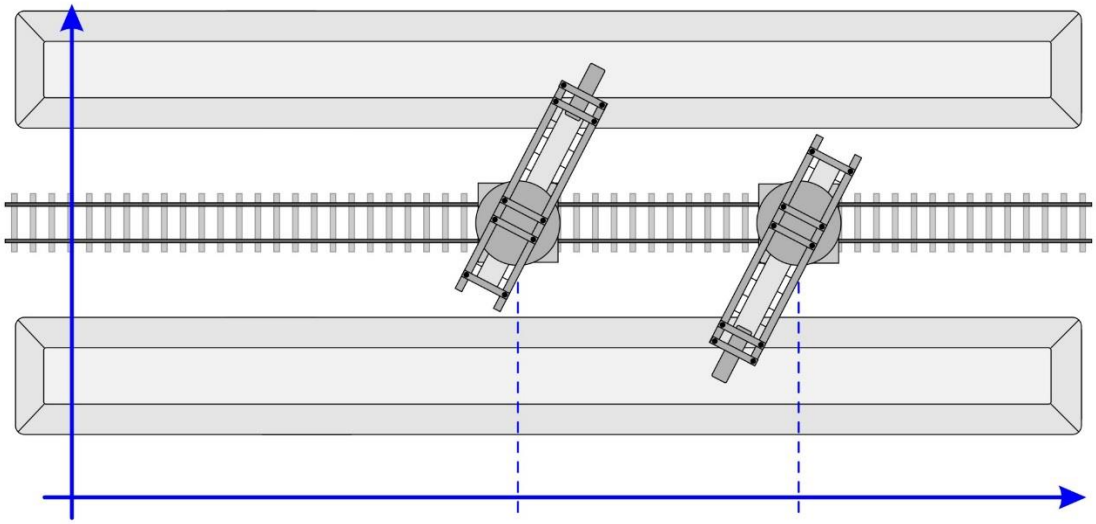


Figure 1.3. – Stacker / Reclaimer Example

1.4. ADDITIONAL INFORMATION

The following documents contain additional information that can assist the user with the module installation and operation.

Resource	Link
Slate Installation	http://www.aparian.com/software/slate
XPosition User Manual XPosition Datasheet Example Code & UDTs	http://www.aparian.com/products/xposition
Ethernet wiring standard	www.cisco.com/c/en/us/td/docs/video/cds/cde/cde205_220_420/installation/guide/cde205_220_420_hig/Connectors.html
Trimble precision devices	http://www.trimble.com/tsg/precision-gnss.aspx

Table 1.1. - Additional Information

1.5. SUPPORT

Technical support is provided via the Web (in the form of user manuals, FAQ, datasheets etc.) to assist with installation, operation, and diagnostics.

For additional support the user can use either of the following:

Resource	Link
Contact Us web link	https://www.prosoft-technology.com/Services-Support/Customer-Support
Support email	support@prosoft-technology.com

Table 1.2. – Support Details

2. INSTALLATION

2.1. MODULE LAYOUT

The module has three ports at the bottom of the enclosure as shown in the figure below. The ports are used for Ethernet, RS232 serial, and power. The power port uses a three way connector which is used for the DC power supply and the earth connection.

NOTE: The RS232 for this module is reserved and should not be used.

The Ethernet cable must be wired according to industry standards which can be found in the additional information section of this document.

Figure 2.1. - XPosition side and bottom view

The module provides three diagnostic LEDs as shown in the front view figure below. These LEDs are used to provide information regarding the module system operation, the Ethernet interface, and the external device communication.

Figure 2.2. – XPosition front and top view

The module provides four DIP switches at the top of the enclosure as shown in the top view figure above.

DIP Switch	Description
DIP Switch 1	Used to force the module into “Safe Mode”. When in “Safe Mode” the module will not load the application firmware and will wait for new firmware to be downloaded. This should only be used in the rare occasion when a firmware update was interrupted at a critical stage.
DIP Switch 2	This will force the module into DHCP mode which is useful when the user has forgotten the IP address of the module.
DIP Switch 3	Reserved
DIP Switch 4	When this DIP Switch is set at bootup it will force the module Ethernet IP address to 192.168.1.100 and network mask 255.255.255.0. The user can then switch the DIP switch off and assign the module a static IP address if needed.

Table 2.1. - DIP Switch Settings

2.2. MODULE MOUNTING

NOTE: This module is an open-type device and is meant to be installed in an enclosure suitable for the environment such that the equipment is only accessible with the use of a tool.

The module provides a DIN rail clip to mount onto a 35mm DIN rail.

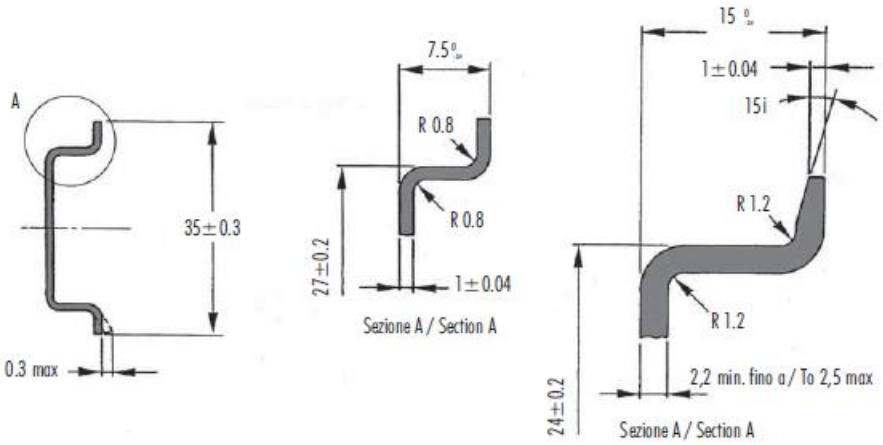


Figure 2.3 - DIN rail specification

The DIN rail clip is mounted on the bottom of the module at the back as shown in the figure below. Use a flat screw driver to pull the clip downward. This will enable the user to mount the module onto the DIN rail. Once the module is mounted onto the DIN rail the clip must be pushed upwards to lock the module onto the DIN rail.

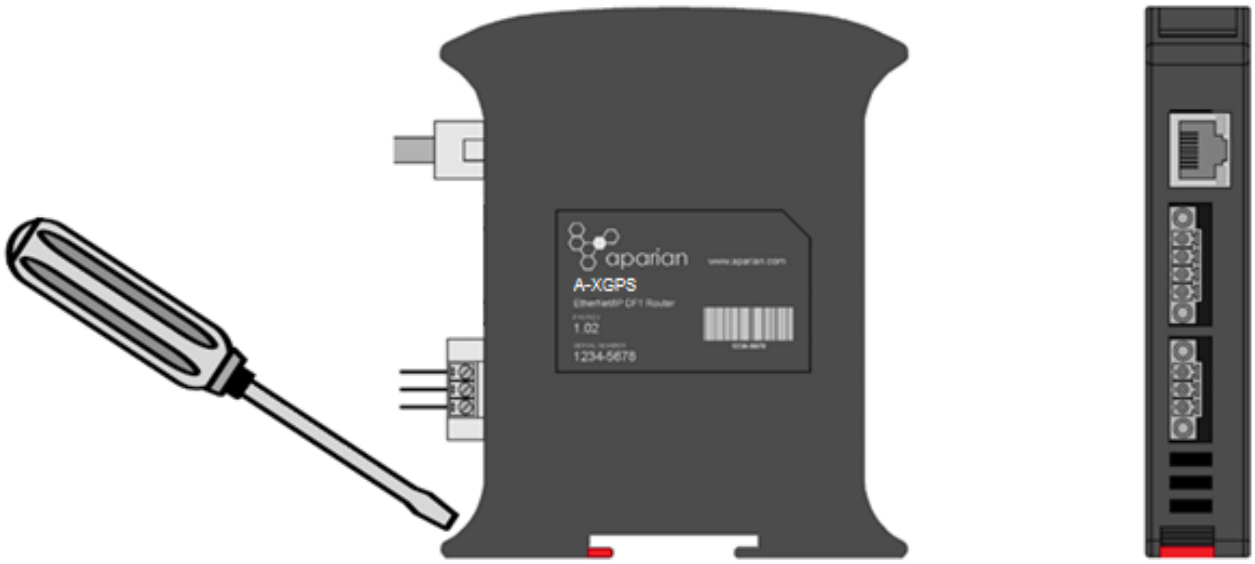


Figure 2.4 - DIN rail mouting

2.3. POWER

A three-way power connector is used to connect Power+, Power– (GND), and earth. The module requires an input voltage of 10 – 28Vdc. **Refer** to the technical specifications section in this document.

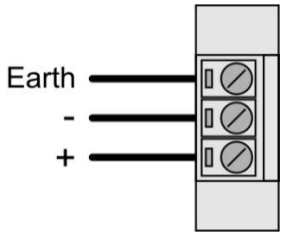


Figure 2.5 - Power connector

2.4. ETHERNET PORT

The Ethernet connector should be wired according to industry standards. **Refer** to the additional information section in this document for further details.

3. SETUP

3.1. INSTALL CONFIGURATION SOFTWARE

All the network setup and configuration of the module is achieved by means of the Aparian Slate device configuration environment. This software can be downloaded from http://www.aparian.com/software/slate.

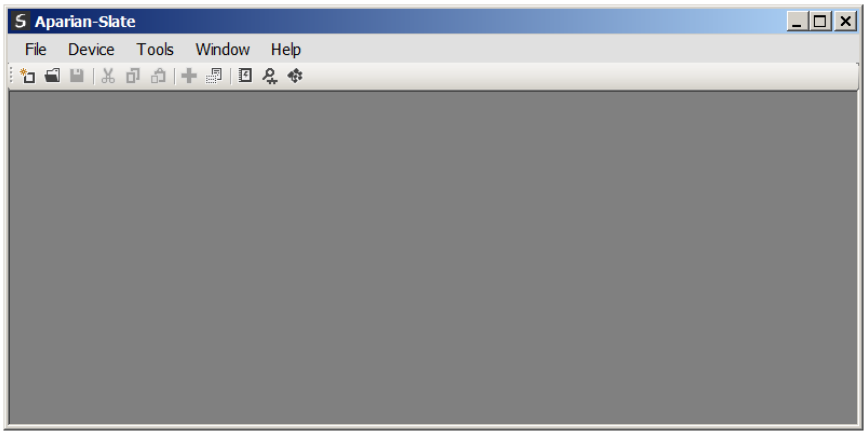


Figure 3.1. - Aparian Slate Environment

3.2. NETWORK PARAMETERS

The module will have DHCP (Dynamic Host Configuration Protocol) enabled as factory default. Thus a DHCP server must be used to provide the module with the required network parameters (IP address, subnet mask, etc.). There are a number of DHCP utilities available, however it is recommended that the DHCP server in Slate be used.

Within the Slate environment, the DHCP server can be found under the Tools menu.

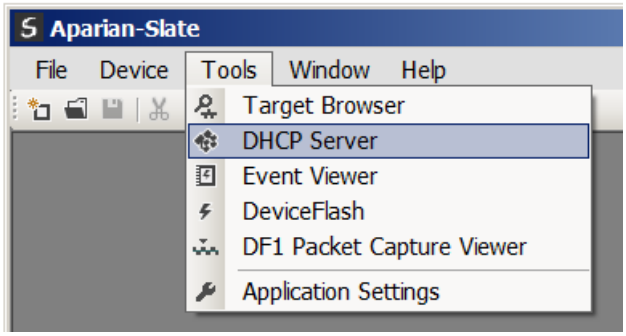


Figure 3.2. - Selecting DHCP Server

Once opened, the DHCP server will listen on all available network adapters for DHCP requests and display their corresponding MAC addresses.

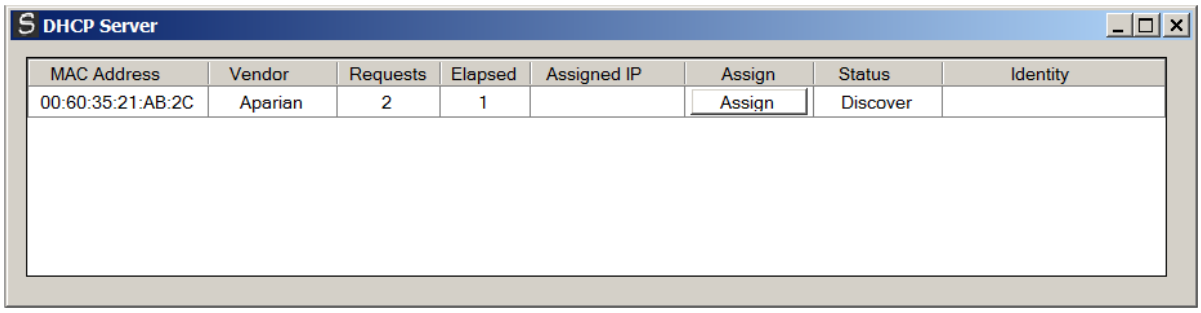


Figure 3.3. - DHCP Server

NOTE: If the DHCP requests are not displayed in the DHCP Server it may be due to the local PC's firewall. During installation the necessary firewall rules are automatically created for the Windows firewall.
Another possibility is that another DHCP Server is operational on the network and it has assigned the IP address.

To assign an IP address, click on the corresponding "Assign" button. The IP Address Assignment window will open.

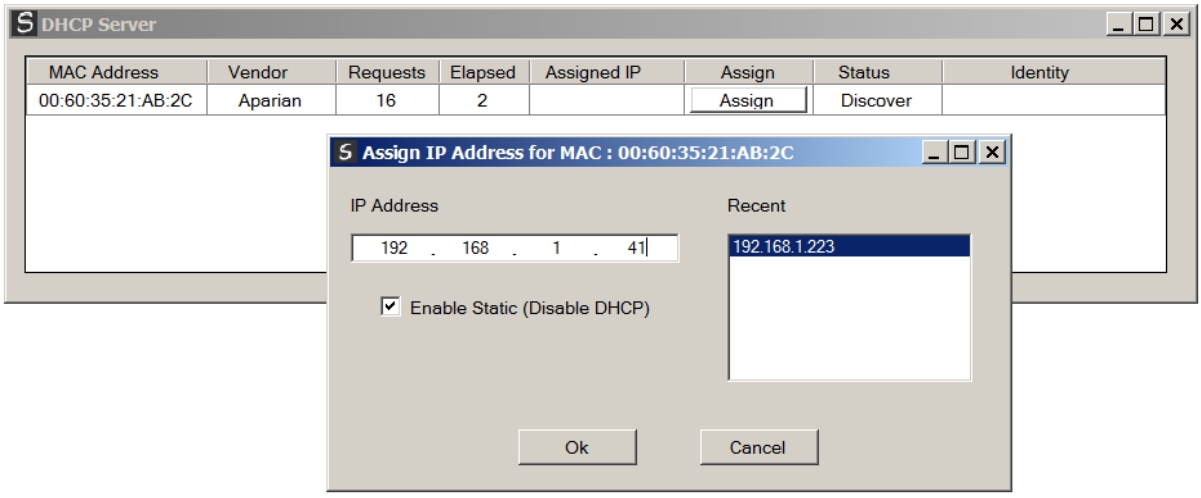


Figure 3.4. - Assigning IP Address

The required IP address can then be either entered, or a recently used IP address can be selected by clicking on an item in the Recent List.

If the "Enable Static" checkbox is checked, then the IP address will be set to static after the IP assignment, thereby disabling future DHCP requests.

Once the IP address window has been accepted, the DHCP server will automatically assign the IP address to the module and then read the Identity object Product name from the device.

The successful assignment of the IP address by the device is indicated by the green background of the associated row.

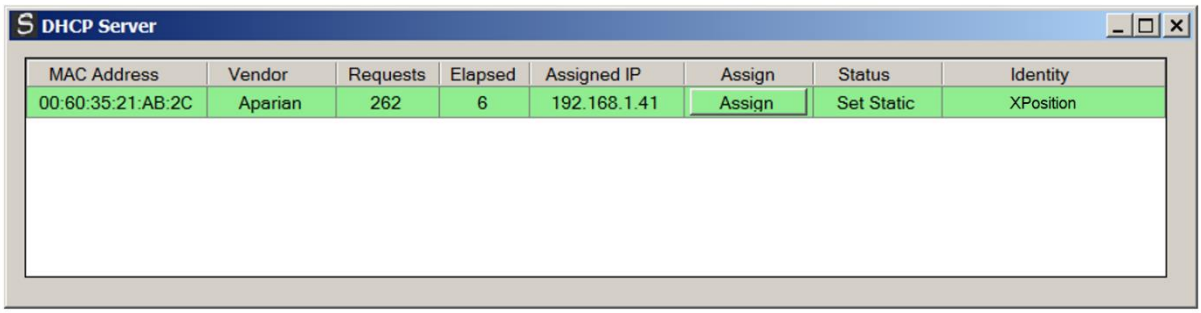


Figure 3.5. - Successful IP address assignment

It is possible to force the module back into DHCP mode by powering up the device with DIP switch 2 set to the On position.

A new IP address can then be assigned by repeating the previous steps.

NOTE: It is important to return DIP switch 2 back to Off position, to avoid the module returning to a DHCP mode after the power is cycled again.

If the module's DIP switch 2 is in the On position during the address assignment, the user will be warned by the following message.

Figure 3.6. - Force DHCP warning

In addition to the setting the IP address, a number of other network parameters can be set during the DHCP process. These settings can be viewed and edited in Slate's Application Settings, in the DHCP Server tab.

Once the DHCP process has been completed, the network settings can be set using the Ethernet Port Configuration via the Target Browser.

The Target Browser can be accessed under the Tools menu.

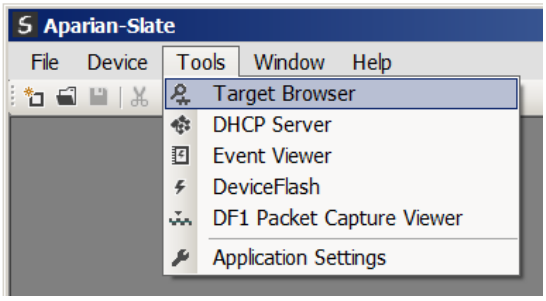


Figure 3.7. - Selecting the Target Browser

The Target Browser automatically scans the Ethernet network for EtherNet/IP devices.

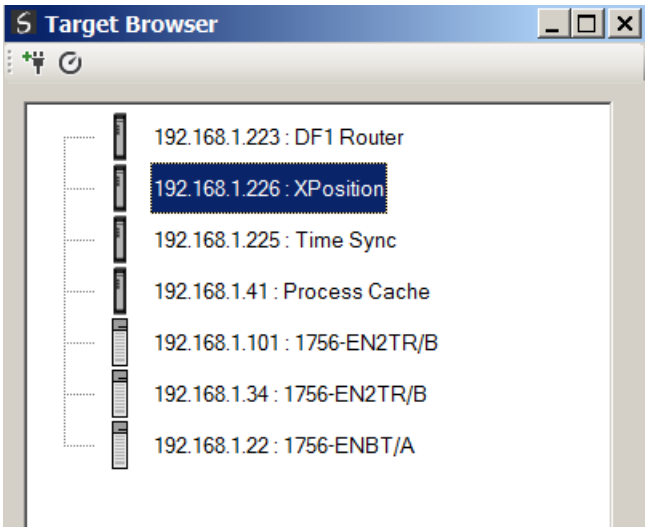


Figure 3.8. - Target Browser

Right-clicking on a device, reveals the context menu, including the Port Configuration option.

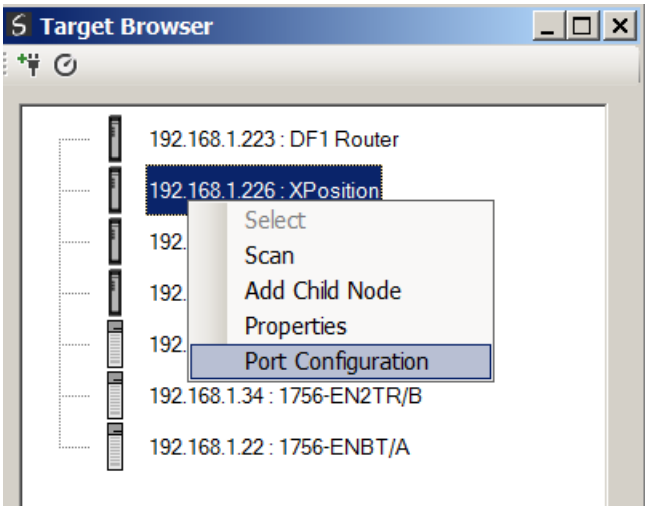


Figure 3.9. - Selecting Port Configuration

All the relevant Ethernet port configuration parameters can be modified using the Port Configuration window.

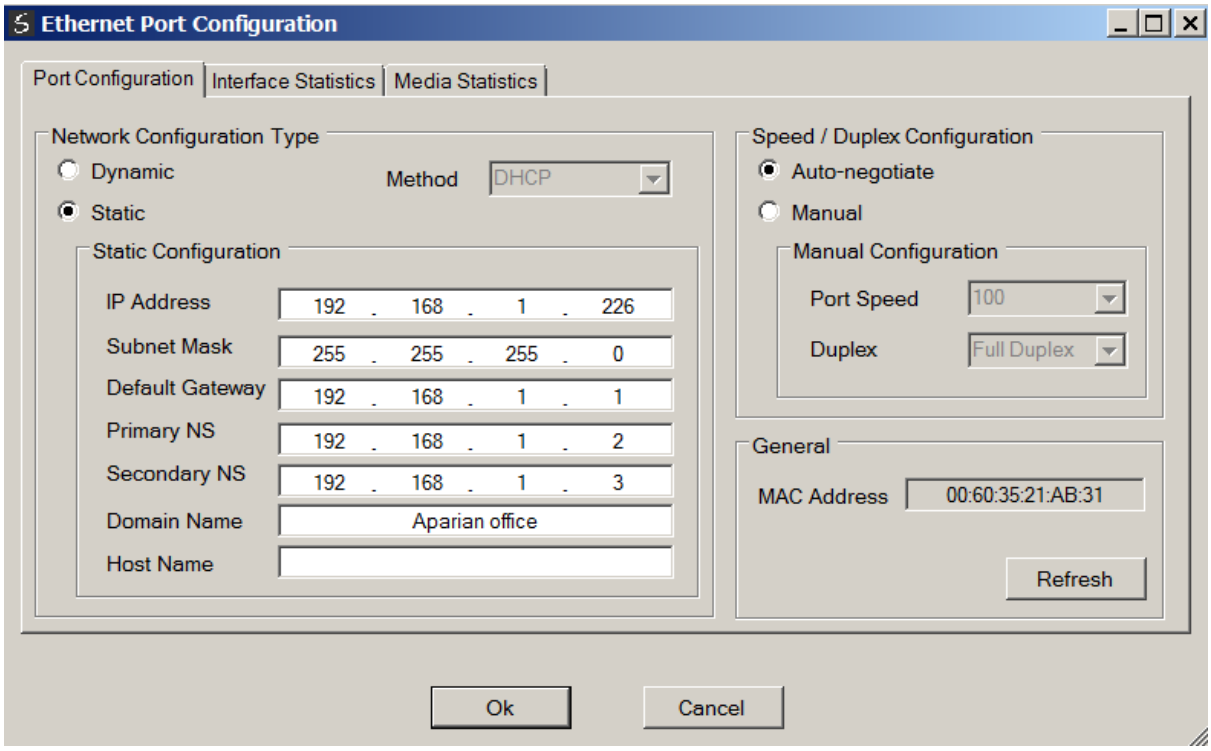


Figure 3.10. - Port Configuration

Alternatively, these parameters can be modified using Rockwell Automation's RSLinx software.

3.3. CREATING A NEW PROJECT

Before the user can configure the module, a new Slate project must be created. Under the File menu, select New.

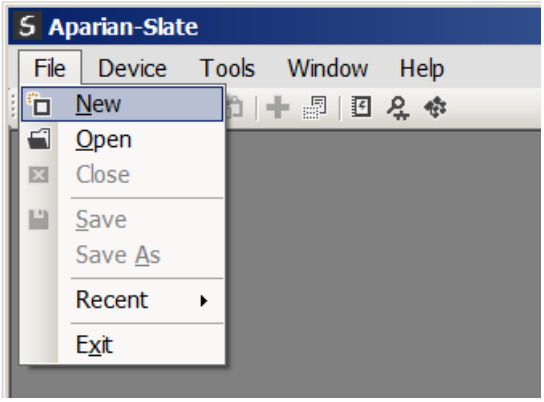


Figure 3.11. - Creating a new project

A Slate project will be created, showing the Project Explorer tree view. To save the project use the Save option under the File menu.

A new device can now be added by selecting Add under the Device menu.

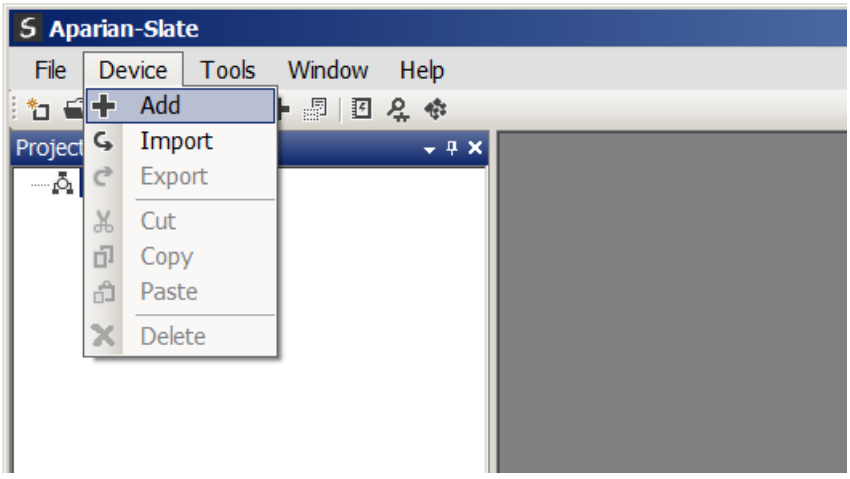


Figure 3.12. - Adding a new device

In the Add New Device window select the XPosition, and click the Ok button.

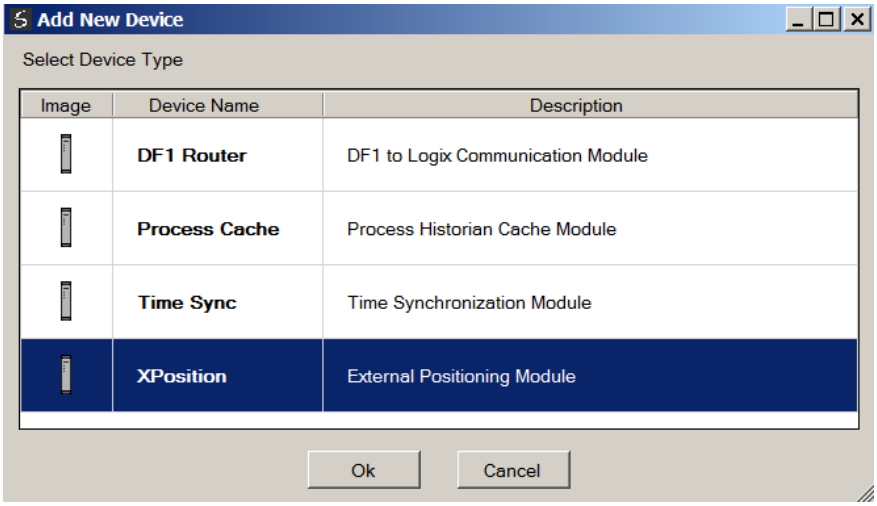


Figure 3.13 – Selecting a new XPosition

The device will appear in the Project Explorer tree as shown below, and its configuration window opened.

The device configuration window can be reopened by either double clicking the module in the Project Explorer tree or right-clicking the module and selecting *Configuration*.

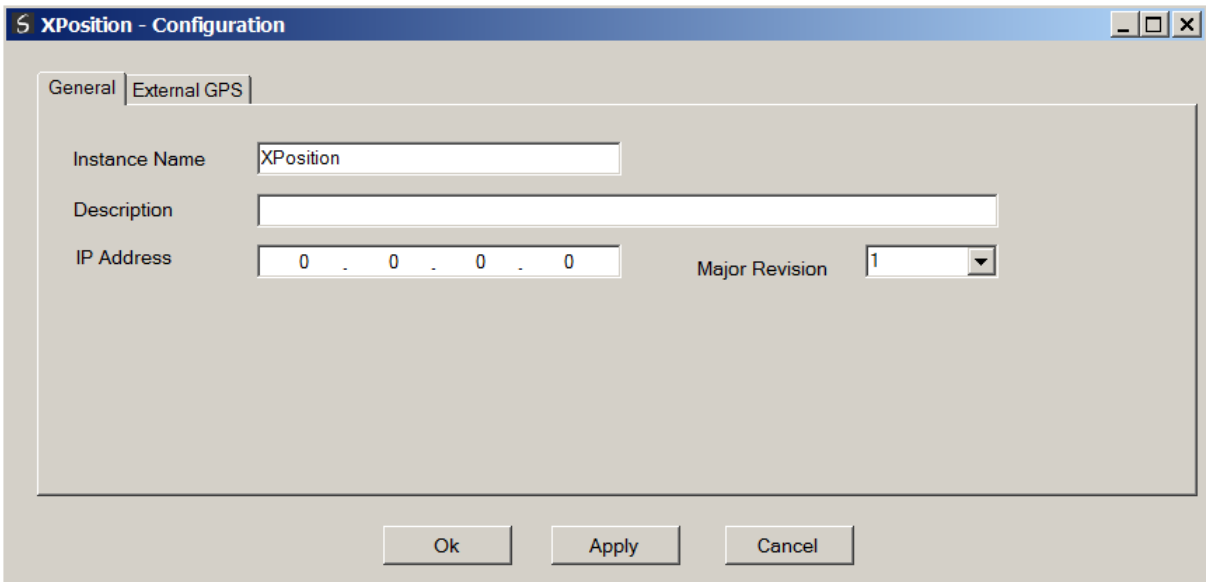


Figure 3.14. – XPosition configuration

Refer to the additional information section in this document for Slate's installation and operation documentation.

3.4. XPOSITION PARAMETERS

The XPosition parameters will be configured by Slate. **Refer** to the additional information section for documentation and installation links for Aparian Slate. The XPosition parameter configuration consists of a general configuration as well as an external Ethernet GPS receiver. When downloading this configuration into the module it will be saved in non-volatile memory that persists when the module is powered down.

NOTE: When a firmware upgrade is performed the module will clear all XPosition configuration and routing maps.

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various XPosition modules.
Description	This parameter is used to provide a more detail description of the application for the module.
IP Address	The IP address of the target module
Major Revision	The major revision of the module

Table 3.1 - General configuration parameters

The general configuration is shown in the figure below. The XPosition general configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting *Configuration*.

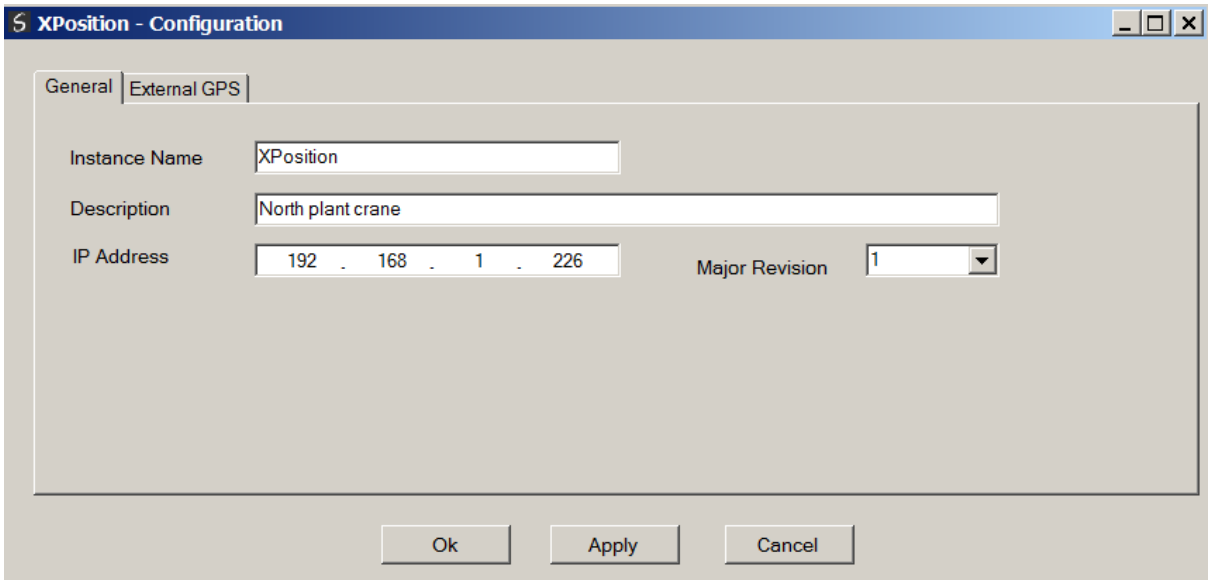


Figure 3.15. - General Configuration

The External GPS configuration consists of the following parameters:

Parameter	Description
IP Address	This is the IP address of the external GPS receiver that will be communicated to.
TCP Port	This is the TCP port of the external GPS receiver that will be used for the NMEA communication.
Connection Timeout	This is the amount of time in milliseconds the XPosition will wait for a packet from the NMEA device before restarting the connection.

Table 3.2 – External GPS configuration parameters

The external GPS configuration is shown in the figure below.

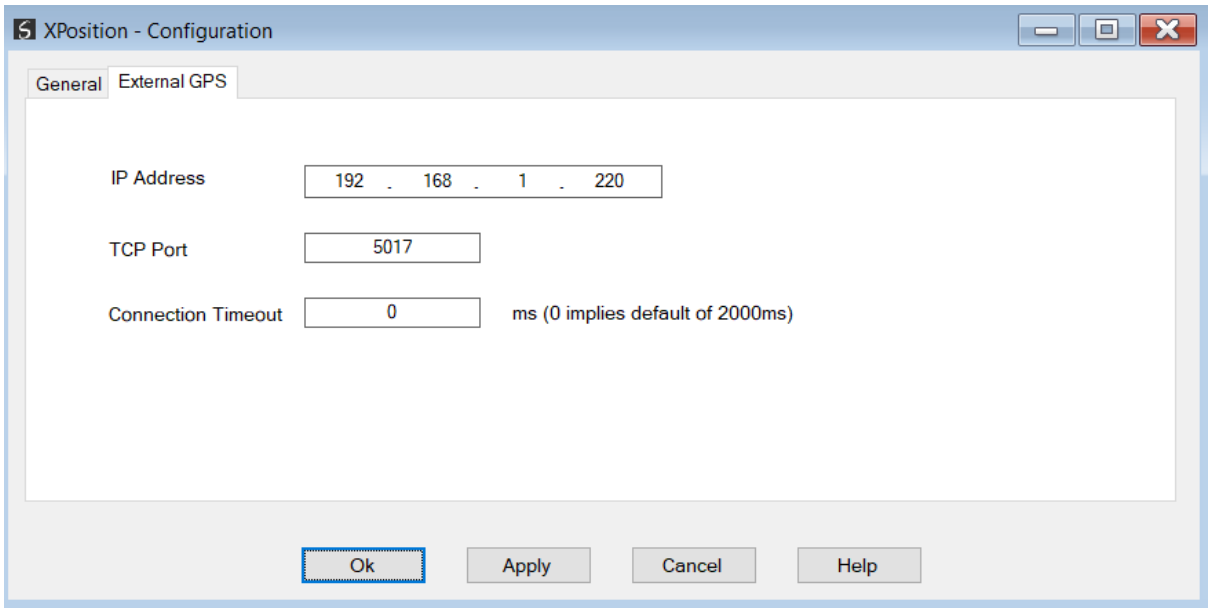
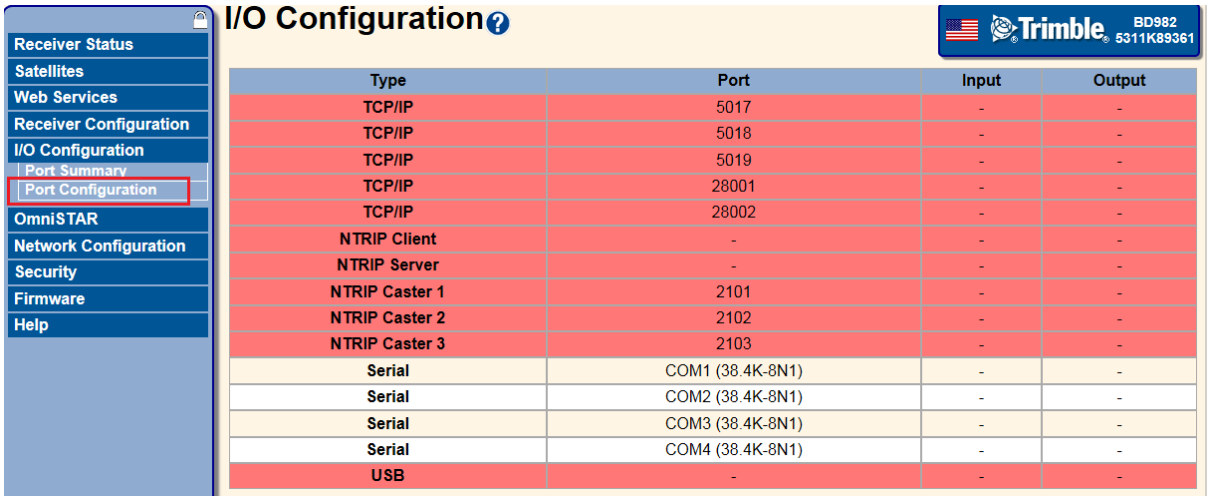


Figure 3.16 – External GPS configuration

3.5. TRIMBLE BX982

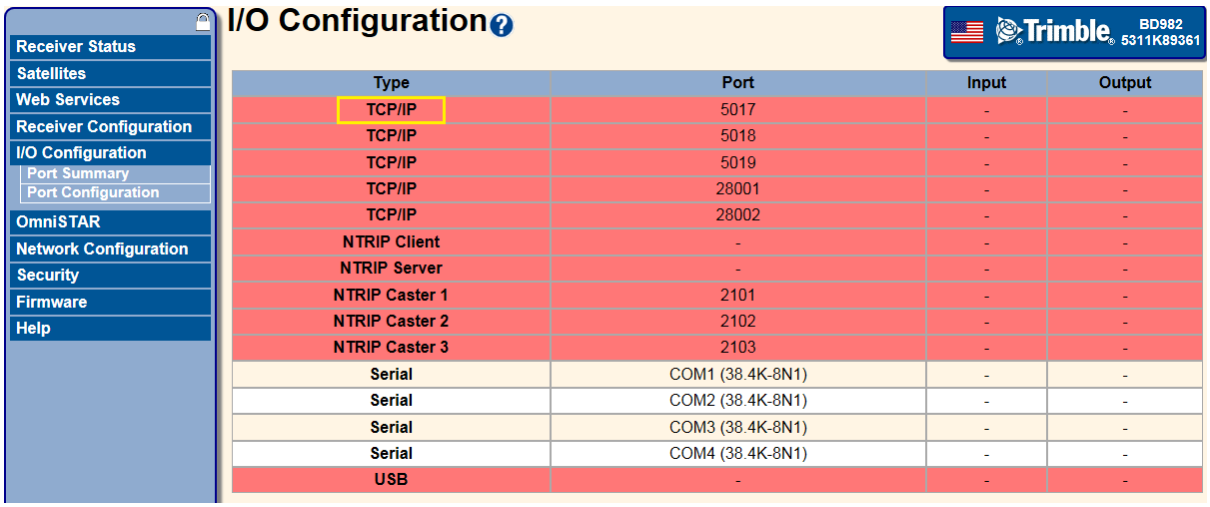
The Trimble BX982 is high precision GPS receiver which communicates over Ethernet using various protocols. The BX982 will need to be configured to communicate with the XPosition module using NMEA over Ethernet. The user must also ensure that the IP address and TCP port selected in the XPosition configuration is the same as that of the BX982. The BX982 is configured through the device webserver. Refer to the documentation for details how to access the webserver and login details (see section 1.4). Once the user has connected to the BX982 via the webserver the IO configuration will need to be set by clicking Port Configuration under the I/O configuration as shown below:



Type	Port	Input	Output
TCP/IP	5017	-	-
TCP/IP	5018	-	-
TCP/IP	5019	-	-
TCP/IP	28001	-	-
TCP/IP	28002	-	-
NTRIP Client	-	-	-
NTRIP Server	-	-	-
NTRIP Caster 1	2101	-	-
NTRIP Caster 2	2102	-	-
NTRIP Caster 3	2103	-	-
Serial	COM1 (38.4K-8N1)	-	-
Serial	COM2 (38.4K-8N1)	-	-
Serial	COM3 (38.4K-8N1)	-	-
Serial	COM4 (38.4K-8N1)	-	-
USB	-	-	-

Figure 3.17 – BX982: Select port configuration

Next a TCP/IP port will need to be configured. This is done by clicking on one of the ports as shown below:



Type	Port	Input	Output
TCP/IP	5017	-	-
TCP/IP	5018	-	-
TCP/IP	5019	-	-
TCP/IP	28001	-	-
TCP/IP	28002	-	-
NTRIP Client	-	-	-
NTRIP Server	-	-	-
NTRIP Caster 1	2101	-	-
NTRIP Caster 2	2102	-	-
NTRIP Caster 3	2103	-	-
Serial	COM1 (38.4K-8N1)	-	-
Serial	COM2 (38.4K-8N1)	-	-
Serial	COM3 (38.4K-8N1)	-	-
Serial	COM4 (38.4K-8N1)	-	-
USB	-	-	-

Figure 3.18 – BX982: Select TCP/IP port

The user will need to configure the protocol for the TCP/IP port as NMEA by selecting it from the drop-down box as shown below:

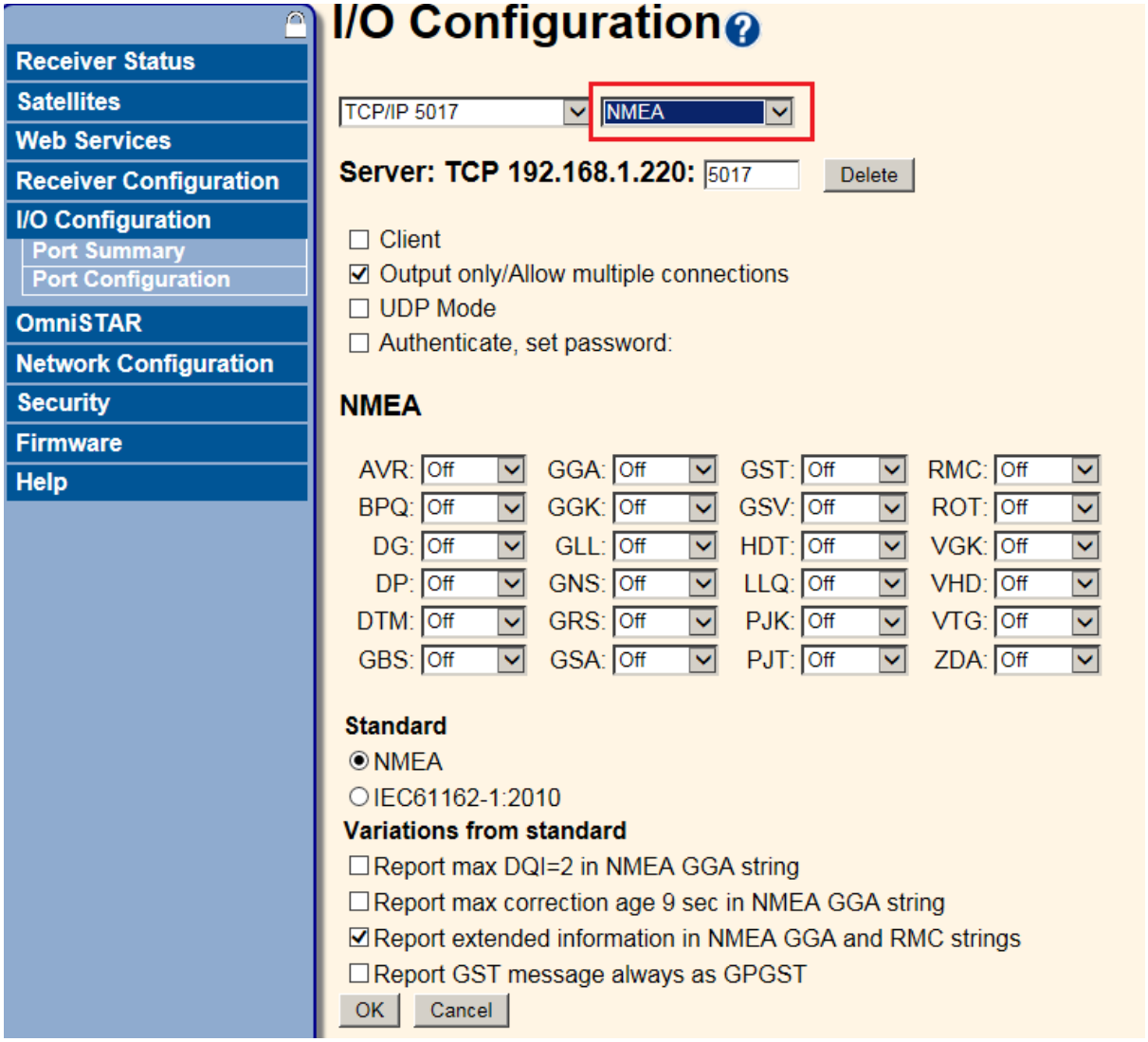


Figure 3.19 – BX982: Select NMEA protocol

The TCP port and IP address (as shown below) must be setup to match the TCP port selected in the XPosition configuration as described in section 3.4.

NOTE: If either the TCP port or IP address configured for the XPosition does not match that of the BX982 no connection will be established and the XPosition will not operate correctly.

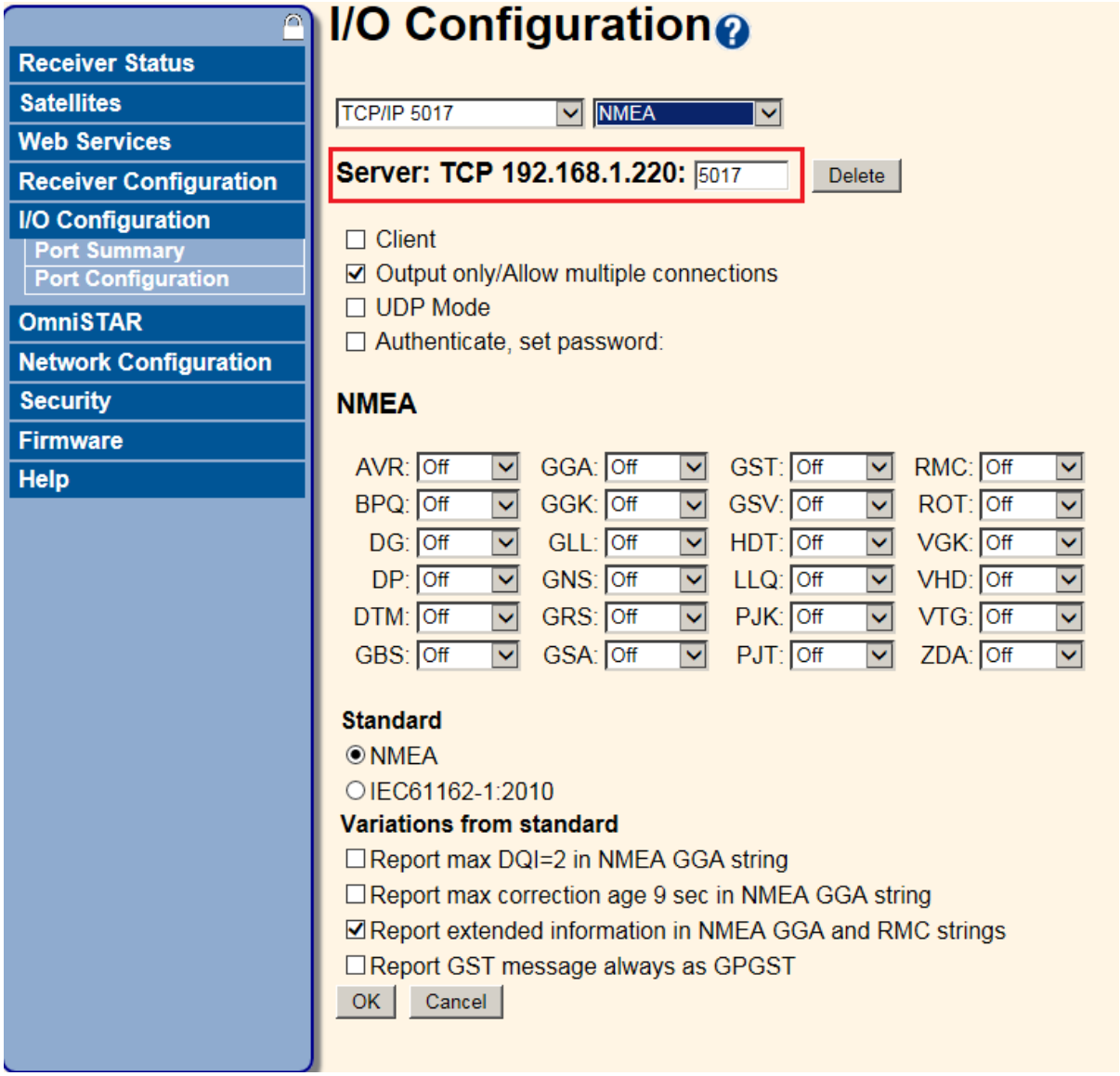


Figure 3.20 – BX982: Select TCP port

Once NMEA has been selected the user will need to select the relevant messages that the BX982 will need to output. The following will need to be selected; AVR, BPQ, GGA, GSA, GST, GSV, HDT, RMC, ROT, VTG, and ZDA. This is shown below:

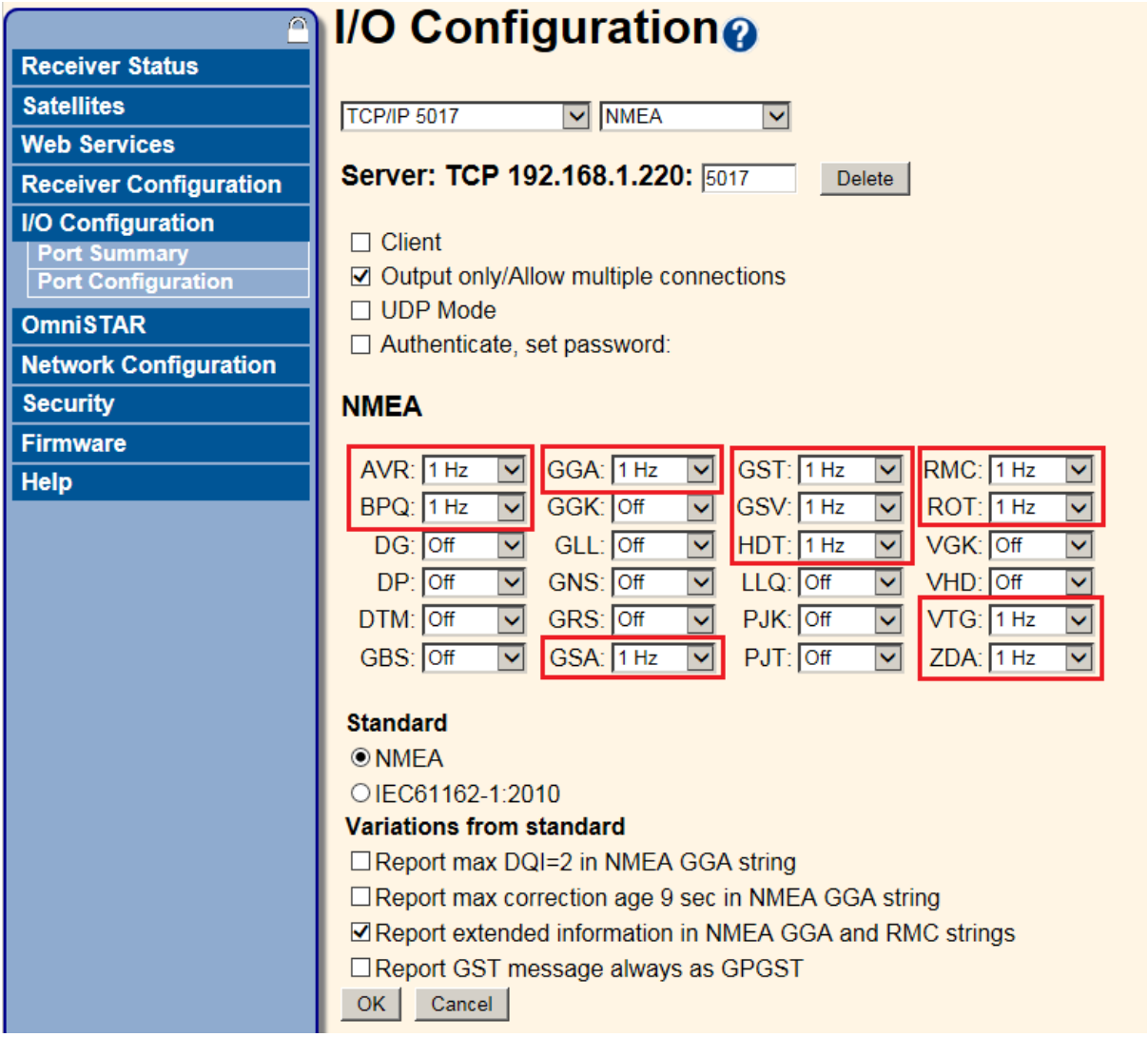
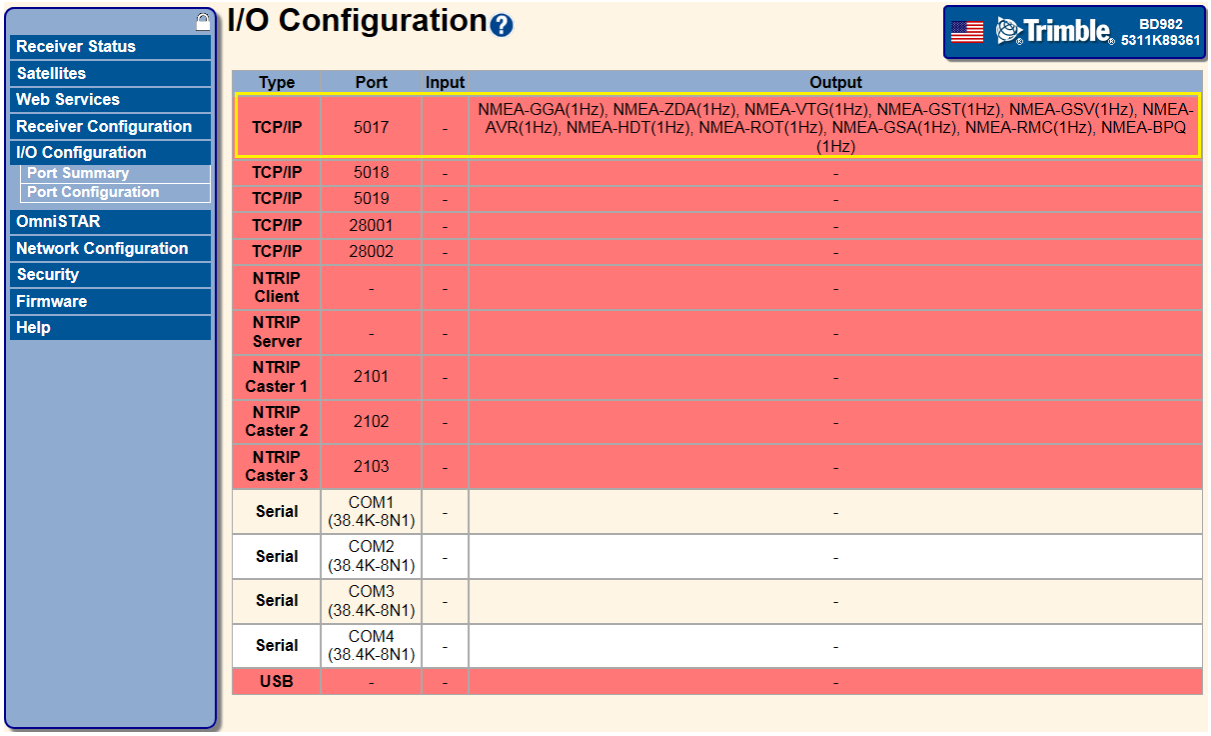


Figure 3.21 – BX982: Select NMEA output messages

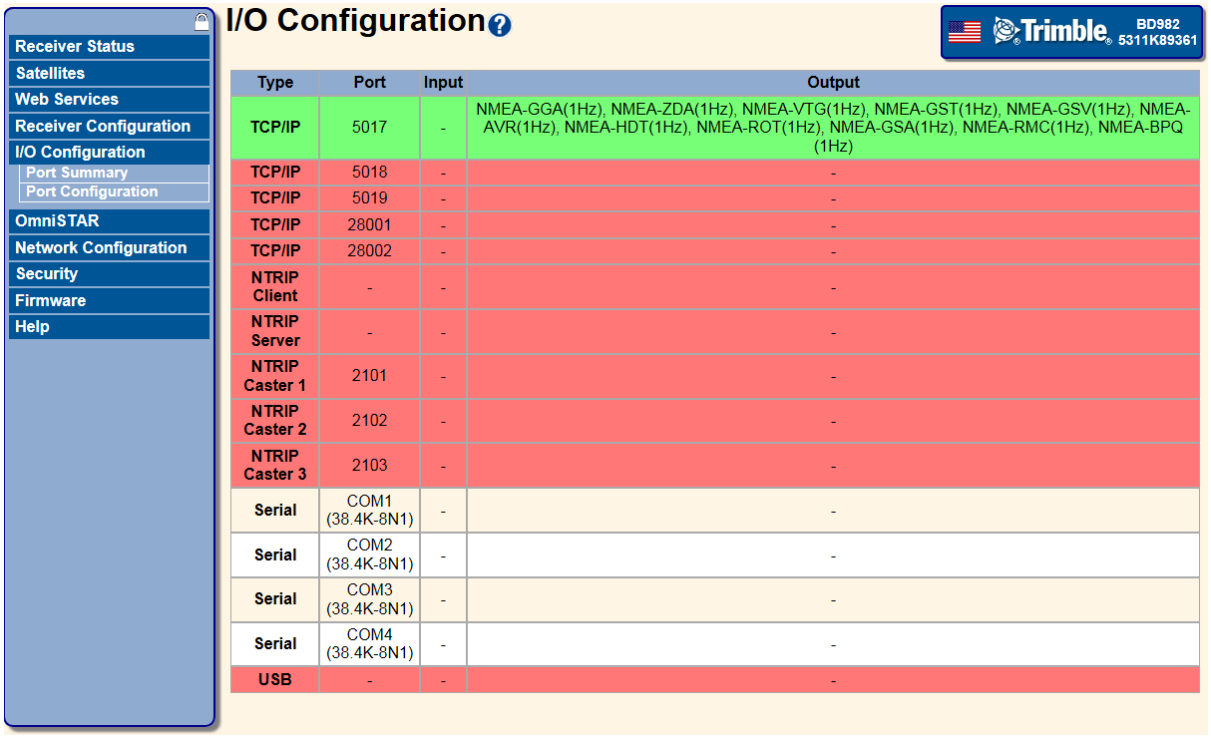
Once done the configured port will listen for a connection request from the XPosition as shown below:



Type	Port	Input	Output
TCP/IP	5017	-	NMEA-GGA(1Hz), NMEA-ZDA(1Hz), NMEA-VTG(1Hz), NMEA-GST(1Hz), NMEA-GSV(1Hz), NMEA-AVR(1Hz), NMEA-HDT(1Hz), NMEA-ROT(1Hz), NMEA-GSA(1Hz), NMEA-RMC(1Hz), NMEA-BPQ (1Hz)
TCP/IP	5018	-	-
TCP/IP	5019	-	-
TCP/IP	28001	-	-
TCP/IP	28002	-	-
NTRIP Client	-	-	-
NTRIP Server	-	-	-
NTRIP Caster 1	2101	-	-
NTRIP Caster 2	2102	-	-
NTRIP Caster 3	2103	-	-
Serial	COM1 (38.4K-8N1)	-	-
Serial	COM2 (38.4K-8N1)	-	-
Serial	COM3 (38.4K-8N1)	-	-
Serial	COM4 (38.4K-8N1)	-	-
USB	-	-	-

Figure 3.22 – BX982: Configured TCP/IP port

Once the XPosition has established a connection to the BX982 the port configured will turn green as shown below:



Type	Port	Input	Output
TCP/IP	5017	-	NMEA-GGA(1Hz), NMEA-ZDA(1Hz), NMEA-VTG(1Hz), NMEA-GST(1Hz), NMEA-GSV(1Hz), NMEA-AVR(1Hz), NMEA-HDT(1Hz), NMEA-ROT(1Hz), NMEA-GSA(1Hz), NMEA-RMC(1Hz), NMEA-BPQ (1Hz)
TCP/IP	5018	-	-
TCP/IP	5019	-	-
TCP/IP	28001	-	-
TCP/IP	28002	-	-
NTRIP Client	-	-	-
NTRIP Server	-	-	-
NTRIP Caster 1	2101	-	-
NTRIP Caster 2	2102	-	-
NTRIP Caster 3	2103	-	-
Serial	COM1 (38.4K-8N1)	-	-
Serial	COM2 (38.4K-8N1)	-	-
Serial	COM3 (38.4K-8N1)	-	-
Serial	COM4 (38.4K-8N1)	-	-
USB	-	-	-

Figure 3.23 – BX982: Connected TCP/IP port

3.6. MODULE DOWNLOAD

Once the XPosition configuration has been completed, it must be downloaded to the module.

Before downloading the Connection Path of the module should be set. This path will automatically default to the IP address of the module, as set in the module configuration. It can however be modified, if the XPosition is not on a local network.

The Connection path can be set by right-clicking on the module and selecting the Connection Path option.

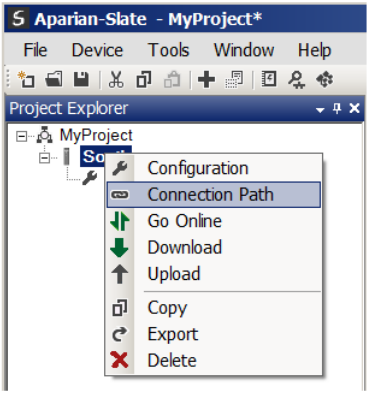


Figure 3.17. - Selecting Connection Path

The new connection path can then be either entered manually or selected by means of the Target Browser.

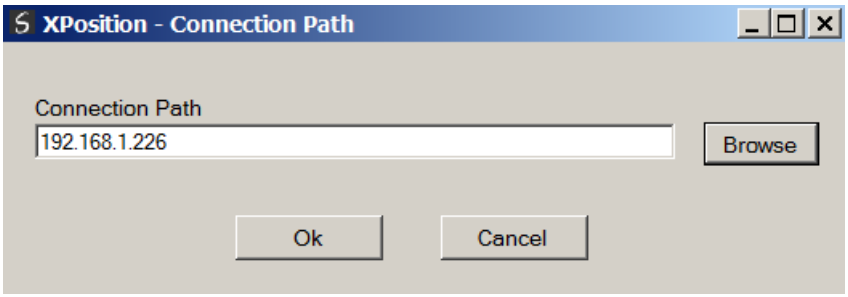


Figure 3.18. - Connection Path

To initiate the download, right-click on the module and select the Download option.

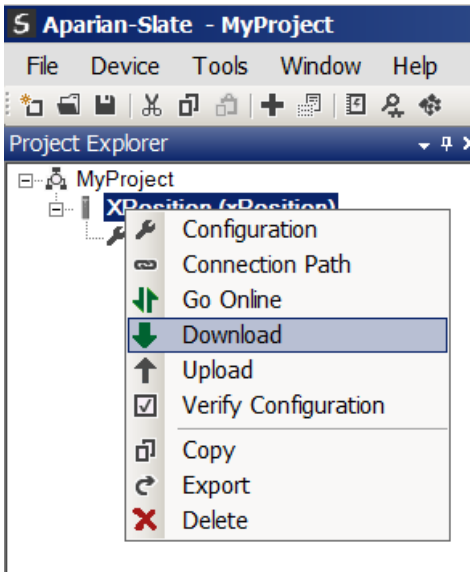


Figure 3.19. - Selecting Download

Once complete, the user will be notified that the download was successful.

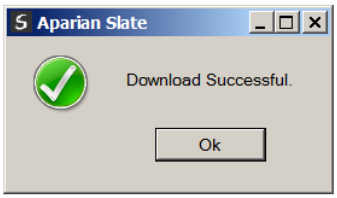


Figure 3.20. - Successful download

During the download process the module's time will be compared to that of the PC's time. Should the difference be greater than 30 seconds, the user will be prompted to set the module time to that of the PC time.

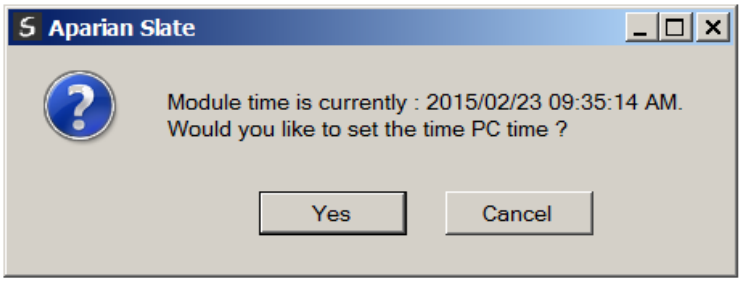


Figure 3.21. – Setting module time

The module time is used only for the event log.

Within the Slate environment the module will be in the Online state, indicated by the green circle around the module.

The module is now configured and will start operating immediately.

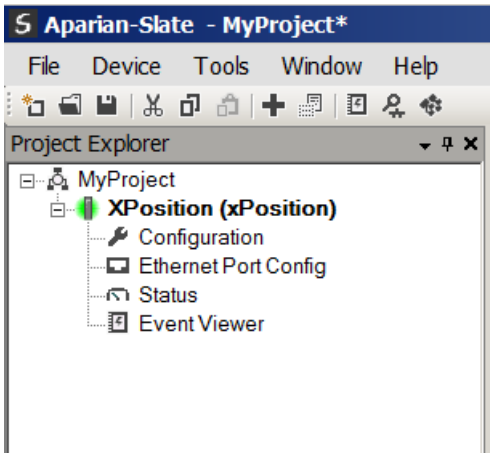


Figure 3.22. - Module online

3.7. RSLOGIX 5000 CONFIGURATION

The XPosition module will need to be configured for EtherNet/IP communication before it will connect to a Logix controller. This is done by setting the mode to EtherNet/IP under the general configuration (as shown below):

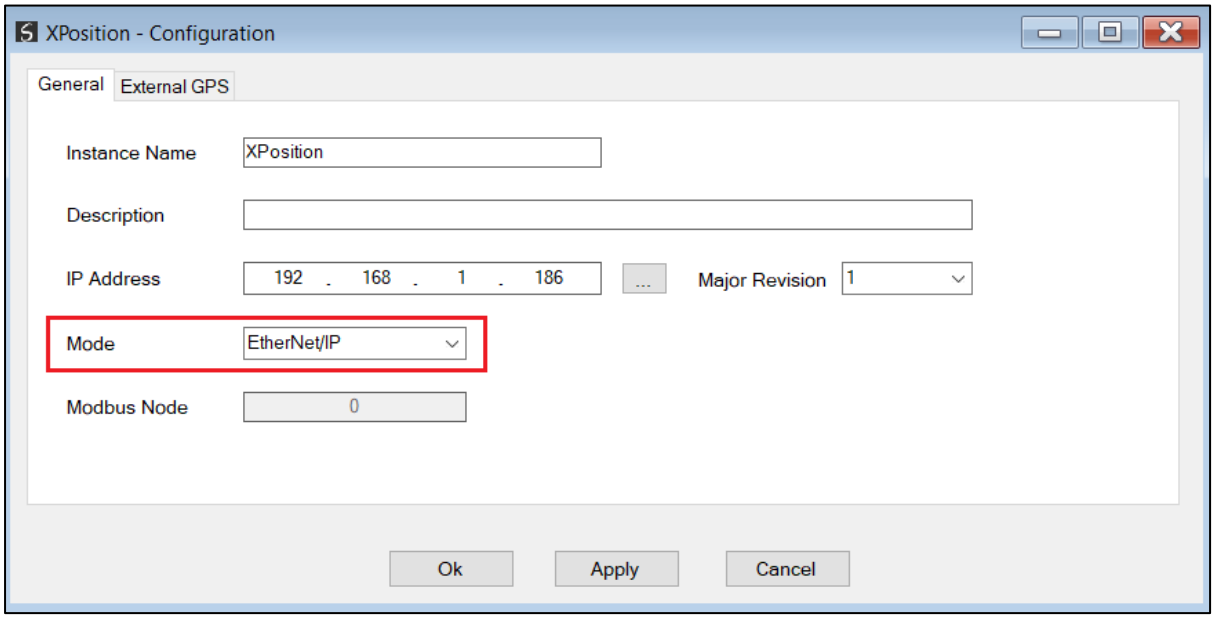


Figure 3.23. – EtherNet/IP mode

3.7.1. ADD MODULE TO I/O CONFIGURATION

The module needs to operate in a Logix "owned" mode. When the module operates in a Logix "owned" mode the XPosition will need to be added to the RSLogix 5000 I/O tree. The module will need to be added as a generic Ethernet module. This is done by right clicking on the Ethernet Bridge in the RSLogix 5000 and selecting *New Module* after which the *ETHERNET-MODULE* is selected to be added as shown in the figure below.

NOTE: See the next section for importing the configuration (L5X).

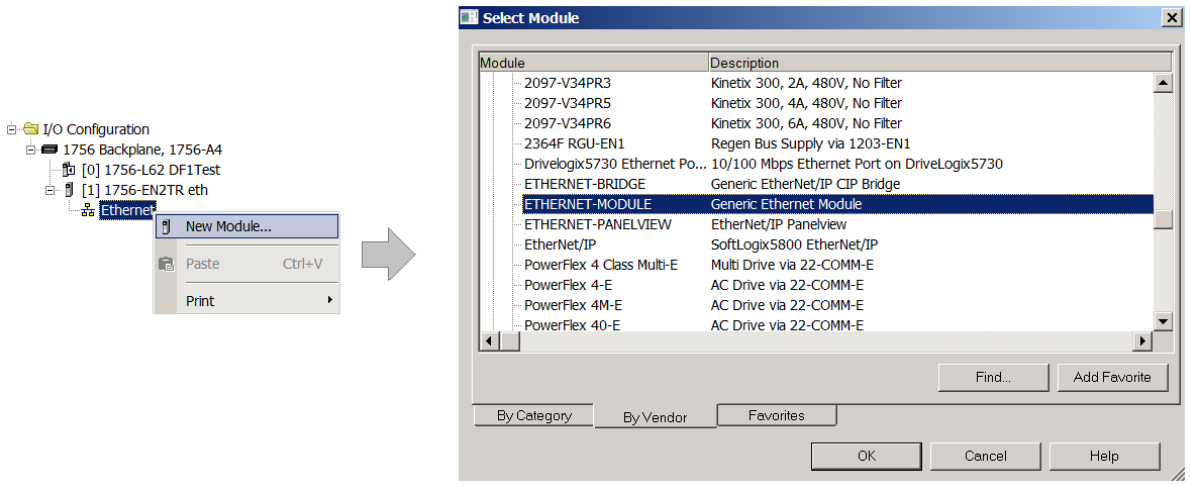


Figure 3.24 - Add a Generic Ethernet Module in RSLogix 5000

The user must enter the IP address of the XPosition that will be used. The assembly instance and size must also be added for the input, output, and configuration in the connection parameters section. Below are the required connection parameters.

Connection Parameter	Assembly Instance	Size
Input	107	59 (32-bit)
Output	124	7 (32-bit)
Configuration	102	0 (8-bit)

Table 3.3 - RSLogix class 1 connection parameters for the XPosition

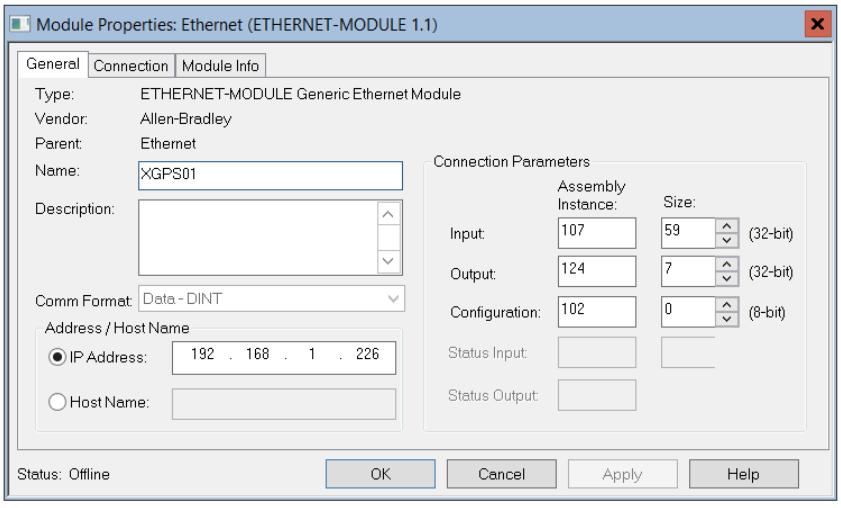


Figure 3.25 - RSLogix General module properties in RSLogix 5000

NOTE: The user will need to enter the exact connection parameters before the module will establish a class 1 connection with the Logix controller.

Next the user needs to add the connection requested packet interval (RPI). This is the rate at which the input and output assemblies are exchanged. The recommended value is 200ms. Refer to the technical specification section in this document for further details on the limits of the RPI.

NOTE: Although the module is capable of running with an RPI of 10ms, it is recommended to set the RPI to 200ms, to avoid unnecessary loading of the module processor.

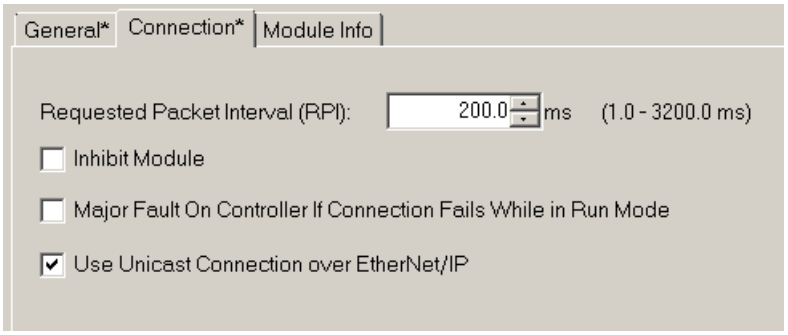


Figure 3.26 - Connection module properties in RSLogix 5000

Once the module has been added to the RSLogix 5000 I/O tree the user must assign the User Defined Types (UDTs) to the input and output assemblies. The user can import the required UDTs by right-clicking on *User-Defined* sub-folder in the *Data Types* folder of the IO tree and selecting *Import Data Type*. The assemblies are then assigned to the UDTs with a ladder copy instruction (COP) as shown in the figure below.

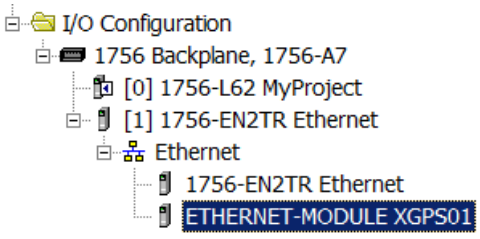


Figure 3.27 – RSLogix 5000 I/O module tree

3.7.2. Importing UDTs and Mapping Routines

To simplify the mapping of the input image, an RSLogix 5000 Routine Partial Import (L5X) file is provided.

This file can be imported by right-clicking on the required Program and selecting the Import Routine option.

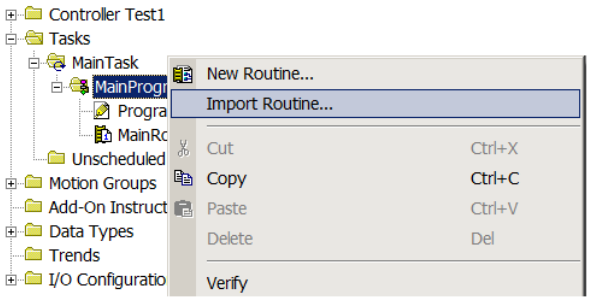


Figure 3.28. – RSLogix 5000 Importing XPosition specific routine and UDTs

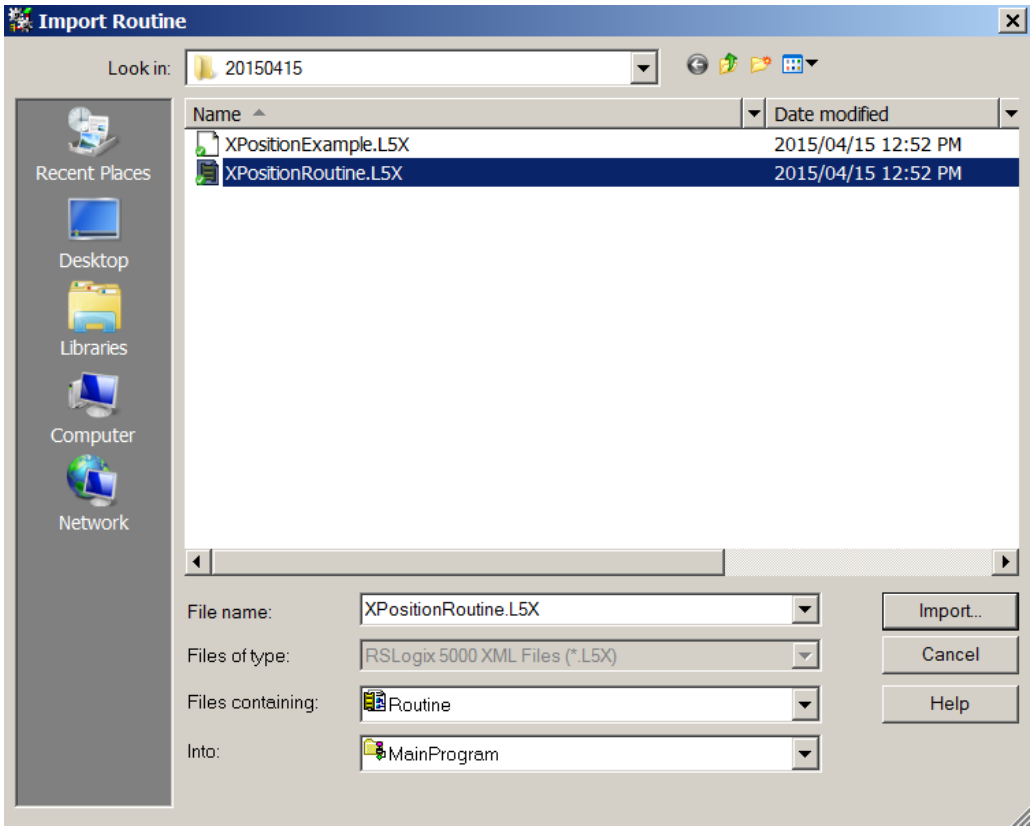


Figure 3.29. - Selecting partial import file

The import will create the following:

- The required UDTs (user defined data types)
- Two controller tags representing the Input and Output assemblies.
- A routine mapping the XPosition module to the aforementioned tags.

The user may need to change the routine to map to the correct XPosition module instance name, and make sure that the mapping routine is called by the Program's Main Routine.

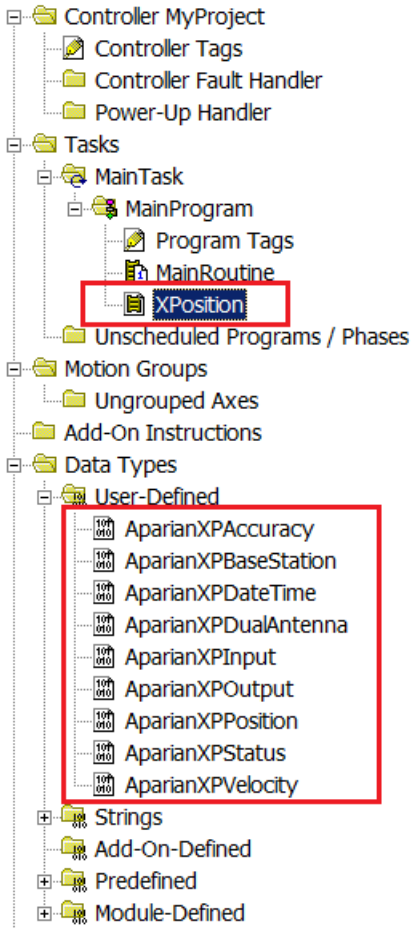


Figure 3.30. - Imported RSLogix 5000 objects

Refer to the additional information section of this document for an example RSLogix 5000 project as well as the required UDTs.

3.8. MODBUS TCP CONFIGURATION

The XPosition module will need to be configured for Modbus TCP communication before a Modbus Master will be able to communicate with it (the XPosition module will operate as a Modbus Slave). This is done by setting the mode to Modbus TCP under the general configuration (as shown below).

The user will also need to configure a Modbus Node address for the XPosition which will be used by the Modbus Master to communicate with the XPosition.

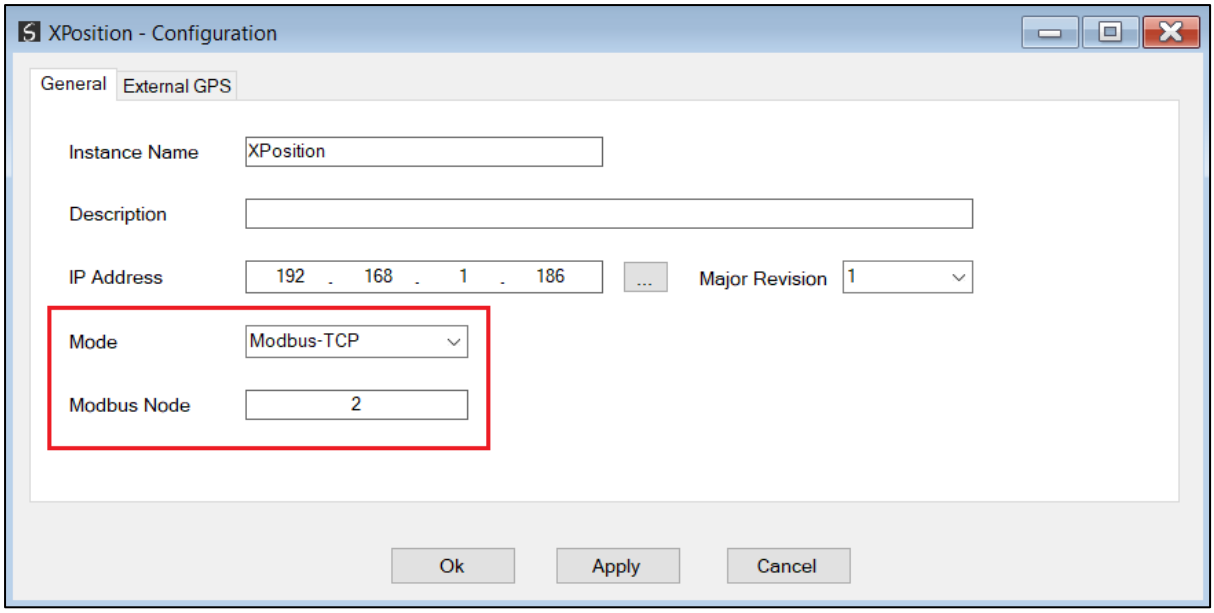


Figure 3.31. – Modbus TCP mode

4. OPERATION

4.1. POSITIONING

The module provides position information that can either be used in its raw format or as a relative format. The module provides Latitude, Longitude, and Altitude (LLA) information in its raw format in the input assembly (see section 4.4.1). The position is also available in a relative LLA position. This affords better accuracy in the input assembly by avoiding the errors associated with single floating-point math. The user can enter the reference LLA position into the output assembly of the module which will be subtracted from the raw LLA data, (using double floating-point (64 bit) math,) providing LLA that is relative to the reference position as shown below:

⊟ XGPS01Input.Position	{...}		AparianXPPosition
XGPS01Input.Position.Latitude	-26.20278	Float	REAL
XGPS01Input.Position.Longtitude	28.002779	Float	REAL
XGPS01Input.Position.Altitude	1600.8	Float	REAL
XGPS01Input.Position.ReferenceLatitude	0.0	Float	REAL
XGPS01Input.Position.ReferenceLongtitude	0.0	Float	REAL
XGPS01Input.Position.ReferenceAltitude	0.0	Float	REAL
XGPS01Input.Position.RelativeLatitude	-26.202778	Float	REAL
XGPS01Input.Position.RelativeLongtitude	28.002777	Float	REAL
XGPS01Input.Position.RelativeAltitude	1600.8	Float	REAL
XGPS01Input.Position.RelativeNorth	2674511.0	Float	REAL
XGPS01Input.Position.RelativeEast	-3220996.8	Float	REAL
⊞ XGPS01Input.Accuracy	{...}		AparianXPAccuracy
⊟ XGPS01Input.BaseStation	{...}		AparianXPBaseStation
⊞ XGPS01Input.BaseStation.ReferenceStationId	34	Decimal	DINT
XGPS01Input.BaseStation.CorrectionAge	0.0	Float	REAL
⊞ XGPS01Input.BaseStation.Type	1	Decimal	DINT
⊞ XGPS01Input.DualAntenna	{...}		AparianXPDualAntenna
⊟ XGPS01Output	{...}		AparianXPOutput
⊞ XGPS01Output.ReferenceLatitudeDegrees	0	Decimal	INT
⊞ XGPS01Output.ReferenceLatitudeMinutes	0	Decimal	INT
XGPS01Output.ReferenceLatitudeSeconds	0.0	Float	REAL
XGPS01Output.ReferenceLatitudeSouth	0	Decimal	BOOL
⊞ XGPS01Output.ReferenceLongtitudeDegrees	0	Decimal	INT
⊞ XGPS01Output.ReferenceLongtitudeMinutes	0	Decimal	INT
XGPS01Output.ReferenceLongtitudeSeconds	0.0	Float	REAL
XGPS01Output.ReferenceLongtitudeWest	0	Decimal	BOOL
XGPS01Output.ReferenceAltitude	0.0	Float	REAL

Figure 4.1. – Relative position with **no** reference position

XGPS01Input.Position	{...}		AparianXPPosition
XGPS01Input.Position.Latitude	-26.20278	Float	REAL
XGPS01Input.Position.Longtitude	28.002779	Float	REAL
XGPS01Input.Position.Altitude	1600.8	Float	REAL
XGPS01Input.Position.ReferenceLatitude	-26.198889	Float	REAL
XGPS01Input.Position.ReferenceLongtitude	28.004028	Float	REAL
XGPS01Input.Position.ReferenceAltitude	1610.0	Float	REAL
XGPS01Input.Position.RelativeLatitude	-3.88888782e-003	Float	REAL
XGPS01Input.Position.RelativeLongtitude	-0.00125	Float	REAL
XGPS01Input.Position.RelativeAltitude	-9.2	Float	REAL
XGPS01Input.Position.RelativeNorth	432.73666	Float	REAL
XGPS01Input.Position.RelativeEast	124.804596	Float	REAL
XGPS01Input.Accuracy	{...}		AparianXPAccuracy
XGPS01Input.BaseStation	{...}		AparianXPBaseStation
XGPS01Input.BaseStation.ReferenceStationId	34	Decimal	DINT
XGPS01Input.BaseStation.CorrectionAge	0.0	Float	REAL
XGPS01Input.BaseStation.Type	1	Decimal	DINT
XGPS01Input.DualAntenna	{...}		AparianXPDualAntenna
XGPS01Output	{...}		AparianXPOutput
XGPS01Output.ReferenceLatitudeDegrees	26	Decimal	INT
XGPS01Output.ReferenceLatitudeMinutes	11	Decimal	INT
XGPS01Output.ReferenceLatitudeSeconds	56.0	Float	REAL
XGPS01Output.ReferenceLatitudeSouth	1	Decimal	BOOL
XGPS01Output.ReferenceLongtitudeDegrees	28	Decimal	INT
XGPS01Output.ReferenceLongtitudeMinutes	0	Decimal	INT
XGPS01Output.ReferenceLongtitudeSeconds	14.5	Float	REAL
XGPS01Output.ReferenceLongtitudeWest	0	Decimal	BOOL
XGPS01Output.ReferenceAltitude	1610.0	Float	REAL

Figure 4.2. – Relative position with reference position

In addition to the relative LLA position the module also provides a relative North and relative East position for the given reference. These values are given in meters from the reference point and simplify the application logic required for equipment positioning and collision avoidance systems.

NOTE: The reference coordinates should not contain negative values. The South and West bits should be set to select the southern and western hemispheres respectively.

4.2. RSLOGIX 5000 ASSEMBLIES

When the module operates in a Logix “owned” mode the Logix controller will establish a class 1 cyclic communication connection with the XPosition. An input and output assembly is exchanged at a fix interval. The UDTs provided will convert the input and output arrays into tag based assemblies. Refer to the additional information section in this document for the input and output UDTs.

4.2.1. INPUT ASSEMBLY

The following parameters are used in the input assembly of the module.

Parameter	Datatype	Description
Instance	STRING	This parameter is the instance name of the module that was configured under the general Time Sync configuration in Slate.
Status.ConfigValid	BOOL	Set if a valid configuration is executing in the module.
Status.ExternalDeviceConnected	BOOL	Set if the XPosition module is connected to the external GPS receiver
Status.Fix2D	BOOL	Set if the GPS receiver has obtained a 2-dimensional fix
Status.Fix3D	BOOL	Set if the GPS receiver has obtained a 3-dimensional fix
Status.FixAutonomous	BOOL	Set if the GPS receiver has obtained autonomous fix. This bit can be used to determine if the module has sufficient satellites to provide accurate time and position information.
Status.FixDifferential	BOOL	Set if the GPS receiver has obtained differential fix. This will only be possible if the differential satellite constellation has been enabled (i.e. SBAS). When the module is set into position mode the SBAS constellation is automatically enabled.
SatelliteCount	SINT	This is the count of satellites used for the position and time fix.
DateTime.Year	INT	Current year.
DateTime.Month	SINT	Current month.
DateTime.Day	SINT	Current day.
DateTime.Hour	SINT	Current hour.
DateTime.Minute	SINT	Current minute.
DateTime.Second	SINT	Current second.
Velocity.TrueCourseOverGround	REAL	This is the true course over ground and is measured in degrees from true north.
Velocity.MagneticCourseOverGround	REAL	This is the magnetic course over ground and is measured in degrees from magnetic north.
Velocity.SpeedOverGroundKnots	REAL	The current speed of the antenna (connected to the Time Sync module) in Knots.
Velocity.SpeedOverGroundKmh	REAL	The current speed of the antenna (connected to the Time Sync module) in Km/h.

Position.Latitude	REAL	Current latitude in degrees format (e.g. -26.106388 degrees). A negative indicates the position is in the southern hemisphere.
Position.Longitude	REAL	Current longitude in degrees format (e.g. 28.00225 degrees). A negative indicates the position is in the western hemisphere.
Position.Altitude	REAL	Current altitude in meters above mean sea level.
Position.ReferenceLatitude	REAL	The reference latitude position from the output assembly in degrees format (e.g. -26.106388 degrees).
Position.ReferenceLongitude	REAL	The reference longitude position from the output assembly in degrees format (e.g. 28.00225 degrees).
Position.ReferenceAltitude	REAL	Reference altitude from the output assembly in meters.
Position.RelativeLatitude	REAL	Relative latitude in degrees format (Raw latitude less Reference latitude). A negative would indicate south of the reference LLA position.
Position.RelativeLongitude	REAL	Relative longitude in degrees format (Raw longitude less Reference longitude). A negative would indicate west of the reference LLA position.
Position.RelativeAltitude	REAL	Relative altitude in meters format (Raw altitude less Reference altitude).
Position.RelativeNorth	REAL	Relative distance in meters from the reference position along the North-South axis. A positive number indicates the antenna is currently north of the reference position.
Position.RelativeEast	REAL	Relative distance in meters from the reference position along the East-West axis. A positive number indicates the antenna is currently east of the reference position.
Accuracy.PDOP	REAL	Position dilution of precision. See section 2.4 for a better understanding as well as the GPS information in section 1.4.
Accuracy.HDOP	REAL	Horizontal dilution of precision. See section 2.4 for a better understanding as well as the GPS information in section 1.4.
Accuracy.VDOP	REAL	Vertical dilution of precision. See section 2.4 for a better understanding as well as the GPS information in section 1.4.
Accuracy.SemiMajorAxisError	REAL	Standard deviation of the semi-major axis
Accuracy.SemiMinorAxisError	REAL	Standard deviation of the semi-minor axis
Accuracy.OrientationError	REAL	Orientation of the semi-major axis.
Accuracy.LatitudeError	REAL	Estimated error (in meters) of the latitude provided.
Accuracy.LongitudeError	REAL	Estimated error (in meters) of the longitude provided.
Accuracy.AltitudeError	REAL	Estimated error (in meters) of the altitude provided.

BaseStation.ReferenceStationId	DINT	When using a base station for differential GPS this is the reference station's ID. Ranges from 0000 to 1023
BaseStation.CorrectionAge	REAL	This is the age of the differential GPS data record received.
BaseStation.Type	DINT	Base station GPS quality indicator: 0 – No Fix 1 – Autonomous GPS fix 2 – Differential SBAS 3 – RTK Fixed 5 – OmniSTAR XP, OmniSTAR HP, Float RTK, or Location RTK
DualAntenna.Heading	REAL	Heading relative to true north in degrees
DualAntenna.Yaw	REAL	Yaw angle in degrees
DualAntenna.Tilt	REAL	Tilt angle in degrees
DualAntenna.Range	REAL	Range in meters
DualAntenna.RateOfTurn	REAL	Rate and direction of turn in degrees/minute. A negative indicates bow turns to port.
DualAntenna.RateOfTurnValid	SINT	0 – Invalid 1 – Valid
DualAntenna.GPSQuality	SINT	0 – No Fix 1 – Autonomous GPS fix 2 – Differential carrier phase solution RTK (Float) 3 – Differential carrier phase solution RTK (Fix) 4 – Differential code-based solution, DGPS

Table 4.1 - RSLogix 5000 input assembly parameters

4.2.2. Output Assembly

The following parameters are used in the output assembly of the module.

Parameter	Datatype	Description
ReferenceLatitudeDegrees	INT	The integer latitude degrees of the of the reference position.
ReferenceLatitudeMinutes	INT	The integer latitude minutes of the of the reference position.
ReferenceLatitudeSeconds	REAL	The floating-point latitude seconds of the of the reference position.
ReferenceLatitudeSouth	BOOL	Used to specify the northern or southern hemisphere. 0 = North 1 = South

ReferenceLongtitudeDegrees	INT	The integer longitude degrees of the of the reference position.
ReferenceLongtitudeMinutes	INT	The integer longitude minutes of the of the reference position.
ReferenceLongtitudeSeconds	REAL	The floating-point longitude seconds of the of the reference position.
ReferenceLongtitudeWest	BOOL	Used to specify the eastern or western hemisphere. 0 = East 1 = West
ReferenceAltitude	REAL	Reference altitude in meters above mean sea level.

Table 4.2 - RSLogix 5000 output assembly parameters

4.3. MODBUS REGISTERS

The Modbus TCP operation is enabled when the mode is set to either Modbus TCP. The XPosition module will then operate as a Modbus TCP Slave supporting the following Modbus registers.

Register Type:	**Holding Registers**			
Input Assembly (read-only)	**Byte Length**	**Date Type**	**Register**	**Description**
Instance Name Length	4	DINT	0	This parameter is the instance name of the module that was configured under the general Time Sync configuration in Slate.
Instance Name	82	SINT[82]	2	
Reserved	2	INT	43	
Status	4	DINT	44	
Status.ConfigValid		BOOL		Set if a valid configuration is executing in the module.
Status.ExternalDeviceConnected		BOOL		Set if the XPosition module is connected to the external GPS receiver
Status.Fix2D		BOOL		Set if the GPS receiver has obtained a 2-dimensional fix
Status.Fix3D		BOOL		Set if the GPS receiver has obtained a 3-dimensional fix
Status.FixAutonomous		BOOL		Set if the GPS receiver has obtained autonomous fix. This bit can be used to determine if the module has sufficient satellites to provide accurate time and position information.
Status.FixDifferential		BOOL		Set if the GPS receiver has obtained differential fix. This will only be possible if the differential satellite constellation has been enabled (i.e. SBAS). When the module is set into position mode the SBAS constellation is automatically enabled.
SatelliteCount	1	SINT	46	This is the count of satellites used for the position and time fix.
Reserved	3	SINT[3]		
DateTime.Year	2	INT	48	Current year.
DateTime.Month	1	SINT	49	Current month.

DateTime.Day	1	SINT		Current day.
DateTime.Hour	1	SINT	50	Current hour.
DateTime.Minute	1	SINT		Current minute.
DateTime.Second	1	SINT	51	Current second.
Reserved	1	SINT		
Velocity.TrueCourseOverGround	4	REAL	52	This is the true course over ground and is measured in degrees from true north.
Velocity.MagneticCourseOverGround	4	REAL	54	This is the magnetic course over ground and is measured in degrees from magnetic north.
Velocity.SpeedOverGroundKnots	4	REAL	56	The current speed of the antenna (connected to the Time Sync module) in Knots.
Velocity.SpeedOverGroundKmh	4	REAL	58	The current speed of the antenna (connected to the Time Sync module) in Km/h.
Position.Latitude	4	REAL	60	Current latitude in degrees format (e.g. -26.106388 degrees). A negative indicates the position is in the southern hemisphere.
Position.Longitude	4	REAL	62	Current longitude in degrees format (e.g. 28.00225 degrees). A negative indicates the position is in the western hemisphere.
Position.Altitude	4	REAL	64	Current altitude in meters above mean sea level.
Position.ReferenceLatitude	4	REAL	66	The reference latitude position from the output assembly in degrees format (e.g. -26.106388 degrees).
Position.ReferenceLongitude	4	REAL	68	The reference longitude position from the output assembly in degrees format (e.g. 28.00225 degrees).
Position.ReferenceAltitude	4	REAL	70	Reference altitude from the output assembly in meters.
Position.RelativeLatitude	4	REAL	72	Relative latitude in degrees format (Raw latitude less Reference latitude). A negative would indicate south of the reference LLA position.
Position.RelativeLongitude	4	REAL	74	Relative longitude in degrees format (Raw longitude less Reference longitude). A negative would indicate west of the reference LLA position.
Position.RelativeAltitude	4	REAL	76	Relative altitude in meters format (Raw altitude less Reference altitude).
Position.RelativeNorth	4	REAL	78	Relative distance in meters from the reference position along the North-South axis. A positive number indicates the antenna is currently north of the reference position.
Position.RelativeEast	4	REAL	80	Relative distance in meters from the reference position along the East-West axis. A positive number indicates the antenna is currently east of the reference position.
Accuracy.PDOP	4	REAL	82	Position dilution of precision. See section 2.4 for a better understanding as well as the GPS information in section 1.4.
Accuracy.HDOP	4	REAL	84	Horizontal dilution of precision. See section 2.4 for a better understanding as well as the GPS information in section 1.4.
Accuracy.VDOP	4	REAL	86	Vertical dilution of precision. See section 2.4 for a better understanding as well as the GPS information in section 1.4.
Accuracy.SemiMajorAxisError	4	REAL	88	Standard deviation of the semi-major axis

Accuracy.SemiMinorAxisError	4	REAL	90	Standard deviation of the semi-minor axis
Accuracy.OrientationError	4	REAL	92	Orientation of the semi-major axis.
Accuracy.LatitudeError	4	REAL	94	Estimated error (in meters) of the latitude provided.
Accuracy.LongitudeError	4	REAL	96	Estimated error (in meters) of the longitude provided.
Accuracy.AltitudeError	4	REAL	98	Estimated error (in meters) of the altitude provided.
BaseStation.ReferenceStationId	4	DINT	100	When using a base station for differential GPS this is the reference station's ID. Ranges from 0000 to 1023
BaseStation.CorrectionAge	4	REAL	102	This is the age of the differential GPS data record received.
BaseStation.Type	4	DINT	104	Base station GPS quality indicator: 0 – No Fix 1 – Autonomous GPS fix 2 – Differential SBAS 3 – RTK Fixed 5 – OmniSTAR XP, OmniSTAR HP, Float RTK, or Location RTK
DualAntenna.Heading	4	REAL	106	Heading relative to true north in degrees
DualAntenna.Yaw	4	REAL	108	Yaw angle in degrees
DualAntenna.Tilt	4	REAL	110	Tilt angle in degrees
DualAntenna.Range	4	REAL	112	Range in meters
DualAntenna.RateOfTurn	4	REAL	114	Rate and direction of turn in degrees/minute. A negative indicates bow turns to port.
DualAntenna.RateOfTurnValid	1	SINT	116	0 – Invalid 1 – Valid
DualAntenna.GPS Quality	1	SINT		0 – No Fix 1 – Autonomous GPS fix 2 – Differential carrier phase solution RTK (Float) 3 – Differential carrier phase solution RTK (Fix) 4 – Differential code-based solution, DGPS
Reserved	2	SINT[2]	117	
Output Assembly (write-only)	**Byte Length**	**Date Type**	**Register**	**Description**
Reference Latitude Degrees	2	INT	500	The integer latitude degrees of the of the reference position.
Reference Latitude Minutes	2	INT	501	The integer latitude minutes of the of the reference position.
Reference Latitude Seconds	4	REAL	502	The floating-point latitude seconds of the of the reference position.
Reference Latitude South	2	INT	504	Used to specify the northern or southern hemisphere. 0 = North 1 = South
Reference Longitude Degrees	2	INT	505	The integer longitude degrees of the of the reference position.
Reference Longitude Minutes	2	INT	506	The integer longitude minutes of the of the reference position.

Reserved	2	INT	507	
Reference Longitude Seconds	4	REAL	508	The floating-point longitude seconds of the of the reference position.
Reference Longitude West	4	DINT	510	Used to specify the eastern or western hemisphere. 0 = East 1 = West
Reference Altitude	4	REAL	512	Reference altitude in meters above mean sea level.

Table 4.3 - Modbus Register Map

5. DIAGNOSTICS

5.1. LEDS

The module provides three LEDs for diagnostics purposes as shown in the front view figure below. A description of each LED is given in the table below.

Figure 5.1 - XPosition front view

LED	Description
Module	The module LED will provide information regarding the system-level operation of the module. Thus if the LED is red then the module is not operating correctly. For example if the module application firmware has been corrupted or there is a hardware fault the module will have a red Module LED. If the LED is green then the module has booted and is running correctly.
Activity	The activity LED will flash every time a packet is received from the external GPS receiver. When the LED flashes green the external GPS receiver has position fix whilst a red flashing LED indicates that the GPS receiver must still obtain position fix.
Ethernet	The Ethernet LED will light up when an Ethernet link has been detected (by plugging in a connected Ethernet cable). The LED will flash every time traffic was detected.

Table 5.1 - Module LED operation

5.2. MODULE STATUS MONITORING IN SLATE

The XPosition can provide a range of statistics which can assist with module operation, maintenance, and fault finding. The statistics can be accessed in full by Slate or using the web server in the module.

To view the module's status in the Aparian-Slate environment, the module must be online. If the module is not already Online (following a recent configuration download), then right-click on the module and select the *Go Online* option.

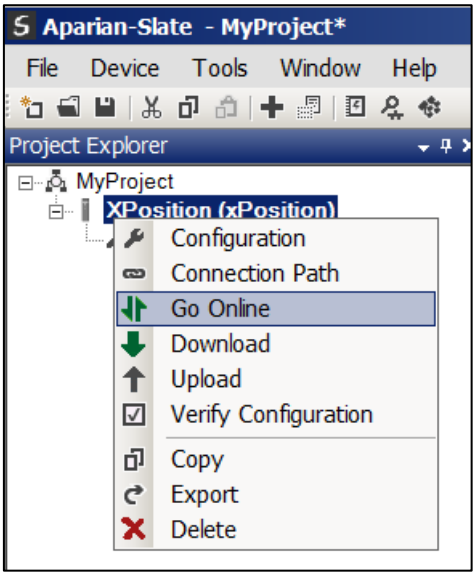


Figure 5.2. - Selecting to Go Online

The Online mode is indicated by the green circle behind the module in the Project Explorer tree.

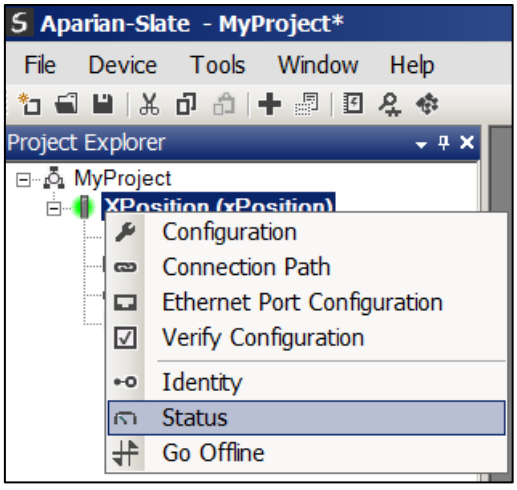


Figure 5.3. - Selecting online Status

The Status monitoring window can be opened by either double-clicking on the *Status* item in the Project Explorer tree, or by right-clicking on the module and selecting *Status*.

The status window contains multiple tabs to display the current status of the module. Most of these parameters in the status windows are self-explanatory or have been discussed in previous sections.

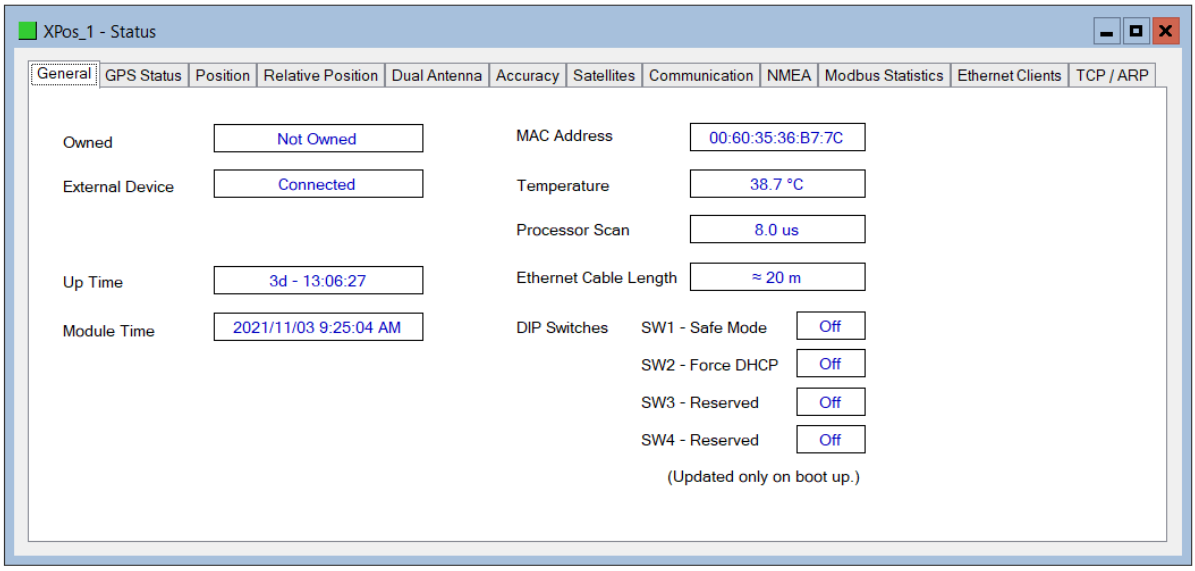


Figure 5.4. - Status monitoring - General

The General tab displays the following general parameters and can also be used to set the module time to the PC time:

Parameter	Description
Owned	Indicates whether or not the module is currently owned (Class 1) by a Logix controller.
External Device	Indicates if the external GPS receiver is connected to the module.
Up Time	Indicates the elapsed time since the module was powered-up.
Module Time	Indicates the module's internal time. The module time is stored in UTC (Universal Coordinate Time) but displayed on this page according to the local PC Time Zone settings.
MAC Address	Displays the module's unique Ethernet MAC address.
Temperature	The internal temperature of the module.
Processor Scan	The amount of time (microseconds) taken by the module's processor in the last scan.
DIP Switch Position	The status of the DIP switches when the module booted. Note that this status will not change if the DIP switches are altered when the module is running.

Table 5.2 - Parameters displayed in the Status Monitoring – General Tab

The Communication tab provides the Communication statistics of the external GPS receiver.

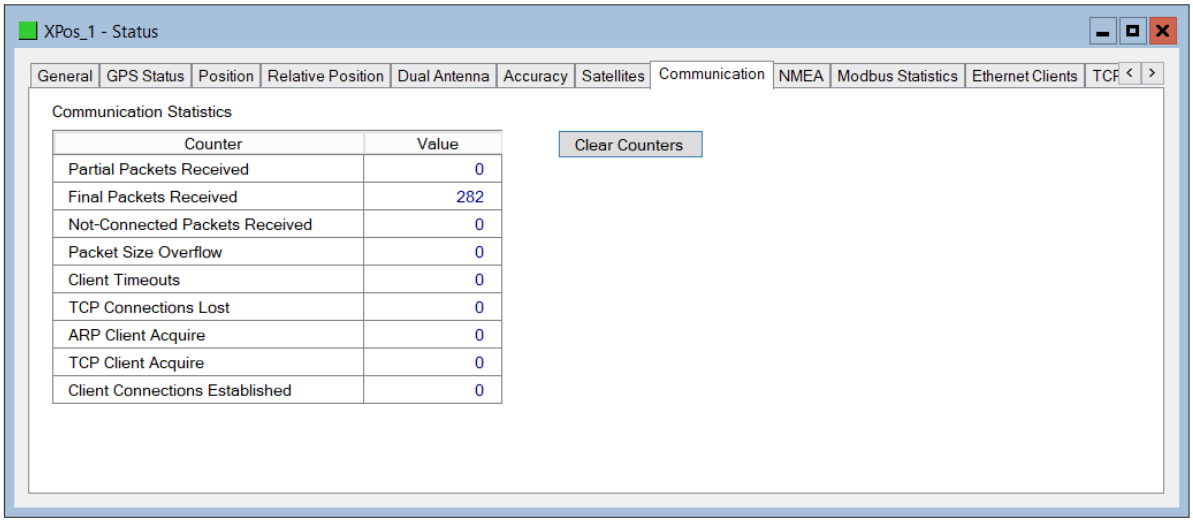


Figure 5.5. - Status monitoring – Communication Statistics

The following Communication statistics are shown:

Statistic	Description
Partial Packets Received	The number of partial NMEA packets received
Final Packets Received	The number of complete NMEA packets received
Not-Connected Packets Received	The number of NMEA packets received after the TCP connections is closed.
Packet Size Overflow	The number of times where the Internal NMEA data buffer overflowed.
Client Timeouts	The number of times where the TCP connection was closed due to inactivity.
TCP Connection Lost	The number of times where the TCP connection was terminated.
ARP Client Acquire	The number of ARP requests sent to resolve the MAC address.
TCP Client Acquire	The number of TCP connection requests sent.
Client Connections Established	The number of times where a successful TCP connection was established.

Table 5.3 - Parameters displayed in the Status Monitoring – Communincation Statistics

The NMEA statistics provides the number of packets received for each specific NMEA type.

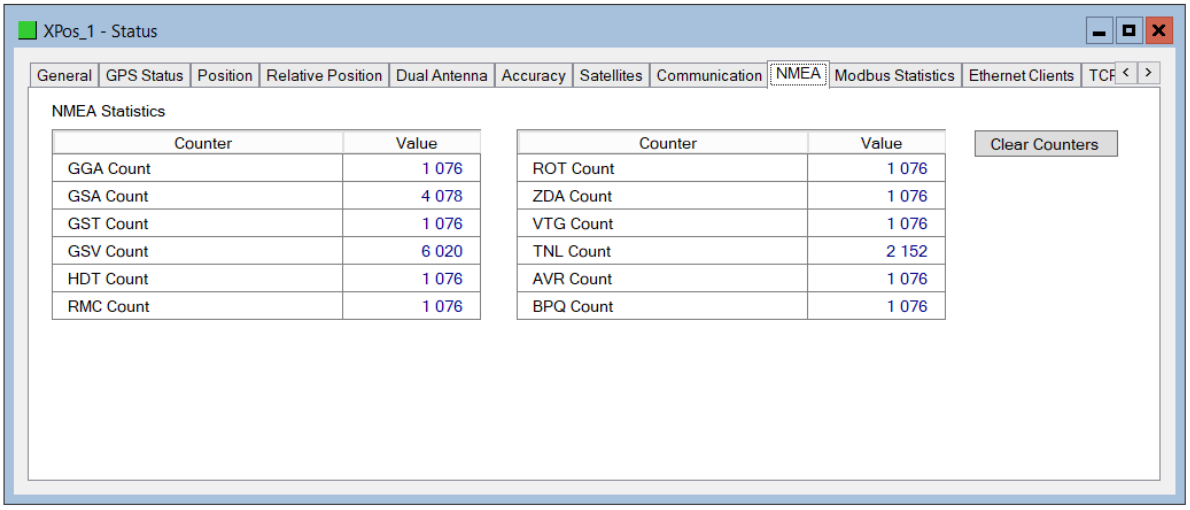


Figure 5.5. - Status monitoring – NMEA

The NMEA Statistics tab displays the following NMEA statistics:

Statistic	Description
GGA Count	The number of GGA packets received (Time, Position and fix data)
GSA Count	The number of GSA packets received (GPS DOP and Active SV information)
GST Count	The number of GST packets received (Position Error statistics)
GSV Count	The number of GSV packets received (SV information)
HDT Count	The number of HDT packets received (Heading)
RMC Count	The number of RMC packets received (Position, Velocity, Time)
ROT Count	The number of ROT packets received (Rate of Turn)
ZDA Count	The number of ZDA packets received (UTC and local time offset)
VTG Count	The number of VTG packets received (Actual Track and Ground Speed)
TNL Count	The number of TNL packets received (Time, Position)
AVR Count	The number of AVR packets received (Yaw, Tilt, Range)
BPQ Count	The number of BPQ packets received (Base station information)

Table 5.3 - Parameters displayed in the Status Monitoring – NMEA Statistics

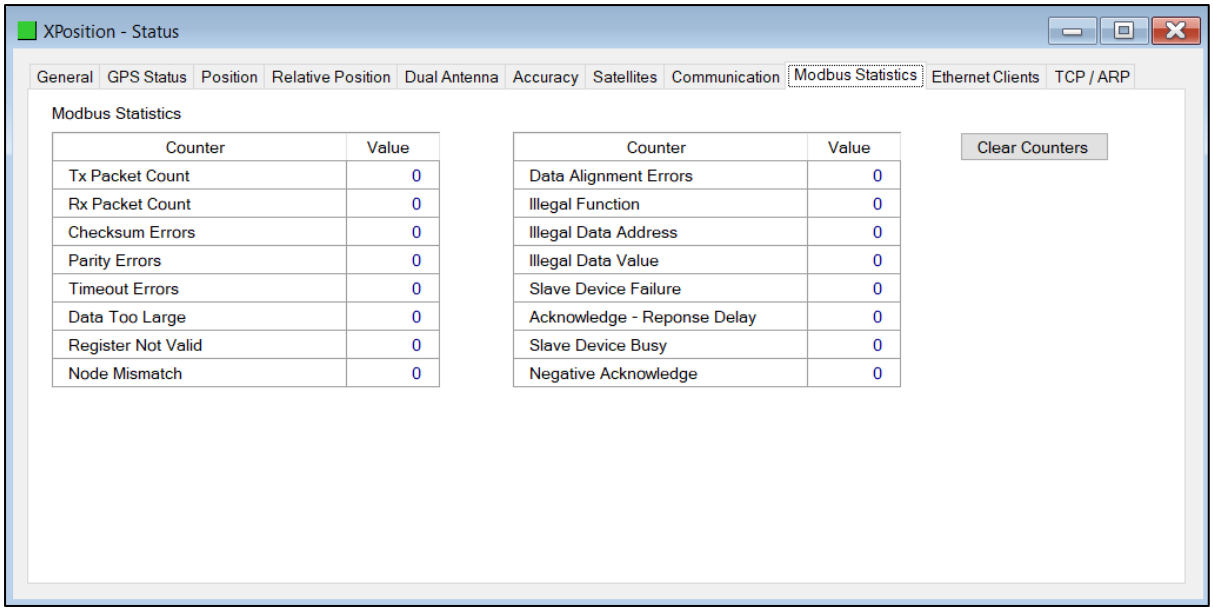


Figure 5.6. - Status monitoring – Modbus Statistics

The Modbus Statistics tab displays the following Modbus Statistics:

Statistic	**Description**
Tx Packet Count	The number of Modbus packets sent by the module.
Rx Packet Count	The number of Modbus packets received by the module.
Checksum errors	The number of corrupted Modbus packets received by the module.
Parity errors	The number of bytes with parity errors received by the module.
Timeout Errors	The number of message response timeouts the module has encountered.
Data Too Large	The number of Modbus requests or responses where the data was too large to process.
Map Item Not Found	The number of Modbus requests did not match any mapped items.
Node Mismatch	The received Modbus request did not match the module's Modbus node address.
Data Alignment Errors	The Modbus request and associated mapped item is not byte aligned with the destination Logix tag.
Illegal Function	The number of times the Modbus device responded with an Illegal Function exception.
Illegal Data Address	The number of times the Modbus device responded with an Illegal Data Address exception.
Illegal Data Value	The number of times the Modbus device responded with an Illegal Data Value exception.
Slave Device Failure	The number of times the Modbus device responded with a Device Failure exception.

Acknowledge –Response Delay	The number of times the Modbus device responded with an Acknowledge exception.
Slave Device Busy	The number of times the Modbus device responded with a Slave Busy exception.
Negative Acknowledge	The number of times the Modbus device responded with a Negative Acknowledge exception.

Table 5.3 - Parameters displayed in the Status Monitoring – Modbus Statistics

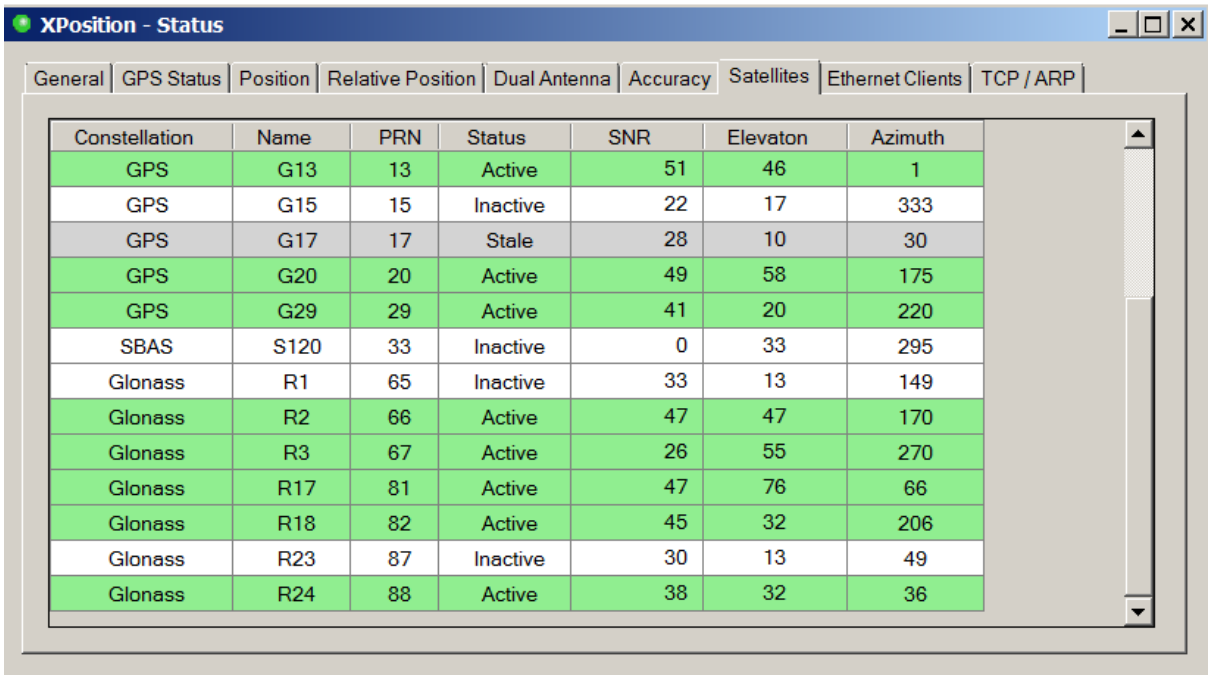


Figure 5.7. - Status monitoring - Satellites

The Satellite page will display all the satellites from various constellations used for position fix. If a certain constellation is disabled (e.g. GLONASS, when module is operating in Time mode) then these satellites will be displayed as either Inactive or Stale.

5.3. MODULE EVENT LOG

The XPosition module logs various diagnostic records to an internal event log. These logs are stored in non-volatile memory and can be displayed using Slate or via the web interface.
To vie them in Slate, select the Event Viewer option in the Project Explorer tree.

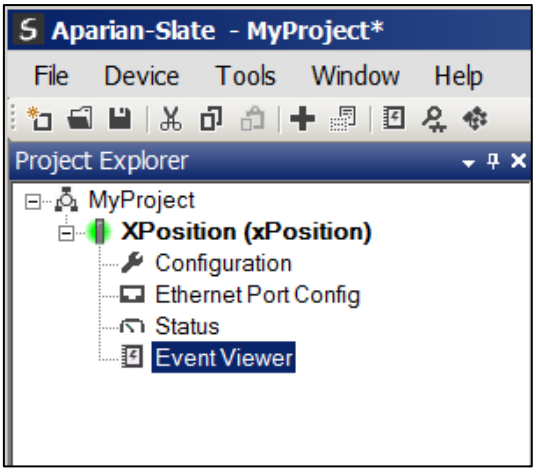
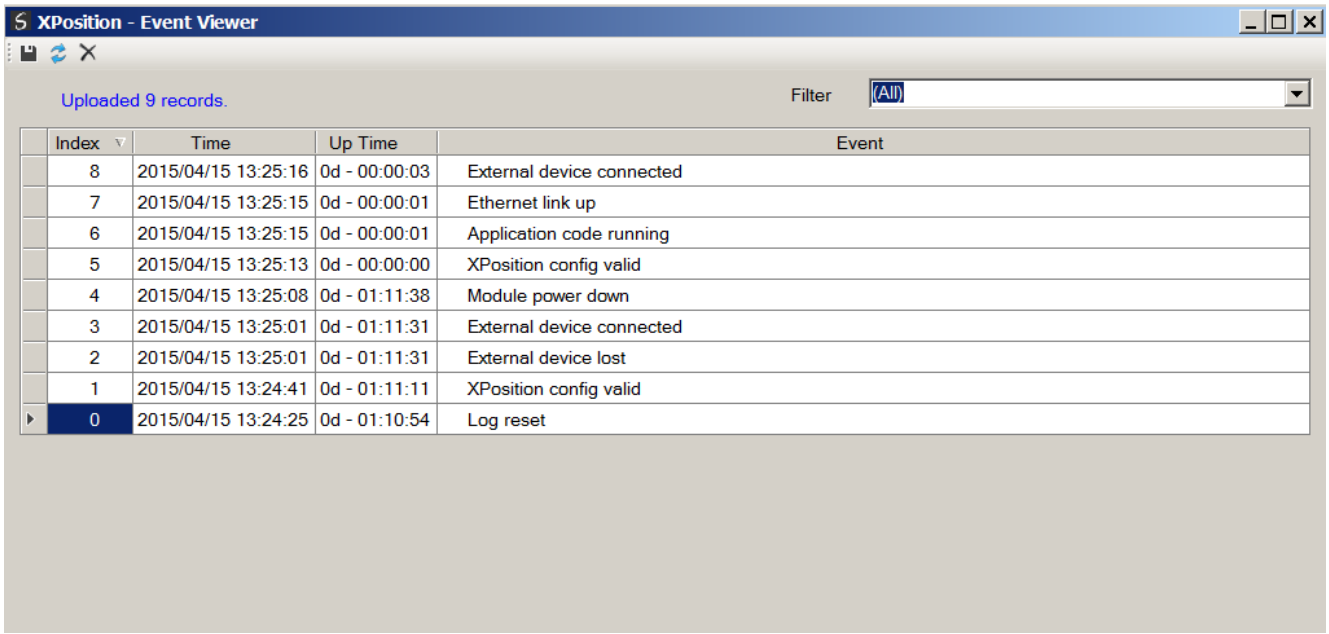


Figure 5.8. - Selecting the module Event Log

The Event Log window will open and automatically read all the events from the module. The log entries are sorted so as to have the latest record at the top. Custom sorting is achieved by double-clicking on the column headings.



Index	Time	Up Time	Event
8	2015/04/15 13:25:16	0d - 00:00:03	External device connected
7	2015/04/15 13:25:15	0d - 00:00:01	Ethernet link up
6	2015/04/15 13:25:15	0d - 00:00:01	Application code running
5	2015/04/15 13:25:13	0d - 00:00:00	XPosition config valid
4	2015/04/15 13:25:08	0d - 01:11:38	Module power down
3	2015/04/15 13:25:01	0d - 01:11:31	External device connected
2	2015/04/15 13:25:01	0d - 01:11:31	External device lost
1	2015/04/15 13:24:41	0d - 01:11:11	XPosition config valid
0	2015/04/15 13:24:25	0d - 01:10:54	Log reset

Figure 5.9. – Module Event Log

The log can also be stored to a file for future analysis, by selecting the Save button in the tool menu.

To view previously saved files, use the Event Log Viewer option under the tools menu.

5.4. WEB SERVER

The XPosition provides a web server allowing a user without Slate or RSLogix 5000 to view various diagnostics of the module. This includes Ethernet parameters, system event log, advanced diagnostics, and application diagnostics (GPS diagnostics).

NOTE: The web server is view **only** and thus no parameters or configuration can be altered from the web interface.

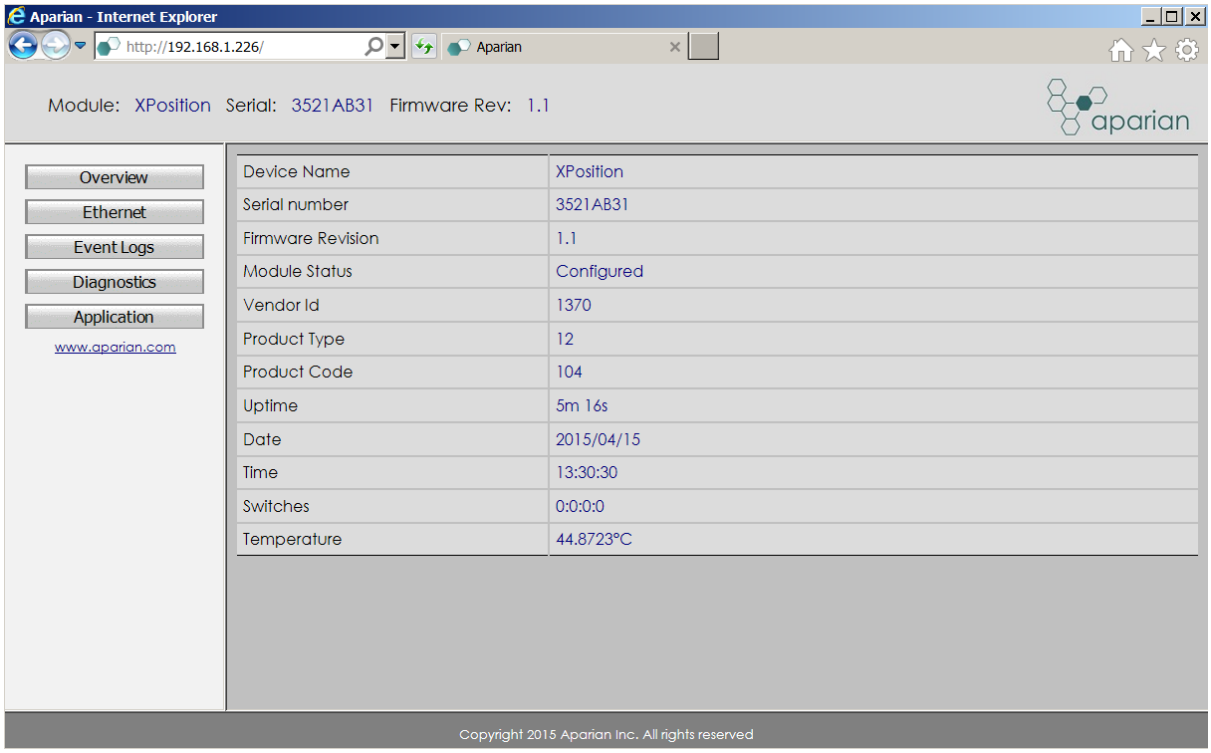


Figure 5.10. - Web interface

6. TECHNICAL SPECIFICATIONS

6.1. DIMENSIONS

Below are the enclosure dimensions as well as the required DIN rail dimensions. All dimensions are in millimetres.

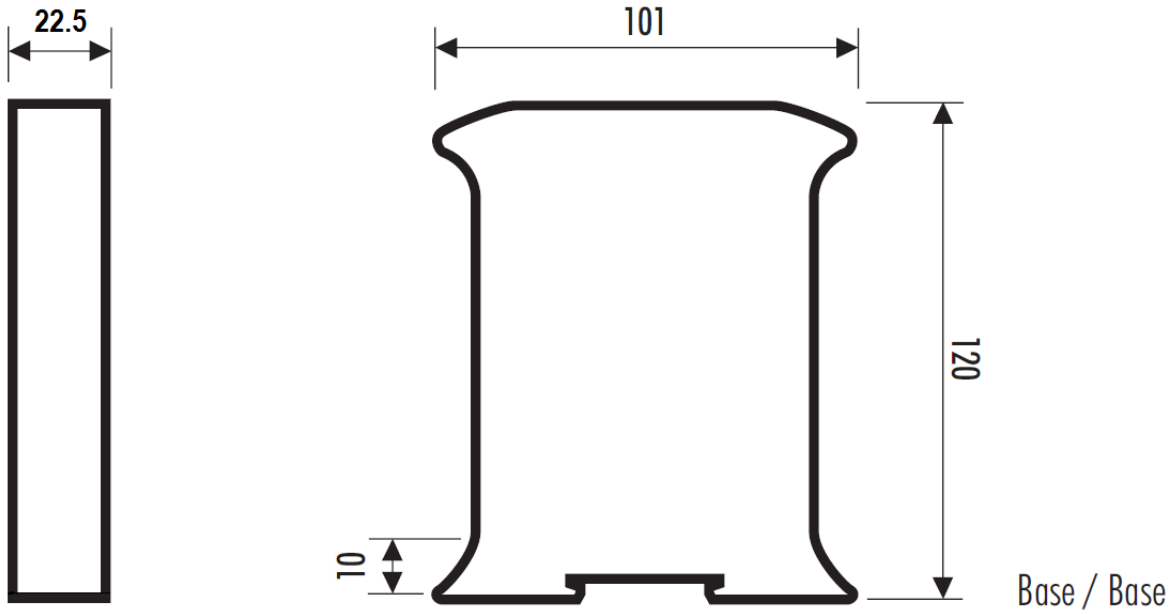


Figure 6.1 - XPosition enclosure dimensions

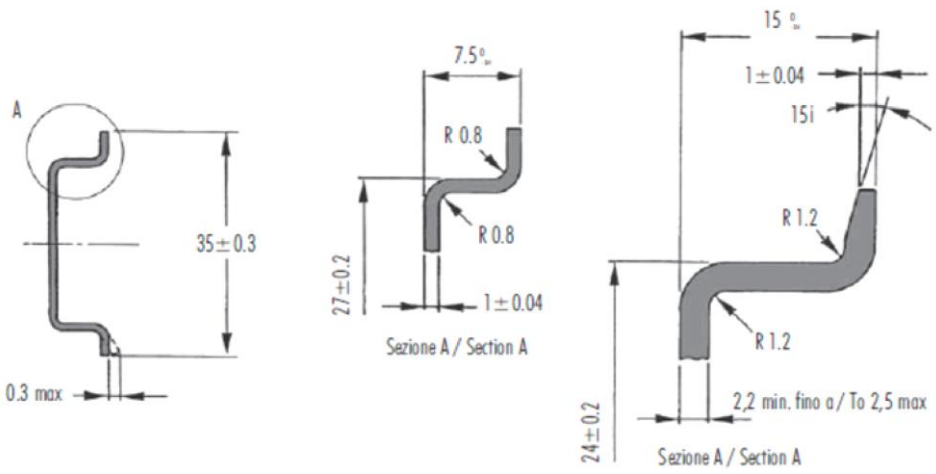


Figure 6.2 - Required DIN dimensions

6.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 10 – 28V DC, (70 mA @ 24 VDC)
Power consumption	1.7 W
Connector	3-way terminal
Conductors	24 – 18 AWG
Enclosure rating	IP20, NEMA/UL Open Type
Temperature	-20 – 70 °C
Earth connection	Yes, terminal based
Emissions	IEC61000-6-4
ESD Immunity	EN 61000-4-2
Radiated RF Immunity	IEC 61000-4-3
EFT/B Immunity	EFT: IEC 61000-4-4
Surge Immunity	Surge: IEC 61000-4-5
Conducted RF Immunity	IEC 61000-4-6

Table 6.1 - Electrical specification

6.3. ETHERNET

Specification	Rating
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 20
TCP connections	Max 20
CIP connections	Max 10
Communication rate	10/100Mbps
Duplex mode	Full/Half
Auto-MDIX support	Yes
Protocol Support	EtherNet/IP Modbus TCP NMEA 0183

Table 6.2 - Ethernet specification

6.4. CERTIFICATIONS

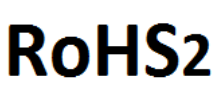
Certification	Mark
CE Mark	
UL Mark File: E494895	 CLASS 1, DIV 2, GROUPS A, B, C, D
RoHS2 Compliant	
RCM	
UKCA	

Table 6.3 – Certifications

7. INDEX

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V

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X

Y