Cell Connect

User Manual

A-CELL

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Revision 1.4

aparian

CONTENTS

1. Preface 5
1.1. Features 5
1.2. Additional Information 6
1.3. References 6
1.4. Support 6
2. Installation 7
2.1. Module Layout 7
2.2. Module Mounting 9
2.3. Power 10
2.4. IO Connections 10
2.5. Ethernet Port 10
2.6. Antenna Port 11
2.7. SIM Card Slot 11
3. Setup 13
3.1. Install Configuration Software 13
3.2. Network Parameters 13
3.3. Creating a New Project 18
3.4. Cell Connect parameters 20
3.5. Module Download 33
3.6. Logix Integration 36
3.6.1. Add Module to I/O Configuration 36
4. Text Message Operations 41
4.1. Sending Messages 41
4.2. Receiving Messages 41
4.3. On-board Actions 43
4.4. Logix Actions 44
4.4.1. Logix Message Actions 44
4.4.2. Unscheduled Pass-Through Message 45
4.5. Modbus Actions 47
5. Data Transfer Operations 49
5.1. Data Centre Registration 49

5.2. COnfiguring a Passphrase....51
5.3. Transfer Functions....52
6. Logix 5000 IO Tree....53
6.1.1. Input Assembly....53
7. Diagnostics....57
7.1. LEDs....57
7.2. Module Status Monitoring in Slate....58
7.2.1. General....59
7.2.2. Cellular Status....60
7.2.3. Cellular Statistics....63
7.2.4. Cellular Data Statistics....64
7.2.5. Cellular Services....66
7.2.6. Security....67
7.2.7. Remote Stations....68
7.2.8. Data Transfer....69
7.2.1. Logix Statistics....70
7.2.1. Modbus Statistics....71
7.3. AT Command Packet Capture....72
7.4. Module Event Log....74
7.5. Web Server....76
8. Technical Specifications....77
8.1. Dimensions....77
8.2. Electrical....78
8.3. Ethernet....78
8.4. Digital Inputs....79
8.5. Relay Outputs....79
8.6. Cellular Network....79
8.7. Cellular Communications....79
8.8. Certifications....80
9. Index....82

Revision History

Revision	Date	Comment
1.0	24 June 2016	Initial document
1.1	16 October 2016	Data Exchange Services Added
1.2	29 April 2017	Add ODVA Conformance mark
1.3	24 May 2017	Update ODVA Conformance mark
1.4	26 June 2017	Update Text Message send parameters

1. PREFACE

1.1. FEATURES

The Cell Connect module can send and receive cellular text messages using Short Message Service (**SMS**) or **Telegram** instant messaging, providing a remote interface between man and machine.

In addition to the on-board 4 digital inputs and 2 relay outputs, the module supports EtherNet/IP and Modbus-TCP, allowing the monitoring of remote devices. Using EtherNet/IP, the module can monitor tags in a Rockwell Automation Logix controller, and initiate a message when the tag value changes.

Similarly, messages can also be initiated when pre-configured Modbus register values change in a Modbus-TCP slave device. The module can also receive messages, which can be used to either change the state of the on-board relays, or write to Logix tags or Modbus registers.



The security of a system is not compromised with the addition of the Cell Connect Module. Only Text Messages received from Phone Numbers listed in the module's configuration are processed. In addition, only configured commands for each specific group will be processed. Attempts to access commands by non-approved users will be shown in the cellular statistics.

The Cell Connect module can also exchange tag data between Logix controllers, registers between Modbus devices, and CIP objects between EtherNet/IP devices securely over a GSM data network using various encryption and security methods. The on-board digital inputs on a remote device can be read over the GSM network and inserted into either a Logix Tag or Modbus Register. Similarly, the relay outputs can be set on a remote module from a Logix Tag or Modbus Register.

In addition to the encryption standards the module also supports passphrases allowing modules to communicate securely over the GSM network. **There is also no need for specific APNs to be set up for the modules to communicate over the GSM network, but rather off-the-shelf SIM cards can be used with very little configuration required**.

The Cell Connect module is configured using the Aparian Slate application. This program can be downloaded from www.aparian.com free of charge.

Hereafter the Cell Connect module will be referred to as the **module**.

1.2. 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
User Manual, Datasheet Example Code & UDTs	http://www.aparian.com/products/cellconnect
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

Figure 1.1. - Additional Information

1.3. REFERENCES

Resource	Link
CIP Routing	The CIP Networks Library, Volume 1, Appendix C:Data Management
Modbus	http://www.modbus.org

Table 1.2. – References

1.4. 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	www.aparian.com/contact-us
Support email	support@aparian.com

Table 1.3. – Support Details

2. INSTALLATION

2.1. MODULE LAYOUT

The module has five ports at the bottom of the enclosure as shown in the figure below. The ports are used for Ethernet, relay outputs, digital inputs, antenna and power. The power port uses a three-way connector which is used for the DC power supply and the earth connection.

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

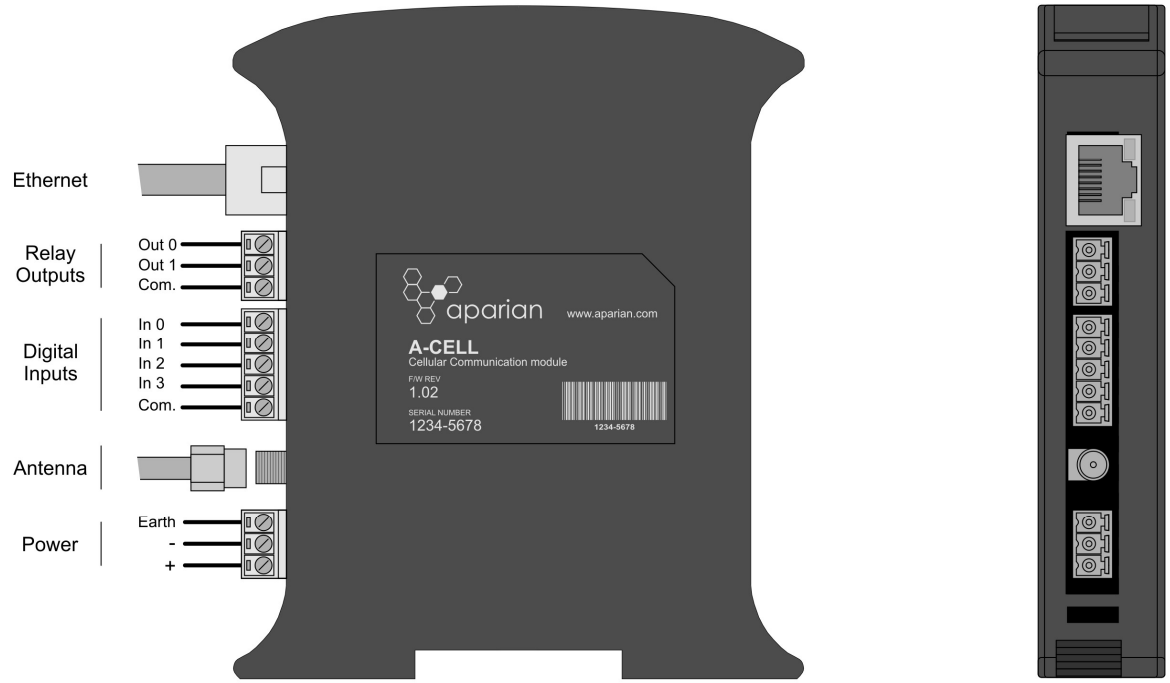


Figure 2.1. – Cell Connect module side view

The module provides four 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, the status of the cellular connection and the cellular activity.

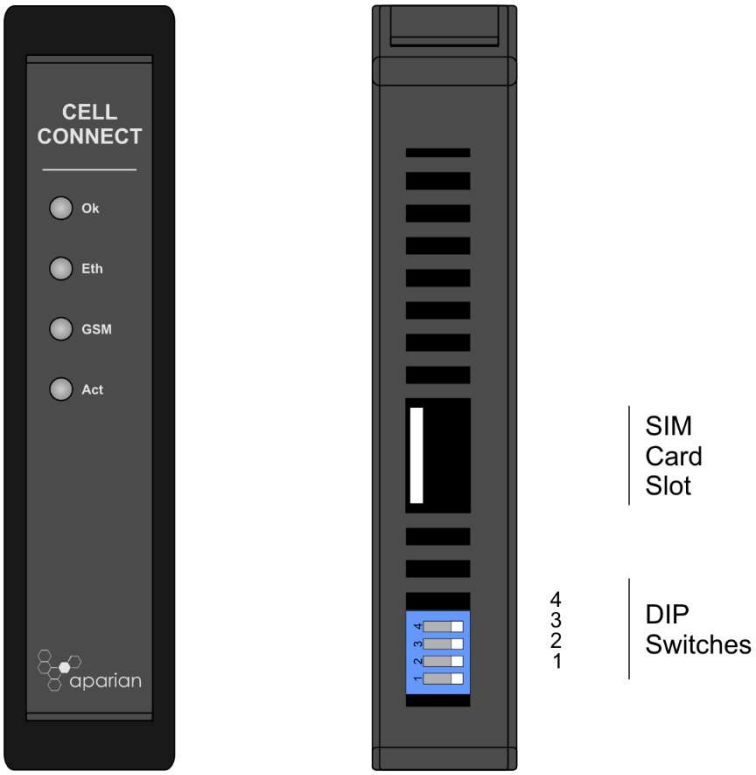


Figure 2.2. – Cell Connect front and top view

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	Reserved

Table 2.1 - DIP Switch Settings

2.2. MODULE MOUNTING

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

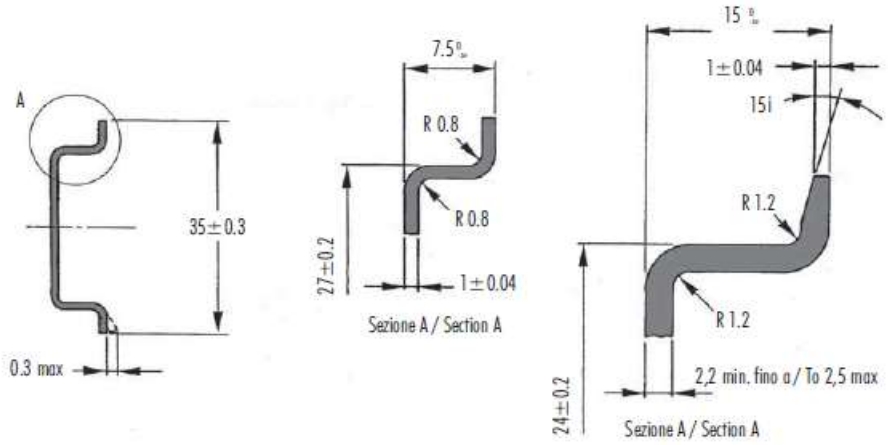


Figure 2.3 - DIN rail specification

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.

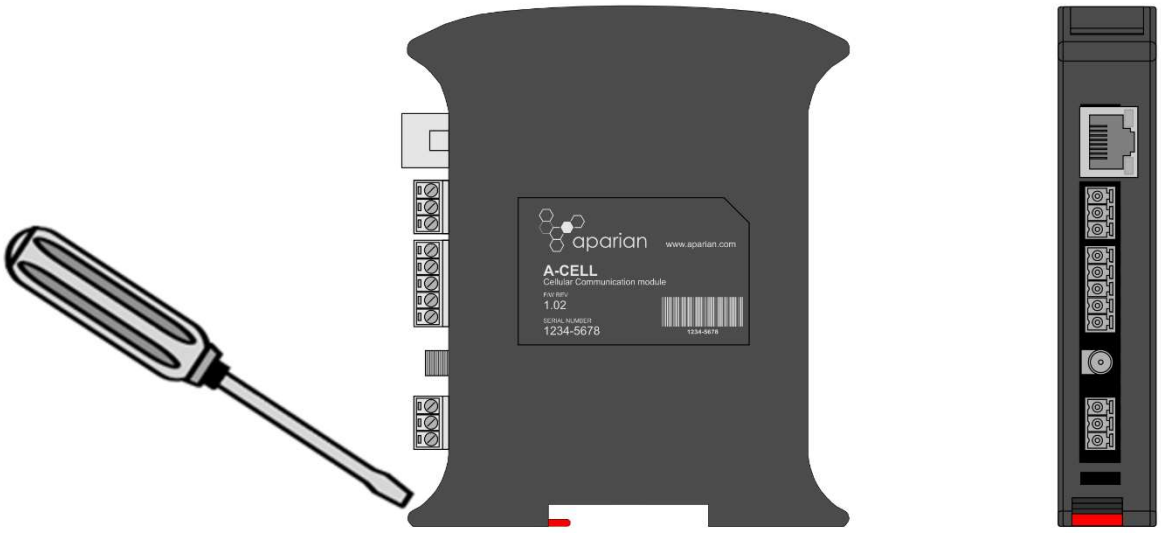


Figure 2.4 - DIN rail mouting

2.3. POWER

A three-way power connector is used to connect Power+, Power– (ground), and earth. The module requires an input voltage of 12 – 28Vdc. **Refer** to the technical specifications section in this document.

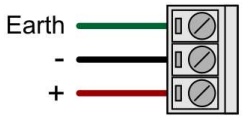


Figure 2.5 - Power connector

2.4. IO CONNECTIONS

The two relay output channels are connected using a single three-way connector. The relays are solid state, normally open, single pole, connected with a single common as shown in the figure below.

NOTE: Each relay is capable of switching a maximum dc current of 500mA.

The four digital input channels are optically-isolated sharing a common ground. A voltage of between 10-32 vdc applied to an input will result in a logic on state for that input.

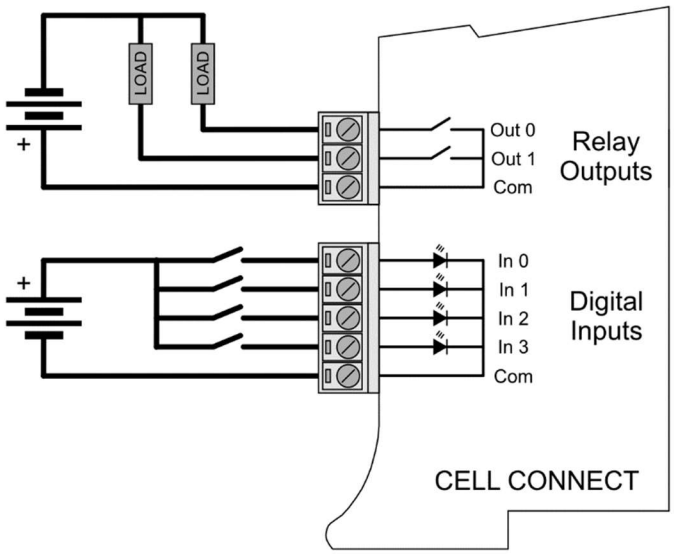


Figure 2.6 - Cell Connect IO connection

2.5. ETHERNET PORT

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

2.6. ANTENNA PORT

The antenna port makes use of an SMA female connector and has an impedance of 50 Ω. The supplied antenna is an adhesive flat bar type, with a 3m (10ft) coax cable and an SMA male connector.

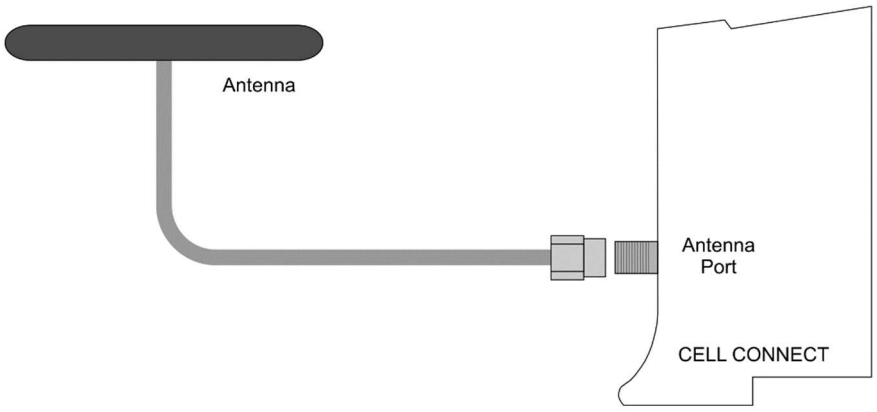


Figure 2.7 – Cell Connect Antenna connection

NOTE: Operating the module without an antenna connected, or making use of an unsuitable antenna may result in permanent damage to the module.

NOTE: To comply with FCC and Industry Canada RF radiation exposure limits, this equipment should be installed and operated with a minimum distance of 20 cm between the radiator and the body of the user or nearby persons. This transmitter must not be colocated or operated in conjunction with any other antenna or transmitter.

NOTE: The gain of the antenna must not exceed 4.25 dBi (850 MHz), 7.30 dBi (1700 MHz) and 2.74 dBi (1900 MHz) for mobile and fixed or mobile operating configurations.

2.7. SIM CARD SLOT

The SIM card slot is located on the top-side of the module adjacent to the DIP switches. The SIM card should be inserted with the contacts facing down.

NOTE: Use caution when inserting and removing the SIM card, so as not to damage it.

NOTE: The module uses a Micro Sim Card.

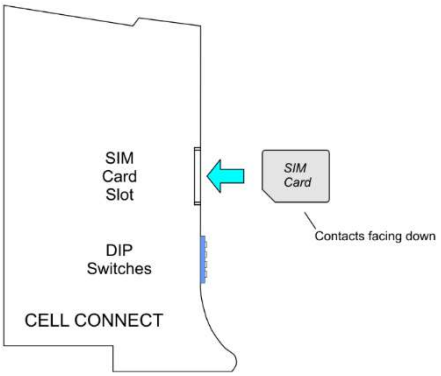


Figure 2.8 – Cell Connect SIM card insertion

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.

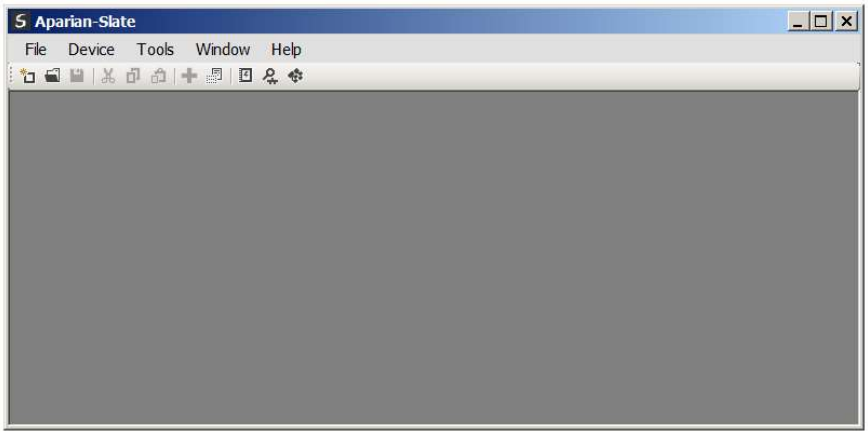


Figure 3.1. - Aparian Slate Environment

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 several 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.

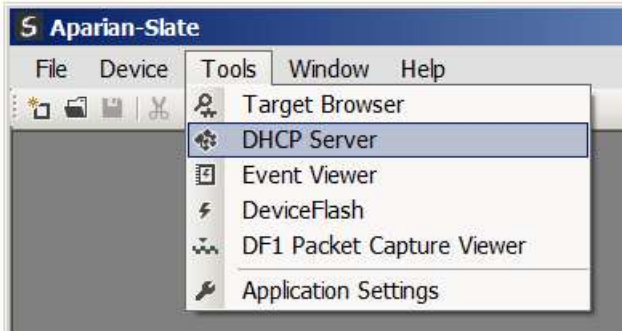


Figure 3.2. - Selecting DHCP Server

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

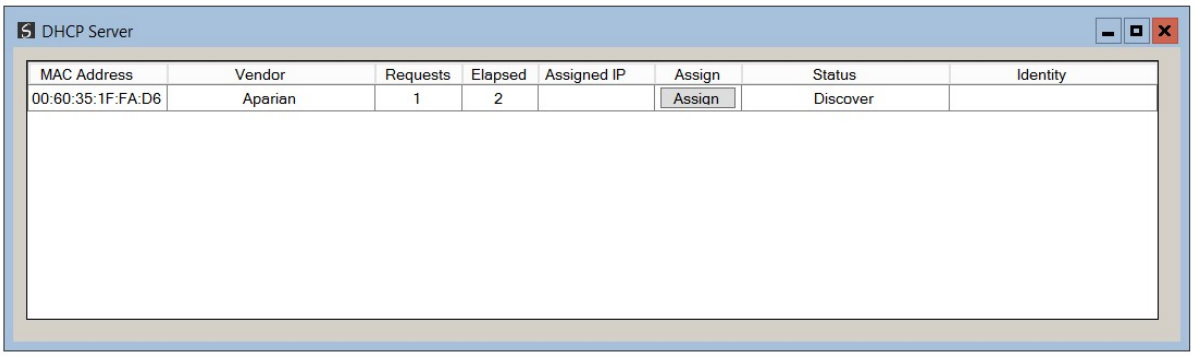


Figure 3.3. - DHCP Server

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.

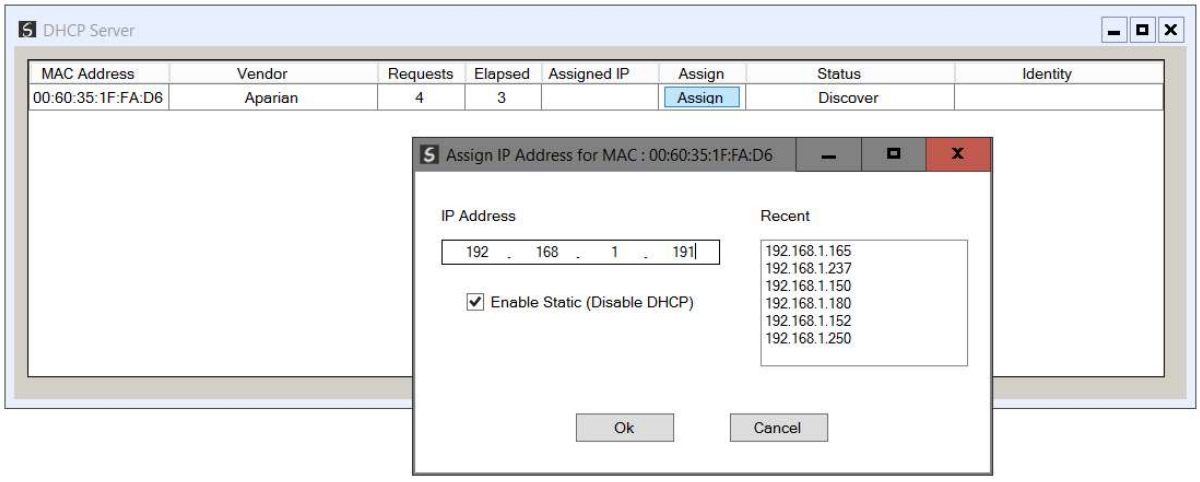


Figure 3.4. - Assigning IP Address

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.

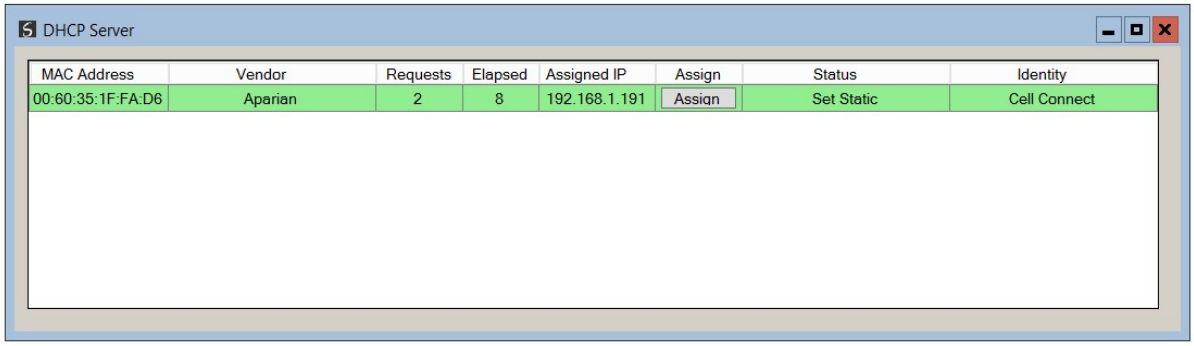


Figure 3.5. - Successful IP address assignment

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.

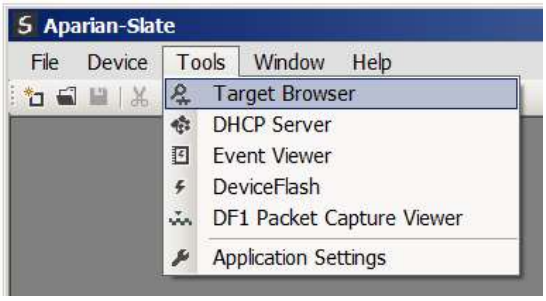


Figure 3.7. - Selecting the Target Browser

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

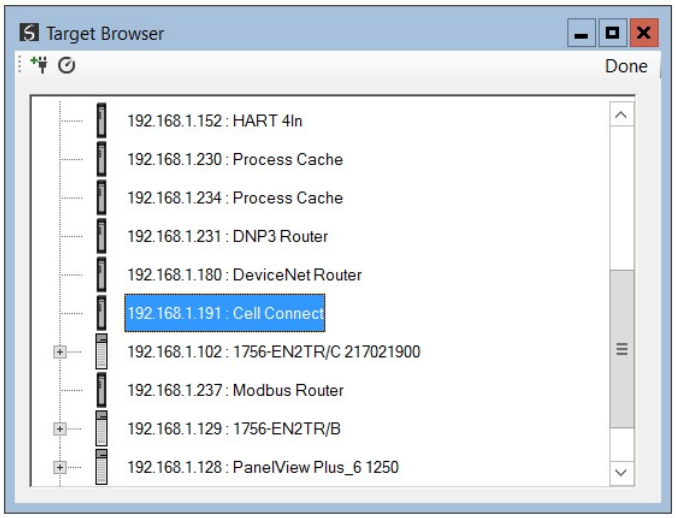


Figure 3.8. - Target Browser

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

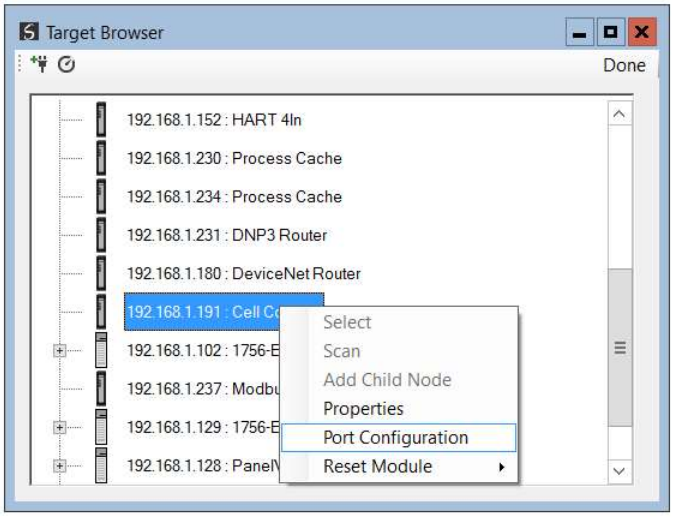


Figure 3.9. - Selecting Port Configuration

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

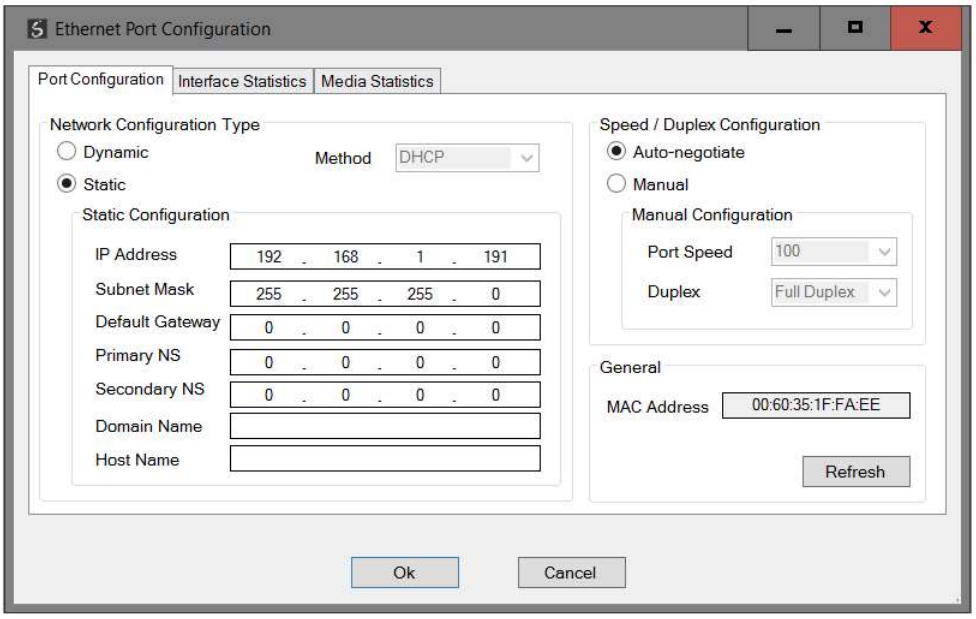


Figure 3.10. - Port Configuration

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.

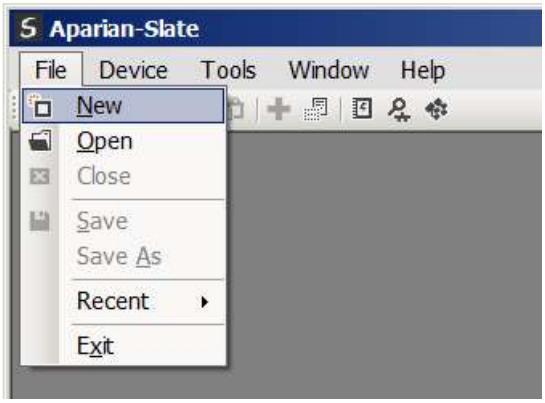


Figure 3.11. - Creating a new project

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.

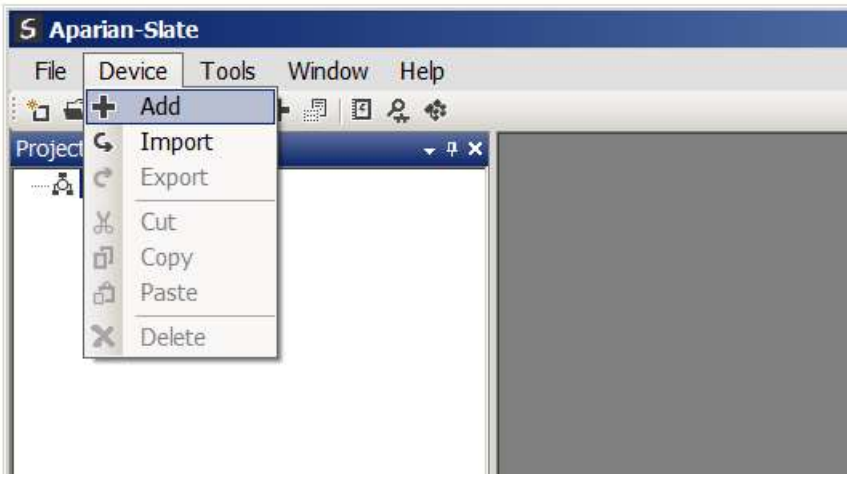


Figure 3.12. - Adding a new device

In the Add New Device window select the Cell Connect module, and click the Ok button.

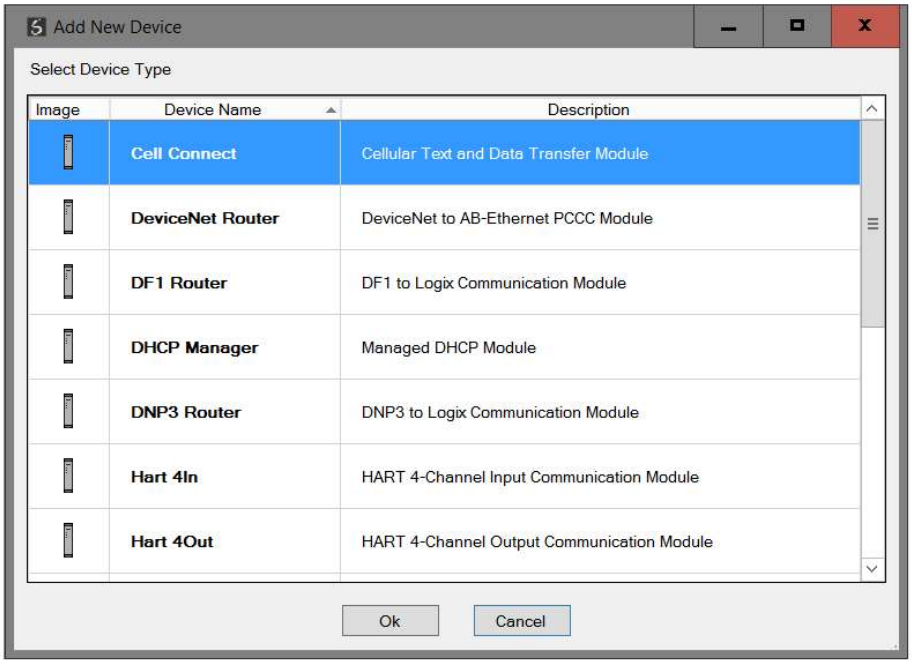


Figure 3.13 – Selecting a new Cell Connect module

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*.

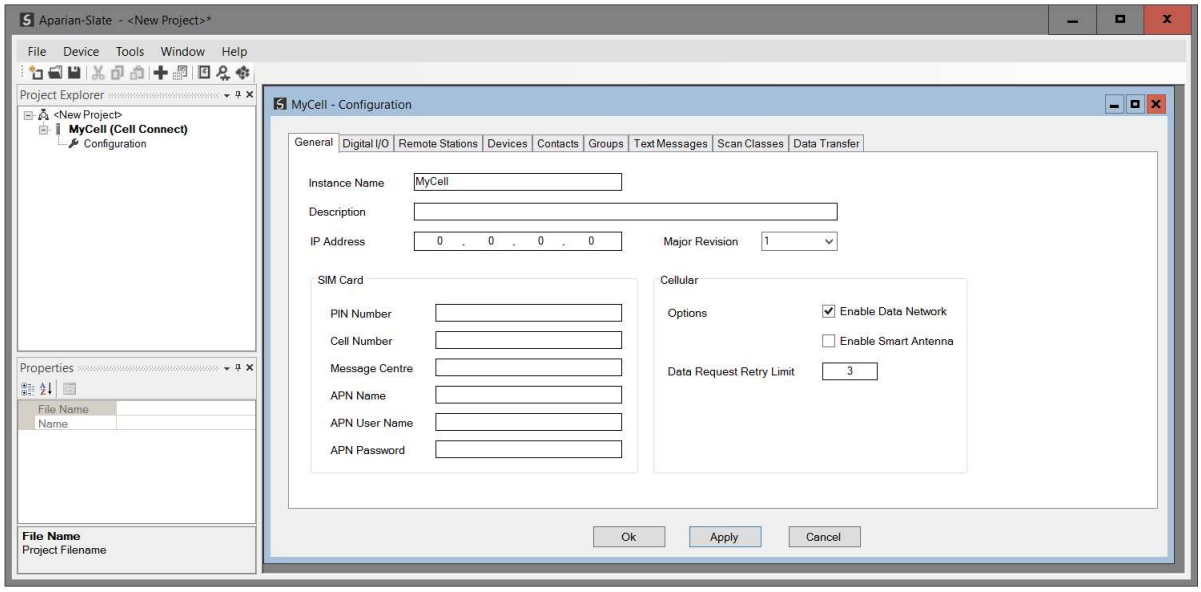


Figure 3.14. – Cell Connect module configuration

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

3.4. CELL CONNECT PARAMETERS

The Cell Connect module parameters are configured using the Slate configuration utility.

The configuration form is divided into multiple tabs to configure the General, Digital IO, Devices, Contacts, Groups, Remote Stations, Message and Data Transfer parameters.

The Message parameters will require Devices and Contact Groups, whilst Groups will require individual Contacts. Data Transfers require Remote Stations, Devices and Scan Classes to be configured. The relationship is illustrated below:

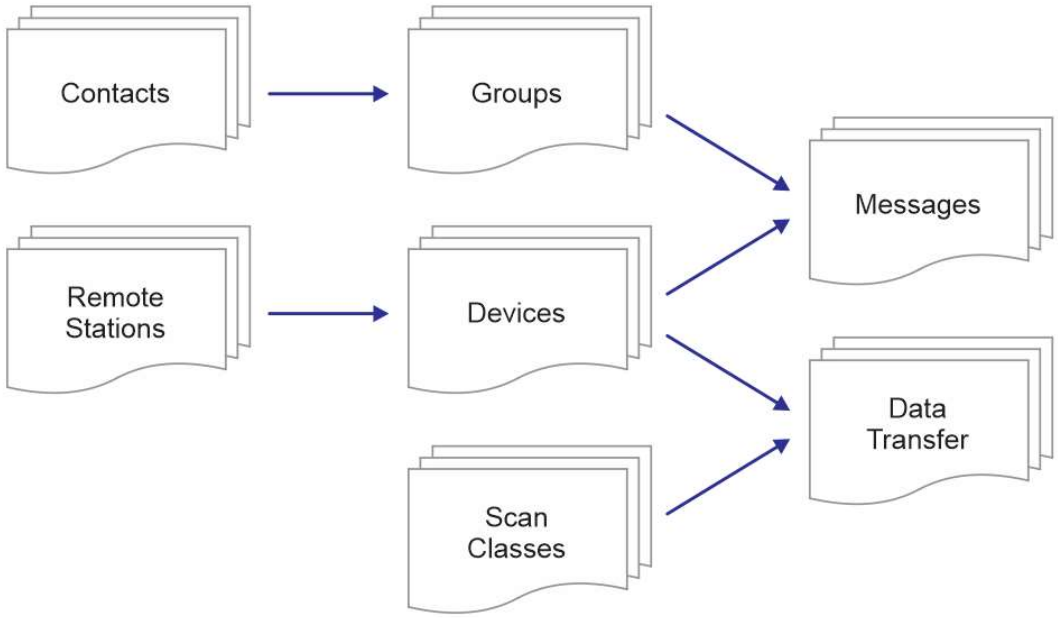


Figure 3.15 - Parameter relationships

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 Cell Connect configuration.

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various Cell Connect 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
SIM Card Parameters	
Pin Number	Used to login into the SIM card, if the PIN code has been enabled. The PIN code is supplied by the service provider. **This can be left blank, if the PIN code has been disabled.**
Cell Number	The local cell number linked to the SIM card and is required for data transfer. This is usually supplied by the cellular service provider. The cell number must be entered in international format starting with '+' sign. **Note: Alternatively, after downloading, the Status form can be used to send a test message to your personal cell phone revealing the required cell number.**
Message Centre	The message centre number provided by the cellular service provider. The message centre number must be entered in international format starting with '+' sign. **Depending on the network, the message centre number is usually automatically detected, and can thus be left blank in this configuration.**
APN Name	The default (public) internet access APN (Access Point Name) provided by the cellular service provider. **Note: Many service providers do not require this setting, in which case it can be left blank.**
APN User Name	The APN user name, if required by the service provider. **Note: Many service providers do not require this setting, in which case it can be left blank.**
APN Password	The APN password linked to the above user name, if required by the service provider. **Note: Many service providers do not require this setting, in which case it can be left blank.**
Cellular Options	
Enable Data Network	Used to enable the data network, required for data transfers and Telegram instant messaging.
Enable Smart Antenna	Enable if a smart antenna is being used. A smart antenna typically contains an internal DC load of 15 kΩ, allowing the module to detect if the antenna has been disconnected. **This should be disabled for standard antennas, like the one supplied with the module.**
Data Request Retry	The number of data transmission retries, before the message is aborted.

Table 3.1 - General configuration parameters

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

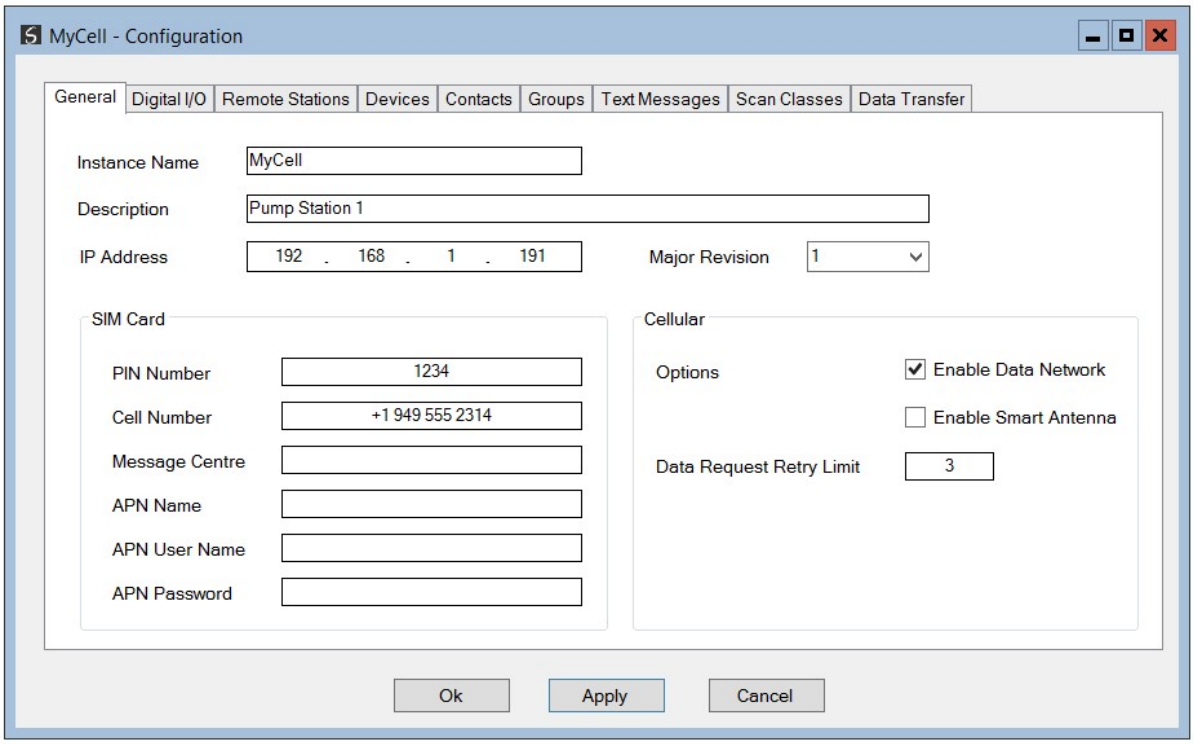


Figure 3.16. - General Configuration

The Digital IO configuration tab consists of the following parameters:

Parameter	Description
Input x Filter	Digital Input de-bounce filters for inputs 0-3. The value entered in milliseconds. This prevents multiple messages from being triggered due to contact bounce etc.
Relay x Pulse Time	Specifies the relay pulse time in milliseconds for relay outputs 0-1. When the relay output is commanded to pulse, it will switch-on for this configured time, and then switch-off.
Relay x Initial State	Specifies the post power-up relay state for relay outputs 0-1.

Table 3.2 - Digital I/O configuration parameters

The digital IO configuration is shown in the figure below. This window is opened by either double clicking on the module in the tree or right-clicking the module followed by selecting *Configuration.* Once in the configuration window select the Digital I/O tab.

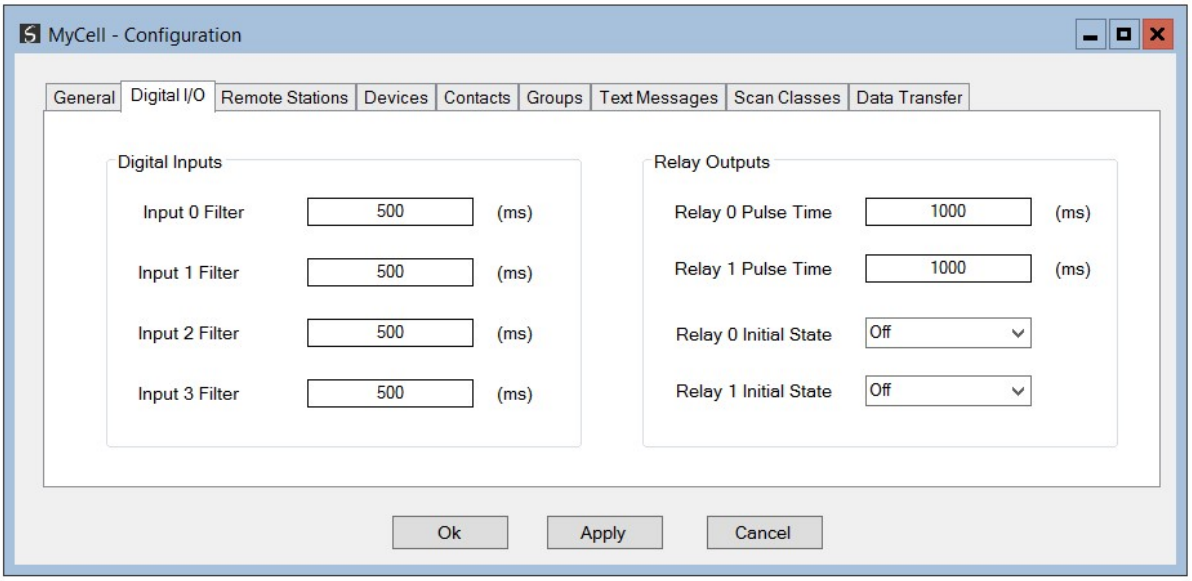


Figure 3.17 – Digital I/O configuration

The Remote Stations configuration tab consists of the following parameters:

Parameter	Description
Station Name	A user defined name for the remote station.
Phone Number	The cell number for the remote station. **The cell number must be entered in international format starting with '+' sign.**

Table 3.3 – Remote Stations configuration parameters

The Remote Stations configuration is shown in the figure below. This window is opened by either double clicking on the module in the tree or right-clicking the module followed by selecting *Configuration.* Once in the configuration window select the Remote Stations tab.

NOTE: Remote stations are used by the data exchange to determine which Cell Connect module to communicate with over the data network.

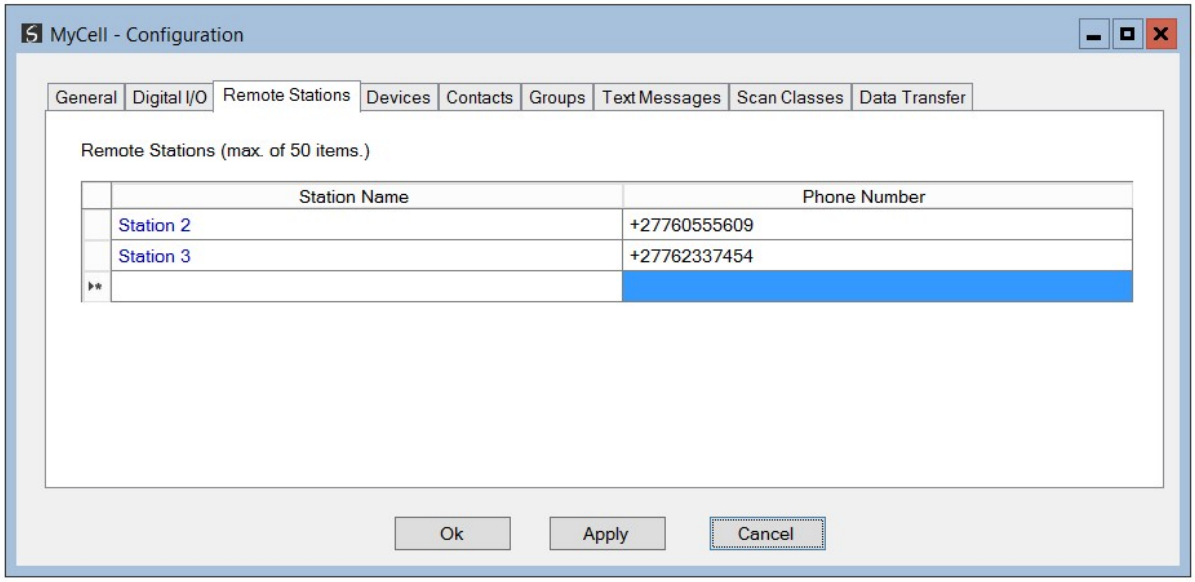


Figure 3.18 – Remote Station configuration

The Device configuration tab allows the user to configure multiple Logix and Modbus-TCP devices to be monitored. Each item comprises the following parameters:

Parameter	Description
Device Name	User defined name for the device.
Device Type	Device Type (either Logix, Modbus-TCP or EtherNet/IP device).
Device Path	Device Path. For Logix (EtherNet/IP) devices enter the full CIP path. For Modbus-TCP devices, enter the IP address and node address separated by a comma. For EtherNet/IP devices, enter the devices IP address. **Note: For stations that for remote devices the user will not be able to browse and need to enter the CIP path of the Logix Controller or EtherNet/IP device manually.**

Table 3.4 - Device configuration parameters

The Devices configuration is shown in the figure below. This window is opened by either double clicking on the module in the tree or right-clicking the module followed by selecting *Configuration.* Once in the configuration window select the Devices tab.

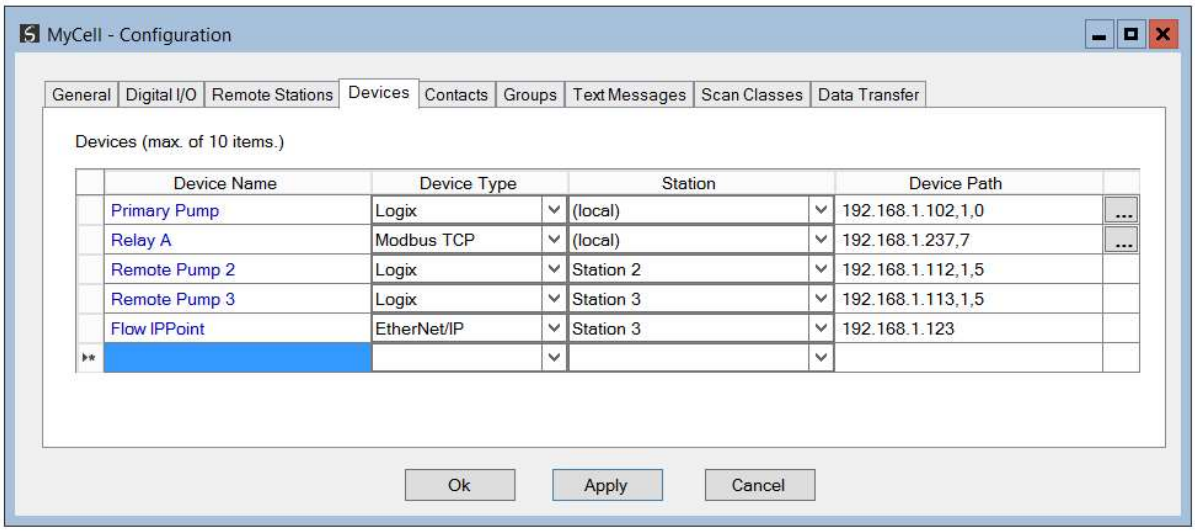


Figure 3.19 – Device configuration

For Logix devices (controllers), the Device Path can either be entered manually or the user can browse and select a device by clicking the Browse (***"…"***) button. The Target Browser will open and automatically scan for all available EtherNet/IP devices.

Note: For stations that for remote devices the user will not be able to browse and need to enter the CIP path of the Logix Controller or EtherNet/IP device manually.

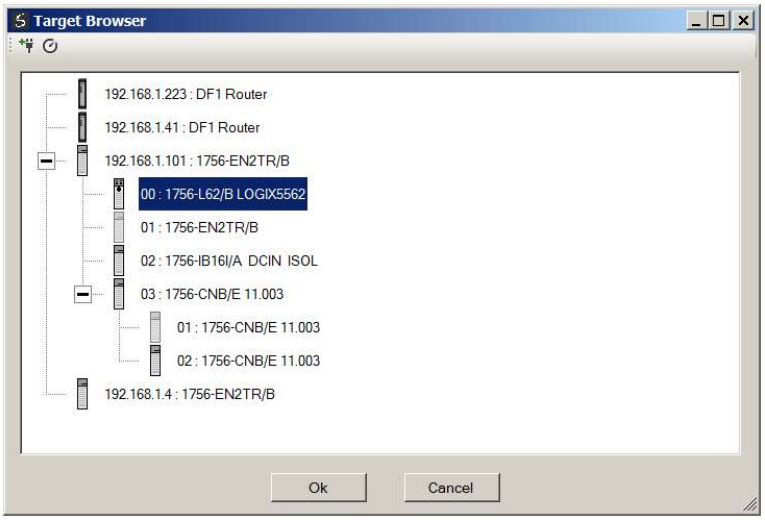


Figure 3.20 - Logix Target Browser

For Modbus-TCP devices, the Device Path can either be entered manually or the user can use the Modbus-TCP Path Builder by clicking the Build (***"…"***) button

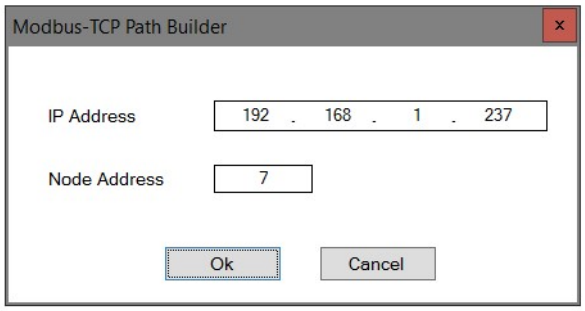


Figure 3.21 – Modbus-TCP Path Builder

The Contacts configuration tab consists of the following parameters:

Parameter	Description
Contact Name	User defined name for the contact.
Phone Number	Mobile (cell) number for the contact. Note: The numbers must be entered in international format starting with a '+'.

Table 3.5 - Contacts configuration parameters

The contacts configuration is shown in the figure below. This window is opened by either double clicking on the module in the tree or right-clicking the module followed by selecting *Configuration.* Once in the configuration window select the Contacts tab.

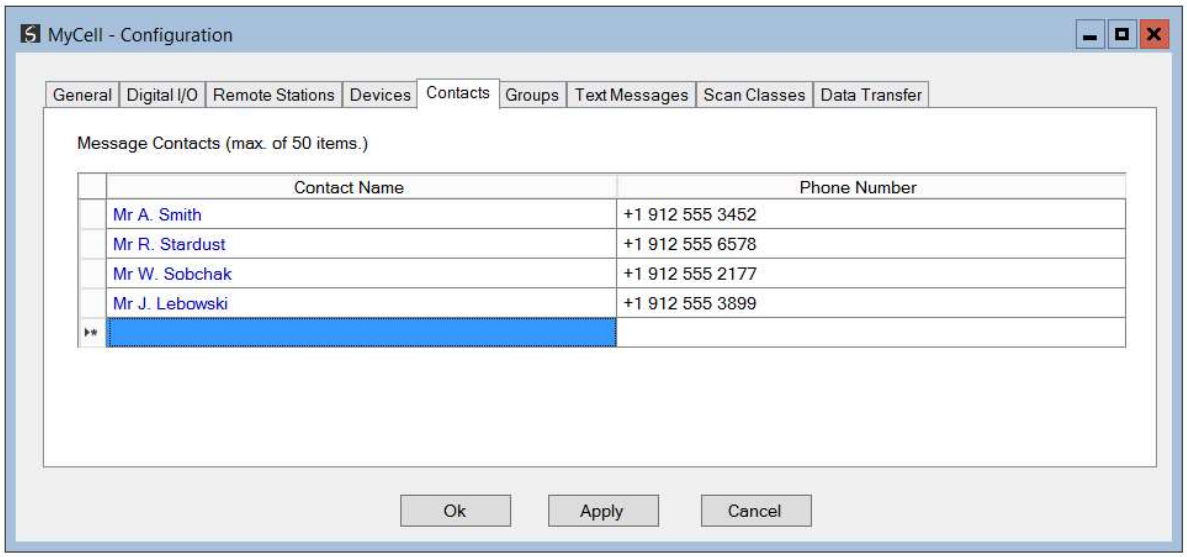


Figure 3.22 – Contacts configuration

The Groups configuration tab is used to define contact groups to which messages can be sent. Once a group has been created using the ***Add*** button, pre-configured Contacts can be added

to the group, using the left (←) and right (→) arrow buttons.

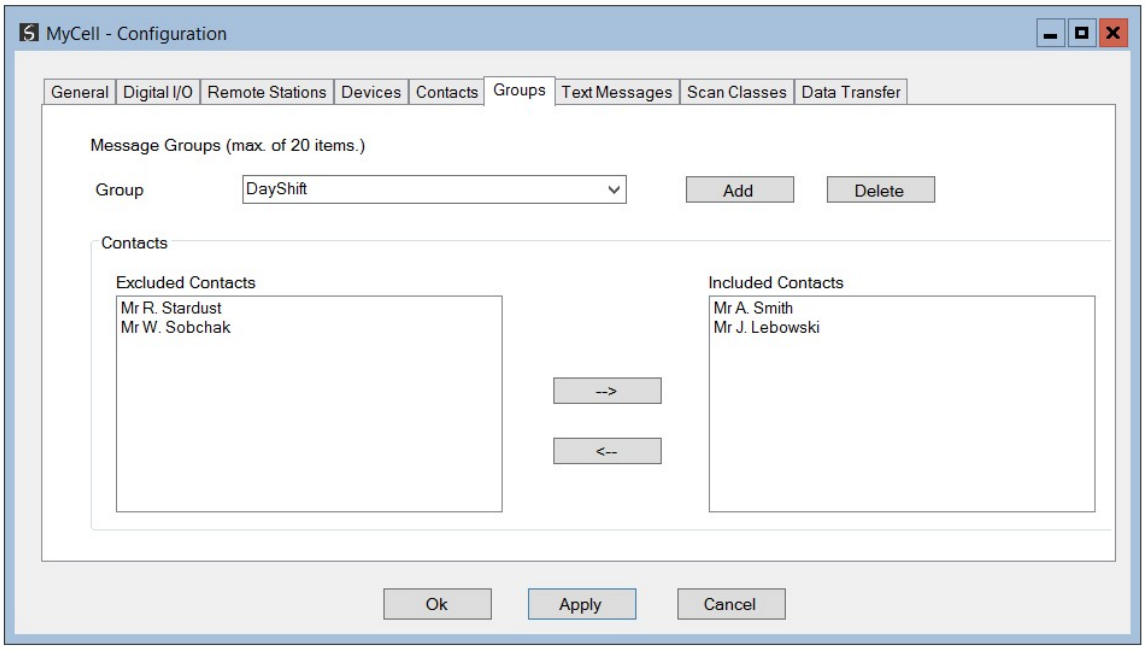


Figure 3.23 – Groups configuration

The Text Message configuration tab is used to configure text messages and the mechanisms that trigger them.

This tab is used to configure messages that are sent out to groups based on some event, as well as messages that are received, that may change a Logix tag or Modbus register value or internal relay output.

Each text message item comprises the following parameters:

Parameter	Description
Message Action	The message action to be taken when the selected item changes or if a corresponding message is received. A full list of the Message Action options is shown in Table 3.7 below.
Telegram	Specifies whether to use standard (SMS) messages or Telegram instant messages.
Ack	Acknowledge a received command. Specifies if a return acknowledge message should be sent to the contact who sent the command. **Applies to command messages only.**
Contact Group	The contact group to be notified of the message. In the case of a command message, the received command must originate from a member of the specified group, otherwise it will be ignored.
Back-Off	The time duration (seconds) before a subsequent trigger for the same item will be executed. This prevents unnecessary duplicate messages from being sent in

	the case of unfiltered inputs etc.
Device	The device name (configured in the device list) that hosts the specific data point. This will be either a Logix controller, or Modbus-TCP device.
Data Point	The specific data-point hosted in the aforementioned device. Either a Logix tag or a Modbus register.
Message	The text message to be sent, in the case of a notification, or the exact text message that must be received in order to initiate a command.

Table 3.6 - Text message (SMS) configuration parameters

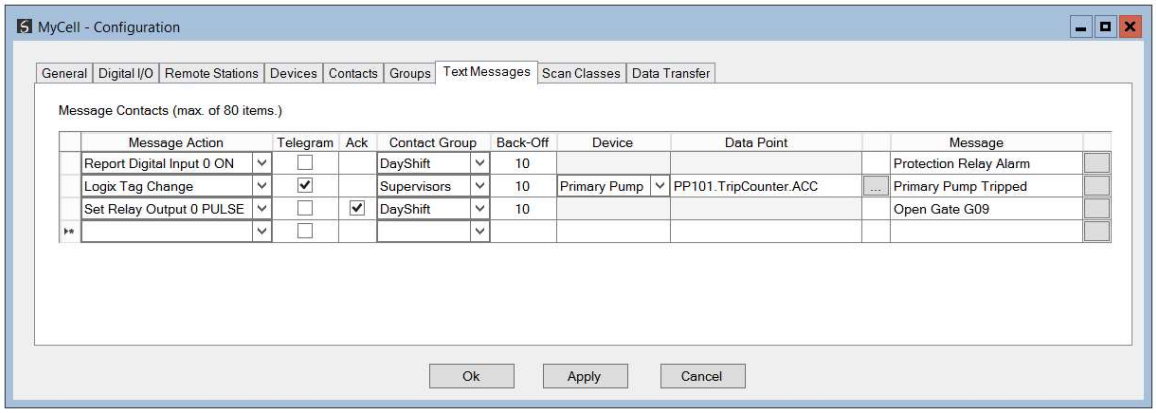


Figure 3.24 – Text Message configuration

Where the Message Action relates to a Logix device (controller), the Device combo will list all the configured Logix device. Once a suitable Logix device has been selected, the user can either manually enter the Logix tag in the Data Point field, or select the Tag Browser button ("…"). The Tag Browser will open.

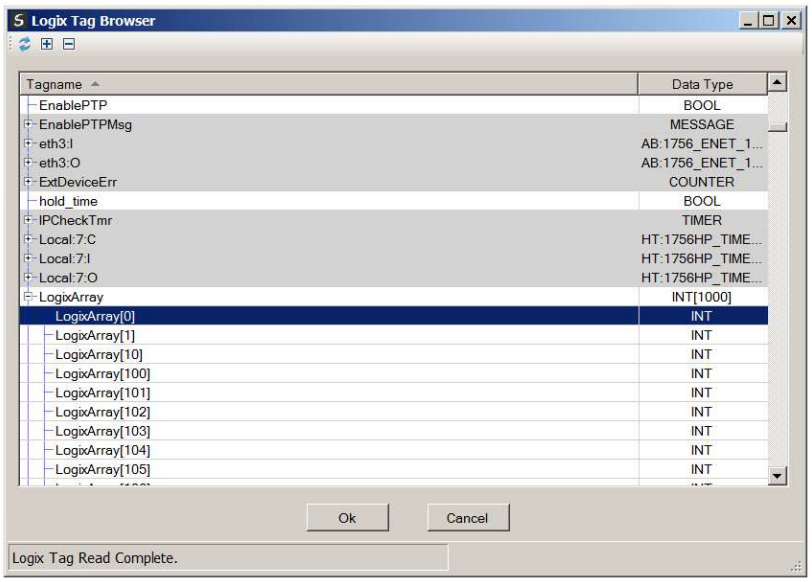


Figure 3.25 – Logix Tag Browser

The message can either be enetered directly into the data grid, or the build button can be selected and the message eneterd into the Message Builder form as shown below.

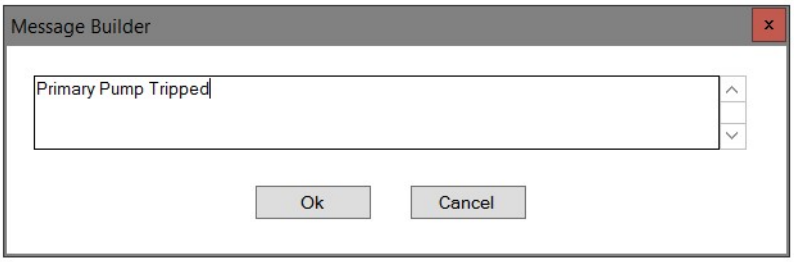


Figure 3.26 - Message Builder form

The table below lists all the available Message Actions. For more detail on each Message Action see the Text Message Operations chapter.

Type	Message Action	Message
On-board Digital Inputs	Report Digital Input 0 OFF	Send
	Report Digital Input 0 ON	Send
	Report Digital Input 1 OFF	Send
	Report Digital Input 1 ON	Send
	Report Digital Input 2 OFF	Send
	Report Digital Input 2 ON	Send
	Report Digital Input 3 OFF	Send
	Report Digital Input 3 ON	Send
On-board Relay Outputs	Set Relay Output 0 ON	Receive
	Set Relay Output 0 OFF	Receive
	Set Relay Output 0 PULSE	Receive
	Set Relay Output 1 ON	Receive
	Set Relay Output 1 OFF	Receive
	Set Relay Output 1 PULSE	Receive
Logix	Logix Tag Change	Send
	Logix Tag Boolean OFF	Send
	Logix Tag Boolean ON	Send
	Logix Tag Set BOOL	Receive
	Logix Tag Set SINT	Receive
	Logix Tag Set INT	Receive
	Logix Tag Set DINT	Receive
	Logix Tag Set REAL	Receive
Modbus	Modbus Device Holding Register Change	Send
	Modbus Device Input Register Change	Send
	Modbus Device Register Set	Receive
	Modbus Device Input Change	Send
	Modbus Device Coil Change	Send

	Modbus Device Coil Set	Receive
General	Power-up Notification	Send

Table 3.7 - Message Actions

Scan Classes are used to control how often Data Transfers are triggered. The Scan Classes configuration tab consists of the following parameters:

Parameter	Description
Scan	The Scan Class name. ('A'-'F')
Interval	The scan interval in seconds. **Note: The minimum data transfer interval is 3 seconds.**

Table 3.8 – Scan Class configuration parameters

The Scan Class configuration is shown in the figure below. This window is opened by either double clicking on the module in the tree or right-clicking the module followed by selecting *Configuration.* Once in the configuration window select the Scan Class tab.

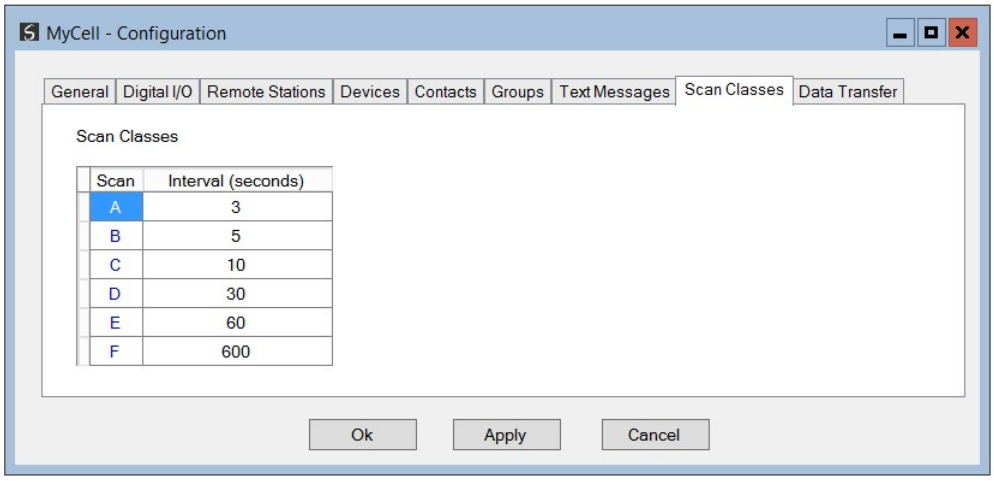


Figure 3.27 – Scan Class configuration

The Data Transfer configuration tab consists of the following parameters:

Parameter	Description
Transfer Function	The require Data Transfer function which will determine what action must be executed by the module (eg. Logix tag exchange). A list of the Data Transfer functions is shown in table 3.10.
Scan Class	The Scan Class defines the interval that the Data Transfer function will execute.

Local Device	The local device, selected from the Device tab. **Note: Only devices that match the pre-selected Transfer Function are selectable.**
Local Data Point	The data point to be accessed inside the local device. For Logix devices, this would be a Logix tag name. For Modbus-TCP devices this would be a Modbus register.
Remote Device	The remote device, selected from the Device tab. **Note: Only devices that match the pre-selected Transfer Function are selectable.**
Remote Data Point	The data point to be accessed inside the remote device. For Logix devices this would be a Logix tag name. For Modbus-TCP devices this would be a Modbus register. For EtherNet/IP devices this would be a CIP object path with the following parameters separated by commas: Service, Class ID, Instance ID, Attribute ID. **Note: All values must be entered in decimal.**
Element Count	Depending on the pre-selected Transfer Function, the element count may need to be entered. This is typically the number of objects to be transferred. Note: In the case of the ***Logix Write CIP Object*** transfer function, the element count specifies the number of bytes to be written and must match that expected by the remote EtherNet/IP device.

Table 3.9 – Data Transfer configuration parameters

The Data Transfer configuration is shown in the figure below. This window is opened by either double clicking on the module in the tree or right-clicking the module followed by selecting *Configuration.* Once in the configuration window select the Data Transfer tab.

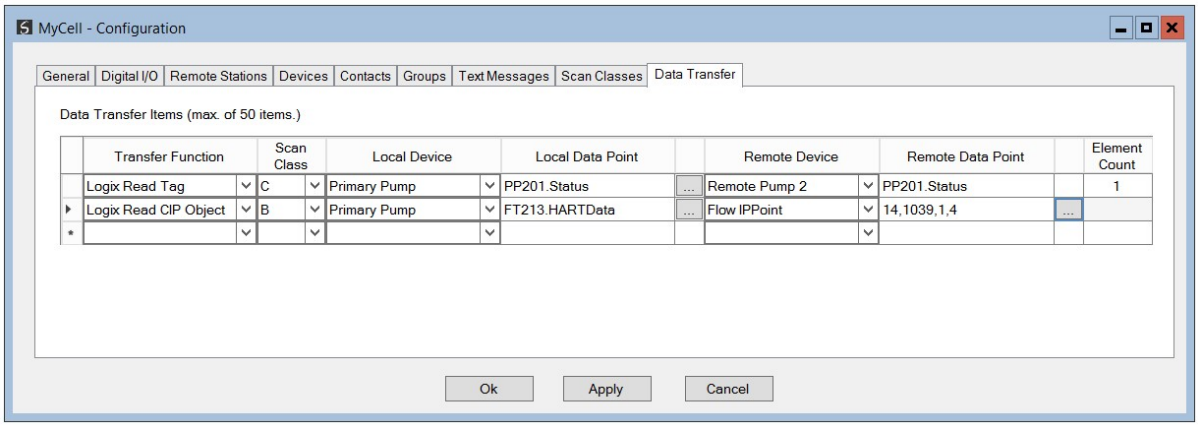


Figure 3.28 – Data Transfer configuration

Where a local Logix device has been selected, the user can either manually enter the Logix tag in the Data Point field, or select the Tag Browser button ("…"). The Tag Browser will open.

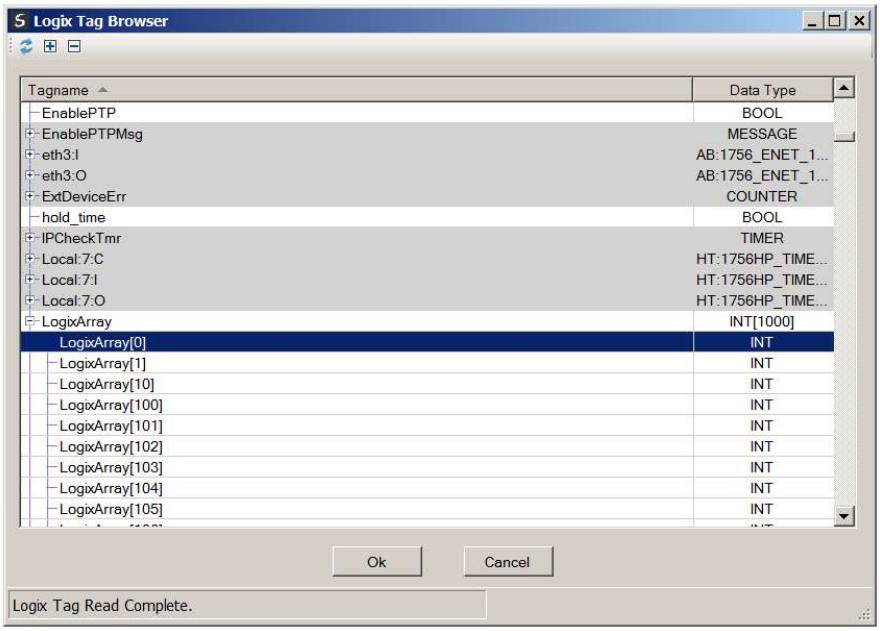


Figure 3.29 – Logix Tag Browser

Where an EtherNet/IP device has been selected, the user can either manually enter the CIP object path Data Point field, or select the Custom CIP Object Builder button ("…").

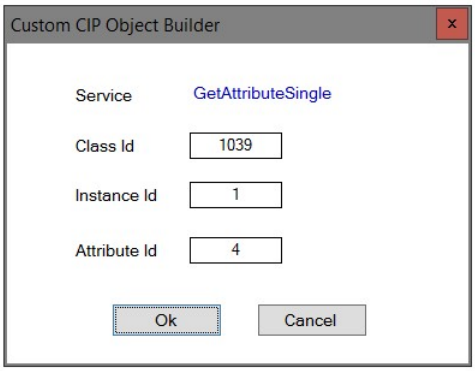


Figure 3.30 – Custom CIP Object Builder

The available Data Transfer Functions are listed below.

Remote Scheduling refers to the remote station scheduling the transfer of the data (unsolicited) rather than the local station requesting it each time. Although the data result is the same, the remote scheduling is more efficient and reduces the network data usage.

Function	*Local Point*	*Dirn*	*Remote Point*	*Remote Scheduled*
Logix Read RIO	Logix Tag	←	On-board IO	
Logix Write RIO	Logix Tag	→	On-board Relays	
Logix Read RIO (Unsol.)	Logix Tag	←	On-board IO	Yes
Logix Read Tag	Logix Tag	←	Logix Tag	
Logix WriteTag	Logix Tag	→	Logix Tag	
Logix Read Tag (Unsol.)	Logix Tag	←	Logix Tag	Yes
Logix Read CIP Object	Logix Tag	←	EtherNet/IP Object	
Logix Write CIP Object	Logix Tag	→	EtherNet/IP Object	
Logix Read CIP Object (Unsol.)	Logix Tag	←	EtherNet/IP Object	Yes
Modbus Register Read RIO	Modbus Register	←	Modbus Register	
Modbus Register Write RIO	Modbus Register	→	Modbus Register	
Modbus Register Read RIO (Unsol.)	Modbus Register	←	Modbus Register	Yes
Modbus Read Register	Modbus Register	←	Modbus Register	
Modbus Write Register	Modbus Register	→	Modbus Register	
Modbus Read Register (Unsol.)	Modbus Register	←	Modbus Register	Yes
Modbus Coil Read RIO	Modbus Coil	←	Modbus Coil	
Modbus Coil Write RIO	Modbus Coil	→	Modbus Coil	
Modbus Coil Read RIO (Unsol.)	Modbus Coil	←	Modbus Coil	Yes
Modbus Read Coil	Modbus Coil	←	Modbus Coil	
Modbus Write Coil	Modbus Coil	→	Modbus Coil	
Modbus Read Coil (Unsol.)	Modbus Coil	←	Modbus Coil	Yes

Table 3.10 - Data Transfer Functions

3.5. MODULE DOWNLOAD

Once the Cell Connect module 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 Cell Connect module is not on a local network.

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

Path option.

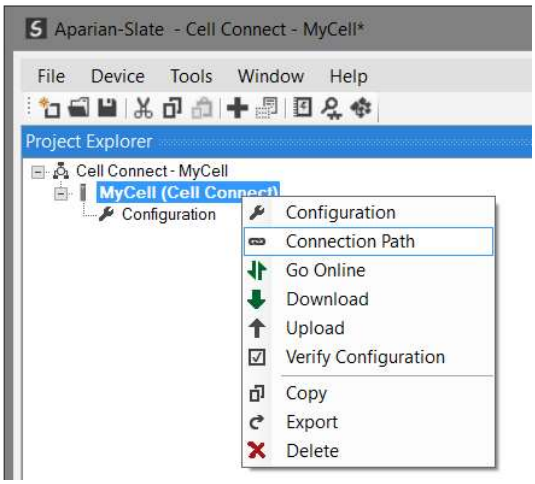


Figure 3.31. - Selecting Connection Path

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

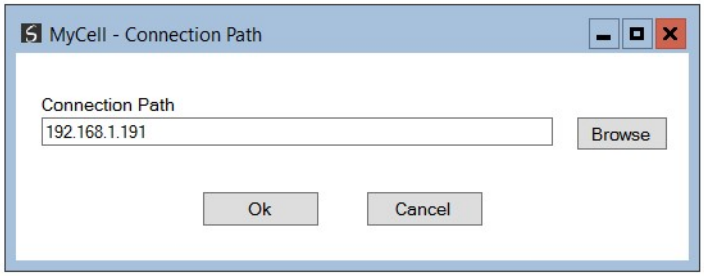


Figure 3.32. - Connection Path

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

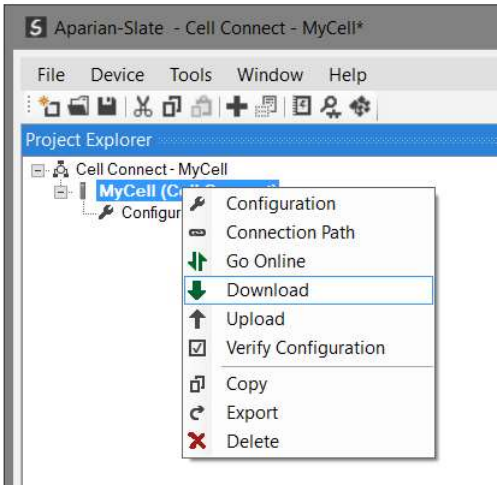


Figure 3.33. - Selecting Download

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



Figure 3.34. - Successful download

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.

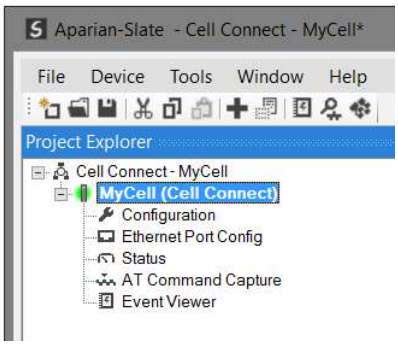


Figure 3.35. - Module online

3.6. LOGIX INTEGRATION

The Cell Connect module can be easily integrated with Allen-Bradley Logix family of controllers.

3.6.1. ADD MODULE TO I/O CONFIGURATION

The Cell Connect module must be added to the RSLogix 5000 I/O tree as a generic Ethernet module. This is achieved 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).

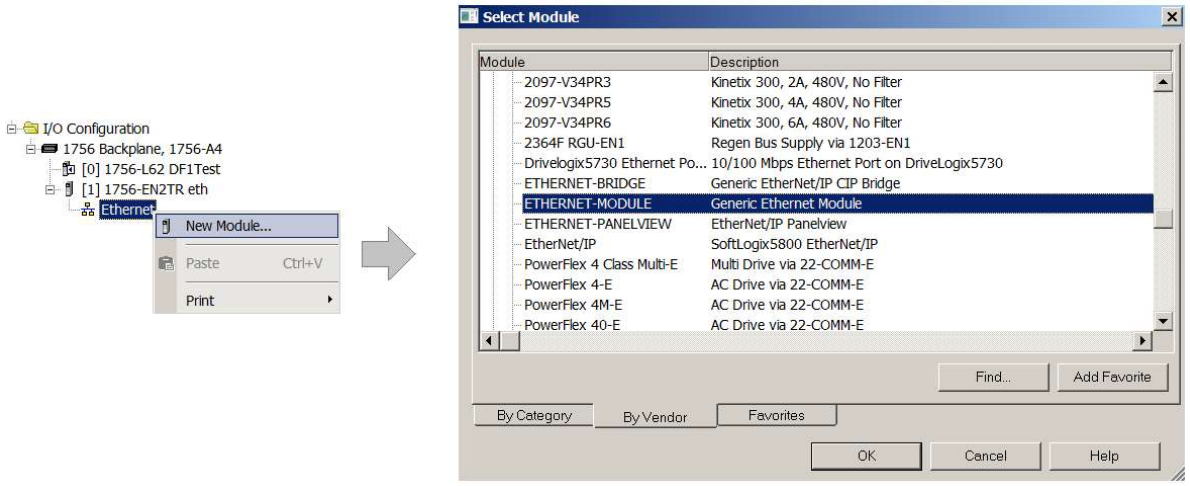


Figure 3.36 - Add a Generic Ethernet Module in RSLogix 5000

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

The required connection parameters for the Cell Connect module are shown below:

Connection Parameter	*Assembly Instance*	*Size*
Input	118	176 (8-bit)
Output	101	4 (8-bit)
Configuration	102	0 (8-bit)

Table 3.11 - RSLogix class 1 connection parameters

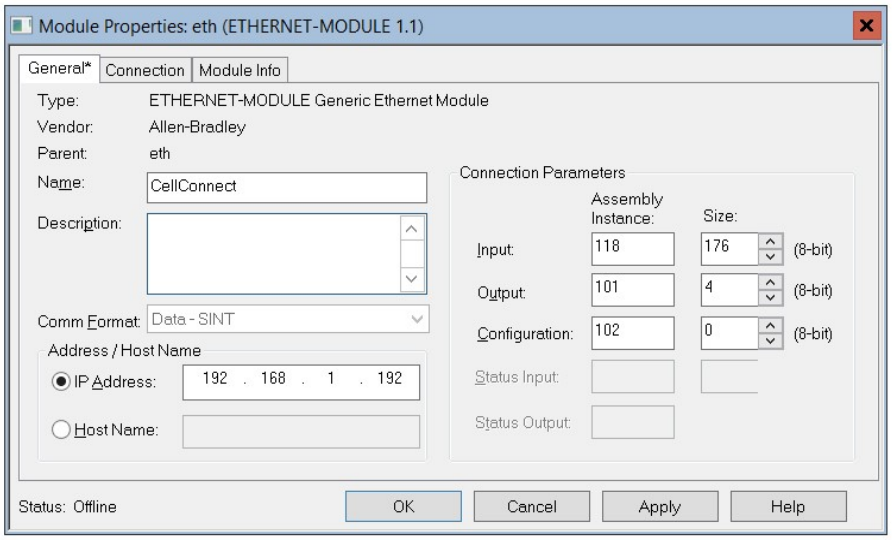


Figure 3.37 - RSLogix 5000 General module properties for **Cell Connect** module

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.

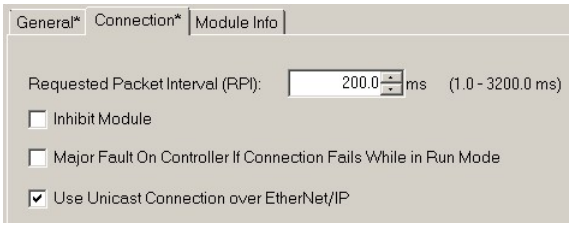


Figure 3.38 - Connection module properties in RSLogix 5000

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 I/O 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.

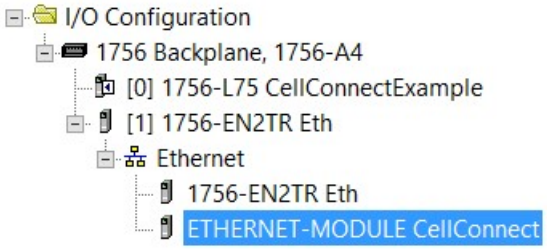


Figure 3.39 – RSLogix 5000 I/O module tree

3.6.1.1. 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.

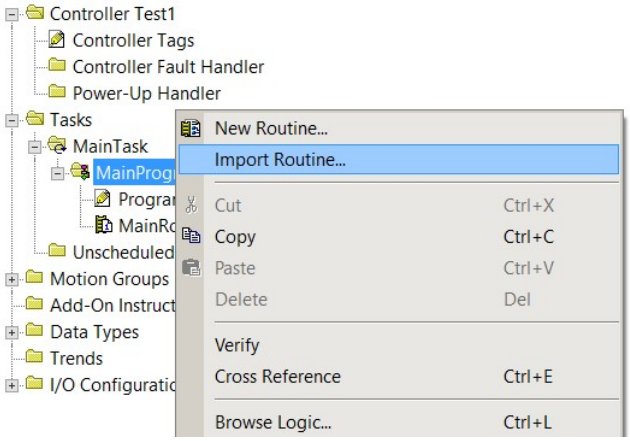


Figure 3.40. – RSLogix 5000 Importing Cell Connect module specific routine and UDTs

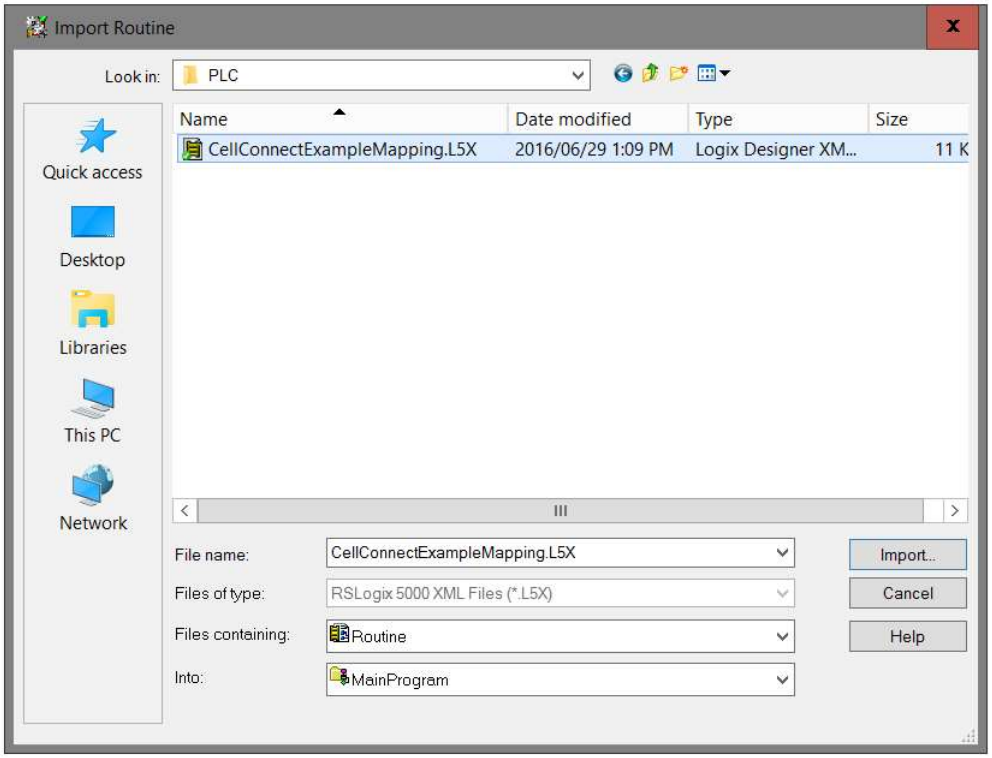


Figure 3.41. - Selecting partial import file

The import will create the following:

- The required UDTs (user defined data types) and Strings
- Controller tags representing the Input assembly.
- A routine mapping the Cell Connect module to the aforementioned tags and an example message instruction.

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

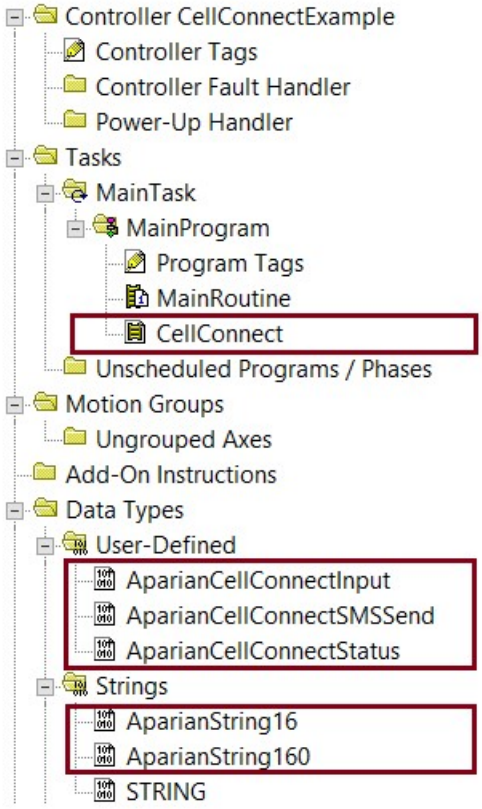


Figure 3.42. - Imported RSLogix 5000 objects

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

CellConnectI	{...}		AparianCellConnectInput
CellConnectI.InstanceName	'Cell6'		STRING
CellConnectI.Status	{...}		AparianCellConnectStatus
CellConnectI.Status.ConfigurationValid	1	Decimal	BOOL
CellConnectI.Status.DigitalInput0	0	Decimal	BOOL
CellConnectI.Status.DigitalInput1	0	Decimal	BOOL
CellConnectI.Status.DigitalInput2	0	Decimal	BOOL
CellConnectI.Status.DigitalInput3	0	Decimal	BOOL
CellConnectI.Status.RelayOutput0	0	Decimal	BOOL
CellConnectI.Status.RelayOutput1	0	Decimal	BOOL
CellConnectI.Status.SIMOk	1	Decimal	BOOL
CellConnectI.Status.NetworkRegistered	1	Decimal	BOOL
CellConnectI.Status.DataNetworkRegistered	1	Decimal	BOOL
CellConnectI.Status.TcpConnectionCount	1	Decimal	BOOL
CellConnectI.Status.TelegramConnected	1	Decimal	BOOL
CellConnectI.Status.SmartAntennaEnabled	0	Decimal	BOOL
CellConnectI.Status.AntennaShorted	0	Decimal	BOOL
CellConnectI.Status.AntennaNotConnected	0	Decimal	BOOL
CellConnectI.Status.SIMNotInserted	0	Decimal	BOOL
CellConnectI.Status.InternetAccess	1	Decimal	BOOL
CellConnectI.Temperature	48.914894	Float	REAL
CellConnectI.NetworkTechnology	2	Decimal	SINT
CellConnectI.AntennaLoad	-1	Decimal	SINT
CellConnectI.SignalQuality	1	Decimal	SINT
CellConnectI.SignalRSSI	24	Decimal	SINT
CellConnectI.DataBytesSent	37514908	Decimal	DINT
CellConnectI.DataBytesReceived	33647924	Decimal	DINT
CellConnectI.DataConnectionsLost	715	Decimal	DINT
CellConnectI.TextMessagesSent	0	Decimal	DINT
CellConnectI.TextMessagesReceived	1	Decimal	DINT

Figure 3.43. – UDT Input Assembly

The input assembly items are described in chapter 6.

4. TEXT MESSAGE OPERATIONS

The Cell Connect module provides multiple Text Messaging Actions which are specified in the Text Messaging tab of the module's configuration form. Each Message Action refers to either when a message should be sent, or what action should be taken if a message is received.

NOTE: The module can send and receive text messages using either traditional SMS messages or Telegram instant messages.

4.1. SENDING MESSAGES

In this sub-set the Message Action denotes what is monitored and what condition is required for the text message to be sent. The item being monitored could be an on-board digital input, a tag in a Logix controller, or a Modbus register in a Modbus-TCP device.

If the required condition is met (e.g. on, off, or change) then the message will be sent to each contact in the associated contact group.

A back-off time (seconds) prevents multiple messages from being sent should the required condition be met multiple times in quick succession.

4.2. RECEIVING MESSAGES

In this sub-set, the Message Action defines the operation to be taken following the receiving of the configured message. If the message is received from a contact that is not a member of the associated contract group, it will be ignored.

The security of a system is not compromised with the addition of the Cell Connect Module. Only Text Messages received from Phone Numbers listed in the module configuration are processed. In addition, only configured commands for each specific group will be processed. Attempts to access commands by non-approved users will be shown in the cellular statistics.

If the Ack (Acknowledge) option has been selected, the module will reply to the sender with a text message confirmation. If the Message Action requires a value to be extracted from the received message (eg. when setting a value in a Logix tag or Modbus register), **this value should be placed at the end of the message and preceded with a space.**

For example, if the message configuration is:

Message Action: ***LogixTagSetINT***

Message: ***Set Fan Speed***

Then an example text message sent to the module could be:

Set Fan Speed 45

Which would result in the value of **45** being written to the associated Logix tag.

NOTE: The text message is **NOT** case sensitive.

NOTE: If a message is sent with the incorrect wording (eg. Set Fans Speed in the example above) then the text message will be ignored.

If the user selected the Message Acknowledge option in the message parameter configuration a text message will be returned indicating if the setting of the tag/register was successful or if it has failed followed by the text message that was sent. Below are the acknowledgement responses that can be returned:

Message Acknowledgement	Description
"SET SUCCESS – Set Fan Speed 45"	Successfully set the configured tag/register to 45.
"SET FAILED (VALUE TOO BIG) – Set Fan Speed 4500"	Failed setting the tag/register because the value was too big for the destination. For example setting a value of 4500 to a SINT.
"SET FAILED (NO TAG/REGISTER) – Set Fan Speed 45"	Failed setting the tag/register because the configured tag/register does not exist.
"SET FAILED (TIMEOUT) – Set Fan Speed 45"	Failed setting the tag/register because no response was received from the destination confirming the write.
"SET FAILED (INVALID VALUE) – Set Fan Speed 4T"	Failed setting the tag/register because the value supplied is not a valid decimal number.
"SET FAILED – Set Fan Speed 45"	Failed setting the tag/register because of an unknown reason.

Table 4.1 – Acknowledge Messages

The text Messaging Actions can also be divided into three main groups:

- On-board IO messaging actions
- Logix messaging actions

- Modbus messaging actions

4.3. ON-BOARD ACTIONS

The on-board functions allow the Cell Connect module to operate in a stand-alone mode. Once configured, the module can notify users of changes of on-board input states, as well as allowing a remote user to control the on-board relays via text messages.

The following Message Actions apply:

Message Action	Operation
Report Digital Input 0 OFF	Send the text message when the on-board Digital Input 0 transitions to an OFF state.
Report Digital Input 0 ON	Send the text message when the on-board Digital Input 0 transitions to an ON state.
Report Digital Input 1 OFF	Send the text message when the on-board Digital Input 1 transitions to an OFF state.
Report Digital Input 1 ON	Send the text message when the on-board Digital Input 1 transitions to an ON state.
Report Digital Input 2 OFF	Send the text message when the on-board Digital Input 2 transitions to an OFF state.
Report Digital Input 2 ON	Send the text message when the on-board Digital Input 2 transitions to an ON state.
Report Digital Input 3 OFF	Send the text message when the on-board Digital Input 3 transitions to an OFF state.
Report Digital Input 3 ON	Send the text message when the on-board Digital Input 3 transitions to an ON state.
Set Relay Output 0 ON	When the message is received, set the on-board Relay 0 to an ON state.
Set Relay Output 0 OFF	When the message is received, set the on-board Relay 0 to an OFF state.
Set Relay Output 0 PULSE	When the message is received, pulse the on-board Relay 0 for the pre-configured pulse duration (see *Cell Connect Parameters* section).
Set Relay Output 1 ON	When the message is received, set the on-board Relay 1 to an ON state.
Set Relay Output 1 OFF	When the message is received, set the on-board Relay 1 to an OFF state.
Set Relay Output 1 PULSE	When the message is received, pulse the on-board Relay 1 for the pre-configured pulse duration (see *Cell Connect Parameters* section).
Power On Notification	Send the text message when the module powers-up.

Table 4.2 - Message Actions - On-board

4.4. LOGIX ACTIONS

The Cell Connect module provides two methods for initiating the sending of Text Messages from a Rockwell Automation Logix controller:

- Message Action
- Unscheduled Pass-through Message

4.4.1. LOGIX MESSAGE ACTIONS

When using the Logix Message Actions, the target Logix controller must first be added in the Devices tab of the configuration.

In the example below, the “Primary Pump” controller is highlighted, with the CIP path of 192.168.1.102,1,0. Note that the “1,0” suffix is made up of the “1” indicating the 1756 backplane, and the “0” indicating slot 0).

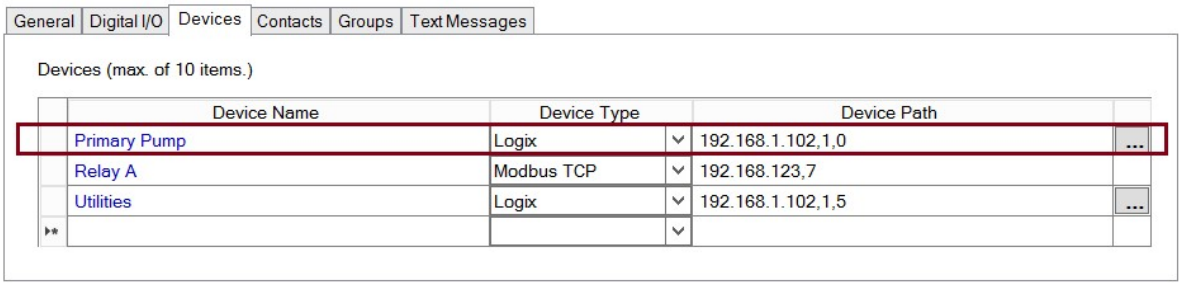


Figure 4.1 - Logix Device Configuration Example

This path can either be entered, or the browse button can be used to select the controller if it is online.

The Text Message item (highlighted below) will then reference the “Primary Pump” device name. The Data Point would be assigned the Logix Tag name.

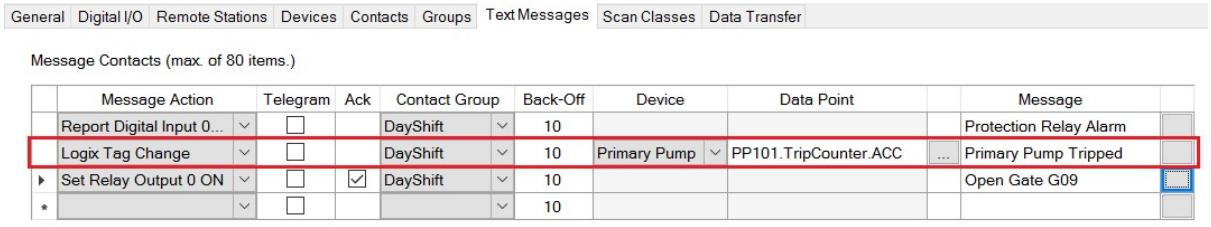


Figure 4.2 - Logix Message Action Configuration Example

The following Message Actions apply:

Message Action	Operation
Logix Tag Change	Send the text message when the value of the configured Logix tag changes. The Logix tag must be any atomic type (e.g. BOOL, SINT, INT, DINT, REAL). **Care must be taken when using a REAL datatype, as the slightest change to the value would trigger the message.**
Logix Tag Boolean OFF	Send the text message when the value of the configured Logix Boolean tag transitions to an OFF state.
Logix Tag Boolean ON	Send the text message when the value of the configured Logix Boolean tag transitions to an ON state.
Logix Tag Set BOOL	When the message is received, set the configured Logix Boolean tag to the state specified in the received message.
Logix Tag Set SINT	When the message is received, set the configured Logix SINT tag to the value specified in the received message.
Logix Tag Set INT	When the message is received, set the configured Logix INT tag to the value specified in the received message.
Logix Tag Set DINT	When the message is received, set the configured Logix DINT tag to the value specified in the received message.
Logix Tag Set REAL	When the message is received, set the configured Logix REAL tag to the value specified in the received message.

Table 4.3 - Message Actions - Logix

4.4.2. Unscheduled Pass-Through Message

The module supports the sending of Text Message using an explicit Logix Message instruction.

An example of this is shown in the figure below.

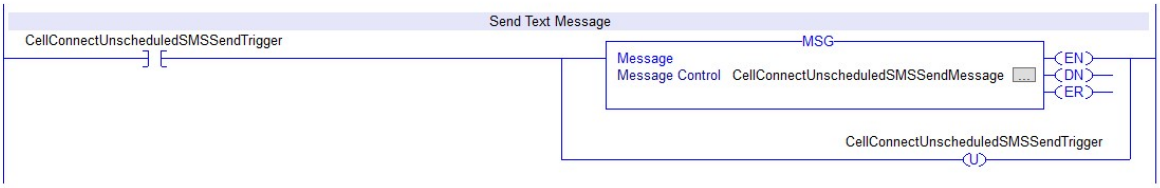


Figure 4.3. – Send Text Message

The required attributes for the message instruction are as follows:

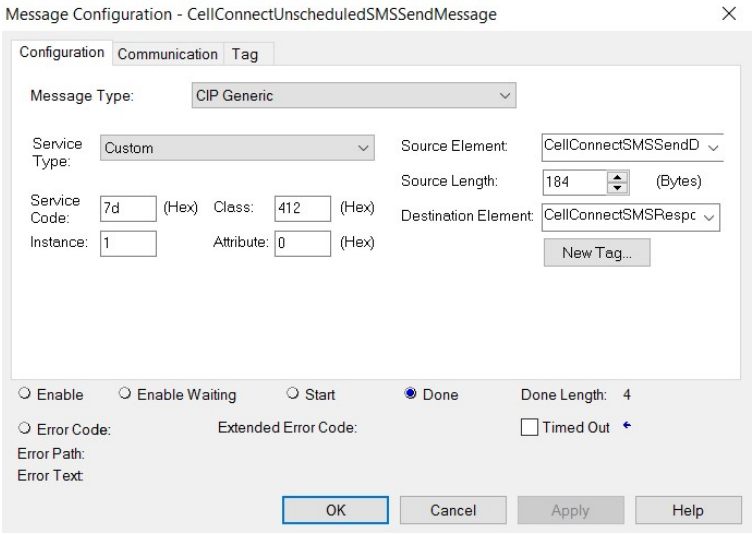


Figure 4.4. – Send Text Message Configuration

Parameter	Value / Description
Message Type	CIP Generic
Service Type	Custom
Service Code	7D Hex (Send Text Message service - SMS)
Class	412 Hex
Instance	1
Attribute	0
Source Element	Tag of type AparianCellConnectSMSSend
Source Length	184
Destination Element	DINT (reserved)

Table 4.4 - Send Text Message parameters

The structure of the source element (*AparianCellConnectSMSSend*) UDT is as follows:

Parameter	Value / Description
DestinationNumber	STRING16
Message Control	DINT Bit 0 – Off: Send Message using SMS On: Send Message using Telegram
Message	STRING160

Table 4.5 - Send Text Message source strucutre

4.5. MODBUS ACTIONS

When using the Modbus device Message Actions, the target Modbus-TCP device must first be added in the Devices tab of the configuration.

In the example below, the “Relay A” Modbus device is highlighted, with the device path of 192.168.1.123,7. Note that the “192.168.1.123” represents the Modbus device’s IP address and the “7” represents the node number.

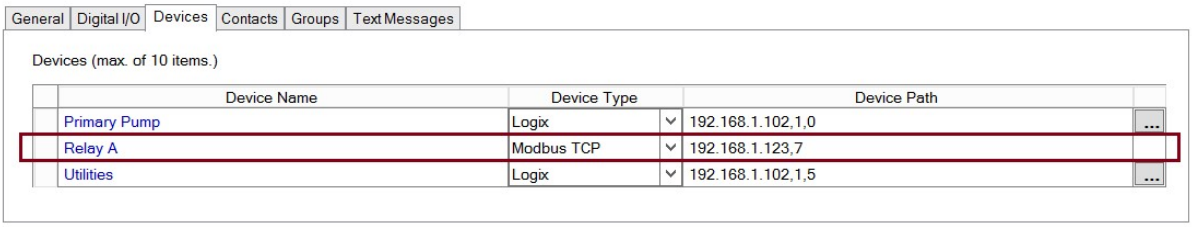


Figure 4.5 - Modbus Device Configuration Example

This path can either be entered, or the Modbus-TCP Path Builder can be used to build the path.

The Text Message item (highlighted below) will then reference the “Relay A” device name. The Data Point would be assigned the Modbus Holding Register (43101 in this example).

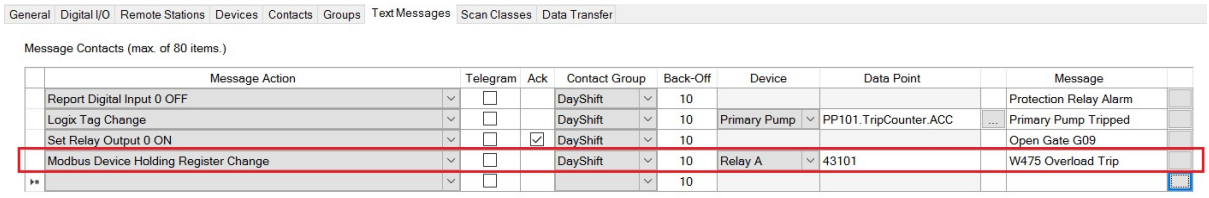


Figure 4.6 - Modbus Message Action Configuration Example

The following Message Actions apply:

Message Action	Operation
Modbus Device Holding Register Change	Send the text message when the value of the configured Modbus Holding register changes.
Modbus Device Input Register Change	Send the text message when the value of the configured Modbus Input register changes.
Modbus Device Register Set	When the message is received, set the configured Modbus register to the value specified in the received message.

Modbus Device Input Change	Send the text message when the state of the configured Modbus Input changes.
Modbus Device Coil Change	Send the text message when the state of the configured Modbus Coil changes.
Modbus Device Coil Set	When the message is received, set the configured Modbus Coil to the state specified in the received message.

Table 4.6 - Message Actions - Modbus devices

5. DATA TRANSFER OPERATIONS

The data transfer functionality, as the name suggests, allows the transfer of user data between remote Cell Connect modules using the cellular network data services.

Data is transferred using multiple levels of authentication and encryption ensuring the highest level of security.

NOTE: Data transfer relies on the availabilty of the celluar network and remote data centre operations. Although these infrastructures generally exhibit extremmely high levels of availability and reliability, it is important to note that the system might not always be available. It is recommended that the module should therefore **not** be used in a safety application, or in the protection of equipment.

5.1. DATA CENTRE REGISTRATION

Before any data transfer can commence the Data Registration process must be completed. This process needs only to be completed once per module, unless the cellular SIM card has been replaced.

To register, the module must be online and the status window open. This is achieved by right-clicking on the module and selecting ***Status***.

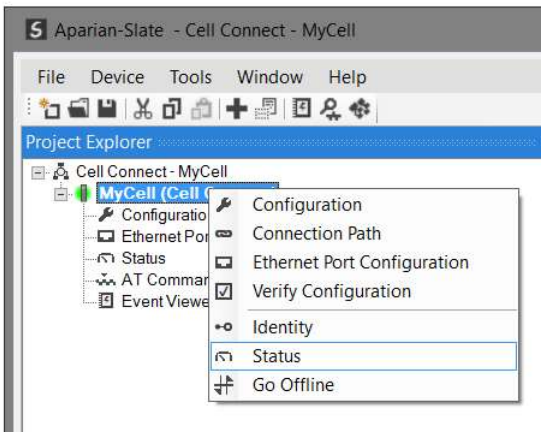


Figure 5.1. - Selecting Online Status

Registration is initiated by selecting the Data Centre Registration button, located on the right-hand side of the Cellular Status tab.

Several conditions are required before this process can be initiated, namely:

- Own number (in configuration) must be valid
- Data Network registered
- Valid Dynamic IP Address must be issued by the cellular network
- Network Time must be valid
- Internet Access must be available

NOTE: If the module is unable to register on the Data Network or access the Internet, then check the cellular netowrk's APN name and APN login requirements.

To initiate the registration process, click on the Data Centre Registration button.

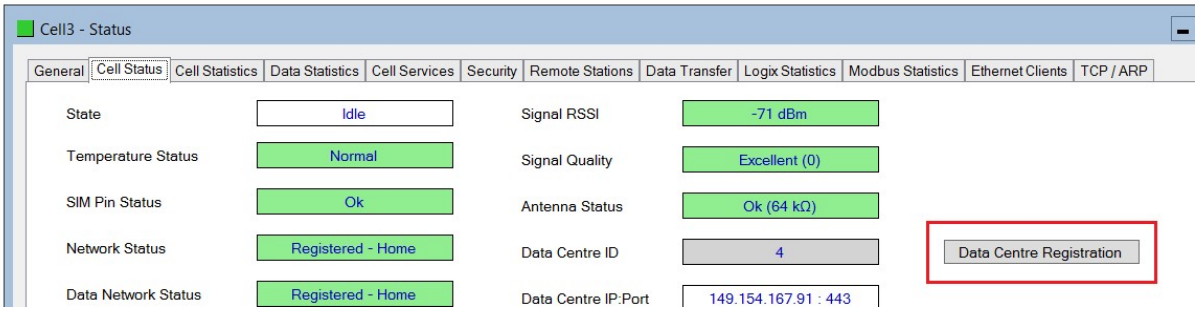


Figure 5.2 – Select Data Centre Registration

Note: The process may take up to two minutes.

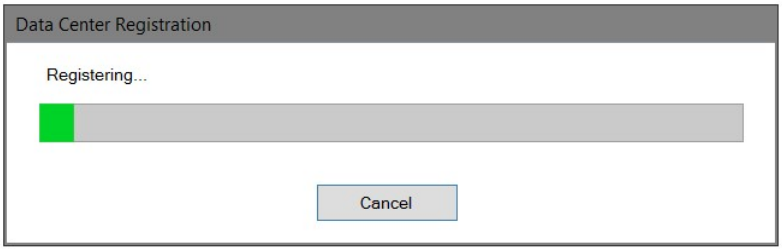


Figure 5.3 – Data Centre Registration progress

Once the process is complete the following message will be displayed.



Figure 5.4 – Data Centre Registration success

5.2. CONFIGURING A PASSPHRASE

To ensure an additional level of security is recommended to configure a passphrase. The same passphrase must be configured on all modules that are transferring data with each other.

To enter a passphrase, navigate to the Security tab of the status window and enter the new passphrase, and then click the ***Download*** button.

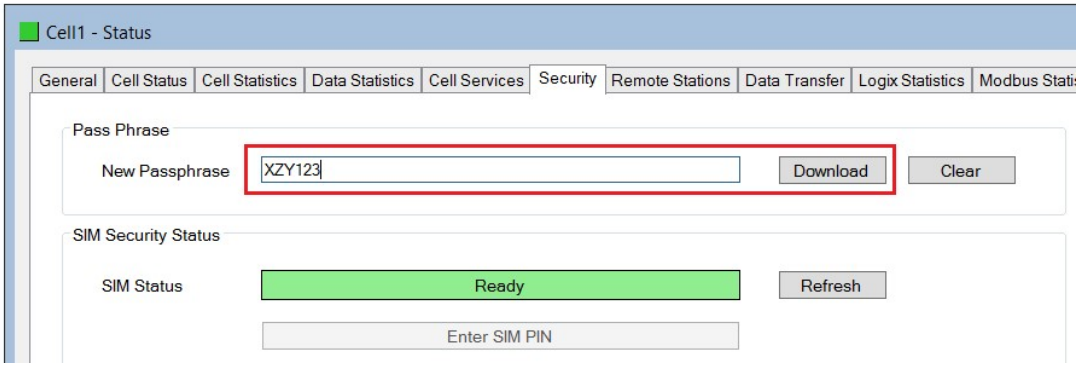


Figure 5.5 – Enter new Passphrase

Then select the ***Download*** button, after which you will be asked to confirm the process.



Figure 5.6 – Passphrase Write confirmation

Successful updating of the passphrase will be indicate by the following prompt:

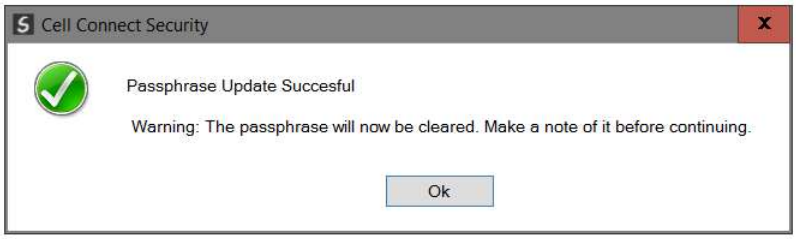


Figure 5.7 – Passphrase Write success

NOTE: After the new Passphrase has been doanloaded, the text will be cleared. It is important to make a note of the passphrase before continueing.

5.3. TRANSFER FUNCTIONS

The individual Data Transfer items, as configured will now be operational. Refer to the Data Transfer Function parameters in Cell Connect Parameters section for a description of the data transfer operations.

6. LOGIX 5000 IO TREE

The Cell Connect module can be added in the Logix IO tree to provide diagnostics information to the Logix controller. The Logix controller will establish a class 1 cyclic communication connection with the Cell Connect module. An input and output assembly is exchanged at a fix interval.

As described in chapter 3, by copying the module's input assembly to the supplied UDT, the following structured parameters can be extracted:

6.1.1. INPUT ASSEMBLY

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

Parameter	Datatype	Description
Instance	STRING	The instance name of the module that was configured under the general Cell Connect module configuration in Slate.
Status		
Configuration Valid	BOOL	A valid Cell Connect configuration was downloaded to the module.
Digital In 0	BOOL	The current state of Digital Input 0
Digital In 1	BOOL	The current state of Digital Input 1
Digital In 2	BOOL	The current state of Digital Input 2
Digital In 3	BOOL	The current state of Digital Input 3
Relay Out 0	BOOL	The current state of Relya Output 0
Relay Out 1	BOOL	The current state of Relya Output 1
Sim Ok	BOOL	Access to the cellular SIM was granted. Note this may be 0, if the SIM PIN is incorrect.
Network Registered	BOOL	The module has successfully connected to the cellular network.
Data Network Registered	BOOL	The module has successfully connected to the cellular network data services.
TCP Socket Connected	BOOL	TCP data connection established.
Telegram Connected	BOOL	Connected to Telegram Data Centre.
Smart Antenna Enabled	BOOL	Smart Antenna enabled in configuration.,
Antenna Shorted	BOOL	Antenna short circuit detected.
Antenna Not Connected	BOOL	No antenna detected. (Required Smart Antenna enabled).

SIM Not Inserted	BOOL	There is no SIM card inserted in the module
Internet Access	BOOL	The module has access to the internet indicating that the data network is operational.
(End of Status)		
Temperature	REAL	The internal temperature of the module in °C.
Network Technology	SINT	Describes the cellular technology used in the connection. 0: GSM 2G 1: GSM Compact 2: 3G (UTRAN) 3: EDGE 4: 3G with HSDPA 5: 3G with HSUPA 6: 3G with HSDPA & HSUPA 7: 4G LTE
Antenna Load	SINT	Measured value of antenna impedance. -1: Open circuit 0: Short circuit [other]: impedance value in kΩ
Signal Quality	SINT	An indicator of the signal quality. 0-7: Signal quality where 0 is the best and 7 is the worst. 99: Unknown See table below for more details.
Signal RSSI	SINT	Received Signal Strength Indication (RSSI): 0: -113 dBm or less 1: -111 dBm 2-30: from -109 to -53 dBm with 2 dBm steps 31: -51 dBm or greater 99: unknown
Data Bytes Sent	DINT	Number of bytes sent using the cellular data services.
Data Bytes Received	DINT	Number of bytes received using the cellular data services.
Data Connections Lost	DINT	Number of data connections lost.
Text Messages Sent	DINT	Number of text messages sent.
Text Messages Received	DINT	Number of text messages received.
Text Message Send Fails	DINT	Number of failed text message send attempts.
Text Messages Received Fails	DINT	Number of failed text message receive attempts.

Antenna Lost Count	DINT	Number of antenna failures.
Logix Services		
Device Response Timeout	DINT	The number of requests sent to a device where no response was received within the allocated time.
Connection Failures	DINT	The number of failed attempts at establishing a class 3 connections with a Logix controller.
Tag Not Exist Errors	DINT	The number of tag read and tag write transactions that failed due to the destination tag not existing.
Privilege Violations	DINT	The number of tag read and tag write transactions that failed due to a privilege violation error. This may be caused by the External Access property of the Logix tag being set to either None or Read Only.
Tag Reads	DINT	The number of Logix tag reads executed by the module.
Tag Writes	DINT	The number of Logix tag writes executed by the module.
ENIP Failures	DINT	The number of EtherNet/IP related failures.
Status		
Modbus Rx Packet Count	DINT	The number of Modbus packets received by the module.
Modbus Tx Packet Count	DINT	The number of Modbus packets sent by the module.
Modbus Timeouts	DINT	The number of timed-out Modbus packets sent by the module. That is, no reply was received.
Modbus Additional Errors	DINT	The number of Modbus errors not defined in any other statistic.

Table 6.1 - Cell Connect Logix 5000 input assembly parameters

The table blow describes the Signal Quality parameter in more detail.

Mode	2G CS and GPRS	2G EGPRS	UMTS	LTE
Quality Code	Bit Error Rate	Mean Bit Error Probability	Energy per Chip/Noise (ECN0) ratio in neagtive dB levels.	Reference Signal Received Quality (RSRQ).
0	< 0.2%	28 to 31	>= 44	< 5
1	0.2% to 0.4%	24 to 27	38 to 44	5 to 10
2	0.4% to 0.8%	20 to 23	32 to 38	10 to 14
3	0.8% to 1.6%	16 to 19	26 to 32	14 to 18
4	1.6% to 3.2%	12 to 15	20 to 26	18 to 22
5	3.2% to 6.4%	8 to 11	14 to 20	22 to 26
6	6.4% to 12.8%	4 to 7	8 to 14	26 to 30
7	> 12.8%	0 to 3	< 8	>= 30
99	Unknown	Unknown	Unknown	Unknown

Table 6.2 - Signal Quality Codes

7. DIAGNOSTICS

7.1. LEDS

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



Figure 7.1 - Cell Connect module 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.
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 when traffic is detected.
GSM	The LED is used to indicate the status of the GSM modem and has 4 different states:

Solid Red	GSM modem has not started the initialization process (usually because of no configuration.
Flashing Red	GSM modem is being initialized. The LED will keep flashing Red until the module has been setup and the SIM has successfully been enabled (eg. correct SIM Pin).

	Flashing Green	The GSM modem is busy registering with the network. Note that if no data network is available the LED will keep flashing whilst trying to connect to the data network. In this state the user can still use all SMS functionality.
	Solid Green	The GSM modem has successfully initialized.
Activity	The LED will flash green when there is data exchange with the GSM modem.	

Table 7.1 - Module LED operation

7.2. MODULE STATUS MONITORING IN SLATE

The Cell Connect module 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.

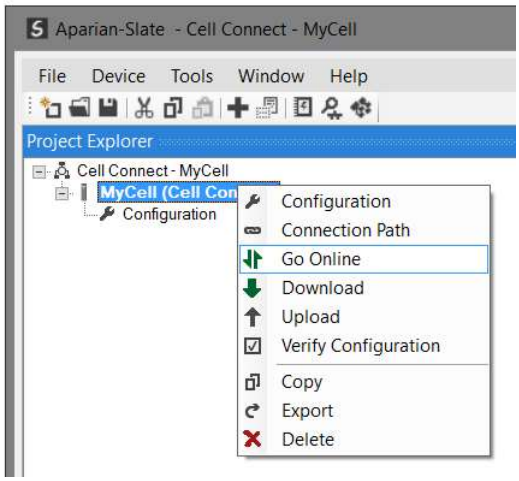


Figure 7.2. - Selecting to Go Online

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

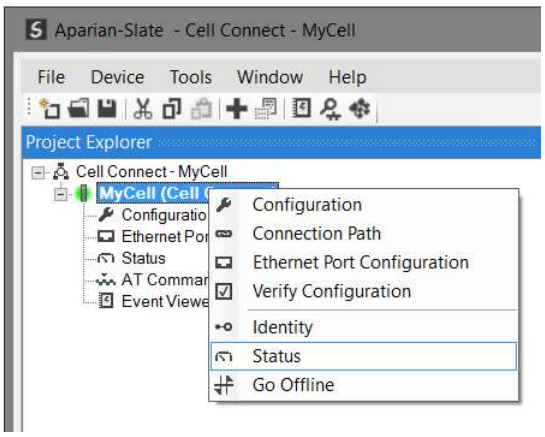


Figure 7.3. - Selecting Online Status

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 status of the module. Most of these parameters in the status windows are self-explanatory or have been discussed in previous sections.

7.2.1. GENERAL

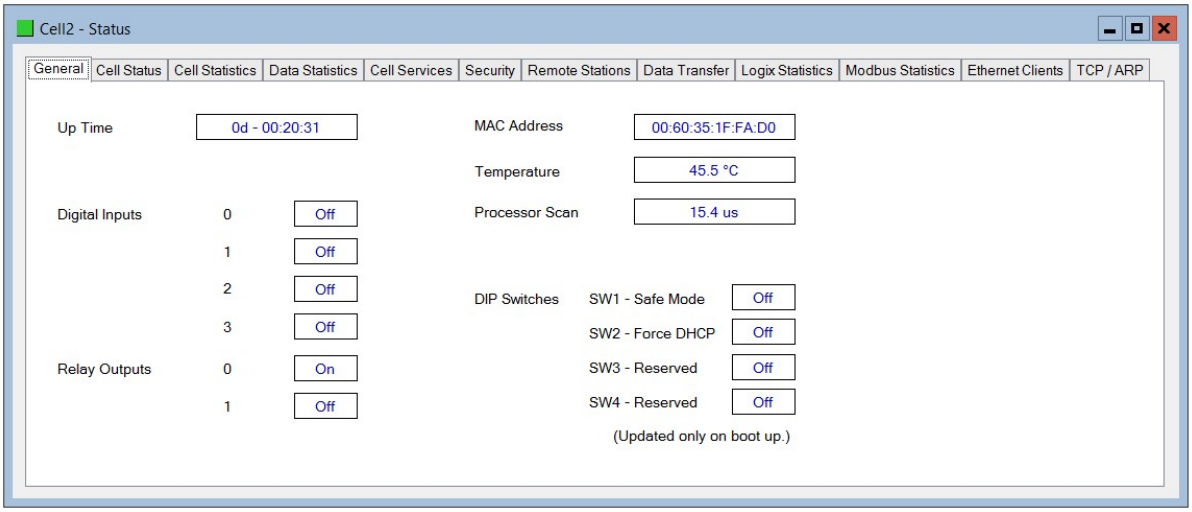


Figure 7.4 - General Status

The General tab displays the following general parameters:

Parameter	Description
Up Time	Indicates the elapsed time since the module was powered-up.
Digital Inputs (0-3)	The current logical state of the 4 digital inputs.
Relay Outputs (0-1)	The current logical state of the 2 relay outputs.
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 7.2 – General tab parameters

7.2.2. CELLULAR STATUS

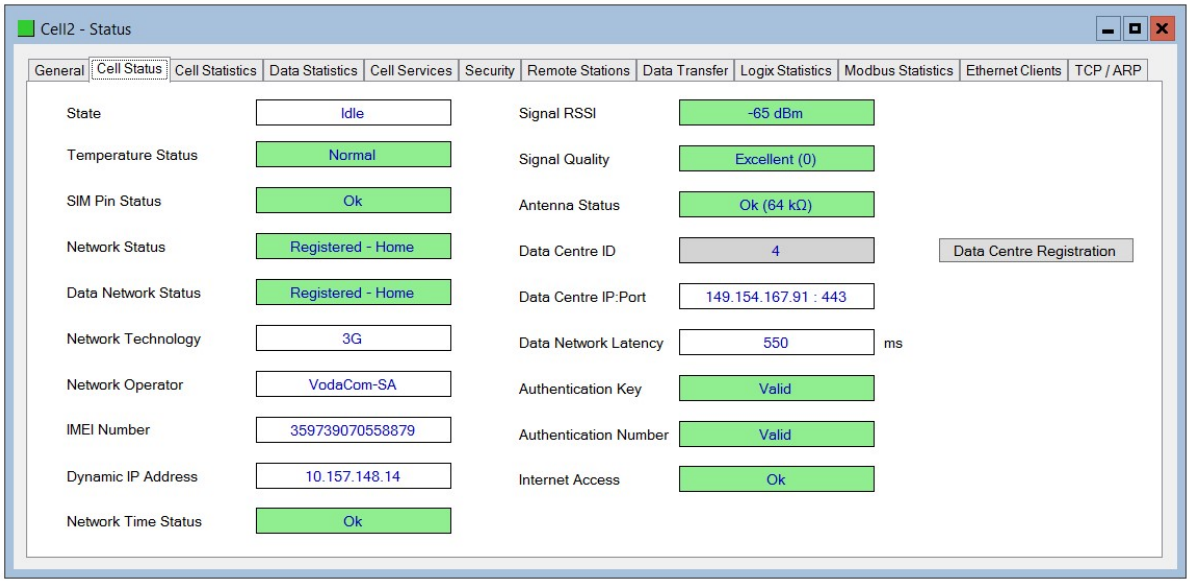


Figure 7.5 - Cellular Status

The Cellular Status tab displays the following general parameters:

Parameter	Description
State	The internal state of the cellular engine.
Temperature Status	The internal temperature of the cellular engine. A warning will appear if the internal temperature is less than -30°C

	or greater than +77°C. Should the temperature drop below -40°C or increase above +97°C, then a "Critical Warning" will appear and cellular communication will be suspended.
SIM Pin Status	Status of the access to the cellular SIM, either Ok or Invalid Pin.
Network Registered	Describes the status of the module's registration on the cellular network: • Not Registered • Registered – Home • Searching • Denied • Unknown Failure • Registered Roaming
Data Network Register	Describes the status of the module's registration on the cellular **data** network: • Not Registered • Registered – Home • Searching • Denied • Unknown Failure • Registered Roaming
Network Technology	Describes the cellular technology used in the connection: • GSM 2G • GSM Compact • 3G (UTRAN) • EDGE • 3G with HSDPA • 3G with HSUPA • 3G with HSDPA & HSUPA • 4G LTE
Network Operator	The name of the cellular network provider.

IMEI Number	International Mobile Equipment Identity of the module.
Dynamic IP Address	The dynamic IP address assigned to module by the cellular network service provider.
Network Time Status	Indicates whether the module is synchronised to the cellular data network time.
Signal RSSI	Received Signal Strength Indication (RSSI).
Signal Quality	An indicator of the signal quality. See table in chapter 5 for more details.
Antenna Load	Measured value of antenna DC impedance. -1: Open circuit 0: Short circuit [other]: impedance value in kΩ Note: Open circuit warning is disabled if the smart-antenna configuration option is disabled.
Data Centre ID	The ID number of the Data Centre currently in use.
Data Centre IP : Port	The IP address and port of the Data Centre currently in use.
Data Network Latency	The latency (milliseconds) experienced by the data network.
Authentication Key	The status of the data centre authentication key.
Authentication Number	The status of the data centre authentication for the local cellular number.
Internet Access	Indicates the status of the data network's internet access.

Table 7.3 - Cellular Status tab parameters

When the module is first powered up and connected to the cellular network, it must be registered with a data centre. This step is required for data transfer and Telegram instant messaging.

Registration is initiated by selecting the Data Centre Registration button, located on the right-hand side of the Cellular Status tab.

Several conditions are required before this process can be initiated, namely:

- Own number (in configuration) must be valid
- Data Network registered
- Valid Dynamic IP Address must be issued by the cellular network
- Network Time must be valid
- Internet Access must be available

To initiate the registration process, click on the Data Centre Registration button. Note that the process may take up to two minutes.

NOTE: The Data Centre registration process is only required after a new cellular SIM card is inserted into the module.

7.2.3. CELLULAR STATISTICS

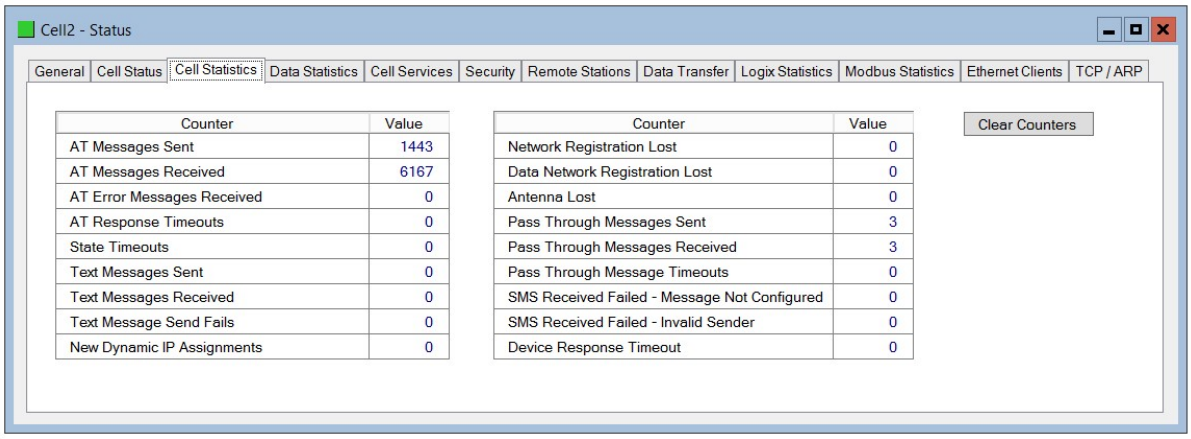


Figure 7.6 – Cellular Statistics

The Cellular Statistics tab displays the following general parameters:

Parameter	Description
AT Messages Sent	Number of AT commands sent to the cellular engine.
AT Messages Received	Number of AT commands received from the cellular engine.
AT Error Messages Received	Number of AT errors received from the cellular engine.
AT Response Timeouts	Number of AT commands failed due to timeout.
State Timeouts	When an error has occurred and the GSM modem was locked in a specific state.
Text Messages Sent	Number of text messages sent by the module.
Text Messages Received	Number of text messages received by the module.
Text Messages Send Fails	Number of unsuccessful text message send attempts.
New Dynamic IP Assignments	Number of dynamic IP address assignments.
Network Registration Lost	Number of occurrences the network connection was lost.
Data Network Registration Lost	Number of occurrences the data network connection was lost.
Antenna Lost	Number of antenna failures.

Pass Through Messages Sent	Number of pass through AT commands sent.
Pass Through Messages Received	Number of pass through AT commands received.
Pass Through Messages Timeouts	Number of pass through AT commands failed due to timeout.
SMS Received Failed – Messages Not Configured	Number of received messages ignored due to no matching configured message.
SMS Received Failed – Invalid Sender	Number of received messages ignored due to sender not in matching group.
Device Response Timeout	The number of messages sent to local devices where no response was received within the required time.

Table 7.4 - Cellular Statistics tab

7.2.4. CELLULAR DATA STATISTICS

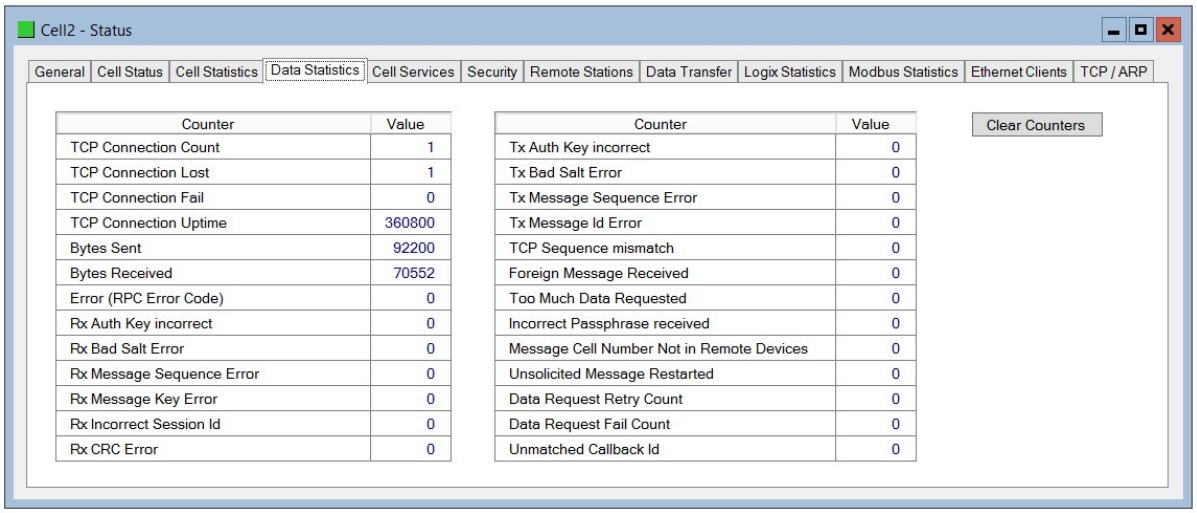


Figure 7.7 – Cellular Data Statistics

The Cellular Data Statistics tab displays the following general parameters:

Parameter	**Description**
TCP Connection Count	The number of TCP connections active.
TCP Connection Lost	The number of TCP connections lost.
TCP Connection Fail	The number of TCP connections that could not be established.
TCP Connection Uptime	The uptime for the current TCP connection.
Bytes Sent	The number of bytes sent since the module booted.
Bytes Received	The number of bytes received since the module booted.
Error (RPC Error Code)	The last error code received from the Data Centre.

Rx Auth Key incorrect	The number of incorrect Authentication Keys received.
Rx Bad Salt Error	The number of bad Salts received.
Rx Message Sequence Error	The number of incorrect message sequence numbers received.
Rx Message Key Error	The number of incorrect Message Keys received.
Rx Incorrect Session Id	The number of incorrect session ids received.
Rx CRC Error	The number of CRC mismatch messages received.
Tx Auth Key incorrect	The number of incorrect Authentication Keys sent.
Tx Bad Salt Error	The number of bad Salts sent.
Tx Message Sequence Error	The number of incorrect message sequence numbers sent.
Tx Message Id Error	The number of incorrect message id sent.
TCP Sequence mismatch	The number of TCP sequence mismatches.
Foreign Message Received	The number of messages received from foreign/non-configured numbers.
Too Much Data Requested	The number of times too much data was attempted to be sent.
Incorrect Passphrase Received	The number of times an incorrect passphrase was received.
Message Cell Number Not in Remote Devices	Message received from a Cell Number not in the Remote Devices configuration list.
Unsolicited Message Restarted	The number of Unsolicited Messages Restarted. **Note that every 5min a configure unsolicited message will be restarted.**
Data Request Retry Count	The number of retries for a Data Exchange Request.
Data Request Fail Count	The number of failed attempts to send/received a Data Exchange Request.
Unmatched Callback ID	A message/data is received without a matching callback id.

Table 7.5 - Cellular Data Statistics tab

7.2.5. CELLULAR SERVICES

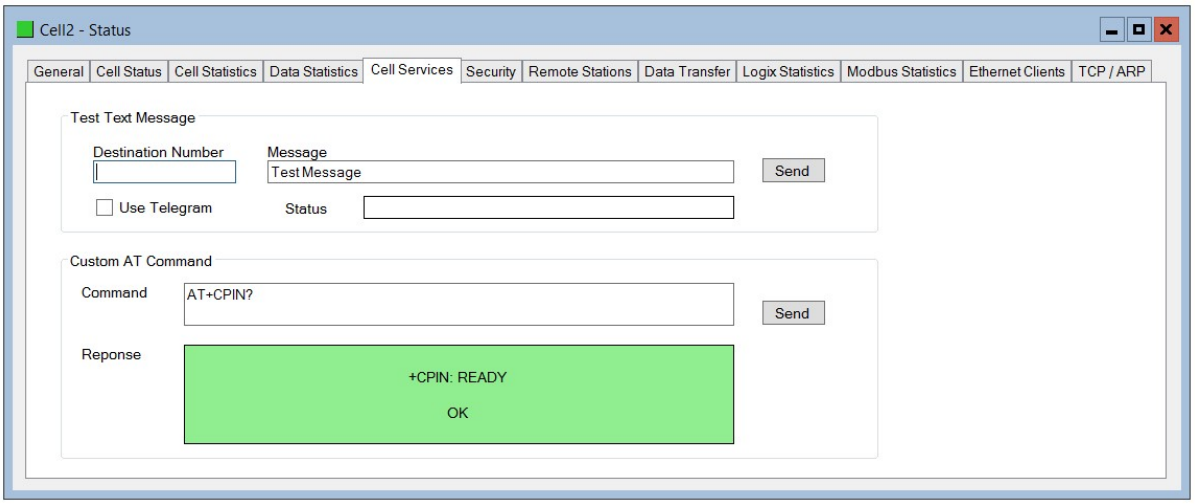


Figure 7.8 – Cellular Services tab

The Cellular Services tab provides two facilities that can be used for testing:

- Test Text Message Send
- Test Instant Message Send
- Custom AT Command

7.2.5.1. TEST SENDING OF TEXT OR INSTANT MESSAGE

This facility provides a quick method to test the module, SIM and network registration by sending a text message or Telegram Instant Message. Enter the destination cell (mobile) number and text message, select whether to use Telegram or not, and press **Send**.

If the message is not sent succesfully, consider the following:

- Check the module status, and the cellular network.
- Is this SIM pin locked.
- Has the service provider enabled text messages (SMS) for the SIM card.

NOTE: When using the Telgram option, note that the Data Centre registration process must first be completed.

NOTE: When using the Telgram option, note that the destination cellular number must exist in the Contacts configuration.

7.2.5.2. CUSTOM AT COMMAND

This facility allows advanced (AT) messages to be sent through to the cellular engine. This functionality is for advanced diagnostic purposes only.

NOTE: Use caution when entering custom AT commands. Certain commands may disrupt the module functionality, and could also lock-out the SIM card.

7.2.6. SECURITY

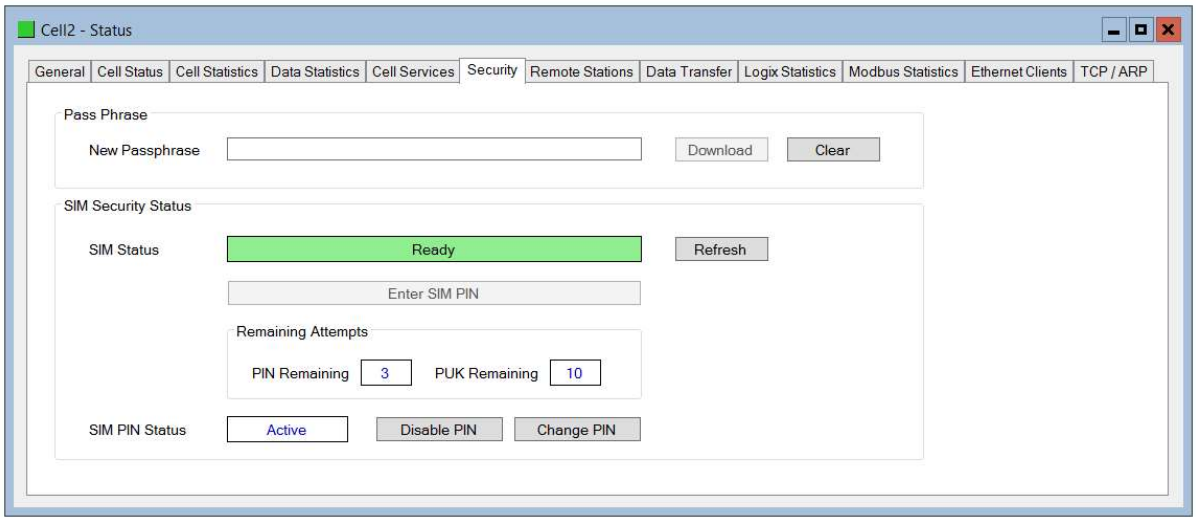


Figure 7.9 –Security tab

The Security tab provides the module and SIM card security options.

When using the Data Transfer functions a passphrase can be applied to ensure additional security. All modules exchanging data, must have the same passphrase configured. The passphrase can have a maximum of 32 characters.

This tab also provides the facility to enable, disable or change the PIN code on the cellular SIM card. When the module boots up, it will attempt to access the SIM card using the PIN code entered in the module's configuration (if the Pin has been enabled on the SIM card). Should the SIM PIN be enabled and the incorrect PIN entered in the configuration, then access to the SIM will fail. The SIM Status will not show "Ready" and will indicate what is required, e.g. "SIM PIN" or "SIM PUK" code required.

To recover from this condition, the user would first need to access the SIM by entering the correct PIN code. This button below the SIM Status will prompt the user to enter the required

PIN or PUK code. The number of remaining attempts allowed for both the PIN and PUK entry are shown in the Remaining Attempts group.

Once the remaining PIN attempts have been exhausted, the SIM will require the entry of the PUK code to recover. Both the PUK code and the initial PIN code are provided by the cellular service provider and usually delivered with the SIM card.

The PIN code can also be disabled, by selecting the Disable PIN button and following the prompts. Once the PIN has been disabled, the PIN in the configuration will be ignored. Similarly, the PIN can be re-enabled by using the Enable PIN button. Note that this process will require the original PIN code.

To change the PIN, select the Change PIN button and follow the prompts. The user will need to enter the old PIN, followed by the new PIN, and then confirm the new PIN.



NOTE: Once the PIN code has been changed, remember to update the module's confgiuration with the new PIN. Failure to do so, may result in the module not connecting to the network after the next power cycle.

7.2.7. REMOTE STATIONS

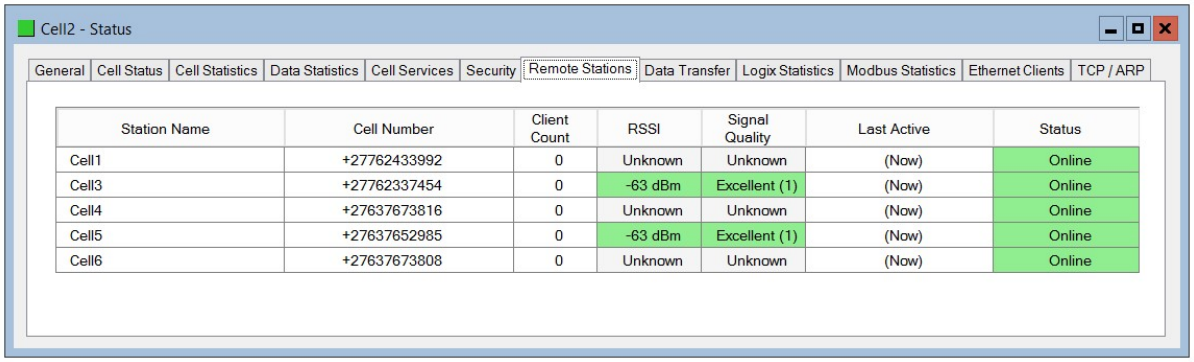


Figure 7.10 – Remote Station Status

The Remote Stations tab displays the status of each remote station connection with the following parameters:

Parameter	Description
Station Name	The configured Station Name.
Cell Number	The configured station's cell number.

Client Count	The number of unsolicited clients in the remote device. **Note a maximum of 5 unsolicited clients is supported per remote device.**
RSSI	The RSSI signal indicator of the remote device.
Signal Quality	The Signal Quality of the remote device.
Last Active	The last time the remote device was online.
Status	The status of item: • Contact not registered • Online • Offline – Recent • Offline – Last Week • Offline – Last Month

Table 7.6 – Remote Stations Status tab

7.2.8. DATA TRANSFER

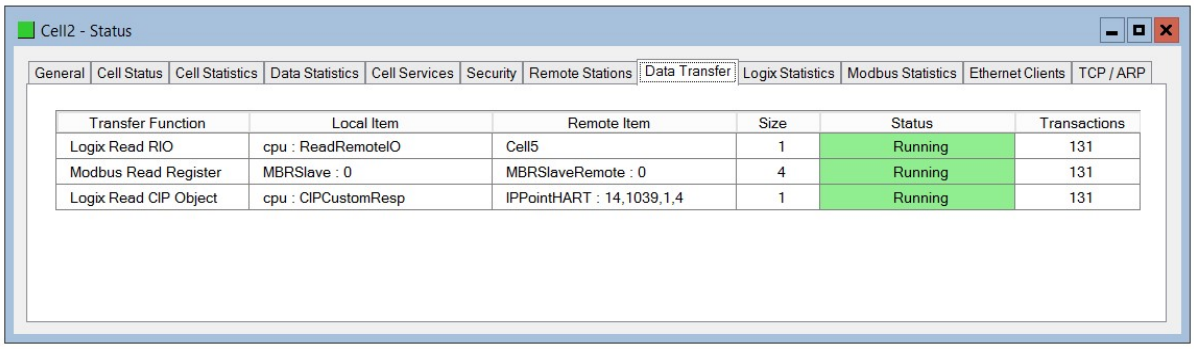


Figure 7.11 – Data Transfer Status

The Data Transfer status tab displays the status of each data transfer item with the following parameters:

Parameter	**Description**
Transfer Function	The configured Data Transfer Function.
Local Item	The local item in the format Device Name : Data Point
Remote Item	The remote item in the format Device Name : Data Point
Size	The configured item size.

Status	The status of item: • Running • Device Offline - the remote station's local device is not responding. • Station Offline - the remote station is offline. • Unconfigured – Remote device is not configured.
Transactions	The number of successful complete transactions.

Table 7.7 – Data Transfer Status tab

7.2.1. LOGIX STATISTICS

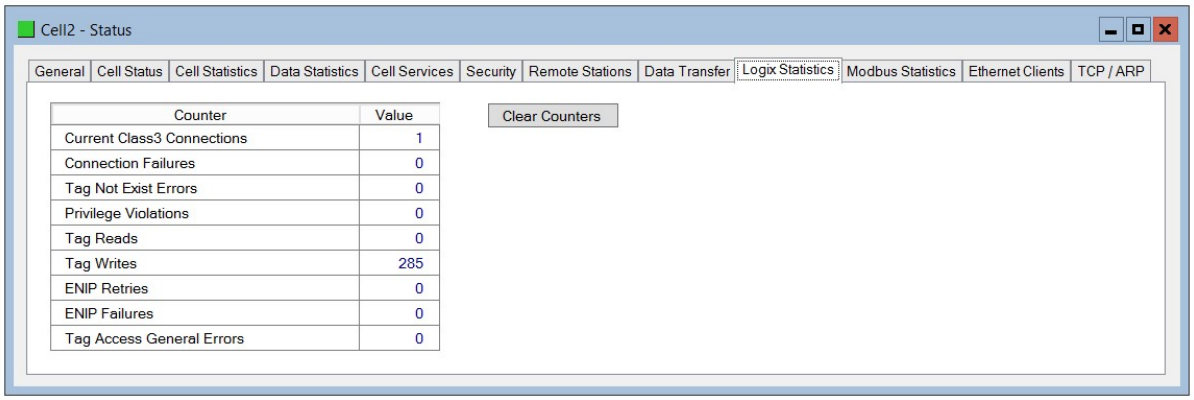


Figure 7.12 – Logix Statitics

The Logix Statistics tab displays the following parameters associated with Logix Tag access:

Statistic	**Description**
Current Class 3 Connections	The number of current open class 3 connections.
Connection Failures	The number of failed attempts at establishing a class 3 connection with a Logix controller.
Tag Not Exist Errors	The number of tag read and tag write transactions that failed due to the destination tag not existing.
Privilege Violation Errors	The number of tag read and tag write transactions that failed due to a privilege violation error. This may be caused by the External Access property of the Logix tag being set to either None or Read Only.
Tag Reads	The number of tag read transactions executed by the module.
Tag Writes	The number of tag write transactions executed by the module.

ENIP Retries	This count increases when no response was received from the Logix Controller by the time the ENIP timeout is reached.
ENIP Failures	This count increases when the ENIP Retry Limit is reached and no response has been received from the Logix Controller.
Tag Access General Errors	This count increases when a tag cannot be accessed for any other reason not reported above.

Table 7.8 - Logix Statistics tab parameters

7.2.1. MODBUS STATISTICS

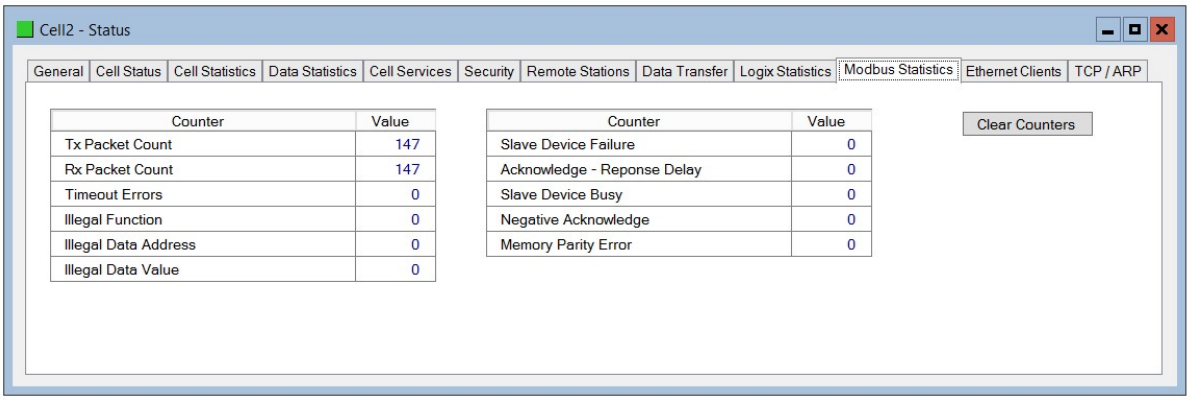


Figure 7.13 – Modbus Statistics

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

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.
Timeout Errors	The number of message response timeouts the module has encountered.
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.
Memory Parity Error	The number of times the Modbus device responded with a Memory Parity exception.

Table 7.9 - Modbus Statistics tab parameters

7.3. AT COMMAND PACKET CAPTURE

The module provides the capability to capture the AT command traffic for analysis. The will allow the user and the support team to resolve any possible issues on site. To invoke the capture of the module, double-click on the AT Command Packet Capture item in the Project Explorer tree.

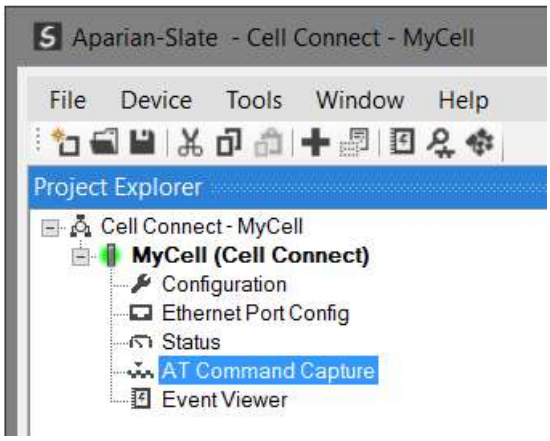


Figure 7.14 - Selecting AT Command Packet Capture

The AT Command Packet Capture window will open and automatically start capturing all AT command packets.

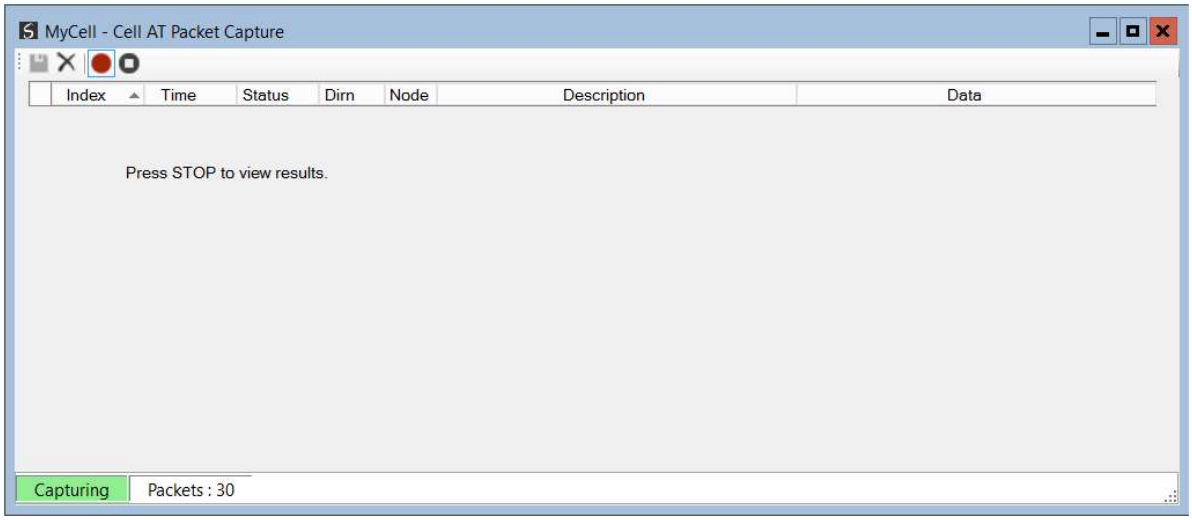


Figure 7.15 – AT Command packet capture

To display the captured AT command packets, the capture process must first be stopped, by pressing the Stop button.

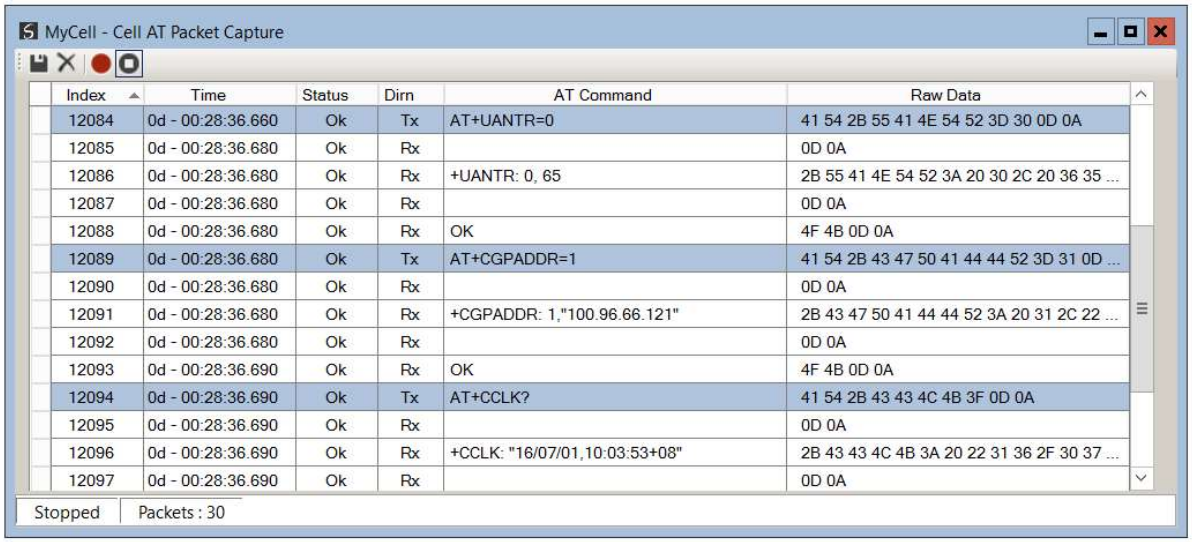


Figure 7.16 – AT Command Packet Capture complete

The captured AT Command packets are tabulated as follows:

Statistic	Description
Index	The packet index, incremented for each packet sent or received.
Time	The elapsed time since the module powered up.
Status	The status of the packet. Received packets are checked for valid DeviceNet constructs and valid checksums.

Dirn	The direction of the packet, either transmitted (Tx) or received (Rx).
AT Command / Response	A brief description of the packet.
Raw Data	The raw packet data.

Table 7.10 - AT Command Packet Capture fields

The packet capture can be saved to a file for further analysis, by selecting the ***Save*** button on the toolbar. Previously saved DeviceNet Packet Capture files can be viewed by selecting the ***AT Command Packet Capture Viewer*** option in the tools menu.

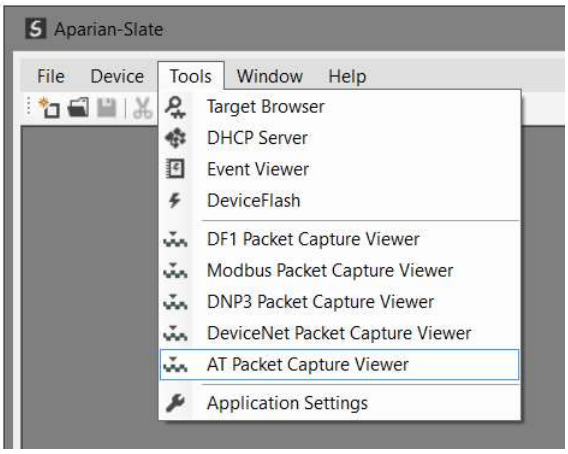


Figure 7.17 - Selecting the AT Packet Capture Viewer

7.4. MODULE EVENT LOG

The Cell Connect 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 view them in Slate, select the Event Viewer option in the Project Explorer tree.

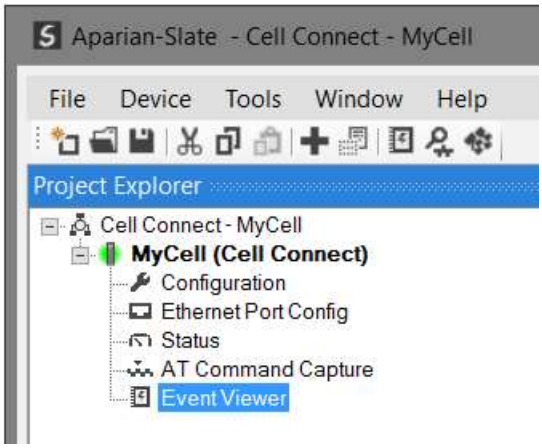
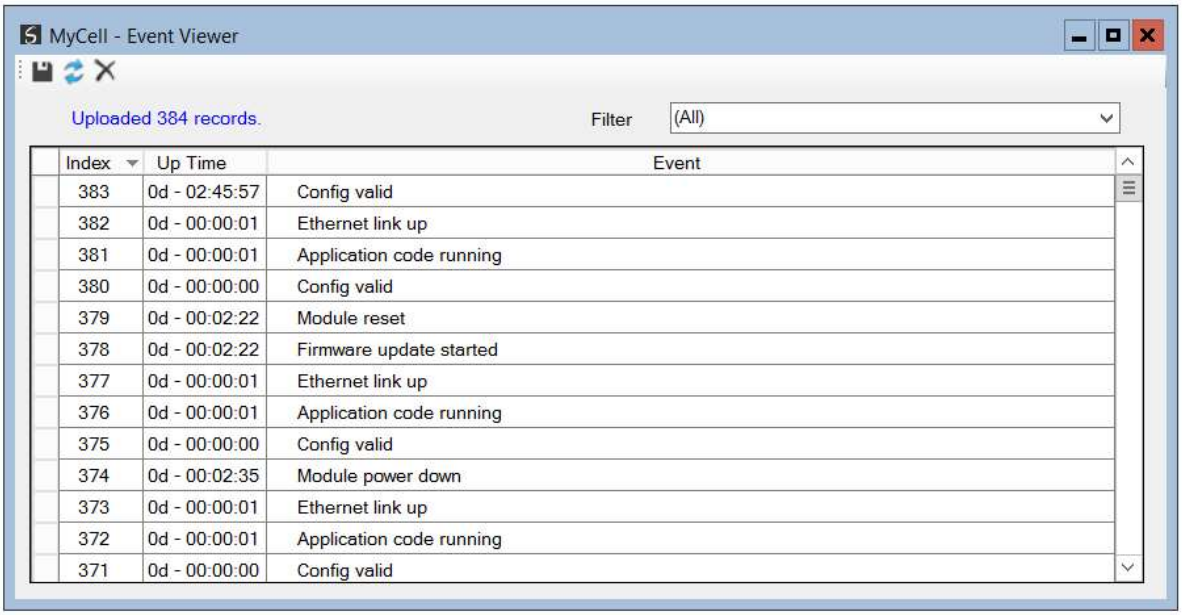


Figure 7.18. - Selecting the module Event Log

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



Index	Up Time	Event
383	0d - 02:45:57	Config valid
382	0d - 00:00:01	Ethernet link up
381	0d - 00:00:01	Application code running
380	0d - 00:00:00	Config valid
379	0d - 00:02:22	Module reset
378	0d - 00:02:22	Firmware update started
377	0d - 00:00:01	Ethernet link up
376	0d - 00:00:01	Application code running
375	0d - 00:00:00	Config valid
374	0d - 00:02:35	Module power down
373	0d - 00:00:01	Ethernet link up
372	0d - 00:00:01	Application code running
371	0d - 00:00:00	Config valid

Figure 7.19. – 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.

7.5. WEB SERVER

The Cell Connect module 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.

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

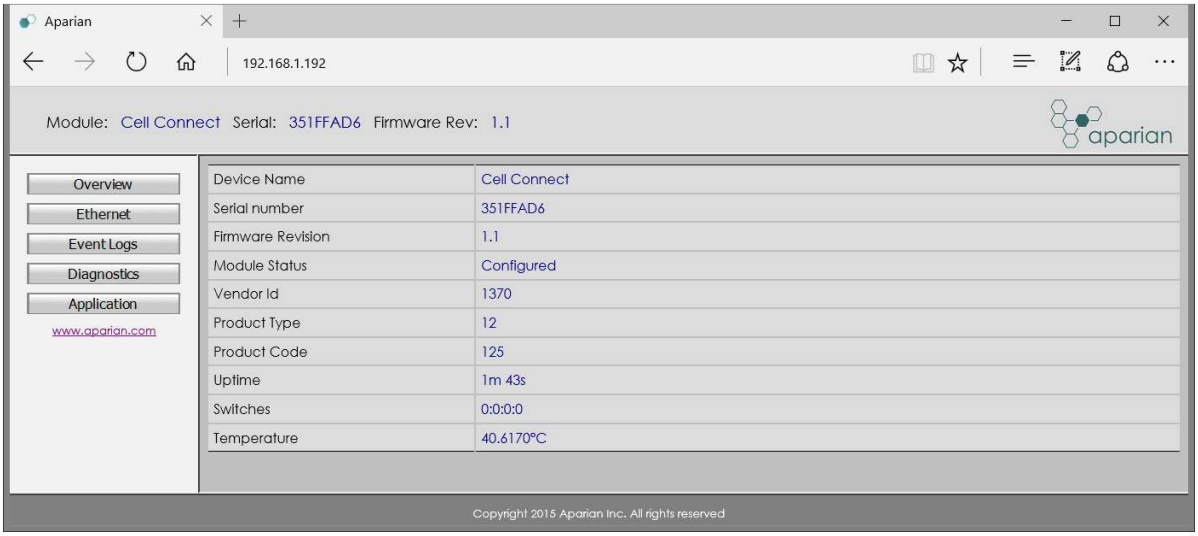


Figure 7.20. - Web interface

8. TECHNICAL SPECIFICATIONS

8.1. DIMENSIONS

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

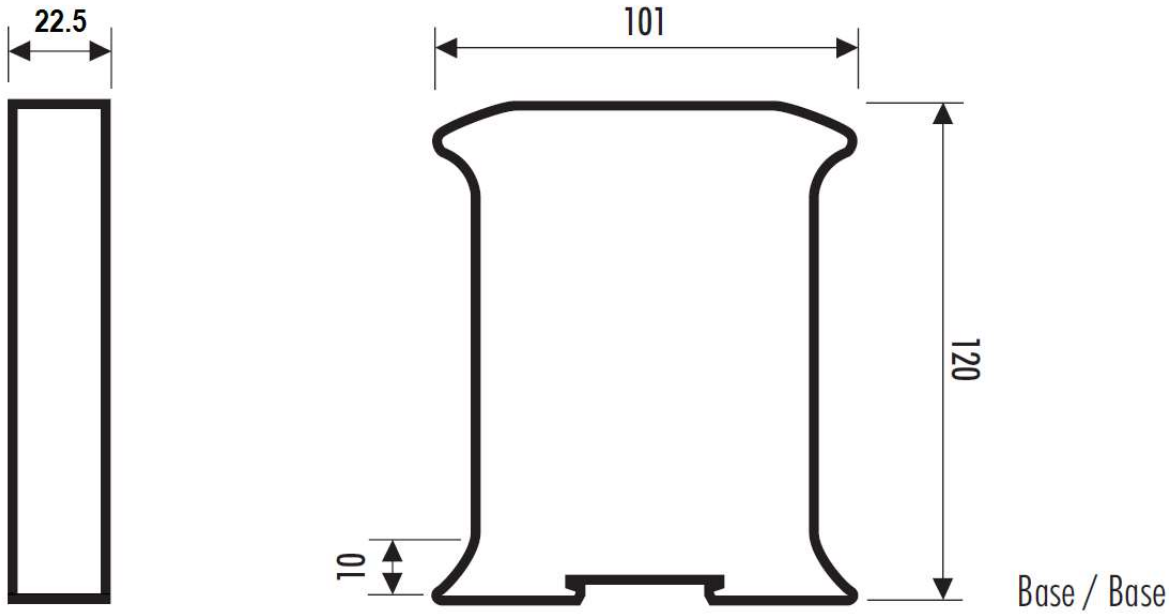


Figure 8.1 - Module Enclosure Dimensions

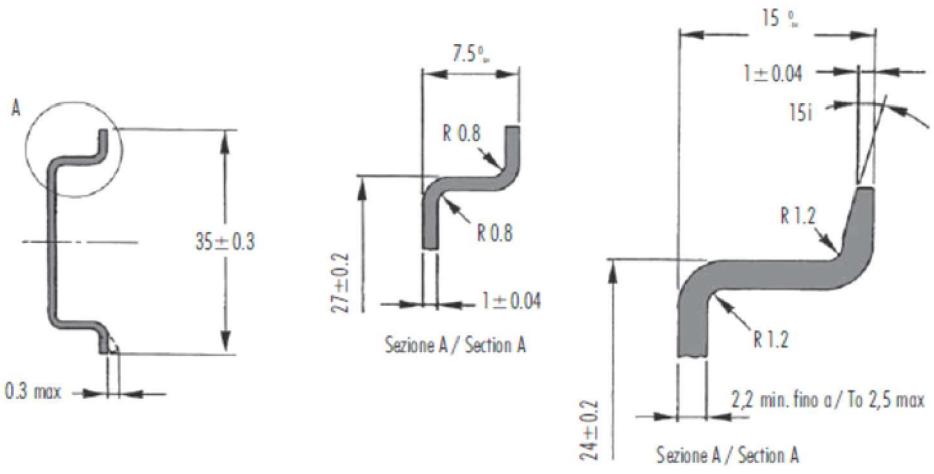


Figure 8.2 – Required DIN Rail Dimensions

8.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 12 – 28V DC, 60mA @ 24 VDC (Typical) 200mA @ 24 VDC (Maximum) 120mA @ 12 VDC (Typical) 400mA @ 12 VDC (Maximum)
Power consumption	1.5 W (Typical) 4.8 W (Maximum)
Connector (Power)	3-way terminal (3.81 mm pitch)
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 8.1 - Electrical specification

8.3. 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

Table 8.2 - Ethernet specification

8.4. DIGITAL INPUTS

Specification	Rating
Number of channels	4
Connector	5-way terminal (3.81 mm pitch)
Type	Optical Isolation
Input impedance	>2.4 kΩ
Logic 1 Voltage	10 – 32 V

Table 8.3 - Digital Input specification

8.5. RELAY OUTPUTS

Specification	Rating
Number of channels	2
Connector	3-way terminal (3.81 mm pitch)
Type	Solid State - Normally Open Single Pole
Load Current	600 mA (maximum)

Table 8.4 - Relay Output specification

8.6. CELLULAR NETWORK

Certification	Mark
SIM Card	Micro Sim
Frequencies	800/850/900/1700/1900/2100 Mhz
Technology	GSM/GPRS/3G/HSPA

Table 8.5 - Cellular Network specification

8.7. CELLULAR COMMUNICATIONS

Certification	Mark
Remote Station Max	50
Local/Remote Device Max	10
Message Contacts Max	50
Message Groups Max	20
Text Message Max	80

Data Transfer Item Max	50
Data Transfer Security	256-bit symmetric AES encryption 2048-bit RSA encryption Diffie–Hellman secure key exchange
Maximum Data Transfer Size per transaction	600 bytes
Unsolicited clients supported per device	5

Table 8.6 - Cellular Communications specification

8.8. CERTIFICATIONS

Certification	Mark
CE Mark	CE
RoHS2 Compliant	RoHS2
FCC	FC **Contains FCC ID: XPYLISAU200** This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Industry Canada (IC)	**Contains IC: 8595A-LISAU200N** This Class B digital apparatus complies with Canadian CAN ICES-3 (B)/NMB-3(B) and RSS-210.
ICASA	ICASA TA 2016-2249 APPROVED

ODVA Conformance	EtherNet/IP™ * F/W 1.003

Table 8.7 - Certifications

9. INDEX

A

Activity LED, 58

Additional Information, 6

Antenna, 11

Antenna Status, 54

Assembly instance, 36

AT Command Packet Capture, 72

B

Back-off time, 27

C

Cell Connect, 19, 53

Cell Connect general configuration, 21

Cell Connect parameters, 20

Cell Connect Pass-through message, 45

Configuration - Channel, 24, 26, 30, 31

Configuration - General, 21

Connection Path, 33

Contact Groups, 26

Contact Us, 6

Contacts, 26

Custom AT Command, 67

D

Data Network IP Address, 62

DC power, 7

DeviceNet, 73, 74

DHCP, 8, 13

Dimensions, 77

DIN rail, 9, 77

DIP, 8

DIP Switch, 15

DIP Switches, 8

E

Ethernet Bridge, 36

Ethernet connector, 10

EtherNet/IP, 25

Event Log, 74

F

Firmware upgrade, 20

G

GSM LED, 57

I

input assembly, 53

Input voltage, 10

Input/Output assembly, 53

IO Configuration, 22, 23

IO Connections, 10

L

Layout, 7

LED, 57

Logix controller, 55, 70

Logix IO Connection, 36

Logix Message Actions, 44

Logix Statistics, 70

Logix UDT, 38

M

Message Action, 29

MODBUS, 6, 55, 71

Modbus Message Actions, 47

Modbus Statistics, 71

Module Download, 33

Mounting, 9

N

Network Technology, 54

New Project, 18

Node Address, 21

O

Onboard Mesasge Actions, 43

P

Port Configuration, 17

Protocol, 21

R

References, 6

Requested packet interval (RPI), 37

Rockwell Automation, 17

RSLinx, 17

RSLogix 5000, 36, 37, 39, 53, 76

S

Safe Mode, 8

Signal Quality, 54, 56

Signal RSSI, 54

SIM, 11

SIM card, 11

SIM Security, 67

Slate, 13, 19, 20, 53, 58, 76

SMS Acknowledge, 27

Static IP address, 14

Statistics, 58

Support, 6

Support email, 6

T

Target Browser, 16, 25

Text Message Operation, 41

Text Messages Receive, 41

Text Messages Send, 41

U

UDT, 40

User Defined Types (UDTs), 37

W

Web server, 58, 76