



TYRION
INTEGRATION

Tyrion Integration

User Manual Version 1.1

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Setup

Provided with Nucleus are two cellular antennas (small), a WiFi antenna (large), and a power supply.

Antenna Connections

Before applying power, please assure the cellular antenna (small antenna) is securely connected to the Cell connector on Nucleus and the WiFi antenna (larger antenna) is securely connected to the WiFi connector. Both connectors can be found on the top (antenna side) plate.

Power Connection

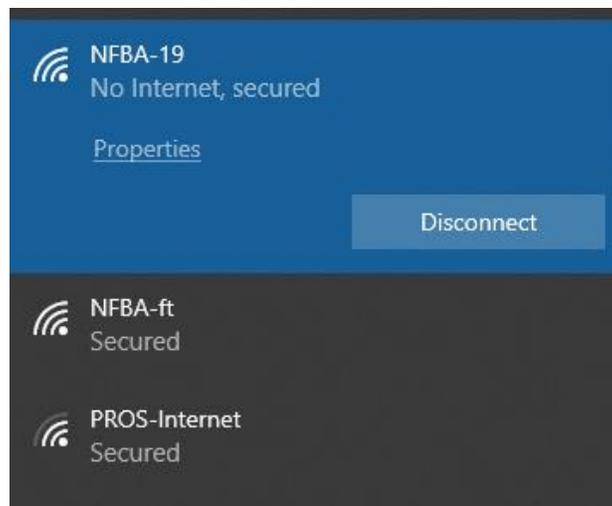
The green power terminal (Vdc) can also be found on the top side of Nucleus. Use the included power supply to complete the connection to Vdc. A green terminal connector can be added to any standard 12-24 VDC power supply to power Nucleus if the provided power supply is not available.

Connecting to Nucleus

Connections to Nucleus can be made via WiFi or Ethernet.

Connecting via WiFi

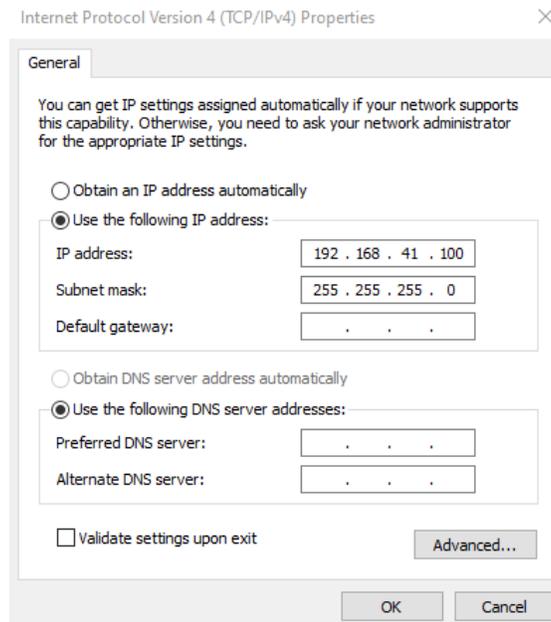
1. By default, Nucleus's WiFi is configured as an access point. After powering Nucleus search for Nucleus's WiFi network on your computer. It should appear as Nucleus's serial number, for example, the WiFi name for a Nucleus with serial number NFBA-19 will be NFBA-19. If you are unaware of what your Nucleus's serial number is, both it and the WiFi name can be found on the label on the back of Nucleus.
2. Once found, click on Nucleus's WiFi network and connect using the default credentials also found on the label (WiFi Passcode). If you are unable to view the label you can determine the WiFi passcode from your Nucleus's serial number. The default WiFi passcode is "1nucleus" followed by the integer(s) at the end of the serial number. For example, the default WiFi passcode for a Nucleus with serial number NFBA-19 is 1nucleus19. If you are presented with a message stating "Enter the PIN from the router label," disregard it and instead click "Connect using a security key instead," and continue with entering your passcode and click "Next." On a windows OS, a successful connection will display as "No internet, secured."



Connecting via Ethernet

1. Nucleus has two ethernet ports. By default LAN 1 is a DHCP Client and LAN 2 is a Static IP set to 192.168.41.1. Connect an ethernet cable from LAN2 of Nucleus to your computer.

2. Ensure that your computer's adapter settings are set as shown:



Cockpit

Cockpit is the Nucleus management interface in which you can view the status of Nucleus as well as adjust network settings and installed code bases.

Accessing Cockpit

- **Access Cockpit** – Your computer must be connected to Nucleus to access Cockpit. Table 1 below shows Nucleus’s network interfaces along with their default configurations and IP addresses.

Table 1: Default Network Interfaces

Nucleus Interface	Cockpit Interface	Default Configuration	Default IP Address
LAN 1	eth1	DHCP Client	
LAN 2	eth0	Static	192.168.41.1
WiFi	wlan0	Access Point	10.42.0.1

If you are connected to Nucleus’s WiFi access point, you can access Cockpit by entering 10.42.0.1:9090 into your browser’s address bar. If you are connected to Nucleus via it’s static ethernet interface you can access Cockpit by entering 192.168.41.1:9090. In either case you may be presented with a “Your connection is not private” dialog. In this case, click “Advanced” and then click the option to proceed.

- **Log In** – Cockpit can be logged into with the default credentials: **Username:** *root* and your Nucleus’s root password.

Cockpit Basics

- **System** – Cockpit opens up to the System tab where you can find basic information such as the date and time, Memory usage, Disk usage, and Network Traffic. From the system tab you can also Restart Nucleus.
- **Containers** – The Containers tab gives you access to the Docker containers running on Nucleus. By default Nucleus gives you access to the Node-RED and Remote Support containers listed as nucleus-node-red and remote-support respectively.
- **Networking** – The Networking tab allows you to view and control Nucleus’s network interfaces. You can also view logs pertaining to network connections.
- **Accounts** – The Accounts tab allows you access to all users on your Nucleus. By default you will find “nobody” and “root” users.
- **Services** – The Services tab lists and allows you to control all services running on Nucleus.
- **Logs** – The Logs tab allows you to view logs for services running on Nucleus. The types of logs can be filtered via the “Severity” tab at the top of the page. The recency can also be filtered by clicking on the Date at the top of the page.
- **Terminal** – The Terminal tab gives you access to Nucleus’s operating system. Here you can enter and display data to make changes to or gather information from Nucleus.

- **Dashboard** – The Cockpit Dashboard is accessible by clicking the gauge icon next to the System tab. Here you will find a more graphical representation of the CPU, Memory, Network, and Disk usage.

Network Connections

Nucleus’s network connections can be viewed and changed via Cockpit’s Networking tab.

LAN1

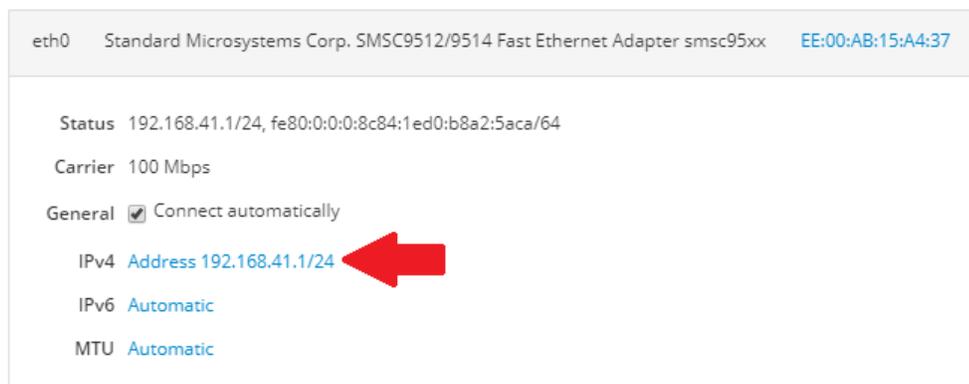
By default LAN1 is set as a client. When opened to the Networking tab, LAN1 populates as eth1 under “Interfaces”.

LAN2

By default LAN2 is set to a static IP of 192.168.41.1. When opened to the Networking tab, LAN2 populates as eth0 under “Interfaces”.

Changing Ethernet Configuration(s)

- **Change Static IP to Client** – Log in to Cockpit and from the tabs on the left, select the Networking tab. Click on the name or IP address of the interface you wish to change from Static IP to Client. From the window that opens, select the IPv4 address.



The IPv4 Settings window will pop up. Click the “Manual” drop down in the upper right and select “Automatic (DHCP)”.

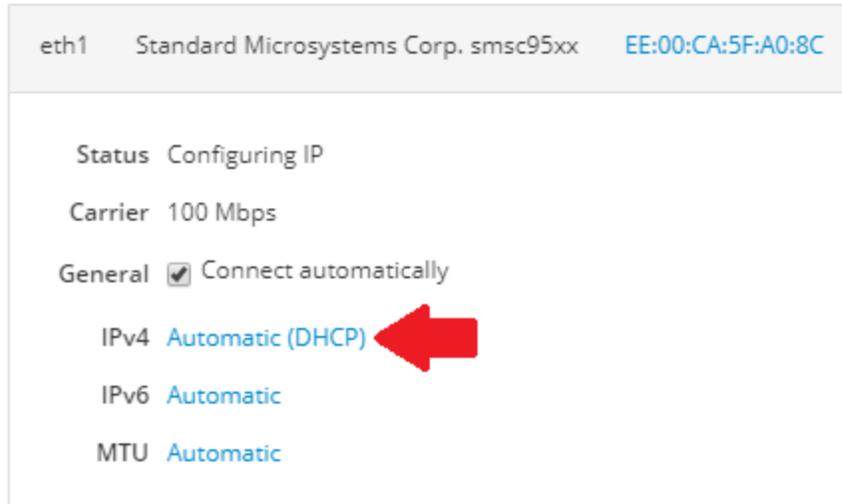
The screenshot shows the 'IPv4 Settings' window. At the top, the 'Addresses' section has a dropdown menu set to 'Manual', indicated by a red arrow. Below this, there is a table with three columns: IP address (192.168.41.1), Subnet (24), and Gateway (Gateway). To the right of the Gateway cell is a minus sign (-). Below the table are sections for DNS, DNS Search Domains, and Routes, each with an 'Automatic' label and an 'ON' toggle switch. At the bottom right are 'Cancel' and 'Apply' buttons.

Next remove the previously present IP address by clicking the minus sign to the right of it.

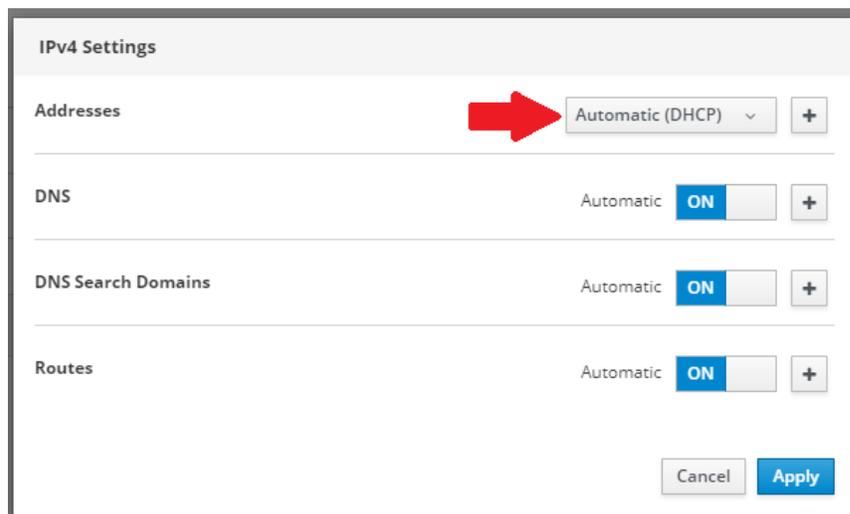
The screenshot shows the 'IPv4 Settings' window after the IP address has been removed. The 'Addresses' section now has a dropdown menu set to 'Automatic (DHCP)'. The table below it still shows the IP address 192.168.41.1 with a minus sign (-) to its right, indicated by a red arrow. The DNS, DNS Search Domains, and Routes sections remain the same with 'Automatic' and 'ON' toggles. 'Cancel' and 'Apply' buttons are at the bottom right.

Click "Apply". Your selected ethernet interface should now be set to client mode.

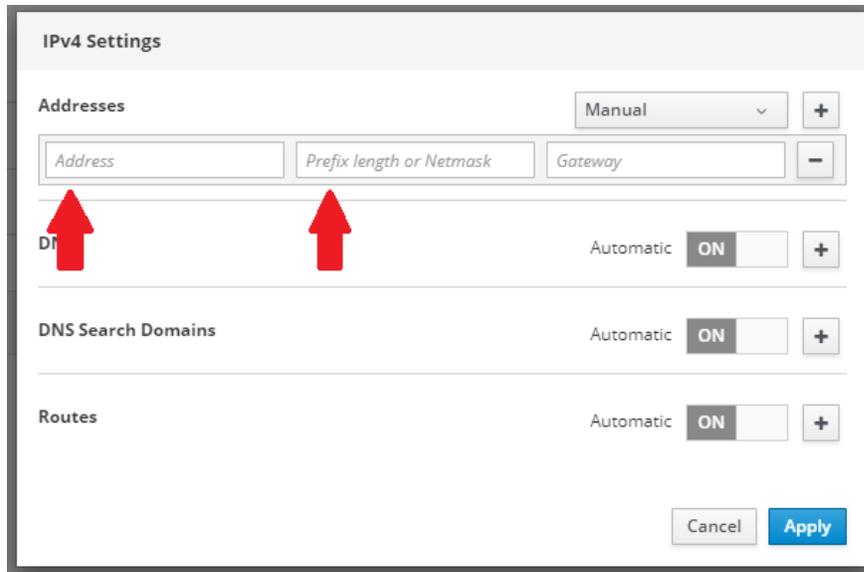
- **Change Client to Static IP** – Plug in an ethernet cable from the client mode port to the device you wish to connect to. Log in to Cockpit and from the tabs on the left, select the Networking tab. Click on the name or IP address of the interface you wish to change from Client mode to a Static IP. From the window that opens, select the IPv4 address (it should be Automatic (DHCP)).



From the IPv4 Settings window that pops up select Automatic (DHCP) from the upper right dropdown and select Manual.

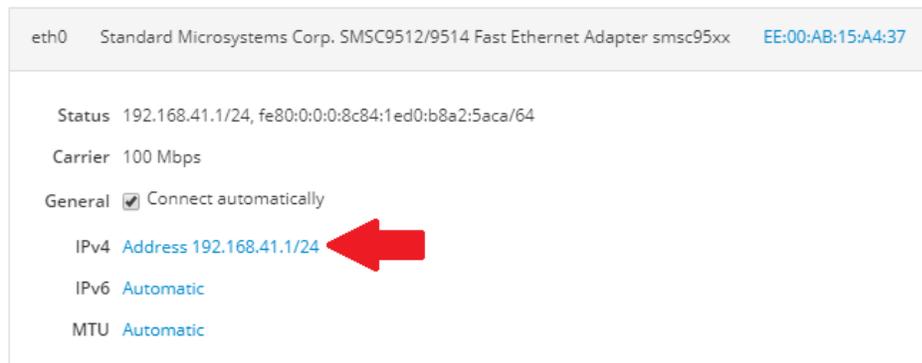


In the "Address" window enter an IP address of 192.168.41.X where X is a number in the range 2 to 255. In the "Prefix length or Netmask" window enter 24. The 24 is the classless inter-domain routing (CIDR) notation for the subnet mask of 255.255.255.0.



Click “Apply”. Your selected ethernet interface should now be set to a Static IP.

- **Change Static IP to another Static IP** – Log in to Cockpit and from the tabs on the left, select the Networking tab. Click on the name or IP address of the interface you wish to change the Static IP of. From the window that opens, select the IPv4 address.



The IPv4 Settings window will pop up. Change the current IP address under “Addresses” to an IP address of your choice. Keep in mind the address must be a form of 192.168.41.X where X is in the range of 2 to 255.

The image shows a screenshot of the 'IPv4 Settings' dialog box. At the top, the title is 'IPv4 Settings'. Below it, there's a section for 'Addresses' with a dropdown menu set to 'Manual' and a '+' button. Underneath, there are three input fields: the first contains '192.168.41.1', the second contains '24', and the third is labeled 'Gateway'. A red arrow points to the first input field. Below the 'Addresses' section are three sections: 'DNS', 'DNS Search Domains', and 'Routes'. Each of these sections has a label 'Automatic' followed by a toggle switch set to 'ON' and a '+' button. At the bottom right, there are two buttons: 'Cancel' and 'Apply'.

Click “Apply”. Your selected ethernet interface should now be changed to your new static IP address.

WiFi

Nucleus’s WiFi is set as an Access Point at IP 10.42.0.1 by default. When opened to the Networking tab, it populates as wlan0 under “Interfaces”.

Cellular

Nucleus will have a cellular connection only if an active sim card has been inserted and a cellular antenna is attached to “Cell”. If a connection has been made and the Networking tab is opened, the cellular network populates as cdc-wdm0 under “Interfaces”. The network IP is visible here.

Node-RED

Nucleus uses Node-RED as the development environment for programming and interacting with Nucleus. The Tyrion Integration nodes make it easier to access data from transmitters, sensors, relays, etc., and make said data accessible from anywhere in the world. This section will give a brief introduction to Node-RED's layout and explain how to use some of Tyrion Integration's nodes.

Accessing Node-RED

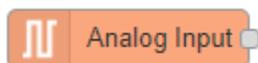
- **Access Node-RED** – Your computer must be connected to Nucleus to access the Node-RED programming interface. If you are connected to Nucleus via WiFi, you can access Node-RED by entering 10.42.0.1:1880 into your browser's address bar. If you are connected to Nucleus via ethernet you can access Node-RED by entering 192.168.42.1:1880.
- **Log In** – Until the password is changed Node-RED can be logged into with the default credentials: **Username:** *user* **Password:** *nucleus*.

Node-RED Basics

- **Palette** – The left-hand panel is called the Palette and contains all the instructions (called "Nodes") available for use in your code. Clicking "Manage Palette" from the upper right menu drop down allows installation of new nodes and lists currently installed nodes.
- **Flow** – The large center area is where your instruction logic lives and is referred to as your "Flow(s)". You can have unlimited flows each on their own tab. To add Nodes to a Flow, click and drag a node from your Palette and drop it onto your Flow.
- **Info & Debug** – The right-hand panel provides quick access to your project including node documentation, context data, and a debug console. Clicking on the "i" icon provides information on nodes and how to use them. Clicking on the bug icon leads you to the Debug console, providing access to logs, errors, and/or information for troubleshooting and monitoring code.
- **Import and Export** – Located in the upper right menu drop down. Pre-written flows can be imported from a JSON file structure. Flows can also be exported as JSON files and saved onto your machine.

Tyrion Integration Nodes

Analog Input Node



Nucleus has four Analog Input channels and assumes a physical connection to a field device such as a 4-20mA transmitter is made.

Configuration – To configure the Analog Input node drag it onto the flow and double click it to bring up the properties dialog as pictured below.

Name – The name is optional and is what will be displayed on the node in your Node-RED flow. If the Name is left blank, by default it will be set to the channel name (AI1, AI2, AI3 or AI4). This is also what the tag will be called in the Cloud. In the photo the Name is set as “Pressure”.

Channel – The channel drop-down allows you to select the physical input channel on Nucleus. There are 4 possible selections (1-4) corresponding to the physical inputs. The photo above selects Channel 1.

Measurement – Select either mA (milliamps) or V (volts) depending on the signal type of the transmitter attached to the selected channel. In the photo above mA is selected.

Raw Transmitter Range – The raw units coming from the transmitter can be set here. Typically, this will be set **from: 4 to: 20** or **from: 0 to: 5**. In the photo above, it is set **from: 4 to: 20** for a 4-20 mA transmitter.

Scaled Engineering Units – These are the human readable units that will be displayed in the cloud application. For example, 0-150 gallons of milk, or 0-10 inches of water. This range is used to scale the bar graphic in the cloud. In the photo above it is set from 0 to 100.

Units – The text description of the units being read can be set here. For example, Gallons Per Minute (GPM) or Barrels Per Day (BPD). This is also displayed in the cloud. The above photo shows configuration of a pressure transmitter’s signal so the units are set to PSI.

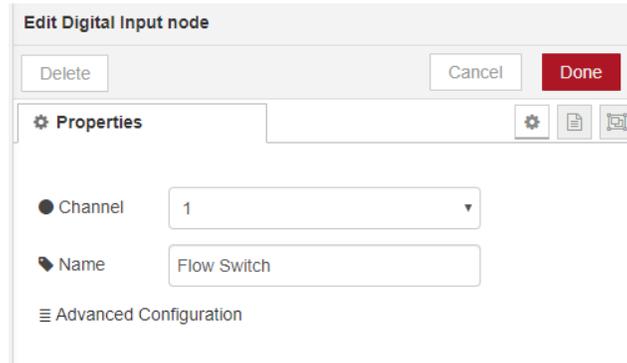
Advanced Configuration – This section allows for configuration of the poll rate. By default the pollrate is set to 1000 ms which is suitable for most applications.

Digital Input Node



The digital input node will read the status of a digital input such as an on/off switch, a flow switch, a high level switch, a low level switch, a pressure switch, etc.

Configuration – To configure the analog input node drag it onto the flow and double click it to bring up the properties dialog as pictured below.

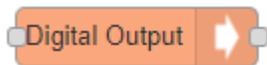


Channel – The channel drop down allows for selection of the physical input channel on Nucleus. There are 10 channels. The channel to which your device is physically connected should be selected.

Name – The name is optional and is what will be displayed on the node in your Node-RED flow. This is also what the tag will be called in the Cloud. If the Name is left blank, by default it will be set to the channel name (DI1-DI10).

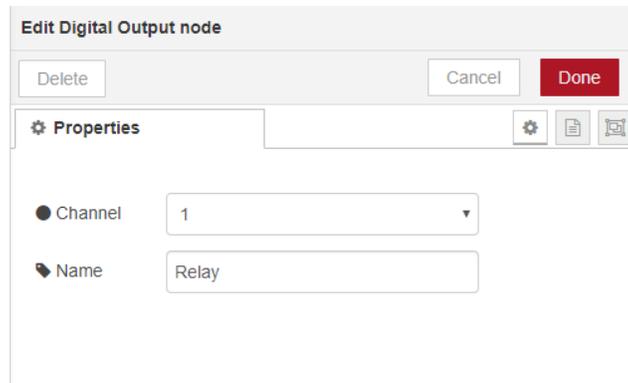
Advanced Configuration – This section allows for configuration of the poll rate. By default the pollrate is set to 1000 ms which is suitable for most applications. The “Return Value By Exception” option is checked by default to increase efficiency. It ensures values are not emitted unless the state of the input has changed. If emitting a value at every reading is desired this option can be unchecked.

Digital Output Node



The Digital Output node is used to control Nucleus’s digital output channels. It is driven by a true/false value.

Configuration – To configure the Digital Output node drag it onto the flow and double click it to bring up the properties dialog as pictured below.



Channel – The channel drop down allows for selection of the physical output channel on Nucleus. There are 5 Digital Output channels. The channel to which your device is physically connected should be selected.

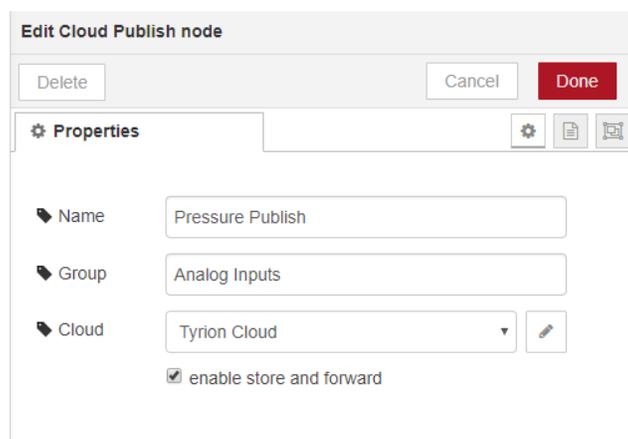
Name – The name is optional and is what will be displayed on the node in your Node-RED flow. This is also what the tag will be called in the Cloud. If the Name is left blank, by default it will be set to the channel name (DO1-DO5).

Cloud Publish Node



The purpose of the Cloud Publish node is to allow for viewing and analyzing of Nucleus’s data in the Tyrion Cloud. It can be paired with various nodes.

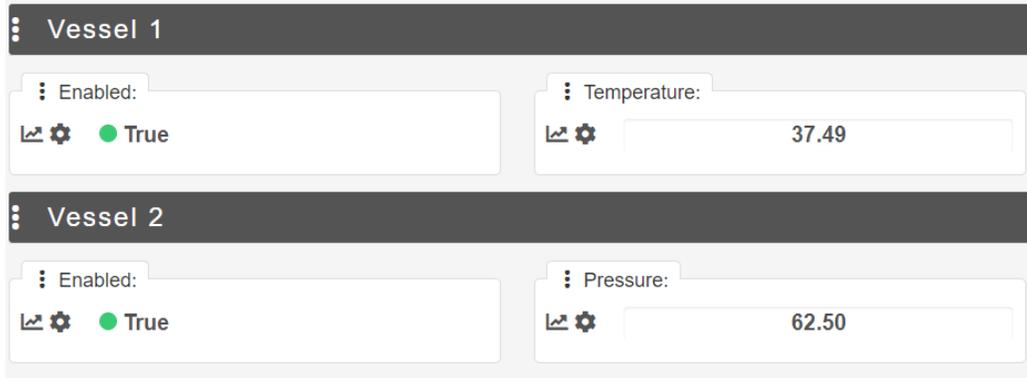
Configuration - Drag a Cloud Publish node onto the flow and double click it to display its properties dialog as pictured below.



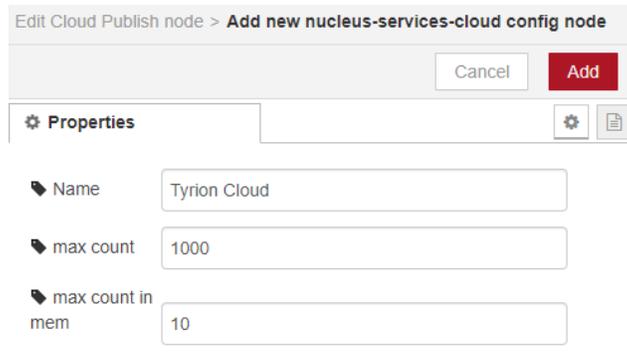
Name – This is what will be displayed on the node in your Node-RED flow. If no name is set the “Group” will be set as the name.

Group – Every tag published to the Tyrion cloud must be assigned to a “Group” of tags. This Group can be any sequence of letters, numbers and spaces. Tag names must be unique within a Group, but can be reused in a different Group. The tags published by the Tyrion Cloud will be displayed by the Groups

defined here. For example, the image below shows inputs publishing to the Tyrion cloud under two groups: Vessel 1 and Vessel 2.



Cloud - Click the pencil icon to open of the Cloud Publish configuration node. This config node handles the communication between Nucleus and the Tyrion Cloud. It should be pre-populated with the Tyrion Cloud properties. Click “Add” to add the Tyrion Cloud configuration and allow for Nucleus’s data to be published to the Tyrion Cloud. Store and Forward properties can also be managed here. Click “Done’ to complete the configuration.



Tyrion Cloud

The Tyrion Cloud application provides access to the viewing and management of Nucleus data.

Accessing the Tyrion Cloud

- **Access the Tyrion Cloud** – To access the Tyrion Cloud navigate to cloud.tyrionintegration.com.
- **Log In** – Log in credentials must be provided to you by Tyrion Integration Services, Inc. Please contact Tyrion Integration Services, Inc. if you wish to access the Tyrion Cloud.

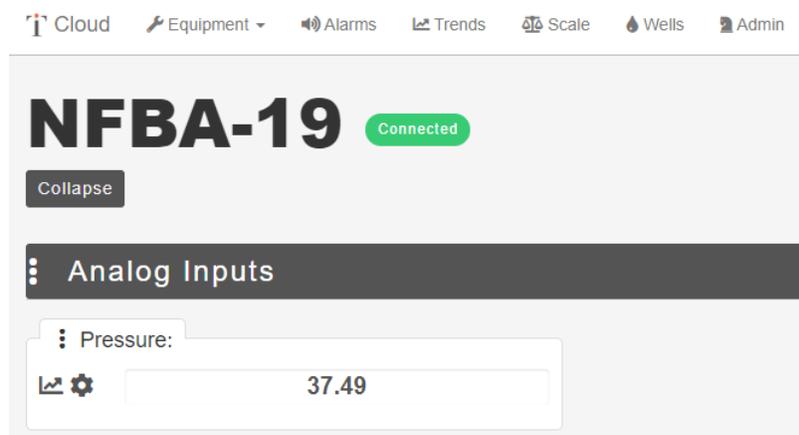
Tyrion Cloud Basics

- **Equipment** – The Equipment tab presents a dropdown menu of all Nucleuses in your fleet. You can choose which Nucleus's data you would like to access by clicking the Equipment tab and then selecting your Nucleus's serial number or application from the dropdown menu.
- **Trends** – The Trends tab gives you access to a more detailed view of trending data. Here you can adjust scales and view data from a specific time window.

Viewing Data in the Tyrion Cloud

If you have implemented a Cloud Publish node in your Node-RED flow, you can view the corresponding data in the Tyrion Cloud. The following instructions will explain how to view the data from an Analog Input node as implemented in the example in the “Cloud Publish Node” section of this document.

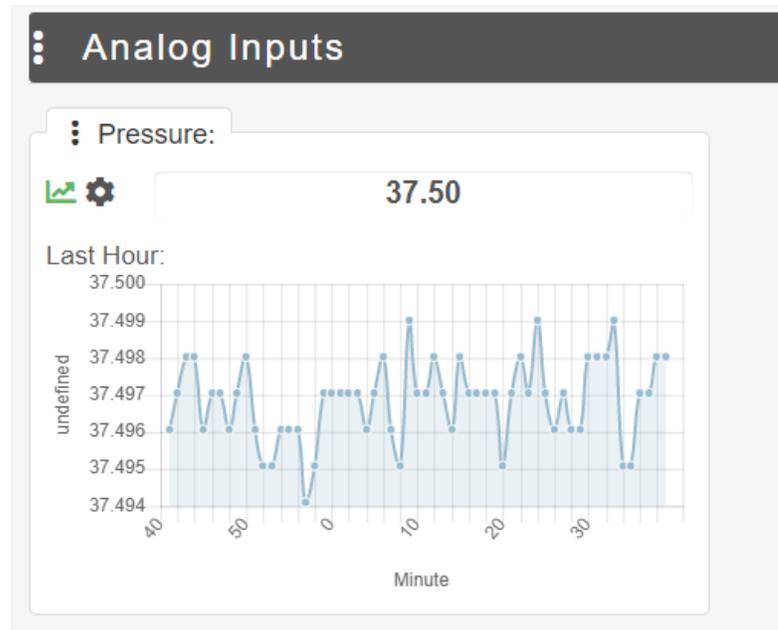
To view Nucleus's data in the Tyrion Cloud, log in to the Tyrion Cloud and select your Nucleus's serial number or application from the Equipment dropdown menu. By default, your Nucleus will populate in this menu by its serial number. You will be taken to the interface for your selected Nucleus. The image below shows the interface for Nucleus NFBA-19 implementing an Analog Input node and a Cloud Publish node.



- **Serial Number or Nucleus Application Name** – The top of the page shows the Nucleus's serial number, in this case NFBA-19. If the Nucleus has been given an application name, the name will appear instead. The serial number will show by default.
- **Connection Status** – Next to the serial number or name, you will find the Nucleus connection status. A green indicator stating “Connected” indicates the Nucleus has an internet connection

and the support container is functional and active. A red indicator indicates there is either no internet connection or there is an error with the remote support container.

- **Data** – Data from your Nucleus’s Node-RED flow will also appear on this page. If the example from Appendix Two of this document was followed, a pressure reading will be visible under Analog Inputs. The current value of the input being read is displayed.
- **Settings** – Clicking the cog icon on the input reading provides access to settings that can be changed without having to return to Node-RED. For this example these settings are the Minimum and Maximum Values, Units, and Data Type.
- **Trending** – Clicking the graph icon to the left of the cog icon will trend the input over the last hour as seen below. After clicking the graph icon, if a more detailed trend is needed, the Trends tab at the top of the page can be selected to view the selected trend(s) on a larger graph and adjustable scale. Trends outside of the 1 hour window are now accessible.



IO Wiring Diagrams

Example IO Wiring diagrams for Nucleus's analog inputs, digital inputs, and digital outputs are available in Table 2 below.

Table 2: IO Wiring Diagrams

Input/Output Configuration	Wiring Diagram
Analog Input	
Digital Input	
Digital Output	

The operating ranges for Nucleus's onboard IO are available in Table 3 below.

Table 3: Nucleus IO Operating Ranges

Inputs/Outputs	Operation Range
Digital Input	3-30 VDC
Digital Outputs	0-24 VDC Open Collector
Analog Inputs	4-20 mA or 0-5 VDC

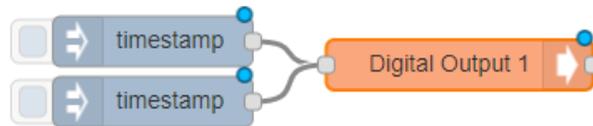
Appendices

Appendix One

Node-RED Digital Output Example

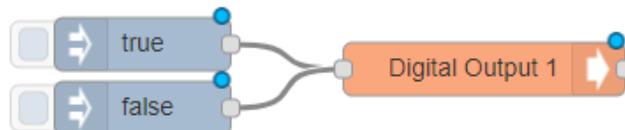
Though there are other ways to trigger a Digital Output node, this example will explain how to trigger the Digital Output node with a boolean payload from standard “inject” nodes.

1. Drag a Digital Output node onto the flow.
2. Double click the node to access its properties dialog.
3. Select Channel 1 under “Channel”.
4. Name the node “Digital Output 1” and click “Done”.
5. Drag two “inject” nodes onto the flow and connect their outputs to the input of the Digital Output Node as pictured below. Until they are properly configured, the inject nodes will state “timestamp”.



6. Double click the upper inject node to open its properties dialog as pictured below.

7. Set the Payload to Boolean. It will automatically be set as true. The rest of the configurations are optional. Click “Done”.
8. Double click the lower inject node to open its properties dialog and set the Payload to Boolean. It will automatically be set as true. Click the payload dropdown and set it to false. Click “Done”.



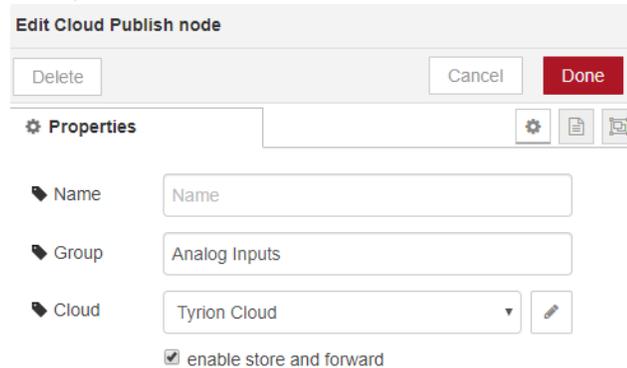
- Click “Deploy”. The Digital Output node is now configured to be triggered by inject nodes. Assuming your device is properly connected to Digital Output 1, clicking “true” will trigger an output high and clicking “false” will trigger an output low.

Appendix Two

Node-RED Cloud Publish Example

This example will explain how to configure the Cloud Publish node to be paired with an Analog Input node.

- Drag an Analog Input node onto the flow. Double click it and configure it as in section 3.2. Name: Pressure, Channel: 1, Measurement: mA, Raw Transmitter Range: from 4 to 20, Scaled Engineering Units: from 0 to 100, Units: PSI
- Drag a Cloud Publish node onto the flow and set the group to Analog Inputs.
- Click the pencil icon and then “Add” to accept the default Tyrion Cloud configuration. Your configuration should be as pictured below. Click “Done”.



- Connect the output of the Analog Input node to the input of the Cloud Publish node.



- Click “Deploy”. The Pressure Analog Input will now publish under Analog Inputs in the Tyrion Cloud as pictured below. Accessing the Tyrion Cloud is explained in a later section.

