

Terminus Tnode Products User Manual



JANUS REMOTE
COMMUNICATIONS

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Tnode Terminus General Description

The Terminus Tnode is a communication control terminal with a compact, rugged enclosure that encapsulates everything needed for short range M2M capabilities. The two orderable frequency types allow for system deployment in different networks with little change in design or investment.

Powered by the Synapse RF engine, the Tnode contains all circuitry required to operate in 2.4Ghz or 915Mhz frequency ranges. It can receive power from a 12v wall wart or a 5v mini USB connection, contains a serial RS-232 for programming and debugging, and has discrete and analog inputs for monitoring.

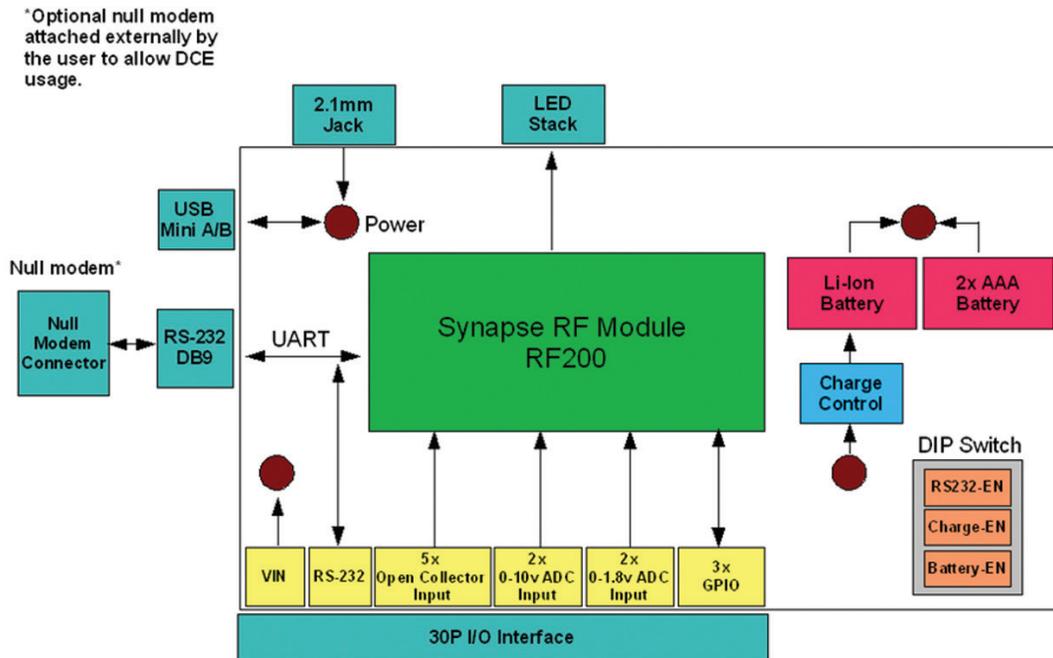


Figure 1: Tnode 2.4 GHz Block diagram, denotes external connections and internal routing

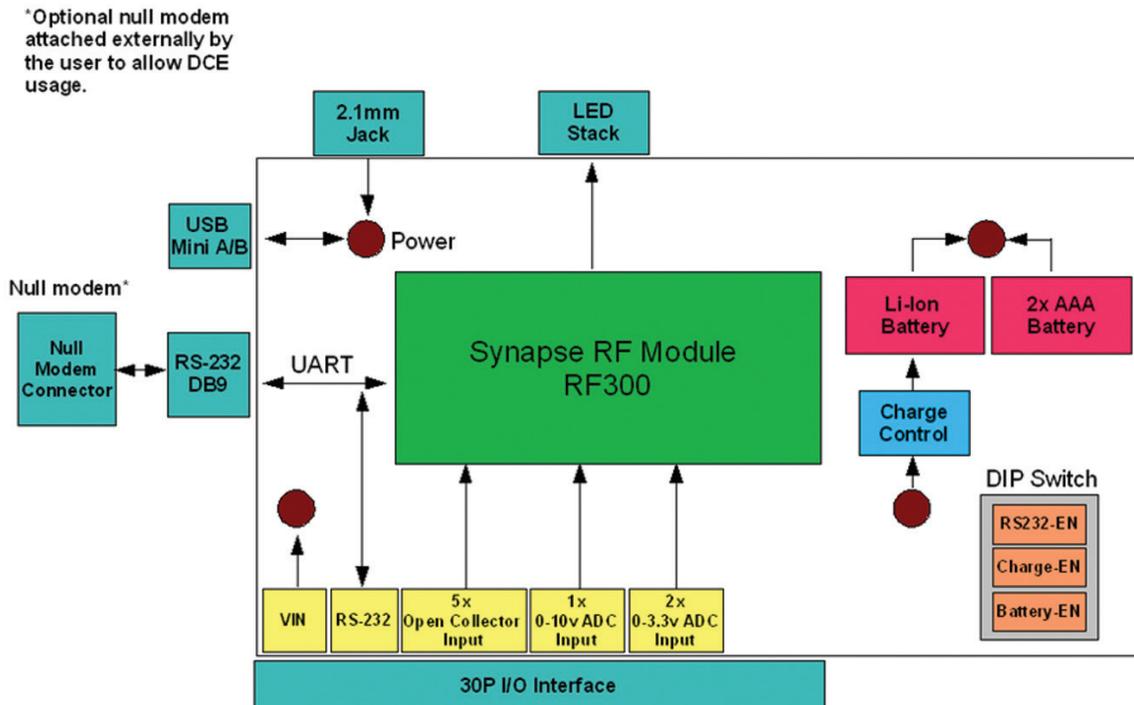


Figure 1: Tnode 915 MHz Block diagram, denotes external connections and internal routing

Tnode Interfaces:

DC Power jack

The 2.1mm center conductor power jack accepts input voltages from 6 to 60VDC.

Pin	Description
Center Pin	Supply (+)
Outer Conductor	Supply (-)

Supply power can also be applied to the unit through the 30 Pin locking header.

USB

The Mini AB USB connector is an alternate power supply connection. It accepts input voltages from 4.75 to 5.5v.

Pin	Name
1	VBUS
2	N/C
3	N/C
4	N/C
5	GND

RS232

The DB9 port follows the standard for RS-232 communications and gives the connections for serial interaction with hardware handshaking. It is, however, pinned as the DCE (host) since the application running abilities make the Tnode an autonomous unit that can control external components. Hardware flow control is not available.

Pin	Description	Direction
2	RXD	Input
3	TXD	Output
5	GND	Supply
1, 4, 6, 7, 8, 9	N/C	-

Reset

The reset button is connected to the reset pin of the Synapse RF module. The reset signal, broken out to the 30P header must be controlled via open collector only, do not use a pull up on this signal.

Input Logic State	Description
HIGH-Z	Active State
0	Reset State

LED Indicators

GPIO controlled LED stack. These are application controlled, by default they are OFF. Drive the noted GPIO HIGH to activate the respective LED.

LED Color	Description
Red	Synapse GPIO18
Yellow	Synapse GPIO9
Green	Synapse GPIO10

Tnode Interfaces continued

30P Header Access

The Tnode's header gives access to many signals not available through standardized connectors. It uses a Samtec polar and locking connector that allows the user to create their own harness to suit the application.

Pin	Description	Direction
1	Reset	Input
2	Power Supply Input	Supply
3	N/C	-
5	N/C	-
6	N/C	-
7	RS232 RX	Input
8	RX232 TX	Output
9	N/C	-
10	N/C	-
13	Low Voltage ADC A	Input
14	O/C Input E	Input
15	Low Voltage ADC B	Input
16	O/C Input A	Input
18	O/C Input B	Input
19	O/C Input D	Input
20	O/C Input C	Input
21	N/C	-
22	N/C	-
23	Synapse GPIO 14	Bidirectional
24	Synapse GPIO 13	Bidirectional
25	Synapse GPIO 12	Bidirectional
26	N/C	-
29	0-10V ADC B	Input
30	0-10V ADC A	Input
4, 11, 12, 17, 27, 28	Supply Ground	N/A

Samtec Part Number:

Housing: IPD1-15-D-K

Janus Store Part Number:

Housing: XT-507-G



Contacts: CC79L-2024-01-L

Contacts: XT-479-G



Tnode Interfaces continued

Signal Mapping Quick Reference

This is the mapping for the external connections to the pins of the Synapse RF modules, and the applicability. The Pin and GPIO value is useful when writing scripts.

Signal Name	Synapse Pin	GPIO	2.4Ghz	915Mhz
Low Voltage ADC A	7, 18	5, 16	Yes	Yes
Low Voltage ADC B	8, 19	6, 17	Yes	Yes
0-10V ADC A	17	15	Yes	Yes
0-10V ADC B	13	11	Yes	No
O/C Input A	2	0	Yes	Yes
O/C Input B	3	1	Yes	Yes
O/C Input C	4	2	Yes	Yes
O/C Input D	5	3	Yes	Yes
O/C Input E	6	4	Yes	Yes
Synapse GPIO 14	16	14	Yes	No
Synapse GPIO 13	15	13	Yes	No
Synapse GPIO 12	14	12	Yes	No
Red LED	20	18	Yes	Yes
Yellow LED	11	9	Yes	Yes
Green LED	12	10	Yes	Yes
UART RX	9	7	Yes	Yes
UART TX	10	8	Yes	Yes

SMA Antenna Connection

This is a bulkhead antenna connection for wireless communication.

Pin	Description
Center Pin	Signal
Shield	Ground

Electrical Specifications

Absolute Maximum Ratings:

Parameter	Minimum	Nominal	Maximum	Unit	Note
Operating Temperature	-40	-	85	°C	1
Supply (Supply & Enable Input)	6	-	76	Volts	1,2
VIN (GPIO)	0	-	3.6	Volts	1
VIN (Open Collector Input)	0	-	3.6	Volts	1
VIN (0-10V ADC)	0	-	10.5	Volts	1
VIN (Low Voltage ADC)	0	-	3.6	Volts	
VIN (RS-232 Inputs)	-25	-	25	Volts	1

Notes:

- 1) Operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions is not implied. Exposure to Absolute Maximum Rating conditions for extended periods of time may affect device reliability.

Recommended Operating Conditions:

Parameter	Minimum	Nominal	Maximum	Unit	Note
Operational Temperature	-30	-	80	°C	
2.1mm Barrel Jack Supply	7	12	28	Volts	
• Peak Supply Current	93	-	-	mA	1,4
• Average Supply Current		-	23	mA	2,4
Mini USB Jack	4.7	5	5.5	Volts	
• Peak Supply Current	109	-	-	mA	1,4
• Average Supply Current	-	-	27	mA	2,4
Lithium Ion Battery	-	3.7	-	Volts	
• Peak Supply Current	-	112	-	mA	3,4
• Average Supply Current	-	28	-	mA	3,4

Notes:

- 1) Peak Supply Current specification is stated as the minimum amount of current the external power supply must be capable of supplying during the TX burst of the embedded radio across the rated input voltages.
- 2) Average Supply Current specification is stated as the maximum average current the Tnode should draw across the rated voltages.
- 3) Peak current draw noted for operating via the internal battery pack during the Tx burst of the embedded radio. Average current draw noted for operating via the internal battery pack during an idle/Rx condition.
- 4) Peak and average draws noted while RS-232 is operating and active and the GPIO are in idle state.

I/O Levels (GPIO – 915Mhz only)

Parameter	Minimum	Nominal	Maximum	Unit	Note
Input Voltage Low - Vil		-	0.6	Volts	
Input Voltage High - Vih	2.7	-		Volts	
Output Voltage Low – Vol	-	-	0.6	Volts	1
Output Voltage High – Voh	2.6	-	-	Volts	1
Output Current - Io	-	-	8	mA	

Notes:

- 1) All typical specifications for 25°C
- 2) These go directly to the Synapse radio, consult the Synapse RF300 datasheet for more information.

Electrical Specifications

I/O Levels (O/C Input)

Parameter	Minimum	Nominal	Maximum	Unit	Note
Output Voltage Low – Vol	-	-	0.1	Volts	1,2
Output Voltage High – Voh	2.7	3.3	-	Volts	1,2
Rpu - Pull Up Resistance	-	10k	-	Ohms	2
Output Current - Io	-	-	0.9	mA	1,2

Notes:

- 1) All typical specifications for 25°C
- 2) These connections are designed with a clamped, PNP based isolation stage. They should ONLY be controlled via open collector. Do not put a pull up on these signals, there is already one tied to 3.3v.

I/O Levels (0-10V ADC)

Parameter	Minimum	Nominal	Maximum	Unit	Note
Pin Input Voltage – 2.4Ghz	0	-	10	Volts	
ADC Range	0	-	1.8	Volts	1
Load Resistance	-	5.3k	-	Ohms	
Input Scaling	-	0.188	-		3
Pin Input Voltage – 915Mhz	0		10	Volts	
ADC Range	0		3.3	Volts	2
Load Resistance	-	3.0k	-	Ohms	
Input Scaling	-	0.33	-		3
Conversion Resolution		10		Bits	

Notes:

- 1) The 2.4Ghz variant voltage reference is a programmable 1.5v, 1.6v, or 1.8v.
- 2) The 915Mhz variant voltage reference is an internal 1.65v source, or selectable to use an external reference (3.3v). Consult the Synapse RF300 manual for doing so.
- 3) To ensure the full 10v range can be used for various sensors, we scale the input voltage to a safe level. (E.G. $8v * 0.188 = 1.504v$ ADC input).

I/O Levels (Low Voltage ADC)

Parameter	Minimum	Nominal	Maximum	Unit	Note
Pin Input Voltage – 2.4Ghz	0	-	3.3	Volts	1
ADC Range	0	-	1.8	Volts	1
Load Resistance	-	150	-	Ohms	3
Pin Input Voltage – 915Mhz	0		3.3	Volts	2
ADC Range	0		3.3	Volts	2
Load Resistance	-	150	-	Ohms	3
Conversion Resolution		10		Bits	

Notes:

- 1) The 2.4Ghz variant voltage reference is a programmable 1.5v, 1.6v, or 1.8v. The I/O is tolerant of 3.3v but the ADC will not read above 1.8v.
- 2) The 915Mhz variant voltage reference is an internal 1.65v source, or selectable to use an external reference (3.3v). Consult the Synapse RF300 manual for doing so.
- 3) Keep note of the increased load of the LV ADC section. If your sensor cannot source this, an inline resistor may be needed.

Electrical Specifications

Radio RF Specifications (2.4Ghz)

Parameter	
Radio Name	RF200PD1
Outdoor LoS Range	3 Miles @ 250Kbps
Transmit Power	15dBm
Data Rates	250Kbps 500Kbps 1Mbps 2Mbps
Receiver Sensitivity	-103dBm (1%PER)
Modulation	Q-QPSK
Number of Channels	16
Agency Approvals	FCC ID: U9O-RF200 IC: 7084A-RF200

RF Antenna (2.4Ghz)

Parameter	
Connector Type	RP-SMA
Impedance	50 Ohms
Approved FCC/IC Antenna	Pulse W1027
Type	Dipole (quarter-wave RPSMA)
Gain	3.2 dBi
Application	Fixed/Mobile
Min. Separation	20 Centimeters

Radio RF Specifications (915 Mhz)

Parameter	
Radio Name	RF300PD1
Outdoor LoS Range	3 Miles @ 150Kbps
Transmit Power	20dBm
Data Rates	150Kbps
Receiver Sensitivity	-99dBm (1%PER)
Modulation	GFSK
Number of Channels	16
Agency Approvals	FCC ID: U9O-RF300 IC: 7084A-RF300

RF Antenna (915 Mhz)

Parameter	
Connector Type	RP-SMA
Impedance	50 Ohms
Approved FCC/IC Antenna	Linx ANT-916-CW-RCL
Type	Dipole (quarter-wave RPSMA)
Gain	0.47dbi
Application	Fixed/Mobile
Min. Separation	20 Centimeters

Getting Started with the Tnode

This will take you through the basic steps required to power the Tnode and communicate with the Portal IDE.

Setting up the Synapse Portal

In order to fully evaluate the Tnode it is required to download and run the latest Synapse Portal IDE. This will allow you to do many things such as set parameters of the radio, and upload scripts via local communications. With evaluation kits or multiple units, this functionality can be expounded further for wireless transfers.

Visit the Synapse Wireless forums, sign up, and download the latest IDE.

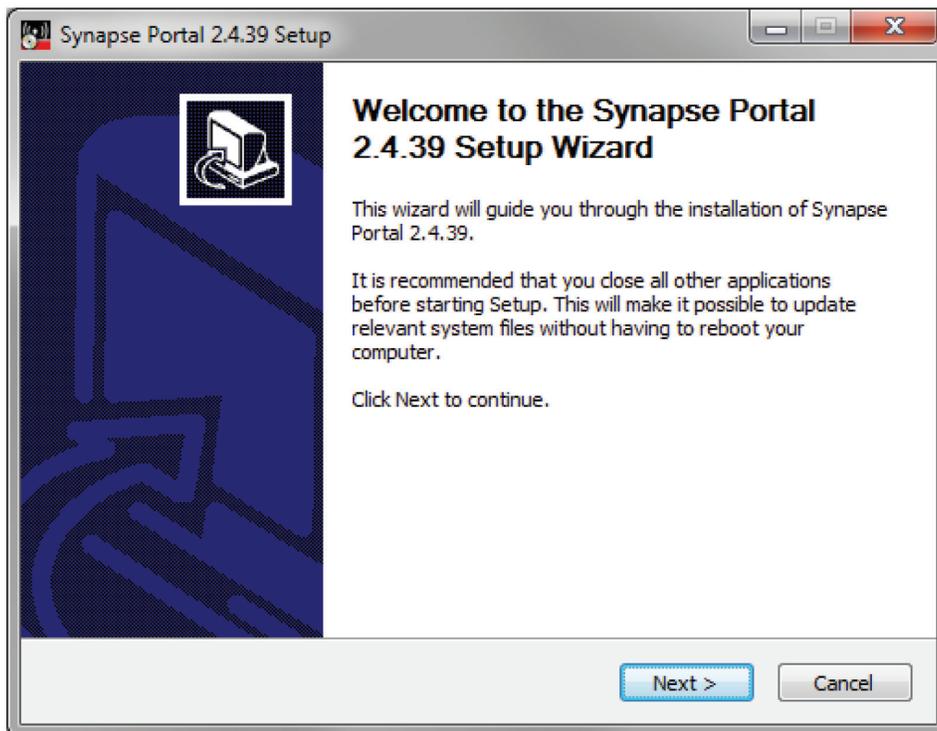
<http://forums.synapse-wireless.com> (look under Software Releases -> latest Releases).

Portal comes bundled with the latest SNAP firmware and documentation

Note that the Tnode does not require Portal to be used in the field, but for the purposes of this demonstration you will familiarize yourself with both the IDE and the hardware.

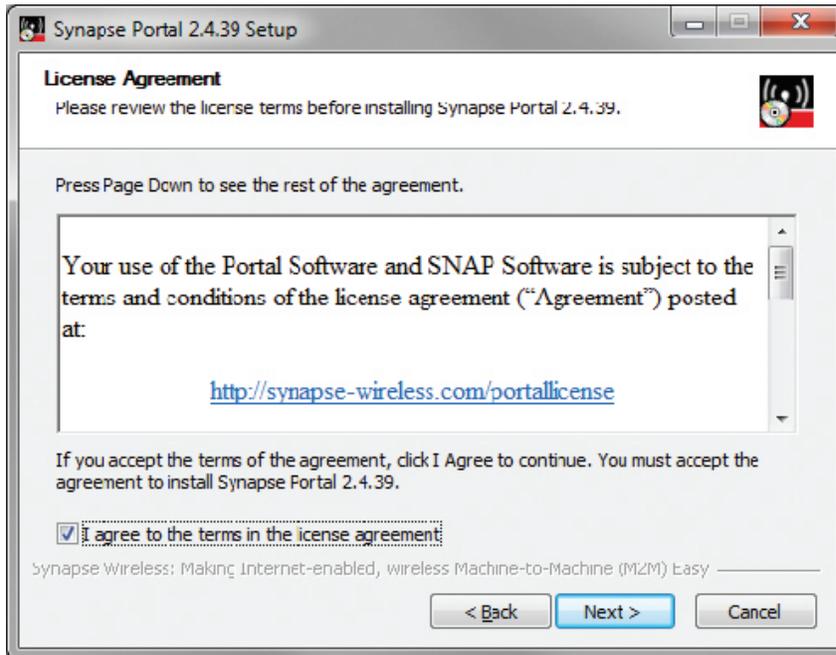
The following screenshots assume you are installing in Windows. Your precise Portal version number might be different from 2.2.39, but the process should be very similar.

A dialog box similar to the following will appear (your version number will be higher).

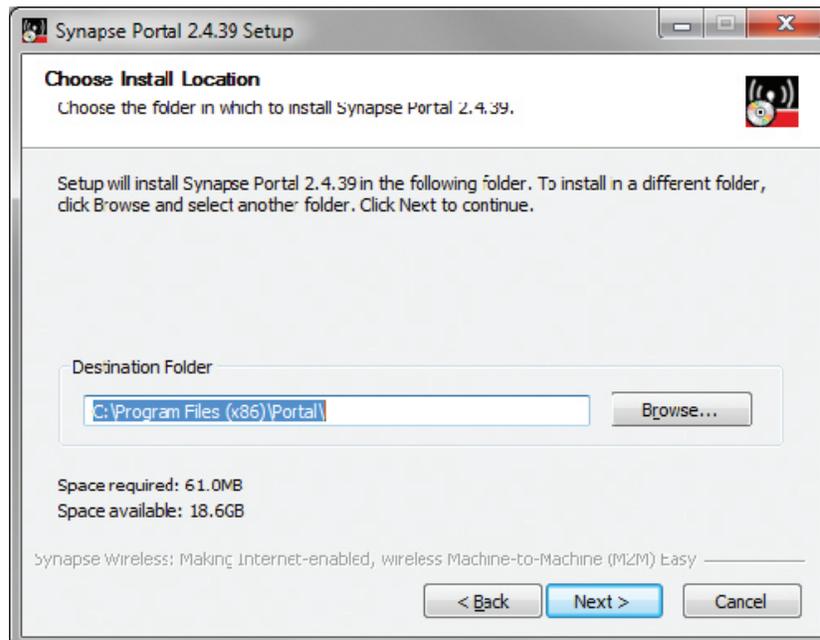


Click the Next button to get the following on next page:

Getting Started with the Tnode continued

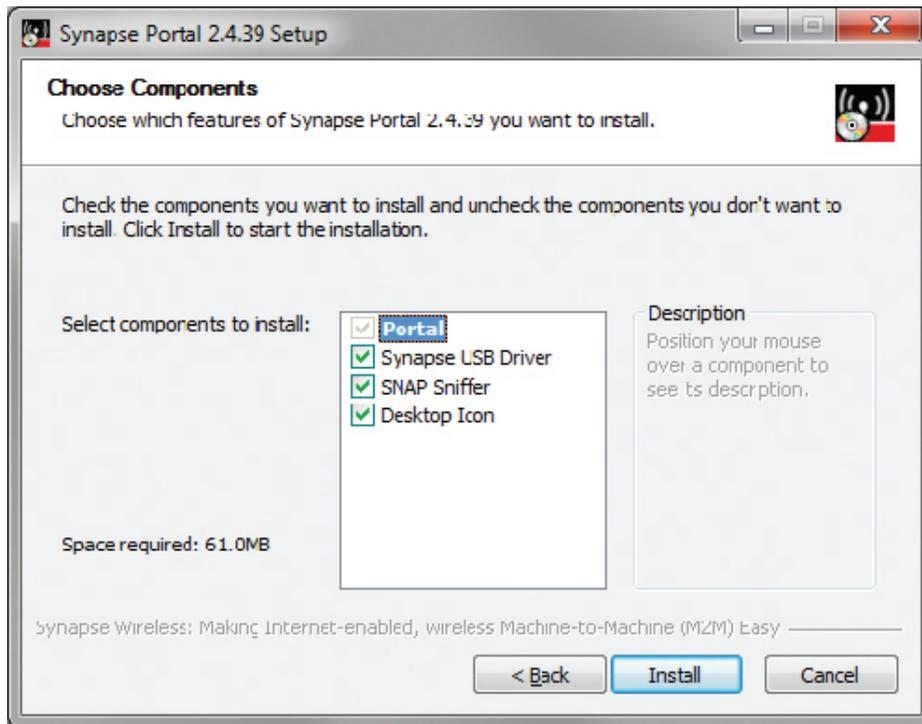


Read the license agreement at the specified URL, check the "I agree" box and then click Next



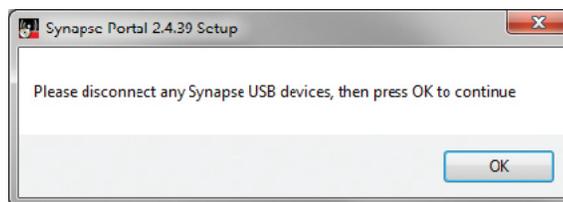
You can either enter the desired destination folder manually, browse to the desired folder, or just click on Next to accept the default.

Getting Started with the Tnode continued



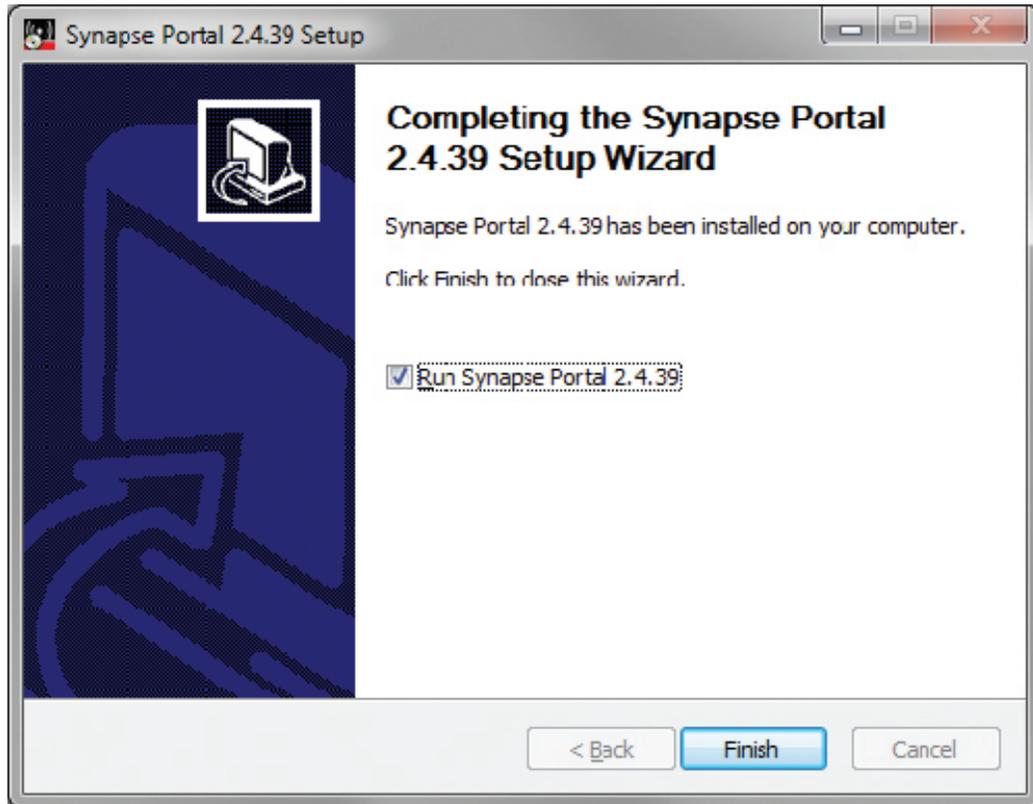
Make sure the desired components are checked, and click on Install.

After several files have been processed, if you specified that USB drivers should be installed you will get the following dialog box:



To ensure that the latest Synapse USB drivers can be installed, you must not be running the old versions of these drivers. Disconnect any Synapse USB devices to ensure this, and then click on the "OK" button. The installation process will continue.

Getting Started with the Tnode continued



You have now successfully installed Portal. There will be a Portal icon on your Windows Desktop (if you specified there should be), as well as in the Start Menu. We recommend that you do not run Portal until you have completed the bridge device driver installation through the following steps, so you should uncheck the “Run Synapse Portal” checkbox before clicking “Finish”.

Connecting to the Tnode

Step 1

Connect the Tnode to the host PC via a serial cable. The Tnode serial interface is pinned as a host, so it’s required to use a null modem. By default, the DIP switch of the Tnode is set to enable RS-232.

Step 2

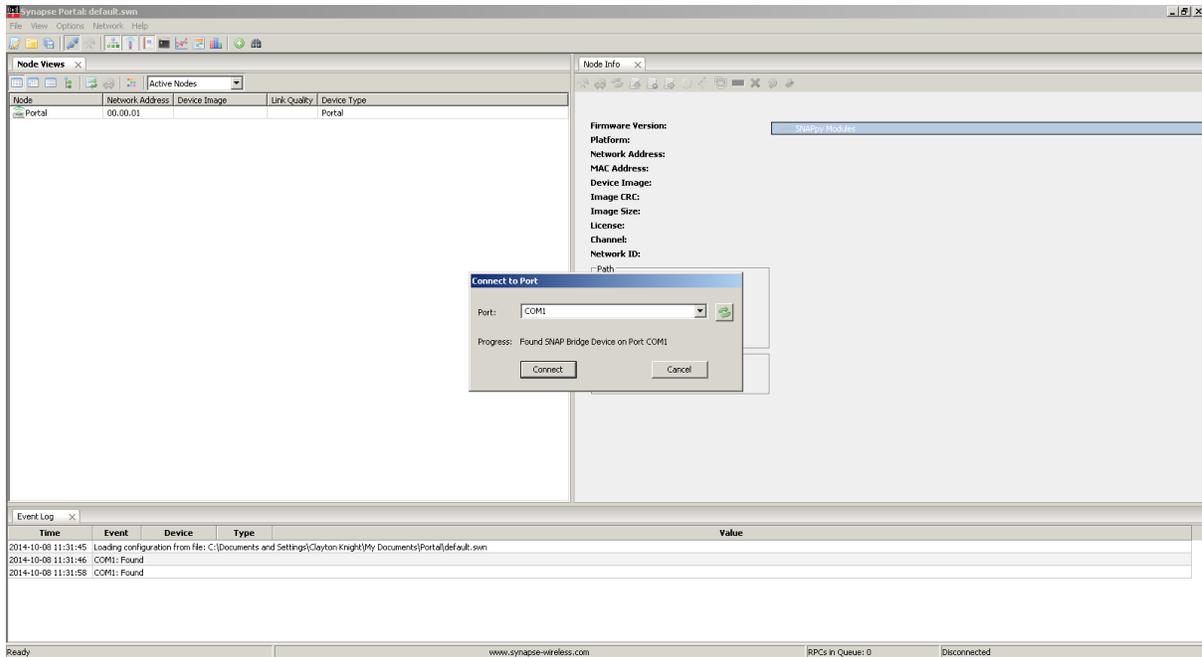
Apply power to the Tnode via the 2.1mm barrel jack, or through the mini USB connection. There will be no feedback until we connect it to Portal.

Getting Started with the Tnode continued

Connecting to the Tnode continued

Step 3

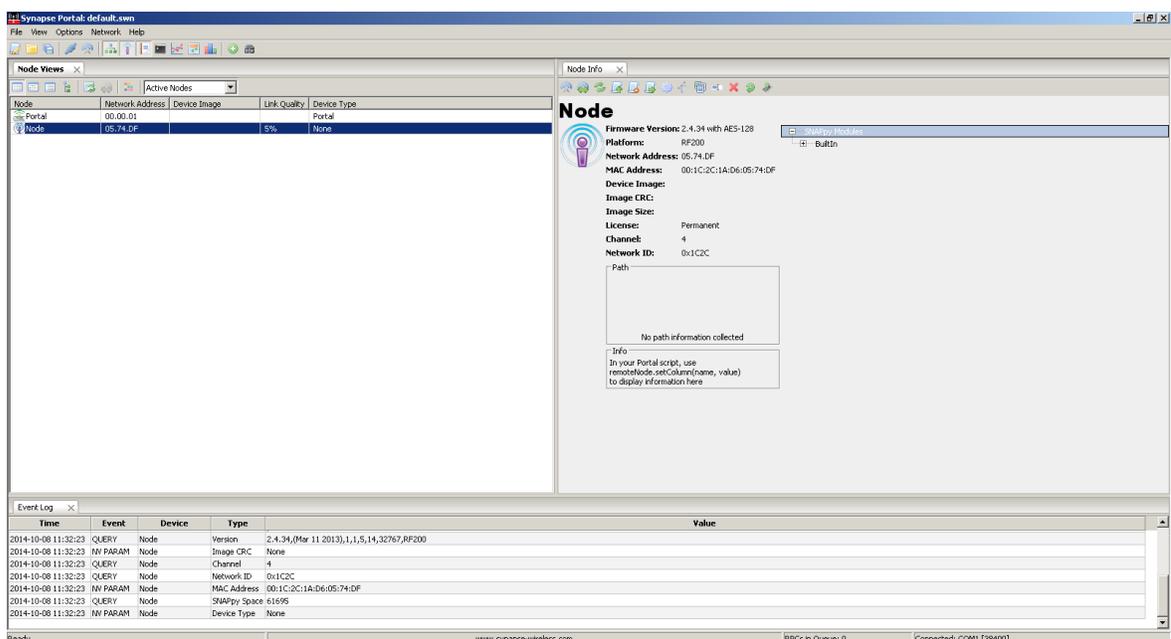
Launch Portal, once open you should see a screen similar to this



You should find a SNAP bridge device on the COM port associated with the physical RS232 serial port being used. If it doesn't come up immediately, you can use the green arrow to the right to refresh the scan.

Step 4

Press Connect. You will see the unit's information filled out in the Node Info window.



Terminus Tnode Products User Manual



Ordering Information

Ordering Information	Description
Tnode v1.0	

Revision History

Revision	Date	Note
A00	10/08/14	Advanced Release - User Manual

JANUS REMOTE
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