



SmartView RTU Application Requirements

A01131 B

Northern Power
29 Pitman Road
Barre, VT 05641 USA
1-877-90-NORTH

www.northernpower.com

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1 Introduction

The purpose of this document is to provide an overview of how to provide a functional environment for a SmartView RTU at a Northern Power wind turbine site.

This document contains recommendations and assumes the reader has sufficient experience to properly interpret and implement them. Please refer to industry best practices when planning an installation.

Please refer to Northern Power document R01129 SmartView RTU Specifications.

Please refer to all relevant standards.

2 Definitions

RTU	Remote Terminal Unit: A computer that resides at the site, acquires data from the turbine, buffers it, and transmits it to Northern Power. Also permits Northern Power technicians to remotely administrate turbine.
SCB	System Control Board: The brain of the turbine. Responsible for all control and some safety functions.
SmartView	A monitoring system consisting of the RTU, the SmartView web server at Northern Power, and the HMI.
HMI	Human Machine Interface: An application that permits a human to monitor and control a machine, in this case a wind turbine.
100BASE-TX	The most common type of 100Mbps Ethernet. Uses twisted pair copper cable, shielded or unshielded, of category 5 or higher quality. Uses 8P8C (aka RJ-45) connectors.

3 Environment

The RTU is a consumer grade PC. It must be installed in a protected, controlled environment. In hot climates this typically means an air conditioned enclosure, and in a cold climate a heated enclosure. Please refer to the RTU specifications for exact environmental limits.

The RTU also acts as a user interface to the turbine. It should usually be installed in a location that is convenient for technicians and operators who may need to monitor or control turbine operation.

4 Networking

4.1 Local Area Network Options

In order for SmartView® Monitoring System to monitor a Northern Power® turbine, both the turbine and the SmartView RTU (computer) must be connected to an Ethernet network. Both the turbine and RTU feature 100BASE-TX Ethernet interfaces. Although theoretically any network which can carry TCP/IP packets may be used to connect them, it's strongly recommended to use Ethernet; it's ubiquitous and reliable.

When planning a site network, it's important to consider are how many turbines are being installed, what are the distances between the turbines and the network to which they are connecting, and is it practical to run cable either below ground or on poles.

Northern Power recommends customers use a qualified computer network engineer to plan and oversee the installation of their site network. A qualified network engineer should at a minimum be familiar with Ethernet, both over fiber and copper cable, TCP/IP, and associated technologies. They should be able to design the network and troubleshoot issues during commissioning.

4.1.1 Fiber Optic

Optical fiber is the preferred option. It is reliable and provides inherent electrical isolation. It is resistant to electromagnetic pulses and power surges from lightning and other causes. It is also resistant to electromagnetic interference (noise). The turbine has spare 100BASE-TX jacks, but no spare fiber jacks. To use fiber cable, the customer must install a media converter in the down-tower junction box connected to the existing 100BASE-TX switch using a short patch cable. The RTU also does not feature a fiber optic port, and so a media converter must also be installed near the RTU. Ethernet switches with internal media converters may also be used.

Northern Power recommends using a standard form of Ethernet over optical fiber, such as 100BASE-FX, 100BASE-SX, or 100BASE-BX. Specification limitations on length and other factors must be observed.

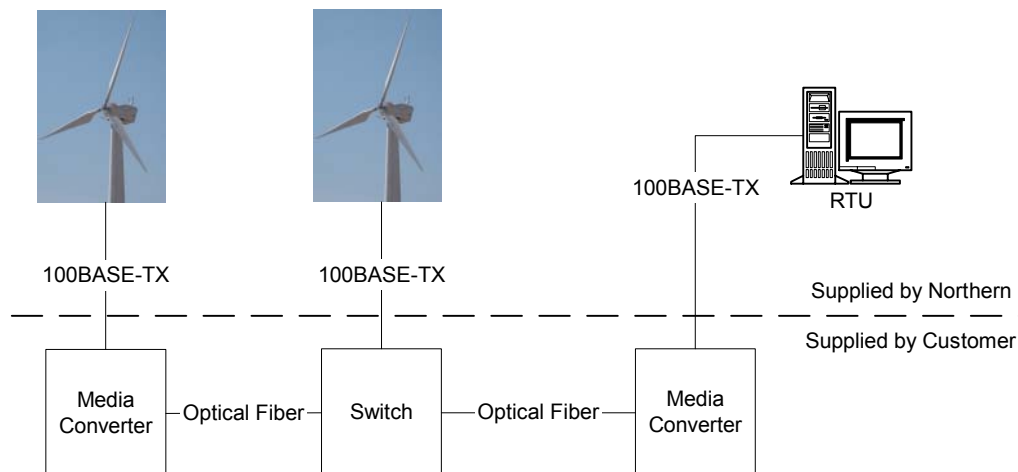


Figure 4-1 Fiber network

4.1.2 100BASE-TX

Twisted pair copper cable meeting the 100BASE-TX specification may be used. Northern Power recommends shielded Category 5e or better. It is appropriate for a site with a single turbine located within 100 meters of the nearest network switch. This is usually the option with the lowest initial cost.

The turbine comes with a 100BASE-TX switch with at least one spare port in the junction box at base of turbine.

Note: This option is **not** recommended for sites which experience frequent lightning strikes.

Warning: Ethernet rated surge suppressors must be fitted in-line with the cable at both the tower and building entrance. Surge suppressors must be connected to a good earth ground, e.g. a ground rod or the grounding bar inside the tower.

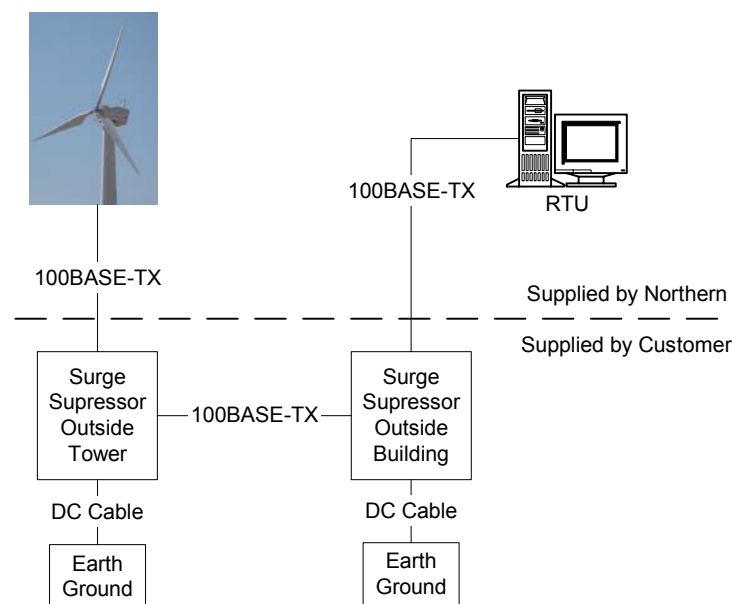


Figure 4-2 Copper network

4.2 Internet Options

As a part of the Northern Power warranty terms, Northern requires the ability to remotely monitor the turbine over the Internet via SmartView. The RTU must have internet access for this reason.

Northern requires the RTU to be accessible from the Internet via a static public IP address or host name. If necessary, Northern can use a service such as DynDNS to establish a static host name for a dynamic IP address.

Northern requires the ability to make inbound connections on port 3307 to the RTU. This may require a port forwarding rule to be configured in the customer's router or firewall.

Northern requires that the RTU be unrestricted in its ability to make outgoing connections to other Internet hosts.

Northern recommends that the customer place both the RTU and the turbine behind a firewall. The turbine should be completely blocked from the outside. The RTU should be blocked except for TCP port 3307.

In general terms the RTU requires broadband Internet.

Internet access is provided by the customer. There are several options.

4.2.1 Existing LAN with Internet Access

If the customer already has a network with Internet service, the most effective option is to connect the RTU to the existing network. The customer should coordinate attachment of the turbine and RTU to the LAN with the customer's IT department.

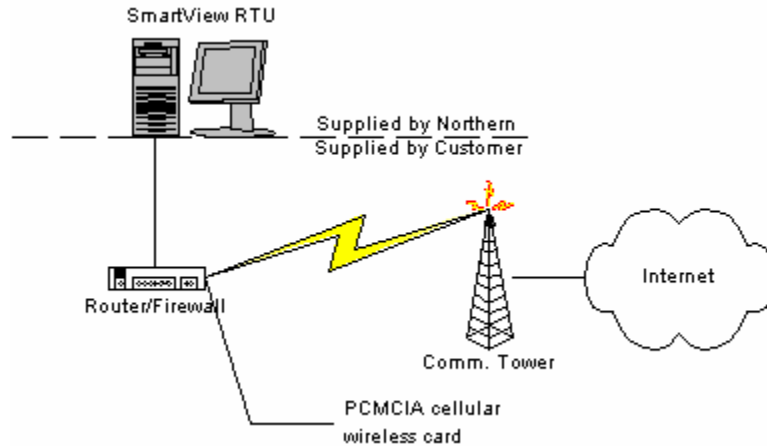


Figure 4-3 Customer LAN Internet

4.2.2 DSL or Cable

Cable modem and DSL type Internet access are widely available and inexpensive. This is a good option for sites without an existing network.

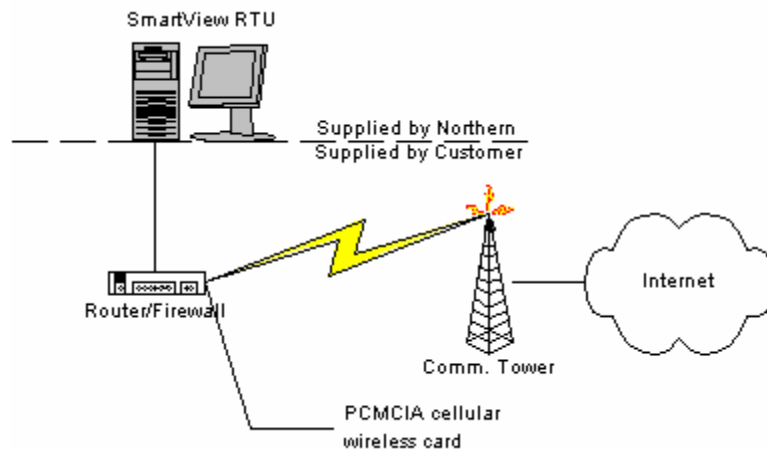


Figure 4-4 DSL or Cable Internet

4.2.3 Cellular Wireless

Broadband cellular wireless is widely available in most locations at reasonable prices and can avoid the expense of long distance cable runs. It usually features data transfer restrictions.

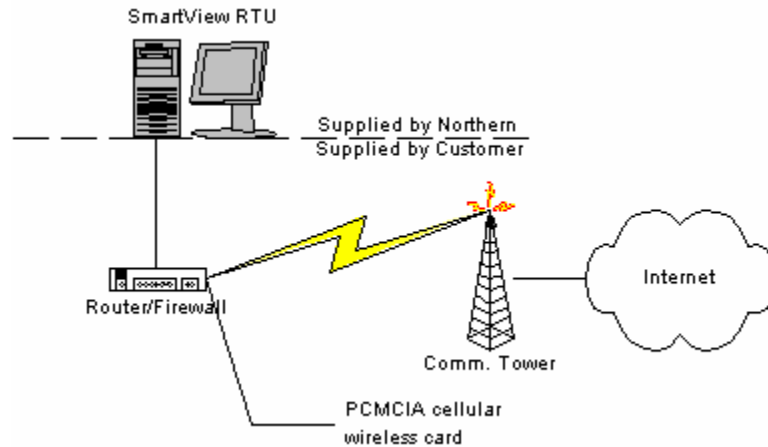


Figure 4-5 Cellular wireless Internet

4.2.4 Satellite

Satellite is Northern's least preferred option. It has higher cost, higher latency, and lower bandwidth. However it is the only option available in some areas. Satellite usually requires a clear view of the southern sky. In high latitudes, a larger dish may be required to achieve the necessary signal strength. There may be data bandwidth or transfer caps with different levels of service.

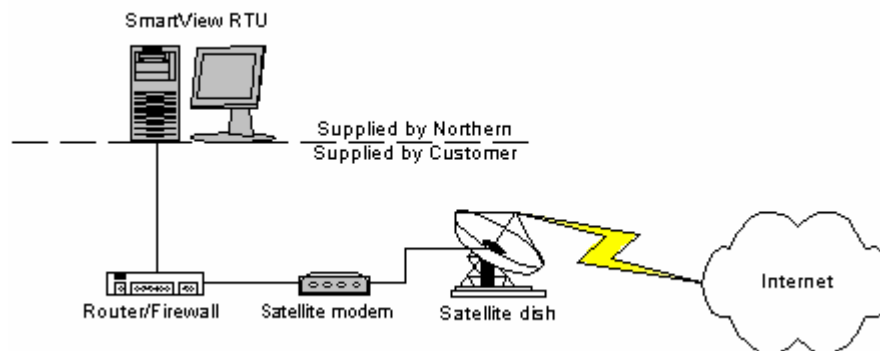


Figure 4-6 Satellite Internet

4.3 Networking Questionnaire

All customers are required to submit to Northern Power a written site network plan, describing how data will move from the SCB to the RTU, and from the RTU over the internet to the SmartView server. Please refer to H01171 SmartView RTU Network Questionnaire for details.

5 Administration & Configuration

The RTU is a special purpose appliance, not a general purpose PC. Northern Power Systems maintains ultimate authority over RTU administration for as long as it is providing remote monitoring services.

The customer is not to install any software on the RTU or change RTU configuration in any way without receiving authorization from Northern (e.g. changing the time zone from UTC to local time).

Northern Power uses a remote desktop system to administrate the RTU. Please do not be surprised to find a Northern technician remotely controlling the RTU. Northern typically uses the LogMeIn.com service which tunnels a VNC connection over a reverse proxy to a LogMeIn bastion host. This usually enables Northern to connect to the PC without requiring the customer to make any changes to their firewall.