

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 1

Climate Station Locations

Version 1.0 (September 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the two year process for siting climate stations for the Central Alaska Network (CAKN) at Wrangell - St. Elias National Park and Preserve (WRST), Denali National Park and Preserve (DENA), and Yukon-Charley Rivers National Preserve (YUCH). This SOP contains a considerable amount of narrative to describe the process. The first section describes the sites that were prioritized from this process including the stations that were installed for the design phase deployment which was necessary prior to writing accurate protocols. Other sites were evaluated and could be used for siting stations in the future. The rest of the SOP describes in detail the thought process behind the site evaluation process. This process has been evaluated by climate experts and is thought to be the preferred method for an evaluation of this nature, with recommendations for other networks to follow suit. The site criteria checklist used in the site evaluation process is included in this SOP as Appendix A.

Climate monitoring sites evaluated, reviewed and prioritized for CAKN Climate Monitoring:

Park	Station Name	Location	Elevation	Latitude	Longitude	Installation Date
WRST	Chititu	Chugach-St. Elias Mtns. South of May Creek	4600'	61° 16' 26.44"	142° 37' 08.71"	8/2004
	Chicken Creek	Kluane Range. S. Nutzotin Mtns. NE of Chisana	5260	62° 07' 27.64"	141° 50' 42.76"	8/2004
	West Fork Tana	Chugach – St. Elias mtns. N. Chugach Cirque Glacier. W of Tana River drainage.	3450	60° 54' 29.79"	142° 53' 58.61"	Pending compliance
DENA	Stampede	North of Outer Range. W. of Toklat Basin in Kantishna Hills	1900'	63° 44' 52"	150° 19' 41"	4/2003
	Dunkle	S. of Alaska Range. In Dunkle Hills NE of West Fork Chulitna drainage.	2855	63° 16' 03"	149° 32' 21"	8/2003
	Yentna	Southern flanks of Alaska Range. Upper West Fork Yentna River	1840	62° 32' 07.80"	152° 31' 41.80"	2005
	Eielson Visitor Center	N Flanks of Alaska Range.	3730'	63° 25' 52.70"	150° 18' 34.00"	2005
YUCH	Coal Creek	Yuokon Tanana Uplands. S. of Yukon River	870'	65° 18' 50.05"	143° 07' 56.38"	9/2004
	Three Fingers	Yukon Tanana Uplands. Upper Charley River drainange	3180	64° 34' 32.47"	143° 14' 27.67"	Pending compliance

In an effort to fill some of the gaps in the existing climate monitoring network and increase the knowledge of climate variability across the three CAKN parks, we identified and evaluated a number of potential new sites during the summer of 2003. Our main criteria in locating sites were 1) to get the best possible coverage across each park, 2) to sample different ecoregions within each park, and 3) to get a good elevational gradient between sites. Additionally, we considered the issue of access: a site must not be too difficult and/or costly to access for routine maintenance over the next many decades. Criteria used in locating sites varied by park. Each park had to be evaluated differently due to both the extent of natural variations within each park and park management concerns and policies, including, for example, wilderness and historic district designations, helicopter compliance regulations, and variations in landscapes and ecoregions. The NPS Geographic Information System (GIS) available for all Alaska parks was used to map ecoregions, precipitation patterns, and land designations. Existing weather sites were plotted on these maps, from that point potential new sites were identified in areas not covered by the existing network, but critical to understanding regional climate patterns. These potential new sites were presented to climatologists in and around the state. This panel included Gary Hufford, Jim Jones, Jim Hunter, and Larry Rundquist – NWS/NOAA, Anchorage, Alaska; Rick Thoman and Eric Stevens – NWS/NOAA, Fairbanks, AK; Rick McClure – Natural Resources Conservation Service, Anchorage, AK; Kelly Redmond and Dave Simeral – Western Regional Climate Center, Reno, Nevada, and Sharon Alden – NPS meteorologist/Fire Weather Program Manager Alaska Interagency Coordination Center Fairbanks Alaska.

While new sites will enhance our knowledge, we must realize that any site that is chosen will not be free from localized effects such as topography, latitude, elevation, and continentality. The severity of conditions that must be endured can vary greatly in short distances, and thus need to be evaluated individually for each site. Especially in regions of high topographic relief, but even in seemingly simpler situations, it is often better to think of stations as providing “index” values, rather than values of the “true” climate, which vary continuously and on fine scales, even to a few meters. The question of what a “representative” site actually represents seldom has a simple and straightforward answer. Climate measurements must meet a higher standard than “weather” measurements. The most demanding of these is consistency through long periods of time. A time frame of 50-100 years should be envisioned (Redmond and Simeral, 2004).

Wrangell-St. Elias National Park and Preserve

Wrangell-St. Elias National Park and Preserve (WRST) contains both coastal and interior climatic regimes as well a transition zone. Two high elevation mountain ranges disrupt movement of weather systems resulting in numerous localized climatic conditions. Because of the immensity of Wrangell-St. Elias National Park and Preserve, the extensive amount of high elevation terrain and large number of climatic regimes, a model to characterize the area was based upon a transect of sites perpendicular to the coast. This transect will contain south and north facing mountain range aspects, sites at high and low elevation, sites in both the coastal and interior regimes, as well as sites within the transition zone. This transect will by necessity incorporate Remote Automated Weather Stations that exist outside the park boundary. Geologist Danny Rosenkrans provided extensive knowledge and expertise in identifying different climatic regimes and representative areas, and locating potential sites within the park. Sites were located along a general north-south transect through the park, utilizing several existing stations along this transect (Chisana, McCarthy, and May Creek). These existing stations are at relatively low elevations, so sites for proposed new stations were located mostly in higher areas in order to get an elevational as well as latitudinal gradient between sites. A number of possible sites were located in each identified area (Chisana, McCarthy, and Tana River). In addition, several other areas outside the transect but representing different ecoregions and/or climatic regimes, or enhancing the spatial extent of the network were identified (Upper Chitina Valley, Tebay Lakes, and Cheshnina areas). Table 1 lists all potential sites and summarizes key points for each; Figures 1 and 2 show locations of potential areas and sites, as well as their relation to existing sites, wilderness boundaries, and ecoregions. On-the-ground evaluations of each site were conducted with dedicated helicopter support on 22–25 July 2003 by Rosenkrans, accompanied by Geoffrey Bleakley (Wrangell-St. Elias NP&P Historian), Pamela Sousanes (Denali NP&P Environmental Specialist) and Paul Atkinson (Denali NP&P Physical Science Technician).

Table 1. Potential new sites in Wrangell-St. Elias National Park and Preserve

Site	Area	Site Type	Elev (ft)	Latitude (NAD27)	Longitude (NAD27)	Ecoregion	Subsection	Access*	Wilderness?	Historic District?	Viewshed Concerns	Visitor Use
Gates Peninsula	McCarthy	high elevation	4060	61° 36' 10.41"	143° 00' 47.54"	Wrangell Mtns	McCarthy Mtns	H	Y	N	N	N
Kennicott Glacier	McCarthy	high elevation	3900	61° 36' 15.57"	143° 05' 59.34"	Wrangell Mtns	McCarthy Mtns	F/H	Y	N	N	L
Jumbo	McCarthy	high elevation	3700	61° 30' 20.36"	142° 51' 50.38"	Wrangell Mtns	McCarthy Mtns	Trail	N	Y	Y	M
Fireweed	McCarthy	high elevation	3770	61° 27' 40.06"	142° 59' 10.30"	Wrangell Mtns	McCarthy Mtns	H	N	N	L	L
Nikolai Mine	McCarthy	high elevation	4700	61° 27' 58.85"	142° 40' 33.26"	Wrangell Mtns	McCarthy Mtns	H	N	N	N	L
Nikolai Pass	McCarthy	high elevation	4400	61° 25' 58.88"	142° 39' 34.24"	Wrangell Mtns	McCarthy Mtns	F/H	N	N	L	L
Sourdough Ridge	McCarthy	high elevation	4160	61° 24' 29.07"	142° 45' 26.20"	Wrangell Mtns	McCarthy Mtns	H	N	N	L	L
Chititu	McCarthy	high elevation	4600	61° 16' 26.44"	142° 37' 08.71"	Chugach-St. Elias Mtns	W St. Elias Foothills	H	N	N	N	N
Iceberg Lake	Tana River	mod elevation	3300	60° 47' 44.55"	142° 58' 05.74"	Chugach-St. Elias Mtns	N Chugach Cirque-Glacier	F/H	Y	N	L	L
Iceberg Bench	Tana River	high elevation	3990	60° 49' 08.53"	142° 58' 17.17"	Chugach-St. Elias Mtns	N Chugach Cirque-Glacier	H/F	Y	N	N	N
Tana Glacier Seismic	Tana River	high elevation	4150	60° 45' 17.68"	142° 49' 43.18"	Chugach-St. Elias Mtns	N Chugach Cirque-Glacier	H©	Y	N	N	N
Ross Green Bench	Tana River	mod elevation	2520	60° 44' 08.47"	142° 29' 03.23"	Chugach-St. Elias Mtns	N Chugach Cirque-Glacier	H/F	Y	N	N	N
Twelvemile Ck	Tana River	mod elevation	3080	60° 45' 05.95"	142° 31' 40.96"	Chugach-St. Elias Mtns	N Chugach Cirque-Glacier	H/F	Y	N	N	N
West Fork Tana	Tana River	mod elevation	3450	60° 54' 29.79"	142° 53' 58.61"	Chugach-St. Elias Mtns	N Chugach Cirque-Glacier	H	Y	N	N	N
Tana River	Tana River	low elevation	1440	60° 56' 22.18"	142° 41' 51.68"	Chugach-St. Elias Mtns	Tana Valley	F	Y	N	Y	L
Euchre	Chisana	high elevation	6860	62° 03' 19.89"	142° 11' 04.36"	Kluane Ranges	S Nutzotin Hills & Mtns	H©/S	boundary	N	N	N
Chicken Airstrip	Chisana	high elevation	5260	62° 07' 27.64"	141° 50' 42.76"	Kluane Ranges	S Nutzotin Hills & Mtns	F/H/S	N	Y	Y	L
Gold Hill	Chisana	high elevation	5930	62° 05' 36.45"	141° 54' 00.48"	Kluane Ranges	S Nutzotin Hills & Mtns	H/F/S	N	Y	N	N
California Creek	Chisana	high elevation	5480	62° 03' 55.23"	141° 46' 42.63"	Kluane Ranges	S Nutzotin Hills & Mtns	H/F/S	boundary	N	N	N
Beaver Lake	Chisana	high elevation	5450	62° 01' 38.20"	141° 53' 04.86"	Kluane Ranges	S Nutzotin Hills & Mtns	H/F/S	Y	N	N	N
Chitina Glacier Seismic	Upper Chitina	mobile	4950	60° 57' 54.69"	141° 20' 16.28"	Chugach-St. Elias Mtns	University-Centennial Mtns	H©	Y	N	N	N
Notch Airstrip	Upper Chitina	mobile	2600	61° 00' 22.41"	141° 31' 55.89"	Chugach-St. Elias Mtns	Chitina & Logan Glaciers	F	Y	N	Y	L
Huberts	Upper Chitina	mobile	2200	61° 01' 36.96"	141° 38' 05.16"	Copper River Basin	Chitina Valley	F/H	Y	N	Y	L
Barnard Glacier	Upper Chitina	mobile	1900	61° 04' 31.91"	141° 47' 56.80"	Chugach-St. Elias Mtns	Chitina Moraines	H/F	Y	N	N	N
Tebay	Tebay Lakes	mobile	2000	61° 11' 17.33"	144° 24' 01.34"	Chugach-St. Elias Mtns	N Chugach Cirque-Glacier	F/H	boundary	N	N	L
Tebay Cabin	Tebay Lakes	mobile	1880	61° 10' 54.12"	144° 20' 15.95"	Chugach-St. Elias Mtns	N Chugach Cirque-Glacier	H/F	N	N	N	N
Cheshnina	Cheshnina	mobile	4940	61° 48' 46.41"	144° 25' 46.39"	Wrangell Mtns	Cheshnina Plateaus & Valleys	H	boundary	N	N	N
Long Glacier	Cheshnina	mobile	4820	61° 49' 19.84"	144° 04' 40.59"	Wrangell Mtns	Cheshnina Plateaus & Valleys	H/F	Y	N	N	N

Note – Only one site will be considered in each of the color coded areas.

Access: (H) helicopter; (F) fixed-wing aircraft; (S) snowmachine/ATV; (H©) helicopter, co-located with seismic station or radio repeater, listed in order of most likely type of access

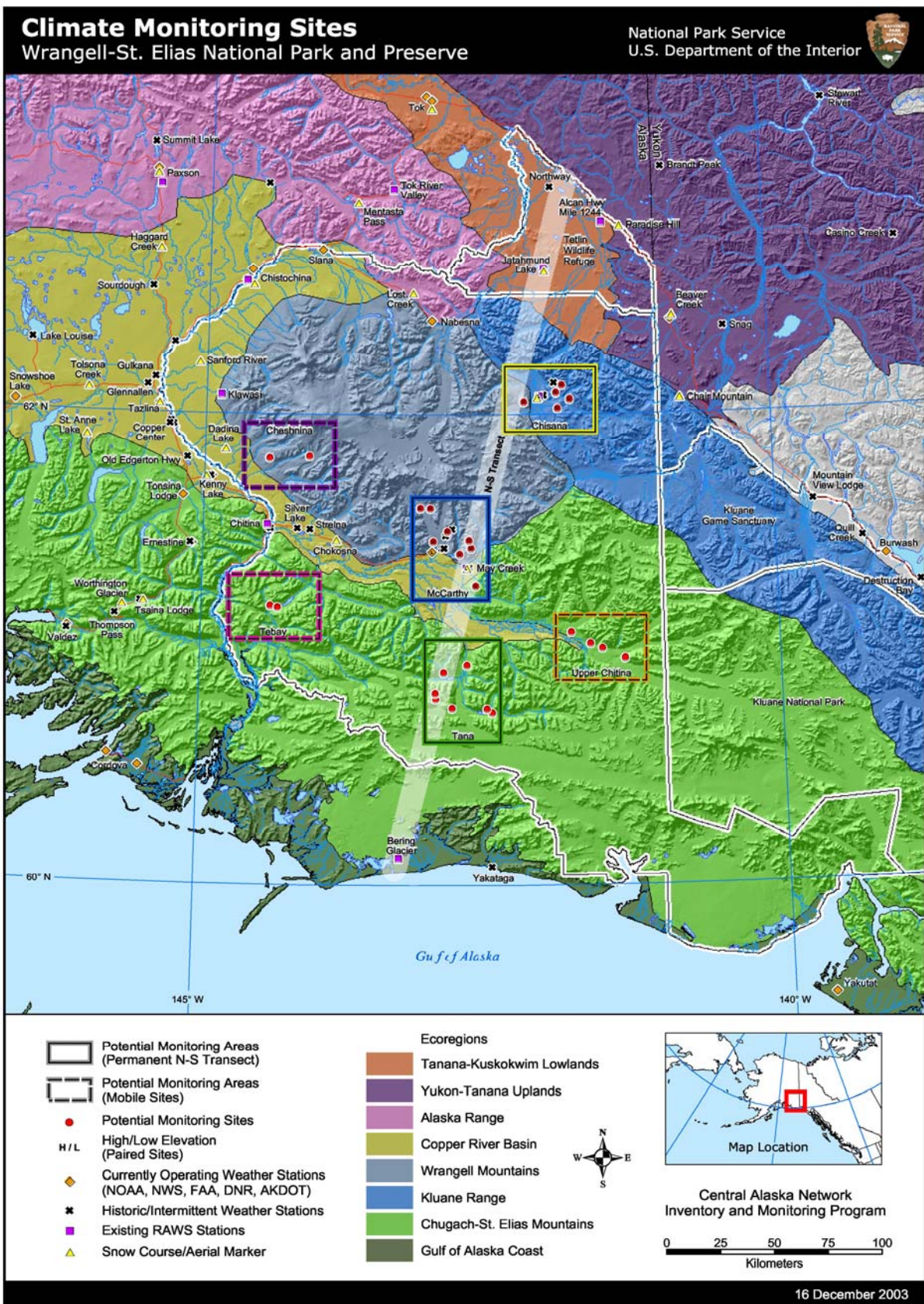


Figure 1 . Location of existing and potential climate monitoring sites in relation to Alaska Ecoregions, Wrangell-St. Elias National Park and Preserve

Climate Monitoring Sites Wrangell-St. Elias National Park and Preserve

National Park Service
U.S. Department of the Interior

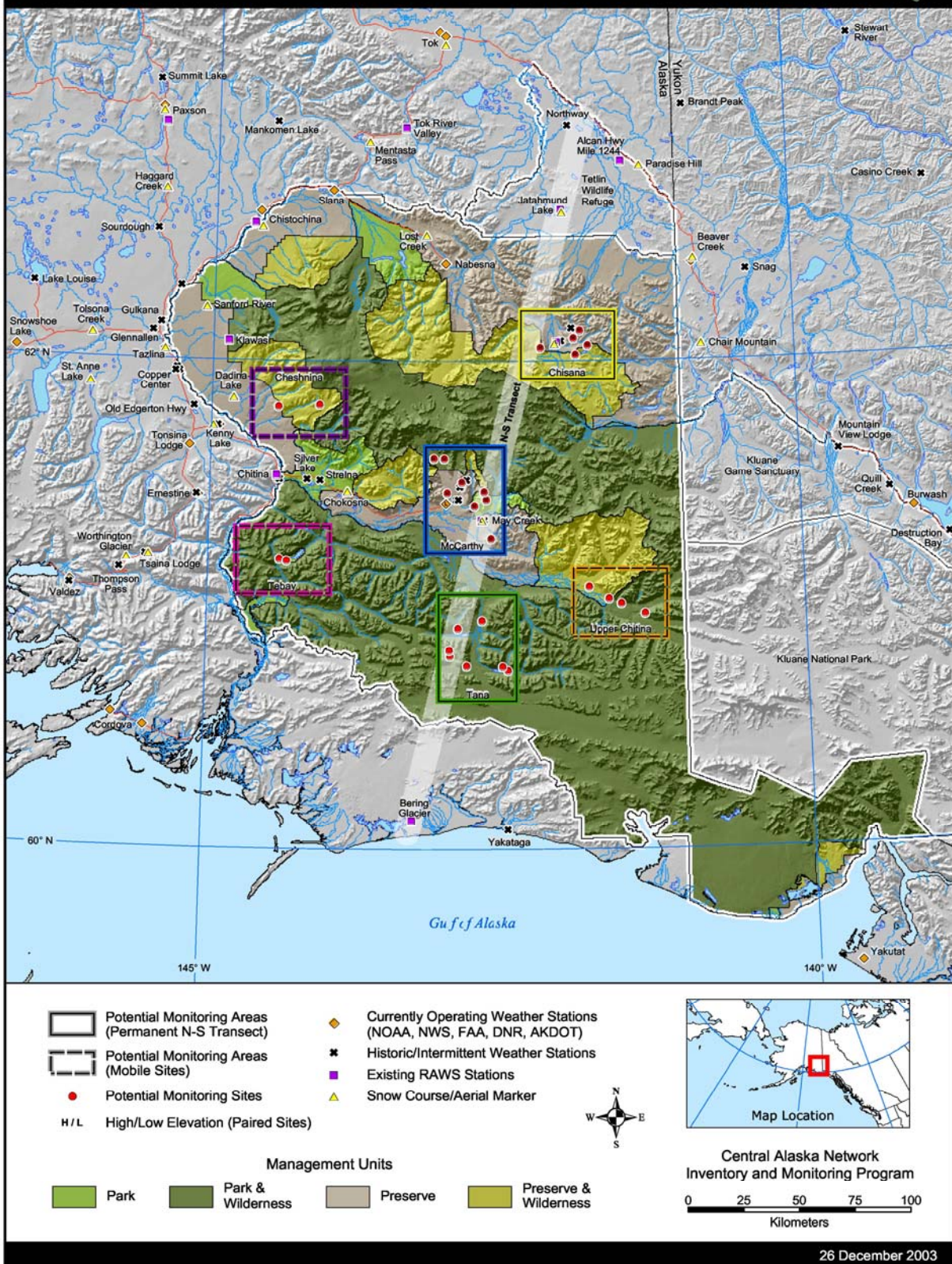


Figure 2 Location of existing and potential climate monitoring sites in relation to management units, Wrangell-St. Elias National Park and Preserve

Yukon-Charley Rivers National Preserve

Yukon Charley Rivers encompasses three ecoregions including the Yukon – Old Crow Basin, the North Ogilvie Mountains, and the Yukon-Tanana Uplands. The Yukon-Tanana uplands have no existing representative climate station so potential siting in that area was a priority. Potential sites in Yukon-Charley were selected based on valuable information on the area supplied by Nikolina Guldager (Yukon-Charley Wildlife Biologist), Jay Martin (Yukon-Charley Park Pilot) and Rick Thoman (National Weather Service Meteorologist). Several factors influenced potential site locations including the ecoregions map and the annual precipitation pattern map, and the general climate pattern described by Rick Thoman. Thoman pointed out that a marked change in climate patterns seems to occur at the 144° West parallel with colder temperatures in the hills and valleys east of the parallel which is just west of the Yukon Charley Rivers boundary.

Several other considerations were given to the area. Firstly, the few climate monitoring sites that currently exist in and around Yukon-Charley are at lower elevations, so an effort was made to find potential new sites at higher elevations within the preserve. Secondly, five new aerial snow markers were installed by Guldager within the preserve in 2001 and 2002, and an effort was made to locate sites near these markers for correlation with snow survey data. We attempted to locate sites proximal to existing airstrips for fixed-wing access. Table 2 lists the potential sites and summarizes key points for each; Figures 3 and 4 show their locations and their relation to existing sites and ecoregions.

Pamela Sousanes, Paul Atkinson, Jay Martin, and Guy Adema (Denali NP&P Physical Scientist) conducted on-the-ground surveys of Coal Creek and Three Fingers sites and fixed-wing overflights of the remaining sites on 27 August 2003.

Table 2 Potential sites identified in Yukon-Charley Rivers National Preserve

Site	Area - Ecoregion	Site Type	Elev (ft)	Latitude (NAD27)	Longitude (NAD27)	Access*	Wilderness?	Historic District?	Viewshed High use?
Three Fingers	Yukon Tanana Uplands	high elevation	3180	64° 34' 32.47"	143° 14' 27.67"	F	N	N	Y
Crescent Creek	Yukon Tanana Uplands	high elevation	2850	64° 48' 31.53"	143° 54' 37.92"	F	N	N	Y
Golvins Airstrip	Yukon Tanana Uplands	mid elevation	2100	64° 49' 20.00"	143° 25' 57.00"	F	N	N	Y
Beverly Airstrip	Yukon Tanana Uplands	high elevation	4110	65° 06' 40.16"	143° 50' 12.20"	F	N	N	N
Coal Creek	Yukon Tanana Uplands	low elevation	870	65° 18' 50.05"	143° 07' 56.38"	F/S	N	Y	Y

*Access: (H) helicopter, (F) fixed-wing aircraft, (S) snowmachine/ATV

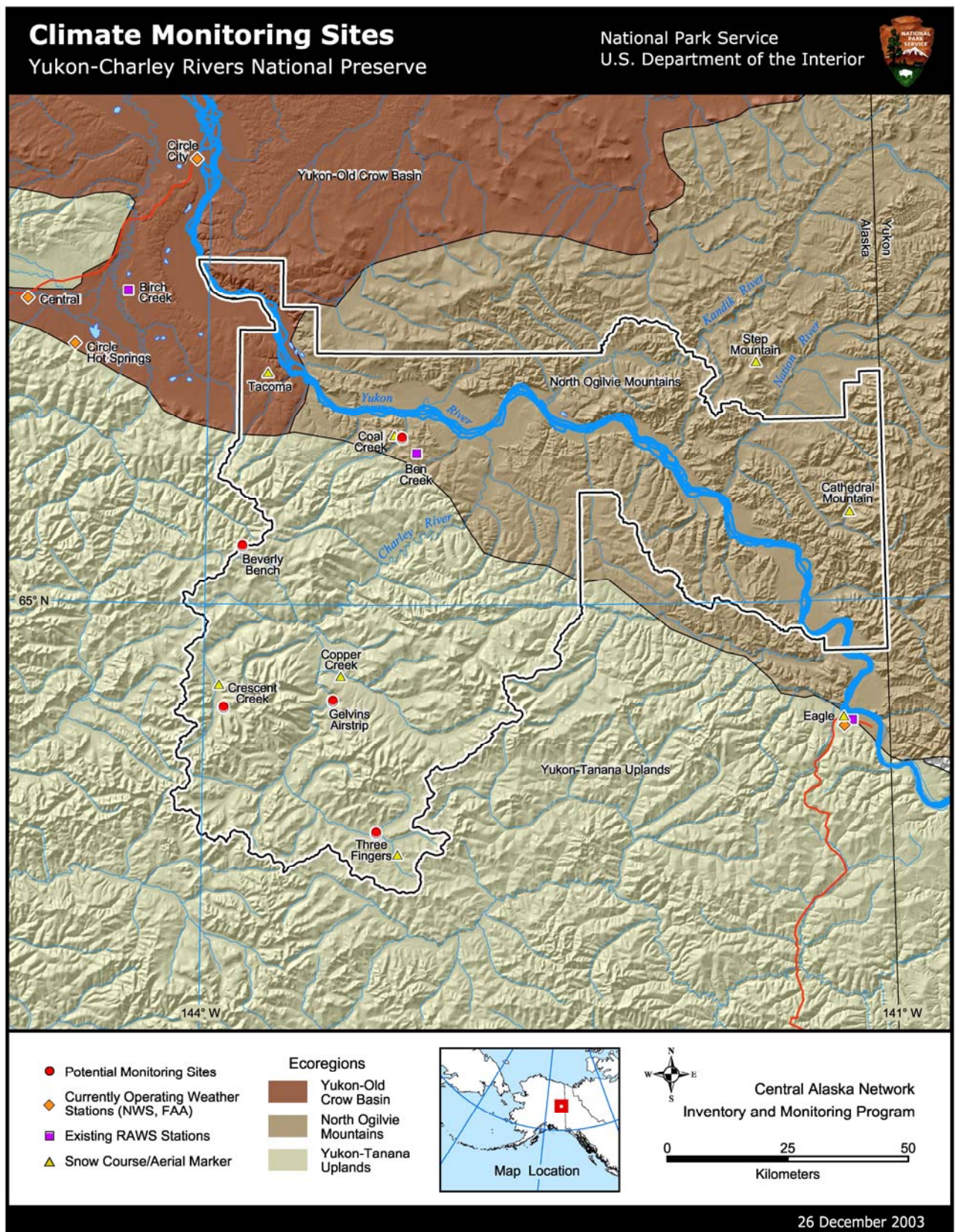


Figure 1 Location of existing and potential climate monitoring sites in relation to Alaska Ecoregions, Yukon-Charley Rivers National Preserve

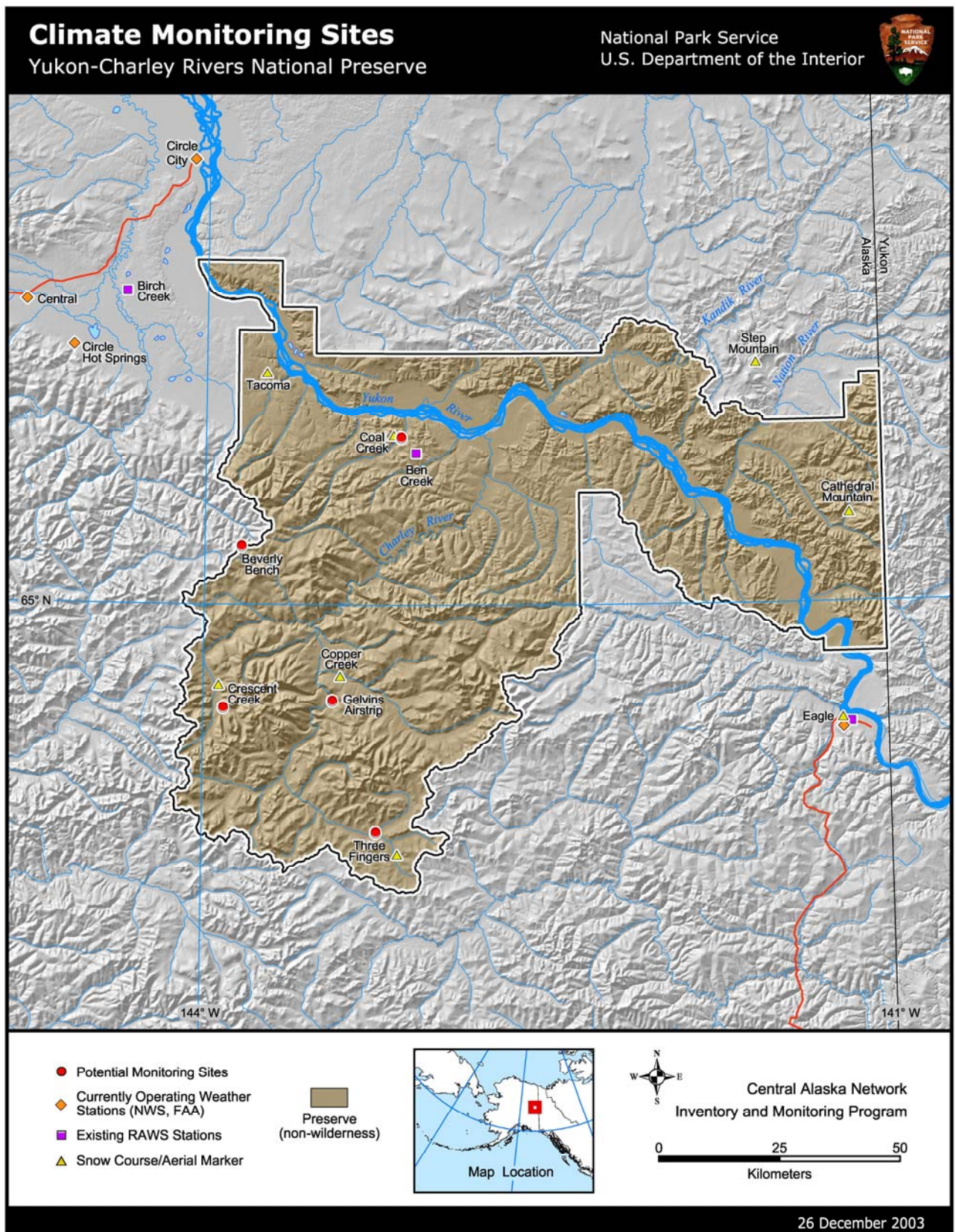


Figure 2 Location of existing and potential climate monitoring sites in relation to land management units, Yukon-Charley Rivers National Preserve

Denali National Park and Preserve

The climate of Denali National Park and Preserve (DNP&P) is characterized by great spatial variability, and includes both transitional maritime (influenced by the ocean) and continental (influenced by the Alaska Range) climate subtypes. Denali lies approximately 140 miles north of the Gulf of Alaska but the prevailing weather patterns generated by the Aleutian Low significantly affect Denali's climate, bringing considerable precipitation in the form of rain and snow to the windward side of the Alaska Range and moderating the air temperatures. On the north side of the range however, the continental interior climate conditions generated by the Arctic High prevail. Temperature variations from summer to winter are high, and precipitation is low.

Although Denali encompasses the boundaries of four ecosystems the Alaska Range ecoregion and the Tanana-Kuskokwim Lowlands dominate the landscape. The Yentna river confluence in the southwest area of the park is part of the Cook Inlet Basin ecoregion, and small sections in the northwest corner of the park in the Minchumina Basin lie within the Kuskokwim Mountains ecoregion. The Denali has had a Long-term Ecological Monitoring (LTEM) program in place for twelve years, and thus has a more extensive network of climate monitoring stations than either Wrangell-St. Elias or Yukon-Charley (although for most of the program, the climate monitoring network was within Rock Creek, a small watershed near Park Headquarters). In 2001, three new locations within the park (Dunkle Hills, Stampede Airstrip, and Wigand Creek) were identified through an internal scoping process with park resource program managers. Standard stations were installed at these sites during the summer of 2003. In addition, we identified several other potential sites based on representative landscape, wilderness, and access issues. These sites were visited for evaluation at various times during the summer by Pam Sousanes, Paul Atkinson, and Rick McClure (NRCS). Table 3 lists the sites and summarizes key points for each; Figures 5 and 6 show their locations and their relation to existing sites, wilderness boundaries, and ecoregions.

Table 3 Potential sites identified in Denali National Park and Preserve

Site	Area	Site Type	Elev (ft)	Latitude (NAD27)	Longitude (NAD27)	Ecoregion	Access*	Wilderness?	Historic District?	Viewshed High use?
West Fork Yentna River	South Side	low elevation	1840	62° 32' 07.80"	152° 31' 41.80"	Alaska Range	H	N	N	N
Tokositna Valley	South Side	low elevation	860	62° 38' 33.52"	150° 47' 46.90"	Alaska Range	H/S	N	N	N
Eielson Visitor Center	North Side	high elevation	3730	63° 25' 52.70"	150° 18' 34.00"	Alaska Range	R/H	N	N	Y
Kantishna	North Side	low elevation	1570	63° 32' 17.21"	150° 59' 06.17"	Alaska Range	R/F	N	N	Y

* Access: (H) helicopter, (F) fixed-wing aircraft, (S) snowmachine/ATV, (R) road

Climate Monitoring Sites

Denali National Park and Preserve

National Park Service
U.S. Department of the Interior

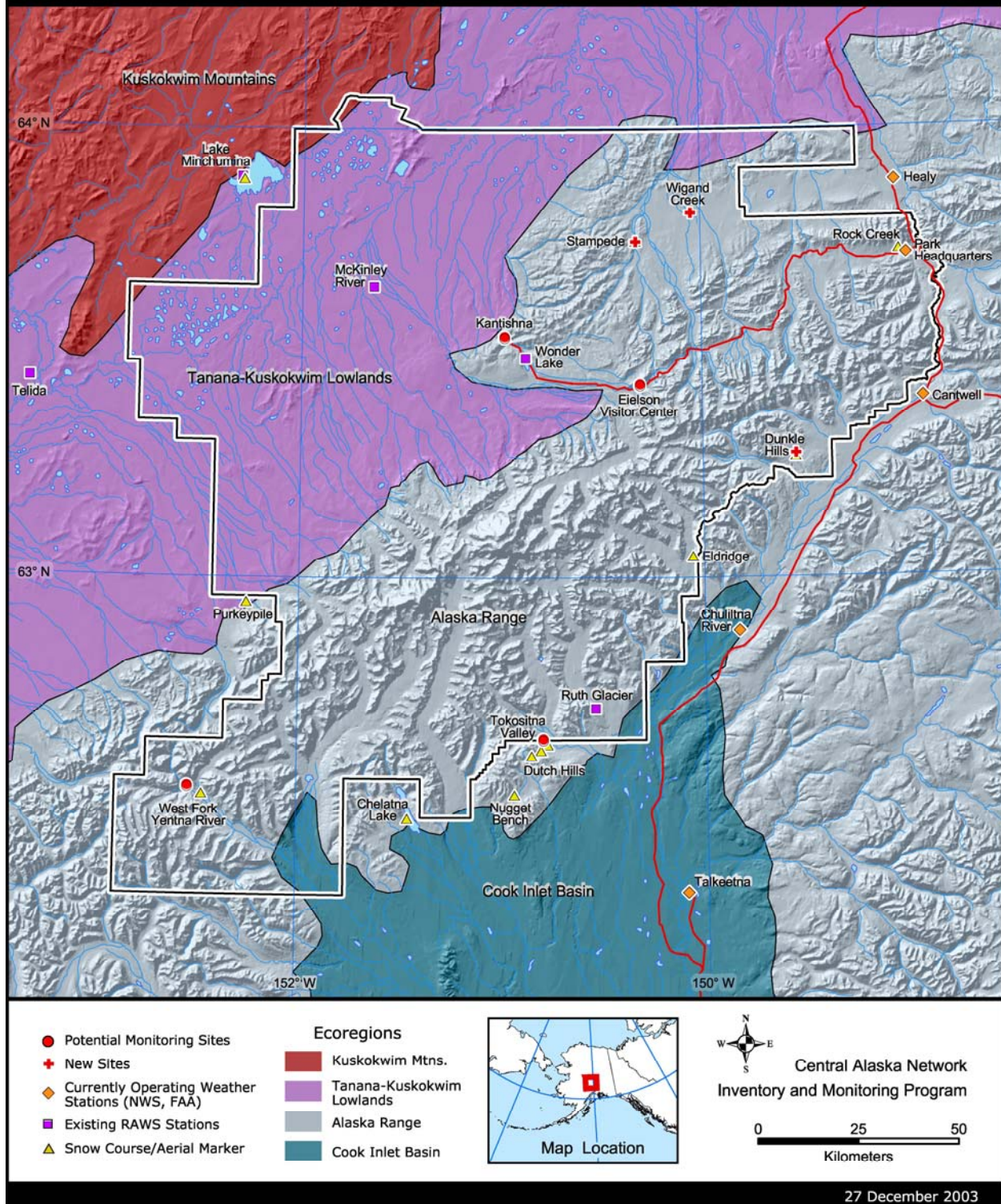


Figure 5 Location of existing and potential climate monitoring sites in relation to Alaska Ecoregions, Denali National Park and Preserve

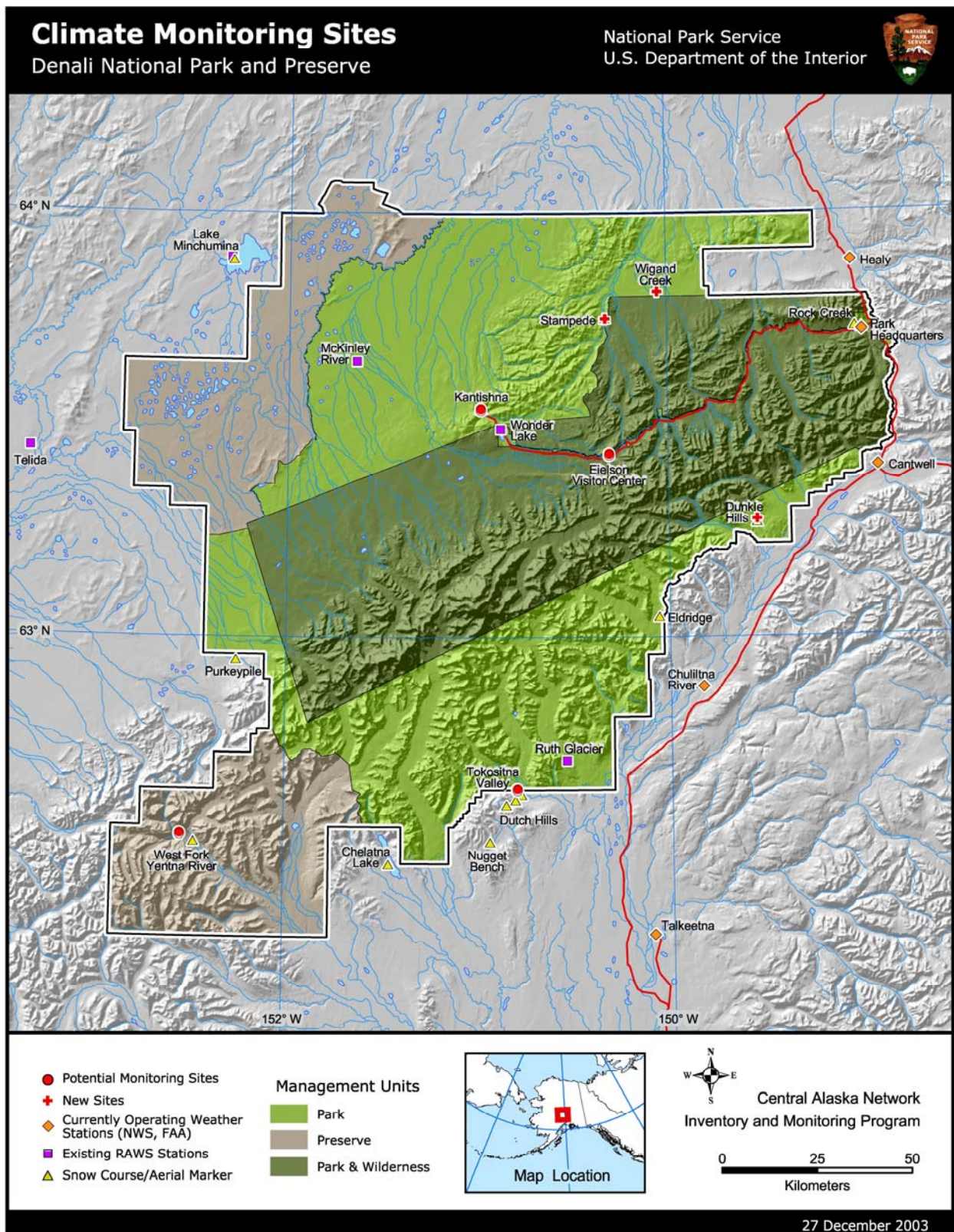


Figure 6 Location of existing and potential climate monitoring sites in relation to management units, Denali National Park and Preserve

Appendix A

Site Evaluation Checklist

Date/Time:

Area/Transect:

Site Location/Description:

Latitude:

Datum:

Longitude:

Elevation:

Flat and anchorable ground?

Pad size? (min 11' x 20')

Clearing size? (distance to trees/cliffs)

South exposure (solar)?

South-east exposure (GOES)?

Soil type:

Vegetation type:

Associated snow course / aerial snow marker?

Recommended instrumentation

AT/RH, SR

soil temperatures

wind

precipitation

snow depth

Access:

Photos:

Notes:

Climate Monitoring Protocol for the Central Alaska Network

Standard Operating Procedure (SOP) # 2

Compliance and Permitting

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the steps necessary to engage in climate monitoring within the National Park Service which is subject to legal justifications of the National Environmental Protection Act (NEPA) of 1969. The purpose of NEPA as stated in section 2 of the act that created it is to *“encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; and to enrich the understanding of the ecological systems and natural resources important to the Nation....”*

During the initial planning phase of the project it is necessary to begin the process of permitting and compliance. The permitting and compliance phase could take up to a year for final processing depending on the level of NEPA compliance necessary. It is also possible that the project or upgrades to the project are not congruous with the management policy of the park. Compliance and permitting are constantly evolving; always inquire about current requirements.

Research permits and compliance

1. Determine if the project is already covered under an existing project name in either individual compliance databases for the park or through the U.S. National Park Service Research and Reporting System (<http://science.nature.nps.gov/research/ac/ResearchIndex>)
2. Follow the guidelines for the individual park to initiate the compliance process. This often begins with the application for a research permit which triggers the internal compliance review within each park.

In future years climate stations will most likely be added to the network. Initial compliance has been done for the three parks for the initial stages of the program. The climate station locations described in SOP 1 have all been subjected to compliance reviews in the parks where they will be located. Some discussion still remains over sites located within designated wilderness areas or areas that are considered suitable wilderness for potential future designation. These lands are subject to more stringent regulations governed under the Wilderness Act of 1964.

The purpose of the Wilderness as stated in section 2 (a) is to *“secure for the American people of present and future generations the benefits of an enduring resource of wilderness... for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and*

enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness...”

Attached to this SOP is an example of a study plan submitted under the National Park Service Research and Reporting System for initial climate station placement in Yukon-Charley Rivers National Preserve.

**Revised Study Plan for
Central Alaska Network (CAKN)
Climate Monitoring
Yukon-Charley Rivers National Preserve
2004**

Submitted by:
Pamela Sousanes
Environmental Specialist
Denali National Park and Preserve
PO Box 9
Denali Park, AK 99755
Phone: (907)683-9573
Fax: (907) 683-9634
E-mail: pam_sousanes@nps.gov.

I. Abstract:

The Inventory and Monitoring Program is the result of the National Parks Omnibus Management Act, which was passed by Congress in 1998. This act directs the National Park Service “to establish baseline [resource] information and to provide information on the long-term trends in the condition of National Park System resources.” To accomplish this formidable task, the NPS has grouped parks into 32 networks which are characterized by their ecological similarities. Four of these networks are in Alaska. Denali National Park and Preserve, Wrangell-St. Elias National Park and Preserve and Yukon-Charley Rivers National Preserve have been organized into the Central Alaska Network (CAKN). One objective of the program is to monitor and record weather conditions at representative locations in order to identify long and short-term trends, provide reliable climate data to other researchers, and to participate in larger scale climate monitoring and modeling efforts.

In an attempt to better understand climate variation as well as possible long-term changes in ecosystems of the Central Alaska Network and in particular Yukon-Charley Rivers National Preserve, two new long-term climate monitoring stations are being proposed within the Preserve. The sites under consideration are the upper east fork of the Charley River near the Three Fingers area and the Coal Creek camp area. These weather stations would record the following parameters: Air temperature, relative humidity, wind speed and direction, incoming solar radiation, precipitation, soil temperature, and snow depth. We are proposing that the station in the Upland area be augmented in two years to become a Natural Resources Conservation Service snow telemetry (SNOTEL) site which would measure year-round precipitation as well as the other parameters. The data from the stations will be available real-time via the internet through the Western Regional Climate Center. These stations are recording long term variations in climate, so it is intended that they remain at the selected locations indefinitely. Once a station is placed it is imperative that the site not be moved in order to have the most accurate long term record possible.

This document includes the original study plan for climate monitoring submitted in March 2004 with some revisions, as well as the amendment for the additional site evaluations done in May of 2004.

II. Overview

Numerous studies describe the effects of climate change on selected ecosystems. It is important to quantitatively monitor meteorological conditions directly so that a reliable record of long term change can be established. Climatic variations are a primary driver of ecosystem dynamics, impacting both terrestrial and aquatic flora and fauna. There is one climate station within Yukon Charley at present located on Ben Creek. In order to better characterize the region we are proposing to add a paired low elevation site near Coal Creek Camp as well as an Upland site in the upper east fork of the Charley River near the Three Fingers area.

The two most important climate parameters to monitor are air temperature and precipitation. Air temperature is a relatively easy measurement to make accurately using the right instrumentation. While rainfall in summer is relatively easy to measure the transitional fall and winter precipitation events and the snowfall in winter are difficult to measure accurately, especially when a station is remote. The Natural Resources Conservation Service (NRCS) has been successfully running remote SNOTEL sites, or snow telemetry sites, in the state of Alaska for many years. These sites have a year-round precipitation gage that accurately records both snow and rain, using a shielded gage to increase accuracy. NRCS has a robust program in place which includes periodic maintenance of sites and data quality control and quality assurance as well as internet data dissemination. NRCS has worked with the NPS for years with snow courses and aerial snow markers and are prepared to engage in an interagency cooperative agreement to install SNOTEL sites within the three CAKN parks. In order to best record changes in precipitation over the next 50-100 years a robust and proven method is necessary. Two sites are being proposed in Denali National Park & Preserve, 2 sites in Wrangell-St. Elias National Park and Preserve, and 1 in Yukon-Charley Rivers National Preserve.

A climate monitoring site evaluation document has been presented to the National Weather Service, the Natural Resources Conservation Service, the Western Regional Climate Center, and Sharon Alden, the meteorologist with the interagency Alaska Fire Service. Comments and reviews have been compiled and the sites proposed in Yukon-Charley Rivers national Preserve meet the recommendations of the peer group.

Objectives

Goal: Monitor principle components of the physical environment.

Objective: Monitor and record weather conditions at representative locations in order to identify long and short term trends, provide reliable climate data to other researchers, and to participate in larger scale climate monitoring and modeling efforts.

III. Methods

A. Study Area

Climate is currently monitored at Yukon Charley Rivers National Preserve at Ben Creek within the Preserve, and Eagle just outside the boundary. Potential new sites in Yukon-Charley were selected

based on valuable information of the area supplied by Nikolina Guldager (YUGA Wildlife Biologist) and Jay Martin (YUGA Park Pilot). Several factors influenced potential site locations. Firstly, the few climate monitoring sites currently existing in and around Yukon-Charley are at lower elevations, so an effort was made to find a potential new site at a higher elevation within the preserve. Secondly, five new aerial snow markers were installed by Guldager within the preserve in 2001 and 2002, and an effort was made to locate sites near these markers for correlation with snow survey data. Initially an attempt was made to locate sites proximal to existing airstrips for fixed-wing access, however after conferring with the Interdisciplinary Compliance Team it was suggested that more remote sites be evaluated due to the concerns of proximity (of the original proposed sites) to the Charley River which is classified as a National Wild and Scenic River. Table 1 lists all of the potential sites with the preferred sites highlighted.

Table 1. Potential sites identified in Yukon-Charley Rivers National Preserve.

Site	Area	Elev (ft)	Latitude (NAD27)	Longitude (NAD27)	Access*
Three Fingers	Y-T Uplands	3180	64° 34' 32.47"	143° 14' 27.67"	F
Crescent Creek	Y-T Uplands	2850	64° 48' 31.53"	143° 54' 37.92"	F
Gelvin's Airstrip	Y-T Uplands	2100	64° 49' 20.00"	143° 25' 57.00"	F
Beverly Airstrip	Y-T Uplands	4110	65° 06' 40.16"	143° 50' 12.20"	F
Coal Creek	Y-T Uplands	870	65° 18' 50.05"	143° 07' 56.38"	F/S
Slaven Cabin	Y-T Uplands	704	65° 21' 02.56"	143° 07' 21.51"	F/S
Three Fingers Aerial Snow Marker Site #1	Y-T Uplands	3082	64° 32' 08.8"	143° 09' 10.4"	H
Site # 2	Y-T Uplands	3570	64° 31' 20.3"	143° 07' 30.7"	H
Site #3	Y-T Uplands	3590	64° 31' 02.0"	143° 11' 58.2"	H
Site #4	Y-T Uplands	3610	64° 30' 14.05"	143° 15' 18.59"	H
Site #5	Y-T Uplands	3530	64° 38' 57.0"	143° 08' 52.27"	H
Site #6	Y-T Uplands	3530	64° 40' 29.2"	143° 51' 00.0"	H

Access: (H) helicopter, (F) fixed-wing aircraft, (S) snowmachine/ATV

Pamela Sousanes, Paul Atkinson (DENA Physical Science Technician), Jay Martin (YUGA Park Pilot), and Guy Adema (DENA Physical Scientist) conducted the initial on-the-ground surveys of Coal Creek and Three Fingers sites and fixed-wing over flights of the remaining sites on 27 August 2003. An additional five sites in the Yukon-Tanana Uplands were evaluated in 2004 via helicopter by Pamela Sousanes and Marsha Henderson. Figure 1 shows the location of all sites included in the original site selection. Topographic maps with site locations, descriptions and photos are included in Appendix A for Three Fingers, and in Appendix B for Coal Creek and Slaven Cabin. Descriptions, maps, and photos for the additional sites evaluated in 2004 are included in the attached amendment.

B. Procedures

In a 2002 scoping meeting the CAKN physical science team met with Larry Hinzman of the University of Alaska Fairbanks to discuss instrumentation. Hinzman has been involved with the Long Term Ecological Research (LTER) areas at Bonanza Creek, Poker Flats and Toolik Lake in Alaska for many years. He made suggestions on instrumentation based on their study design and others like it around the country. During the site evaluation process the instrumentation was also presented and was accepted by all. Through discussions with the CAKN technical committee it was

decided that temperature and precipitation were the most important variables or drivers in the ecosystem context, followed by wind, solar radiation, and relative humidity. The station design described below was submitted and approved by the technical committee.

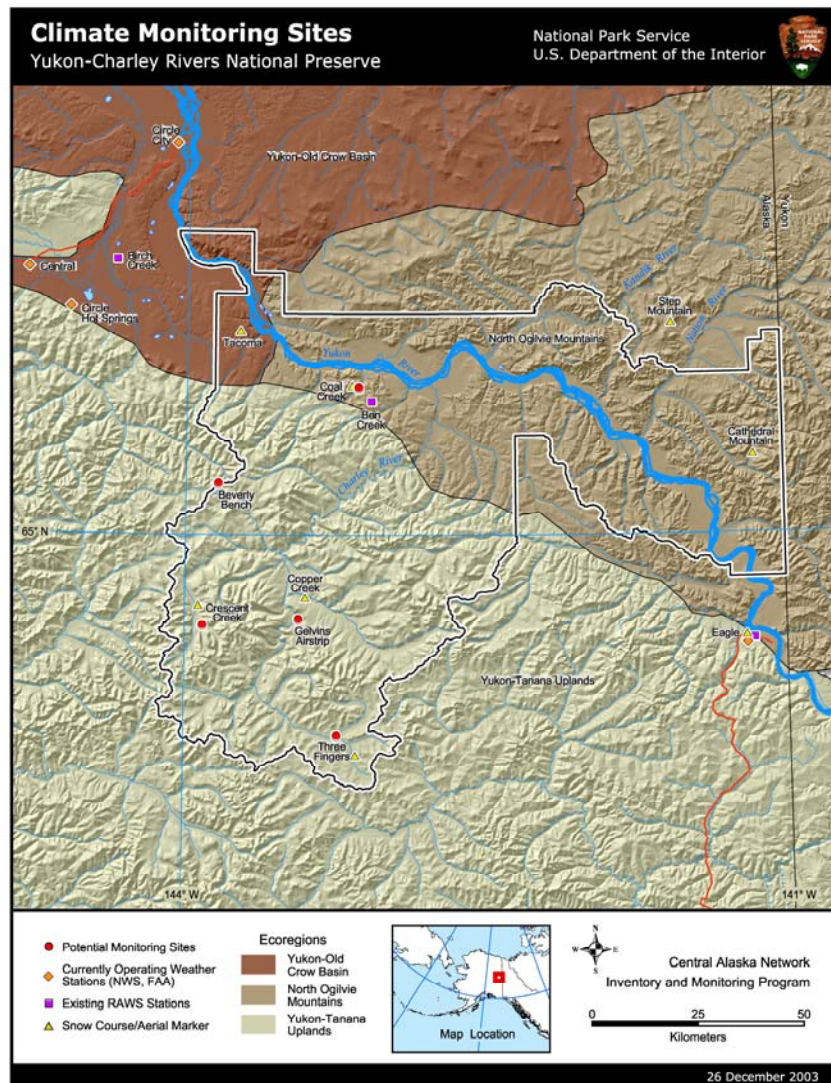


Figure 1 Location of sites in selection process.

There are two variations of climate stations being proposed, a standard tripod station and a tripod station with the additional instrumentation necessary to upgrade to a NRCS SNOTEL station. The NRCS SNOTEL station would be installed after 2-3 years of data were collected from both the climate station and the aerial snow marker in the area. The standard tower is a ten-foot mast on a tripod base with a 12' diameter footprint. The station is guyed via cable to itself and augmented with guy wires to the surrounding ground surface via cable and rebar (1/2" diameter x 3' length). The station includes a Campbell Scientific, Inc. CR10X data logger and Seimac High Data Rate GOES satellite data transmitter. Basic instrumentation includes air temperature, relative humidity, wind speed and direction, incoming solar radiation, tipping bucket rain gauge, an acoustic snow depth sensor, and 3 soil temperature probes. The soil temperature probes are inserted into the ground near

the station via a 1" diameter soil auger, the ground disturbance is minimal. A pipe (2" diameter x 3' length) will be inserted in the ground and used to hold the precipitation tipping bucket 30 cm above the vegetation. Figure 2 shows a typical station.

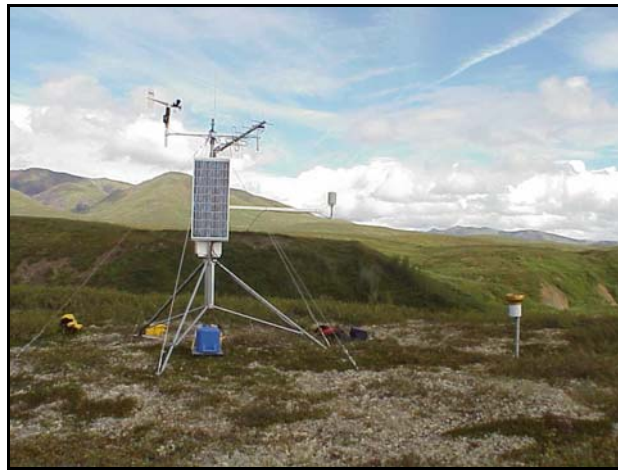


Figure 2 Standard climate station

The equipment for the new stations was purchased in 2002 and 2003. Three of these stations have already been deployed in a testing phase at remote locations in Denali; the remaining nine are currently set up near the Denali National Park & Preserve Visitor Center for testing and assessment prior to deployment in 2004. This testing phase is an extremely valuable stage for the network. Inherent bugs in programming, instrumentation, power systems, and many other miscellaneous problems will be identified before these stations go remote. The stations were specifically designed for remote, high latitude, extreme cold conditions. Special consideration was taken to minimize visual and physical impacts by making the stations as compact as possible to comply with wilderness values within national park lands. The stations have a small footprint, low-impact anchoring systems, and wooden platforms to stand on while visiting the site to minimize vegetation disturbance. Stations are powered year-round by two solar panels. A sealed lead-acid battery is enclosed in an insulated cargo container and is the only hazardous material on site (Figure 3). This station is ready for deployment in summer 2004.



Figure 3 Battery and enclosure for climate station

The augmented SNOTEL station would continue to use the tripod configuration to measure the meteorological parameters described in the previous section, with the addition of a rocket type year-round precipitation gage and a small shelter (4' x 4' x 8') with a 20' tower attached for a solar panel

and telemetry antenna. The precipitation gage would be constructed from irrigation pipe with a pressure transducer in the bottom of the device. A mixture of propylene glycol would be used in the reservoir to melt the falling snow (It would be contained in the system). The shelter will sit on 16" x 16" concrete pads at each corner. The precipitation gauge will also be anchored on a 16" x 16" concrete pad. The precipitation gage height would be @ 6-7 feet. The equipment will be painted brown to blend in as much as possible with the surroundings. Figure 4 shows an example of a snow telemetry (SNOTEL) site using the year round precipitation gage used by NRCS at Coldfoot. Site specifics, including maximum annual snowfall will ultimately determine the final design and of the station. Data from the aerial snow marker in the area will be used to determine the height of the gage. The aerial marker was installed in 2002 and at least two more years of data are necessary to determine the gage height, putting an installation date of the augmented SNOTEL site in 2006.



Figure 2 Example of SNOTEL site at Coldfoot

Some brushing might be necessary in the immediate area surrounding the station to ensure accuracy of the measurements. At the Upland site this will be minimal due to the location above treeline. At the lower proposed site every attempt will be made to locate the station within an adequate clearing, however the site might require some maintenance brushing over the years as vegetation changes take place.

C. Data Collection Methods

Data will be collected and stored electronically at all sites. Campbell Scientific Inc. CR10X dataloggers will be used for data collection at each station proposed for Yukon-Charley

Rivers national Preserve. Measurements will be taken at 60 second intervals and recorded hourly. Data are stored on-site within the datalogger which has a one million datapoint capacity; these data will be retrieved from the site during annual maintenance trips. These data are also sent out via satellite each hour and will be disseminated and archived at the Western Regional Climate Center (WRCC) in Reno, Nevada. A corresponding database will also be archived within the CAKN network with the data manager. After a site visit the data will be sent via ftp to WRCC to ensure there are no data gaps due to satellite problems. The data will also ultimately be archived with the National Climatic Data Center (NCDC) in Asheville, NC.

Air Temperature and Relative Humidity

A Vaisala HMP45C air temperature and relative humidity sensor will be used to record hourly minima, maxima and average air temperatures and relative humidity. Temperature measurements will be recorded in degrees Celsius and relative humidity will be recorded in percent.

Solar Radiation

The Li-Cor LI-200X pyranometer sensors that will be used consist of silicon photodiodes which measure total sun plus sky radiation in the 280 to 2800 nm spectral band. Average solar radiation will be recorded in W/m^2 and summarized as daily global radiation in $\text{MJ/m}^2/\text{day}$. Solar radiation figures will be considered reliable only when daytime temperatures are above freezing since snow and frost will occasionally accumulate on the sensors, thus obscuring them from the sky.

Wind

A R.M. Young Wind Monitor will be used to measure horizontal wind speed and direction at each site. Average wind speed and unit vector mean wind direction will be logged every hour; standard deviation of wind direction and maximum gust speed and direction will also be recorded. All wind speeds will be recorded as meters per second. It should be noted that because wind gusts can occur in very short time intervals and because speeds are sampled only once every 60 seconds, some peak gusts may not be recorded.

Precipitation

A Texas Electronics TE525WS tipping bucket will be used to measure seasonal precipitation. Because this tipping bucket will not be heated, precipitation can only be measured when temperatures are reliably above the freezing point – most likely between June and September. Precipitation is measured in millimeters.

A Campbell Scientific acoustic distance sensor will be used to measure snow depth. This sensor records the difference between the sensor and the snow surface and subtracts the distance from the sensor to the ground surface giving you the snow depth. These measurements will be taken every 15 minutes and averaged hourly. Snow depth will be recorded in meters.

Soil Temperatures

Soil temperatures will be measured using a Campbell scientific 107 temperature probe inserted in the ground at .5m and 1 m. Soil temperatures will be sampled every 15 minutes and averaged hourly. Temperatures will be recorded in degrees Celsius.

D. Analysis

These data will be used to support various projects occurring within the Central Alaska Network as well as statewide research applications, National Weather Service forecasting, fire weather indices, and global climate models. The potential use of these data is unlimited. Annual summaries will be compiled for the CAKN climate monitoring network which will include a narrative presentation of the data as well as summary charts and graphs. In the protocol development stage of the program (Fall 2004) the details of the annual reporting will be addressed in detail.

Meaningful climatic trend analysis will require a longer period of record than just a few years. Analysis schedules will be addressed in detail in the protocol development slated for completion in fall 2004. However, correlation of preliminary data with other nearby sites will be documented. A number of summaries and products will be available in real-time via the WRCC webpage including daily and monthly summaries, time series graphs, wind rose graphs, and histograms. The stations metadata will also be archived at this location as well as with the data manager for CAKN and with the Environmental Specialist (Climate Monitoring) at Denali. Specific analysis might be done on an individual project basis depending on the information needed, or through global models used by NOAA, NWS, or university researchers. Again, the potential use of these data is unlimited.

E. Schedule

The tentative schedule plan for climate monitoring in Yukon-Charley Rivers is as follows:

June: Reconnaissance site visit to Coal Creek via fixed-wing to identify site specifics. Photo document and mark exact location with GPS. Clear with cultural resources team. Potentially cache some of the equipment at Coal Creek Camp for future deployment.

August/September: Deployment of climate station at Coal Creek and/or upper east fork of the Charley. This work will be accomplished by Pamela Sousanes and a Physical Science Technician. They will spend approximately 1 full day at each site installing the station and another day at Coal Creek troubleshooting any potential problems. Preferably they would stay at Coal Creek camp during the visit.

September: If necessary visit site(s) an additional time before winter to ensure everything from initial setup is running as desired.

F. Budget

The budget for this program is part of the Central Alaska Network pilot projects for 2004. The budget includes the OAS cost of fixed-wing access to Coal Creek and helicopter access to the upper east fork Charley River site and per diem for Sousanes and the physical science technician involved in the installation. The equipment for the climate stations was purchased in 2002. Additional miscellaneous tools and equipment might be necessary depending on the ultimate location. The proposed cooperative SNOTEL site would be funded for 2006, but design development would occur this fiscal year. Some of the instrumentation for the SNOTEL sites has already been acquired. Annual maintenance will be required and built into the budget of the program. The stations will require annual visits for sensor calibrations and general maintenance. The maintenance trip could be coordinated with the annual Remote Automated Weather Station (RAWS) maintenance trip.

V. PRODUCTS

- A. **Publications and reports** – These data will be used to support various projects occurring within the Central Alaska Network as well as statewide research applications, National Weather Service forecasting, fire weather indices, and global climate models. The potential use of these data is unlimited. Annual summaries will be compiled for the CAKN climate monitoring network which will include a narrative presentation of the data as well as summary charts and graphs. In the protocol development stage of the program (Fall 2004) the details of the annual reporting will be addressed in detail.
- B. **Collections** – None
- C. **Data and other materials** - Photographs, handouts, exhibits, presentations, raw data, and GIS coverages will be developed using these data. These data will be available on the CAKN website and through WRCC. The climate station sites will be plotted as an NPS coverage with links to the data and metadata.

VI. LITERATURE

Nothing was cited specifically in this proposal but reference to all of the reports below has gone into the culmination of this program.

AMAP, 1998. AMAP Assessment Report: Arctic Pollution Issues. Arctic pollution Issues. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. 859 pp.

Juday, G.P. 2000. Recent climate and forest history of the Denali National Park and Preserve Headquarters area, based on tree ring analysis. Agricultural and Forestry Experiment Station. University of Alaska Fairbanks. Report to U.S. Geological Survey Biological Research Division. 26 pp.+ figures.

McClure, R.J. 1998. Artificial Shielding of precipitation Gauges in the Arctic. Report to Soil

Conservation Service, Anchorage Alaska. 1 p.

- Searby, H.W. 1970. Mount McKinley National Park Alaska – Climatic Summaries of Resort Areas. National Oceanic and Atmospheric Administration-National Weather Service. No. 21-49-1. 5pp.
- Simpson, J.J., G.L. Hufford, M. Fleming, J.S. Berg and J.B. Ashton. 2002, Long-term climate patterns in Alaskan surface temperature and precipitation and their biological consequences, *IEEE Trans. Goes. Rem. Sens.*, **40**, 1164-1184
- Simpson, J.J., G.L. Hufford, C. Daly, J.S. Berg, M.D. Fleming, Submitted to *Weather and Forecasting*. Two Views of Alaskan Surface temperature and Precipitation: Implication for the Development of an Improved Operational Climate Monitoring System.
- Solomon, H. 1992. A preliminary report on meteorological observations on Mt. McKinley, Alaska. The Journal of the Japanese Alpine Club. Sangaku. Vol. 87. A25-A27.
- Stafford, J.M., G. Wendler, J. Curtis. 2000. Temperature and precipitation of Alaska: 50 year trend analysis. *Theor. Appl. Climatol.* **67**, 33-44.
- Sousanes, P.J. 2002. 2001 Long term Ecological Monitoring. Climate Data Summary. Denali National Park and Preserve. 120 p.
- Walter, H. 1963. Climatic diagrams as a means to comprehend the various climatic types for ecological and agricultural purposes. Pp. 3-9 in Rutter, A.J. and F.H. Whitehead (ed.). The Water relations of plants. A symposium of the British Ecological Society, London, 5-8 April 1961. London. Blackwell Scientific Publications.
- Weller, G. 1979. Alaska's Weather and Climate – A collection of articles written for the educated layman by staff members of the Geophysical Institute and the National Weather Service in Alaska. Geophysical Institute, University of Alaska Fairbanks. 24 pp.

Monthly Publications (February – May)

Natural Resources Conservation Service. Alaska Basin Outlook Report. (Month, Year)

National Oceanic and Atmospheric Administration. Climatological Data. Alaska (Month, Year).

VII. QUALIFICATIONS

Pamela Sousanes has been working in Denali National Park and Preserve for 11 years as a Backcountry Ranger, Physical Science Technician, and most recently an Environmental Protection Specialist in Physical Sciences. Pamela has been working with the climate monitoring program for the Long-term Ecological Monitoring program in Denali for 5 years. This program

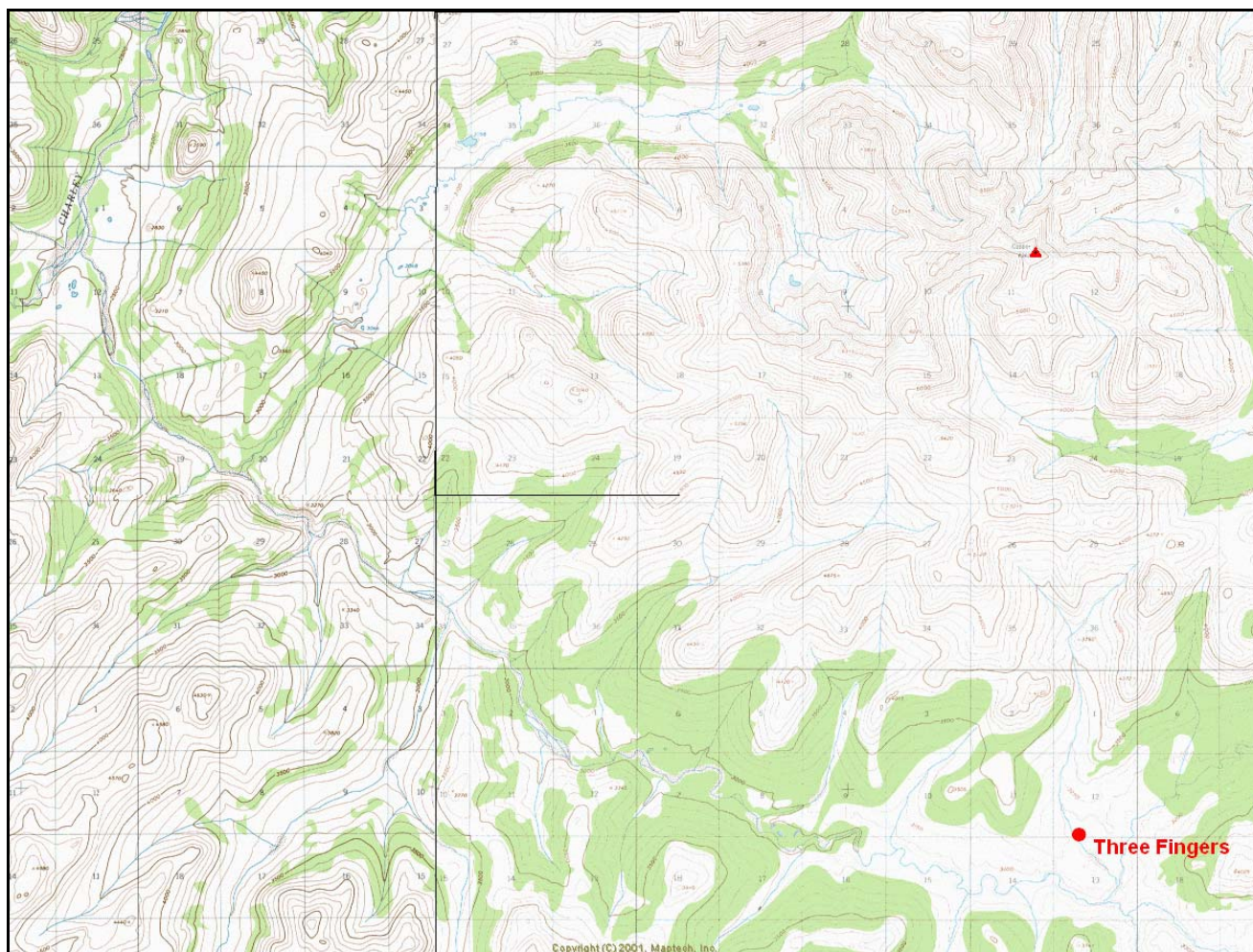
will continue indefinitely so the Principle Investigator for the project will most likely change over time.

VIII. SUPPORTING DOCUMENTATION AND SPECIAL CONCERNS

- A. **Safety** – Fixed-wing aircraft and a helicopter will be used to access the sites. All personnel will have updated required certification courses for aircraft use.
- B. **Access to study sites** – Access will be by fixed wing aircraft and helicopter. For the initial deployment of the climate stations two people will be on site for three days. Coal Creek camp is the preferred lodging choice for work in the area. Logistics and arrangements will be made with the park well in advance of the trip. Barring any major equipment failures, an annual maintenance trip will be made to each new site to swap out sensors for calibration, download data, and perform routine work. If a station fails during the year and a fixed wing flight is available additional day trips might occur. These might also coincide with snow surveys or other project work that is occurring in the area.
- C. **Use of mechanized and other equipment** – The climate stations described and pictured above will be on site. These sites will remain indefinitely. If, for any reason, the site needs to be removed there will be no evidence of site manipulation once the station is removed.
- D. **Chemical use** – Two 100 amp hour deep cycle sealed 12 volt battery will be used to power the station. The battery will be housed in a specialized cargo box and be protected from the weather and wildlife. The batteries will be swapped approximately every 4-5 years. The SNOTEL site will require the use of propylene glycol within the precipitation gage to melt the falling snow. The gage is contained and leakage should not be a problem. This site will also have 12 volt deep cycle sealed batteries on site.
- E. **Ground disturbance** – Ground disturbance would minimal. A small soil auger would be used to bore a hole 1m deep and a second one at .5m depth to insert the two soil temperature probes. Once in place the soil would be packed around the probe and any vegetative covering removed to start the hole would be replaced with little to no observable damage to the ground surface.
- F. **Animal welfare** - Not an issue unless they consume part of the station or get stuck in the guy wires supporting the station.
- G. **NPS assistance** – Accommodation for two people at Coal Creek Camp for 3 nights in August or early September. Use of the park pilot, if available, for flight from Fairbanks to Coal Creek. Use of park ATVs or snowmachines, if necessary, to access Coal Creek site.

Wilderness “minimum requirement” protocols – A helicopter is necessary to get all of the equipment to the Upland site for the installation. Due to the amount of equipment necessary to do annual maintenance annual helicopter trips will be necessary to maintain the station at this site. The footprint of the climate station requires no permanent foundation or footings. The footprint of the SNOTEL site is also minimal, but will require concrete anchors as footings for the precipitation gage and the shelter.

Appendix A: Map and photos of Three Fingers Site



Site: **Three Fingers**

Area: Yukon-Tanana Uplands Ecoregion

Coordinates: 64° 34' 32.47" N, 143° 14' 27.67" W (NAD27)

Elevation: 3180'

Description: Broad, open plain at headwaters of Charley River. Level, well-drained gravel with scattered dwarf birch on floodplain next to small creek. Bench above floodplain very tussocky with denser, higher dwarf birch. Site is ~5 km from existing aerial snow marker.

Access: Airstrip suitable for landing a 185



Appendix B: Coal Creek and Slaven Cabin



Site: **Coal Creek**

Area: Yukon-Tanana Uplands Ecoregion

Coordinates: 65° 18' 50.05" N, 143° 07' 56.38" W (NAD27)

Elevation: 870'

Description: Bottom of broad, open valley, ~4 km above confluence with Yukon River (170 feet higher than Yukon River). Occasional, protected openings in dense alder and willow thickets; rocky substrate (old gold dredge tailings)

Access: Adjacent to large, well-maintained airstrip near Coal Creek Camp.



Site: **Slaven Cabin**

Area: Yukon-Tanana Uplands Ecoregion

Coordinates: 65° 21' 02.56" N, 143° 07' 21.51" W

Elevation: 704'

Description: Near historic Slaven Cabin located adjacent to Yukon River just downstream of mouth of Coal Creek. Mixed forest with open tundra meadow to the south of cabin.

Access: ATV/Snowmachine accessible road from Coal Creek airstrip.



**Amendment to
Study Plan for
Central Alaska Network (CAKN)
Climate Monitoring
Yukon-Charley Rivers National Preserve
May 2004**

Submitted by:
Pamela Sousanes
Environmental Specialist
Denali National Park and Preserve
PO Box 9
Denali Park, AK 99755
Phone: (907)683-9573
Fax: (907) 683-9634
E-mail: pam_sousanes@nps.gov.

After discussions and meetings with the Integrated Compliance team which reviewed the original permit it was decided that further reconnaissance of sites within and outside the boundaries of the Preserve was necessary. On May 19, 2004 Pam Sousanes and Marsha Henderson visited the Preserve and evaluated a number of sites within the upland area of the preserve and those areas beyond the boundary to the south.

After reviewing comments submitted by many climate experts it was determined that locating a site with the Yukon-Tanana Uplands was the priority for this area. A number of Remote Automated Weather Stations (RAWS) currently exist in the lower elevations within the boreal forest including Ben Creek, Preacher Creek, Birch Creek, and Eagle. There are no sites that exist at higher elevations.

Site Selection

Kelly Redmond the Deputy Regional Climatologist for the Western Regional Climate Center offered the following relevant comments when presented with the entire suite of sites to consider for the Central Alaska Network.

Climate measurements must meet a higher standard than “weather” measurements. The most demanding of these is consistency through long periods of time. A time frame of 50-100 years should be envisioned, and a few decades at minimum. The process of choosing appropriate sites for long-term climate monitoring should take into account a variety of considerations: representativeness, accessibility, security, budgetary demands (personnel & maintenance), communications, stability of exposure characteristics, local hazards (flooding, avalanches, riming, etc). In some cases, successional processes may

be at work, and the site supervisor is confronted with choices: an open site may become a closed site as a forest regrows, or as the climate changes and new vegetative forms replace old, or as a burn or disease opens up closed vegetation.

No site will be without local influences of some sort: on wind, on precipitation, on temperature, on humidity, on solar radiation, or on any other climate element. The best and only recourse is to thoroughly document the site, and to re-document periodically as the site changes with time. It is impossible to over-document. The rule of thumb is to preserve whatever information will be needed to properly interpret the each of the separate element records a generation or two hence, when today's site supervisor is no longer accessible or even in existence.

Scientific justification for choosing a particular site over another.

This is an inherently difficult task especially when mountainous topography is introduced. When doing reconnaissance for the climate station site evaluation process in 2003 the following list of criteria was used, this comprises not only the scientific justification, but the social implications as well.

- Ecoregion representation
- Vegetation and soil type
- Known precipitation and temperature trends
- Gaps in knowledge
- Access to site
- Elevation
- Land management issues (Wilderness, Preserve)
- Use patterns (hiking, snowmachine, etc.)
- High density bear habitat, wildlife trails
- Exposure (solar and GOES capabilities)
- Wind scour

It is not a matter of finding the ultimate scientifically valid site – there are many. What is necessary is to find one that suits most criteria for our climate monitoring plan and also fits best with the views of park management. Again, it is hard to make a case for a single site that is scientifically superior to any other sites within the same ecoregion.

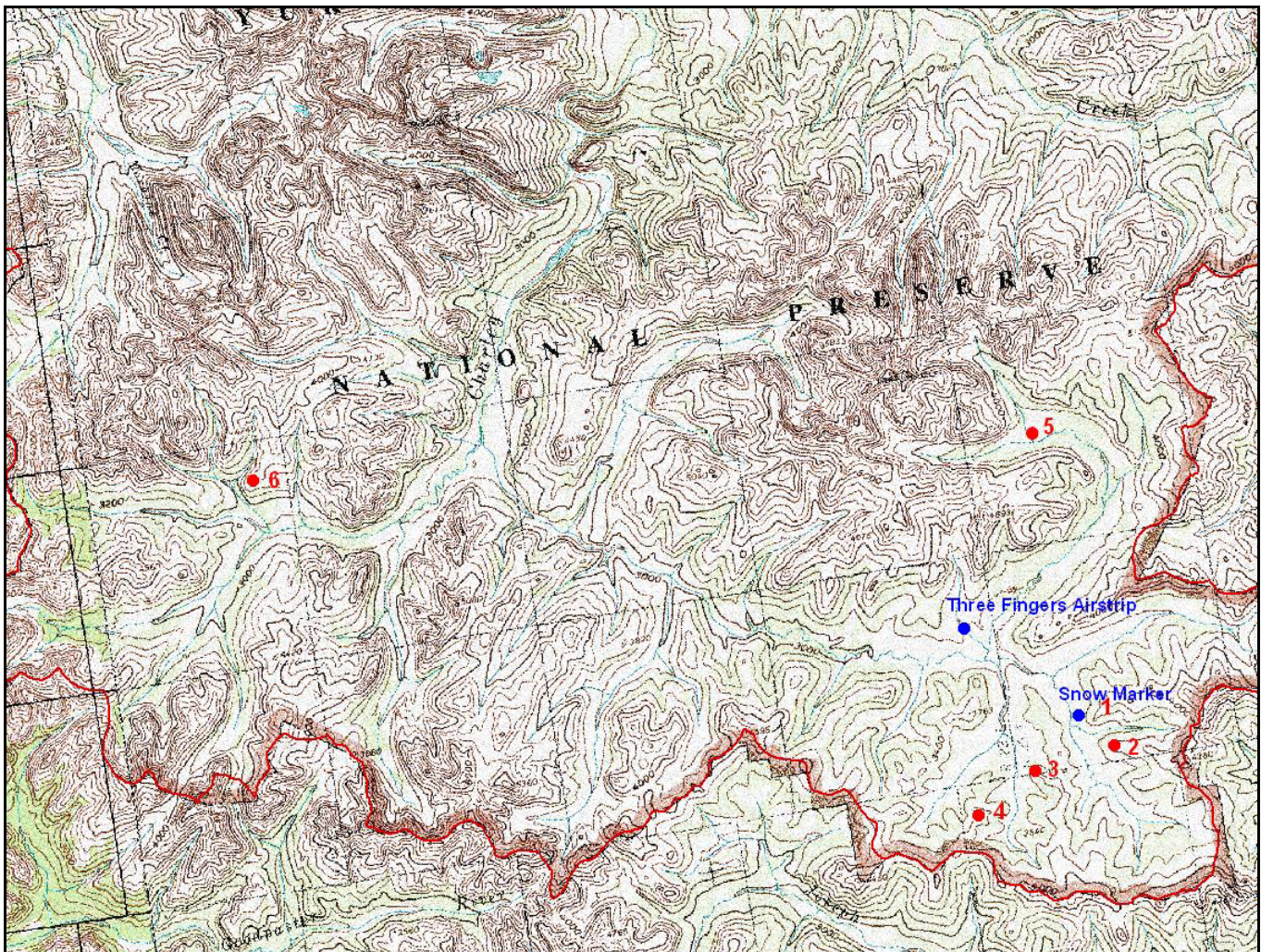
Process for second reconnaissance mission

- Review comments from review team
- Review comments from climatologists who provided valuable insight to our task
- Review maps of Yukon-Tanana upland Area
- Complete reconnaissance of upland area including areas to the southwest, southeast and south of the preserve boundary
- Photo document
- Fill out siting criteria form
- Prepare compiled evaluation

Site Selection May 2004

The following list of sites represents what was found to be the best choices for an alternative upland site to the originally proposed Three Fingers Airstrip site. Sites outside of the Preserve boundary were considered but not evaluated because we could not find a location that fit our criteria within a reasonable distance. The drainages were steeper and deeper, lacking the gentle undulating hills that offer broad expanses and a more representative view of climate. On the map it looked as if the area northeast of the Three Fingers Airstrip looked promising, but found that the site would be in a large bowl, almost a hole, with steeper mountains on all sides (Site #5). The Copper River area was evaluated, but the open areas that would make more suitable climate sites were at elevations that were 1000' below the areas we looked at the SE area of the Preserve and we are hoping to get sites in at higher elevations. The upper west fork of the Charley River offered another suitable location; however the mountains were in closer proximity to the potential site than any in the upper east fork of the Charley River, which might create more of a microclimate.

Map of sites

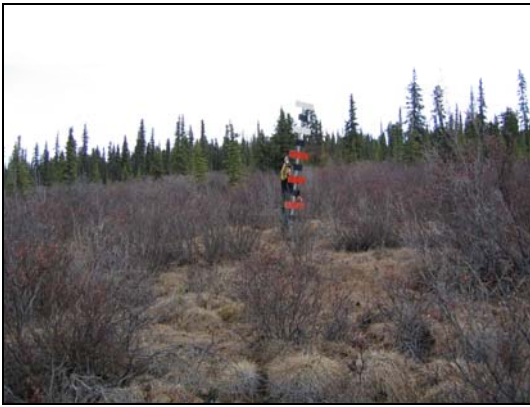


Site #1

Description: This site would be co-located with the existing aerial snow marker on a west sloping drainage of the upper east fork of the Charley River. Below band of spruce in a broad open area with dwarf birch about 3-4' in height. Ground surface is hummocky and uneven with standing water during the spring breakup period. 3.8 miles SE of Three Fingers Airstrip. Note: The ground surface is uneven and tussocky and would make anchoring a station difficult.

Coordinates: 64° 32' 08.8" N, 143° 09' 10.4" W (NAD 27). Elevation: 3082'

Photos for Site #1



Site #2

Description: Southeast upper Charley River drainage, southeast of aerial snow marker. Broad, level hilltop in rolling hills with good exposure in all directions. Covered in dwarf birch about 3' in height. Just above the highest spruce band. 5 miles SE of Airstrip
Coordinates: 64° 31' 20.3" N, 143° 07' 30.7" W (NAD 27). Elevation: 3570'

Photos of site #2



Site # 3

Description: Southeast upper Charley River drainage. Long bench just above treeline. Expansive and open in all directions. Scattered dwarf birch cover 1-2' in height. Located in drainage to the southeast of snow marker 4.2 miles SE of airstrip.

Coordinates: 64° 31' 02.0" N, 143° 11' 58.2" W (NAD 27). Elevation: 3590'

Photos Site # 3



Site #4

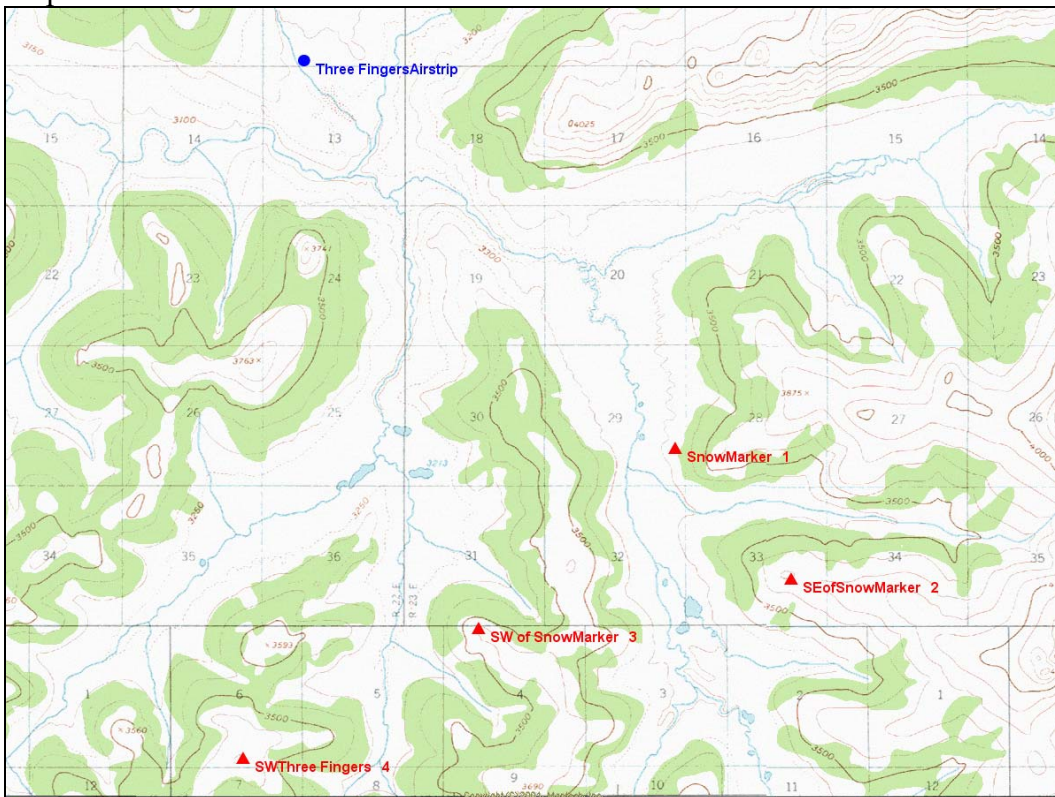
Description: Southeast upper Charley River drainage. Knoll above spruce in upper SW corner of the drainage. Open expanses on all sides, some higher ridges to the distant south. Dwarf birch cover 1-2' in height. 5 miles south of airstrip.

Coordinates: 64° 30' 14.05" N, 143° 15' 18.59" W. Elevation: 3610'

Photos of Site #4



Map of Sites #1-4



Site #5

Description:

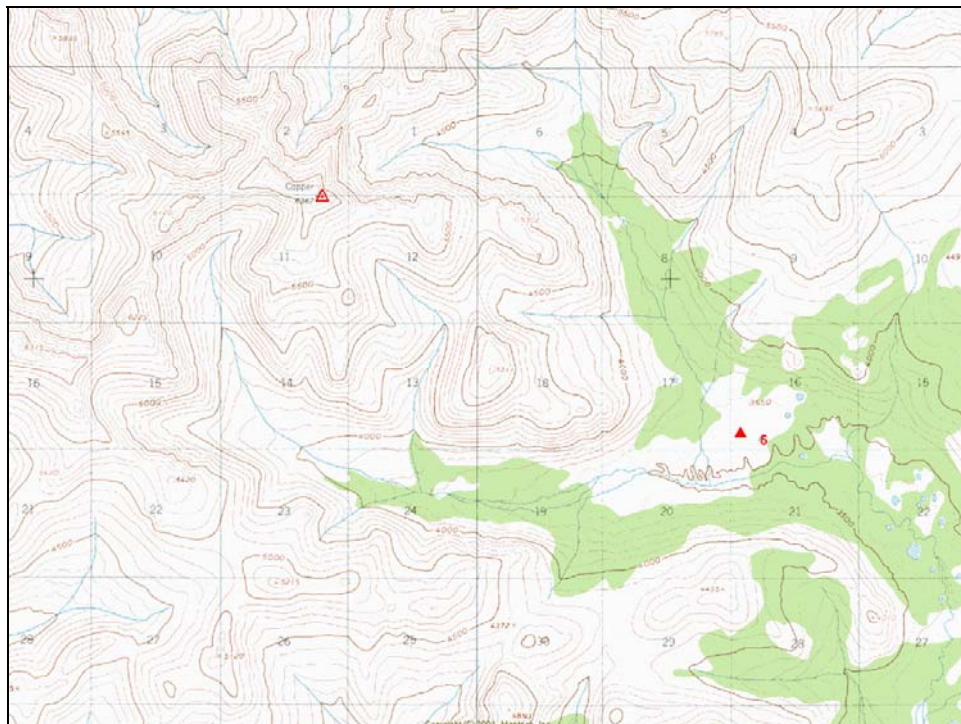
Upper reaches of the east fork of Charley River 5.8 miles NE of airstrip. At confluence of far northeast drainages. Open area surrounded on all sides by higher mountains. Scattered dwarf birch cover.

Coordinates: 64° 38' 57.0" N, 143° 08' 52.27" W (NAD 27). Elevation: 3530'

Photo of site #5



Map of site #5



Site # 6

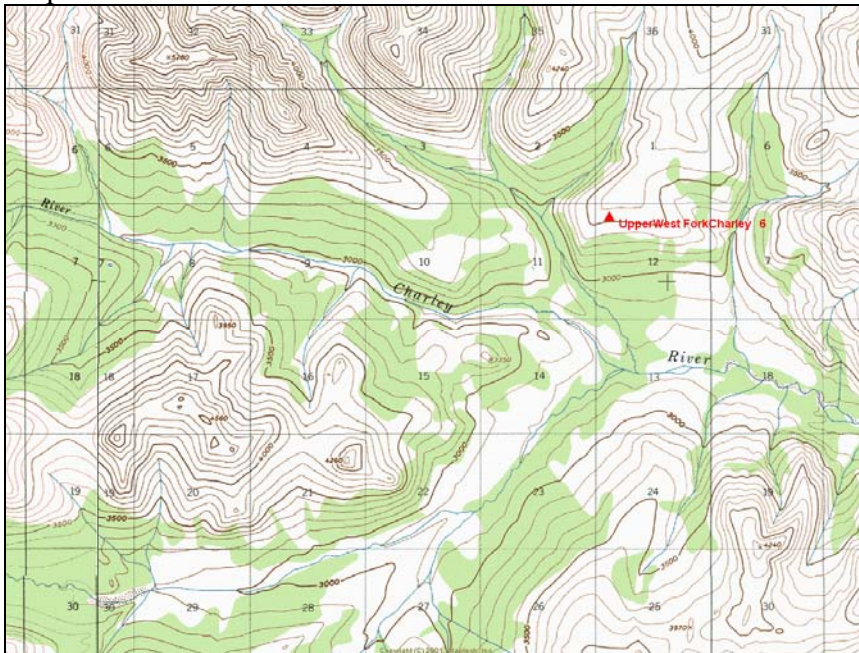
Description: Large rounded knob in middle of upper west fork Charley River drainage above confluence of three branches of the river. Good exposure on all sides. Scattered spruce and dwarf birch with open areas with only low ground vegetation. Higher mountains in all directions.

Coordinates: 64° 40' 29.2" N, 143° 51' 00.0" W (NAD 27). Elevation: 3530'

Photos of Site # 6



Map of Site #6



Preferable site: Site #3

After that #4, #6, #2, #1, #5

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 3

Initial Climate Equipment Procurement List

Version 1.0 (September 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP details the acquisition of a climate station, including a list of equipment, vendor, model numbers, descriptions, 2004 costs, and photos.

Table 1 lists the initial equipment procurement for a single climate station for the Central Alaska Network from Campbell Scientific, Inc. (<http://www.campbellsci.com/home.html>) and Table 2 lists the power system requirements and 2004 costs.

Table 1. CAKN Climate Station Equipment Procurement - Instrumentation

Description	Item #	2004 Pricing
10' tripod tower CM10w/grounding kit	CM10	345.00
CM10 guy Kit		90.00
CR-10X Datalogger	CR10X	1250.00
Extended Temperature testing for CR10X	XT CR10X	125.00
Datalogger Support Software	LoggerNet	395.00
GOES DCP Platform w/ SATHDR GOES transmitter, CH12R power regulator, battery cables, 16"x18" enclosure, 10 Watt solar panel, GPS antenna, GOES Antenna w/coax cable	DCP 100	3575.00
Keyboard/Display	XT-CR10K	280.00
Vaisala HMP45C temperature and Relative Humidity probe/w10' cable	HMP45C – L10	555.00
RM Young 12-plate Gill Radiation Shield for	41002	173.00

HMP45C		
RM Young 05103 Wind Monitor/w15' cable	05103-L15	885.00
Texas Electronics 8" Tipping Bucket Rain Gage w/25' cable	TE525WS-L25	370.00
Li-Cor Silicon Pyranometer w/11' cable	LI200X-L11	295.00
CSI Soil Temperature Probe (3) w/25' cable	107-L25	230.00
Aluminum Crossarm Sensor Mount	019ALU	75.00
LiCor base and Leveling Fixture for LI200X	LI2003S	58.00
CSC Ultrasonic Distance Sensor (Snow Depth) w/15' cable	SR50-L15	945.00
	Sub-Total	9646.00

Table 2. CAKN Climate Station Equipment Procurement – Power System

PVX 1040T Concorde Battery (2)	320.00
MSX-64 Watt Solar Panel	256.00
Battery Box	215.00
Sub-Total	791.00
Total for Climate Station	\$10,437.00*

*This cost does not reflect miscellaneous mounting hardware and tools required for installation.

The tripod stations are shown below in a typical station (Figure 1) and one that is modified for the CAKN Climate Monitoring Program (Figure 2.)

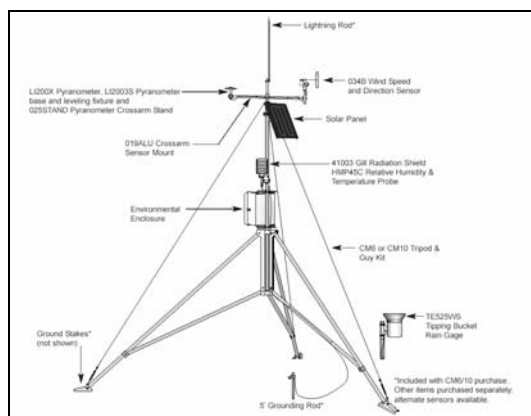


Figure 1 Climate Station diagram from Campbell Scientific, Inc.



Figure 2 CAKN Climate Station - Design Phase

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 4

Climate Station Specifications/Sensor Matrix

Version 1.0 (September 2004)

This SOP outlines the specifications of the sensors and equipment used on a CAKN climate station. These specifications are for the Campbell Scientific, Inc. instrumentation. It also provides the guidelines for sampling frequency, measurement and processing intervals, and sensor placement above ground level.

Datalogger

Model CR10X

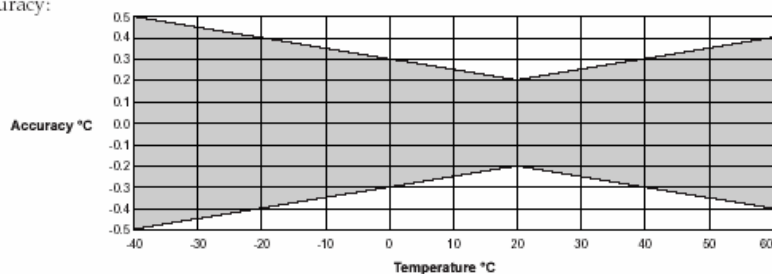
Extended temperature Range: -55° to $+85^{\circ}$ C
2 Mbytes additional memory
Program execution rate: Up to 64 Hz
Number of Channels: 6 differential inputs, 2 pulse counters, 3 excitation, and 8 control ports
Power requirements: 9.6 – 16 volts
Current drain: 1 mA quiescent, 13 mA processing, 46 mA analog measurement
Data Storage: 62,000 data points

Air Temperature and Relative Humidity

Model HMP45C

Sensors: Temperature 1000 Ω PRT
Relative humidity - HUMICAP® H-Chip
Relative Humidity range: 0.8 to 100% RH, non-condensing
Relative Humidity accuracy: $\pm 2\%$ RH (0-90%)
 $\pm 3\%$ RH (90-100%)
Temperature Range: -39.2° to $+60^{\circ}$ C
Temperature Accuracy:

Accuracy:



Soil temperatures

Model 107B soil temperature probe

Sensor: Thermistor

Range: -35° to 50°C

Accuracy: typically $\pm 0.2^{\circ}\text{C}$

Solar Radiation

Model LI2100X silicon pyranometer

Sensor: Silicon photocell

Sensitivity: 0.2 kW m⁻² mV⁻¹

Requirements: LI2003S base and leveling fixture

Wind Speed and Direction

Model 5103 Wind Monitor

Sensors: Propeller vane

Temperature range: -50° to +50°C

Wind Speed Range: 0 to 134 mph, gust survival 220 mph

Wind Speed threshold: 2.2 mph

Wind Speed distant constant: (63% recovery): 8.9 ft.

Wind direction delay distance (50% recovery): 4.3 ft

Vane range: 360° mechanical, 355° electrical

Vane threshold: 2.0 mph @ 10° displacement, 2.9 mph @ 5° displacement

Precipitation

Model TE525WS Tipping Bucket Rain Gauge

Sensor: magnetic switch

Orifice: 8" diameter

Sensitivity: 0.01"/tip

Snow Depth

Model SR50 ultrasonic distance sensor

Power requirements: 9 to 16 VDC

Power consumption: 2mA (quiescent), 250mA (measurement peak)

Measurement range: 0.5 to 1.0

Accuracy: ± 1 cm or 0.4% of distance to target w/external temperature compensation

resolution: 0.1mm

Beam acceptance angle: approximately 22°

Communication

SAT HDR GOES transmitter

On-Board memory: Non-volatile flash for setup parameters. 16Kbytes for self-timed data

Power requirements: 9.6 to 16 VDC, 1 mA quiescent, 350 mA during GPS fix and less than 4 Amps during transmission.

Transmit power: 7.9 watts for 100 and 300 bps, 15.9 watts for 1200 bps

Temperature Rating: -40° to 50°C

Table 1 represents the type of sensor used, the location of the sensor in relation to the ground surface, the sampling frequency, measurement processing and recording intervals.

Table 1. Sensor Matrix, Intervals, and Standard Placements

Parameter	Instrument	Sampling Frequency	Measurement processes and Recording Interval	Remarks
Air Temperature (°C) Relative Humidity (%)	<i>Vaisala HMP35C/HMP45C</i> Temperature/RH Probe	Every 60 seconds	Average, Minima, and Maxima stored hourly °C	Sensor housed inside 12-plate gill radiation shield 2 m above ground level
Wind Speed (m/s) Wind Direction (°)	<i>RM Young Wind Monitor</i> 05103	Every 60 seconds	Mean horizontal WS in, unit vector mean WD, max WS, max WS direction stored hourly	3 m above ground level or 10 m above ground for existing tower stations
Solar Radiation (W/m ²)	<i>Li-Cor LI-200S</i> Pyranometer Sensor	Every 60 seconds	Averages stored hourly	3 m above ground level
Precipitation (mm)	<i>Texas Electronics 525WS</i> Tipping Bucket	Every 60 seconds	Hourly totals stored hourly	Collected when temps are mostly >0°C
Soil Temperature (°C)	Temperature Probe 107	Every 60 seconds	Averages stored hourly	0 (surface), 50 and 100 cm below ground level
Snow Depth (m)	CSC Ultrasonic Distance Sensor	Every 60 seconds	Average stored hourly	Above max snow depth
Battery Voltage	12 V - 100 Amp Hour External Battery	Every 60 seconds	Minimum recorded hourly	Housed in insulated battery box

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 5

Datalogger Software Instructions

Version 1.0 (October 2004)

Revision History Log:

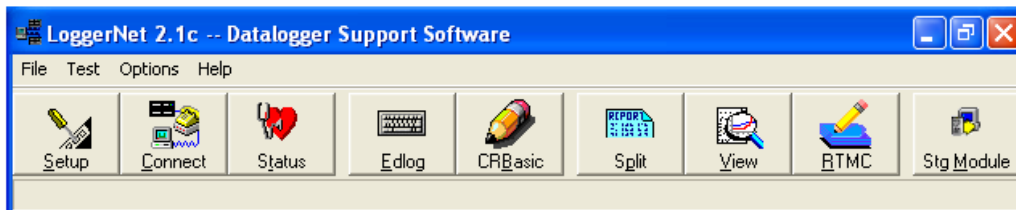
Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP outlines a brief overview of the datalogger programming software needed to program a CR10X datalogger. The software that supports the Campbell Scientific, Inc. (CSI) CR10X datalogger is called Loggernet. Loggernet supports programming, communications, and data retrieval between the CR10X and a PC. It is possible to connect this software directly to a running datalogger, but due to the remote nature of the stations in the CAKN network this is not possible, therefore the software is used primarily for programming.

The programming can be done in the office or in the field. It is recommended that the programming done in the office, and only done in the field if necessary. The software should be loaded onto all PCs and portable laptop computers that may be used for programming climate stations. It is imperative that the CSI website is checked before any field work for any updates to the current software version. The LoggerNet Instruction Manual is included in any purchase of Loggernet software.

The following instructions outline the basic steps in configuring the datalogger, sending programs to the datalogger, and viewing data collected from the datalogger. There are a number of other tools within the software that will not be described in this SOP, but are available in the manual or online at <http://www.campbellsci.com/software.html>.

Once LoggerNet is loaded onto a PC or laptop the toolbar below is used to navigate through the various functions.

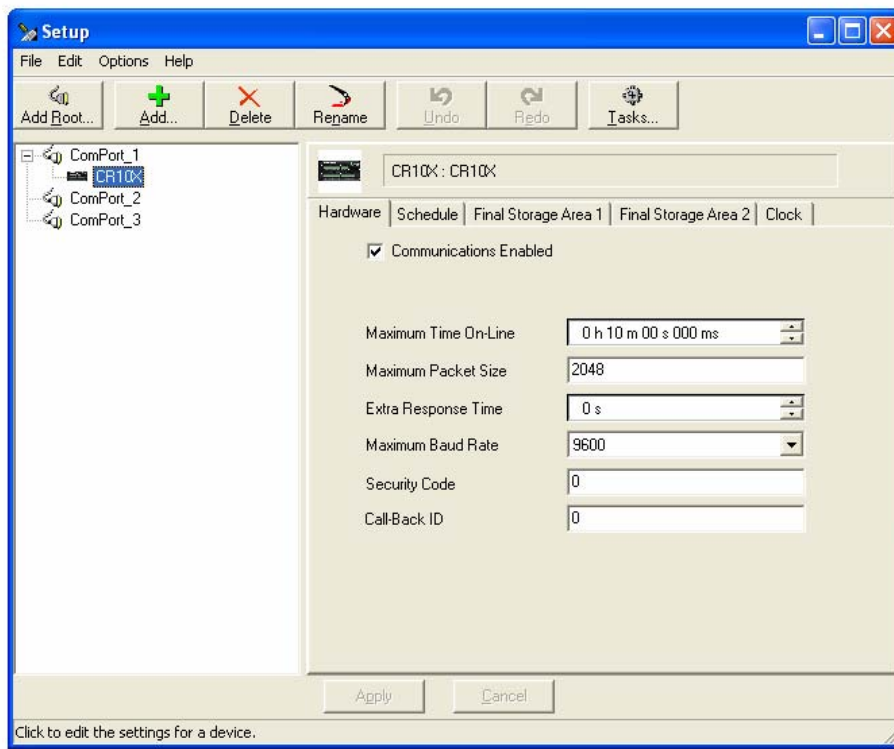


LoggerNet Overview

- **Setup:** Describes the configuration of COM ports, modems, dataloggers, and other devices; sets up the data collection protocols and schedules.
- **Connect:** Connects to each automated weather station configured in the “setup” option; synchronizes datalogger clock with the computer’s clock; collects data and downloads .DLD files to dataloggers from a PC; views collected data and graphs real-time measurements.
- **Status:** Checks the communication and data collection status of all stations in the network; shows station names, whether or not a specific station is on line, error rates, time and date when the last data collection was attempted, how much data was collected, and the next call schedule.
- **Edlog:** Creates and edits datalogger programs for the CR10X.
- **CR Basic:** Creates and edits programs for the CR5000 and CR9000 dataloggers.
- **Split:** Used to separate mixed array data files into individual files based on the array ID. Split can also be used to create files in custom reports.
- **View:** Used to look at data files. The data is displayed in either comma separated or tabular format by record or array.
- **RTMC:** Real-Time Monitor and Control creates and displays real-time graphic display screens using the data collected from the dataloggers by LoggerNet.
- **Stg Module:** Retrieves files from storage modules via either a CR10X and PC Cards or the CSMI/MCRI interface or directly from a PCMCIA slot in the computer with separate tab settings for the categories “setup”, “programs”, “data”, and “erase”.

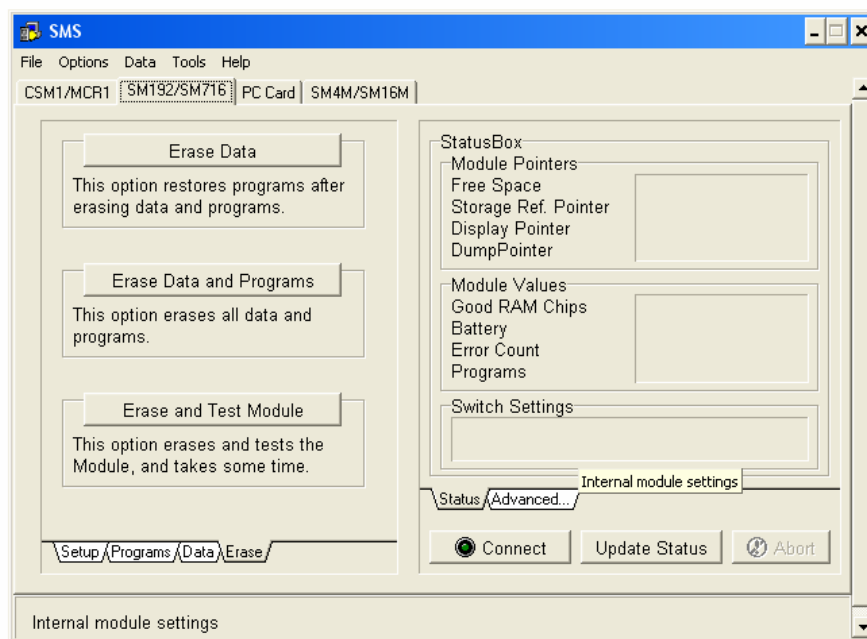
Details on application for the CAKN Climate Monitoring Program:

1. **Setup:** The Setup button is used to define the communications paths between the computer and the dataloggers. It serves other functions, but this is the one necessary for programming. To connect the datalogger to the PC you need to address the nine pin communication port (Com Port) that will be used. The default is Com Port1. Add the datalogger to the setup screen by clicking the Add button, this allows you to choose CR10X from a list of possible datalogger choices. At this point you can choose to name the station, however the sample uses the default name of “CR10X”. The datalogger name then appears under the Com Port 1 tab as shown in the screen below. Hit the Apply button to save the edits. In the near future comm. Ports might be obsolete. The use of USB connections is becoming the standard. The USB connection can be made by adding the datalogger to Com Port XX.



2. **Connect:** The Connect button is used to connect the computer to the data logger for the main purpose of transferring a program file and viewing the data. This button can also be used to transfer the data from the datalogger to the computer if a laptop is taken into the field on a site visit. Choose the station name (default on the sample screen is CR10X) and then click on connect. To collect data from a station click on Collect Now under the Data Collection tab and it will retrieve all of the data from the datalogger and store it under the name of the connection. Use the standard name for the station so that the data files are easily found. To send a program to the datalogger, click on Send under the Program box and it will allow you to browse through your files. Select the program you want to send and click send again. It will send the file and compile the program. A warning message will appear before you send the program alerting you that all data will be lost if you send a new program. because of this make it a standard practice to collect all the data from the datalogger before sending any new programs.

3. **Stg Module:** The Stg Module button is used for the stations in Denali National Park that were installed in the early 1990s as part of the Long-term Ecological Monitoring (LTEM) Program. These stations do not have satellite telemetry and the datalogger memory is small, so all data is stored on an external storage module that is manually swapped out at monthly intervals. This button connects the storage module to the computer so the data can be transferred from the module to the computer. The storage module is then erased and used again on the next trip. The storage module is also used to transfer programs to the data logger in the field. There are tabs at the bottom of the page that navigate through the various functions available under this button.



The **Edlog** button is the main button used for programming. This will be described in a separate SOP called “Programming”.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 6

Programming the Datalogger with Edlog

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the steps taken to create a climate station program using Edlog the programming software included in the LoggerNet software package from Campbell Scientific, Inc. Standard Operating Procedure #5 describes the basics of LoggerNet, this SOP details the programming aspect of Edlog. All CR10x dataloggers come with the manual titled ***CR10x Measurement and Control System Operator's Manual*** that describes in detail the functions of the datalogger.

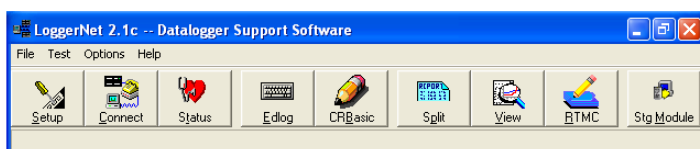
The CAKN dataloggers are programmed to measure the suite of sensors every 60 seconds, store the values, and output the hourly calculation to the satellite transmitter at 5 minutes after the hour every hour. In order for the data stream to be processed by the National Interagency Fire Center in Boise, ID the output has to follow the RAWS-7 data format outlined in the *SAT HDR GOES Transmitter Instruction Manual*.

RAWS-7 refers to the standard file format that is processed by fire weather managers, the RAWS-7 measurements are; precipitation, wind speed, wind direction, air temperature, fuel temperature, relative humidity, and battery voltage. Data values beyond the RAWS-7 are transmitted individually to the satellite transmitter after the first seven are sent as a package. The file format specifies the number of decimal places for each measurement.

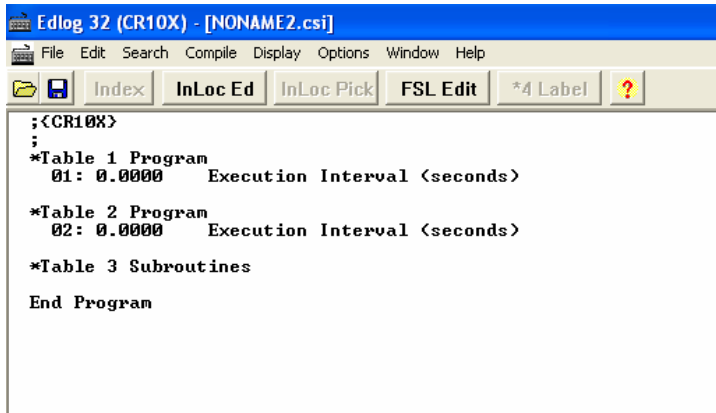
The CAKN stations also transmit peak wind direction, peak wind speed, solar radiation, snow depth, minimum air temperature, maximum air temperature, soil temperature at 50 cm, and soil temperature at 100 cm.

Procedure:

1. To start programming the CR10X open LoggerNet and click on the Edlog button



- The software will open the last program you were working with, to create a new program click on File|New. At this point you will be prompted to enter the type of datalogger you will be using. The screen below shows a new file. The file name for the current program for the climate stations is CAKN_1. The nomenclature for future programming versions should include a date but the file name cannot exceed 8 characters, an example would be V1_12004 where V1_1 is Version 1.1 created in 2004, subsequent versions would increment to the next number, i.e. V1_22005.
- The first step is to set the execution interval or how often you want the datalogger to run through the program. The CAKN climate station standard is 60 seconds.



```

;{CR10X}
;
*Table 1 Program
01: 0.0000 Execution Interval <seconds>

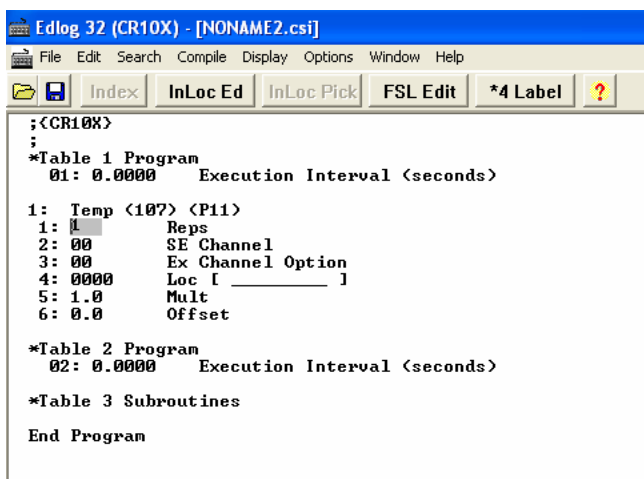
*Table 2 Program
02: 0.0000 Execution Interval <seconds>

*Table 3 Subroutines

End Program

```

- The next step is to start programming. Instructions can be inserted after the execution interval line in the Table 1 Program. Instructions that cue the datalogger to take a measurement are listed in the CR10X manual and are also detailed in the individual Instruction manuals that come with the sensors.
- Use the Shift +Insert key to pull up a menu of instructions or type in the number of the instruction after consulting either of the manuals. Each instruction will require a number of inputs including repetitions, signal inputs, excitation channels, location of output, multipliers, and offsets. All of this information is available in the manuals. The screen below shows an example of the instruction used to measure the soil temperature 107 probe.



```

;{CR10X}
;
*Table 1 Program
01: 0.0000 Execution Interval <seconds>

1: Temp <107> <P11>
1: 1 Reps
2: 00 SE Channel
3: 00 Ex Channel Option
4: 0000 Loc [ ]
5: 1.0 Mult
6: 0.0 Offset

*Table 2 Program
02: 0.0000 Execution Interval <seconds>

*Table 3 Subroutines

End Program

```

6. If you add a sensor to the climate station it will require an instruction within the program to measure and record in order for it to be recorded. Some of the sensors require more than one instruction to complete the measurements, for example the HMP45C measures both air temperature and relative humidity and requires a total of five instructions to complete the measurements. The following screens show the measurement instructions for the CAKN_1 program.

```
Edlog 32 (CR10X) - [C:\CAMPBELL\SCI\PROGRAMS\1\PROGRAMS\CAKN_1.CSI]
File Edit Search Compile Display Options Window Help
Index InLoc Ed InLoc Pick FSL Edit *4 Label ?

;{CR10X}

; RAWS CR10X program for Central Alaska Network Climate Stations
;for DENA, WRST and YUCH
;Program measures Batt. Volt., AT, RH, Precip, WS, WD, Solar Rad,
;| Surface temp, Soil temp at 50cm and 100cm
;and snow depth every 60 seconds.
; 2004

;Set program interval to measure sensors every 60 seconds

*Table 1 Program
01: 60 Execution Interval (seconds)

;Measure battery voltage
1: Batt Voltage (P10)
1: 1 -- Loc [ BattVolt ]

; Measure temp (deg C) and RH (%) (HMP45C)
2: Do (P86)
1: 41 Set Port 1 High

3: Excitation with Delay (P22)
1: 1 Ex Channel
2: 0 Delay W/Ex (0.01 sec units)
3: 15 Delay After Ex (0.01 sec units)
4: 0 mV Excitation

4: Volt (SE) (P1)
1: 1 Reps
2: 5 2500 mV Slow Range
3: 1 SE Channel
4: 2 Loc [ AirTemp ]
5: 0.1 Mult
6: -40 Offset

5: Volt (SE) (P1)
1: 1 Reps
2: 5 2500 mV Slow Range
3: 2 SE Channel
4: 3 Loc [ RelHum ]
5: 0.1 Mult
6: 0.0 Offset

6: Do (P86)
1: 51 Set Port 1 Low

; Measure Wind Speed (m/s) and Direction (RM Young 05103)
7: Pulse (P3)
1: 1 Reps
2: 1 Pulse Input Channel
3: 21 Low Level AC, Output Hz
4: 4 Loc [ WindSpeed ]
5: 0.0980 Mult
6: 0.0 Offset

8: Excite-Delay (SE) (P4)
1: 1 Reps
2: 5 2500 mV Slow Range
3: 3 SE Channel
4: 2 Excite all reps w/Exchan 2
5: 2 Delay (units 0.01 sec)
6: 2500 mV Excitation
7: 5 Loc [ WindDir ]
8: 0.142 Mult
```

```

;Measure precipitation <mm>
9: Pulse <P3>
1: 1      Repr
2: 2      Pulse Channel 2
3: 2      Switch Closure, All Counts
4: 6      Loc [ Precip_mm ]
5: 0.254  Mult
6: 0      Offset

; Measure Solar Radiation <W/m2> <LI200X>
10: Volt <Diff> <P2>
1: 1      Repr
2: 22     7.5 mV 60 Hz Rejection Range
3: 3      DIFF Channel
4: 7      Loc [ SolarRad ]
5: 200    Mult
6: 0      Offset

;Measure soil temps at surface and depth of 50cm and 100cm
11: Temp <107> <P11>
1: 3      Repr
2: 7      SE Channel
3: 3      Excite all reprs w/E3
4: 8      Loc [ SoilSurfa ]
5: 1.0    Mult
6: 0.0    Offset

; Measure/Calculate Snow Depth <m>
12: If time is <P92>
1: 0      Minutes <Seconds --> into a
2: 60     Interval <same units as above>
3: 30     Then Do

13: SDI-12 Recorder <P105>
1: 0      SDI-12 Address
2: 1      Start Measurement <aM1!>
3: 2      Port
4: 11     Loc [ SnowDepth ]
5: -1.0   Mult
6: 0.0    Offset

14: Z=X+F <P34>
1: 2      X Loc [ AirTemp ]
2: 273.15 F
3: 12     Z Loc [ TempK ]

15: Z=F x 10^n <P30>
1: 273.15 F
2: 0      n, Exponent of 10
3: 13     Z Loc [ RefTemp ]

16: Z=X/Y <P38>
1: 12     X Loc [ TempK ]
2: 13     Y Loc [ RefTemp ]
3: 14     Z Loc [ SnowMult ]

17: Z=SQRT(X) <P39>
1: 14     X Loc [ SnowMult ]
2: 14     Z Loc [ SnowMult ]

```

```

18:  Z=X*Y (P36)
1: 11      X Loc [ SnowDepth ]
2: 14      Y Loc [ SnowMult ]
3: 11      Z Loc [ SnowDepth ]

; Height of sensor above bare-ground level

19:  Z=X+F (P34)
1: 11      X Loc [ SnowDepth ]
2: 1.95    F
3: 11      Z Loc [ SnowDepth ]

; Set snow depth values less than 1cm to zero

20:  If (X<=>F) (P89)
1: 11      X Loc [ SnowDepth ]
2: 4       <
3: 0.01    F
4: 30      Then Do

21:  Z=F x 10^n (P30)
1: 0       F
2: 0       n, Exponent of 10
3: 11      Z Loc [ SnowDepth ]

22:  End (P95)

23:  End (P95)

```

7. The next step involves some preliminary processing and calculations. It is common to eliminate negative solar radiation values and relative humidity values above 100%. This can be accomplished by using processing instructions. It is also necessary to store values of measurements beyond the RAWS-7 data points such as peak wind speed and direction at peak and minimum and maximum air temperatures in an intermediate storage location, the following screens show the calculations and processing for this next step.

```

;*****
; Calculations/processing sent to input locations

; Set negative solar radiation values to zero

24:  If (X<=>F) (P89)
1: 7      X Loc [ SolarRad ]
2: 4       <
3: 0       F
4: 30      Then Do

25:  Z=F (P30)
1: 0       F
2: 0       Exponent of 10
3: 7       Z Loc [ SolarRad ]

26:  End (P95)

; Eliminate RH values greater than 100

27:  If (X<=>F) (P89)
1: 3      X Loc [ RelHum ]
2: 3       >=
3: 100    F
4: 30      Then Do

28:  Z=F (P30)
1: 100    F
2: 0       Exponent of 10
3: 3      Z Loc [ RelHum ]

29:  End (P95)

```

```

30: If time is <P92>
1: 0      Minutes <Seconds --> into a
2: 60      Interval <same units as above>
3: 10      Set Output Flag High <Flag 0>

31: Set Active Storage Area <P80>
1: 3      Input Storage Area
2: 42     Loc [ MaxWindSp ]

32: Maximum <P73>
1: 1      Reps
2: 00     Time Option
3: 4      Loc [ WindSpeed ]

33: Sample on Max or Min <P79>
1: 1      Reps
2: 5      Loc [ WindDir ]

34: Minimum <P74>
1: 1      Reps
2: 00     Time Option
3: 2      Loc [ AirTemp ]

35: Maximum <P73>
1: 1      Reps
2: 00     Time Option
3: 2      Loc [ AirTemp ]

36: Time <P18>
1: 3      Store Year,Day,Hr,Min,Sec in 5 consecutive locations
2: 0      Mod/By
3: 46     Loc [ Year ]

```

8. Sending the hourly values to the transmitter is the next step. The CAKN climate stations are set up to calculate hourly averages for air temperature, relative humidity, wind speed, mean vector wind direction, solar radiation, soil temperatures, and snow depth. This program also records hourly precipitation totals and the maximum and minimum air temperatures and peak wind speeds and direction. See the following screens for the programming involved in the data transmission process. This section of the programming is bulky because each measurement needs to be sent individually to the transmitter.

```

;*****
;Write hourly RAWS-7 data to final storage area 1
;and then send to transmitter
;Order is important, First in-First out.
;Precip <Hourly total>
;Wind Speed
;Wind Direction
;Air temperature <Hourly average>
;Fuel temperature <Hourly average>
;Relative Humidity <Hourly average>
;Battery Voltage <Hourly minimum>
;After RAWS-7 is sent to transmitter append other measurements
;Deg dir max gust, w/s max gust, Solar Rad, snow depth
;Min Air temp, Max Air Temp.
;Temp 50 cm, temp 100cm

37: If time is <P92>
1: 0      Minutes <Seconds --> into a
2: 60      Interval <same units as above>
3: 10      Set Output Flag High <Flag 0>

```

```

38: Set Active Storage Area <P80>
1: 1      Final Storage Area 1
2: 1      Array ID

|
39: Totalize <P72>
1: 1      Repts
2: 6      Loc [ Precip_mm ]

40: Wind Vector <P69>
1: 1      Repts
2: 60     Samples per Sub-Interval
3: 01     S, 01 Polar
4: 4      Wind Speed/East Loc [ WindSpeed ]
5: 5      Wind Direction/North Loc [ WindDir ]

41: Average <P71>
1: 1      Repts
2: 2      Loc [ AirTemp ]

42: Average <P71>
1: 1      Repts
2: 8      Loc [ SoilSurfa ]

43: Average <P71>
1: 1      Repts
2: 3      Loc [ RelHum ]

44: Minimum <P74>
1: 1      Repts
2: 0      Value Only
3: 1      Loc [ BattVolt ]

;send only the RAWS-7 data to the transmitter using the ASCII RAWS -7 Format

45: If time is <P92>
1: 5      Minutes <Seconds --> into a
2: 60     Interval <same units as above>
3: 30     Then Do

46: Data Transfer to HDR GOES <P126>
1: 0      Append to Self-Timed Buffer
2: 3      ASCII RAWS-7 Format
3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

47: If <X(<=>F)> <P89>
1: 15     X Loc [ P126_RC ]
2: 3      >=
3: 1      F
4: 30     Then Do

      48: If <X(<=>F)> <P89>
1: 15     X Loc [ P126_RC ]
2: 4      <
3: 7      F
4: 30     Then Do

;Try P126 again

      49: Data Transfer to HDR GOES <P126>
1: 0      Append to Self-Timed Buffer
2: 3      ASCII RAWS-7 Format
3: 15     Result Code Loc [ P126_RC ]

50: End <P95>

51: End <P95>

```

```

;Send additional measurements including Max wind gust direction, max wind speed
;solar radiation, snow depth, min temp, max temp, soil temp 50, soil temp 100

;send max wind gust direction to GOES use XXX format for NIFC

52: Do <P86>
1: 10      Set Output Flag High <Flag 0>

53: Sample <P70>
1: 1      Reps
2: 43     Loc [ DirPeakWS ]

54: Data Transfer to HDR GOES <P126>
1: 0      Append to Self-Timed Buffer
2: 7      ASCII xxx Format
3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

55: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 3      >=
3: 1      F
4: 30     Then Do

56: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 4      <
3: 7      F
4: 30     Then Do

;Try P126 again

57: Data Transfer to HDR GOES <P126>
1: 0      Self-Timed/Append
2: 7      ASCII xxx Format
3: 15     Result Code Loc [ P126_RC ]

58: End <P95>

59: End <P95>

;Send peak wind speed to transmitter

60: Do <P86>
1: 10     Set Output Flag High <Flag 0>

61: Sample <P70>
1: 1      Reps
2: 42     Loc [ MaxWindSp ]

62: Data Transfer to HDR GOES <P126>
1: 0      Append to Self-Timed Buffer
2: 7      ASCII xxx Format
3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

63: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 3      >=
3: 1      F
4: 30     Then Do

64: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 4      <
3: 7      F
4: 30     Then Do

;Try P126 again

65: Data Transfer to HDR GOES <P126>
1: 0      Self-Timed/Append
2: 7      ASCII xxx Format
3: 15     Result Code Loc [ P126_RC ]

66: End <P95>

67: End <P95>

```

```

;Send average solar radiation to transmitter

68: Do <P86>
1: 10      Set Output Flag High <Flag 0>

69: Average <P71>
1: 1      Reps
2: 7      Loc [ SolarRad ]

70: Data Transfer to HDR GOES <P126>
1: 0      Append to Self-Timed Buffer
2: 8      ASCII xxxxx Format
3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

71: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 3      >=
3: 1      F
4: 30     Then Do

72: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 4      <
3: 8      F
4: 30     Then Do

;Try P126 again

73: Data Transfer to HDR GOES <P126>
1: 0      Self-Timed/Append
2: 8      ASCII xxxxx Format
3: 15     Result Code Loc [ P126_RC ]

74: End <P95>

75: End <P95>

;Send snow depth to transmitter

76: Do <P86>
1: 10      Set Output Flag High <Flag 0>

77: Average <P71>
1: 1      Reps
2: 11     Loc [ SnowDepth ]

78: Data Transfer to HDR GOES <P126>
1: 0      Append to Self-Timed Buffer
2: 4      ASCII xxx.x Format
3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

79: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 3      >=
3: 1      F
4: 30     Then Do

80: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 4      <
3: 7      F
4: 30     Then Do

```

```

;Try P126 again

      81: Data Transfer to HDR GOES <P126>
        1: 0      Self-Timed/Append
        2: 4      ASCII xxx.x Format
        3: 15     Result Code Loc [ P126_RC ]

      82: End <P95>

83: End <P95>

;Send min AT to transmitter

84: Do <P86>
    1: 10      Set Output Flag High <Flag 0>

85: Sample <P70>
    1: 1      Reps
    2: 44     Loc [ MinAT ]

86: Data Transfer to HDR GOES <P126>
    1: 0      Append to Self-Timed Buffer
    2: 7      ASCII xxx Format
    3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

    87: If <X<=>F> <P89>
        1: 15     % Loc [ P126_RC ]
        2: 3      >=
        3: 1      F
        4: 30     Then Do

            88: If <X<=>F> <P89>
                1: 15     % Loc [ P126_RC ]
                2: 4      <
                3: 7      F
                4: 30     Then Do

;Try P126 again

      89: Data Transfer to HDR GOES <P126>
        1: 0      Self-Timed/Append
        2: 7      ASCII xxx Format
        3: 15     Result Code Loc [ P126_RC ]

      90: End <P95>

    91: End <P95>

;Send max AT to transmitter

    92: Do <P86>
        1: 10      Set Output Flag High <Flag 0>

    93: Sample <P70>
        1: 1      Reps
        2: 45     Loc [ MaxAT ]

    94: Data Transfer to HDR GOES <P126>
        1: 0      Append to Self-Timed Buffer
        2: 7      ASCII xxx Format
        3: 15     Result Code Loc [ P126_RC ]

```

;Check result code for P126; if between 1 and 6, P126 will be executed again

```
95: If <X<=>F> <P89>
1: 15      X Loc [ P126_RC ]
2: 3       >=
3: 1       F
4: 30      Then Do

96: If <X<=>F> <P89>
1: 15      X Loc [ P126_RC ]
2: 4       <
3: 7       F
4: 30      Then Do
```

;Try P126 again

```
97: Data Transfer to HDR GOES <P126>
1: 0       Self-Timed/Append
2: 7       ASCII xxx Format
3: 15      Result Code Loc [ P126_RC ]
```

98: End <P95>

99: End <P95>

;Send soil temp at 50 cm to transmitter

```
100: Do <P86>
1: 10      Set Output Flag High <Flag 0>
```

```
101: Average <P71>
1: 1       Reps
2: 9       Loc [ Soil50cm ]
```

```
102: Data Transfer to HDR GOES <P126>
1: 0       Append to Self-Timed Buffer
2: 7       ASCII xxx Format
3: 15      Result Code Loc [ P126_RC ]
```

;Check result code for P126; if between 1 and 6, P126 will be executed again

```
103: If <X<=>F> <P89>
1: 15      X Loc [ P126_RC ]
2: 3       >=
3: 1       F
4: 30      Then Do

104: If <X<=>F> <P89>
1: 15      X Loc [ P126_RC ]
2: 4       <
3: 7       F
4: 30      Then Do
```

;Try P126 again

```
105: Data Transfer to HDR GOES <P126>
1: 0       Self-Timed/Append
2: 7       ASCII xxx Format
3: 15      Result Code Loc [ P126_RC ]
```

```

106: End <P95>

107: End <P95>

;Send soil temp at 100 cm to transmitter

108: Do <P86>
1: 10      Set Output Flag High <Flag 0>

109: Average <P71>
1: 1      Reps
2: 10     Loc [ Soil100cm ]

110: Data Transfer to HDR GOES <P126>
1: 0      Append to Self-Timed Buffer
2: 7      ASCII xxx Format
3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

111: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 3      >=
3: 1      F
4: 30     Then Do

112: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 4      <
3: 7      F
4: 30     Then Do

; Try P126 again

113: Data Transfer to HDR GOES <P126>
1: 0      Self-Timed/Append
2: 7      ASCII xxx Format
3: 15     Result Code Loc [ P126_RC ]

114: End <P95>

115: End <P95>

;Send year, date and time stamp - send first three of the five input locations starting with YEAR

;send year with xxxxx format

116: Do <P86>
1: 10     Set Output Flag High <Flag 0>

117: Sample <P70>
1: 1      Reps
2: 46     Loc [ Year ]

118: Data Transfer to HDR GOES <P126>
1: 0      Append to Self-Timed Buffer
2: 8      ASCII xxxxx Format
3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

119: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 3      >=
3: 1      F
4: 30     Then Do

120: If <X<=>F> <P89>
1: 15     X Loc [ P126_RC ]
2: 4      <
3: 7      F
4: 30     Then Do

```

```

; Try P126 again
        121: Data Transfer to HDR GOES <P126>
          1: 0      Self-Timed/Append
          2: 8      ASCII xxxxx Format
          3: 15     Result Code Loc [ P126_RC ]

        122: End <P95>

123: End <P95>

;send julian date

124: Do <P86>
    1: 10      Set Output Flag High <Flag 0>

125: Sample <P70>
    1: 1      Reps
    2: 47     Loc [ Date ]

126: Data Transfer to HDR GOES <P126>
    1: 0      Append to Self-Timed Buffer
    2: 8      ASCII xxxxx Format
    3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

127: If <X<=>F> <P89>
    1: 15     X Loc [ P126_RC ]
    2: 3      >=
    3: 1      F
    4: 30     Then Do
        128: If <X<=>F> <P89>
            1: 15     X Loc [ P126_RC ]
            2: 4      <
            3: 7      F
            4: 30     Then Do

; Try P126 again

        129: Data Transfer to HDR GOES <P126>
          1: 0      Self-Timed/Append
          2: 7      ASCII xxx Format
          3: 15     Result Code Loc [ P126_RC ]

        130: End <P95>

131: End <P95>

; send hour minute in xxxxx format

132: Do <P86>
    1: 10      Set Output Flag High <Flag 0>

133: Sample <P70>
    1: 1      Reps
    2: 48     Loc [ Hour ]

```

```

134: Data Transfer to HDR GOES (P126)
1: 0      Append to Self-Timed Buffer
2: 8      ASCII xxxxxx Format
3: 15     Result Code Loc [ P126_RC ]

;Check result code for P126; if between 1 and 6, P126 will be executed again

135: If (X<=>F) (P89)
1: 15     X Loc [ P126_RC ]
2: 3      >=
3: 1      F
4: 30     Then Do

136: If (X<=>F) (P89)
1: 15     X Loc [ P126_RC ]
2: 4      <
3: 7      F
4: 30     Then Do

; Try P126 again

137: Data Transfer to HDR GOES (P126)
1: 0      Self-Timed/Append
2: 8      ASCII xxxxxx Format
3: 15     Result Code Loc [ P126_RC ]

138: End (P95)

139: End (P95)

;End of measurement transmissions
;*****

```

9. The last part of the programming is for diagnostics regarding the satellite transmissions. The datalogger registers the number of times it attempts to send the data to the transmitter and sends an error code if something is wrong. This step helps in the diagnostic phase if the transmissions are interrupted.

```

;*****
; Read GOES last message status and error register

140: HDR GOES Status (P127)
1: 2      Read Last Message Status
2: 17     Result Code Loc [ P127_RC21 ]

141: HDR GOES Status (P127)
1: 4      Read Error Register
2: 31     Result Code Loc [ P127_RC41 ]

142: End (P95)

; Store P127 GOES Last Message Status (without lat/longs) and Error Register
; to Final Storage Area 2 every hour at 10 minutes past the hour

143: If time is (P92)
1: 10     Minutes (Seconds --) into a
2: 60     Interval (same units as above)
3: 10     Set Output Flag High (Flag 0)

144: Set Active Storage Area (P80)
1: 2      Final Storage Area 2
2: 0201   Array ID

```

```

;*****
; Read GOES last message status and error register
140: HDR GOES Status <P127>
1: 2      Read Last Message Status
2: 17     Result Code Loc [ P127_RC21 ]

141: HDR GOES Status <P127>
1: 4      Read Error Register
2: 31     Result Code Loc [ P127_RC41 ]

142: End <P95>

; Store P127 GOES Last Message Status <without lat/longs> and Error Register
; to Final Storage Area 2 every hour at 10 minutes past the hour

143: If time is <P92>
1: 10     Minutes <Seconds --> into a
2: 60     Interval <same units as above>
3: 10     Set Output Flag High <Flag 0>

144: Set Active Storage Area <P80>
1: 2      Final Storage Area 2
2: 0201   Array ID

145: Real Time <P77>
1: 1220   Year,Day,Hour/Minute <midnight = 2400>

146: Sample <P70>
1: 14     Reps
2: 17     Loc [ P127_RC21 ]

147: Sample <P70>
1: 10     Reps
2: 31     Loc [ P127_RC41 ]

; Clear Error Register if any errors are registered

148: If time is <P92>
1: 10     Minutes <Seconds --> into a
2: 60     Interval <same units as above>
3: 30     Then Do

149: If <X<=>F> <P89>
1: 32     X Loc [ P127_RC42 ]
2: 3      -- >=
3: 1      F
4: 30     Then Do

150: HDR GOES Status <P127>
1: 5      Clear Error Register
2: 41     Result Code Loc [ P127_RC5 ]

151: End <P95>

152: End <P95>

*Table 2 Program
02: 0      Execution Interval <seconds>

*Table 3 Subroutines

End Program

```

10. After the programming is complete, the entire file is compiled and checked for errors and then saved in multiple file formats. Clicking on the save button automatically initiates these functions. The file is then ready for transfer to the data logger.

The programming will be changed over time as technology advances. Documentation of program changes should be included with the metadata for the program. Version numbers will help clarify what was changed and when it was changed.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 7

Obtaining a GOES/DCS ID

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the process of obtaining an ID number that will put a climate station online for satellite telemetry. Data cannot be transmitted without first acquiring an ID. Use of the GOES Data Collection System (DCS) is regulated, by law, to the collection of environmental data by U.S. federal, state, and local government agencies, and by international government agencies and research organizations with a U.S. government sponsor.

A prospective user must first apply for and be granted a System Use Agreement (SUA) by NESDIS, which is typically renewable every 5 years (2 years for manufacturers). Once the SUA has been approved and signed, the user must purchase equipment that has been certified to be compatible with the GOES DCS.

The initial System Use Agreement for the CAKN climate monitoring program was filed in 2002 for the thirteen GOES/DCS IDs listed below: All are Channel 172 and are 1 hourly with 10 second window.

Primary Address	TransmissionTime
3960060C	00:32:30
3960157A	00:32:40
396020E0	00:32:50
39603396	00:33:00
39604506	00:33:10
39605670	00:33:20
396063EA	00:33:30
3960709C	00:33:40
39608018	00:33:50
3960936E	00:34:00
3960A6F4	00:34:10
3960B582	00:34:20
3960C312	00:34:30

Below is a copy of application form with the policies governing the use of the GOES system attached to the agreement. If a current form is required to request additional platform IDs if more stations are added to the network, check with the NOAA GOES Data Collection System (DCS) website at: <http://noaasis.noaa.gov/DCS/index.html>. The original letter requesting the use of the GOES/DCS System and application for use follows:

November 7, 2002

*National Environmental Satellite, Data, and Information Service
DCS Coordinator
Federal Office Building 4
Suitland, MD*

Attn: Carol Green

Dear Carol:

I would like to formally request permission to collect data using the GOES DCS capability for the National Park Service. The data will be collected as part of Denali National Park and Preserve's Long Term Ecological Monitoring Program and the Central Alaska Network which also includes Wrangell St. Elias National Park and Preserve and Yukon Charley Rivers National Preserve. The data we would like to transmit is meteorological data from thirteen proposed weather stations to be located in remote areas of the three national parks.

The objective of the weather-monitoring program at the three National Parks is to monitor and record weather conditions at representative locations in order to identify long and short-term trends, provide reliable climate data to other researchers, and to participate in larger scale climate monitoring and modeling efforts.

Attached is the questionnaire used to facilitate presentation of information needed to properly consider this request.

Regards,

*Pamela J. Sousanes
Environmental Specialist
National Park Service
Enclosure (1)*

GOES DCS System Use Agreement

In order to use the GOES Data Collection System (GOES DCS) you must complete the System Use Agreement and sign it. After reviewing the completed agreement, the Approving Authority will sign and approve the agreement, as appropriate. The agreement will go into effect at the time of approval. The policies governing the use of the GOES DCS are printed on pages 8 to 13.

Name of the program:

Program Administrator (User): Title (Dr., Mr., Ms., etc...)

Last Name: _____ ***First Name:***

Title:

Organization:

Department:

Mailing Address:

City: _____ ***State/Province:***

Zip Code: _____ ***Country:***

Telephone: _____ ***Fax:***

Email:

The User Certifies that he/she has read and understands the policies governing the use of the GOES DCS and hereby undertakes to follow them. The User also certifies that there are no commercial space-based services that meet the User's requirements.

User's Signature: _____ ***Date:***

For Approving Authority Use Only

This agreement is approved and shall remain in force for up to _____ years.

This agreement is not approved.

Comments:

Approving Authority: _____ **Date:**

Title:

Signature:

Name of the Program:

Detailed Description of Program Objectives (Purpose of Data Collection):

This Agreement is an:

Initial Agreement

Renewal Agreement

The Organization which will operate this program is a (check all that apply):

Government User

Non-profit user

Non-Government User

If not a government agency, please include sponsoring agency name and phone number :

Agency:

Name of Contact Person:

Phone Number:

Email Address:

Government User means agencies of international governmental organizations, national government, or any other subdivision thereof, or any of those agencies' contractors or grantees, so long as the contractor is using the data collected by the GOES DCS to fulfill it's contractual obligations to the government agency, or in the case of a grantee, that these data are being used in accordance with the Statement of Work for the award.

Non-profit user means a not-for-profit academic, research, or other non-governmental organization, which is using these data for education and/or scientific, noncommercial purposes.

Agency Contact Information

(a) Program implementer (e.g., principal investigator, technical representative, etc.):

Last Name: _____ *First Name:*

Title:

Organization:

Department:

Mailing Address:

City: _____ *State/Province:*

Zip Code: _____ *Country:*

Telephone: _____ *Fax:*

Email:

(b) Agency contact responsible for installation and/or maintenance of Data Collection Platform/equipment:

Last Name: _____ *First Name:*

Title:

Organization:

Department:

Mailing Address:

City: _____ *State/Province:*

Zip Code: _____ *Country:*

Telephone: _____ *Fax:*

Email:

(c) Agency contact responsible for operating Data Collection Platform/equipment:

Last Name: _____ ***First Name:***

Title:

Organization:

Department:

Mailing Address:

City: _____ ***State/Province:***

Zip Code: _____ ***Country:***

Telephone: _____ ***Fax:***

Email:

(d) Destination (final user) of data collected:

Title:

Organization:

Department:

Mailing Address:

City: _____ ***State/Province:***

Zip Code: _____ ***Country:***

Telephone: _____ ***Fax:***

Email:

Technical Specifications

(1) Program Information:

a. Check one that applies:

Operational []

Experimental []

Manufacturer []

b. Environmental parameters measured:

c. Anticipated time frame for data collection:

Start: _____ End: _____

3. Platform information:

a. Platform types to be used:

Check all that apply:

Interrogated (I) []

Self-timed (S) []

Random (R) []

Self-timed and Random (S/R) []

Self-timed and Interrogate (S/I) []

Random and Interrogate (R/I) []

b. Number of Platforms: (Complete as appropriate)

I: [] S/R: []

S: [] R/I: []

R: [] S/i: []

c. Total number of Platforms with Emergency Alarm/Random

Capability: _____

d. *Anticipated deployment for each platform type:*
(e.g., 20 Interrogate in April 1995, 10 Self-timed in March, 2000, etc...)

e. *General Location of Platform by generic type:*
(If needed attach separate sheet with additional information about each platform in the following format.)

	<i>#Fixed Platforms</i>	<i>Geographic Region</i>		
			<i>GOES-East</i>	<i>GOES-West</i>
			<i>GOES-East</i>	<i>GOES-West</i>
			<i>GOES-East</i>	<i>GOES-West</i>
			<i>GOES-East</i>	<i>GOES-West</i>
			<i>GOES-East</i>	<i>GOES-West</i>
			<i>GOES-East</i>	<i>GOES-West</i>
<i>(Note: Latitudes and Longitudes must be entered into database by the user.)</i>				
	<i>#Mobile Platforms (Latitude/longitude of boundaries):</i>			

f. *Platform data format:*

Check all that apply:

ASCII []

Pseudo ASCII []

Bits per sensor message _____

Bytes per message (8 bits/byte) _____

- g. *Desired platform reporting times:*
Rank in order of priority (1 = highest priority)

1 hour []

3 hour []

4 hour []

6 hour []

12 hour []

Other (please explain) []

If one hour is selected, please supply a justification relating to your program needs:

4. *Anticipated data delivery method:*

Check one:

DOMSAT: []

Dial-in to Wallops CDA, baud rate: []
(300, 1200, 2400, 9600, 14.4)

Internet Connection to Wallops CDA []

Direct Readout Ground System (DRGS): []

Dedicated Circuit: []

Commercial Service (specify which one): []

Other (please explain): []

I Background

The GOES Data Collection System (GOES DCS) is operated by the United States' National Oceanic and Atmospheric Administration (NOAA). The GOES DCS is managed by NOAA's Office of Satellite Data Processing and Distribution (OSDPD). The system consists of: instruments provided by NOAA, which are flown aboard NOAA geostationary satellites; user supplied data collection platforms (DCPs); and NOAA's DCS Automated Processing System (DAPS) data and user management system. Users may also receive data directly from the GOES satellite through Direct Readout Ground Systems (DRGS) or from NOAA's rebroadcast of those data through communication satellites or systems. NOAA is authorized to enter this agreement under the authority granted to it in 15 USC 313 and 49 USC 44720.

II GOES System Use Policy

1. Scope

- a) This policy applies to any person who operates or proposes to operate data collection platforms to be used with the GOES DCS either directly or through an affiliate or subsidiary.*
- b) These policies apply to all existing GOES DCS users as well as all future agreements for use of the GOES DCS.*

2. Definitions

For purposes of this agreement and policy:

(a) Approving authority means NOAA, which is represented by the Director, Office of Satellite Data Processing and Distribution for the GOES DCS.

(b) Assistant Administrator means the Assistant Administrator for Satellite and Information Services, NOAA, or his/her designee.

(c) Environmental data means environmental measurement data for the purpose of using the GOES DCS.

(d) Environmental measurement data means data that relate to the characteristics of the Earth and its natural phenomena by helping to better understand, evaluate, or monitor its natural resources.

(e) Government interest means that the use is determined in advance to be of interest to one or more governmental entities of the United States, or a state or local government.

(f) Government user means agencies of international governmental organizations, national government or any subdivision thereof, or any of those agencies' contractors or grantees, so long as the contractor is using the data collected by the GOES DCS to fulfill its contractual obligations to the government agency or in the case of a grantee that these data are being used in accordance with the statement of work for the award.

(g) Non-profit user means a not-for-profit academic, research, or other non-governmental organization, which is using these data, for education and/or scientific, non-commercial purposes.

(h) Operational use means the use of data in a situation where the utility of the data are significantly reduced if not collected or delivered in a specific time window. This includes situations where extensive preparation work is in place and a delay in acquisition of data would jeopardize the project.

(i) Platform compatibility means the compatibility of the platform with the space segment of the system, and includes elements such as message length and composition, signal strength, and transmission protocol (e.g., continuous versus event drive).

(j) Testing use means the use of the GOES DCS by manufacturers of platforms for use in conjunction with the GOES DCS, for the limited purpose of testing and certifying the compatibility of new platforms with the technical requirements of the GOES DCS.

(k) User means the entity and/or organization which owns or operates user platforms for the purpose of collecting and transmitting data through the GOES DCS.

(l) User platform means devices, designed in accordance with the specifications delineated and approved by the Approving Authority, used for the in-situ collection and subsequent transmission of data via the GOES DCS. Those devices which are used in conjunction with the GOES DCS are referred to as data collection platforms (DCP).

(m) User requirement means the requirement expressed and explained in the System Use Agreement.

3. Use of GOES Data Collection System

a) Use of the GOES DCS will only be authorized in accordance with the conditions and requirements set forth in paragraphs (b), (c), and (d) of this section.

b) (1) Use of the GOES DCS will only be authorized where it is determined that there are no commercial space-based services available that meet the user's requirements.

(2) A determination under (b)(1), above, must be based on such factors as satellite coverage, accuracy, data throughput, platform power consumption, size and weight, service continuity and reliability, platform compatibility, system access mode, and, in the case of government agencies, cost-effectiveness.

c) (1) Except as provided in paragraphs (2) and (3) of this section, GOES DCS shall only be used for the collection of environmental data by governmental and/or non-profit users.

(2) Non-governmental, environmental use of the GOES DCS is only authorized where there is a Government interest in the collection and/or receipt of the data.

(3) Testing use of the GOES DCS will only be authorized for manufacturers of GOES DCS platforms, that require access to the system in order to test and certify prototype and production models.

d) In the event that GOES DCS capacity limitations require that priority determinations be made,

applicants will be admitted to use the GOES system in accordance with the following priority:

(1) NOAA programs or users whose data are required for implementation of NOAA programs, as determined by the Assistant Administrator, will be accorded first priority.

(2) Users whose data are desired to support NOAA programs will be accorded second priority.

(3) Users whose data and/or use of the GOES DCS will further a program of an agency or department of the U.S. Government, other than NOAA, will be accorded third priority.

(4) Users whose data are required by a state or local Government of the United States will be accorded fourth priority.

(5) Testing users of the system will be accorded fifth priority.

(6) No other usage will be authorized for the GOES DCS.

4. GOES Data Collection System Use Agreements

- a) In order to use the GOES DCS, each user must have an agreement with the approving authority .*
- b) These agreements will address, but may not be limited to, the following matters:*
 - (1) The period of time the agreement is valid and procedures for its termination,*
 - (2) The authorized use(s), and its priorities for use,*
 - (3) The extent of the availability of commercial space-based services which meet the user's requirements and the reasons for necessitating the use of the GOES DCS,*
 - (4) Any applicable government interest in the data,*
 - (5) Required equipment standards,*
 - (6) Standards of operation,*
 - (7) Conformance with applicable ITU and national agency radio frequency agreements and regulations,*
 - (8) Reporting time and frequencies,*
 - (9) Data formats,*
 - (10) Data delivery systems and schedules, and*
 - (11) User-borne costs.*
- c) The Approving Authority shall evaluate user requests and conclude agreements for use of the GOES DCS.*
- d) The period of agreements for use of the GOES DCS shall be as follows:*
 - (1) Agreements for the collection of environmental data, by the GOES DCS, shall be valid for 5 years from the date of initial in-situ deployment of the platforms, and may be renewed for additional 5-year periods.*
 - (2) Agreements for the testing use of the GOES DCS by equipment manufacturers shall be valid for 1 year from the date of initial testing, and may be renewed for additional 1-year periods.*

5. Treatment of Data

All GOES DCS users must agree to permit GOES Participating Agencies, and their governments' agencies the full, open and timely use of all environmental data collected from their platforms; this may include the international distribution of environmental data under the auspices of the World Meteorological Organization. Any proprietary data will be protected in accordance with applicable laws.

6. Technical requirements

- a) All platform operators of the GOES DCS must use a data collection platform radio set whose technical and design characteristics are certified to conform to applicable specifications and regulations.*
- b) All platform operators are responsible for all costs associated with the procurement and operation of the platforms, and for the acquisition of data from those platforms, either directly from the satellite or from the applicable data processing system.*

III Understandings

- a) The Approving Authority reserves the right to terminate or suspend the user's participation in this program in the event of spacecraft or ground equipment limitations requiring curtailment or elimination of services.*
- b) DCPs which the user plans to implement as part of the GOES DCS are subject to type-certification by the operator before deployment. However, such certification does not imply any judgment or endorsement as to the DCP's performance.*

IV Specific Responsibilities of the User

The User shall:

- a) Notify the Operator, within a reasonable time, of any changes to the program.*
- b) Obtain and utilize DCPs manufactured and type-certified in accordance with the specifications and rules stipulated in the «GOES Data Collection Platform Transmitter Certification Standards» document available from the Operator upon request.*
- c) Obtain authorization from the appropriate national authorities to transmit on the frequency specified in the user assignments.*
- d) Comply with all applicable laws and regulations, and the terms and conditions for operation of the system which have been agreed to by the Approving Authority (and which shall be available upon request).*
- e) Maintain current information in the DAPS data bases describing parameters of all platforms, including proper location and emergency contact information.*
- f) Make all reasonable efforts to deactivate platforms which are either performing outside the system specifications; malfunctioning in a manner that interferes with the other platforms or with general system operations, or are in a program which has been terminated.*

V Specific Responsibilities of Operator

The Operator shall:

- a) Oversee the collection, processing , and transmission of GOES data.*
- b) Notify the User of changes to the established operational plan. Notification will normally be prior to initiation of such changes, except when sudden abnormal spacecraft or operational conditions preclude such prior notification. In any event, notification will be made as soon as possible.*
- c) Notify the user , by the most efficient means available, whenever GOES System monitoring indicates that a platform is performing outside system specifications or is malfunctioning in a manner that interferes with the other platforms or with general system operation; and require the user to make every reasonable effort to deactivate or correct such a platform.*

VI Disclaimers

- a) The Operator will make every effort to maintain the GOES DCS in full operation at all times subject to the availability of appropriations. The Operator will bear no responsibility for any losses as a result of the non-availability of the DCS.*
- b) The Operator can not guarantee the timeliness of data dissemination, the accuracy of the data provided or their suitability for any application whatsoever, and cannot be held responsible for any damage, including loss of life, resulting from defective operation of the GOES DCS.*

c) In the event of damage being suffered by the goods or personnel of the User or third parties, and insofar as such damage arises out of the use of the equipment, the Operator shall not be liable.

d) The User agrees not to make any claim or bring any action against the Operators, or any of their employees or agents and the user agrees to indemnify and hold each such entity and individual harmless against any such claim or action brought by any third party and any award of damages, loss, or other expense incurred in connection therewith (including attorneys' fees) where such claim or action is based, directly or indirectly in whole or in part on the use of the GOES System. Indemnification shall not be applicable in those instances where the user is not allowed by applicable law to indemnify.

VII Period of Use/Termination

a) Either party to the System Use Agreement may request amendments by letter to the signatories of this System Use Agreement and such amendments will take effect upon the consent of all parties.

b) Within 30 days of the expiration of the approved period of use, users may request to renew the system use agreement. These agreements will be renewed in accordance with all applicable laws and regulations. Renewal is not automatic, however, and there may be instances when the agreements will not be renewed.

VIII Dispute Settlement

In the case of any disputes arising out of the terms of this agreement, the matter will be referred to the Approving Authority .

Policies and Procedures Regarding Use of the NOAA Space-Based Data Collection Systems (15 CFR 911) explains the system use policy for using the GOES DCS to ensure that the Government will not allow its space-based data collection systems to be used where there are commercial space-based services available that fulfill users' requirements. The regulation contains the minimum information requirements necessary to determine if a user meets these criteria and is thereby granted use of the GOES DCS. In accordance with the regulation, responses to the collection of information are mandatory to conclude agreements for use of the GOES DCS.

A standard part of the system use agreement with accepted applicants is that the user must provide free and open access to the data by U.S. Government agencies. No confidentiality is promised or provided.

Public reporting burden for this collection of information is estimated to average 3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Direct Services Division (E/SP3), Room 3320, FB-4, NOAA, 5200 Auth Road, Suitland, MD, 20746-4304.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with a collection of information, subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB control number.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 8

Programming the HDR GOES Transmitter

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP details the steps for programming the SAT HDR GOES transmitter for the CAKN climate stations. This protocol will describe the steps required to program the transmitter. It is suggested that the programming be done in the office and tested prior to field installation. A transmitter in the field can be upgraded or reprogrammed by bringing a laptop with the DCPCComm software and the proper cable connection.

Overview of the Transmitter Functions

The SAT HDR GOES transmitter supports one-way communication, via satellite, from a Campbell Scientific datalogger to a ground receiving station (Figure 1). The transmitter utilizes non-volatile memory to store configuration information, such as platform ID, transmission baud rate, channel number, scheduled transmission time, offset time, and message window length. The clock is maintained with a GPS receiver.

Typical system

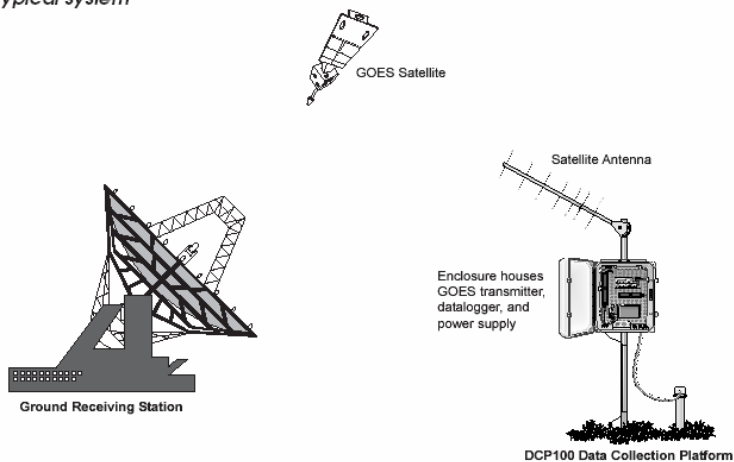


Figure 1 GOES System communication links

The DCP transmitter sends data via Geostationary Operational Environmental Satellites (GOES). GOES satellites have orbits that coincide with the Earth's rotation, allowing each satellite to remain above a specific region. The GOES system is administered by the National Environmental Satellite Data Information Service (NESDIS). NESDIS assigns addresses, uplink channels, and self-timed/random transmit time windows. Self-timed windows allow data transmission only during a predetermined time frame. Alaska is positioned to use the GOES West satellite.

The Campbell Scientific, Inc. Instruction Manual for the SAT HDR GOES transmitter outlines in detail the GOES system, transmitter functions, using the software DCPCComm, programming the Datalogger, and Field Installation. This manual is available online at <http://www.campbellsci.com/satellite.html#goes>.

Programming the Transmitter

There is certain information that is unique to each transmitter. This setup information includes: platform ID, transmission baud rate, channel number, scheduled transmission time, offset time, and message window length. This setup information is entered in the SAT HDR GOES with a computer running DCPCComm software.

The following steps are taken from the SAT HDR GOES Instruction Manual with additional notes that pertain directly to the setup of the CAKN climate stations.

Step1.

Install DCPCComm. Inquire with Campbell Scientific, Inc. to ensure that the latest version of the software is being used.

Step 2.

Load the configuration file. The configuration file contains the information unique to the transmitter, i.e. platform ID. A unique configuration file can be saved for each DCP in service. The default configuration file is GOESTerminalVersion3.0.

Only the white fields in the configuration can be changed, the others are set at the factory.

2.1 Platform ID

Starting from the top of the file select the “value” field for terminal ID Number and enter one of the thirteen assigned IDs for the Central Alaska Network. It is important to keep a log with the IDs used in the network so a platform ID is not duplicated.

2.2 Mode

The mode is the data type. The CAKN stations will use ASCII format, so enter a 1 in this field.

2.3 Message Window

The message window is the length of the assigned self-timed transmission window. The value entered for the CAKN climate stations is 8 even though the transmission window assigned is 10. This allows a few seconds leeway so the message doesn't overlap the assigned time

window. The data stream transmitted for CAKN takes approximately 4 seconds to transfer.

- 2.4 Minimum Voltage Supply
Leave this value as the default 96 (9.6 volts).
- 2.5 Timed Configuration
The interval must be set for self timed transmissions. Four values must be entered. Select 0 days, 1 hour, 0 minute, 0 seconds.
The offset is the time after midnight of the first transmission of the day. This is the transmission time that is assigned with the platform ID. In the example for Stampede it is 0 hours, 34 minutes, and 10 seconds.
- 2.6 Timed Channel
The timed channel is also assigned with the platform ID. All of the CAKN stations are currently on channel 172.
- 2.7 Baud rate
The Baud rate must also match your channel assignment. The baud rate assigned to the CAKN climate stations is 300.
- 2.8 Interleaver
The interleaver can be used to provide some error correction to the data transmission, however the number of bytes transmitted will increase, therefore CAKN stations have a 0 value entered here to leave the interleaver off.
- 2.9 Random Configuration
The CAKN stations are on self timed transmissions so these values are left at 0.
- 2.10 GPS Fix time Out
The default settings work fine for this section.
- 2.11 Communication Port Type
The communication port type sets the active port on the transmitter. The CSI port is used with Campbell Scientific dataloggers. Enter a 3 in this field.
- 2.12 Serial Time Out
The serial time out is set long enough for all data to be copied from the datalogger to the transmitter before the time out expires. The default setting of 20 for serial time out and 5 for wait before sleep should be entered.
- 2.13 SDI-12 Settings
These fields are not used for the CAKN stations – leave the default values.
- 2.13 Debug
Leave default settings for debug and Allow test mode.

Below is an example from the Stampede climate station in Denali:

File Sensor configuration DCP Communications Terminal SDI-12 Factory Tests Password Window Help Start U.I. Mode cfg Exit mode UI			
Sensor name and number		Item name	Value
GOES Transmitter	1	Terminal ID number	3960a6f4 H
	1	Mode [ASCII=1 Pseudo=3]	1
	1	1200 baud AGC level	c00 H
	1	100/300 baud AGC level	900 H
	1	Message window (seconds)	8
Transmit Limits	2	SWR max	94
	2	SWR min	56
	2	Minimum supply voltage (1/10 volts)	96
	2	RF max	ff H
	2	RF min	0 H
Timed Configuration	3	Interval Days	0
	3	Hours	1
	3	Minutes	0
	3	Seconds	0
	3	Offset Hours	0
	3	Minutes	34
	3	Seconds	10
	3	Channel	172
	3	Baud rate(1=100 2=300 3=1200)	2
	3	Interleaver(0=none 1=small 2=large)	0
Random Configuration	4	Interval Hours	0
	4	Minutes	0
	4	Seconds	0
	4	Channel	0
	4	Baud rate(1=100 2=300 3=1200)	1
	4	Interleaver(0=none 1=small 2=large)	0
GPS	5	Fix timeout (seconds)	300
	5	First fix timeout (seconds)	1200
	5	Fix attempt interval	3600
	5	Max time without GPS fix - 100/300 baud	9000
	5	Max time without GPS fix - 1200 baud	18000
Communication	6	Port type (0=SDI 2=AUX 3=CSI)	3
	6	Config port baud rate	25
	6	Aux/CSI baud rate	96
	6	Serial timeout (seconds)	20

Communication	6	Port type (0=SDI 2=AUX 3=CSI)	3
	6	Config port baud rate	25
	6	Aux/CSI baud rate	96
	6	Serial timeout (seconds)	20
	6	Wait before sleep (seconds)	5
SDI Sensor 1	7	Sample Interval (seconds)	3600
	7	Offset from midnight (sec)	0
	7	Address	0
	7	Command	NNN
SDI Sensor 2	8	Address	1
	8	Command	NNN
SDI Sensor 3	9	Address	2
	9	Command	NNN
SDI Sensor 4	10	Address	3
	10	Command	NNN
SDI Sensor 5	11	Address	4
	11	Command	NNN
SDI Sensor 6	12	Address	5
	12	Command	NNN
SDI Sensor 7	13	Address	6
	13	Command	NNN
SDI Sensor 8	14	Address	7
	14	Command	NNN
SDI Sensor 9	15	Address	8
	15	Command	NNN
SDI Sensor 10	16	Address	9
	16	Command	NNN
Factory Setups	17	Clear debug entries	E007D00E007
	17	Debug (1=on 0=off)	0
	17	Allow test mode (1=yes 0=no)	0
	17	TCXO Real time clock equipped	0
	17	Set TCXO table to defaults	DDDDDDDD
	17	Calculate checksum	WWWWWWW

Step 3.

Transferring the configuration information to the SAT HDR GOES

The configuration port is an RS232 port utilizing a DB9 female connector. Figure 2 shows the location of the configuration port (and other ports) on the transmitter. The DCPCComm software communicates with the transmitter through the configuration port. Use this port to transfer the configuration file from the computer to the transmitter. You must have the proper cable that was included with the purchase of DCPCComm. Connect one end to the Com Port on your PC and one end to the Config Port on the transmitter

SAT HDR GOES Operations

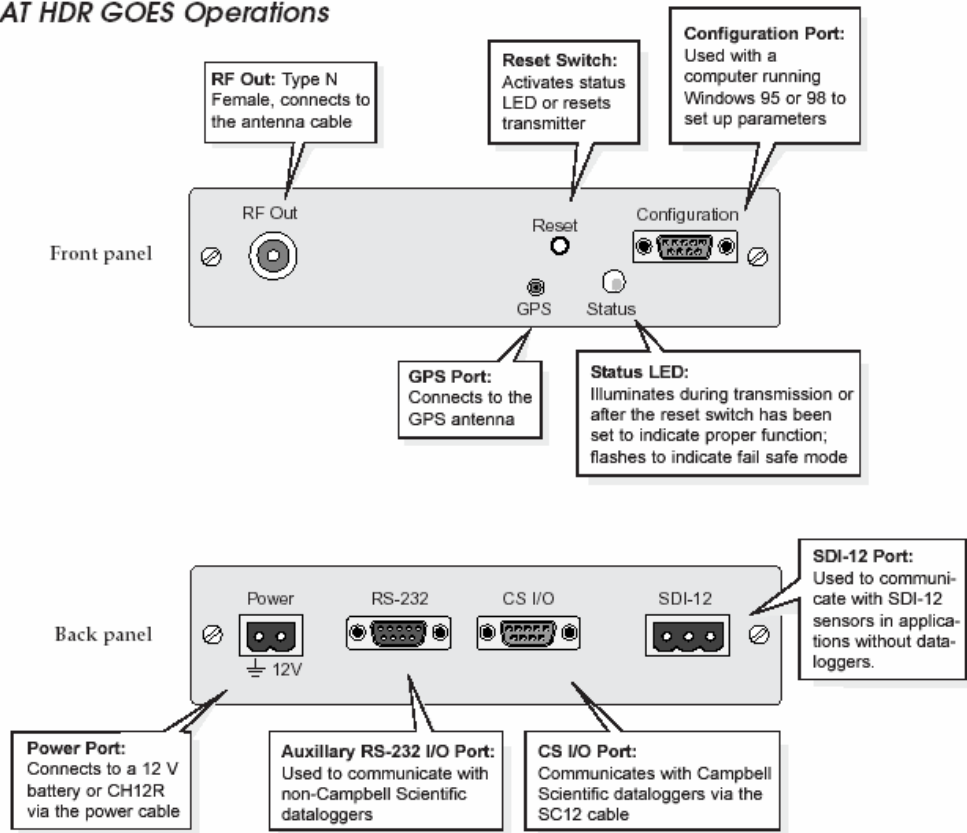


Figure 2 SAT GOES Transmitter ports

Edit and save the configuration file under the station name before transferring it to the transmitter. Open DCPCComm and then open the configuration file you wish to send. From the main menu select “DCP Communications/Start User Interface”. You will receive a message that the user interface mode started. From the main menu, select “DCP Communications/Send Configuration”. Wait for the message “Configuration Sent”. From the main menu, select “DCP Communications/Stop User Interface Mode”. After the configuration file is sent it is ready to be installed in the field.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 9

Station Deployment Equipment List

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP lists the equipment required for a complete climate station deployment and suggests methods of packaging the equipment for transportation to a remote site via fixed-wing aircraft or helicopter.

Equipment Checklist

√	Station Equipment	Weight lbs.
	Tripod tower/mast	75
	Guy kit	10
	Specialized Battery enclosure	15
	2 12V Batteries	140
	Lightning rod	5
	NEMA enclosure	25
	Wind monitor	5
	Pyranometer	5
	AT/RH sensor	5
	Snow Depth Sensor	5
	GOES antenna	5
	GOES GPS antenna	5
	GOES coax cable	5
	Solar panel (64 watt)	25
	AT shield	5
	Tipping bucket	10
	Tipping bucket pipes (1)	5
	Tipping bucket conduit	5

Wind/Pyranometer	5
Wind pipe extension	2
Pyranometer stand	5
Lightning rod cable (black)	2
Lightning rod cable (green)	2
Battery cable	2
Battery cable conduit	5
Battery cable bifurcating Y	2
Tower rebar pegs	5
Extra long rebar pegs	5
Enclosure putty	2
Desiccant	5
CR10X Datalogger	5
CR10KD Keypad	2
Datalogger Ribbon cable	2
GOES transmitter	5
Charging regulator	5
Humidity indicator card	2
Platform under battery box	10
Platform for standing	10
(2) 24" X 24" plywood (for snow depth sensor surface)	20
(2) 1"x 4" x 48" cedar planks	5
Channel Unistrut (2) 2', (1) 4' and (1) 6' piece	15
Nuts, Bolts and Washers for Unistrut construction	5

√

Tools Needed for Deployment/Maintenance

Tape measure
 Teflon tape/Pipe Dope
 Straight Bit Screwdriver
 Philips Head Screwdriver
 Needle Nose Pliers
 Pliers
 Pocket Knife
 Wire cutters
 Wire strippers
 Nut drivers 3/8", 5/16"
 Hex wrench set
 Open Ended Wrenches: 3/3", 7/16", 1/2", 9/16"
 Socket Wrench and 7/16" deep well, 9/16" and 1/2" sockets
 Adjustable Wrench

Electrical tape
Tie-wraps
Level
Small sledgehammer
Pipe wrenches (2 – 12’)
Rock bar
Step ladder (4 or 6’)
Shovel
Drill
Soil Auger
Weed Whip
Loppers
Tool Box with nuts/bolts/washers/ turnbuckles/screws

√ **Miscellaneous Equipment/Tools Listed**

Thermometer (°C)
Voltmeter
Radio and batteries
Satellite Phone
Pencil
Calculator
Sharpie
Compass w/known magnetic declination of area
Inclinometer
GPS unit for marking location
Camera and extra batteries
Binoculars
Bungee cord
Station checklists
CR10X wiring diagrams
CR10X program
CR10X prompt sheet
GOES program
Desiccant packs
Palm PDA w/cables w/PC Connect
Laptop w/LoggerNet and DCPCComm

√ **Personal Equipment**

Warm Clothing
Waterproof Jacket and Pants
Small Tarp
Food
Sunscreen

Personal Protective Equipment for aircraft (if applicable)
Bear spray
Watch

Climate Station - Size and weights for transport



Hazardous Material

Batteries are sealed lead-acid batteries. For transport in aircraft follow the NPS guidelines for aviation safety. Do not have battery terminal bolts exposed. Use electrical tape to cover the terminals to avoid contact with any other items in the aircraft. It is preferable to have them transported within the original box they were shipped in if

possible. Bear spray is also hazardous. Ensure that it is stowed in a secure box, preferably in a cargo area that is not attached to the cockpit.

Packaging recommendations

See above Figure for recommended packaging for transport in aircraft.

Equipment in the Battery Box: Tipping Bucket, Conduit, Snow Depth Sensor, Battery Cables, Soil Temperature Probes (Figure 2)



Figure 2 Equipment in battery box

Equipment in NEMA Enclosure: Guy kit, pyranometer, AT/RH Sensor, GOES GPS, GOES Cable, AT Shield, wind pipe extension, pyranometer stand, lightning rod cable (black and green), battery cable, battery cable conduit, desiccant, ribbon cable, power regulator, Humidity Indicator,

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 10

Climate Station Installation

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

SOPs 10 and 10a describe the steps for installing a climate station installation which is almost solely based on the Campbell Scientific Inc. Tripod Weather Station Instruction Manual. The manual is included as part of this SOP (as Sop 10a) and is also available at <http://www.campbellsci.com/towers.html>

There are certain steps of the installation process that were tailored for the CAKN climate stations. These deviations from or additions to the CSI Instruction Manual are described below. They pertain to the following topics:

- Mounting device for snow depth sensor and AT/RH sensor.
- Mounting of solar panel
- Attaching the external battery

Mounting device for snow depth sensor and AT/RH sensor

Channel unistrut was used to create a mounting device for the AT/RH sensor and the snow depth sensor in order to distance the sensors from the large solar panel mounted to the tripod. The mounting device consists of a 6' length, a 5' length and (2) 2' lengths for support. Figure 1 shows the mounting set up on a CAKN climate station.

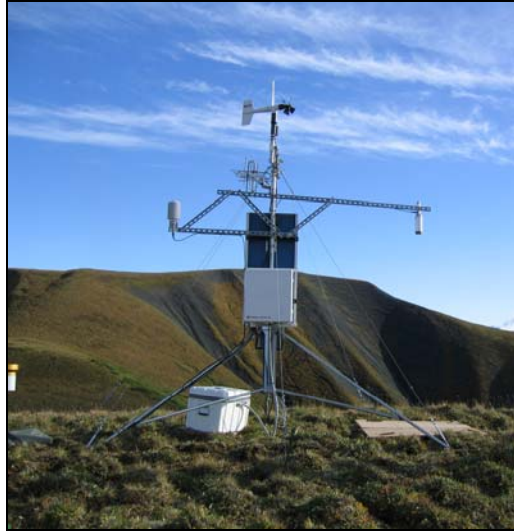


Figure 1 CAKN station

The channel unistrut is attached with bolts and large flat washers. The radiation shield attaches to the unistrut directly via the two existing holes on the shield, and the snow sensor is attached with a 1" B-Line clamp. See the Figure 2 below for detailed views for building the mounting device.





Figure 2. Close up shots of mounting devices on CAKN stations

Mounting Device for Solar Panel

Due to the location of the CAKN climate stations (60-65° latitude) they require solar panels ≥ 50 watts. The CAKN stations have been equipped with 64 Watt solar panels plus a 10 watt solar panel. The larger panels are approximately 2' x 4'. Custom mounting brackets were designed for the panel with two holes in the center for a u-bolt attachment to the tripod. The drawing for the design is shown below. Two of these brackets are attached with bolts to the frame of the solar panel. The actual size of the mounting hardware will be determined by the size of the frame surrounding the individual panel.

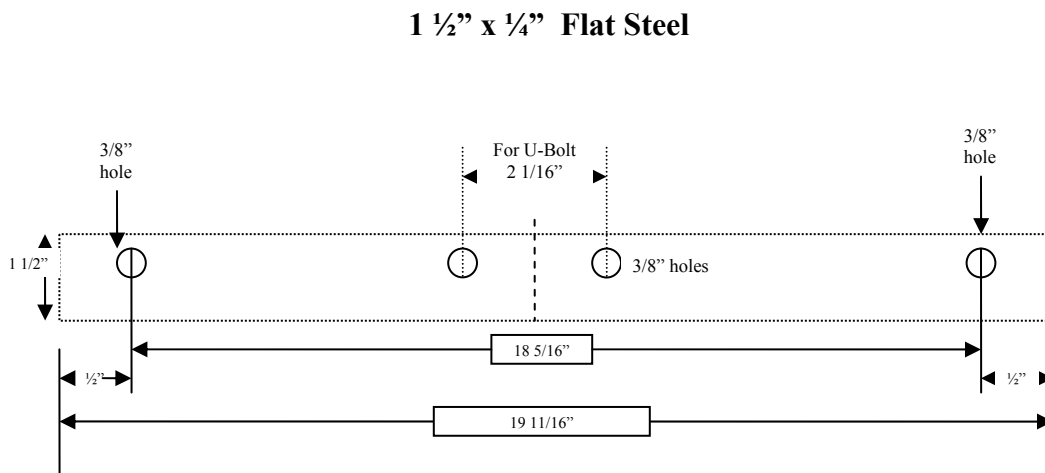


Figure 3. Detailed drawing of solar panel mounts

The solar panel is mounted flush to the south side of the tripod using U-bolts to attach the panel to the mast. Figure 4 shows of a 64 watt solar panel attached to a climate station.

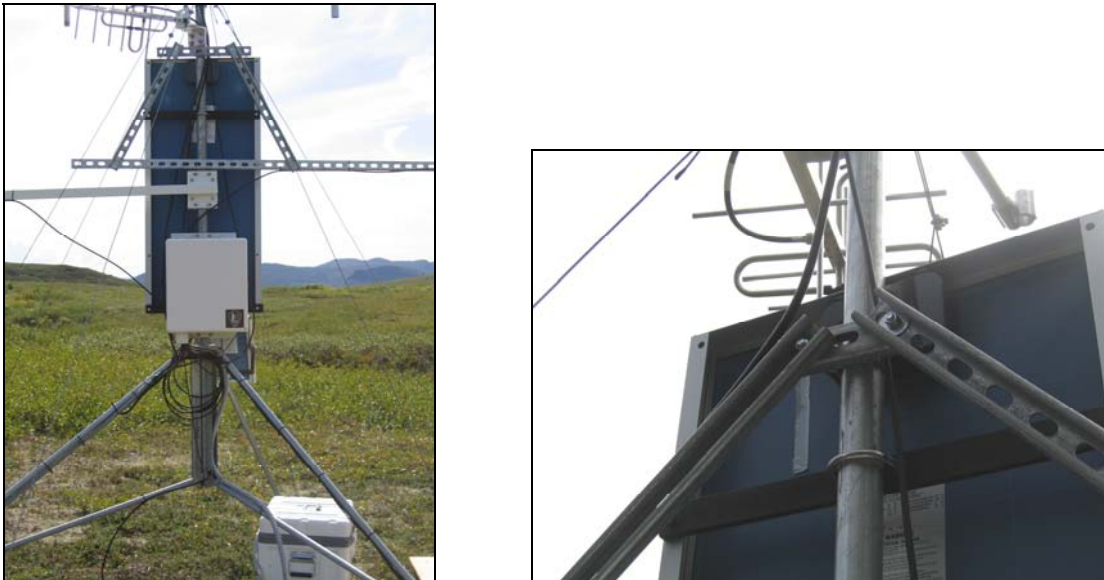


Figure 4. Solar panel mounted to CAKN station

Attaching the External Battery

Two 12 volt 100 amp hour batteries are used at each climate station. The batteries can be purchased from a number of local dealers or procured on the web. The batteries need to be connected to the CH12R charging regulator with the connector supplied by Campbell Scientific, Inc. This battery cable needs to be put in a metal conduit so that it is protected from wildlife. The conduit is attached to the battery box with conduit fittings shown in the photos below. A 90° elbow is used at the battery box and a ring clamp is used to secure it to the enclosure. Battery terminal connectors are placed on the end of the wire, the red wire is attached to the positive terminal and the black wire is attached to the negative terminal. The batteries are connected in parallel with battery terminal connectors. Attach the red connector to the positive terminal of each battery, and the black connector to the negative terminal of each battery. Figure 5 shows detailed photos of attaching a battery to the system.

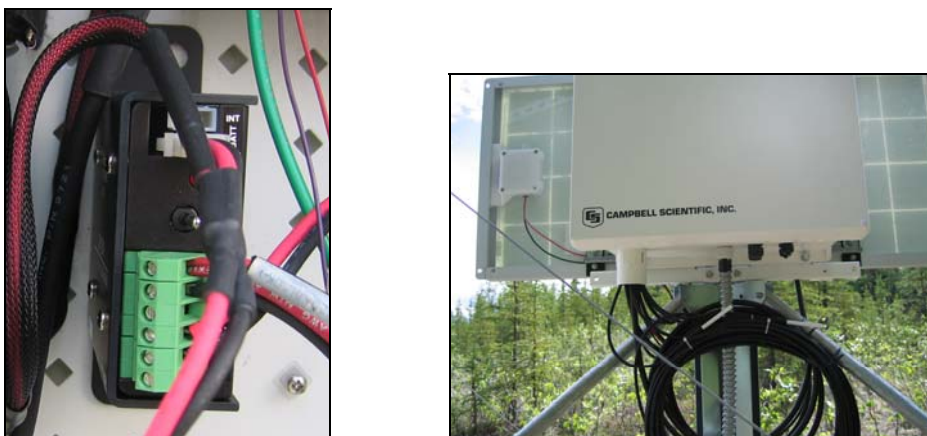




Figure 5. External battery connection

S.O.P 10a is an Adobe PDF file of the Campbell Scientific tripod Installation Instruction Manual taken from the Campbell Scientific, Inc. website

<ftp://ftp.campbellsci.com/pub/outgoing/manuals/tripod.pdf>

**TRIPOD WEATHER STATION
INSTALLATION MANUAL**

**CAMPBELL SCIENTIFIC MODELS
CM6, CM10 TRIPODS**

REVISED: 4/98

COPYRIGHT (c) 1993-1998 CAMPBELL SCIENTIFIC, INC.

WARRANTY AND ASSISTANCE

The **CM6 AND CM10** are warranted by CAMPBELL SCIENTIFIC, INC. to be free from defects in materials and workmanship under normal use and service for twelve (12) months from date of shipment unless specified otherwise. Batteries have no warranty. CAMPBELL SCIENTIFIC, INC.'s obligation under this warranty is limited to repairing or replacing (at CAMPBELL SCIENTIFIC, INC.'s option) defective products. The customer shall assume all costs of removing, reinstalling, and shipping defective products to CAMPBELL SCIENTIFIC, INC. CAMPBELL SCIENTIFIC, INC. will return such products by surface carrier prepaid. This warranty shall not apply to any CAMPBELL SCIENTIFIC, INC. products which have been subjected to modification, misuse, neglect, accidents of nature, or shipping damage. This warranty is in lieu of all other warranties, expressed or implied, including warranties of merchantability or fitness for a particular purpose. CAMPBELL SCIENTIFIC, INC. is not liable for special, indirect, incidental, or consequential damages.

Products may not be returned without prior authorization. To obtain a Returned Materials Authorization (RMA), contact CAMPBELL SCIENTIFIC, INC., phone (435) 753-2342. After an applications engineer determines the nature of the problem, an RMA number will be issued. Please write this number clearly on the outside of the shipping container. CAMPBELL SCIENTIFIC's shipping address is:

CAMPBELL SCIENTIFIC, INC.

RMA# _____
815 West 1800 North
Logan, Utah 84321-1784

CAMPBELL SCIENTIFIC, INC. does not accept collect calls.

Non-warranty products returned for repair should be accompanied by a purchase order to cover the repair.



CAMPBELL SCIENTIFIC, INC.

815 W. 1800 N.
Logan, UT 84321-1784
USA
Phone (435) 753-2342
FAX (435) 750-9540
www.campbellsci.com

Campbell Scientific Canada Corp.
11564 -149th Street
Edmonton, Alberta T5M 1W7
CANADA
Phone (403) 454-2505
FAX (403) 454-2655

Campbell Scientific Ltd.
Campbell Park
80 Hathern Road
Shepshed, Leics. LE12 9RP
ENGLAND
Phone (44)-50960-1141
FAX (44)-50960-1091

TABLE OF CONTENTS

	PAGE
1. PREPARATION AND SITING	1-1
1.1 Installation Tasks.....	1-1
1.2 Tools Required	1-1
1.3 Siting and Exposure	1-3
1.4 Determining True North for Wind Vane Orientation	1-5
2. TOWER/TRIPOD INSTALLATION	2-1
2.1 Tower/Tripod Installation	
2.2 Sensor Mounting Brackets	
3. INSTRUMENTATION INSTALLATION	3-1
3.1 Enclosure, Datalogger, and Power Supply	
3.2 Sensor Connection	
3.3 Communication and Data Storage Peripherals	
3.4 Sealing and Desiccating the Enclosure	
4. SENSOR INSTALLATION	4-1
4.1 034A Met One Windset	4-1
4.2 014A Met One Wind Speed Sensor	4-1
4.3 024A Met One Wind Direction Sensor	4-2
4.4 05103 and 05305 RM Young Wind Monitors	4-2
4.5 03001 RM Young Wind Sentry Wind Set	4-3
4.6 03101 RM Young Wind Sentry Anemometer	4-3
4.7 LI200S Li-Cor Silicon Pyranometer/LI190SB Quantum Sensor	4-4
4.8 107/108 Temperature Probe	4-4
4.9 107B Soil Temperature Probe	4-5
4.10 CS500 Vaisala Temperature and RH Probe	4-5
4.11 HMP35C Vaisala Temperature and RH Probe.....	4-6
4.12 CS105 Vaisala Barometric Pressure Sensor	4-6
4.13 TE525 Texas Electronics Tipping Bucket Rain Gage	4-7
4.14 CS700-L Rain Gage	4-7
4.15 SR50 Sonic Ranging Sensor	4-8
4.16 CS615-L Water Content Reflectometer	4-8
4.17 237 Leaf Wetness Sensor	4-9
4.18 257 Soil Moisture Sensor	4-9
4.19 Wind Direction Sensor Orientation	4-10
5. SOFTWARE INSTALLATION	5-1
6. MAINTENANCE AND TROUBLESHOOTING	6-1
6.1 Maintenance	6-1
6.2 Troubleshooting.....	6-2

TABLE OF CONTENTS

LIST OF TABLES

3.3-1	Station ID Numbers and Corresponding Switch Settings**	3-12
3.3-2	Station ID Numbers and Corresponding Switch Settings	3-14

LIST OF FIGURES

2.1-1	CM10 Weather Station	2-1
2.1-2	Extending the Tripod Legs.....	2-1
2.1-3	Tripod and Component Orientation	2-2
2.1-4	Ground Rod and Clamp.....	2-2
2.1-5	Tripod Ground Clamp	2-3
2.2-1	019ALU Crossarm and Lightning Rod.....	2-4
2.2-2	Gill Radiation Shield	2-4
2.2-3	015 Pyranometer Mounting Arm.....	2-4
2.2-4	025 Pyranometer Crossarm Stand	2-4
3.1-1	ENC 12/14 Enclosure on CM6/CM10	3-1
3.1-2	ENC 12/14 Enclosure on UT10	3-1
3.1-3	ENC 16/18 Enclosure on UT30	3-1
3.1-4	21X Mounted Inside of the ENC 12/14 Enclosure	3-2
3.1-5	21X Alkaline Batteries	3-2
3.1-6	21XL Rechargeable Batteries.....	3-3
3.1-7	BPALK 12 Volt Power Supply	3-3
3.1-8	PS12LA 12 Volt Power Supply	3-4
3.1-9	MSX10 Solar Panel	3-4
3.2-1	Routing and Wiring Sensor Leads to the Datalogger	3-5
3.3-1	SM192/SM716 Storage Module.....	3-6
3.3-2	DC112 Modem with 6362 Surge Protector	3-7
3.3-3	COM100 Cellular Transceiver	3-7
3.3-4	SRM-5A and SC932 at Datalogger	3-9
3.3-5	SRM-5A Wiring.....	3-10
3.3-6	RF95 RF Modem and RF100/RF200 Transceiver	3-11
3.3-7	RF232 Base Station Installation	3-13
3.3-8	MD9 Multidrop Interface	3-13
3.3-9	MD9 Multidrop Interface at the Computer	3-15
3.4-1	Enclosure Supply Kit.....	3-16
4.1-1	Met One 034A Wind Speed and Direction Sensor	4-1
4.2-1	Met One 014A Wind Speed Sensor	4-1
4.3-1	Met One 024A Wind Direction Sensor	4-2
4.4-1	05103 RM Young Wind Monitor	4-2
4.5-1	03001 Mounted to the Mast.....	4-3
4.5-2	03001 Mounted to 019ALU Crossarm.....	4-3
4.6-1	03101 RM Young Wind Sentry Anemometer	4-3
4.7-1	LI200S/LI190SB and LI2003S Leveling Fixture.....	4-4
4.8-1	107 Temperature Probe	4-4
4.10-1	CS500 Temperature and RH Probe	4-5
4.11-1	HMP35C Vaisala Temperature and RH Probe.....	4-6
4.12-1	CS105 Vaisala Barometric Pressure Sensor in a Custom Weather Station Enclosure	4-6
4.12-2	CS105MD Vaisala Barometric Pressure Sensor in a MetData1 Enclosure	4-6
4.13-1	TE525 Texas Electronics Rain Gage	4-7
4.14-1	CS700-L Rain Gage and CM100 Mounting Bracket.....	4-7
4.15-1	SR50 Sonic Ranging Sensor	4-8
4.16-1	CS615 Water Content Reflectometer with CS615G Probe Insertion Guide	4-8
4.17-1	237 Leaf Wetness Sensor	4-9
4.18-1	257 Soil Moisture Sensor	4-9
4.19-1	Magnetic Declination for the Contiguous United States	4-10
4.19-2	Declination Angles East of True North Are Subtracted From 0 to Get True North.....	4-11
4.19-3	Declination Angles West of True North Are Added to 0 to Get True North	4-11

SECTION 1. PREPARATION AND SITING

These guidelines apply to several different Campbell Scientific weather stations.

1.1 INSTALLATION TASKS

1.1.1 INDOORS

- Immediately upon receipt of your shipment...
 - ⇒ Open shipping cartons.
 - ⇒ Check contents against invoice. Contact CSI immediately about any shortages.
- Several days prior to the planned installation date...
 - ⇒ Collect tools and site information (Section 1)
 - ⇒ Assemble datalogger, communications device, and power supply in enclosure (Section 3)
 - ⇒ Install datalogger support software on PC (Section 5)
 - ⇒ Establish communications between the datalogger and the PC (Section 5)
 - ⇒ Program datalogger, test sensors, and retrieve data (Section 5)
 - ⇒ Trial run the tower / tripod installation, assembling as much as possible (Section 2)
 - ⇒ Repackage equipment for transport to the field site

1.1.2 OUTDOORS

- Locate suitable site (Section 1)
- Prepare tower or tripod base (Section 2)
- Tripod and UT10 (3 meter tower) tower stations:
 - ⇒ Raise tripod or tower (Section 2)

⇒ Install instrumentation enclosure (Section 3)

⇒ Install sensors (Section 4)

- UT30 (10 meter tower) tower stations:

⇒ Install 3 to 10 meter level sensors (Section 4)

⇒ Raise tower (Section 2)

⇒ Install instrumentation enclosure (Section 3)

⇒ Install 0 to 3 meter level sensors (Section 4)

- ET101 / ET106 ET Stations:

⇒ Place instrumentation enclosure low on the ET Tower (Section 3)

⇒ Install sensor option (Section 4)

⇒ Slide enclosure to top of tower and secure with correct orientation (Section 3)

1.2 TOOLS REQUIRED

Tools required to install and maintain a weather station are listed below.

1.2.1 TOOLS FOR TOWER INSTALLATION

All Towers

Shovel

Rake

Open end wrenches: 3/8", 7/16", 1/2",
(2) 9/16"

Magnetic compass

6' Step ladder

CM6/CM10

Tape measure (12')

Level (12" to 24")

Small sledge hammer

Teflon tape or pipe dope

Allen hex wrench (5/64)

SECTION 1. PREPARATION AND SITING

UT10

Tape measure (12' to 20')

Level (24" to 36")

Pick or digging bar

Claw Hammer

Materials for concrete form:

Hand saw

(4) 12" wood stakes

(1) 2"x 4"x 8' piece of lumber

(8) 8p double-head nails

(8) 16p double-head nails

Concrete trowels

(2) 1 to 1.5" thick x 24" boards

to support base above

forms (optional)

Concrete (0.4 cubic yards)

ET Tower

Tape measure (12' to 20')

Claw hammer

Level (24" to 36")

Hand saw

Materials for concrete form:

(4) 1" x 2" x 12" stakes

(2) 2" x 4" x 96" lumber

(12) 8p double-head nails

(8) 16p double-head nails

20 ft form wire

½ Yard concrete

Concrete trowel, edger

Electrical Fish tape or 20 feet of

small diameter rope

Wheelbarrow

UT30

Tape measure (12' and 20')

Nut driver (3/8")

Level (36" to 48")

Small sledge hammer

Pliers

Tie wire

Climbing harness

Hard hat

Haul rope (50')

Non-stretch line (20')

Wire rope cutters

Materials for B18 Base and UTEYE Anchors:

(4) Wood stakes 12"

Pick or digging bar

Concrete form materials (2"x 4"

lumber, stakes, saw,

hammer, nails, etc.)

Concrete trowel and edger

Materials for UTDUK Duckbill Anchors

Sledgehammer

Highlift jack

Chain (to attach jack to anchor loops)

Materials for RFM18 Base:

(3) anchors appropriate for mounting surface

(3) bolts and washers to secure base to anchors

1.2.2 TOOLS FOR INSTRUMENTATION AND MAINTENANCE

All Towers

Lock and key for enclosure

Magnetic declination angle (Section 4)

Magnetic compass

Straight bit screwdrivers (small, medium, large)

Phillips-head screwdrivers (small, medium)

Small diagonal side-cuts

Needle-nose pliers

Wire strippers

Pocket knife

Calculator

Volt / Ohm Meter

Electrical Tape

Step ladder (6')

Datalogger prompt sheet (Section 6)

Station manuals

Station log and pen

Open end wrenches: 3/8", 7/16", ½", (2) 9/16"

Socket wrench and 7/16" deep well socket

Adjustable wrench

Pliers

Conduit and associated tools (as required)

Felt-tipped marking pen

Claw hammer

Pipe wrench (12")

CM6/CM10

Tape measure (12')

Level (12" to 24")

Teflon tape or pipe dope

UT10

Tape measure (12' to 20')

3/8" nut driver

Level (24" to 36")

Teflon tape or pipe dope

(12) ¼" washers (for the 015 Crossarm stand only)

Allen wrench set

UT30

Tape measure (12' to 20')
 3/8" nut driver
 Level (36" to 48")
 Pliers
 Climbing harness
 Hard hats
 50' haul rope
 Crescent wrench
 Channel-lock pliers
 1/4" washers (spacers for U-bolts)
 5/64" Allen hex wrench

1.2.3 SUPPLIES FOR POWER AND COMMUNICATIONS OPTIONS

AC Power

Wire, conduit, and junction boxes as needed

Phone Modem

Hayes compatible calling modem for PC
 Phone line to weather station or junction box

Short-Haul Modem

4 Conductor communications cable from PC to weather station or junction box
 6' copper ground rod and clamp for PC surge protection (optional)

1.3 SITING AND EXPOSURE

CAUTION: If any part of the weather station comes in contact with power lines, you could be killed. Contact local utilities for the location of buried utility lines before digging or driving ground rods.

Selecting an appropriate site for the weather station is critical in order to obtain accurate meteorological data. In general, the site should be representative of the general area of interest, and away from the influence of obstructions such as buildings and trees.

The weather station should not be located where sprinkler irrigation water will strike sensors or instrument enclosure.

Some general guidelines for site selection are listed below, which were condensed from EPA (1988)¹, WMO (1983)², and AASC (1985)³ publications.

1.3.1 WIND SPEED AND DIRECTION

Wind sensors should be located over open level terrain, and at a distance of at least ten times (EPA) the height of any nearby building, tree or other obstruction, as illustrated in Figure 1.3-1.

Standard measurement heights:

3.0 m $\pm$ 0.1 m recommended (AASC)
 2.0 m $\pm$ 0.1 m, 10.0 m $\pm$ 0.5 m optional (AASC)
 10.0 m (WMO and EPA)

1.3.2 TEMPERATURE AND RELATIVE HUMIDITY

Sensors should be located over an open level area at least 9 m (EPA) in diameter. The surface should be covered by short grass, or where grass does not grow, the natural earth surface. Sensors should be located at a distance of at least four times the height of any nearby obstruction and at least 30 m (EPA) from large paved areas. Sensors should be protected from thermal radiation, and adequately ventilated.

Situations to avoid include:

- large industrial heat sources
- rooftops
- steep slopes
- sheltered hollows
- high vegetation
- shaded areas
- swamps
- areas where snow drifts occur
- low places holding standing water after rains

Standard measurement heights:

1.5 m $\pm$ 1.0 m (AASC)
 1.25 - 2.0 m (WMO)
 2.0 m temperature (EPA)
 2.0 m and 10.0 m for temperature difference (EPA)

1.3.3 PRECIPITATION

A rain gage should be sited on level ground that is covered with short grass or gravel. In open areas, the distance to obstructions should be two to four times (EPA, AASC) the height of the obstruction.

The height of the opening should be as low as possible, but should be high enough to avoid splashing from the ground. Wind shields, such as those used by the National Weather Service, are recommended for open areas.

SECTION 1. PREPARATION AND SITING

Collectors should be heated, if necessary, to properly measure frozen precipitation. The gage must be mounted above the average level of snow accumulation in areas that experience significant snowfall.

Standard measurement heights:

1.0 m $\pm$ 1.0 cm (AASC)

30.0 cm minimum (WMO, EPA)

1.3.4 SOLAR RADIATION

Pyranometers should be located to avoid shadows on the sensor at any time. Mounting it on the southern most (northern hemisphere) portion of the weather station will minimize the

chance of shading from other weather station structures. Reflective surfaces and sources of artificial radiation should be avoided. The height at which the sensor is mounted is not critical.

1.3.5 SOIL TEMPERATURE

The measurement site for soil temperature should be at least 1 m² and typical of the surface of interest. The ground surface should be level with respect to the immediate area (10 m radius).

Standard measurement depths:

10.0 cm $\pm$ 1.0 cm (AASC)

5.0 cm, 10.0 cm, 50.0 cm, 100.0 cm (WMO)

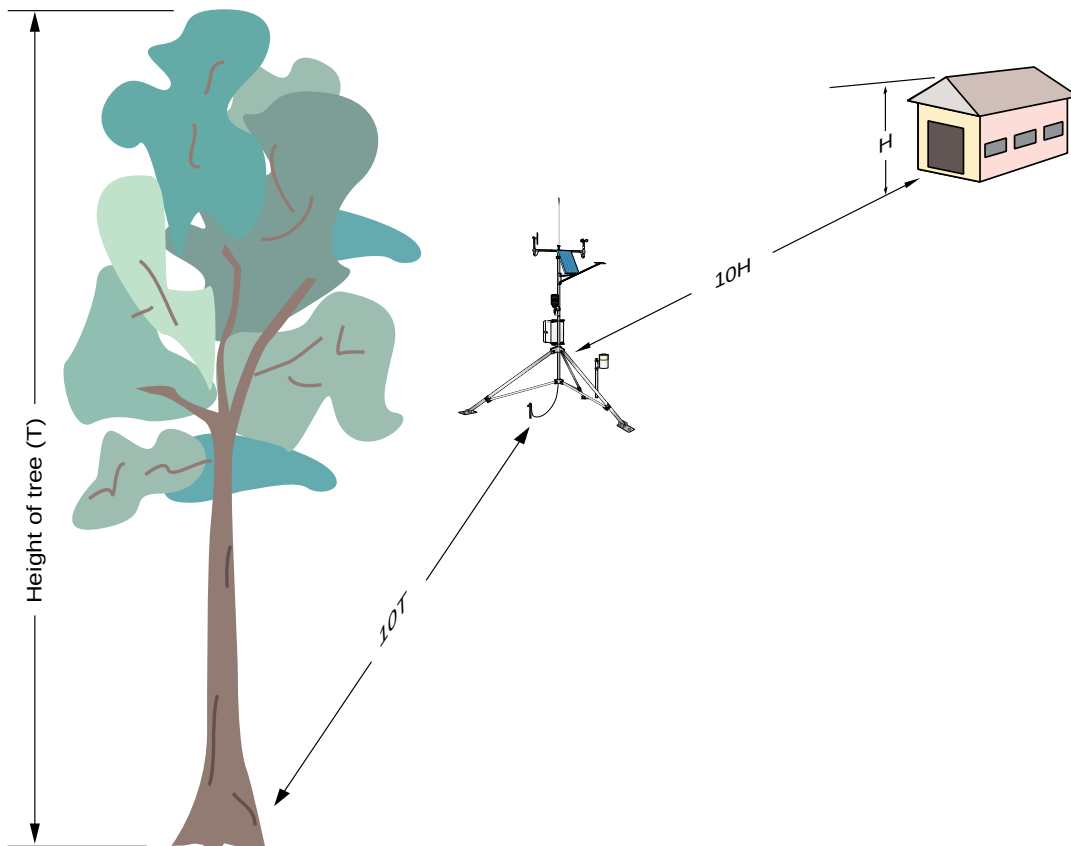


FIGURE 1.3-1. Effect of Structure on Wind Flow

1.4 DETERMINING TRUE NORTH FOR WIND VANE ORIENTATION

Magnetic declination, or other methods to find True North, should be determined prior to installing the weather station. True North is usually found by reading a magnetic compass and applying the correction for magnetic declination*; where magnetic declination is the number of degrees between True North and Magnetic North. Magnetic declination for a specific site can be obtained from a USFA map, local airport, or through an internet service called NSSDC CGM (Section 1.4.1). A general map showing magnetic declination for the contiguous United States is shown in Figure 1.4-1.

Declination angles east of True North are considered negative, and are subtracted from 0 degrees to get True North as shown Figure 1.4-2. Declination angles west of True North are considered positive, and are added to 0 degrees to get True North as shown in Figure 1.4-3. For example, the declination for Logan, Utah is 14.5° East. True North is $360^\circ - 14.5^\circ$, or 345.5° as read on a compass.

* Other methods employ observations using the North Star or the sun, and are discussed in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV - Meteorological Measurements⁴.

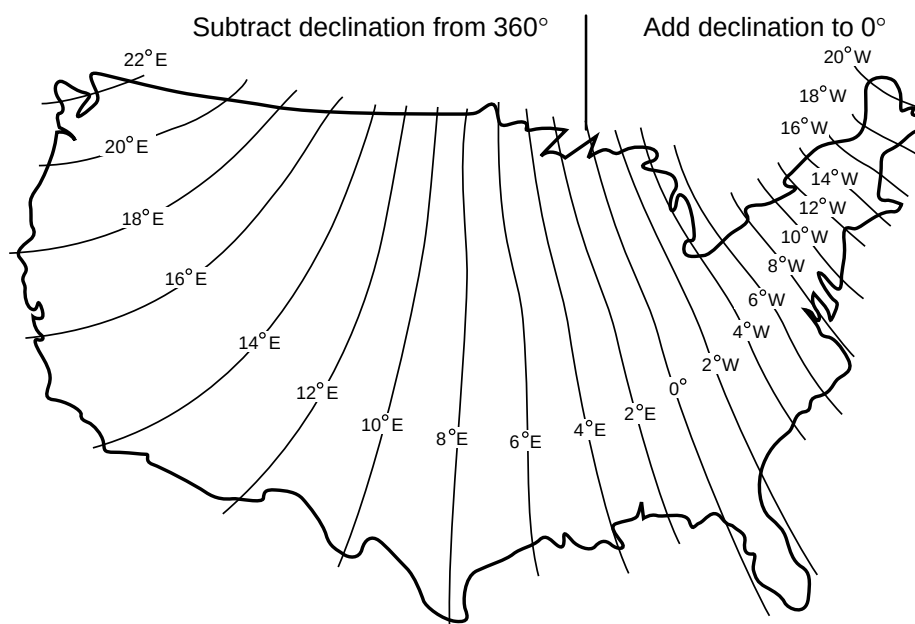


FIGURE 1.4-1. Magnetic Declination for the Contiguous United States

SECTION 1. PREPARATION AND SITING

1.4.1 NSSDC CGM SERVICE

The NSSDC CGM (Corrected Geomagnetic) Service provides an easy way of determining magnetic declination of a specific site. Since magnetic declination fluctuates with time, it should be determined each time the wind vane orientation is adjusted. It can be accessed on the world wide web at

<http://nssdc.gsfc.nasa.gov/space/cgm/cgm.html>

If you know the latitude and longitude of your site, fill out Form 1 as shown below for an accurate magnetic declination. If you do not know the latitude and longitude of your site, fill out Form 2 for estimate of magnetic declination. Note that longitude is expressed in 0 to 360 degrees east of the Greenwich prime meridian, and that north latitudes are positive.

Query Form 1: Latitude/Longitude

Latitude/Longitude below specified in:

Geographic

Year (from 1945 to 2000): 1998

Altitude above Earth's surface (km) [from 0. to 40000.]: 0

Latitude (degrees) [from -90.00 to 90.00]: 42.03

Longitude (degrees) [from 0.00 to 360.00]: 248.15

Query Form 2: Image Map

Year (from 1945 to 2000): 1998

Altitude above Earth's surface (km) [0. - 40000.]: 0

Click on map to specify location and submit: (select area on map provided)

A table containing similar information to the following will be returned after submitting Forms 1 or 2.

Geographic		Alt.	CGM		IGRF Magnetic Field			Dipole	
Lat.	Long.	(km)	Lat.	Long.	H(nT)	D(deg)	Z(nt)	Lat.	Long.
42.03	248.15	0.	49.80	311.06	20608.	14.417	50505.	49.68	312.14

SECTION 1. PREPARATION AND SITING

Magnetic declination is bold in this example to show its location in the table. A positive declination is east, while a negative declination is west. The declination in this example is 14.417 degrees. As shown in Figure 1.4-1, the declination for Logan, UT is east, so True North for this site is $360 - 14.417$, or 345.5 degrees.

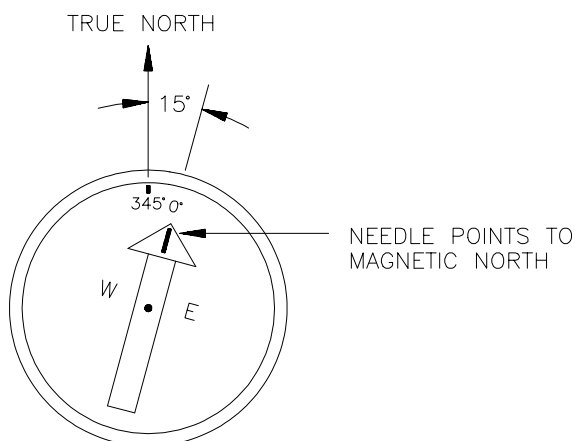


FIGURE 1.4-2. Declination Angles East of True North Are Subtracted From 0 to Get True North

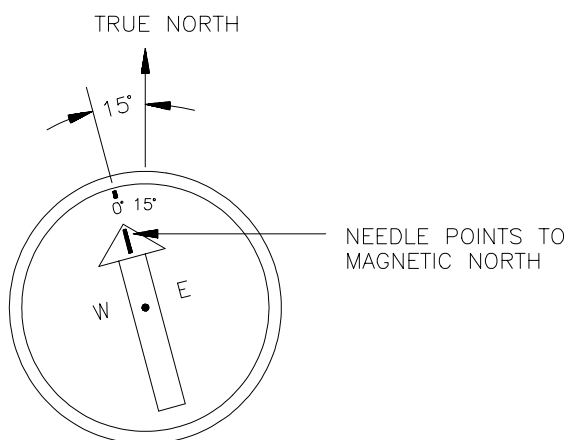


FIGURE 1.4-3. Declination Angles West of True North Are Added to 0 to Get True North

References

¹ EPA, (1987). On-Site Meteorological Program Guidance for Regulatory Modeling Applications, EPA-450/4-87-013. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

² WMO, (1983). Guide to Meteorological Instruments and Methods of Observation. World Meteorological Organization No. 8, 5th edition, Geneva, Switzerland.

³ The State Climatologist, (1985) Publication of the American Association of State Climatologists: Height and Exposure Standards for Sensors on Automated Weather Stations, v. 9, No. 4 October, 1985.

⁴ EPA, (1989). Quality Assurance Handbook for Air Pollution Measurement Systems, EPA Office of Research and Development, Research Triangle Park, North Carolina 27711.

SECTION 2. CM6/CM10 TRIPOD INSTALLATION

The CM6 and CM10 tripods provide a support structure for mounting weather station components. Figure 2-1 shows a typical guyed CM10 tripod weather station equipped with instrumentation enclosure, meteorological sensors, and solar panel.

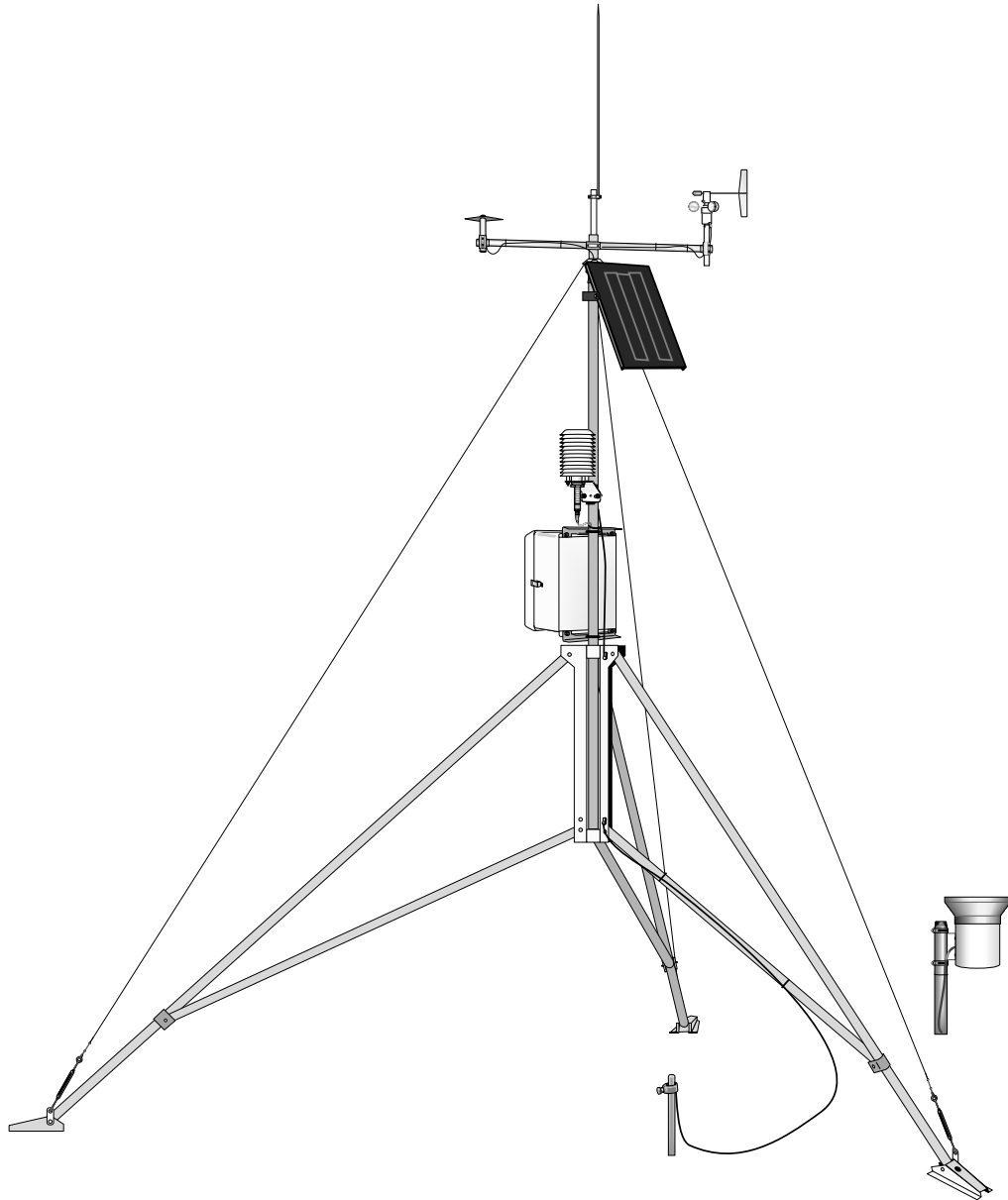


FIGURE 2-1. CM10 Weather Station

SECTION 2. TRIPOD INSTALLATION

2.1 SPECIFICATIONS

CM6 Tripod

Maximum height (zero leg extension)	7.5 feet
Minimum height (full leg extension)	5.5 feet
Wind Load (Wind Sensors at 2 meters)*	
Maximum wind load	100 mph
Gust survival	130 mph
Tripod Leg Diameter (See Table 1-5)	
d = diameter	
h = height at top of bell reducer	
$d = 2 (4.834 + (54.5^2 - (h - 42.4)^2)^{0.5})$	

CM10 Tripod

Maximum height (zero leg extension)	11 feet
Minimum height (full leg extension)	7.2 feet
Wind Load (Wind Sensors at 3 meters)*	
No Guy Wires	
Maximum	70 mph
Gust survival	100 mph
With Guy Wires	
Maximum	120 mph
Gust survival	150 mph
Tripod Leg Diameter (See Table 1-6)	
d = diameter	
h = height at top of bell reducer	
$d = 2 (4.834 + (78.75^2 - (h - 62.35)^2)^{0.5})$	

*Wind Load data assumes 4.5 ft² of area placed at the top of the tripod mast

TABLE 2-1. CM6 Heights and Leg Diameters

Height mark is 1 1/4 inch above bell reducer

Height (In)	Diameter (In)
70	104 6/8
72	102 3/8
74	99 6/8
76	97
78	93 6/8

TABLE 2-2. CM10 Heights and Leg Diameters

Height (In)	Diameter (In)
109	138
111	135 1/8
113	131 7/8
115	128 1/2
117	125

2.2 TRIPOD PARTS

Tripods are either shipped complete and mostly assembled (CM6 or CM10), or as a kit that requires the user to supply some parts (CM10K).

If a preassembled CM6 or CM10 Tripod was ordered, the following parts should have been received:

- (1) Tripod Base Assemble
- (1) Mast Assembly
- (1) Cross Arm Mount (Short Pipe)
- (1) Lightning Rod with Clamp
- (1) Grounding Rod with Clamp
- (1) 5 ft 4 AWG Wire
- (1) 4 ft 12 AWG Wire
- (3) Hold Down Stakes
- (12) Cable Ties

If the CM10K Tripod Kit was received, first assemble the tripod base assembly and mast assembly according to Section 1 in the CM10K Tripod Kit Manual.

The following items are also part of the CM10K Tripod Kit:

- (1) Cross Arm Mount (Short Pipe)
- (1) Lightning Rod with Clamp
- (1) Grounding Rod with Clamp

The following items need to be procured to complete the CM10K Tripod Kit:

- (1) 5 ft 4 AWG Wire
- (1) 4 ft 12 AWG Wire
- (3) Hold Down Stakes
- (12) Cable Ties

2.3 TRIPOD INSTALLATION

CM6 and CM10 tripods are designed to allow installation in many types of terrain. The following installation instructions, however, assume an installation on flat and reasonably level ground.

1. Prepare the area where the tripod will be installed. In most installations, the tripod requires an area 9 feet (CM6) or 12 feet (CM10) in diameter. Natural vegetation and the ground surface should be disturbed as little as possible, but brush and tall weeds should be removed.
2. Lay the tripod base and mast assemblies on the ground. Apply pipe dope or Teflon tape to threads on the crossarm mount (short pipe) and the 1 1/4 inch end of the mast. To prevent cross-threading, hand thread the crossarm mount into the mast's bell reducer and then tighten with a pipe wrench. Hand thread the mast into the threaded coupling on the tripod center bracket and then tighten with a pipe wrench.
3. Using a tape measure and a felt-tipped pen, mark the tripod legs to indicate how far they should extend. From the end of the 3/4" pipe that attaches to the foot (Figure 2-2), measure up 23" on the CM10, or 26" on the CM6, and mark each leg with a felt tip pen.
4. Each leg has a slide collar with a single bolt for loosening or tightening the collar (Figure 2-2). Loosen the bolt on each collar with a 1/2" wrench.

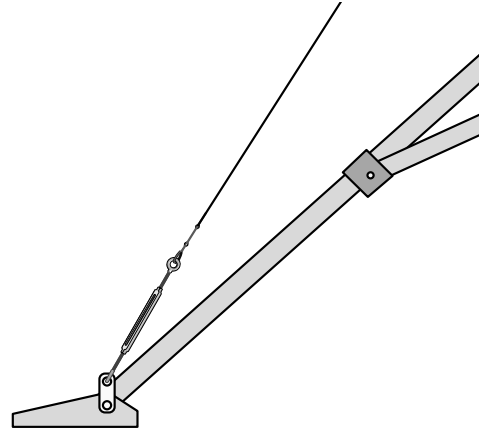


FIGURE 2-2. Extending the Tripod Legs

5. Stand the tripod upright and orient it so one leg points south (Figure 2-3). Extend the leg until the top of the slide collar is even with the mark from Step 3 and tighten the bolt. Extend the other legs in the same manner.
 6. Plumb the mast by adjusting the south and northeast facing legs. Loosen the slide-collar bolt on the south facing leg. With the level on the south side of the mast, adjust the leg so the level reads plumb, then tighten the bolt. Repeat the same procedure for the northeast facing leg with the level on the east side of the mast.
- NOTE:** Adjusting the legs can be made easier by spraying the slide collar and leg with a silicon spray, and tapping on the leg with a hammer.
7. Three rebar stakes are provided for securing the tripod to the ground. Drive the stakes through the holes in the feet. Some users prefer to drive 4 foot "T" posts next to each leg, and attach the legs to the posts with 2" u-bolts.

SECTION 2. TRIPOD INSTALLATION

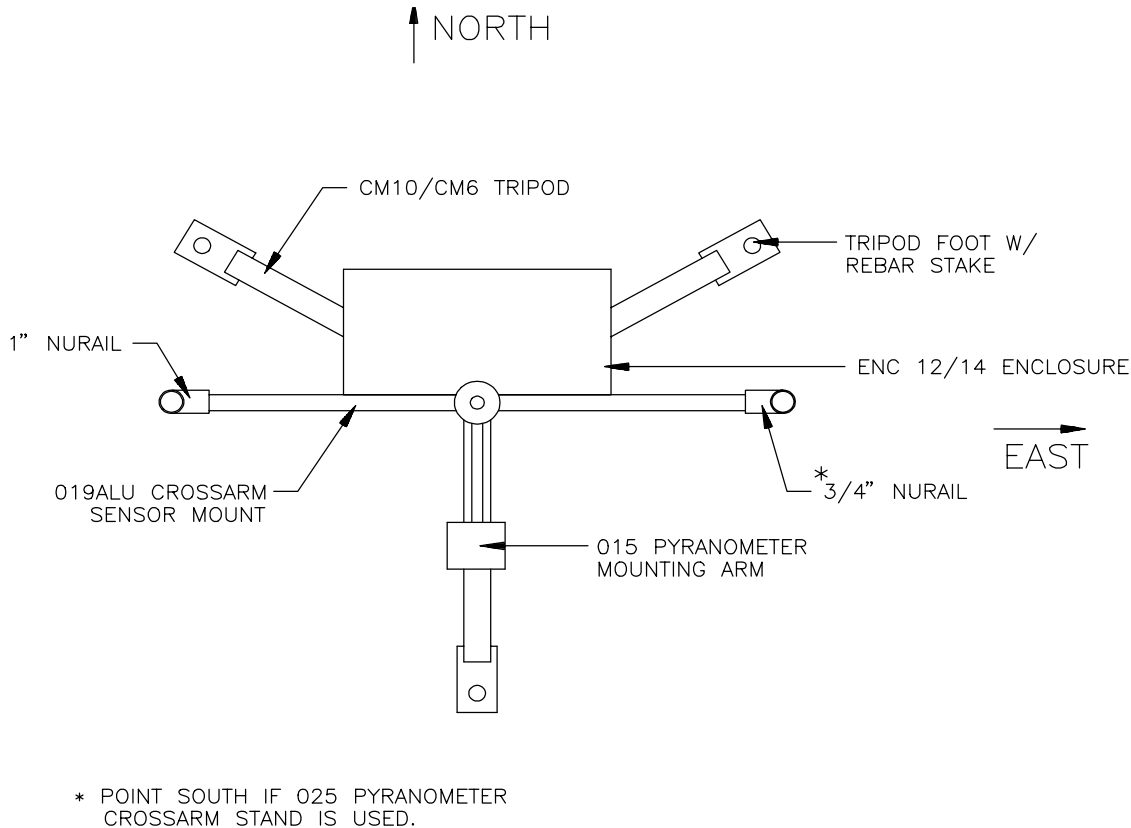


FIGURE 2-3. Tripod and Component Orientation

2.4 TRIPOD GROUNDING

Ground the tripod and shown in Figures 2-1, 2-4, and 2-5.

1. Drive the ground rod close to the center of the tripod using a fence post driver or sledge hammer. Slide the clamp down the rod before driving it in the ground. This will eliminate the frustration of trying to get the clamp to fit over a hammer damaged rod end. Drive the rod at an angle if an impenetrable hardpan layer exists. In hard clay soils, a gallon jug of water can be used to "prime" the soil and hole to make driving the rod easier.
2. Loosen the bolt that attaches the clamp to the ground rod. Strip 1 inch of insulation from one end of the 4 AWG wire and insert it between the rod and the clamp. Tighten the clamp bolt (Figure 2-4).

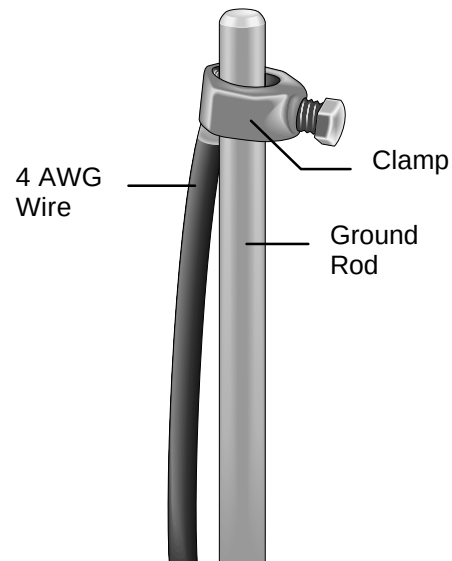


FIGURE 2-4. Ground Rod and Clamp

SECTION 2. TRIPOD INSTALLATION

3. Loosen the set screws in the two brass ground lugs attached to the center bracket of the tripod (Figure 2-5). Strip 1 inch of insulation from the other end of the 4 AWG wire and insert it into the lower ground lug. Tighten the set screw. Strip 1 inch of insulation from one end of the 12 AWG wire and insert it into the upper ground lug. Tighten the set screw. The other end of the 12 AWG wire will attach to the ground lug of the instrumentation enclosure.
4. Attach the lightning rod to the mast as shown in Figure 2-1. If the weather station includes an 019ALU crossarm, attach it to the mast first, as described in Section 2.2-1 of the weather station installation manual. Loosen the two screws on the lightning rod mounting bracket. Position the mounting bracket 4 inches down from the top of the mast, then tighten both screws evenly. Make sure the lightning rod set screw is tight.

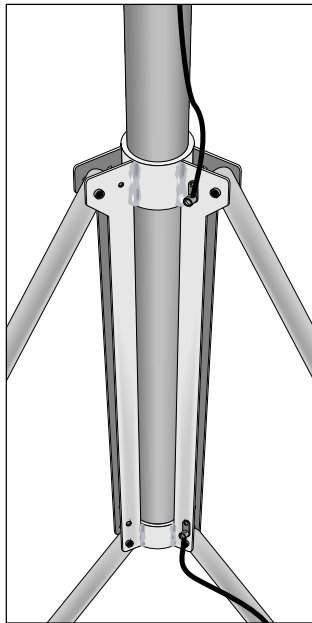


FIGURE 2-5. Tripod Ground Connections

2.5 CM10 GUY KIT INSTALLATION

The CM10 Guy Kit is an option when purchasing the CM10 Tripod or CM10K Tripod Kit. It can be installed to improve the CM10 Tripod wind load rating. Table 2-3 lists items in the CM10 Guy Kit.

TABLE 2-3. CM10 Guy Kit Parts

Item #	CSI Part #	Description	Quantity
G1	10845	Wire Rope	3
G2	10846	Turnbuckle	3
G3	10848	Top Plate	1
G4	10849	Bottom Plate	3
G5	6131	Thimble	6
G6	6132	U-Bolt	12

Install the guy kit as shown in Figure 2-6.



FIGURE 2-6. Guy Wire Installation

1. Construct an assembly consisting of the top plate, wire ropes, 3 thimbles, and 6 u-bolts.
 - a. Place a thimble into each of the three small holes of the top plate. Twist each thimble slightly, as shown in Figure 2-7, to accomplish this.
 - b. Thread a piece of wire rope through each of the three small top plate holes. Double the wire rope back on itself about 8 inches. Clamp the doubled wire with two u-bolts per wire, forming a loop. Fit the wire loop into the thimble groove. Adjust the u-bolts as needed. Once the thimble and wire loop are fitted together, tighten the u-bolts to secure the clamps.

SECTION 2. TRIPOD INSTALLATION

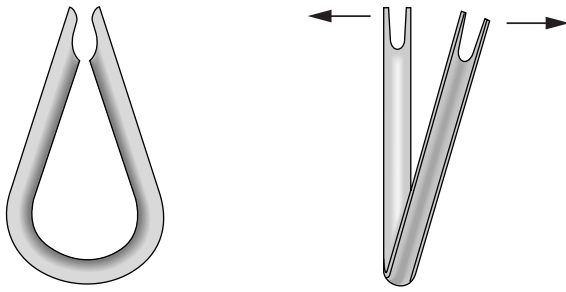


FIGURE 2-7. Thimble Twisting

2. Slide the top plate down the crossarm mount so that it rests on the bell reducer.
3. Attach the 3 bottom plates to the tripod feet with the existing tripod foot bolts. Make certain that each bottom plate is oriented such that the second hole is above the tripod foot.
4. Extend each turnbuckle to its functional limit
5. Attach the loop-end of the turnbuckles to the free end of each wire rope as shown in Figure 2-8. Use the remaining thimbles and u-bolts as done in step 1. Only finger-tighten the u-bolts, however.



FIGURE 2-8. Turnbuckle Assembly

6. Place the hook-end of each turnbuckle into a bottom plate, in an orderly fashion, so that each wire rope spans to the top plate untangled and unobstructed.

7. Sequentially pull the free end of the wire ropes to tighten each turnbuckle loop. When each is as hand tight as possible, tighten the u-bolts to secure the clamps.
8. Tighten the turnbuckles sequentially, one turn per cycle. Only tighten the turnbuckles until the wire rope is taught. **DO NOT OVER TIGHTEN!** The turnbuckles and wire rope are strong enough to buckle the mast if over tightened.
9. Check plumbness of the mast and adjust the guy wire tightness as needed.

2.6 SENSOR MOUNTING BRACKETS

Mounting brackets provide a means of mounting the sensors to the tripod. Bracket mounting heights are referenced from the top of the bell reducer; orientation is shown in Figure 2-3.

2.6.1 019ALU CROSSARM SENSOR MOUNT

Attach the 019ALU to the mast as shown in Figure 2-9.

Slide the center NU-RAIL connector of the 019ALU down the crossarm mount (short pipe) until it rests on top of the bell reducer. In most applications, the center of the NU-RAIL connector should be about 113" above the ground surface. Orient the 019ALU in a East/West direction with the 3/4" NU-RAIL facing East (northern hemisphere) and tighten the set screws. If the 025 Crossarm Stand is used (Section 2.6.4), orient the 019ALU North-South with the 3/4" NU-RAIL facing South.

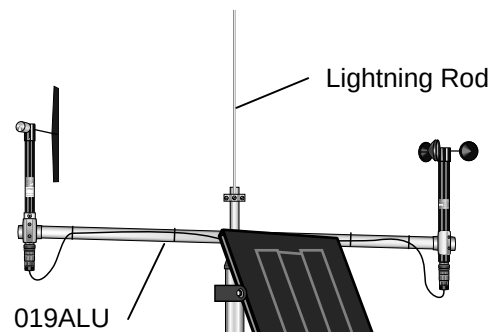


FIGURE 2-9. 019ALU Crossarm and Lightning Rod

SECTION 2. TRIPOD INSTALLATION

2.6.2 GILL RADIATION SHIELDS

Attach the Gill Radiation Shield (41002, 41004 and 41301) to the mast as shown in Figure 2-10.

Position the radiation shield on the side of the mast that faces the prevailing wind, with the top of the black plastic mounting base 36" down from the top of the bell reducer on the CM10, or against the bottom of the bell reducer on the CM6.

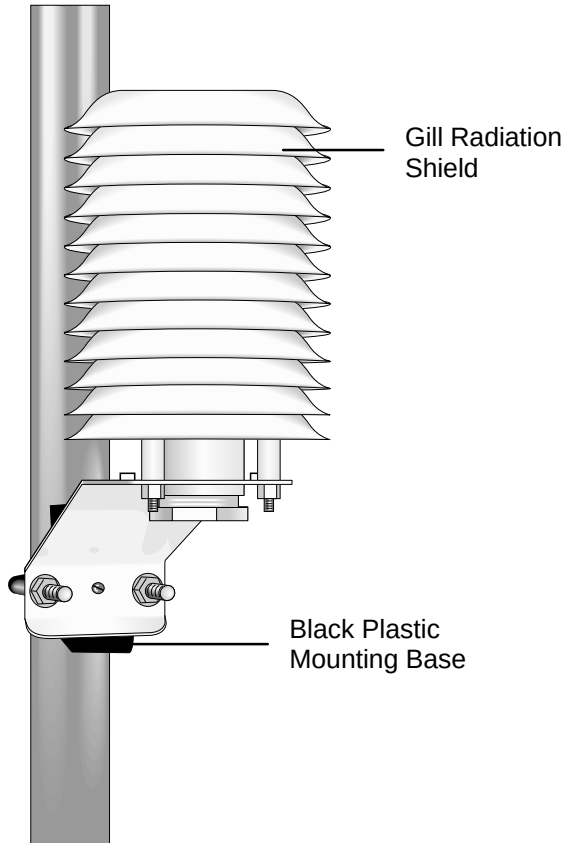


FIGURE 2-10. Gill Radiation Shield

2.6.3 015 PYRANOMETER MOUNTING ARM

Attach the 015 Pyranometer Mounting Arm to the mast as shown in Figure 2-11.

Position the 015 on the south side of the mast (northern hemisphere), with the top of the mounting base 17" down from the top of the bell reducer on the CM10, or 3 1/2" down on the CM6.

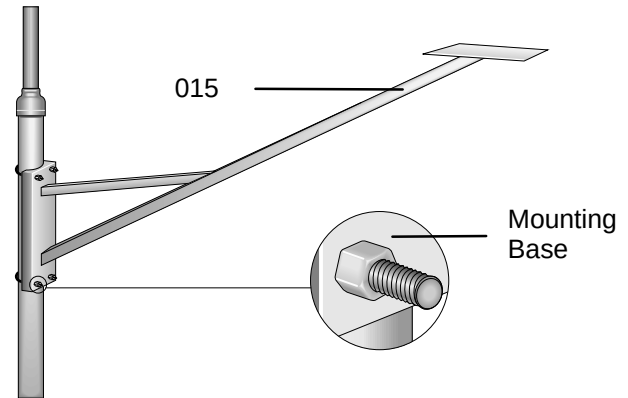


FIGURE 2-11. 015 Pyranometer Mounting Arm

2.6.4 025 PYRANOMETER CROSSARM STAND

Attach the 025 Pyranometer Crossarm Stand to the 019ALU as shown in Figure 2-12.

Position the mounting plate 5" above the 3/4" NU-RAIL and tighten the set screws.

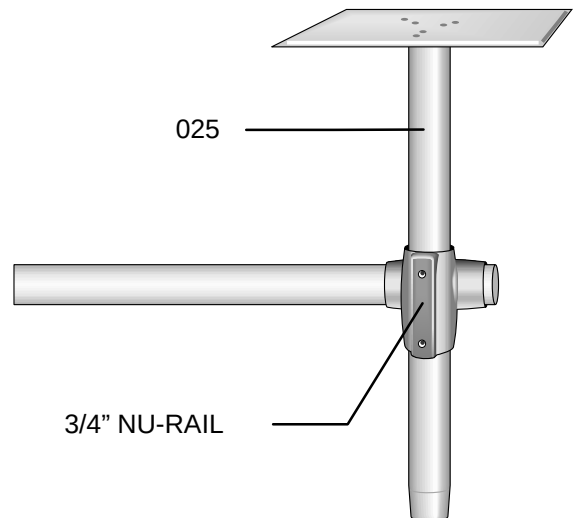


FIGURE 2-12. 025 Pyranometer Crossarm Stand

SECTION 3. INSTRUMENTATION INSTALLATION

3.1 ENCLOSURE, DATALOGGER, POWER SUPPLY

3.1.1 ENCLOSURE

All instrumentation (datalogger, power supply, and communication peripherals) are mounted in the enclosure. A PVC bulkhead port is installed in the enclosure for routing the sensor and communication cables to the instrumentation.

Mount the enclosure to the mast as shown in Figure 3.1-1.

1. Position the enclosure on the north side of the mast or tower (northern hemisphere) as shown in Figure 3.1-1, 3.1-2, or 3.1-3. Attach the enclosure with the U-bolts provided.
2. Route the 14 AWG wire from the brass tripod grounding clamp (Section 2) to the enclosure grounding lug. Strip one inch of insulation from each end of the wire and insert the end of the wire into the grounding lugs and tighten the set screws.

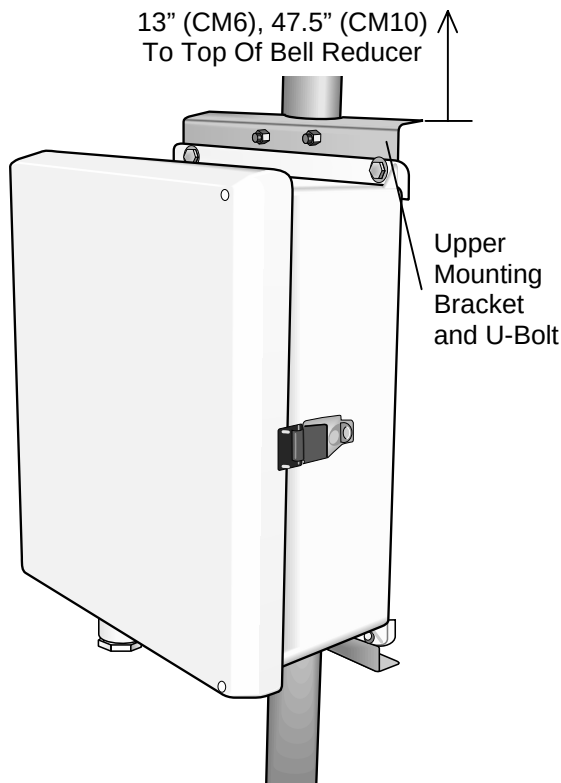


FIGURE 3.1-1. ENC 12/14 Enclosure on CM6/CM10

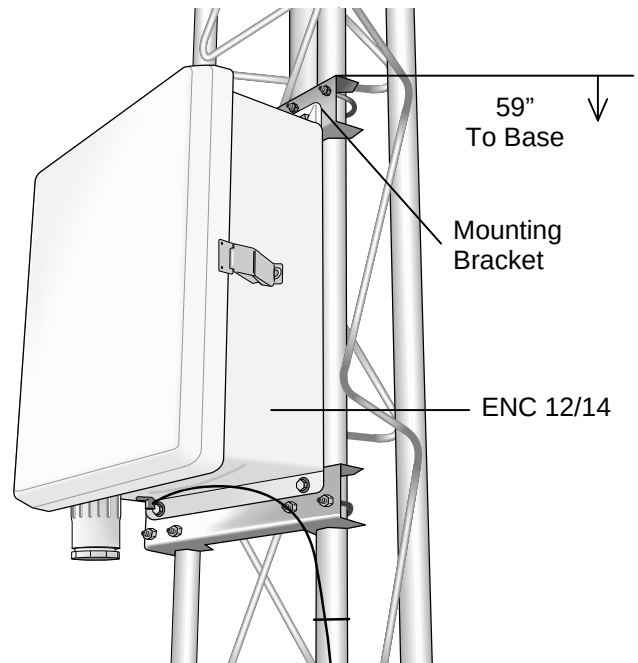


FIGURE 3.1-2. ENC 12/14 Enclosure on UT10

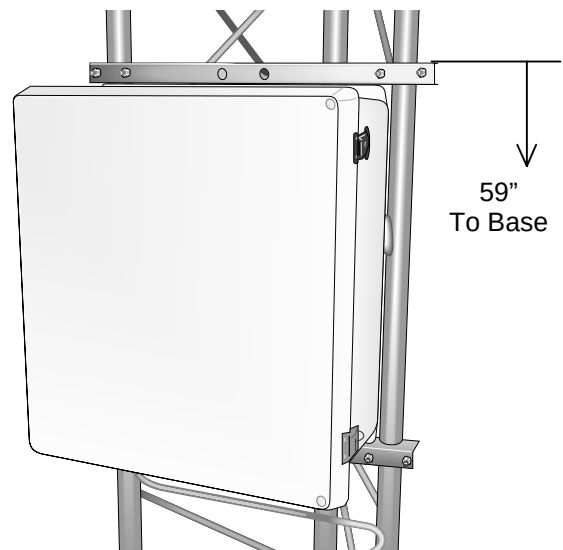


FIGURE 3.1-3. ENC 16/18 Enclosure on UT30

SECTION 3. INSTRUMENTATION INSTALLATION

3.1.2 CR10X DATALOGGER

The CR10X Datalogger and PS12 12 V Power Supply mount to the enclosure backplate as shown in Figure 3.1-7. Two screws (PN 447) attach the CR10X, four screws (PN 505) attach the PS12.

3.1.3 BPALK ALKALINE POWER SUPPLY

The BPALK battery pack houses eight alkaline "D" cell batteries. To install the batteries, loosen the thumb screw and remove the cover (Figure 3.1-7).

1. Make sure the red and black wires attached to the left end of the BPALK are connected to the "12 V" and "G" terminals on the CR10X.
2. Disconnect the battery pack from the external connector on the left end of the BPALK. Remove the battery pack and insert eight alkaline "D" cell batteries. Replace the battery pack.
3. Connect the battery pack to the external connector labeled "INTERNAL BATTERY" and replace the cover.

3.1.4 PS12LA RECHARGEABLE POWER SUPPLY

The PS12LA houses a sealed monoblock rechargeable battery. To install the battery, loosen the two thumb screws and remove the cover (Figure 3.1-8).

1. With the PS12 power switch "OFF", insert the battery and plug the battery lead into the connector labeled "INT".
2. Make sure the red and black wires attached to the "+12 V" and "G" terminals on the PS12 are connected to the "12 V" and "G" terminals on the CR10X Wiring Panel.
3. An AC transformer or unregulated solar panel (Section 3.1-5) should be connected to the PS12LA at all times. Connect the lead wires from the transformer or solar panel without regard to polarity to the two terminals labeled "CHG" (Figure 3.1-8); the red LED should light when voltage is present.

NOTE: The wall transformer converts 120 VAC input to 18 VAC output. Maximum charging current is 1.1 A.

WARNING: Maximum input voltage into the "CHG" terminals is 26 VAC or 26 VDC. Do not connect 110 VAC directly to "CHG" terminals.

4. Turn power switch to "ON", and replace cover.

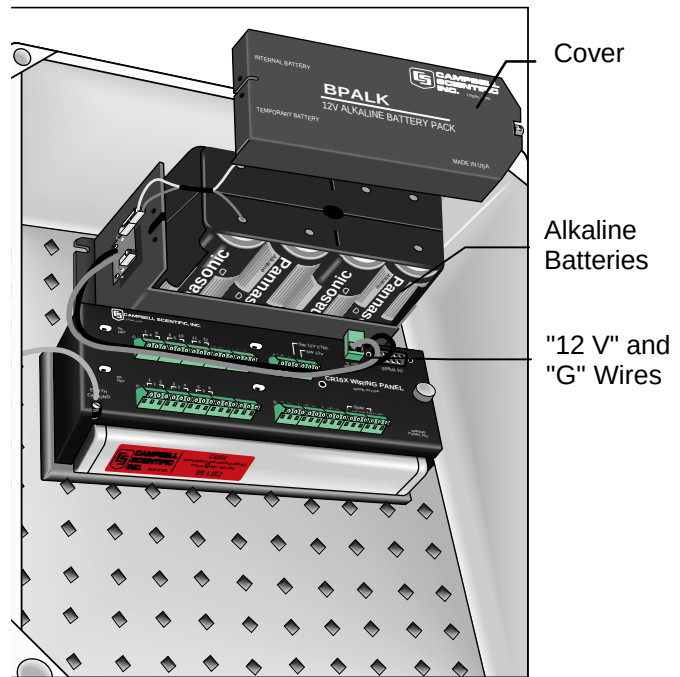


FIGURE 3.1-7. BPALK 12 Volt Power Supply

3.1.5 MSX10 SOLAR PANEL

Solar panels purchased from CSI are shipped with a charge plug taped to the back of the panel. The charge plug is not used with the PS12LA. Refer to the solar panel manual for installation instructions.

1. Mount the MSX10 solar panel to the mast, facing south (northern hemisphere) as shown in Figure 3.1-9. Position the MSX10 at the top of the 1 1/4 inch diameter section of the mast. Install the U-bolt, muffler clamp, and nuts as shown in Figure 3.1-9.
2. The solar panel should be oriented to receive maximum insolation over the course of the year. Suggested tilt angles (referenced to the horizontal plane) are listed below.

Site Latitude	Tilt Angle
0 - 10 degrees	10 degrees
11 - 20	Latitude + 5 degrees
21 - 45	Latitude + 10 degrees
46 - 65	Latitude + 15 degrees
> 65	80 degrees

SECTION 3. INSTRUMENTATION INSTALLATION

3. After determining the tilt angle, loosen the two bolts that attach the mounting bracket to the panel. Adjust the angle, then tighten the bolts. Secure the lead wire to the mast using wire ties.

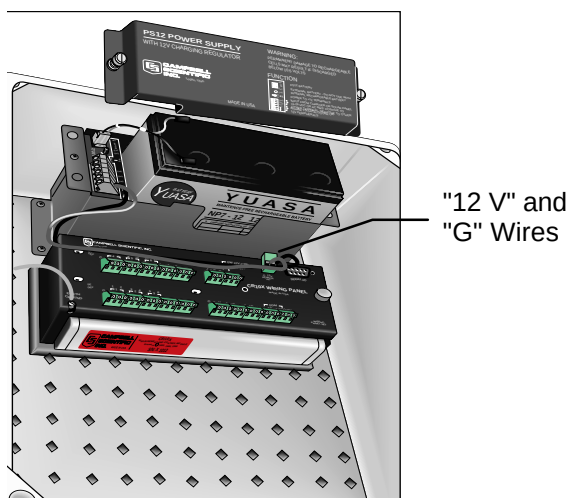
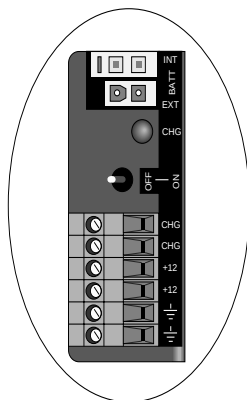


FIGURE 3.1-8. PS12LA 12 Volt Power Supply

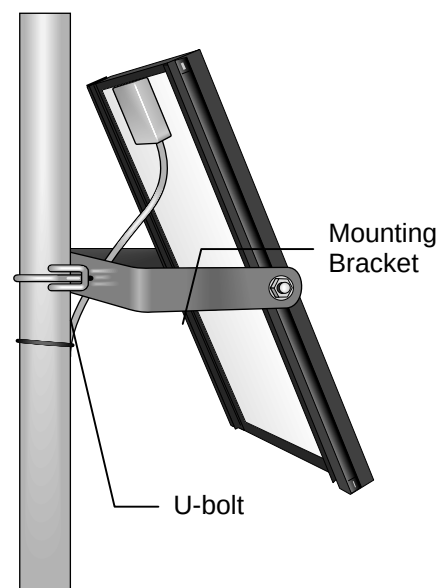


FIGURE 3.1-9. MSX10 Solar Panel

3.2 SENSOR CONNECTION

1. After the sensors have been mounted, route the sensor leads through the entry hole in the bottom of the enclosure and to the datalogger. Secure the leads to the left side of the enclosure using cable ties and tabs (Figure 3.2-1). Any excess cable should be neatly coiled and secured to the tabs.
2. To connect a lead wire, loosen the appropriate screw terminal and insert the lead wire (wires should be stripped 5/16"), and tighten the screw using the screwdriver provided with the datalogger.

If a datalogger program has been developed, the sensors will have to be wired to the channels specified by the measurement instructions.

If a program has not been developed, Short Cut can be used to generate a program and wiring diagram. Run Short Cut, and wire the sensor leads as specified by the wiring diagram in the .DEF file.

For more complex programming, or when sensors are used which are not supported by Short Cut, EDLOG (PC208 Software) must be used. If desired, wire the sensors and develop the program using EDLOG and the measurement instructions as shown in Section 5.

SECTION 3. INSTRUMENTATION INSTALLATION

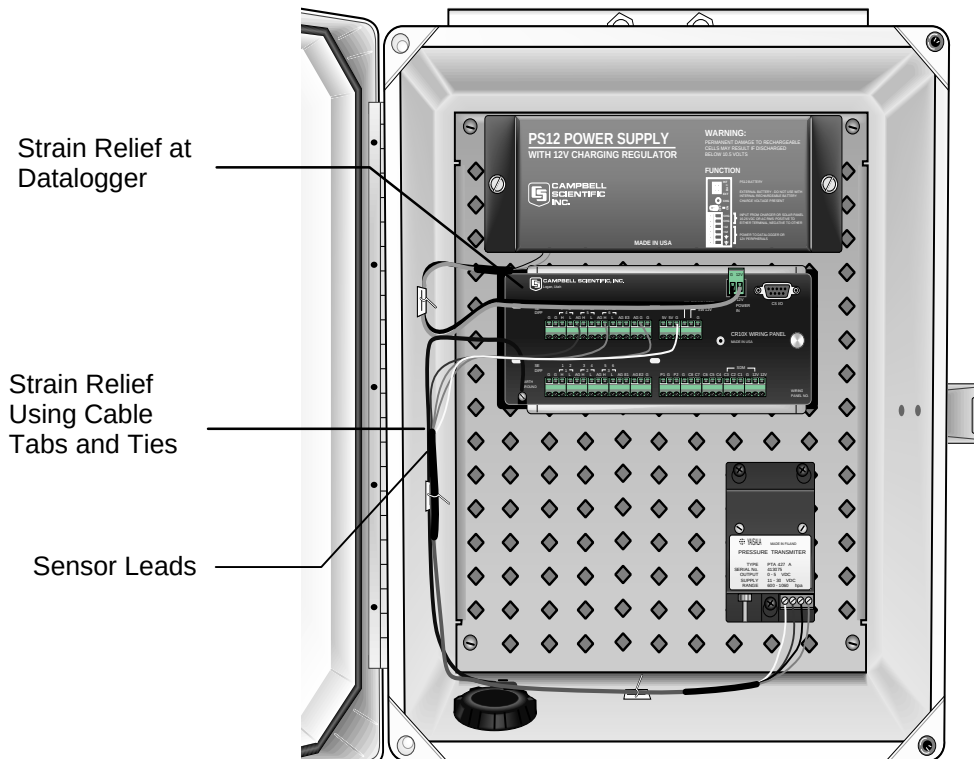


FIGURE 3.2-1. Routing and Wiring Sensor Leads to the Datalogger

3.3 COMMUNICATION AND DATA STORAGE PERIPHERALS

One or more peripherals (i.e., storage modules, modems, etc.) can be mounted to the enclosure backplate (ENC 12/14 or ENC 16/18 enclosures).

3.3.1 SM192/SM716 STORAGE MODULE

Storage modules extend the amount of memory that is available for storing data, and also provide on-site backup for data and programs.

Mount the SM192 to the enclosure backplate as shown in Figure 3.3-1.

1. Attach the mounting bracket (PN 6234) to the backplate using the four screws and nylon grommets provided.
2. Connect the storage module to the datalogger's I/O port with an SC12 cable. Place the storage module in the bracket and fasten the Velcro straps.

3.3.2 COMM200/COM300 PHONE MODEMS

A phone modem enables communication between the datalogger and the computer (with a Hayes compatible phone modem) over a dedicated telephone line. The COM300 additionally supports voice synthesis for voice calls.

Mount the modem to the enclosure backplate as shown in Figure 3.3-2.

1. Mount the modem to the backplate using the four screws and nylon grommets provided.
2. Connect the modem to the datalogger's I/O port with the SC12 cable provided.
3. The telephone company generally provides surge protection, and a patch cord that plugs into the RJ11C jack. If surge protection has not been provided, the Model 6362 Surge Protector Kit can be installed to the enclosure backplate. Connect the two terminals on the surge protector to the "tip" and "ring" terminals on the modem as shown in Figure 3.3-2.
4. Refer to COM300 manual for COM300 programming instructions.

SECTION 3. INSTRUMENTATION INSTALLATION

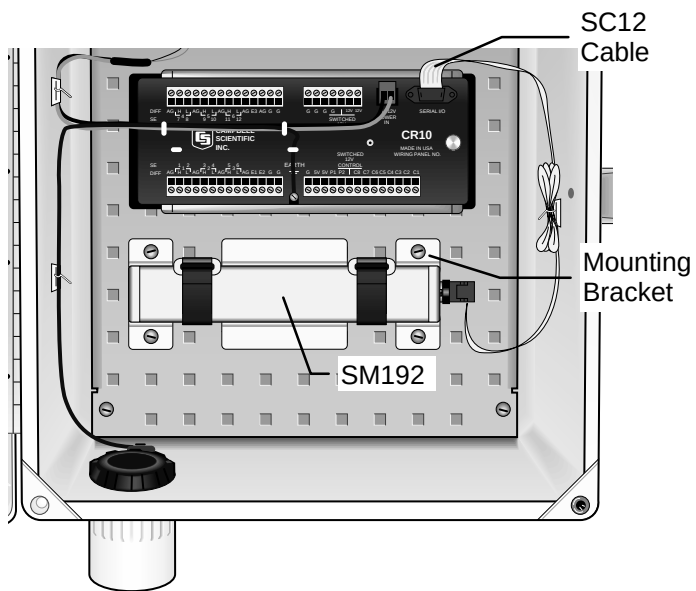


FIGURE 3.3-1. SM192/SM716 Storage Module

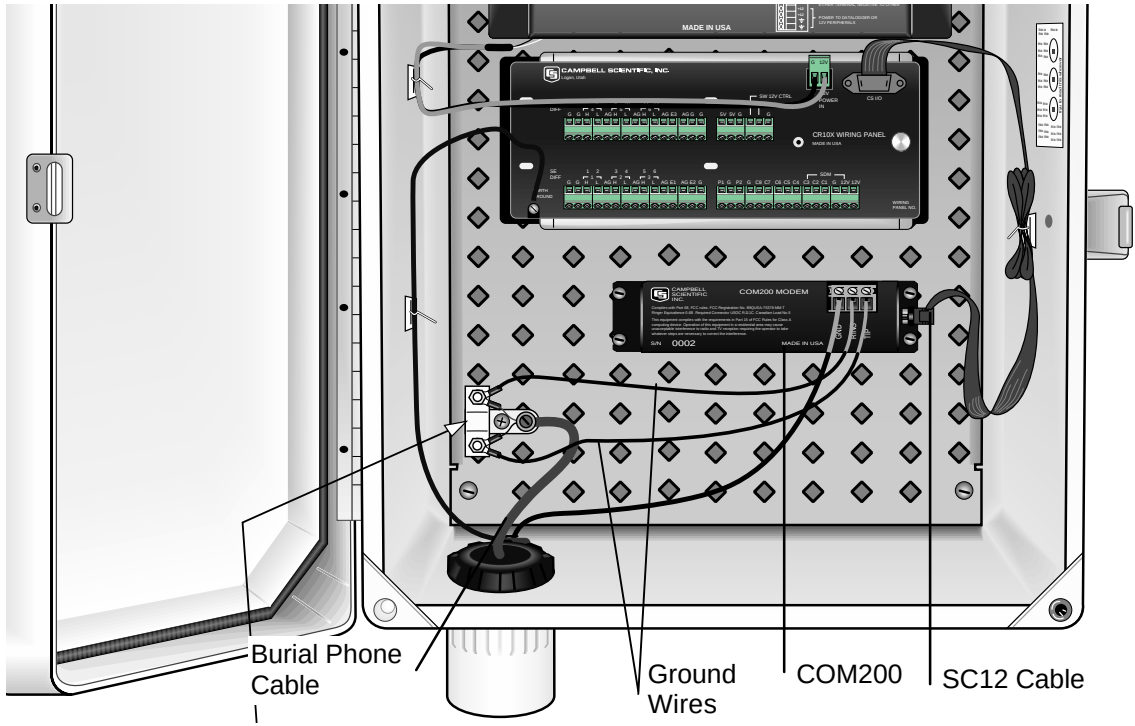


FIGURE 3.3-2. DC112 Modem with 6362 Surge Protector

SECTION 3. INSTRUMENTATION INSTALLATION

3.3.3 COM100 CELLULAR TRANSCEIVER

A cellular transceiver enables communication between the datalogger and a PC (with a Hayes compatible phone modem) over cellular service. The COM100 requires either the COM200 or COM300 modem.

Mount the COM100 in the enclosure as shown in Figure 3.3-3 with the following steps:

1. Mount the COM100 to the enclosure backplate using the four screws and nylon grommets provided.
2. Connect the modem to the datalogger's I/O port with an SC12 cable.
3. Mount the cellular Yagi antenna on a grounded mast, positioning it to point toward the nearest cellular tower, with the radiating elements oriented vertically. Route the coaxial cable into the enclosure through the wiring port and connect it to the cellular transceiver's coaxial connector. Provide strain relief for the cable on the left side of the enclosure with a cable tie and tab.
4. Connect 12V, ground, and control lines as described in the COM100 manual. Connect the modem and RJ-11C interface with the RJ-11 patch cord.

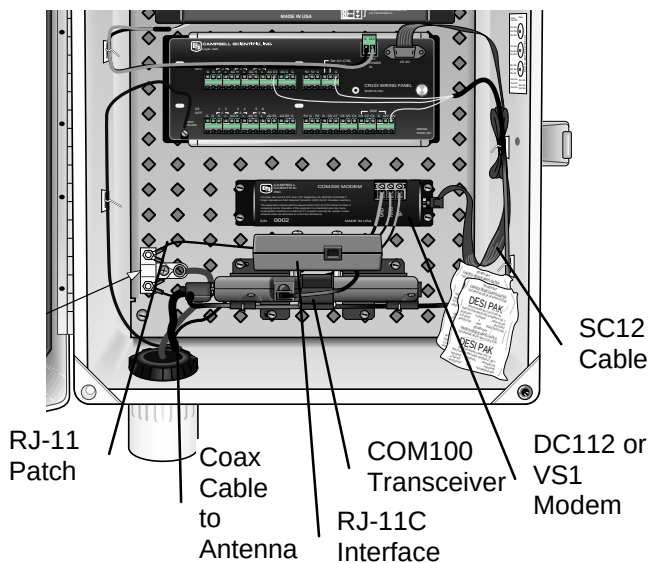


FIGURE 3.3-3. COM100 Cellular Transceiver

3.3.4 SRM-5A RAD MODEM AND SC932C INTERFACE

Rad Modems enable communication between the datalogger and computer over 4-wire unconditioned telephone line, or cable with two twisted pairs of wires.

The maximum distance between modems is determined by baud rate and wire gauge. At 9600 baud the approximate range is 5.0 miles using 19 gauge wire, 4.0 miles using 26 gauge wire.

Installation requirements depend on the type of cable that is used, and how it is installed (direct burial, conduit, etc.). In general, follow state and local electrical codes.

A recommended rodent-proof burial cable is PN F-02P22BPN, available from ANIXTER. Call ANIXTER at (708) 677-2600 for the name of a local distributor.

SRM-5A at the Datalogger

1. Plug the SRM-5A into the SC932(C). Position the notched tabs in the mounting bracket over the two screws in the SRM-5A (refer to Figure 3.3-4). Thread the SRM-5A screws through the bracket and into the SC932(C).
2. Attach the SRM-5A and SC932(C) mounting bracket to the enclosure backplate using the two screws and nylon inserts provided (Figure 3.3-4).
3. Connect the SC932(C) to the datalogger's I/O port with an SC12 cable.
4. Mount the 6361 Surge Protector to the enclosure backplate using the hardware provided. Connect the ground wire to the enclosure ground lug (Figure 3.3-5).
5. Cut a 12" long piece of two twisted pair cable and connect it to the SRM-5A as shown in Figure 3.3-5. Fasten the cable to the strain relief tab with a cable tie.
6. Route the cable previously attached to the SRM-5A, and the two twisted pair cable (from the other SRM-5A) to the 6361. Connect the cables as shown in Figure 3.3-5. Strain relief the cables to the side of the enclosure using cable ties and tabs.

SECTION 3. INSTRUMENTATION INSTALLATION

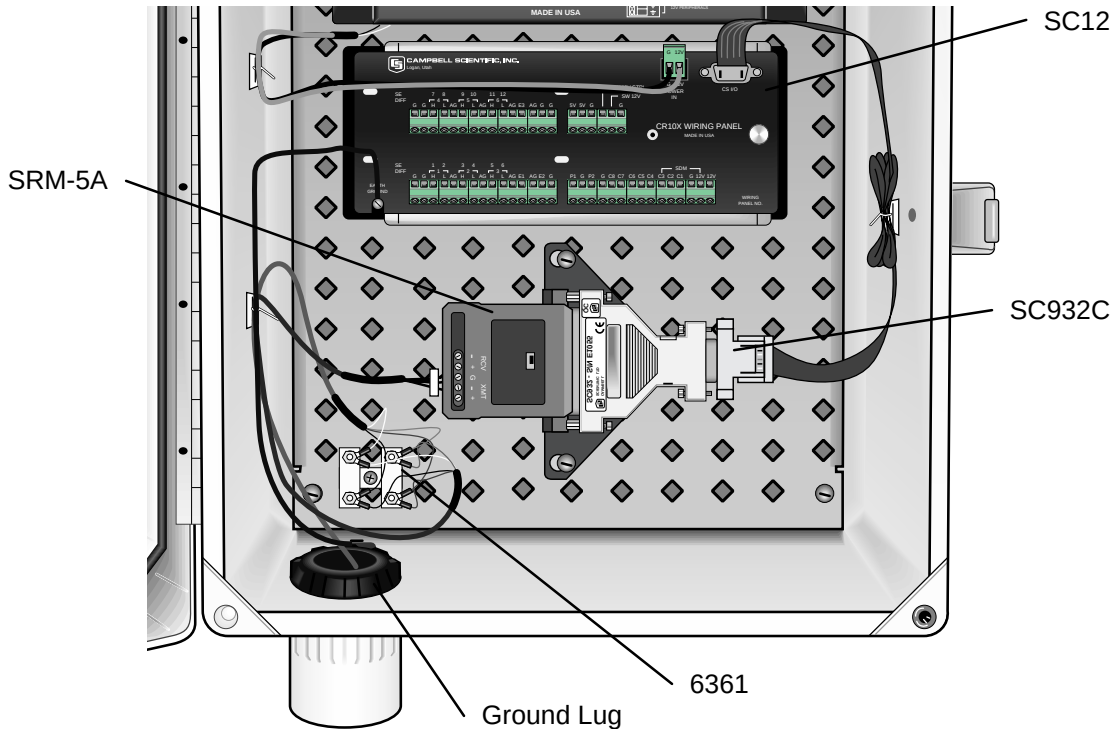
3.3.4.2 SRM-5A at the Computer

1. Mount the 6361 (or 5563) Surge Protector to a flat surface (close to the computer) using two screws. Ground the center terminal to an earth (or building) ground using a 12 AWG or larger diameter wire.
2. Cut a piece of two twisted pair cable long enough to reach from the 6361 to the computer. Connect the cable to the SRM-5A as shown in Figure 3.3-5. Fasten the cable to the strain relief tab with a cable tie. Connect the SRM-5A to the computer's serial port.
3. Route the cable from the remote SRM-5A, and the cable from the SRM-5A attached to the computer to the 6361.

Connect the cables as shown in Figure 3.3-5. Strain relief the cables using cable ties and tabs.

3.3.5 RF95 RF MODEM AND RF100/RF200 TRANSCEIVER

Radiotelemetry (RF) enables communications between one or more dataloggers and the computer over an FCC-assigned radio frequency in the VHF or UHF band. The maximum distance between any two communicating stations is approximately 20 miles and must be line-of-sight. Longer distances and rough terrain may require intermediate repeater station(s). Refer to the Radiotelemetry Network Applications manual for RF repeater stations and RF Networks accessed remotely by phone.



SECTION 3. INSTRUMENTATION INTALLATION

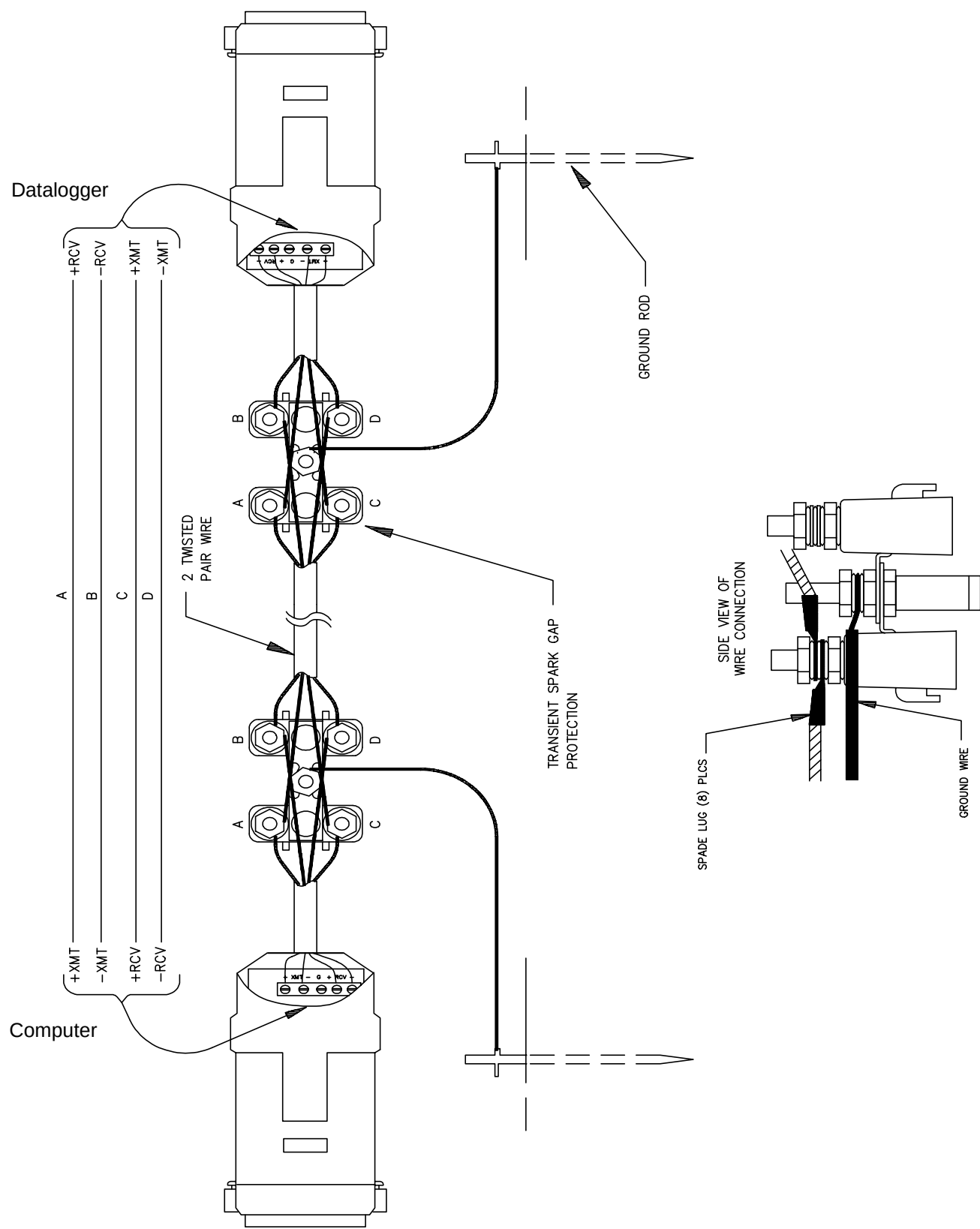


FIGURE 3.3-5. SRM-5A Wiring

SECTION 3. INSTRUMENTATION INSTALLATION

3.3.5.1 RF95 Modem and RF100/RF200 Transceiver at the Datalogger

Mount the RF95 RF Modem and the radio transceiver to the enclosure backplate as shown in Figure 3.3-6.

1. Remove the four screws that attach the lid to the RF95 modem. Remove the lid, then remove the single screw that secures the circuit board to the base. Remove the circuit board, and mount the base to the enclosure backplate using the two screws and plastic grommets provided.
2. Set the dip switches on the circuit board to the appropriate Station ID (Table 3.3-1). Each RF95 must have a unique station ID; address 1 is usually used for the base station, address 2 for first remote station, address 3 for the next remote station, etc. Switch 9 should be in the "OPEN" position. Reassemble the circuit board and lid. Do not tighten the four lid screws at this time.
3. Attach the radio mounting bracket to the RF95 lid and tighten the four lid screws.
4. Connect the radio to the RF95 with the cable provided. The ends of the cable are labeled "RF95" and "RADIO". Route the red and black wires to the PS12. Connect the RF95 to the datalogger using an SC12 cable.
5. Mount the antenna to the mast according to the manufacturer's instructions. Connect the antenna cable to the antenna and route the cable to the radio. Connect the antenna cable to the radio as shown in Figure 3.3-6.
6. Connect the red wire to a 12V terminal. Connect the black wire to a = terminal.

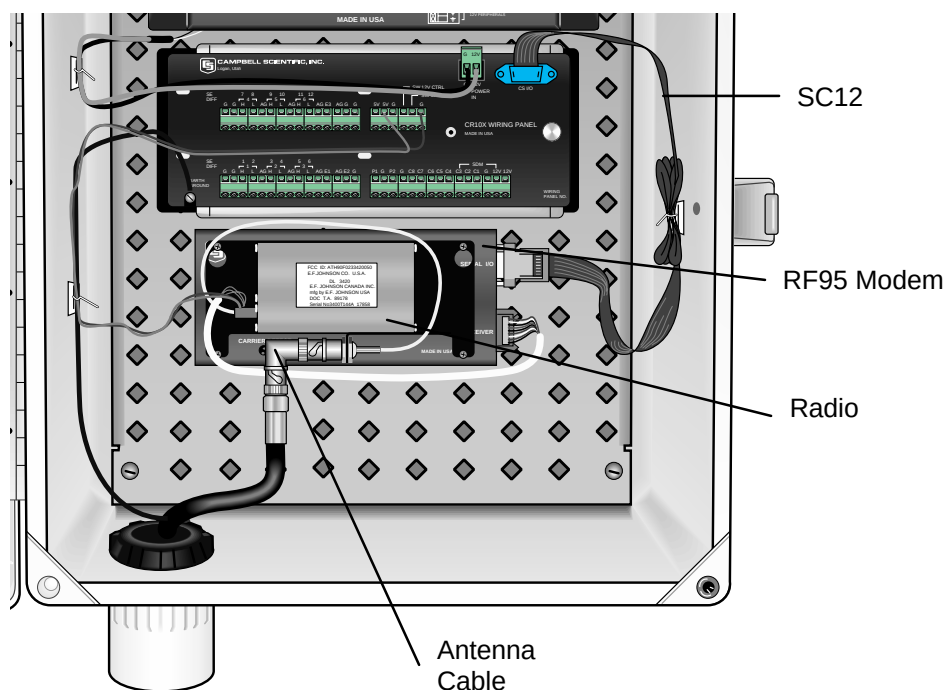


FIGURE 3.3-6. RF95 RF Modem and RF100/RF200 Transceiver

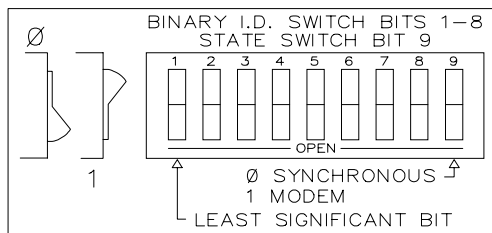
SECTION 3. INSTRUMENTATION INSTALLATION

TABLE 3.3-1. Station ID Numbers and Corresponding Switch Settings**

Station ID	Switch Settings	
ID	1234	56789
0	0000	0000X
1	1000	0000X
2	0100	0000X
3	1100	0000X
4	0010	0000X
5	1010	0000X
6	0110	0000X
7	1110	0000X
8	0001	0000X
9	1001	0000X
10	0101	0000X
11	1101	0000X
12	0011	0000X
*255	1111	1111X

* Station ID 255 is reserved for phone-to-RF base stations.

** See Appendix A in the Radiotelemetry Network Applications Manual for a table of switch settings.



3.3.5.2 RF232 RF Base Station

1. Install the base station antenna according to the manufacturer's instructions. Connect the antenna cable to the antenna and route the cable to the RF232.
2. With the power cord disconnected, remove the four screws that attach the RF232 lid. Remove the lid, and install the radio transceiver as shown in Figure 3.3-8. Connect the red wire to the "12 V" terminal, and the black wire to the "GND" terminal inside the RF232. Connect the multi-colored ribbon cable to the RF modem; make sure that the keyway is properly aligned.
3. Connect the antenna cable to the antenna connector on the radio. Reassemble the RF232 lid using the screws previously removed.

4. With the power switch "OFF", connect the power cord to 110V AC. Connect the serial port to the computer's serial port using an SC25PS cable for a 25-pin serial port, or a PN7026 cable for a 9-pin serial port. Toggle the power switch to "ON" to operate the RF232.

3.3.6 MD9 MULTIDROP INTERFACE

The MD9 Multidrop Interface enables communication with one or more dataloggers and the computer over a single 75 ohm coaxial cable. An MD9 network can be connected directly to the computer, or can be connected to a telephone modem (refer to the MD9 Manual) and accessed remotely.

Total coax length may be up to three miles. Since each MD9 attenuates the signal 0.2 db, the maximum length depends on the number of MD9s in the network (refer to the MD9 manual).

Coaxial cable and BNC connectors may be ordered from CSI, or purchased locally (Belden Type 9100 RG59/U or equivalent). Call Belden Wire and Cable at (317) 983-5200 for the name of a local distributor.

Installation requirements depend on the type of cable that is used, and how it is installed (direct burial, conduit, etc.). In general, follow state and local electrical codes.

3.3.6.1 MD9 Multidrop Interface at the Datalogger

Mount the MD9 to the enclosure backplate as shown in Figure 3.3-8.

SECTION 3. INSTRUMENTATION INSTALLATION

1. Remove the four screws that attach the lid to the MD9. Remove the lid, and the single screw that attaches the circuit board to the base. Remove the board and mount the base to the enclosure backplate using the two screws and nylon grommets provided.
2. Set the dip switches on the circuit board to the appropriate Station ID (Table 3.3-2). Each MD9 must have a unique ID; address 1 is usually used for the MD9 at the computer, address 2 for the next MD9, address 3 for the next MD9, etc. The default baud rate is 9600, which can be changed with the jumpers next to the dip switches (Table 3.3-2).
3. Reassemble the circuit board and lid using the screws previously removed.
4. Route the coaxial cable(s) to the MD9. Connect the cable(s) to the MD9 using the BNC "T" provided. The first and last MD9s of the network must be terminated with 75 ohm Coax Terminators (Model MD9CT) to prevent signal reflection.
5. Connect the green ground wire to the "⏏" terminal on the MD9, and to datalogger ground. Connect the MD9 to the datalogger with an SC12 cable.

3.3.6.2 MD9 Multidrop Interface at the Computer

Connect the MD9 and the SC532 9 Pin Peripheral to RS232 Interface to the computer as shown in Figure 3.3-9.

1. Connect the SC532 to the computer's serial port using an SC25PS cable for a 25-pin serial port, or a PN7026 cable for a 9-pin serial port. Connect the MD9 to the SC532 with an SC12 cable.
2. Route the coaxial cable to the MD9; connect the cable and an MD9CT to the MD9 using the BNC "T" provided.

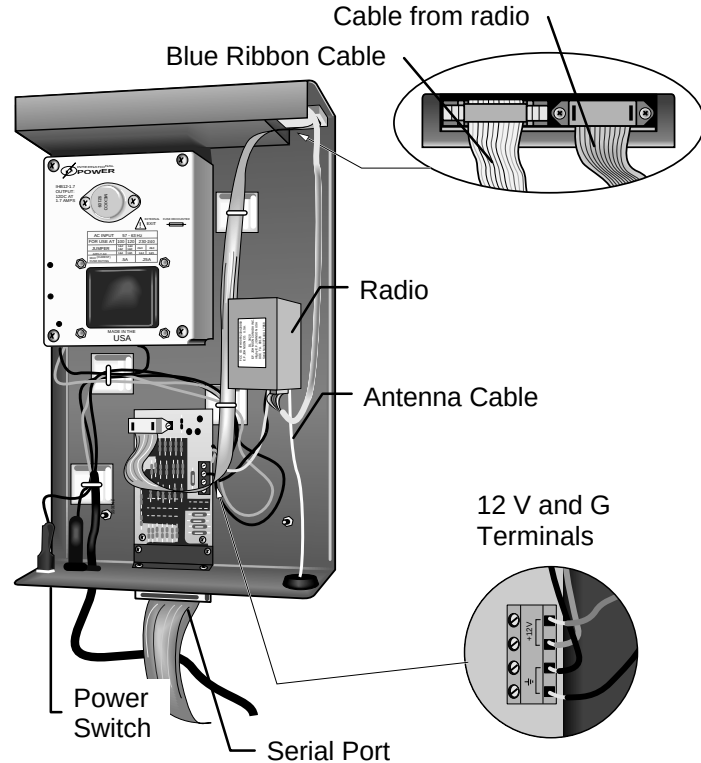


FIGURE 3.3-7. RF232 Base Station Installation

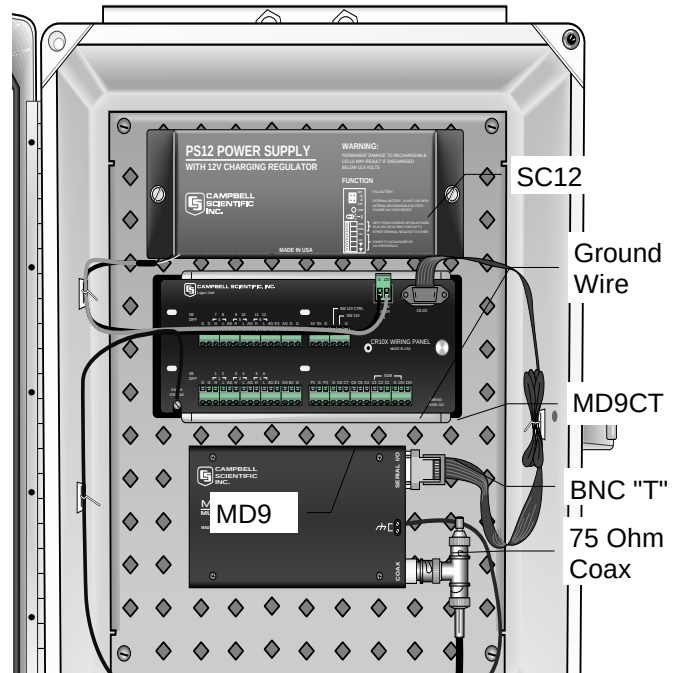
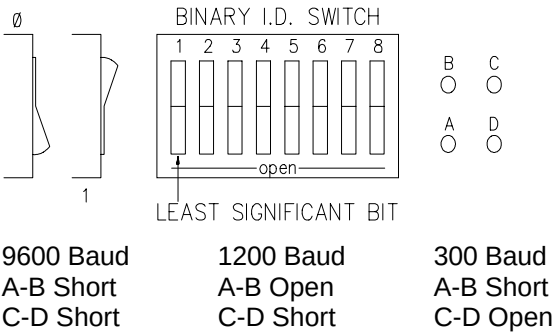


FIGURE 3.3-8. MD9 Multidrop Interface

SECTION 3. INSTRUMENTATION INTALLATION

TABLE 3.3-2 Station ID Numbers and Corresponding Switch Settings



Station	Switch Settings	
ID	<u>1234</u>	<u>5678</u>
0	0000	0000
1	1000	0000
2	0100	0000
3	1100	0000
4	0010	0000
5	1010	0000
6	0110	0000
7	1110	0000
8	0001	0000
9	1001	0000
10	0101	0000
11	1101	0000
12	0011	0000
*255	1111	1111

NOTE: Addresses 1-254 are valid for an MD9 connected to a datalogger or computer. Address 255 is used only when the MD9 is connected to a telephone modem or computer.

SECTION 3. INSTRUMENTATION INSTALLATION

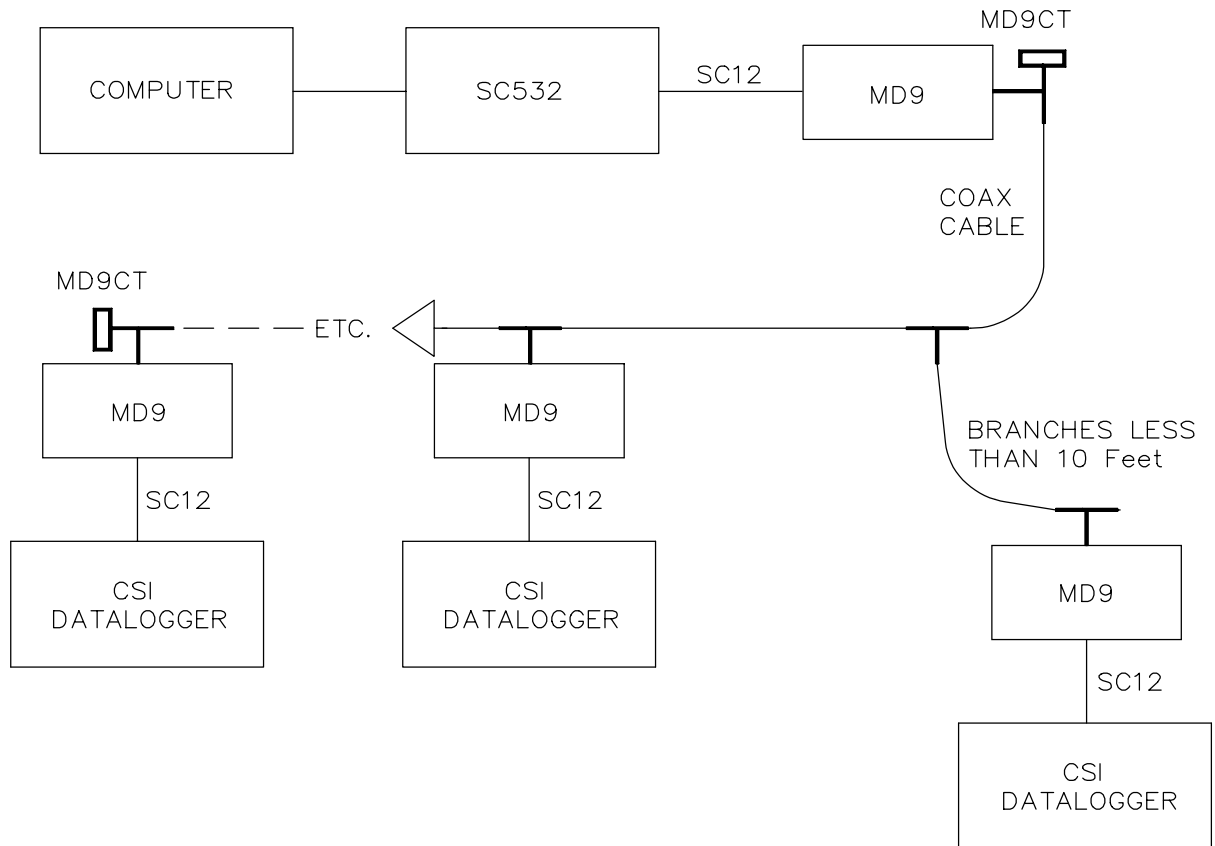


FIGURE 3.3-9. MD9 Multidrop Interface at the Computer

SECTION 3. INSTRUMENTATION INTALLATION

3.4 SEALING AND DESICCATING THE ENCLOSURE

CSI enclosures include an Enclosure Supply Kit with the following items:

- (4) Desiccant packs
- (1) Humidity indicator card
- (6) 4-inch cable ties
- (6) 8-inch cable ties
- (4) Cable tabs
- (1) 4 oz. sealing putty

Items in the Enclosure Supply Kit are used to strain relief the sensor leads, and to seal and desiccate the enclosure, as shown in Figure 3.4-1.

1. Secure the sensor leads to the left side of the enclosure and to the datalogger using cable ties and tabs.
2. Seal around the sensor leads where they enter the enclosure. Place a roll of putty around the sensor leads and press it around the leads and into the coupling to form a tight seal.
3. Remove the RH indicator card and two desiccant packs from the sealed plastic bag. Remove the backing from the indicator card and attach the card to the right side of the enclosure.

The humidity indicator card has three colored circles which indicate the percentage of humidity. Desiccant packs inside the enclosure should be replaced with fresh packs when the upper dot on the indicator begins to turn pink. The indicator card does not need to be replaced unless the colored circles overrun.

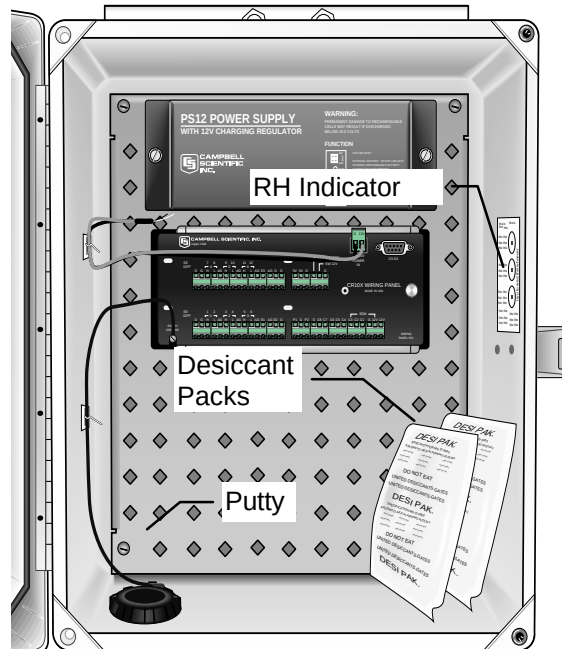


FIGURE 3.4-1. Enclosure Supply Kit

SECTION 4. SENSOR INSTALLATION

Sensor leads should be routed down the North side of the mast to the enclosure and secured with cable ties.

4.1 034A MET ONE WINDSET

Mount the 034A to the 019ALU crossarm as shown in Figure 4.1-1.

1. Place the 034A stem and bushing into the 3/4" x 1" NU-RAIL fitting.
2. With the shoulder screw in place, orient the counter weight to point due south. See Section 4.19 for final calibration.
3. Tighten the NU-RAIL set screws and remove the shoulder screw.

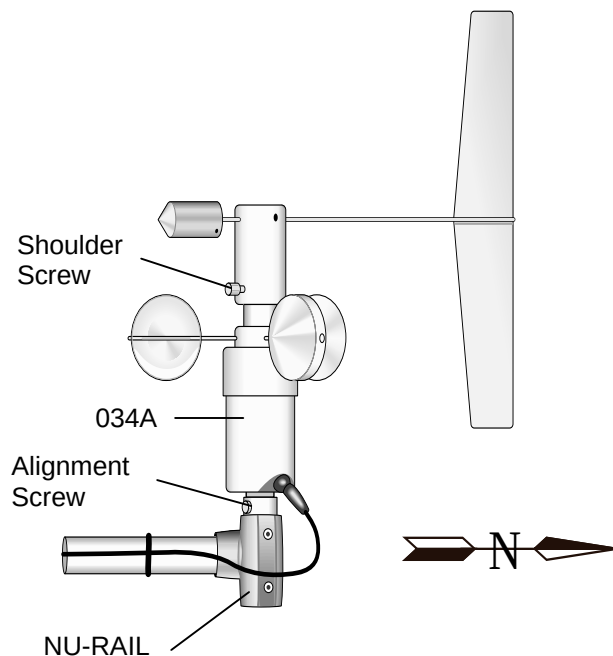


FIGURE 4.1-1. Met One 034A Wind Speed and Direction Sensor

4.2 014A MET ONE WIND SPEED SENSOR

Mount the 014A sensor to the 019ALU crossarm as shown in Figure 4.2-1.

1. Insert the base of the sensor through the 3/4" NU-RAIL. Position the sensor 1" below the NU-RAIL and tighten the set screws.
2. Connect the sensor lead to the sensor. A small amount of lithium grease applied to the threads of the connector will prevent problems due to corrosion.

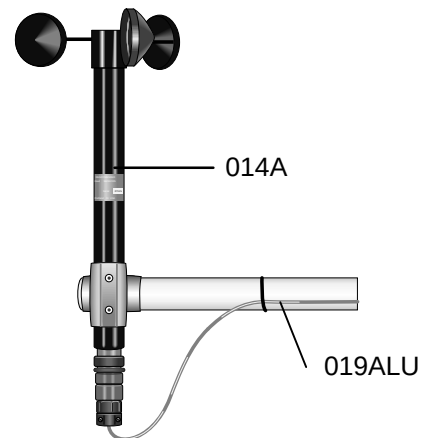


FIGURE 4.2-1. Met One 014A Wind Speed Sensor

SECTION 4. SENSOR INSTALLATION

4.3 024A MET ONE WIND DIRECTION SENSOR

Mount the 024A sensor to the 019ALU crossarm as shown in Figure 4.3-1.

1. Remove the hex-head screw located 3" from the base of the sensor. Insert the base of the sensor through the aluminum bushing provided with the sensor. Align the hole in the bushing with the hole in the sensor and replace the screw.
2. Insert the base of the sensor through the 1" NU-RAIL until the bushing screw rests on the NU-RAIL. Orient the sensor so the counter weight points south and tighten the set screws (see Section 4.19 for final calibration). Remove the shoulder screw to allow the vane to rotate.
3. Connect the sensor lead to the sensor. A small amount of lithium grease applied to the threads of the connector will prevent problems due to corrosion.

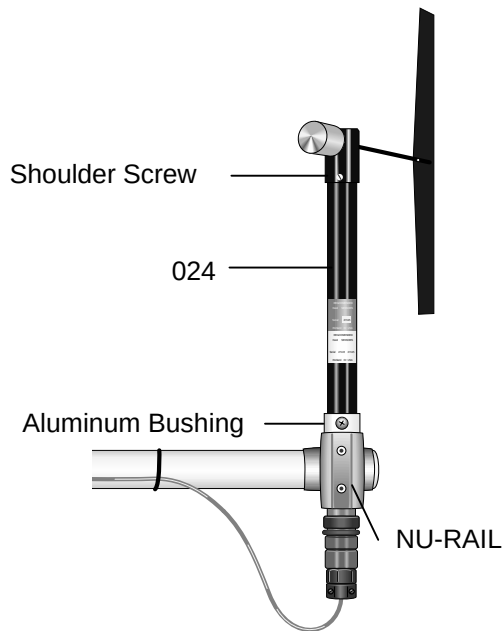


FIGURE 4.3-1. Met One 024A Wind Direction Sensor

4.4 05103 AND 05305 RM YOUNG WIND MONITORS

Mount the 05103 (or 05305) to the 019ALU crossarm as shown in Figure 4.4-1.

1. Position the top of the mounting post 5" above the 1" NU-RAIL and tighten the set screws.
2. Slide the orientation ring and the 05103 onto the mounting post. Rotate the sensor base so that the square wiring box points south. Engage the key in the orientation ring with the keyway on the sensor and tighten the band clamps (see Section 4.19 for final calibration).
3. Remove the plastic nut on the propeller shaft. Slide the propeller onto the shaft (face the side with the lettering out) and replace the nut.

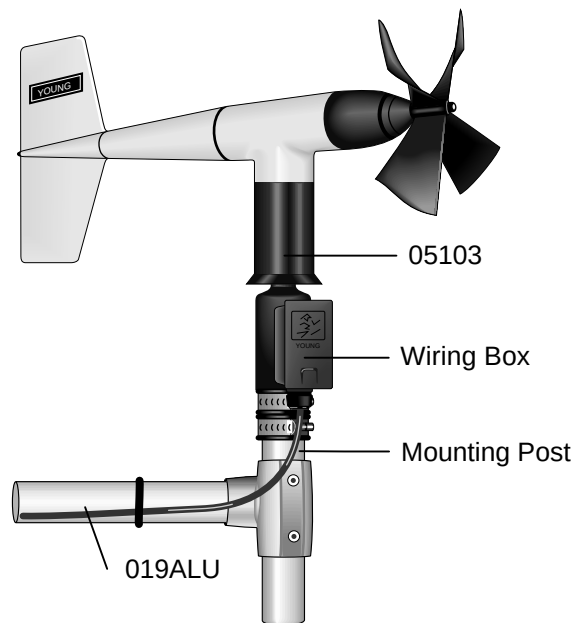


FIGURE 4.4-1. 05103 RM Young Wind Monitor

4.5 03001 RM YOUNG WIND SENTRY WIND SET

The 03001 can be mounted directly to the mast, or to the 019ALU Crossarm.

4.5.1 03001 MOUNTED TO THE MAST

Mount the 03001 to the mast as shown in Figure 4.5-1.

1. Slide the crossarm mounting bracket onto the mast. Orient the crossarm so the vane end points north, and tighten the band clamp (see Section 4.19 for final calibration).
2. Attach the cup assembly to the anemometer shaft using the allen wrench provided.

4.5.2 03001 MOUNTED TO 019ALU CROSSARM

Mount the 03001 to the 019ALU crossarm as shown in Figure 4.5-2.

1. Position the top of the mounting post 5" above the 3/4" NU-RAIL and tighten the set screws.
2. Slide the crossarm mounting bracket onto the mounting post. Orient the crossarm so the vane end points north, and tighten the band clamp (see Section 4.19 for final calibration).
3. Attach the cup assembly to the anemometer shaft using the allen wrench provided.

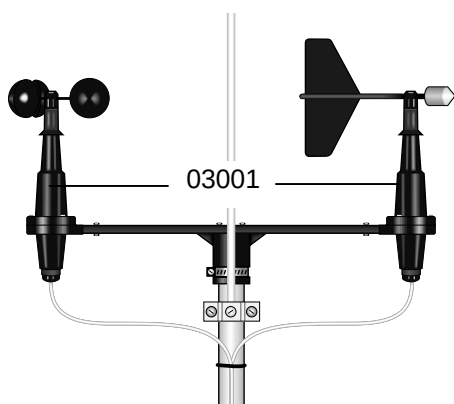


FIGURE 4.5-1. 03001 Mounted to the Mast

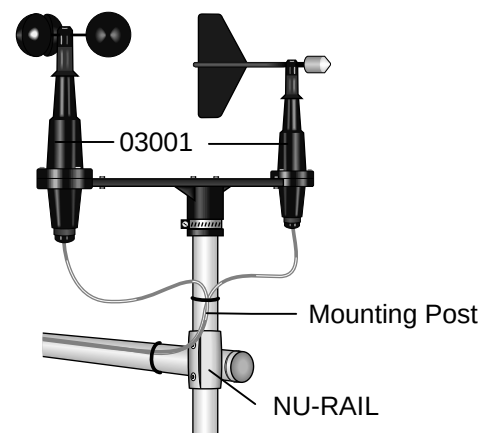


FIGURE 4.5-2. 03001 Mounted to 019ALU Crossarm

4.6 03101 RM YOUNG WIND SENTRY ANEMOMETER

Mount the 03101 to the 019ALU crossarm as shown in Figure 4.6-1.

1. Screw the mounting post into the mounting bracket on the sensor.
2. Position the top of the mounting post 5" above the 3/4" NU-RAIL and tighten the set screws.
3. Attach the cup assembly to the anemometer shaft using the allen wrench provided.

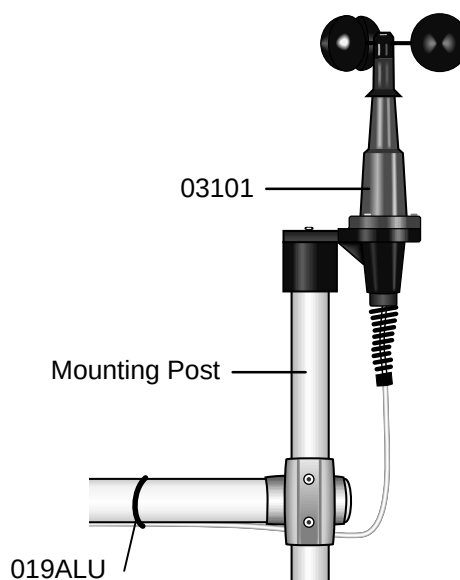


FIGURE 4.6-1. 03101 RM Young Wind Sentry Anemometer

SECTION 4. SENSOR INSTALLATION

4.7 LICOR SILICON RADIATION SENSORS (LI200X, LI200S, LI190SB)

Mount the Radiation Sensor to the LI2003S Base and Leveling Fixture as shown in Figure 4.7-1.

1. Position the base of the sensor in the mounting flange on the LI2003S, and tighten the set screw with the allen wrench provided. Adjust the three leveling screws flush with the bottom of the LI2003S.
2. Mount the LI2003S to the 025 or 015 (Section 2.2) using the three mounting screws provided. Do not tighten the screws at this time.
3. Level the LI2003S using the bubble level and leveling screws and tighten the mounting screws. **Remove the red protective cap prior to use.**

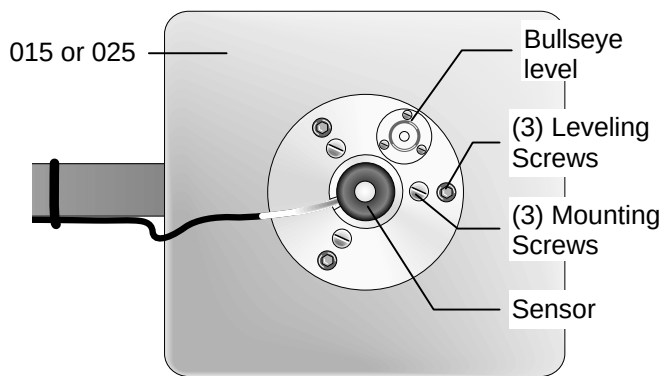


FIGURE 4.7-1. LI200X/LI200S/LI190SB and LI2003S Leveling Fixture

4.8 107/108 TEMPERATURE PROBE

Mount the 107 temperature probe inside the 41301 (UT6P) 6-Plate Gill Radiation Shield as shown in Figure 4.8-1.

1. Loosen the two mounting clamp screws on the base of the 41301 (UT6P). Insert the 107 probe through the mounting clamp until the white heat shrink is even with the bottom of the clamp.
2. Tighten the two screws evenly until the clamp is snug against the sensor lead.

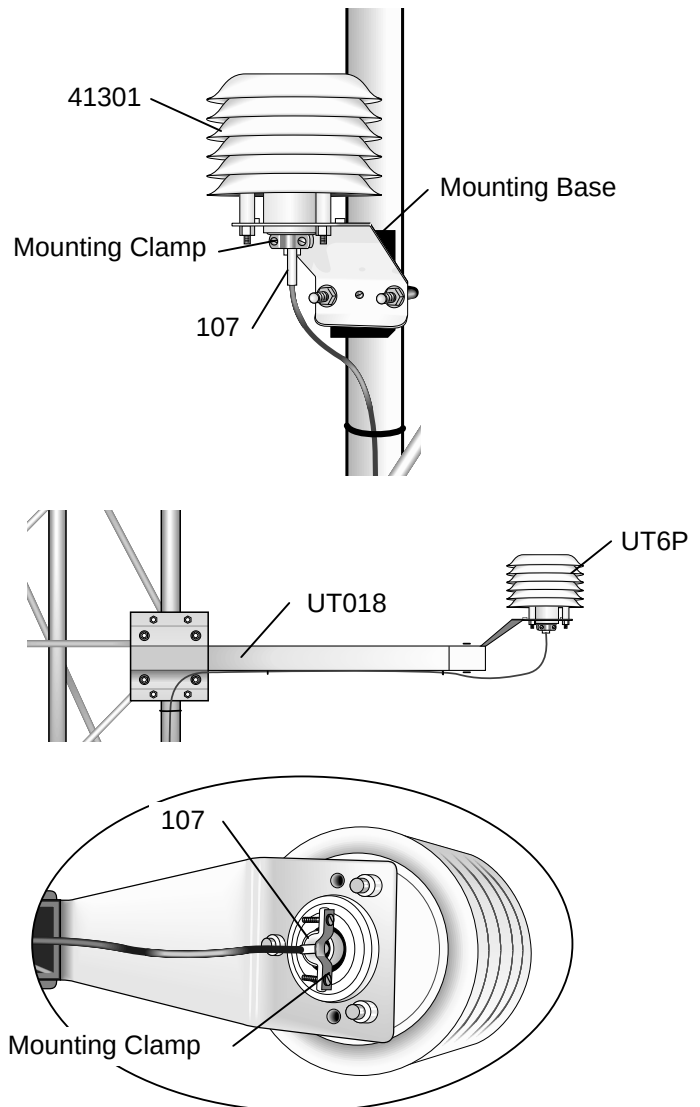


FIGURE 4.8-1. 107 Temperature Probe

4.9 107/108 SOIL TEMPERATURE PROBE

1. Select an undisturbed area of ground on the side of the tower that will receive the least amount of traffic. Route the sensor lead from the datalogger to the selected area.
2. Dig a narrow trench next to the sensor lead, ending the trench at least 6" short of the probe tip. Lay the sensor lead into the trench.
3. Use a screwdriver to poke a horizontal hole into the undisturbed soil at the end of the trench at the appropriate measurement depth. Insert the probe tip into the hole and carefully backfill the trench.
4. If bare soil is required, a soil sterilant such as Paramitol® can be applied to the area where the probe is buried. Soil erosion can be a problem when the probe is under bare soil. To prevent erosion from occurring, bury a 36" square frame constructed from 2" x 4" lumber around the probe, with the top of the frame even with the soil surface.

4.10 CS500 VAISALA TEMPERATURE AND RH PROBE

Mount the CS500 probe inside the 41301 (UT6P) 6-Plate Gill Radiation shield as shown in Figure 4.10-1.

1. Loosen the two mounting clamp screws on the base of the radiation shield. Insert the CS500 sensor through the clamp until the base of the sensor is even with the bottom of the clamp.

Tighten the two screws evenly until the clamp is snug against the sensor base.

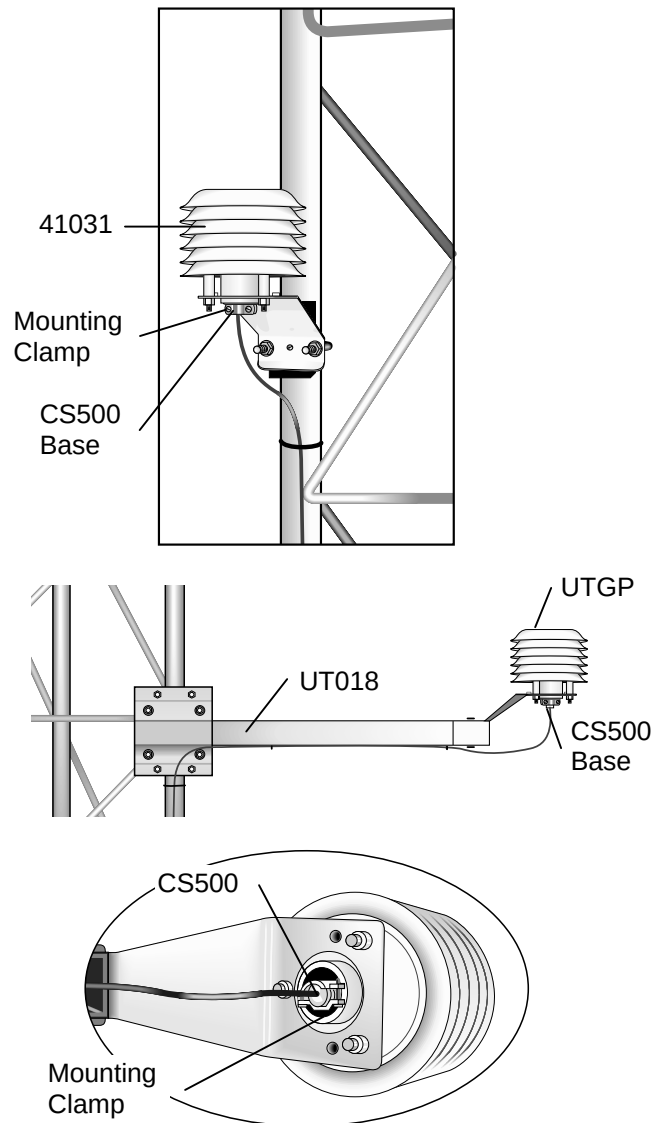


FIGURE 4.10-1. CS500 Temperature and RH Probe

SECTION 4. SENSOR INSTALLATION

4.11 HMP45C/HMP35C VAISALA TEMPERATURE AND RH PROBE

Mount the probe inside the 41002 or UT12VA 12-Plate Gill Radiation shield as shown in Figure 4.11-1.

1. Loosen the split plastic nut on the base of the shield. Insert the probe and tighten the nut.

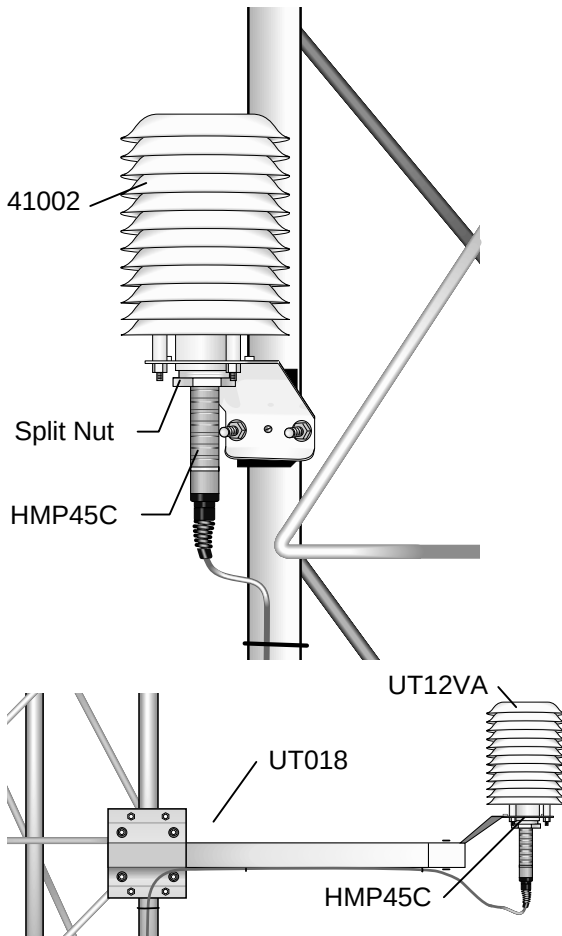


FIGURE 4.11-1. HMP35C Vaisala Temperature and RH Probe

4.12 CS105 VAISALA BAROMETRIC PRESSURE SENSOR

Mount the CS105 sensor to the enclosure backplate as shown in Figure 4.12-1 or Figure 4.12-2.

1. Mount the CS105 to the mounting plate using the two screws and grommets provided.

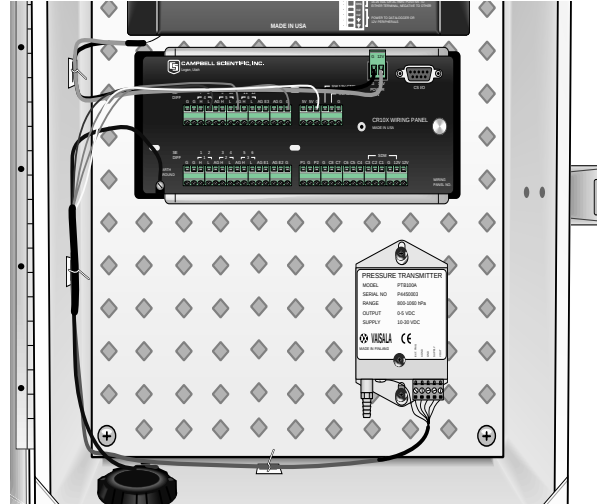


FIGURE 4.12-1. CS105 Vaisala Barometric Pressure Sensor in a Standard Weather Station Enclosure

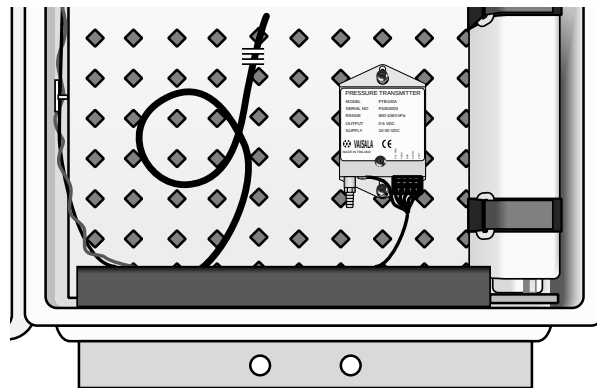


FIGURE 4.12-2. CS105MD Vaisala Barometric Pressure Sensor in a MetData1 Enclosure

4.13 TEXAS ELECTRONICS TIPPING BUCKET RAIN GAGES (TE525, TE525WS, TE525MM)

1. Mount the rain gage to a vertical pipe as shown in Figure 4.13-1. Mounting the gage directly to the tripod or tower is not recommended.
2. Dig a 6" diameter hole 24" deep.
3. Center a 1 1/4" to 2" IPS pipe in the hole and fill the hole with concrete. Use a level to plumb the pipe as the hole is filled.
4. After the concrete has cured, attach the rain gage to the top of the pipe with the hose clamps provided. Route the sensor lead to the tripod in plastic or metal conduit.

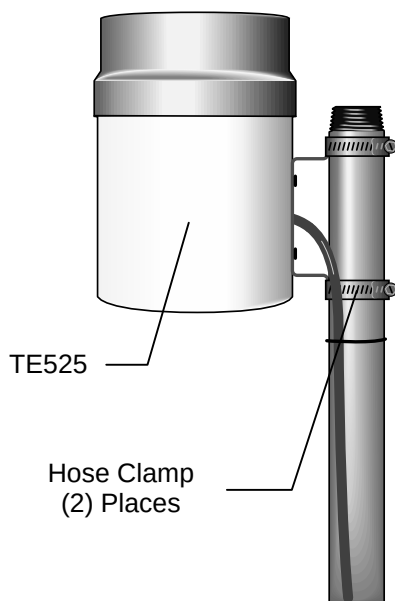


FIGURE 4.13-1. TE525 Texas Electronics Rain Gage

4.14 CS700-L RAIN GAGE

The CS700-L should be mounted in a relatively level spot that is representative of the surrounding area. The lip of the funnel should be horizontal and at least 30 inches above the ground. The ground surface around the rain gage should be natural vegetation or gravel. The gage should not be installed over concrete or pavement.

1. Mount the CS700 to either the CM100 (Figure 4.14-1) or a user supplied bracket. Remove the CS700-L funnel from the base by removing the three screws and lifting upward. Adjust the three nuts on the CM100 bracket to level the rain gage. On user supplied brackets, shims or washers can be used to level the rain gage. A bubble level is mounted on the CS700-L base to facilitate leveling.
2. Remove the rubber shipping band and cardboard packing securing the tipping bucket assembly. Tip the bucket several times to insure the tipping mechanism is moving freely.
3. Replace the housing assembly and tighten the three screws to secure the housing to the base.

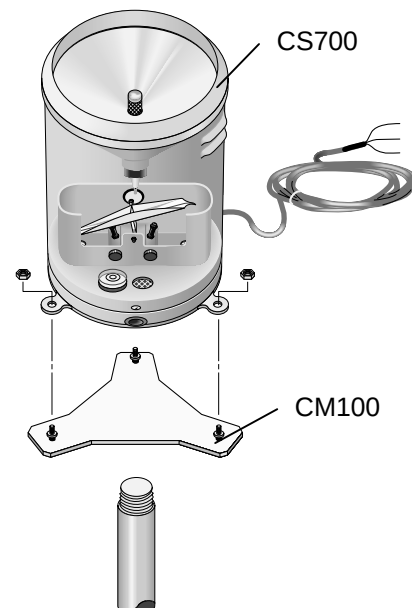


FIGURE 4.14-1. CS700-L Rain Gage and CM100 Mounting Bracket

SECTION 4. SENSOR INSTALLATION

4.15 SR50 SONIC RANGING SENSOR

The SR50s mounting stem enables various installation options. A 3/4" x 1" NU-RAIL (CSI part number 1049) enables the SR50 to mount to a horizontal 3/4" pipe. The mounting stem also has 1" pipe thread to accommodate other threaded installation options. The UT018 crossarm and part number 6880 bracket can be used to mount the SR50 to 3/4" - 1.25" diameter vertical pipe.

The SR50 should be mounted perpendicular to the target surface, without obstructions. See Figure 4.15-1.

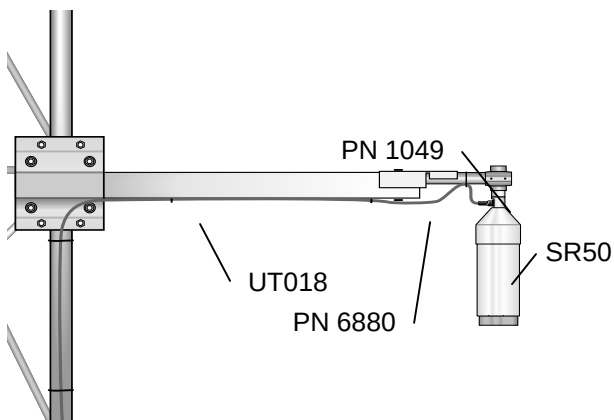


FIGURE 4.15-1. SR50 Sonic Ranging Sensor

4.16 CS615 WATER CONTENT REFLECTOMETER

Probe rods can be inserted vertically or horizontally into the soil surface, as shown in Figure 4.16-1, or buried at any orientation to the surface. A probe inserted vertically into a soil surface will give an indication of the water content in the upper 30 cm of soil. Horizontal installation will detect the passing of wetting fronts. Insertion at a 30 degree angle with the surface will measure water content in the upper 15 cm of soil.

Probes must be inserted such that no air voids are created around the rods, and that the rods remain as parallel as possible. Use the CS615G probe insertion guide to minimize errors due to improper insertion.

The standard calibration for the CS615 probe, as programmed in Short Cut, is valid for loamy soils with low organic content. In other types of soils, reporting the output in units of period will make it possible to apply your own calibration during post processing of data.

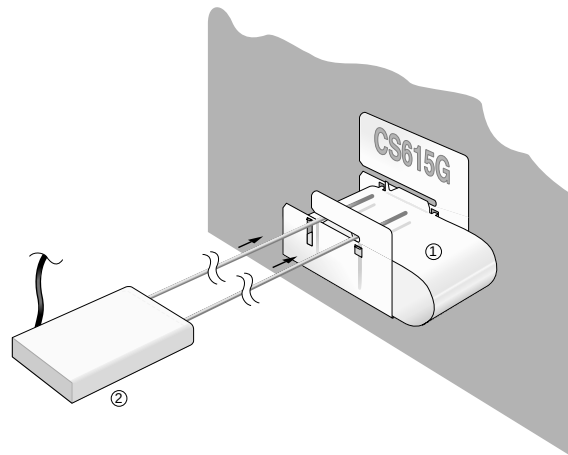


FIGURE 4.16-1. CS615 Water Content Reflectometer with CS615G Probe Insertion Guide

4.17 237 LEAF WETNESS SENSOR

Mounting and orientation considerations are left to the user to determine. Consult the 237 manual for preparation and other information. Normally, the sensor is mounted away from the meteorological tower in or near a plant canopy.

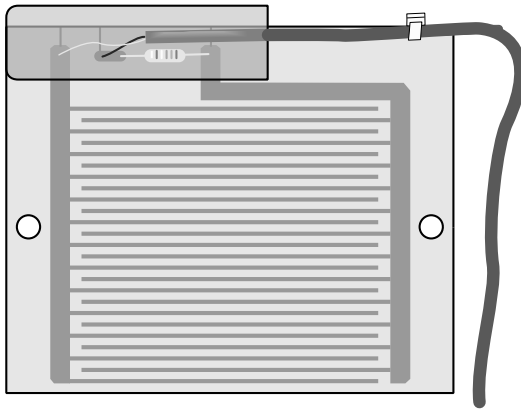


FIGURE 4.17-1. 237 Leaf Wetness Sensor

4.18 257 SOIL MOISTURE SENSOR

1. Soak the sensor end of the 257 in irrigation water for 12 to 14 hours. Allow the sensor to dry for 1 to 2 days after soaking and repeat the soak/dry cycle twice to improve sensor response. Always install a wet sensor.
2. Install the sensor into soil representative of the field conditions you wish to monitor. Avoid high or low spots. Placement south of the weather station mast (northern hemisphere) will avoid the effects of the mast shade. Installation in the root zone is best if measurements are used for irrigation purposes.
3. The 257 should be removed from the soil prior to harvest or cultivation operations to avoid damaging the sensor or sensor cable. Remove when soil is moist.

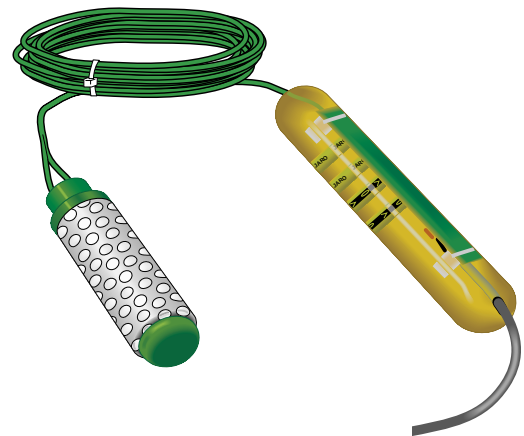


FIGURE 4.18-1. 257 Soil Moisture Sensor

SECTION 4. SENSOR INSTALLATION

4.19 ENCLOSURE HUMIDITY SENSOR

Install the PN 10162, HM2000 Humidity Sensor in the enclosure to monitor enclosure humidity. The MetData1 and ET101/106 are shipped with this sensor pre-installed.

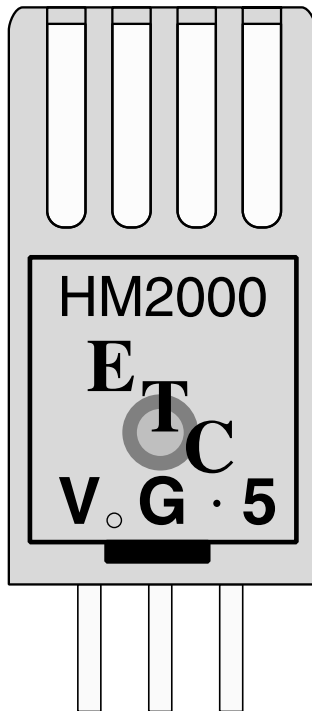


FIGURE 4.19-1. Enclosure Humidity Sensor

4.20 WIND DIRECTION SENSOR ORIENTATION

4.20.1 DETERMINING TRUE NORTH AND SENSOR ORIENTATION

Orientation of the wind direction sensor is done after the datalogger has been programmed, and the location of True North has been determined. True North is usually found by reading a magnetic compass and applying the correction for magnetic declination*; where magnetic declination is the number of degrees between True North and Magnetic North. Magnetic declination for a specific

site can be obtained from a USFA map, local airport, or through a computer service offered by the USFS called GEOMAG (Section 4.20.2). A general map showing magnetic declination for the contiguous United States is shown in Figure 4.20-1.

Declination angles east of True North are considered negative, and are subtracted from 0 degrees to get True North as shown Figure 4.20-2. Declination angles west of True North are considered positive, and are added to 0 degrees to get True North as shown in Figure 4.20-3. For example, the declination for Logan, Utah is 16° East. True North is $360^\circ - 16^\circ$, or 344° as read on a compass.

Orientation is most easily done with two people, one to aim and adjust the sensor, while the other observes the wind direction displayed by the datalogger.

1. Establish a reference point on the horizon for True North.
 2. Sighting down the instrument center line, aim the nose cone, or counterweight at True North. Display the input location for wind direction using the *6 Mode of the datalogger, or, the Monitor Mode of GraphTerm with an on-line PC.
 3. Loosen the band clamps or set screws that secure the base of the sensor to the mast or crossarm. While holding the vane position, slowly rotate the sensor base until the datalogger indicates 0 degrees. Tighten the band clamps or set screws loosened previously.
 4. Engage the orientation ring indexing pin in the notch at the instrument base (05103 and 05305 sensors only), and tighten the band clamp on the orientation ring.
- * Other methods employ observations using the North Star or the sun, and are discussed in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV - Meteorological Measurements⁴.

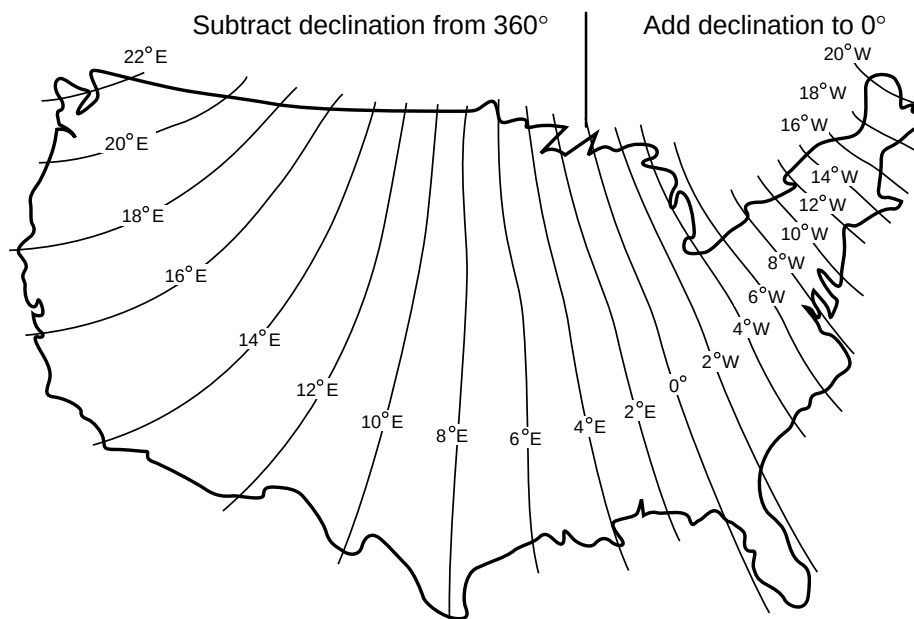


FIGURE 4.20-1. Magnetic Declination for the Contiguous United States

4.20.2 PROMPTS FROM GEOMAG

GEOMAG is accessed by calling 1-800-358-2663 with a computer and telephone modem, and communications program such as GraphTerm (PC208 Software). GEOMAG prompts the caller for site latitude, longitude, and elevation, which it uses to determine the magnetic declination and annual change. The following Menu and prompts are from GEOMAG:

MAIN MENU**Type**

- Q for Quick Epicenter Determinations (QED)
- L for Earthquake Lists (EQLIST)
- M for Geomagnetic Field Values (GEOMAG)
- X to log out

Enter program option: M

Would you like information on how to run GEOMAG (Y/N)? N

Options:

- 1 = Field Values (D, I, H, X, Z, F)
- 2 = Magnetic Pole Positions
- 3 = Dipole Axis and Magnitude
- 4 = Magnetic Center [1] : 1

Display values twice [N]: press return
 Name of field model [USCON90]: press return
 Date [current date]: press return

Latitude : 42/2 N
 Longitude : 111/51/2 W
 Elevation : 4454
 Units (m/km/ft) : ft

Example of report generated by GEOMAG:

Model: USCON90 Latitude: 42/2 N
 Date : 7/27/93 Longitude: 111/51/2 W
 Elevation: 4454.0 ft

D

deg min

15 59.6

Annual change:

0 -6.1

The declination in the example above is listed as 15 degrees and 59.6 minutes. Expressed in degrees, this would be 15.99 degrees. As shown in Figure 4.20-1, the declination for Utah is east, so True North for this site is $360 - 15.99$, or 344 degrees. The annual change is -6.1 minutes.

SECTION 4. SENSOR INSTALLATION

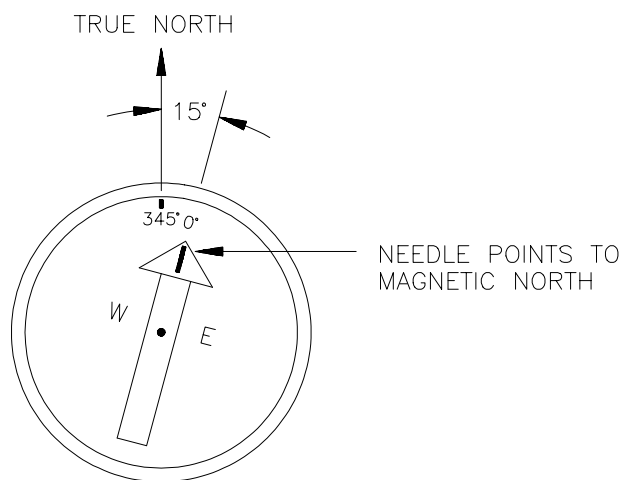


FIGURE 4.20-2. Declination Angles East of True North Are Subtracted From 0 to Get True North

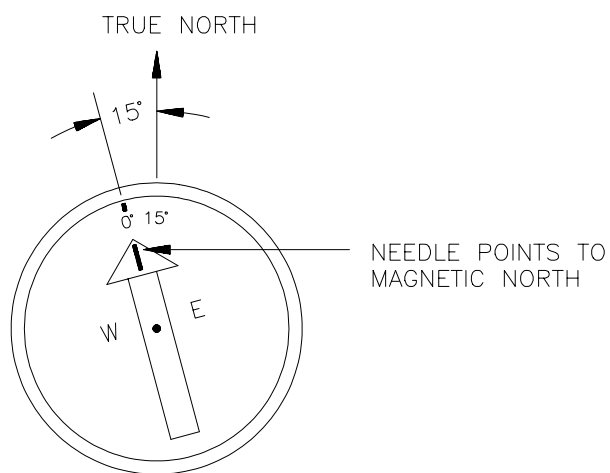


FIGURE 4.20-3. Declination Angles West of True North Are Added to 0 to Get True North

SECTION 5. STANDARD SOFTWARE INSTALLATION

Software required for a weather station consists of the datalogger program and a datalogger support software suite for Windows or MS-DOS.

5.1 DATALOGGER PROGRAM

The datalogger program operates the weather station. It programs the datalogger to measure sensors, process the measurements, and store data in the datalogger's memory. The datalogger program is most easily created using Short Cut for MS-DOS. Short Cut is compatible with Windows DOS emulator. A separate manual covers the use of Short Cut in detail.

5.2 DATALOGGER SUPPORT SUITE

A datalogger support software suite, either PC208W or PC208, enables interfacing with the MetData1 through Windows or MS-DOS. Follow the installation procedure outlined in the front of the software manual. PC208(W) is used to download programs to the weather station datalogger. It is also used to monitor data in real time and retrieve data stored in the datalogger.

5.3 QUICK START REVIEW

Follow these steps to program the weather station datalogger and install the datalogger support software suite.

- 1) Install PC208W or PC208, and Short Cut, into your Windows or DOS computer as outlined in their respective manuals.
- 2) Start Short Cut by entering "SC" at a DOS prompt. Create the weather station program by following the four steps outlined.
- 3) Print the DEF file produced by Short Cut. Follow the wiring assignments in the DEF file when connecting sensors to the weather station datalogger.
- 4) Start PC208 by typing "PC208E" at the DOS prompt OR start PC208W from Windows.
- 5) Create a station file with PC208 (**File | New | Station**) OR create a station on the PC208W device map (**Setup | Add Device**).
- 6) Establish communications with the datalogger. With PC208W **Connect | Connect** will activate the communication and confirm communications by reporting the datalogger clock time. With PC208 **File | Open | Station** then **RealTime | Call** then **Tools | Clock Set / Check** will activate the station file and confirm communications by checking the datalogger clock.
- 7) Download the program created in Step 2. With PC208W **Connect | Send** will download the weather station program. With PC208 **Tools | Send Datalogger Prog** will download the weather station program.
- 8) After the appropriate length of time, retrieve data from the datalogger to an ASCII file. With PC208W **Connect | Collect** will retrieve data. With PC208 **DataCollection | Call Now (CurrentStn)** will retrieve data.
- 9) Weather reports can be generated. PAR files created by Short Cut can be used to create simple reports. With PC208W **Report | File | Open** will select a PAR file. With PC208, **File | Reports | Edit Param File** will select a PAR file.

SECTION 6. MAINTENANCE AND TROUBLESHOOTING

These guidelines apply to several different Campbell Scientific weather stations.

6.1 MAINTENANCE

Proper maintenance of weather station components is essential to obtain accurate data. Equipment must be in good operating condition, which requires a program of regular inspection and maintenance. Routine and simple maintenance can be accomplished by the person in charge of the weather station. More difficult maintenance such as sensor calibration, sensor performance testing (i.e., bearing torque), and sensor component replacement, generally requires a skilled technician, or that the instrument be sent to Campbell Scientific or the manufacturer.

A station log should be maintained for each weather station that includes serial numbers, dates that the site was visited, and maintenance that was performed.

6.1.1 INSTRUMENTATION MAINTENANCE

The instrumentation requires a minimum of routine maintenance. A few preventative maintenance steps will optimize battery life and decrease the chances of datalogger failure.

6.1.2 BATTERIES

Instruction 10 can be used to measure battery voltage. By recording battery voltage the user can determine how long a fresh set of batteries will last (see the Installation Section of the datalogger Operator's Manual for cold temperature effects on alkaline batteries). Short Cut and ETPro automatically program the weather station to measure battery voltage.

When alkaline batteries are used, the battery voltage should not be allowed to drop below 9.6 VDC before replacement. Where CR10 or 21X dataloggers are used in the instrumentation, an external battery must be used to maintain power to the datalogger when changing batteries, otherwise the clock, program, and data will be lost (refer to the Installation Section of the datalogger's Operator's Manual for details). When not in use, remove the eight cells to eliminate potential corrosion of the contact points, and store in a cool dry place.

Rechargeable power supplies should be connected to an AC transformer or unregulated

solar panel at all times. The charge indicating diode should be "ON" when voltage to the charging circuitry is present. Be aware of battery voltage that consistently decreases over time, which indicates a failure in the charging circuitry.

6.1.3 DESICCANT

Enclosure humidity is monitored in the ET Enclosure and MetData1 systems by an RH chip incorporated into the connector board. Change the desiccant packs when the enclosure RH exceeds 35%. The RH chip should be changed every 3 to 5 years.

In standard weather stations, a humidity indicator card is provided with the enclosure. A small RH sensor (10162) can be purchased separately to record the RH inside the enclosure. Change the desiccant when either the card or the sensor read about 35% RH.

Desiccant may be ordered through Campbell Scientific (DSC 20/4).

Desiccant packs inside of the dataloggers do not require replacement under normal conditions.

6.1.4 SENSOR MAINTENANCE

Sensor maintenance should be performed at regular intervals, depending on the desired accuracy and the conditions of use. A suggested maintenance schedule is outlined below.

1 week

- Check the pyranometer for level and contamination. Gently clean, if needed.
- Visually inspect the wind sensors and radiation shield.

1 month

- Check the rain gage funnel for debris and level.
- Do a visual/audio inspection of the anemometer at low wind speeds.
- Check the filter of the temperature/humidity sensor for contamination.

SECTION 6. MAINTENANCE AND TROUBLESHOOTING

General Maintenance

- An occasional cleaning of the glass on the solar panel will improve its efficiency.
- Check sensor leads and cables for cracking, deterioration, proper routing, and strain relief.
- Check the tripod or tower for structural damage, proper alignment, and for level/plumb.

6 months

- Clean the temperature/humidity sensor.
- Clean the Gill Radiation Shield.

1 year

- Replace anemometer bearings.
- Calibrate the rain gage.
- Calibrate the HMP45C/HMP35C probe.
- Check calibration of CS500 RH Probe; replace RH chip if necessary.
- Check internal RH chip (MetData1 and ET101/106 only). Replace if >5% off.

2 years

- Calibrate the solar radiation sensors (some users suggest yearly).
- Calibrate the temperature sensor.
- Replace the wind vane potentiometer and bearings.

4 - 5 years

- Replace sensor cables as required.

6.2 TROUBLESHOOTING

6.2.1 NO RESPONSE USING THE KEYPAD

Check keypad response after each of the following steps.

- Make sure the battery has been installed, and the power switch, if any, is "ON" (Section 7).
- Use a voltmeter to measure the voltage on the 12 V and G terminals; the voltage must be between 9.6 and 16 VDC.

- Disconnect any sensor or peripheral wires connected to the 5 V and 12 V terminals.
- Disconnect any communications or storage peripherals from the datalogger.
- Reset the datalogger by turning the power switch to "OFF", then to "ON" or disconnecting and reconnecting the battery.
- If still no response, call Campbell Scientific.

6.2.2 NO RESPONSE FROM DATALOGGER THROUGH SC32A OR MODEM PERIPHERAL

At the datalogger:

- Make sure the battery has been installed, and the power switch, if any, is "ON" (Section 7).
- Use a voltmeter to measure the voltage on the 12 V and G terminals; the voltage must be between 9.6 and 16 V DC.
- Make sure the datalogger is connected to the modem, and the modem is properly configured and cabled (Section 9).

At the computer:

- Make sure the Station File is configured correctly (PC208 Manual).
- Check the cable(s) between the serial port and the modem. If cables have not been purchased through Campbell Scientific, check for the following configuration using an ohm meter:

25-pin serial port:

<u>computer end</u>	<u>modem end</u>
2	2
3	3
7	7
20	20

9-pin serial port:

<u>computer end</u>	<u>modem end</u>
2	3
3	2
4	20
5	7

- Make sure the modem is properly configured and cabled (Section 9).
- If still no response, call Campbell Scientific.

6.2.3 -99999 DISPLAYED IN AN INPUT LOCATION

- A. Make sure the battery voltage is between 9.6 and 16 VDC.
- B. With the MetData1 or ET106, verify that the sensor is connected to the proper bulkhead connector. With custom weather stations, verify the sensor is wired to the analog channel specified in the measurement instruction or Short Cut .FSL file (single-ended channels are not labeled on the older silver-colored wiring panels and are numbered sequentially starting at 1H; i.e. 1L is single-ended channel 2).
- C. Make sure the Range parameter in the measurement instruction covers the full scale voltage output by the sensor.

6.2.4 UNREASONABLE RESULTS DISPLAYED IN AN INPUT LOCATION

- A. Inspect the sensor for damage and/or contamination.
- B. Make sure the sensor is properly wired to the datalogger.
- C. Check the multiplier and offset parameters in the measurement instruction.

6.2.5 6999 OR 99999 STORED IN FINAL STORAGE (OR STORAGE MODULE)

- A. Final Storage format limitations exceeded (any number larger than 6999 in low resolution, or 99999 in high resolution format is stored as the maximum number). Change the datalogger program.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 12

Climate Station Data Collection -PDA

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the procedure to download data from a CR10X datalogger in the field. This can be accomplished in two ways, with a laptop or with a Palm PDA. The following is a summary of the procedures involved in collecting data via a Palm handheld. Detailed descriptions can be found in the Campbell Scientific, Inc. ***PConnect for the Palm Handheld Instruction Manual***, available with the purchase of PConnect or available online at <ftp://ftp.campbellsci.com/pub/outgoing/manuals/pconnect.pdf>

Procedures:

1. Obtain PConnect from Campbell Scientific, Inc. and load the software on a PC. PConnect software allows you to connect your Palm handheld to a CR10X datalogger to perform all of the standard datalogger support functions, including:
 - Send and receive datalogger programs
 - View and edit input locations
 - Collect data
 - View data in tabular and graphical form
2. Once PConnect is loaded on your PC a Palm device can be connected to the PC and the PConnect program will be transferred to the Palm by using the HotSync button. The HotSync button is the method of transferring files between the Palm device and your PC. Files stored in the PConnect folder will be transferred to the Palm device. Datalogger program files can be stored in this file. The file name can be no longer than 8 characters for the transfer to be successful.

Connecting the Palm device to the datalogger

1. The Palm handheld connects to the datalogger via the communications port on the bottom of the device and terminates with the 9-pin (female) serial port connector. The cable is specific to the Palm OS handheld model and needs to be purchased directly from Palm.
2. After connecting the cable to the PDA use the supplied PDA to CS I/O adapter to connect the datalogger's CS I/O port. See photo below.



3. Start the PConnect software on the Palm handheld by double clicking on the icon. In order to connect to a station you need to give it a name. Use the name of the station as a naming convention. This is critical. Once the data is downloaded from the station it will be stored under this file name. To edit the default name hit the EDIT button. Click OK when done.
4. Select the station name and hit CONNECT. The current measurements will appear on the Palm handheld. If there is an error connecting, make sure the cable is connected properly to the Palm handheld. This is a loose connection and can disconnect easily.

To Collect Data

1. To collect the data touch the menu in the upper right hand corner of the screen on the Palm PDA. Choose **Collect Data**. Next choose **Collect All** from the pull down menu. The palm will start to transfer the data from the datalogger. This can take a few minutes. The Palm will beep when it is finished collecting the data and display the message **Data Has Been Successfully Collected**. Hit **OK**
2. To view the data you just downloaded first hit **Disconnect**. Choose the name of the station from the list on the left and instead of hitting **Connect** hit **View Data**. There will be two storage areas for the CAKN stations, select final storage area 1. The data will be displayed in columns. From the pull down menu choose the array ID number. There will be only 1 array ID number in final storage 1. The columns will be displayed again. To graph a column double click on the column heading.
3. Once the data is collected to the Palm handheld use the HotSync cradle and HotSync the Palm to your PC. All of the files from the handheld will be transferred to the PConnect file and appended to the data file on the PC named after the station from which it was retrieved.

To Transfer a Program

1. To transfer a program from the Palm handheld touch the menu in the upper right hand corner and select **Transfer Program**.
2. The pull down menu on the next screen will list the programs that were transferred from your PC to the PDA when you used the HotSync button as described above. Choose the name of the program you want to transfer, i.e. the program for the CAKN climate stations is currently CAKN_1. Select the program and hit **Send**. A message will appear asking if you are sure you want to do this. Once a new program is sent the existing program and memory will be erased. The program will be transferred and compiled

Reference

2002. Campbell Scientific, Inc. *PConnect for the Palm Handheld Instruction Manual*. Software Support for Campbell Scientific Dataloggers. Version 2.0, Revision 6/02.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 13

Climate Station Data Collection -Laptop

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

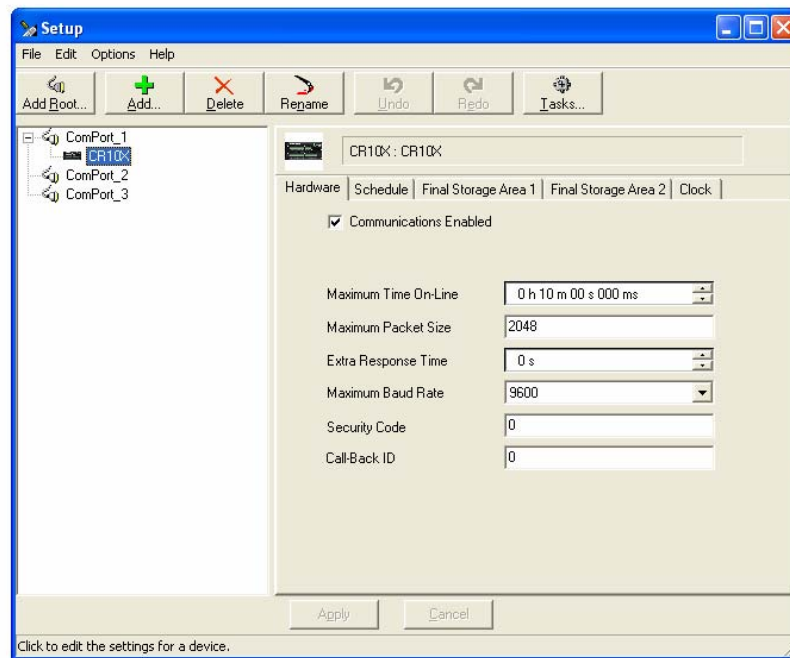
This protocol describes the procedure to download data from a CR10X datalogger in the field. This can be accomplished in two ways, with a laptop or with a Palm PDA. The following is a summary of the procedures involved in collecting data via a laptop with Campbell Scientific, Inc. LoggerNet software installed.

Procedures

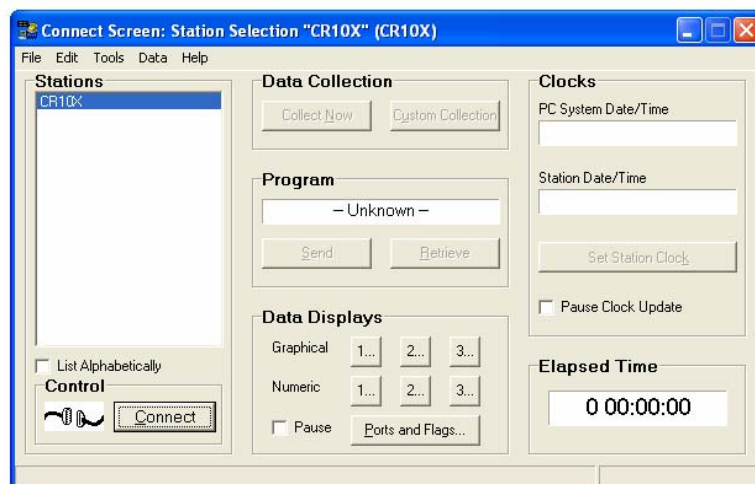
For a full description of the LoggerNet software refer to SOP #5 Datalogger Software Instructions

Collecting data in the field

1. Connect the datalogger to the laptop using the 9-pin CSI serial cable for battery powered laptops.
2. In LoggerNet hit the **Setup** button and add the name of the station you are visiting under ComPort_1. The default will say CR10X. Click the **Rename** button up top and then **Apply**. It is important to name the station at this point.
3. Click **Connect** on the LoggerNet toolbar. The station name should appear in the box on the left. If it doesn't go back to **Setup** and add the station. Click on the station and then click **Connect** at the bottom of the screen.



4. The icon at the lower left should show that you are connected and the elapsed time indicator will start.
5. Click on **Collect Now** under **Data Collection**. The data from the datalogger will be collected and stored in a file named *stationname.dat* in the LoggerNet file under the Campbellsci folder.



Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 14

Climate Station Data Collection -Storage Module

Version 1.0 (October 2004)

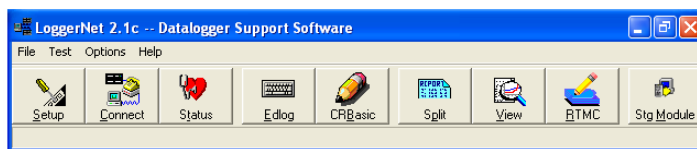
Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

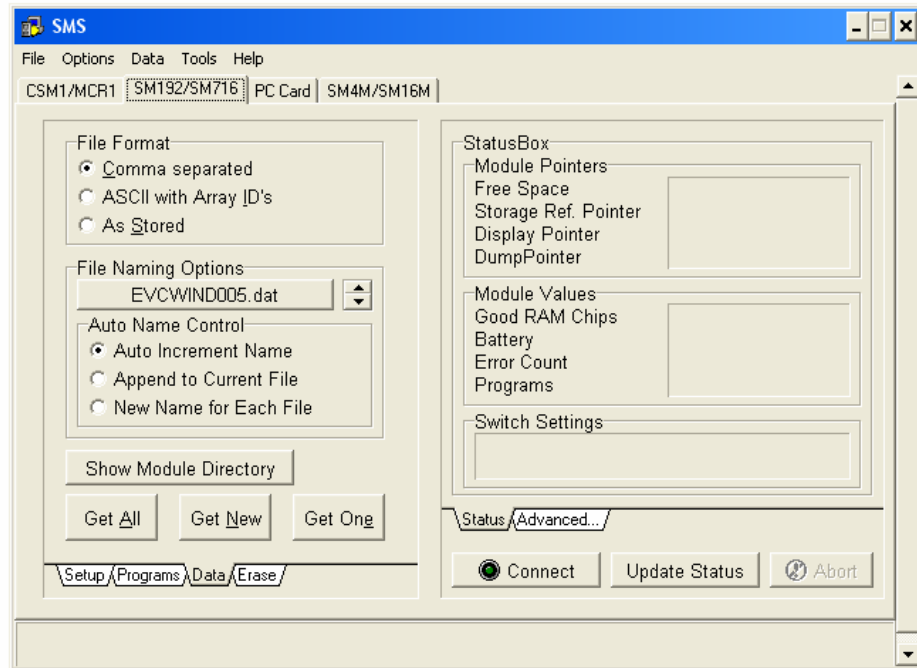
This SOP describes the procedures for storing data onsite with a Campbell Scientific, Inc. (CSI) SM192 or SM716 storage module. The number of the storage module refers to the amount of storage available on the module. These modules are considered retired products according to CSI, but are still supported. These modules are used on the Long-term Ecological Monitoring (LTEM) climate stations at Denali National Park and Preserve.

Procedures

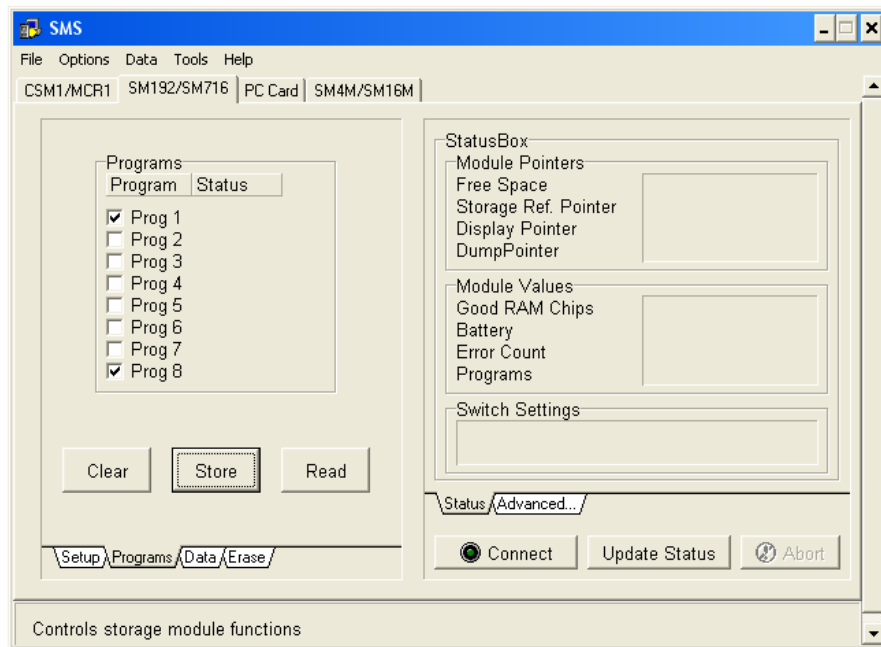
1. The storage modules are connected to the datalogger using a CSI ribbon cable to connect the 9-pin serial port on the storage module with the serial port on the datalogger.
2. The station must be programmed to send the data that is stored in final storage to the storage module every hour using a P92 command in the EDLOG programming software. SOP 6 gives an example of a programmed used on the 21Xs.
3. During a bi-monthly site visit the storage module is swapped for a fresh module. This swap can occur at anytime except for on the hour. This is when the data are being transferred.
4. The full module is downloaded back at the office using an SC 532 which enables communication between the storage module and a PC with LoggerNet software installed.
5. Open LoggerNet and select Stg Module



6. On the Stg Module toolbar select the SM192/SM716 tab. Select the Setup tab to set the connection between the storage module and the PC. The default setting is COM 1 (Communication Port 1) at 9600 baud.
7. Select Connect to enable the connection between the two devices.



8. Next select the **Data** tab on the bottom. Under the **File Format** select **Comma separated**. Under file naming options name the file with the following naming convention: 2 letter station abbreviation, 3 number Julian day, and two number year, i.e. PF13204 would be Permafrost station, Day 132 of year 2004. The following is the list of the two letter abbreviations for the LTEM stations in Denali:
 - Forest-FO
 - Permafrost – PF
 - Treeline – TL
 - Lower Ridge – LR
 - Upper Ridge – UR
9. After the file has been named select **Get All** from the bottom left. Depending on the amount of stored data this could take a few minutes.
10. Once the data are transferred check to make sure the file is complete. At this point make a copy of the entire data file and export it into an Excel spreadsheet with the same naming convention. The original file format will be an ASCII supported file type on the PC, i.e. Surfer. Verify that there are two copies of the file on the PC.
11. Select the **Erase** tab on the bottom of the Stg Module Toolbar. Select **Erase data and Programs**. This will clear the storage module and it will be ready for the next site visit. These storage modules can be used on any of the stations.
12. Programs can be stored in the Storage Module and transferred to the datalogger in the field using the keypad on the datalogger. To store a program select the **Programs** tab on the bottom of the Stg Module toolbar. Select **Prog 1** and **Prog 8** and then select **Store**. This window allows you to browse through your PC to locate the program for the station. Find the program and double click on the file. The same file will be loaded into both Program 1 and 8. Verification of the transfer can be done by selecting **Read** and naming the file. Naming this file check or test will make it easier to find for verification.



13. After the download is complete and the data and programs are erased select **Disconnect**.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 15

Station Maintenance / Calibration Schedule

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the calibration schedule for the standard sensors used on the CAKN climate stations. The suggested maintenance schedule is outlined below:

Six Months

1. Download data from datalogger
2. Check the pyranometer for level and clean if necessary
3. Check tipping bucket for debris
4. Clean the radiation shield
5. Clean the enclosure
6. Replace desiccant

One year

1. Download data
2. Calibrate the HMP45C probe. Swap sensor
3. Calibrate the rain gage in the field.
4. Change desiccant in SR50
5. Replace desiccant in enclosure
6. Tighten guy wires

Two years

1. Calibrate the pyranometer. Swap sensor.

Three Years

1. Replace anemometer bearings and wind vane potentiometer.
2. Calibrate the datalogger. Check with CSI.

Five years

1. Replace sensor cables as necessary
2. Replace batteries

Five to ten years

1. Replace soil temperature probes

General maintenance

1. Inspect station
2. Check sensor leads for damage
3. Ensure that tripod is level and plumb
4. Check alignment of GOES antenna
5. Clean glass on solar panel

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 16

Station Maintenance Checklist

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the items needed for a maintenance visit to a CAKN climate station. Each station needs to be visited a minimum of once a year, two times a year is preferable if the budget allows.

Climate Station Toolbox

√	Tools Needed for Deployment/Maintenance
	Tape measure
	Teflon tape/Pipe Dope
	Straight Bit Screwdriver
	Philips Head Screwdriver
	Needle Nose Pliers
	Pliers
	Pocket Knife
	Wire cutters
	Wire strippers
	Nut drivers 3/8", 5/16"
	Hex wrench set
	Open Ended Wrenches: 3/3", 7/16", 1/2", 9/16"
	Socket Wrench and 7/16" deep well, 9/16" and 1/2" sockets
	Adjustable Wrench
	Electrical tape
	Tie-wraps
	Level
	Extra nuts/bolts/washers/screws
	Enclosure putty

Equipment needed, but not carried in toolbox

√	Equipment/tools
	Silicone spray
	Hacksaw
	Pipe wrench 12"
	Small sledgehammer
	Rock bar
	Step ladder (4 or 6')
	Shovel
	Drill
	Soil Auger
	Weed Whip
	Loppers
	Paper towels
	Desiccant
	Thermometer (°C)
	Voltmeter
	Radio and batteries
	Satellite phone
	Calculator
	Calculator
	Sharpie/Pencil
	Compass w/known magnetic declination of area
	Inclinometer
	Camera and extra batteries
	Binoculars
	Bungee cord
	Station checklists
	CR10X wiring diagrams
	CR10X program
	CR10X prompt sheet
	GOES program
	Desiccant packs
	Palm PDA w//PC Connect and cables
	Laptop w/LoggerNet and DCPCComm and cables

Personal safety and survival gear

√	Personal Equipment
	Warm Clothing
	Waterproof Jacket and Pants
	Small Tarp
	Water/Food
	Sunscreen
	Personal Protective Equipment for aircraft (if applicable)
	Bear spray
	Watch

The following is the maintenance checklist required for each station visit

Site Checklist
Central Alaska Network Long-Term Ecological Monitoring Program

Site: _____

Operator: _____

Date: _____ Time: _____

*5 A – Year		
A – Julian Day		
A – Time (AST)		
*6 A – Battery Voltage 01:		
A – Panel Temperature 02:		
A – Air Temperature 03:		
A – Relative Humidity 04:		
A – Wind Speed 05:		
A – Wind Direction 06:		
A – Solar Radiation 07:		
A – Soil Temperature 50cm 08:		
A- Soil Temperature 100cm 09:		
A – P126 Transmit Code 10:		
A – Transmit Counter 11:		
A – P127 Status Code 12:		
*6 26A – P127 Error Register 26:		
*B AAA – # E08 Count 04:		Reset? (Key 88)
A – # Overrun Count 05:		Reset? (Key 88)
AAA – Lithium Batt Volt08:		> 2.9?
A – Low 12V Batt Count09:		Reset? (Key 88)
Battery / Solar Panel OK? (Y/N)		
Desiccant Changed? (Y/N)		
HMP45C Swapped		Serial # In: Serial # out:
LI200X Swapped		Serial # In: Serial # out:
Wind monitor Swapped		Serial # In: Serial # out:

Other service/maintenance performed:

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 17

Photo Documentation Checklist

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the steps taken to photographically document the climate site during the annual maintenance trip. All photos will be cataloged with at least the minimum metadata required using ThumbsPlus software.

Photographical Documentation Checklist for CAKN Climate Station Annual Visit

☐ Photos taken By: _____ Date: _____

Photos should be made when there is good visibility at 100 meters. File names should include the compass direction where appropriate. Archive file format is .jpg. Photos should be taken in order listed below so they will properly be labeled and created.

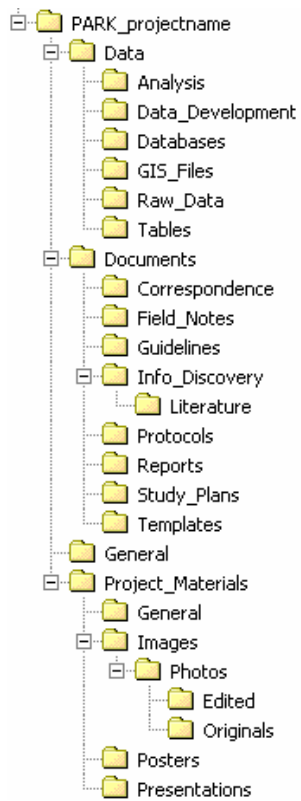
1. At least four general site views that represents the most informative overall perspective.
2. From a position 4 meters west of the station and starting at due south, nine still photos taken every 22.5 degrees clockwise to due north. Stitch photos into a single 180-degree image. **To be retaken at each annual site visit and archived.**

Start with S, SSW, SW, WSW, W, WNW, NW, NNW End with N

3. From a position four meters east of the station and starting at due north, nine still photos taken every 22.5 degrees clockwise to due south. Stitch photos into a single 180-degree image. **To be retaken at each annual site visit and photos placed in the archive.**

Start with N, NNE, NE, ENE, E, ESE, SE, SSE, End with S

4. File the photos under images in the file structure suggested in the CAKN Data management Plan. The photos will be filed under *Images*.



Reference:

Wilder, D., editor, 2004. Data Management Plan, Central Alaska Network. National Park Service. Inventory and Monitoring Program, Fairbanks, AK. xx pg.

NOAA Climate Reference Network, Photographical Documentation Checklist for USCRN Site, 2004.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 18

Keeping Maintenance Logs

Version 1.0 (October 2004)

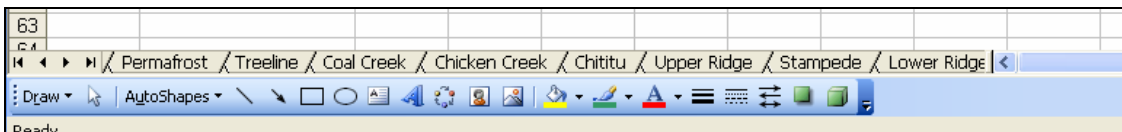
Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP outlines the procedures for maintaining a log for all CAKN climate station site visits. The log will be created in Microsoft Excel and filed according to the file naming protocol identified in the CAKN Data management plan.

Procedure:

1. Create an Excel spreadsheet with individual climate station names on individual worksheets.



2. After returning from the field, use the site checklist to update the maintenance log. Not all of the information needs to be transferred, but critical information like sensor replacements and maintenance should be entered into an electronic log for easy reference. An example is shown below.

7		
8		
9		
10	9/9/2003	Installed 2 soil probes 1 at 50 cm and 1 at 100cm. Located NW of station straight out from W facing leg.
11		Downloaded data
12		Replaced dessicant
13		Loaded CAKN soil program
14		
15		
16	5/24/2004	Transmissions not working due to leap year bug but station is still collecting data.
17		Swapped transmitter: In: 53988, Out: 18655
18		Swapped AT/RH Sensor: In: 3410056, Out 3410052
19		Checked for transmission with Wallops - All good
20		Downloaded all station data.
21		
22	8/13/2004	upgrade station
23		Swap AT/RH In: Y2410067
24		Add snow depth sensor
25		Add 2nd battery
26		Download data with Palm
27		Add second battery, how

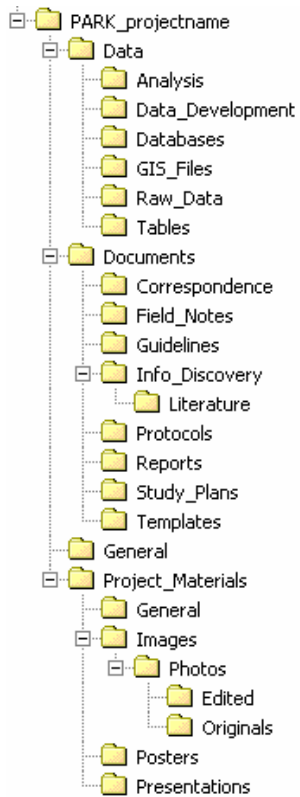
3. In another worksheet keep a log of the sensor calibration schedule for all of the stations. For example, record that the Dunkle station air temperature and relative humidity sensor was swapped on 8/5/2004. See example below.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2													
3													
4													
5	Site	Forest	Permafrost	Treeline	Lower Ridge	Upper ridge	Dunkle	Stampede	Wigand	Chititu	Chicken Creek	Coal Creek	
6	AT/RH	11/5/2001	5/30/2001	8/27/2002	7/16/2001	7/16/2001	8/1/2002	9/24/2002	8/1/2003	8/1/2004	8/1/2004	9/1/2004	
7		5/29/2003	5/29/2003	6/5/2003	8/6/2003	8/6/2003	8/5/2004	8/13/2004	8/13/2004				
8		8/31/2004	6/21/2004										
9													
10													
11	Pyranometer	7/12/2000	5/30/2001	5/30/2001	7/16/2001	7/16/2001	8/1/2002	9/1/2002	8/1/2003	8/1/2004	8/1/2004	9/1/2004	
12		9/26/2002	9/8/2003	8/6/2003	8/7/2003	8/6/2003	8/22/2004						
13		8/26/2003											
14													
15													
16	Wind	7/17/2002	7/22/2002	8/11/2002	8/15/2000		8/1/2002	9/24/2002	8/1/2003	8/1/2004	8/1/2004	9/1/2004	
17													
18													
19	Battery	7/2/2003	8/7/2003	8/7/2003	8/7/2003	7/1/2000	2/5/2004	new 20003	new 2003	8/1/2004	8/1/2004	9/1/2004	
20													

4. In another worksheet keep a running log of the serial numbers and calibration dates for each sensor. The sensors will be sent in to Campbell Scientific, Inc. for calibration in the early spring. See example below.

4/27/2004	HMP35C Calibrations 636996, 3845ORC2, 467151, 3845ORC1, HMP45C Calibrations X3410043, X3410044, Y2410067, X3410055, X3410056, X3410061, X3410049, X3410060, X3410057, X3410062, X3410063, X3410059,
6/9/2004	LiCor pyranometer calibrations PY45239, PY46219, PY46238, PY18075, PY36882, PY43204, PY43090, PY43169, PY43040, PY43110, PY43206,

5. File the field checklists in a file as a hardcopy backup within the file structure set up for CAKN_Climate Monitoring shown below. The maintenance logs would fit under Documents/Field_Notes.



Reference:

Wilder, D., 2004. Data Management Plan, Central Alaska Network. National Park Service. Inventory and Monitoring Program, Fairbanks, AK. xx pg.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 19

Data Quality - Accessing ASCADS

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the procedure for accessing the Automated Sorting, Conversion and Distribution System distributed by the National Interagency Fire Center (NIFC) Remote Automated Weather Station (RAWS) Depot in Boise, Idaho. The ASCADS system is used to log all of the maintenance information and sensor data from climate station maintenance visits. It helps track serial numbers, annual maintenance dates, sensor lists, and includes a narrative field for comments. The system also provides a watchdog system by alerting operators if a measurement value is out of range or remains constant for two many counts.

The following procedure must be followed to access ASCADS:

STEP 1:

In order to access ASCADS, you must first obtain a logon ID and password.

- [Access Profile Request](#) (included as part of SOP)
- Users must also read and understand these access [guidelines](#). Also included as part of SOP.

PLEASE NOTE: You will not be contacted about your logon information. Once you have set your computer up to access ASCADS, you must call the BLM's Remote Sensing Fire Weather Support Unit (RSFWSU) to obtain your logon information. Do not call RSFWSU until you have your computer set up properly (STEP 2).

STEP 2:

Contact Kolleen Shelley kshelley@fs.fed.us or Linnea Keating lkeating@fs.fed.us to obtain the instructions on setting up your computer to access ASCADS.

Please include the following information in your request:

Name

Email Address

Telephone Number

Reason for Requesting ASCADS Access

Incomplete requests will not be honored.

GENERAL RULES AND GUIDELINES GOVERNING THE USE OF BUREAU OF LAND MANAGEMENT COMPUTER SYSTEMS

According to the Department of Interior Manual 375 DM 19.10B, *"It is the responsibility of each employee to report all suspected, actual or threatened incidents involving automated information systems to the authorities indicated below."*

- § **Bureau of Land Management (BLM) employees shall report observed computer security incidents or suspected computer security violations immediately to the Installation Information Technology (IT) Security Manager and to their supervisors.**
- § **The BLM Installation IT Security Manager may recommend the removal of any individual's User ID and password from any BLM computer system and/or application system in the event of a security incident.**
- § **Unauthorized access or misuse of BLM computer systems may subject violators to criminal, civil or administrative action. Criminal Penalties include fines and/or imprisonment of up to 20 years. Disciplinary action for administrative violations of the following rules may range from a verbal or written warning, removal of system access for a specific period of time, reassignment to other duties, or other action as deemed appropriate.**

Violations of the following rules are considered computer security incidents:

1. **CLASSIFIED INFORMATION.** No classified National Security information will be entered into any BLM computer system.
2. **GOVERNMENT PROPERTY.** Computer hardware, software, and data of the BLM are considered to be the property of the U.S. Government. BLM computer systems shall be used for official business only. No games, personal software, private data, unlicensed proprietary software, or otherwise non-government information will be used on or entered into any Government-owned computer system. Any use of computers, software or data for other than official business is expressly prohibited, except as permitted by the BLM Internet Acceptable Use Policy.
3. **PROPRIETARY PROPERTY.** Commercially developed and licensed software shall be treated as proprietary property of its developer. Title 17 of the U.S. Code states that "It is illegal to make or distribute copies of copyrighted material without authorization." The only exception is the user's right to make a backup for archival purposes, assuming one is not provided by the manufacturer. It is illegal to make copies of software for any other purpose without permission of the publisher. Unauthorized duplication of software is a Federal crime. Penalties include fines of up to \$100,000 per infringement and jail terms of up to 5 years.
4. **ACCOUNTABILITY.** Individual User IDs and passwords shall be assigned only to persons having a valid requirement to access BLM computer systems. All activity accomplished under this User ID is directly attributable to the user to whom it is assigned.

GENERAL BUSINESS PRACTICES, which if not followed can lead to security incidents, are listed below. Noncompliance with these practices may result in removal of access and/or disciplinary or legal action being taken, consistent with the nature and scope of such activity.

1. **INDIVIDUAL USER IDs AND PASSWORDS.** Do not share your individual User IDs and passwords. They are to be used only by the individual owner. User IDs and passwords should not be written down except on the original assignment document. Once memorized, this document should be destroyed or, at a minimum, be kept in a locked safe or cabinet.

Under no circumstances should User IDs and passwords be posted ANYWHERE! Nor should they be kept in accessible locations. Never use personal information (e.g., telephone numbers, names of family members, pets, etc.) or dictionary words for your passwords. Passwords should be eight characters in length and consist of at least one numeric character, a special character, and both upper and lower case letters. Passwords should be changed at required intervals. If you believe your User ID and password have been compromised, change your password, notify your supervisor, and report the incident to the Installation IT Security Manager.

2. **UNAUTHORIZED ACCESS.** Access to BLM computer systems requires management approval. Do not attempt to gain access to any Information Technology system for which you do not have an approved and authorization to access.
3. **LOG OFF** when not actively working on the computer system. At a minimum, lock your workstation when leaving your work area for short periods of time or invoke the computer system's locking screen saver. **Remember, you are responsible for all activity logged under your User ID.**

**National Interagency Fire Center
Office of Fire and Aviation**

Circle One

**ASCADS COMPUTER ACCESS / INFORMATION CHANGE / TERMINATION
REQUEST**

Full Name, Phone # and Email are all that's required for a login termination request.

Full Name, Phone # and Email along with changes are that's required for a information change request.

Applicant:

Name: _____ ,

Last

First

MI

Email Address:

Short Name / System Login Name: _____ ie. jdoe

Phone #: _____ - _____ extension: _____

Federal Employee: YES / NO ?

Contractor: YES / NO ?

Agency / Organization / Company:

Agency: _____ Unit or Forest Name: _____

Region: _____

Address: _____

Is this a temporary (Detail) assignment: YES / NO ? If yes give estimated date of termination: _____

Maintenance:

Will you be doing weather station repairs: YES / NO ? If yes, will you be entering maintenance history in ASCADS narrative & updating sensor serial numbers: YES / NO ? If repairing weather stations. Do you work on the entire Region, Forest or a single weather station? _____

Please initial to acknowledge you have read the General Rules and Guidelines Governing The Use of BLM Computer Systems Form 1264-3. The rules & guidelines apply to **ALL ASCADS USERS**. Not just BLM employees.

Applicant's initials: _____

Supervisor's Initials: _____

Special Instructions or requests:

Immediate Supervisor or Other Responsible Official:

I acknowledge that the above individual needs an account on the ASCADS system.

Agency / Organization:

Address:

Email address:

Phone #:

Print Name

Signature

Date

Depot Use Only: Please forward to NIFC IT Security Manager

Login Name:

Date Added:

Please Fax signed form to the RSFWSU Depot at 208-387-5397

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 20

Entering Metadata into ASCADS

Version 1.0 (September 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

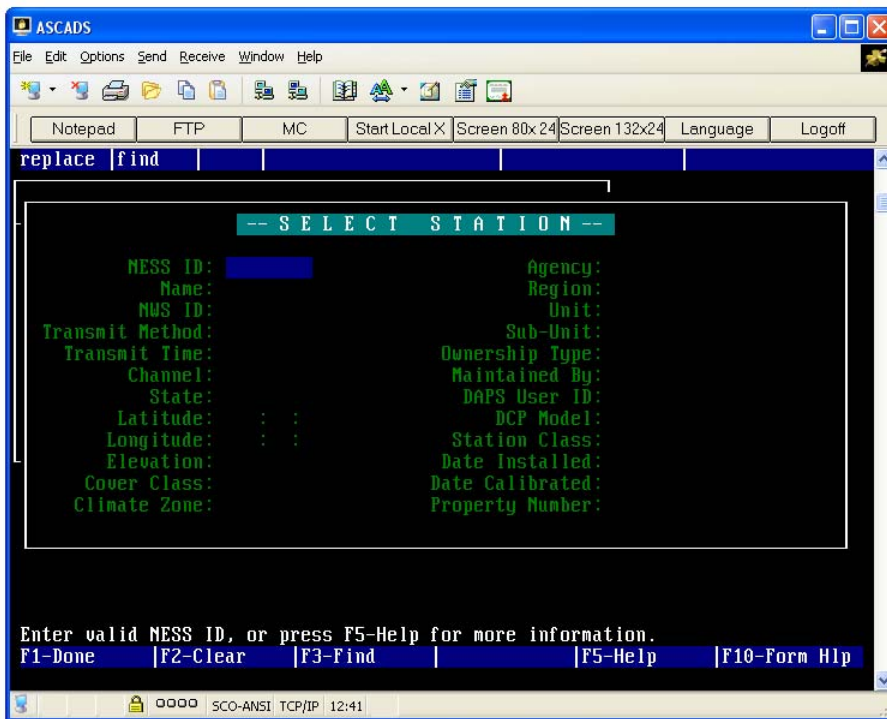
This SOP describes the use of the National Interagency Fire Agencies (NIFC) Automated Sorting, Conversion and Distribution System (ASCADS).If you need additional assistance call the Remote Sensing Support Unit at (208) 387-5475, and they can help with the software and access issues.

ASCADS is a user-friendly, menu driven interface that gives users the most current information on individual climate stations that have been integrated into the system. If a new station is installed, alert Boise at the number above, and they can add it to the system. It is important to update the information in the system each time a site is visited. By keeping the system up to date the metadata associated with the station can be stored accurately and consistently.

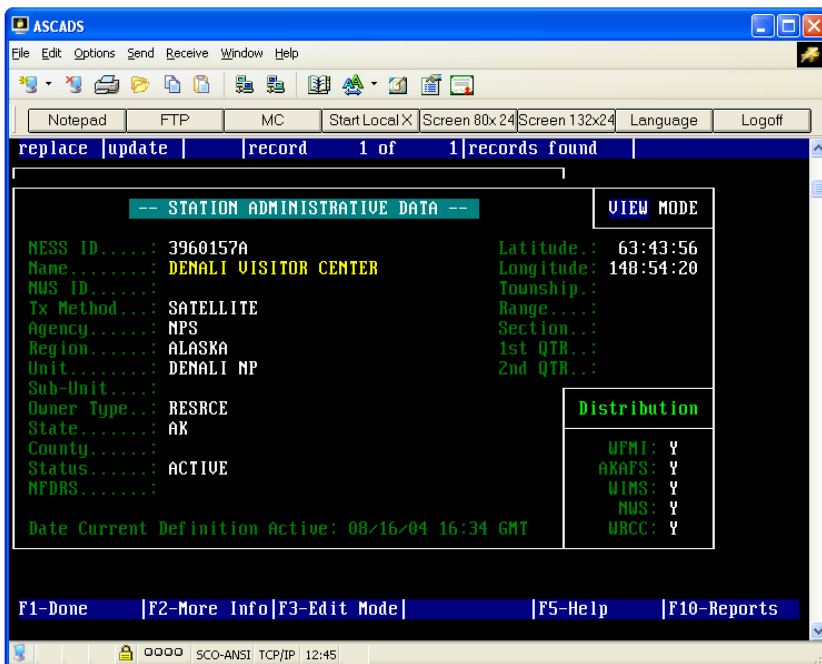
Access to ASCADS is through Secure Net Term. The procedures for installing Secure Net term on a PC are provided to you when you set up for an account which is outlined in SOP 15 – Accessing ASCADS.

Procedures for using ASCADS:

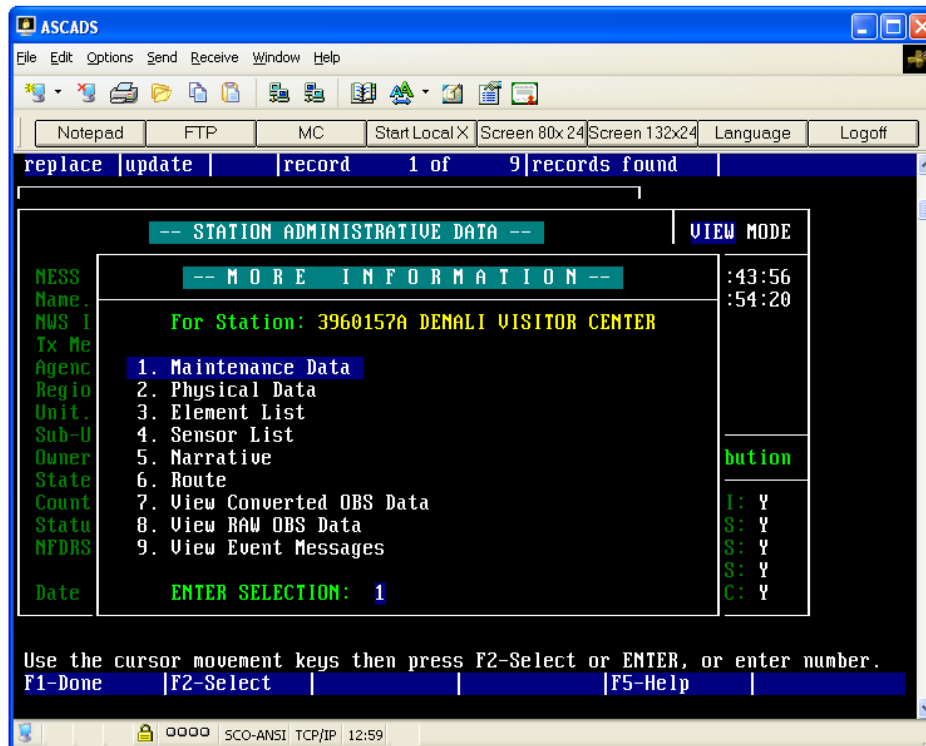
- 1) Open Secure Net Term. Select **File | Connect**. A box will pop up and prompt you for your User ID, a second box will prompt you for your Password.
- 2) Press Enter two times to get through the introductory screens. The next screen 9shown below) prompts you to enter either a NESS ID or station name. Type in the first three letters of the station name and hit F3. Navigate through the pages by using the Function keys at the bottom of the screen. F5 is always available as Help.



- 3) Once you have entered the name of the station it displays the administration information describing the station. Some of these fields can be edited and some are set in Boise. Use the F3 for edit mode.



- 4) To access more information about the station, select F2 – More Info. This brings up the menu screen shown below. The selections are described below.



- Selection 1. Maintenance Data - This page shows the annual maintenance date for the station. When the station is due you will receive a Watchdog warning generated by the system alerting you that it is time for the annual maintenance trip. Other information on this page includes: datalogger type, owner, Goes transmission time and window length, GOES channel, interval, and GOES antenna angle and azimuth settings.
 - Selection 2. Physical Data – includes information such as station elevation, slope angle, aspect, and site description.
 - Element List – This is filled in at Boise and describes the measurements recorded at the station and the units used.
 - Sensor List – provides the list of sensors and model numbers.
 - Narrative - Text describing the station or the program the station is affiliated with can be added in this space.
 - Route – This page is set up in Boise when the station is first integrated into the system.
 - View Converted OBS – This page displays the current data after it has been processed by ASCADS. The CAKN climate data comes into the system in metric units and is converted to Standard units for dissemination to the fire weather programs.
 - View Raw Obs Data – this page displays the current data in RAW format
 - View Event messages – Displays the time and date of each error, including missed transmissions, data outliers, data stream problems, etc. These messages are compiled and a weekly Watchdog message is sent to the operator.
- 5) When all of the information is updated exit the system by using the F1 key until it prompts you with the question Exit ASCADS? Enter Y and Enter to close the session.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 21

Data Access/Archive

Version 1.0 (October 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP describes the locations and frequency of data archiving and the provides links for both real-time climate data access and climate data archives for the Central Alaska Network climate monitoring program.

1. Data Archiving

Archive Location	Data Format	Data resolution	Archiving Frequency
Western Regional Climate Center	ASCII Delimited Columnar Excel HTML	Hourly Daily Weekly Monthly	Daily
Alaska State Climatologist	ASCII	Hourly	In development
WIMS	ASCII	Hourly	Daily
Alaska Fire Service	ASCII	Hourly	Daily
NWS/NOAA/NCDC	ASCII	Hourly	In development

2. Data Access

Data	Method	Who Can Access
Real Time	Western Regionnal climate Center http://www.wrcc.dri.edu/	Anyone
	Alaska Fire Service –Weather Link http://fire.ak.blm.gov/	Anyone
	University of Utah Dept. Of meteorology http://www.met.utah.edu/mesowest/	Anyone
	National Weather Service http://www.arh.noaa.gov/obs.php	In Development

	University of Alaska Fairbanks Alaska Climate research Center http://climate.gi.alaska.edu/	In Development
Daily Reports	Western Regionnal climate Center http://www.wrcc.dri.edu/	Anyone
Monthly Reports	Western Regionnal climate Center http://www.wrcc.dri.edu/	Anyone
RAW Data	Western Regionnal climate Center http://www.wrcc.dri.edu/	Anyone

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 22

Climate Monitoring Reporting

Version 1.0 (September 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP details the procedures for producing an annual report. The details of the analysis are being developed concurrently with the protocols through a contract, and will be finalized in 2005. The general reporting theme will remain the same, but the content might vary. The reporting tools are also being developed through a cooperative agreement with the Western Regional Climate Center. This SOP will need to be revised in 2005 following the completion of a number of tasks outlined in the above mentioned cooperative agreements and contracts that will include the following:

WRCC agreement: (Due December 31, 2004)

- Develop web based tools for analysis of CAKN climate data by December 31, 2004. Products may include capabilities to produce and analyze data derived from original climate data, including departures from normal, interim averages and trends, trends and manipulations (averages, etc) of individual data streams. An ability to compare data with derived data. Chart and table production and download capability (in common file formats). A packaged report suite that could serve as a period report for CAKN parks (i.e.: “annual station report for CAKN” might include charts parameter with all stations on the chart, a table of station averages and departures from normal, comparisons to longer-term Alaska stations (FAI, ANC).)

Climate data Analysis Contract (Due June 2005)

- Analyze existing data – mean, maxima, and minima temperatures, diurnal temperature ranges, and total precipitation for all sites using statistical methods most suitable to the dataset which may include, linear trends using time series modeling, spectral analysis, quadratic regressions, Autoregressive (AR) and Autoregressive Integrated Moving Average (ARIMA) models using an iterative process, Autocorrelation functions (ACF) and Partial Autocorrelation functions (PACF). Produce climate norms for weather stations with data sets with 30+ year records, and highlight years where there were marked shifts from the norm. A full narrative description of the steps involved in the analysis will be included in the findings.

An example of a climate monitoring report is included as Appendix E.

Climate Monitoring Protocol for Central Alaska Network

Standard Operating Procedure (SOP) # 23

Revising the Protocol

Version 1.0 (September 2004)

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP explains how to make changes to the Climate Monitoring Protocol Narrative and accompanying SOPs, and tracking these changes for the Central Alaska Network. Observers asked to edit the Protocol Narrative or any one of the SOPs need to follow this outlined procedure in order to eliminate confusion in how data are collected and analyzed. All observers should be familiar with this SOP in order to identify and use the most current methodologies.

Procedures:

1. The Climate Monitoring Narrative for the Central Alaska Network and accompanying SOPs has attempted to incorporate the most sound methodologies for collecting and analyzing climate data. However, all protocols regardless of how sound require editing as new and different information and technology becomes available. Required edits should be made in a timely manner and appropriate reviews undertaken.
2. All edits require review for clarity and technical soundness. Small changes or additions to existing methods will be reviewed in-house by Central Alaska Network physical science staff. However, if a complete change in methods is sought, than an outside review is required. Regional and National climate experts with familiarity in climate research and data analysis will be utilized as reviewers.
3. Document edits and protocol versioning in the Revision History Log that accompanies the Protocol Narrative and each SOP. Log changes in the Protocol Narrative or SOP being edited only. Version numbers increase incrementally by hundredths (e.g. version 1.01, version 1.02, ...etc) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0 ...). Record the previous version number, date of revision, author of the revision, identify paragraphs and pages where changes are made, and the reason for making the changes along with the new version number.
4. Inform the Data Manager about changes to the Protocol Narrative or SOP so the new version number can be incorporated in the Metadata of the project database. The database may have to be edited by the Data Manager to accompany changes in the Protocol Narrative and SOPs.
5. Post new versions on the inter-net and forward copies to all individuals with a previous version of the effected Protocol Narrative or SOP.

Reference

Pietz, D.G., S.G. Fancy, L.P. Thomas, B. Witcher. 2002. Bird Monitoring Protocol for Agate Fossil Beds National Monument, Nebraska and Tallgrass Prairie National Preserve, Kansas. Prairie Cluster Prototype Monitoring Program. Prepared for: National Park Service, U.S. Department of the Interior, 24p.