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## **CR10X Data Collection Program Version 792.0 September 7, 2003**

CR10X data collection program version 792 is a MicroMet telemetry data collection system for SCAN stations operating on AMBCS. This program is based on Aniak.CSI, provided by NRCS.

This program has a normal sensor update rate of 10 seconds, however most sensors other than wind, precip and snow depth are sampled at a 20 minute interval. 792 produces several hourly report groups and a daily summary group via MicroMet. A single hourly report is saved to the local memory module. The MicroMet report values are scaled for transport, while the hourly logging report is stored in real number form. In this way, each report is optimized for its destination. The MicroMet daily summary is sent at midnight, then is resent again at noon. 792 includes a process to calculate Vitel soil parameters for up to seven Vitel soil probes. 792 can handle any number of Vitel probes, up to seven.

### **Sensor Rapid Update Feature**

791 implements an operator controlled rapid update feature, which allows the technician to view sensor data without having to wait for the normal sensor update period to occur. To utilize this feature, simply set the CR10X **F1** flag with PC208. Once done, this will cause the program to update **all** of its sensors at the maximum update rate of once per ten seconds. This includes the Vitel soil parameter reduction process, so that soil moisture and temperature can be viewed directly with PC208 or with a Palm device. There is no hazard with using this feature, as it automatically turns off at the end of each hour.

### **Operator Tunable Variables**

Several CR10X Input Locations are provided, with which the operator may adjust sensor offsets and adjust site variables. These locations may be edited directly with PC208.

<b>Location</b>	<b>Function</b>
SiteID	The operator may set this variable to a numeric value unique to each site. This variable is included in the locally logged reports.
Soil	Set to soil type for Vitel soil probes. See also AMBCS SCAN station Input Labels.
ProbeType	Set to Vitel Probe type. See also AMBCS SCAN station Input Labels.
VitelCnt	Set to the number of Vitel Probes in place at this site. Defaults to seven.
SnowDOff	Set to the measured height of the Judd snow sensor above the ground. The snow depth is derived from the distance measurement taken by the Judd sensor minus the SnowDOff.

## Sensor Configuration

Sensor configuration is addressed in the NRCS site documentation for the Aniak (AK601) data site.

### Control Port Usage

Control	Function
C1	AM416 RES
C2	AM416 CLK
C3	MicroMet Serial IO RTS
C4	MicroMet Serial IO DATA
C5	not used
C6	HMP45C AirTemp/Rh
C7	Judd Snow Depth
C8	Sw 12V

### Sensors, Input Channels & Associated Input Labels

Sensor	Input Channel	Input Label
Site Battery	-	BATT_VOLT
Internal Temperature	-	INT_TEMP
Vitel Soil Probes	SE1..SE4 (MUX)	Probe1_v1..Probe7_v4 volwater1..volwater7 Tsoil1..Tsoil7
Tipping Bucket Precip	P2	PRECIP_in
Wind Speed (Met One)	P1	WINDSPEED
Wind Direction	SE6	WIND
Solar Radiation	DIFF6	SOLAR_RAD
Air Temperature	SE7	AIR_TEMP
Relative Humidity	SE8	RH_
Snow Depth	DIFF5	SnowHeight + SnowDoff = SnowDepth

### Subroutines for AMBCS SCAN Sites 790.0

Sub #	Functionality
1	Vitel Soil Probe Processor - Temperature
2	Vitel Soil Probe Processor - Diode
3	Vitel Soil Probe Processor – Diode Child
4	Vitel Soil Probe Processor – Entry Point
5	Judd Snow depth processor
6	Unused
7	MicroMet data message processor

## Data Reports

### Multiple Sensor Groupings for AMBCS SCAN Stations

#### Group 1 Reported Hourly

Ch	Sensor	Interval	Units
1	Battery	Current	Volts
2	Precip for the hour	Total	Inches
3	Air temperature	Current	Deg C
4	Air temperature	Maximum	Deg C
5	Air temperature	Minimum	Deg C
6	Air temperature	Average	Deg C
7	Solar radiation	Average	W/M2
8	Wind speed	Average	Mph
9	Wind direction	Average	Degrees
10	Wind Speed	Maximum	Mph
11	Relative Humidity	Maximum	Percent
12	Relative Humidity	Minimum	Percent
13	Snow Depth	Current	Inches
14	Precip year to date	Total	Inches
15			

#### Group 2 Reported Hourly

Ch	Sensor	Interval	Units
1	Vitel SM-1	Current	Wfv
2	Vitel ST-1	Current	Deg C
3	Vitel SM-2	Current	Wfv
4	Vitel ST-2	Current	Deg C
5	Vitel SM-3	Current	Wfv
6	Vitel ST-3	Current	Deg C
7	Vitel SM-4	Current	Wfv
8	Vitel ST-4	Current	Deg C
9	Vitel SM-5	Current	Wfv
10	Vitel ST-5	Current	Deg C
11	Vitel SM-6	Current	Wfv
12	Vitel ST-6	Current	Deg C
13	Vitel SM-7	Current	Wfv
14	Vitel ST-7	Current	Deg C
15			

#### Group 3 Reported Hourly

Ch	Sensor	Interval	Units
1	CS107 Soil Temp 1	Current	Deg C
2	CS107 Soil Temp 2	Current	Deg C
3	CS107 Soil Temp 3	Current	Deg C
4	CS107 Soil Temp 4	Current	Deg C
5	WaterMark Kohm1	Current	
6	WaterMark Kohm2	Current	
7	WaterMark Kohm3	Current	
8	WaterMark Kohm4	Current	
9	WaterMark BAR 1	Current	
10	WaterMark BAR 2	Current	
11	WaterMark BAR 3	Current	
12	WaterMark BAR 4	Current	
13			
14			
15			

#### Group 4 Reported at Midnight

Ch	Sensor	Interval	Units
1	Battery	Current	Volts
2	Air temperature	Current	Deg C
3	Air temperature	Max for day	Deg C
4	Air temperature	Min for day	Deg C
5	Air temperature	Ave for day	Deg C
6	Solar Radiation	Ave for day	Inches
7	Wind speed	Ave for day	Mph
8	Wind direction	Ave for day	Degrees
9	Wind speed	Max for day	Mph
10	Relative Humidity	Max for day	Percent
11	Relative Humidity	Min for day	Percent
12	Snow Depth	Current	Inches
13	Precip for the day	Total	Inches
14	Precip year to date	Total	Inches
15	Program version #	n/a	n/a

## Hourly logging report

The hourly logging report is only slightly modified from the original NRCS version, now beginning with the SiteID, and the ProgID.

<b>Field</b>	<b>Label</b>	<b>Description</b>
1	SiteID	Numeric Station ID edited into input location.
2	ProgID	SAMPLE Numeric CR10X program ID
3	BATT_AVG	Hourly average battery voltage
4	INT_TEMP	Hourly average internal CR10X temperature
5	AIR_TEMP	Hourly average air temperature
6	RH_HrMax	Hourly maximum relative humidity
7	RH_HrMin	Hourly minimum relative humidity
8	SOLRAD_AV	Hourly average solar radiation
9	PRECIP_TOT	Hourly tipping bucket precipitation
10	WindSpAvg	Hourly wind vectors
11	WindDirAvg	
12	SoilTAvg1	Hourly average soil temperatures (CS107)
13	SoilTAvg2	
14	SoilTAvg3	
15	SoilTAvg4	
16	KohmAvg1	Hourly average watermark resistances
17	KohmAvg2	
18	KohmAvg3	
19	KohmAvg4	
20	BAR_Avg1	Hourly average watermark water potentiails
21	BAR_Avg2	
22	BAR_Avg3	
23	BAR_Avg4	
24	Probe1_v1	28 Hourly average Vitel Probe voltages
25	Probe2_v1	
26	Probe3_v1	
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## AMBCS SCAN Site Input Labels

This program uses some three hundred input labels as setup parameters, hourly and daily summary parameters, and as temporary data storage. Many important input labels are described in this section. Most, but not all input labels should **never** be moved from their relative positions. **Extreme care should be exercised when adding new input labels or deleting existing labels, since the CR10X program often writes to sequential storage locations without reference to individual labels.**

These labels are either used by the program during initialization, or are set by the user to tune sensors.

<b>Setup</b>	<b>Function</b>
Prognit	Set by program when it initializes (do not edit)
ProgID	792.0 for this revision
SiteID	Set to a unique number for this site
ProbeType	Vitel 1=TypeA, otherwise 0 – default is 1
Soil	Vitel soil type 1=Silt, 2=Clay, 3=Sand – default is 1
VitelCnt	Number of Vitel sensors installed
SnowDOff	User set to height of snow depth sensor above ground

These labels hold current data, either direct sensor input, or derived.

<b>NowValues</b>	<b>Function</b>
BATT_VOLT	Current battery voltage
INT_TEMP	Current CR10x internal temperature
AIR_TEMP	Current Air Temp, deg C
RH__	Current Relative Humidity, %
SOLAR_RAD	Current Solar Radiation w/m2
WINDSPEED	Current Wind Speed
WIND_DIR	Current Wind Direction
PRECIP_in	Tipping bucket tips this cycle
Sn_height	Height of snow depth sensor above ground or snow pack, negated
Sn_Depth	Current Depth of the snow pack
VITEL_1..VITEL_28	4 times 7 Vitel voltages
Volwater1..volwater7	7 Vitel soil moisture values
Tsoil_1..Tsoil_7	7 Vitel soil temperature values in deg C
TsoilM_1..TsoilM_4	4 CS107 soil temperature values in deg C
Kohm_1..Kohm_4	4 WaterMark sensor voltages
BAR_1..BAR3	4 WaterMark water potential values

These labels hold hourly summary data, derived programatically.

<b>HourValues</b>	<b>Function</b>
BATT_AVG	Hourly average battery voltage
PREC_TOT	Hourly totalized tipping bucket precip, totalized at end of hour
SnDepAvg	Hourly average snow depth
AirTHrMax	Hourly maximum air temperature
AirTHrMin	Hourly minimum air temperature
AirTHrAvg	Hourly average air temperature
SOLRAD_AV	Hourly average solar radiation
WINDSPMAX	Hourly maximum wind speed
WINDSPAVG	Hourly average wind speed
WINDDIR_AV	Hourly average wind direction
SoilTAvg1..SoilTAvg4	4 Hourly average soil temps CS107
KohmAvg1..KohmAvg4	4 Hourly average WaterMark readings
BAR_Avg1..BAR_Avg4	4 Hourly average Watermark water potentials
PREC_ACUM	Total Accumulated tipping bucket. Rolls back to 0.00 at 40.95

These labels hold daily summary data, derived programatically.

<b>DayValues</b>	<b>Function</b>
AIRT_MAX	Daily maximum air temperature
AIRT_MIN	Daily minimum air temperature
AIRT_AVG	Daily average air temperature
SolRadDay	Daily average solar radiation
WindSpDMx	Daily maximum wind speed
WindSpDMn	Daily minimum wind speed
WindSpDAv	Daily average wind speed
PrecDay	Daily total precipitation
RH_DayMax	Daily maximum RH
RH_DayMin	Daily minimum RH

These labels hold midnight values, which are not retained elsewhere.

<b>MidNtVals</b>	<b>Function</b>
BattMn	Midnight battery voltage
AirTMn	Midnight Air Temperature
SnDepMn	Midnight hour average snow depth
RH_Mn	Midnight Relative Humidity
PrecMn	Midnight Tipping bucket Accumulation

These labels are used by the Vitel subroutines to derive soil parameters from raw voltages

<b>VitelLbIs</b>	<b>Function</b>
Probe1_v1	Voltage inputs for Vitel Soil processing, 4 voltages per probe
Probe2_v1	
Probe3_v1	
Probe4_v1	
.	
.	
Probe7_v4	
Rediecon1..rediecon7	
Imdiecon1..imdiecon7	
Tredieco1..Tredieco7	
Timdieco1..Timdieco7	
Salinity1..salinity7	
Soilcond1..soilcond7	
Tsoilcnd1..Tsoilcnd7	
Twtrcnd1..Twtrcnd7	

This group of labels holds sensor values, which have been formatted for transport via the MicroMet data modem. The message is sent from this sequence.

<b>MicroMet</b>	<b>Function</b>
Pri	Message priority
Metday	The julian date for message time stamp
Hhmm	The time of day for message time stamp
Group	The sensor group number
S1	Sensor number one
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.	
S15	Sensor number fifteen

These labels are used by the program to define the scope of each data message for MicroMet.

<b>MsgCtrl</b>	<b>Function</b>
Priority	MicroMet message priority
GroupID	MicroMet sensor group identifier
MsgCount	MicroMet message sensor count