SCRIPPS INSTITUTION OF OCEANOGRAPHY

Meteorological Acquisition System

(MET)

Shipboard Meteorological System
MetAcq Operator's Manual

Shipboard Technical Support

Revision 2.12
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Table of Contents

1. General Information

The Shipboard Meteorological Acquisition System (MetAcq) acquires, filters, averages, corrects, displays and distributes meteorological sensor data from a wide variety of sensor types and data input devices.

Meteorological sensors such as ones made by RM Young, Vaisala and most sensors that have an RS485, RS422, RS232 digital interface or any analog sensor that can output a voltage, frequency or 4-20ma current can be accommodated.

A typical system measures air temperature, barometric pressure, wind speed/direction, relative humidity, short wave radiation, long wave radiation, seawater temperature and seawater conductivity. Sensor information is combined with time and GPS position information and displayed on the local video display or Web Server and written to data files. The main acquisition device is a Windows based computer that has at least two serial ports. Data can be acquired simultaneously on all enabled ports. One or more ports can be configured to support RS485 communications through RS232 to RS485 converters. Sensors that have analog outputs are first connected to signal conditioning modules that are physically located near the sensor. These modules then convert the analog signal to RS485 that is then routed to the lab. Collected data is stored on data files at user-selected intervals. This interval is typically once every 30 seconds. Acquired data that has been collected from the sensors (uncalibrated) is stored in an uncorrected data file. Data that has been corrected by applying the most recent precruise calibration data is stored in a corrected data file.

Atmospheric meteorological sensors are generally located on either the forward part of the ship on the MET mast and/or above the ship's upper bridge deck. Sensors that measure seawater properties are generally located near the uncontaminated seawater in-take area or in one of the ship's laboratories that has a connection to the uncontaminated seawater line.

1.1.0 Meteorological Acquisition Program

The acquisition program was written in the Labview programming language. It acquires, displays and stores meteorological data in real-time.

Main features:

1. Acquire data from any number of sensors or instrumentation.
2. Tabulated Data Displays that present data (either calibrated or uncalibrated).
3. Real-time 20-strip chart displays that chart user selected data vs. time that includes
        a history scroll bar on each strip chart that allows viewing of previously displayed data.
4. Write data to files, serial devices and/or UDP ports at user selected intervals.
5. User defined data output formats that can be output to UDP, serial port or file.
6. Ability to playback and view any standard data file.
7. Can automatically email data files to any address.
8. Has a built in Web Server or it can also utilize any user supplied web server.

1.2.0 Minimum Systems Requirements

Microsoft Windows xp, 7, 8 (32 or 64 bit systems)
Linux Redhat, Scientific, SUSE, Centos (32 bit systems only)
Video interface and monitor capable of 1280x1024 resolution or better

National Instruments Labview Runtime engine
National Instruments VISA Runtime engine

1.3.0 Contact Information

For help or assistance with any part of the meteorological system contact:

Shipboard Technical Support
Tel (858)534-6054 or (858)534-1907
email: sts-cr@ucsd.edu and/or all-at-seg@sts.ucsd.edu

Meteorological Acquisition Program written by:
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cmattson@ucsd.edu
tel (858)534-8285

2. Meteorological Sensor types

A sensor type is a software module that produces one complete data set for a particular function. For example, WND is a module of the wind sensor type; it consists of two sensors that output one data set that contains two raw values – 1.Wind Speed, 2.Wind Direction. From these two raw values, calculations may be applied to output corrected values as well as calculated values. For example the wind sensor type can be set to output True Wind Speed and True Wind Direction as well as the relative values. Each sensor type has an ID that is similar to the address values of the older Alden IMET system modules.

The first three letters of the sensor module name must begin with one of the following Type designators. The next two characters should be an ID to determine which module is selected. Each sensor used on SIO ships is assigned it's own ID. In this system there are 30 predefined module types that cover the most requested sensor types.

Item	TYPE	Description	Associated Parameters (Appendix A)
1	TMP	Air Temperature	AT, AF, WC, WF
2	HRH	Relative Humidity, Temperature	RH, RT, DP, RF, DF, WB, WF
3	BPR	Barometric Pressure, [Compensation Temp]	BP, BC
4	PRC	Precipitation	PR, PT
5	WND	Wind Speed, Wind Direction	WS, WD, WK, TK, TW, TI
6	SWR	Short Wave Radiation	SW
7	LWR	Long Wave Radiation Dome Temperature, Body Temperature, Thermopile voltage	LW, LD, LB, LT
8	FLW	Flowmeter	FM, FI
9	SST	Surface Seawater Temperature	ST, SF
10	SSC	Surface Seawater Conductivity	SC
11	VLT	A/D Volts	VT
12	FLU	Fluorometer	FL, TB
13	XMS	Transmissometer	TR, BA
14	OXY	Oxygen	OC, OT, OS, OX, OG
15	TSG	Thermosalinograph	TT, TF, TC, SA, SD, SV
16	USP	Unspecified (user defined)	XX
17	PAR	Surface PAR	PA
18	AWT	Auxiliary Water Temperature	WT
19	AXT	Auxiliary air Temperature	AX
20	IST	Instrumentation	IP, IT, IS, IA, IV, IX
21	PRS	Pressure	PS
22	PDR	Water Depth	BT
23	NME	NMEA messages	LA, LO, GT, CR, SP, ZD,GA,GS
24	GYR	Gyro	GY
25	ASH	Ashtech Heading, Pitch, Roll	SH, SM, SR
26	TSV	Time Server	TS
27	WCH	Winch Wire Out, Wire Speed, Tension	ZO, ZS, ZT
28	ALK	Alkalinity (pH)	PH
29	VRU	Vertical Reference Unit (Pitch, Roll, Heave)	VP, VR, VH, VY, VX
30	SOW	Ship's Speed Log (Speed over water)	SL
31	UCW	Uncontaminated Seawater Pump(s) status	PZ
32	MBD	Multibeam (Center beam Depth)	MB
33	PCT	PCO2	PC
34	SND	Depth Sounder	BT, LF, HF
35	MAG	Magnetometer	MG, MD, MS, MG
36	GRV	Gravimeter	GC

Sensor Type Default Settings

Sensor Type	Num Raw Values	Num Cor Values	Precision	Parameter Tag	Range MIN	Range MAX
TMP	1	1	2	AT	4.00E+1	5.00E+1
HRH	2	3	2	RH	0.00E+0	1.00E2
			2	RT	-4.00E+1	5.00E1
			2	DP	-4.00E+1	5.00E1
BPR	1	2	2	BP	8.00E+2	1.10E+3
				BS	8.00E+2	1.10E+3
PRC	1	1	1	PR	0.00E+0	5.00E+1
WND	2	4	1	WS	0.00E+0	2.00E+2
			1	WD	0.00E+0	3.60E+2
			1	TW	0.00E+0	2.00E+2
			1	TI	0.00E+0	3.60E+2
SWR	1	1	1	SW	-5.00E+3	5.00E+3
LWR	3	4	2	LD	2.00E+2	5.00E+2
			2	LB	2.00E+ 2	5.00E+2
			1	LT	-5.00E+3	5.00E+3
			1	LW	-2.00E+3	2.00E+3
FLW	1	1	1	FI	0.00E+0	1.00E+3
SST	1	1	3	ST	-5.00E+0	5.00E+1
SSC	1	1	3	SC	-5.00E+0	9.00E+1
VLT	1	1	3	VT	-1.00E+2	1.00E+2
FLU	1	1	3	FL	-5.00E+2	1.00E+5
XMS	1	2	3	TR	0.00E+0	1.00E+2
			3	BA	-1.00E+2	1.00E+2
OXY	2	4	3	OC	-5.00E+0	1.00E+4
			3	OT	-5.00E+0	5.00E+1
			3	OX	-1.00E+1	1.00E+4
			4	OS	-1.00E+1	1.00E+4
TSG	2	5	3	TT	-5.00E+0	5.00E+1
			3	TC	-5.00E+0	1.00E+2
			3	SA	0.00E+0	8.00E+1
			3	SD	0.00E+0	5.00E+1
			3	SV	1.40E+3	1.60E+3
USP	1	1	3	XX	-1.00E+6	1.00E+6
PAR	1	1	2	PA	-1.00E+5	1.00E+5
AWT	1	1	2	WT	-5.00E+0	5.00E+1
AXT	1	1	2	AX	-4.00E+1	5.00E+1
IST	6	6	2	IP	-2.00E+1	1.50E+4
			3	IT	-1.00E+1	5.00E+1
			3	IS	0.00E+0	1.00E+2
			1	IA	-2.00E+0	1.00E+3
			3	IV	-1.00E+1	1.00E+1
			2	IX	-9.00E+1	1.00E+2
PRS	1	1	2	PS	-5.00E+1	1.00E+5
PDR	1	1	1	BT	-5.00E+0	1.50E+4
NME	8	8	6	LA	-9.00E+1	9.00E+1
			6	LO	-1.80E+2	1.80E+2
			1	GT	0.00E+0	8.64E+4
			1	CR	0.00E+0	3.60E+2
			1	SP	-5.00E+0	8.00E+1
			1	ZD	0.00E+0	1.00E+10
			1	GA	-2.00E+2	2.00E+2
			1	GS	-1.00E+1	5.00E+2

GYR	1	1	1	GY	0.00E+0	3.60E+2
ASH	3	3	1	SH	0.00E+0	3.60E+2
			1	SM	-3.00E+1	3.00E+1
			1	SR	-6.00E+1	6.00E+1
TSV	1	1	0	TS	0.00E+0	8.64E+4
WCH	3	3	1	ZO	-1.00E+5	1.00E+5
			1	ZS	-2.00E+4	2.00E+4
			1	ZT	-1.00E+5	1.00E+5
ALK	1	1	2	PH	-1.50E+1	1.50E+1
VRU	3	5	1	VP	-6.00E+1	6.00E+1
			1	VR	-6.00E+1	6.00E+1
			2	VH	-1.00E+4	1.00E+4
			1	VY	-6.00E+1	6.00E+1
			1	VX	-6.00E+1	6.00E+1
SOW	1	1	1	SL	0.00E+0	8.00E+1
UCW	1	1	0	PZ	0	1
MBD	1	1	1	MB	0	110000
PCT	1	1	2	PC		
SND	3	3	1	BT, LF, HF	0	110000
MAG	3	3	3	MG		
			1	MD		
			1	MS		
GRV	1	1	0	GC		

The above values are what the program uses for default values.
Default settings for any sensor type can be changed and/or can be overridden in the ACQ file using the Keys: TAGS-C, TAGS-R, PRC-C, PRC-R and RANGE (Section 9).

3. Installation

Certain applications must be installed on the computer before the system can operate.
1. National Instruments Labview Runtime engine
2. National Instruments VISA Runtime engine
3. STS MetAcq.exe Acquisition program and supporting files

Refer to documentation supplied by National Instruments for instructions on installing the NI Labview Runtime engine and NI VISA Runtime engine.

The Windows path name is set to include C:\Wbin in the main path.
The following files are installed in C:\Wbin:MetAcq.exe
MetAcq.dsp is generated by MetAcq and contains the display settings.

Web Server support files are installed in C:\Wbin\www.
Met system manuals and documentation are usually located in C:\MET or the selected data directory.

3.1.0 Program setup and corrections file

This file contains serial port, program parameters, sensor setup and calibration data that the program uses for the following operations:

1. Activation and setup of computer serial or UDP ports
2. Activation and selection of sensor input modules
3. Setup of sensor address and communication parameters
4. Setup of desired correction/calibration algorithm
5. Sensor calibration coefficients
6. Data averaging parameters
7. Specify user defined output modules for serial port/data file writes

Program setup and corrections file <name>.ACQ is located in a user-designated directory (default directory is C:\MET). All MET data is written to the same directory that the selected ACQ file is located. See Sections 7 and 9 for details on the setup and corrections file.

4. Operation
After the Met acquisition computer is properly configured and setup then the following procedures can be used to perform program operations.
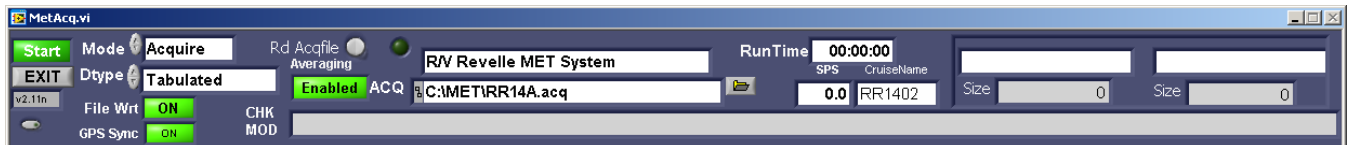
4.1.0 Startup Procedure (quick)
1. Power ON the MET computer
2. Ensure power is ON to all Met sensors
3. Observe that the Windows operating system is properly booting up.
4. The acquisition program will start. The program control panel will appear on the monitor.
5. At this point do one of two things.
    1. Do nothing; the program will start in about 30 seconds.
    2. Click on the green control button labeled <Start>

Note that the acquisition program can be set to start automatically upon Windows boot up by placing the MetAcq icon in the Windows startup folder.

4.2.0 Startup Procedure (detailed)
1. Ensure power is ON to all Met sensors
2. Ensure acquisition computer is powered up and booted up to the Windows operating system
3. On the Windows desktop display, using mouse, select the icon labeled MetAcq.exe
4. After the acquisition program is loaded, the user will see a control panel. At this point the program is in Standby. During Standby mode select the desired met configuration   file, mode of operation, type of display, enable/disable of automatic time sync and enable/disable data averaging. The lower control panel also contains several status indicators that can be observed during program operation.
5. After making the desired selections, click on the green control button labeled <Start>

4.2.1 Modes of Operation

1. <Acquire> This is the normal mode for data acquisition
2. <Playback> Playback any archived data file
3. <Cascade> Display data sent by RS232 or UDP from the primary acquisition PC
4. <Emulate> Sensor Emulation mode

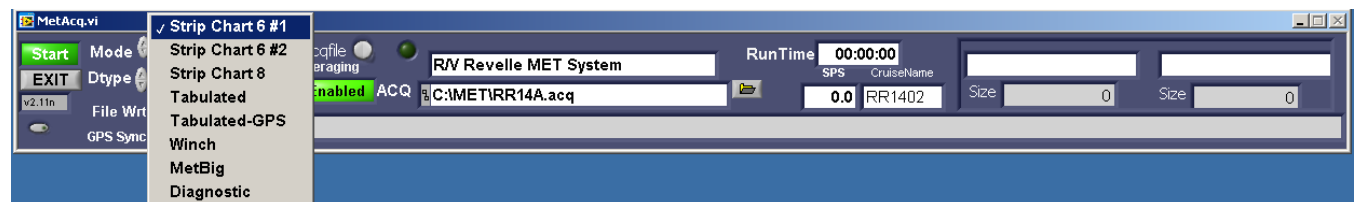### 4.2.2 Configuration File Select

The configuration file used by the acquisition program may be selected by using the indicated control. Just click on the little yellow folder symbol on the right side of the control. The configuration files are indicated be the file extension ACQ (For example SPROUL.ACQ). Input ports and sensor selection and calibration parameters are located in this file. Just to the right of the Mode control is a control call "Rd Acqfile". It allows the configuration file to be reread during acquisition without having to restart the program. Most sensor parameters other than the serial port configuration may be updated during program runtime.

4.2.3 Time Synchronization

If a Network timeserver is connected to the network then the system time of the MET acquisition computer can be set to automatically synchronize to the timeserver time using NTP protocol. When no network timeserver is connected then the MET acquisition computer will be synchronized to the time obtained from GPS if enabled. When GPS Sync is enabled, and it is desired to synchronize the time manually, then click on the Time Sync control located just below the GPS Sync control. To enable or disable GPS sync then set the following directive to in the .ACQ file to TRUE or FALSE. GPS_SYNC=TRUE (see section 9.2.0).

4.2.4 Display Modes

1. <Strip Chart6 #1> Selects 6 strip charts with 30 numeric parameter display indicators.
2. <Strip Chart6 #2> Selects 6 strip charts with 30 numeric parameter display indicators.
3. <Strip Chart8> Selects 8 strip charts
4. <Tabulated>   Selects Tabulated display with 30 parameter display indicators.
5. <Tabulated-GPS> Selects Tabulated display with GPS indicators and 30 displays.
6. <Winch> Selects Display With large Winch readouts.
7. <MetBig> Selects display with large MET data and winch readouts.
8. <Diagnostic> Selects diagnostic display

The Display mode has no effect on what data is stored in the MET data files. The information in the data files is determined by which sensors are activated in the configuration file.

4.2.5 Read ACQ file control

Prior to starting the program select the designated ACQ file using the ACQ Control on the front panel. The ACQ file has the port assignments and sensor module for the particular installation.
Upon start of the acquisition the ACQ file gets read into the program once. If any changes are made to the ACQ file then there are two ways to read it back. 1. Stop and Restart the program 2. If the ACQ file has been changed such as updating a set of calibration coefficients the new ACQ file may be re-read into the program without stopping the program. To update, click on the Rd Acqfile control button on the front panel. Note that If changes are made to the Ports section of the ACQ file then it is necessary to stop then restart the program.

4.2.6 Enable Data Averaging

When ON data averaging is enabled. The averaging setup parameters must be specified in the module section of the setup file (see section 9.3.0). Averaging can be enabled or disabled individually for any sensor. Averaging time can also be specified for any sensor. There are two types of averaging available. 1-Normal, 2-Vector. Vector averaging is used only on sensors that output in angular degrees such as wind direction.

4.2.7 Status Indicators

Runtime indicator – displays the length of time the program has been executing without interruption.

Scans Per Second (SPS) indicator – displays the number of times per second that the program scans through all of the sensors. This gives a general idea of how well the program is working. With several sensors the SPS will be lower; with few sensors the SPS will be higher. Generally the SPS should always be above 0.5 to indicate proper program execution.

Data Files indicator – displays the name and path of the data file that is currently being written. There are at least two files that the program updates every write interval. One file for the corrected data and the second for the uncorrected data. A new set of data files are started at the beginning of each (GMT) day beginning at 0000Z. Section 10 describes the data files.

SIZE indicator – displays the size in bytes of the data files.

CHK MOD indicator **–** Displays a list of sensors that fail to respond or output data. If a failure has been indicated there are 3 possibilities.

1. The sensor(s) have failed
2. The sensor power is OFF
3. The sensor(s) have been disconnected.

CruiseName indicator – displays the current cruisename. The cruisename is set by editing the cruisename.txt file located in C:\MET

4.3.0 Program Operation – Acquisition Mode

After the program has been started in Acquisition Mode as described in sections 4.1.0 or 4.2.0, the main display Window appears. This Window will be one of eight different configurations depending on the Display Modes setting. The Display Mode setting may be changed to another type of display at any time. In each display mode every window has it's own menu to select desired values to display and plot.   To change the displays – click the control button to access the pop up menu on the upper left – labeled <Displays>. In the pop-up display sensor data, sensor number and number of decimal places can be changed. When finished making selections click on the <X> on the upper right corner of the display.

Screen-shot of Variable Selection Menu for Upper Display Indicators on Strip Charts
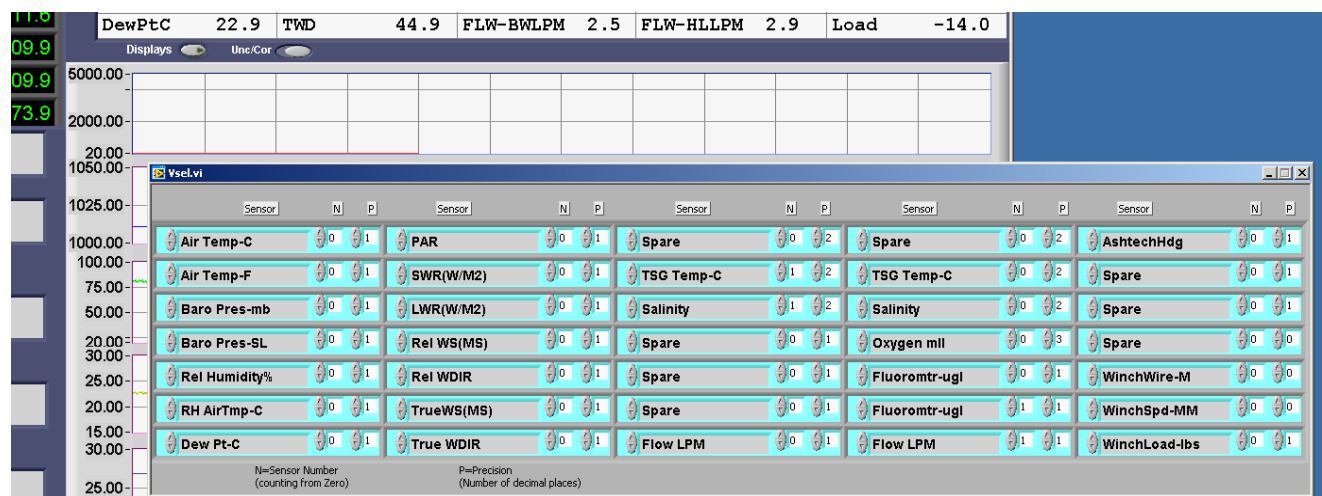
The <Plot Scales> control enables a pop-up where parameters and attributes are selected for plotting data on strip charts. In this pop-up display select the sensor data, sensor module, number of decimal places, auto scale enable, minimum scale value and maximum scale value. The sensor module selection on either the display selection or plot section allows the selection of redundant sensors. For example, if there were two air temperature modules and it is desired to chart the second one, select it's module number. Module numbers are numbered starting from zero. Zero being the first module. The minimum and maximum scale values can only be accepted if the auto-scale is turned OFF. When auto-scale is ON the program automatically adjusts the minimum and maximum scale values. The AUTOSCALE is initially enabled but if it is desired to manually set the scales of the Plot. Click on auto-scale to disable it. Then either enter the Min/Max values in the Plot Scales pop-up or simply click on the upper and lower scale values on the chart, then enter the desired values.
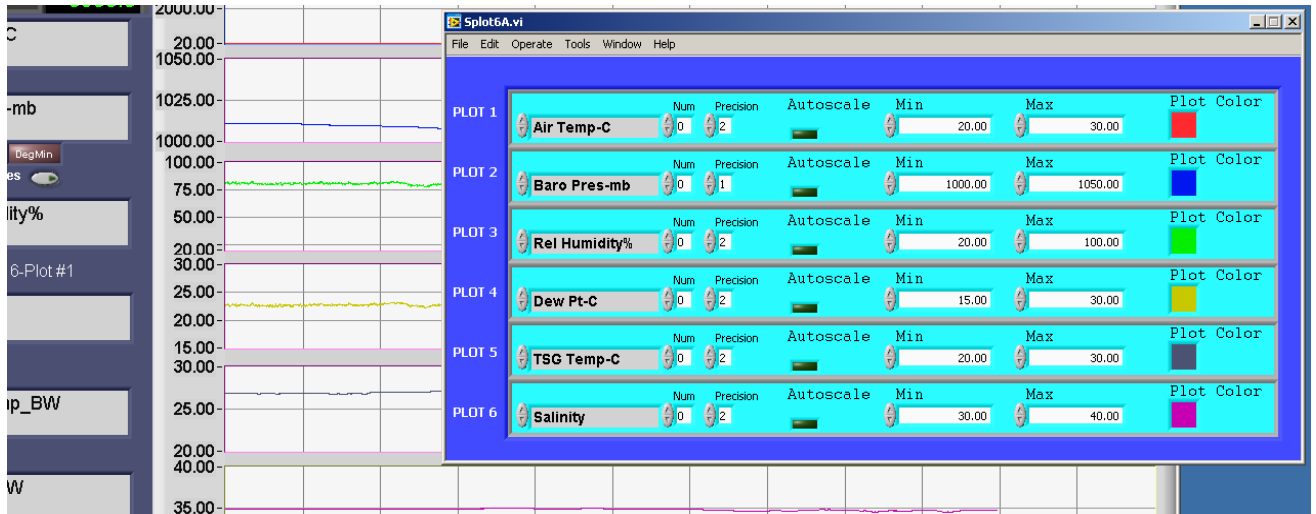
Screen-shot of Strip Chart 6-plot after activating plot selection menu

The strip charts have a history bar. If it is desired to view data that has already scrolled off the screen move the history bar to the desired setting.
The Clear Plot control clears the plot and plot history.

The Time Scale may be changed to any value in hours. Initially it is set to 24 hours. To change, move the mouse on the control and click to enter the value. Each time the Time Scale is changed it may be necessary to also click on the clear plot control to view the new chart time scale.

Screen-shot of Strip Chart 6-Plot

MetDisp6A.vi

									AshHDG	126.4
GPS	23:59:36	AirTmpC	27.7	PAR	669.3					
LAT	13 02.487N	AirTmpF	81.9	SWR	192.6	TT_HL	27.75	TT_BW	27.81	
LON	132 52.718E	BP	1008.8	LWR	389.1	Sal_HL	34.66	Sal_BW	34.65	
COG	129.9	BP_SL	1010.8	RWSMS	11.5			O2MLL	4.159	
SOG	10.6	RH	75.6	RWD	336.2			Fluor	20.7	Payout 20
3.5KHZ	5770.9	RhTmpF	27.7	TWSMS	6.9			Fluor#2	0.0	Spd 0
Depth Sndr	5770.9	DewPtC	23.0	TWD	85.2	FLW-BWLPM	2.5	FLW-HLLPM	3.1	Load -60.0
Depth MB	5842.6									

Displays   Unc/Cor

Air Temp-C
27.70

Baro Pres-mb
1008.8

DegMin
Plot Scales

Rel Humidity%
75.56

6-Plot #1

Dew Pt-C
23.03

TSG_Temp_BW
27.81

Salinity_BW
34.65

Clear   Hrs 24
Print   LW 1

Screen-shot of Strip Chart 8-plot.

GPS TIME 23:59:31 LAT 56 39.414S LON 092 29.720W COG 78.6 SOG 12.0 Gyro 77.7 Depth 5013

Rel WS KTS
17.1

Rel WDIR
238.5

True WS KTS
24.7

True WDIR
290.8

VRU Pitch
-0.2

VRU Roll
0.8

Latitude
-56.66

Plot Scales

SOG (GPS)
12.00

Clear   Hrs 24
Print   LW 1

Screen-shot of Tabulated Display

Press the "Select" control to change the displayed parameters

Screen-shot of Variable Selection Menu for Tabulated Display

Screen-shot of MetBig display

TIME	02:45:05	Air Temp-C	26.2	CAST6 Winch
LAT	15 23.599N	Air Temp-F	79.2	WIRE OUT
LON	129 46.226E	WndChill-F	79.2	20.3

COG 124.5 | Rel Humidity% 80.5 | SPEED MPM
SOG 10.6 | Dew Pt-C 22.6 | 0.0

HYDRINS OutB iXBlue
Satellites: 06
GPS OK

TENSION LBS
-50

Select   Select Clr   CYN/BLK

Baro Pres-mb 1009.9
Baro Pres-SL 1011.9

GYRO (Deg) 121.0
Speed Log (Knts)
Depth Multibeam 5667.8 | Salinity_BW 34.805
Depth 3.5KHZ 5660.0 | SWR(W/M2) 563.4
Depth 12.0Khz | LWR(W/M2) 360.8

WINCH0
WIRE OUT
0.0

SPEED MPM
0.0

Port Wind	Port Wind Select 1	Starboard Wind	Stbd Wind Select 0
	Rel True		Rel True
SPD	23.3 16.5 Knts	SPD	24.1 19.0 Knts
DIR	324.5 58.0 Deg	DIR	315.9 48.9 Deg

TENSION LBS
0

Press the "Select" control to change the displayed parameters

4.3.1 GPS Display - Setting Waypoints

On the Display mode selector control, set the display to Tabulated-GPS. Waypoints may be viewed and selected on the right side of the display. Once selected the following data will be calculated and continuously updated in the appropriate displays.

1. ETA – Estimated Time of Arrival to selected waypoint.
2. EDA – Estimated Date of Arrival.
3. TTG – Time to go before arriving at waypoint.
4. Distance in Nautical Miles to the selected waypoint
5. Bearing from the present location to the selected waypoint
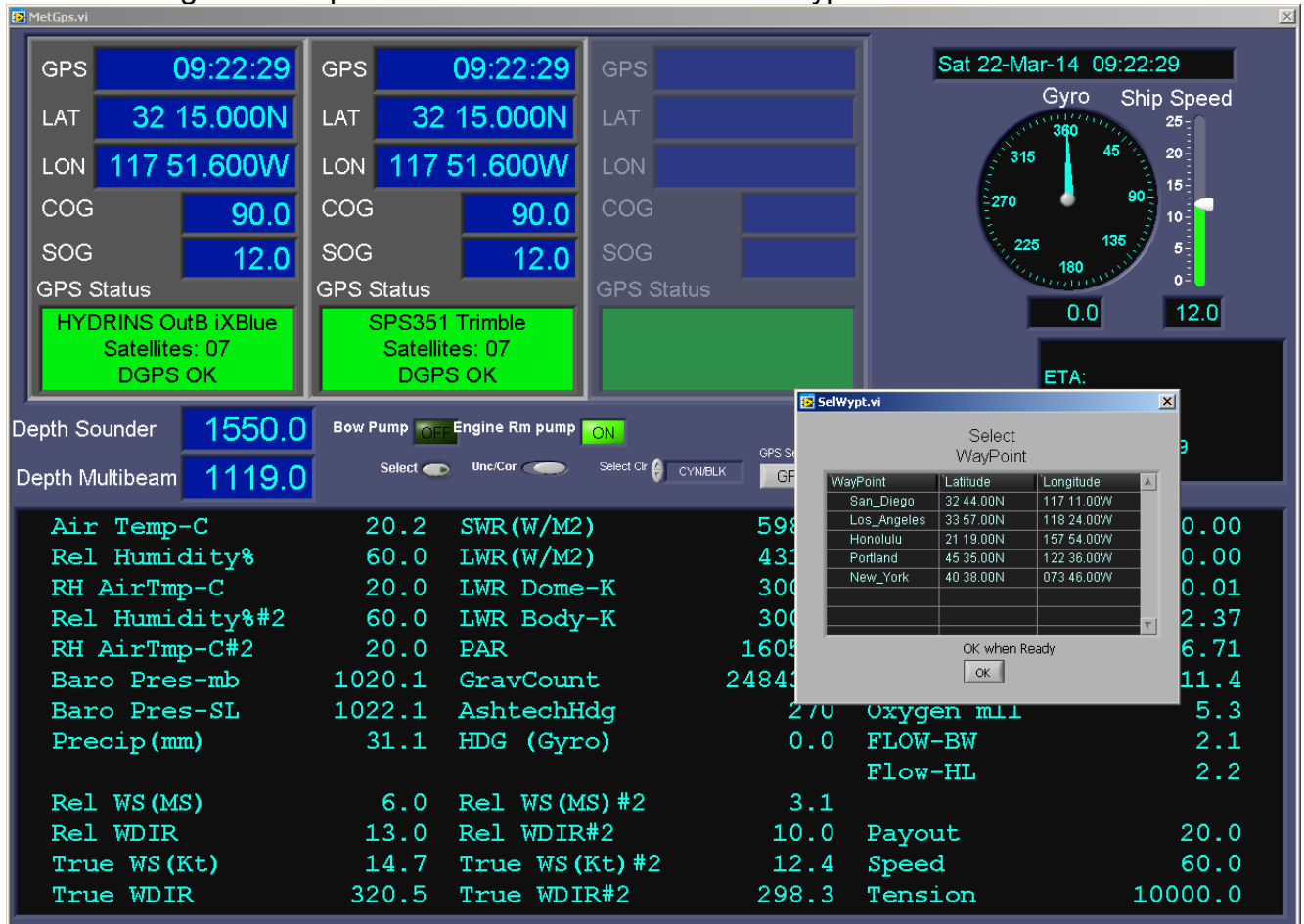
Press the "Select" control to change the displayed parameters

In order to utilize this function it is necessary to setup a waypoints file and place this file in the same directory that the ACQ file is in and where the data files are written. Upon startup the program first looks for a file called <Waypoints>, if this file is not present then it will look for a file called <MetAcq.wpt>. The format of the waypoints file only allows one type of format as follows. Station, LAT, LON (deg min)   001, 32 30.0N 117 30.0W

```
Test  42 46.32 N  58 54.52 W 3100
001   43 14.80 N  50 37.00 W   81
002   43 10.00 N  50 41.00 W   85
003   43  6.00 N  50 45.00 W   95
```

The Format of the MetAcq.wpt file can be one of three types of formats as follows:

```
# MetAcq Waypoints List
# delimit by commas or tab
# FORMAT=0  Station, LAT, LON (decimal)          001, 32.500, -117.500
# FORMAT=1  Station, LAT, LON (signed deg min) 001, 32 30.0 -117 30.0
# FORMAT=2  Station, LAT, LON (deg min)          001, 32 30.0N 117 30.0W
# Waypoint name or number, Latitude, Longitude
#
FORMAT=2
Test  42 46.32 N  58 54.52 W 3100
001   43 14.80 N  50 37.00 W   81
002   43 10.00 N  50 41.00 W   85
003   43  6.00 N  50 45.00 W   95
```

In both types of files, the waypoint can be a number or a name. Do not use spaces within the name of a waypoint. E.g. a waypoint called San Diego should be designated as San_Diego. Lines beginning with '#' are comments and ignored. Any number of waypoints may be entered in the file.

The Waypoints file can be read into the program at any time. It is not necessary to stop and start the program. Just place the new waypoints file in the data directory, then click on the control labeled <Read New Waypoints>. The new waypoints will then be available for selection.

If the Bearing to waypoint is greater than +/- 45 degrees of the ship's heading the indicated ETA will say <CHK WPT>. Once the ship's heading (COG) agrees (more or less) with the Bearing then a calculated ETA will be displayed.

4.3.2 Winch Display

On the Display mode selector control, set the display to Winch. Winch readouts include Winch wire out in Meters, Winch Speed in Meters/Minute and Winch tension in pounds (LBS). If there is a CTD input signal then CTD depth, CTD Speed (calculated from pressure), and CTD Altimeter readouts will also be displayed otherwise these areas will be blank. There is a Strip chart for winch tension. The max Y-scale in pounds (lbs) can be set by the Y-scale control. The max X-scale in time (hours) can be set by the X-scale control.
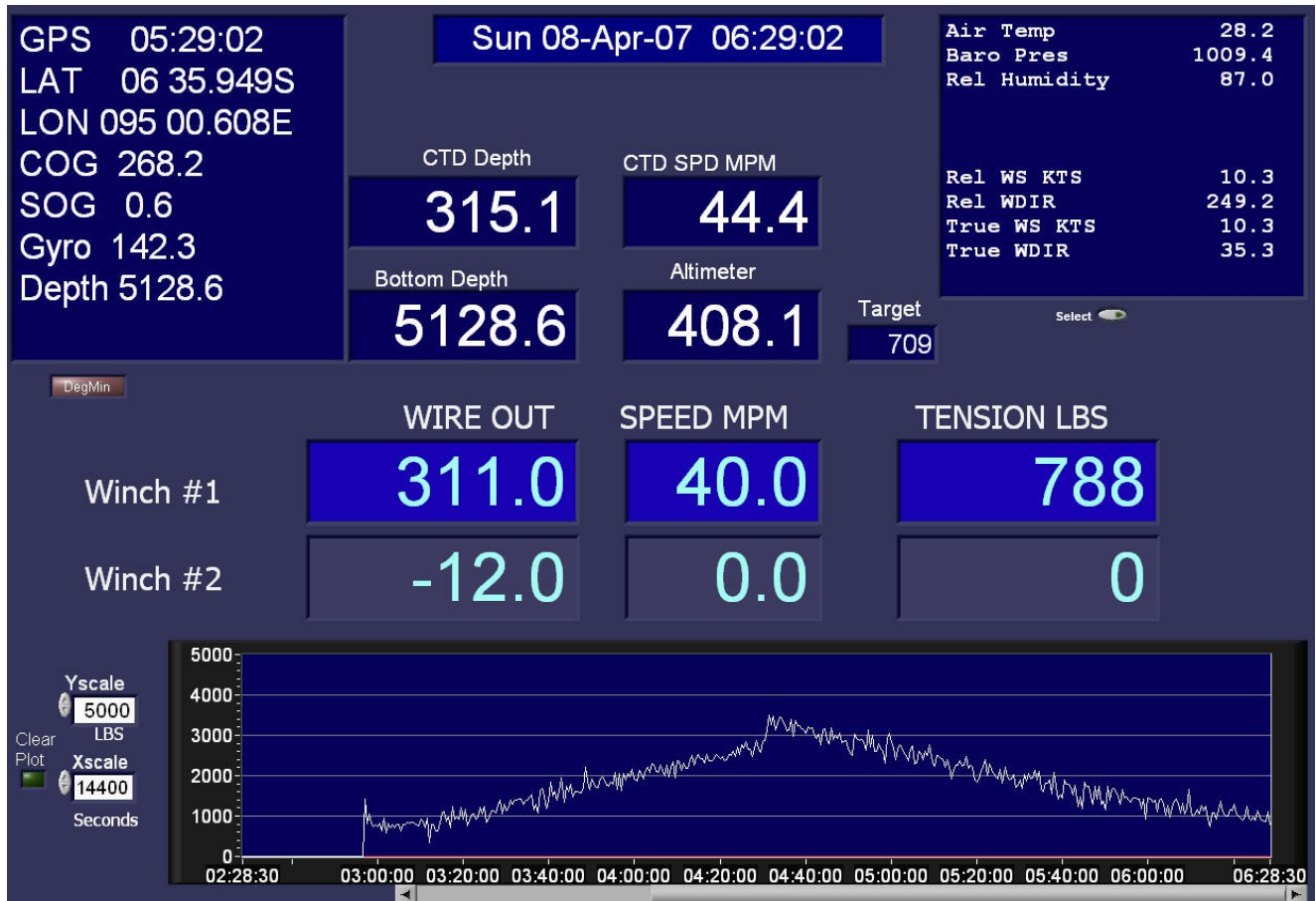
Press the "Select" control to change the displayed parameters in the upper right section

Some winch readouts, such as the LCI90, contain a winch ID value. A descriptive name can be assigned to this winch ID so that it will be displayed on the MET winch page just left of the "Wire out" indicator. Place this name in the "GENERAL" section of the .ACQ file using the directive "WID+Winch ID=" as follows.

      WID1 = DESH5 Winch
      WID2 = CAST6 Winch
      WID3 = TRACTION Winch

For example ,when the MET sees that the winch signal contains the winch ID of '2' then it will display "CAST6 Winch" and for an ID of '3' it will display "TRACTION Winch" on the MET readout page as shown below.
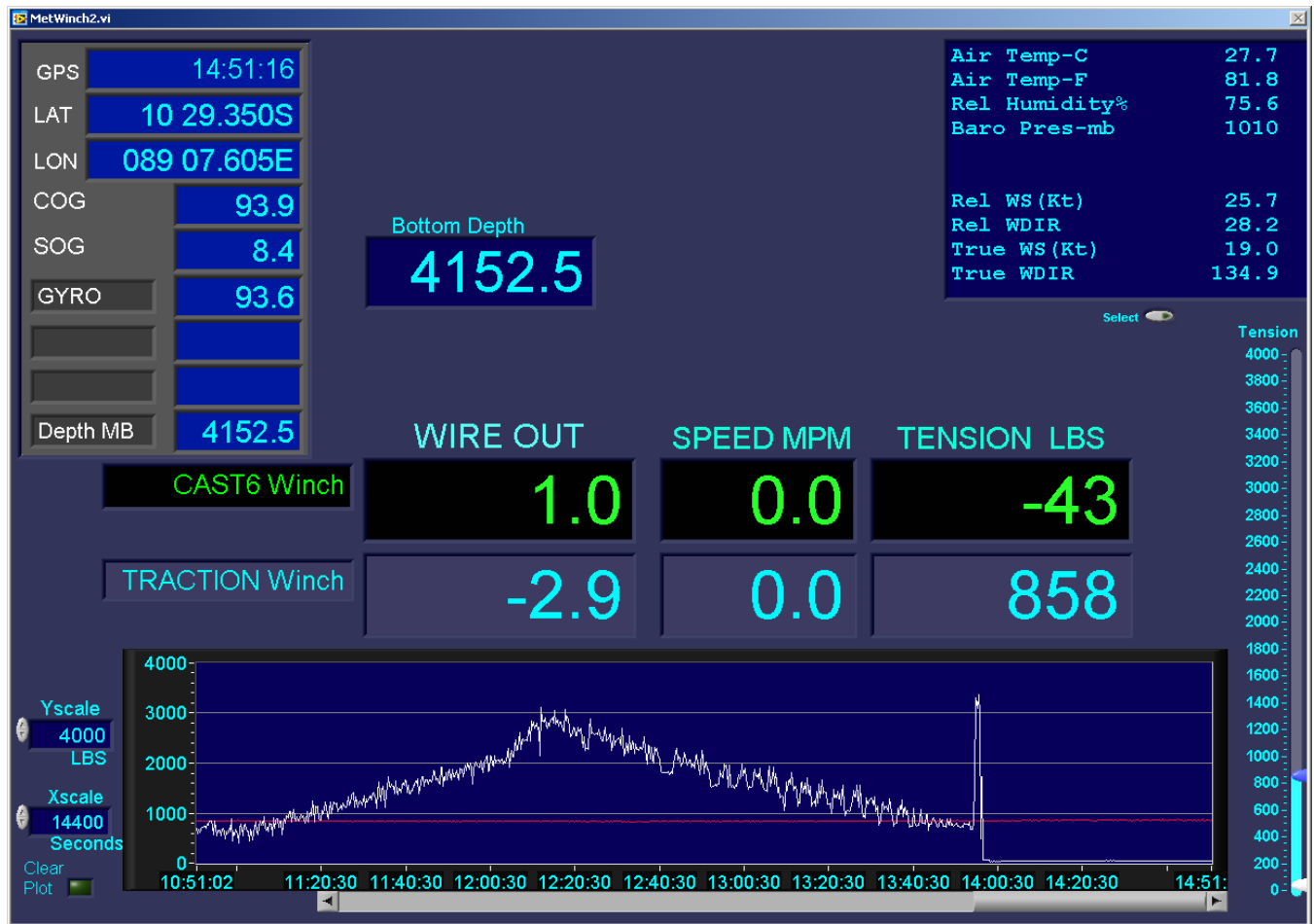
The winch signals are usually connected via RS232 or RS422. The ACQ file is edited to include a Winch data sensor section. This section is defined as WCH. An example of a winch input section in the ACQ file is indicated below:

```
Serial Ports Configuration  (Refer to  Section 7)
UNIT30  1 COMM30 19200 NONE 8 1  # RS232 Input  - Winch Data
[WCH02]
        SENSOR          = Winch Readouts
        MODEL           = LCI90
        SERIAL          = 1234
        MFG             = MTNW
        CAL_LAB         = n/a
        CAL_DATE        = n/a
        LOCATION        = Main Lab
        OWNER           = Melville
        TAGS-C          = ZO,ZS,ZT,ZI
        TAGS-R          = ZO,ZS,ZT,ZI
        PRC-C           = 1,1,0,0
        PRC-R           = 1,1,0,0
        LABELS-TAB      = Payout, Speed, Tension, WinchID
        LABELS-SC       = Payout, Spd, Load, WchID
        # Module setup parameters
        MSP             = 30 3 0 0 1 0 0 4  5 4 3 1 0 0 0 0
        MCP             = 0 1 4 0  0 0 0 0 0 0 0 0
        # Emulation Value
        Emulation= 0 0 0 0
```

A description of Sensor Module sections can be found in section 9.
A description of Data Input Ports can be found in section 7.

4.3.3 Diagnostic Display

The diagnostic display shows the actual raw data as it comes directly from the sensors. If a parameter is not displayed or shows the word "INOP" then the diagnostic page can be checked to see if any data is coming from the sensors. If the incoming data is not present then there are several possibilities as to the cause, such as, inoperable sensor, power loss to the sensor, connection problems to the sensor or serial port issues on the MET acquisition system. If there is incoming data then you can check to see if is formatted correctly, out of range or showing the expected value.

Select the UNIT number of the data port that you wish to view. RS232, RS422 and UDP data will be displayed in the uppermost window. If the data is RS485 data then each sensor on the RS485 node will be displayed in different windows. If there are many RS485 devices then you can change the value in the "RS485 Device" control to allow it to be viewed.

Screen-shot of Diagnostic display
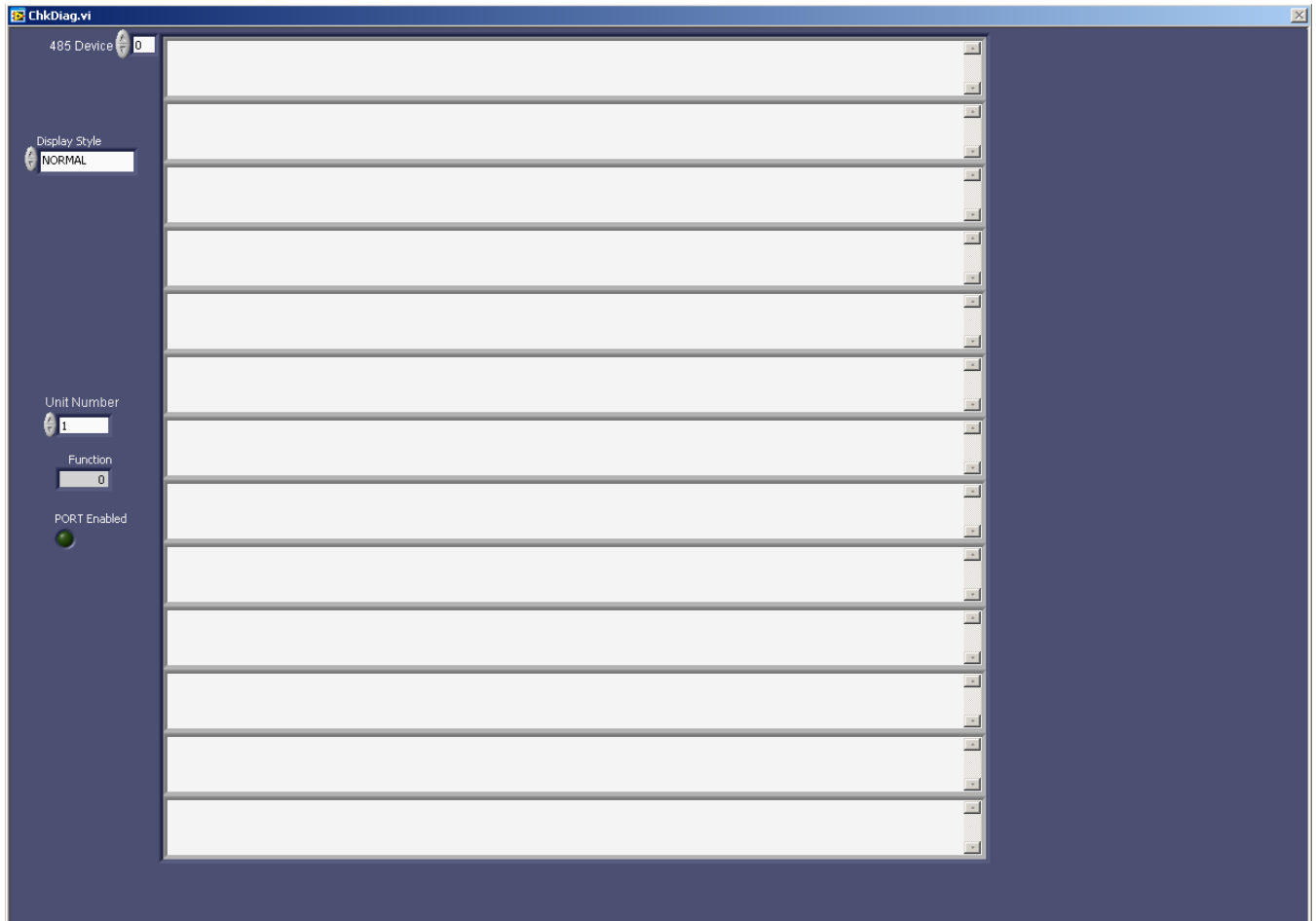
4.3.5 Program Termination procedure

To terminate the acquisition program move the mouse to the red control labeled <Stop> located in the lower left side of the screen. Click the mouse on this control. A pop-up window will appear to verify that acquisition is to be stopped. If this is confirmed then click on the red <STOP> control located in the pop-up window. The acquisition program will stop acquisition and data file logging and then enter standby mode.

To End the acquisition Click on the red <Stop> button

Control Panel During Acquisition

After the Verify pop-up appears, Click on the red <Stop> button to stop the program.
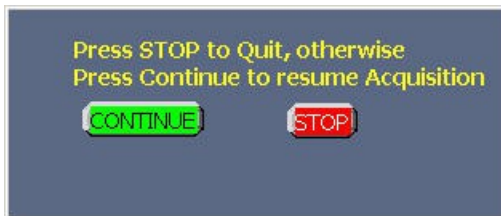
The Program is now in standby.
The program can then be reactivated at any time by hitting the green <Start> control.

If it is desired to quit the acquisition program completely, click on the control labeled <EXIT>.
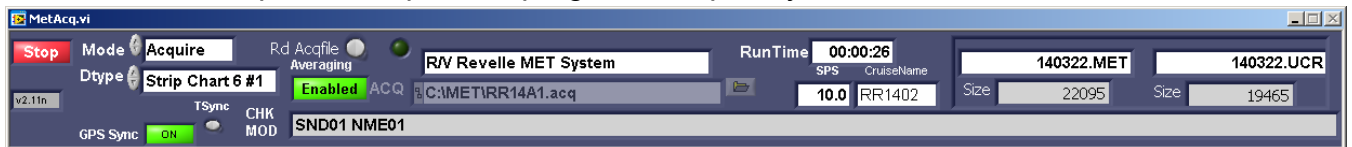
The <EXIT> control can only be reached during standby mode.

4.5.0 Playback Mode

MET data files can be played back by entering PlayBack mode. Click on the Mode Control button and the mode types will appear. Select PlayBack Mode. After selecting PlayBack mode you will notice that the File Wrt button is in the OFF position. This prevents data from being written over the any data files. However, there are cases when writing data during playback is desired. For more info on writing files during playback see section 4.5.1.
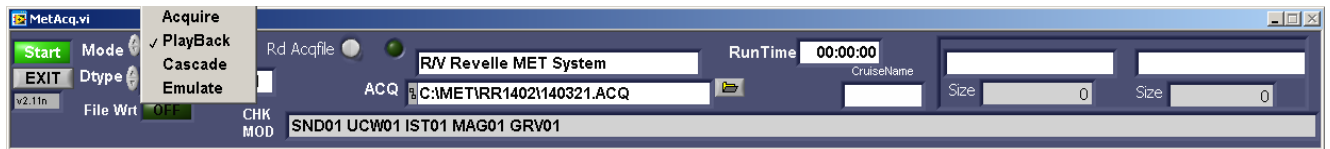
When MET data is acquired, the ACQ file that was in use at the time is copied over into a file with the same name as the data file but keeps the same extension -.ACQ. This is necessary because the sensor configuration may change from time to time and when sensors are replaced or new calibration coefficients are entered. It is very important to use the same ACQ file that was used at the time of acquisition otherwise the data will not display correctly.

After selecting the mode, choose the ACQ file that is associated with the data file that is desired to be played back. Click on the teensy yellow folder icon located just to the right of the ACQ control. The following popup will appear.
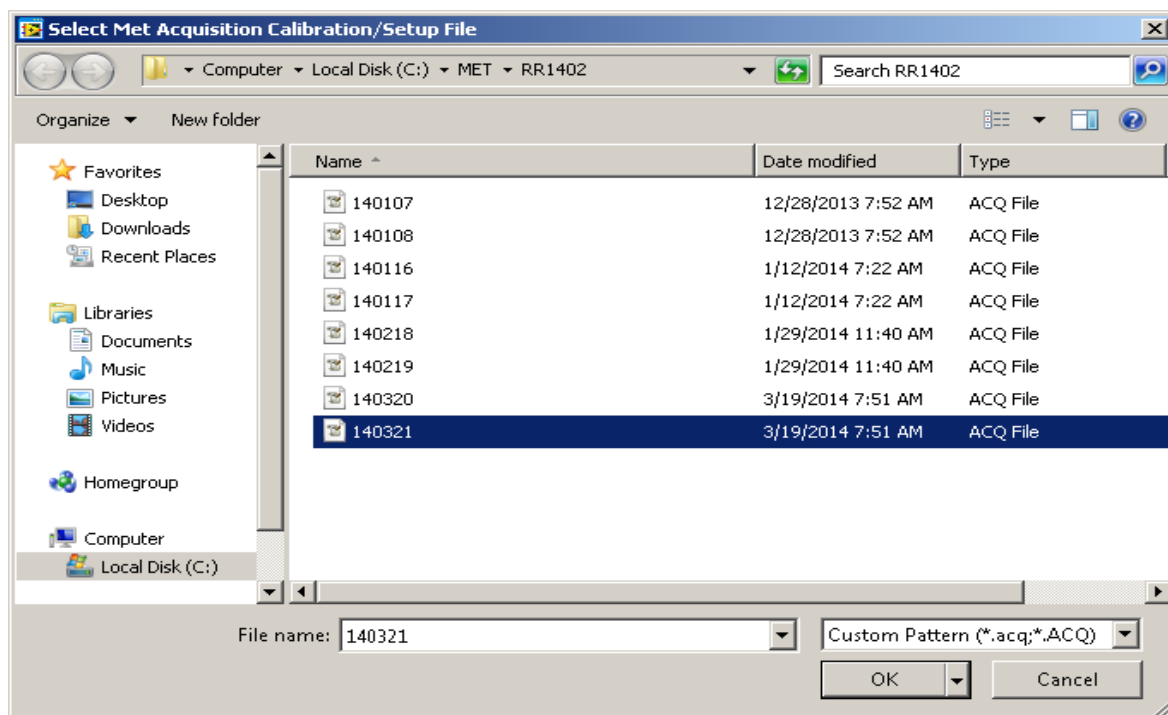
In this case we want to playback the data file 14021.COR which is located in C:\MET\RR1402. Select 140321.ACQ from this folder as above then click OK.

Another popup will appear that contains the file selection menu. You can select any type of data file that has the following extensions .COR, .MET, .UCR, .UNC. Before selecting the data file, choose the extension type of the file that is to be played back. In this case we will choose a .COR file.
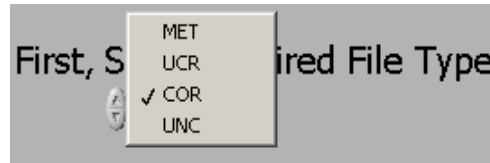
After this is selected then a list of all the .COR files that are located in the directory will appear. Choose the file that is desired to be played back. In this case, we select 14021.COR
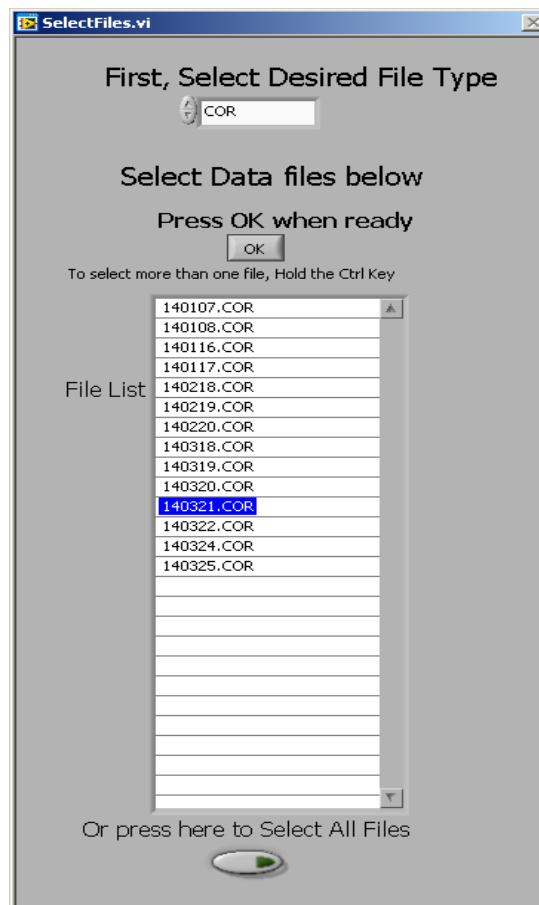
After the data file is selected, click on the OK button. The data file will now play back. In playback mode all serial, email and UDP ports are automatically disabled.
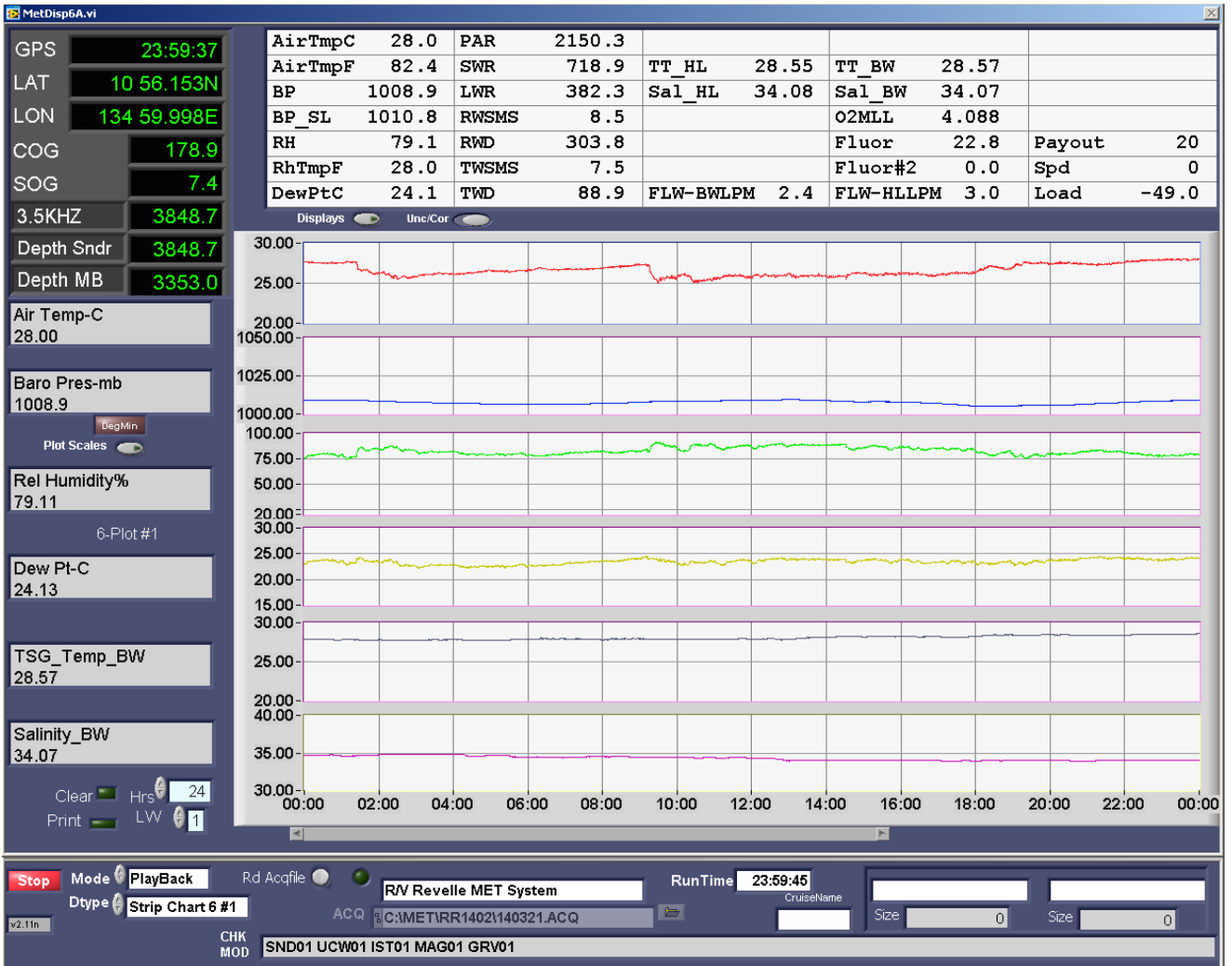
Depending on the computer processing capability it will take about a minute (more or less) for a full days worth of data to be played back across the screen. All data displays are running during playback mode and you can select anyone using the Dtype control. After the file has completed playing the displays will stop. During this time you can still select the various displays to look at the data. The scales can be changed by clicking directly over the values shown just to the left of each strip chart.

After you are finished looking at the data, click on the red STOP button on the lower left of the screen to finish the playback process. You can now select another file or exit the program.

4.5.1 Writing data files during PlayBack

If a sensor(s) needed to have updated calibration factors or if a sensor was changed before the ACQ file was updated before acquistion then it is possible to re-create new data files with the updated calibration or sensor information. First, update the .ACQ file that was used during acquisition. Make a new folder and place only the updated ACQ file and .UCR or .UNC files into the folder. Select playback. Click on File Wrt and ensure that it is ON (Important). Select the updated ACQ in the new folder. Then select the UCR file type and the .UCR file in question and press OK. The data file will be played back and it will create new .COR and .MET data files using the new information in the .ACQ file. (Note that if the original .COR and .MET files already exist then no data files will be created so ensure that these file types are not located in this folder).

4.6.0 Cascade Mode

Cascade Mode allows a separate met program running on another computer to acquire and display MET sensor data from one data stream without having any impact on the main MET acquisition system. A cascaded system can be set up anywhere on the ship and it would have the ability to display data in real-time and have local control over what is displayed.

For example, you can setup a PC or laptop on the ship's bridge, connect it up to the network (no other connections required) and be able to display real-time MET data and have local control over what is displayed. Display settings, colors and pages can be changed by the watch personnel as needed for that location.

To set this up, on the main MET system a WICOR output needs to be added to the ACQ file. The UDP output can be sent to a specific IP or broadcast to a range of IP's.

UNIT75 19 UDP   40119 NONE 40219 137.110.149.255 1 # Output – WICOR

In this example we setup a 1 second WICOR output that sends UDP data out on port 40119 to all systems with an IP subnet of 137.110.149.255. In this example, the PC on the bridge has an IP on this subnet (Ensure that the bridge PC firewall is set to accept UDP data on this port).

Place a copy of the same .ACQ file that is running on the main system onto the bridge PC in C:\MET

Start MetAcq on the bridge PC. Select the ACQ file in C:\MET. In this case select RR14A.acq.Place the MODE select in Cascade Mode and click START.
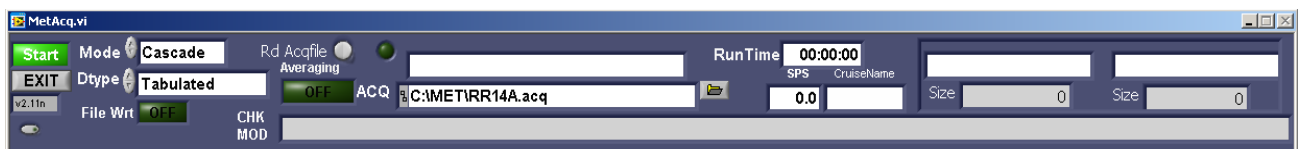
The following popup will appear. Select Port_Type UDP,and UDP port 40119 and click OK.
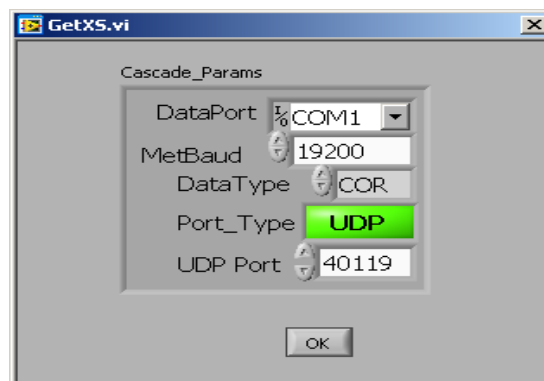
The system should now be displaying MET data. In cascade mode all serial, email and UDP ports are automatically disabled except the UDP port selected in the above popup. No changes to the local ACQ file are needed. Cascade mode can also work over a serial port instead of UDP. In this case, select serial port settings as needed.

4.7.0 Emulation Mode

Emulation mode is used to simulate a MET system and is used for showing the MET program in a DEMO mode on shore-based PC's for demonstration and training purposes. It is also used to test newly developed ACQ files before loading them on real MET systems. In Emulate Mode you can change display settings, MET pages, use the MET web browser, write data files and it will even output serial and UDP messages according to the setup in the ACQ file, etc. You can do everything that you can do in "Acquire" mode except you cannot send mail and you cannot acquire real data.

The data that is displayed during Emulate mode comes from the .ACQ file. In each module section there is a statement called "Emulation =". There should be one or more numbers on this line depending on the module. E.g. If the module is supposed to return one value then there should be one number on this line. This value is an example of the raw uncorrected value that is returned by the sensor.

Referring to example#1 (Air temp module) in section 9.3.5 you see following emulation value

Emulation = 0.7

The displayed value for Air Temperature will be the computed value of the coefficients and the emulation value. In this case the resulting displayed value will be 20.163 Deg C. This is a way to test the ACQ file to ensure that the calculation and coefficients produces the expected value. In other modules, there may not be any coefficients applied, such as, GPS data. In this case, you should expect that the same value(s) that are on the Emulation line will be displayed on the MET pages.

First, select the desired ACQ file. In this example we select RR14A.acq. Next, place the Mode control in "Emulate". Click start.
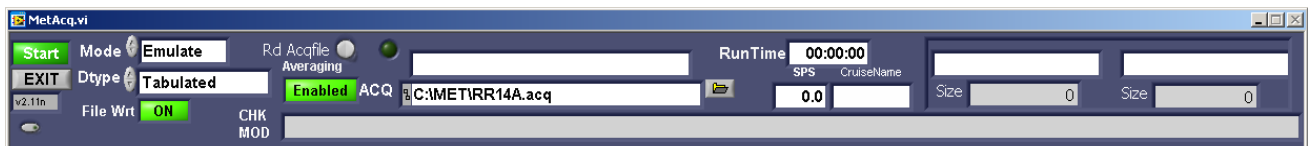
The MET program will now start and display numbers from the Emulation lines on the screen. Data files will also be written (if File Wrt is enabled).

You will also notice a small obscure dot located on the lower left of the MET control panel -below the version number (also shown in the above image). This dot is only visible during emulation mode. You can click on it to get a kind of an animation going on the pages to somewhat simulate a real system. Click on it again to stop the animation.

.

5. Connecting to the WEB Server

The meteorological displays can be viewed on any computer that is connected to the network. A web browser such as Microsoft Internet explorer or Firefox that is running on any computer can access the MET Display.

5.1.0 Setting up the MET web interface

The following files (obtained from STS) must be installed in C:\Wbin\www

Index.html	Favicon.ico
MetDisp6A.htm	MetDisp6B.htm
MetDisp8.htm	Metgps.htm
Metnum.htm	MetWinch2.htm
MetAcq.pdf	MetSpecs.pdf

In C:\Wbin\www make a folder called images C:\Wbin\www\images

The MET system can utilize either the Labview web server or a 3rd party web server such as the Apache Web Server. Only one web server can be used at a time. All others should be disabled.

5.11 Configuring the Labview web server

The files "niwebserver.conf" and "MetAcq.ini" should be located in C:\Wbin.

Niwebserver.conf
NI.AddLVRouteVars ErrorLog "$LVSERVER_ROOT/logs/error.log", level=2, anew TypesConfig "$LVSERVER_ROOT/mime.types" LimitWorkers 10 LoadModulePath "$LVSERVER_ROOT/..;$LVSERVER_ROOT/modules; $LVSERVER_ROOT/LVModules" LoadModule LVAuth lvauthmodule LoadModule LVSnapshot lvsnapshotmodule LoadModule LVRFP lvrfpmodule Listen 80 # # Directives that apply to the default server # NI.ServerName LabVIEW DocumentRoot "/Wbin/www" InactivityTimeout 60 SetConnector netConnector AddHandler LVAuth AddHandler LVSnapshot snap AddHandler LVRFP

```
AddHandler LVSnapshot
AddHandler fileHandler ""
AddOutputFilter chunkFilter
DirectoryIndex index.html
```

MetAcq.ini
[MetAcq] server.app.propertiesEnabled=True server.tcp.serviceName="My Computer/VI Server" server.vi.propertiesEnabled=True WebServer.Enabled=True WebServer.TcpAccess="c+*" WebServer.ViAccess="+*" DebugServerEnabled=False DebugServerWaitOnLaunch=False

5.1.2 Configuring the Apache Web Server

The file "MetAcq.ini" with the following content should be located in C:\Wbin.

MetAcq.ini
[MetAcq] server.app.propertiesEnabled=True server.tcp.serviceName="My Computer/VI Server" server.vi.propertiesEnabled=True WebServer.Enabled=False WebServer.TcpAccess="c+*" WebServer.ViAccess="+*" DebugServerEnabled=False DebugServerWaitOnLaunch=False

Install the Apache Web server according to the Apache installation instructions. After installation stop the Apache service. Replace the httpd.conf file with the pre-configured httpd.conf file that is obtained from STS and restart the Web service.

5.1.3 Web User Interface

After MetAcq is running the program continuously updates the images of each MET page by writing .png files into the C:\Wbin\www\images folder once every 10 seconds. These images can be viewed on a browser on any PC that is on the network. In the browser's location bar enter the host-name or IP of the PC that is running the MET program. On SIO systems you can just enter the word met. You should see a screen similar to the on shown on the below image. Just click on the desired link

Screen Grabs (regularly refreshed)

- Stripchart Display 6-Plot #1
- Stripchart Display 6-Plot #2
- Stripchart Display 8-Plot
- Tabulated Display
- Tabulated-GPS Display
- Winch Display

Documentation

- MET Program Manual (PDF)
- MET Sensor Specifications (PDF)

Download

- MET data (HTTP)
- MET data (rsync)
- MET configuration data (rsync)

5.1.4 Downloading images

To download any display image such as a strip chart, place cursor on display and right click on the mouse. Select "Save image as…" then enter filename info to save the file.

6. Configuring E-MAIL Outputs

MetAcq can be configured to output certain data by email.

Specify the mail server by using the following directive: MAIL_SERVER =

If a SMTP server is installed on the MET acquisition system then it is permissible to specify localhost or 127.0.0.1. A locally installed SMTP server is preferable to specifying an external server in which case the local SMTP server will then take over the task of spooling the mail to the external server but if a local SMTP server is not available then simply enter the hostname or IP value for the external mail server.

When MetAcq first starts up it checks to see if the Mail server is connected and active. If no mail server is detected then an error message will be displayed. After it times out the MET mail service will be disabled and MetAcq will resume startup and acquisition. In addition, If a MAIL_SERVER is not specified then the MET mail service will be disabled and no mail will be sent.

MAIL_SERVER = 127.0.0.1

For all E-Mail messages the ship's call sign needs to be specified with the directive CALL_SIGN=

e.g. CALL_SIGN = KAOU

The mail return address also needs to be specified:

MAIL_RETADD   = sts-cr@ucsd.edu

6.1.0 SAMOS E-Mail settings

SAMOS formatted data will be mailed to the comma delimited recipients list specified by the following directive:

MAIL_RECEP = samos_data@coaps.fsu.edu

e.g. MAIL_RECEP = abc@abc.com, def@abc.com, ghi@abc.com

If the MK_DCC directive is set to true and a valid mail server is specified and valid mail address are specified on the recipients list then the SAMOS formatted zip file containing one days worth of data will be sent at the end of the GMT day. Additional details about SAMOS files can be found in section 10.3.0.

6.1.1 OPSUM E-Mail settings

If MAIL_OPSUM has a valid email address and if MK_DCC is set to TRUE then a packet containing one hours worth of SAMOS formatted data will be sent every hour to the address(es) specified in the MAIL_OPSUM= directive.
MAIL_OPSUM   = opsum@icefloe.net

(OPSUM is normally only used on the Healy)

6.1.2 PCO2 E-Mail settings

If MAIL_PCO2 has a valid address and if there is an actively defined PCO2 input module (PCTxx) then a packet containing a data line from the PCO2 system along with selected MET data will be emailed to the address(es) specified in the MAIL_PCO2= directive.

MAIL_PCO2   = pco2@icefloe.net

The subject line will look like this "140325.P06" and consists of yymmdd.Ppp. The pp is the input UNIT value.

The data will look like this:

2010128.04635,1880.08,37.72,1019.58,294.70,10.63,292.9,3163.44,47,0,Equil,32.34560,-117.56780,90.0,12.0,6.718,36.713,0.00,265.1,23.6,1000.1,1395711611

PCO2 data, Lat, Lon, COG, SOG, Sea temp, Salinity, Fluorometer, True Wind Dir, True Wind Spd(kts), Barometric Pres, GPS Date time in seconds

If OUTPORT_PCO2= is defined then the same data will be sent out a UDP port. Enter the UNIT number of the UDP output port e.g.

UNIT68 81 UDP   33504 NONE 61581 255.255.255.255 # Output - PCO2

OUTPORT_PCO2   = 68

(MAIL_PCO2) is normally only used on the Healy)

6.1.3 SIO SHIPTRACK E-Mail settings

If the SHIPTRACK_RECEP directive contains a valid address then, every minute one line of WICOR formatted data will be emailed to the address(es) specified in the SHIPTRACK_RECEP= line

The Subject line will read "WICOR_+cruisename". e.g. WICOR_RR1402

NOTE: you must also set the cruisename in C:\MET\cruisename.txt

For SIO the shiptrack address is

SHIPTRACK_RECEP = sio-shiptracks@ucsd.edu

Shiptrack data for each ship can be viewed at http://droopy.ucsd.edu/ships2/

6.1.4 NOAA E-Mail settings

The NOAA formatted weather report with be mailed once per hour if a valid address is specified with the directive MAIL_NOAA=

The NOAA address is:

MAIL_NOAA   = webship@noaa.gov

The mail subject line will read "ShipTrackerMessage".

Each data line will contain the following info:

```
Ship,
date,
time,
radio call sign,
LAT,
LON,
Wind Direction,
Wind Speed,
Temperature,
relative humidity,
barometric pressure,
sea water temp,
Software version,
```

An example of the NOAA output is shown below:

```
<<< REVELLE,03/24/2014,10:13:00 >>>
<,KAOU,GPS-LAT,GPS-LON,SAMOS-TKS-Value,SAMOS-TIS-Value,RMY-Temp,RMY-
Humidity,RMY-Baro,Water-Temp-A,V2.X.x,>
<,none,deg,deg,kts,DEG,Deg. C,Percent,millibars,Deg C,V2.X.x,>
<,,3215.0000N,11751.6000W,320.47,14.73,20.16,60.00,1022.14,20.00,SIOv2.1.1,>
```

7. Configuring Data Ports

7.1.0 Functional Description

The first part of the acquisition setup file determines how ports are assigned as well as the characteristics of each port. Up to 128 ports may be accommodated. In the section that follows, each line begins with a UNIT device number. This number is not the computer's COMM port number but is the Logical Device number that the labview program uses to identify a particular port. There are three basic types of ports: RS232, RS485 and UDP.

7.1.1 RS232

RS232 devices transmits their signal in a dedicated unbalanced transmission line. The transmitted signal is referenced to signal ground.

7.1.2 RS422

RS422 devices transmits their signal in a dedicated balanced transmission line. In a balanced differential system the voltage produced by the driver appears across a pair of signal lines sometimes referred to as A and B output terminals.

7.1.3 RS485

The EIA RS-485 Standard permits a balanced transmission line to be shared in a party or multi-drop mode. As many as 32 driver/receiver pairs can share a multi-drop network. Many characteristics of the drivers and receivers are the same as RS422. Each RS485 device is accessed to talk by sending it the correct address and command line string. The instrument then responds to the particular command then it relinquishes the transmission line.

7.1.4 UDP (User Datagram Protocol)

UDP provides simple, low-level communication among processes on computers. Processes communicate by sending datagrams to a destination computer or port. A port is the location where data is to be sent. IP (Internet Protocol) handles the computer-to-computer delivery. IP performs the low-level service of moving data between computers. IP packages data into components called datagrams. A datagram contains, among other things, the data and a header that indicates the source and destination addresses. IP determines the correct path for the datagram to take across the network or Internet and sends the data to the specified destination. Once the datagram reaches the destination computer, UDP moves the datagram to its destination port. If the destination port is not open, UDP discards the datagram.

7.1.5 Analog Input devices

MET sensors that output analog signals such as volts, 4-20ma current and frequency are usually connected to an analog to RS485 converter located near the sensor. The converter can be a multichannel or single channel device. Popular types are the ADAM 4117 8 channel voltage module, ADAM 4118 8 channel millivolt module, ADAM 4017+ 8 channel module, ADAM 4080 Frequency module, DGH Corp 5132 4 channel +/- 5V module, D5122 4 Channel module, D2102 10mv module, D2112 100mv module, D2602 frequency input module and many others.

http://www.advantech.com/products/Robust-Remote-I-O-Modules/sub_1-2MLC85.aspx
http://www.advantech.com/products/Analog-I-O-Modules/sub_GF-5VTD.aspx
http://www.dghcorp.com/default.asp

7.2.0 Port Data Types

	Col1	Col 2 Function	Col 3	Col 4	Col 5	Col 6	Col 7	Col8
Serial Port Receive	UNITx	Code 1	COM Port	Baud Rate (9600)	Parity NONE, EVEN, ODD	Data Bits 7 or 8	Stop Bits 1 or 2	Ignored
Serial Port Send	UNITx	Codes 2,3,4,5,6,7, 8,10,12,13, 14,15,16, 17,20,23	COM Port	Baud Rate (9600)	Parity NONE, EVEN, ODD	Data Bits 7 or 8	Stop Bits 1 or 2	OUTPUT Interval (except 20)
DAQ IO Device	UNITx	Code 70	Ignored	Device Number	Termination Type	Start: End Channel	Input Range	Ignored
UDP Receive	UNITx	Code 80	Ignored	REMOTE Port (61551)	Ignored	Ignored	Ignored	Ignored
UDP Send	UNITx	Codes 9,11,19,21, 22,81	Ignored	REMOTE Port (61553)	Ignored	LOCAL Port (61552)	REMOTE IP or 255.255.255.25 5	OUTPUT Interval (except 81)
UDP Multicast Receive	UNITx	Code 82	Ignored	REMOTE Port (61551)	Ignored	Ignored	REMOTE IP or 255.255.255.25 5	Ignored
UDP Multicast Send	UNITx	Code 83	Ignored	REMOTE Port (61553)	Ignored	LOCAL Port (61552)	REMOTE IP or 255.255.255.25 5	Ignored

*Defaults shown in parentheses.

*UDP local and remote ports port will default to the values in the above table if not set or is set to values less than 1024. UDP remote IP will default to 255.255.255.255 (network broadcast).

*Serial Port defaults: Baud-9600, Parity-NONE, Data bits-8, Stop Bits-1 If values are entered incorrectly or out of range of normal values then the serial port parameters will use the default settings.

The value in column 8 is the output interval in seconds. If this is not specified then the output interval will be the value specified in the "SerialWriteInterval =" statement that is located in the GENERAL section of the ACQ file(see paragraph 9.2.0)

Everything after Column 8 is ignored by the program. This area can be used for descriptive comments.

```
###########################################################################
# UNIT 1-2: MAINBOARD DB9 COM Ports Configuration
###########################################################################
UNIT1   0 COM1    9600 NONE 8 1   0 # Spare
UNIT2   0 COM2    9600 NONE 8 1   0 # Spare
###########################################################################
# UNIT 3-34: COMPUTER LAB RocketPort RJ45 COM Ports Configuration
###########################################################################
UNIT3   1 COM3    9600 NONE 8 1   0 # RS485 I/O    - Fwd MET Mast Sensors
UNIT4   1 COM4    9600 NONE 8 1   0 # RS485 I/O    - Flo-thru (Analytical-Lab)
UNIT5   1 COM5    9600 NONE 8 1   0 # RS232 Input  - FlowMeter, Sea Temp(Bow Rm)
UNIT6   1 COM6    4800 NONE 8 1   0 # RS232 Input  - GP150 GPS
UNIT7  20 COM7    4800 NONE 8 1   0 # RS232 Output - Wind Data to X-band Radar
UNIT8   1 COM8    9600 NONE 8 1   0 # RS232 Input  - Knudsen 320B/R Depth
UNIT9  20 COM9    9600 NONE 8 1   0 # RS232 Output - OUT09 to SGG echo-02 (mag)
UNIT10  1 COM10   9600 NONE 8 1   0 # RS232 Input  - Meridian Gyro
UNIT11 12 COM11   4800 NONE 8 1   0 # RS232 Output - Alternate GLL, HDT to Seatel
UNIT12  1 COM12   4800 NONE 8 1   0 # RS232 Input  - ADU5 Ashtech
UNIT13 13 COM13   9600 NONE 8 1   0 # RS232 Output - SSV to EM122
```

```
UNIT14 20 COM14   4800 NONE 8 1   0 # RS232 Output - OUT06 to LabGPS switchbox
UNIT15 14 COM15   9600 NONE 8 1   0 # RS232 Output - Surface PAR to SBE11 - 14
UNIT16  1 COM16  19200 NONE 8 1   0 # RS232 Input      - F-185 VRU
UNIT17  1 COM17   9600 NONE 8 1   0 # RS232 Input  - SeaSpy Magnetometer(s)
UNIT18  1 COM18   1200 NONE 8 1   0 # RS232 Input  - BGM-3 gravimeter counts
UNIT19  1 COM19  19200 NONE 8 1   0 # RS232 Input  - Seatex VRU
UNIT20  1 COM20   9600 NONE 8 1   0 # RS232 Input  - SBE45 (Analytical Lab)
UNIT21 20 COM21   9600 NONE 8 1   0 # RS232 Output - OUT21 to Dark Lab 1
UNIT22  0 COM22  19200 NONE 8 1   0 # Spare
UNIT23  0 COM23   9600 NONE 8 1   0 # Spare
UNIT24  4 COM24   9600 NONE 8 1   0 # RS232 Output - MET Data to ORB: removed 2013
UNIT25  0 COM25   4800 NONE 8 1   0 # Spare
UNIT26  1 COM26   4800 NONE 8 1   0 # RS232 Input  - switched GPS "LabGPS"
UNIT27  4 COM27   9600 NONE 8 1   0 # RS232 Output - MET Data to ORB: removed 2013
UNIT28  0 COM28   4800 NONE 8 1   0 # Spare
UNIT29  1 COM29   9600 NONE 8 1   0 # RS232 Input  - EM122 Center Beam Depth
UNIT30  1 COM30  19200 NONE 8 1   0 # RS232 Input  - Winch Data
UNIT31  1 COM31  19200 NONE 8 1   0 # RS232 Input  - F185 Gyro/GPS (NMEA)
UNIT32  0 COM32   9600 NONE 8 1   0 # Spare
UNIT33  0 COM33   9600 NONE 8 1   0 # Spare
UNIT34  0 COM34   9600 NONE 8 1   0 # Spare
####################################################################
# UNIT 35-42: MAIN LAB COM-via-net Serial Ports Configuration
####################################################################
UNIT35 20 COM35   9600 NONE 8 1   0 # RS232 Output - OUT35 to Seasoar
UNIT36 20 COM36   4800 NONE 8 1   0 # RS232 Output - OUT36 to Photo Lab GPS
UNIT37 20 COM37   4800 NONE 8 1   0 # RS232 Output - OUT37 to RMC
UNIT38 20 COM38   4800 NONE 8 1   0 # RS232 Output - OUT38 to Seabird CTD unit
UNIT39 20 COM39  19200 NONE 8 1   0 # RS232 Output - OUT39 to ROV van (MV1209)
UNIT40 20 COM40   9600 NONE 8 1   0 # RS232 Output - OUT40 to SGG sesimic (MV1206)
UNIT41 20 COM41   4800 NONE 8 1   0 # RS232 Output - OUT41 to MV1308 for HDT
UNIT42  1 COM42  19200 NONE 8 1   0 # RS232 Input  - CTD Depth, Descent Rate, Altimeter
####################################################################
# UNIT 43-44: Bos'n locker (MET mast) COM-via-net Serial Ports Configuration
####################################################################
UNIT43  1 COM43   4800 NONE 8 1   # RS232  Input - Garmin 17x
UNIT44 20 COM44   9600 NONE 8 1   # Spare
####################################################################
# UNIT 64-127: UDP/IP datagram modules
# As practical, Source port = Destination port + 100
####################################################################
UNIT64  9 UDP     40009 NONE 40109 10.110.150.255  0 # Output - DCC Data to Acq subnet broadcast
UNIT65 19 UDP     40019 NONE 40119 10.110.150.255  0 # Output - $WICOR to Acq subnet broadcast
UNIT65 19 UDP     40019 NONE 40119 137.110.150.255 1 # Output - $WICOR 1Hz to Sci subnet broadcast
(Terrill)
UNIT66 81 UDP     40183 NONE 40283 10.110.150.255  0 # Output - OUT06 to Acq subnet broadcast
UNIT67 80 UDP     55000 NONE NONE  NONE            0 # Input  - Knudsen 3260 UDP feed from subnet
broadcast
```

Any port may be assigned to any program UNIT number. But it is not permissible to assign a port more than once. For example if UNIT's 8 and 14 was assigned Com Port 14 then UNIT 8 will be COM14 and UNIT 14 will be disabled. If a UNIT is disabled then the port number on that UNIT number is ignored.

UNIT numbers that assign an active port to a particular sensor are placed in the Sensor Type setup file in the first number following the <MSP = > keyword. (See Section 9.2.0)

Throughout the ACQ file, if the first character of a line starts with the '#' sign then it is treated as a comment line and ignored by the program. Blank lines are also ignored

8. Sending Data

8.1.0 Functional Description

Serial data of various formats may be transmitted from the Acquisition computer to an external device or distribution network.

To assign output data to a serial port put the appropriate Output Code in the UNIT code location then set the desired baud rate, parity, data bits, stop bits and output interval (if applicable).
The following pre-defined outputs are available. To specify user defined outputs see section 9.4.0

8.1.1 Output Data Types

Data Type	Function Code	Output Interval	Comments
MET Data (MET Format)	2	Any	RS232 (Format in Section 10)
MET Data (UNC Format)	3	Any	RS232 (Format in Section 10)
MET Data (COR Format)	4	Any	RS232 (Format in Section 10)
Seabeam 2100 Sound Velocity	5	5 Secs	RS232
Seabeam 2100 Navigation	6	1 Sec	RS232
Seabeam 2000 Navigation	7	1 Sec	RS232
DCC Data (Serial)	8	DCC Rate	RS232
DCC Data (UDP)	9	DCC Rate	UDP
VTG, HDT Message to the MRU	10	1 Sec	RS232 (Appendix B)
EM120 Sound Velocity - UDP	11	Any	UDP Primary TSG
GLL, HDT to Seatel	12	1 Sec	RS232
EM120 Sound Velocity - Serial	13	1 Sec	RS232 Primary TSG
Surface Par Output	14	1 Sec	RS232 to Analog
Winch Data To Signboard (Healy)	15	1 Sec	RS232
(Unassigned)	16		
Calcofi(2003 MET Data Stream)	17	5 Sec	RS232
GLL, VTG, DBT, HDT	18	1 Sec	RS232 (Appendix B)
MET Data (Corrected) UDP Port	19	Any	UDP
User Defined – Serial Port	20	Any	RS232 (Section 9.4.0)
EM120 Sound Velocity - UDP	21	Any	UDP Secondary TSG
NAV Data to Mapserver (Healy)	22	Any	UDP
EM120 Sound Velocity - Serial	23	1 Sec	RS232 Secondary TSG
DAQ IO	70	(Input)	DAQ (Needs to be Enabled)
UDP Input	80	(Input)	UDP input
UDP Output	81	Any	UDP Output USER defined

9. MET Input/Output Configuration

A sensor input module is defined as a sensor or data stream that sends data to the acquisition system. A sensor output module is a user defined data stream that sends data from the acquisition system to an output device such as a RS232 port.

For each sensor module (input device or output data stream) there are three steps to configuring the program.
1. Define the sensor module section.
2. Assign the sensor module to an active port device such as a RS232 port.
3. Activate the module in the Module Activation Section.

The acquisition setup and calibration ACQ file consists of several components:
1. Input/Output port definition section. This is where Ports are defined and attributes such as baud rates and data bits are entered (See Section 7).
2. Following the Input/Output Ports section is the Module Activation Section. Both Input and Output Modules are activated or deactivated here.
3. Next is the Output device section where output data streams are defined.
4. Last is the Input device section where all of the input devices are defined. Devices such as Meteorological sensors and GPS NMEA input devices are entered here.

9.1.0 Module Activation Section

After the serial port section, the module selection section follows. Specifying the Sensor ID will activate sensors. Each Sensor ID that is specified must have its associated setup/calibration section attached in the latter part of the setup file.

The word STARTMOD must be placed at the beginning of the sensor list. Each module has a 5 character ID that conforms to the specification from section 2. Each module included in the sensor list must have an entry in the module setup and calibration section.

```
STARTMOD
PRC01 TMP01 HRH01 BPR01 WND01 SWR01 LWR01 AXT11 VLT05 TSG01 FLW01 WND09 OXY02 AWT02
FLW02 FLU02 PAR01 NME01 GYR01
ENDMOD
```

The word ENDMOD must be placed at the end of the sensor list. When removing sensors it is only necessary to remove the module from the above list. It is not necessary to delete the sensor section itself.

To disable a module simply delete it out of the string or place a comment character at the beginning of the line that contains all the modules that are to be deactivated. The module can then be reactivated by removing the comment and restarting the program.

9.2.0 General Section

General Section Keynames

[GENERAL]		Defaults
TITLE	Title	TITLE = R/V Sproul
SHIP	Ship Name	
CALL_SIGN	Ship Radio Call Sign	
MKCRUISEDIRS	Enable/Disable cruise directories	MKCRUISEDIRS=FALSE
MK_MET	Enable/Disable MET FileTRUE or FALSE	MK_MET = TRUE
MK_UCR	Enable/Disable UCR FileTRUE or FALSE	MK_UCR = TRUE
MK_COR	Enable/Disable COR FileTRUE or FALSE	MK_COR = FALSE
MK_UNC	Enable/Disable UNC File TRUE or FALSE	MK_UNC = FALSE
MK_LOG	Enable/Disable LOG File TRUE or FALSE	MK_LOG = FALSE
MK_DCC	Enable/Disable DCC File TRUE or FALSE	MK_DCC = FALSE
CHART_RATE	Interval in Seconds that the Strip Chart Updates	CHART_RATE = 2.0
TIMEOUT	Timeout in milliseconds to wait for Sensor Response	TIMEOUT = 300
FileWriteInterval	Interval in Seconds between File Writes	FileWriteInterval=30.0
SerialWriteInterval	Interval in Seconds between Serial out messages	SerialWriteInterval=30.0
MAX_SCAN_RATE	Set Max rate in Seconds that sensors are scanned	10.0
ONEGPS2FILE	Allows only one GPS data set in the data files (see section 9.3.2)	FALSE
SPARSCL	Surface Par Output (Slope, Offset) for use with Output code 14 Table 8.1.1	1.0, 0.0
GPS_SYNCH	Enables the System PC to time synch it's clock to GPS Time	TRUE
WID1-9	WINCH ID display name assignment (sec 4.3.2)	WID1=HYDRO Winch
RD485MINTO	Minimum Time Out for RS485 devices	0.05
RD485MAXTO	Maximum Time Out for RS485 devices	0.32
MAIL_SERVER	Mail server	
MAIL_RETADD	Mail Return Address	
MAIL_RECEP	Mail Recipients list to send the DCC file	
MAIL_MSG	Message to include in the above mail	
DCC_INTERVAL	Interval in Seconds between DCC File Writes	60.0
MAIL_NOAA	Mail Recipients to send ship weather rpts	
MAIL_PCO2	Mail Recipients to send PCO2 data (Healy)	
OUTPORT_PCO2	UNIT output port to send PCO2 data (Healy)	
MAIL_OPSUM	Mail Recipients to send OPSUM data (Healy)	
SHIPTRACK_RECEP	Mail Recipients to send ship track information	

9.3.0 Input Module Setup and Calibration Section

Each Active module has a section that starts with the 5-character module ID enclosed in brackets. In these sections key names are used to assign sensor characteristics.

Input Module Section Key names

Keys		
SENSOR	Sensor Description	SENSOR = Air Temperature
MODEL	Model Number	MODEL = 41342LC
MFG	Manufacturer	MFG = RM Young
SERIAL	Serial Number	SERIAL = 3944
OWNER	Organization/owner of Sensor	OWNER = STS
CAL_DATE	Calibration Date	CAL_DATE = 03-Feb-03
CAL_LAB	Calibration Lab	CAL_LAB = ODF
LOCATION	Where Sensor is installed	LOCATION = FWD MAST
INSTALL_DATE	Date sensor was installed	INSTALL_DATE=15-APR-05
COMMENTS	Any Info	COMMENTS = Pri Air Sensor
SENSORTYPE	Specify sensor type -overrides default type	(not normally used)
CMD	Module address and/or command sent to Sensor. (Details on next page)	CMD = #x\r (see backslash codes below)
MSP	Module Setup Parameters (see 9.3.1)	MSP = 3 1 0 0 10 0 1 1 0 0 0 0 0 0
MCP	Module Calibration Parameters (see 9.3.2)	MCP = 1 1 1 0 13 0 0 0 0 0 0 0
TAGS-C	Parameter Tags to include in corrected data file	TAGS-C = AT
TAGS-R	Parameter Tags to include in uncorrected data file	TAGS-R = AT
PRC-C	Precision (Num Decimals)corrected data	PRC-C = 2
PRC-R	Precision (Num Decimals)uncorrected data	PRC-R = 3
EMULATION	Emulation of Values before corrections	EMULATION = 70.0
AVGTYPE	Type of Average 0-None 1-Normal 2-Wind Vector	AVGTYPE = 1
SECSTOAVG	Number of seconds to average data	SECSTOAVG = 10.0
ADCALTYPE	A/D calibration type of each parameter	ADCALTYPE = 0,0,0,0,0,0,0,0
UCR_RANGE	Parameter Range limits – Uncorrected data	
ADCAL	A/D corrections	ADCAL = 1.0, 0.0
EVAL	Expression parser used in formula mode Section 9.3.3	EVAL = x*a+c
COR	Parameter corrections	COR = 9.96E-01, –49.92 1.0
RANGE	Parameter Range limits – Corrected data	RANGE = -40.0, 50.0
ADDTOFILE	Include in Data Files	ADDTOFILE = TRUE
DELIMITERS	Input data Delimiters Delimiters can be any ascii character(s) That are used to separate input values. Defaults are \t \n \r \s ,	DELIMITERS = \t \n \r \s , (see backslash codes below)
EMPTY_TOKS	If TRUE then empty tokens are recognized By default EMPTY_TOKS=FALSE	EMPTY_TOKS=FALSE
LABELS-SC	Display Labels on Strip chart displays	LABELS-SC = AirTmp
LABELS-TAB	Display Labels on Tabulated displays	LABELS-TAB = Precipitation
SLD	Display Location descriptor - strip chart	SLD = BOW
TLD	Display Location descriptor - Tabulated	TLD = MLab
DCC	If TRUE include the data from this module in the DCC file	DCC = FALSE

DCC_MASK	MASK data params in the DCC File	DCC_MASK=1 1 0 0 0 0 0 0
SAMOS_LD	SAMOS Location descriptor (Sec 10.3.0)	

The CMD directive has three different cases.
1. CMD line for RS485 devices (device types 0,1,2,9,17)
2. CMD Line for serial devices (not requiring an interrogation command) (device type 3)
3. CMD line for some NMEA Module types (device type 8)

In the case of RS485 and any other device that requires an interrogation then the CMD= line contains the address command string.
CMD line for RS485 devices (device types 0,1,2,9,17)

> The CMD key name specifies the command that is sent to the module. If a module has an address of SWR01 and a attention character of "#" and an additional command Of "C" then the CMD line would be CMD = #SWR01C
> The attention character is the character that the module recognizes as the attention character. It is usually a '#' but it can sometimes be '$' or '!'.
>
> Backslash codes can be used in the CMD command. Some modules require a terminating character on the end of the command string which is usually a carriage return. This can be specified with the '\r' character. E.g. CMD = #x\r   where x is the module address/command. If the module requires binary addresses and/or commands then use the backslash hex value. Only two hex characters can be specified per backslash. For more hex characters just keep adding backslashes and two hex characters. E.g. CMD = #\F0\01\E4\0A This sends the 32 bit binary integer F001E40A to the module.

CMD line for serial devices (not requiring an interrogation command)(device type 3)

> In the case of serial input devices that do not require an interrogation command and if the input always contains the same type of data then the CMD directive can be omitted. For example, The device outputs the following line of data.
> 123.2<CR><LF>
> 124.0<CR><LF>
> 123.3<CR><LF>
>
> In the above case the CMD line can be omitted because all inputs lines are valid data.
>
> In special cases when the serial device outputs several lines of different types of data then you can specify the CMD directive with the lead-in characters of the line that needs to be selected. For example,
>
> A serial device outputs the following sequence of lines over and over:
> MAKE = ACME CORP<CR><LF>
> SERIAL Number = 1234<CR><LF>
> AIRTEMP = 23.4<CR><LF>
> HUMIDITY = 90.0<CR><LF>
> DEW POINT = 14.0<CR><LF>
>
> You are only interested in the line that starts with AIRTEMP therefore, assign AIRTEMP to the CMD= .
>
> CMD = AIRTEMP
> The system will now ignore all lines except the one that begins with "AIRTEMP"

CMD line for NMEA devices (device type 8)

NMEA messages begin with the NMEA talker message. When several NMEA messages are coming in on the same port then in some cases it is necessary to choose the message that is identified with the module type. This done by entering the 3 (or 4) character NMEA type.

It is not necessary to specify the CMD line in the following NMEA module types (NME, WND, PDR, SND, MBD, GYR, ASH and SOW) but in other types it is needed.

For example, in case of the following USPxx module type that inputs data from a sensor that returns a NMEA MDA message, you specify MDA on the command line. The parameters from the MDA message will be assigned to the USP25 module.

MDA - Meteorological Composite
$WIMDA,29.825,I,1.010,B,17.6,C,,,32.7,,1.0,C,213.9,T,201.4,M,2.4,N,1.2,M*51

```
[USP25]
SENSOR = weather station
MODEL = XYZ
SERIAL = 1234
MFG = ACME
CAL_LAB = ACME
CAL_DATE = 27-Jun-2007
LOCATION = MAST
INSTALL_DATE = 02-Feb-2009
OWNER = SIO/STS
TAGS-C = BP, AT, RH, DP
TAGS-R = BP, AT, RH, DP
PRC-R = 2 2 2 2
PRC-C = 2 2 2 2
RANGE = 800.0 1100.0
RANGE2 = -50.0 50.0
RANGE3 = 0.0 110.0
RANGE4 = -50.0 50.0
CMD = MDA
# Module setup parameters
# Returned values Baro Pres, Air Temp, Humidity, Dew Point
MSP = 12 8
MCP = 1 1 4 0
```

Backslash ('\') Codes

Code	LabVIEW Interpretation
\00 - \FF	Hex value of an 8-bit character; must be uppercase
\b	Backspace (ASCII BS, equivalent to \08)
\f	Form feed (ASCII FF, equivalent to \0C)
\n	Linefeed (ASCII LF, equivalent to \0A)
\r	Carriage return (ASCII CR, equivalent to \0D)
\t	Tab (ASCII HT, equivalent to \09)
\s	Space (equivalent to \20)
\\	Backslash (ASCII \, equivalent to \5C)

Backslash codes can be used in the Keys: CMD and DELIMITERS as well as in an output module section with the FORMAT statement (Section 9.4.0).
A backslash placed at the end of a line will append the line that follows.

Some modules can get data from more than one addressable source. In this case the source must be specified for each input parameter.

Key names CMD, MSP, RANGE, UNC_RANGE, ADCAL and COR can be individually set for each source of data by appending a numeric identifier.

CMD = (first input parameter)
CMD2 = (second input parameter)
CMD3 = (third input parameter)

In these cases it is required that the key names CMD, MSP, and COR be individually specified. Key names RANGE, UNC_RANGE, ADCAL are usually optional.

Display Labels

The total character length of upper display indicators of strip chart displays is 14. The default labels can be changed using the key LABELS-SC. The character length of the labels should be no more than 6. The total character length of the display indicators of the tabulated displays is 24. These labels can be changed using the key LABELS-TAB. The character length of these labels should be no more than 14. In all cases the labels will be truncated if the label length plus value length exceeds available space. When using the keys, be sure to state a label for each parameter in the correct order. E.g.

LABELS-SC = LwrDM, LwrBD, LwrTP, LWR

Alternatively, instead of using the above display label keys a location descriptor can be applied next to each displayed parameter by using the keys TLD and/or SLD. Use TLD for labels on the tabulated pages and SLD for the upper display labels on the stripchart. E.g.

[WND01] Wind module
TLD=Bow

#Will cause all of the parameters from the WND01 module on the tabulated display to change from this:
RelWS-kt   2.6
RelWDIR   311.0

#To this:
Bow RelWS-kt   2.6
Bow RelWDIR   311.0
#This would identify the wind sensor as being the one on the bow mast.

The keys LABELS-TAB and LABELS-SC should not be used with TLD and SLD. IF they are all present in the same module then LABELS-TAB and/or LABELS-SC will have priority.

9.3.1 MSP Module Setup Parameters

1 UNIT Number	0-Disable UNIT >0 - UNIT number
2 Input Device type	0-RS485 Sensor Module 1-RS485 DGH Analog Input Module 2-RS485 ADAM Module 3-RS232 Continuous Serial Data 4-Time Server (old) 5- 6-SBE21 TSG Unit 7-Simrad EM VRU 8-NMEA RS232 9-RS485 DGH Digital HEX Input Module 10-Hippy 120 VRU (old) 11- 12-NMEA UDP (old) 13- 14-NMEA UDP (new) 15-UDP (Non-NMEA data string) 16- 17-RS485 ADAM Frequency Module (4080) 18-Read National Instruments DAQ card or USB device 19- 20- 21-Seaspy Magnetometer 22-BGM-3 Gravimeter
3	0-Normal
4	0-Normal
5 Term character	Decimal value of the terminating character of the data returned from sensor. 10-Normal, 13 for ADAM module, 3 if using ALDEN IMET Module.
6	0-Normal
7	Number of variables returned from sensor
8	Index for variable #1
9	Index for variable #2
10	Index for variable #3
11	Index for variable #4
12	Index for variable #5
13	Index for variable #6
14	Index for variable #7
15	Index for variable #8

When determining index numbers, input values are delimited only by recognized delimiters. Delimiters may be specified as per section 9.3.0. Defaults are spaces, commas, tabs and carriage returns. Line feeds are delimiters if they are not specified as terminating characters.

Empty Tokens are treated differently depending on whether the input data is a NMEA message or coming from a non-NMEA source.
1. NMEA messages – In a NMEA message all tokens are recognized whether they are empty or not.
2. non-NMEA input strings – If using the default value for DELIMITERS then Tokens are recognized only if they contain data.

For example, if an input string from a non-NMEA source contains the following line
24.0,,,45.9,,,23.0
If using the default value for DELIMITERS then the values are indexed as follows:
1-24.0 2-45.9 3-23.0
In a NMEA message the same input string is indexed as follows:
1-24.0 4-45.9 7-23.0

If "DELIMITERS =" is specified without the '\s' character then empty tokens are recognized. Or if EMPTY_TOKS=TRUE is specified then empty tokens are also recognized so that a non-NMEA source will be indexed he same way that NMEA message is parsed.

Consider the following string that could be received from a module. If it is an Air temperature module and the actual set of values are returned are:
1000, 25.0 60.0 10.0<cr><lf>
Count, Air Temperature, R1value, R2value
Then the correct index number is 2 as it selects the second item in the string as air temperature.

9.3.2 NMEA Input Messages

NMEA messages that can be input to the MET program include:
GGA, GNS, RMC, GLL, VTG, HDT, VHW, VBW, DPT, DBT, DBS, PKE, PASHR ATT, ZDA, MWV, GSA, MDA, HDG, XDR

Sensor modules are programmed to input NMEA messages by setting the device number field in the MSP line to the number '8'.

Modules can be defined for multiple NMEA devices. The primary GPS is the module name first specified in the STARTMOD section. The STARTMOD section may contain the following line
STARTMOD
NME06 NME04 NME03
ENDMOD

NME06 in the above line is the primary GPS. The module section can be defined as follows:

```
[NME06]
SENSOR = Garmin GPS
MODEL = GPS17
SERIAL = 80733302
MFG = GARMIN
LOCATION = Aft Stack rail
OWNER = New Horizon
# Module setup parameters
MSP = 19 8
```

With this type of module it is not necessary to have a MCP, ADCOR, COR and in most cases don't need CMD lines (see section 9.3.0). However, if these lines are present then it is ok. They will be ignored. On the MSP line only the first two values are needed.

When specifying a NME sensor type then this module will accept any of the GGA, VTG, RMC, GNS and ZDA messages that are present. The output will provide LAT, LON, Time, COG, SOG, GPS Datetime, Altitude and status. To input position data from a GPS receiver use the NME sensor type.

If the Met program is configured to write one GPS to file and if several NME sensor types are activated then the program will write the data from the primary GPS. If this GPS fails then the system will automatically select the next operational GPS. The data from the backup GPS will be written to file. The .LOG files will indicate which GPS is used. When a GPS of higher priority comes back on line then the system will then automatically switch to this GPS.
To enable this feature set the following line in the GENERAL section of the ACQ file.
ONEGPS2FILE = TRUE

When specifying a PDR sensor type then this module will accept any of the DBT, DPT, DBS and PKE messages that are present. The output will provide Water Depth.

Other NMEA sensor types are defined according to the following table.

The module Sensor type specifies the NMEA string.

NMEA	MET Parameters	MET Sensor Type
GGA, GNS, GLL	LA LO GT GA GS	NME
VTG	CR SP	NME
RMC	LA LO GT CR SP ZD GA GS	NME
HDT	GY	GYR
ZDA	ZD	NME
MWV	WS WD	WND
PASHR, ATT	SH SM SR	ASH
VHW	SL	SOW
VBW	SL SX	SOW
DBT	BT	PDR
PKEL99	LF, HF, BT	SND
DPT	MB	MBD

9.3.3 MCP Module Calibration Parameters

1	0-Calibrations not applied in Acquisition program 1-Calibrations applied in Acquisition program
2	0-Calibrations not applied in MET sensor Module 1-Calibrations applied in MET sensor Module
3	3-Number of parameters to be computed from the returned variables
4	Calibration method for A/D correction
5	Calibration method for parameter #1
6	Calibration method for parameter #2
7	Calibration method for parameter #3
8	Calibration method for parameter #4
9	Calibration method for parameter #5
10	Calibration method for parameter #6
11	Calibration method for parameter #7
12	Calibration method for parameter #8

9.3.4 Calibration Method types

0-None
1-Offset   Result = X+offset   COR = offset
2-Offset(+/- 0-360Deg)Result = X+offset   COR = offset
3-Slope, Offset Result = (X+offset)*slope   COR = Slope, offset
4-Polynomial   Result = X+AX2+BX+C   (2-10 coefficients)   COR = A, B, C
5-Polynomial   Result = AX2+BX+C   (2-10 coefficients)   COR = A, B, C
6-Polynomial   Result = X+AX2+BX+C+DT (2-10 coefficients)   COR = A, B, C, DT
7-Polynomial   Result = AX2+BX+C+DT   (2-10 coefficients)   COR = A, B, C, DT
8-LWR calculation (Tbody, Tdome, microvolts) Eppley   COR = Cal factor
9-Thermistor temperature Excitation Volts, Series Res, A, B, C coeffs, Slope, Offset   COR = Exc Volts, R1, A, B, C, Slope, Offset
10-RTD resistance to temperature Calculation from Rtp Rga Rrtd
11-Seabird T from Frequency Calculated using g,h,i,j,f0,slope,offset   COR = g, h, I, j, f0, slope, offset
12-Seabird C from Frequency Calculated using g,h,i,j,ctcor,cpcor,slope,offset   COR = g, h, i, j, ctcor, cpcor, slope, offset
13-Slope, Offset Result = (X*slope+offset) * Y [Y defaults to 1.0 if not specified]   COR = Slope, offset, 1.0
14-Slope, Offset, DT (BP cal)
15-Dew Point Calculation from HRH
16-Seawater Salinity Calculation From TSG
17-Seawater Density Calculation From TSG
18-Seawater Sound Velocity Calculation From TSG
19-True Wind Speed Calculation From Relative Wind
20-True Wind Direction Calculation From Relative Wind
21-Seawater Oxygen Calculation From SBE13   COR = soc, boc, tcor, pcor, tau, wt
22-Seawater Oxygen Calculation From SBE43 using pre 2008 coefs   COR = soc, boc, tcor, pcor, tau, wt

23-Oxygen Saturation value of Seawater	
24	
25-pH from SBE-18 slope, offset COR = slope, offset	
26-SWR calculation (Slope, Offset, Calfactor) ((X+Offset)*Slope)/CalFactor COR = Slope, offset, Cal factor	
27-LWR calculation (Tbody, microvolts) Zipp/Zonen COR = Cal factor	
28	
30-Formula mode (See following paragraph on Formula mode)	
31-Oxygen (Aanderra Optode 3835) corrected with TSG Salinity – Result in ml/l	
32-Calculate a new Lat/Lon position with Offset from GPS antenna (Bearing (deg), Distance offset (Meters) Output = Latitude COR = bearing(deg), distance(meters)	
33-Same as above but Output = Longitude	
34-Seawater Oxygen Calculation From SBE43 using post 2008 coefs COR = soc, Voffset, Tau20, A, B, C, E	
35-Seabird C from Frequency Calculated using g,h,i,j (no slope offset correction) COR = g, h, i, j, ctcor, cpcor	
36-Pump On indicator from flow device	
37-Barometric Pressure Sea Level calculation COR = Altitude(Meters)	

38- Light Transmission – Wetlabs transmissometer
       A0= factory voltage output in air
      Y0= factory dark or zero (blocked path) voltage
       A1= current (most recent) voltage output in air
       Y1= current (most recent) dark or zero (blocked path) voltage
      W0= factory voltage output in pure water
         z = Path Length in Meters
      COR = A0, Y0, A1, Y1, W0, z	

39- Light Transmission – Wetlabs transmissometer Beam Coefficient	
40- Rinko III Oxygen Calculation (uses the TSG Temperature) COR = A, B, C, D, E, F, G, H	
41- Wet Bulb Temperature calculation from Humidity, Air Temp and BP	
42-HTM25X0 Humidity sensor calculation COR = Slope, offset	
44-HM1500 Humidity sensor calculation COR = Slope, offset	

Notes:
Sensor Type OXY should always be calibrated to ml/l.
Sensor Type WND should always be calibrated to M/S.
Sensor Type FLW should always be calibrated to LPM.

Refer to section 11 for information on calculation methods.

Using the Keyword <EVAL> enter in the mathematical equation that is needed to compute the desired result. There are predefined variables to use:

Variable	Meaning
x	Current value returned by the module
a thru t	Coefficients defined in the COR= statement
v1 thru v7	Previously calculated results
at bc st tt ax	MET primary parameter as defined in Appendix A

For example if the module section includes the following statements:
EVAL = x*a+b
COR = 50.0, 7.0

The variable a will refer to the first coefficient; variable b will be the next coefficient. So if the raw value returned by the module equals 2.5 then the result will be (2.5*50+7) which equals 132.0

If the module returns two values and the result of the second result depends on the value of the first result then use the keyword to refer to the second expression:
EVAL2 = x+a/b*c+v1
COR2 = 2.0 , 5.0, 8.0

In this case if the module returns the values 2.5 and 6.0 then the result of the second computed value will be (6+2/5*8+132) = 141.2

Constants can be included in the equations as long as they are not expressed in scientific notation.
Correct use of constants: EVAL = x * 0.001
Incorrect use of constants: EVAL = x * 1e-3

If a constant needs to be expressed in scientific notation then make it a coefficient and refer to it as a variable such as:
EVAL = x*a
COR = 1e-3

Functions such as sin, cos, tan, sqrt can also be used such as:
EVAL = sqrt(x) * a + b

The following operators can be used:
+ and -   addition and subtraction
* and /   multiplication and division
^   exponentiation

Formula Mode Functions

Function	Description
abs(x)	Returns the absolute value of x.
acos(x)	Computes the inverse cosine of x in radians.
Acosh(x)	Computes the inverse hyperbolic cosine of x.
asin(x)	Computes the inverse sine of x in radians.
Asinh(x)	Computes the inverse hyperbolic sine of x.
atan(x)	Computes the inverse tangent of x in radians.
Atanh(x)	Computes the inverse hyperbolic tangent of x.
ceil(x)	Rounds x to the next higher integer (smallest integer x)
ci(x)	Computes the cosine integral of x where x is any real number.
Cos(x)	Computes the cosine of x, where x is in radians.
Cosh(x)	Computes the hyperbolic cosine of x.

cot(x)　　　Computes the cotangent of x (1/tan(x)), where x is in radians.
Csc(x)　　　Computes the cosecant of x (1/sin(x)), where x is in radians.
Exp(x)　　　Computes the value of e raised to the x power.
Expm1(x)　Computes one less than the value of e raised to the x power ((e^x) – 1).
Floor(x)　　Truncates x to the next lower integer (largest integer x).
gamma(x)　(n + 1) = n! for all natural numbers n
getexp(x)　Returns the exponent of x.
getman(x)　Returns the mantissa of x.
int(x)　　　Rounds x to the nearest integer.
Intrz(x)　　Rounds x to the nearest integer between x and zero.
Ln(x)　　　Computes the natural logarithm of x (to the base of e).
lnp1(x)　　Computes the natural logarithm of (x + 1).
Log(x)　　　Computes the logarithm of x (to the base of 10).
Log2(x)　　Computes the logarithm of x (to the base of 2).
Sec(x)　　　Computes the secant of x, where x is in radians (1/cos(x)).
Si(x)　　　Computes the sine integral of x where x is any real number.
Sign(x)　　Returns 1 if x > 0, returns 0 if x = 0, and returns –1 if x < 0.
Sin(x)　　　Computes the sine of x, where x is in radians.
Sinc(x)　　Computes the sine of x divided by x (sin(x)/x), where x is in radians.
Sinh(x)　　Computes the hyperbolic sine of x.
sqrt(x)　　Computes the square root of x.
tan(x)　　　Computes the tangent of x, where x is in radians.
Tanh(x)　　Computes the hyperbolic tangent of x.

9.3.5 Examples of setting up an Input Module section

Example #1

An RM Young Air Temperature sensor is connected to a RS485 network on a COM port assigned on UNIT3 that has an ADAM 4117 module with an address of '02' on input channel 4 (counting from 0).
UNIT3   1 COM3   9600 NONE 8 1   # RS485 I/O   - MET Mast Sensors

The returned data looks like this:
>+5.8222+0.0000+0.0000+0.0000+0.7000+0.0000+0.0000+0.0000

The MSP line is set to UNIT(3), RS485 ADAM input type(2), (0), (0),Term Character (13),0,Number of values needed from sensor(1), Index number of value (5)

The index will point to the data line coming in on UNIT3, item number 5 (counting from 1). This value is 0.7 volts.
The correction factors that will convert the value in volts to temperature are in the COR = line. Since it is a slope offset then you can choose Cal type 13 or 5 and the result will be the same. In this case with 0.7 Volts input then the temperature will compute to 20.163 Deg C.

```
[TMP12]
SENSOR             = Air Temperature
MODEL         = 41342VC
SERIAL             = 11708
MFG                = RM Young
CAL_LAB            = STS
CAL_DATE           = 27-Feb-2013
LOCATION           = MET Mast 56'above MWL
OWNER         = SIO/STS
INSTALL_DATE       = 10-Oct-2013
DCC                = TRUE
SAMOS_LD      = B
## Module address
## Adam 4117 address of 02
CMD                = #02\r
## Module setup parameters
MSP           = 3 2 0 0 13 0 1  5 0 0 0 0 0 0 0
MCP           = 1 1 1 0 5 0 0 0 0 0 0 0 0
Emulation     = 0.7
AVGTYPE        = 1
SECSTOAVG     = 60.0
## A/D Calibration
ADCAL       = 1.0 0.0
## Corrections (A. slope, B. offset)
COR           = 9.98626433E+1, -4.97463987E+1
## Temperature = Volts*A+B
```

Example #2

The Eppley acquires thermopile data from a analog to RS485 converter. The thermopile temperatures are measured with the same device that measures the thermopile voltage. The thermopile channel of the ADAM4118 is set to measure 0-15mv, the temperature channels are set to a range of 0-2.5V. All channels have the same address and all values are returned from the ADAM module in the same packet. Note that the 2nd value on the MSP line is a 2 (section 9.3.1).

```
[LWR02]
SENSOR      = Long Wave Radiation
MODEL       = PIR
SERIAL      = 30026F3
MFG         = Eppley Labs
CAL_LAB     = Eppley
CAL_DATE    = 18-Mar-2013
LOCATION    = MET Mast 68'above MWL
OWNER       = SIO/STS
INSTALL_DATE    = 12-Oct-2013
DCC         = TRUE
DCC_MASK    = 0,0,0,1,0,0,0,0
SAMOS_LD    = B
# ADAM 4118 0-15mv Thermopile CH1, 0-2.5VDC Dome CH4, Body CH5
CMD         = #04\r
# Module setup parameters
MSP         = 3 2 0 0 13 0 3  4 5 2 0 0 0 0 0
MCP         = 1 0 4 0  9 9 3 8 0 0 0 0
# Emulation values
Emulation  = 1.200 1.200 114.7
# A/D Calibration
ADCAL       = 1.0 0.0
# Dome, Body, Thermopile
# EVAL          = (1.0/(c+ln((x*0.001)/((a-
(x*0.001))/b))*(d+e*(ln((x*0.001)/((a-(0.001*x))/b))^2))))*f+g
# Corrections for Dome Glass Temp sensor
COR         = 4.95, 82500, 0.0010295, 0.0002391, 1.568e-7, 1.0, 0.0
# Corrections for Body Temp sensor
COR2        = 4.95, 82500, 0.0010295, 0.0002391, 1.568e-7, 1.0, 0.0
# Eppley correction factors
# Thermopile Slope Offset (in uv)
COR3        = 1000.0, 0.0
# Eppley cal factor
# Cal Factor  volts/watts meter -2
COR4        = 3.59e-6
```

Example#3

The Eppley acquires thermopile data from a millivolt to RS485 converter. The thermopile temperatures are measured with a different device than the one that measures the thermopile voltage. In this case the thermopile is measured with a DGH D2102 (0-10mv). the temperature channels are measured with a DGH D5132 (0-5V). Each channel has a different address. Note that the 2nd value on the MSP line is a '1' (section 9.3.1).

```
[LWR00]
SENSOR = Long Wave Radiation
MODEL = PIR
SERIAL = 27926F3
MFG = Eppley Labs
CAL_LAB = Eppley
CAL_DATE = 17-Dec-2008
LOCATION = Top Bridge 36'above MWL
OWNER = SIO/STS
INSTALL_DATE = 06-Jan-2009
DCC = TRUE
DCC_MASK = 0,0,0,1,0,0,0,0
SAMOS_LD=T
# DGH D2102 0-10mv VDC (Thermopile)
# DGH D5132 0-5v VDC  (Dome Temp, Body Temp)
CMD = #p\r
CMD2 = #q\r
CMD3 = #m\r
# Module setup parameters
MSP = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MSP2 = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MSP3 = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MCP = 1 0 4 3  9 9 0 8 0 0 0 0
# Emulation values
Emulation = 1200 1200 114.7
ADCALTYPE = 3 3 0 0
# A/D Calibration
ADCAL = 0.001, 0.0
ADCAL2 = 0.001, 0.0
ADCAL3 = 1.0, 0.0
ADCAL4 = 1.0, 0.0
# Dome, Body, Thermopile
# EVAL = (1.0/(c+ln((x*0.001)/((a-(x*0.001))/b))*(d+e*(ln((x*0.001)/((a-
(0.001*x))/b))^2))))*f+g
# Corrections for Dome Glass Temp sensor
COR = 10.0, 80000, 0.0010295, 0.0002391, 1.568e-7, 1.0, 0.0
# Corrections for Body Temp sensor
COR2 = 10.0, 80000, 0.0010295, 0.0002391, 1.568e-7, 1.0, 0.0
# Eppley correction factors
# Thermopile Slope Offset (in uv)
COR3 = 1.0, 0.0
# Eppley factor, Stefan-Boltzmann Const, absorption/dome glass IR
# Cal Factor  volts/watts meter -2
COR4 = 3.79e-6, 5.6697e-8, 1.97
```

Example #4
A fluorometer that outputs RS232 data at 9600 baud is connected to COMM 3. There are calibration factors applied by the MET program. Fluorescence and turbidity needs to be logged. Note that the 2nd value on the MSP line is a '3' (section 9.3.1).

The sensor outputs the following data stream:
Turner SCUFA II (Pcdate, Pctime, Raw-fluorescence, Temp-corr-fluorescence, Turbidity, Uncalib-temperature)
02/28/01 15:11:45 13.502 13.807 0.410 26.6<cr><lf>

First, identify the sensor type as a Fluorometer then assign a unique two-number Sensor ID. From section 2 the fluorometer is determined to be type FLU. Next assign a unique two-number code (E.g. FLU11). Only one defined sensor for each ID is allowed. It is not permissible to have more than one FLU11 in the system. If you have another fluorometer then give it an ID that is not used such as, FLU12.

Enter the new Sensor as [FLU11]. Then enter information about the sensor.

```
[FLU11]
SENSOR = Fluorometer
MODEL = SCUFA II
SERIAL = 12345
MFG = Turner
CAL_LAB = Turner
CAL_DATE = 01-FEB-2003
LOCATION = AFT LAB – Revelle
OWNER = MLRG
COMMENTS = Used on Calcofi Cruise Feb-2003
# For an RS232 port "CMD = " must be Zero
CMD = 0
# Module setup parameters
# 1 serial port unit number.  2 Device – RS232 Port
# 3, 4 – 0                              4 Termination character (decimal value) –
10 (Line Feed)
# 5 – 0                                 6 – Number of values returned
# 7 Index number of Fluorometer value (3rd position in string)
# 8 Index number of Turbidity value (4th position in string)
# 9-14 unused
MSP = 4 3 0 0 10 0 6  3 4 0 0 0 0 0 0
MCP = 0 1 2 0  0 0 0 0 0 0 0 0
# Since the default tag setting is FL then in order to acquire both FL and TB it is
necessary to override the defaults. The Precision also needs to be specified.
TAGS-R = FL TB
TAGS-C = FL TB
PRC-R = 3 3
PRC-C = 3 3
EMULATION = 13.502 0.410
ADCAL = 1.0 0.0
COR = 1.0, 0.0
COR2 = 1.0, 0.0
```

Serial Port and Sensor Configuration section
UNIT4   1 COMM4 9600 NONE 8 1   RS232 Input – SCUFA II Fluorometer

Example #5 Magnetometer

UNIT23 1 COMM23 9600 NONE 8 1   # RS232 Input - SeaSpy Magnetometer(s)

```
[MAG01]
SENSOR       = Magnetometer
MODEL        = SeaSpy
SERIAL       = ?????
MFG          = Geometrics
CAL_LAB      = n/a
CAL_DATE     = n/a
LOCATION     = Towed Fish, 300m, 600m or 700m behind the ship.
OWNER        = SIO/STS
DCC          = FALSE
# Module setup parameters
MSP          = 23 21 0 0 10 0 6  1 2 3 4 5 6 0 0
MCP          = 1   1 6 0  0 0 0 0 0 0 0 0
# Emulation value(s) can be Mag Mode, e.g.:
# *12.118/07:49:28.0 F:029129.131 S:184 D:+001.1m  L0 0965ms Q:99
# ... or Grad Mode, e.g.:
# *12.127/03:43:32.5 F[024996.573 153 0466 +0033.5 ___] R[024996.263 158 0466
+0023.5 ___] +000000.310
Emulation       = 026452.728, 35.0, 150 0 0 0
# A/D Calibration
ADCAL        = 1,0.0
# Corrections RH
COR          = 1.0,0.0
# Corrections RT
COR2         = 1.0,0.0
```

Example #6 GPS input

The NMExx module inputs GPS data from the following messages – GGA, VTG, ZDA.
It will also take GLL or RMC data if necessary. No modifications are needed for any of the
above messages.

UNIT13 1 COMM13 19200 NONE 8 1   # RS232 Input - trimble-sps351-1 GPS NMEA (Aft Mast)

```
[NME03]
SENSOR       = GPS
MODEL        = SPS351
SERIAL       = 5242D53000
MFG          = Trimble
CAL_LAB      = n/a
CAL_DATE     = n/a
LOCATION     = Comp Lab
INSTALL_DATE= 09-Jan-2013
OWNER        = STS
DCC          = FALSE
DCC_MASK     = 1,1,0,1,1,0,0,0
SAMOS_LD     = M
## Module setup parameters
MSP          = 13 8
## Emulation Value
Emulation    = 32.3456 -117.5678 4000.0 90.0 12.0 1018724200.0 25.0 208.0

# DESCRIPTION: Bridge primary GPS antenna, aft mast
```

9.4.0 Output Module Setup Section

In addition to the standard output Data files (section 10) and standard pre-defined serial data output formats that are described in section 8 it is possible to generate custom user defined output data format(s). These defined formats are specified in an output module section of the ACQ file. Data can be output to any number of available serial ports and/or written to any number of user files. For each defined output module, a separate user file is written and/or a separate message is output to a serial port. Any number of user defined output modules can be specified for most kinds of desired outputs. So it is possible to output different messages out different serial ports and/or written to different files. Output modules are specified in the .ACQ file in a section that starts with OUT followed by two identifier digits. The first defined output module will be setup in a section called OUT01. Output module names need to be added to the STARTMOD section after all of the input modules.

Output Module Key names

Keys	Description	Example
SERUNITNUM	Serial Output Unit Number 0 – Disable Serial Output >0 Enable Serial Output on designated UNIT. If Serial output is enabled: In the Serial Port configuration section in the column just after UNIT# set function to 20	SERUNITNUM=2 Output data on port designated by Unit #2 Function for Unit#2 Set Function to 20
PARAMETERS	MET Parameter tag (from Appendix A)	PARAMETERS=AT BP LA LO
PARAMETER NUMBERS	MET Parameter Sensor number 0 – First sensor 1 – Second Sensor 2 – Third Sensor (and so on)	PARAMETER NUMBERS= 0 0 0 0
PRECISION	Number of decimal places for each parameter	PRECISION=3 3 5 5
INTERVAL	Time Interval (in seconds that data is either Stored in a file and/or output to a serial port	INTERVAL=10.0
MK_OUTFILE	Enables/Disables writing the selected data to a USER File	MK_OUTFILE=TRUE
ADDCRC	Enables/Disables Addition of NMEA style Checksum to end of line	ADDCRC=TRUE
ADDTIMESTAMP	Enables/Disables Time stamp at the beginning of each line	ADDTIMESTAMP=TRUE
LEADER	Specify any desired leader string	LEADER=$WIUSER
NMEA	Specify one or more standard NMEA message(s) to include in the output. If no NMEA messages are desired then do not specify this key. NMEA messages that can be output: GGA, GNS, GLL, RMC, VTG, ZDA, HDT, VHW, MWV, MWD, MTW, XDR, DBS,DBT,DPT,PASHR-ATT	NMEA=GGA VTG ZDA See Appendixes B and D for more info on NMEA message content.
DELIMITERS	Delimiters may be any character or several characters or any of the backslash codes Described in Section 9.3.0	DELIMITERS = , Or DELIMITERS = \s
FORMAT	Output FORMAT syntax.	FORMAT = %6.3f %.4f
HEADER	Line that appears at the start of the file	
EXTENSION	File Extension (up to 6 characters)	

The FORMAT keyword, if defined,overrides the PRECISION and DELIMITERS keywords. Data is output according to the defined syntax.

%[–][+][^][0][Width][.Precision][{unit}]Conversion Code

The conversion code can be "e, f or g"
f floating-point number with fractional format (for example, 12.345)
e floating-point number in scientific notation (for example, 1.234E1)
g floating-point number using e format if the exponential is less than –4 or greater than Precision, or f format otherwise

Data is formatted using a 'C' like format specifier string such as in a "printf" statement. An example would be:
PARAMETERS = AT, BP, RH
FORMAT= Air Temperature %7.3f Deg C\tBP %7.2f mb\tHumidity %5.2f Percent

Alternately, each parameter grouping can be separated by the '|' character. This is desired when outputting parameters such as latitude, longitude and time in something other than a decimal format (See below). The vertical bar, if used, must be placed around all parameter format specifiers.
FORMAT = %7.3f |%2.4f | %2.1e

Using FORMAT, values are not automatically delimited. The DELIMITER keyword has no effect in this mode. It is necessary to include delimiters in the FORMAT statement. Delimiters may be backslash codes to indicate TABS or SPACES or any desired character. SPACES can be either '\s' or ' '.

The '|' '%' characters have special meaning. However, if is desired to put these characters in the output string use the backslash codes as described in Section 9.3.0.
\7C represents the '|' character.
\25 represents the '%' character.

Generally there is only one format specifier per selected parameter. Such as, for the parameter AT the format specifier of %4.1f may be used. The exceptions can be for parameters for time(GT, TS, ZD, SY), latitude(LA) and longitude(LO). For time parameters use one format specifier e.g. %.1f to output the time in floating point format (time of seconds since 1970) or use special format codes to format the time parameter in a particular format. If, for example, it is desired to output time in hours, minutes, seconds 23:56:00. Use %H:%M:%S. The below table shows the format codes that can be used to format time parameters.

If latitude specified in decimal format is desired then use one format specifier e.g. %.5f. Otherwise if latitude expressed in degrees and minutes is desired then use additional format specifiers along with the vertical bar '|' as follows:
Latitude %02.0f %06.3f%1s| Longitude %03.0f %06.3f%1s

This produces:
Latitude 32 30.042N Longitude 117 30.042W

Format Codes for the Time Format String

Format Code	Value
%%	a single percent character
%a	abbreviated weekday name (e.g. Wed)
%A	full weekday name (e.g. Wednesday)
%b	abbreviated month name (e.g. Jun)
%B	full month name (e.g. June)
%c	locale's default date and time representation
%d	day of month (01–31)
%H	hour (24-hour clock) (00–23)
%I	hour (12-hour clock) (01–12)
%j	day number of year (001–366)
%m	month number (01–12)
%M	minute (00–59)
%p	AM or PM flag
%S	seconds (00–59)
%<digit>u	fractional seconds with <digit> precision
%U	week number of the year (00–53), with the first Sunday as the first day of week one
%w	weekday as a decimal number (0–6), with 0 representing Sunday
%W	week number of the year (00–53), with the first Monday as the first day of week one
%x	locale's date representation
%X	locale's time representation
%y	year within century (00–99)
%Y	year, including the century (for example, 1997)
%Z	time zone name or abbreviation, depending on the operating system locale settings

The following are some examples of an output module section.

Example#1

```
[OUT01]
SERUNITNUM = 2
PARAMETERS= AT BP RH LA LO
PARAMETER NUMBERS = 0 0 0 0 0
PRECISION = 3 3 3 5 5
MKOUTFILE = TRUE
INTERVAL = 10.0
ADDCRC = TRUE
ADDTIMESTAMP = TRUE
LEADER = $WIUSR
NMEA = GGA, VTG, ZDA
```

This will produce an output that looks like:

```
$WIUSR,180000,20.000,1010.000,80.123,32.12345,-117.12345*A0
$GPGGA,225531.811,3241.3954,N,11708.6334,W,1,08,1.4,033.1,M,036.0,M,,*7F
$GPVTG,000.0,T,346.8,M,000.0,N,000.0,K*47
$GPZDA,225533.00,21,03,2003,00,00,*4B
```

Be sure that the name OUT01 is added to the STARTMOD section.

If ADDTIMESTAMP is TRUE then the time will be placed just before the data and just after the leader string. If there is no leader then the time will be at the beginning.
Of each line. All above four lines of data will be output on Serial Port#2 every 10 seconds. This will also be written to a file in the data directory every 10 seconds.

```
Example #2
[OUT02]
SERUNITNUM = 3
PARAMETERS= AT BP RH LA LO GY SP
PARAMETER NUMBERS = 0 0 0 0 0 0 0
PRECISION = 3 3 3 5 5 1 1
MKOUTFILE = FALSE
INTERVAL = 5.0
ADDCRC = FALSE
ADDTIMESTAMP = FALSE
```

This will produce an output that looks like:
25.123,1010.000,75.000,32.12345,-117.12345,270.0,10.0

In this case, data goes out port#3 every 5 seconds. No NMEA messages, Data not written to file. No leader, no timestamp and no Checksum.

```
Example #3 Using the Format Keyword
[OUT02]
SERUNITNUM = 3
PARAMETERS= AT BP RH LA LO GY SP
PARAMETER NUMBERS = 0 0 0 0 0 0 0
MKOUTFILE = FALSE
INTERVAL = 5.0
ADDCRC = FALSE
ADDTIMESTAMP = FALSE
FORMAT = AT: %7.3f BP: %6.1f  RH: %.2f LA: %.4f LO: %.4f GY: %5.1f SP: %4.1f
```

This will produce an output that looks like:
 AT: 25.123 BP: 1010.0 RH: 75.00 LA: 32.1234 LO: -117.1234 GY: 270.0 SP: 10.0

For each defined output module a different file name will be assigned. For the first defined output module the file name will be something like 030401.M00. For each additional output that may be defined the number will increment by one. E.g. a second defined output module will be 030401.M01 If the EXTENSION = parameter is defined then that value will be used instead of the default Mxx value. For example if EXTENSION=TSG then the filename will be 030401.TSG instead of 030401.M00.

All data will always be written to the standard data files regardless of (if or how) any output modules are defined or specified. The standard data files are described in the next section.

Example #4
More than one output unit can be assigned to the SERUNITNUM statement. The output wil be sent out all designated ports. In this case, the below formatted NMEA data is sent out on 5 ports (one serial port and 4 UDP ports) every second. Be sure that the name OUT66 is added to the STARTMOD section.

```
UNIT4  20 COMM4    4800 NONE 8 1                        # RS232 Output - OUT66 to LabGPS switchbox
-
UNIT66 81 UDP     40183 NONE 40182 10.110.149.255      # Output - OUT66 to Acq-LAN
UNIT67 80 UDP     55000 NONE NONE                       # Input  - Knudsen 3260 UDP
UNIT68 80 UDP      8112 NONE NONE                       # Input  - HYDRINS NAV BOC MRU-LAN
UNIT69 80 UDP      8115 NONE NONE                       # Input  - HYDRINS GPS LIKE MRU-LAN
UNIT70 19 UDP     40021 NONE 40020 10.110.149.255   60 # Output - $WICOR  60s interval
UNIT71 19 UDP     40023 NONE 40021 10.110.149.255  300 # Output - $WICOR 300s interval
UNIT72 80 UDP      8212 NONE NONE                       # Input  - PHINS III NAV BOC
UNIT73 80 UDP      8215 NONE NONE                       # Input  - PHINS III GPS LIKE
UNIT74 81 UDP     40024 NONE 40023 137.110.149.33      # Output - OUT66 GGA to turo xbt
UNIT75 19 UDP     33003 NONE 33002 137.110.149.115  60 # Output - WICOR for RR1401
UNIT76 81 UDP     33001 NONE 33000 137.110.149.115     # Output - out66 GPS for RR1401

[OUT66]      # DESCRIPTION: 1Hz NMEA 0183 position/heading for UDP and RS232
       SERUNITNUM          = 4,66,74,76
       MKOUTFILE           = FALSE
       INTERVAL            = 1.0
       NMEA                = GGA,VTG,ZDA,HDT
```

10. MET Data Files

The location of the selected MET .ACQ file determines the location where the MET data files are written. On SIO ships the .ACQ file is located in C:\MET and the data files will be written in the same directory unless MKCRUISEDIRS is set to TRUE.

If the following directive in the selected MET .ACQ file is set to TRUE then data files are written into a cruise directory that is located as a sub-directory to the one where the .ACQ file is located and is specified in the file C:\MET\cruisename.txt. The name in cruisename.txt is restricted to a total length of six characters.

MKCRUISEDIRS   = TRUE

If it is false or not specified then data files are written into the .ACQ file directory. For example, the selected .ACQ file is named RR14A.acq and it is placed in C:\MET. The cruisename .txt file contains the name RR1402. The data files will be written to C:\MET\RR1402. The cruisename.txt file can be changed while MetAcq is running. After changes are made then in 30 seconds or less MetAcq will make a new directory (if it doesn't already exist) with the name specified in cruisename.txt and start writing data files into it.

10.1.0 MET data file format description

The acquisition program generates at least two files. One file is corrected data, which is the sensor return value that has calibration corrections applied within the acquisition program. The other file is uncorrected data which is the sensor return value unaltered by the program. The corrected data file is of type .MET. The Uncorrected data file is of type .UCR. If enabled, the program will also generate additional files written in the Translator format. These files are of type .COR and .UNC.
Data files start upon program execution or at the beginning of each (GMT) day beginning at 0000Z. At the end of the day at 2359Z the file is closed and a new set of files start again at 0000Z the next GMT day.

The .MET and .UCR files are enabled by setting the following directives in the .ACQ file:
MK_MET = TRUE
MK_UCR = TRUE

MET, UCR Files:
Four lines of header information begin the file
Shipname
Date Time
Data Type
Header – Each data parameter is identified using this line

An abbreviated example of a MET corrected data file follows:
```
# R/V New Horizon Meteorological Data Center
# Fri 16-Aug-2002 19:37:22
# Met Data - Corrected
#Time     AT       BP        WS        WD        RH        LA        LO        CR        SP
193722  30.03    1002.94  6.0       10.0      70.43     32.345600 -117.567800 45.0      10.0
193752  30.03    1002.94  6.0       10.0      70.43     32.345600 -117.567800 45.0      10.0
193822  30.03    1002.94  6.0       10.0      70.43     32.345600 -117.567800 45.0      10.0
```

An abbreviated example of a UCR uncorrected data file follows:
```
# R/V New Horizon Meteorological Data Center
# Fri 16-Aug-2002 19:37:22
# Met Data - Uncorrected
```

```
#Time      AT       BP       WS       WD       RH       LA        LO         CR      SP
193722  0.70000  3.70000  6.00     10.00    0.70000  32.345600 -117.567800 45.0     10.0
193752  0.70000  3.70000  6.00     10.00    0.70000  32.345600 -117.567800 45.0     10.0
193822  0.70000  3.70000  6.00     10.00    0.70000  32.345600 -117.567800 45.0     10.0
```

The order that each sensor data is stored is determined in the Module selection section in the acquisition and calibrations setup file (See section 9.1). The precision of any stored data point is determined by use of the PRC key name (Section 9.3.0).

The header line in the MET and UCR files use a two-character parameter ID to identify the data. If, for example, a second air temperature sensor were added, it would be identified in the header as AT-2 (See Appendix A).

COR, UNC Files:
The .COR and .UNC files are in the DOS translator format and are used in those applications that expect the MET data to be in this format.
These files will only be generated if enabled in the [GENERAL] section of the ACQ file.
[GENERAL]
MK_COR = TRUE
MK_UNC = TRUE

An abbreviated example of a Translator COR corrected data file follows:
```
$WICOR,020902,140316,30.03,AT8,1002.94,BP8,6.0,WS8,10.0,WD8,70.43,RH8,32.345600,LA8,
-117.567800,LO8,45.0,CR8,10.0,SP8*06
$WICOR,020902,140346,30.03,AT8,1002.94,BP8,6.0,WS8,10.0,WD8,70.43,RH8,32.345600,LA8,
-117.567800,LO8,45.0,CR8,10.0,SP8*06
```

An abbreviated example of a Translator UNC uncorrected data file follows:
```
$WIUNC,020802,140316,0.70000,AT8,3.70000,BP8,25.00,BC8,6.00,WS8,10.00,WD8,0.70000,RH8,0.70000,RT8,32.345
600,LA8,-117.567800,LO8,45.0,CR8,10.0,SP8*10
$WIUNC,020802,140346,0.70000,AT8,3.70000,BP8,25.00,BC8,6.00,WS8,10.00,WD8,0.70000,RH8,0.70000,RT8,32.345
600,LA8,-117.567800,LO8,45.0,CR8,10.0,SP8*10
```

The WICOR and WIUNC files contain Data Corrected and Data Uncorrected files respectively. The file name indicates the date (yymmdd) plus the extension .COR for corrected data or .UNC for uncorrected. Each line begins with the title $WICOR or $WIUNC to identify corrected or uncorrected data, followed by the date (ddmmyy) and time (hhmmss). The MET sensor data follows in the sequence it was acquired as specified in the sensor enable section. The data is followed by latitude, longitude, course, speed and gyro. Each data point in the .COR and .UNC files has a 2 character ID to identify it. There is also a third character to help clarify the type of data. E.g. +25.3,AT0 (air temperature, calibrations not applied).
0 – Calibration coefficients not applied
1 – Calibration coefficients applied in Sensor Module
2 – Calibration coefficients applied in Acquisition computer
3 – Calibration coefficients applied in Sensor Module and Acquisition computer
7 – Data Out of Range
8 – Data is Emulated (Not Real)
9 – Data invalid

Any data file can be used to regenerate a file of another type when in PLAYBACK MODE. For example when playing back a file of type .UCR files of type .MET, .COR and .UNC can be generated. When playing back files of type .MET it is possible to generate a file of type COR. When in PLAYBACK MODE be sure to enable the FILE WRT Control in the control panel after selecting the data file to playback (See section 4.5.0).

10.2.0 MET log file description

When MK_LOG is set to TRUE the program will generate a log and status file one every day at about 2200 GMT. This file gives information on sensor operational status, sensor configuration, the source of MET parameters and information on what parameters are written to the data files. It also indicates the currently selected .ACQ setup/configuration file and active sensor modules.

The file name is of type .LOG.
when MK_LOG is set to TRUE the program makes a copy of the currently selected .ACQ file to the filename of type .ACQ.

If the program wrote data and log files on April 27, 2003 the file names would be
030427.MET Corrected data file
030427.UCR Uncorrected data file
030427.ACQ Copy of currently selected setup/cal file
030427.LOG Met system LOG and status file

10.3.0. SAMOS data exchange format

The SAMOS data exchange format file will be generated if the following directive is set in the GENERAL section of the .ACQ file.

MK_DCC = TRUE

DCC stands for Data Collection Center.

Additional options that can be defined for the SAMOS DCC are
# SAMOS Settings
CALL_SIGN = (Ship call sign)
MAIL_SERVER = (shipboard mail server name)
MAIL_RECEP = samos_data@coaps.fsu.edu, (Mail recipients comma delimited list)
MAIL_RETADD = (set your email return address)
MK_DCC = TRUE
# Interval to write each sample to the file
DCC_INTERVAL = 60.0

The .DCC file will be zipped up at the end of each GMT day and if the Mail server options are defined in the ACQ file then it will email the zipped data file as an attachment to the list of mail recipients at 0001GMT each day. If the MAIL_SERVER is not defined, blank or not present then the DCC file will not be emailed but will still be generated if MK_DCC is set to TRUE.

Parameter Opcodes are defined in Appendix A. Additional Opcodes in the DCC format are:
CS Ship Call Sign
YMD Year, Month, Day
HMS Hour, Minute, Second

The Data are tagged using the 2 letter opcodes plus a 3rd letter may be present that indicates the general location of the sensor aboard ship.

B=Bow mounted MET Mast	L=Bow (below decks – inside)
F=Bow (weather deck)	U=UCW intake area
J=01 or 02 deck forward	G=01 or 02 deck aft
A=Aft (stern weather deck)	Z=Aft (stern below decks – inside)
P=Port	
S=Starboard	
H=Aft Hangar (On top)	K-Fwd Hangar(On Top)
M=Mast (Main mast or upper midships area)	
T=Bridge (On Top)	
W=Wet Lab	Y=Hydro Lab
C=Computer Lab	N=Main Lab
E=Engine room	O=Bio Lab

Each sensor Module that is defined in the .ACQ file may be marked for inclusion in the DCC file. If the Module is not marked then it will not be included. The statement DCC = TRUE marks
The module for inclusion in the DCC file and the line SAMOS_LD=B indicates that the sensor is located on the bow mast as follows:

[TMP22]
SENSOR = Air Temperature
MODEL = 41342LC
SERIAL = 15166
MFG = RM Young
CAL_LAB = ODF
CAL_DATE = 17-Dec-2008
LOCATION = Forward Jackstaff 85'above MWL
INSTALL_DATE = 02-Feb-2009
DCC = TRUE
SAMOS_LD=B

The following paragraph describing this format is taken from the SAMOS Data Exchange Format file available at the SAMOS web site.
http://samos.coaps.fsu.edu/html/participate.php

The exchange format uses two separators, one between tagged pairs "," and one between the designator and the data value ":". Each tagged pair consists of an alphanumeric designator and the data value associated with the designator. An example of the format:
$SAMOS:001,CS:KAOU,YMD:20030907,HMS:000011,AT:17.40,BP:1010.27,…,
WSP:5.6,WDP:354.4,TWP:5.4,TIP:278.3,WSS:6.7,WDS:350.5,TWS:6.6,TIS:274.4,...,
LA:44.66956,LO:-130.35859,COG:149.5,SOG:0.9,GY:284.7,CS8:23
Note 1: The format is designed to have all values for a single observation time (YMD, HMS) in a single line.

11. MET System Calculation Methods.

MET sensor parameters are calibrated to output data in units according to the MET parameter list in appendix A. Raw data from sensors are usually corrected using either slope/offset or polynomial corrections using coefficients obtained from sensor calibration sheets. Some parameters are calculated using oceanographic or atmospheric algorithms. These parameters include seawater salinity, density, sound velocity, oxygen; true wind speed/direction, dew point and long wave radiation.

Surface Seawater calculations:
Seawater Temperature data that are displayed and recorded in data files are calibrated to *ITS(T90). Seawater Salinity calculations in *PSU are derived according to *PSS 1978 using *TSG temperature and conductivity values. Surface seawater sound velocity (M/S) calculations are made using TSG temperature and TSG salinity values according to the Chen/Millero 1977 equation. Seawater oxygen values are calculated using oxygen temperature, oxygen current, oxygen saturation and seawater salinity values. Oxygen saturation is first calculated, then oxygen is calculated to ml/l. Seawater temperature is converted internally to *ITS(T68) prior to calculating salinity, density, sound velocity and oxygen. References in section 11.1.0.

*Thermosalinograph(TSG)
*Practical Salinity Units
*PSS 1978 Practical Salinity Scale 1978
*ITS(T68) International Temperature Scale of 1968 ITS-68
*ITS(T90) International Temperature Scale of 1990 ITS-90

Wind Calculations:
Wind Direction is defined as the direction from which the wind is coming from.

True Wind Speed and direction are calculated using relative wind speed, relative wind direction, Ship's heading (Gyro-compass), Ships course (GPS COG) and Ships speed (GPS SOG).True Wind calculations are computed according to the WOCE-MET publication on True Winds listed in the References in section 11.1.0.

Dew Point Calculation:
Dew point is calculated using relative humidity, air temperature and barometric pressure.

Long Wave Radiation (Pyrgeometer):
LW irradiance in W m^{-2} is calculated using thermopile volts, body temperature, dome temperature and calibration factor from instrument calibration sheet.
References in section 11.1.0.

11.1.0 REFERENCES

Surface Seawater Salinity
Lewis, E. L., 1980. The Practical Salinity Scale 1978 and Its Antecedents. IEEE Journal of Oceanographic Engineering,OE-5, 3-8.
Culkin, F. and Smith, N. D., 1980. Determination of the Concentration of Potassium Chloride Solution Having the Same Electrical Conductivity, at 15C and Infinite Frequency, As Standard Seawater of Salinity 35.0000ppt (Chlorinity 19.37394ppt), IEEE Journal of Oceanographic Engineering, Vol. OE-5, No. 1.
UNESCO, 1981, Background Papers and Supporting Data on the Practical Salinity Scale 1978, Technical Papers in Marine Science,   No. 37.

Surface Seawater Sound Velocity
Millero, F.J. and Li, X., "Comments on 'On equations for the speed of sound in seawater'" 1994,JASA,95,2757-2759. Chen & Millero, 1977,JASA,62,1129-1135.

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Millero, F. J., Chen, C. T., Bradshaw, A. and Schleicher, K., 1980 A New High Pressure Equation of State for Seawater. Deep-Sea Research 27A, 255-264.
Fofonoff, N. P. and Millard, R. C., 1983. Algorithms for Computation of Fundamental Properties of Seawater. UNESCO Report No. 44, 15-24.

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Seabird SBE43 Dissolved Oxygen Sensor Application Note No. 64
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Weiss, R.F., 1970: The solubility of nitrogen, oxygen and argon in water and seawater. Deep-Sea Res., 17, 721-735.

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Wind WOCE MET Calculations of True Winds.
Shawn R. Smith, Mark A. Bourassa, and Ryan J. Sharp, 1999: Establishing more truth in true winds, Published: December 99, Vol. **16**, pp. 939-952 Center for Ocean-Atmospheric Prediction Studies (COAPS).

Long Wave Radiation
Albrecht, B., and S. K. Cox. 1977. "Procedures for Improving Pyrgeometer Performance."
Journal of Applied Meteorology 16:188-197
Fairall, C.W., P.O.G. Persson, E.F. Bradley, R.E. Payne, and S.P. Anderson, 1998. A new look at calibration and use of Eppley precision infrared radiometers. Part I: Theory and Application. *Journal of Atmosphere and Oceanic   Technology*, 15, 1229-1242.
Payne, R.E. and S.P. Anderson, 1999. A new look at calibration and use of Eppley precision infrared radiometers. Part II: Calibration and use of the Woods Hole Oceanographic Institution Improved Meteorology Precision Infrared Radiometer. *Journal of Atmosphere and Oceanic Technology*, 16, 739-751.

Philipona, R., C. Frohlich, and C. Betz, 1995: Characterization of pyrgeometers and the accuracy of atmospheric long-wave radiation measurements. Applied Optics: Lasers, Photonics, and Environmental Optics, **34,** 1598–1605.

Dew Point
Saucier, W. J., 1955: *Principles of Meteorological Analysis*. University of Chicago Press, Chicago, 438 pp.

Appendix A MET Parameter Index

Number	Parameter	Description	Units
0	AT	Air Temperature	Deg C
1	BP	Barometric Pressure	millibars (mb)
2	BC	Barometric Pressure Temp	Deg C
3	SW	Short Wave Radiation (SWR)	W/M^2 (Pyranometer)
4	LW	Long Wave Radiation (LWR)	W/M^2 (Pyrgeometer)
5	LD	LWR Dome Temperature	Deg K
6	LB	LWR Body Temperature	Deg K
7	LT	LWR Thermopile	Volts
8	PR	Precipitation	millimeters (mm)
9	PT	Precipitation	mm/hr
10	RH	Relative Humidity	%RH
11	RT	Air Temp (RH module)	Deg C
12	DP	Dew Point	Deg C
13	WS	Rel Wind Speed	M/S
14	WK	Rel Wind Speed	Knots
15	TW	True Wind Speed	M/S
16	TK	True Wind Speed	Knots
17	WD	Rel Wind Direction	Deg (Direction wind is coming from)
18	TI	True Wind Direction	Deg (Direction wind is coming from)
19	ST	Sea Surface Temperature	Deg C
20	TT	Thermosalinograph Temperature	Deg C
21	TC	Thermosalinograph Conductivity	milliSiemens per centimeter (mS/cm) (with slope, offset correction)
22	SA	Salinity	PSU
23	SD	Sigma-t	Kg/m^3
24	SV	Sound Vel (Chen/Millero)	M/S
25	OX	Oxygen	ml/l
26	OG	Oxygen	mg/l
27	OC	Oxygen Current	ua
28	OT	Oxygen Temperature	Deg C
29	OS	Oxygen Saturation value	ml/l
30	PH	Alkalinity (pH)	
31	FL	Fluorometer	ug/l
32	TB	Turbidity	NTU
33	TR	Transmissometer	%
34	BA	Beam Attenuation	
35	PA	Surface PAR	uE/Second/Meter^2
36	FM	USW Flow Meter	GPM
37	FI	USW Flow Meter	LPM
38	VT	Volts	Volts
39	MA	Current	m/a
40	WT	Auxiliary water Temp	Deg C
41	AX	Auxiliary Air Temperature	Deg C
42	PS	Pressure	PSI
43	XX	Unspecified	
44	LA	Latitude Decimal format	Deg
45	LO	Longitude Decimal format	Deg
46	CR	Ships Course (GPS COG)	Deg
47	SP	Ship's Speed (GPS SOG)	Knts
48	SL	Ship's Speed Log –Longitudinal	Knots
49	SX	Speed Log – Transverse	Knots

50	GY	Ships Heading (Gyrocompass)	Deg
51	GT	GPS Time of Day	GMT Secs 0-86400
52	TS	Time Server Time of Day	GMT Secs 0-86400
53	ZD	GPS DateTime	GMT Secs Since 00:00:00 01/01/1970
54	GA	GPS Altitude	Meters above/below Mean Sealevel
55	GS	GPS Status/Number Satellites	1st digit – Status (see below)** Last two digits – Number satellites
56	SY	System DateTime	GMT Secs Since 00:00:00 01/01/1970
57	BT	Bottom Depth	Meters
58	SH	Ashtech Heading	Deg
59	SM	Ashtech Pitch	Deg
60	SR	Ashtech Roll	Deg
61	ZO	Winch Wire Out	Meters
62	ZS	Winch Speed	MPM
63	ZT	Winch Tension	LBS
64	VP	VRU Pitch	Deg
65	VR	VRU Roll	Deg
66	VH	VRU Heave	Meters
67	VY	Ship's List	Deg
68	VX	Ship's Trim	Deg
69	RX	Accelerometer X	Meters/Second
70	RY	Accelerometer Y	Meters/Second
71	RZ	Accelerometer Z	Meters/Second
72	IP	CTD Depth	Meters
73	IT	CTD Temperature	Deg C
74	IS	CTD Salinity	PSU
75	IA	CTD Altimeter	Meters
76	IV	CTD Velocity	Meters/Second
77	IX	Instrumentation Aux	
78	PZ	UCW Pump Status	ON/OFF
79	TG	Thermosalinograph Conductivity	MilliSiemens per cm (ms/cm) (no slope, offset correction)
80	MB	Multibeam Depth	Meters
81	BS	Barometric Pressure Sealevel (Corrected to Sea Level)	Millibars (mb)
82	PC	pCO2 (partial pressure of CO2)	(uatm) Micro-atmospheres
83	AF	Air Temperature (Deg F)	Deg F
84	WC	Wind Chill (Deg C)	Deg C
85	WF	Wind Chill (Deg F)	Deg F
86	LF	Depth Sounder (3.5Khz)	Meters (Below Surface)
87	HF	Depth Sounder (12Khz)	Meters (Below Surface)
88	MG	Magnetometer	nanoTesla
89	MD	Magnetometer Depth	Meters (Below Surface)
90	MS	Magnetometer Status	Signal Strength (>80 = good)
91	GV	Gravity	mGal
92	GC	Gravity Counts	Counts
93	FB	Fluorometer Optical Brighteners	PPB
94	FO	Fluorometer Oil	PPB
95	FF	Fluorometer Fuel	PPB
96	FT	Fluorometer Temperature	Deg C
97	SF	Sea Surface Temperature	Deg F
98	TF	Thermosalinograph Temperature	Deg F
99	RF	Air Temp (RH module)	Deg F
100	DF	Dew Point	Deg F

101	WB	Wet Bulb Temperature	Deg C
102	WF	Wet Bulb Temperature	Deg F
103	ZI	Winch ID	Numbers 1 thru 9

**GPS status indicator

0 = fix not available or invalid
1 = GPS SPS mode, fix valid
2 = differential GPS, SPS mode, fix valid
3 = GPS PPS mode, fix valid
4 = Real Time Kinematic. Satellite system used in RTK mode with fixed integers
5 = Float RTK. Satellite system used in RTK mode with floating integers
6 = Estimated (dead reckoning) mode
7 = Manual input mode
8 = Simulator mode

Appendix B NMEA-0183 Standard Sentence Formats

National Marine Electronics Association NMEA-0183 Standard Sentences

The Following NMEA-0183 Sentences can be sent to and from the MetAcq System:
$--GGA - Global Positioning System Fix Data
$--GNS – Global Navigation Satellite System
$--GLL - Geographic Position, Latitude/Longitude
$--RMC - Recommended Minimum Specific GPS/TRANSIT Data
$--VTG - Track Made Good and Ground Speed
$--ZDA - UTC Date / Time and Local Time Zone Offset
$--HDT - Heading, True
$--MWV - Wind Speed and Angle
$--VHW – Water Speed and Heading
$--VBW – Dual Ground/Water Speed
$--DBT - Depth Below Transducer

The Following NMEA-0183 Sentences can also be sent from the MetAcq System:
$--XDR - Transducer Measurements
$--MTW - Water Temperature
$--MWD - Wind Direction

NMEA Talker Identifiers	(Partial listing)
GP	Global Positioning System (GPS)
GN	Global Navigation Satellite System (GNSS)
GL	GLONASS Receiver
SD	Sounder, Depth
WI	Weather Instruments
HC	Heading sensor: compass, magnetic
HE	Heading Sensor: gyro, north seeking
HN	Heading Sensor: gyro, non-north seeking
VD	Velocity sensor: Doppler, other/general
VM	Velocity Sensor: speed log, water, magnetic
VW	Velocity Sensor: speed log, water, mechanical
AG	Heading/track controller (autopilot) general
AP	Heading/track Controller Magnetic
AI	Automatic identification system

This appendix contains only a partial listing of NMEA formats A complete description can be found in the NMEA 0183 standards document.

$GPGGA Global Positioning System Fix Data

$GPGGA,180432.00,4027.027912,N,08704.857070, W,2,07,1.0,212.15,M,-3.81,M,4.2,0555*73

Field	Value	Meaning
1	180432.00	UTC of position fix in hhmmss.ss
2	4027.027912	Geographic latitude in ddmm.mmmmmm format
3	N	Direction of latitude (N - North, S - South)
4	08704.857070	Geographic longitude in dddmm.mmmmmm
5	W	Direction of longitude (E - East, W - West)
6	2	GPS quality indicator 0 = fix not available or invalid 1 = GPS SPS mode, fix valid 2 = differential GPS, SPS mode, fix valid 3 = GPS PPS mode, fix valid 4 = Real Time Kinematic. Satellite system used in RTK mode with fixed integers 5 = Float RTK. Satellite system used in RTK mode with floating integers 6 = Estimated (dead reckoning) mode 7 = Manual input mode 8 = Simulator mode
7	07	Number of satellites in use (00-12)
8	1.0	Horizontal DOP
9	212.15	Antenna height above/below MSL (mean sea level) reference
10	M	Unit of altitude (meters)
11	-33.81	Geoidal separation (-33.81 m)
12	M	Unit of geoidal separation (meters)
13	4.2	Age of differential GPS data record
14	0555	Differential Reference Station ID (0000-1023)

Each NMEA Sentence ends with a checksum delimiter "*" Followed by a two hexadecimal character checksum. The sentence terminates with <CR><LF>

$GPGLL Geographic Position – Latitude/Longitude

$GPGLL,4027.027912,N,08704.857070,W, 180432.00,A,D*7A

Field	Value	Meaning
1	4027.027912	Geographic latitude in ddmm.mmmmmm
2	N	Direction of latitude (N - North, S - South)
3	08704.857070	Geographic longitude in dddmm.mmmmmm
4	W	Direction of longitude (E - East, W - West)
5	180432.00	UTC of position fix in hhmmss.ss format
6	A	A = data valid V = data invalid
7	D	Mode Indicator A-Autonomous M-Manual D-Differential S-Simulator E-Dead Reckoning N-Data Not Valid

$GPGNS Global Navigation Satellite System

$GNGNS,122310.2,3722.425671,N,12258.856215,W,AN,14,0.9,212.210,-33.81,4.2,23*59

Field	Value	Meaning
1	122310.2	UTC of position fix in hhmmss.ss
2	3722.425671	Geographic latitude in ddmm.mmmmmm format
3	N	Direction of latitude (N - North, S - South)
4	12258.856215	Geographic longitude in dddmm.mmmmmm
5	W	Direction of longitude (E - East, W - West)
6	AN	Mode Indicator A variable length valid character field type with the first two characters currently defined. The first character indicates the use of GPS satellites, the second character indicates the use of GLONASS satellites. N = No fix. Satellite system not used in position fix, or fix not valid. A = Autonomous.Satellite system used in non-differential mode in position fix. D = Differential. Satellite system used in differential mode in position fix. P = Precise. Satellite system used in precision mode. Precision mode is defined as: no deliberate degradation(such as Selective Availability), and higher resolution code (P-code) is used to compute position fix. R = Real Time Kinematic. Satellite system used in RTK mode with fixed integers. F = Float RTK. Satellite system used in real time kinematic mode with floating integers. E = Estimated (dead reckoning) Mode. M = Manual Input Mode. S = Simulator Mode.
7	14	Number of satellites in use
8	0.9	Horizontal DOP
9	212.15	Antenna height above/below MSL (mean sea level) reference
11	-33.81	Geoidal separation (-33.81 m)
13	4.2	Age of differential GPS data record
14	23	Differential Reference Station ID

$GPRMC Recommended Minimum Specific Data

$GPRMC,180432,A,4027.027912,N,08704.857070,W, 000.04,181.9,131000,1.8,W,D*25

Field	Value	Meaning
1	180432	UTC of position fix in hhmmss format
2	A	A = data valid V = Navigation receiver warning
3	4027.027912	Geographic latitude in ddmm.mmmmmm format
4	N	Direction of latitude (N - North, S - South)
5	08704.857070	Geographic longitude in dddmm.mmmmmm
6	W	Direction of longitude (E - East, W - West)
7	000.04	Speed over ground knots
8	181.9	Track made good (heading-degrees)
9	131000	Date in ddmmyy format (October 13, 2000)
10	1.8	Magnetic variation -degrees
11	W	Direction of magnetic variation (E - East, W - West)
12	D	Mode Indicator A-Autonomous M-Manual D-Differential S-Simulator E-Dead Reckoning N-Data Not Valid

$GPVTG Course Over Ground and Speed Over Ground
$GPVTG,360.0,T,348.7,M,000.0,N,000.0,K,A*43

Field	Value	Meaning
1	360.0	Course Over Ground (COG), degrees TRUE
2	T	T-TRUE
3	348.7	Course Over Ground (COG), degrees MAGNETIC
4	M	M-MAGNETIC
5	000.0	Speed Over Ground (SOG), Knots
6	N	N-Knots
7	000.0	Speed over ground (SOG), km/hr
8	K	K-km/hr
9	A	Mode Indicator A-Autonomous M-Manual D-Differential S-Simulator E-Dead Reckoning N-Data Not Valid

$GPZDA Time & Date
$GPZDA,024611.08,25,03,2002,00,00*6A

Field	Value	Meaning
1	UTC Time	hhmmss.ss
2	UTC Day	01-31
3	UTC Month	01-12
4	UTC Year	yyyy (2002)
5	Local zone hours	Offset to local time zone in hours (00 to +/- 13)
6	Local zone Minutes	Offset to local time zone in minutes (00 to 59)

$HEHDT Heading, True
$HEHDT,180.0,T*6A

Field	Value	Meaning
1	180.0	Heading, Degrees True
2	T	TRUE

$SDDBT Depth Below Transducer
$SDDBT,1000.0,f,304.8,M,166.6,F*6A

Field	Value	Meaning
1	1000.0	Water Depth, Feet
2	f	f-feet
3	1000.0	Water depth, Meters
4	M	M-Meters
5	1000.0	Water Depth, Fathoms
6	F	F-Fathoms

$EMDPT Depth Below Transducer
$EMDPT,1000.0,0.0*6A

Field	Value	Meaning
1	1000.0	Water Depth, Meters
2	0	Offset from Transducer (Meters) Positive value – Distance from transducer to water line Negative value– Distance from transducer to keel

$--VBW   Dual Ground/Water Speed

$VMVBW,10.0,0.5,A,11.0,-1.1,A,0.0,A,0.0,A*6A

Field	Value	Meaning
1	10.0	Longitudinal water speed (see note 1), knots
2	0.5	Transverse water speed (see note 1), knots
3	A	Status water Spd: A = data valid V = data invalid
4	11.0	Longitudinal ground speed (see note 1), knots
5	-1.1	Transverse ground speed (see note 1), knots
6	A	Status ground Spd: A = data valid V = data invalid
7	0.0	Stern transverse water speed (see note 1), knots
8	A	Status Stern water spd: A = data valid V = data invalid
9	0.0	Stern transverse ground speed (see note 1), knots
10	A	Status Stern ground Spd: A = data valid V = data invalid

NOTE 1 Transverse speed: "-" = port, Longitudinal speed: "-" = astern.

$--VHW   Water Speed and Heading

$VMVHW,90.0,T,75.0,M,5.0,N,2.5,K*6A

Field	Value	Meaning
1	90.0	Heading, degrees True
2	T	T - True
3	75.0	Heading, degrees Magnetic
4	M	M - Magnetic
5	5.0	Speed, knots
6	N	N - Knots
7	2.5	Speed, km/h
8	K	K – Speed km/h

$WIMWD   Wind Direction & Speed

$WIMWD,90.0,T,90.0,M,10.0,N,6.0,M*6A

Field	Value	Meaning
1	90.0	Wind Direction, 0-359 degrees True
2	T	T-TRUE
3	90.0	Wind Direction, 0-359 degrees Magnetic
4	M	M-Magnetic
5	10.0	Wind Speed, Knots
6	N	N-Knots
7	6.0	Wind Speed, Meters/Second
8	M	M-Meters

$WIMWV Wind Speed & Angle

$WIMWV,90.0,R,10.0,N,A*6A

Field	Value	Meaning
1	90.0	Wind Angle 0-359 degrees
2	R or T	R-Relative T-Theoretical
3	10.0	Wind Speed
4	K/M/N	K-km/hour M-Meters/Second N-Knots
5	A or V	A-Data Valid V-Data Not valid

$WIXDR Transducer Measurements

$WIXDR,C,20.0,C,H,80.0,P,P,1.010,N,L,35.00,S*6A

Field	Value	Meaning
1	Type-C	C-Temperature
2	20.0	Air Temperature
3	Units-C	C-Degrees C
4	Type-H	H- Humidity
5	80.0	Relative Humidity
6	UnitsP	P-Percent
7	Type-P	P-Pressure
8	1.010	Barometric Pressure BARS
9	Units-B	B-Bars
10	Type-L	L-Salinity
11	35.0	Salinity PSU
12	Units-S	S-PSU

$WIMTW Water Temperature

$WIMTW,20.0,C*6A

Field	Value	Meaning
1	20.0	Water Temperature
2	C	C-Degrees C

Appendix C Miscellaneous Message Formats

EM-120 Temperature, Sound Velocity Message Format
Surface SeaWater Temperature, Sound Velocity
        20.00 1500.0

Field	Value	Meaning
1	20.00	Surface Seawater Temperature-Degees C (%7.2f)
2	1500.0	Surface Sound Velocity-Meters/Second (%7.2f)

$PASHR, ATT Ashtech Attitude Message Format

Field	Value	Meaning
1	153663.5	GPS Receive time Seconds of week
2	092.09	Heading Degrees
3	-000.48	Pitch Degrees
4	+000.04	Roll Degrees
5	0.0027	MRMS (Measurement RMS error) Meters
6	0.0103	BRMS (Baseline RMS error) Meters
7	0	Attitude reset flag [0-Good 1-Invalid Value]
8	*20	NMEA Checksum value

$PASHR POSMV Attitude Message Format
$PASHR,233930.005,124.51,T,0.02,-0.34,0.07,0.018,0.018,0.011,2,1*32

Field	Value	Meaning
1	233930.01	HHMMSS.sss
2	124.51	Heading Degrees 0 to 359.99
3	T	TRUE
4	0.02	Roll Degrees -90.00 to +90.00
5	-0.34	Pitch Degrees -90.00 to +90.00
6	0.07	Heave Meters -99.00 to +99.00
7	0.02	Accuracy Roll
8	0.02	Accuracy Roll
9	0.01	Accuracy Roll
10	2	Flag Accuracy Heading 0 = no aiding 1 = GNSS aiding 2 = GNSS & GAMS aiding
11	1	Flag – IMU 0 = IMU out 1 = satisfactory
12	*20	NMEA Checksum value

Appendix D User predefined Output Formats

These are additional output messages that can be specified on the NMEA= line in User Output modules described in Section 9.4.0. The last letter of the sentence identifier identifies the sensor set. For example in $PSSRA the last letter 'A' indicates the primary sensor. 'B' indicates the secondary sensor, 'C' the third and so on.

SOLAR RADIOMETERS
$PSSRA,1197.60,10.000,827.58,1.250,300.30,0.500,299.75,0.510*4D
1. $PSSRx (x=A, B, C, D etc. as described above)
2. SWR W/M^2
3. SWR Raw millivolts
4. LWR W/M^2
5. LWR Raw millivolts
6. LWR Dome Temperature (Deg K)
7. LWR Dome Temperature Raw Volts
8. LWR Body Temperature (Deg K)
9. LWR Body Temperature Raw Volts

SURFACE PAR SENSOR
$PSSPA,1656.26,1.000*40
1. $PSSPx
2. Surface PAR uE/Sec/M^2
3. Surface PAR Raw Volts

Paroscientific MET3A SENSOR or RM Young 26700 Translator as set in the ACQ file
$PSMEA,20.00,50.00,1000.00,0.02*7E
1. $PSMEx
2. Air Temperature (Deg C)
3. Relative Humidity (%)
4. Barometric Pressure millibars
5. Precipitation (mm) millimeters total accumulation

AIR TEMPERATURE
$PSATB,2.00,1940.00*89
1. $PSATx
2. Air Temperature (Deg C)
3. Air Temperature Raw Value

Relative Humidity
$PSRHA,80.00, 10.00, 2.00,1940.00*89
1. $PSRHx
2. Humidity %
3. Air Temperature (Deg C)
4. Humidity Raw Value
5. RH Air Temperature Raw Value

Barometric Pressure
$PSBPB,1013.00,1.450*89
1. $PSBPx
2. Barometric Pressure (millibars)
3. Barometric Pressure Raw Value

Precipitation
$PSPRA,25.00,1.2*89
1. $PSPRx
2. Precipitaion (millimeters)

3. Precipitation Raw Value

WIND SENSORS
$PSWDA,10.00,3.09,266.67,9.23*61
1. $PSWDx
2. Relative Wind Direction (deg)
3. Relative Wind Speed (m/s)
4. True Wind Direction (deg)
5. True Wind Speed (m/s)

THERMOSALINOGRAPH
$PSTSA,20.000,50.0000,36.713,1523.39*73
1. $PSTSx
2. Thermosalinograph Water Temperature (Deg C)
3. Thermosalinograph Water Conductivity (mS/cm) millisiemens/centimeter
4. Thermosalinograph Water Salinity (PSU)
5. Thermosalinograph Sound Velocity (m/s)

SURFACE SEAWATER TEMPERATURE – HULL INTAKE
$PSSTA,7.003,3282.400*7E
1. $PSSTx
2. Sea Surface Water Temperature (Deg C)
3. Sea Surface Water Temperature Raw Value

OXYGEN SENSOR
$PSOXA,3.137,2.000,20.000,20.000*51
1. $PSOXx
2. Oxygen ml/l (Computed with Salinity value from the thermosalinograph)
3. Oxygen Raw Value
4. Oxygen Temperature (Deg C)
5. Oxygen Temperature Raw Volts

FLUOROMETER
$PSFLA,21.000,2.100,5.200,5.200*78
1. $PSFLx
2. Fluorometer ug/l
3. Fluorometer Raw Volts
4. Turbidity NTU (Not used)
5. Turbidity Raw Volts (Not used)

Transmissometer
$PSTRA,80.00,2.100*78
1. $PSTRx
2. Transmissometer
3. Transmissometer Raw Volts

Nutrients
$PSNTA,80.00,2.100*78
1. $PSNTx
2. Nutrients
3. Nutrients Raw Volts

FLOWMETER
$PSFMA,0.13,2.000*79
1. $PSFMx
2. FlowMeter LPM LitersPerMinute
3. FlowMeter Raw Frequency

Short Wave Radiation
$PSSWA, 1197.60,10.000*78
1. $PSSWx
2. SWR W/M^2
3. SWR Raw Value

Long Wave Radiation
$PSLWA,827.58,300.30,299.75,120.0,0.500,0.510*4D
1. $PSLWx
2. LWR W/M^2
3. LWR Dome Temperature (Deg K)
4. LWR Body Temperature (Deg K)
5. LWR Thermopile (uV microvolts)
6. LWR Dome Temperature Raw Volts
7. LWR Body Temperature Raw Volts

PRESSURE GAUGE
$PSPSA,25.00,2.500*42
1. $PSPSx
2. Pressure PSI
3. Pressure Raw Volts

Aux WATER TEMPERATURE
$PSXTA,7.003,3282.400*7E
1. $PSXTx
2. BOW Water Temperature (Deg C)
3. BOW Water Temperature Raw Value

Appendix E (ACQ file example)

```
# SP13C.ACQ
# 2013-10
#
# Requires MetAcq.exe v 2.10a or higher.
#
# STS Meteorological Acquisition Program
# Serial Port and Sensor Configuration/Calibrations file
# R/V Sproul
#
################################################################################
# UNIT 1-2: MAINBOARD DB9 COM Ports Configuration
################################################################################
UNIT1   0 COMM1  9600 NONE 8 1   Spare
UNIT2   0 COMM2  4800 NONE 8 1   Spare
################################################################################
# UNIT 3-34: COMPUTER LAB RocketPort RJ45 COM Ports Configuration
################################################################################
UNIT3   1 COMM3  9600 NONE 8 1   RS485 I/O    - MET Sensors Top Bridge
UNIT4   0 COMM4  9600 NONE 8 1   Spare
UNIT5   1 COMM5  9600 NONE 8 1   RS232 Input  - SBE-45
UNIT6   1 COMM6  4800 NONE 8 1   RS232 Input  - GPS GP90
UNIT7   1 COMM7  4800 NONE 8 1   RS232 Input  - Gyro
UNIT8   1 COMM8  9600 NONE 8 1   RS232 Input  - Knudsen Depth
UNIT9   1 COMM9  4800 NONE 8 1   RS232 Input  - Ashtech
UNIT10  1 COMM10 4800 NONE 8 1   RS232 Input  - GPS Garmin GP17x
UNIT11 20 COMM11 9600 NONE 8 1   RS232 Output - Winch Data Out to Splitter
UNIT12 14 COMM12 9600 NONE 8 1   RS422 Output - Surface PAR to CTD
UNIT13  1 COMM13 19200 NONE 8 1  RS232 Input  - CTD Data in
UNIT14  0 COMM34 9600 NONE 8 1   RS232 Output - MET Data out (COR)
UNIT15 20 COMM14 4800 NONE 8 1   RS232 Output - RMC, GLL, VTG, DBT
UNIT16  1 COMM16 19200 NONE 8 1  RS232 Input  - Winch Wire Out
UNIT17  0 COMM17 2400 NONE 8 1   Spare
UNIT18  0 COMM18 2400 NONE 8 1   Spare
UNIT19  1 COMM19 9600 NONE 8 1   RS485 I/O    - Sea Temp Sensors
UNIT20  0 COMM20 9600 NONE 8 1   RS232 Input Speed Log
UNIT21  1 COMM21 4800 NONE 8 1   RS323 Input - GPS GP150D
UNIT22  0 COMM22 9600 NONE 8 1   Spare
UNIT23  0 COMM23 9600 NONE 8 1   Spare
UNIT24  0 COMM24 9600 NONE 8 1   Spare
UNIT25  0 COMM25 9600 NONE 8 1   Spare
UNIT26  0 COMM26 9600 NONE 8 1   Spare
UNIT27  0 COMM27 9600 NONE 8 1   Spare
UNIT28  0 COMM28 9600 NONE 8 1   Spare
UNIT29  0 COMM29 9600 NONE 8 1   Spare
UNIT30  0 COMM30 9600 NONE 8 1   Spare
UNIT31  0 COMM31 9600 NONE 8 1   Spare
UNIT32  0 COMM32 9600 NONE 8 1   Spare
UNIT33  0 COMM33 9600 NONE 8 1   Spare
UNIT34  0 COMM34 9600 NONE 8 1   Spare
################################################################################
# UNIT 64-127: UDP/IP datagram modules
# As practical, Source port = Destination port - 1
################################################################################
UNIT64  9 UDP   40009 NONE 40008 10.110.148.255  # Output - DCC Data to Acq subnet broadcast
UNIT65 19 UDP   40019 NONE 40018 10.110.148.255  # Output - $WICOR to Acq subnet broadcast
UNIT66 81 UDP   40183 NONE 40182 10.110.148.255  # Output - OUT66 to Acq subnet broadcast
UNIT70 19 UDP   40021 NONE 40020 10.110.148.255  60 # Output - $WICOR to subnet broadcast, 60s interval
################################################################################
STARTMOD
TMP09 BPR01 PRC08 HRH42 WND15 SST33 PAR08
SND01 NME01 GYR01 ASH01 WCH02 TSG98
OUT02 OUT05 OUT66
ENDMOD
################################################################################
[GENERAL]
GPS_SYNCH           = TRUE
##########################################################################
# Vessel Info
##########################################################################
TITLE               = R/V Sproul MET System
CALL_SIGN           = WSQ2674
SHIP                = Sproul
##########################################################################
# Write settings
##########################################################################
PRINT_EN            = FALSE
MK_COR              = TRUE
MK_UNC              = FALSE
```

```
MK_LOG                  = TRUE
MK_DCC                  = TRUE
MKCRUISEDIRS            = TRUE
DCC_INTERVAL            = 60.0
FileWriteInterval       = 15.0
SerialWriteInterval     = 15.0
TIMEOUT                 = 400
ONEGPS2FILE             = TRUE
MAX_SCAN_RATE           = 10.0
######################################################################
# Global E-mail settings
######################################################################
MAIL_SERVER             = 127.0.0.1
MAIL_RETADD             = sts-cr@ucsd.edu
######################################################################
# SIO shiptrack E-mail settings.
# NOTE: you must also set the cruisename in C:\MET\cruisename.txt
######################################################################
SHIPTRACK_RECEP               = sio-shiptracks@ucsd.edu
######################################################################
# SAMOS and NOAA E-mail Settings
######################################################################
MAIL_NOAA               = webship@noaa.gov
MAIL_RECEP              = samos_data@coaps.fsu.edu
        ############################################################
        # Note the following SAMOS locations for module configuration:
        # E.G. SAMOS_LD      = B
        ############################################################
        # B = Bow mounted MET Mast
        # U = UCW intake area
        # A = Aft (stern weather deck)
        # P = Port
        # S = Starboard
        # H = Aft Hangar (On top)
        # K = Fwd Hangar(On Top)
        # M = Mast (Main mast or upper midships area)
        # T = Bridge (On Top)
        # R = Bridge/Chart Room
        # W = Wet Lab
        # Y = Hydro Lab
        # C = Computer Lab 01 Van
        # N = Main Lab
        # E = Engine room
        # O = Bio Lab
#       Winch Labels
WID1    = CTD Winch
WID2    = Trawl Winch


##########################################################################
# Customized output modules, in alphanumeric order.
##########################################################################

[OUT02]
SERUNITNUM              = 15
MKOUTFILE               = FALSE
INTERVAL                = 1.0
NMEA                    = GGA, ZDA, VHW, DBS

[OUT05]
# DESCRIPTION:  Winch data.
SERUNITNUM              =11
PARAMETERS              = ZO ZS ZT IP IV IA LA LO SY
PARAMETER NUMBERS       = 0 0 0 0 0 0 0 0 0
PRECISION               = 1 1 1 1 1 1 5 5 3
MKOUTFILE               = TRUE
ADDCRC                  = FALSE
INTERVAL                = 2.0
ADDTIMESTAMP            = TRUE
FORMAT                  = %5.0f,%3.0f,%5.0f,%5.0f,%6.1f,%5.1f,%8.4f,%9.4f,%.1f
EXTENSION               = WCH
HEADER                  = #Date Time   Count MPM   LBS  CTDD  CSpd  Altim    LAT      LON      Secso

[OUT66]
# DESCRIPTION: 1Hz NMEA 0183 position/heading for UDP.
SERUNITNUM              = 66
MKOUTFILE               = FALSE
INTERVAL                = 1.0
NMEA                    = GGA,VTG,ZDA,HDT
```

```
# Sensor modules, in alphanumeric order.

[ASH01]
SENSOR          = Attitude
MODEL           = ADU2-1
SERIAL          = AD00209
MFG             = Ashtech
CAL_LAB         = n/a
CAL_DATE        = n/a
LOCATION        = 01 Lab
OWNER           = SIO/STS
INSTALL_DATE    = 27-Nov-06
## Module address
CMD             = SHR
## Module setup parameters
MSP             = 9 8
## Emulation Value
Emulation       = 270.0 10.0 5.0


[BPR01]
SENSOR          = Barometric Pressure
MODEL           = PTB101C
SERIAL          = Y1640005
MFG             = Vaisala
CAL_LAB         = STS
CAL_DATE        = 20-Mar-2013
LOCATION        = Top Bridge 33'above MWL
INSTALL_DATE    = 02-Jul-2012
OWNER           = SIO/STS
DCC             = TRUE
SAMOS_LD        = T
# Module address
CMD             = #h\r
# Module setup parameters
MSP             = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MCP             = 1 1 2 0   13 37 0 0 0 0 0 0
Emulation       = 1600.0
AVGTYPE         = 1 1
SECSTOAVG       = 60.0 60.0
# A/D Calibration
ADCAL           = 1.0 0.0
# Corrections
COR             = 8.01401751E-2 8.99287949E+2
# Altitude of sensor above water line in Meters
COR2            = 10.0


[GYR01]
SENSOR          = Gyro
MODEL           = SC-30
SERIAL          = ??
MFG             = Furuno
CAL_LAB         = n/a
CAL_DATE        = n/a
LOCATION        = SIO/STS
OWNER           = Sproul
DCC             = TRUE
SAMOS_LD        = R
# Module setup parameters
MSP             = 7 8
Emulation       = 279.0
MCP             = 1 1 1 0   0 0 0 0 0 0 0 0


[HRH42]
SENSOR          = Relative Humidity
MODEL           = HMP110A
SERIAL          = J3640002
MFG             = Vaisala
CAL_LAB         = Vaisala
CAL_DATE        = 05-Sep-2013
LOCATION        = Top Bridge 33' Above MWL
INSTALL_DATE    = 25-Sep-2013
OWNER           = SIO/STS
DCC             = TRUE
SAMOS_LD        = T
DCC_MASK        = 1,1,0,0,0,0,0,0
# Module address
CMD             = #a\r
CMD2            = #b\r
# Module setup parameters
MSP             = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
```

```
MSP2           = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MCP            = 1 1 3 0  13 13 15 0 0 0 0 0
# Emulation value
Emulation      = 600 600
AVGTYPE        = 1 1 0
SECSTOAVG      = 60.0
# A/D Calibration
ADCAL          = 1.0 ,0.0
# Corrections RH
COR= 0.1 0.0
# Corrections RT
COR2= 0.12 -40.0

[TSG98]
SENSOR         = Thermosalinograph
MODEL          = SBE45
SERIAL         = 0198
MFG            = Seabird
CAL_LAB        = Seabird
CAL_DATE       = 16-Apr-2013
LOCATION       = Ocean Lab
OWNER          = SIO/STS
INSTALL_DATE   = 03-Oct-2013
DCC            = TRUE
SAMOS_LD       = W
DCC_MASK       = 1,1,1,0,0,0,0,0
# Module setup parameters
MSP            = 5 3 0 0 10 0 2  1 2 0 0 0 0 0 0
MCP            = 1 1 6 0  0 3 16 17 18 35 0 0
# Emulation value
EMULATION      = 20.0 5.0
AVGTYPE        = 1 1 0 0 0
SECSTOAVG      = 60.0
# A/D Calibration
ADCALTYPE      = 0 3
ADCAL          = 1.0 0.0
ADCAL2         = 10.0 0.0
COR            = 1.0, 0.0
COR2           = 1.0, 0.0

[NME01]
SENSOR         = GPS
MODEL          = GP90D
SERIAL         = ??
MFG            = Furuno
CAL_LAB        = n/a
CAL_DATE       = n/a
LOCATION       = Bridge
INSTALL_DATE   = ????
OWNER          = Sproul
DCC            = TRUE
SAMOS_LD       = R
DCC_MASK       = 1,1,0,1,1,0,0,0
## Module setup parameters
MSP            = 6 8
## Emulation Value
Emulation      = 32.3456 -117.5678 4000.0 90.0 12.0 1018724200.0 25.0 208.0

[PAR08]
SENSOR         = Surface PAR
MODEL          = QSR-240P
SERIAL         = 6368
MFG            = Bisopherical Instruments
CAL_LAB        = Bisopherical Instruments
CAL_DATE       = 18-Jun-2013
LOCATION       = Top Bridge 36'above MWL
INSTALL_DATE   = July 2013
OWNER          = SIO/STS
DCC            = TRUE
SAMOS_LD       = T
CMD            = #f\r
PRC-C          = 2
PRC-R          = 3
## Module setup parameters
MSP            = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MCP            = 1 1 1 0  13 0 0 0 0 0 0 0
## Emulation value
Emulation      = 200
AVGTYPE        = 1
SECSTOAVG      = 30.0
```

```
## A/D Calibration
ADCAL            = 1.0, 0.0
## Corrections Surface PAR V/(MicroEinsteins/sec/cm2)
## Slope, Offset, scale
COR              = 1.60375, 0.0, 1.0


[SND01]
SENSOR           = Depth Sounder
MODEL            = 320BR
SERIAL           = ??
MFG              = Knudsen
CAL_LAB          = n/a
CAL_DATE         = n/a
LOCATION         = 01 Lab
INSTALL_DATE     = 01-Jan-00
OWNER            = SIO/STS
DCC              = TRUE
SAMOS_LD         = C
DCC_MASK         = 1,0,0,0,0,0,0,0
## Module setup parameters
MSP              = 8 8
MCP              = 1 1 3 0  0 0 0 0 0 0 0 0
## Emulation Value
Emulation        = 1000
## A/D Calibration
ADCAL            = 1.0 0.0
## Corrections
COR              = 0.0


[PRC08]
SENSOR           = Precipitation
MODEL            = 50202
SERIAL           = 1301
MFG              = RM Young
CAL_LAB          = STS
CAL_DATE         = 10-Jul-12
LOCATION         = Top Bridge 36'above MWL
OWNER            = SIO/STS
INSTALL_DATE     = 10-Jul-12
DCC              = TRUE
SAMOS_LD         = T
# AD Volts Module DGH D5132
CMD              = #g\r
# Module setup parameters
MSP              = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MCP              = 1 1 1 0  13 0 0 0 0 0 0 0
Emulation        = 2000.0
# A/D Calibration
ADCAL            = 1.0 0.0
# Corrections
COR              = 1.05603766E-2 -2.06144501E+0


[SST33]
SENSOR           = Sea Surface Temperature
MODEL            = SEG14
SERIAL           = 5152
MFG              = SEG
CAL_LAB          = ODF
CAL_DATE         = 10-SEP-2010
LOCATION         = Hull-2nd platform(ADCP void)
OWNER            = SIO/STS
INSTALL_DATE     = 13-SEP-2010
DCC              = TRUE
SAMOS_LD         = E
CMD              = #1\r
# Module setup parameters DGH  D5132
MSP              = 19 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MCP              = 1 1 1 0  13 0 0 0 0 0 0 0
# Emulation value 10.352
Emulation        = 20.0
AVGTYPE          = 1
SECSTOAVG        = 60.0
# A/D Calibration
ADCAL            = 1.0 0.0
# Sensor Corrections  (slope, offset)
COR              = 1.0 0.0


[TMP09]
SENSOR           = Air Temperature
MODEL            = 41342V
```

```
SERIAL           = 8013
MFG              = RM Young
CAL_LAB          = STS
CAL_DATE         = 28-Feb-2013
LOCATION         = Top Bridge 33'above MWL
INSTALL_DATE     = 02-Jul-2012
OWNER            = SIO/STS
DCC              = TRUE
SAMOS_LD         = T
# Module address
CMD              = #e\r
# Module setup parameters
MSP              = 3 1 0 0 10 0 1  1 0 0 0 0 0 0 0
MCP              = 1 1 1 0 13 0 0 0 0 0 0 0
Emulation        = 60.49
AVGTYPE          = 1
SECSTOAVG        = 60.0
# A/D Calibration
ADCAL            = 1.0 0.0
# Corrections
COR              = 9.96690729E-2 -5.00083289E+1


[WCH02]
SENSOR           = Winch Readouts
MODEL            = LCI90
SERIAL           = ??
MFG              = ??
CAL_LAB          = n/a
CAL_DATE         = n/a
LOCATION         = Main Lab
OWNER            = Sproul
# Module setup parameters
MSP              = 16 3 0 0 10 0 4  5 4 3 1 0 0 0 0
MCP              = 0 1 4 0  0 0 0 0 0 0 0 0
# Emulation Value
Emulation        =  0 0 0 0
# A/D Calibration
ADCAL            = 1.0 0.0


[WND15]
SENSOR           = WIND
MODEL            = 85106
SERIAL           = 01995
MFG              = RM Young
CAL_LAB          = n/a
CAL_DATE         = n/a
LOCATION         = Top Bridge 33'above MWL
OWNER            = SIO/STS
INSTALL_DATE     = 03-Jul-2012
DCC              = TRUE
SAMOS_LD         = T
# Module address
CMD              = #Z9R1\r
# Module setup parameters
MSP              = 3 0 0 0 10 0 2  4 2 0 0 0 0 0 0
MCP              = 1 1 4 0  3 0 19 20 0 0 0 0
# Emulation value
Emulation        = 6.0 10.0
AVGTYPE          = 1 2 0 0
SECSTOAVG        = 60.0
# A/D Calibration
ADCAL            = 1.0 0.0
# Corrections Wind Speed
COR              = 0.51444, 0.0
# Corrections Wind Direction
COR2             = 1.0, 0.0
```