

Sampling Modes

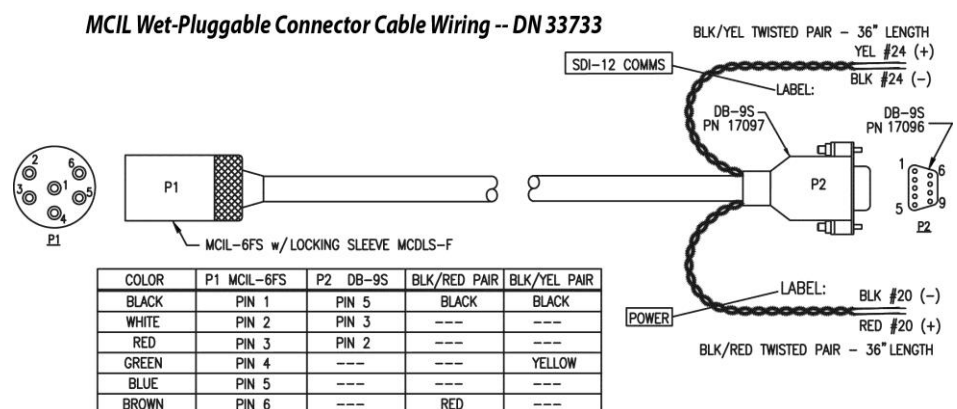
- **Polled sampling** – On command, run pump, take one sample, and send data to computer. Alternatively, command HydroCAT to transmit last sample in memory while sampling autonomously.
- **Autonomous sampling** (*not compatible with SDI-12 deployments.*) – At pre-programmed intervals, wake up, run pump, sample, store data in FLASH memory, and go to sleep. Data can also be transmitted real-time for RS-232 deployments.

Setup

1. Install batteries:
 - A. **Remove connector end cap:** Wipe dry housing/end cap seam. Remove 2 cap screws, twist end cap counterclockwise, and pull out. Disconnect Molex connecting to battery pack. Wipe dry O-ring mating surfaces with lint-free cloth.
 - B. **Remove battery pack, install batteries:** Loosen captured screw in battery pack cover. Use handle to lift pack out of housing. Keep handle upright. Unscrew cover plate. Roll 2 O-rings on side of pack out of grooves. Insert batteries, and roll 2 O-rings back into grooves. Align pin on cover plate PCB with post hole, keep handle upright, and screw cover plate onto battery pack.
 - C. **Reinstall battery pack and connector end cap:** Align D-shaped opening and pins on shaft. Lower battery pack into housing; push gently to mate. Tighten captured screw to secure battery pack in housing. Remove water from O-rings and mating surfaces with lint-free cloth. Inspect O-rings and mating surfaces for dirt, nicks, and cuts. Clean as necessary. Apply light coat of O-ring lubricant to O-ring and mating surfaces. Plug Molex connector together. Fit end cap into housing. Reinstall 2 cap screws.
2. Install supplied RS-232 data I/O cable on HydroCAT and connect to computer serial port.
3. Double click on UCI.exe; UCI opens.
4. On UCI Dashboard, click **Connect**. In Connect dialog box: select HydroCAT, enter baud rate (default 19200); click *Try All Baud Rates*; and click **Connect**. Connection Mode shows **Transition**, and then shows **Setup** when connection established.
5. Via **Transfer Data** in UCI, upload all existing data in UCI.
6. (if desired) Via **Temperature Check** and **Conductivity Check** in UCI, verify temperature and conductivity output stability and accuracy.
7. Via **HydroCAT Settings** in UCI, establish setup parameters for next deployment.
8. Via **Command Terminal** in UCI, check configuration (**GetCD**) and calibration coefficients (**GetCC**) to verify setup.
9. Via **Start** in UCI, start autonomous sampling and view data to verify setup and operation. Click **Stop** when done.
10. Via **Deploy HydroCAT** in UCI:
 - A. Set Operating Mode (Autonomous or Polled Sampling).
 - For Autonomous Sampling: set sample interval and start date and time.
 - For Polled Sampling: set SDI-12 address and bad data flag.
 - B. Set parameters to output and parameter units for real-time data.
 - C. Synchronize time in HydroCAT with computer time, and (if desired) make entire memory available for recording.
11. For SDI-12 deployments: Program SDI-12 controller to send periodic requests to run pump and sample (aM!, aMC!, aC!, or aCC! store data in HydroCAT FLASH memory; aM1!, aMC1!, aC1!, or aCC1! do not store data in FLASH memory), and then transmit sample (aD0!, aD1!).

Deployment

1. Wiring – Install cable (not supplied) between HydroCAT and controller. Install locking sleeve on HydroCAT.
2. Remove yellow protective label from intake and exhaust.
3. Verify that Anti-Foulant Devices are installed (see manual for details).
4. Mount HydroCAT **with connector at top (sensors at bottom) for proper operation** – see manual for details.



Data Upload

1. Connect to HydroCAT with UCI.
2. Via **Transfer Data** in UCI, upload desired data to a .csv file.
3. Review data; you can modify parameters output and / or units (via **HydroCAT Settings**) and upload again if desired.

RS-232 Command Instructions and List

- Input commands in upper or lower case letters and register commands by pressing Enter key.
- If in quiescent (sleep) state, re-establish communications by clicking Connect in Communications menu or pressing Enter key.
- If a new command is not received within 2 minutes after completion of a command, HydroCAT returns to quiescent (sleep) state.
- HydroCAT sends an error message if invalid command is entered.

Shown below are commands used most commonly in field. See Manual for complete listing and detailed descriptions.

Category	Command	Description
Status	GetCD	Get and display configuration data.
	GetSD	Get and display status data.
	GetCC	Get and display calibration coefficients.
	GetEC	Get and display event counter data.
	ResetEC	Reset event counter.
	GetHD	Get and display hardware data.
	Help	Display list of currently available commands.
	DS	Get and display status.
General Setup	DC	Get and display calibration coefficients.
	DateTime=x	x= mmdyyyhhmmss (real-time clock month, day, year, hour, minute, second).
	BaudRate=x	x= baud for RS-232 communication (600*, 1200*, 2400*, 4800, 9600, 19200, 38400, 57600, 115200). Default 19200. (*600-2400 valid only if no oxygen sensor installed) Note: 1200 baud is used for SDI-12 communication, and is independent of baud set for RS-232 communication.
	ReferencePressure=x	x = reference pressure (decibars) (used when HydroCAT has no pressure sensor).
RS-232 Setup	*Default	Reset most user-input settings to factory defaults.
	QS	Place HydroCAT in quiescent (sleep) state. Logging and memory retention not affected.
SDI-12 Setup	OutputExecutedTag=x	x=Y: Output XML Executed and Executing tags for RS-232 communications. x=N: Do not.
	TxRealTime=x	x=Y: Output real-time RS-232 data while sampling autonomously. x=N: Do not.
Pump Setup	SetAddress=x	x= address (0-9, a-z, A-Z) for SDI-12.
	SetSDI12Flag=x	x= out-of-range value (-9999999 to +9999999; must include + or -) for SDI-12 (OutputFormat=3). Default +9999999.
	MinCondFreq=	x= minimum conductivity frequency (Hz) to enable pump turn-on for sampling. Default factory setting (Zero Conductivity Frequency + 1 Hz).
	AdaptivePumpControl=x	x=Y: If oxygen installed, run pump using Adaptive Pump Control; run pump for [OxNTau * OxTau20 * ft * fp]. Default. x=N: If oxygen installed, do not use Adaptive Pump Control; run pump for [OxNTau * OxTau20].
	OxNTau=x	x= pump time multiplier (0 – 100.0). Default 7.0.
	PumpOn	Turn pump on, for testing (pump turns off when PumpOff sent or 2 minutes without communications have elapsed).
Memory Setup	PumpOff	Turn pump off, if turned on with PumpOn.
	InitLogging	Initialize logging to make entire memory available for recording.
Output Format Setup	SampleNumber=x	x= sample number for last sample in memory. SampleNumber=0 equivalent to InitLogging .
	OutputFormat=x	x=0: Output raw decimal data. x=2: Output converted decimal data, XML format. x=1: Output converted decimal data. x=3: Output converted decimal data, SDI-12 format.
	OutputTemp=x	x=Y: Output temperature (units defined by SetTempUnits=). x=N: do not.
	SetTempUnits=x	x=0: Temperature output °C, ITS-90. x=1: °F, ITS-90.
	OutputCond=x	x=Y: Output conductivity (units defined by SetCondUnits=). x=N: do not.
	SetCondUnits=x	x=0: Conductivity output S/m. x=1: mS/cm. x=2: µS/cm.
	OutputPress=x	x=Y: Output pressure (units defined by SetPressUnits=). x=N: do not.
	SetPressUnits=x	x=0: Pressure output decibars. x=1: psi (gauge).
	OutputOx=x	x=Y: Output oxygen (units defined by SeOxUnits=). x=N: do not.
	SetOxUnits=x	x=0: Oxygen output ml/L. x=1: mg/L.
	OutputSal=x	x=Y: Output salinity (psu). x=N: do not.
	OutputSV=x	x=Y: Output sound velocity (m/sec). x=N: do not.
	OutputSC=x	x=Y: Output specific conductivity (units defined by SetCondUnits=). x=N: do not.
	UseSCDefault=x	x=0: Use SetSpCA= value. x=1: Use default (0.020) thermal coefficient (specific conductivity).
	SetSCA=x	Only applicable if UseSCDefault=0. x= thermal coefficient (specific conductivity calculation).
Autonomous Sampling (Logging)	TxSampleNum=x	x=Y: Output sample number with each polled sample. x=N: do not.
	SampleInterval=x	x = interval between samples (6-21600 sec).
	StartNow	Start logging now.
	StartDateTime=x	x= mmdyyyhhmmss (delayed logging start month, day, year, hour, minute, second).
	StartLater	Start logging at delayed start time.
Polled Sampling	Stop	Stop logging or waiting to start logging. Press Enter before sending Stop. Must send Stop before uploading data.
	TS	Do not pump. Take sample, store data in buffer, output data.
	TPS	Run pump, take sample, store data in buffer, output data.
	TPSS	Run pump, take sample, store data in buffer and in FLASH memory, output data.
	TSN:x	Do not pump. Take x samples, output data.
	TPSN:x	Run pump continuously while taking x samples and outputting data.
	T63	Do not pump. Take sample from SBE 63, output oxygen data in format set by SetFormat= in SBE 63.
Data Upload	SL	Output last sample stored in buffer.
Calibration Coefficients	GetSamples:b,e	Upload scan b to e; format defined by OutputFormat=. Send Stop before sending. Maximum 5000 samples.
	See manual.	

SDI-12 Standard Commands

Note: Responses to Start Measurement commands include:

- a = SDI-12 address
- ttt = maximum amount of time (sec) until data is ready
- n (1digit, for M commands) **or**
nn (2 digits, for C [Concurrent] commands) = number of parameters in data string (can include T, C, P, DO, salinity, sound velocity, specific conductivity, sample number; dependent on which outputs are enabled)

Command	Response	Description
Break	None; initiate search for valid mark.	12 millisecc spacing on line - Wake all HydroCATs on line. Note: '!' command termination and <CR><LF> do not apply.
a!	a<CR><LF>	Check that HydroCAT 'a' is responding.
a!	Allccccccmmmmmmvvnnnnn oooooooo<CR><LF> where ll = SDI-12 version compatibility (13 = 1.3) cccccc = vendor ID ('SeaBird') mmmmm = Instrument ID ('HCAT') vvv = HydroCAT firmware version ('213') nnnn = HydroCAT serial number oooooooo = up to 8 characters, designation of optional sensors (P if pressure installed, O if Oxygen installed) Example string when HydroCAT's SDI-12 address is 0, serial number is HC-32345 and pressure and oxygen installed: 013SeaBird HCAT 21332345PO	Identify instrument. Notes: • Serial number is last 5 characters of serial number. • Firmware version in a! response is limited to number of digits shown. Use aXV! (see SDI-12 Extended Commands) to get full firmware version. For example, for firmware version 2.13.0, a! returns '213' (sending 2 digits for the number after the first decimal point), while aXV! returns '2.13.0'.
?!	a<CR><LF>	Get HydroCAT's SDI-12 address; valid only if just 1 HydroCAT online.
aAb!	b<CR><LF>	Change HydroCAT's SDI-12 address from 'a' to 'b'.
aM!	atttn<CR><LF> (followed by) a<CR><LF> (when data is ready)	Start Measurement TPSS (run pump, store data in memory) - Send TPSS to HydroCAT (run pump, take sample, store data in buffer, store data in HydroCAT FLASH memory for later upload). Hold results in HydroCAT buffer until another sample taken. Service request issued when data ready.
aMC!	Same as aM!	Start Measurement TPSS - Same as aM!, but response in buffer includes 3character checksum before <CR><LF>.
aC!	atttn<CR><LF>	Start Measurement TPSS - Same as aM!, but service request (a<CF><LF>) not sent.
aCC!	Same as aC!	Start Measurement TPSS - Same as aC!, but response in buffer includes 3character checksum before <CR><LF>.
aM1!	atttn<CR><LF> (followed by) a<CR><LF> (when data is ready)	Start Measurement TPS (run pump, do not store data in memory) - Send TPS to HydroCAT (run pump, take sample, store data in buffer). Hold results in HydroCAT buffer until another sample taken. Service request issued when data ready.
aMC1!	Same as aM1!	Start Measurement TPS - Same as aM1!, but results in buffer includes 3-character checksum before <CR><LF>.
aC1!	atttn<CR><LF>	Start Measurement TPS - Same as aM1!, but service request (a<CF><LF>) not sent.
aCC1!	Same as aC1!	Start Measurement TPS - Same as aC1!, but results in buffer includes 3character checksum before <CR><LF>.
aM2!	atttn<CR><LF> (followed by) a<CR><LF> (when data is ready)	Start Measurement TS (do not run pump or store data in memory) - Send TS to HydroCAT (do not run pump ; take sample, store data in buffer). Hold results in HydroCAT buffer until another sample taken. Service request issued when data ready.
aMC2!	Same as aM2!	Start Measurement TS - Same as aM2!, but response in buffer includes 3-character checksum before <CR><LF>.
aC2!	atttn<CR><LF>	Start Measurement TS - Same as aM2!, but service request (a<CF><LF>) not sent.
aCC2!	Same as aC2!	Start Measurement TS - Same as aC2!, but response in buffer includes 3-character checksum before <CR><LF>.
aD0!	a<values><CRC><CR><LF> where <values> = parameters in data string (can include T, C, P, salinity, sound velocity, specific conductivity, sample number; dependent on which outputs are enabled). CRC is sent if Start Measurement command included CRC request (aMC!, aMC1!, aCC!, aCC1!, etc.)	Send data from HydroCAT buffer. If string is too long, additional commands (aD1!, aD2!, etc.) required to retrieve remaining data. Number of characters in values plus CRC string is limited to 75 for Concurrent data (sampling command string includes 'C'), or 35 for non-Concurrent data (sampling command string includes 'M').

SDI-12 Extended Commands

Note: For all extended commands with an argument (x): If the argument is omitted, the response provides the current setting.

Command	Response	Description
aXV!	av.v.v, mmm dd yyyy hh:mm:ss <CR><LF> <i>where</i> v.v.v = firmware version (2.13.0) mm dd yyyy hh:mm:ss = firmware date and time	Get full firmware version string (firmware version and firmware date and time).
aXPx!	ax <CR><LF>	Send PumpOn (1) or PumpOff (0) . Turn pump on to test or remove sediment; runs continuously, drawing current.
aXMCFx!	ax<CR><LF>	Send MinCondFreq=x . Minimum conductivity frequency (Hz) to enable pump turn-on, to prevent pump from running in air. Configuration Sheet lists frequency output at 0 conductivity. Typical MinCondFreq values: fresh water: (0 conductivity frequency + 1). salt water & estuarine: (0 conductivity frequency + 500).
aXMRx!	xx<CR><LF> <i>where</i> xx is current sample number Note: must send aXMR0! twice. Response to first command shows current sample number. Response to second command shows that current sample number has been reset to 0, indicating that memory has been reset.	Send InitLogging when x=0 . After all data has been uploaded , initialize logging before starting to sample again to make entire memory available for recording. If not initialized, data will be stored after last recorded sample. HydroCAT requires this command to be sent twice, to prevent accidental reset of memory.
aXUTx!	ax<CR><LF>	Send SetTempUnits=x . x=0 : Temperature output °C, ITS-90. x=1 : °F, ITS-90.
aXUCx!	ax<CR><LF>	Send SetCondUnits=x . x=0 : Conductivity output S/m. x=1 : mS/cm. x=2 : µS/cm.
aXUPx!	ax<CR><LF>	Send SetPressUnits=x . x=0 : Pressure output decibars. x=1 : psi (gauge).
aXUOx!	ax<CR><LF>	Send SetOxUnits=x . x=0 : Oxygen output ml/L. x=1 : mg/L.
aXOxxxxxxxx!	xxxxxxxx<CR><LF> <i>where</i> xxxxxxxx=enable (1)/disable (0) status for each output parameter (in order: temperature, conductivity, pressure, oxygen, salinity, sound velocity, specific conductivity, sample number) <i>Example (enable T, C, P, DO, salinity):</i> a11111000 <i>Example (enable T, C, DO, salinity; no pressure installed):</i> a11011000	Send OutputTemp=x , OutputCond=x , OutputPress=x , OutputOx=x , OutputSal=x , OutputSV=x , OutputSC=x , TxSampleNum=x . x=0 : Disable output. x=1 : Enable output.