



UCM-60 / UCM-60DL Operating Manual

Revision 1.10 Revision 1.10

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1 Introduction

This manual is intended for all personnel who operate the UCM-60 Ultrasonic Meter. It describes the programming of the instrument, installation configurations, interconnection to external terminal and data retrieval.

1.1 Parameters

The UCM-60 Ultrasonic Current Meter is basically designed for the measurement of:

- Current speed
- Current direction related to current meter orientation or true current direction
- Sound velocity
- Tilt

Additional sensors are available for the measurement of:

- Sea temperature
- Depth or pressure
- Conductivity

The UCM-60 further performs calculation of:

- Salinity
- Density

1.2 Configurations

Both direct reading and recording configurations are available. The direct reading configuration provides bi-directional communication with external terminal, enabling real-time data output as well as user-interaction. The recording configuration contains a FLASH-RAM memory module. Computed data stored in the memory enables data retrieval without opening the current meter housing.

Operating parameters such as sampling rate, sampling schedule, data averaging period etc., may be defined and programmed by the user.

The absence of moving parts reduces mechanical wear to a minimum and makes it less sensitive to marine growth and pollution in the sea.

1.3 Sensors

The current meter does not need to be aligned with the current direction before an accurate measurement can take place. The current may therefore be measured at high sampling rates in order to detect rapid changes in the fluid flow. As the measurement is not based on the acceleration of any physical mass, a very low velocity threshold is offered (1 mm/s) with a wide dynamic range (1 mm/s - 3 m/s or 2 mm/s - 6 m/s).

A compass can be included to establish the true direction of the current velocity.

The sea temperature is sensed by means of a fast response Pt-element protruding from the lower part of the instrument case. The standard measuring range is -5°C to $+45^{\circ}\text{C}$.

For measuring the pressure of water head above the current meter (instrument depth), a high impedance pressure transducer can be mounted on the lower part of the instrument case (option). Different ranges available.

Conductivity is measured by an electrode less induction type conductivity cell. The standard measuring range is 2-77 mmho/cm. The conductivity cell, which is an optional extra, can be mounted on the lower part of the instrument case.

1.4 Microprocessor

The UCM-60 is software controlled. A 16-bit microprocessor controls data acquisition from the various sensors. The analogue signals for current, temperature, pressure and compass are converted by an external A/D-converter. The digital outputs from the A/D-converter are read by the microprocessor, together with the digital output signals from the sound velocity and conductivity measurements. The microprocessor performs continuous data averaging based on pre-set sampling period and integration period. The microprocessor also executes continuous calculations of current speed and direction. Density and salinity are calculated from CTD parameters.

The UCM-60 software also controls a power-off function between each observation period.

1.5 Communication

The microprocessor includes a bi-directional UART (full duplex serial port) to handle the bi-directional transmission. The UART may be programmed to various baud rates. The utilised format is 8-bit data, no parity and one stop bit.

Baud rates 300, 600, 1200, 2400, 4800, 9600 or 19200 baud.

Note! 9600 bits/s at cold reset (default value).

Available data interface is RS232C .

1.6 Real - Time Clock

The internal real-time clock keep count of year, month, hours, minutes and seconds.

A Start time (alarm) can be pre-set up to 30 days to initialise current meter operation. By means of lithium batteries, the real-time clock and the RAM will provide exact time and logging format for approximately 5 years.

1.7 Data Output

ID	Date	Time	E	Hor	Dir	Vert	Sound	Temp	Dept	Comp	Tilt	XY
00	950622	095608	0	4	8	1	1497	2531	1	319	0	0
00	950622	095609	0	1	45	0	1497	2531	0	319	0	0
00	950622	095609	0	2	30	-2	1497	2531	0	319	0	0
00	950622	095609	0	1	135	-0	1497	2529	0	319	0	0
00	950622	095609	0	1	34	1	1497	2530	0	319	0	0
00	950622	095609	0	3	52	-0	1497	2531	0	319	0	0

Figure 1. Data Output Example

Heading line description:

ID	Instrument identification number (address)
DATE	YYMMDD (Year, Month, Day)
TIME	HHMMSS (Hour, Minute, Second)
E	Error message
Hor	Horizontal velocity; mm/s
DIR	Direction; degrees
Vert	Vertical velocity; mm/s
Sound	Sound velocity; m/s
Temp	Sea temperature; 1/100°C
Dept	Current meter depth; m (dm)
Comp	Compass reading
Tilt XY	Tilt in X and Y directions; degrees (pos.. value X = centre leg tilted down, refer fig.1.3) (pos.. value Y = right leg tilted down, refer fig. 1.3)

In addition may the following be displayed if sensor installed:

Cond	Conductivity; 10 ⁻⁵ mho/cm
Salin	Salinity; ppm
Densi	Density; 10 ⁻⁵ kg/dm ³

1.8 Ultrasonic Measuring principle

The UCM-60 Ultrasonic Meter is based on a precise measurement of the difference in transit time between an ultrasonic wave that is propagated along a defined distance through the water, and an ultrasonic wave that is simultaneously transmitted in the opposite direction over the same distance. The transit time for a pulse along one path is dependent upon the fluid velocity component along the same path. The difference in transit time for the two pulses transmitted simultaneously in opposite directions will therefore be a direct expression for the current speed resolved along the same axis.

The velocity of the acoustic pulse will vary with the water temperature, pressure (depth) and salinity. The current meter, however, automatically compensates for variations in the sound velocity by measuring the pulse transit time, deriving the actual sound velocity and adjusting the sensitivity to the correct value.

The turbulence and wake effects are compensated for in software.

1.8.1 Travel time difference principle

The UCM-60 Ultrasonic Current Meter works on the travel time difference principle exploiting the interaction effects between a moving fluid and acoustic waves.

By exciting two piezoelectric transducers with sharp voltage steps of approximately 350 V at a repetition rate of typically around 20 excitations per second simultaneously, each of the transducers generate bursts of high frequency ultrasound, typically 4 MHz, at the same repetition rate.

If the transducers, the active parts of which are small discs of piezoelectric material, stay in the moving fluid at an internal distance l , it can be shown that the time difference Δt between up and down stream sonic travel times, t_1 and t_2 respectively, corresponds to the mean flow velocity along the sonic path according to the equation.

$$t_2 - t_1 = \Delta t = 2 \cdot l \cdot v / c^2$$

l = the sound path between transducers.

v = the mean flow velocity component along the acoustic path.

c = the sound velocity through the fluid.

In order to reduce the effects of current flow circulation and wake around the transducer probes, compensation is performed by the computer.

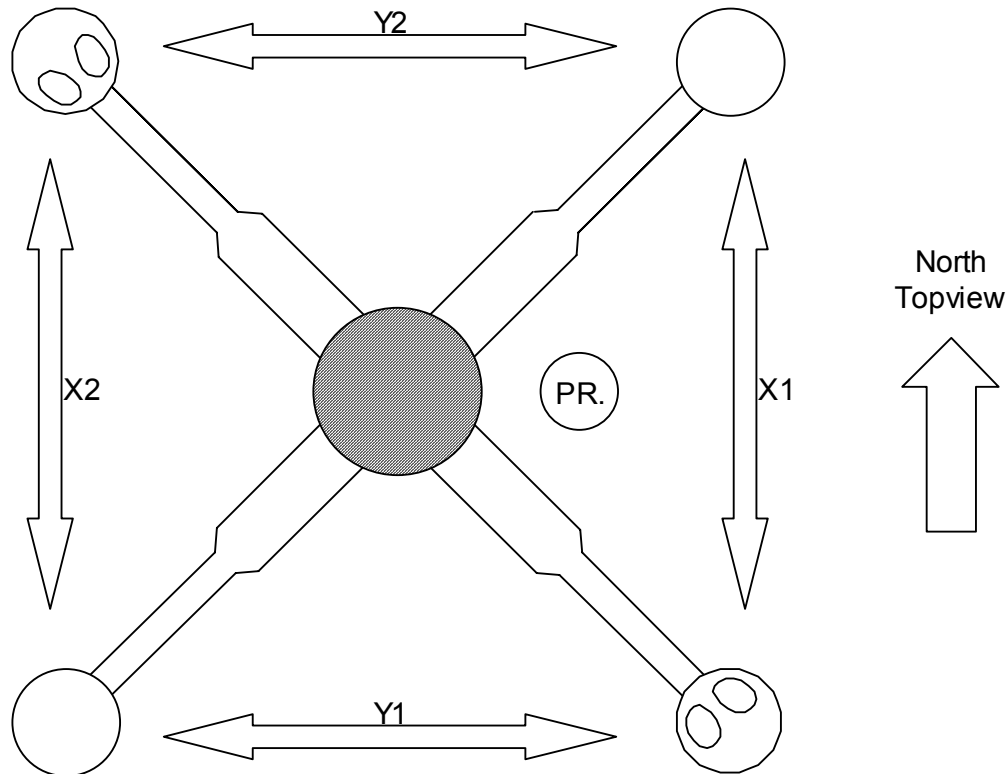


Figure 2. UCM-60 Ultrasonic Current Meter, Measuring Principle

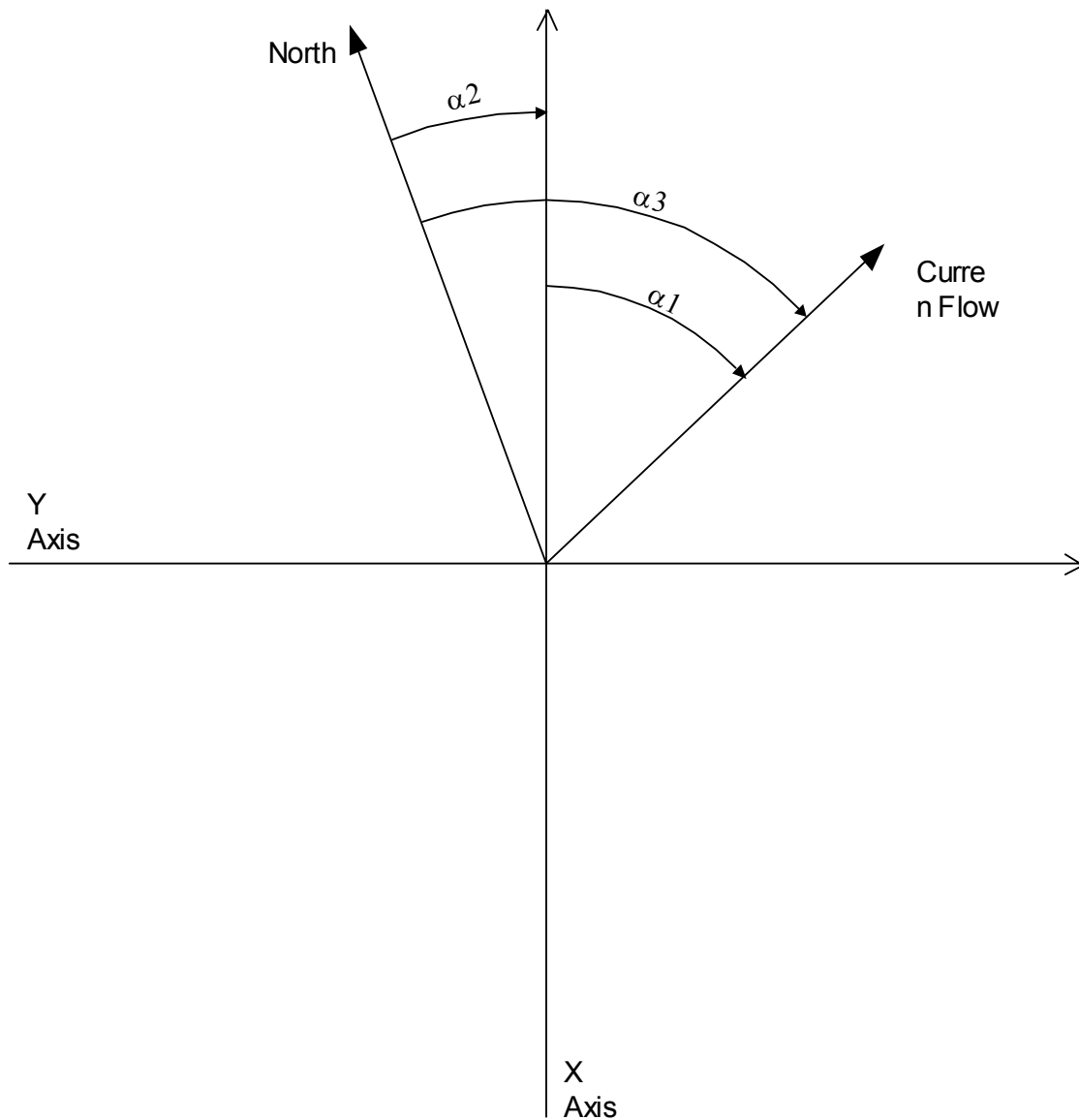


Figure 3. Current Direction referred to UCM-60 Axes and North.

- $\alpha 1$ Current direction output (no compass included, current direction ref. To instrument)
- $\alpha 2$ Compass reading ref. To instrument
- $\alpha 3$ $\alpha 1 + \alpha 2 =$ current dir. Ref. To north

If a SENSOR TEST is performed for this figure

X current = positive

Y current = negative ($\sim 3/4$ X value)

Compass reading = $\sim 10^\circ$

1.9 Timing principal

The principle of timing is laid out below. In the standard and opti program a sample is one cycle of single read-outs of all the sensors. Defined by the *number of integration* setting a number of samples are integrated into one observation. Observations are presented on the screen and/or written to flash memory. How many observations there are in one observation period is defined by the *number of observations* parameter.

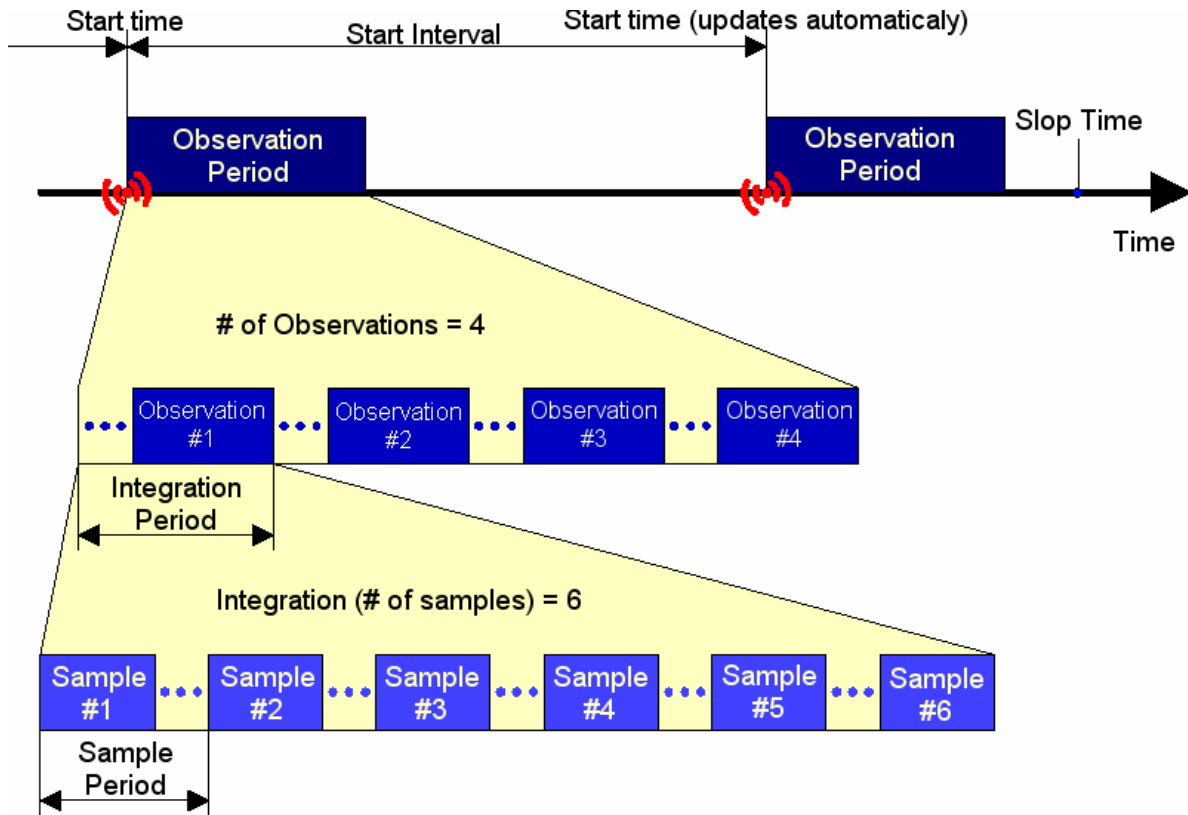


Figure 4. Relationship of timing parameters.

Under normal circumstances, i.e. not in standby mode, the instrument is turned off between observation periods. The instrument is awakened by an alarm function in its Real Time Watch. The *start time* reflects the alarm setting. At the beginning of each observation period the start time of the next observation period is calculated and updated. If *stop time* has expired the alarm function will be disabled.

Note !

Ensure that power is applied before "start time" arrives. If "Start Time" elapses before power is connected, the UCM-60 will not start. If you want auto operation, a new "Start Time" has to be set.

The programming determines, Limits:

Start time	Any day and time of the month (Updated with Start interval at each alarm).
------------	--

Start interval	Same format as Start time and being added to Start time at each alarm.
Stop time	Same format as watch (YY MM DD HH MM SS WD WN). Ends setting of new alarms after Stop time passed.
Observations	Setting in no's of Observations (Integration periods) up to 65535.
Integrations	Setting in no's of Samples up to 65535.
Sample period	50 ms to 65535 ms

1.10 Application

The versatility of the UCM-60 makes it an ideal instrument for a wide variety of purposes:

- Measurement in connection with general oceanographic research and meteorological forecasts
- Water column profiling
 - CTD measurements
- Near bottom measurement in connection with
 - pipe laying
 - sub sea constructions
 - bottom surveying
 - submarine ROV operations
 - erosion measurements
- Measurements in the intermediate layers in connection with
 - pipe laying
 - estimation of forces on cables
 - estimation of forces on risers
 - estimation of forces on sub sea constructions
 - estimation of transport of particles and polluting material
- Measurement in the surface layer in connection with
 - offshore loading and unloading activities
 - navigation and positioning (offshore and in harbour)
 - anchoring
 - estimation of forces on constructions
 - search and rescue operations
 - anti pollution operations (dimensioning Criteria etc.)
- River flow measurements
- Fish-farming
- Harbour control

2 Technical specifications

2.1 General

Power supply	12 - 28 VDC
Power consumption	1.5 W
Sampling frequency	Up to 20 Hz
Output (input) signals	ASCII RS232C 8 bit data, no parity, 1 stop bit
Input/output connections	8 wires power lines, 4 data lines, 2 control lines Underwater plug able connector
Depth capability	2000 m (Optional: 6000m)

2.1.1 Container tube

Material, cylinder	Stainless steel AISI-316L
Material, lower part	Stainless steel AISI-316L

2.1.2 Dimensions

Total length	1015 mm
Cylinder diameter.	100 mm

2.2 Sensors

2.2.1 Current Velocity Sensors

Measuring principle	Acoustic travel time difference
Velocity vectors	Three axes: X, Y and Z
Range (programmable)	0 to +/-3 m/s, 0 to +/-6 m/s
Resolution (depends on range)	1 mm/s or 2 mm/s
Accuracy, normal operation	+/- 5mm/sec or 1% whichever is greater
"", worst case, heavy tilted	3% of range +/- 5mm/sec. (mean value)
Acoustic carrier frequency	approx.. 4 MHz

2.2.2 Sound Velocity Sensor

Range	1380 - 1580 m/s
Resolution	2.0 m/s
Accuracy	5 m/s

2.2.3 Temperature Sensor (optional)

Type	CS-1/10 Platinum resistance detector element, NE-Sensortec housing
Range	-5°C to +45°C
Resolution	0.01°C
Accuracy	0.1°C(0.02°C option)
Response time	<1.0 s(60 ms option, at flow rate 1 m/s.)

2.2.4 Pressure Sensor (optional)

Type	Piezo-resistive, High Impedance Corrosion Resistant Pressure Transducer
Range	0-20 bar (standard)(From 5 to 200 bar FS option)
Resolution	0.04% FS
Accuracy	Within 0.2% of F.S
Response time	<50 ms

2.2.5 Conductivity Sensor (optional)

Type	Aanderaa 2990S, Inductive cell
Range	2-74 mmho/cm
Resolution	0.01 mmho/cm
Accuracy	0,06 mmho/cm
Response time	0.05 s

2.2.6 Tilt Sensor

Type	Electrolytic Tilt Sensor
Range	+/-30°
Resolution	1°
Accuracy	10% of reading
Response time	<0.05 s

2.2.7 Compass

Type	3 - AXIS Fluxgate
Resolution	1°
Accuracy	+/- 1 deg.

Response time 0,05 s

2.3 Processor

Type INTEL 80C196NT

2.3.1 Output channels

- Identification number
- Date (Day, Month, Year)
- Time (Hour, Minute, Second)
- Status data
- Current velocity, horizontal plane (compensated for compass and tilt)
- Current velocity, vertical plane (compensated for tilt)
- Sound velocity
- Temperature
- Pressure
- Conductivity
- Salinity (calculated)
- Density, based on CTD parameters
- Compass direction
- Tilt

2.3.2 Initialisation menu

- Addressing
- Setting/check of date/time
- Selection of channels to be sampled
- Setting of observation-, integration periods and start-up times

3 Operation

3.1 General

The interconnection of the UCM-60 to external terminal is described in the Installation chapter.

The operator communicates with the UCM-60 via any standard terminal. However, be aware that some terminals will require that function keys are being dedicated to some of the symbols/characters being used e.g. ^, @ etc.

Remember to use same baud rate and other settings on the UCM-60 and the terminal. (Default value from factory 9600 baud, 8 bit, 1 stop bit, no parity).

The UCM-60 can be operated via two modes, being Operator Mode (@OPER) or Command Line Mode (@CMDL). The Command Line Mode is described in a separate Chapter.

Note!
The UCM60 must be in vertical position ± 30 degr. (within range of tilt sensor) to operate.

3.2 System level

3.2.1 Initialisation

When power is applied, the UCM-60 can be wakened either by:

- An alphanumeric character via the serial input line.
- Automatically by the internal real-time clock provided start time and intervals are programmed.

3.2.1.1 UCM-60 wakened by serial line event

After power has been applied, the instrument can be awakened by a receive-event on the serial line. Any character will do.

Since the serial port is brought up from tri-stat the first line received at the terminal may be rubbish. The next few lines should contain the version and test information:

```

ÿøþÿÿ
UCM-60 - Firmware Version 1.01.160.
All rights reserved, NE-Sensortec as.

IO PORT TEST
WATCH TEST
4 Mbytes of FLASH detected.
Wake-up test completed.
*
```

The instrument is now in system mode for about 10s before it will power down. Any operator activity will reset the power down timer, though.

3.2.1.2 UCM-60 wakened by the internal real-time clock

When the timing parameters have been programmed, a logging sequence will start at the predetermined intervals.

3.2.1.3 Cold Reset

Cold reset should only be used if you for any reason should have lost contact with the UCM-60 and all other attempts to re-establish contact fail; (The UCM-60 must be in power on mode).

After a cold reset all calibration constants will be unchanged, including tilt adjustment. ID-number, output choice, page length and current range.

However, set-up will revert to default.

3.2.2 System prompt

3.2.2.1 Symbols

* System Prompt

3.2.2.2 Commands

At the system prompt the operator has a set of options:

- @OPER Enter UCM-60 Operator Mode.
- @CMDL Enter UCM-60 Command Line Mode.
- Ctrl V Start a single observation period.
- Q Quit. Power down immediately or abort an observation period
- *? Help page. List of all commands available in system mode.

3.2.2.3 @OPER (Operator mode)

Within 10 seconds, type desired command i.e. "@oper".

```
@oper.␣
UCM-60 Operator Mode.

UCM-60 - MAIN MENU
-----
1.Time           2.Status
3.Test           4.Programming
5.Log            6.MENU EXIT
>
```

You may now check status of settings or go into programming menu to program the desired interrogation rate, choose speed range, select which parameters to be displayed, set clock etc. (see ‘Operator Mode Reference’).

3.2.2.4 Ctrl-V (single observation period)

Provided timing parameters are programmed accordingly, Ctrl-V will launch a single Observation period.

3.2.2.5 ? (Help)

```
*?

H E L P     P A G E

Commands available at * prompt:
@OPER <addr*> - Enter operator mode (Menu).
@CMDL <addr> - Enter command line mode.
@RESYNC <addr> - Resynchronise start time.
@START <addr> - Start in 5 seconds.
@STANDBY - Enter standby mode.
@EXIT - Leave standby mode and turn off power.
Ctrl-v(SYN) - Do one observation period.
```

3.3 UCM-60DL

The UCM-60DL is as standard equipped with a 4Mbyte Flash-RAM memory for data logging. The capacity can be expanded in 2Mbyte steps to a maximum of 16Mbyte.

The logger functions in much the same way as a hard disc. Files can be created, given names, files be appended to, retrieved, erased, recalled and up-loaded to a PC.

Each file can be given a name of max. 23 characters.

3.3.1 Observation period Header

The logged data is (observation period header)(observation #1)(observation #2)...(observation #n).

The observation period header is fixed length, 10 words long, and is stored once per observation period.

Byte 1					Byte 2										
seconds					minutes										
hours					date										
month					year										
week day					week no										
cur	vert	vel	temp	dept	cond	sali	tilt	ad1	ad2	ad3	ad4	scre			
sample period															
high word integrations															
low word integrations															
high word observations															
low word observations															

* Instrument address is needed in standby mode only

3.3.2 Observations

Each observation parameter is a word, unlike the header the observation has a dynamic length. The output setting, which is a part of the header data, controls the number of parameters included in an observation.

3.3.3 Flash memory

The flash memory consist of 256 pages of 64kbytes each (16Mbyte). Since each page stores a couple of pointers and the file name, the exact size available for observation data, is 65.520 bytes or 32.760 words per page.

3.3.4 Example 1

Assuming you want to store all parameters (13 words) and do observation periods with 100 observations per period, one observation period will require $10+13*100 = 1310$ words of Flash space.

In this case the flash can hold a maximum of $(32.760/1310)*256*100 = 640.195$ observations.

3.3.5 Example 2

In a minimum configuration you might want to store only current related data (6 bytes) and stick to 100 observations per period. The space requirement for one observation period will then be $10+6*100= 610$ words. The maximum number of observations in this case will be $(32.760/610)*256*100= 1.374.845$ observations.

NOTE!
Examples are based on 16 Mbytes Flash memory. To get figures for a standard 4 Mbytes memory, divide by 4.

3.4 Error messages

Sensor failures will be indicated by 9999 in the data output in addition to a one digit change in the data string.

Error code	Transducers/Sensors				
	X1	X2	Y1	Y2	CTD
E					
0					
1	*				
2		*			
3	*	*			
4			*		
5	*		*		
6		*	*		
7	*	*	*		
8				*	

9	*			*	
A		*		*	
B	*	*		*	
C			*	*	
D	*		*	*	
E		*	*	*	
F	*	*	*	*	

Figure 5. Error codes. * = Faulty transducer(s) or sensor(s)

3.5 Multi UCM-60 operation

The UCM-60 may be configured in three different modes:

- Individual operation. Each instrument needs it's own serial line.
- Multi UCM-60 operation on full duplex. Several instruments may share one set of serial lines.
- Multi UCM-60 operation on half duplex. Several instruments may share one communication line.

3.5.1 Individual operation

Normal configuration; the instrument is hooked up to its own terminal.

3.5.2 Multi UCM-60 Operation on Full Duplex

The UCM-60s must be given ID-numbers from 10 to 49. Echo mode is on. That is: Echo is on if the instrument is addressed.

These instruments must be addressed individually to obtain contact (#xxx). Instruments with ID-numbers different from the one addressed will be quiet while the operator communicates with the selected instrument.

When communication with the selected instrument is finished, and all instruments shall start sending data. It is important that instruments do not send data simultaneously. This will destroy the data output.

The instruments should not run on their internal clock because of possible drift. The starting time should be set to 0/0/0/0, and the instruments synchronised with a sync. char (16H). After one observation period, the instruments must be resynchronised.

Data output delay must be set to allow one instrument to finish transmission before the next starts.

Data transmission of one full data string with header takes approx. 220 ms at 9600 baud. Then it takes about 30 ms. for the R232 to go into "tri- state". The instruments should be configured 300 ms. apart. In this configuration three UCM-60s may be connected in parallel, each with an output rate of 1 Hz.

ID = #001 No transmission delay.
ID = #002 300 ms transmission delay.
ID = #157 600 ms transmission delay.

For more than 3 units in parallel, the data string must be shortened or data rate reduced.

If you loose contact with an instrument (try "Xon"), and a cold reset must be performed, remember to address the instrument by its ID-number.

Baud rate 300 baud. (All instruments must eventually be reprogrammed from the default values.)

3.5.3 Multi UCM-60 Operation on Half Duplex

The instruments must be given ID-numbers from 50 to 99. Echo mode is off.

The above description of full duplex operation applies also for half duplex operation except for the following:

4 Operator Mode Reference

The operator mode is a menu driven user interface to UCM-60 setup and configuration.

4.1 General

4.1.1 Menu navigation

Waking the UCM-60 by typing any alphanumeric character. The response will normally be:

```

ÿøþÿÿ
UCM-60 - Firmware Version 1.01.160.
All rights reserved, NE-Sensortec as.

IO PORT TEST
WATCH TEST
4 Mbytes of FLASH detected.
Wake-up test completed.
*
```

Typing `@oper ↵` will take you to the Operator Mode displaying the Main Menu:

```

* @oper ↵

UCM-60 Operator Mode.
HJ

UCM-60 - MAIN MENU
-----
1. Time                2. Status
3. Test                4. Programming
5. Log                 6. MENU EXIT
>
```

Menu items are selected by entering the digit or letter that prefixes the menu item. A menu item may be a submenu, a set-up or configuration item, or action items.

Submenus are navigated the same way the main menu is. Additionally the `^`-key or the ESC-key is used to escape the submenu, (i.e. go up one level).

Set-up or configuration items respond with descriptive prompt followed by the current setting enclosed in parenthesis and a question mark. The operator may enter new value(s) and press CR-key or just press the `^`-key or the ESC-key to keep current value(s).

Submenu titles are prefixed by numbering to indicate where the submenu belong in the menu hierarchy.

4.1.1.1 Symbols

- # Instrument address prefix
- ! Error message prefix
- \$ Will replace digits of numbers that are to large to be displayed (i.e. if calibration data bad)
- > Menu prompt.

4.1.1.2 Command summary

- CR (↵) Select an item or enter new data.
- BS (←) Back space. Delete typed characters.
- ESC or ^ Skip entering data or up one menu level.

4.2 Main menu

```

UCM-60 - MAIN MENU
-----
1.Time                2.Status
3.Test                4.Programming
5.Log                 6.MENU EXIT
>
    
```

You can now get to the desired sub-menu by typing the corresponding number after prompt (>).

Menu Hierarchy diagram at front of this section will show you the sub- and sub-sub- menus of the Main Menu. The purposes and functions of the various menus will be described in subsequent chapters. We will in the following give a short description:

- 1.Time Will let you " Read Watch", "Change Watch" and give you "Watch Status". "Watch Status" will tell you if Alarm and Timer are set plus some additional information.
- 2.Status Will tell you status of the instrument such as "Timing", "Offset, gain and output" and "Configuration". No changes to settings or parameters can be done under Status menu. If changes are required, you will have to go to menu 4. Programming and its sub-menus.
- 3.Test Elaborate means of testing the instruments performance are provided under this menu. Some information, helpful in doing diagnostics on the instrument, is also provided.
- 4.Programming In the Programming Menu with its sub- and sub-sub menus the parameters vital to the operation of the instrument, can be programmed. Entry to the Program Menu is protected by a password. This to prevent that inexperienced personnel alter settings. The sub-menu 3, Calibration is protected by an additional password.
- 5.Log The File Menu lets the operator manage logging and storage of data much in the same way as done in a normal file system on a PC. One of the main differences are that files can be given names with up to 23 characters allowing geographic locations and/or latitude/longitude to be used as file names.
- 6.MENU EXIT Exit from operator menu.

4.2.1 Time menu

To set or check the watch, go to the main menu and choose menu *1 Time*, by simply pressing 1 the terminal responds.

```
1 - TIME MENU
-----
1.Read watch          2.Change watch
3.Read watch status
```

4.2.1.1 Read Watch

To check the watch, press 1.

```
Current real time watch setting:
  Tuesday February 24th. 1995 12:22:14, week #8
```

4.2.1.2 Change Watch

To set the real time watch, press 2.

```
Enter Real Time Watch setting YY MM DD HH MM SS WD WN:
No day No Month 223rd. 1956 255:144:254, week #254
..is this okay <Y>/<N> or <Q> to keep old setting:
```

Information in second line above (No day No month 223rd etc.) indicates that no valid values have been entered.

4.2.1.3 Read Watch Status

To check real time watch status, press 3 (This is mainly intended for service purpose).

```
Current Real Time Watch Status:
Watch running.
Alarm is not set, and disabled.
Timer is set, but stopped
Test bit not set.
Pulse output frequency 256 Hz.
  press any key to continue...
```

Alarm set	Alarm has triggered.
Alarm not set	Alarm has not triggered.
Alarm enabled	Alarm time has been input.
Alarm disabled	Alarm time has not been input.

The other information under watch status are intended for service purposes.

4.2.2 Status menu

To check the timing, offset, configuration status return to the main menu and select 2 Status by pressing 2.

```
2 - STATUS MENU
-----
1. Timing          2. Offset, gain and output
3. Configuration
```

4.2.2.1 Timing Status

To check the timing status, press 1.

```
TIMING
PARAMETER          STANDARD  OPTI
```



```

Observation per.: 0.500 s 5.000 s Start time, day: 0 time: 0:00:001
Integration per.: 0.049 s 0.049 s Interval, days: 0 time: 0:00:00
Sample period   : 50 ms 50 ms Watch=1 Alarm=0/0 Timer=0/02
Current mode    : Standard Test=0 Pulse=02

Current time : Tuesday June 20th. 1995 10:39:51, week #25
Stop time    : Tuesday No Month 0th. 1900 0:52:00, week #253
--- press any key to continue...
    
```

Comments:

The Observation period and Integration period, given in seconds, are calculated results of sample period, number of Observations and Integrations set in Timing Menu.

4.2.2.2 Status, Offset, gain and output

To check the Offset, gain and output status, press 2 in Status menu

```

SENSOR OFFSET, GAIN and OUTPUT
ITEM          OFFSET    GAIN OUT STA ITEM          OFFSET    GAIN OUT STA
Current X1    -0.03  1.0543 on  - Current X2    -51.11  1.1672 on  -
Current Y1   -51.81  0.6820 on  - Current Y2     0.13  1.1815 on  -
Vertical      -      -   on  - Velocity      0.000  1.1381 on  -
Temperature -1500.00 0.00999 on off Pressure    -506.62  0.0019 on off
Depth         1.0132 99.2600 on on Conductivity 0.000  !NaN on off
Salinity      -      -   on  - Density      -      -   on  -
Tilt X        1023.53 0.0999 on on Tilt Y        1023.59 0.0999 on on
Deviation     0.000  -   -   -
--- press any key to continue...
    
```

In general the final values presented from the various sensors are the result of a calculation as follows: (Offset + measured value) · gain = presented result. For current some additional calculations required.

Depth Offset Air pressure at sea surface. Depth gain = Depth factor/Pressure

Velocity gain Length of sound path in dm.

Pressure gain Pressure range/2500

Tilt Offset and Gain are values indicating time between pulses from tilt sensor

On X1, X2, Y1 and Y2 axis 1 bit corresponds to 1mm/s or 2mm/s, depending on selected speed range, 3 or 6 m/s respectively. These offset values should never exceed +/- 200.

NaN (printed after conductivity sensor above) = Not a Number. Here meaning the sensor has not been initialised.

4.2.2.3 Configuration Status

To display the configuration status, press 3 in Status Menu

```

CONFIGURATION
Current range 3 m/s  Baud rate 9600  System clk 16.00 MHz
    
```

¹ If setting a Start time that has already been passed, alarm will not go before next month.

² As described under para 3.1.1.3 mainly intended for service purposes.

³ **Note: Actual Stop time will be the Stop time given here plus one Start interval.**

```

Page length 25      Parity      off      Velo.clock 16.00 MHz
Screen       on       Odd par.   On       Direction  absolute
Status line  off      Send      CRLF    Hor.corr.  on
Logfile     off      Strip LF  on       Delay      0.0000 s
Name        Echo      on
Idle mode   off      Terminal  VT52
--- press any key to continue...
    
```

4.2.3 Test menu

To test the A/D-converter, sensors and various other parameters of the instrument, go to the main menu and select MENU 3.

```

3 - TEST MENU
-----
1.Selftest          2.Sensor test
3.A/D test          4.Zero x-ing
5.Probe test        6.Sample pins
7.Analyze           8.Blank test
9.Error buffer
>
    
```

Various test possibilities will be shown (some of the data obtained and displayed are difficult to understand and explain. They are mainly intended for use by qualified service engineers).

4.2.3.1 Self test

Selecting selftest will produce the following.

```

Place UCM-60 in a bucket of water and press any key to continue...

UCM-60 Self Test
A/D TEST - Reference Voltage Source (5000 mV ± 0.2%): 5002.47 mV PASSED
ZERO CROSSING TEST - Zero crossing (> 200mV or< -200mV): 214.00 mV PASSED
PROBE TEST -          X1    X2    Y1    Y2
# of X > 12   :      0     0     0     0
    
```

No sample should be greater than 12. If any of the samples are greater than 12 '***FAILED***' will appear at the end of the line.

```

# of X < -12 :      0     0     0     0
    
```

No sample should be less than 12. If any of the samples are less than -12 '***FAILED***' will appear at the end of the line.

```

Highest value :      5     8     6     5
Lowest value  :     -4    -3    -6    -6
    
```

Should be as low as possible.

```

Means of X    :  0.39  0.87  0.36 -0.11
    
```

Within ± 2.5 for acceptance

```

Std.deviation :  1.87  1.72  1.70  1.63 PASSED
    
```

Below 5 for acceptance.

```

IO PORT TEST PASSED.
    
```

Testing driveability of the 10 processor ports

```

WATCH TEST PASSED.
    
```

Testing watch status.

```

FLASH TEST -
Chip 0 Page Buffer test PASSED.
    
```

```
Chip 1 Page Buffer test PASSED.
```

Only 2 FLASH modules installed. 4Mbyte.

```
! #000 - FLASH module(test_buffer), chip 2 bit(s) stuck low, mask FC01h.
! #000 - FLASH module(test_buffer), chip 2 bit(s) failed, mask 03FEh.
! #000 - FLASH module(test_buffer), chip 3 bit(s) stuck low, mask FC01h.
! #000 - FLASH module(test_buffer), chip 3 bit(s) failed, mask 03FEh.
! #000 - FLASH module(test_buffer), chip 4 bit(s) stuck low, mask FC01h.
! #000 - FLASH module(test_buffer), chip 4 bit(s) failed, mask 03FEh.
! #000 - FLASH module(test_buffer), chip 5 bit(s) stuck low, mask FC01h.
! #000 - FLASH module(test_buffer), chip 5 bit(s) failed, mask 03FEh.
! #000 - FLASH module(test_buffer), chip 6 bit(s) stuck low, mask FC01h.
! #000 - FLASH module(test_buffer), chip 6 bit(s) failed, mask 03FEh.
! #000 - FLASH module(test_buffer), chip 7 bit(s) stuck low, mask FC01h.
! #000 - FLASH module(test_buffer), chip 7 bit(s) failed, mask 03FEh.
press any key to continue...
```

4.2.3.2 Sensor test

```
Place UCM-60 in a bucket of water and press any key to continue...
```

```

          X1      X2      Y1      Y2
Current   -2.32   1.19    0.49   -1.51 mm/s
Velocity 1498.46  -      -      -
```

```
Compass X   : 222.00
Compass Y   : 179.00
Compass Z   : -593.00
Temperature : 25.80 Deg.C
Pressure    : 1013.183 mBar
Conductivity: !NaN mS
X axis Tilt : 0.01 Deg.
Y axis Tilt : 0.02 Deg.
press any key to continue...
```

4.2.3.3 A/D test

```
A/D TEST - Reference Voltage Source (5000 mV ± 0.2%): 5001.04 mV
press any key to continue...
```

4.2.3.4 Zero x-ing

```
ZERO CROSSING TEST - Zero crossing (>200mV or < -200mV): 214.00 mV
press any key to continue...
```

4.2.3.5 Probe test menu

```
PROBE TEST MENU
-----
1.Display X1          2.Display X2
3.Display Y1          4.Display Y2
5.Run test
>
```

4.2.3.5.1 Display X1, X2, Y1 and Y2.

```
:
:
+
:
:=
:
:=
```

```

+====
:=====
:=====
:=====
:=====
-+-----
:=====
:=====
:==
:=
+
:
:
:
:
+
:
X1:
    
```

The above print-out is based on 1000 measurements. Each = represents nearest 10. The above is representative and acceptable and should be similar on X2, Y1 and Y2. Used to judge quality of each sound path.

4.2.3.5.2 Run test

```

Place UCM-60 in a bucket of water and press any key to continue...
PROBE TEST -      X1      X2      Y1      Y2
# of X > 12 :      0      0      0      0
# of X < -12 :      0      0      0      0
Highest value :      6      7      8      5
Lowest value  :     -6     -4     -6     -5
Means of X    :    0.46  0.66  0.44 -0.03
Std.deviation :    1.89  1.66  1.73  1.68
press any key to continue...
    
```

See under Selftest explanation to the above

4.2.3.6 Sample pins

```

Pins sampled, select Analyze to display,
press any key to continue...
    
```

4.2.3.7 Analyze (Sample pins print-out)

See below Analyze print-out after Sample pins test with a correct pattern for an operational unit without failures. Be aware that print-outs in Analyze are proprietary information mainly intended for service and fault finding purposes.

```

TILT_Xr: _____
TILT_Xf: _____
TILT_Yr: _____
TILT_Yf: _____
-VPP_EN: _____
CLD_STR: _____
-INT_AD: _____
TXP:  _____
RXP:  _____
RTC_INT: _____
CLR_RTC: _____
CLR_C.ST: _____
RY/BY#: _____
    
```

```

WP# :-----
RP# :-----
-STB :-----
A :-----
B :-----
C :-----
P1.1 :-----
P1.2 :-----
XOSEL :-----
6m/s :-----
  
```

4.2.3.8 Blank test

```

0 : .XXXXXXXXXXXXXXXXX.....
1 : .....
2 : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3 : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4 : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
5 : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
6 : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
7 : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
press any key to continue...
  
```

The Blank test shows used and unused FLASH memory space. In the above print-out 960 KB of 2 MB is used in module 0. In module 1, nothing is used. X would indicate used space representing 64 KB each. Xes in lines 2 through 7 here indicates that these memory modules are not installed. Each line represents 2 MB of memory space.

4.2.3.9 Error buffer

```

ERROR BUFFER FOR INSTRUMENT #000.
95/06/20 10:22:22 - SEQUEN module(sequencer), wait expired early.
95/06/20 10:28:52 - SEQUEN module(sequencer), CURR_NULL command time-out.
95/06/20 10:28:52 - SEQUEN module(sequencer), CURR_Y2 command time-out.
95/06/20 10:28:52 - SEQUEN module(sequencer), CURR_X1 command time-out.
95/06/20 10:28:52 - SEQUEN module(sequencer), TEMP command time-out.
95/06/20 10:28:52 - SEQUEN module(sequencer), PRESSURE command time-out.
95/06/20 10:28:52 - SEQUEN module(sequencer), COMPASS_X command time-out.
95/06/20 10:28:52 - SEQUEN module(sequencer), COMPASS_Y command time-out.
Reset buffer?
press any key to continue...
  
```

Entering <y> will clear the buffer.

The Error buffer has space for 200 error messages.

4.2.4 Programming menu

The Programming menu require a password to enter. The password is 'VIPS'.

To do the programming of time intervals do as follows, starting from MAIN MENU:

```

Password: *****
  
```

For security reasons the password will be hidden as it is entered. The terminal responds:

```

4 - PROGRAM MENU
-----
1.Time intervals          2.Configuration
3.Calibration
>
  
```

4.2.4.1 Timing menu

The timing menu provides access to the various parameters.

4.1 - TIMING MENU

```
-----
1.Start time           2.Start interval
3.Stop time           4.Observations
5.Integrations        6.Sample period
>
```

Note!
You may use the pre-set default values and only set the starting time.

The default values from factory are:

Start time:	00 00:00:00	DD HH MM SS
Start interval:	00 00:00:00	DD HH MM SS
Observations:	100	Number of observations
Integrations:	10	Number of integrations
Sample period:	50ms	Sample period in milliseconds

4.2.4.1.1 Start time

Selecting this menu item produce the response:

```
Start time, DD HH MM SS (22 9 15 50)?
```

Where:

DD	Day of month
HH	Hour of day
MM	Minute
SS	Second

The current starting time is 22nd 9:15:50.

4.2.4.1.2 Start interval

Selecting this menu item produce the response:

```
Start interval, DD HH MM SS ( 0 0 01 00)? ↵
```

Where:

DD	Days
HH	Hours
MM	Minutes

SS Seconds

The range is 4⁴ seconds to 30 days.

The start interval will at every new start-up be added to the old 'starting time' immediately after power on

4.2.4.1.3 Stop time

Selecting this menu item produce the response:

```
Stop time No day No Month 1st. 1900 0:10:255, week #111
Enter new stop time YY MM DD HH MM SS WD WN:
```

Where:

YY Year
MM Month of year
DD Day of month
HH Hour of day
MM Minute of hour
SS Second of minute
WD Day number of week
WN Week number of year

No day No Month etc. tells that valid data has not been entered.

4.2.4.1.4 Observations

Selecting this menu item produce the response:

```
Number of observations (60)?
```

The observation period can be chosen between 1 second and 30 days. If the observation period exceeds the start interval, the ucm-60 will perform continuous monitoring.

4.2.4.1.5 Integrations

```
Number of integrations (4)?
```

Setting depending on users requirement.

4.2.4.1.6 Sample period

```
Sample period in milliseconds (50)?
```

The sampling period range is 50 ms to 9999 ms. Default is 50ms.

4 UCM-60 with PWR ON/OFF-function: The power on/off function takes approx.. 3 seconds on 9600 baud. (Make sure that the start interval is at least 3 seconds longer than the observation period.) Start-up intervals < 1 min. will require battery back-up replacement more often than every five years. A UCM-60 without the PWR ON/OFF-function should be used for start intervals < 10 seconds.

4.2.4.2 Configuration menu

In this menu the user can set up the instrument configuration the way he/she wants. The details explained in the following.

```

4.2 - CONFIG. MENU
-----
1.Current range          2.Address
3.Output choice         4.Page length
5.Correct direction     6.Communication
7.Delay                8.Hor.correction
9.Idle mode
>
    
```

4.2.4.2.1 Current range

```
Current range, 3 or 6 (3 m/s)?
```

Current range is user selectable, options are 3m/s or 6m/s. The 6m/s range has half the resolution of the 3m/s range. 3m/s is default.

4.2.4.2.2 Address

```
Instrument address (000)?
```

Instrument address can be set from 000 to 255. Used in a multiple instrument on a single serial line configuration.

4.2.4.2.3 Output choice

```

4.2.3 - OUTPUT MENU
-----
1.Current                on
2.Vertical current      on
3.Sound velocity        on
4.Temperature           on
5.Pressure              off
6.Depth                 on
7.Conductivity          off
8.Salinity              off
9.Density               off
A.Compass and tilt     on
B.Screen                on
C.Status                on
>1
Output current y/n (Yes)?
    
```

- Item 1-A Determines which parameters to display and log.
- Item B Screen will switch on/off RS232 port in instrument. In "off" This means the user will not be able to display data from instrument if on-line but commands from terminal will be displayed and recognized by the instrument. When instruments used for long time deployment powered by battery, it is an advantage to set to "off" as this will save somewhat on battery consumption.
- Item C Status will switch on/off a status line on the display showing as seen from left side of screen "Time of next alarm with day of month and time, |X| logging of data, number of error messages in error buffer, Depth, Heading, Tilt x and y,

complete current date and time

4.2.4.2.4 Page length

```
Page length (0)? 25
```

Number of data lines between heading line. Numbers up to 255 are accepted. 0 will give no heading line. Default is 25.

4.2.4.2.5 Correct direction

```
Correct for compass and tilt y/n (Yes)?
```

"y" will output current absolute referred to North and "n" will output relative to instrument.

4.2.4.2.6 Communication menu

```
4.2.6 - COMMUNICATION MENU
-----
1.Baud rate           2.Parity
3.Odd parity         4.Echo
5.Send LF            6.Send CR
7.Strip LF           8.Terminal mode
>
```

4.2.4.2.6.1 Baud rate

```
Baud rate (19200.00)?
```

```
Set baud rate at terminal within 20s and wait...
If you can read this you may press Y within 5s to keep new setting.
Keep?
```

Ensure that baud rates in instrument and in terminal program of users PC are the same.

4.2.4.2.6.2 Parity

```
Set parity y/n (No)? n
```

4.2.4.2.6.3 Odd parity

```
Set odd parity y/n (Yes)? y
```

4.2.4.2.6.4 Echo

```
Set echo y/n (Yes)? y
```

4.2.4.2.6.5 Send LF

```
Set send LF y/n (Yes)? y
```

4.2.4.2.6.6 Send CR

```
Set send CR y/n (Yes)? y
```

4.2.4.2.6.7 Strip LF

```
Set strip incoming LF y/n (Yes)? y
```

4.2.4.2.6.8 Terminal mode

```
Terminal mode (VT52)?
```

Available VT52, VT100, VT300. Have to be entered with capital letters

4.2.4.2.7 Delay

```
Delay (0 s)?
```

The delay is intended used when more than one unit are synchronized from a host computer and transmitting data on a common line. In combination with address setting, this function will, if used correctly, prevent transmission from several units simultaneously.

4.2.4.2.8 Hor.correction

Set horizontal correction y/n (Yes)? Y

A calculation/correction related to the influence of a tilted housing on current measurement. Should be set to "y" on all instrument models other than UCM-60H.

4.2.4.2.9 Idle mode

Set idle mode y/n (No)? n

A function related to saving of power in battery operation. Not implemented at time of writing manual and in most cases not visible on menu before implementation. If inadvertently set to "y" will cause problems for user.

4.2.4.3 Calibration Menu

Note!
The instrument is calibrated before it leave the factory and it should not be necessary to perform this part of the menu unless you suspect something has changed e.g. new software installed, ageing of sensors, change of back-up batteries, suspected damage to probes, etc.

The Calibration menu require a password to enter. The password is '*IRON*'.

Password: ****

For security reasons the password will be hidden as it is entered.

```
4.3 - CALIBRATION MENU
-----
1.Auto calibrate          2.Current
3.Temperature            4.Deviation
5.Depth                  6.Conductivity
7.Pressure                8.Tilt
9.Velocity
>
```

On some of the parameters it is possible to increase the performance if precise references are available .e.g. on temperature.

4.2.4.3.1 Auto calibrate menu

```
4.3.1 - AUTO CALIBRATION MENU
-----
1.Current                2.Conductivity
3.Pressure              4.Depth
5.Tilt adjustment
>
```

4.2.4.3.1.1 Current

Overall gain (1.00)?

Should only be changed if a special scaling of the current output is required.

Important!
It is vitally important that the bucket contains absolutely stagnant water, and that the water temperature and the surrounding air temperature are equal. It is also important to remove all air bubbles that may appear around the transducer probes.

Place UCM-60 in a bucket of water and press any key to continue...

Reference sound velocity calculated (v=1492.87)

Reference sound velocity is calculated from the assumption that the instrument is in fresh water with the measured temperature.

If temperature sensor is not mounted, take care that over range is obtained by shortening P12 pin 1/2 and P12 pin 3/4 on power & analogue PCB. (NB! Do not shorten 1/2 with 3/4) This will ensure that reference sound velocity will be measured and not calculated.

ITEM	OFFSET	GAIN	ITEM	OFFSET	GAIN
Current X1	-4.02	0.9840	Velocity X1	0.00	1.2195
Current X2	9.65	0.9862	Velocity X2	0.00	1.2167
Current Y1	-20.77	0.9885	Velocity Y1	0.00	1.2139
Current Y2	-3.40	0.9878	Velocity Y2	0.00	1.2148

press any key to continue...

- | | | |
|----------|--------|--|
| Current | Item | name of the actual acoustic path |
| | Offset | the difference on measured analogue levels compared to a measurement with shortened input, these values are used for auto zeroing of the current |
| | Gain | (overall gain) x (sound velocity.gain/1.20) Scaling of each path based on path length |
| Velocity | Item | name of the actual acoustic path. |
| | Offset | Programmable under menu 4.3- 9 (velocity) Can be used to calibrate the velocity counter. |
| | Gain | path length for each acoustic path based on measurements of the acoustic travel time for each path. |

Note!
Always check that the Reference sound velocity is correct, this is vitally important for the calculation of current and velocity gain.

4.2.4.3.1.2 Conductivity

Note!
To perform this operation, sensor should be in air and be completely dry.

Have on hand the Aanderaa Instrument Resistor Set 2653, supplied with the instrument fitted with conductivity sensor. Also have the calibration sheet with conductivity sensor data on hand.

Conductivity form factor (2.8500)?

The form factor can be found in the calibration sheet. Next follow instructions:

Insert 100 ohm resistor (Set 2653) and press any key to continue...
 Insert 1000 ohm resistor (Set 2653) and press any key to continue...

Gain and offset values are calculated during above operation.

ITEM	OFFSET	GAIN
Conductivity	-9.99	0.0282,

press any key to continue...

4.2.4.3.1.3 Pressure

Pressure sensor range (5.0000 Bar)?
 Actual pressure (1013.2500 mBar)?

ITEM	OFFSET	GAIN
Pressure	-447.11	0.0020,

press any key to continue...

Offset Reading of analogue value at actual pressure, used to obtain correct pressure offset.

Gain Scaling of output based on sensor range.

4.2.4.3.1.4 Depth

Calculating offset, assuming currently at sea-level...

ITEM	OFFSET	GAIN
Depth	1.0132	99.2600,

press any key to continue...

Offset Current pressure reading, used for zeroing the depth.

Gain Also called depth factor programmable under menu 4.3 - 5 (depth). this value is related to the mean density of the expected water column.

4.2.4.3.1.5 Tilt adjustment

Be sure the UCM-60 is as close to vertical as possible before this operation. The UCM-60 software performs an automatic tilt adjustment.

Place the instrument in a vertical position and press any key to continue...

ITEM	OFFSET	GAIN
Tilt X	1093.45	0.1000
Tilt Y	1020.13	0.1000,

press any key to continue...

Item Name of tilt axis

Offset Reading in vertical position, used for zeroing of tilt

Gain Scaling of tilt sensor, can be adjusted under menu 4.3 - 8 (tilt)

4.2.4.3.2 Current

X1 path offset (-4.02)?
 ...and gain (0.984017)?
 X2 path offset (9.65)?
 ...and gain (0.986281)?
 Y1 path offset (-20.77)?
 ...and gain (0.988555)?

```
Y2 path offset (-3.40)?
...and gain (0.987796)?
```

Here it is possible to manually insert gain and offset values.

4.2.4.3.3 Temperature

Temperature gain and offset are set for standard range and should for normal operation not be changed.

```
Correction for -5 Deg.C (0.000000)?
Correction for  0 Deg.C(0.000000)?
Correction for  5 Deg.C (0.000000)?
Correction for 10 Deg.C (0.000000)?
Correction for 15 Deg.C (0.000000)?
Correction for 20 Deg.C (0.020000)?
Correction for 25 Deg.C (0.040000)?
Correction for 30 Deg.C (0.080000)?
Correction for 35 Deg.C (0.120000)?
Temperatur gain (0.0100)?
Temperatur offset (-1500.0000)?
```

Correction for.. Values as per correction table in Certificate of Conformity. The instrument interpolates readings between each 5 Deg.

Temperature gain Gain is 0.01 as standard

Temperature offset Offset is -1500 as standard

4.2.4.3.4 Deviation

```
Deviation (0.00)?
```

Deviation is the difference between magnetic and geological North in degrees.

4.2.4.3.5 Depth

```
Depth factor (99.2600)?
Depth offset (1.0132)?
```

Depth factor $10.197 / \text{density [m/bar]} = 9.926$ where 10.197 is the inverse of gravity(9.80665m/s^2) Density is the mean value for the expected water column. Density in example is 1.0273 (mean density in the North sea). Density for standard sea water is 1.0281 (0 deg. and 35‰ salinity). To obtain dm resolution multiply depth factor by 10.

Depth offset pressure at the site where depth is zeroing.

4.2.4.3.6 Conductivity

```
Conductivity gain (0.028240)?
Conductivity offset (-9.985182)?
```

4.2.4.3.7 Pressure

```
Pressure gain (0.0020)?
```

Press Esc. or ↵ to keep or insert new values.

```
Pressure offset (-447.1084)?
```

4.2.4.3.8 Tilt

```
X axis tilt offset(1093.45)?
```

```

    ..and gain (0.10)?
Y axis tilt offset(1020.13)?
    ..and gain (0.10)?
    
```

Press Esc. or ↵ to keep or insert new values.

4.2.4.3.9 Velocity

```

Velocity offset (0.000000)?
X1 path length (1.219491)?
Velocity clock (15999999.05)?
    
```

velocity offset value to adjust velocity counter, normally 0.0

X1 path length also called velocity gain, normally under auto calibration of current.

Velocity clock frequency, normally 16MHz. Optional with a separate velocity clock to increase the resolution for this parameter

4.2.5 File menu (Log)

The logger can be used much in the same way files are handled in a regular PC. Files can be created, given names (23 characters), be appended to, be retrieved and played back. and erased. The standard logger has capacity for 4 MB. This can be extended to 16 MB in 2 MB steps if required. To get to the logging menu (File menu), type 5 when in Main Menu:

```

5 - FILE MENU
-----
1.Open                2.Append
3.Close              4.Erase
5.Up-load            6.List
>
    
```

4.2.5.1 Open

```
File to create?
```

An up to 23 character name, all keyboard characters, can be given. Be aware that this is case sensitive.

```
! #000 - FLASH module(open), invalid file name. press any key to
continue...
```

This error message indicates that user has pressed enter without giving a file name.

4.2.5.2 Append

This feature is used for appending data to a previously created file.

```
File to append to?
! #000 - FLASH module(append), file dose not exist.
press any key to continue...
```

This error message indicates that user has pressed enter without giving a file name.

4.2.5.3 Close

If no file was open:

```
Logfile not active, press any key to continue...
```

If a file was open:

```
File closed, press any key to continue...
```

4.2.5.4 Erase

```
File to erase?
Are you sure y/n (No)?
press any key to continue...
```

First enter a file name to erase a file or * to erase all files in directory. Next a prompt will require confirmation of the operation. Input <y> or <n>.

4.2.5.5 Up-load

Used to transfer data from instrument to PC.

```
File to up-load?
```

Entering a valid file name will start up-loading that file to the PC.

An invalid filename will result in an error:

```
! #000 - FLASH module(upload), file dose not exist.
press any key to continue...
```

4.2.5.6 List

The list feature will provide a listing of all files in the directory of the instrument data logger.

```
#000 Directory:
File Name           Status      File Size      Date           Time
test1                948 KBytes   94.09.01       02:52:01
1 file in directory, 49 Blocks / 3136 KBytes free.
press any key to continue...
```

Where #000 is the instrument address.

If a file is open, it will be indicated as active in the status column.

4.2.6 MENU EXIT

The MENU EXIT command (menu 6 in the main menu) provides exit from the programming menus. The UCM 60 will now turn off and a logging sequence will start at the last set starting time. The UCM 60 will then operate as programmed.

```
End operator mode.
```

ID	Date	Time	E	Hor	Dir	Vert	Sound	Temp	Dept	Comp	Tilt	XY
00	950622	095608	0	4	8	1	1497	2531	1	319	0	0
00	950622	095609	0	1	45	0	1497	2531	0	319	0	0

5 Command line mode

5.1 General

5.1.1 Special characters

- # Character is the instrument address prefix. The character is always followed by a three digit number representing the instrument address.
- ! Character is the error message prefix.
- > Is the command line prompt.
- \$ Will replace digits of numbers that have become too large to be displayed (i.e. if calibration data is bad).

5.1.2 Prompt

The command line mode prompt is '>', however it is always preceded by the instrument address.

Ex.: If the instrument address is configured to be 12, this would be the prompt.

```
#012>
```

Obviously the prompt will pop up after each command executed, thus, it may serve as a command terminator.

5.1.3 Error Messages.

Error messages always start with an error message prefix followed by the instrument address, then the name of the software module follows in capital letters and the function name enclosed by parenthesis and finally the message itself.

The software module name and function name, though it might be meaningful to the user, is primarily intended for Sensortec internal use. Likewise the message itself might not make any sense unless proprietary information is available, this is also intended for NE Sensortec internal use only.

Ex.: If you try to open an existing file an error will occur in the open function in the flash module:

```
#012>OPEN MYLOGFILE
! #012 - FLASH module(open), file name exist.
#012>
```

Some error messages are self explanatory, like the one given above, a few where the meaning is not obvious but still would make sense to know about, are explained below.

```
! #012 - SEQUEN module(sequencer), xxxxx command time-out.
```

The sequencer function is the Sequence Description Language (SDL) interpreter. A SDL program defines the measurement sequence and this function executes the SDL program commands. The measurement commands are all executed in the following fashion: When the command is encountered the measurement is set up and set off, since measurements take a while the processor goes off to attend to other tasks. When the measurement is finished it should interrupt the processor. If this does not happen within a given time frame the error above

is generated. The most common reason for this error is that something is obstructing the current measurement path. The 'xxxxx' represents any measurement command.

```
! #012 - SEQUEN module(sequencer), wait expired early.
```

In a SDL program there might be the command pair:

```
START 50
:
:
WAIT
```

START will load its parameter into a timer and start the timer. When the WAIT command is reached the SDL program will stall execution until the timer expires. In-between the command pair normally all the measurements are done. If measurements take too long, for instance due to time-outs, or if the START parameter is too low, and the timer expires before the WAIT command is reached this message is generated. If standard or opti program is used the START parameter corresponds to the sample time setting.

5.1.4 Floating point errors.

A special class of errors are the ones generated by the floating point module. This will not produce error messages as described above but will show up instead of the offending number. The possibilities are as follows.

- !INF Infinity (divide by zero).
- !NaN Not a Number - usually because it has not been initialized.
- !DNO Denormal number.

5.2 Watch

Watch command is used to set the Real Time Watch. The Real Time Watch will keep the current time and date as well as start time. The start time is the alarm setting for the built in alarm function.

The start time will auto-update on each alarm, reinitializing to start time + start interval. If start interval is zero the alarm function will be disabled. The alarm function will also be disabled if stop time has expired.

COMMANDS			COMMENT	
Watch (wt) ▼	Start (st)	<date><hour><minute><second>		Real Time Watch alarm setting. The alarm will start an observation period.
	Stop (op) ▼	Time (tm)	<hour><minute><second>	The stop time and date is compared to the current time, when surpassed the start time will not be reinitialized and the alarm function will be disabled.
		Date (dt)	<year><month><date><day><week>	
	Interval (in)	<day><hour><minute><second>		The interval is the time with which start time will be incremented.
	Time (tm)	<hour><minute><second>		Time and date is the current time setting.
	Date (dt)	<year><month><date><day><week>		

Ex.: In this example the current time and date is set Monday December 7th week 49 15:42:00. The instrument is configured to start an observation period the next day, on the 8th at 18:00:00 hours, and then do an observation period every 2 hour.

```
#012>watch time 15 42 0
#012>watch date 94 12 7 1 49
#012>watch start 8 18 0 0
#012>watch interval 0 2 0 0
#012>
```

5.3 Sequence

This command controls the metrics of an observation period. There are two alternative settings, standard and opti, that can be toggled easily.

COMMANDS		COMMENT	
sequence (sq) ▼	standard (st)	<integrations> <observations> >	Standard mode integration and observation setting.
	opti (op)	<integrations> <observations> >	Opti mode integration and observation setting.
	sample (sa)	<period>	The sample period setting.
	mode (md)	standard opti (st op)	Selects standard or opti mode.
	debug	on off	If on the sequencer will print SDL commands as they are executed. Exercise caution using this option since it may cause errors or even software hang if too many samples are run.

5.4 Calibrate

The calibrate command allow the user to set gain and offset values either automatically or manually. Automatic calibration require that certain parameters are known, therefor none of the automatic options should be selected unless the instrument is accessible.

Calibrating conductivity automatically require a special calibration resistors (resistor set 2653) that the user will be prompted to insert. Calibrating current automatically require a bucket of still fresh water. Calibrating tilt automatically require that the instrument is leveled.

Calibrating pressure automatically require that the instrument is at sea level.

COMMANDS			COMMENT	
Calibrate (cl) ▼	auto (au) ▼	conductivity (cd)	<form factor>	
		current (cr)	<gain> ⁵	Nominal gain is 1.
		tilt (tl)	-	
		pressure (pr)	<range> <air pressure>	
		depth (dp)	<density>	
	x1	<offset> <gain>		
	x2	<offset> <gain>		
	y1	<offset> <gain>		
	y2	<offset> <gain>		
	conductivity (cd)	<offset> <gain>		
	temperature (tp)	<offset> <gain>		
	tempcurve (tc)	<offset 1>,<offset 2>... ..<offset 10>		
	velocity (vl)	<offset><gain><vel.clock>		
	pressure (pr)	<offset> <gain>		
	depth (dp)	<offset> <gain>	Gain = Density	
	tiltx (tx)	<offset> <gain>		
	tilty (ty)	<offset> <gain>		
	ad1	<offset> <gain>	Not implemented.	
	ad2	<offset> <gain>	Not implemented.	
	ad3	<offset> <gain>	Not implemented.	
ad4	<offset> <gain>	Not implemented.		

⁵ A temperature measurement makes up the bases for the calculation of the true sound velocity. The Sound velocity in turn is used for current gain calibration of each path individually. If temperature is off rang, i.e. temperature sensor not equipped, the operator will be prompted for the water temperature. If none are supplied, the X1 path will serve as a reference for the other paths.

	deviation (dv)	<offset>	
--	---------------------------	----------	--

5.5 Output.

The output command allow the user to select the parameter that will be printed to screen and/or saved to flash memory.

Output current command also controls whether current output is related to the instrument or to geological directions, and it controls the range (high = 6m/s and low = 3m/s).

COMMANDS		COMMENT	
Output (ou) ▼	current (cu)	on off relative(re) absolute(ab) high(6) low(3)	
	vertical (vh)	on off	
	velocity (vl)	on off	
	temperature(tp)	on off	
	pressure (pr)	on off	
	depth (dp)	on off	
	conductivity(cd)	on off	
	salinity (sa)	on off	
	density (de)	on off	
	tilt (tl)	on off	
	ad1	on off	Not implemented.
	ad2	on off	
	ad3	on off	
	ad4	on off	
	screen (sc)	on off	This control whether parameters are printed to the screen at all.
status (st)	on off	Output status turns on or off the status line that may be printed to the screen between measurements.	

The status line is printed a couple of times per second on average. It is preceded by a prologue and followed by an epilogue. The actual prologue and epilogue depends on the terminal mode selected.

Mode	VT52	VT100	VT300	None
prologue		ESC[24;1f ESC[7m	CSI1\$} CSI7m	@
epilogue		ESC[0m ESC[1;23r ESC8	CSI0\$} CSI0m	%

5.6 Set.

The set command gathers the remaining miscellaneous setup parameters. Some of these parameters are remains from the development process and are left for future NE Sensortec internal use. Changing this might result in problems.

COMMANDS		COMMENT
Set ▼	baud (bd)	<baud rate> Baud rate can be set to any value, however, with higher values the resulting baud rate will differ from that selected.
	send (sn)	cr lf crlf This will determine what will be sent as the line terminator.
	strip (tr)	on off If your terminal or terminal emulator insists on sending both CR and LF when you press enter you should set this option to strip the LF character.
	idle(id)	on off DO NOT USE THIS OPTION
	hcorr (hc)	on off Normally set to on. Set to off on model UCM-60H.
	terminal (te)	0 1 2 3 Terminal mode determines the type of control code used. Available modes are: 0 – NONE 1 - VT52 2 - VT100 3 - VT300
	clock (cl)	<frequency> System clock (CPU clock). Changing this will cause problems with baud rate calculations.
	pagelength (pl)	<pagelength> Page length defines the number of lines (observations) printed between each heading. Setting it to zero will make the heading go away.
	address (ad)	<address> Instrument address.
	delay (dl)	<delay> Delay, in ms, from a SYN character is received till the measurement is started. Works only in standby mode.

5.7 Measure.

This command includes a number of ways to start a measurement.

COMMANDS		COMMENT
measure (ms) ▼	sample(sp)	Make a single sample.
	single (si)	Make a single observation.
	multi (mu)	Run an observation period.

5.8 Logfile commands.

This set of commands is all related to the logger, except the upload command, which also allows uploading of some other data.

COMMANDS		COMMENT
open (op)	<filename> ⁶	Open a new file.
append (ap)	<filename>	Append to an existing file.
close	-	Close the open file, if any.
list (ls)	-	List all files in memory.
erase (er)	<filename>	Erase a selected file, or * will erase all files.
Upload ▼	<filename>	Upload selected file.
	program	Upload the sequencer program currently in memory. The last measurement run will decide what is in memory.
	setup	Upload all the CMOS RAM based setup data.
	timing	Upload the timing portion of the CMOS RAM based setup data.
	offset	Upload the offset portion of the CMOS RAM based setup data.
	config	Upload the config portion of the CMOS RAM based setup data.
	display	Upload a graphic display of the sampled processor I/O pins. The actual sampling takes place during self-test (in command line mode).
	error	Upload hidden error messages. Up to 200 messages may be buffered. If buffer gets full, newer messages will be discarded.
statistics	Statistics are gathered during the last measurement. Most important part is the buffer utilization value, if this approaches 100% the stream of observations will contain time lapses.	

Ex.: If we start with an empty flash (the * will erase all files) open a file and list. Since nothing has been logged yet the date and time is not saved and cannot be displayed.

```
#012>ERASE *
#012>OPEN MyLogFile
#012>LIST
Directory of instrument #012
File Name Status File Size Date Time
```

⁶ Filename is maximum 23 character string.

```
MyLogFile Active 12 Bytes $$.$$.$$ $$:$$:$$
1 file in directory.
#012>
```

..now lets imagine we have made a bunch of samples..

```
#012>LIST
Directory of instrument #012
  File Name Status File Size Date Time
MyLogFile Active 135 KBytes 94.12.17 15:44:59
1 file in directory.
#012>UPLOAD MyLogFile
ID Date Time E Hor Dir Vert Sound Temp Dept Cond Salin Densi Com Tilt
XY
00 941217 154459 0 83 273 84 1480 1445 10 2821 32123 101654 312 1
-1
00 941217 154459 0 84 275 86 1480 1446 10 2812 32143 101651 312 1
-1
00 941217 154500 0 83 274 85 1480 1447 11 2823 32125 101656 312 1
-1
:
:
00 941218 222723 0 245 88 134 1480 1323 10 2812 32143 101687 345 -2
0
#012>CLOSE
#012>OPEN MyLogFile2
Directory of instrument #012
  File Name Status File Size Date Time
MyLogFile 135 KBytes 94.12.17 15:44:59
MyLogFile2 Active 12 Bytes $$.$$.$$ $$:$$:$$
2 files in directory.
#012>
```

5.9 Miscellaneous.

This is all the other stuff that I didn't know where to stick.

COMMANDS		COMMENT
dump (dp)	<page><from><length>	Dump a portion of flash to screen. Requires proprietary knowledge of flash content. Intended for diagnostic use only.
selftest (st)	-	Selftest is partly the same as wake-up test except it generates more output. Also, all the flash positions are tested even those not equipped.
exit (ex)	-	Exit command line mode and powers off if not in standby mode.

6 Installation and maintenance

The UCM-60 / UCM-60DL Ultrasonic Current Meter is shipped in one reusable transport case. The standard delivery consists of:

- UCM-60 Ultrasonic Current Meter
- Instruction manual
- Certificate of Conformity UCM-60 / UCM-60DL
- Set of Zinc anodes
- UCM-60 Test cable
- Dummy plug (UCM-60DL)

The current meter is normally not supplied with any arrangement for attachment or deployment, which therefore must be designed according to individual requirements or the NE Sensortec standard frame can be ordered as an option.

Cable, as regards cable length, must be ordered separately.

Prior to deploying the current meter, check the unit for possible shipping damage. This applies specially to the lower part of the UCM-60, carrying the probes and the sensors.

Before deployment of the current meter, check the points listed below:

- Programming performed.
- Zinc anodes mounted on bottom of instrument.
- O-ring installed on top and bottom flanges. Clean and grease O-ring groove when current meter is assembled. Use silicone compound MS4 or equivalent. Replace O-rings if damaged.

Warning!
Do not use without zinc anodes.

Use silicone spray when assembling the top end plug.

Screws (bottom flange) securely fastened.

If anti-fouling compound is used, take care to avoid sensors and ceramic discs.

Use of mounting frame is strongly recommended to avoid damage to instrument container and sensors.

6.1 Change of battery pack in UCM-60DL.

- The battery pack is built from 8 standard alkaline batteries, serial connected with a voltage of ≥ 12 VDC. Type: Fuji 7100 LR20, D-size, Alkaline (1.5V)
- O-ring is 82,14 - 3,53 NBR 70 shore A, (i.e. Freudenberg). Silicon grease is Dow Corning MS4 or similar.
- Screws are M3x16 A4 quality.

6.1.1 Procedure

- Loosen the four M3x16 screws and remove the upper flange, use two M4x20 screws to loosen the flange (switch between the screws with approx. 2 turns each time)
- Disconnect the 10 pin plug by separating the two parts.
- Disconnect the battery leaders by pressing a small screwdriver into the rectangular hole beside the leaders.
- Connect a new battery pack Inspect the O-ring , if necessary clean and apply silicon grease. Press on the flange and tighten the four M3x16 screws.(NB! make sure that the M4x20 screws are not building between the flange and housing).
- Connect the instrument to a terminal and check that the system is working. To save power during programming an external power supply with $\geq 14\text{VDC}$ will save the internal battery pack.
- Remember to use the dummy plug when using the instrument as a stand alone system (To avoid electrolytic effects on the plug.).

7 Technical description

7.1 General

The block diagrams in figures 5.2 and 5.3 show the UCM-60 hardware structure and the analogue/digital signal processing.

7.2 UCM-60 hardware

The UCM-60 contains the following printed circuit boards:

- Power and Analogue Board
- RS232 Driver PC
- Current Motherboard and Processor PC
- Time Relay
- Control PC
- Tilt Interface
- Integrator PC
- FMAD Hybrid (2 ea.)
- Compass Interface PCB
- Memory PCB

The supply voltage required to operate the UCM-60 is 12 - 28 VDC and be able to supply 0,4 Amp.

7.3 Housing

The current meter electronics is housed in a watertight stainless steel housing and is designed to withstand pressure at depths up to 6000 meters (standard 2000m).

The printed circuit boards are plug connected and are accessible when removing the bottom flange and the container cylinder.

7.4 Transducer probes

The acoustic transducers are discs of piezoelectric material (lead zirconate titanate) resonant at 4 MHz. They are glued to the inside of the transducer probes by means of epoxy resin. Electrical connection to the measuring circuits is made with a twisted pair cable through the centre of the leg.

7.5 Removal of power on/off function

To switch of POWER ON/OFF function, P15 pin 1 and pin 2 on Power Analogue board must be shorted. P15 is located under the square RS232 PCB. Pins 1 and 2 are the uppermost on the vertical pin row (see drawing below).

Note!
The consequence of this operation is that UCM-60 will always be ON when power is applied.

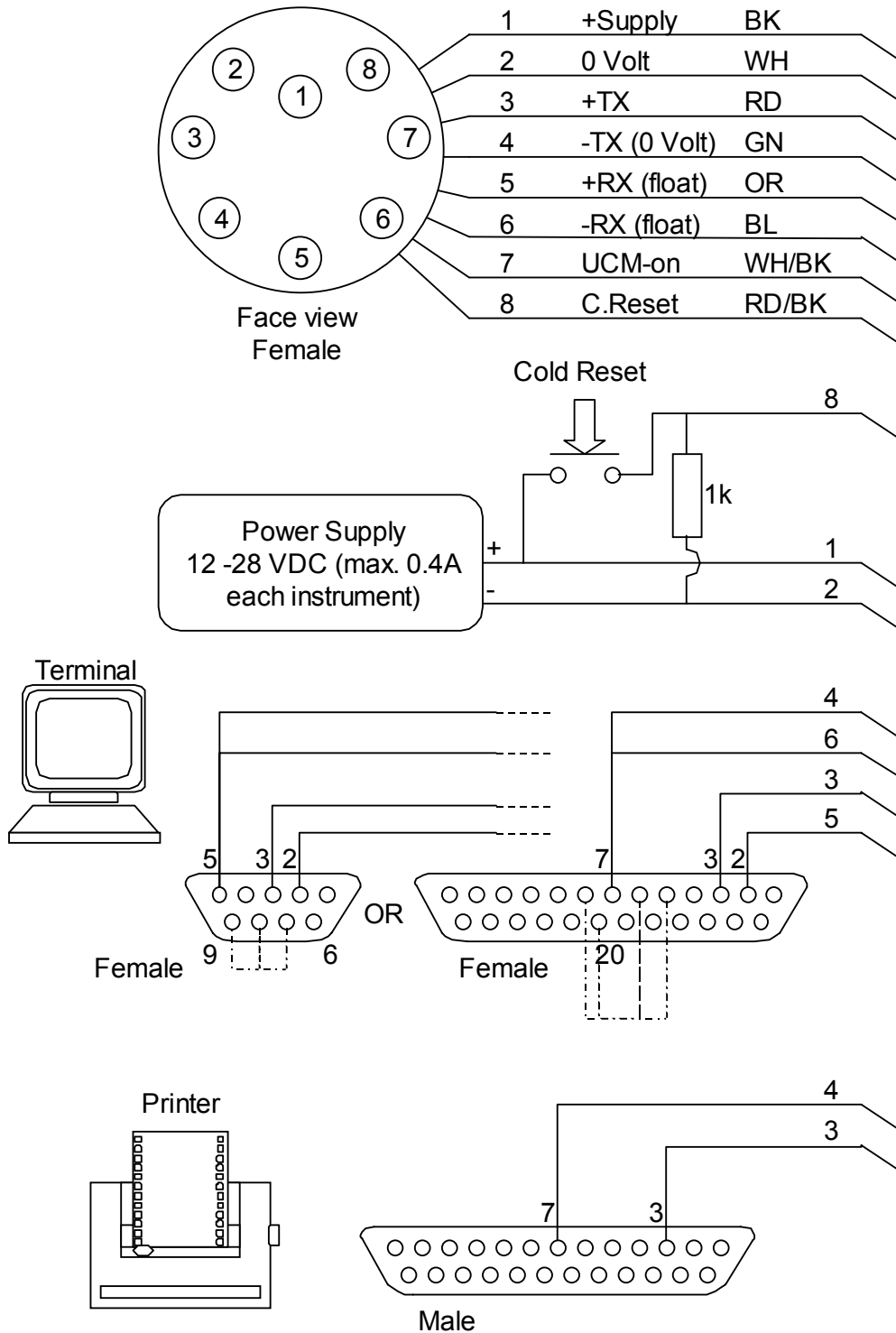


Figure 6. Interconnection of UCM-60 to external devices.



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