



Monitoring Earth's Water Resources Since 1911

MSO SERIAL COMMANDS

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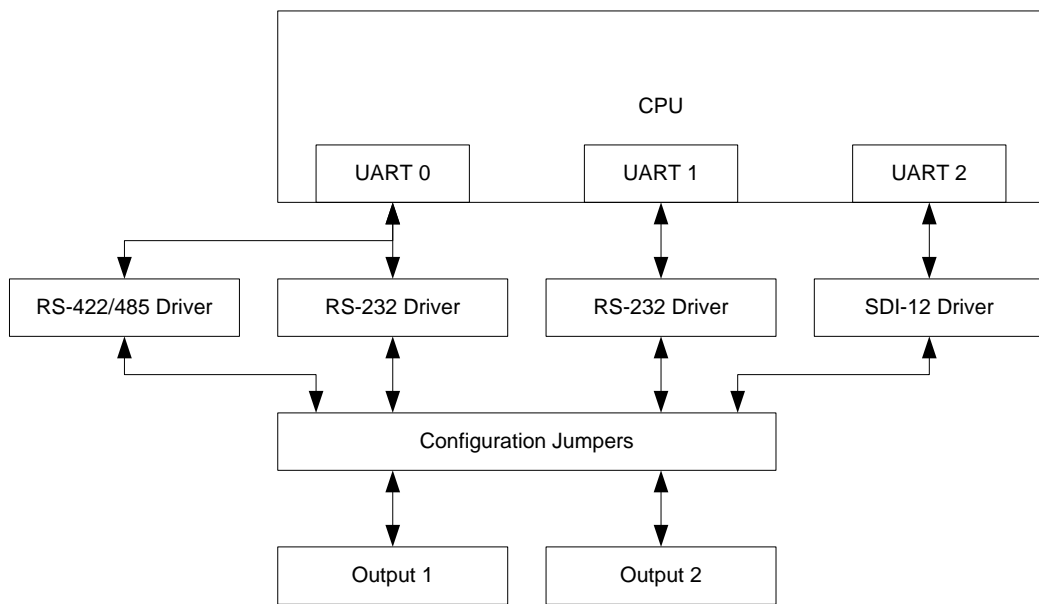
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1. Overview

A serial interface is the primary method for exchanging data with the MSO sensor. The serial interface has a set of commands for configuration and retrieving measurement data.

1.1. Serial Interface

The hardware supports three (3) UART type serial ports. UART 0 can be configured as RS-232, RS-422 and RS-485. UART 1 is always configured as RS-232. UART 2 is always configured as SDI-12.



Output 1 and 2 are determined by the configuration jumpers. The output configuration combinations are shown in the table below.

Output 1	Output 2
RS-232 : UART 0	RS-232 : UART 1
RS-422 Tx :UART 0	RS-422 Rx : UART 0
RS-485 : UART 0	RS-232 : UART 1
RS-485 : UART 0	SDI-12 : UART 2
RS-232 : UART 0	SDI-12 : UART 2
SDI-12 : UART 2	RS-232 : UART 1

1.2. Measurement Output

The MAIO will report data either at a rate of once-a-second or polled with a trigger string. Use the `OI1` command to set the output rate to once-a-second. Use the `OIO` command to set the output to polled mode. Use the `ST` command to set the trigger string. Then poll the unit by sending the trigger string.

The MAIO will only support one output format. This format will use fixed length fields but also include commas to accommodate either CSV import of the data or legacy programs which expect fixed length fields.

The parameter order is shown in the table below.

Field	Parameter	Format	
01	Wind Speed (m/s or mph)	999.9	
02	Wind Direction (Deg)	999	
03	Ambient Temperature (C or F)	+999.9	
04	Relative Humidity (%)	999	
		mbar	inHg
05	Barometric Pressure	9999.9	099.99
		mm	in
06	Rain	999.99	099.99
07	Reserved – Solar (W/m ²)	9999	
08	Battery Voltage (V)	99.99	

An example is shown below with pressure units set to mbar and rain set to mm.

```
1234567890123456789012345678901234567890123456789012345678901234567890
999.9, 999, +999.9, 999, 9999.9, 999.99, 9999, 99.99, *9999<CR><LF>
```

An example is shown below with pressure units set to inHg and rain set to inches.

```
999.9, 999, +999.9, 999, 999.99, 999.99, 9999, 99.99, *9999<CR><LF>
```

Note: when displaying the pressure in inHg, there will be an extra leading zero character but the fixed length of the field will not change.

A check sum parameter will be added to the end of the message (*9999).

The check sum is the addition of all the characters from the start of the message through the first character preceding the asterisk (*). The check sum is expressed as a decimal number. This is a 16 bit sum and should not overflow past 4 digits given the number of characters in the output string.

2. Terminal Commands

Terminal mode is activated by entering three carriage return characters within a 2 second period. Terminal mode times-out after 2 minutes of inactivity.

Commands are terminated with a carriage return <CR> (keyboard Enter key) (0x0D) character.

For ease of readability, the <CR> character is not shown in the command tables below but it is required to terminate all commands and is implied in the table.

The port settings are 9600 baud, 8 data bits, no parity, with 1 stop bit (8N1).

These commands are available on UARTs 0 and 1.

User Command Summary

Command	Description
DC	Calibrate Direction Sensor.
HE	Display the Help menu.
MD	Set magnetic declination.
OI	Set output interval.
PU	Set pressure units.
QU	Quit command mode and save any changes.
RU	Set rain fall units.
SA	Set SDI-12 address.
SU	Set wind speed units.
ST	Set serial trigger address.
TU	Set temperature units.
VN	Display model and firmware version.

HE – Help Menu

Command	Result
HE	Display the Help menu Command: HE<cr> HE - This Help Menu DC - Calibrate Direction Sensor OI - Set Output Interval PU - Set Pressure Units QU - Quit command mode and save any changes RU - Set Rain Fall Units SA - SDI Address ST - Set Serial Trigger Address SU - Set Speed Units TU - Set Temperature Units VN - Display Firmware Version Number.

2.1. DC – Direction Calibration

This command is used to calibrate the Direction Sensor at the factory or any time that the pot has to be replaced. The procedure is to move the vane to 180 degrees and issue this command to calibrate the direction offset.

Command	Results
DC	Report the Direction Calibration.
DC1	Set the Direction Calibration.

Examples:

Command (HE for Help, QU to Quit): DC

DC = 0.0

DC - Calibrate Direction Sensor

DC<cr> Report Direction Offset

DC1<cr> Set Direction Offset

Command (HE for Help, QU to Quit): DC1

Move direction sensor to the 180 degree point.

Are you sure you want to proceed? Y

DC = -1.3

The offset will be saved after quitting menu mode.

2.2. OI – Output Interval

Read or Set the Output Interval setting.

Command	Results
OI	Report the output interval setting.
OIO	Set output interval off for polled mode.
OI1	Set output interval to 1 second (Default).

Examples:

```
Command (HE for Help, QU to Quit): OI
```

```
OI = 1 (1 Second)
```

```
  OI - Set the Output Interval
```

```
  OIO<cr> for Serial Trigger (Address must be set with ST command)
```

```
  OI1<cr> for 1 Second Interval
```

```
Command (HE for Help, QU to Quit): OI1
```

```
Output Interval (1 Second)
```

```
Command (HE for Help, QU to Quit): oi0
```

```
Output Interval (Serial Trigger Selected)
```

2.3. PU – Pressure Units

Setting this value will affect all of the output ports – COM1, COM2 and SDI-12.

Command	Results
PU	Report pressure units setting.
PU0	Set pressure units to millibars (mbar) (Default).
PU1	Set pressure units to inches of mercury (inHg).

Examples:

```
Command (HE for Help, QU to Quit): pu
```

```
PU = 1 (inHg)
```

```
PU - Set the Pressure Units
```

```
PU0<cr> for Millibars(mbar)
```

```
PU1<cr> for Inches of Mercury(inHg)
```

```
Command (HE for Help, QU to Quit): pu0
```

```
PU = 0 (mbar)
```

2.4. QU – Quit Command Mode

Command	Results
QU	Quit command mode and save or revert changes.

Example:

```
Command (HE for Help, QU to Quit): qu
```

```
To save changes type 'Y' : y
```

```
Changes have been saved
```


2.5. RU – Rain Fall Units

Setting this value will affect all of the output ports – COM1, COM2 and SDI-12.

Command	Results
RU	Report rain fall units setting.
RU0	Set rain fall units to millimeters (mm) (Default).
RU1	Set rain fall units to inches (in).

Example:

```
Command (HE for Help, QU to Quit): ru
```

```
RU = 0 (mm)
```

```
RU - Set the Rain Units
```

```
RU0<cr> for mm
```

```
RU1<cr> for in
```

```
Command (HE for Help, QU to Quit): ru1
```

```
RU = 1 (in)
```

2.6. SA – SDI-12 Address

This command allows for the user to easily set the SDI-12 address without the need for and SDI-12 master device.

Command	Results
SA	Report SDI-12 address setting.
SAx	Set the SDI-12 address to x.

Example:

```
Command (HE for Help, QU to Quit): sa
```

```
SA = 0
```

```
SA - Set the SDI-12 Address
```

```
SAx<cr> where 'x' is in the range  
[0-9] [A-Z] or [a-z] Case Sensitive
```

```
Command (HE for Help, QU to Quit): sa5
```

```
SDI-12 Address will be set to '5'
```

2.7. SU – Wind Speed Units

Setting this value will affect all of the output ports – COM1, COM2 and SDI-12.

Command	Results
SU	Report wind speed units setting.
SU0	Set wind speed units to meters-per-second (m/s).
SU1	Set wind speed units to mile-per-hour (mph).

Example:

```
Command (HE for Help, QU to Quit): su
```

```
SU = 1 (mph)
```

```
    SU - Set the Speed Units
```

```
    SU0<cr> m/s
```

```
    SU1<cr> mph
```

```
Command (HE for Help, QU to Quit): su0
```

```
SU = 0 (m/s)
```

2.8. ST – Serial Trigger

Read or Set the Serial Trigger character string used for polled mode.

Command	Results
ST	Report the serial trigger setting.
STxxx	Set the serial trigger character string.

Example:

```
Command (HE for Help, QU to Quit): st
```

```
Serial Trigger String Setting Menu
```

```
The string is currently set to 'xxx'
```

```
Where the string is between the single quotes above.
```

```
To enter or change the string type ST followed by the string.
```

```
The string must be between 1 and 20 characters in length.
```

```
Use the carat symbol (^) as a prefix to enter control characters.
```

```
I.E. a carriage return, line feed sequence would be ^M^J.
```

```
To place a carat (^) in the string use '^' (carat, carat).
```

```
Strings beginning with three exclamation points (!) are not allowed.
```

```
Command (HE for Help, QU to Quit): st123^M
```

```
Serial Trigger String Setting Menu
```

```
If this is correct, type 'Y' : y
```

```
The string will be saved after quitting menu mode.
```

2.9. TU – Temperature Units

Read or Set the Temperature units setting.

Setting this value will affect all of the output ports – COM1, COM2 and SDI-12.

Command	Results
TU	Report the temperature units setting.
TU0	Set temperature units to Fahrenheit (F).
TU1	Set temperature units to Celsius (C).

Example:

```
Command (HE for Help, QU to Quit): tu
TU = 1 (F)
    TU - Set the Temperature Units
    TU0<cr> for C
    TU1<cr> for F
Command (HE for Help, QU to Quit): tu0
TU = 0 (C)
```

2.10. VN – Firmware Version

Command	Results
VN	Report model and firmware version.

Example:

```
Command (HE for Help, QU to Quit): vn
Met One xxxxxx - V0.1.0 - S/N: J12345
Firmware Version Main=0.1.0
```

SDI-12 Commands

Name	Command	Command Response
Address Query	?!	<i>a</i> <CR><LF> Where <i>a</i> = address
Acknowledge Active	<i>a</i> !	<i>a</i> <CR><LF> Where <i>a</i> = address
Send Identification	<i>aI</i> !	<i>a13Met One mmmmmm0.2 0Axxxxx</i> <CR><LF> Where <i>a</i> = address, <i>mmmmmm</i> = model and <i>xxxxx</i> = S/N
Change Address	<i>aAb</i> !	<i>b</i> <CR><LF> Where <i>b</i> = new address
Start Measurement	<i>aM</i> !	<i>a0007</i> <CR><LF> Where <i>a</i> = address
Start Measurement with CRC	<i>aMC</i> !	<i>a0007</i> <CR><LF> Where <i>a</i> = address
Send Data	<i>aD0</i> !	<i>a+bbb.b+ccc.c+ddd.d+eee.e</i> <CR><LF> Where <i>a</i> = address, <i>bbb.b</i> = wind speed, <i>ccc.c</i> = wind direction, <i>ddd.d</i> = temperature, and <i>eee.e</i> = relative humidity
	<i>aD1</i> !	<i>a+ffff.f+ggg.gg+hhhh+ii.ii</i> <CR><LF> Where <i>a</i> = address, <i>ffff.f</i> = barometric pressure, <i>ggg.gg</i> = rain since last poll, <i>hhhh</i> = solar, <i>ii.ii</i> = power supply voltage.
Start Concurrent Measurement	<i>aC</i> !	<i>a00007</i> <CR><LF> Where <i>a</i> = address
Start Concurrent Measurement with CRC	<i>aCC</i> !	<i>a00007</i> <CR><LF> Where <i>a</i> = address
Continuous Measurements	<i>aR0</i> !	<i>a+bbb.b+ccc.c+ddd.d+eee.e</i> <CR><LF> Where <i>a</i> = address, <i>bbb.b</i> = wind speed, <i>ccc.c</i> = wind direction, <i>ddd.d</i> = temperature, and <i>eee.e</i> = relative humidity
	<i>aR1</i> !	<i>a+ffff.f+ggg.gg+hhhh+ii.ii</i> <CR><LF> Where <i>a</i> = address, <i>ffff.f</i> = barometric pressure, <i>ggg.gg</i> = rain since last poll, <i>hhhh</i> = solar, <i>ii.ii</i> = power supply voltage.
Continuous Measurements with CRC	<i>aRC0</i> !	<i>a+bbb.b+ccc.c+ddd.d+eee.e{crc}</i> <CR><LF> Where <i>a</i> = address, <i>bbb.b</i> = wind speed, <i>ccc.c</i> = wind direction, <i>ddd.d</i> = temperature, <i>eee.e</i> = relative humidity, and { <i>crc</i> } = CRC
	<i>aRC1</i> !	<i>a+ffff.f+ggg.gg+hhhh+ii.ii{crc}</i> <CR><LF> Where <i>a</i> = address, <i>ffff.f</i> = barometric pressure, <i>ggg.gg</i> = rain since last poll, <i>hhhh</i> = solar, <i>ii.ii</i> = power supply voltage, and { <i>crc</i> } = CRC

2.11. SDI-12 Extended Commands

Changing settings with the Extended SDI-12 commands only affects the SDI-12 port, the standard serial ports COM1 and COM2 are not affected.

Name	Command	Command Response
Report Wind Units	<i>aXSU!</i>	<i>aXSUb!</i> <CR><LF> Where <i>a</i> = address, and <i>b</i> = 0 for meters-per-second (default), or 1 for miles-per-hour
Set Wind Units	<i>aXSUb!</i>	
Report Temperature Units	<i>aXTU!</i>	<i>aXTUd!</i> <CR><LF> Where <i>a</i> = address, and <i>d</i> = 0 for Celsius (default), or 1 for Fahrenheit
Set Temperature Units	<i>aXTUd!</i>	
Report Pressure Units	<i>aXPU!</i>	<i>aXPUf!</i> <CR><LF> Where <i>a</i> = address, and <i>f</i> = 0 for millibars (default), or 1 for inches of Mercury
Set Pressure Units	<i>aXPUf!</i>	
Report Rain Fall Units	<i>aXRU!</i>	<i>aXRUG!</i> <CR><LF> Where <i>a</i> = address, and <i>g</i> = 0 for millimeters (default), or 1 for inches
Set Rain Fall Units	<i>aXRUG!</i>	
Report Version Number	<i>aXVN!</i>	<i>aXVNxx.x!</i> <CR><LF> Where <i>a</i> = address and <i>xx.x</i> = firmware version