



TOIP *Pty*
Ltd
Telemetry Over Internet Protocol

YDOC RTU

Setup and Configuration

Version 3.0B4
Copyright Nov 2017

Contents

1	YDOC Remote Telemetry Unit (RTU).....	6
2	Model Numbers and Ordering.....	7
2.1	Breather Vent.....	8
2.2	Antenna.....	8
2.3	Mounting.....	9
2.4	Cable Entry.....	10
2.5	Accessory Port.....	11
2.5.1	Camera.....	11
2.5.2	GPS Module.....	11
2.5.3	Satellite Module.....	12
3	Setup and Configuration.....	13
3.1	Unpack and Check Contents.....	13
3.2	Prepare Case for Cable Glands and Vent.....	13
3.3	Power Board (Cover) Connection.....	14
3.3.1	PV Cover.....	14
3.3.2	LI Cover.....	14
3.3.3	DC Cover.....	14
3.4	Sensor Connection.....	15
3.5	SIM Holder.....	16
3.6	Memory Card.....	17
4	Configuration.....	18
4.1	Terminal Setup.....	18
4.2	Device Menu.....	18
4.3	Check Firmware Version.....	19
4.4	Set the RTU Time.....	20
4.5	General Settings.....	20
4.5.1	Set the RTU Name.....	20
4.5.2	Logging Interval.....	20
4.5.3	Reading Time Alignment (Logging at 00:00).....	21
4.6	Setting the Time and Time Zone.....	22
4.6.1	Time Zone.....	22
4.6.2	Setting the Time.....	22
4.6.3	Using NTP Server.....	22

4.7 Modem Settings.....	22
4.7.1 Provider Selection.....	23
4.7.2 Network Type.....	24
4.7.3 Access Point Configuration.....	24
4.7.4 Signal Strength Tests.....	25
4.7.5 APN Login Test.....	26
4.8 Setting the YDOC Server (TCP) Connection.....	27
4.8.1 Set the connection interval.....	27
4.8.2 Set the TCP Server Details.....	28
4.8.3 Complete a TCP Communications Test.....	29
4.9 Starting the Logger.....	30
5 Sensor Configuration.....	31
5.1 GSM Signal Strength.....	31
5.2 Adding Internal Sensors.....	31
5.3 Adding Analogue Sensors.....	32
5.3.1 Voltage Sensors.....	32
5.3.2 4-20mA Sensors.....	33
5.4 Adding Pulse Inputs.....	34
5.4.1 Rain Gauges.....	35
5.4.2 Flow Meters.....	37
5.4.3 Pulse Wind Speed Sensors.....	38
5.5 Adding SDI-12 Sensors.....	39
5.6 Adding Calculated and Aggregate Sensor Channels.....	41
5.6.1 Adding a Calculated / Derived Channel.....	41
5.7 Adding an Aggregated Channel.....	43
5.8 Testing SDI-12 Sensors.....	45
5.9 Powering High Current Drain Sensors.....	46
5.10 Setting up Alarms.....	46
5.10.1 Setting up an Alarm SMS.....	47
5.10.2 Setting up an Alarm Email.....	49
6 Saving and Uploading Configurations.....	51
6.1 Saving an RTU Configuration.....	51
6.2 Loading a Configuration to an RTU.....	51
6.3 Erasing an RTU Configuration.....	52

7 Other Functions (Accessories).....	53
7.1 Setting Up a Camera.....	53
7.2 Camera Troubleshooting.....	57
7.2.1 With RTU in Run Mode Using YDOC Terminal.....	57
7.2.2 With RTU in Config Mode.....	58
7.3 Displaying Images in YDOC Insights.....	58
7.3.1 Image Location on PC.....	59
7.4 Sending Data via FTP.....	59
7.5 Sending Data Via MQTT.....	59
7.6 Using The Iridium Satellite Modem.....	60
7.6.1 Pre-Testing.....	61
7.6.2 RTU Configuration.....	62
7.6.3 Connection to Telemetry Unit.....	62
7.6.4 Testing in RTU.....	63
7.7 Using the GPS Receiver.....	64
8 Manual Download.....	66
8.1 Transferring Data to YDOC Insights.....	67
9 Remote access to RTU.....	69
9.1 Configuring Remote Access.....	69
9.2 Opening a remote session.....	69
10 Firmware Upgrade.....	71
11 Setup for Specific Sensors.....	72
11.1 Rika RK510 Soil Moisture Sensor.....	72
11.2 Integrated Irrigation Analogue Level.....	75
11.3 Aquamonix/Pentair PT05.....	76
11.4 Holykell HPT613-D1 (SDI-12).....	77
11.5 Sensor MPM4700 (MODBUS).....	78
11.6 Holykell HPT604 & HPT613 (MODBUS).....	79
Test the sensor using the method shown in section 5.10.....	79
11.7 Micro Sensor MPM4700 (MODBUS).....	80
11.8 InSitu LevelTroll 400.....	81
11.9 Leeg LMP633 4-20mA 2 wire.....	82
12 Testing MODBUS Sensors.....	83
13 Exporting to Sentek IrriMax.....	84

14	Diagnostics.....	85
14.1	Diagnostic LEDs.....	85
14.2	Check Power Supply.....	85
14.3	Modem Diagnostics.....	86
14.4	Diagnostic Messages in the log file.....	87

1 YDOC Remote Telemetry Unit (RTU)

The YDOC ML315DS-PV Remote Telemetry Unit (RTU) integrates telemetry and data logger functionality into a compact IP 67 rated case.

The RTU has 4GB MB of on storage, provided through a Micro-SD memory card (located beneath the SIM card).

A USB interface is provided on the main printed circuit board and is used to program the unit, to issue transparent SDI-12 commands (to facilitate sensor testing) and to check the signal strengths and perform diagnostic checks on the mobile data connection.



2 Model Numbers and Ordering

When ordering your YDOC RTU, first decide what model you will need and the options that may be purchased with it:

MLN315DS SDI-12/RS232/RS485 and Pulse

MLN315ADS SDI-12/RS232/RS485, Pulse, Analogue, Accessory

Then select the required power source / cover:

PV Front cover with integrated solar panel and 3 off NiMH rechargeable cells

LI Front cover with holder for Lithium Battery (non rechargeable)

3LI Front cover with holder for up to 3 Lithium Battery (non rechargeable)

DC-AA Front Cover with DC Regulator and option for backup NiMH batteries

DC-LI Front Cover with DC Regulator and single use Lithium battery

TFT Front cover with built in display. This model makes use of the Power board from the DC Cover

The standard RTU (PV) is powered via an internal NiMH battery pack which is charged by the unit's integrated solar panel.

The "LI" option deletes the solar panel and replaces the battery pack with a 3.6V 13AH "D" size single use Lithium Thionyl battery. When purchasing batteries, do not purchase the cheap "bobbin" type cells as they will not be able to deliver enough current to run the modem. Always purchase quality cells such as the SAFT LSH20 (which can deliver 2A peak current). The 3LI cover can accommodate up to 3 off LSH20 cells for a total of 39 AH capacity.

The DC-AA version may be powered from a DC plug-pack or either a 2W or 5W external solar panel. The unit includes rechargeable NiMH batteries. The DC-LI version is set up for external power but utilises a SAFT LSH20 battery as the standby power source rather than rechargeable cells.

The final option is the "TFT" unit which has a small display fitted in place of the solar panel. This unit must be charged via a DC Plug-pack or external

solar panel/regulator. The power board from the DC Cover is mounted piggy back style on to the front panel PCB.

2.1 Breather Vent

To avoid build up of moisture in the case, the telemetry units should be fitted with a breather vent. This must be installed on the top of the case. The vent can be fitted through a 12mm hole or screwed into a hole which has been drilled to 11mm and threaded with a 12mm x 1.5mm tap. In lieu of the breather vent the case could also be fitted with a cable gland with internal breather. These must be fitted to the bottom of the case and are hence not as effective as a top mounted breather vent.

**BVENT-
M12X15** Breather vent M12 x 15mm



2.2 Antenna

The RTU is fitted with a PCB mounted antenna for the mobile data modem. This antenna will be sufficient for installation on sites with good mobile coverage. For sites with poor reception an external antenna should be fitted.

A “UFL” antenna socket is provided on the main PCB for the external antenna. As most antennae utilise an SMA connector, you will need a UFL to SMA adaptor cable: the UFL end is plugged into the socket and the SMA end mounted on the bottom of the case. When using an external antenna, change the position of the Antenna Jumper on the main board from INT to EXT. If you order the option YDOC-UFL with your RTU, the case will be drilled to suit the bulkhead mounting SMA socket. If you order the adaptor separately you will have to drill the case and fit the adaptor yourself.

When using the internal antenna you should use the plastic post mounting bracket as the metal one may interfere with the signal from the internal antenna.

YDOC-UFL SMA to UFL adaptor cable
100mm



GIDM90T-SM-xx Antenna 3G850 5.1 dBi cable and SMA male connector (xx=02 2m cable, xx = 05 5m cable)



2.3 Mounting

The RTU can be mounted directly on a wall or plate.

Two post mounting kits are available: one made of metal and the other of plastic:

- YDOC-PMK-AL: Use the metal bracket when the RTU is fitted with an external antenna
- YDOC-PMK: Use the plastic bracket when the RTU uses its internal antenna
- YDOC-PMK-POLY: A laser cut plastic base which may be used with both internal and external aerials.

YDOC-PMK Post mounting kit plastic for YDOC ML315. Includes mounting plate, hose clamps and 4 off 6mm bolts & nuts



YDOC-PMK-AL Post mounting kit aluminium for YDOC ML315. Includes mounting plate, hose clamps and 4 off 6mm bolts & nuts. For use only with external antenna

YDOC-PMK-POLY

Laser cut polypropylene base plate which can be mounted with hose clamp in centre or top and bottom. Suitable for use with internal and external antenna



2.4 Cable Entry

The YDOC RTUs are supplied without any holes drilled in the case. During pre-delivery a 12mm hole is drilled on top of the case and a breather vent fitted. The bottom of the case will also be drilled with holes for the sensor cables, external antenna connector etc.

The standard cable glands are size M12 and will accept cables in the range 3 to 6mm. If you are going to use cables more than 6mm in diameter, you will need to specify M16 cable glands.

Note that the case will accept a maximum of 5 M12 cable glands or 4 M12 cable glands or in combination, 3 M12 glands and 2 M16 glands.

GLANDM12-X

Drill and fit M12 cable glands. X = 1, 2, 3, 4

As an alternative your RTU may be supplied with 3 off black M12 glands and one grey, vented gland



Should you wish to bring the USB port to the outside of the case, a bulkhead mounting waterproof USB socket is available. This allows the unit to be configured without having to open the case.

YDOC-USB

Bulkhead mounting USB Mini connector



As an alternative to cable glands, the case can be fitted with 5 pin sockets and the sensors fitted with the matching 5 pin plugs.

YDOC-CON5P 5 pole Waterproof connector for sensor connection: plug and socket



2.5 Accessory Port

The MLN315-ADS version of the RTU includes an additional serial port which is used to connect a variety of accessories.

2.5.1 Camera

The YDOC RTU may be used to capture regular still images from a remote monitoring site. Although YDOC manufactures a low res and high res camera, only the high resolution unit is currently on offer in Australia.

The RTU must be fitted with a SIM card with a sufficiently high data allowance (typ 20 MB per month).

When using the Accessory Port, you will require the DC-AA power board with either a 2W or 5W external solar panel or external DC power source.

ML315ADS-XX YDOC RTU with camera interface and power supply of choice



YDOC-CAM-D1 Digital Camera 1280x1024 45 degree lens with IR LED's for night time use (to 20m)



2.5.2 GPS Module

A GPS Receiver option is also available on the ML315 ADS loggers. The GPS Receiver is a separate waterproof module which mounts outside of

the RTU case and connects via cable (and cable gland) to the Accessory Port on the ADS version RTU.

YDOC-GPS

GPS Receiver for ML315ADS Telemetry Unit



Note that the GPS Receiver needs to be mounted on a suitable plate. TOIP can supply a small mounting bracket for this purpose or you can make your own.

2.5.3 Satellite Module

An External Satellite Modem may be fitted to provide communications at sites where no mobile data coverage is available. This option is only available for the MLN315 ADS telemetry units.

The modem is an Iridium unit manufactured by Hirschmann.

ITAS

Iridium Edge satellite modem for ML315ADS Telemetry Unit



ENC-AL-SOL

5W solar panel with aluminium enclosure 7AH battery and solar regulator



Although YDOC specify the 5V version of the Iridium modem, this is not readily available in Australia and the 12V version should be used in its place. This requires use of an external 12V solar power supply (which can also power the RTU) which can be supplied by TOIP.

Be careful to check that your intended application will fit within the data allowance of your satellite provider. Most Iridium plans only allow for 30 kB per month, which restricts you to a couple of readings per day from one or two sensors.

3 Setup and Configuration

3.1 Unpack and Check Contents

On receipt of your logger, check that the contents are complete. The package should contain:

- 1 off ML315 telemetry unit (PV, LI, DC or TFT)
- 1 off Bag of components
 - 4 off case screws, 4 off cable glands, 3 off input connector headers (1 off 3 pin, 1 off 4pin, 1 off 6 pin) 1 off template, 1 off power connection lead

Note: if TOIP has prepared your unit, the case will be assembled, the cable glands fitted and a breather vent installed on top of the case.

3.2 Prepare Case for Cable Glands and Vent

If the RTU case has not been supplied with the breather vent and cable glands re-installed:

- Undo the 4 #1 Torx screws holding the Main PCB to the case and carefully remove the PCB. Place it inside an anti-static bag
- Determine how many cable glands are required
- Lay the template down on the bottom of the case (the blue part)
- Line the template up so that the edge closer to the printing sits against the raised edge of the case
- Using a scribe or spring loaded centre punch, mark the position for the centre of the holes
 - Use hole 2/3 for a single gland; use holes 1/3 and 3/3 for 2 glands; use holes 1/3 2/3 and 3/3 for 3 glands and use holes 1/4 through 4/4 for 4 glands
- Drill a pilot hole using a 3mm drill bit
- Then carefully drill the holes out to 12mm (cable glands and vent) or 8mm (external antenna)
 - If you want to thread the vent and cable gland holes, drill the holes with an 11mm bit then thread with a 12 by 1.5mm tap
- To fit the breather vent, turn the case over, lay the template on top, then repeat the process of drilling a 12mm hole in the top
- Fit the cable glands and breather vents into the holes and secure with lock nuts
- Clean out any plastic debris from inside the case

- Re-fit the Main PCB
- Check that the logger is functioning properly.

3.3 Power Board (Cover) Connection

The PV cover has a small solar panel on the lid whereas the LI and DC covers are flat and the lid houses a holder for the D size battery. The TFT lid houses the TFT display and a DC power board with 3 off AA rechargeable cells.

The lid on each model connects to a matching connector on the Main printed circuit board (PCB) using a 100mm Power Connection lead.

Plug one end of the Power Connection lead to the 2 pin socket marked X3 on the Lid PCB and the other end to the matching socket on the Main PCB marked X15.

3.3.1 PV Cover

The PV Cover must be fitted with 3 off 1800 to 2100 mAH NiMH batteries. These are installed in the plastic holder in the base of the lid. Follow the polarity markings on the inside of the battery holder. Due to the high current requirements of the modem, make sure that you purchase high quality, name brand cells: cheap cells will not be able to hold their terminal voltage under high load conditions (which will be evident as not able to access the modem).

3.3.2 LI Cover

The ML315-LI must be fitted with a suitable battery:

SAFT	LSH-20	3.6V D 18AH
Tekcell	SB-D02	3.6V D 19AH

3.3.3 DC Cover

The ML315-TFT must be connected to a suitable power source: either a DC Plug-pack or a solar set with charge regulator and battery.

The external power source (9V to 30 V DC) connects to the two pin header labelled X4. Wire the connector as follows:

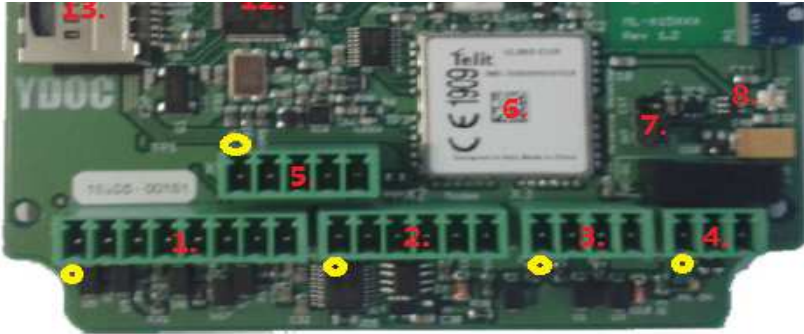
Pin 1	Power
Pin 2	Ground

The DC Cover is available in two versions:

- LI: includes a holder for a D size Lithium cell
- AA: includes a holder for 3 off AA NiMH rechargeable cells

3.4 Sensor Connection

The picture below shows the location of the input connectors on the RTU. The yellow dot marks Pin 1 of each socket (always to the left).



Connector	Pin	Function
ADS and DS		
X2	1	RS232 Tx
X2	2	RS232 Rx
X2	3	RS485 A (+)
X2	4	RS485 B (-)
X2	5	SDI-12 Data
X2	6	Ground
X4	1	12V Sensor Power (Switched)
X4	2	-
X4	3	-
X3	1	Pulse input (Rain) 1
X3	2	Pulse input (Rain) 2
X3	3	Pulse input (Rain) 3
X3	4	Ground
ADS Only		

X1	1	AN1 0-20mA
X1	2	AN2 0-20mA
X1	3	AN3 0-10V
X1	4	AN4 0-10V
X1	5	Ground
X1	6	Ground
X1	7	AN5 Resistance
X1	8	AN5 3.3 V Ref
X5	1	Switched 5V DC (power to camera)
X5	2	Ground
X5	3	-
X5	4	Tx
X5	5	Rx

Locate the headers for the connectors and fit the sensor wires to the corresponding pin on the header.

3.5 SIM Holder

The RTU requires a SIM with a data plan in order to operate. A 5MB per month plan is sufficient for most applications.

Check that your Telemetry unit is fitted with the correct modem for operation on the 850 MHz 3G network in Australia: it should be marked with the model number UL865-N3G.

The SIM holder is located on the middle left of the main PCB. Slide the SIM into the holder: the square edge goes in and the notched edge should face out. Ensure PIN request is turned off on the SIM card.



3.6 *Memory Card*

At the lower edge of the SIM holder you should also see the edge of the Memory Card. The RTUs are fitted with a 4GB Micro SD card. Push the card in to unlock it. You can then place the card in a Micro Card adaptor, plug the adaptor into an SD card slot or SC card reader and view the card's contents. Under normal circumstances you will never have to remove the Micro SD card.

4 Configuration

The RTU is configured using the USB interface on the centre of the main PCB (Mini USB connector). If you wish to be able to access the programming port without opening the RTU, fit the external USB connector.

4.1 Terminal Setup

You can use the YDOC Terminal program or any other terminal emulator to configure the units. YDOC Terminal has some additional functionality such as a button to take a test picture from an attached camera. The latest build of YDOC Terminal can be downloaded from:

<http://www.your-data-our-care.com/datalogger-utilities.html>

Plug a Mini USB cable into the socket on the RTU

- Windows should detect the unit and try and install a serial port driver
- If not check that the unit has been recognised in Control Panel / Device Manager
- you may also wish to uninstall YDOC Terminal and, with the RTU connected, install it again to make sure the serial port drivers are loaded.

Set Up HyperTerminal or YDOC Terminal:

- Settings 19200/8/N/1
- COM Port Number: as identified in Device Manager
- Connect to the RTU

4.2 Device Menu

Although the menus display letters in upper case, the menu options only respond to lower case characters. So when the RTU says to press **Ctrl + A**, you must actually press **Ctrl + a**

If using YDOC Terminal, click with your mouse in the terminal window to open it. Press Enter to display the device menu.

```

YDOC - HyperTerminal
File Edit View Call Transfer Help
4 0 71 69 72 0
0
#
<09:12:52>
ML-315 Logger Version 1.9 Build 3
- for Configuration Menu: Press <Ctrl>A<Shift>M<Ctrl>D
- for Actual Values: Press <Ctrl>A<Shift>V<Ctrl>D
- for Processing Status: Press <Ctrl>A<Shift>S<Ctrl>D
-

```

To activate the command interface:

- click on the **Show Configuration Menu** button or Press the following key sequence: **Ctrl a, Shift m, Ctrl d**

The Configuration Menu will then display.

```

Configuration Menu ML-315 Logger Version 1.9 Build 3
[0] Run
[1] Date & time >> 2015/07/17 00:29:06
[2] System information >> 5024765
[3] Configuration setup >> YDOC_01
[4] Configuration review
[5] Maintenance
>

```

NOTE: if when using the menus the screen seems to freeze up, check to see if the red Modem LED has lit up: if the RTU powers up the modem to connect to the server, it blocks communications over the serial port until it has finished controlling the modem. You will have to wait until the Modem LED turns off before continuing.

4.3 Check Firmware Version

With the Configuration Menu on screen, the first task you perform should be to check the firmware version to make sure the unit has the latest issue.

The firmware can be downloaded from the YDOC web site:

<http://www.your-data-our-care.com/datalogger-firmware.html>

For more detailed instructions on how to upgrade the firmware, refer to section: 10:

- download the firmware to a folder on your PC's hard driver (Desktop or
- select the 5 Maintenance Menu and from there select 7 Firmware Update
- when prompted, from the YDOC Terminal Menu select Control ? YMODEM transfer / Send file and then select the file from the folder to which you downloaded it
- the unit's firmware will be upgraded. Once it is complete, disconnect the terminal program (Control Disconnect) unplug the USB port for 5 seconds, then plug it back in. Once the USB port is recognised you can select Control Connect again and issue the key sequence to activate the menus.

4.4 Set the RTU Time

From the Configuration Menu, to set the time press **1**

```
>
Date & time
2015/07/17 01:15:10
Date (YY/MM/DD): 2015/07/15
Time (hh:mm:ss): 01:15:
```

When prompted, type in the date in the format `yyyy/mm/dd`

Then enter the Time in the format `hh:mm:ss`

- Note that the time should be set in local time
 - The time zone will be entered in step 4.6.1.

4.5 General Settings

This menu option allows you to set the RTU Name and time zone.

From the Configuration Menu, to go to `Config Setup` press **3**

To select the `General Setup` Menu press **1**

4.5.1 Set the RTU Name

From the General Settings Menu select `Device Name` **1**

Give the unit a name e.g. `YDOC_nnn` and press `Enter`

4.5.2 Logging Interval

The logging interval must be set to match the application: 15 minutes is typically used for soil moisture and weather monitoring. Sensors can be set

to be recorded at the default log interval or at a different rate e.g climate sensors at 15 min, water level at 4 hr.

From the General Settings Menu, select Data Log Interval **2**

You can then select the logging rate to be used in Normal Mode (1) and in Alarm Mode (2)

- By default, Alarm Mode is deactivated (shows as Not Used)
- If for instance you were monitoring stream height and wanted to increase the frequency of logging once the level exceeded a set threshold, you would enter the higher rate in the Alarm Mode.

```
[0] Exit
[1] Seconds
[2] Minutes
[3] Hours
>
Normal data log interval

The normal interval must be greater than the alarm interval
and can't be greater than the smallest normal send interval
and can't be smaller than the highest normal sample interval

[0] Exit
[0] 1 Minute
[B] 2 Minutes
[C] 3 Minutes
[D] 4 Minutes
[E] 5 Minutes
[F] 6 Minutes
[G] 10 Minutes
[H] 12 Minutes
[I] 15 Minutes
[J] 20 Minutes
[K] 30 Minutes
>_
```

After selecting an option (1 or 2), you will be prompted for the time units: select 1 for seconds, 2 for minutes or 3 for hours

- After pressing enter you will be asked to select the period from the list of available times
 - For 15 minute rate select 2 for minutes then I for 15.
- At the menu press 0 to go back to the previous menu level.

4.5.3 Reading Time Alignment (Logging at 00:00)

With the default settings the RTU will time stamp the readings at the time they are finished. A log of SDI-12 data which started at 09:00 and took 33 seconds to finish would be time stamped as 09:00:33. Another RTU, with a smaller sensor count may finish (and hence be logged) earlier. To force the RTUs to time stamp the data at the nominal time e.g. 09:30:00, use the Time Stamp Round Down function:

- under General Settings, select option **3 Time Stamp Round Down**

- then, enter the number of seconds which must elapse before a reading can get a new time stamp
- if you are logging every 15 minutes a good value would be 60 seconds

4.6 *Setting the Time and Time Zone*

4.6.1 Time Zone

To allow the display of readings to be offset to local time, you can select the Time Zone for the location in which the RTU will be deployed.

From the General Settings menu, to set the Time Zone press **8**

- Then enter the number of hours either ahead or behind UTC
 - For central Australia i.e. 09:30, enter the time zone as **9.5**

4.6.2 Setting the Time

From the Main Menu select Date and Time **1**

When prompted set the Date and time to the current local time in the format shown on screen.

4.6.3 Using NTP Server

You can synchronise the RTU time with a network time server (NTP Server) to ensure that it never drifts appreciably from the nominal time.

From the Main Menu:

- select Configuration Setup **3**
- select NTP time update **3**
- turn on the auto time update by selecting **1**
- in the server name enter ***au.pool.ntp.org***
 - you can also search the Internet for the names of servers in your area
- perform an update test **T**
 - the RTU will turn on the modem, connect to the APN server and then try to synchronise to the NTP server
 - if it fails, double check the server name and try an alternate server.

4.7 *Modem Settings*

To set up the modem, go to the Configuration Menu and select **2**

Make sure you have a SIM card loaded into the SIM holder and that you are in a location with network coverage.

If you are using the internal antenna, the antenna selection plug should be in the INT position; if using the external antenna, set the link to EXT.

When changing a Modem setting, always go back out of the modem menu: you will be promoted to save the changes – always select “Y” at this level, then go back to the modem menu to make your next selection.

After installing the SIM, perform a signal strength test to check that the SIM is recognised:

- From the menu select Signal Strength test **S**
- Watch the results displayed on the screen
- If the SIM is not valid or is not found you will see the message:
Please wait...
ATE0;S0=1;+CMEE=2;+CCLK="15/10/29,07:30:21+00";+CFUN=5;+CPIN?
+CME ERROR: SIM not inserted

4.7.1 Provider Selection

This option allows you to view the available networks (AT+COPS command) and choose which will be used as the default. The RTU default setting is to use automatic provider selection, however you can over-ride this if you want to make sure a specific network is selected.

From the modem menu to invoke Provider Selection type **1**

The RTU will turn on the modem and check what networks are available locally.

Provider selection

```
ATE0;+COPS=3,0
OK
```

Provider selection

```
AT+COPS=3,0;+COPS?
+COPS: 1,0,"Telstra Mobile",0
AT+COPS=?
+COPS: (1,"Vodafone AU",,"50503",2),(1,"Vodafone AU",,"50503",0),
(1,"Vodafone AU
```

```
R",,"50502",2),(1,"Vodafone AU R",,"50502",0),(3,"Telstra  
Mobile",,"50501",0),,  
(0-4),(0,2)
```

```
[0] Exit  
[A] Automatic selection >> Off  
[1] Vodafone AU (3G)  
[2] Vodafone AU (2G)  
[3] Vodafone AU R (3G)  
[4] Vodafone AU R (2G)  
[5] Telstra Mobile (2G) >> Fixed  
[D] Deregister network
```

Once the networks have been detected, they will be displayed and a sub-menu shown from which you can select whether to use Automatic selection or to choose a specific network. In the above example, the Telstra GSM (2G) network has been set as the network.

4.7.2 Network Type

The RTU can use 2G (GSM) or 3G (WCDMA) networks depending on the modem fitted internally and the networks available in the area

- The default should always be 3G, with fall-back to 2G if 3G services are not available
- Select Network **2**
- Select 3G with 2G fall-back, **1**

4.7.3 Access Point Configuration

The APN needs to be set to match the settings give to you by your provider

```
Select Access Point Name 3
```

Enter the Name:

```
Telstra telstra.internet  
Vodafone live.vodafone.com
```

The APN User Name and Password are normally blank. If you need to change them select the menu option (4 or 5) and enter the details given to you by the provider.

4.7.4 Signal Strength Tests

If you have loaded a SIM and completed the above setup, you can perform a signal strength and APN login test:

- Select Signal Strength **S**
 - The screen will display the progress as the modem is enabled and the unit connects to the GSM network

Network signal test

Network signal start

```
ATE0;S0=1;+CMEE=2;+CCLK="15/07/14,04:10:34+40";+CFUN=5;+CPIN?  
+CPIN: READY
```

OK

```
AT+CREG=2;+CREG?
```

```
+CREG: 2,1,"13A9","D3A4",0
```

OK

```
Registered on 2G network
```

```
AT+CSQ
```

```
+CSQ: 4,5
```

OK

```
AT+CIND?
```

```
+CIND: 0,5,1,0,0,0,0,1
```

OK

Signal bars (0-5) = 1

Signal strength = -105 dB

Raw signal value = 4

Bit error rate = 5

Modem idle

Is the signal OK?

Choose yes/no >

If the signal strength test fails:

- Make sure that you have a valid SIM card: if you are not sure, try it in a mobile phone (refer section)
- Ensure that you actually are in a location with network coverage
- Try raising the unit higher to see if you can get signal
 - The ML315 is fitted with a PCB mounted antenna

- The Main PCB has a socket for a “UFL” connector in to which an external antenna can be plugged
- If fitting an external antenna, shift the Jumper JP3 from the INT to the EXT position
- You will also need to drill an extra hole in the case through which to pass the antenna cable.

If you receive a message that the “Modem is Busy”, wait 1 to minutes for the RTU to complete initialisation then try again.

4.7.5 APN Login Test

- If the Signal strength test succeeds, you should then perform an APN login test to make sure the unit can connect to the provider’s cellular data service
- From the menu select **APN Login Test** **T**

APN test

```
ATE0;S0=1;+CMEE=2;+CCLK="15/07/14,04:10:46+40";+CFUN=5;+CPIN?
+CPIN: READY
OK
AT+CREG=2;+CREG?
+CREG: 2,1,"13A9","D3A4",0
OK
Registered on 2G network
ATS12=20;#DSTO=1;+CGDCONT=1,"IP","live.vodafone.com";#SGACTCF
G=1,5,180,1
OK
AT#SGACT?
#SGACT: 1,1
OK
Modem idle
```

APN test OK

- If the APN test fails, double check that you have the correct APN settings. You may also want to check with another device at the same location that it can connect to the APN.

4.8 Setting the YDOC Server (TCP) Connection

The RTU can send data to a server using 4 methods: TCP, FTP, Email and MQTT. The default (with data going to YDOC Insights) is TCP mode. The other methods will be used if you are sending the information to a different server. See the respective sections for more detail on FTP, Email and MQTT setup.

Once you have verified that the RTU can connect to the mobile network and establish a data connection, you can configure the settings for the connection to the YDOC Insights server

- If you are operating your own copy of YDOC Insights, adjust the server settings to suit.

To configure the TCP settings, from the Config menu select **E**

4.8.1 Set the connection interval

The default connection interval is 6 hours. This has been chosen to keep power consumption within the capacity of the solar panel in European latitudes, with short winter day lengths. You can use YDOC's on line Power Consumption calculator to determine whether a unit will get sufficient charge at a location to support the chosen sensors, log rate and transfer rate.

From the TCP Menu select Send Interval **2**

- You then have two options: Normal Mode and Alarm Mode
- Normal Mode is the rate during normal communications
- Alarm Mode allows you to send at a higher rate upon receiving an alarm
 - Using the example of the stream monitoring station, you may wish to send data every 12 hours in Normal Mode but to send it every 15 minutes after an alarm
- Select the parameter (Normal or Alarm), then select the time base (Hours or Minutes), then from the list, choose the appropriate time period.

Send interval

[0] Exit

[1] Normal mode >> 06:00:00

[2] Alarm mode >> Not used

>

Normal send interval

The normal interval must be greater than the alarm interval and must be greater or equal to the normal data log interval

[0] Exit

[2] Minutes

[3] Hours

>

Normal send interval

The normal interval must be greater than the alarm interval and must be greater or equal to the normal data log interval

[0] Exit

[I] 15 Minutes

[J] 20 Minutes

[K] 30 Minutes

>

Send interval

[0] Exit

[1] Normal mode >> 00:30:00

[2] Alarm mode >> Not used

4.8.2 Set the TCP Server Details

To set the TCP Server Address, select **4**

- If you are using the YDOC server, set the address to your-data-our-care.com
- If you are using TOIP's server set the address to toip-server.net.au or 120.150.31.37

To set the Server Port, select **5**

- Check that the port is set to **37**

To set the TCP User Name, select **6**

- Enter the User Name e.g. toip

To set the TCP Password, select **7**

- Enter the Password e.g. p10t

4.8.3 Complete a TCP Communications Test

After checking that all of the parameters are correct, you can perform a test to ensure that the RTU can connect to the server and log in.

To perform the TCP Test, select

T

- The RTU will turn on the modem, connect to the GSM network, register on the data network, then attempt to log in to the server.

TCP start

Please wait...

```
ATE0;S0=1;+CMEE=2;+CCLK="15/07/14,12:30:18+00";+CFUN=5;+CPIN?  
+CPIN: READY
```

OK

```
AT+CREG=2;+CREG?
```

```
+CREG: 2,1,"13A9","D3A4",0
```

OK

Registered on 2G network

```
ATS12=20;#DSTO=1;+CGDCONT=1,"IP","live.vodafone.com";#SGACTCF  
G=1,5,180,1
```

OK

```
AT#SGACT?
```

```
#SGACT: 1,0
```

OK

```
AT#SGACT=1,1,"",""
```

```
#SGACT: 10.82.229.198
```

```
AT#PKTSZ=0;#SD=1,0,37,"www.your-data-our-server.com",255,0,0
```

CONNECT

```
CMD=1&MODULE=YDOC&V=1.9&SN=5024346&NAME="YDOC_346"&IN
```

```
T=21600&CNT=1&USR="TOIP"&PSW="*****"
```

TCP message send

ACK

+++ send

OK

```
AT#SH=1
```

OK

End TCP OK

Modem idle

TCP test OK

Press any key!

If the test fails, make sure that you have all of the TP details correct. You should also check that you can still perform the Network and APN tests successfully.

After the test runs, you should check with the computer running YDOC Insights to which the data is being sent:

- The RTU sends a dummy file to the server
- The file will be stored in the folder
C:\YDOC\YDOC Insights\archive\ydocdatacollector
- In this folder you will see a ZIP file for each RTU, with the files being named DOC_YDOC_<serial_no>_<transfer No>.zip
- The date and time stamp on the file should match the time of the test transmission
- You can open the file to check that it was received without corruption: it should contain a number of lines, each showing punctuation characters, 0 to 9, a to z and A to Z.

4.9 Starting the Logger

The RTU will not start logging and sending values until it is put in to RUN mode. You must ensure you do this after configuring the logger or after selecting any of the test modes:

- Connect to the RTU in your Terminal
- Activate the menu by typing the key sequence CTRL-a, SHIFT-m, CTRL-d
- When the menu displays, check what level in the menu you are at
 - If any of the sub-menus display, press 0 to go back to the Configuration Menu
- At the Configuration Menu select Run by typing **0**
- The RTU will respond with a prompt to say it is running.

<18:23:31>

Configuration Menu ML-315 Logger Version 1.9 Build 5

```
[0] Run
[1] Date & time      >> 1970/01/04 18:26:45
[2] System information >> 5900152
[3] Configuration setup >>
[4] Configuration review
[5] Maintenance
>
```

Running

NOTE:

- If you fail to do this, the YDOC RTU will NOT Transmit any readings to the server
- **Always make your last step before disconnecting the USB cable is to place the unit in RUN mode.**

5 Sensor Configuration

The ML315DS-PV can accept pulse and SDI-12 sensors. It can also log a range of internal parameters for diagnostic purposes.

5.1 GSM Signal Strength

The RTU allows you to log the GSM Signal strength for diagnostic purposes – especially when first setting up a new RTU:

- Go to the Configuration menu 3
- Select option 9 Network signal sensor
- Leave the log interval on the default value
- Select option 5 Network Signal dB
- Select option 1 and change the name to GSM_SQ
- Save the changes.

Note that if you are in an area where signal strength is not likely to change, you may wish to disable the Signal Strength monitoring once the system is stable. This is because the modem must be powered up for additional time to record the signal strength. Turning this function off will thus help maximise battery life.

5.2 Adding Internal Sensors

To add Internal sensors, from the Configuration menu select 6
The list of available Internal Sensors and their status will display:
Internal sensors

```
[0] Exit
[1] Name >> Internal
[2] Sample interval >> Data log interval
[3] Battery capacity >> 0 mAh
[4] Battery replaced >> No
[5] Rest capacity >> Rest capacity
```

[6] Rest power	>> Not used
[7] Processor temperature	>> Processor temperature
[8] Average voltage	>> Not used
[9] Max voltage	>> Not used
[A] Min voltage	>> Min voltage
[B] Average current	>> Not used
[C] Max current	>> Not used
[D] Min current	>> Not used
[E] Operating cycle	>> Operating cycle
[F] Free disk space	>> Not used
[R] Remove	

To enable a measurement, select the number next to it from the menu

- Interval: normally this is set to the same as the data logging interval, but you can change the rate
- Battery Capacity: if you are using a Lithium battery, enter the battery capacity here, the RTU can monitor the battery charge status
- Battery Replaced: when you fit a new Lithium battery, select this and choose 1 to record that a new battery has been fitted
- Enable Average Battery Voltage (8) and Average Current (B)
- If you select a value by mistake, use the “R” option to delete it
- The list will update to show the parameters which are active and those which are not
- When finished, select 0 to exit and then Y to save the changes.

5.3 Adding Analogue Sensors

Analogue sensors (Voltage and 4-20mA) are only available on the “ADS” versions of the RTU, not with the “DS” units. There are two 4-20mA (1,2) and 2 voltage channels (3,4).

5.3.1 Voltage Sensors

The voltage inputs on the RTUs are scaled for 0 to 10V. The channels have 12 bit resolution (4096 steps) so when used on 0 to 2.5V sensors, you will still achieve 10 bit resolution (1024 steps).

To add an Analogue voltage sensor on Port 3:

- From the Configuration Menu select Analogue Sensors 7
- Select Port 3
- When the Analogue Sensor menu displays, set the parameters for the sensor

- Name Give the sensor an appropriate name e.g. Water Level
- Power Switch: The Power switch should be enabled so the sensor is only turned on during the Read operation. Select 2, then type 1 to enable the Power Switch, then enter the warm up time e.g. 2 sec
- Sample Interval Leave at the data log interval
- Select Parameter Settings (5) and set the values to suit the sensor
 - Name Give the sensor a short name e.g. LEV
 - Code type a short code for the sensor. You should keep the code consistent for all sensors of this type e.g. WL (water level), AT (air temp) RH (Relative humidity) BP (barometric pressure), SR (solar radiation etc.)
 - Units Enter the units to be used for the measurement e.g. m (always try to use the standard SI measurement units)
 - Value factor: this allows you to enter a multiplier to scale the value :
 - Offset: an offset to be added to the reading.

5.3.1.1 Range Conversion

Analogue signals may be transformed using the Value Factor and Offset or with the Parameter Value at 0V and Parameter Value at 10V settings.

Value and Offset

The Value factor and offset are used together to provide simple calibrations in the form $Y = a x + b$, where $a = \text{Value factor}$ and $b = \text{offset}$.

For instance with a 5m range sensor which is installed 20m below the surface. To express the level as a depth below the surface: Value factor = -1; Offset = 20. If the sensor reads 3m, $y = -1 * 3 + 20 = 17\text{m}$ below the surface.

Parameter at xV

The Parameter values at 0V and Parameter Value at 10V (6 and 7) are used to specify the outputs to display at the 0V and 10V values.

For a relative humidity sensor which provides a 0 to 100% output over a range 0 to 2.5V:

- Value at 0V = 0%
- Value at 10V = Value at 2.5V X 4 = 400%

5.3.2 4-20mA Sensors

To add a 4 to 20mA sensor on Port 1:

- From the Configuration Menu select Analogue Sensors 7

- Select Port 1
- When the Analogue Sensor menu displays, set the parameters for the sensor
 - Name Give the sensor an appropriate name e.g. Water Level
 - Power Switch : The Power switch should be enabled so the sensor is only turned on during the Read operation. Select 2, then type 1 to enable the Power Switch, then enter the warm up time e.g. 2 sec
 - Sample Interval Leave at the data log interval
 - Port Mode Select 0 for sensors which are scaled for 4 to 20mA or 1 for sensors which are scaled for 0 to 20mA
- Select Parameter Settings (5) and set the values to suit the sensor
 - Name Give the sensor a short name e.g. LEV
 - Code type a short code for the sensor. You should keep the code consistent for all sensors of this type e.g. WL (water level), AT (air temp) RH (Relative humidity) BP (barometric pressure), SR (solar radiation etc.)
 - Units Enter the units to be used for the measurement e.g. m (always try to use the standard SI measurement units)
 - Value factor: this allows you to enter a multiplier to scale the value. For 4-20mA sensors, leave on 1
 - Offset: an offset to be added to the reading; for 4-20mA sensors, leave on 0
 - OK the changes and go back to the Analogue sensor menu
- Use the Parameter Value at 4mA and Parameter Value at 20mA to specify the readings at each end of the scale
 - E.g. for a water level sensor which reads over a 5m range, the value at 4mA would be 0m and the value at 20mA would be 5m
 - If you wanted to apply a depth to reference level e.g. for a sensor installed at a depth of 20m with a range of 5m, the Value at 4mA would be 20m and the Value at 20mA would be 15m.

5.4 Adding Pulse Inputs

The RTUs allow you to capture pulse data in 3 different formats:

- Counter: a totaliser which captures the total rain or flow (and can be viewed as an equivalent to the dial on the front of a meter). This can be left incrementing continually or reset every day (running total daily rain)
- Quantity: captures the rain or flow in the log interval (the standard way of looking at rain)

- Rate: converts the pulse count in to a rate over time (i.e. converts a flow volume (e.g. 10 m³) to a flow rate e.g. 40 m³/hour
 - You can capture the actual, maximum and minimum rates.

By default, pulse sensors are added as a Counter; you can then enable the Quantity and/or Rate channels.

5.4.1 Rain Gauges

Rain Gauges are connected to any of the three Digital Input channels. To add a Rain Gauge on the first input:

- From the Configuration Menu, select Digital Sensors **8**
- Select the Port – 1 for the first gauge **1**

Digital sensors

```
[0] Exit
[1] Port 1          >> Not used
[2] Port 2          >> Not used
[3] Port 3          >> Not used
[T] Digital input test    >> Not done
```

- As this is a rain gauge, select 1 for a Digital Pulse input (if you were setting an entry alarm or other on-off channel, you would select 2)

```
[0] Exit
[1] Digital pulse
[2] Digital alarm
>
```

Digital pulse sensor

- Now configure the settings to match the sensor

```
[0] Exit
[1] Name           >> Digital pulse
[2] Sample interval >> Data log interval
[3] Port mode      >> Port 1; Internal pull up
[4] Units per pulse >> 1
[5] Register mode  >> Pulse (low frequency)
[6] Register value >> 0 Pulses
[7] Register reset >> Off
[8] Log each counter change >> Off
```

- [9] Counter (unit) >> Counter
- [A] Quantity (unit) >> Not used
- [B] Mean rate (unit/h) >> Not used
- [C] Max rate (unit/h) >> Not used
- [D] Min rate (unit/h) >> Not used
- [R] Remove

- Set the **Name** to Precipitation
- Leave the **Sample Interval** at the Data Log Interval
- Leave the **Port Mode** on Internal Pullup
- Set the **Units per pulse** to match the gauge
 - For a 0.2mm per tip rain gauge, the Units per pulse will be 0.2
- **Register Mode** - Leave the on Pulse (low frequency)
 - You can change this if connecting to a high pulse rate flow meter
- **Register Value** – this can be left on 0
- **Register Reset**
 - For a long term totaliser leave this to Off
 - If you want the totaliser to capture the daily rain (midnight), set it to On. The totaliser will then count up each day and reset at midnight
- Log each counter change – leave on Off
- Now select **Counter** 9 and set the parameters for the Counter channel
 - Set the Name to Daily Rain
 - Set the Code to PRD
 - Set the Value factor to 0.2 (for 0.2mm per tip gauges)
 - Leave the Value factor and offset on 0
 - Set the Number of Decimals to 1
- Now select **Quantity** A and set the parameters for the normal pulse counter
 - Set the Name to Rain
 - Set the Code to PR
 - Set the unit to mm
 - Set the Value factor to 0.2 (for 0.2mm per tip gauges)
 - Leave the Value factor and offset on 0
 - Set the number of decimals to 1
 - Make sure item 7, Data log is set to **On**
- If you want to capture the Rain Intensity, you can enable the Mean, Max and Min Rate at options B, C and D
 - Set the Name Mean Intensity / Min Intensity / Max Intensity

- Set the code PRIAV / PRIMN / PRIMX
- Set the value factor to 0.2, the factor and offset to 0
- Leave the decimals at 3.

Check all the settings and then save the changes.

5.4.2 Flow Meters

Flow Meters are connected to any of the three Digital Input channels. To add a flow meter on the first input:

- From the Configuration Menu, select Digital Sensors **8**
- Select the Port – 1 for the first meter **1**
- As this is a flow meter, select 1 for a Digital Pulse input (if you were setting an entry alarm or other on-off channel, you would select 2)
- Now configure the settings to match the sensor
- Set the **Name** to Flow Meter
- Leave the **Sample Interval** at the Data Log Interval
- Leave the **Port Mode** on Internal Pullup
- Set the **Units per pulse** to match the rate given on the meter head e.g. 1 kl/pulse
- **Register Mode** - Leave the on Pulse (low frequency)
 - Change this to High if you are expecting more than 10 pulses per second
- **Register Value** – this can be left on 0, or if you want to make it read the same as the dial on a meter, type in the current meter reading
- **Register Reset**
 - For a long term totaliser leave this to Off
- Log each counter change – leave on Off
- Now select **Counter** 9 and set the parameters for the Counter channel
 - Set the Name to FM1 (or name of block on which meter installed)
 - Set the Code to FMTOT
 - Set the Value factor to the number of units per pulse
 - Leave the Value factor and offset on 0
 - Set the Number of Decimals to 1
- Now select **Quantity** A and set the parameters for the normal pulse counter which count the flow in each logging interval
 - Set the Name to Flow
 - Set the Code to FM
 - Set the unit to the units on the meter head e.g. kl

- Set the Value factor to the number of units per pulse e.g. 1
- Leave the Value factor and offset on 0
- Set the number of decimals to 1
- Make sure item 7, Data log is set to **On**
- If you want to capture the Flow Rates, you can enable the Mean, Max and Min Rate at options B, C and D
 - Set the Name Mean Flow / Min Flow / Max Flow
 - Set the code FMAV / FMMN / FMMX
 - Set the value factor to the number of flow units per pulse, the factor and offset to 0
 - Leave the decimals at 3.

Check all the settings and then save the changes.

5.4.3 Pulse Wind Speed Sensors

Pulse output wind speed sensors (anemometers) have the advantage that they are easy to read and do not require external power.

Pulse wind sensors are connected to any of the three Digital Input channels. To add an anemometer on the first input:

- From the Configuration Menu, select Digital Sensors **8**
- Select the Port – 1 for the sensor **1**
- Select 1 for a Digital Pulse input
- Now configure the settings to match the sensor
- Set the **Name** to Wind Speed
- Set the **Sample Interval** to 1 sec
- Leave the **Port Mode** on Internal Pullup
- Set the **Units per pulse** to match the sensor
 - for Davis D6410 0.001032
- **Register Mode** - Leave the on Pulse (low frequency)
 - You can change this if connecting to a high pulse rate flow meter
- **Register Value** – leave this on 0
- **Register Reset** – leave this OFF
- **Log each counter change** – leave on OFF
- **Counter** - leave on NOT USED
- **Quantity** - leave on NOT USED
- **Mean Rate** - select and configure as follows
 - Name Wind Speed Avg
 - Code WSAVG
 - Unit set to match sensor e.g. km.h

- Value factor 1 (or to convert to m/s 0.277778)
- Value offset 0
- Decimals 3

Check all the settings and then save the changes.

5.5 Adding SDI-12 Sensors

SDI-12 sensors are added in the Serial Port section of the Configuration menu.

From the Configuration Menu, for Serial port, select **A**
Then for the Serial Port selection choose SDI-12 **3**
The SDI12 Sensor menu will display.

To give the sensor a name choose **1**

- After selecting 1, you will be prompted for a name
- Enter the name you want to use for the sensor e.g. Otto SMP

You must then set the sensor address

- From the menu select Port Settings **2**
- From the Port Settings menu, select Address **4**
- When prompted choose the address to use for the sensor e.g. 0

You can now set the power control parameters

- From the menu select Sensor Power Switch **3**
- Select 1 to enable power switching: the sensor power will then only turn on when it is time to read the sensors
- You will then be prompted for a Warm Up time in seconds before the read will be performed. If you are not sure whether one is needed, allow 2 seconds
 - >Sensor power switch usage (0 = Disabled, 1 = Enabled): 1
 - Warm up time (resolution 0.25 sec): 2

Set the Sampling Interval

- You can leave the SDI-12 read rate at the same figure as the Sampling Interval or can set it to a higher value to allow averaging
- If you have set the Sampling Interval to 15 minutes, the options available to you will be 1, 3, 5 and 15. If you select 3 for instance, the sensor will be read every 3 minutes and the 5 readings averaged every 15 minutes

- If you are using Event based logging (with a different rate after an alarm event) you can enter the rate to use after the alarm condition here under option 3.

Set the Measurement Command

- From the menu select Measurement Command **5**
- You will then be prompted for the Command Type – M or C – and the Measurement Number (0 to 9)
 - Select the command and measurement number to match your sensor

You must now add the individual measurements as parameters

- From the Menu select Parameter 1 **6**
- Select 1 and give the sensor a name e.g. SM 010cm
- Select 2 and set the Code for the measurement. Use the same code for a given type of measurement
 - soil moisture SM<depth> e.g. SM010
 - soil temperature ST<depth> e.g. ST010
 - soil conductivity EC<depth> e.g. EC010
 - air temperature AT
 - relative humidity RH
 - wind speed use WS
 - wind direction WD
 - leaf wetness LW
 - solar radiation SR
 - water level WL
- Select 3 and enter the units e.g. %
- If you want to apply a multiplier and offset, they can be added under options 4 and 5
 - New value = (X & Value Factor) + Offset
 - Value Factor multiplier with default of 0
 - Value Offset Offset to be added to value, default = 0

You can use the real time value display mode and COM Port redirection to make test measurements on your sensors.

5.6 Adding Calculated and Aggregate Sensor Channels

The RTUs allow you to generate new Calculated channels based on the values of other sensors. This enables alarms to be configured on the calculated rather than the raw sensor value. You can also create Aggregated channels which calculate the average of sum of a tag value over time (e.g. for generating average wind).

5.6.1 Adding a Calculated / Derived Channel

First perform the device setup and add the standard sensor as per section 5.5. Then write down the formula you want to use to convert this raw value into a calculated channel.

Go back to the SDI-12 sensor setup and make a note of the **CODE** you have given to the sensor in the config e.g. a soil moisture sensor named SM010cm has been set a code of SM010; the Soil temperature sensor, ST010cm has been set a code of SM010 etc.

- When using sensors in the equation you prefix the code with a colon e.g. :SM010 or :SM010.

To create a calculated sensor:

- From the main menu select Configuration Setup **3**
- From the Config menu select Derived Channels **C**
- from the Derived Channels menu select **2** Calculations
- To add the first calculated channel select Channel 1 **1**
- Now select the first Parameter **1**
- Enter the new name for the channel under option **1**
 - Type in the new name e.g. SM Cal 010cm
- Give the new parameter a short code **2**
 - e.g. SMC010
- Select the Engineering Unit for the sensor e.g. mm **3**
- Accept these settings **0**
- Now select the Formula option **2**

The Formula Editor will display. The editor shows you the range of available functions.

Parameters Must be prefixed with a colon (":")
e.g. :SM010

Supported operators: + - * /

Supported parentheses: ()

Functions with one argument:

abs(x) returns the absolute value of x

sqrt(x) returns the square root of x

ln(x) returns the natural logarithm of x

exp(x) calculates the exponent of e to x

sin(radians) returns the sinus of radians

cos(radians) returns the cosine of radians

tan(radians) returns the tangent of radians

asin(x) returns the arc sinus of x in radians

acos(x) returns the arc cosine of x in radians

atan(x) returns the arc tangent of x in radians

torad(degrees) converts degrees to radians

todeg(radians) converts radians to degrees

floor(x) returns the largest integer not greater than x

ceil(x) returns the smallest integer not less than x

round(x) rounds to the nearest integer

Functions with multiple arguments:

atan2(x;y) return the arc tangent of x/y

mod(x;y) return the remainder of x/y

pow(x;y) returns x to the power of y

clip(x;min;max) returns x clipped between min & max

Comparisons with 2 arguments:

eq(x;y) returns x if x=y else y

lt(x;y) returns x if x<y else y

le(x;y) returns x if x<=y else y

gt(x;y) returns x if x>y else y

ge(x;y) returns x if x>=y else y

Comparisons with 4 arguments:

eq(x;y;q;p) returns q if x=y else p

lt(x;y;q;p) returns q if x<y else p

le(x;y;q;p) returns q if x<=y else p

gt(x;y;q;p) returns q if x>y else p

ge(x;y;q;p) returns q if x>=y else p

The calibration for an MP02 takes the form: **$ax^2+bx+cx+d$**

For a 50/50 mineral-organic soil : a = 0.0007 b = -0.01226 c = 1.53233 d = -27.231

To enter this in the formula editor (assuming that the raw soil moisture reading is SM010):

$0.00007*\text{pow}(:\text{SM}010;3) - 0.01226*\text{pow}(:\text{SM}010;2) + 1.53233*:\text{SM}010 - 27.231$

After entering the Formula, take note of the value that displays in the Result section: look at the current value for the sensor tag(s) and check that the calculation yields the correct result.

Every time a new value is recorded by the logger the calculated parameter will be evaluated and saved.

You can use this function to calculate the Soil Moisture Sum (Refer Section 5.5 for info on setting up SDI-12 soil moisture sensors) in the logger rather than in the software:

- Assuming you have a 5 sensor soil moisture probe with sensors at 10, 20, 30, 50 and 70cm
- Review the setup of the sensors and record the “Code” you have allocated to each: in this case assume that they are SM010, SM020, SM030, SM050 and SM070
- The formula would become:
 $:\text{SM}010 + :\text{SM}020 + :\text{SM}030 + :\text{SM}050 + :\text{SM}070$
- After entering the formula look at the line below the formula to see if it shows an error message:
 - If the result shows 0 or a number (assuming the sensors has readings) then the formula has no errors
 - If the line shows “Error at position : x” , review the formula and correct the error

5.7 Adding an Aggregated Channel

Aggregation is very useful with pulse wind speed sensors and enables you to calculate the Average, Maximum and Minimum over the full sampling period. It can also be used to create a Vector Wind Average.

The RTU can accommodate up to 8 Aggregate channels, each which can handle 600 values. The sampling rate and log rate must be chosen to fit within this 600 value range e.g 10 minute log period allows 1 sec sample rate; for 15 minute log rate use 2 second sampling rate.

To add an Aggregated Channel:

- First set the wind speed sensor up as a Digital Input (Refer section 5.4.3)
- From the Config Menu select **C** Derived Channels
- When the Derived Channels option displays, select **1** Aggregations
- select the first Aggregated Channel
- select 1 and give the aggregated channel a name e.g. WS Aggregate
- select 2 and set the appropriate Aggregation Period e.g. 10 min> Note that this can be the same as the Log Period or shorter (e.g. if log period = 15 min and Aggregation period = 5 min you will get a rolling 5 min average)
- leave option 3 (Vector Aggregation) off
- select option 4 and set the Name to Wind Speed Avg
- select option 5 and set the Name to Wind Speed Min
- select option 6 and set the Name to Wind Speed Max
- the Wind Gust may also be selected at option 7: this is the highest 3 sample average over the aggregation period

If adding a Wind Direction Sensor:

- set the Name to Wind Direction
- set Vector Aggregation to ON
- enable Average Direction and Deviation

5.8 Testing SDI-12 Sensors

The RTU provides a facility for configuring and testing SDI-12 sensors. This is referred to as Com Port Redirection i.e. commands typed to the USB port are directed to the SDI-12 port.

To activate COM Port redirections:

- From the menu select Maintenance **5**
 - Then select Com Port redirect **2**
 - Then select Com Port **1**
 - Then select SDI-12 **3**
 - The RTU will then display a message saying Comport redirection is active
 - LED 3 will turn on to indicate that the USB port is active
 - The PS ON LED will turn on indicating that the switched sensor power is on
 - If you do not type any commands for 30 seconds the function will time-out
 - You can now type commands which you want sent to the sensor
 - Note that the commands are not echoed on the screen
 - Make sure the commands are sent in Upper Case
 - Each command must terminate with an exclamation mark ("!")
- e.g. Type 0!
RTU Responds with 013TEKBOX_LCSMP_2.30_00088
- e.g. Type 0C1!
RTU responds with 000102
- Type 0D0!
RTU responds with 0+5.23+16.26
- You can issue all of the standard SDI-12 commands or any Extended commands accepted by the sensor
 - When finished, type CTRL Z or allow the function to time out.

If you do not see a response when you type SDI-12 commands into the terminal window:

- measure the battery voltage and make sure it is above 3.9V. If the battery voltage is lower than this, try a set of charged fresh batteries or with another Cover (e.g. a DC-AA cover connected to a plugpack)

- make sure that the modem light is not: when the modem is powered up the combined current draw for the modem and the DC-DC converter which powers the SDI-12 sensors is too high. Wait until the modem light goes off and then try again
- if there is not already sensor connected to the unit, connect one and set the configuration to suit. Set the Log rate to 5 minutes and then, after setting the unit to RUN mode, watch to see that the sensors have been read

5.9 Powering High Current Drain Sensors

The DC-DC Converter which generates the 12V supply for your sensors can only supply 100 mA. Connecting sensors with a higher current draw than this may cause the converter to fail.

A separate DC-DC Converter module is available on the DC-AA power board and this can supply up to 200 mA. It can also be switched between 12 and 24V. On the 24V range it can supply 70mA.

To use the 200 mA DC-DC Converter on the DC-AA board:

- disconnect the Power and Ground leads from the SDI-12 or analogue sensors (X4 Pin 1)
- locate the 3 pin header labelled X2 on the DC-AA board
- make up a link of insulated wire 150mm long with stripped & tinned ends. Then connect this wire from Pin 1 of X1 on the RTU PCB to Pin 1 of X2 on the DC-AA board.
- This wire routes the switched DC voltage from the RTU to the control input on the DC-AA cover which in turn turns on the DC-DC converter
- locate the header X1 on the DC-AA board. The pins on this header carry Ground and the switched
 - Pin 1, 2, 3 Ground
 - Pin 4, 5, 6 Switched 12V
- to test the DC-AA Power source, select Com Port Redirect from the Maintenance Menu on the Rtu and confirm that when the RED LED is on, you have 12V between pins 1 and 4 on X1.

5.10 Setting up Alarms

The RTUs can be configured to send an SMS alarm or Email (V2.4B4 onwards) when the values of a parameter go beyond specified limits. These

alarms are separate from the alarms which may be added within YDOC Insights.

Alarms can be added based on the value of any physical or calculated channel. Although this section refers to setting up alarms on an analogue channel, the process is the same for other types of channels.

The RTUs define two levels of high and low alarm:

- Low limit - generally used for a warning
- Low low limit - used for an alarm
- High limit - generally used for a warning
- High high limit - used for an alarm

You can enter a delay (number of samples) that a condition must stay above/below a threshold before the alarm is triggered and a hysteresis value (to prevent multiple alarms if a value is hovering around the alarm value).

5.10.1 Setting up an Alarm SMS

To add an SMS alarm:

- Go to the RTU menu and select the Configuration Menu
- First you must enable SMS alerts. There are two levels of Alerts: System Alerts (which warn for events such as a delay in communication) and Data Alerts (which test the value of a sensor)
 - System alerts can be useful for diagnosing problems with communications and can be turned on for testing and then disabled again
 - Because all of these functions are available remotely, you can setup and change alarms without visiting the site
- To set up a Data Alert:
 - Select the option Alarm SMS 4
 - Select Data Alarm 2
 - Then select option 1 to enable the alarms
 - Select option 3 Cellphone First recipient and enter the mobile phone number to which you want the alarm to be sent
 - Select option 4 Cellphone Second recipient and enter the second mobile phone number to which you want the alarm to be sent
 - You can now perform an SMS test and send a test message to the selected phone. Note that the SMS Test will not work if you

- are remotely connected because the modem is already in use for the connection
- Now go back to the Configuration menu and select the channel to which you wish to add an alarm (this example assumes an analogue channel)
 - Select the Parameter number for the channel to edit its settings
 - Select option 9 Alarm SMS and then select 1 to turn the alarm SMS on for this channel. The full parameter list will display, which includes all the alarm settings
 - Option C Low low limit Enter the value at which you want the low alarm to occur
 - Option D Low limit Enter the value at which you want a warning to occur: set the value to the minimum range if you don't want to use this warning
 - Option E High limit Enter the value at which you want a warning to occur: set the value to the maximum range if you don't want to use this warning
 - Option F High high limit Enter the value at which you want the high alarm to occur
 - Option G Alarm set delay This is normally on 1 so the alarm will occur as soon as the event occurs. If you enter a value higher than 1, the condition will need to be met for that many successive samples in order for the alarm to be sent
 - Option H Alarm reset hysteresis The hysteresis value can be adjusted to prevent un-necessary alarm repeats. For a High alarm at 70 and a hysteresis of 5, the value must drop down to 65 before another high alarm will be accepted.

The text below shows a Low (Lo) and Low-ow (LoLo) alarm from a water level sensor. The alarm shows the RTU mobile number, RTU name, Tag name, Alarm name and current value:

2016/01/21 06:38:20AM

From: +61437772480 YDOC_148 5900148: waterlevel 2m Lo
Alarm 32.962 cm

2016/01/21 07:18:16AM

From: +61437772480 YDOC_148 5900148: waterlevel 2m LoLo
Alarm 28.539 cm

5.10.2 Setting up an Alarm Email

To add an Email alarm:

- Go to the RTU menu and select the Configuration Menu
- First you must enable Email Sending
 - from the **Config** menu select **Email Output E**
 - select **1** Name and change this to Email Alarm
 - leave the Send Interval **2** at 6 hour
 - leave the Send delay **3** set to Not Used
 - select **4** SMTP Server and enter the name of your Email Server
 - check with your Email provider for the SMTP Port to use. If unsure, leave on the default value
 - select **6** User Name and enter the User Name used to log in to the mail server
 - select **7** Password and enter the password for login
 - select **8** Originator address and enter the Email address from which the Emails will be sent
 - select **9** Destination address and enter the email address for the recipient
 - select **A** Subject and enter the Subject you wish the emails to carry e.g. YDOC RTU <nnnnnn> Alarms
 - make sure that the Data Format at **B** is left on Native
 - select **B** Data Filter and select Diagnostics
 - select Option **0** and save the changes, then come back to the Email menu again
 - select **T** Test to send a test message. Wait for the test to complete and check that the message is received by the intended target. If not, double check all the settings and try again
- Now go back to the **Configuration menu** and select the channel to which you wish to add an alarm (this example assumes an analogue channel)
- Select the Parameter number for the channel to edit is settings
- If you had previously enabled Alarm SMS sending **9** disable it now
- select option **A** Alarm Log and set it to ON
- select Option **B** The full parameter list will display, which includes all the alarm settings
 - Option **C** Low low limit Enter the value at which you want the low alarm to occur
 - Option **D** Low limit Enter the value at which you want a warning to occur: set the value to the minimum range if you don't want to use this warning

- **Option E** High limit Enter the value at which you want a warning to occur: set the value to the maximum range if you don't want to use this warning
- **Option F** High high limit Enter the value at which you want the high alarm to occur
- **Option G** Alarm set delay This is normally on 1 so the alarm will occur as soon as the event occurs. If you enter a value higher than 1, the condition will need to be met for that many successive samples in order for the alarm to be sent
- **Option H** Alarm reset hysteresis The hysteresis value can be adjusted to prevent un-necessary alarm repeats. For a High alarm at 70 and a hysteresis of 5, the value must drop down to 65 before another high alarm will be accepted.

If your RTU can not send an Email, download and review the data file (in YDOC Native format). Look for any WDT (watchdog timer) entries relating to the Email sending

- YDOC uses the SMTP command stack built in to the Telit modems. Telit incorrectly used the HELO command to log in to SMTP servers rather than the expected EHLO command. Most Email servers are now configured to reject this
- Telit added an SMTPCFG command to the modem firmware which, in conjunction with Version 3B.05 and later includes a command to switch the modem so it uses the correct command
- contact TOIP to organise an upgrade to the firmware in the modem on your RTU (or a changeover PCB).

6 Saving and Uploading Configurations

After you have configured an RTU you can save the configuration file on your PC. You can then reload it in to the RTU if the configuration is lost or use it to configure a replacement RTU if the RTU fails. In the same way you can also create files to match your most common RTU configurations and load them in to the logger rather than setting up each function manually.

6.1 Saving an RTU Configuration

Once you have finished configuring the RTU, make sure that you work back through the menu tree and save the changes. To save a configuration:

- At the main menu select 5 Maintenance
- From the Maintenance Menu select 5 Configuration Download
 - The RTU will show the Sending file dialogue
- From HyperTerminal select Transfer / Receive file and make sure that the Y-Modem protocol is selected
- The file will be transferred to the download folder used by HyperTerminal.

6.2 Loading a Configuration to an RTU

Connect to the RTU using the USB cable and open HyperTerminal or YDOC Terminal then:

- At the main menu select 5 Maintenance
- From the Maintenance Menu select 6 Configuration Upload
 - The RTU will show the Receiving file dialogue
- Click on Transfer / Send File, then browse to locate the file holding the configuration
- The file will be transferred to the logger
- when the transfer finishes you will be prompted as to whether you wish to overwrite the site name
 - if you are copying the config to a duplicate site, answer No
 - if you are replacing an existing RTU which has failed, answer Yes
- After the transfer completes, review the configuration and make any needed changes i.e. altering the Serial Number or Site Name.

6.3 Erasing an RTU Configuration

If you want to quickly restore an RTU to the default settings, you can erase or delete the configuration:

- At the main menu select 5 Maintenance
- From the Maintenance Menu select 9 Bootloader Menu
- when prompted select "Y" to confirm that you wish to invoke the Bootloader menu
- disconnect and then reconnect the terminal session
- from the Bootloader Menu select E Erase Config

7 Other Functions (Accessories)

7.1 Setting Up a Camera

A Camera (Part Number YDOC-CAM-D1) may be connected to the ML315ADS-PV unit. Refer to section 2 for details on ordering. If you want to send the images to your own server, set the transfer mode to FTP; if you want to view the images in YDOC Insights, use TCP Transfer mode.

The camera plugs in to the Accessory port via Connector (X5). Cameras are supplied with a 7 pin header pre-wired to the cable. You will need to remove the header in order to feed the cable through a cable gland on the logger



- If you have not already drilled the case, add an extra gland for the camera cable
- If the cable colours are different from the table below, make a note of the colours of the wires on each terminal then disconnect the header
- Feed the cable through the cable gland
- Re-terminate the camera cable using the colour codes identified above (Pin 1 is on the left).

Accessory Pin	Colour	Function
1	Red	Power
2	Black	Ground
3	-	-
4	Yellow	Tx
5	Green	Rx

The camera should be mounted to the pole on which the telemetry unit is installed using a suitable bracket. The camera mount can be adjusted through various angles and you can select from 3 different mounting positions on the camera to help keep it balanced at the angle on which it is installed.

Add the camera to the configuration:

- From the menu select Configuration Setup 3
- Select Accessory Port B

- From the list of options select **C** Camera
- Makes sure that Independent Data log (4) is set to ON (so the camera can send images at a different rate to the other on board sensors)
- Set the log interval under option 5 to 24 hours (or more often if needed)
- Set the Interval Shift (6)
 - If this is not set the image will be taken at 00:00
 - Set the offset to the number of minutes after 00:00 at which you want the photo to be taken e.g. 360 for 6 am
- Select the image resolution (7)
 - A higher resolution yields better images but requires a higher data allowance on your SIM card
 - Monthly data requirement = horizontal resolution X vertical resolution X number of images per day X 31 X 1.05 (to allow for overheads)
- Now test the connection by selecting option **C**
 - The RTU will take a test image to confirm communications with the camera are OK
 - This image is not sent to the FTP server but via the USB cable to your PC

```
[T] Camera test      >> Not done
>
  Camera test
<15:39:26>
Shooting...
```

- After a few seconds you should be prompted to transfer the file to your PC

```
<05:56:48>
Select Y-Modem transfer from your terminal program menu,
to receive the picture file "ML-315_YDOC_152.jpg"
```

```
Press <Esc> to abort transfer
Sending...
```

- From your terminal program, select **Receive File** and set the protocol to **Y-Modem**
- When the download has completed, open the file and check that the image is OK.

Now you can set up the FTP Transfer

- TOIP will assign a unique user name and password for each camera to ensure images are secure (see naming convention below).

If you are using your own FTP Server (e.g. FileZilla):

- Create a Group to which all accounts used for downloading will be a member of e.g. group = ydoc
- Create an account on the FTP server for the RTU
 - Give the account the same name as the “Name” in the FTP settings of the RTU e.g. ydoc_<serial Number> for a logger with Serial Number 152, use a name of “ydoc_152”
 - Make sure the account type is set to require a password and allocate a suitable password
- In the Shared Folders section of FileZilla, create a folder for the user e.g. ftp/ydoc/ydoc_152
- Make this folder the user’s “Home” folder
 - Any files transferred by the RTU will be transferred to this folder
- Give the user Read, Write, Append and Delete permissions to the folder.

Now set up the FTP parameters in the RTU:

- From the Configuration Menu select TCP Output **D**
- Enter the details for the server to which you are sending the images. If you do not have your own server you can send to the TOIP server
 - Name ydoc_<serial Number>
 - Send interval typically 1 per day but set to meet your requirements
 - Send delay An offset from 00:00 after which the image will be taken. Entered in minutes.
TO shoot at 6:00 am offset = $60 \times 6 = 360$
 - Password as per FTP account
 - Server toip-server.net.au (or URL of your own server)
 - Port 21 (or port for your server)
 - User Name ydoc_<serial Number>
 - Password as per setup of FTP account
- After checking the settings, select 0 from the menu and when prompted, save the changes
- Then go back to the FTP Settings and perform a test.

FTP settings

```
[0] Exit
[1] Name    >>  ydoc_152
[2] Send interval >> 08:00:00
[3] Send delay >> Not used
[4] Server  >>  toip-server.net.au
[5] FTP port >>  21
[6] FTP mode >>  Active
[7] Username >>  ydoc_152
[8] Password >>  *****
[9] Directory >>
[A] Data format >> Native(txt)
[R] Remove
[T] FTP test >>  Passed
```

After completing the setup, perform an FTP test **T** to make sure you can connect to the server.

FTP test

FTP start

```
ATE0,S0=1;+CMEE=2;+CCLK="15/09/25,05:48:47+00";
+CFUN=5;+CPIN?
+CPIN: READY
OK
AT+CREG=2;+CREG?
+CREG: 2,1,"A550","32E0AC3",2
OK
Registered on 3G network
ATS12=20;#DSTO=1;+CGDCONT=1,"IP","telstra.internet";#SGACT
CFG=1,5,180,1
OK
AT#SGACT?
#SGACT: 1,1
OK
AT#FTPOPEN="toip-server.net.au:21","ydoc_152","*****",0
OK
AT#FTPTYPE=1;#FTPPUT="YDOC_YDOC_152_5900152_150925
_054849.txt"
CONNECT
FTP message send
+++ send
```


NO CARRIER
AT#FTPCLOSE
OK
End FTP OK
Modem idle

Is the test FTP file received correctly?
Choose yes/no >

A small text file should have been transferred to the FTP server. The file contains 50 rows of alphanumeric characters. If the test fails check with the administrator of the FTP server: the server log files should show the incoming login attempt and the reason for the transfer being disallowed.

7.2 Camera Troubleshooting

For diagnostic and troubleshooting purposes, you should connect to the RTU using YDOC Terminal.

7.2.1 With RTU in Run Mode Using YDOC Terminal

- Open YDOC Terminal
- Connect the PC to the RTU using a Mini USB cable
- If the unit is not already in RUN mode, select it from the menu
- From the YDOC Terminal menu select **Control / Camera / Show**
 - YDOC Terminal will try to communicate with the camera - you will see a message “Initialising camera, please wait”
 - If it can't connect, you will see a message “Initialising camera failed, timeout occurred”. If this happens, double check the wiring to the camera. Check also that the red LED in the bottom right corner of the PCB is coming on and check with a multi-meter that you have +5V between pins 1 and 2 of the camera connector (X5)
 - After initialisation the terminal will display “Shooting picture, please wait”
 - YDOC Terminal will transfer the image to your PC.

7.2.2 With RTU in Config Mode

This test is completed using the Config menu and may be completed in any terminal emulator:

- Open YDOC Terminal and press Ctrl A, Shift D, Ctrl M
- Select 3 for Config mode
- Select B Accessory Port
- Select T Camera Test
- The display will show and “Camera Test: the time and “Shooting
- After taking the image you will be prompted to transfer the file to your PC
- Select Control / Y Modem data transfer, then choose the folder into which the image will be saved
- Open File Explorer, browse to the directory you selected and open the image file: the file will be named with the logger name (e.g. YDOC_152) and the image number

7.3 Displaying Images in YDOC Insights

To display images in YDOC Insights, you must configure the camera for TCP Transfer. The image files will be visible in the Assets tab. The Slide Show report can be used to view the images in a web browser via the Map page.

To add the Slide Show Report:

- obtain a copy of the report template from your distributor. The file is named “slideshow.rpt” and should be copied to the location C:\YDOC\Insights\Templates
- open YDOC Insights
- select the site to which the camera is connected
- go to the Reports, right mouse click and select New Report
- locate the slideshow report in the list and select it
- once the report has been created, make sure that the checkbox to Display the report as an icon on the Map Page is ticked
- locate the site in the RTU list, right mouse click on it and select Properties
- when the properties dialogue box displays, click on the Map tab
- drag the Slide Show icon to the desired position on the page.

When users with access to this site select the Map page, they will be able to scroll through the images.

7.3.1 Image Location on PC

The images transferred to Insights are saved in the Archive directory in the zip file for the RTU for the particular day:

C:\YDOC\ydocinsights\archive\ydocdatacollector\

7.4 Sending Data via FTP

In addition to, or instead of, transferring readings to YDOC Insights, you can set up an automatic transfer of the data to an FTP server. The data file can be sent in YDOC format or as a CSV file.

To add an FTP export:

- Connect to the logger and activate the menu
- Go to the Configuration menu
- Select Configuration Setup 3
- Select TCP Output E
- In the TCP Settings menu
 - Set the Name to the characters you wish to be added as a prefix to the file name
 - Set the interval to the required frequency e.g. hourly
 - If you want the send time to be offset from 00:00, set the delay. Note that the delay here is in seconds and the highest available value is 1000 (16 min and 40 seconds)
 - Set the Server to the IP Address of the FTP server
 - Set the Port to match the port of the FTP server
 - After creating a User Name and Password for FTP access on the server, enter the User Name and Password at options 6 and 7
 - Perm a TCP Test (Option T) to confirm that the RTU can connect to the server, log in and transfer a file. You should then be able to log in to the FTP server and locate the test file.

7.5 Sending Data Via MQTT

MQTT (Message Queuing Telemetry Transport) is a protocol which was designed in the early 2000's but was not widely adopted until the advent of the "Internet of Things " (IoT). It is a simple, rugged protocol designed around getting messages from one system to another. The addition of MQTT support to the YDOC RTUs means that readings can be sent to many of the new IoT server platforms. Within MQTT there are two types of device functions: Publishers, wherein devices make data available; and Subscribers, wherein devices subscribe to a feed of data from a Publisher.

It is a two way system so devices can send sensor data and receive control commands.

You can not use MQTT and Email communications together, so if you want to activate MQTT, you must first disable Email

When sending data from an RTU, the RTU becomes the publisher and the server the subscriber. To set up a connection to an MQTT server:

- from the Logger Menu select 3 Configuration Setup
- from the Config menu select E Email Output
- from the TCP Menu select R to disable TCP
- now go back to the Config menu and select I MQTT Output
- at option 2 set the Send interval to the required time (e.g. 15 min)
- at option 3 you can enter a delay to prevent all the devices hitting the server at the same time
- at option 4 enter the IP Address of URL for the MQTT server
- at option enter the Port on which the MQTT allocated to the MQTT server
- at option 6 & 7 enter the allocated User Name and Password for the account used to access the server
- option 9 is the Topic which will be used to identify this data stream on the MQTT server. Enter the name which you have agreed to use (e..g. YDOC/<serial_no>)
- at option 10 select the Security protocol used by the server (default is basic but better to use TLS so everything is encrypted)
- at option A when sending data to a Server which is logging the information you can set the Data Output to “Log Values”; if you are using the MQTT servcie to display just the current value (e.g. on a Smart Phone App) set the output to “Actual Values”
- at option B, select a data format compatible with the server (you will need to coordinate this with the system owner).

7.6 Using The Iridium Satellite Modem

The YDOC MLN315ADS-XX units may be fitted with an external Iridium Satellite modem which will enable them to be used in locations where there is no mobile phone coverage.

Modem

Because of the difficulty in sourcing the 5V version of the modem (stock is usually not kept in Australia and minimum order quantities of 10 units apply) it is simpler to use the standard 12V version. This must be powered through an external 12V power supply (5W 12V solar cell, 7 AH battery and solar regulator)

Satellite Plan

Your provider will set the unit up on an appropriate satellite data plan
e.g. KSAT 30kb plan

Unlike cellular plans, satellite plans only provide very small data allowances and penalties for going over the allocation are steep. As a consequence you must be careful to minimise both the amount of data sent by lengthening the connection interval and logging rates.

The provider will need the following information:

- IP Address and Port for server e.g. 120.150.31.37 Port 80
- Email address for copy of messages.

7.6.1 Pre-Testing

Prior to connecting the unit to the telemetry unit, you should test it by connecting it to your PC:

- Place the antenna in a location where it has clear view of the sky
- connect the modem to a PC using a USB to serial adaptor
- connect the red and black fly leads on the cable to the + and – terminals on a 5V power supply
- open HyperTerminal
- enable auto registration AT+SBDAREG=1
- to check the registration AT+SBDREG?
 - 0 detached 2 Registered on N/W
- check signal strength AT+CSQ
- setup test message in buffer AT+SBDWT=helloThere
- Initiate data session AT+SBDIX
 - the response, which will appear in a couple of seconds takes the format:

+SBDIX <status><message_no><length.<No queued messages>

e.g. +SBDIX: 0, 20, 0, 0, 0, 0

- look for a 0, 1 or 2 in the status to indicate a successful session
- other codes indicate a failure: 18=lost connection, 32=no network
- the message number should increment with each message
- clear the buffer again AT+SBDD0

- now watch to see if an email is delivered to your email address with the test message
 - the message will carry an attachment with the contents of the message. Open this to check that what you typed is what was received.

7.6.2 RTU Configuration

You now must configure the RTU to get rid of any unnecessary sensors and to set the log and transfer rates at an appropriate value for the satellite service. Connect to the RTU using YDOC Terminal or HperTerminal and set/check the following:

- from the main menu select 3 Configuration Setup
- go to 1 General settings and set the Log rate (e.g. 12 hours)
- go to B Accessory port and select Iridium Modem
- make sure the port parameters are set to 19200, 8, , 1
- turn the Power switch on and select a warm up time of 30 seconds
- go to 6 Data Transpond and select whether you want to send just the latest value (lowest amount of data) or the logged values (all values since the last transmission)
- leave the Backup mode on Not Used (1)
- go to 6 Internal Sensors and turn off all the Internal sensors
- go to A Serial Port and set up the parameters for your SDI-12 sensor
 - for each parameter you wish to transmit over the satellite, set “Data transpond” to ON

7.6.3 Connection to Telemetry Unit

Cut the 9 pin D connector from the end of the cable and connect the Modem to the MLN315ADS-xx as follows:

Iridium Cable Colour		Accessory Port (X5)	Function
Early units	Current units		
Grey	Yellow	Pin 5	Rx
Violet	Green	Pin 4	Tx
Blue	Grey	-	Ext 12V
Black	Black	Pin 2 Ground	
-	Brown	Pin 3 Ground	Ext Gnd

Red	Pink	Pin 1	Pwr Control
-----	------	-------	-------------

Note: The early Iridium units had the cable directly connected to the satellite modem. Later units have a short cable from the modem which connects to a 5m cable tail. In both cases the cable is terminated in a 9 pin D Connector and two banana plugs

7.6.4 Testing in RTU

You can now monitor communications with the unit to check whether it is sending data.

```
Running
Module power switch on
System log...WDT;Iridium Satellite
ATE0
<16:40:04>
ATE0
<16:40:19>
ATE0
READY
AT+SBDWB=42      (setup for binary transfer of 42 characters)
2
OK
READY
OK
AT+SBDI          (send message to satellite server)
+SBDI: 1,32
OK
AT+SBDD0        (message sent OK)
```

7.7 Using the GPS Receiver

YDOC's GPS Receiver may be fitted to the MLN315-ADS-xx versions of the RTU. The GPS connects to the Accessory port.

Wire the GPS Module to the Accessory connector as follows:

Function	Colour	Accessory Pin
Power	Red	1
Ground	Black	3
Rx (to RTU Tx)	Green	4
Tx (to RTU Rx)	White	5

The RTU must now be configured for the GPS:

- Connect to the RTU and activate the Menu
- Select 3 Configuration Setup
- Select B Accessory Port
- Select 3 GPS
- Go to option 3 Power Switch and Enable the Power Switch, then set the Warm Up time to 60 seconds
- Select option 4 Independent Data log is set to OFF
- select 5 Sample Interval and set the rate to match the log rate (e.g. 15 minutes)
- if you want to keep a track of how many satellites were in range, activate option F, otherwise select it and choose R to remove
- if you want to track signal strength, select it at option I or remove it if you do not want to use it.

Save the configuration and start the unit running.

You can monitor communications between the GPS and the RTU using Com Port Redirect (select the Accessory Port, RS232, 9600/8/N/1). The GPS uses the NMEA-0183 protocol and the communications are thus not in plain text so are hard to interpret.

If you set the unit to Run mode and monitor communications in YDOC Terminal, you can monitor the progress with readings:

```
Module power switch on
<09:15:00>
2016/06/10 09:15:00 Actual Values ML-315 Logger Version 2.3 Build 4
SCNT Satellites          9
LAT Latitude            -34.066406 deg
```


LON	Longitude	137.589981	deg
MINVi	Min voltage	3.72	V
OCi	Operating cycle	900	sec
PTi	Processor temperature	27.9	C
AVGVi	Average voltage	3.8	V
AVGCI	Average current	82	mA
Data log...done			
Module power switch off			

8 Manual Download

Information capture in the logger can be manually downloaded. This allows you to examine the RTU's logs to help diagnose problems and also to transfer captured readings to a text file. You may need to do this if you lose mobile data comms and need to transfer the data to the server manually.

To perform a manual download:

- From the menu select **5 Maintenance**
- From the Maintenance Menu select **3 Data Download**
- When prompted the start date and time, end date and time, date format and file format.

Data download

Start date or <CR> for this day (YY/MM/DD): 15/09/18

Start time or <CR> for midnight (hh:mm:ss):

End date or <CR> for this day (YY/MM/DD): 15/09/24

End time or <CR> for midnight (hh:mm:ss): 10:00:00

Download data from 2015/09/18 00:00:00 till 2015/09/24 10:00:00

Data format (0 = Native(txt), 1 = CSV(,), 2 = CSV(,:)): 1

Date format (0 = YYYY/MM/DD, 1 = DD/MM/YYYY, 2 = MM/DD/YYYY): 0

When prompted for the data format make you selection as follows:

- Diagnostic purposes: select "0" for Native Format
 - This captures the logger status information (lines prefixed with "S") and the data (lines prefixed with "D")
- To capture data for importing to another program: select "1"
 - This will send the data records only
 - The data will be sent in comma delimited form using "." as the decimal point (do not use Option 2 as this will send the data with a comma for decimal point and a colon separator)
 - There are two header rows at the start of the file which show the column names
- For use with YDOC Insights, select Native format
- The file will be saved with the name of the logger

- If you have selected native format the file will be saved as a .TXT file but if you select 1, it will be saved as a .CSV file

A prompt will then display asking you to commence a Y-Modem transfer of the file to your PC. In HyperTerminal select **Transfer / Receive File**.

Once the transfer completes, go to the folder in which your terminal program saves transferred files. You can then examine the file or transfer it to YDOC Insights or another program for analysis.

8.1 Transferring Data to YDOC Insights

After generating a data file from a manual download, you can transfer the file to YDOC Insights and have it automatically uploaded.

First check the file name and if needed, rename it according to the format used by YDOC Insights:

```
YDOC_<rtu name>_<rtu sn>_<yymmdd>_<hhnss>.csv
```

e.g. YDOC_ B52-80_1234567_160112_100000.csv

Now copy the file to the folder:

```
C:\YDOC\ydocInsights\import\YDOCDataCollector
```

YDOC Insights will recognise the file and load the data. The processed file will be zipped up and saved in to the archive folder:

```
C:\YDOC\ydocInsights\archive\YDOCDataCollector
```

The names of the archives are YDOC_<rtu name>_<rtu sn>_<yymm>.zip

If the automatic update fails, try a manual upload:

- In the locations list, locate the RTU and right click on it
- From the menu select Data Import Wizard
- When the Open Import File dialogue displays, locate and select the file from the folder in which you have saved it
- The import wizard will show a preview of the file
- Click on the File Format tab and make sure that the settings match those in the file
 - Field separator comma
 - Decimal separator dot
 - Test marker double quote

- Date format yyyy/mm/dd hh:nn:ss
 - Names row 1
 - Codes row 3
 - Units row 2
- Click on the Column Properties tab and then, in the Tag columns area, you select each field in the file and match it to the corresponding field in the data table
 - Select Next to import the data.

9 Remote access to RTU

Providing you have been given access to the YDOC Insights Server, you can create a remote connection to an RTU using the YDOC Terminal program.

Remote access is only supported in TCP/IP mode: if you want to use remote access, makes sure that you configure the unit for TCP access.

9.1 *Configuring Remote Access*

To setup remote access to an RTU:

- Open YDOC Messenger
- Select File / New / TCP-Socket Connection
- When the session properties display, configure the connection
 - IP Address: local or remote IP address of the Insights server
 - Port: the port assigned to TCP connections on the server (typ 37)
 - Serial Number: The Serial Number for the logger you wish to connect to (e.g. 5900152)
 - User name: The user name to log on to the server with
 - Password: The password for the account
- After checking the details, select OK, then use File / Save to save the session with a suitable name e.g. Remote access 5900152.

9.2 *Opening a remote session*

Open YDOC Terminal and using the File Menu, open the session you created in section 9.1 for this RTU.

When YDOC Terminal opens the session, it will log in to the server using the credentials saved in the configuration file

- If the login was successful, the screen will display a message indicating the time remaining until the next connection is expected to be made
- When the RTU connects to the server, it will stay on line. When the Terminal session is closed, the RTU will shut down and go back to its normal poll schedule.

When the RTU comes on line, you can access the command menu in the same manner as if you were directly connected

- If you make any configuration changes, make sure that you put the RTU back in to RUN mode before closing the session (if you forget, the unit will not log any data)
- Make sure that you allow plenty of time after selecting a command as the units can be quite slow to respond.

10 Firmware Upgrade

The RTU firmware can be upgraded via the USB Port. Obtain a copy of the latest firmware from TOIP and save it in a suitable location on your PC.

To upgrade the firmware:

- Connect to the RTU using a terminal emulator
- Activate the menu **Ctrl-A Shift-D Ctrl-M**
- Select Maintenance **5**
- Select Firmware Upgrade **7**
- You will then be prompted to upload the file using the Y-Modem protocol
 - The screen will display “CCCC...” while it waits for the file transfer
- Select Send File and then select the file from the location in which you saved it.
- When the transfer finishes, the RTU will re-start: disconnect and your terminal program and wait for 30 seconds
- Connect to the RTU, activate the menu and verify that the new firmware version is shown at the top of the menu page.

11 Setup for Specific Sensors

The following section gives information on how to configure and use the YDOC RTUs with specific sensors.

11.1 *Rika RK510 Soil Moisture Sensor*

The RK510 is a single level soil moisture sensor which measures moisture content using a fixed frequency SWR technique.

The Default MODBUS address for the sensor is 0xFF (255) which is outside of the range accepted by the YDOC unit. The address must be changed prior to connecting the sensor. This can be carried out using MODBUS POLL (). Note that the un-licensed version will run for only 10 minutes at a time:

- download and install Modbus Poll (you cannot use the Projex Modbus program for this function as it will only recognise addresses up to 254)
- run Modbus Poll
- select Connect and when prompted for the license select Register Later
- set the COM port parameters to 9600, 8, N, 1 and the mode to RTU
- select Setup / Read Write definition
- set the address to 255 and the mode to 03 – Read Holding Registers
- verify that when you put your hand on the sensor the reading changes (the value = 10 * SM)

Now to change the address (in this case to 0x33 or 51 decimal) select Functions Test Centre

- in the text box type in the following
00 10 00 01 00 01 02 00 33 EA 04
(each pair of digits is separated by a space)
- this will send the command to change the address to 0x33
- click on Send
- the bottom window will then echo your text followed by the sensor response:

```
002-Tx:00 10 00 01 02 00 33 EA 04  
003-Rx:00 10 00 01 00 01 51 D8
```


- note that the EA04 is the CRC for the values with address 33. If you want to use a different address, delete the last two bytes and enable the “Add Check” and “CRC” buttons so that the program will calculate the CRC for you
- you can verify that the Slave address has been sent by typing:
00 03 00 01 00 01
- the unit will echo your command (with CRC attached and the sensor response:
04-Tx:00 03 00 01 00 01 D4 1B
05-Rx:00 03 02 00 33 C5 91
(in the above line 33 is the slave address)
- close the Functions Centre and select Setup / Read Write Definition
- change the address to 51 and make sure you still have the Function set to 03 – Read Holding Register, the Address set to 0 and the Quantity to 1
- verify that the unit connects (i.e. you do not see a Timeout) and that the value changes when you place your hand on the sensor.

You can now connect the sensor and configure the RTU.

Sensor Wiring

Connector	Pin	Function	Wire Colour
X2 (6 pin connector)	3	A	Green
X2	4	B	Blue
X2	5	Ground	Black
X4 (3 pin connector)	1	12V	Red

Connect the RTU to a PC and activate the Menu. Go to the Configuration menu and select

- at the Serial Port menu select Serial Port (A) RS485 2
- in the MODBUS Sensor setup set the Name to RK510 at option 1
- select Port Settings (2) and set the Mode to RS485
- then select a Baud Rate 9600 (3)
- set the address to 51
- ensure the Power Switch (3) is enabled and set the warmup period to 1 second

- leave the Sample Interval at the Data Log Interval
- at (5) set the Protocol to RTU
- options 6, 7 and 8 can be left at Not Used
- at option 9, set the Register Type to Holding (3)
- at Option A set the start register to 0
- at Option B set the Data Type to Word
- then select Option C and set the values at parameter 1 to suit the sensor
- set the Name to Soil Moisture
- set the code to SM010
- set the units to %
- set the Value factor to 0.1 (because the sensor outputs SM% * 10)
- save the changes
- start the unit logging.

To check the sensor values:

- allow the unit to run for at least one log period (you can increase the log rate to make this happen faster)
- click on the Actual Values icon in the menu (Hash symbol) or at the menu prompt type Ctrl A Shift V Ctrl D to activate the Actual values display
- check that a value is displayed against the SM010 entry
- if this still does not show a value (i.e you see “No Response”) you will need to try COM Port Redirect Mode and set Modbus Poll up to use the COM port used by YDOC Terminal (Refer Section 12).

11.2 Integrated Irrigation Analogue Level

The Integrated Irrigation Water Level sensors provide an analogue 0-5V signal proportional to level over a 0 to 2m range. They must be used with the ML315ADS-xx RTUs.

Wiring (for Analogue 3)

X1 (8 pin connector)	Pin 3	AN 3	Yellow
X1	Pin 5	GND	Green
X4 (3 pin connector)	Pin 1	12V	Red

Connect the RTU to a PC and activate the Menu. Go to the Configuration menu and select

Analogue Sensors 7

- Select the channel Port 3 (V) 3
- Set the sensor name Name 1
- Select option 2 and set the sensor power switch to On with a warm up time of 2 seconds
- Select option 5 to edit the analogue sensor parameters
 - Set the Name to Level
 - Set the Code to WL
 - Set the units to m
 - Set the value factor 1
 - Set the offset to 0
- Select option 6 and set the value at 0V to 0
- Select option 7 and set the value at 10V to 4m (i.e. 5V at 2m)
- Save the changes
- Select the Analogue Input Test T
 - Place the sensor in a test tank and verify that the voltage readings change in line with the sensor depth.

11.3 Aquamonix/Pentair PT05

The PT05 10.10 pressure transducer, which has a range of -100 to 100 kPa, may be fitted to an Irrrometer Tensiometers to produce a logging tensiometer. As the RTU has 2 off 4-20 mA channels, you can connect two PT05 sensors.

Connect the PT05 to the 4-20 mA channels on an MLN315ADS RTU as shown below:

Wiring (for Analogue 3)

X1 (8 pin connector)	Pin 1	AN 1	Sensor 1 Blue
X1	Pin 2	AN 1	Sensor 2 Blue
X1	Pin 5	GND	Black
X4 (3 pin connector)	Pin 1	12V	Red

Connect the RTU to a PC and activate the Menu. Go to the Configuration menu and select **Analogue Sensors** **7**

- Select the channel Port 1 (mA) **1**
- Set the sensor name Name **1**
- Select option 2 and set the sensor power switch to On with a warm up time of 2 seconds
- Select option 5 to edit the analogue sensor parameters
 - Set the Name to Tension xxc m
 - Set the Code to IRR
 - Set the units to kPa
 - Set the value factor 1
 - Set the offset to 0
- Select option 6 and set the value at 4 mA to **-100**
- Select option 7 and set the value at 20 mA to **100**
- Save the changes
- Select the Analogue Input Test **T**
 - Connect the sensor to a tensiometer
 - From the menu select Maintenance (5) / Field Testing (1) / Analogue Input Test (2)
 - verify that the current reading is sensible: -50 kPa = 8 mA; 0 kPa = 12 mA

11.4 Holykell HPT613-D1 (SDI-12)

The HPT613-D1 is an SDI-12 version of the HPT613 family of level sensors.

Sensor Type	Water Level (vented)
Range	0 to 5m
SDI Address	0 (default)
Measurements	M 0 Level (mm)

Connect the sensor as follows:

Connector	Pin	Function	Cable Colour
X2	5	SDI-12 Data	Blue
X2	6	Ground	Black
X4	1	Power	Red

Connect the RTU to a PC and activate the Menu:

- Go to the Configuration menu and select **Serial Sensors A**
- Select option 3 SDI12 Sensors
- Select option 1 and set the name to Water Level
- Select option 2 Port settings and set the SDI-12 address
- Select option 3 Sensor power switch and Enable the power switch
- Select option 5 and set the Measurement Command to M and the command number to 0
- Select option 6 Parameter 1
 - set the Name to LEVEL
 - set the Code to WLEV
 - set the units to mm
- save the changes
- test the sensor using Com Port Redirect.

11.5 Sensor MPM4700 (MODBUS)

The Micro Sensor PM4700 Level sensors provide a MODBUS output. They can be used only with the ML315ADS-xx RTUs.

Wiring

X2 (6 pin connector)	Pin 3	RS485A	Yellow
X2 “	Pin4	RS485B	White
X2 “	Pin 5	GND	Red
X4 (3 pin connector)	Pin 1	12V	Black

CAUTION: Note the reversal in colours on the power and ground wires from the normal convention.

Connect the RTU to a PC and activate the Menu. Go to the Configuration menu and select **Serial Sensors A**

- Select option 2 for RS485 sensors
- From the MODBUS/RTU Sensor Menu Set the sensor name Name 1 (e.g. MS LEVEL)
- Select Port Settings 2
 - Select Option 2 Port Mode and select option 2 (8N1, 19200)
 - Select Option 3 and set the baud rate to 19200 – option g)
 - Select option 4 and set the Address to 63
- Select Option 3 Power Switch and set Power Switch ON with a warm up of 2 seconds
- Select Option 4 and set this to Data Log Interval
- Select Option 5 and select a register type of Input 4
- Select Option 6 and set the Register Starting Address to 0
- Select Option 7 and set the Data Type to Word 0
- Select Option 8 and set the sensor parameters
 - Set the Name to Water Level
 - Set the Code to WL
 - Set the units to m
 - Set the value factor 1
 - Set the offset to 0
- Save the changes

Place the sensor in a test tank and verify that the voltage readings change in line with the sensor depth.

11.6 Holykell HPT604 & HPT613 (MODBUS)

The Holykell HT604 Level sensors provide a MODBUS output. They can be used only with the ML315ADS-xx RTUs.

Wiring

X2 (6 pin connector)	Pin 3	RS485A (+)	White
X2 “	Pin 4	RS485B (-)	Blue
X2	Pin 5	GND	Black
X4 (3 pin connector)	Pin 1	12V	Red

Connect the RTU to a PC and activate the Menu. Go to the Configuration menu and select **Serial Sensors A**

- Select RS485 sensors Option 2
- From the MODBUS/RTU Sensor Menu, Set the sensor name Name 1 (e.g. WLEVEL)
- Select Port Settings 2
 - Select Option 2 Port Mode and select option 2 (RS485 8N1)
 - Select Option 3 and set the baud rate to 9600 – option f)
 - Select option 4 and set the Address to 1
- Select Option 3 Power Switch and set Power Switch ON with a warm up of 2 seconds
- Select Option 4 and set this to Data Log Interval
- Select Option 5 and select a register type of Input 4
- Select Option 6 and set the Register Starting Address to 32
- Select Option 7 and set the Data Type to Word 0
- Select Option 8 and set the sensor parameters
 - Set the Name to Water Level
 - Set the Code to WLEV
 - Set the units to m
 - Set the value factor 1
 - Set the offset to 0
- Save the changes

Place the sensor in a test tank and verify that the voltage readings change in line with the sensor depth.

Test the sensor using the method shown in section 12.

11.8 InSitu LevelTroll 400

The LevelTroll 400 sensors provide a MODBUS output. They can be used only with the ML315ADS-xx RTUs. Refer to the InSitu MODBUS manual for details on the register addressing and cabling.

Before connecting the sensor use the “WinSitu” utility to configure the sensor for the desired units.

Wiring

X2 (6 pin connector)	Pin 3	RS485A (+)	Blue
X2 “	Pin 4	RS485B (-)	Green
X2	Pin 5	GND	Black
X4 (3 pin connector)	Pin 1	12V	Red

The Aquatroll 400 can return 3 parameters: pressure, temperature and Level. You can choose to retrieve one, two or all three of these. Each requires a separate sensor to be setup.

Connect the RTU to a PC and activate the Menu. Go to the Configuration menu and select

Serial Sensors A

- Select RS485 sensors Option 2
- From the MODBUS/RTU Sensor Menu, Set the sensor name Name
 1 (e.g. WLEVEL)
- Select Port Settings 2
 - Select Option 2 Port Mode and select option 7 (RS485 **8E1**)
 - Select Option 3 and set the baud rate to 9600 – option **f**)
 - Select Option 4 and set the Address to **1**
- Select Option 3 Power Switch and set Power Switch ON with a warm up of 2 seconds
- Select Option 4 and set this to Data Log Interval
- Select Option 5 and select a register type of Holding 3
- Select Option 6 and set the Register Starting Address to 38
- Select Option 7 and set the Data Type to Float 4
- Select Option 8 and set the sensor parameters
 - Set the Name to Pressure
 - Set the Code to PRES
 - Set the units to kPa
 - Set the value factor 1
 - Set the offset to 0
- Save the changes

Repeat this setup for the Temperature (Register 46) and Level (Register 54).

Place the sensor in a test tank and verify that the readings change in line with the sensor depth.

11.9 Leeg LMP633 4-20mA 2 wire

These instructions are for the Leeg LMP633 in 4-20mA, 2 wire configuration.

Connect the sensor as follows:

Wiring (for Analogue 3)

X1 (8 pin connector)	Pin 1	AN 1	Black
X4 (3 pin connector)	Pin 1	12V	Red

Connect the RTU to a PC and activate the Menu. Go to the Configuration menu and select **Analogue Sensors 7**

- Select the channel Port 1 (A) 1
- Set the sensor name Name 1
- Select option 2 and set the sensor power switch to On with a warm up time of 2 seconds
- Select option 5 to edit the analogue sensor parameters
 - Set the Name to Level
 - Set the Code to WL
 - Set the units to m
 - Set the value factor 1
 - Set the offset to 0
- Select option 6 and set the value at 4mA to 0
- Select option 7 and set the value at 20mA to 5m (alter to suit max depth rating of sensor)
- Save the changes
- Select the Analogue Input Test T
 - Place the sensor in a test tank and verify that the voltage readings change in line with the sensor depth
 - check the depth to water and verify that the reading is correct (convert for 4mA=0, 20mA = max range).

12 Testing MODBUS Sensors

As the MODBUS protocol makes use of binary codes with each line ending with a pair of error checking characters, it is difficult to read and interpret the flow of characters to and from the sensors. Instead, you can use YDOC's MODBUS testing software (Projex MODBUS) in conjunction with the YDOC Terminal program to make manual readings.

If you have not already done so, obtain a copy of the Projex MODBUS software and install it on your PC.

Now use Com Port Redirect to take a reading

- open Projex MODBUS
- set the Port to that used by the RTU
- set the data rate to match the sensor
- set the MODBUS Slave address to match the sensor
- set the Register type to match the sensor
- set the Polling interval to 2000 (2 seconds)
- temporarily disconnect but do not close the program
- open YDOC Terminal and connect using the COM Port, but with the speed set to 9600
- From the Main Menu select Maintenance 5
- Select Com Port Redirect 2
- Select Serial Port 1
- From the Port Mode options select RS485 8N1 2
(change comms settings to suit sensor)
- From the baud rate menu select 9600 g (change speed to suit sensor)
- once COM Port Redirect has started, close YDOC Terminal
- select Projex MODBUS again and click on Start to begin scanning the RS485 line
- watch to see if the registers are successfully read
- note that if there is no activity for a while, COM Port Redirect on the RTU will time out (indicated by the Output Power LED turning off again) and you will have to open YDOC Terminal and activate it again.

13 Exporting to Sentek IrriMax

If you configure the RTU to use the FTP export format, you can send the data to an FTP server from where it can be uploaded in to IrriMax.

Note that the IrriMax FTP uploader requires a fixed file name whereas the default for YDOC is to write a new file each log and to append the time stamp to the file.

To set up an RTU for IrriMax:

- Configure the RTU as normally i.e. log interval, Sentek probe setup etc.
- go to the FTP configuration options
- set the Server address and port to match the FTP server
- set the user name and password allocated by the owner of the FTP server
- if you want to nominate a particular folder to write the file to, set the name in the Directory option (9)
- select option A – Omit Timestamp
- then when prompted select 1 for Yes
- exported files will be allocated the RTU name only

When using this function, to ensure that you do not miss any readings, make sure that IrriMax is searching for an updated file at least twice as often as the RTU is sending them.

14 Diagnostics

14.1 Diagnostic LEDs

The RTU is fitted with a number of LEDs which illuminate when specific functions are performed.

LED	Colour	Location on PCB	Function
Modem ON	Orange	Beneath USB socket	Indicates that the Modem is on <ul style="list-style-type: none">- Connection to server- Signal strength test- APN login test- TCP test
PS ON	Red	Bottom right corner	Indicates that the switched 12V power to the sensors is turned on <ul style="list-style-type: none">- Scheduled sensor read- Direct SDI-12 commands (Comport Redirect)
LED 3	Green	On LHS of modem	Indicates activity on the USB port

14.2 Check Power Supply

The RTU is made up of two units: the Main PCB (which sits in the base of the case) and the Power PCB (incorporated in to the lid). The 3 variants of the Power PCB connect to the Main PCB using a two pin connector. Regardless of which variant is used, the voltage across the connector should be 3.6 to 4.5 volts

- Disconnect the plug from the connector on the Power PCB
- Connect a DVM between the two pins and check the voltage
- If it is lower than 3.6V:
 - If using the solar unit, remove the AA batteries and charge them in a suitable charger. Alternatively fit new, charged batteries and re-test
 - If using the Lithium battery version, remove the battery from the holder and check the voltage

- For setup and testing you can also power the RTU from a regulated 4.5V DC plug-pack.

14.3 Modem Diagnostics

If you are having troubles with a unit connecting, you can use the Modem command mode from the maintenance menu to send commands direct to the modem to check signal strengths and whether the unit is connecting to the GSM network.

From the Main Menu:

- Select Maintenance **5**
- Select Com Port Redirect **2**
- Select Modem **M**
- The RTU will then go in to direct command mode for the modem
 - Note that the commands you type are not echoed on the screen

Turn on full error reporting **at+cmee=2**

Display full cell info with network registration **at+creg=2**

To check signal strength **at+csq**

Returns csq <signal strength>,<error rate>

- The first number is the signal strength
 - 0 < - 113 dBm
 - 2 – 30-109 to -53 dBm (2 dBm per step)
 - 31 > -51 dBm
 - 99 not detectable

```
at+csq
+CSQ: 99,99      No signal
```

```
AT+CSQ
+CSQ: 31,99     Good signal strength
```

To check the pin status **at+cpin?**

- The unit will display the status of the SIM which should be “Ready”. If not ,check that the SIM is OK and that no PIN is set by placing it in a normal phone
- ```
at+cpin?
```

```
+CPIN: READY
```

To check the available networks

**at+cops?**

- This command shows  
at+cops?

+COPS: 2

To check for GSM network registration

**at+creg?**

- 0,0 not registered & no networks
- 2,2 searching
- 2,1 registered

at+creg?

+CREG: 2,0

Not registered

AT+ CREG?

+CREG: 2,1,"A550","32E0AC3",2

Registered on NextG

OK

## **14.4 Diagnostic Messages in the log file**

The RTUs write two types of entries to the data file on the Micro SD card in the file datalog.txt: Data or D records and System or S records. The S records are used to signal error conditions such as low battery, failure to read a sensor etc.

If you are transferring data using TCP or are using FTP with the data sent in YDOC Native format, you can view both the S & D entries in the data file. However if you are using ASCII or CSV modes, the S records are not written to the downloaded data file.

To view the S records, either

- perform a download in YDOC Native mode
- if you have access to the YDOC Insights server, locate the archive files for the device. In that folder you will find a sub folder for each RTU. These are named in the format YDOC\_<RTU Name>\_<RTU Serial Number>. Within each sub folder you will see a daily zip folder which holds compressed copies of each downloaded file. You can then copy the files for the relevant period to your PC for analysis
- or copy the datalog.txt from the Micro SD card to your PC

| <b>CODE</b>  | <b>Text</b>         | <b>Meaning</b>                                                   | <b>When / Causes</b>                                                                                 |
|--------------|---------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| SYS_START    | "System name & S/N" | System is started and deployed                                   | At power on, or reset                                                                                |
| SYS_DEPLOYED | "System name & S/N" | System is deployed                                               | After a delayed deployment                                                                           |
| SYS_UPGRADED | "System name & S/N" | Firmware upgrade detected                                        | After firmware upgrade                                                                               |
| CFG_CHANGED  | "System name & S/N" | Configuration has changed                                        | After configuration editing                                                                          |
| CFG_ERR      |                     | Configuration error                                              | Firmware downgrading, or configuration upload with wrong version                                     |
| NO_CFG       |                     | No configuration detected                                        | Data logger is not yet configured                                                                    |
| CFG_UPL      | "cause of failure"  | Configuration upload failed                                      | Disruption in the data transfer, or SD card failure                                                  |
| FW_UPG       | "cause of failure"  | Firmware upgrade failed                                          | Disruption in the data transfer, or SD card failure                                                  |
| PVD_DIP      | "number"            | Power voltage detection dips                                     | When the internal power (temporarily) drops unexpectedly below 2.9V and is restored before power off |
| SD_FAIL      | "number"            | Number of temporary SD card failures                             | SD card failure                                                                                      |
| NETWORK      | "fallback;2G"       | Network fallback (only for 2G+3G Modems)                         | When 3G network is not available                                                                     |
| WDT          | "Sensor name"       | Shows the sensor driver name where the watchdog timeout occurred | Sensor defect, or wrongly connected, or warmup time too                                              |



|     |                  |                                                                         |                                                                        |
|-----|------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------|
| WDT | MODEM_INIT       | Watchdog timeout while initializing Modem                               | No response from Modem, or no SIM, or SIM not detected, or PIN failure |
| WDT | NETWORK_REGISTER | Watchdog timeout while trying to register on a network                  | No response, or (temporarily) no network coverage, or SIM              |
| WDT | APN_OPEN         | Watchdog timeout while trying to find an internet access point          | No response, or APN access point name wrong                            |
| WDT | APN_LOGIN        | Watchdog timeout while trying to login to the internet access point     | No response, or APN user or password wrong, or authentication failure  |
| WDT | SERVER_LOGIN     | Watchdog timeout while trying to login to the Email/FTP/TCP/HTTP server | No response, or server not available, or credentials wrong             |
| WDT | FILE_OPEN        | Watchdog timeout while trying to open a file on the FTP server          | No response, or file handling error on the server                      |
| WDT | DATA_SENDING     | Watchdog timeout while sending data to the Email/FTP/TCP/HTTP server    | No response, or unexpected network disruption, or server error         |
| WDT | TCP_RESPONSE     | Watchdog timeout while waiting for acknowledge from the TCP/HTTP server | No response, or unexpected network disruption, or server error         |
| WDT | DATA_END         | Watchdog timeout while trying to disconnect from the                    | No response, or unexpected network disruption, or server               |

|     |                   |                                                                                                             |                                                                                                                           |
|-----|-------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
|     |                   | Email/FTP/TCP/HT<br>TP server<br>connection                                                                 | error                                                                                                                     |
| WDT | "STATE<br>number" | Modem state<br>machine step where<br>the watchdog<br>timeout occurred                                       | No response                                                                                                               |
| ERR | "Driver name"     | Shows the driver<br>name were an error<br>occurred, with if<br>applicable some<br>additional<br>information | Sensor defect, or<br>unknown failure                                                                                      |
| ERR | MODEM_INIT        | Error while<br>initializing Modem                                                                           | No SIM, or SIM not<br>detected, or PIN on<br>SIM                                                                          |
| ERR | NETWORK_RE<br>G   | Error while trying to<br>register on a<br>network                                                           | (Temporarily) no<br>network coverage,<br>or SIM subscription<br>failure<br>(inactive/invalid/bloc<br>ked or black listed) |
| ERR | APN_OPEN          | Error while trying to<br>find an internet<br>access point                                                   | APN access point<br>name wrong                                                                                            |
| ERR | APN_LOGIN         | Error while trying to<br>login to the internet<br>access point                                              | APN user or<br>password wrong, or<br>authentication<br>failure                                                            |
| ERR | SERVER_LOGI<br>N  | Error while trying to<br>login to the<br>Email/FTP/TCP/HT<br>TP<br>server                                   | Server not available<br>or credentials wrong                                                                              |
| ERR | FILE_OPEN         | Error while trying to<br>open a file on the<br>FTP server                                                   | File handling error<br>on the server                                                                                      |
| ERR | DATA_SENDING      | Error while sending                                                                                         | Unexpected                                                                                                                |

|               |                        |                                                               |                                                             |
|---------------|------------------------|---------------------------------------------------------------|-------------------------------------------------------------|
|               |                        | data to the Email/FTP/TCP/HTTP server                         | network disruption, or server error                         |
| ERR           | TCP_RESPONSE           | Error while waiting for acknowledge from the TCP/HTTP server  | Unexpected network disruption, or server error              |
| ERR           | DATA_END               | Error trying to disconnect from the Email/FTP/TCP/HTTP server | Unexpected network disruption, or server error              |
| ERR           | "STATE number"         | Modem state machine error                                     | Unknown                                                     |
| SMS_SEND_ERR  |                        | An error occurred while sending SMS                           | See the Modem ERR/WDT message before for more details       |
| SMS_SEND_OK   |                        | Sending of the SMS was successful                             |                                                             |
| SMS_RECV_ACVA | "Phone number"         | An ACVA SMS was received                                      |                                                             |
| SMS_RECV_ERR  | "Phone number"         | An invalid SMS was received                                   |                                                             |
| CNT_RESET     | "digital sensor name"  | Shows the reset of the pulse counter                          | When reset at midnight option is on, or after manual change |
| STR           | "Driver name;raw data" | Shows the raw data log                                        | When this option is enabled (generic serial string and GPS) |
| TIME_FIX      | " +/- number of sec"   | Shows the number seconds the internal clock was adjusted      | After a NTP time synchronization                            |
| TIME_FIX      | "Summer time started"  | Shows that the clock is adjusted to                           | When summer time (daylight saving)                          |

|             |                     |                                                            |                                                      |
|-------------|---------------------|------------------------------------------------------------|------------------------------------------------------|
|             |                     | the start of summer time                                   | option is enabled                                    |
| TIME_FIX    | "Summer time ended" | Shows that the clock is adjusted to the end of summer time | When summer time (daylight saving) option is enabled |
| ALARM_SET   | "Code;limit;value"  | Shows the parameter code, alarm limit and actual value     | When the alarm is raised                             |
| ALARM_RESET | "Code;limit;value"  | Shows the parameter code, alarm limit and actual value     | When the alarm is cleared                            |