TOIP Pty Ltd
Telemetry Over Internet Protocol

YDOC RTU

Installation Manual

Version 4.3
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Contents

1 Introduction

This manual has been written to cover the ML417 family of remote telemetry units (RTUs) manufactured by Your Data Our Care (YDOC).

2 Product Details

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

ML417ADS-M1	SDI-12/RS232/RS485, Pulse, Analogue, Accessory, Universal Cat M1 modem

Other versions (e.g. pulse only, analogue only, pulse-digital only) are available on request.

Then select the required power source / cover:

Cover	Description
AL	Front cover for 3 off D sized alkaline cells
DC	Simple cover for use with external battery backed DC supplies (solar or mains). Does not hold any batteries
DC-NIMH	Front Cover with DC Regulator and option for backup NiMH batteries. Use this option for frequent logging and transfer (15 min) or for high sensor counts
DC-LI	Front Cover with DC Regulator and single use Lithium battery. Use this option for low sensor counts and very infrequent logging and transfer(e.g. 2 hour log and 4 hour transfer)
LI	Front cover with holder for Lithium Battery (non rechargeable)
3LI	Front cover with holder for up to 3 Lithium Battery (non rechargeable)
LFP	Cover for 1 to 4 off 18650 LIFEPO4/LFP batteries
PV	Front cover with integrated solar panel and 3 off NiMH rechargeable cells. Suitable for infrequent logging and transfer (e.g hourly log and 2 hourly transfer)
SLA	Front cover with charger for SLA or LiFEPO4 / LFP batteries
TFT	Front cover with built in TFT display. This model makes use of the Power board from the DC

Cover

Enclosure Choice:

- the unit can be built around the compact YDOC case or a larger enclosure, made of either plastic or metal
- if using a metal case, an external antenna must be fitted
- the standard YDOC enclosure has a hinged lid which is held closed with 4 stainless steel screws.

The YDOC enclosure can be used with all power options except the SLA charge board.

ML-BOX Enclosure with hinged lid, polycarbonate, white cover and blue base

2.1 Breather Vent

To avoid build up of moisture in the case, the telemetry units should be fitted with a breather vent. A 6mm vent is supplied with the YDOC units. But if you are using your own enclosure, you should install a 6m or 12mm breather on the top of the case.

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	

GIDM70T-SM-xx Antenna 4G700 5.1 dBi cable and SMA male connector (xx=02 2m cable, xx = 05 5m cable)

ANT_YAG-70 Antenna directional 5 element Yagi 11dBi gain

2.3 Mounting

The YDOC Enclosure can be mounted directly on a wall or face plate. For post mounting use the Post Mounting kit.

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

2.4 Cable Entry

If they have not been pre-drilled, the case must be drilled to hold the cable glands through which the sensor and power cables will pass.

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 obtain larger M16 cable glands.

GLANDM12-X Drill and fit M12 cable glands. X = 1, 2, 3, 4

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. 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 or SLA power board with either a 2W or 5W external solar panel or external DC power source.

ML417ADS-XX or ML417ADS-M1-XX	YDOC RTU with camera interface and power supply of choice
YD-CAM-2.0M-xx	Digital Camera 2MP with IR LED's for night time use (to 20m) xx=60 – 60 degree lens xx=90 – 90 degree lens

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 on units which carry the Accessory Port (e.g. ML417ADS). Two satellite modem options are available: Iridium Edge and Swarm Space.

EDGE	Iridium Edge satellite modem for ML315ADS Telemetry Unit	
ML-AB-TILE	Expansion board for Swarm Space Modem	

Iridium Edge:

- 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. YDOC offers a compressed data mode which reduces data volumes but only allows up to 15 parameters to be sent. In compressed mode, you must use single character Codes for the various parameters.

Swarm Space Modem:

- the Swarm Space modem utilises an expansion board which plugs into the expansion port on the PCB

2.6 Expansion Boards

The ML417 units are fitted with an expansion port in to which one or more Expansion boards may be connected. These allow you to add more input channels to the RTU. Boards can be stacked on top of one another, but only one of a given type can be used.

To fit the expansion board:

- locate the expansion port on the PCB
- remove the two mounting screws
- remove the protective Kaptan tape form the posts on the expansion board
- carefully slide the expansion board down over the pins on the port, making sure it sits evenly and that no pins are bent
- secure the board in place with the 2 screws
- when you power up the unit, open the configuration menu and check that the board has been recognised.

ML-IO-AD-80MV	Com Port Expansion board 2 x 16 bit differential amplifier 10/20/40/80mV	
ML-OI-AD-2V	Com Port Expansion board 2 x 16 bit differential amplifier 0.25/0.5/1/2V	
ML-OI-AD-10V	Com Port Expansion board 4 x 0-10V	
ML-OI-AD-20MA	Com Port Expansion board 4 x 4-20mA channels	
ML-OI-BP	Com Port Expansion board for YDOC MLN417 RTU – Barometric Pressure Sensor	
ML-OU-BLE	Expansion Board Bluetooth LE for Wireless comms to RTU	

ML-OI-OP-524	Expansion Board to provide 12V power source for external sensors. 5V@300mA, 12V@200mA, 24V@100mA	
ML-OI-AX-DI	Adds 4 off digital/pulse inputs	
ML-OI-AX-DSB18B20	Allows connection of up to 4 off 1 wire digital temperature sensors (thermistors) of type DSB18B20	
ML-OI-AX-RH	Supports connection of an external 1 wire relative humidity sensor of type AM2315/T9602D3/SHT3X	
ML-I-COM-UART	For connection of TTL serial sensors	
ML-OI-COM-RS232	Supports connection of a GPS if the Accessory port is already in use or not fitted	
ML-OI-COM-RS485	Provides an addition RS485 port for connection to RS485/MODBUS sensors	
ML-OI-COM-SDI	Provides an additional SDI-12 port	
ML-OA-RS232	Provides an additional RS232 port for accessories such as a camera	
ML-OA-WIFI	Adds a WIFi connection to the RTU, enabling it to send data via a local WiFi network rather than a cellular connection	
ML-OO-MODBUS	Allows the RTU to send data to an on-site SCADA system	

ML-OO-SW	Adds 4 solid state switch outputs for control of external systems	
ML-OC-W2P	Waveform to pulse converter for interfacing to flow meters and anemometers which provide a passive coil output	
ML-AB-TILE	Expansion board for Swarm Space Satellite Modem	

3 Prepare Case for Cable Glands and Vent

If you are installing the RTU board in the standard YDOC case, drill the case to take the breather vent and cable glands:

- 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 scriber 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 ¼ 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) using a step drill
- To fit the breather vent, turn the case over, lay the template on top, then repeat the process of drilling a 6mm 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.

4 Power Board Connection

The section below describes each power option in detail and applies to the “Cover” (lid and power board) or power board on its own.

YDOC Enclosures:

- The PV cover has a small solar panel on the lid whereas the SLA, NIMH, LI and DC covers are flat. 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.

TOIP ML417M1 Enclosure:

- the enclosure comes with the cable glands and breather vent fitted and the telemetry and charge board installed.

4.1 DC Cover

The DC cover or DC board on its own, can be used on systems where you have an alternative source of battery backed power, such as a 12V solar recharge unit. Connect the external source to the header on the PCB, then check that you have 3.6V on the output to the RTU.

4.2 PV and NIMH Cover

The PV and NIMH Cover must be fitted with 3 off 2500 mAH NiMH batteries. The batteries in these covers yield 5 VA of stored energy. The batteries 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 being able to access the modem).

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

4.2.1 NiMH Cell Capacity Testing

If you are not sure of the capacity of your cells perform a short circuit test using a multi-meter with a 20A current range. This test can be applied to new cells or to cells which have been in use in the fieldd:

- if the battery is not already fully charged, charge it first
- set the meter to the 20A range and ensure the leads are in the correct position (usually COM or GROUND and CURRENT 20A)
- turn the meter on
- hold the black lead to the “-” terminal of the battery

- push the red lead on to the “+”terminal of the battery and hold it there for 5 seconds
- the current reading should be over 1 amp: if it is under 3A the battery is not suitable

4.3 LI and DC-LI Cover

The Li and DC-LI must be fitted with a suitable battery:

SAFT LSH-20 3.6V D 13AH Spiral Wound
GEBC ER34615M 3.l6V D 13AH Spiral Wound

The 3LI cover accepts up to 3 of these cells.

The DC-LI cover must be connected to a plugpack with a 12V 1A output.

The external power source connects to the two pin header labelled X4. Wire the connector as follows:

Pin 1 Power
Pin 2 Ground

4.4 AL Cover

The AL Cover is designed to operate from a set of 3 off D sized alkaline batteries. Please ensure that you only use high quality brand name cells (Duracell, Energizer). Use the YDOC Battery consumption calculator to calculate expected battery life for the cells in this unit. It may also be used with the LI and 3LI covers:

https://www.ydoc.biz/datalogger-power-consumption.html

4.5 SLA Cover

The SLA cover requires a solar panel with a nominal open circuit voltage (OC) of 21V. Although you can use solar cells with a lower DC voltage, they will not commence charging the battery until much later in the day and will stop charging earlier in the day.

You will need to drill the SLA cover to fit a cable gland for the solar panel and another for the connection to the battery. Alternatively you can fit the YDOC PCB, the SLA board and battery into a larger enclosure.

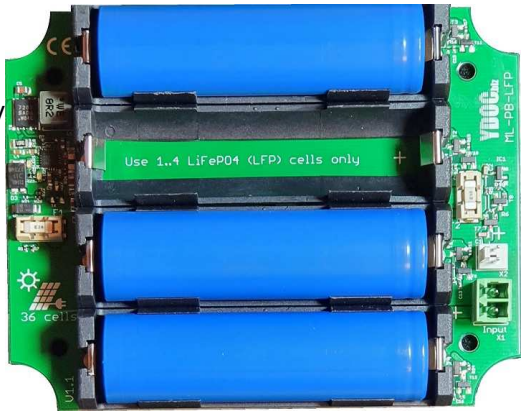
The minimum battery size for the SLA charge board is 12V 3AH. TOIP can supply a 12V 3AH LiFePO4 (LFP) battery pack. A 4 cell 3AH LFP battery pack yields 38 VA, whilst a 7AH SLA cell yields 84 VA.

The battery signal is available via a low voltage protection s witch on pins 3 and 4 of the OUT socket. This can be used to power sensors which require permanent power.

The MON signal may be connected to one of the two Analogue inputs to monitor battery voltage (X1 3 or X1 4)

4.6 LFP Cover

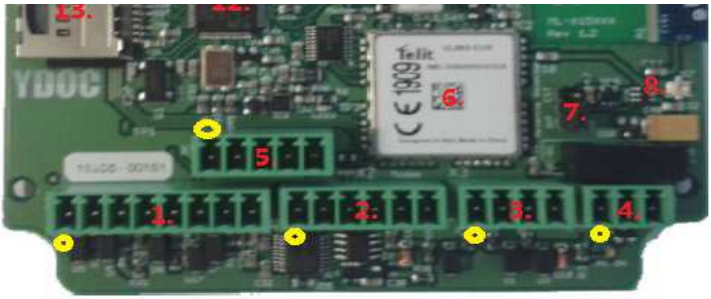
The LFP cover can be fitted with from 1 to 4 LiFePO4 (LFP) 18650 size batteries. These have a 3.2V output and capacity of 1.5 to 2 AH. A single cell 1.5AH gives 4.8VA of capacity, and 4 cells yields 19 VA. The cells are connected in parallel rather than series, which makes battery management much easier.



Fit the required number of cells to the holder.

5 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).

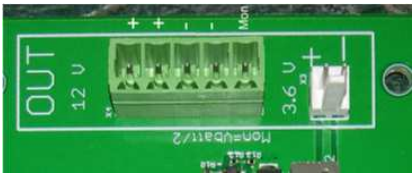


Connector	Pin	Function
X2	1	RS232 Tx
X2	2	RS232 Rx
X2	3	RS485 A (+)
X2	4	RS485 B (-)
X2	5	SDI-12 Data
X2	6	Ground
X4	1	12V Sensor Power (Switched)
X4	2	-
X4	3	Ground
X3	1	Pulse input (Rain) 1
X3	2	Pulse input (Rain) 2
X3	3	Pulse input (Rain) 3
X3	4	Ground
X1	1	AN1 0-20mA
X1	2	AN2 0-20mA
X1	3	AN3 0-10V
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.

5.1.1 Switched Sensor Power 12V 100mA

The Switched 12V output at X4 Pin 1 can supply up to 100 mA. This output will turn on any time a sensor is being read (analogue, SDI-12, MODBUS).



5.1.2 Permanent 12V Power

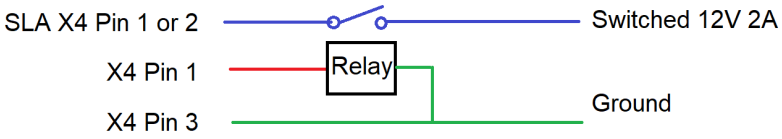
The SLA charge board offers a permanent 12V power source which can provide up to 2A of current. The output is fused and will shut off under low voltage conditions (battery voltage below 10.8V).

If your application requires permanent sensor power or current higher than that available on the switched 12V, use the SLA charge board which has a protected output from the battery (12V).

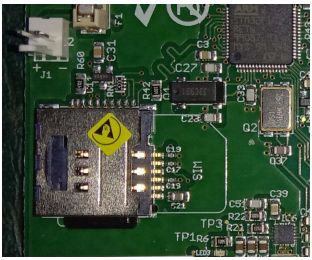
Connect the MON pin to one of the 2 analogue inputs if you want to monitor the battery voltage. The Monitor output is at half the battery voltage so when scaling the battery monitor set the Value factor 2 to bring it back to full range.

5.1.3 Switched 12V Power - High Current

If you require a switched output at more than 100 mA, use a solid state relay to switch the 12V from the SLA charge board to the sensors.



5.2 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.

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.

The SIM card must support Cat M1.

5.3 Memory Card

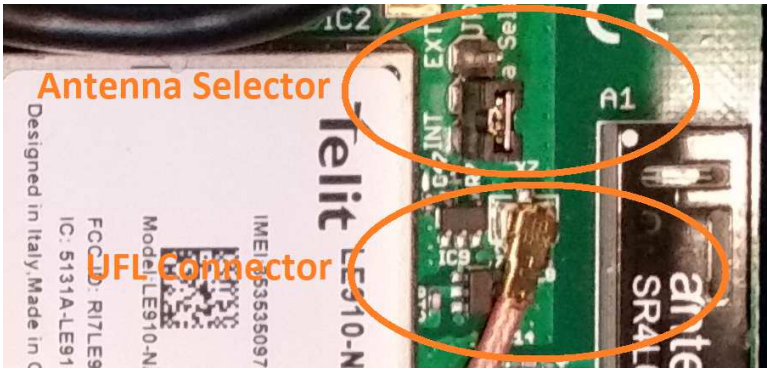
At the lower edge of the SIM holder you should also see the edge of the Memory Card.

The RTUs are fitted with an 8GB 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. But they are prone to failure if the RTU is exposed to prolonged low battery conditions. This may show up as Write Errors in the logs or as the RTU power consumption suddenly increasing. If you see these errors, you can format the card from the Maintenance Menu (or from a PC). If it still gives errors, replace it.

When replacing the card, remember to note that it is installed with the contact pins facing upwards.

6 Antenna Selection

If you are using the internal antenna, the Antenna Selection jumper on the PCB must be left in the INT position.



If you are using an External antenna:

- always leave the Antenna Selection jumper in the INT position until you have completed installation and connection of your antenna
- drill a 6.5mm hole in the enclosure and mount your UFL-SMA adaptor on it
- carefully fit the UFL to SMA adaptor to the UFL socket which is located next to the antenna selection jumper
- connect the antenna cable to the SMA socket on the case
- mount the antenna on the post: the higher the antenna is installed, the more signal you will capture
- double check that everything is correctly connected
- switch the Antenna Selection jumper to the EXT position
- perform a signal strength test
- if you ever need to disconnect the external antenna, first move the Antenna Selection jumper back to the INT position.

7 Mounting the Enclosure

The post mounts on the enclosures are sized to allow them to be mounted on a steel post of 40 to 60mm diameter. If you require installation on a larger diameter post, secure longer hose clamps.

To provide maximum protection from the sun, always mount the enclosure on the South side of the post (north side in the Northern Hemisphere). The solar panel should be mounted on the opposite side: facing north (south in the northern hemisphere).

If you are using an external antenna, mount it has high as possible on the post.

The post should be concreted into the ground using a minimum of 10l of pre-mixed concrete. Ensure the post is level before allowing the concrete to set.