

# TC-ULINK USER/INSTALLER GUIDE

## GENERAL DESCRIPTION

The TC-ULINK series are full-duplex microwave data transceivers operating in a variety of licensed and unlicensed microwave frequency allocations. They feature true full-duplex operation at data rates up to 10Mbps (20Mbit Capacity) with a variety of interface options. Most features of the unit such as frequency and User Data Interface configuration are programmable, with parameters held in non volatile memory (NVRAM). Most configuration parameters are accessible using the TC-U Series Programmer which will run under Windows 95/98/NT4 and uses a PC serial port. It is essential that each unit is programmed to suit individual requirements prior to operation. For detailed information refer to the TC-ULINK User Installation Manual. Critical parameters can be monitored in real time (and optionally logged) with the TC-ULINK Diagnostics package which will also run under Windows 95/98/NT4.

The Radio consists of an ODU (Out Door Unit), an ITU (Indoor Terminating Unit) the interconnecting cable, and power supply. The ODU contains the radio, modem, interface circuitry and the antenna. The ITU terminates the users data cable, the interface cable from ODU, the power supply, and provides a host port for programming and Diagnostics. The ITU also contains status indicator LEDs.

## WARNINGS

Microwave equipment of any type presents potential hazards to users, installers and support personnel alike, so it is important to understand how to install and service the radio safely. The following precautions are designed to provide exposure levels much less than the recommended safe limits of ANSI C95.1 or AS2772.1:

1. For temporary exposure maintain 500mm separation from feed.
2. Never look directly into the waveguide or horn if the TC-ULINK Series radio is being operated without its dish assembly.
3. Never stand immediately in front of an operational TC-ULINK Series radio.
4. For permanent exposure, the minimum recommended distance to an operating TC-ULINK Series radio is 50m in the main lobe ( $\pm 5^\circ$ ), 10m behind ( $\pm 5^\circ$ ), and 1m at the rear of the ODU ( $\pm 110^\circ$ ), as per Figure 1.

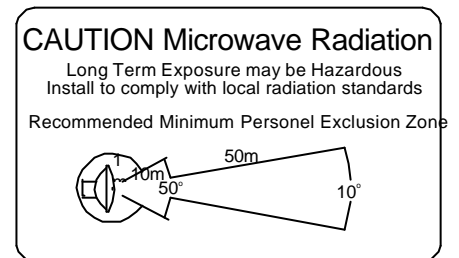


Figure 1 – Radiation Hazard Label

## INSTALLATION

### Tools & Accessories

The TC-ULINK is supplied with the following items:

- 1 out-door data radio unit (ODU).
- 1 in-door termination unit (ITU).
- 1 10m length of ODU-ITU cable with connector (or additional length if specified in order).
- 1 CDROM containing TC-ULINK Programmer, TC-ULINK Diagnostics, TC-ULINK User and Installation Manual and a copy of Adobe Acrobat Reader.
- 3 75mm mounting pipe clamps.
- 1 mounting bracket with adjustable azimuth and elevation.
- 2m serial cable for Diagnostics / PC Interface (Dmin 9 pin male to female).

Optional (available for purchase if required):

- 1 5mm ball-end Allen key
- 1 sashay of neutral-cure silicon grease
- 4 spare dish mount sealing washers
- 4 spare dish mount O-rings

The following are tools recommended for installation:

- 2 PC's or laptops running Windows 95/98/NT4
- Network evaluation software/hardware
- A ratchet with 15 & 17mm long-reach sockets
- Rope and pulley block
- Digital multimeter
- CAT.5 cable tester
- Trio ODU cable breakout adapter
- Sighting compass (for link distances > 2 km)

## Polarization

The antenna for the TC-ULINK Series radio is supplied with either horizontal or vertical polarization – as specified in the order. To determine the polarization of the antenna there is a polarization sticker on the dish (see Figure 2), and a H and a V embossed on the heatsink support pillar of the ODU. When the H embossed on the heatsink is in line with the polarization sticker the antenna is Horizontally polarized. When the V embossed on the heatsink is in line with the polarization sticker the antenna is Vertically polarized.

*Note:* the dish must **always** be mounted so the polarization sticker is at the **top**, and the Company logo on the radome is horizontal. This ensures the drainage holes in the radome face downwards.

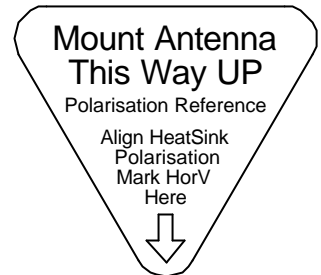
If the polarization has to be changed the heatsink must be rotated on the dish, hence the radome must be removed to expose the antenna/heatsink mounting screws.

To change the polarization:

1. Sit TC-ULINK on raised flat surface with a central hole to protect the 17 pin Mil "C" connector with antenna facing upwards.
2. Remove the 8 screws around the perimeter of the radome holding radome to antenna dish. 8 x M4 (ss) nyloc nuts, 8 x 4 mm (ss) washers and 8 x M4 (ss) screws.
3. Carefully remove the radome (cover).
4. Using a 6mm Ball Driver or Allen Key remove the four (ss) M8 bolts, spring and flat washers holding the dish and casagrain reflector mounts to the heatsink. *Note:* there are 4 x 8 mm fibre washers between the heatsink and the antenna.
5. Rotate the **antenna dish** 90 degrees so that either the "H" or "V" embossed in the heatsink aligns with the polarization sticker on the antenna and screw the 4 bolts with all other hardware back in using a torque wrench to a torque of 8N/m.
6. Re-align radome mounting holes with antenna ensuring drain holes are at the bottom.
7. Fix 8 x mounting hardware ensuring that the screws are held from rotating. Only the nuts are turned on the screw with a washer under nut. Only tighten until end of screw is flush with top of nyloc - do not do these screws up any further.

*Note:* It is imperative that the seal and silicon grease be replaced carefully for ultimate hermetic sealing. Warranty will be void if this is not performed correctly.

Figure 2 – Polarization Label



## ODU

The ODU is a self contained unit that holds the radio, modem, interface circuitry and the antenna. It is connected to the ITU via a 17 pin Mil. Spec. weatherproof circular connector and cable. The unit weighs approximately 22kg so must be handled with the correct lifting techniques and preferably by two people. The unit is mounted via its adjustable bracket to a 75mm OD mast with two U-Bolts. The wall thickness of the mast, and method used for mounting the mast to the tower or building should meet all the required building and safety requirements/standards. The absolute minimum wall thickness is 3mm seamless steel. Note for a 700mm dish the 3dB Beamwidth is  $\pm 0.6^\circ$  and the 10dB beamwidth is  $\pm 1^\circ$ , and under normal wind loading the flex in the mast should be less than  $\pm 0.3^\circ$ .

## Cable

The recommended cable connecting the ODU to the ITU is custom made of two flexible Category 5 cables (blue and green) and a figure-8 cable for power, encapsulated in an all weather polyurethane sheath, and is available from TrioDataCom pre-terminated. The pinout for the plug shown is Figure 3.

Rear View of pins showing Connection Nomenclature

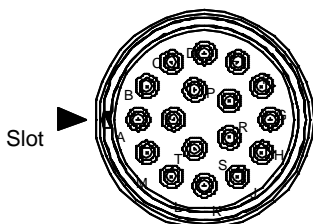


Figure 3 – 17 pin connector

Pin	Type	Colour	Circuit
A	Shield/Drain		ODU GND
	UTP/Grn	Brn-mate	ODU GND
	UTP/Grn	Blu-mate	ODU Gnd
B	UTP/Blu	Or	10BaseT RXD+
C	UTP/Blu	Or-mate	10BaseT RXD-
D	2.0sq mm	Blk	Supply -
E	UTP/Grn	Brn	RS232 CTS
F	UTP/Grn	Blu	RS232 RTS
G	UTP/Grn	Or	RS232 TXD
H	UTP/Grn	Grn	RS232 RXD
J	UTP/Blu	Brn	RSSI
K	2.0sq mm	Red	Supply +
L	UTP/Blu	Grn	10BaseT TXD+
M	UTP/Blu	Grn-mate	10BaseT TXD-
N	UTP/Grn	Grn-mate	RS232 Gnd
	UTP/Grn	Or-mate	RS232 Gnd
P	NC		
R	UTP/Blu	Blu	Alarm
S	UTP/Blu	Blu-mate	Spare
T	NC		
NC	UTP/Blu	Brn-mate	

When cable is being installed the following items should be noted:

1. Before connecting to the outdoor unit, the large black rubber washer must have silicon grease top and bottom, then the stainless steel washer fitted.
2. Make sure the cable is not laid near other cabling that supplies power to inductive loads such as motors and fluorescent lights, etc...
3. Make sure the cable is protected from destructive vermin such as parrots, rats, etc...
4. Make sure the installation meets the local building codes and the requirements for electrical safety, safety of personnel, and protection of users data equipment.
5. Fit properly grounded lightning surge arrestors as required.

## ITU

The ITU is used to terminate the cable from the ODU, the users data, power, and provide a host port for programming and local diagnostics.

- The power required by the unit is 48VDC  $\pm 25\%$ , at <20Watts - the connector is shown in Figure 4. If the PWR LED indicator is not illuminated once power is supplied, check the internal 0.5A slow-blow fuse. If necessary, replace this fuse only with a slow-blow fuse of the same rating!
- The modular connector on the ITU is used to connect the Radio link to the users data network. The modular socket connections are shown in Figure 5. The 10Base-T interface on the ITU is wired like a computer therefore a standard Cat.5 patch cable can be used to connect it directly to an Ethernet Hub or Switch. If the TC-ULINK is to be connected directly to a computer then a crossover is needed. This can be implemented by connecting a patch cable to the PC and a second patch cable to the ITU, and then joining the two patch cables with the RJ-45 Crossover box.

Figure 4 - Power Connector (as viewed from front of socket)

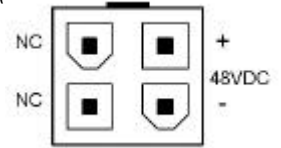
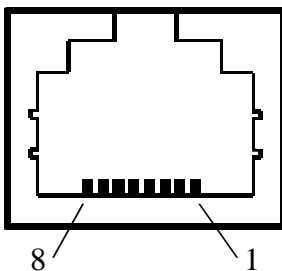


Figure 5 – 10BaseT port (as viewed from front of socket)



Pin	Signal
1	TXD+
2	TXD-
3	RXD+
4	N/C
5	N/C
6	RXD-
7	N/C
8	N/C

- The maintenance port on the ITU is a 9-pin D connector that is used to connect a programmer or Diagnostics PC to the Radio link. This requires a standard serial cable (including all control lines) and is supplied with the unit.
- There are five LEDs that show status information.

PWR -Shows there is a 48V supply connected.

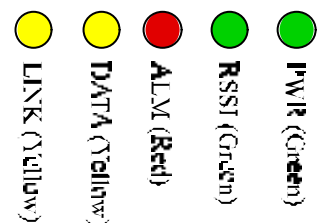
RSSI - This is a visual indication, where the brightness of the LED is directly proportional to the Received Radio Signal Strength.

ALM - This LED will flash if there is a minor alarm or will be permanently illuminated if there is a major alarm.

DATA - This LED indicates Rx and Tx Data activity on the 10Base-T LAN interface.

LINK - Standard 10Base-T "Link Integrity" LED indicates there is a valid physical connection between the Radio link and the Ethernet device it is connected to.

Figure 6 – Status LEDs



NOTE: The DATA and LINK LEDs are inoperative whilst the maintenance port is connected to a computer.

Before the ITU can be mounted, the cable from the ODU, and any auxilliary cables must be terminated in the ITU. Take the cover off the ITU and feed the cable from the ODU through the cable gland, and any auxilliary cables through the AUX hole in the ITU. The PCB inside the ITU has two terminal blocks – the Main Terminal Block and the Auxilliary Terminal Block. The Main Terminal Block terminates the cable from the ODU. It has a label which shows the signal identifiers and wire colours. Terminate all the wires of the cable from the ODU making sure there is sufficient strain relief looping in the individual wires.

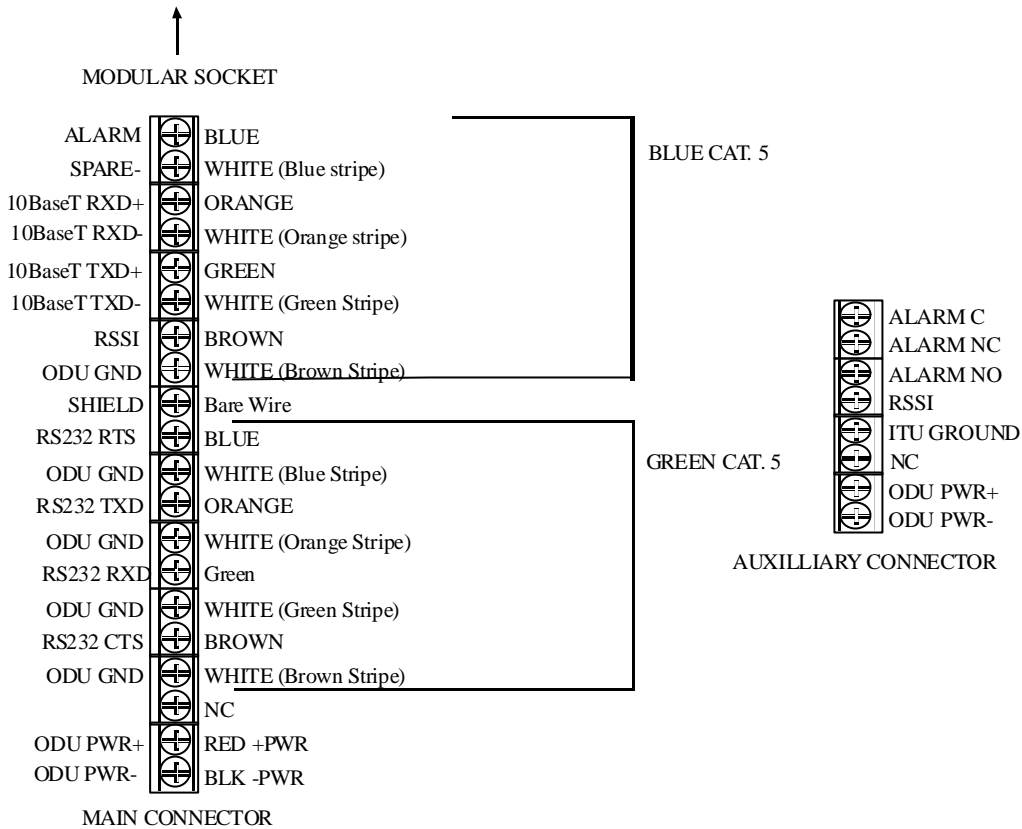


Figure 7 – Terminal Blocks (viewed from top)

The auxilliary terminal block is used for the Alarm Relay contact, RSSI signal, and a user power supply.

- The Alarm Relay terminals provide Common, Normally Open (NO), and Normally Closed (NC) **LOW VOLTAGE** relay contacts which are rated at 24VDC 2A maximum.
- The RSSI signal is a DC voltage between 6 and 10V, the received signal strength can be calculated using the following formula:  
 $RX \text{ signal strength (dBm)} = ((RSSI \text{ [Volts]} - 6) * 256 / 8) - 109$   
 Some typical values are shown in the table below:

Received Signal Strength (dBm)	RSSI voltage (V)
-90	6.6
-80	6.9
-70	7.2
-60	7.5

- The radio can be powered from the switchmode power pack that plugs into the ITU, OR another power supply wired up to the terminal block inside the ITU. **DO NOT USE BOTH.**

Terminate all the auxilliary wires making sure there is sufficient strain relief looping in the individual wires. The cover can now be put back on and the ITU mounted. The ITU is mounted on a flat surface with 4 screws – see figure 8 for the mounting details for the screws.

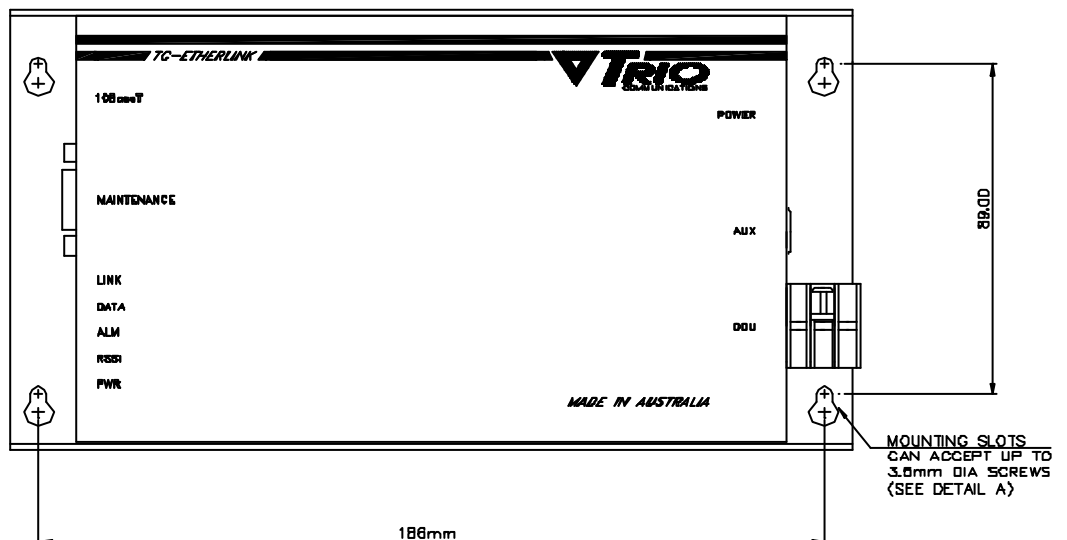


Figure 8 – ITU mounting plate dimensions (not to scale)

## Dish Alignment

The TC-ULINK Series unit is supplied with a mounting bracket which includes vernier screw adjustment of elevation and azimuth. When firmly mounted on a vertical support tube the bracket as supplied allows for  $\pm 5^\circ$  of azimuth adjustment and  $\pm 5\frac{1}{2}^\circ$  degrees of elevation adjustment for normal long range applications and  $+11\frac{1}{2}^\circ$  or  $-11\frac{1}{2}^\circ$  if reassembled with the elevation pivot bolt in one of the extended pivot holes for short range sites of greatly different elevation. For applications requiring extreme elevation a mounting scaffold will need to be specially fabricated to suit.

For reference purposes the adjustment rate for azimuth is around  $2\frac{1}{2}$  turns per degree, and for elevation 3 turns per degree. The 3dB nose of the 700mm dish at 23GHz is  $\pm 0.6^\circ$  and the first signal null at  $\pm 1\frac{1}{2}^\circ$ . Initial elevation alignment for long range paths is best done by first setting the dish aiming horizontal by using a small builders level on the rear (vertical) face of the rear cover of the ODU, and then adjusting the bolt by an amount calculated from the path profile information. Coarse adjustment of azimuth can be done by fixing the spare (3<sup>rd</sup>) U bolt to the support tube immediately below the bottom U bolt of the mounting bracket and with the link mounting U bolts slightly loose – panning the antenna until some signal is observed. The above method works well on short paths of say less than 3 to 4k as long as neither dish is more than  $\pm 5^\circ$  off alignment. On longer paths however the angular errors from coarse alignment at both ends will most likely result in signals too weak to find and in these cases accurate optical or compass sighting will be required before vernier adjustment can start.

Trio offers an alignment aid which clips onto the dish and uses a high quality scope with zoom optics for direct alignment onto the remote station, alternatively this same device can be used to site across the dish at right angles from the ground thus setting up a reference point for a precision sighting compass. Further information is available on sighting and aligning methods the accompanying CDROM.

## COMMISSIONING

Once the coarse aligning has been completed, the following steps should be taken to commission the link:

1. Use the TC-ULINK diagnostics package to check supply voltage, that all PLL's are locked, and that the deviation is  $\pm 2.5$ MHz. For more information on the TC-ULINK Series diagnostics package see the Installation Manual on the CDROM.
2. Ensure that the received signal strength at both ends of the link is close to the value predicted by the Path Profile calculations after taking into account atmospheric conditions. Some further alignment of the dishes may be required.
3. Confirm that the transmission path and modem circuits are reliable by conducting end-to-end BER tests within the diagnostics program supplied. The resultant BER should be within an order of magnitude of that specified for the RSSI level indicated.
4. Conduct a BER or data throughput test from external data sources to ensure the cabling and Data Bridges and Muxes are operating reliably. The result should be approaching that measured by the internal BER test above.
5. Check all connections and hardware for security before connecting the users data circuits. Conduct user data throughput to ensure complete compatibility between the user data network and the link equipment.
6. Record all test conditions and results in the following form for future reference.

## TC-ULINK Installation Test Results

### SITE No. 1

Site Location:	Unit Serial Number:
Internal Temperature (C):	Tx Power (dBm):
Rx Mixer Current (mA):	RSSI (dBm):
Supply Voltage (V):	BER:
Peak Deviation (MHz):	Deviation Offset (MHz):
Rx Tuning Voltage (V):	Tx Tuning Voltage (V):
Installation Company:	Installers Name:

### SITE No. 2

Site Location:	Unit Serial Number:
Internal Temperature (C):	Tx Power (dBm):
Rx Mixer Current (mA):	RSSI (dBm):
Supply Voltage (V):	BER:
Peak Deviation (MHz):	Deviation Offset (MHz):
Rx Tuning Voltage (V):	Tx Tuning Voltage (V):
Installation Company:	Installers Name:

## Final Commissioning

Once the unit is functioning correctly, for long term reliability it is recommended that the following items are thoroughly checked:

- There are no nicks/cuts in the sheath of the cable where water could enter and ingress up the cable.
- The connector at the rear of the ODU is secure and watertight (amalgamating tape can be used).
- The outer weather seal on the heatsink is seated correctly.
- The mounting bracket bolts are tight. The seal around the radome is watertight.



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