

ISM Microhard IP Radio

Data Sheet

Introduction:

The ISM pMDDL IP radio is a feature-rich, high-power, 2x2 MIMO, wireless data link. The radio integrates a swappable microhard pMDDL series radio with ports for usage in UAV applications in a lightweight and robust package.

The pMDDL radio can be configured using microhardards built in webUI which does not require any additional tools or software for setup. The unit can operate as a master, slave, or relay (future) to establish a high throughput high-speed data link between GCS and UAV as well as between UAVs. The unit comes stock with the pMDDL 2350.

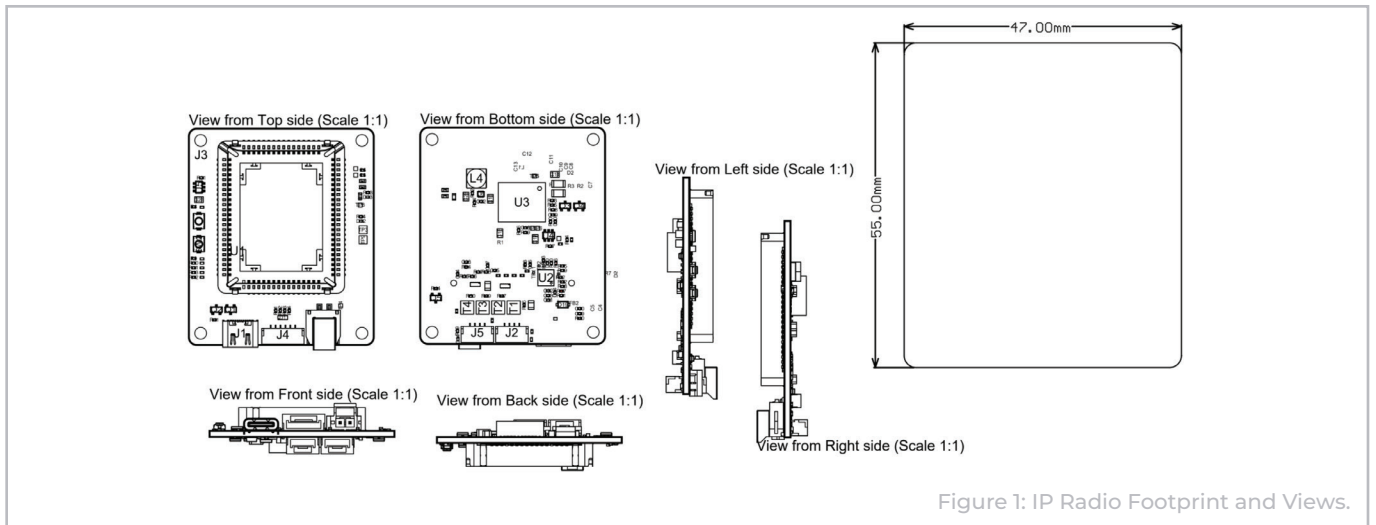


Figure 1: IP Radio Footprint and Views.

Package List:

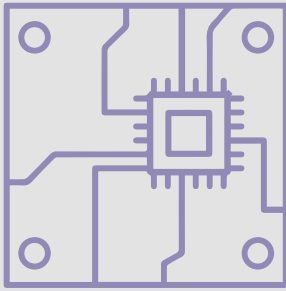
Air Unit

- 1x ISM MH Carrier Board
- 1x MH pDDL/pMDDL Chipset w/ Heatsink
- 1x 5v Fan
- 2x UFL to SMA extensions
- 2x Antenna (rubber ducky)
- 1x Serial Cable for Pixhawk Cube (15cm)
- 1x LAN Cable for Video/Companion Computer (15cm)
- 1x Molex Power Input Cable (20cm)

Ground Unit

- 1x ISM MH Carrier Board
- 1x MH pDDL/pMDDL Chipset w/ Heatsink
- 1x 5v Fan
- 2x UFL to SMA extensions
- 2x Antenna (rubber ducky)
- 1x LAN to RJ45 Cable (100cm)
- 1x Molex Power Input Cable (20cm)

Performance

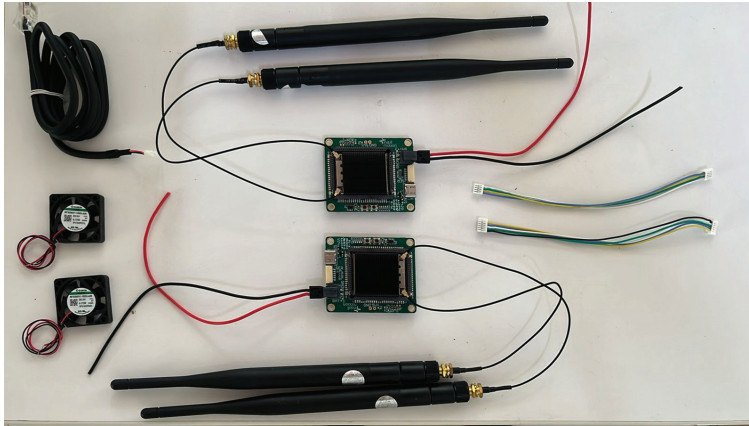


- >50km range with direction and tracking antennas.
- 25+ Mbps data rates.
- 36dBm total power output (4W).
- 2x2 MIMO. Simultaneous IP and serial data.
- 2.304 - 2.390 GHz.
- Maximal ratio combining (MRC), maximal likelihood decoding (ML).
- Low-density parity check (LDPC).
- Small footprint of 47mm x 39mm.
- Low weight of 18g (minus antennas).
- Point-to-point, point-to-multipoint, mesh.
- Dual Ethernet ports - LAN, WAN.
- Port forwarding, ACL, firewall.
- Extended operational temperature range (-45C to 85C).
- 128-bit AES Encryption (256-bit AES Encryption optional).
- Local/remote firmware upgrades.
- Configurable via Telenet, web browser, and local console.

- LAN port - 4-pin JST GH
- WAN port - 4-pin JST GH
- Pixhawk standard serial port - 6 pin JST GH - 3.3v UART
- USB C port - USB 2.0 data, USB power delivery sink, Ethernet, and Serial over USB.
- Battery Connector - 2-pin Molex Nano Fit - 4.5 to 55V input.
- 5v and GND pads for fan.
- Configuration and Reset buttons.
- LED indicators for power, wireless TX RX, RSSI, and LAN link status.
- Reverse polarity protection.

Interfaces





Quick Start Guide Steps:

To set up the Microhard pMDDL series module, follow these detailed steps:

1. Insert the Module:

- Place the Microhard pMDDL series module into the holder.
- Apply thermal paste to the bottom of the module.
- Ensure the antennas face the rear of the module, away from the connectors.

2. Attach Antenna Extensions:

- Connect the Ipex-SMA extensions to the ant1 and ant2 ports on the MH chipset of the radio module.

3. Secure Antennas:

- Screw the antennas onto the extensions.
- Warning: Never power on the module without the antennas connected to avoid damage.

4. Connect to Computer:

- Use an Ethernet cable to connect your computer to the LAN port on the radio module.

5. Connect Autopilot Telemetry:

- Use a 6-pin cable to connect the autopilot's telemetry/serial port to the Serial port on the radio module.

6. Power the Module:

- Connect an appropriate power supply (ranging from 4.5V to 55V) to the power port on the radio module or connect power via the USB C port.

7. Initialization:

- Power on the module.
- Wait for the module to initialize. The green status LED should become solid, indicating successful initialization.

8. Configure Network Settings:

- Ensure your PC's network settings are configured as follows:
- DHCP: The modem will assign an IP address automatically.
- Static IP (alternative option): Set the IP address to 192.168.168.10 and the subnet mask to 255.255.255.0.

9. Access the Module via Browser:

- Open a web browser and enter 192.168.168.1 in the address bar.

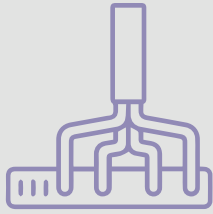
10. Login:

- Use the factory default credentials:
- ID: admin
- Password: ilpl123

11. Configuration:

- Follow the setup guide provided by Microhard to configure the radio module with settings tailored to your application.
- Use the suggested parameters for standard Point-to-Point (P2P) operation as supplied.

By following these steps, you will successfully set up and configure your Microhard pMDDL series module for operation.

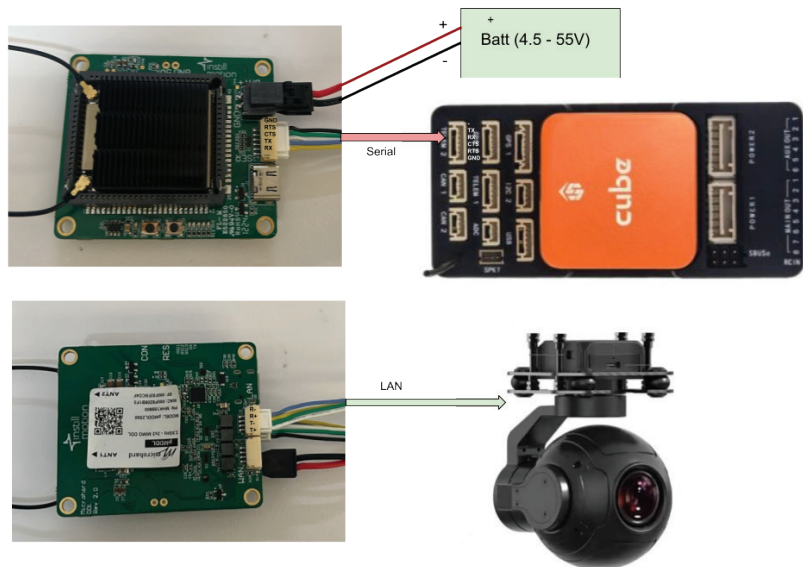


Suggested Wiring Setup for UAVs

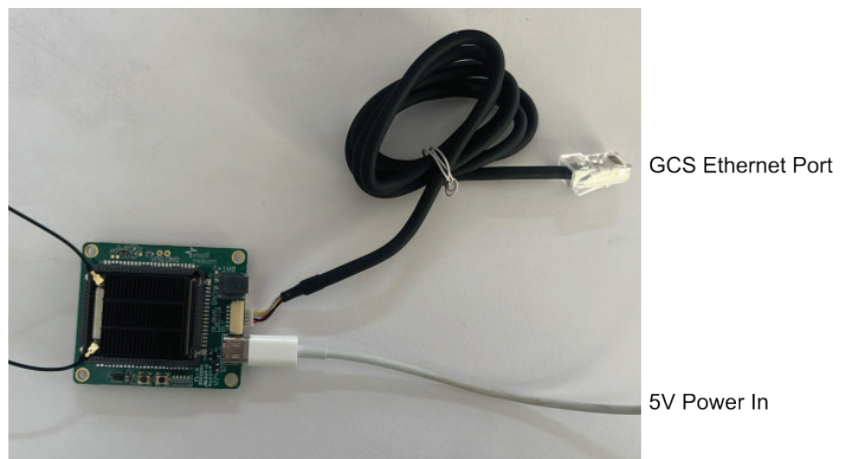
The following setup will allow you to use the ISM IP Radio as a conduit for HD video and telemetry P2P communication.

The standard set out of the box at maximum power output will allow up to 20 km of range. Ensure the setup has adequate cooling.

● Air Unit (Master)



● Ground Unit (Slave)



Suggested Configuration for UAVs P2P Communication _____ AIR UNIT

Configuration details for the air unit and ISM IP radios:

Master Configuration:

- The air unit is set as the master.
- Default IP for the master: 192.168.168.101.

Default Settings:

- The ISM IP radios come pre-configured and are already bound out of the box.
- The master unit is set to the lowest power setting initially to avoid damage during bench testing.

Power Settings:

- If you need to use higher power settings, ensure the unit has adequate cooling.
- Utilize the heatsink and fan if necessary to prevent overheating.

Make sure to adjust the power settings appropriately and monitor the temperature to maintain the equipment's safety and performance. If you have any specific questions or need further details on configuring or operating the units, feel free to ask or refer to the Microhards Operational Manual!

System >> General Settings

System Information							
Host Name		UserDevice		Description		mypMDDL2350	
Product Name		pMDDL2350		System Date		1969-12-31 17:06:32	
Hardware Version		Rev A		System Uptime		5 min	
Software Version		v1.4.0		Build Date		2020-03-16	
Software Build		1022		Build Time		17:01:17	
LAN Status							
MAC Address		00:0F:92:08:EB:11					
IP Address		192.168.168.101		Connection Type		static	
Subnet Mask		255.255.255.0		Gateway		192.168.168.102	
RF Status							
General Status							
MAC Address	Operation Mode	Network ID	Bandwidth	Frequency	Tx Power	Encryption Type	
00:0F:92:FB:EC:DF	Master	pMDDL	8 MHz	2377 MHz	20 dBm	AES-128	
Traffic Status							
Receive Bytes		Receive Packets		Transmit Bytes		Transmit Packets	
446.575KB		6414		1018.371KB		5875	
Connection Info							
MAC Address	Tx Mod (MIMO)		Rx Mod (MIMO)		SNR (dB)		RSSI (dBm)
00:0F:92:FB:CD:4F	BPSK FEC 1/2(On)		64-QAM FEC 5/6(On)		64		-30
Stop Refreshing Interval: 20(in seconds)							

AIR UNIT

Network >> Status Page

Network Status

LAN Port Status

General Status

IP Address	Connection Type	Subnet Mask	MAC Address
192.168.168.101	static	255.255.255.0	00:0F:92:08:EB:11

Traffic Status

Receive bytes	Receive packets	Transmit bytes	Transmit packets
474.706KB	8656	1.181MB	8000

Default Gateway

Gateway	192.168.168.102
---------	-----------------

DNS

DNS Server(s)	None
---------------	------

IPv4 Routing Table

Destination	Gateway	Subnet Mask	Flags	Metric	Ref	Use	Interface
0.0.0.0	192.168.168.102	0.0.0.0	UG	0	0	0	(br-lan)
192.168.168.0	0.0.0.0	255.255.255.0	U	0	0	0	(br-lan)

Network >> LAN Settings

System	Network	Wireless	Firewall	Serial	Diag	Admin
Status	LAN	WAN	USB	DHCP	Routes	Ports
						Device List

Network LAN Configuration

LAN Configuration

Spanning Tree (STP)	Off ▾
IGMP Snooping	On ▾
Connection Type	Static IP ▾
IP Address	192.168.168.101
Netmask	255.255.255.0
Default Gateway	192.168.168.102
Default Route	Yes ▾
DNS Mode	Manual ▾
Primary DNS	
Secondary DNS	

LAN DHCP

DHCP Server	Enable ▾
Start IP Address ⓘ	192.168.168.101
Number of Address ⓘ	150
Lease Time (in minutes) ⓘ	720
Alternate Gateway	
Preferred DNS server	
Alternate DNS server	
WINS/NBNS Servers	
WINS/NBT Node Type	none ▾

AIR UNIT

Network >> WAN Settings

System	Network	Wireless	Firewall	Serial	Diag	Admin
Status	LAN	WAN	USB	DHCP	Routes	Ports
Device List						

WAN Port Configuration

Configuration

Working Mode ⓘ Bridge with LAN Port ▼

Network >> USB Settings

System	Network	Wireless	Firewall	Serial	Diag	Admin
Status	LAN	WAN	USB	DHCP	Routes	Ports
Device List						

USB Port Configuration

Configuration

Working Mode ⓘ Bridge with LAN Port ▼

Wireless >> RF Settings

System	Network	Wireless	Firewall	Serial	Diag	Admin
Status	RF					

Wireless Configuration

RF Configuration

Radio ☒ On ☐ Off

Channel Bandwidth 8MHz ▼

Channel-Frequency 68 - 2377 MHz ▼

Tx Power 20 dbm ▼

Wireless Distance 3000 (m)

TX Antenna Chains 1+2 ▼

RX Antenna Chains 1+2 ▼

Operation Mode Master ▼

TX Rate Auto (recommended) ▼

Ceiling Rate ☐

Extended Addressing ON ▼

Network ID pMDDL

Encryption Type AES-128 ▼

Encryption Key *****

Show password ☐

RF Serial Port Configuration

Serial Port TX Rate Normal Rate ▼

AIR UNIT

Serial >> Console Settings

System
Network
Wireless
Firewall
Serial
Diag
Admin

Status
Console
Gadget

Serial Port Configuration

Port Configuration

Port status	Data
Escape Sequence	Disabled
Data Baud Rate	57600
Data Format	8N1
Data Mode ⓘ	☐ Seamless ☒ Transparent
Character Timeout	24
Maximum Packet Size	256
No-Connection Data ⓘ	☐ Disable ☒ Enable
MODBUS TCP Status	☒ Disable ☐ Enable
IP Protocol Config	TCP Server

TCP Configuration

Server Mode	☒ Monitor ☐ Polling
Polling Timeout (seconds)	10
Local Listening port	20002
Incoming Connection Timeout(seconds)	60
Fast Recovery ⓘ	☒ Disable ☐ Enable

Suggested Configuration for UAVs P2P Communication _____ GROUND UNIT
configuration details and important points for using the ISM IP radio pairs:

Configuration and Binding:

- The ground unit is set up as the slave device.
- All ISM IP radio pairs are pre-configured and come bound out of the box.

Default IP Address:

- The default IP address for the slave (ground unit) is 192.168.168.100.

Power Settings:

- The radios are set to the lowest power setting by default to prevent damage during bench testing.
- If higher power settings are required, ensure the following:
 - Adequate cooling is in place.
 - Use the heatsink and fan as necessary to avoid overheating.

These steps are crucial for safe and efficient use of the ISM IP radio pairs, particularly during initial testing and setup. If you have any specific questions or need further details on setup or troubleshooting, feel free to ask or look up Microhards Operational Manual!

GROUND UNIT

System >> General Settings

Summary

Settings

Services

Maintenance

Reboot

System Information

System Information

Host Name	UserDevice2	Description	myPMDDL2350
Product Name	PMDDL2350	System Date	2020-03-16 17:18:31
Hardware Version	Rev A	System Uptime	13 min
Software Version	v1.4.0	Build Date	2020-03-16
Software Build	1022	Build Time	17:01:17

LAN Status

MAC Address	00:0F:92:08:B1:F3	Connection Type	static
IP Address	192.168.168.100	Gateway	192.168.168.101
Subnet Mask	255.255.255.0		

WAN Status

MAC Address	00:0F:92:09:B1:F3	Connection Type	dhcp
IP Address	N/A	Gateway	N/A
Subnet Mask	N/A	Secondary DNS	N/A
Primary DNS	N/A		

RF Status

General Status

MAC Address	Operation Mode	Network ID	Bandwidth	Frequency	Tx Power	Encryption Type
00:0F:92:FB:CD:4F	Slave	PMDDL	8 MHz	2377 MHz	20 dBm	AES-128

Traffic Status

Receive Bytes	Receive Packets	Transmit Bytes	Transmit Packets
2.325MB	15895	1.525MB	16738

Connection Info

MAC Address	Tx Mod (MIMO)	Rx Mod (MIMO)	SNR (dB)	RSSI (dBm)
00:0F:92:FB:EC:DF	64-QAM FEC 5/6(On)	BPSK FEC 1/2(On)	64	-31

Stop Refreshing

Interval: 20(in seconds)

Copyright © 2017-2020 Microhard Systems Inc. PMDDL2350

GROUND UNIT

Network >> Status Page

System	Network	Wireless	Firewall	Serial	Diag	Admin	
Status	LAN	WAN	USB	DHCP	Routes	Ports	Device List

Network Status

LAN Port Status

General Status			
IP Address	Connection Type	Subnet Mask	MAC Address
192.168.168.100	static	255.255.255.0	00:0F:92:08:B1:F3

Traffic Status			
Receive bytes	Receive packets	Transmit bytes	Transmit packets
239.492KB	2050	427.321KB	1779

WAN Port Status

General Status			
IP Address	Connection Type	Subnet Mask	MAC Address
N/A	dhcp	N/A	00:0F:92:09:B1:F3

Traffic Status			
Receive bytes	Receive packets	Transmit bytes	Transmit packets
72.560KB	603	7.348KB	22

Default Gateway

Gateway
192.168.168.101

DNS

DNS Server(s)
None

IPv4 Routing Table

Destination	Gateway	Subnet Mask	Flags	Metric	Ref	Use	Interface
0.0.0.0	192.168.168.101	0.0.0.0	UG	0	0	0	(br-lan)
192.168.168.0	0.0.0.0	255.255.255.0	U	0	0	0	(br-lan)

[Stop Refreshing](#) Interval: 20 (in seconds)

Copyright © 2017-2020 Microhard Systems Inc. pMDDL2350

GROUND UNIT

Network >> LAN Settings

System	Network	Wireless	Firewall	Serial	Diag	Admin
Status	LAN	WAN	USB	DHCP	Routes	Ports
						Device List

Network LAN Configuration

LAN Configuration

Spanning Tree (STP)	Off ▾
IGMP Snooping	On ▾
Connection Type	Static IP ▾
IP Address	192.168.168.100
Netmask	255.255.255.0
Default Gateway	192.168.168.101
Default Route	Yes ▾
DNS Mode	Manual ▾
Primary DNS	
Secondary DNS	

LAN DHCP

DHCP Server	Enable ▾
Start IP Address ⓘ	192.168.168.100
Number of Address ⓘ	150
Lease Time (in minutes) ⓘ	720
Alternate Gateway	
Preferred DNS server	
Alternate DNS server	
WINS/NBNS Servers	
WINS/NBT Node Type	none ▾

Network >> WAN

System	Network	Wireless	Firewall	Serial	Diag	Admin
Status	LAN	WAN	USB	DHCP	Routes	Ports
						Device List

WAN Port Configuration

Configuration

Working Mode ⓘ	Independent WAN ▾
----------------	-------------------

WAN Configuration

Connection Type	DHCP ▾
Default Route	No ▾
DNS Mode	Auto ▾

GROUND UNIT

Network >> USB

System	Network	Wireless	Firewall	Serial	Diag	Admin	
Status	LAN	WAN	USB	DHCP	Routes	Ports	Device List

USB Port Configuration

Configuration

Working Mode ⓘ Bridge with LAN Port ▼

Wireless >> RF

System	Network	Wireless	Firewall	Serial	Diag	Admin
Status	RF					

Wireless Configuration

RF Configuration

Radio ☒ On ☐ Off

Channel Bandwidth 8MHz ▼

Channel-Frequency 68 - 2377 MHz ▼

Tx Power 20 dbm ▼

Wireless Distance 3000 (m)

TX Antenna Chains 1+2 ▼

RX Antenna Chains 1+2 ▼

Operation Mode Slave ▼

TX Rate Auto (recommended) ▼

Ceiling Rate ☐

Extended Addressing ON ▼

Network ID pMDDL

Encryption Type AES-128 ▼

Encryption Key *****

Show password ☐

RF Serial Port Configuration

Serial Port TX Rate Normal Rate ▼

GROUND UNIT

Serial >> Console

System

Network

Wireless

Firewall

Serial

Diag

Admin

Status

Console

Gadget

Serial Port Configuration

Port Configuration

Port status	Data ▾
Escape Sequence	Disabled ▾
Data Baud Rate	57600 ▾
Data Format	8N1 ▾
Data Mode ⓘ	☒ Seamless ☐ Transparent
Character Timeout	24
Maximum Packet Size	256
No-Connection Data ⓘ	☐ Disable ☒ Enable
MODBUS TCP Status	☒ Disable ☐ Enable
IP Protocol Config	TCP Client ▾

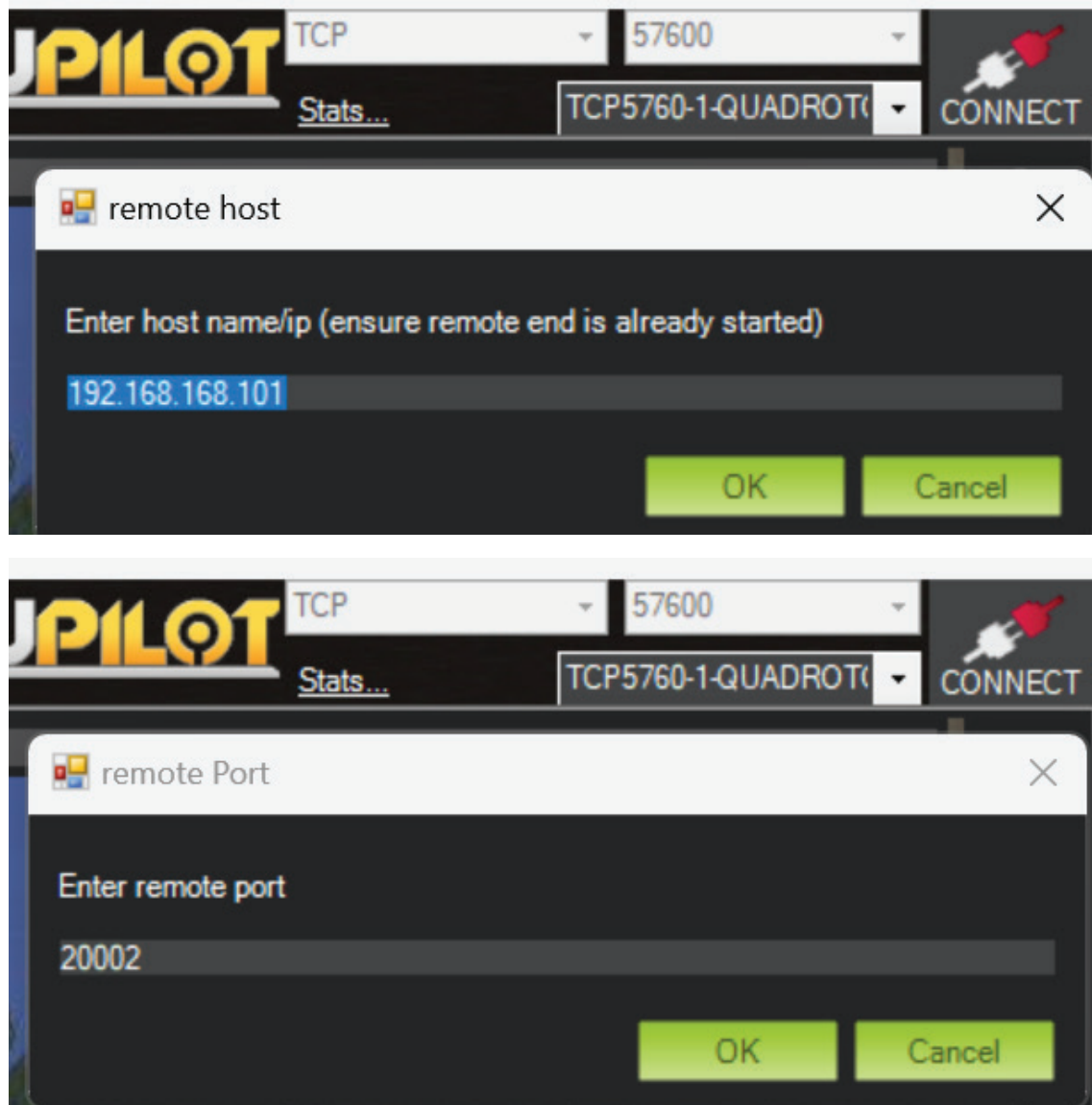
TCP Configuration

Remote Server IP Address	192.168.168.101
Remote Server port	20002
Outgoing Connection Timeout(seconds)	60
Fast Recovery ⓘ	☒ Disable ☐ Enable

Setup _____ GCS

The standard setup for configuring a master-slave point-to-point communication involves using a TCP connection. The standard configuration out of the box uses the following settings.

Mission Planner >> TCP Connection



Setup _____ GCS

Autopilot >> Serial Port Configuration (Telem 2)

SERIAL_PASS1	0	-1:Disabled 0:Serial0 1:Serial1	This sets one side of pass-through between two serial ports. Once both sides are set then all data received on either port will be passed to the other port.	☐
SERIAL_PASS2	-1	-1:Disabled 0:Serial0 1:Serial1	This sets one side of pass-through between two serial ports. Once both sides are set then all data received on either port will be passed to the other port.	☐
SERIAL2_BAUD	57	1:1200 2:2400 4:4800	The baud rate of the Telem2 port. Most stm32-based boards can support rates of up to 1500. If you setup a rate you cannot support and then can't connect to your board you should load a firmware from a different vehicle type. That will reset all your parameters to defaults.	☐
SERIAL2_OPTIONS	0		Control over UART options. The InvertRX option controls invert of the receive pin. The InvertTX option controls invert of the transmit pin. The HalfDuplex option controls half-duplex (onewire) mode, where both transmit and receive is done on the transmit wire. The Swap option allows the RX and TX pins to be swapped on STM32F7-based boards.	☐
SERIAL2_PROTOCOL	2	-1:None 1:MAVLink 1 2:MAVLink 2	Control what protocol to use on the Telem2 port. Note that the Frsky options require external converter hardware. See the wiki for details.	☐
BRD_SER1_RTSCTS	2	0:Disabled 1:Enabled 2:Auto	Enable flow control on serial 1 (telemetry 1). You must have the RTS and CTS pins connected to your radio. The standard DF13 6 pin connector for a 3DR radio does have those pins connected. If this is set to 2 then flow control will be auto-detected by checking for the output buffer filling on startup. Note that the PX4v1 does not have hardware flow control pins on this port, so you should leave this disabled.	☐
BRD_SER2_RTSCTS	2	0:Disabled 1:Enabled 2:Auto	Enable flow control on serial 2 (telemetry 2). You must have the RTS and CTS pins connected to your radio. The standard DF13 6 pin connector for a 3DR radio does have those pins connected. If this is set to 2 then flow control will be auto-detected by checking for the output buffer filling on startup.	☐

VLC/QGC/MP >> Video Stream >> RTSP Settings

Note - the RTSP address used will be the one assigned to your IP camera. If you plan on using a non-IP camera, you will need an IP encoder or companion computer to use it directly with the module.

