IPICOSPORTS

iP-X DF RFID STK Lite Reader
User Manual

Version 1.07

2 November 2007

Doc No: IP7083

DF STK Lite Reader
IP3458

IMPORTANT

Please read instructions before operating this device. This device may cause interference with other electronic equipment that is sensitive to magnetic radiation.

Only an authorized technician may open and work on this unit.

Explosive atmospheres

User shall switch off this unit and obey all safety requirements in these areas. This unit may only be operated if the area is declared safe by a safety official. Hazardous areas typically include fuelling areas, below decks on boats, fuel or chemical transfer/storage points, blasting locations and areas where air contains chemical particles such as grain dust or metal powders.

SAFETY

Avoid any extended human exposure directly in front of the reader, up to a distance of 5cm, when the unit is switched on.
Only qualified personnel may open the unit.

NOTICE

iPico Inc shall not be liable for any errors or for incidental or consequential damages in connection with the furnishing, performance or use of this document, hardware and/or software.
All information in this document including the design and specification are subject to change without notice for the purpose of product improvement.
For further information contact +27 12 345-9520.

APPROVALS

FCC Part 15 Subpart C

FCC ID: VHY-IP3458A

FCC Declaration (USA)

FCC Rules and regulations section 15.19
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Information to user (FCC Rules and regulations section 15.21)
The user is cautioned that any changes or modifications not expressly approved by IPICO or authorized representative could void the users authority to operate the equipment.

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HISTORY

Version	Date	Responsible Person	Detail
1.00	20070119	R. Vergottini	First Release
1.01	20070404	R. Vergottini	Add detail to mat setup and document IP number
1.02	20070513	MVD	Add new faceplate detail
1.03	20070523	MVD	Update faceplate detail
1.04	20070622	R. Vergottini	Update faceplate and USB data storage detail
1.05	20070705	R. Vergottini	Added details to charging section, notice of removal of serial and PSU-B, correct TX level indictor statement, update USB logger operation.
1.06	20070820	R. Vergottini	Change faceplate details, remove ref. to serial and PSU-B.
1.07	20071102	R. Vergottini	Add FCC documentation

1. INTRODUCTION

This manual is intended as a general guide in the setup and usage of the STK Lite system. It must be understood that setup environment can influence the performance of the system. This manual attempts to guide the user into establishing a reliable setup that delivers optimum tag read performance under most conditions.

2. SYSTEM FEATURES

- Read passive RFID tags at an average of 0.75m distance
- Continuous operation from fully charged internal batteries of up to 4 hours.
- Based on the proven iPX protocol for high speed and tag density
- Low maintenance
- Easy setup
- Easy operation
- Easy to transport
- Start/Stop pushbutton for digital marker insertion
- Water resistant and rouged
- Allows connection of backup external battery pack for prolonged operation
- Auto-tuning of mat transmit antenna
- Ethernet and USB connectivity
- Ability to log data to USB flash memory disk

3. SYSTEM LIMITATIONS AND STANDARDS

The STK Lite was designed with small athletics events in mind and it is recommended that for larger events the STK Elite should rather be used. The STK Lite has the following limitations pertaining to setup and usage.

- The STK Lite may only power two timing mats, which can effectively cover an area of no more than 4m².
- Timing accuracy is dependant on the physical layout of the timing mats to the actual timing line or point and the average speed at which tags move over the timing mat. The system has a time resolution of 10ms and as such timing can be accurate to a minimum of 10ms and 50ms average for tag travel speed of 10m/s over a 1m wide timing area.
- With the top lid closed and locked in place the reader unit is waterproof, once the lid is open the reader is at best splash proof.

- The STK Lite should not be operated in ambient temperatures exceeding 40 degrees celcius.
- Use only approved external battery packs and charging units supplied by iPico. Failure to do so may result in electric shock, degraded performance and/or system damage.
- The STK Lite offers a raw data-stream which contains tag data as they are read in the following format:

Byte	Description	Info
0	Header character 1	Frame header, 'a'
1	Header character 2	Frame header, 'a'
2-3	Reader ID	0-255 in ASCII hex
4-15	Tag ID	MS digit first, excluding CRC
16-19	I and Q channel counter	Binary counters 0-255 in ASCII hex
20 –33	Date/Time	Date and time with 10ms resolution. 390ms/10 = 39 = "27" (27 = 0x32 + 0x37) and the month 12 is 0x31+ 0x32.
34-35	LRC	Checksum on bytes 2 to 33
36-37	End of packet (CR, LF)	0x0d, 0x0a

Example:

Tag with an ID = 580011223344 is read at 14:05:20.39 on 2006-12-30 the data packet received from the reader would be

aa00580011223344090006123014052027xx\r\n

where xx is the calculated LRC.

Further details can be obtained from the iPico Reader Serial Protocol document.

4. KNOW YOUR READER

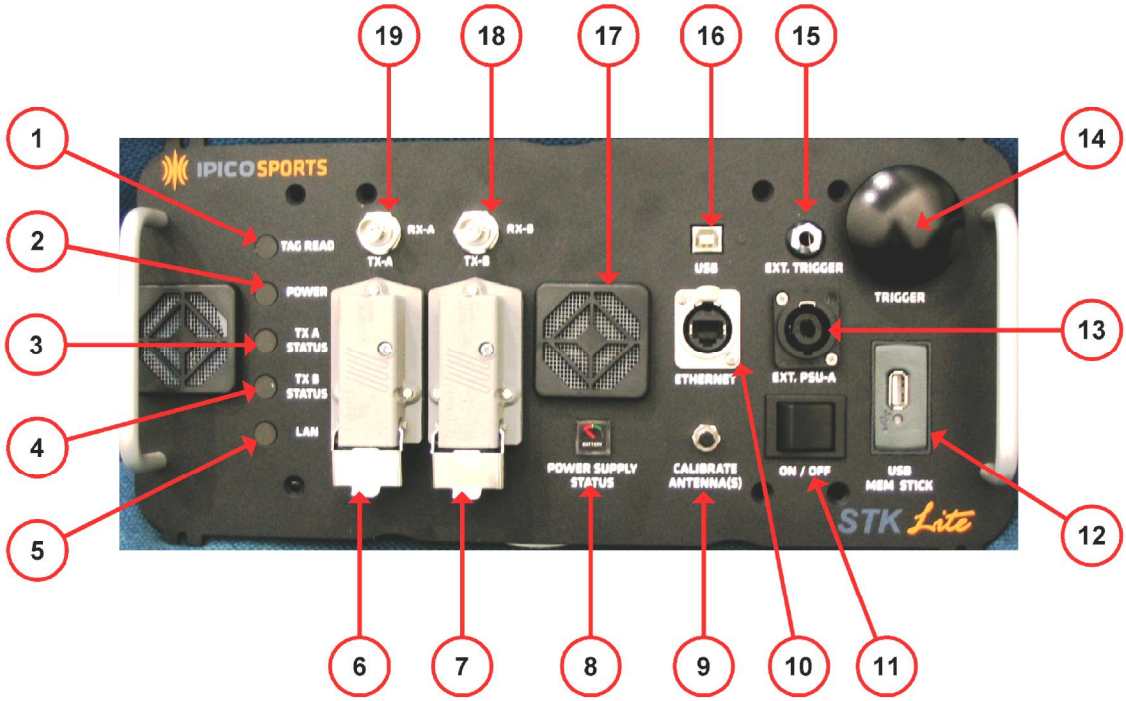


Figure 1 – STK Lite Reader Interface panel

Summary	
1. Tag read indicator	11. Power ON/OFF switch
2. Power indicator	12. USB Memory stick controller
3. TX-A Level indicator	13. External power supply connector
4. TX-B Level indicator	14. Trigger button
5. LAN Activity indicator	15. External trigger connector
6. Antenna A transmitter connector	16. USB communications connector
7. Antenna B transmitter connector	17. Ventilation Fan/Filter
8. Power supply status indicator	18. Antenna B receiver connector
9. Antenna calibration button	19. Antenna A receiver connector
10.Ethernet communications connector	

Table 1 : Interface panel summary

1. Tag Read Indicator: This indicator will illuminate green each time that a tags ID has been successfully read and the internal buzzer will sound. It also indicates the status of the RF Transmitter and will illuminate red when for any reason the RF transmitter is off.
2. Power Indicator: This indicator is illuminated when the system is turned ON via the On/Off power switch and indicates the available battery power. Green = Battery power level high, Red = Battery power level low to medium, indicating that the units internal batteries must be recharged or the unit should be connected to an approved external power supply for extended operation.
3, 4. TX-A Level and TX Level-B: Indicates the level of output power / tuning effectiveness of the reader channel A and B transmitters. Green = Acceptable power output and Red = Poor power output which will result in unacceptable read performance.
5. LAN Activity: Indicates red when an Ethernet connection is present and flashes green as data is exchanged with reader and connected device.
6, 7. TX-A and TX-B connectors: Connect the reader to the TX loops of the STK mat antennas.
8. Power supply status indicator: Rough indication of the power supply status. Range is from approximately 10.1V – 13.8V. The reader will automatically switch off when the power supply level reaches 10.5 Volts to prevent permanently damaging lead acid batteries.
9. Calibrate Antenna(s) button: This push button allows the user to initiate an automatic tuning of the TX loop antennas. This feature can be useful in the event where mats are moved or external environment changes rapidly but there is not enough time to wait for an automatic tune event to take place.

10.	Ethernet connector: Ethernet connection to the reader's data port. Default IP address = 192.168.1.32 : port 10000. IP address can be changed using telnet or the MOXA network enabler administrator tool (See section 5.5).
11.	ON/OFF switch: Power switch.
12.	USB Memory Stick: Used to dynamically store race data on a 1Gbyte USB 2.0 memory stick. Stop of data logging controlled via the Trigger button (see section 5.3).
13.	Ext. PSU-A connector: This is to connect external battery whilst the unit is operational or a battery charger to the unit when not operational and the power switch is OFF.
14.	Trigger button: This allows the user to insert a digital marker into the data-stream and to initiate or finalize logging of data to a USB flash disk. When a USB flash disk is inserted the unit will be automatically initialized which will be indicated by a two audible beeps. Data logging can then be stopped by holding down the button until the buzzer sounds 5 times, indicating finalization of data logging. (Data logging must be finalized as described above to prevent lost and/or corrupt data !). The digital marker can indicate the start/stop of an event. This trigger can also be used to manually mark the time that a runner passes over the timing mats. This will ensure a correct count of the actual number of runners who passed over the timing mats in case of suspected tag failures or runners who have lost their tags etc. (see section 5.3).
15.	Ext. Trigger: This input can be used to connect an external trigger source to the reader i.e. remote Start gun button.
16.	USB connector: USB connection to the reader's data port via a CP210x device driver at a default baud rate of 38400.

17. Fan filter: The filters and internal fan ensure that that the reader unit does not overheat and cause internal component failure. Filters must be kept clean and unblocked by foreign objects to ensure correct operation.
18, 19. RX-A and RX-B connectors: Connect the RX loops from the STK mat antenna via BNC connectors to the reader.

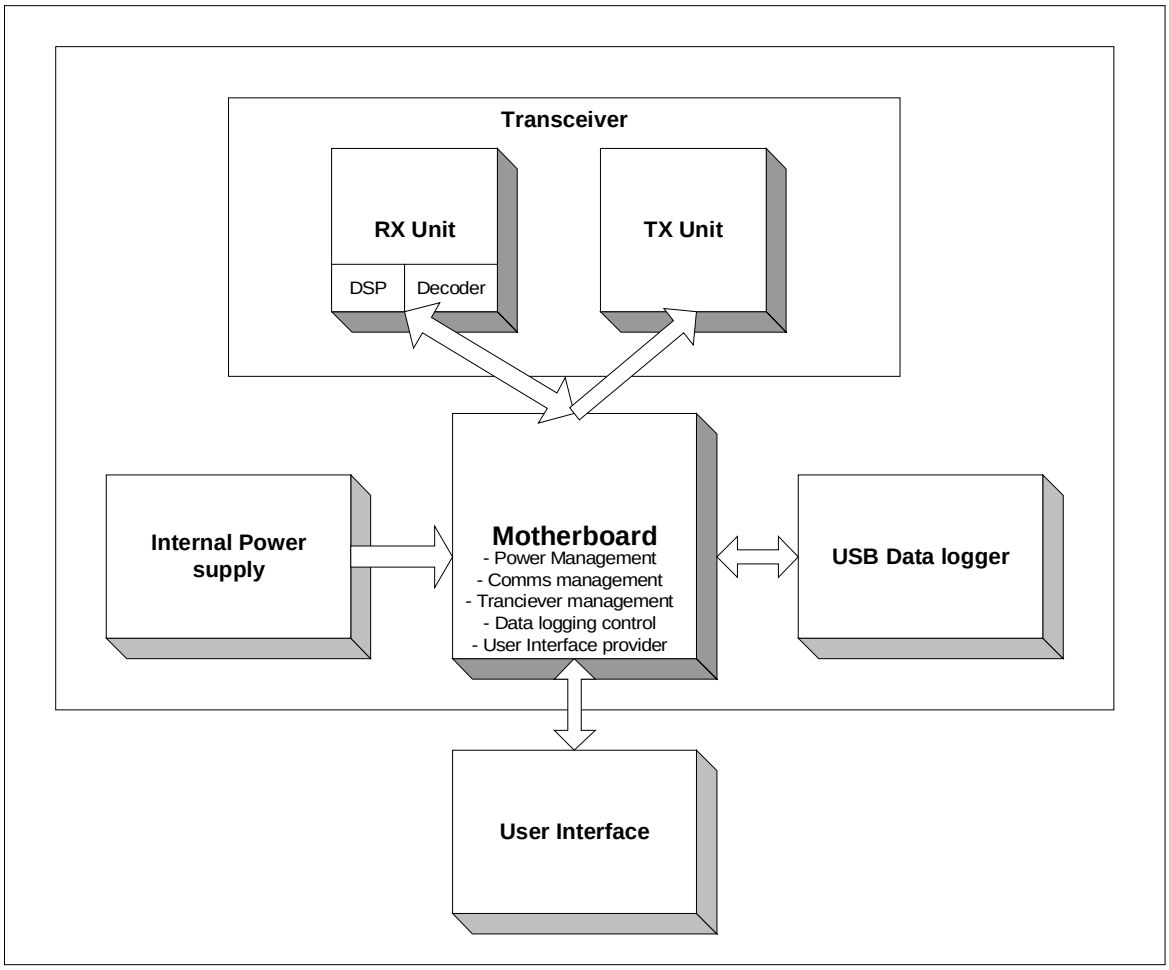


Figure 2: System overview

5. USING THE STK LITE

This section serves as a general guideline to the use of the STK Lite.

5.1 Battery charging

The STK Lite is supplied with a 3 stage charger which displays the charge state of the unit internal batteries via 3 color lamp.

5.1.1 Ensure that the unit is turned OFF

5.1.2 Plug in the charger connector to the Ext. PSU A plug on the user interface panel.

5.1.3 Plug the charger power lead into an electrical outlet.

5.1.4 Turn ON the electrical outlet power to start charging.

5.1.5 Leave the unit on charge until the charger lamp is green, indicating a full battery charge.

5.1.6 After charging has completed, simply unplug the charger connector from the unit user interface panel and switch OFF the charger.

Note: DO NOT LEAVE THE UNIT ON CHARGE FOR MORE THAN 12 HOURS EVEN IF CHARGER INDICATOR IS NOT GREEN, AS THIS WOULD INDICATE DAMAGED BATTERIES).

5.2 System Pre-Use checks

5.2.1 Please ensure that the internal batteries have been fully re-charged on first use and after every event. If the system is not used for a period of more than 2 weeks the batteries will need to be recharged.

When fully charged the internal batteries can provide the system with optimal power for a period of up to 4 hours. Please ensure that you have a backup 12V battery available in the event that longer operating hours are required. The Amp-Hour rating of which can be approximately determined by multiplying the expected number of operating hours by 4.

Ex.

Expected number of operating hours: 6 hours

Required external battery pack minimum Amp-Hour (Ah) rating

= 6hours x 4Amps = 24Ah

5.2.2 Check that the connectivity option to be used (Ethernet or USB) is functional.

5.2.3 Check that data is logged to flash disk if used.

5.2.4 Check that tags can be powered up and read by the system by using the active test tag provided with the reader.

5.2.5 Turn on the active test tag and hold it high above the center of each mat, and lower it slowly. The tag will start beeping as soon as it has enough power available. The reader will beep when the tag can be read. In general the active test tag will start beeping before the reader, this is because of the fact that there may be enough power for the tag to operate but the coded transmitted to the reader is too weak to be detected. As the tag is lowered the reader should start to beep.

5.3 System usage

5.3.1 Lay out the antenna mats at the required position keeping the guidelines given in the following section in mind.

5.3.2 Connect the mat antennas to the reader antenna connectors and ensure that the connector is fully inserted and locking clips are closed.

5.3.3 Switch on the reader via the On/Off power switch.

5.3.4 Use the active test tag to ensure that both reader TX and RX is functional.

5.3.5 Use a test tag of the same type used for the event and ensure that the minimum required read range is obtained. For athletics a minimum range of 0.7m is required.

5.3.6 NOTE: TX A and TX B level indicators must indicate green for correct operation. If not so, refer to the setup guidelines in the following section and the troubleshooting section of this document to attempt correcting the output power of the antenna mats.

5.3.7 Connect the reader via Ethernet cable to network / stand alone PC or via USB. Connect to the reader on port 10000 when using ethernet to gain access to the internal decoder.

5.3.8 Set the current date/time accordingly. (See section 5.4).

5.4 USB disk data logging

5.4.2 With the system powered ON and fully operational, insert the USB flash disk drive into the USB Stick data logger.

5.4.3 The reader will automatically start logging data as soon as a logging file has been successfully created. (Two beeps will be heard when this step has been successful)

5.4.4 Once data logging is completed, press and hold the Trigger button until five audible beeps are generated by the reader, and the USB stick activity light has settled to a steady state indication. It is now safe to remove the USB flash disk memory stick.

5.4.5 Data logging has now been finalized, and the logged data stored into a file named TAGDATA.LOG in the root directory of the USB flash disk memory stick.

5.4.6 Data is stored as normal ASCII text, which can be viewed by any text editor such as Microsoft Windows NotePad, WordPad or Microsoft Office Word etc. under the Windows operating system platform.

5.4.7 NOTE: Previous logged data will not be erased. Instead new data will be appended to the bottom of the existing log file incase the log file has not been deleted before logging is started.

5.5 Setting system date/time

To set the date/time of the system, a specific system message containing the date and time to be set must be sent from a PC to the system which has the following format,

Hdr		ID		Len		Cmd		Date						Day		Time							
								y	y	m	m	d	d	n	n	h	h	m	m	s	s	<CR>	<LF>
a	c	0	0	0	7	0	1	0	1	0	2	1	0	0	4	2	2	1	5	2	3	\r	\n

= ac00070101021004221523\r\n

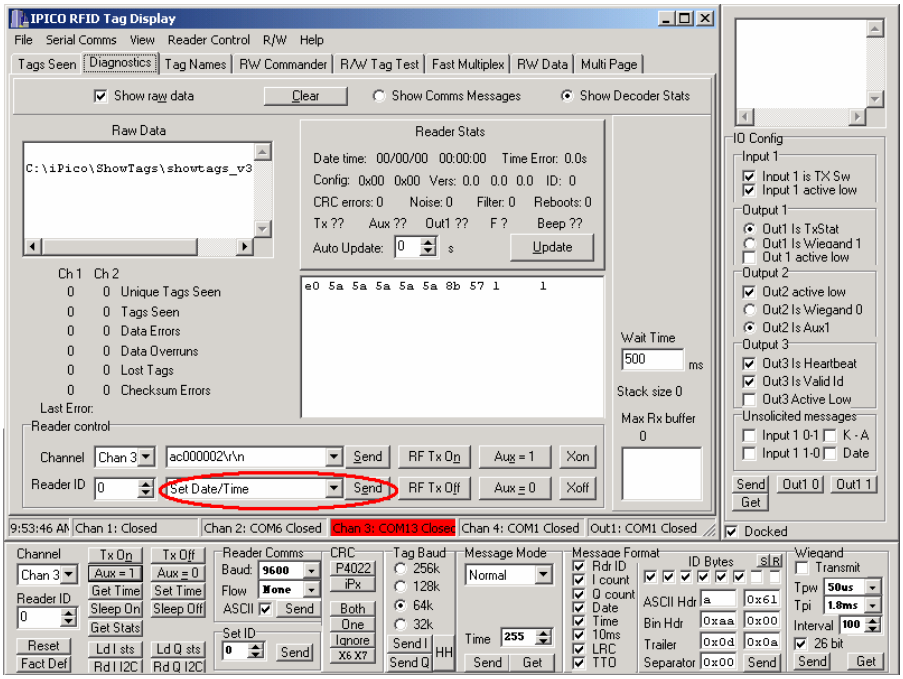
where the variables of date, day and time are to be adjusted to the date/time to be set.

In the above example the date/time to set will thus be: 2001/02/10, 4th day of week(Thursday), 22:15:23 p.m.

Acknowledgement from system:

Hdr		ID		Len		Cmd		LRC		<CR>	<LF>
a	b	0	0	0	0	0	1	2	1	\r	\n

To setup the date/time of the system to be exactly equal to the PC to which the unit is connected, the iPico freeware program ShowTags which is supplied on the CD which accompanies the unit can be used.



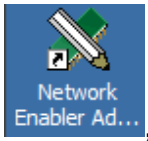
By connecting to the unit over either USB or Ethernet, and sending the Set Date/Time command as shown in the figure above, the units time will be set equal to the PC to which the unit is connected.

For more information please view the ShowTags User Manual, supplied on the accompanying CD.

5.6 Changing Ethernet connectivity settings

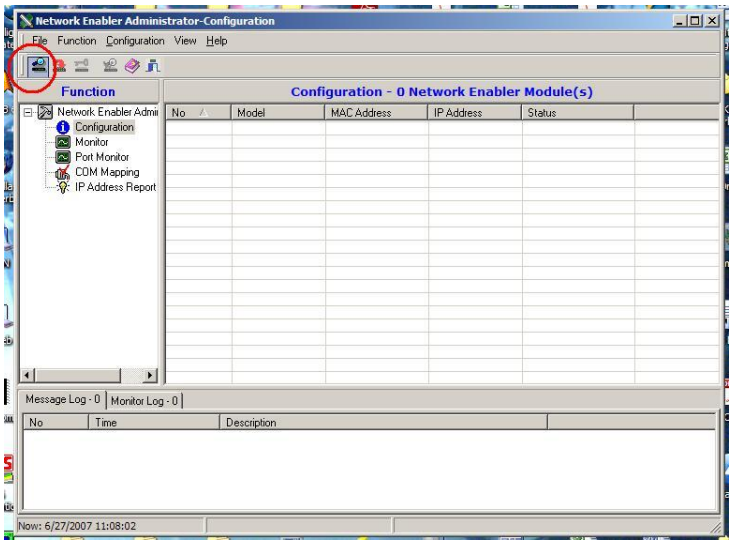
5.6.2 Using MOXA Network Enabler software for Windows

1. Please install the MOXA Network Enabler Administrator software package by running setup.exe found on the STK Lite software CD, under the MOXA SDK directory.
2. Ensure that the reader is connected via straight through cable to a network access point / hub and that your PC is connected to the same network. If you are connecting directly to the reader, use a cross over Ethernet cable and change your Windows Network TCP/IP settings to match the subnet of the reader.

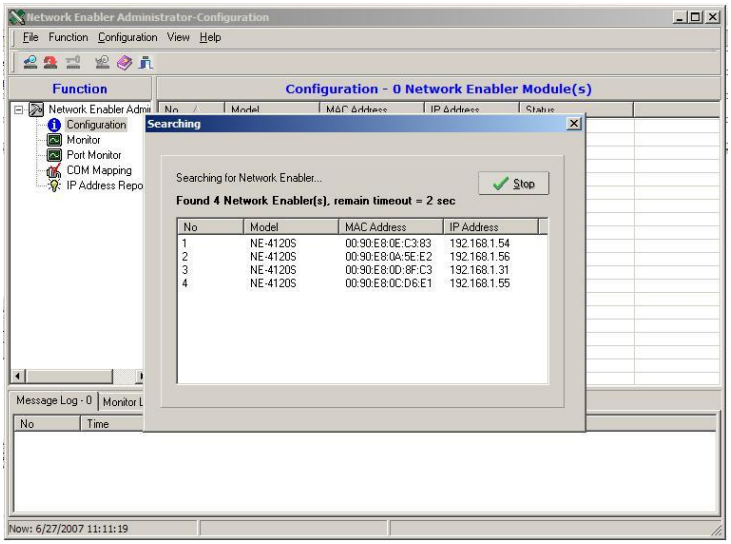
3. Start the MOXA Network Enabler Administrator software package by clicking the icon on your desktop 

, or Selecting from the Start Menu in Windows XP, : Start -> All Programs -> Network Enabler Administrator -> Network Enabler Administrator.

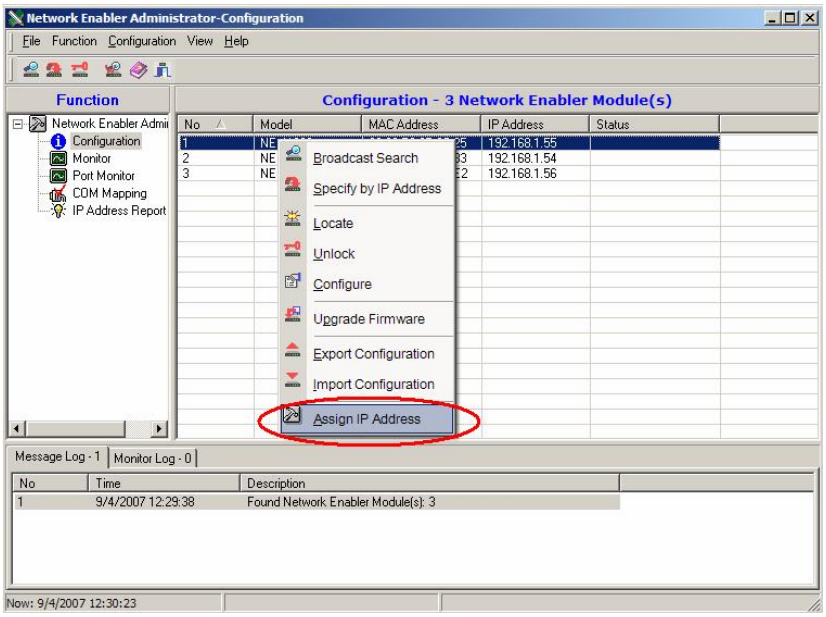
4. Start a broadcast search by selecting the icon as indicated by the red circle in the top left hand corner in the figure below



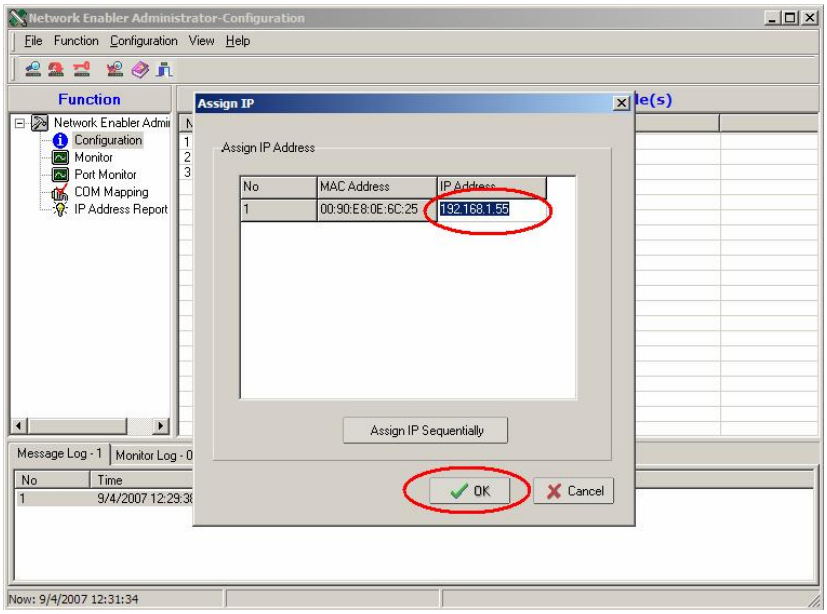
5. After clicking the broadcast search button, A window which times out automatically will appear which will look similar to the figure below.



6. Right click on the device in the list to open a drop down menu, and select Assign IP Address as shown in the figure below.



7. In the window that appears, enter the new IP address to be set, and select OK as shown in the figure below.



5.6.3 Using a Telnet session

1. From a command shell or the Windows Run box, connect to the system using Telnet with the default Telnet port.

   Type in telnet proceeded with the system IP address to connect to the Moxa console configuration.

   Ex. telnet 192.168.1.32

2. Type 2 to select Network Settings, and press Enter.
3. Type 1 to select IP Address, and press Enter.
4. Use the Backspace key to erase the current IP address, type in the new IP Address and then press Enter.

6 ANTENNA MATS SETUP GUIDELINES

Figure 3 below illustrates a typical read setup.

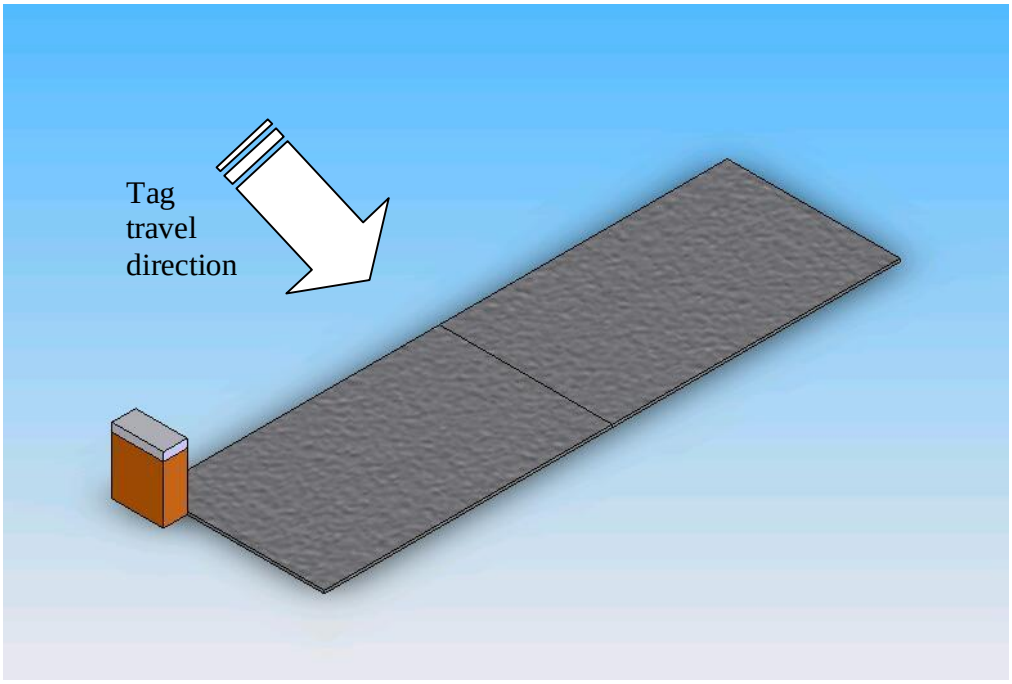


Figure 3 – Typical read setup

6.1 Timing mats are to placed at least 0.5m from any large metal / conducting objects such as fences, barb wire etc.

6.2 The STK Lite reader and mats are to placed at a distance of at least 10m from other electromagnetic field generating equipment such as fan motors, audio equipment etc.

6.3 No AC power lines including extension cords should be placed at a distance of less than 1m from the reader unit and timing mats.

6.4 Ensure that mats are lain out in there full length and breadth and not rolled up or folded when being used as this could prevent the mats from operating at maximum efficiency due to incorrect tuning.

6.5 When laying mats out, overlap the edges of the two mats such that the wires within the mats are directly over each other.

6.6 Run the lead of the furthest mat through the centre of other mats to the reader, and never down the side edges of the mats.

6.7 Always keep the tag orientation to the timing mat antenna in mind. Maximum coupling and thus read range occurs when the magnetic flux lines of the two loops pass through each other. Figure 4 below illustrates typical tag and mat antenna orientations with indications as to where good and poor coupling take place.

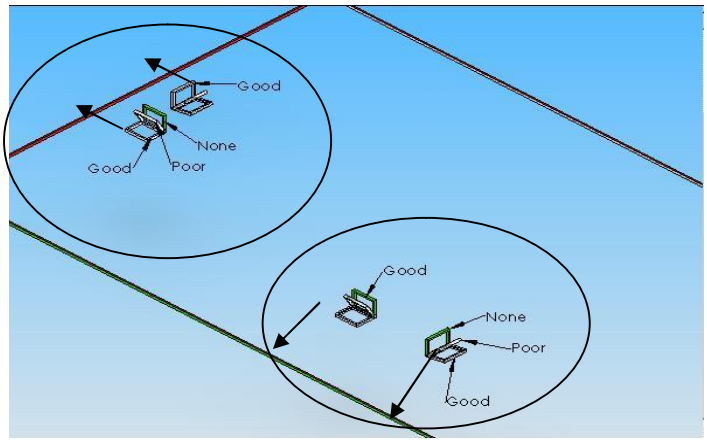


Figure 4: Tag/Mat antenna orientations

6.8 When it is critical that all tags be read and the environment is of such nature that effective read range cannot be obtained due to tuning limitations it is advised to place one timing mat behind the other effectively forming a second loop on which the same tag can be read. The backup mat format has proved so essential that this kind of setup is preferred under most conditions and is also used by competing RFID time keeping systems. Figure 5 below illustrates a typical setup of this format.

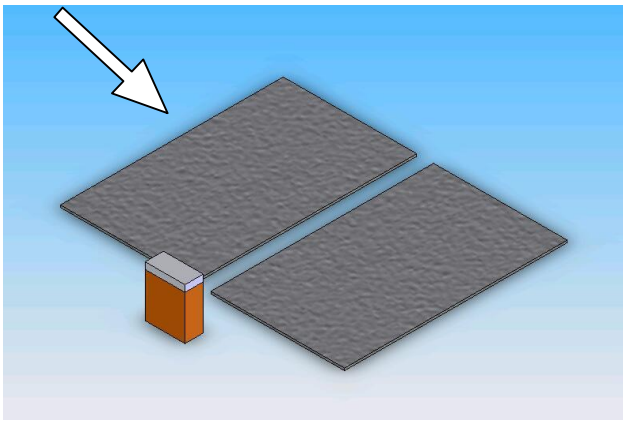


Figure 5: Critical backup setup

6.9 When using multiple readers to cover an extended area the following layout is advised.

Mat connected to TX-A of reader 1	Mat connected to TX-B of reader 1	Mat connected to TX-A of reader 2	Mat connected to TX-B of reader 2	Mat connected to TX-A of reader n	Mat connected to TX-B of reader n

6.10 When using multiple readers to cover an extended area, and the backup mat format is required the following layout is advised.

Mat connected to TX-A of reader 1	Mat connected to TX-B of reader 2	Mat connected to TX-A of reader 3	Mat connected to TX-B of reader 4	Mat connected to TX-A of reader 5	Mat connected to TX-B of reader n

Mat connected to TX-B of reader 1	Mat connected to TX-A of reader 2	Mat connected to TX-B of reader 3	Mat connected to TX-A of reader 4	Mat connected to TX-B of reader 5	Mat connected to TX-A of reader n

7 TROUBLESHOOTING

7.1 The minimum required read range is not obtained

Press and hold the Calibrate antennas pushbutton and test the read range once more. If the read range has not improved it may be that the environment is of such nature that an optimal tune cannot be obtained. Move the antennas to a new location and determine whether read range improves. Also make sure to follow the setup guidelines given in the previous section.

7.2 TX Output indicates acceptable power output but tag cannot be read

It is possible that the RX channel is faulty, antenna not connected or environment noise too high to read the tag.

7.3 TX Level indicator stays red

Environment around antenna mats do not allow for optimal output power tuning, transmitter output faulty, antenna not connected or TX output set to OFF via software.

7.4 Reader buzzer sounds when reading tag but no data received via Ethernet or USB connection

Possible causes are: Faulty Ethernet module, Faulty USB module, cable damaged or not connected or incorrect reader hardware (serial to Ethernet converter) setup or incorrect USB serial baud setting.

7.5 Reader not functional (Power indicator not functional)

Possible causes are: Depleted internal batteries, Power switch not turned ON or faulty reader.

8 TECHNICAL SPECIFICATIONS

Power supply	12VDC @ 4A avg. consumption Internal supply: 12V DC (2x7Ah) batteries External supply: 12V DC Charger
Transmitter power	250V Pk-Pk @ 100% duty cycle
Operating frequency	TX @ 125kHz & 127kHz RX @ 6.8MHz
Antenna type	Externally connected, matched to 50Ohm (Electrical/Physical configuration to comply with ETSI and FCC). Typical antenna used is the STK timing 2m x 1m antenna mat lying flat on ground.
Read range	Dependant on reader antenna, tag and environment. Typical read ranges using half credit card size STK shoe tags are 0.6m to 1.5m
Communication	Reader/Host: USB and Ethernet Reader/Tag: IP-X Read Only
Data storage	External USB flash disk. Recommended USB 2.0 compliant with size 256Mb to 1Gb. (Disk not included)
Electrical Interface	TX: Hirschmann ST series 3 pole connector RX: BNC External charge/Power: Neutrik 4 pole audio connector
Environmental	IP65 with Lid closed. High impact glass filled Nylon enclosure.
Physical	440 x 220 x 340 mm Weight un-packed: 12.0 kg without antennas
Accessories	External charge/battery lead with Neutrik Connector, and Ethernet cable hood

Table 2 : Technical specifications

9 SUPPORT

Ordering Info:

IP Number	Product Code	Description
IP3458	iP-X DFRDR-LR-STK-LI-RO	DF Long Range STK Lite Reader Read Only
IP0903		12V DC 4A Battery Charger
IP2227		5m CAT5 Ethenet patch lead
IP0823		1.8m USB 2.0 patch lead
IP2226		1m External PSU connection cable.
IP0824		12V DC 7AH CSB GP1272 battery

10 TECHNICAL ASSISTANCE

iPico Sports online: http://www.ipicosports.com

iPico Inc online: http://www.ipico.com