# IP-X™ DF Registration Reader

# IP 3491-1 (USB)

# IP 3491-2 (RS422)

User Manual


Version 1.00

10 September 2010

# IMPORTANT

**Please read instructions before operating this devise. This device maybe influence by other electronic equipment that creates magnetic radiation.**

**Only use an IPICO approved power supply.**

**Only an authorised technician may open and work on this unit.**

**Warranty is void if you open or tamper with this device.**

**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 chemicals or particles, such as grain, dust or metal powders.

# NOTICE



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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 +1 905 631 6310.

# SAFETY

In most aircraft and hospitals the use of RF devices are prohibited. Please consult the local authorities and safety official when operating this device.

This is a low voltage device. Only qualified personnel may open the unit.

# APPROVALS

FCC Part 15: **Pending**

EN 300-330: **Pending**

IEC 60950 (CE): **Pending**

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# HISTORY

| Version | Date | Person | Reason |
|---|---|---|---|
| 1.00 | 10-08-2010 | MVD | Created. Release for review/use. |
| | | | |
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# GLOSSARY

| | |
|---|---|
| CMRR | Common-mode rejection-ratio |
| CW | Continuous Wave |
| dB | Decibels |
| DF | Dual Frequency |
| DSP | Digital Signal Processor |
| PC | Personal computer |
| RFID | Radio Frequency Identification |
| RS422 | Serial communications interface |
| RX | Receive |
| TX | Transmit |
| USB | Universal Serial Bus |

# 1. Know your reader.


1. Communications and Power interface
   a. USB – Terminated in a Type A (male) connector
   b. RS 422 – Un-terminated (see par 3 for wiring detail)
2. Reader with integrated antenna
3. Status indicator
4. Quick Start manual
5. CD with manual, Data sheets, demo software and drivers files
6. Wall-mount bracket
7. 4x M3x20mm Philips screws
8. Carry bag
9. 1.5m USB extension cable for USB reader only

**Figure 1. Reader & Accessories overview**

# 2. Functional overview

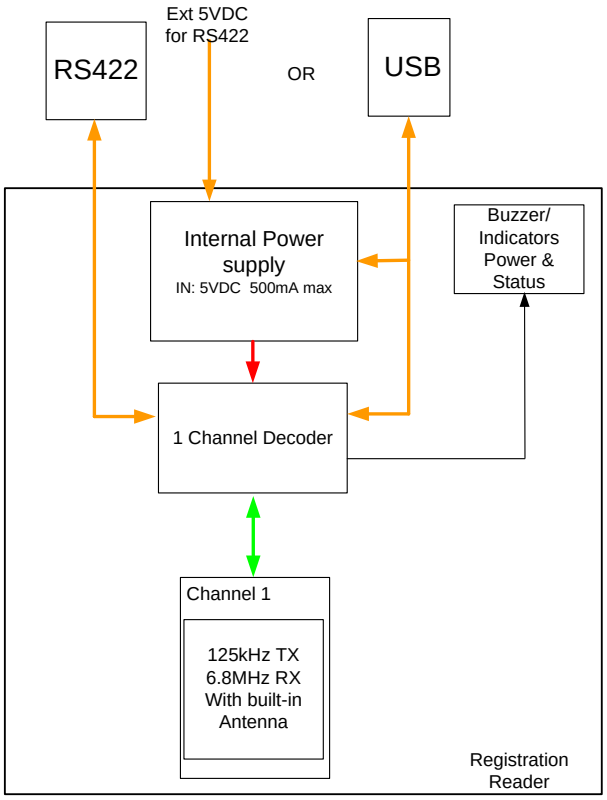


**Figure 2. Functional overview**

## *2.1 Reader interfaces*

The Reader consists of 4 main functional blocks, namely;

a. Single channel transceiver stage with an integrated Antenna

b. Single channel decoder/communication controller

c. Status indicator and Buzzer

d. Power/Communication interfaces (USB or RS422)

A reader has a single channel transceiver to excite a DF tag at 125 KHz and receive ID's on 6.8 MHz. The ID signal is received, filtered and decoded. After successful decoding the tag ID/DATA is passed onto the communication process. Once error checking and other processing is done, data is send to the host.

In case of TTO type tags or other security enhanced tags, the decoder will apply additional processes in order to decode the incoming signals.

The Controller transmits tag ID's immediately through the communication ports to the host. No data buffering/storage takes place in the reader. In case the communication link is down the transmitted ID's will be lost.

The Communications ports options are

a. USB (Power/Data/Control) or

b. RS 422 (Data/Control) separate 5VDC is required.

# 3 Installation and Set-up

***Note:***

***Installation and performance will be site dependent.***

***Performance will be influenced by strong electromagnetic signals near the reader i.e SMPS, electric motors, Variable Speed drives etc.***

***Warning !!!***

***Ensure mains power is switched OFF during installation and maintenance.***

## *3.1 Power supply*

The USB reader is powered via the USB port.

The RS 422 reader is powered from an external power supply. The typical requirement for this supply is a Linear 5VDC +/- 5% @ 500mA max supply with a ripple less than 50mV under load. In case a SMPS is used, the required Conducted and Radiated EMC levels must meet EN55022, FCC part 15 Level B.

## *3.2 Communication set-up*

**Connect the reader via USB.** Install the ***Ipico_USB_cdc.inf*** driver file included on the CD when prompted by Windows. After installation go to Window's Ports in the Hardware device manager and find the Virtual COM port number assigned to the reader. The typical baud rate is 9600, 8 Data bits, No parity, 1 Stop bit and No Flow control.

**Connect the reader via RS 422.** No special driver is required, except if the device is connected to a PC via a RS 422/RS232 converter. This may require a Virtual Com port driver. Follow the instructions obtained with such a device. The typical baud rate is 9600, 8 Data bits, No parity, 1 Stop bit and No Flow control. ***Note that the CMRR is ± 60V between reader and the host, so care must be taken during installation that this will not be exceeded.***

RED = +5VDC @ 500mA max (Note : No reverse polarity protection)
BLACK = GND
Screen = GND
WHITE = TX+ (to RX+ on Host side)
YELLOW = TX- (to RX- on Host side)
ORANGE = RX+ (to TX+ on Host side) **(RX +/- lines are internally terminated with 120ohm resistor)**
BROWN = RX - (to TX- on Host side)

At 9600 the communication cable can be as long as 1500m although additional surge protection will be needed and care should be takes not to exceed the CMRR criteria, especially in areas that are susceptible for lightning or other conditions that can generate a high common-mode offset i.e railway environments. In case the power is also transferred over the communication cable, the voltage drop need to be taken into consideration as the input at the reader must be +5VDC +/-5%. Any good quality 2 or 3pair twisted individually and overall screened cable can be used that can handle up to 38.4 kbps.

### *3.3 Reader set-up*

4 Refer to the IP-X protocol document, included in the CD for different options with regards to the Message mode and Message Format.

5 The default message format is set to standard that produces the following string :

**Typical string reply from reader when a tag is presented**

aa000580015dcc4c1dde010004010100015118000000 79

| Header | Reader ID | 48 bits tag ID | UID CRC | I and Q counts | Date stamp Yy,mm,dd | Time stamp 4Bytes HH:MM:SS and n x 10ms (i.e n=0f) | TTO 1 Byte ID session handle | TTO 1 Byte Page # (0=ID) | TTO 1Byte Tamper/FS/LS 00=No Tamper 01 = Tamper 80 = First seen 60 = Last seen | LRC of complete string |
|---|---|---|---|---|---|---|---|---|---|---|
| 1Byte | 1Byte | 6Bytes | 2Bytes | 2Bytes | 3Bytes | 4 Bytes | 1Byte | 1Byte | 1Byte | 1Byte |
| aa | 00 | 0580015dcc4c | 1dde | 01 00 | 040101 | 00 01 51 18 | 00 | 00 | 00 | 79 |

6 The default Message mode = Normal. Tag ID's will just stream to the Host as long as the tag is present in the reader's antenna area.


**Figure 3. Typical way to present a tag**

# 4. Troubleshooting

### Audio/Visual indicator guide

- GREEN Random flashing + Buzzer indicates valid tag ID's are decoded.
- Amber 1HZ flashing indicates Heartbeat (Shows Reader is operational).

| Symptom | Possible causes |
|---|---|
| Amber LED Static OFF | Reader switched OFF |
| | Indicator board faulty |
| | Reader internal Power Supply faulty |
| Amber LED Static ON | Reader faulty/Unknown state. |
| Green LED OFF if tag is presented | Faulty Tag or incorrect Tag baud rate selection. |
| | Tag not orientated correctly. |
| | Faulty Reader front end |
| | High levels of ambient RF noise operating in the same frequency spectrum as reader. |

**Table 1. Troubleshooting guide**

# 5. Maintenance

This is a low maintenance device. The user must make sure that the reader is kept clean and dry where possible. Do not use solvents to clean this unit. This reader must be used indoors. If it is required to use it outdoors, care must be taken to protect it from the elements. Make sure electrical supply to the reader is stable and protected against reverse polarity and surges.

# 6. Technical specification

| | |
|---|---|
| **Power supply requirement** | Input: 5VDC +/-5% @ 500mA max. Ripple less than 50mV. In case of a SMPS, the EMC limits must be at least comply to EN55022, FCC part 15 Level B.<br>NOTE: There is No reverse polarity or overvoltage protection on this reader. |
| **Transmitter power** | < 62dBuAm @ 10m |
| **Operating frequency** | TX = 125 KHz 10ms ON/OFF, RX = 6.8 MHz |
| **Antenna type** | Internal, coil |
| **Read range** | Depends on the antenna type and tag type.<br>Typical read ranges with IP3278 CR80 tag is 40-60mm that can be obtained in best orientation and in electrical noise free environments. |
| **Communication** | **Reader/Host:** RS422 (point to point) or USB.<br>**Reader/Tag:** iP-X Read Only, Read/Write and TTO enabled.<br>EM4322 (X3), EM4522 (X5), EM4321(X8) |
| **Data storage** | Configuration data only, No user data |
| **Electrical interface** | USB = Communication and Power terminated via Type A connector<br>RS 422 = Un-terminated<br>RED = +5VDC @ 500mA max<br>BLACK = GND<br>Screen = GND<br>WHITE = TX+ (to RX+ on Host side)<br>YELLOW = TX- (to RX- on Host side)<br>ORANGE = RX+ (to TX+ on Host side)<br>BROWN = RX - (to TX- on Host side) |
| **Environmental** | Operating temperature range: -10 to +60 Deg C<br>Storage temperature range: -20 to +85 Deg C<br>Humidity: 20 to 95 %RH non-condensing<br>IP rating: IP65 |
| **Physical** | Reader Approx dimension: 128 (L) x 116 (W) x 25 (H) mm<br>Weight: Approx. 200g unpacked<br>Shipping box Approx dimension: 200 (L) x 150 (W) x 60 (H) mm<br>Weight: Approx 500g Packed for shipping |
| **Accessories** | Wall mount bracket and 4x M3x20mm Philips screws<br>Carry pouch<br>1.5m USB extension cable (for USB version only)<br>CD with manual, data sheets, demo software and drivers |

**Table 2. Technical Specifications**

## 7. Support

**Ordering information**

Reader

Model number:

**IP 3491-1 (USB)**

**IP 3491-2 (RS422)**

Part Name: **IP-X DF Registration Reader**

Package Includes:

1x Wall mount bracket

4x M3x20mm Philips screws

1x 1.5m USB extension cable (IP3491-1 only)

1x Carry pouch

1x Quick start manual

1x CD manual, data sheets, demo software and drivers

***Please consult your local dealer for more information regarding system integration***

## 8. Technical Assistance

Please log onto http://www.ipico.com or email us at support@ipico.com.

# 9. Appendix A: Mechanical layout of reader module

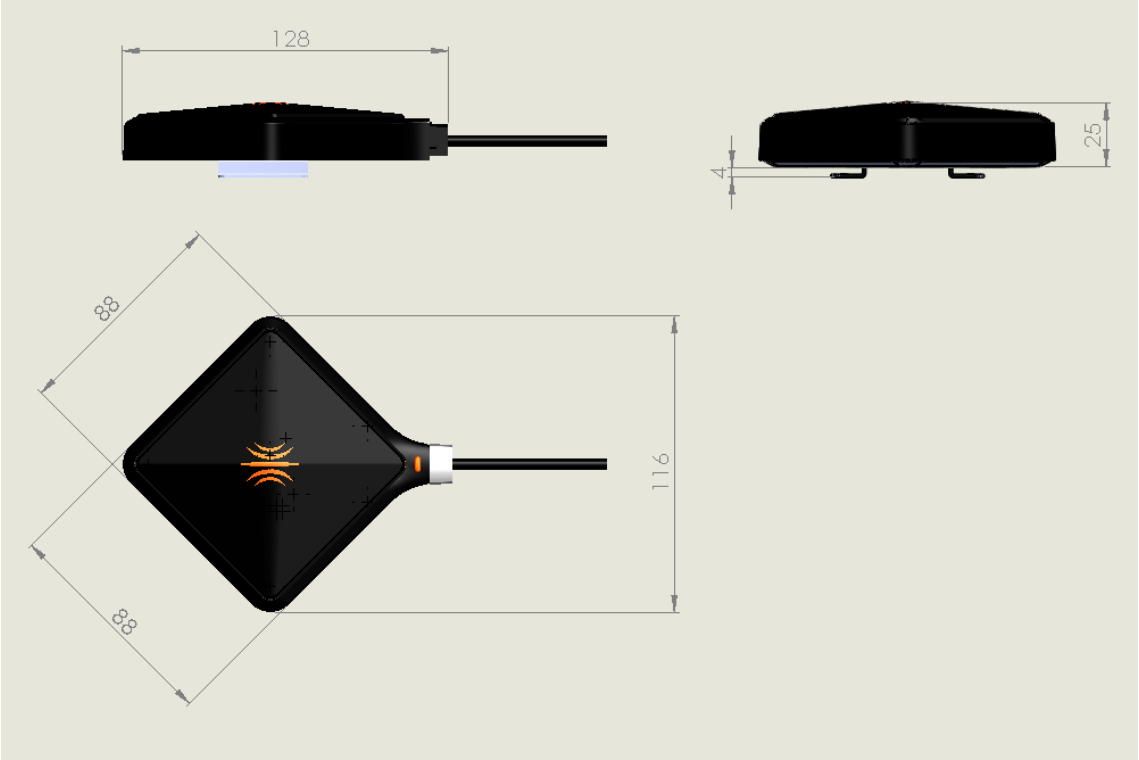


**Figure 4. Registration Reader dimensions**

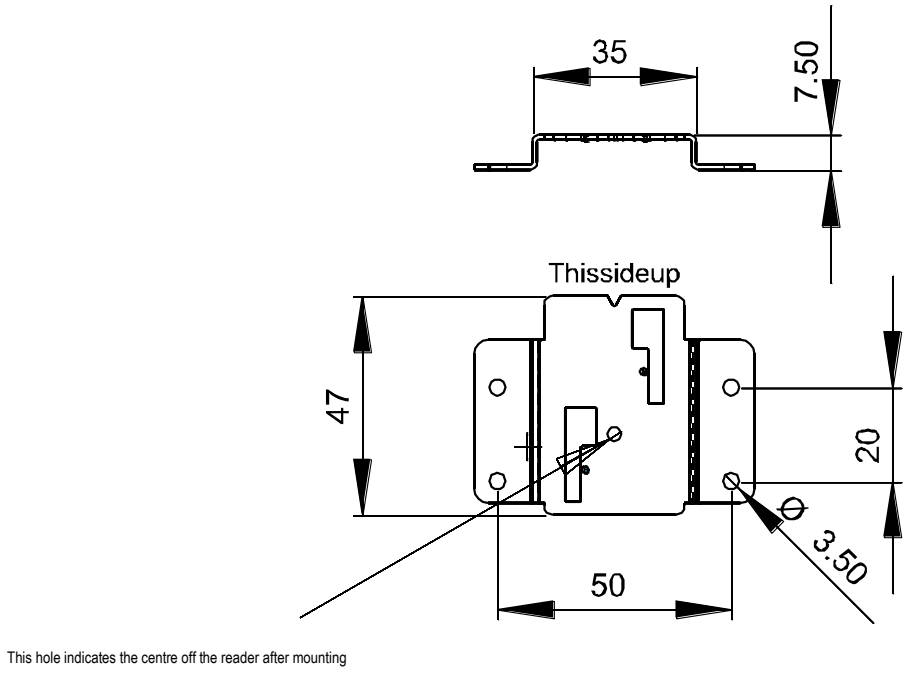


**Figure 5. Wall mount details**

# 10. Appendix B: Read/Write SW interface overview

Reader will typically connect to one host i.e. PLC or PC.

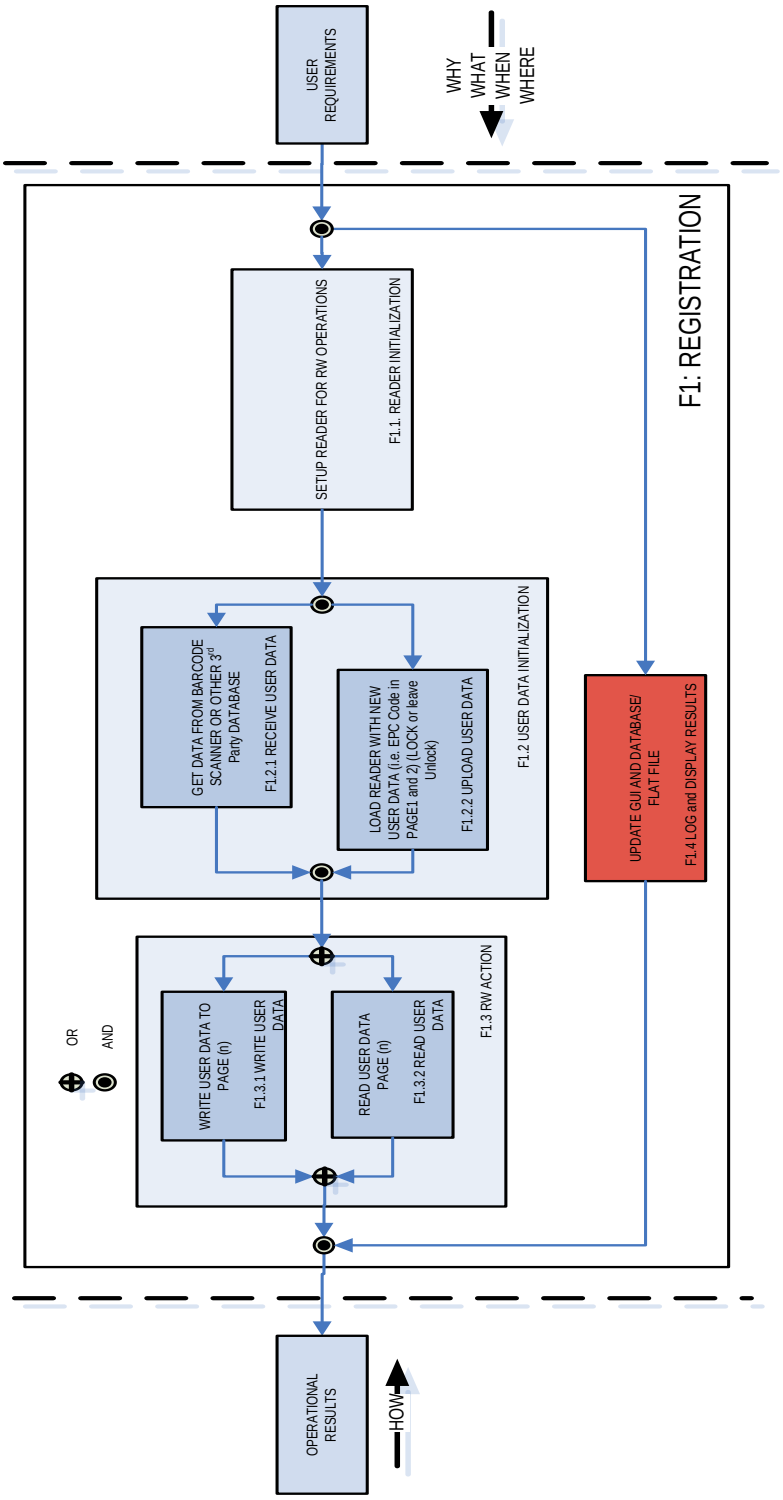


**Figure 6. FFBD of RW functionality**

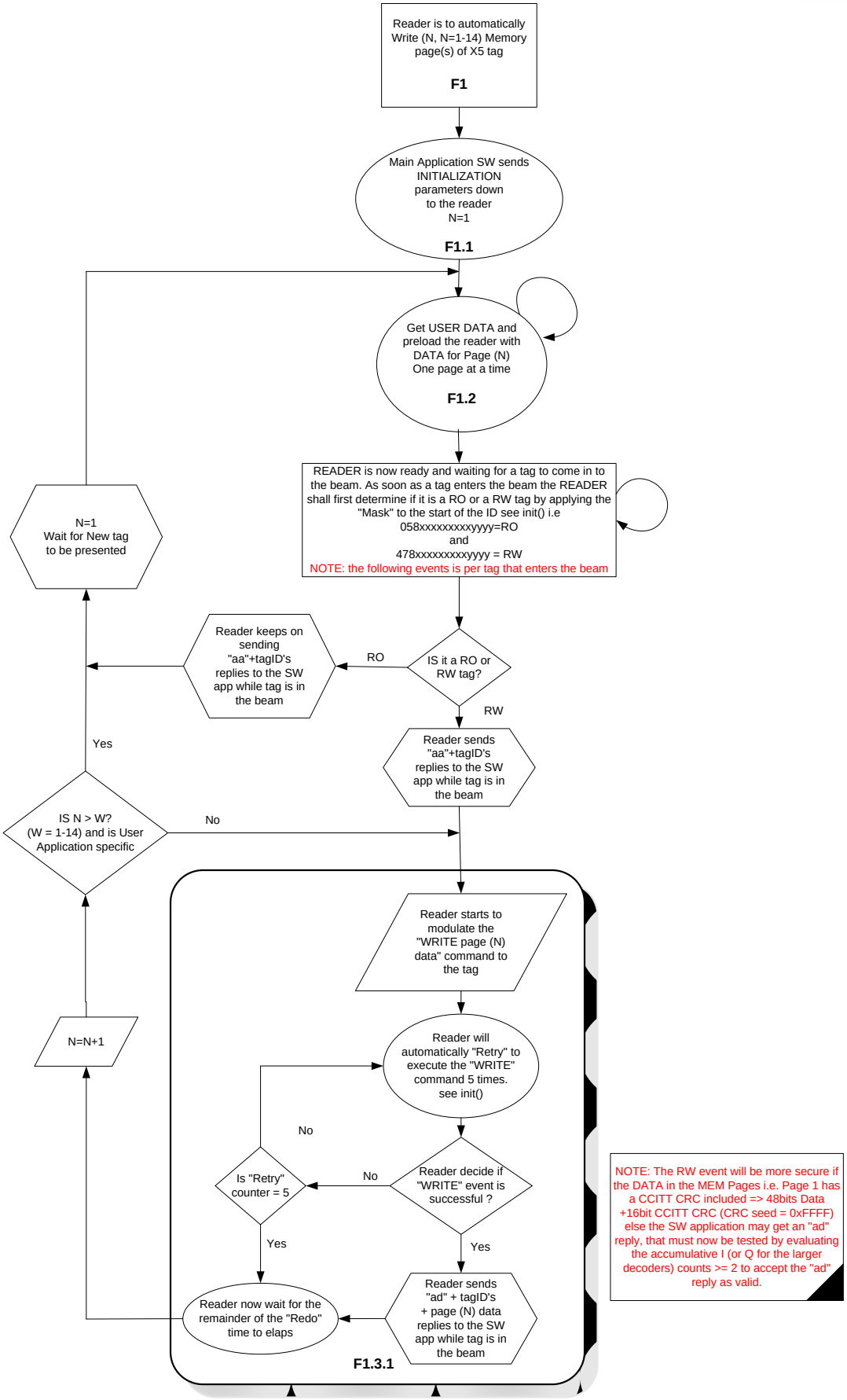


**Figure 7. WRITE DATA - Transition Mode diagram (single page at a time)**

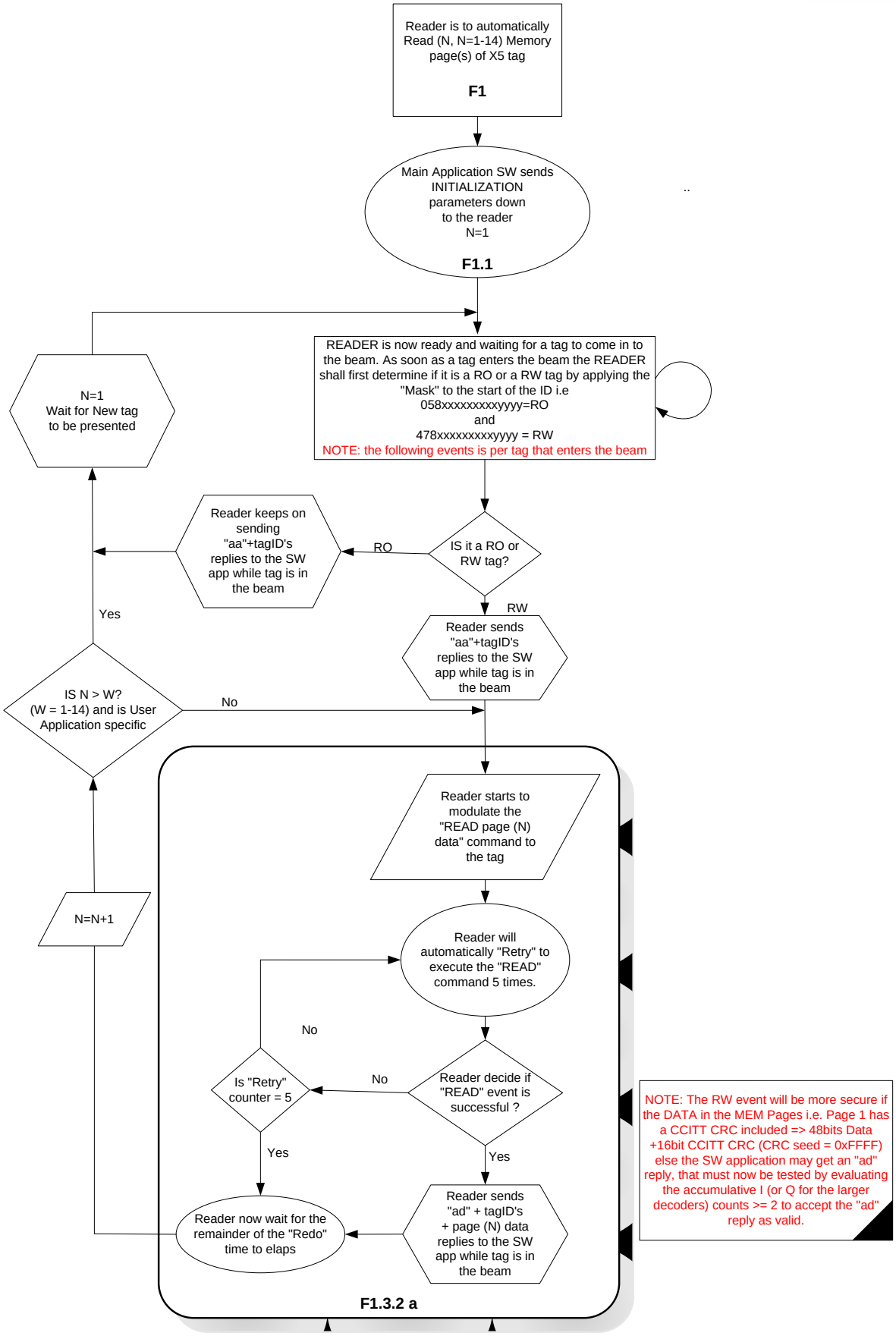


**Figure 8. READ DATA - Transition Mode diagram (single page at a time)**

## F1.1 Reader initialization

| Step | Description | String From Host to Reader | Return String |
|---|---|---|---|
| 1.1.1 | **Set Message Format in a semi reduced format i.e.**<br>Rd ID, I count, All 8 UID bytes and LRC | ab00091143ff6161aa000d0a00d3\r\n | ab00001122 |
| 1.1.2 | **Set Message Mode i.e.**<br>Normal | ab00030900ff07bf\r\n | ab00000929 |
| 1.1.3 | **Stop any RW actions** | ab00002325\r\n | ab00002325 |
| 1.1.4 | **Resume all tags** | ab000125e0bd\r\n | ab00002527 |
| 1.1.5 | **Set RW transmit rate for DF reader at 4kbps** | ab000117cdf0\r\n | ab00001728 |
| 1.1.6 | **Set timeouts**<br>Data=220, Redo=1, Retry=5, Rd Retry =3 | ab00062400dc016d050316\r\n | ab00002426 |
| 1.1.7 | **Set Tag Baud Rate**<br>128kbps (HH option using Showtags) | ab0001120286\r\n | ab00001223 |
| 1.1.8 | **Set Match Mask** | ab0008224ff00000000000009c\r\n | ab00002224 |
| | | | |
| | | | |

## F1.2 Preload Reader with USER DATA

| Step | Description | String From Host to Reader | Return String |
|---|---|---|---|
| 1.2.1 | **Get USER DATA from Database or 3rd party device i.e Barcode scanner. Now send USER DATA to reader. USER DATA to be configured with or without CRC and must be 8 bytes per Page i.e.**<br>**" IPICO " written Hex format**<br>Without CRC<br>• Page 1 = 495049434f000000<br>With CRC16 seeded with FFFFh<br>• Page 1 = 495049434f003231<br>With CRC CCITT seeded with FFFFh<br>• Page 1 = 495049434f00FD34<br>**NOTE: Only ONE Page can be loaded at a time and WRITE to the tag.** | ab00082149504943 4f0000008b\r\n | ab00002123 |

## F1.3.1 WRITE DATA Command and Automatic VERIFY (Data is known) Action

| Step | Description | String From Host to Reader | Return String |
|---|---|---|---|
| **1.3.1.1** | **Issue WRITE Command i.e.** Page 1, Target = Addressed | ab0003200011624f\r\n | ab00002022 |
| ***Reader will now perform the WRITE function according to the preloaded Retry count value and Redo timer value*** | | | |
| **1.3.1.2** | **Upon Successful WRITE an "ad" string with the UID and DATA page info will return to the host.** | | ad004699000010deca65f109495049434f000000b5 |

Decoding of the return string is as follows

| Header | Reader ID | UID including CRC | Page 1<br>Page 2 = 02 etc<br>x= 0 hex to f hex incrementing for each WRITE command issued until x=f hex. Then x=0 again. | Sequence number | USER DATA in Page 1 | LRC for complete string |
|---|---|---|---|---|---|---|
| ad | 00 | 4699000010deca65 | x1 | 09 | 495049434f000000 | b5 |

For more information refer to Table 10 in the IPICO Reader Serial Protocol 100 20071120.pdf