Model S4 - Single to 4 Antenna Ports Reader

Model SPR/A Series Single Piece Reader/Antenna

902-928 MHz (Americas, Australia, China)

865.6-867.6 MHz (Europe)

Product Manual

- Serial/USB
- TCPIP
- Wiegand
- Modbus RTU & TCP
- Ethernet/IP
- Profinet

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How to Contact Us

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Reader Part Numbers

Model Number	Part Number	Description
	For -0x suffix use: -01, -02, -03, or -04 to indicate number of Antenna ports	All Readers come with: Power connector for adaptation to AC power supply USB cable See accessories section below for AC power supply and audible beeper part numbers
S4-8010E-0x	808-8010-0x	Wiegand + USB Reader + Serial, 26 bit, 24vdc, 1 to 4 Antenna ports
S4-8030E-0x	808-8030-0x	Serial + USB Reader, 24vdc, 1 to 4 Antenna ports
S4-8040E-0x	808-8040-0x	Ethernet/IP + USB Reader + Serial, 24vdc, 1 to 4 Antenna ports
S4-8050E-0x	808-8050-0x	TCPIP Ethernet + USB Reader + Serial, 24vdc, 1 to 4 Antenna ports
S4-8060E-0x	808-8060-0x	DeviceNet + USB Reader + Serial, 24vdc, 1 to 4 Antenna ports
S4-8070E-0x	808-8070-0x	Profibus + USB Reader + Serial, 24vdc, 1 to 4 Antenna ports
S4-8080E-0x	808-8080-0x	Modbus TCP + USB Reader + Serial, 24vdc, 1 to 4 Antenna ports
S4-8085E-0x	808-8085-0x	Modbus RTU + USB Reader + Serial, 24vdc, 1 to 4 Antenna ports

Antenna Part Numbers

Model Number	Part Number	Description
UHF-A3205C	719-0032-.5C	32mm diameter x 5mm tall, ABS Antenna, 0.5dBi, SMA connector
UHF-A32M05C-Hex	719-0032-.5C-Hex	32mm diameter x 5mm tall, ABS Antenna, 0.5dBi, SMA connector, hex nut mount
UHF-A4030C	719-4030-.5C	40x30x13mm, ABS Antenna, 0.5dBi, mounting ears, SMA connector
UHF-A06C	719-0006-2C	6” Dual Whip Antennas, 2dBi, SMA connector
UHF-A115226C	719-115226-C	115x22x6mm with 40cm cable, sticky back, 2.5dBi, SMA connector
UHF-A115226C-MCX	719-115226-C-MCX	115x22x6mm with 40cm cable, sticky back, 2.5dBi, MCX connector
UHF-A25C	719-2525-02C	25x25x4mm Ceramic Antenna on 35mm backplane, 2dBi, mounting holes, SMA connector
UHF-A36C	719-3636-02C	36x36x4mm Ceramic Antenna on 40mm backplane, 2dBi, mounting holes, SMA connector
UHF-A45C	719-4545-03C	45x45x6mm Ceramic Antenna on 65mm backplane, 3dBi, mounting holes, SMA connector
UHF-A64C	719-6464-04C	64x64x6mm Ceramic Antenna on 65mm backplane, 4dBi, mounting holes, SMA connector
UHF-A80C	719-8080-55C	80x80x6mm Ceramic Antenna on 120mm backplane, 5.5dBi, mounting holes, SMA conn.
UHF-A80C-08	719-8080-08C	80x80x6mm Ceramic Antenna on 120mm backplane, 8dBi, mounting holes, SMA conn.
UHF-A55V	719-0505-02V	4.5" x 4.75" x 0.08", 2dBi, PCB, Vertical Polarized, 4 mounting holes, N Conn., 5' cable
		Antennas, for 15’ or 25’ of cabling option substitute -15 or -25 in place of -10 suffix
UHF-A78R-10	719-0708-07R-10	7" x 8" x 1.75", 7dBi, Circular Polarized, mounting bracket, N Connector, 10' cable
UHF-A78V-10	719-0708-07-10	7" x 8" x 1.75", 7dBi, Linear Vertical Polarized, mounting bracket, N Connector, 10' cable
UHF-A78H-10	719-0708-07H-10	7" x 8" x 1.75", 7dBi, Linear Horizontal Polarized, mounting bracket, N Conn., 10' cable
UHF-A99C-10	719-0909-09C-10	9.75" x 8.5" x 2.5", 9dBi, Circular Polarized, mounting bracket, N Connector, 10' cable
UHF-A99V-10	719-0909-09V-10	9.75" x 8.5" x 2.5", 9dBi, Linear Vertical Polarized, mounting bracket, N Conn., 10' cable
UHF-A99H-10	719-0909-09H-10	9.75" x 8.5" x 2.5", 9dBi, Linear Horizontal Polarized, mounting bracket, N Conn., 10' cable
UHF-A10C-10	719-1010-08C-10	10" x 10" x 1.5", 8dBi, Circular Polarized, mounting bracket, N Connector, 10' cable
UHF-A10H-10	719-1010-08H-10	10" x 10" x 1.5", 8dBi, Linear Horizontal Polarized, mounting bracket, N Conn., 10' cable
UHF-A13C-10	719-1313-09C-10	13" x 13" x 2.5", 9dBi, Circular Polarized, mounting bracket, SMA connector, 10' cable
UHF-A13H-10	719-1313-09H-10	13" x 13" x 2.5", 9dBi, Linear Horizontal Polarized, mounting bracket, SMA Conn., 10' cable
UHF-A18C-10	719-1818-12C-10	18" sq. Ant x 1.25", 12dBi, Circular Polarized, mounting bracket, N Connector, 10' cable
UHF-A18V-10	719-1818-12V-10	18" sq. Ant x 1.25", 12dBi, Linear Vertical Polarized, mounting bracket, N Conn., 10' cable
UHF-A18H-10	719-1818-12H-10	18" sq. Ant x 1.25", 12dBi, Linear Horizontal Polarized, mounting brack, N Conn., 10' cable
UHF-A3304H-10	719-3304-12H-10	33" x 4" x 1", 12dBi, Linear Polarized, SMA connector, 10' cable

Single Piece Reader/Antenna Part Numbers

Model Number	Part Number	Description
Choose Polarity C, V, H	Choose Polarity C, V, H	NOTE: RJ connector standard for TCPIP, Ethernet/IP, Profinet & Modbus TCP, on 10' of cabling. NOTE: All units supplied with 10' pigtail wiring for power & serial. See Connector Accessories at the bottom of this section to add connectors.
SPR/A10-8030E-9C/V/H	818-8030-10-9C/V/H	Single Piece Reader/Antenna combo, 10" sq., Serial/USB, 9dBi
SPR/A10-8040E-9C/V/H	818-8040-10-9C/V/H	Single Piece Reader/Antenna combo, 10" sq., Ethernet/IP/USB/Serial, 9dBi
SPR/A10-8050E-9C/V/H	818-8050-10-9C/V/H	Single Piece Reader/Antenna combo, 10" sq., TCPIP/USB/Serial, 9dBi
SPR/A10-8060E-9C/V/H	818-8060-10-9C/V/H	Single Piece Reader/Antenna combo, 10" sq., DeviceNet/USB/Serial, 9dBi
SPR/A10-8070E-9C/V/H	818-8070-10-9C/V/H	Single Piece Reader/Antenna combo, 10" sq., Profibus/USB/Serial, 9dBi
SPR/A10-8075E-9C/V/H	818-8075-10-9C/V/H	Single Piece Reader/Antenna combo, 10" sq., Profinet/USB/Serial, 9dBi
SPR/A10-8080E-9C/V/H	818-8080-10-9C/V/H	Single Piece Reader/Antenna combo, 10" sq., Modbus TCP/USB/Serial, 9dBi
SPR/A10-8085E-9C/V/H	818-8085-10-9C/V/H	Single Piece Reader/Antenna combo, 10" sq., Modbus RTU/USB/Serial, 9dBi
SPR/A18-8010E-9C/V/H	818-8010-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., Wiegand/USB/Serial, 12dBi
SPR/A18-8030E-9C/V/H	818-8030-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., Serial/USB, 12dBi
SPR/A18-8040E-9C/V/H	818-8040-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., Ethernet/IP/USB/Serial, 12dBi
SPR/A18-8050E-9C/V/H	818-8050-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., TCPIP/USB/Serial, 12dBi
SPR/A18-8060E-9C/V/H	818-8060-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., DeviceNet/USB/Serial, 12dBi
SPR/A18-8070E-9C/V/H	818-8070-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., Profibus/USB/Serial, 12dBi
SPR/A18-8075E-9C/V/H	818-8075-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., Profinet/USB/Serial, 12dBi
SPR/A18-8080E-9C/V/H	818-8080-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., Modbus TCP/USB/Serial, 12dBi
SPR/A18-8085E-9C/V/H	818-8085-18-12C/V/H	Single Piece Reader/Antenna combo, 10" sq., Modbus RTU/USB/Serial, 12dBi
		SPR/A Wiring & Connector Accessories
CON-SPR/A-9pin	138-0013-00	9pin Serial D-sub connector added to cabling of SPR/A series Readers
CON-SPR/A-POWER	138-0045-01	Quick connect power jack added to SPR/A cabling to mate with 720-0013-00-WCD AC adaptable power supply

Accessories Part Numbers

Model Number	Part Number	Description
PS24v2.5a	720-0013-00-WCD	24vdc AC adaptable power supply, 2.5amp, AC to DC, regulated, quick connect jack
CAB-PJ	730-0050-06FT-M	Mating pwr conn for 720-0013-00-WCD w/leads to adapt to S4 Reader pwr terminals
PS24v2.5a-PT	720-0013-01-WCD	24vdc AC adaptable power supply, 2.5amp, AC to DC, regulated, pigtail wiring
CAB-213-10-NM-TNCM	730-0038-10-NM-TNCM	Antenna cable, Coax RG213, 10', N-Type male to TNC male
CAB-213-15-NM-TNCM	730-0038-15-NM-TNCM	Antenna cable, Coax RG213, 15', N-Type male to TNC male
CAB-213-25-NM-TNCM	730-0038-25-NM-TNCM	Antenna cable, Coax RG213, 25', N-Type male to TNC male
CAB-213-10-NM-SMAM	730-0038-10-NM-SMAM	Antenna cable, Coax RG213, 10', N-Type male & converter to SMA male
CAB-213-15-NM-SMAM	730-0038-15-NM-SMAM	Antenna cable, Coax RG213, 15', N-Type male & converter to SMA male
CAB-213-25-NM-SMAM	730-0038-25-NM-SMAM	Antenna cable, Coax RG213, 25', N-Type male & converter to SMA male
	131-0018-00	Converter, N-Type female to TNC male
	131-0014-00	Converter, N-Type female to SMA male
	131-0014-01	Converter, N-Type female to SMA female
	131-0021-00-NMNF90	Converter, 90 degrees, N-Type male to N-Type female
	202-0002-00	Beeper, for external connection
	730-0052-10FT	USB cable, 10'
	730-0047-10FT	RS232 cable, 10'

FCC ID # YVURFIDUHF

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. Changes of modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. It is recommended users maintain 21cm separation from the antenna at all times.

Product Operations

Hardware Description

This is a passive Tag RFID product line whereby Tags do not carry their own power source yet remain dormant and energized by the Reader Antenna RF signal when introduced into the Reader Antenna's RF field. Tags are all read write (RW) but capable of being locked such that they become read only (RO).

Reader

The Reader receives the Tag data, decrypts the Tag data, and provides RF to digital translation of the data, further processing the data into the protocol language specific to your particular Reader (USB, RS232, TCPIP, Wiegand, PLC protocols, etc.). Advanced error detection algorithms provide error-free operation.

The Reader can also operate on variable power sources of 8vdc to 28vdc. For connection blocks J1 and J2, connection to the Reader is made using low-cost shielded twisted pair cables (22 AWG up to 21 feet, above 21 feet 16 AWG is recommended) and easy to use angle entry screw terminal connectors further simplify installation.

This Reader is to provide by default 1W TPO (total power output), which equates to 30dBm. The dBm setting can be changed through software command. EIRP is calculated through a combination of dBm (TPO) and Antenna dBi gain. FCC mandates a 4W maximum EIRP. See page 42 for a full explanation and page 48 for the command to change dBm setting.

Reader Specifications (S4)

Physical:	Dimensions (Housing Only):	7.10" x 6.2" x 2.7"	180mm x 157mm x 69mm
	Weight (w/o mounting brackets)	12 lb. + 12 oz.	1243 grams
	Antenna Connectors:	TNC-Female	
	Number of Antennas Ports	1 to 4	
	Enclosure:	Aluminum	
Read Range:	Up to 25 meters, Tag and Antenna dependent		
Certifications:	RoHS, CE, FCC US: FCC-OET Bulletin 65 Supplement. 'C'		
	EPC Gen-2 ISO 18000-6 Standard		
RF:	FHSS (Frequency Hopping Spread Spectrum)		
	1W (30 DBM) TPO (Total Power Output)		
	DBM can be lowered through software command to accommodate higher gain Antennas		
Extra Features:	Relay 60VADC @ 350mA (NO) and Loop Detector (Input)		
	Adjustable Internal Beeper		
Electrical:	Voltage Input:	9vdc to 28vdc	
	Draw:	1.2A Single Antenna	1.5A Four Antennas
	Frequency:	902-928 MHz	865.5-867.5 MHz
Environmental:	Temperature, Storage:	-67° to +185°F	-55° to +85°C
	Temperature, Operating:	-40° to +131°F	-40° to +55°C
	Ingress Protection:	IP20 = 8010 & 8030 versions	IP40 = all others
Communications:	Standard on all models:	USB and serial	(default 115.2k, 8, 1, N)
	Allen Bradley:	Ethernet/IP	DeviceNet
	Siemens:	Profibus	Profinet
	Modicon:	Modbus RTU	Modbus TCP
	Other:	TCPIP Ethernet	Wiegand

Reader Specifications (SPR/A Series)

Physical & Electrical:	Dimensions SPR/A10 (housing)	10.15" x 10.15" x 3.82"	258mm x 258mm x 97mm
	Weight (w/o mounting brackets)	4 lb.	1.8 kg
	Dimensions SPR/A18 (housing)	17.7" x 17.7" x 3.54"	450mm x 450mm x 90mm
	Weight (w/o mounting brackets)	4.4 lb.	2 kg
	Antenna Front Body	Radome, ABS w/UV Protection	Aluminum Back Plate
	Reader Rear Body	Aluminum	Bottom Cable Gland
	Voltage & Draw	9vdc to 28vdc	1.2 Amps

Read Range:	SPR/A10 - Up to 25 meters, Tag dependent SPR/A18 - Up to 30 meters, Tag dependent

Certifications:	RoHS, CE, FCC US: FCC-OET Bulletin 65 Supplement 'C'
	EPC Gen-2 ISO 18000-6 Standard

Antenna RF:	C denotes Circular Polarized H denotes Horizontal Polarized V denotes Vertical Polarized
	SPR/A10 Gain = 9dBi Horizontal Beam Width 68° Vertical Beam Width 65°
	SPR/A18 Gain = 12.5dBi
Reader RF:	902-928 MHz North America 865.6-867.6 MHz Europe & others
	FHSS (Frequency Hopping Spread Spectrum)
	Up to 4W (30 DBM) TPO (Total Power Output)
	Reader DBM can be lowered through software command to adjust range

Extras:	Relay (pins internal) 60VADC @ 350mA (NO) and Loop Detector (Input)
	Adjustable Internal Beeper

Environmental:	Temperature, Storage:	-67° to +185°F	-55° to +85°C
	Temperature, Operating:	-40° to +131°F	-40° to +55°C
	Ingress Protection:	IP65	

Comms:	Standard on all models:	USB and Serial	(default 115.2k, 8, 1, N)
	Allen Bradley:	Ethernet/IP	DeviceNet
	Siemens:	Profibus	Profit
	Modicon:	Modbus RTU	Modbus TCP
	Other:	TCPIP Ethernet	Wiegand

Antennas and Tags

Antennas are solid state devices that simply provide a means of emitting the RF signal to energize a Tag, receive data back from a Tag and pass Tag data back to the Reader. Antennas are available in a variety of shapes, sizes, polarizations and dBi gains. The higher the gain, the more range is capable from a Tag, however, there are FCC limits, specifically 4 Watts EIRP, which is a factor of Total Power Output (TPO) or also expressed as DBM's and the gain of the Antenna. See External Antenna section on page 42 for a detailed explanation and formulas. Also affecting Tag read range is resistance added by the cable length and gauge.

Horizontal Polarized – From the face of the Antenna, a 3D RF beam is strongest directly forward and spanning East -West in degrees differing from Antenna to Antenna, say 43° or 60°. See the product data sheet for each Antenna specification.

Vertical Polarized – From the face of the Antenna, a 3D RF beam is strongest directly forward and spanning North - South in degrees differing from Antenna to Antenna, say 43° or 60°, see the product data sheet for each Antenna specification.

Circular Polarized – From the face of the Antenna, a balloon or egg shaped RF pattern is emitted.

In order to prevent rear RF backscatter and increase Antenna RF signal strength, most flat panel Antennas contain an aluminum backing.

Tags

Tags consist of varying amounts of data depending upon the eeprom chip they contain. Data sizes, in bits, are 96, 128, 512, 1k, 2k, and 8k.

Hardware Installation Guide

Mounting the Reader (S4)

The Reader comes with 2 mounting brackets that can be installed in place of the red stripes seen on each side of the Reader. To install, at the end with the block connectors J1 and J2, remove the 4 plastic screw covers, then remove the 4 screws using a TORX star bit #T10. You will then be able to view and remove 4 small screws requiring a 1.5mm Hex Key, and continue to replace the red metal inserts with the supplied mounting brackets, reinstalling the Hex screws, TORX screws and screw covers. Take care not to overtighten the TORX screws lest the head snap off. IMPORTANT: If our Reader is to be mounted into another enclosure, it must be a metal enclosure. This Reader is housed in its own metal enclosure in order to radiate heat inherent with any UHF RFID Reader. The ambient temperature external to the housing needs to be lower than the heat internal to the enclosure (normally about 140°F) in order for that radiation to occur. If this Reader is mounted in a plastic box, heat will not radiate and the Reader will shut down.

Mounting the Reader (SPR/A)

The Reader comes with a mounting bracket that can be bolted onto the rear of the assembly, normally for pole mounting however common mechanical sense allows for many other mounting options.

Wire Specifications

Shielded (22 AWG for cable length up to 25’ and 16 AWG for communication lengths beyond 25’) insulated, stranded wire is recommended and all wires should be stripped approximately 3/8 inches and tinned.

Model S4 - Connections in General

There are a series of terminal blocks on the front face of the Reader for connections, J1, J2, Ethernet or RJ type, USB and power. See diagram and table on page 12.

Model SPR/A - Connections in General

Aside from internal USB connector located behind the right most plastic screw plug at the bottom of the Reader housing, all wiring hangs from cable gland located at bottom of housing in a 10’ length. See table on following page.

Cabling the Reader – Power (Model S4)

The Reader is delivered with two power connection options. For direction connection to an industrial power supply, use the angle entry screw terminals which connect to the power terminal block. If using RFID, Inc.’s AC adaptable power supply each Reader also comes with an angle entry screw terminal that has a quick connect single male pole jack pre-applied.

Cabling the Reader – Power (Model SPR/A)

The hanging wires will be either bare leads (white for +VDC, black for ground) or can be ordered with a quick connect adaptor used with our mating AC adaptable power supply.

Power Requirements

The Reader can be powered from regulated, linear, or switching power sources having the characteristics defined in the Specifications section of this document (9 to 28 volts). The Reader should be operated from a grounded supply that has the same ground reference as the host computer or logic device.

Model S4 - Cabling the Reader - Communications

Wiegand – Use connections 1 & 2 of connector block J1 as shown on the following page.

USB – A "B" type USB connector is present on the Reader face plate.

Serial – The Reader is capable of RS232, RS422, and RS485. Connection details are shown on the following page. Serial Model 8030 Readers come with a female 9pin D-sub cable for your convenience.

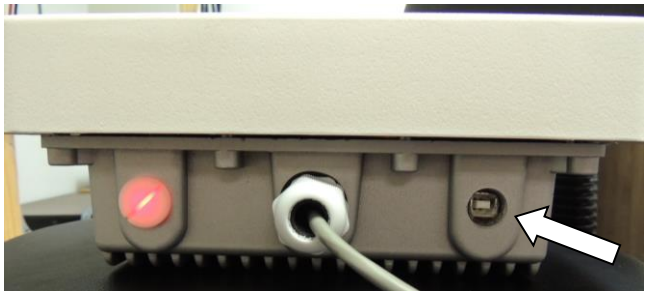
Ethernet – An RJ45 port is present on the Reader face plate, cable not included.

Model SPR/A - Cabling the Reader - Communications

Serial, Profibus, Wiegand – Color codes for hanging wires are:

WIRE COLOR	SIGNAL NAME
RED	9-28VDC
BLACK	DC Ground (-)
GREEN	RS232 = TD, WIEGAND = DATA 0
WHITE	RS232 = RD, WIEGAND = DATA 1
YELLOW	SIGNAL GROUND
BROWN	RELAY 1
ORANGE	RELAY 2
BLUE	LOOP DETECTOR
BARE/DRAIN	EARTH GROUND

USB – A type "B" USB connector is present behind the right plastic screw plug.



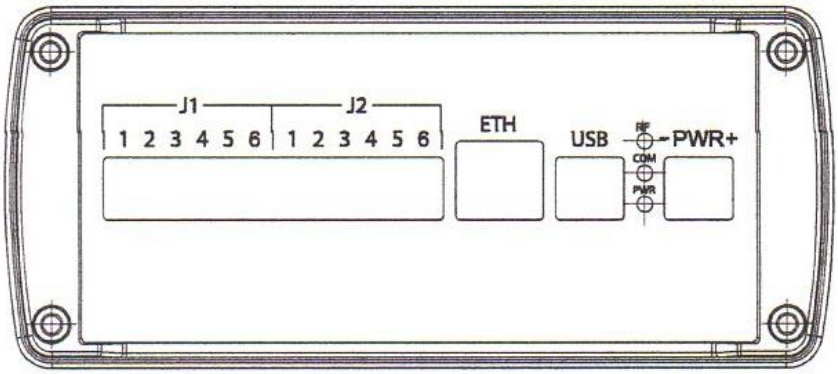
TCPIP, Ethernet/IP, Profinet & Modbus TCP – Hanging wires will terminate with an RJ45 connector.

External Antenna (not applicable to Model SPR/A series)

To cable the Reader to the external Antenna, all cabling and connections are provided with converters from TNC to N-Type and SMA. This device is FHSS enabled, Frequency Hopping Spread Spectrum, such that it will change the frequency of the Antennas many times per second, from 912 MHz to 924 MHz so that Antennas will not interfere with each other. This also allows the Reader to coexist with other RF devices at the same bandwidths.

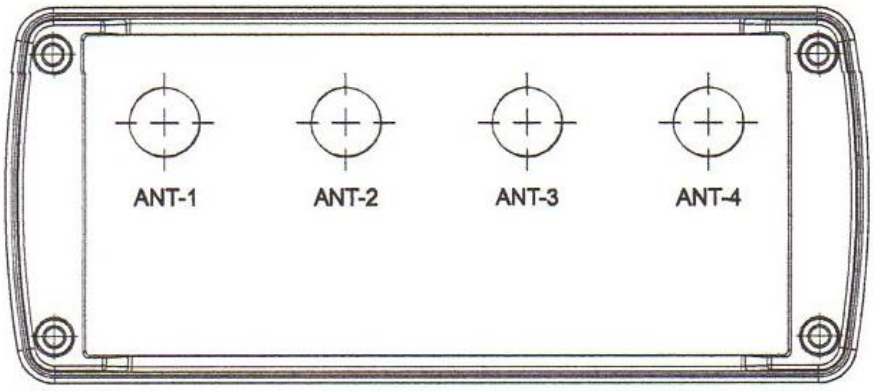
Model S4 Reader Diagram

Front Plate



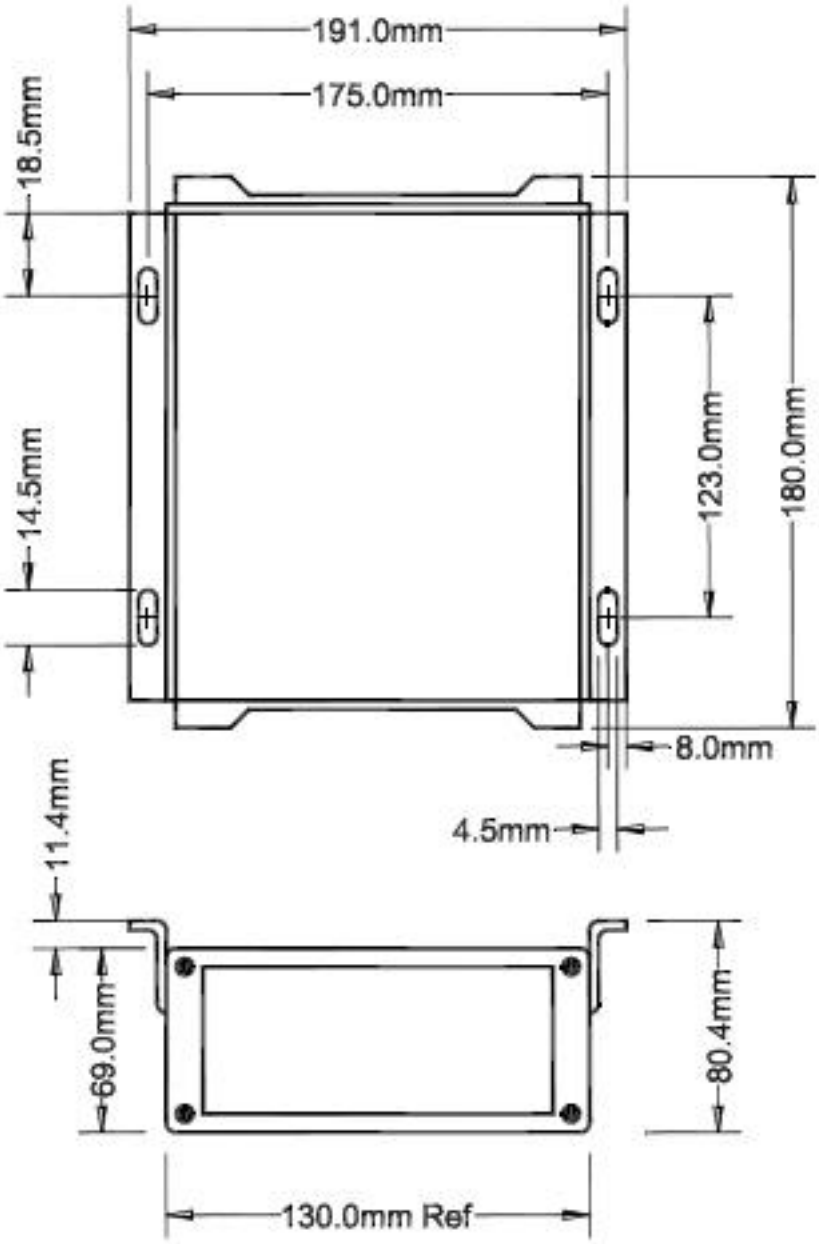
J1		J2	
Pin 1	Wiegand D1	Pin 1	Ground
Pin 2	Wiegand D0	Pin 2	RX1 (RS232) _A (RS422/485)
Pin 3	Loop Detector Input 2, Active Lo	Pin 3	RX2 _B (RS422/485)
Pin 4	Loop Detector Input 1, Active Lo	Pin 4	Ground
Pin 5	Relay 2	Pin 5	TX1 (RS232) _Y (RS422/485)
Pin 6	Relay 1	Pin 6	TX2 _Z (RS422/485)
RF	LED comes solid and blinks on to off 1x per second while Antenna port(s) is on		
COM	LED comes solid indicating communication(s) ports are operating correctly		
PWR	LED comes solid indicating power is applied		

Back Plate



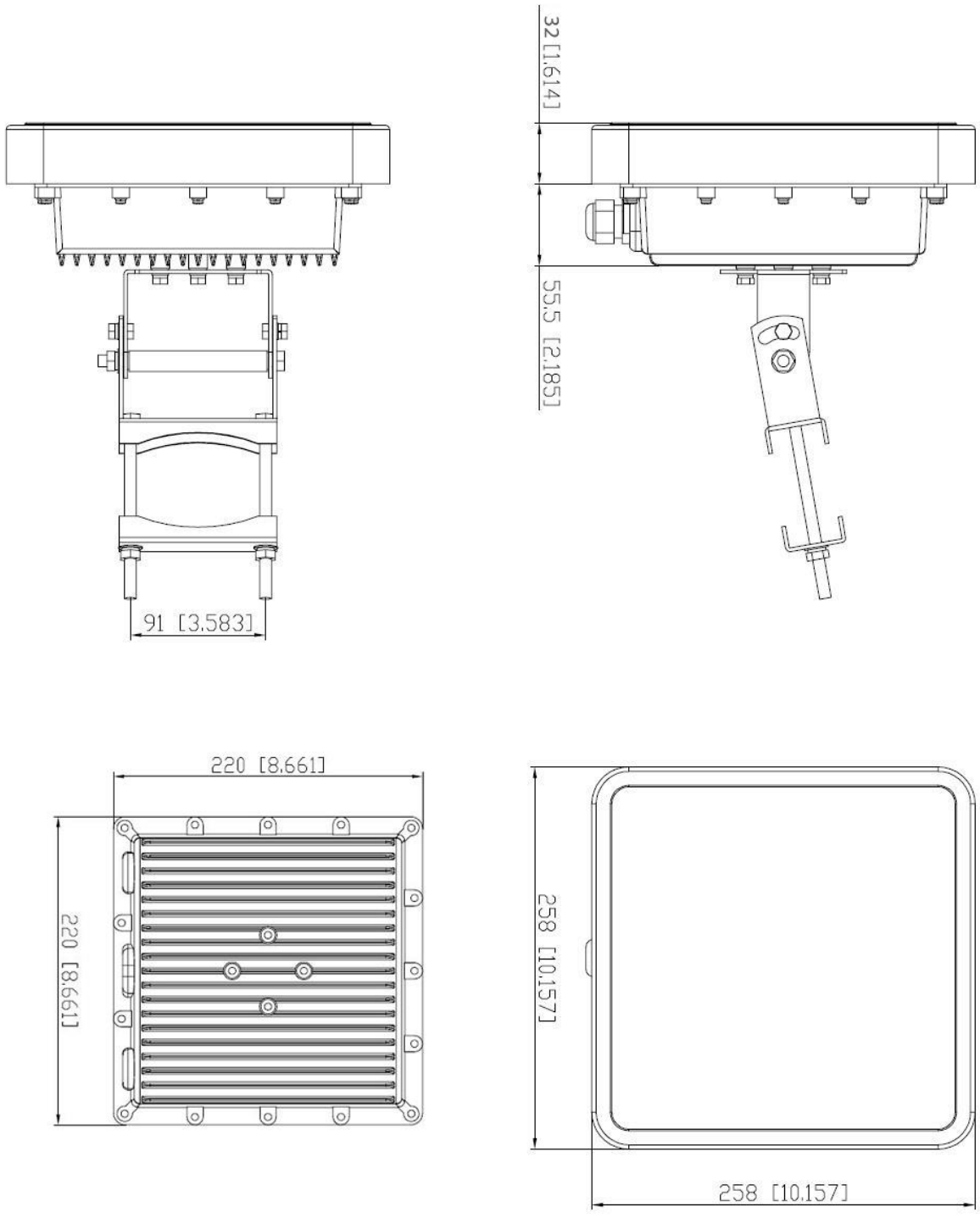
Model S4 Enclosure Dimensions w/mounting hardware

(in mm's)



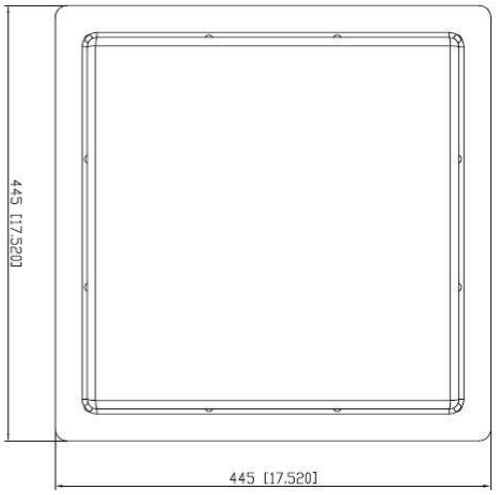
Model SPR/A10 Enclosure Dimensions w/mounting hardware

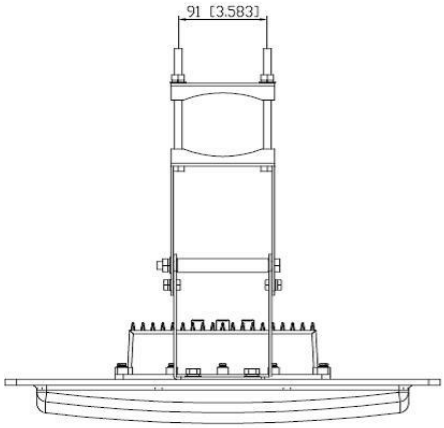
(in mm's)

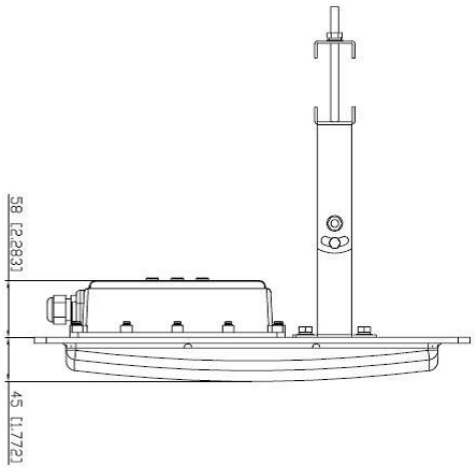


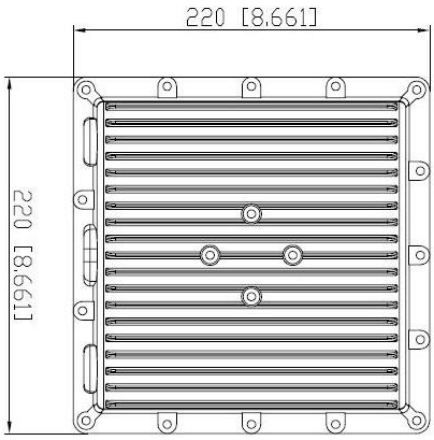
Model SPR/A18 Enclosure Dimensions w/mounting hardware

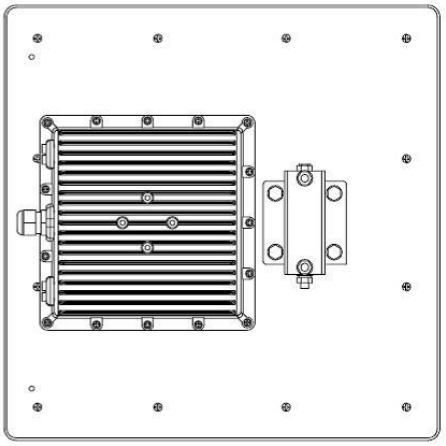
(in mm's)











Quick Start Guide

Reading Tags without Demonstration Software

Connect the Antenna to the Reader prior to powering the Reader. Do not switch Antennas without first powering the Reader down else the Reader tuning circuit will not operate at peak performance.

Power the Reader. On the S4 Reader, of the 3 LED's, RF, COM and PWR should illuminate solid indicating the Reader is ready for operation. The (top) RF LED will blink off to on every second which confirms the Antenna ports are operating correctly and a port is enabled. Notice the RF LED will go off when the Reader is placed into Polling Mode via the [P] command, thus turning the Antenna port off. The command to read a Tag, or Transfer Data [T], will bring the RF LED solid for the period of time it takes to read a Tag or timeout with no data. The (middle) COM will blink off to on each time a Tag is read. The (bottom) PWR will remain solid as long as power is applied. Any Tags within range will now begin reading. Although there is an on board beeper, there is a louder external beeper accessory available which would need to be connected red wire to the +PWR pin and the black wire to J1-6. The 4 LED's on top of the S4 Reader are reserved for PLC protocols of Ethernet/IP & Profinet.

Tag Read Modes -The Reader may be in 1 of 3 Tag reporting modes, **Single** report, **Duplicate** report or **Polling** mode. Note: Factory default for S4 Reader is Polling Mode. Factory default for SPR/A series is Duplicate Mode. If the Reader is in Single report mode, a Tag will read only once with a factory default 3 second timeout between reads assuming the Tag is completely removed from the read field. If the Tag represented to the Reader within the timeout period, the 3 second clock of not reporting the Tag will begin again. This length of timeout can be changed via the [Sxx] command detailed on page 46.

Testing Tags – You can now begin to present a Tag or Tags in different orientations to the Antenna to understand Tag orientations relevant to read range. A few notes to consider. Tag ranges are increased when held by hand as the human body acts as a reflector of the RF signal and assists in boosting the RF signal. However if a Tag is held behind the back or folded into a fist thus completely blocking the RF signal, no reads will occur. Attach the Tag to a wooden yard stick or some other item and hold it away from the body when testing. If Tags are designated as metal mountable, they will actually perform better when mounted on metal thus a metal yard stick or ruler will provide more accurate results.

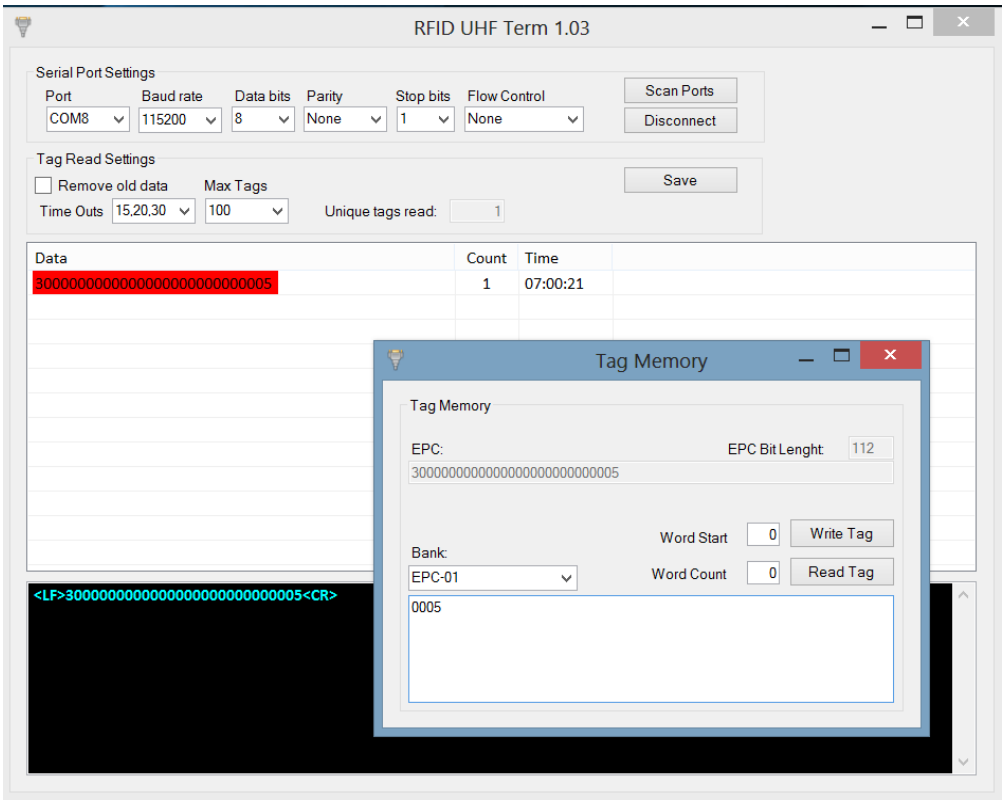
Reading & Writing Tags With Demonstration Software

RFID, Inc. provides a free software demo program called "RFID UHF Term" and a download and instructions are available here, https://www.rfidinc.com/resource-center/. Download, unzip and install the program by double clicking on the executable file. The program will appear in your Programs menu as RFIDIncUHFTerm. Any terminal program can be used as well. All Readers are factory default set to 115,200 baud, 8 data bits, None Parity, 1 stop bit and None Flow Control (115.2k, 8, N, 1, N).

(1) Plug the USB or serial connector into your computer and the Reader.

(2) Ensure the Antennas are connected and power the Reader on.

(3) Execute the RFID, Inc. Terminal Program if not already done so. The program should appear on your PC screen and look like this:



(4) Select "Scan Ports" found upper right. This allows the program to scan which port address is connected to the Reader. In the upper left, under "Ports" use the pull down menu to choose the port discovered.

(5) Set the baud rate and remaining communication settings to 115,200 baud, 8 data bits, None Parity, 1 stop bit and None Flow Control (115.2k, 8, N, 1, N). You can also view which port is connected by going to your Desktop, right click on My Computer, choose Properties, Hardware and Device Manager, then open the Ports directory tree.

(6) Select "Connect." Presenting a Tag to the Antenna should now bring that Tag data onto the main white area as well as the lower black area. The main screen area (white) is solely used for display of Tag data. The lower screen area (black) will display Tag data and also allow you to enter commands to the Reader.

Remove Old Data - This program also offers the ability to "Remove Old Data" by checking this box under "Tag Read Settings," a process of deleting Tag reads from the screen set to the timeouts you choose in the pull down menu. For example if you choose 5,10,15 Timeout, Tag data will begin highlighted in green for the first 5 seconds, then become highlighted in yellow at 5 seconds time, then turn to red at 10 seconds time, and finally be deleted at 15 seconds time.

Maximum Tags – This program also offers the ability to time how long it takes to read the amount of Tags you wish to test by choosing the number of Tags under the "Max Tags" setting. You will see the

data field to the right increment as the Reader counts how many unique Tags have been read. If you choose 100 as your Max Tags setting, once the Reader has read 100 unique Tags a pop up box will appear advising you the amount of time this procedure took.

Save – This box will prompt you to save Tag data to a text file with time and date stamp.

Single Report Tag Read Mode – Place your cursor in the lower screen area and type [S]. This will initiate the Single Report Tag Read Mode and the Reader will respond with "OK."

Duplicate Report Tag Read Mode - Place your cursor in the lower screen area and type [D]. This will initiate the Duplicate Report Tag Read Mode and the Reader will respond with "OK."

There is more in depth information on how to read a specific portion of Tag memory data and how to program specific portions of Tag memory data covered in the product manual later. For more advanced users using the EPC control methods of programming Tags, you can right click on Tag data in white area of program to bring up Mask Address (Word Start) and Mask Length (Word Count). You can also copy all or part of a Tag data from the black area of the program to paste it into "Tag Memory" box for writing purposes.

Setting up the Reader

The following sections are presented by communications type, USB, Serial, Ethernet, Wiegand, and Modbus RTU.

Interfacing the Reader to your PC – USB

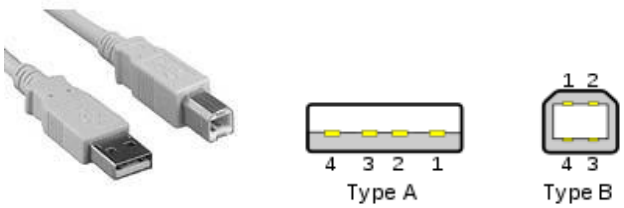
In general, cables have only plugs, and hosts and devices have only receptacles. Hosts almost universally have Type A receptacles, and devices one or another Type B variety. Type A plugs mate only with Type A receptacles, and Type B with Type B; they are deliberately physically incompatible.

Wire Specifications

The maximum length of a standard USB cable (for USB 2.0 or earlier) is 5.0 meters (16.4 ft). The primary reason for this limit is the maximum allowed round-trip delay of about 1,500 ns. If USB host commands are unanswered by the USB device within the allowed time, the host considers the command lost.

USB Connector

Plug the Type A plug from one end of the cable into the Type A connector located on your computer. Plug the Type B plug from the other end of your cable into the Type B connector located on the Reader PCBA (see picture below).



USB Driver Installation

Once the computer is fully powered and connected to the Reader via the USB port, power up the Reader. Your computer will then display that new hardware is found and Figure 1 below will be displayed. Select the "Yes, this time only" option then press "Next>" to continue. At this point Figure 2 should be displayed and you then select "Install the software automatically (Recommended)" then press "Next>" to continue.

Figure 1

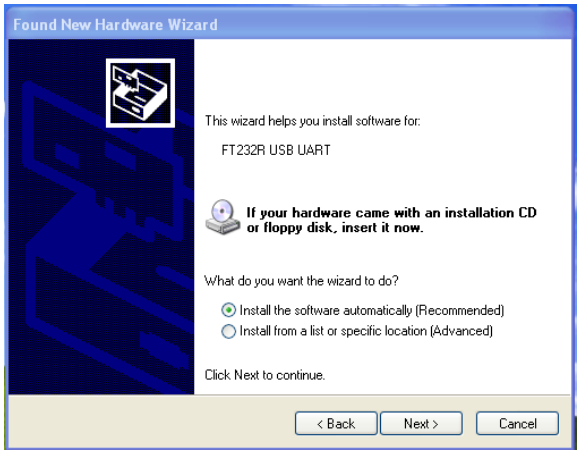
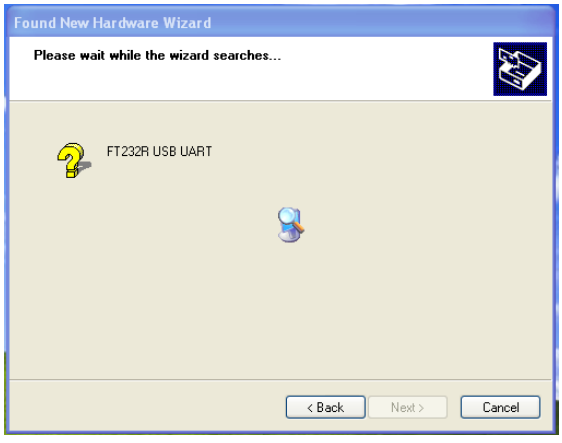
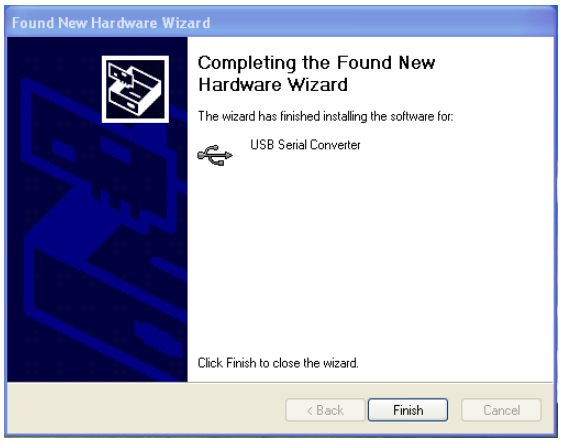


Figure 2

The software will then start looking for the appropriate drivers for the USB device and Figure 3 will then be displayed (which may also say "? USB Serial Port"). Once the Driver is found and installed, Figure 4 will then be displayed, showing that the driver is installed properly.

If your computer cannot find the necessary USB driver, instead of searching the internet for the appropriate driver, we have included both 32 bit and 64 bit USB drivers to you either on CD ROM or you can find them here, http://www.ftdichip.com/Drivers/VCP.htm select either 32 or 64 bit OS. To find out whether your computer is operating on 32 or 64 bits, from your desktop right click on My Computer and select Properties. If there is no My Computer icon on your desktop, go to your Control Panel via the Start menu and select System. Either way, in figure 2 below you will need to choose "Install from a list or specified location", choose the location you saved the USB Drivers we supplied to you, and continue.





Interfacing the Reader to your PC – Serial

Cable the Reader and your PC (or logic device) using your own or the supplied serial cable. Upon powering the Reader a Startup Message is transmitted on the serial line, but not the USB line.

Termination Resistance – RS232, RS422, and RS485

RS232 needs no termination resistance. Please note, when configuring to RS422, 120 ohms resistance must be applied by shunting pins at PCB addresses JP2 (for Rx) and JP3 (for Tx) located directly behind the serial connectors. For RS485, either JP2 or JP3 may be shunted, but one must be.

Wiegand Output

Wiegand Readers are defaulted to the Single read operating mode. This is a 26 bit standard Wiegand protocol with Data 0 and Data 1 normally resting at zero voltage and moving to +5 volts on logic 0 or logic 1. The single line voltage rests at 2.5 volts and pulses to +5 volts for logic 1 and down to 0 volts for logic zero. The Reader is defaulted to a bit length in time of 30 microseconds and bit interval in time of 150 microseconds, which are also the minimum times available. The maximum bit length is 100 microseconds and the maximum bit interval is 1000 microseconds and these are the default settings. These settings are held in non-volatile memory. For wiring the Data 0 and Data 1 Wiegand wire to the Reader, see Reader illustration on page 11. To adjust timing, see the [ZTVal] command on page 49. Given the standard Wiegand protocol of 26 or 32 fixed bits, no Antenna addressing is available.

Change Communications Settings through Virtual Dipswitch

Power must be recycled in order for any Virtual Dipswitch settings to take effect. The [DIP1xx] and [DIP2xx] commands sets the EEPROM virtual dip switch bits of 1-8 represented in the table below using hexadecimal values to be represented by 2 hex characters, one for bits 8-5 and one for bits 4-1. Each bit is either being turned on (1) or off (0). For example [DIP107] sets DIP SWITCH 1 to 00000111.

DIP = command

1 = dipswitch 1

07 = bits 3, 2, 1 being On (adding hex values 4 + 2 + 1 equals 7)

This equates to MODBUS disabled, ADDRESS disabled, (bit 6 is inactive), RS232, 115200.

VIRTUAL DIP SWITCH-1							
Hex Character #1				Hex Character #2			
Bit 8 (hex 8)	Bit 7 (hex 4)	Bit 6 (hex 2)	Bit 5 (hex 1)	Bit 4 (hex 8)	Bit 3 (hex 4)	Bit 2 (hex 2)	Bit 1 (hex 1)
MDBRTU	ADDRESS	MDBTCP	SER HW 2	SER HW 1	Baud 3	Baud 2	Baud 1

Examples:

If you wanted all of the bits on the command you would enter would be [DIP1FF].

[DIP188] you are asking to set switches 8 and 4 to on, the rest off (10001000).

[DIP142] you are asking to set switches 7 and 2 on, the rest off (01000010).

[DIP1F0] you are asking to set switches 5, 6, 7 and 8 ON, the rest off (11110000).

Bit 8 MODBUS
1 = MODBUS ENABLED, 0 = MODBUS DISABLED (default)

Bit 7 ADDRESS
1 = ADDRESS ENABLED, 0 = ADDRESS DISABLED (default)

Bit 6 MODBUS TCP
1 = MODBUS ENABLED, 0 = MODBUS DISABLED (default)

Bits 5-4	Serial Settings	Bits 3-1	Baud Rate Settings
	11 = Not Used		111 = 115200 (default)
	10 = RS422 4 Wire		110 = 57600
	01 = RS485 2 Wire		101 = 38400
	00 = RS232 (default)		100 = 19200
			011 = 9600
			010 = 4800
			001 = 2400
			000 = 1200

VIRTUAL DIP SWITCH-2							
Hex Character #1				Hex Character #2			
Bit 8 (hex 8)	Bit 7 (hex 4)	Bit 6 (hex 2)	Bit 5 (hex 1)	Bit 4 (hex 8)	Bit 3 (hex 4)	Bit 2 (hex 2)	Bit 1 (hex 1)
SINGLE ANTENNA	FB_EN	FB_MODE	RSSI	--	--	--	--

Bit 8 SINGLE ANTENNA
1 = Single Antenna (Antenna 1) (default), 0 = Multiple Antennas Allowed

Bit 7 FB_EN
1 = Field Bus Disabled, 0 = Enabled (default)

Bit 6 FB_MODE
1 = 24 Character, Antenna Code = bits 6:7 command byte, 0 = 6 characters all Antennas in one 24 byte frame, separate Antenna toggle bits (default)

Bit 5 RSSI
1 = RSSI Enabled, 0 = RSSI Disabled (default) (only works in single Antenna mode)

Bits 4-1 Unimplemented, Always 0, (future use)

[DIP280] sets DIP SWITCH 2 to 10000000 which enables the single Antenna mode. The Reader will only use antenna 1 and will behave like single Antenna Reader. No antenna addressing will be used.

Interfacing the Reader to your PC – Ethernet

Note, our UHF Demo Program will not work with TCPIP. Seek to use HyperTerminal, Teraterm or similar. This Reader is a standard TCP/IP Ethernet device employing a Lantronix XPort Ethernet modem. It will be necessary to load a program termed DeviceInstaller in order to setup your preferred properties. You can also access the latest version here,
https://www.lantronix.com/products/deviceinstaller/

Specifications:

Protocol: TCP/IP

Connectors: RJ45

Serial Baud rate: 10 Base-T or 100 Base-TX (auto-sensing)

Maximum cable run: 2000'

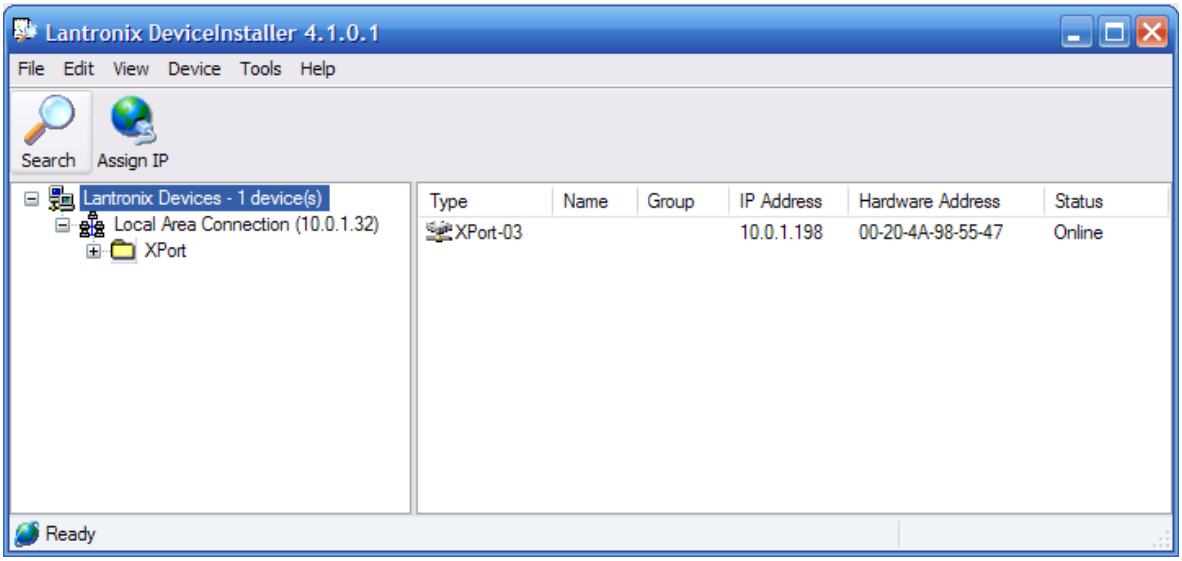
Configuring the XPORT with DeviceInstaller - Open the zip file named DeviceInstaller that should have been provided to you. This program will assist you in the setup of the Ethernet Interface. Unzip and extract the files contained to your PC. Go to the folder you extracted the files to and execute the setup.exe file. Note; if you receive the following message:

Windows Installer Loader

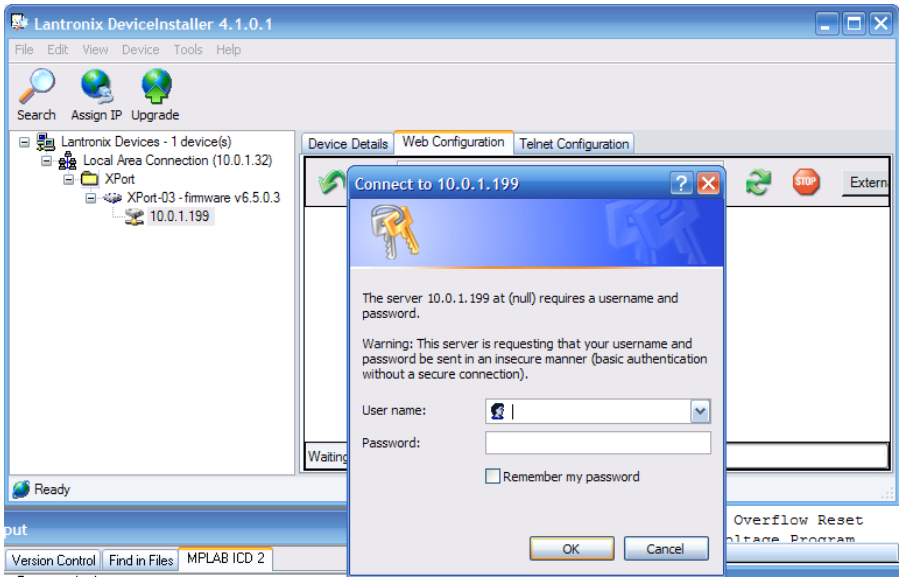
This setup requires the .NET Framework version 1.1.4322. Please install the .NET Framework and run this setup again. The .NET Framework can be obtained from the web. Once the download is found you will be prompted, "Would you like to do this now?"

Say yes and download the file to the same folder you chose for the DeviceInstaller then execute the .Net Framework setup.exe file you just downloaded and follow the prompts. Then go back to original setup.exe file for DeviceInstaller and follow the prompts to install the files in a Lantronix folder under Programs.

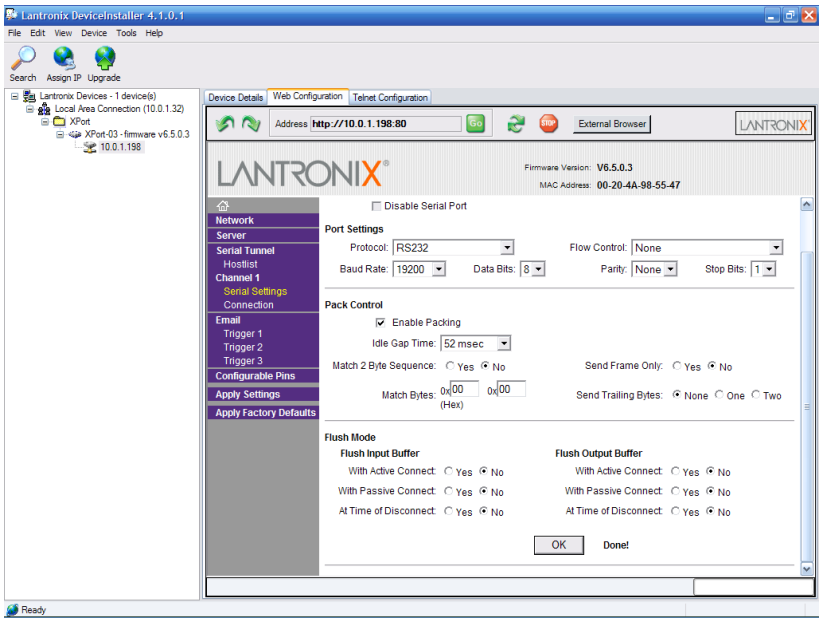
Connect the Reader to an Ethernet port, not your laptop or PC, but the same network your laptop or PC is connected, then power the Reader. Verify the light on the left of the Ethernet connector is either solid orange or solid green. Go to your Programs folder under Lantronix and execute the Application File "DeviceInstaller.exe." Then click the search button and wait for DeviceInstaller to find your device.



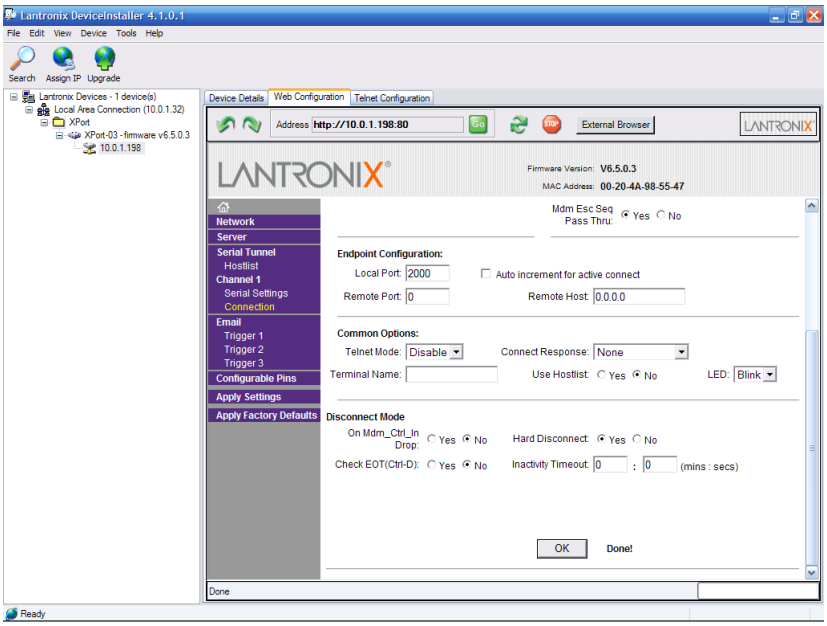
If your device is found, a folder named XPort will appear; expand it to expose the firmware version and expand it one more time to expose its IP address. Navigate to the IP ADDRESS, select it. 3 tabs will appear on the right. Device Details, Web Configuration, and Telnet Configuration; select Web Configuration and click the green button labeled GO. A password window will pop up. Leave it blank and click OK.



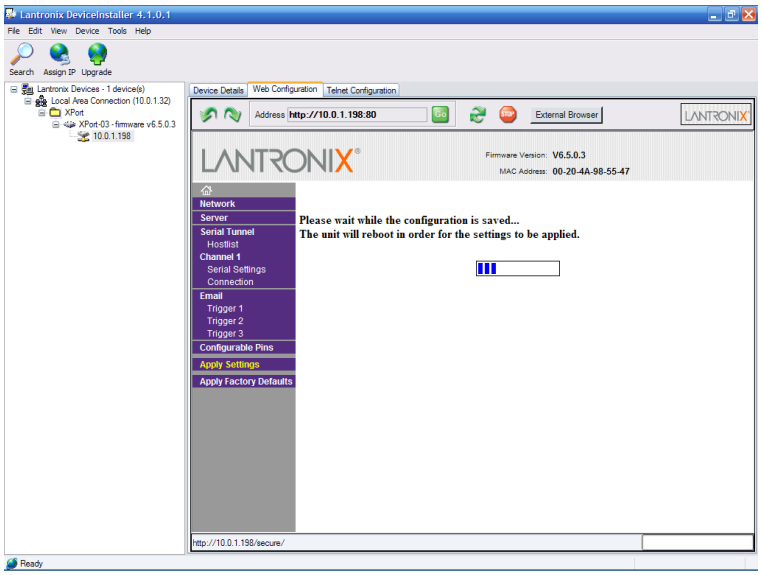
Select Serial Settings, change the baud rate to match that of the serial port (default 9600), check enable packing, select 12msec idle gap time. Upon completion the next screen should look like that below. Scroll down and click the OK button. While there is still a "Done!" label next to the OK button select Connection on the left to change pages.



Change local port to 2000 and click OK, while the “Done!” is still present by the OK button click on the Apply settings link on the left.



This is what it should look like while the settings are being applied.



Once the Reader is done updating the settings, turn the unit off for 5 seconds and then back on. Wait until the light on the left of the Ethernet connector is stable and solid and then go back to the DeviceInstaller program and click search. Follow the same steps you used to change Serial and Connection settings, however this time do not click OK. You are simply verifying the changes have taken effect. Setup is finished. If you like, you can use the supplied terminal program (or your own) to test communications with the Reader.

Modbus RTU & TCP Communications

If you have ordered the Modbus RTU version of this Reader, data is still sent to the USB and Ethernet ports. The serial port now become MODBUS RTU port.

Reading Data (Output Registers)

When the serial port is set as MODBUS RTU it stops sending normal tag reads and responses, instead all data and responses the reader produces are placed in a buffer mapped to MODBUS register address 256 (40257). These registers will contain the last data or response produced by the Reader. The buffer is 46 bytes long (23 registers). The output data or response inside these registers will often not consume all 18 registers and it will be in the format Line Feed followed by data in ASCII followed by a carriage return. The table below represents the data present in Output registers address 256 (40257) after a tag read.

Tag ID = 300055555555555333338877765

REG#	0		1		2		3		4		5		6		8		9	
Byte#	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Data	LF	3	0	0	0	5	5	5	5	5	5	5	5	5	5	5	5	3
REG#	10		11		12		13		14		15		16		17			
Byte#	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33		
Data	3	3	3	3	8	8	7	7	7	6	5	CR						

In retrieving the Tag data from the Reader read registers 0 to 15, the Low byte of register 15 contains the closing CR of the Tag data. In this case the rest of the registers are unused, values undefined.

Writing commands to the Reader (Input Registers)

Another set of registers at address 0 (40001) is used to issue commands to the Reader. Write the commands to those registers. For example if we want to set the Reader to polling mode we need to issue the command [P] so we write it to the Input registers as follows

Input REG 0 (40001) = High Byte = [Low Byte = P

Input REG 1 (40002) = High Byte =] Low Byte = NULL

The MODBUS Data sent would look like this:

Slave Address	Function Code	Start Address High	Start Address Low	Number Of Registers High	Number Of Registers Low	Byte Count	Data			
23	16	00	00	00	02	4	[	P	]	0
0x17	0x10	0x00	0x00	0x00	0x02	0x04	0x5B	0x53	0x5D	0x00

Write Registers to MODBUS Slave 23, command [P]. The Response to this command will be in the Output Registers. You can Read Multiple Registers starting at Register Address 256 (40257) to read the response.

We use absolute 0 based address in this document.

Address 0:

Command Registers. Write commands like [D], [I], [S] etc… to registers starting at address 0. The result/response can be read on these same registers.

Address 256: (hex 0x0100)

Antenna 1 tag read registers. Every time a tag is read, the registers are updated with new tag data. If the system is single antenna these are the only tag data registers

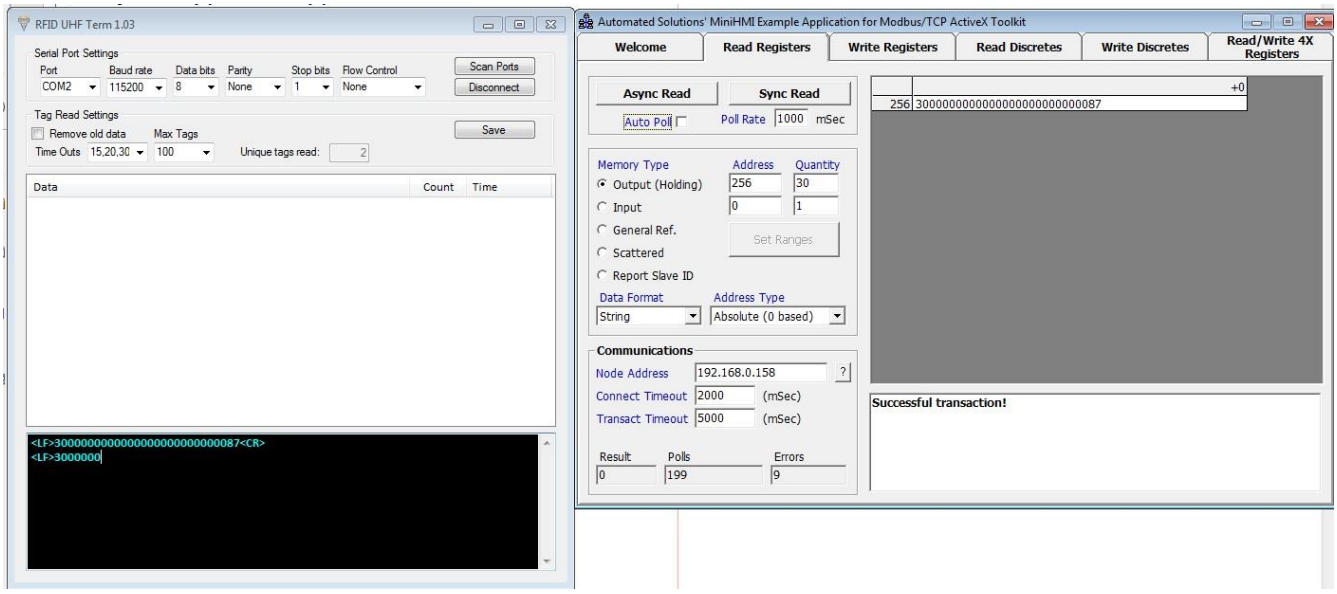
When reading tag read registers the number of registers to read depends on the tags number of characters.

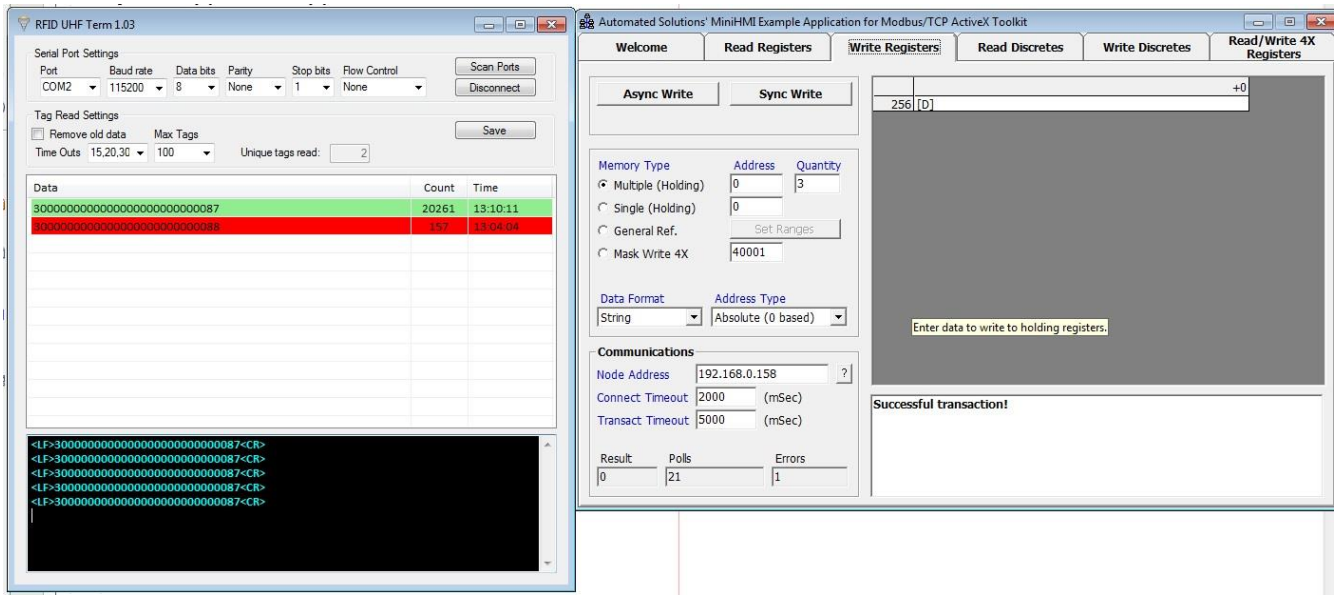
8 Characters read 5 registers (10 bytes)

16 characters read 9 registers (18 bytes)

24 characters read 15 registers (30 bytes)

Tag data in registers will be in <LF> data <CR> format





These registers are the same for both MODBUS RTU serial port or MODBUS TCP Ethernet port. It is not recommended to enable MODBUS on both ports at the same time. Select one using the DIP1 EEPROM switches.

Address 1280: (hex 0x0500)

There is a register at address 1280 that increments with every reads up to 65535 then it rolls over and continues incrementing with every read.

If you have multiple antennas their data will be in the following addresses

Address 512:

Antenna 2 tag read registers.

Address 768:

Antenna 3 tag read registers.

Address 1024:

Antenna 4 tag read registers.

Configuring Ethernet/IP and PROFINET

There are 4 status LED's on top of the enclosure. Looking at the picture let's call the left most LED 1 for reference and the right most LED 4.

Ethernet/IP Status LED's

LED 1 Network Status

- Off = No power or no IP address
- Green = Ethernet/IP connection established
- Green Flashing = No Ethernet/IP connection established
- Red = Duplicate IP address detected
- Red Flashing = Ethernet/IP connection timed out
- Alternating Red/Green = Self-test in progress

LED 2 Module Status

- Off = No power
- Green = Ethernet/IP connection established

- Green Flashing = No Ethernet/IP connection established
- Red = Major Fault (unrecoverable)
- Red Flashing = Minor Fault (recoverable)
- Alternating Red/Green = Self-test in progress

LED 3 Data Rate

- Off = 10 Mbps
- Green = 100 Mbps
- Alternating Red/Green = Self-test in progress

LED 4 Link Activity

- Off = No power
- Green = Connected to Ethernet network
- Green Flashing = RX/TX Activity
- Alternating Red/Green = Self-test in progress

PROFINET Status LED's

LED 1 Network Status

- Off = Offline or No power
- Green = Online, IO controller in RUN
- Green Flashing = Online, IO controller in STOP/CLEAR
- Red = Internal Error, contact RFID Inc.
- Alternating Red/Green = Self-test in progress

LED 2 Module Status

- Off = Not initialized or no power
- Green = Normal operation
- Green Flashing = Network settings error, IP address or station ID not set
- Red = Internal Error, contact RFID Inc.
- Red Flashing = Configuration Error
- Alternating Red/Green = Self-test in progress

LED 3 Diagnostics

- Off = Not initialized or no power
- Green Flashing = Identification, used by engineering tools to identify nodes
- Red Flashing = Diagnostic event available
- Alternating Red/Green = Self-test in progress

LED 4 Link Activity

- Off = Not initialized or no power
- Green = Link Sensed
- Green Flashing = Exchanging packets
- Alternating Red/Green = Self-test in progress

Ethernet/IP and PROFINET Setup Commands

Setup commands may be sent via USB or serial connection. It should be noted that anytime an incorrect command is sent to the Reader, the Reader will respond with a question mark (?). The following commands are entered using a terminal program like HyperTerminal or the free demo program supplied by RFID, Inc., or another free terminal program Teraterm found here, https://osdn.net/projects/ttssh2/downloads/67179/teraterm-4.94.exe/. The Reader will echo back the command as noted in each response. This is done in order to verify the command you sent was received and correctly executed.

Note: All commands are issued in ASCII CAPITAL letters, and they are preceded by an open square bracket [and ended with a closed square bracket]. Commands are held in non-volatile memory, meaning that if power is taken away from the Reader the last command or settings will be retained when re-powered. The EIP Reader is setup via its serial or USB port. Default factory settings are RS232 full duplex and 115200 baud with 8, N, 1, N settings. The EIP version of this Reader is not capable of RS422 or RS485 serial options. The commands for setup via RS232 or USB are:

[4] = IP address

This command sets the IP address (you must type the equals sign).

Host: [**4=NNN.NNN.NNN.NNN**] Where: **4** = command and **N** = numeric digits of address.

Reader Response: **<LF>OK<CR>**

Where: **<LF>** = Line Feed
OK = response
<CR> = Carriage Return

Example: [4=10.0.1.42] Set new IP address

[5] = Mask

This command sets the Mask.

Host: [**5=NNN.NNN.NNN.NNN**] Where: **5** = command and **N** = numeric digits of mask.

Reader Response: **<LF>OK<CR>**

Where: **<LF>** = Line Feed
OK = response
<CR> = Carriage Return

Example: [5=255.255.255.0] Set new subnet mask

[6] = Gateway

This command set the Gateway.

Host: [**6=NNN.NNN.NNN.NNN**] Where: **6** = command and **N** = numeric digits of gateway.

Reader Response: **<LF>OK<CR>**

Where: **<LF>** = Line Feed **OK** = response **<CR>** = Carriage Return

Example: [6=10.0.1.1] Set new gateway

[7] = IP Settings

This command retrieves the current IP settings.

Host: [**7**] Where: **7** = command

Reader Response: IP=10.0.1.42
Mask=255.255.255.0
Gateway=10.0.1.1

Example: [7] Request IP settings

[8] = Toggle to Disable or Enable EIP and Profinet

This command disables either Ethernet/IP or Profinet operations (dependent upon the Reader you have) making the Reader much faster to operate via RS232 or USB port, typically used for setup or diagnostics.

Host: [8] Where: 8 = command

Reader Response: <LF>OK<CR>

Where: <LF> = Line Feed
OK = response
<CR> = Carriage Return

This table Only applies to Ethernet/IP and Profinet versions of S4 reader. It contains every possible setting using the upper bits of DIP2, yellow and orange are not recommended.

	VDS 8 MULTI	VDS 7 FB_EN	VDS 6 FB_MODE	VDS 5 RSSI
Multiple antennas 6 characters per antenna	0	0	0	0
Multiple antennas 6 characters per antenna	0	0	0	1
Multiple antennas 24 character, ant code in command byte	0	0	1	0
Multiple antennas 24 character, ant code in command byte	0	0	1	1
Multiple antennas Field Bus disabled	0	1	0	0
Multiple antennas Field bus disabled	0	1	0	1
Multiple antennas Field bus disabled	0	1	1	0
Multiple antennas Field bus disabled	0	1	1	1
Single antenna RSSI disabled	1	0	0	0
Single antenna RSSI enabled	1	0	0	1
Single antenna RSSI disabled	1	0	1	0
Single antenna RSSI enabled	1	0	1	1
Single antenna Field bus and RSSI disabled	1	1	0	0
Single antenna Field bus disabled, RSSI enabled	1	1	0	1
Single antenna Field bus and RSSI disabled	1	1	1	0
Single antenna Field bus disabled, RSSI enabled	1	1	1	1

Dip switch group 2 table

It is recommended to only use the setups in green above and represented below as these commands:

	Command
Multiple antennas 6 characters per antenna	[DIP200]
Multiple antennas 24 character, ant code in command byte	[DIP220]
Single antenna RSSI disabled	[DIP280]
Single antenna RSSI enabled	[DIP290]

Setting up Ethernet/IP Reader or PROFIENT Reader

For Ethernet/IP, it is not necessary to have an EDS file. Simply use the existing Generic ETHERNET MODULE on RSLinx5000 and configure it as in the screenshot in step 1. An ACD and EDS file is supplied in the link below. For PROFINET, a GSDML file must be used, which can also be downloaded at this link, https://www.rfidinc.com/resource-center/.

Notice that command bits and data frame are the same. The only difference is the BUS configuration.

Setting up our Ethernet/IP reader using a generic ETHERNET MODULE. Figure 1 shows module properties. The Instances and Sizes are 100 size 26 bytes for Input and 150 size 26 bytes for Output.

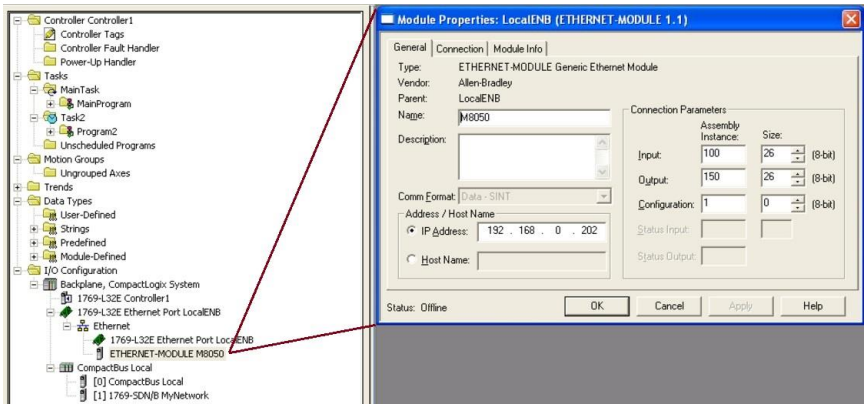


Figure 1 - Ethernet/IP Module

Figure 2 is a screenshot of Controller Tags of the ETHERNET MODULE. Setting all the Controller Tags to ASCII except for the first which allows you to see Tag text. The first Controller Tag is best set to hex or binary to view the command bits more easily.

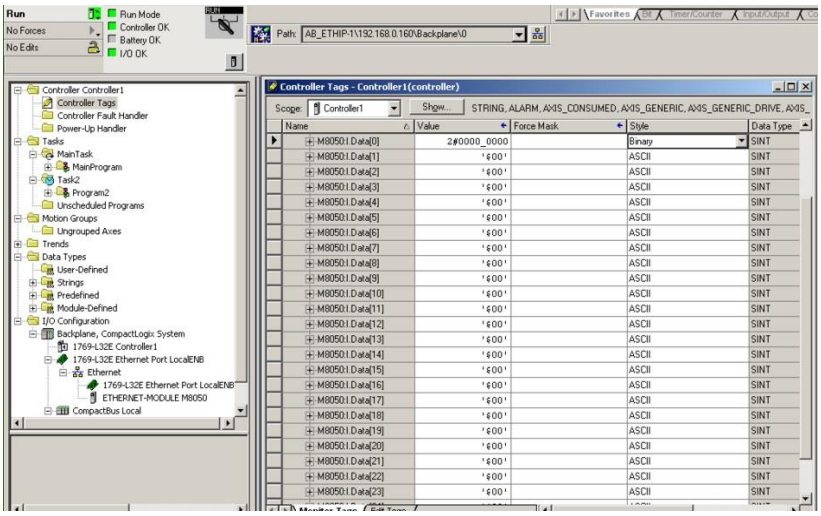


Figure 2 - Controller Tags

Setting up PROFINET Reader using a PROFINET master simulator. Figure 3 shows the opening of the GSDML xml file while figure 4 shows the selection of Input/Output 032 bytes

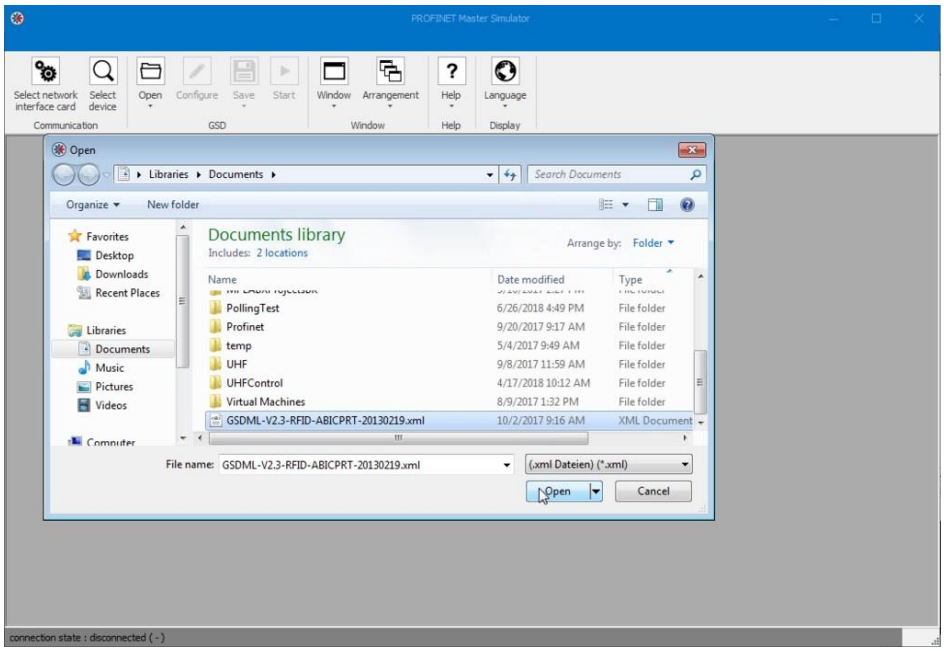


Figure 3 - GSDML File

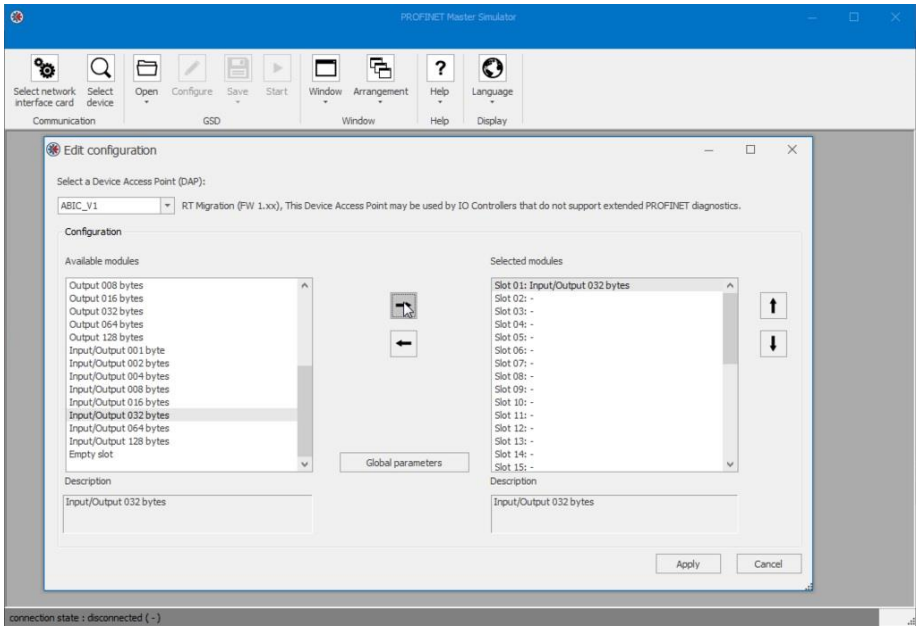


Figure 4 - Ins/Outs set to 32 bytes

Ethernet/IP Reader or PROFIENT Fieldbus data

The Command Byte is used to send and receive command bits and status bits. There is an Output command byte used by the PLC to send commands to the Reader, and an Input command byte used by the Reader to respond to commands and to report reads.

Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
-	-	-	-	Command code	Command code	Command code	Toggle bit

Table 1 Output Command Byte

Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
Multi antenna code	Multi antenna code	Buffer not empty	Error bit	Command code	Command code	Command code	Toggle bit

Table 2 Input Command Byte

Bit 6:7 Multi Antenna command code (only used in multiple Antenna mode with Full EPC data (independent reads)

- 00 Antenna 1
- 01 Antenna 2
- 10 Antenna 3
- 11 Antenna 4

Bit 5 Buffer not empty bit

- 1 Buffer not empty, more tag reads still in buffer. (this happens in duplicate mode as the Reader captures tags faster than it can report them
- 0 Buffer empty all tags reported

Bit 4 Error bit

- 1 Error, (failed to execute a command) most commonly in polling mode failed to read a Tag
- 0 No error

Bit 1:3 Command code bits. If you issue the command bits on the Output Command Byte, the response will have the same bits in the Input Command Byte after execution of the command

- 100 Read command (also appears indicating Tags read in single or duplicate mode)
- 010 Single mode command
- 111 Duplicate mode command
- 011 Polling mode command

Bit 0 Toggle bit

- This bit changes value every time new data arrives from the Reader even if the data has the same value, for example if a Tag with the same ID is read twice the toggle bit will change value twice.

Figure 5 is an example of the Single Antenna EIP data frame consisting of 26 bytes and is divided into Byte 0 = Command Byte (red), Bytes 1 to 24 = EPC tag data (Green). Byte 25 is always set as 0x0D (carriage return).

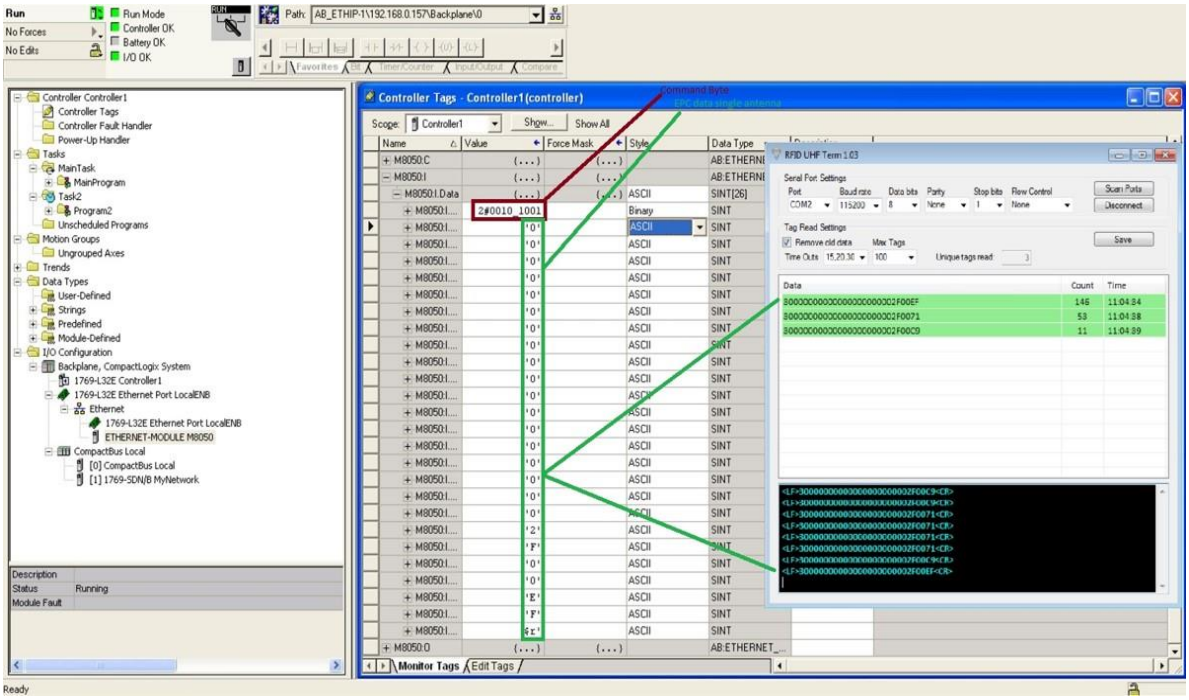


Figure 5 - Single Antenna EIP

Figure 6 is an example of the Single Antenna PROFINET data frame. It is identical to the EIP frame.

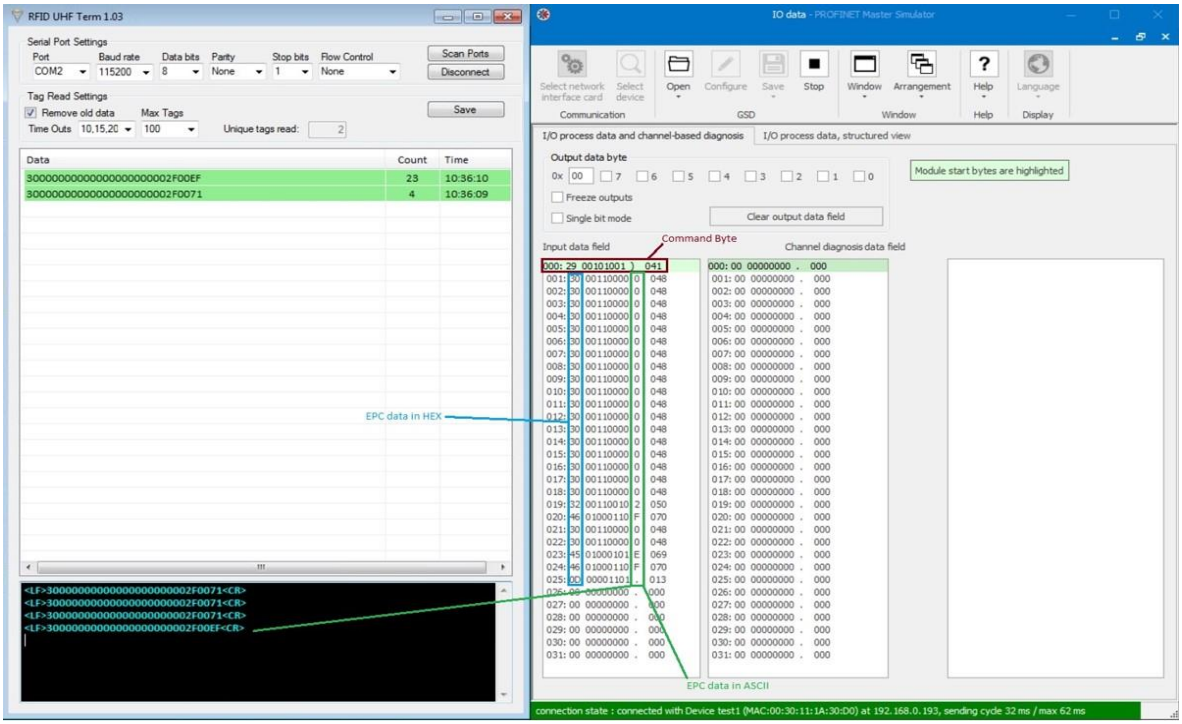


Figure 6 - Single Antenna PROFINET

Multiple Antenna Modes

There are 2 multiple Antenna modes. We will call them Multi Antenna 1 and Multi Antenna 2. The first mode (Multi Antenna 1) displays the full EPC of a Tag read and indicates what Antenna reads it on bits 6 and 7 of the Command Byte. This mode looks exactly like single Antenna mode except for Command Byte bits 6:7 becoming active. The second mode (Multi Antenna 2) takes the last 6 characters of EPC data from each Antenna and places them all into the Field bus frame, the position of the data in the frame determines the Antenna. A separate Antenna Toggle bits Byte is added after the Command Byte to signal every time each Antenna reads.

New Antenna toggle bits (Table 2)

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
Not used always 0	Not used always 0	Not used always 0	Not used always 0	Antenna 4 toggle	Antenna 3 toggle	Antenna 2 toggle	Antenna 1 toggle

Figure 7 is an example of Multi Antenna mode 2 EIP. We still have 26 total bytes of data divided as:

- Byte 0 Command Byte (Figure 5 Red)
- Byte 1 New Antenna toggle bits (Figure 5 Orange) (see table 2)
- Bytes 2:7 Antenna 1 data (Figure 5 Green)
- Bytes 8:13 Antenna 2 data (Figure 5 Blue)
- Bytes 14:19 Antenna 3 data (Figure 5 Purple)
- Bytes 20:25 Antenna 4 data (Figure 5 Violet)

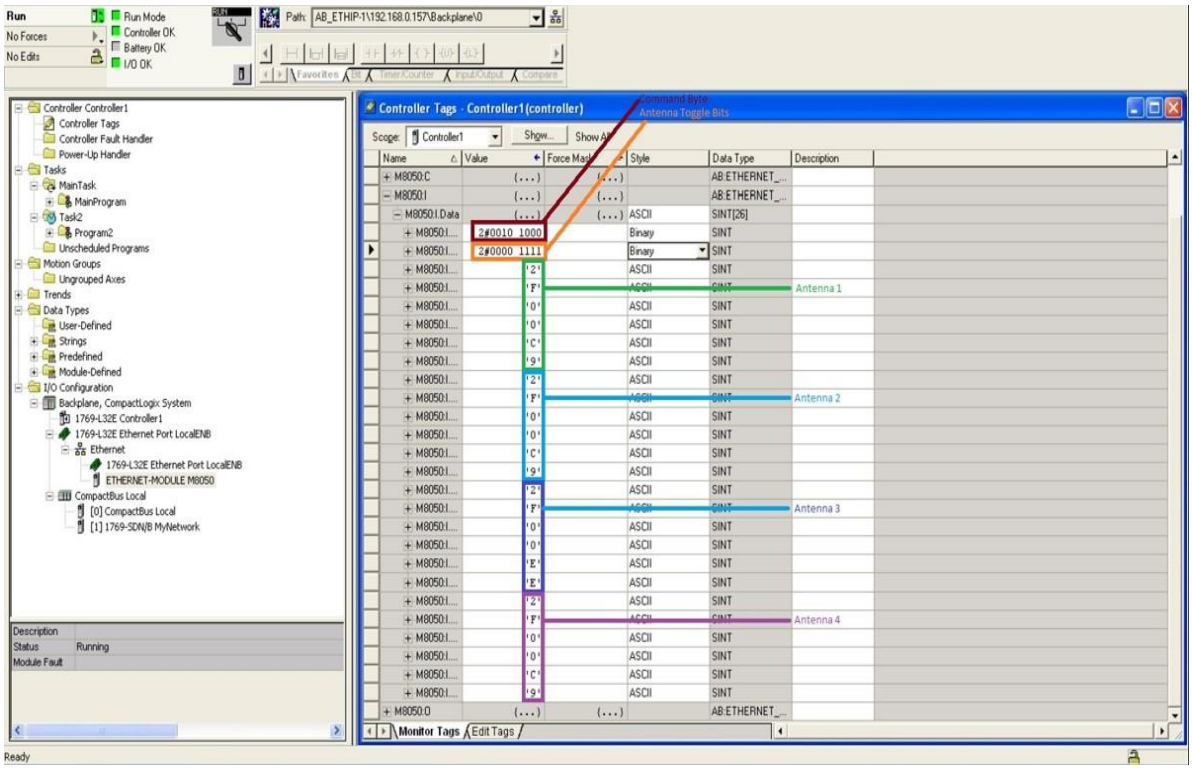


Figure 7 - Multi Antenna 2 mode EIP

Figure 8 is an example of Multi Antenna mode 2 PROFINET. It is exactly the same as the EIP version.

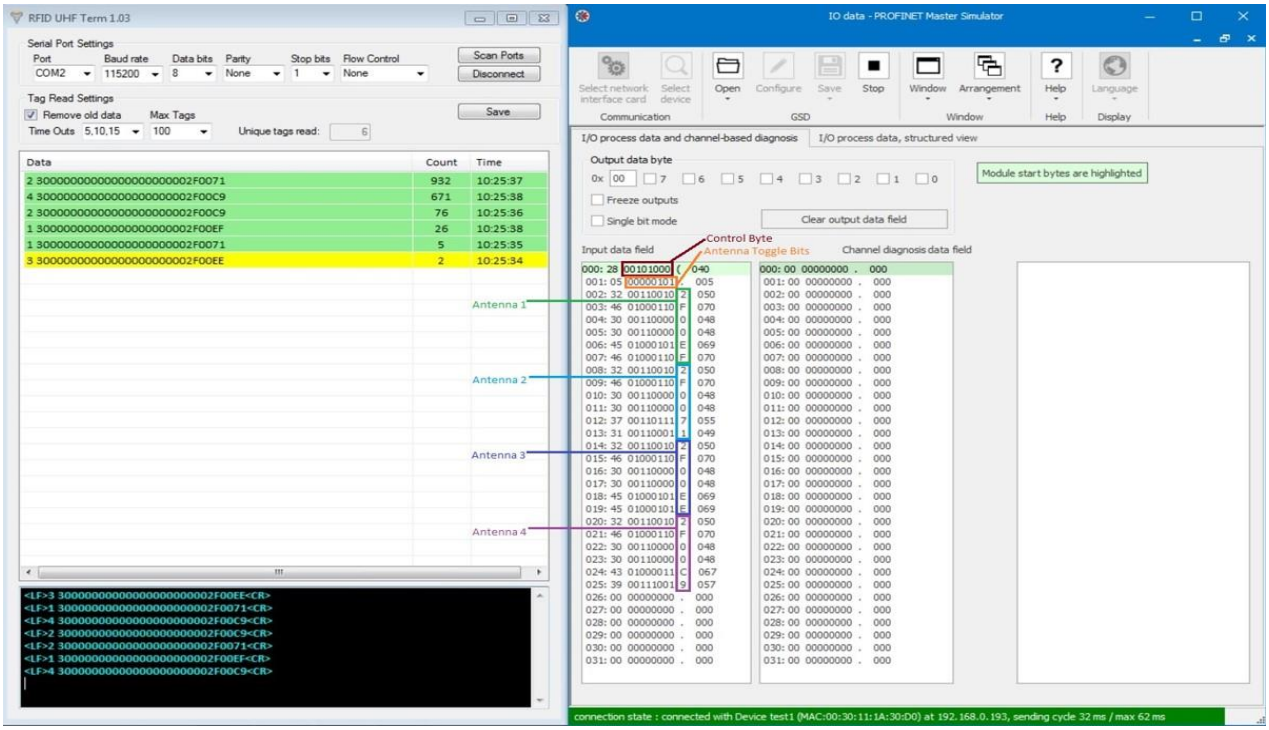


Figure 8 - Multi Antenna 2 mode PROFINET

Figures 9 & 10 are another example. The first byte is the Command Byte and remains the same. Second byte is the new Antenna toggle bits. The lower 4 bits each toggle independently when the Antenna associated with it receives a fresh read. The next 24 bytes of EIP data are divided in to 4 Antenna areas. Each Antenna area has the last 6 characters of EPC data.

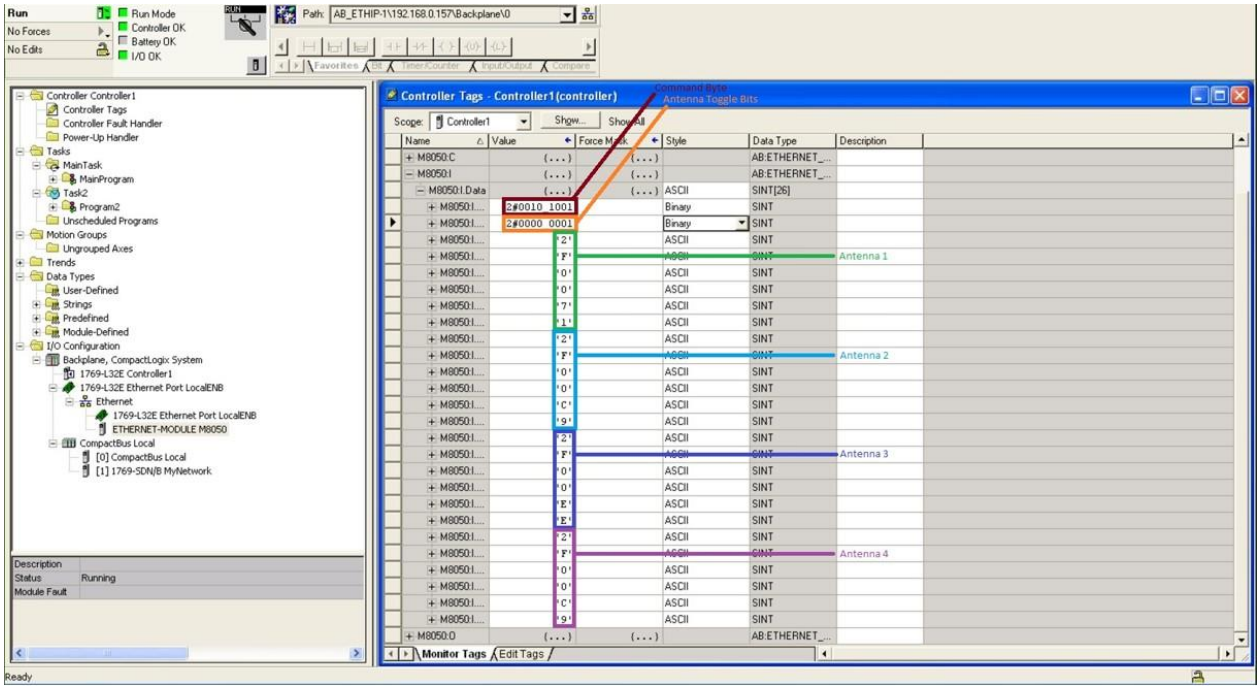


Figure 9 - Multi Antenna 2 mode EIP

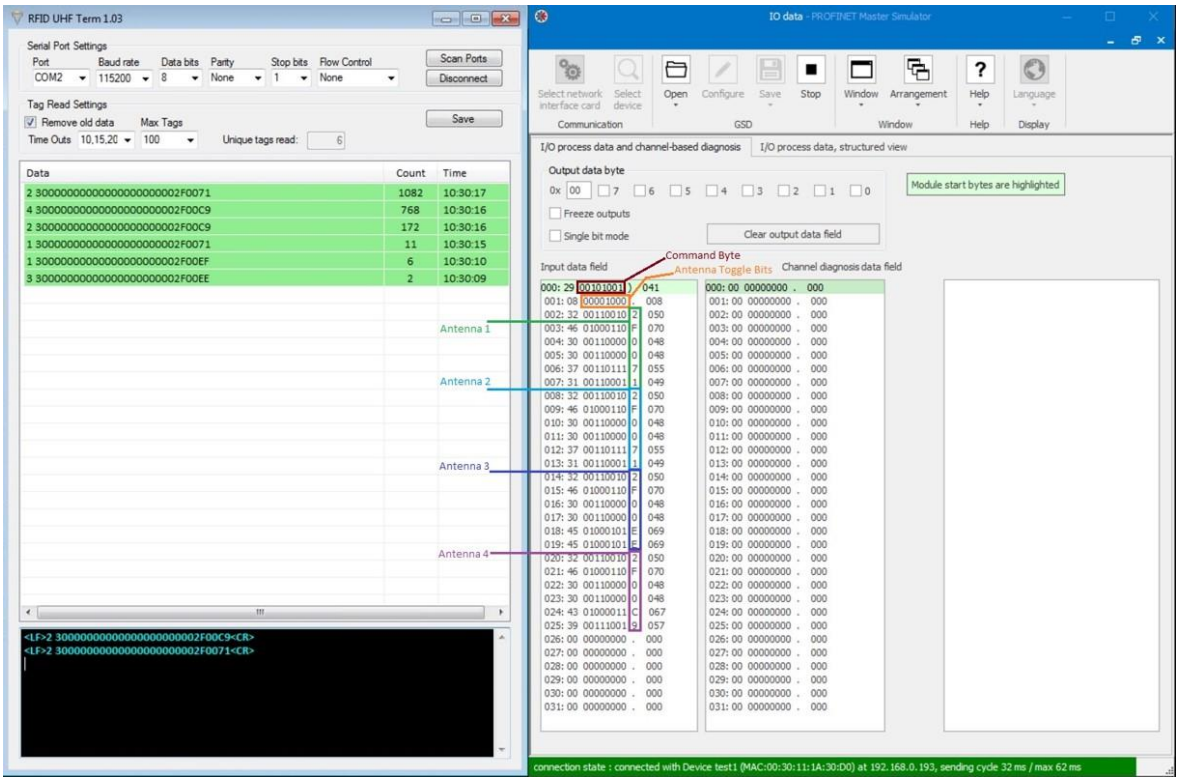


Figure 10 - Multi Antenna 2 mode PROFINET

Notice how Antenna toggle bits change from figure 8 to figure 10 indicating reads are occurring. The original toggle bit (bit 0 of command byte) still toggles on every read as before. We just added the individual toggle bits on top of that.

Change to Single Antenna Mode. In figures 11 & 12 the Antenna toggle bit byte is gone, and we have 24 characters of EPC data.

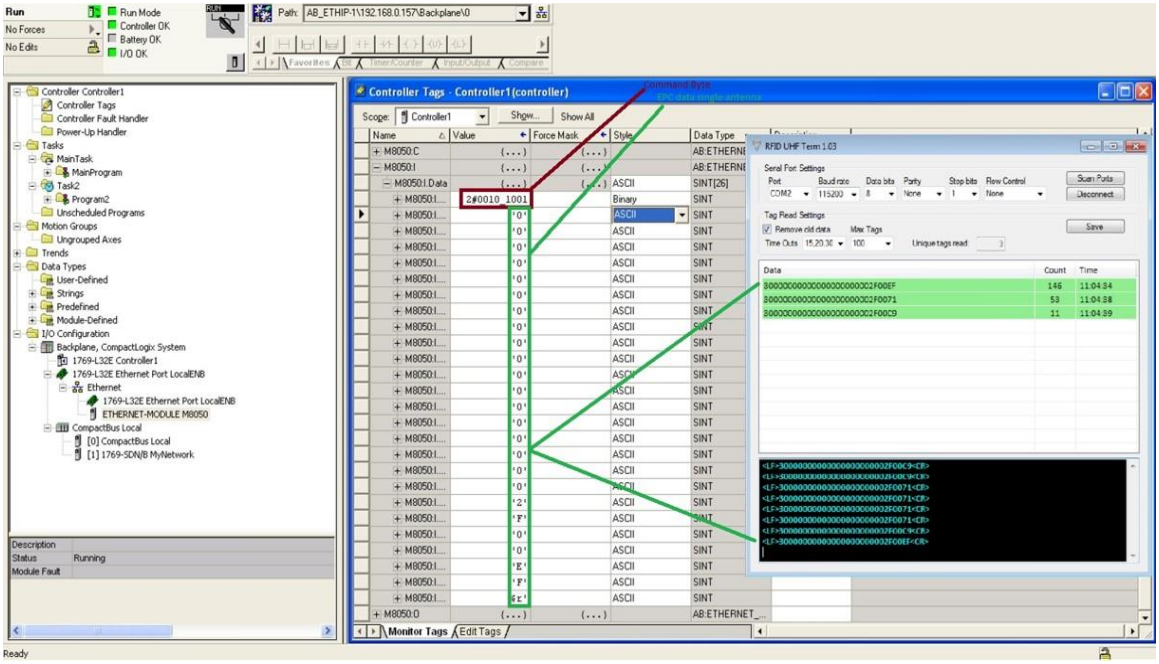


Figure 11 - Single Antenna Mode EIP

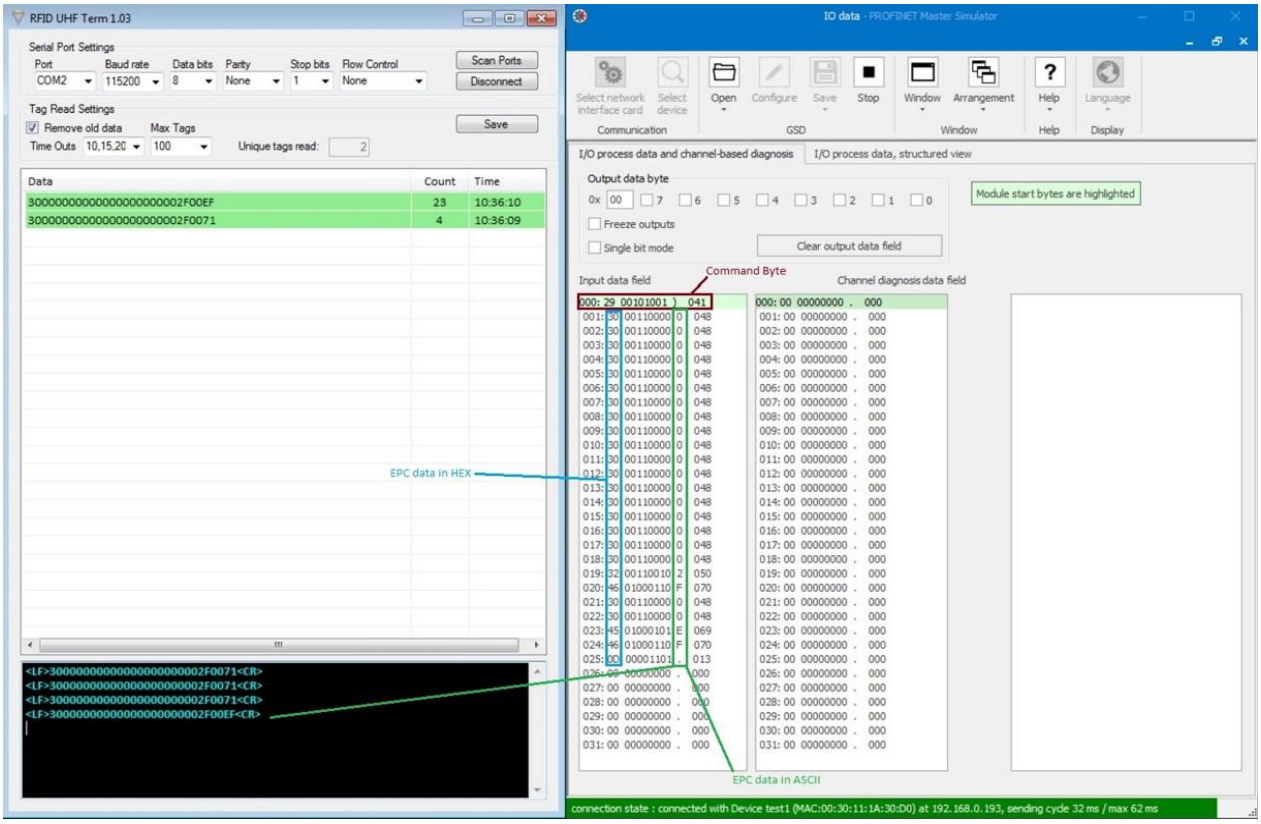


Figure 12 - Single Antenna Mode PROFINET

Issuing Commands via Ethernet/IP or PROFINET

There are 4 commands that can be issued via the RJ port using command bits in the following format (all other commands must be entered via USB or serial port):

1. Single Mode = 010
2. Duplicate mode 111
3. Polling mode = 011
4. Transfer (read) command = 100 (this is the bit code displayed for any tag read)

INPUT Command byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Antenna number		Empty buffer	Error bit	Command bits			Toggle bit

Table 3 INPUT Command byte

The Reader fills in these bits to signify the current command response or tag read.

Bit 6, 7 Antenna number bits: Only used in multi antenna mode 1.
Bit 5 Empty buffer bit: is 0 when the buffer is empty, 1 if there are Tags left to report.
Bit 4 Error bit: 1 if a failure to read occurred (polling mode), 0 if read was successful.

Bits 1, 2, 3 Command bits.

Bit 0 Toggle bit: flips every time new data is available.

OUTPUT Command byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved				Command bits			Toggle bit
Write with zeros				1	0	0	X

Table 4 OUTPUT Command byte

The user fills these bits to trigger commands.

Bits 4 to 7: Not used

Bits 1, 2, 3 Command bits: (Enter 1 of the 4 commands above)

Bit 0 Toggle bit: User must flip this bit to every time a new command is issued telling the Reader to execute it.

Tag Data & Number of Antennas with Ethernet/IP and PROFINET

As of this writing, the maximum number of characters of Tag data available for a single Antenna Reader, the part number ending in -01, is 24 characters and there is an option to limit this to 8 or 16 characters as well. For Readers containing 2, 3, or 4 Antenna ports (part numbers ending with -02, -03, -04) the number of Tag characters is limited to 6. A future firmware release will allow for:

4 antenna - 6 characters

3 antenna - 8 characters

2 antenna - 12 characters

Reading tags with Ethernet/IP and PROFINET

Let us take a moment to understand the Tag data. Let us assume a single Antenna unit and Tag data of:

3000E2008366661100671320 8E54

When reported over the EIP or PNET port, only the 24 characters of memory bank 02, word address 02 to 07 will be reported, E2008366661100671320 8E54, the Protocol Control words of 3000, 3400, 5000 or 5400 will not be reported. The Protocol Control word (and any other imbedded data for that matter) will be seen on the Reader's serial or USB ports, but not on the EIP bus.

Memory Bank	Word Address	Data	Description	Memory Size	Mask Offset
00	00		Kill Password	32 bits	
	01		Access Password	32 bits	
01(1)	00		CRC-16	16 bits	
Not Reported With EIP or PROFINET	01	**3000**	Protocol Control (this is the first 4 Tag data bytes) 3000 = no data in user memory, EPC Length 6 words (factory default) 3400 = data present in user memory, EPC Length 6 words (factory default) 5000 = no data in user memory, EPC Length 10 words 5400 = data present in user memory, EPC Length 10 words	16 bits	00
	02	**E200**	(total EPC data in words 02 to 07 = 96 bits) EPC Data	16 bits	16
	03	**8366**	EPC Data	16 bits	32
	04	**6611**	EPC Data	16 bits	48
	05	**0067**	EPC Data	16 bits	64
	06	**1320**	EPC Data	16 bits	80
	07	**8E54**	EPC Data	16 bits	96
10(2)			TID (tag identification) ROM, cannot be changed	96 bits	
11(3)	Varies 00-?		User Memory, most often 512 bits, some as high as 2k bits	Varies	

Table 5 EPC Tag Memory map

Reading tags - Single mode

Tags are updated to the EIP/PROFINET field bus instantly. The toggle bit is updated and the command bits are set to 100. The PLC does not have to output anything, need only monitor toggle bits and retrieve the data from the input bytes when toggle bit changes.

Reading Tags - Polling mode

In polling mode Tags are never updated to the field bus instantly, they are kept in a buffer up to 10 reads. The PLC has to set the out command bits to read and toggle bit 0 of the command byte. Each time bit 0 is toggled a tag is pushed out of the buffer and into the EIP field bus.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved				Command bits			Toggle bit
Write with zeros				1	0	0	X

Table 6 OUTPUT Command byte set for reading. Command bits are 100.

Writing Tags

Writing is not available using Ethernet/IP but may be done so via serial or USB ports.

External Hardware Guide

External Antenna

Antennas are available in differing gains and sizes. The Reader Antenna port is a TNC female connector. Larger Antennas come with N type connectors and a conversion cable is supplied. Smaller Antennas come with an SMA male connector and a conversion cable or connector is supplied. Cable lengths are standard at 10', 15' and 25'. Cables are normally either RG213 (thick) or RG174 (thin). Less range will be realized with the 25' cable or with thin RG174 cabling due to resistance. Larger Antennas also come with mounting hardware. Cable length between Antenna and Reader is found in the ordering table and a standard mounting bracket is included. To order your products, see the table of Antenna part numbers on page 5.

The higher the gain of the Antenna, the more range is capable from a Tag, however, there are FCC limits, specifically EIRP. The maximum allowed in the USA is 4 Watts EIRP. EIRP is calculated through a combination of the Reader's dBm, or Total Power Output (TPO), and Antenna dBi gain.

With a Reader set to 30dBm the Antenna can only have a maximum gain of 6dBi. If the power at the transmitter is lowered by 1dB, the antenna gain can be increased by an additional 3dB. For example, if an installation reduced power at the transmitter to 29dBm, it could use an antenna having a gain of 9dBi. In general, for every 1dB power reduction at the transmitter from 30dBm, an installation can add 3dB gain at the antenna. Here is a breakdown of the transmitter dBm (Reader) versus Antenna dBi gain.

30dBm transmit = 6dBi antenna - 29dBm transmit = 9dBi antenna - 28dBm transmit = 12dBi antenna

Transmitted power must be configured correctly to prevent potential interference problems due to the effective isotropic radiated power exceeding the limits as defined in FCC part 15.247(i). As defined in FCC part 15.247(i), the power transmitted by the transmitter can only have a maximum power level of 1 watt or 30dBm, and our Reader meets this mandate.

In summary, if an Antenna higher in gain than 6dBi is used, our Reader's dBm must be turned down through the software command [16xxx] referenced on page 48.

Relay Driver

Quantity: 2 each for USB, Serial, Wiegand and TCPIP Ethernet versions, 1 each for all PLC protocols. These are NO (normally open) Reed relay rated at 60VADC@350mA available and when it closes its J1 pin 5 or 6 to ground, see drawing next page. The relay can be enabled or disabled independently with the [**7**] and [**8**] commands, see page 48 (**by default the relay is enabled**). An enabled relay will close (activate) whenever a Tag is read and will remain active until its timer expires then open (deactivate). **The default timer setting is 50 milliseconds**. The timer can be set (see J command on page 49) from 01 to 99 seconds or 05 to 99 milliseconds. The relay can also be triggered to close manually with the [**9**] command. Do not confuse this with enabling the relay. The [**9**] command simply triggers the relay for one timer cycle whether the relay has been enabled or not.

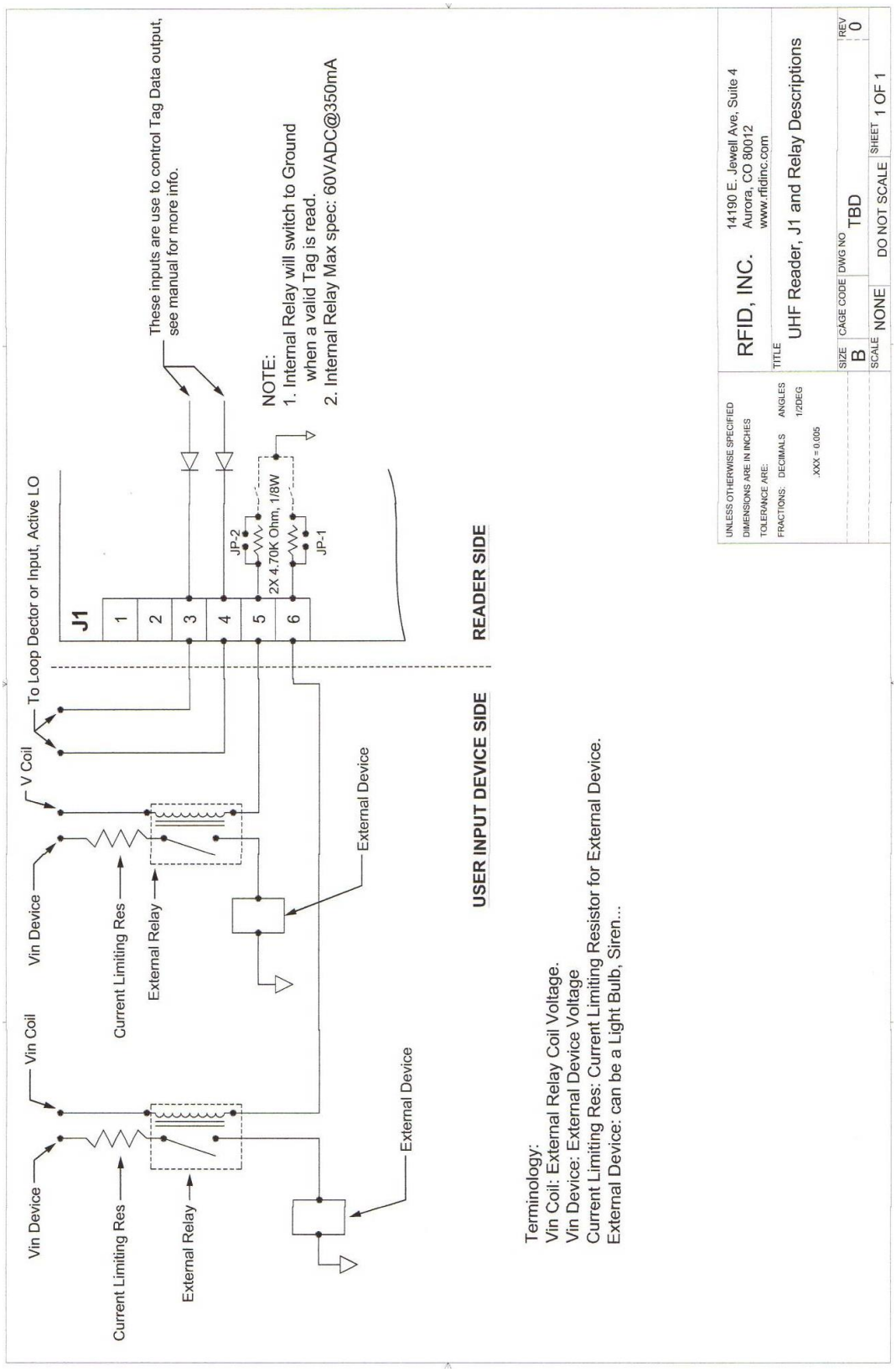
Loop Detector or Input

Quantity: 2 each for USB, Serial, Wiegand and TCPIP Ethernet versions, 1 each for all PLC protocols.

Although termed a Loop Detector input for use in parking applications, this option can be used as input by any peripheral. See pin 5 in below illustration noted as RY2 and drawing on next page. Wire a peripheral output to this input, the peripheral must be able to take GND from our Reader's GND

connection directly to the left of this input (screw terminal 4) and apply it to the loop detector input to enable reading.

Input or Loop Detector Drawing



General Reader Commands and Responses (Tag Writing not included here)

First it should be noted that anytime an incorrect command is sent to the Reader, the Reader will respond with a question mark (?). The following commands are entered using a terminal program like HyperTerminal or the demo program supplied by RFID, Inc. These commands allow you to control and access certain Reader functionalities. The Reader will echo back the command as noted in each response. This is done in order to verify the command you sent was received and correctly executed.

Note:

- All commands are issued in ASCII CAPITAL letters, and they are preceded by an open square bracket and ended with a closed square bracket.
- Commands are held in non-volatile memory, meaning that if power is taken away from the Reader the last command or settings will be retained when re-powered.

Operating Modes – How the Reader reports data

Single Antenna – [DIP280]

Multiple Antennas – [DIP200]

Single Report Mode – [S] series of commands.

Duplicate Report Mode – [D] series of commands.

Polling Report Mode – [P] & [T] commands.

Note: Factory default for S4 Reader is Polling Mode. Factory default for SPR/A series is Duplicate Mode.

Enabling Antennas

Your Reader will ship factory defaulted to the number of Antennas specified in your order, specifically the Reader part number suffix signifies the number Antenna ports activated. It should be noted, if you enable an Antenna port and use the Reader without an Antenna connected to that port, you will damage the Reader over time. You can enable (or disable) Antennas on your own by issuing either the [Dxxxx] or [Sxxxx] commands below. Obviously if you ordered a 2 port Antenna Reader, Antenna ports 3/4 will not be available whether you turn them on or not. Once Antennas are enabled they will remain enabled even if you issue other operating mode commands such as [S] [D] or [P]. The more Antennas on a Reader, the slower the read rate, as the Reader cycles through each Antenna, enabling and disabling one at a time.

Do not operate the Reader with Antennas enabled but not connected!!!

[MBIDxx] – Assign Reader Addressing

All Readers have a default address of 01 however the address function will not operate until enabled. Valid addresses are 01 to 32. This command assigns a Reader address, not to be confused with Antenna addressing below. This feature is available on Reader versions 2.20 and up. Following example sets the Reader address to 15.

Host: [**MBID15**]

Where: **MBID** = command and **15** = address

Reader Response: **<LF>OK<CR>**

[DIP147] – Enable Reader Addressing

This virtual dipswitch command, reference page 20, enables Reader addressing, not to be confused with Antenna addressing discussed below.

Host: [**DIP147**]
Where: **DIP147** = command
Reader Response: **<LF>OK<CR>**

NOTE: With the exception of the AN command below, once addressing is enabled any subsequent commands must be preceded by Axx. For example, the [S] command now becomes [AxxS].

[AN] – Discover Reader Address

This command displays current Reader address.

Host: [**AN**]
Where: **AN** = command
Reader Response: **<LF>15<CR>** (assuming Reader address = 15 per above)

[DIP200] – Enable Multiple Antenna Mode

Enter this mode to enable multiple Antennas (whatever number are available on your Reader). There is a label on the Reader indicating the number of Antennas defaulted at shipment.

Host: [**DIP200**]
Where: **DIP200** = command
Reader Response: **<LF>OK<CR>**

A power reset is now necessary for this command to take effect followed by the appropriate [Dxxxx] or [Sxxxx] command. Ensure all (the appropriate number) of the Antennas are connected! Do not operate the Reader with Antennas enabled but not connected!!!

[DIP280] – Enable only Antenna port #1.

Enter this mode to enable on a single Antenna. If your Reader has only 1 Antenna port, the DIP280 command is already enabled.

Host: [**DIP280**]
Where: **DIP280** = command
Reader Response: **<LF>OK<CR>**

A power reset is now necessary for this command to take effect followed by the appropriate [D] or [S] or [P] command. Ensure all (the appropriate number) of the Antennas are connected! Do not operate the Reader with Antennas enabled but not connected!!!

[D] - Duplicate Report Operating Mode (factory default) – Single Antenna

Tag data is reported in a duplicate manner, over and over again, as long as a Tag is present.

Host: [**D**]
Where: **D** = command
Reader Response: **<LF>OK<CR>**

[Dxxxx] - Duplicate Report Operating Mode – Multiple Antennas

If you have multiple Antennas, simply issuing the [D] command will not suffice, this will affect only Antenna #1. This command issues the Duplicate Report Mode to specified Antennas using the structure of 4321 where if you wish to set Antenna numbers 1 and 3 to the Duplicate Report Mode you would issue the command [D0101] with 1 being the significant indictor and zero not. Note, this command will also turn Antennas on or off. For example, if you issue the command [D1111] setting all

Antennas to the Duplicate Report Mode, then follow that with [D0101], Antenna #'s 2 & 4 will be turned off and not report any Tag data.

Host: [**Dxxxx**]
Where: **D** = command
xxxx = Antenna signifier, 1 being on and zero being off

Reader Response: **<LF>OK<CR>**

[S] - Single Report Operating Mode Command – Single Antenna

This command moves the Reader from its factory default Duplicate Report Operating Mode to Single Report Operating Mode for a single Antenna Reader. It will also be necessary to define the timeout counter of the buffered memory although there is a factory default timeout setting of 30 seconds. There is a 10 Tag memory buffer, (this can be changed via use of the [**4xx**] command) hence as long as 10 Tags or less are present, they will report only once until taken away from the Reader for the amount of time specified in the Y command. If more than 10 Tags are present, the 11th will overwrite the buffer of the oldest reported Tag.

Host: [**S**]
Where: **S** = command

Reader Response: **<LF>S<CR>**

[ST] + [Sxx]– Set Timing of Single Report Operating Mode Command

The ST command allows for Tags to be re-reported in the Single Report Operating Mode every nth amount of time as defined by the subsequent command [Sxx]. You would first issue the [ST] command to enter single report timing mode and then [Sxx] to define the amount of time in seconds between the same Tag being re-reported. You can exit the ST mode by issuing any other operating mode commands like [S], [D] or [P].

Host: [**ST**]
Where: **ST** = command

Reader Response: **<LF>ST<CR>**
Host: [**S10**] (sets to 10 seconds)
Where: **ST10** = command

Reader Response: **<LF>ST10<CR>**

[4xx] – Change Single Mode Memory Buffer Size

This command allows you to change the memory buffer from 1 to 10. Note, if 01 is designated the Reader will not read a new Tag until the original leaves the RF field.

Host: [**4xx**]
Where: **4** = command
xx = number of Tags to be buffered from 01 to 10

Reader Response: **<LF>OK<CR>**

[Sxx] - Single Report Operating Mode Command – Change Timeout Setting

This command moves the Reader from its factory default Duplicate Report Operating Mode to Single Report Operating Mode and allows you to define the time a Tag would need to leave the RF field before being re-reported for a single Antenna Reader. The factory default timeout setting is 3 seconds. There is a 10 Tag memory buffer, hence as long as 10 Tags or less are present, they will report only once until taken away from the Reader for the amount of time specified in this command. If more than 10 Tags are present, the 11th will overwrite the buffer of the oldest reported Tag.

Host: [**Sxx**]
Where: **S** = command
xx = time in seconds

Reader Response: **<LF>OK<CR>**

[Sxxxx] - Single Report Operating Mode Command – Multiple Antennas

If you have multiple Antennas, simply issuing the [S] command will not suffice. This command issues the Single Report to specified Antennas using the structure of 4321 where if you wish to set Antenna numbers 1 and 3 to the Single Report Mode you would issue the command [S0101] with 1 being the significant indictor and zero not. Note, this command will also turn Antennas on or off. For example, if you issue the command [S1111] setting all Antennas to the Single Mode, then follow that with [S0101], Antenna #'s 2 & 4 will be turned off and not report any Tag data. The Reader is factory default in the Duplicate Report Operating Mode. There is a 10 Tag memory buffer for the entire Reader, not per Antenna, hence as long as 10 Tags or less are present, they will report only once until taken away from the Reader for the amount of time specified in this command. If more than 10 Tags are present, the 11th will overwrite the buffer of the oldest reported Tag.

Host: [**Sxxxx**]
Where: **S** = command
xxxx = Antenna signifier

Reader Response: **<LF>OK<CR>**

[P] – Polling Mode Command

This command will place the Reader into a polling mode whereby no data will be reported until the Reader is issued the T command. To escape this mode, issue the D or S command.

Host: [**P**]
Where: **P** = command

Reader Response: **<LF>OK<CR>**

[Tx] - Transfer Request (Polling) Command for a single Tag

This command will turn on a specific Antenna for 400 milliseconds. If a Tag is present it will be read and reported. If the response "e" is received, no Tag was read.

Host: [**T1**]
Where: **T** = command
1 = Antenna #1

Reader Response: **<LF>T1<CR>**
<LF>1 DDDDDDDDDDDDDD<CR>
Where: **T1** = command echo
1 DDDDDDDDDDDDDD = Antenna address + Tag data

[5xx] – Set Counter for Number of Times a Tag is to be Read before being Reported

This command allows you to set the number of times the Reader should see the Tag before sending the data, from 1 to 99.

Host: [**5xx**]
Where: **5** = command
xx = 01 to 99

Reader Response: **<LF>OK<CR>**

[5xx] [Sxx] [S] – Set Counter of Times Tag is to be Read in nth Time before Reporting

This command in intended for applications fearing an unintended read. Imagine if you have 1 Tag in front of the Reader being monitored during a process, and another Tag or Tags pass by out of range but occasionally reports. This could interfere with the logic of your process thus this command will not report a spurious read. To return to the default settings issue [501] then [S03] then [S].

Host: [**5xx**] then [**Sxx**] then [**S**] Issue these commands one at a time
Where: **5** = number of times a Tag would need to read before being reported

xx = 01 to 99
S = amount of time that number of Tags would need to be read within
xx = 01 to 99 in seconds
S = To ensure Reader is in Single Report Mode.

Reader Response: **<LF>OK<CR>** after each of the 3 commands

[M5BWS] – Set Tag Memory Section to Read

This command allows you to place the Reader into a mode whereby it reads only a specified section of Tag memory. By default this option is not turned on except for Wiegand Readers with a factory default of [M5106].

Host: [**M5BWS**]
Where: **M5** = command
B = memory bank 1, 2 or 3
WS = word start 01, 02, 03 etc.
Receiver Response: **<LF>OK<CR>** for all settings

[STID] or [DTID] – Enable or Disable TID Data Reporting in Single Tag Report Mode

Host: [**STID**] or [**DTID**]

Reader Response: **<LF>OK<CR>**

Note: To disable this mode, simply enter the [S] or [D] command.

[SRFM] or [DRFM] – Enable or Disable Temperature Tag Data

Note: RFID, Inc.'s custom Temperature Sensing Tag must be used. Tag data will be reported like any regular EPC Tag but with the addition of XX.X with the X's representing a temperature in degrees C.

Host: [**SRFM**] or [**DRFM**]

Reader Response: **<LF>OK<CR>**

Note: To disable this mode, simply enter the [S] or [D] command.

[16xxx] – Change dBm Setting

This command allows you to change the Reader's dBm setting. Factory default is 27dBm. The parameters are with a precision of .05 dBm, thus substitute 245 for xxx to set to 24.5dBm.

Host: [**16xxx**]
Where: **16** = command
xxxx = new dBm setting
Receiver Response: **<LF>OK<CR>** for all settings

[15] – View Current dBm Setting

This command allows you to check the current dBm setting.

Host: [**15**]
Where: **15** = command
Receiver Response: **<LF>270<CR>** signifying 27.0dBm.

[7x] – Enable Relay numbers 1 or 2

This command enables the relay, closes the contacts.

Host: [**7x**]
Where: **7** = command and **x** = relay number 1 or 2
Receiver Response: **<LF>71<CR>** or **<LF>72<CR>**

[8x] – Disable Relay numbers 1 or 2

This command enables the relay, closes the contacts.

Host: [**8x**]
Where: **8** = command and **x** = relay number 1 or 2
Receiver Response: **<LF>81<CR>** or **<LF>82<CR>**

[9x] – Trigger Relay number 1 or 2

This command manually triggers a relay; closes the contacts for 1 timer cycle. The timer cycle is set by the [J] command.

Where: **9** = command and **x** = relay number 1 or 2

Host: [**91**] or [**92**]

Where: **91** or **92** = command

Receiver Response: **<LF>91<CR>** or **<LF>92<CR>**

[JMRTT] –Relay Program Timer

This command sets the individual relay timer to a user defined cycle. The default is 50 milliseconds.

Host: [**JP1TT**]

Where: **J** = command

M = Cycle mode, use '**P**' for milliseconds and '**H**' for seconds

R = Relay number, 1 or 2

TT = Cycle time, 01-99 seconds for H mode, 05-99 milliseconds for P mode

Receiver Response: **<LF>Echo of your command<CR>**

Example: Host: [**JP299**] sets relay #2 to 99 milliseconds and the Reader returns **<LF>JP299<CR>**

[LDx] –Loop Detector (Input) Command

This command enables or disables the Loop Detector Input. This is a toggle command.

Host: [**LDx**]

Where: **LD** = command & **x** = Loop detector #1 or #2

Readers Response: **<LF>LD11<CR>** or **<LF>LD10<CR>** or **<LF>LD21<CR>** or **<LF>LD20<CR>**

LD11 or LD21 = signifies loop detector activated

LD10 or LD20 = signifies loop detector disabled

The following two commands will place the Reader in a mode to remit the TID data as well as the default EPC data, both in the Single and Duplicate read modes by prefacing the command with an S or D. Refer to the Tag memory organization table on page 50. These commands currently work only with Antenna address 1.

[ZTVal] – Adjust Wiegand Times

Host: [**ZTVal**]

Where: Z = Base command

T = Time to adjust, 1 = pulse, 2 = gap

Val = Time in microseconds, minimum is 30, maximum is 3200

(defaults are Pulse = 100 and Gap = 1000)

If setting pulse to 200, the command is [**Z1200**]

Reader Response: **<LF>Z1200<CR>**

[ERS] – Reset EEPROM to Factory Defaults

Host: [**ERS**]

Reader Response: **<LF>OK<CR>**

Note: Power must be recycled in order for this command to take effect.

[I] – View Firmware Version Number

Host: [**I**]

Reader Response: **<LF>Version Number OK<CR>**

[V] – View Current Settings (available on firmware version 1.37 and higher)

Host: [**V**]

Reader Response:

Mode R = D (Single or Duplicate Reading Mode)

Tag Length = (this is the EPC data length, options of 8, 16, 24 and 40)

Mode R = (options are 1, 2, 3, the latter is standard, 1 & 2 are proprietary modes)

DIP 1 = (see page 20, use hex scheme of 8,4,2,1. 07 response would equal bits 8, 7, 6, 5 all being OFF represented by 0 for hex character 1 and bits 3, 2, 1 being ON represented by hex character 7, 4+2+1=7)

Baud Rate = (self-explanatory)

Modbus RTU = (options are OFF or ON)

Modbus TCP = (options are OFF or ON)

DIP 2 =

Single or Multiple Antennas = (number of Antennas turned on, see DIP200 and DIP280 commands)

RSSI = (OFF or ON)

Number of Channels = (options are ALL or specifically tuned channels)

Understanding Options to Programming UHF Tags

There are two methods or operating modes for programming Tags.

1. RFID, Inc.'s EasyWrite™ proprietary firmware (patent pending). This a very simple method of programming Tags through simple ASCII keystrokes. Off the shelf this option offers 24 hex characters of data (0-9 + A-F) however more can be provided upon request.
2. EPC standard open Tag memory protocol. Due to the amount of security and safeguards written into this ISO Standard, the writing of Tag memory is in depth, arduous. The following section details this method of writing Tags first. If this is too in depth for your needs and EasyWrite™ is preferred, skip down to that section. All necessary commands and information will be repeated where necessary. However you may wish to peruse this first section to understand the architecture of Tag memory.

EPC Standard Open Tag Memory Protocol

Let's take a look first at the organization of Tag memory. A word is 16 bits, also known as 2 bytes and appears as 4 hex characters.

Block or Bank	Word Address	Description	Memory Size
00	00	Kill Password	32 bits
	01	Access Password	32 bits
01	00	CRC-16	16 bits
	01	Protocol Control (this is the first appearance of Tag data) 3000 = no data in user memory 3400 = data present in user memory	16 bits
	02	EPC Data (total EPC data in sub-addresses 02-07 = 96 bits	16 bits
	03	EPC Data	16 bits
	04	EPC Data	16 bits
	05	EPC Data	16 bits

	06	EPC Data	16 bits
	07	EPC Data	16 bits
02		TID (tag identification) ROM, cannot be changed	96 bits
03	Varies 00-?	User Memory, most often 512 bits, some as high as 2k bits	Varies

Let's take a look at the following Tag data that reports by default upon a Tag read:

3000E20083666611006713208E54

Now let's use the same table above and fill in this Tag data broken into 16 bits (1 word) increments.

Block or Bank	Word Address	Data	Description	Memory Size
00	00		Kill Password	32 bits
	01		Access Password	32 bits
01	00		CRC-16	16 bits
	01	**3000**	Protocol Control (this is the first 4 Tag data bytes) 3000 = no data in user memory, EPC Length 6 words (factory default) 3400 = data present in user memory, EPC Length 6 words (factory default) 5000 = no data in user memory, EPC Length 10 words 5400 = data present in user memory, EPC Length 10 words	16 bits
	02	**E200**	EPC Data (total EPC data in sub-addresses 02-07 = 96 bits	16 bits
	03	**8366**	EPC Data	16 bits
	04	**6611**	EPC Data	16 bits
	05	**0067**	EPC Data	16 bits
	06	**1320**	EPC Data	16 bits
	07	**8E54**	EPC Data	16 bits
02			TID (tag identification) ROM, cannot be changed	96 bits
03	Varies 00-?		User Memory, most often 512 bits, some as high as 2k bits	Varies

Now that the memory structure is understood, it is also important to understand that this is an anti-collision technology, meaning more than one Tag can be read AND written at a time. This is a potential catastrophic problem that needs rules to avoid reading and writing the wrong Tag. If a write command is sent from the Reader, unless a particular Tag is addressed, the wrong Tag or Tags within the Reader's reach will be written. The same goes for reading Tags. If a read or write command is

sent, ALL Tags within the Reader's reach will be read or written. In order to avoid this potential catastrophic problem, you can call out for a single particular Tag among many to be read or written by matching the EPC section of the Tag's memory in the command to read or write.

Complex Read [R] or Write [W] for EPC Standard:

The commands have the format of [RAEPCBBWAWL] or [WTAEPCBBWAWLData] to Read or Write a particular set Tag words.

Parameter	Description
R or WT	Read Words Command = R Write Words Command = WT
EPC	Actual EPC data bank of the target Tag
BB	Bank to be read
WA	Word address to begin read or write
WL	Word length of how many words to be read or written

Example assuming this Tag EPC data:

3400E234000000671289EA12E3AF

Note: The first word of EPC data (3400) is never used.

Command to Read - [RE234000000671289EA12E3AF030502]

Read the words from Block 3 USER memory starting at word 05, 2 words.

Command to Write - [WTE234000000671289EA12E3AF03050212345678]

Write the 2 words 12345678 in Block 3 USER memory starting at word 05.

If the parameters are correct, if the EPC matches the data in the EPC memory of the Tag, the Reader will allow the Read or Write command responding with:

Read - the section of memory requested

No Read – <e>

Write Fail - <LF>FAILED<CR>

Write Successful - <LF>PROGRAMMED<CR> followed by Tag data

RFID, Inc.'s EasyWrite™ Tag Programming

An easier method to program the EPC memory portion of Tags is to use our EasyWrite™ method by simply issuing a [Wdata] for Readers with a single Antenna or [WAdata] command for Readers with multiple Antennas, where W = Write and A=Antenna. If there is more than one Tag present, the Write will fail thus you need not worry about the danger of programming unintended Tags as the Reader will fail to program any Tag and respond with <LF>MORE THAN ONE TAG<CR> <LF>Failed<CR> if there is more than one Tag present. You can ensure this success by either creating a process whereby other Tags are well out of range, or non-intended Tags are stored in a metal box or wrapped in tin foil.

If you would simply like to program 100 Tags with the data A100 to A199, the command you would enter to program the first Tag is as simple as this: [W1A100], where W = Write and 1 = Antenna #1. Our firmware automatically places the data left justified and fill any unspecified characters in with zeroes.

The resulting responses from the Reader will be either:

1. <LF>MORE THAN ONE TAG<CR> <LF>FAILED<CR>
2. <LF>PROGRAMMED<CR> followed by Tag data

<LF>3000A10000000000000000000000<CR> or
<LF>3400A10000000000000000000000<CR> or
<LF>5000A10000000000000000000000<CR> or
<LF>5400A10000000000000000000000<CR>

The Protocol Control data being reported in the first 4 characters as either 3000, 3400, 5000, or 5400.

Troubleshooting

Question: When I apply power, none of the red LED's come on. It looks as if the unit is dead.

Answer 1: Repower the unit, it may have locked up.

Answer 2: Check to see if power polarity is reversed. If so, our 250VAC 2amp fuse may need replacing. If power is reversed long enough it is possible to have rendered the Reader unrepairable.

Question: When presenting a Tag to the Antenna I do not get a read indication on the COM LED.

Answer 1: Check the connections to the Antenna to ensure any male pins have not bent.

Answer 2: Are the LED's dim or fully bright. If dim, not enough wattage is being supplied to the Reader.

Question: When presenting a Tag to the Antenna I do get a read indication on the COM LED but no Tag data appears in the terminal program.

Answer: Concentrate first on your communications cable and connections (say USB or TCPIP). Remember the default baud rate is 115,200. Test your cable elsewhere if possible or switch out using a known good cable. Then look to the settings of communications, specifically say the COM port chosen if using RS232 or USB, followed by the baud rate.

Warranty

RFID, Inc. products are warranted against defects in materials and workmanship for one (1) year from date of shipment. RFID, Inc. shall, at its option, either repair or replace products that prove to be defective and are returned with freight prepaid to RFID, Inc.'s plant within the warranty period. The foregoing warranty shall not apply to defects resulting from abuse, misuse, accident, alteration, neglect or unauthorized repair or installation. RFID, Inc. shall have the right of final determination as to the existence and cause of the defect.

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