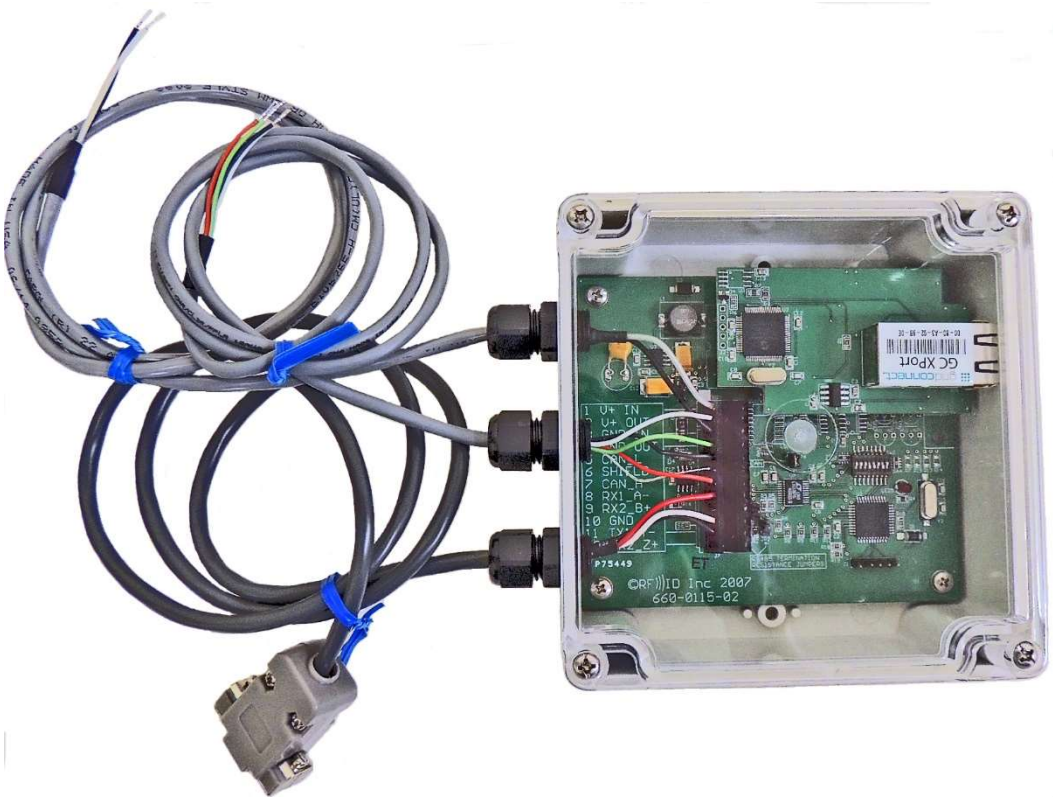
Product Manual

Model 8080E Modbus TCP Series Interface

for LF 125 kHz and 148 kHz Smart Antennas



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How to Contact Us

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Part Numbers

Model Number	Part Number	Description
8080E-04SA08	801-8080-04SA08	Model 8080E-04SA08 Modbus TCP Interface, CAN Smart Antennas, 1 each M12 connection for CAN only, 10' power pigtail wiring, 24vdc, 8 characters
8080E-04SA08M12M	801-8080-04SA08M12M	Model 8080E-04SA08M12M Modbus TCP Interface, CAN Smart Antennas, 1 each M12 male conn for CAN & 1 each M12 male conn for pwr, 24vdc, 8 char
8080E-04SA08M12F	801-8080-04SA08M12F	Model 8080E-04SA08M12F Modbus TCP Interface, CAN Smart Antennas, 1 each M12 female conn for CAN & 1 each M12 female conn for pwr, 24vdc, 8 char
8080E-14SA08	801-8080-14SA08	Model 8080E-14SA08 Modbus TCP Interface, CAN Smart Antennas, 10' pigtail wiring for CAN & power, 24vdc, 8 characters
8080E-24SA08	801-8080-24SA08	Model 8080E-24SA08 Modbus TCP Interface, CAN Smart Antennas, 10' dual pigtail wiring for CAN & power, 24vdc, 8 characters
8080E-04SA16	801-8080-04SA16	Model 8080E-04SA08 Modbus TCP Interface, CAN Smart Antennas, 1 each M12 connection for CAN only, 10' power pigtail wiring, 24vdc, 16 characters
8080E-14SA16	801-8080-14SA16	Model 8080E-14SA08 Modbus TCP Interface, CAN Smart Antennas, 10' pigtail wiring for CAN & power, 24vdc, 8 characters
8080E-24SA16	801-8080-24SA16	Model 8080E-24SA08 Modbus TCP Interface, CAN Smart Antennas, 10' dual pigtail wiring for CAN & power, 24vdc, 8 characters

Hardware Description

This Interface is the master in managing a network of up to 32 networkable CAN based RFID Readers termed Smart Antennas (or as a Modbus TCP bridge from our series of serial Reader Models 4000E, 5000E, and 7000E), and ultimately presents RFID Tag data from the networked Smart Antennas in Ethernet/IP format. Any sections of this manual pertaining to settings or functions with serial RFID Readers have the word serial highlighted in yellow to alert users of the CAN based Smart Antennas those sections can be skipped or ignored. Dual pigtail wiring would be used if the Interface is to be located in the center of the trunk network line of Smart Antenna RFID Readers thus providing a connection in either direction or an M12 T-Connector can be used to split the single on board M12 connector into two directions.

Specifications

Physical:	Dimensions (w/o connectors):	4.8" square x 2.175"	122mm square x 55mm
	Weight (w/o cable):	11 oz.	312 grams
	Connector Options:	CAN Port(s): M12 or pigtails	Power: M12, Quick Connect power jack or pigtails
		RS232 Port: 9pin D-sub or pigtails	Ethernet/IP: RJ45

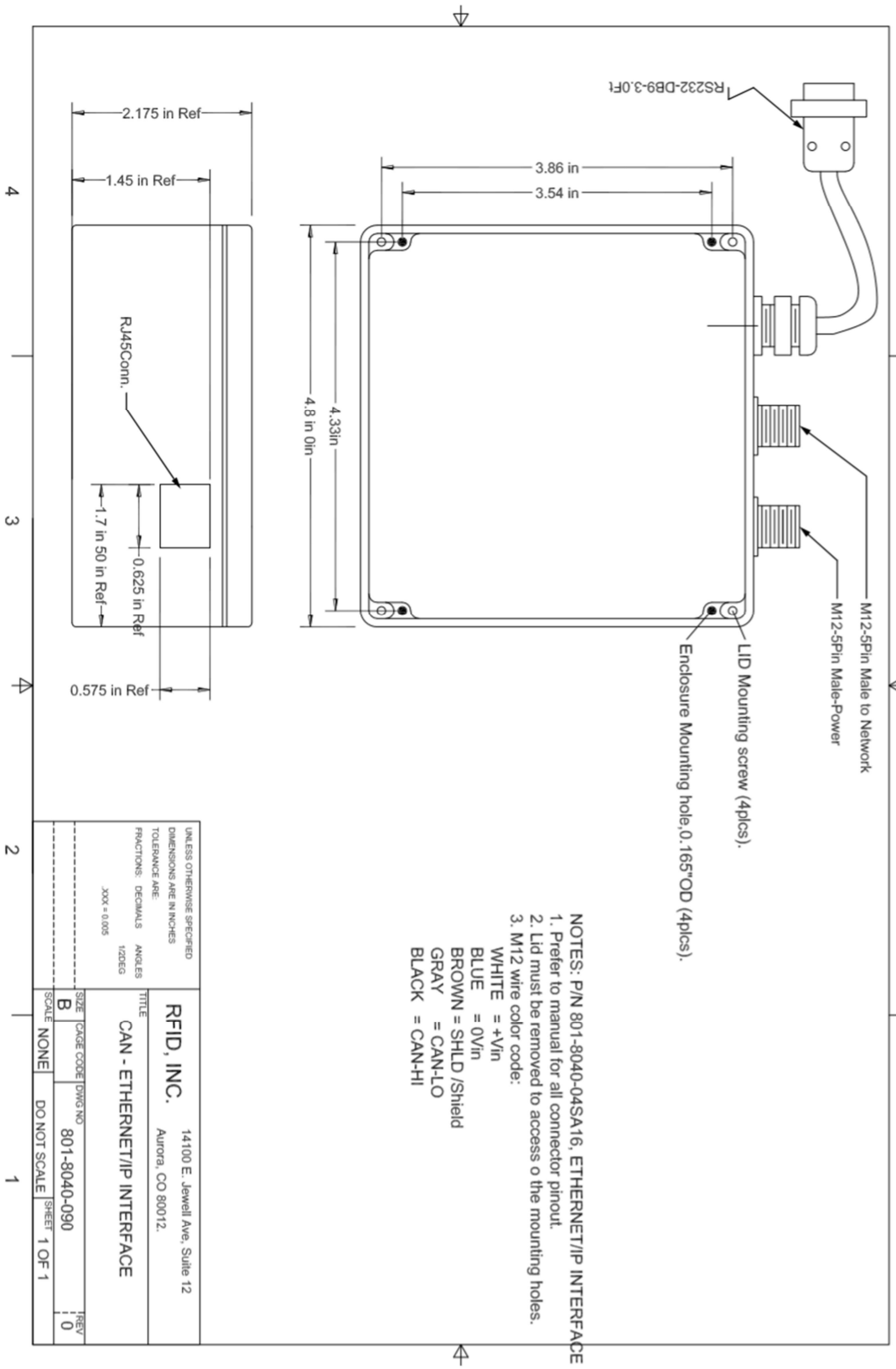
Electrical:	Input:	+9VDC – +28VDC	
	Draw:	125mA min – 200mA max	150mA typical

Materials:	Housing, Base:	Polycarbonate, opaque	NEMA 4X
	Lid:	Polycarbonate, clear	
	LED:	On = power	Blink = read achieved

Environment:	Storage Temperature:	-40°F to 185°F	-40°C to +85°C
	Operating Temperature:	-40°F to +131°F	-40°C to +55°C
	Certs:	IP-50	RoHS & CE

Drawing

Modbus TCP Interface w/M12 Connectors Drawing Shown


RS232-DB9-3.0Ft
2.175 in Ref
1.45 in Ref
RJ45Conn.
1.7 in 50 in Ref
0.625 in Ref
0.575 in Ref
3.86 in
3.54 in
4.8 in 0in
4.33in
M12-5Pin Male to Network
M12-5Pin Male-Power
LID Mounting screw (4plcs).
Enclosure Mounting hole,0.165"OD (4plcs).
NOTES: P/N 801-8040-04SA16, ETHERNET/IP INTERFACE
1. Prefer to manual for all connector pinout.
2. Lid must be removed to access o the mounting holes.
3. M12 wire color code:
WHITE = +Vin
BLUE = 0Vin
BROWN = SHLD /Shield
GRAY = CAN-LO
BLACK = CAN-HI
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCE ARE:
FRACTIONS DECIMALS ANGLES
.XXX = 0.005 1/2DEG
RFID, INC.
14100 E. Jewell Ave, Suite 12
Aurora, CO 80012.
TITLE
CAN - ETHERNET/IP INTERFACE
SIZE B
CAGE CODE
DWG NO 801-8040-090
REV 0
SCALE NONE
DO NOT SCALE
SHEET 1 OF 1

Pigtail Wire Specifications

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

Power Requirements

The Interface 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 Interface should be operated from a grounded supply that has the same ground reference as the host computer or logic device.

Cabling the Interface – Power

The Interface is delivered with either a single set of pigtail wires, a single M12 CAN connector, or dual pigtail connectors, according to the following part number suffixes:

-04SA08 or -04SA16 – Single M12 connector (drawing shown on page 5)

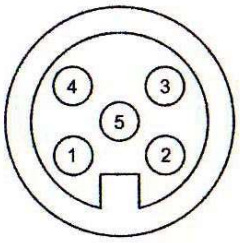
-14SA08 or -14SA16 – Single set of pigtail wiring (photo shown on page 1)

-24SA08 or -24SA16 – Dual sets of pigtail wiring

Wiring Color Codes

CAN WIRE COLOR	SIGNAL NAME
RED	+9 to +28VDC Input Unfused
BLACK	DC Ground (-)
WHITE	CAN-HI
BLUE	CAN-LO
BARE/DRAIN	EARTH GROUND, DRAIN, SHIELD
RS232 WIRE COLOR	**SIGNAL NAME**
BLACK	Tx
RED	Rx
WHITE	Ground

M12 Pinouts



Pin No.	Description
1	DRAIN
2	+VDC
3	-VDC
4	CAN-HI
5	CAN-LO

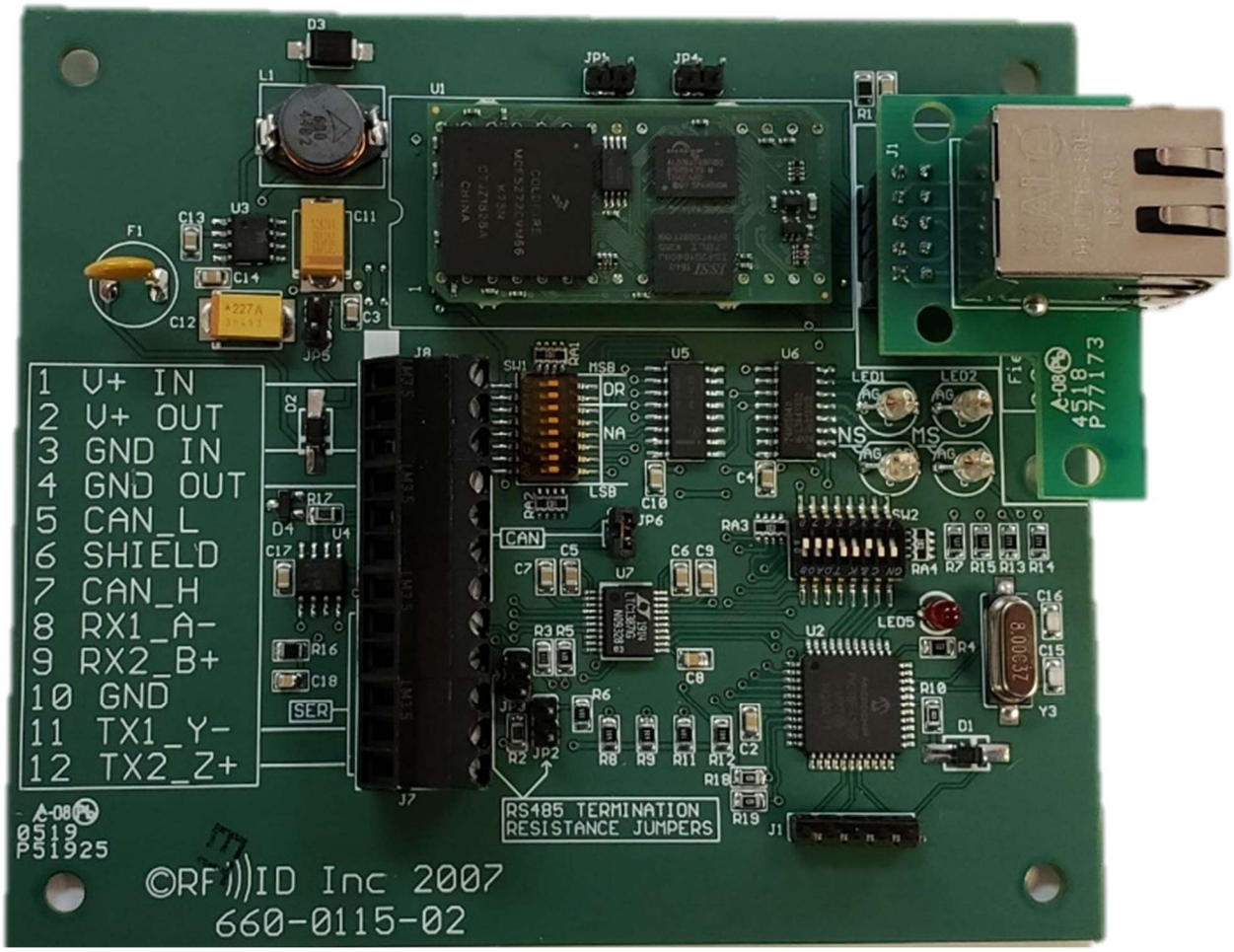
CAN-M12
CONNECTOR

Cabling the Interface to Networkable Smart Antenna Readers

It is necessary to apply termination resistance to both ends of the network trunk line with 120 Ohm resistors. RFID, Inc. supplies an accessory M12 connection with termination resistor installed. For

Interfaces with pigtail wiring, it is necessary for you to source and solder your own resistor across the CAN high and CAN low lines.

For most operations, the Interface is at the beginning of the network trunk with Readers cabled in one direction and termination resistance applied at the last Reader. The Interface contains a built-in resistor to complete the inherent trunk resistance needs. This resistor can also be disabled. As an option, the Interface can be placed in the trunk line with Readers cabled in separate directions, for example 16 Readers in one direction, and 16 Readers in another direction. In this case the Interface's built-in resistor needs to be disabled and termination resistance added to each of the last Readers. To disable the Interface's termination resistance, remove the shunt from the 2 pins located in the direct center of the Interface's PCBA labeled CAN or JP6.



CAN Smart Antenna Readers and LF Passive RFID Tags

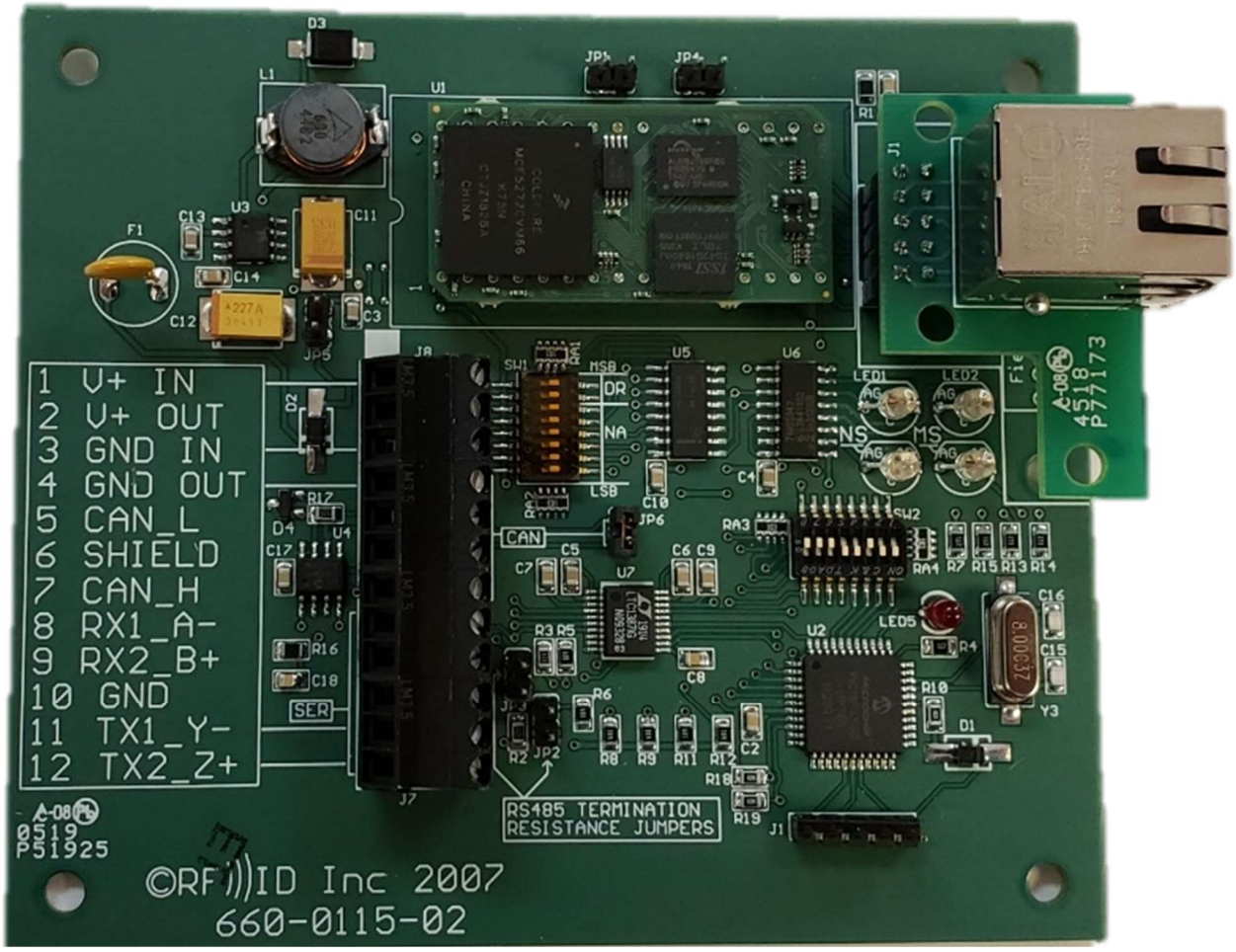
Smart Antenna RFID Readers are addressable and simply provide a means of emitting the RF signal to energize a Tag, receive data back from a Tag and pass Tag data back to the Interface. Smart Antennas can also program RFID Tags. RFID Tags store 8 or 16 ASCII characters (limited to capital letters, numbers and some symbols). Smart Antenna Readers operate at +9VDC to +28VDC consuming 160mA max.

Integer Data

Although the Smart Antenna RFID Readers and Tags use 8 or 16 character formats, the Model 8080E Interface can convert DINT data from the Modbus TCP scanner to 8/16 character numerical strings and convert the string from the Tag into a DINT before sending to the Modbus TCP bus.

SW1 & SW2 Dipswitches

The SW1 switch block is inactive. SW2 is located at right center shown below used to configure ASCII or Integer data, serial type, and serial baud rate.



RW/RO (read write or read only)

All Smart Antenna Readers are RW. When the Interface is configured for RO however, you are simply removing Tag data from the scanner output. Use the SW2 dipswitch settings of the first 4 rows below for networkable CAN Smart Antenna Readers and the second 4 rows for serial Readers like the Models 4000E, 5000E, 7000E:

Summary Default Settings

RS232 - Full Duplex, 9600, 8, N, 1, Single Read Mode

Modbus TCP – CAN RW Integer, Dynamic IP Address, Single Tag Report Read Mode

Defaults are noted with an asterisk in tables below

Switch 1 (LSB)	Switch 2	Switch 3	Smart Antenna Data Type
OFF	ON	OFF	CAN ASCII RW*
ON	ON	OFF	CAN INTEGER RW
OFF	ON	ON	CAN ASCII RO
ON	ON	ON	CAN INTEGER RO
OFF	OFF	OFF	SERIAL ASCII RW
ON	OFF	OFF	SERIAL INTEGER RW
OFF	OFF	ON	SERIAL ASCII RO
ON	OFF	ON	SERIAL INTEGER RO

Table 1 - SW2 CAN Smart Antenna Interface Modes

The Modbus TCP Interface can only use even values. The extra byte of data must be ignored

Type	CMD	DATA	Total	Actual
CAN ASCII RW*	1	16	17	18
CAN INTEGER RW	1	4	5	6
CAN ASCII RO	1	16	17	18
CAN INTEGER RO	1	4	5	6

Table 2 - CAN Smart Antenna Modbus TCP data sizes

Serial Port Settings

Switch 4	Switch 5	Switch 6	Serial Baud Rate
OFF	OFF	OFF	1200
ON	OFF	OFF	2400
OFF	ON	OFF	4800
ON	ON	OFF	9600*
OFF	OFF	ON	19200
ON	OFF	ON	38400
OFF	ON	ON	Do not use
ON	ON	ON	Do not use

Table 3 - SW2 & Baud Rate Selection

*9600, 8, 1, N

RS232 full duplex, RS422 full duplex (5 wire), RS422 half-duplex (3 wire)

Switch 7	Switch 8	Serial hardware type
OFF	OFF	RS232 full duplex*
ON	OFF	RS422 half-duplex
OFF	ON	RS422 full duplex

Table 4 - SW2 Serial Port Hardware Select

The Modbus TCP Interface can only use even values. The extra byte of data must be ignored.

TYPE	CMD	DATA	Total	Actual
SERIAL ASCII RW	1	16	17	18
SERIAL INTEGER RW	1	4	5	6
SERIAL ASCII RO	1	16	17	18
SERIAL INTEGER RW	1	4	5	6

Table 5 – Serial Port Modbus TCP Data Sizes

Start & End Characters for Serial to Modbus TCP Bridge Mode

This section pertains only to use of the Interface when linked with serial Readers, NOT the networkable CAN Smart Antenna Readers. The serial port software frames Tag data from the Smart Antenna RFID Readers based on its End and Start character settings. Start may be set to zero in which case any character is accepted as a start character. End must be set to a value other than zero to delimit incoming tag data.

The default settings are:

Start = 0x00

End = 0x0D (Carriage return)

Serial Port Commands to the Interface

The characters of open square bracket and closed square bracket are used to frame an incoming command message. When the serial port software receives the open square bracket [character it expects the rest of the message to be a command and the last character to be a closed square bracket].

[1CXX]

Format: 1 = Start and End Char setting, C = Start or End character, XX = hex value

Valid values: C = ‘S’ or ‘E’, XX = a hex value. Values outside of ASCII letters and numbers are recommended

Response: OK

Example 1: [1S0A] sets the start character as a Line Feed

Example 2: [1E0D] sets the end character as a Carriage Return

Example 3: [1S00] sets the start character to none

[2NNOO] – Change Reader Address

Format: 2 = Set Reader CAN address, NN = New CAN address, OO = Current (old) CAN address

Valid Addresses: 01 to 32

Response: OK, FAILED1, or FAILED2

Example: [23001] change Reader from address #01 to address #30

Example response 1: OK = #01 existed on the CAN bus and has been reset to #30

Example response 2: FAILED1 = #01 does not exist on the bus

Example response 3: FAILED2 = #30 is already in use

[3]

Format: 3 = Scan for present Readers

Response: Reader addresses found including character length as in ADD-LEN

Example: [3] Request a scan of present Readers

Example response 01-08 07-08 19-08 31-08

[S] (default operating mode)

This command changes the data output mode to SINGLE on the Modbus TCP connection, meaning a Tag will be read and reported one time.

Format: S = Single Mode

Response: OK

Example: [S]

[SC]

This command changes the data output mode to SINGLE on the Serial connection.

Format: SC = Single Mode

Response: OK

Example: [SC]

[P]

This command changes the data output mode to POLLING on the Modbus TCP connection. Use [TAA] command below to poll.

Format: P = Polling Mode

Response: OK

Example: [P]

[PC]

This command changes the data output mode to POLLING on the Serial connection. Use [TAA] command below to poll.

Format: PC = Polling Mode

Response: OK

Example: [PC]

Serial Port Commands to the Smart Antenna RFID Readers

[8AAXX]

This command enables or disables the antenna Tag Present functionality. When enabled the reader will report all Fs when the tag leaves the field. The interface uses that information to set or clear the TP bit.

Response: Reader address followed by OK

Example: [80201] Enable TP for antenna 02

Example: [80400] Disable TP for antenna 04

Example response: 01 OK

[MAAXX]

This command changes the write mode of the addressed Smart Antenna Reader. There are different types of RFID Tags with differing types of coils and tuning. The values discussed below place a Smart Antenna Reader into the writing mode appropriate to the RFID Tags in your possession. Default mode is 18, used for all planar coil-based Tags. Mode 08 is used for all ferrite coil-based RFID Tags. Contact us if you are unsure or having difficulty in writing Tags.

Format: M = mode command, AA = CAN address, XX = value

Valid values: 00, 08, 10, 18

Response: If successful OK, if not ERROR

Example: [M1218] Establish new WRITE MODE value to Smart Antenna Reader #12

Example response: 12 OK, 12 = Reader #, OK = successful EEPROM change

[VAA]

This command reads the addressed Reader's write mode

Format: AA = CAN address, V = view

Response: The value of addressed Reader write mode

Example: [V07] Read WRITE MODE value of Reader #07

Example response: 07 18, 07 = reader #, 18 = WRITE MODE

[TAA]

This command erases the Readers' Tag buffer causing it to read the tag again if one is present. If the Reader does not respond within 400mS, the master ends the command by sending a lower-case e. If a Tag is present to the Reader, then the master outputs the Tag data normally

Format: AA = CAN address, T = poll

Response: e = no tag in range, or Tag data = Tag present to Reader

[IAA]

This command reads the firmware version of the addressed Reader

Format: AA = CAN address, I = Firmware Version

Response: The current Firmware version AA v.x.xx

Response format: AA = Reader address, v.x.xx = Firmware Version

Example: [I22] Read the Firmware Version of Reader #22

Example response: 22 v.1.12, 22 = Reader #, v.1.12 = firmware version

[WAADATA]

Writes 8 or 16 characters of data for tag on addressed Reader

Format: W = Write command, AA = CAN address, DATA = 8 or 16 ASCII characters

Response: PROGRAMMED if successful, FAILED if not successful

Example: [W015555555533333333] Write 5555555533333333 to tag on Reader 1

Example response successful: PROGRAMMED

Example response if failure: NO RESPONSE

Setting up Modbus TCP Interface

Our Interface uses an XPORT loaded with special MODBUS TCP software. We ship the units set for DHCP dynamic IP by default. Use Lantronix DeviceInstaller to search for our device in your network.

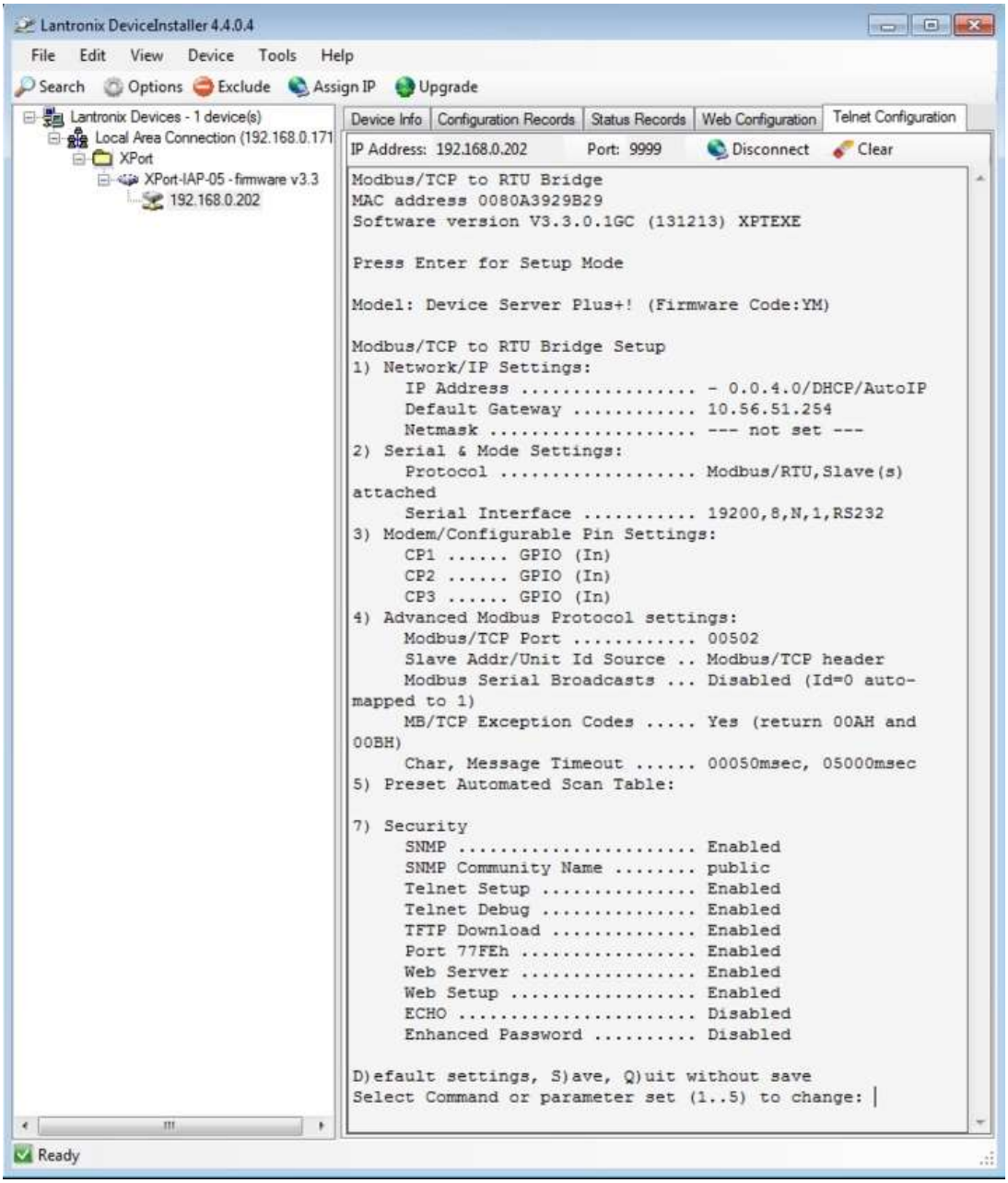


Figure 1 - Find Device

On the telnet tab you can find the XPORT settings, leave as sent from the factory. To change the IP to static. Use the button Assign IP as seen on Figure 2 and follow the wizard.

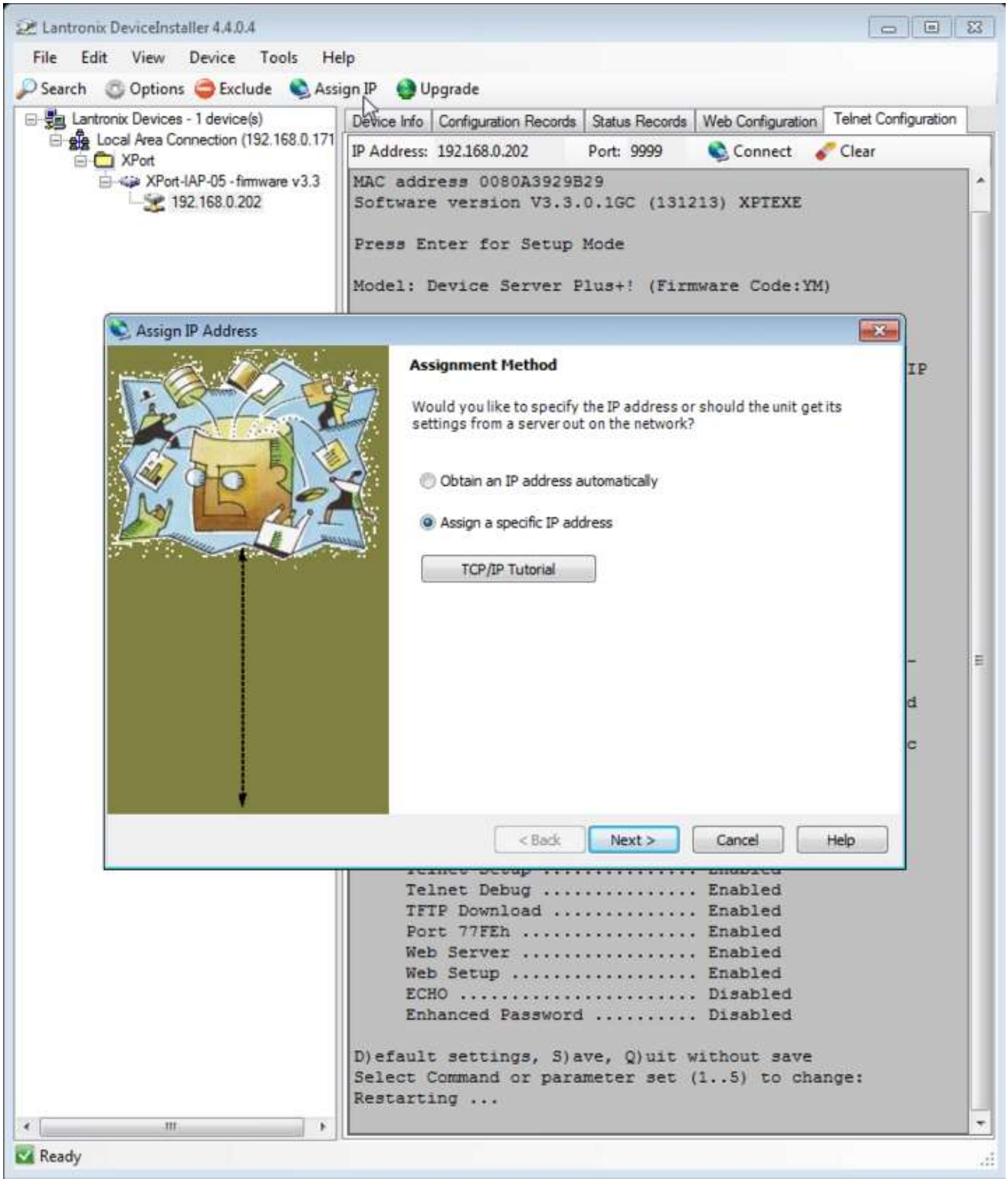


Figure 2 - Assign IP

Issuing Commands via Modbus TCP

Use registers 0x0001 to 0x0024 issue the same commands used on the serial port. Just write the command to those registers and it will be executed.

"I/O Command Bits 1 Byte"

Description

This Byte should be the first one on any setup. It is via this byte that commands are sent from the Ethernet/IP scanner to the Smart antennas. The In Byte contains error bits to indicate command failure types; the data type bits are also there, they indicate if ASCII or Integer mode is being used.

Command Byte Out (from scanner):

Byte	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
CMD	Not Used, Write with Zeros				Command code bits			Out Toggle

Command Byte In (to scanner):

Byte	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
CMD	Data Type Bits		TP	Error	Command code bits			In Toggle

Out Toggle bit

Every time this bit is toggled, the slave will execute the command as per the command bits.

In Toggle bit

The salve toggles this bit every time it loads new values on to the field bus.

Tag Present Bit

If enabled the antenna will set this bit while when reading, and clear it when the tag leaves.

Smart Antenna ASCII	0	0
Smart Antenna INTEGER	0	1
Serial Reader ASCII	1	0
Serial Reader INTEGER	1	1

Table 6 - Data Type Bits 6:7

Smart Antenna Reader Addressing

Description

Smart Antenna Readers retain their address in onboard EEPROM. To change the address, use the RS232 connection to issue the [2XXXX] command. If two or more Smart Antenna Readers have the same address on the bus, the system will not know due to the anti-collision hardware. It is the responsibility of the user to manage Smart Antenna Reader addresses. Always use permanent labels to mark your addresses.

New Smart Antenna Reader installation

New Smart Antennas come with the address 01; before they can be used, you need to assign them an operational address

1. Use the command [2xx01] to assign the new address where xx = new address.
2. You should receive the response of OK. If so, skip the rest you are done.
3. If you receive a FAILED_X response, refer to Serial Port Commands to the Smart Antenna RFID Readers on page 12 for details.

Reassign Smart Antenna Reader Address

1. If you don't know a Smart Antenna Reader's address disconnect all **other** Readers from the network.
2. Run a [3] scan command to learn the Reader address.
3. Use [2XXXX] to assign a new address.
4. Reconnect the rest of your Readers and run [3] scan command again.
5. If the number of addresses on the scan matches the number installed, you are done.
6. If you have duplicate addresses in the network, remove one Reader at a time while running [3] scan each time.
7. After removing a Reader check that the [3] command returns one less Reader address than before.
8. If you remove a Reader and the [3] command returns the same number of addresses it did before you removed it, you have found the duplicate. Follow steps 1 to 4 to assign it a new address.

Smart Antenna Reader Register Addresses

Each antenna uses 9 registers (18 bytes) in 16-character mode, 5 registers (10 bytes) in 8-character mode and 3 registers (6 bytes) in Integer mode.

Antenna	Hex ZERO based	Hex ONE based	Modicon 5 char
1	0x0200	0x0201	40513
2	0x0228	0x0229	40553
3	0x0250	0x0251	40593
4	0x0278	0x0279	40633
5	0x02A0	0x02A1	40673
6	0x02C8	0x02C9	40713
7	0x02F0	0x02F1	40753
8	0x0318	0x0319	40793
9	0x0340	0x0341	40833
10	0x0368	0x0369	40873

11	0x0390	0x0391	40913
12	0x03B8	0x03B9	40953
13	0x03E0	0x03E1	40993
14	0x0408	0x0409	41033
15	0x0430	0x0431	41073
16	0x0458	0x0459	41113
17	0x0480	0x0481	41153
18	0x04A8	0x04A9	41193
19	0x04D0	0x04D1	41233
20	0x04F8	0x04F9	41273
21	0x0520	0x0521	41313
22	0x0548	0x0549	41353
23	0x0570	0x0571	41393
24	0x0598	0x0599	41433
25	0x05C0	0x05C1	41473
26	0x05E8	0x05E9	41513
27	0x0610	0x0611	41553
28	0x0638	0x0639	41593
29	0x0660	0x0661	41633
30	0x0688	0x0689	41673
31	0x06B0	0x06B1	41713
32	0x06D8	0x06D9	41753

Table 7 - Antenna data register address.

Other Registers

Registers	Hex ZERO based	Hex ONE based	Modicon 5 characters	Max Reg
Command Registers	0x0000	0x0001	40001	18
Last Command	0x0100	0x0101	40257	18

Table 8 - Command and Last command register area.

Tag registers expanded. (Using antenna 1 as an example with hex ONE based addressing)

Register	High byte	Low byte
0x0201	Command bits	Rightmost tag Character 1 (MSB)
0x0202	Character 2	Character 3
0x0203	Character 4	Character 5
0x0204	Character 6	Character 7
0x0205	Character 8	Character 9
0x0206	Character 10	Character 11
0x0207	Character 12	Character 13
0x0208	Character 14	Character 15
0x0209	Leftmost tag Character 06 (LSB)	Not used left as 0

Table 9 – 16 character antenna 1 expanded.

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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