A Sierra Monitor Company

# Driver Manual

**(Supplement to the FieldServer Instruction Manual)**

# FS-8700-32 Modbus Tek_Air

**APPLICABILITY & EFFECTIVITY**

**Effective for all systems manufactured after January 2012**

| | |
|---|---|
| Driver Version: | 1.02 |
| Document Revision: | 3 |

## TABLE OF CONTENTS

# 1 MODBUS TEK-AIR DESCRIPTION

The Tek-Air Modbus RTU driver allows the FieldServer to transfer data to and from Tek-Air devices over either RS-232 or RS-485 using the Enhanced Tek-Air Modbus RTU protocol. The driver was developed for Modbus Application Protocol Specification V1.1a" from Modbus-IDA. The specification can be found at www.modbus.org. Modbus_Tekair is the same as Modbus_RTU, except that it has the ability to concentrate bytes of data in a packet to create floating point values. The order in which the bytes are combined and the address range used was developed specifically for the Tek-Air/Modbus interface. To accommodate this, the driver must be configured to poll using odd numbered addresses as two integer registers are used for every floating point value. If this value is stored in a floating point data array, it will be retrievable in the correct format on the Server side. Note that the Tekair "Double" data type is not supported.

The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer.

# 2 DRIVER SCOPE OF SUPPLY

## 2.1 Supplied by FieldServer Technologies for this Driver

| FieldServer Technologies PART # | DESCRIPTION |
|---|---|
| FS-8915-10 | UTP cable (7 foot) for RS-232 use |
| FS-8917-02 | RJ45 to DB9F connector adapter |
| FS-8917-01 | RJ45 to DB25M connection adapter |
| SPA59132 | RS-485 connection adapter |

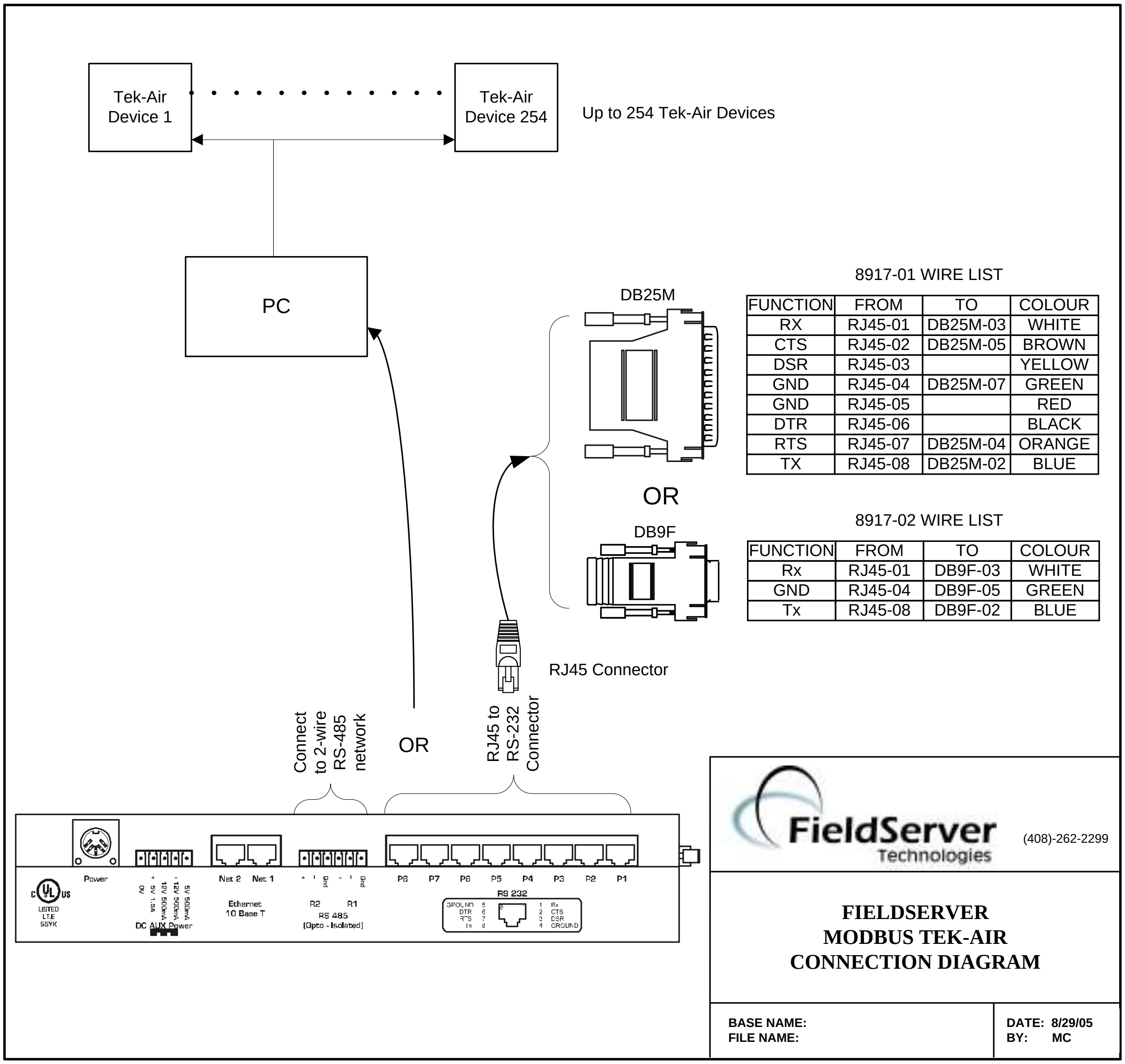
## 2.2 Provided by Supplier of 3rd Party Technology

| PART # | DESCRIPTION |
|---|---|
|  | Tek-Air device |

# 3 HARDWARE CONNECTIONS

The FieldServer is connected to the Modbus_Tekair as shown in connection drawing.

Configure the Modbus Tek-Air according to manufacturer's instructions



8917-01 WIRE LIST

| FUNCTION | FROM | TO | COLOUR |
|---|---|---|---|
| RX | RJ45-01 | DB25M-03 | WHITE |
| CTS | RJ45-02 | DB25M-05 | BROWN |
| DSR | RJ45-03 | | YELLOW |
| GND | RJ45-04 | DB25M-07 | GREEN |
| GND | RJ45-05 | | RED |
| DTR | RJ45-06 | | BLACK |
| RTS | RJ45-07 | DB25M-04 | ORANGE |
| TX | RJ45-08 | DB25M-02 | BLUE |

8917-02 WIRE LIST

| FUNCTION | FROM | TO | COLOUR |
|---|---|---|---|
| Rx | RJ45-01 | DB9F-03 | WHITE |
| GND | RJ45-04 | DB9F-05 | GREEN |
| Tx | RJ45-08 | DB9F-02 | BLUE |

FIELDSERVER
MODBUS TEK-AIR
CONNECTION DIAGRAM

BASE NAME:
FILE NAME:

DATE: 8/29/05
BY: MC

# 4 DATA ARRAY PARAMETERS

Data Arrays are "protocol neutral" data buffers for storage of data to be passed between protocols. It is necessary to declare the data format of each of the Data Arrays to facilitate correct storage of the relevant data.

| Section Title |
|---|
| Data_Arrays |

| Column Title | Function | Legal Values |
|---|---|---|
| Data_Array_Name | Provide name for Data Array | Up to 15 alphanumeric characters |
| Data_Array_Format | Provide data format. Each Data Array can only take on one format. | INT16, INT32, BIT, FLOAT |
| Data_Array_Length | Number of Data Objects. Must be larger than the data storage area required by the Map Descriptors for the data being placed in this array. | 1-10, 000 |

**Example**

```
//   Data Arrays
Data_Arrays
Data_Array_Name     , Data_Array_Format     , Data_Array_Length
DA_AI               , Float                 , 100
DA_AO               , Float                 , 100
DA_DI               , Bit                   , 100
DA_DO               , Bit                   , 100
```

# 5 CONFIGURING THEFIELDSERVER AS A TEK-AIR MODBUS CLIENT

For a detailed discussion on FieldServer configuration, please refer to the FieldServer Configuration Manual. The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer (See ".csv" sample files provided with the FieldServer).

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with a Tek-Air Modbus Server.

## 5.1 Client Side Connection Parameters

| **Section Title** | | |
|---|---|---|
| Connections | | |
| **Column Title** | **Function** | **Legal Values** |
| Port | Specify which port the device is connected to the FieldServer | P1-P8, R1-R2[1] |
| Baud* | Specify baud rate | 300-**9600**-38400 |
| Parity* | Specify parity | Even, Odd, **None** |
| Data_Bits* | Specify data bits | 7, **8** |
| Protocol | Specify protocol used | Tek-Air |
| Poll Delay* | Time between internal polls | 0-32000s,**1s** |
| Stop_Bits | | **1**, 2 |

**Example**

```
//   Client Side Connections

Connections
Port   Baud   , Parity   , Data_Bits   , Stop_Bits   , Protocol   , Poll_Delay   , Poll_Delay
P1     9600   , None     , 8           , 1           , Tek_Air    , 0.100s       , 0.100s
```

## 5.2 Client Side Node Parameters

| **Section Title** | | |
|---|---|---|
| Nodes | | |
| **Column Title** | **Function** | **Legal Values** |
| Node_Name | Provide name for Node | Up to 32 alphanumeric characters |
| Node_ID | Modbus station address of physical server node | 1-255 |
| Protocol | Specify protocol used | Tek-Air |
| Port | Specify which port the device is connected to the FieldServer | P1-P8, R1-R2[1] |

[1] Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

**Example**

```
//    Client Side Nodes
//
Nodes
Node_Name     , Node_ID     , Protocol     , Port
Tek_01        , 1           , Tek-air      , P1
```

## 5.3 Client Side Map Descriptor Parameters

### 5.3.1 FieldServer Related Map Descriptor Parameters

| Column Title | Function | Legal Values |
|---|---|---|
| Map_Descriptor_Name | Name of this Map Descriptor | Up to 32 alphanumeric characters |
| Data_Array_Name | Name of Data Array where data is to be stored in the FieldServer | One of the Data Array names defined in Section 4. |
| Data_Array_Offset | Starting location in Data Array | 0 to (Data_Array_Length -1) as defined in Section 4. |
| Function | Function of Client Map Descriptor. Refer to Appendix A.2 | Rdbc, Wrbc, Wrbx, Arcs |

### 5.3.2 Driver Related Map Descriptor Parameters

| Column Title | Function | Legal Values |
|---|---|---|
| Node_Name | Name of Node to fetch data from | One of the node names specified in Section 5.2 |
| Address | Starting address of read block | 30001, 30003, 30005 ...<br>40001, 40003, 40005 ...<br>10001, 10002, 10003 ...<br>00001, 00002, 00003 ... |
| Length | Specifies how many register bits etc. to read. Refer to Appendix B.1 | 0 - 125 |
| Data_Array_Low_Scale* | Scaling zero in Data Array | -32767 to 32767, **0** |
| Data_Array_High_Scale* | Scaling max in Data Array | -32767 to 32767, **100** |
| Node_Low_Scale* | Scaling zero in Connected Node | -32767 to 32767, **0** |
| Node_High_Scale* | Scaling max in Connected Node | -32767 to 32767, **100** |

For information on applying scaling, please refer to the Configuration Manual.

### 5.3.3 Timing Parameters

| Column Title | Function | Legal Values |
|---|---|---|
| Scan_Interval* | Seconds per Scan | 0-32000, **20** |

### 5.3.4 Map Descriptor Example

```
//   Client Side Map Descriptors
//
Map_Descriptors
Map_Descriptor_Name   , Data_Array_Name   , Data_Array_Offset   , Function   , Node_Name   , Address   , Length   , Scan_Interval
CMD_AI_1              , DA_AI             , 0                   , Rdbc       , Tek_01      , 30001     , 3        , 20.000s
CMD_AO_1              , DA_AO             , 0                   , Rdbc       , Tek_01      , 40001     , 3        , 20.000s
CMD_DI_1              , DA_DI             , 0                   , Rdbc       , Tek_01      , 10001     , 3        , 20.000s
CMD_DO_1              , DA_DO             , 0                   , Rdbc       , Tek_01      , 1         , 3        , 20.000s
```

# 6 CONFIGURING THEFIELDSERVER AS A TEK-AIR MODBUS SERVER

For a detailed discussion on FieldServer configuration, please refer to the FieldServer Configuration Manual. The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer (See ".csv" sample files provided with the FieldServer).

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with a Modbus Tek_Air Client.

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for Modbus Tek_Air communications, the driver independent FieldServer buffers need to be declared in the "Data Arrays" section, the FieldServer virtual Node(s) needs to be declared in the "Server Side Nodes" section, and the data to be provided to the clients needs to be mapped in the "Server Side Map Descriptors" section. Details on how to do this can be found below.

Note that in the tables, * indicates an optional parameter, with the **bold** legal value being the default.

| Section Title |
|---|
| Connections |

| Column Title | Function | Legal Values |
|---|---|---|
| Port | Specify which port the device is connected to the FieldServer | P1-P8, R1-R2[2] |
| Baud* | Specify baud rate | 110 – 115200, standard baud rates only, **9600** |
| Parity* | Specify parity | Even, Odd, **None** |
| Data_Bits* | Specify data bits | 7, **8** |
| Stop_Bits* | Specify stop bits | **1** (Vendor limitation) |
| Protocol | Specify protocol used | Tek-Air |

**Example**

```
Connections
Port            , Baud     , Parity     , Data_Bits     , Stop_Bits     , Protocol
P1              , 9600     , None       , 8             , 1             , Tek-Air
```

[2] Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

## 6.1 Server Side Node Parameters

| Section Title |
|---|
| Nodes |

| Column Title | Function | Legal Values |
|---|---|---|
| Node_Name | Provide name for Node | Up to 32 alphanumeric characters |
| Node_ID | Modbus station address of physical server node | 1-255 |
| Protocol | Specify protocol used | Tek-Air |
| Port | Specify which port the device is connected to the FieldServer | P1-P8, R1-R2[1] |
| Node_Offline_Response* | Set the FieldServer response to the Modbus Tek-Air when the Server Node supplying the data has gone offline | **No_Response**,<br>Old_Data,<br>Zero_Data,<br>FFFF_Data,<br>Refer to Appendix A.1 for further information. |

**Example**

```
//   Server Side Nodes
//
Nodes
Node_Name    , Node_ID    , Protocol    , Port
Tek_01       , 1          , Tek-Air     , P1
```

## 6.2 Server Side Map Descriptor Parameters

### 6.2.1 FieldServer Related Map Descriptor Parameters

| Column Title | Function | Legal Values |
|---|---|---|
| Map_Descriptor_Name | Name of this Map Descriptor | Up to 32 alphanumeric characters |
| Data_Array_Name | Name of Data Array where data is to be stored in the FieldServer | One of the Data Array names defined under Section |
| Data_Array_Offset | Starting location in Data Array | 0 to (Data_Array_Length -1) as defined in section |
| Function | Function of Server Map Descriptor | Passive |

### 6.2.2 Driver Related Map Descriptor Parameters

| Column Title | Function | Legal Values |
|---|---|---|
| Node_Name | Name of Node to fetch data from | One of the Node names specified in Section 6.1 |
| Address | Starting address of read block | 30001, 30003, 30005 ...<br>40001, 40003, 40005 ...<br>10001, 10002, 10003 ...<br>00001, 00002, 00003 ... |
| Length | Specifies how many register bits etc. to read | 0 - 125 |
| Data_Array_Low_Scale* | Scaling zero in Data Array | -32767 to 32767, **0** |
| Data_Array_High_Scale* | Scaling max in Data Array | -32767 to 32767, **100** |
| Node_Low_Scale* | Scaling zero in Connected Node | -32767 to 32767, **0** |
| Node_High_Scale* | Scaling max in Connected Node | -32767 to 32767, **100** |

For information on how to apply scaling, please refer to the Configuration Manual.

### 6.2.3 Timing Parameters

| Column Title | Function | Legal Values |
|---|---|---|
| Scan_Interval* | Seconds per Scan | 0-32000s, **20s** |

### 6.2.4 Map Descriptor Example

```
//   Server Side Map Descriptors
//
Map_Descriptors
Map_Descriptor_Name   , Data_Array_Name   , Data_Array_Offset   , Function   , Node_Name   , Address   , Length   , Scan_Interval
CMD_AI_1              , DA_AI             , 0                   , Passive    , Tek_01      , 30001     , 3        , 20.000s
CMD_AO_1              , DA_AO             , 0                   , Passive    , Tek_01      , 40001     , 3        , 20.000s
CMD_DI_1              , DA_DI             , 0                   , Passive    , Tek_01      , 10001     , 3        , 20.000s
CMD_DO_1              , DA_DO             , 0                   , Passive    , Tek_01      , 1         , 3        , 20.000s
```

# Appendix A. Useful Features

## Appendix A.1. Node_Offline_Response

In systems where data is being collected from multiple Server Nodes and made available on a FieldServer configured as a Modbus TEK_AIR Server, when a Server Node goes offline the default behavior of the FieldServer would be to stop responding to polls for this data. This might not be what the user wants. Various options exist making it possible to signal that the data quality has gone bad without creating error conditions in systems sensitive to the default option.

The following options can be configured under the Node parameter, Node_Offline_Response, to set the response of the FieldServer to the Modbus TEK_AIR Client when the Server Node supplying the data is offline:

- No_Response - this is the default option. The FieldServer simply does not respond when the corresponding Server Node is offline.
- Old_Data - The FieldServer will respond, but with the last known value of the data. This maintains the communication link in an active state, but may hide the fact that the Server Node is offline.
- Zero_Data - The FieldServer will respond, but with the data values set to zero. If the user normally expects non-zero values, this option will signal the offline condition without disrupting communications.
- FFFF_Data - The FieldServer will respond, but with the data values set to FFFF (hex). If the user normally expects other values, this option will signal the offline condition without disrupting communications.

When configured as a Server this parameter can force a desired exception response as follows:

- Node_Offline_Message or Exception_4 - FieldServer's response will be Exception 4
- Gateway_Path_Unavailable or Exception_A - FieldServer's response will be Exception A
- Gateway_Device_Failed or Exception_B - FieldServer's response will be Exception B

**Example:**

```
Nodes
Node_Name   , Node_ID   , Protocol   , Node_Offline_Response      , Port
DEV11       , 11        , Tek-Air    , No_Response                , -
DEV12       , 12        , Tek-Air    , Old_Data                   , -
DEV15       , 15        , Tek-Air    , Zero_Data                  , -
DEV16       , 16        , Tek-Air    , FFFF_Data                  , -
DEV17       , 17        , Tek-Air    , Exception_4.               , -
DEV18       , 18        , Tek-Air    , Gateway_Path_Unavailable   , -
```

## Appendix A.2. Map Descriptor Functions

| Function | Description |
|---|---|
| Rdbc | This is an active Map Descriptor which polls the device once every scan interval. The function will also execute writes from the Data Array to a remote device when a change is detected, but only when used in conjunction with writeable addresses. |
| Arcs | This function will perform the same operation as an Rdbc (Arc) function, but will sequence through the range of addresses starting at "Address" and wrapping at "Address + Length". A length of 1 will be used for every one of the Addresses that gets polled. |
| Wrbx | The Wrbx function will write data from the Data Array to the remote device. The write is triggered by a change in the associated Data Array. If the associated Data Array is updated a write will occur, even if the value/s within the Data Array have not changed. The "Scan_Interval" parameter is not required for this function as writes are event driven and not continuous |
| Wrbc | This is similar to the Wrbx function, except that the writes occur at a regular interval rather than on an event driven basis. The frequency of the writes is determined by the "Scan_Interval" parameter. |

# Appendix B. Troubleshooting

## Appendix B.1. Effect of the Length Parameter – Data Read/Write

When usng WRBC or WRBX as functions to write data, then the number of points written is determined by the length parameter. However, when using RDBC the points are written one at a time even if Length is greater than 1.