FieldServer

FS-8700-01 Modbus RTU

&

FS-8700-08 Modbus ASCII

There are several similarities between these two drivers and we have incorporated them into the same manual to ensure that our information stays current. Although both drivers are referenced in this manual, they are different drivers and need to be ordered separately.

Driver Manual

(Supplement to the FieldServer Instruction Manual)

APPLICABILITY & EFFECTIVITY

Effective for all systems manufactured after November 2015

Kernel Version:	4.06
Document Revision:	3

Contact Information:

Thank you for purchasing the FieldServer.

Please call us for Technical support of the FieldServer product.

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1 MODBUS RTU/MODBUS ASCII DESCRIPTION

The Modbus RTU and Modbus ASCII drivers allow the FieldServer to transfer data to and from devices using Modbus RTU or Modbus ASCII protocol respectively. Data can be transferred over either RS-232 or RS-485. The driver was developed for Modbus Application Protocol Specification V1.1a" from Modbus-IDA. The specification can be found at www.modbus.org. The FieldServer can emulate either a Server or Client.

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

There are various register mapping models being followed by various vendors

To cover all these models FieldServer uses the following three Models

- **Modicon_5digit** – Use this format where addresses are defined in 0xxxx, 1xxxx, 3xxxx or 4xxxx format. A maximum of 9999 registers can be mapped of each type. This is FieldServer driver's default format.
- **ADU** –Application Data Unit address. Use this format where addresses of each type are defined in the range 1-65536
- **PDU** –Protocol Data unit address. Use this format where addresses of each type are defined in the range 0-65535.

The key difference between ADU and PDU is for example if Address_Type is ADU and address is 1, the driver will poll for register 0. If Address_Type is PDU, the driver will poll for address 1.

Note 1: If vendor document shows addresses in extended Modicon (i.e. 6 digit) format like 4xxxxx then consider these addresses as xxxxx (omit the first digit) and use either ADU or PDU

Note 2: The purpose of providing 3 different ways of addressing the Modbus registers is to allow the user to choose the addressing system most compatible with the address list being used. At the protocol level, the same protocol specification is used for all three with the exception of the limited address range for Modicon_5digit.

2 DRIVER SCOPE OF SUPPLY

2.1 Supplied by Sierra Monitor Corporation for this driver

Sierra Monitor Corporation **PART #**	**Description**
FS-8915-10	UTP cable (7 foot) for RS-232 use[1]

2.2 Provided by the Supplier of 3rd Party Equipment

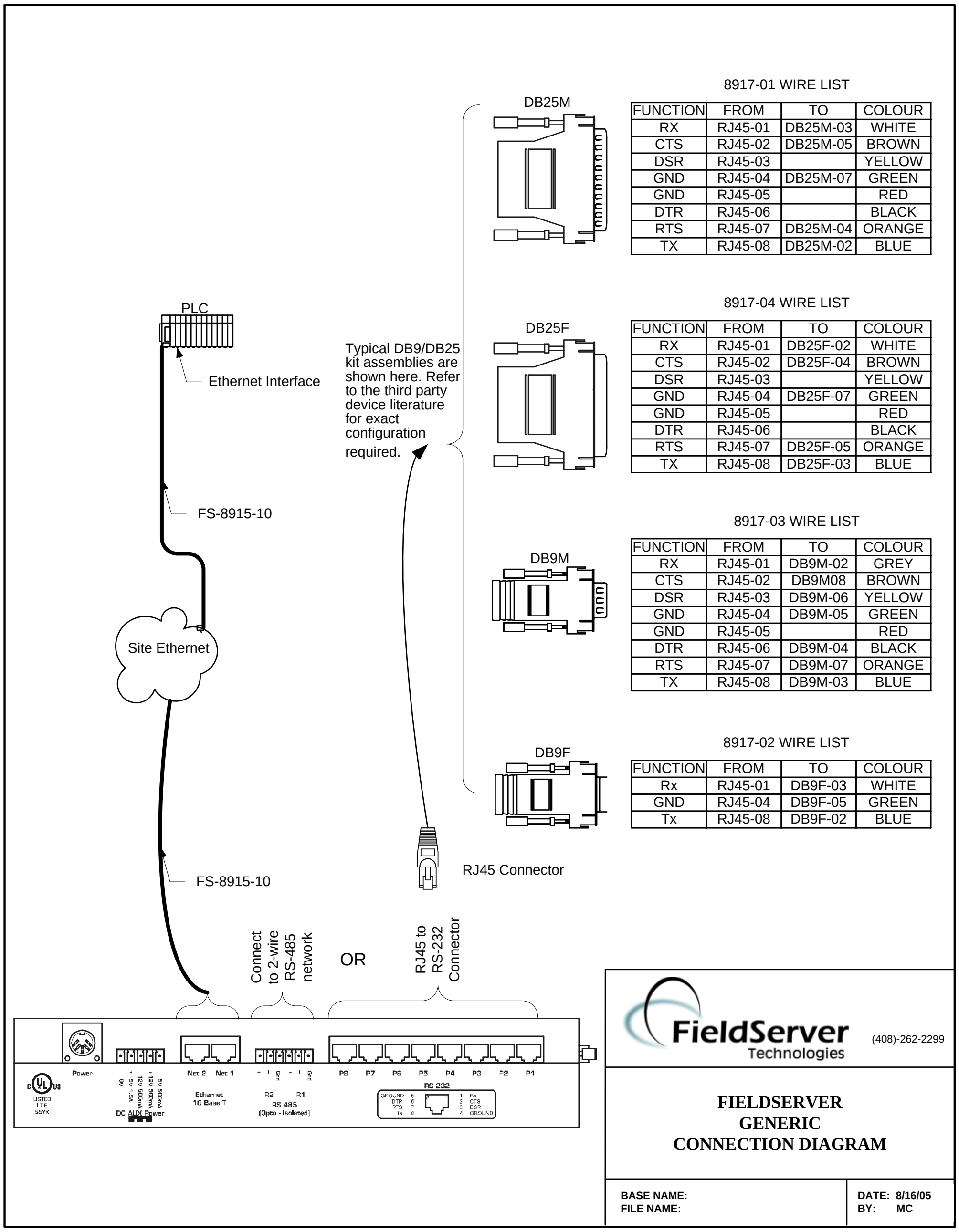
Part #	**Description**
	Modbus TRU or Modbus ASCII device

[1] This cable is necessary for connection to the driver. It is shipped with the FieldServer and not separately with the driver.

3 HARDWARE CONNECTIONS

It is possible to connect a Modbus RTU or Modbus ASCII device to any of the existing serial ports on the FieldServer[2]. These ports simply need to be configured for the appropriate driver in the configuration file.

Configure the Modbus RTU or Modbus ASCII device 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

8917-04 WIRE LIST

FUNCTION	FROM	TO	COLOUR
RX	RJ45-01	DB25F-02	WHITE
CTS	RJ45-02	DB25F-04	BROWN
DSR	RJ45-03		YELLOW
GND	RJ45-04	DB25F-07	GREEN
GND	RJ45-05		RED
DTR	RJ45-06		BLACK
RTS	RJ45-07	DB25F-05	ORANGE
TX	RJ45-08	DB25F-03	BLUE

8917-03 WIRE LIST

FUNCTION	FROM	TO	COLOUR
RX	RJ45-01	DB9M-02	GREY
CTS	RJ45-02	DB9M08	BROWN
DSR	RJ45-03	DB9M-06	YELLOW
GND	RJ45-04	DB9M-05	GREEN
GND	RJ45-05		RED
DTR	RJ45-06	DB9M-04	BLACK
RTS	RJ45-07	DB9M-07	ORANGE
TX	RJ45-08	DB9M-03	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

Figure 1 - Generic Connection Diagram

[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.

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.	FLOAT, BIT, UInt16, SInt16, Packed_Bit, Byte, Packed_Byte, Swapped_Byte
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_01           , UInt16               , 200
DA_AO_01           , UInt16               , 200
DA_DI_01           , Bit                  , 200
DA_DO_01           , Bit                  , 200
```

5 CONFIGURING THE FIELDSERVER AS A MODBUS RTU OR MODBUS ASCII 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 Modbus RTU or Modbus ASCII 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[3]
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**,2
Protocol	Specify protocol used	Modbus RTU Modbus _RTU Modbus ASCII MB_ASCII
Poll_Delay*	Time between internal polls	0-32000s, **0.05s**

Example

```
//    Client Side Connections

Connections
Port    , Baud    , Parity    , Data_Bits    , Stop_Bits    , Protocol          , Handshaking    , Poll_Delay
P1      , 9600    , None      , 8            , 1            , Modbus _RTU[4]    , None           , 0.100s
```

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

[4] Change protocol to MB_ASCII to use Modbus ASCII protocol

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	Modbus RTU
		Modbus_RTU
		Modbus ASCII
		MB_ASCII
Port	Specify which port the device is connected to the FieldServer	P1-P8, R1-R2[3]
Address_Type[5]	Specify Register Mapping Model	ADU,PDU, -, **Modicon_5digit**
Write_Fnc*	Set to Multiple if Remote Server Node only supports Write Multiple function code 15 & 16	Multiple, **-**,
Write_Length*	Set to Map Descriptor Length if write-thru operation should write all registers as specified by Map Descriptor length. By default write-thru writes a single register. If Write_Length also specified on Map Descriptor, Map Descriptor's parameter will be used.	Map Descriptor Length, **-**, **1**,

Example

```
//    Client Side Nodes
// For devices where 65536 addresses are available in each memory area.
Nodes
Node_Name          , Node_ID    , Protocol           , Port    ,Address_Type
Modbus device 1    , 1          , Modbus _RTU[6]     , P1      ,ADU
Modbus device 2    , 2          , Modbus_RTU         , P1      ,PDU
// For devices where only 9999 registers are available in each memory area.
Nodes
Node_Name          , Node_ID    , Protocol           , Port
Modbus device 3    , 3          , Modbus_RTU         , P1
```

[5] Optional for Modicon 5 digit devices
[6] Change protocol to MB_ASCII to use Modbus ASCII protocol

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 from Section 4
Data_Array_Offset	Starting location in Data Array	0 to (Data_Array_Length -1) as specified in Section 4
Function	Function of Client Map Descriptor.	Wrbc, Wrbx, Rdbc, Arcs. Refer to Section 5.3.4 for more information.

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 “Client Node Descriptor” above
Data_Type[7]	Specify memory area. Refer to Appendix A.1.2 on how to transfer 32 Bit values using Modbus registers.	Address_Type = ADU Coil, Discrete_Input, Input_Register, Holding_Register, Single_Coil, Single_Register, Slave_Id Address_Type = PDU FC01, FC02, FC03, FC04, FC05, FC06, FC15, FC16 Address_Type = Modicon_5digit - (Dash), Single_Register, Single_Coil All Address_Type Float_Reg, 32Bit_Reg, Input_Float, Input_Reg_32Bit

Address	Starting address of read block	Address_Type = ADU
		1-65536
		Address_Type = PDU
		0-65535
		Address_Type = Modicon_5digit
		40001, 30001, etc

Length	Length of Map Descriptor.	1-125 (For Analog polls), 1-800 (For Binary polls).
Other_Addresses	Scattered Read holding register addresses	
Write_Length*	Set to Map Descriptor Length if write-thru operation should write all registers as specified by length parameter. By default write-thru writes a single	Map Descriptor Length, **1**,

[7] Optional only for Modicon_5digit addressing, and only if Single writes do not need to be forced

	register.	
Data_Array_Low_Scale*	Scaling zero in Data Array	Any signed 32 bit integer in the range: -2,147,483,648 to 2,147,483,647. **0**
Data_Array_High_Scale*	Scaling max in Data Array	Any signed 32 bit integer in the range: -2,147,483,648 to 2,147,483,647. **100**
Node_Low_Scale*	Scaling zero in Connected Node	Any signed 32 bit integer in the range: -2,147,483,648 to 2,147,483,647. **0**
Node_High_Scale*	Scaling max in Connected Node	Any signed 32 bit integer in the range: -2,147,483,648 to 2,147,483,647. **100**

5.3.3 Timing Parameters

Column Title	**Function**	**Legal Values**
Scan_Interval*	Rate at which data is polled	0-32000, **1**

5.3.4 Map Descriptor Examples.

```
//   Client Side Map Descriptors
// Note: All three examples below are addressing the same Modbus registers.

// For Nodes where Address_Type is ADU
Map_Descriptors
Map_Descriptor_Name    , Data_Array_Name    , Data_Array_Offset    , Function    , Node_Name            , Data_Type           , Address    , Length    ,Scan_Interval
CMD_AI_01              , DA_AI_01           , 0                    , Rdbc        , MODBUS DEVICE1       , Input_Register      , 1          , 20        ,1.000s
CMD_AO_01              , DA_AO_01           , 0                    , Rdbc        , MODBUS DEVICE1       , Holding_Register    , 1          , 20        ,1.000s
CMD_DI_01              , DA_DI_01           , 0                    , Rdbc        , MODBUS DEVICE1       , Discrete_Input      , 1          , 20        ,1.000s
CMD_DO_01              , DA_DO_01           , 0                    , Rdbc        , MODBUS DEVICE1       , Coil                , 1          , 20        ,1.000s

// For Nodes where Address_Type is PDU
Map_Descriptors
Map_Descriptor_Name    , Data_Array_Name    , Data_Array_Offset    , Function    , Node_Name,           , Data_Type           , Address    , Length    ,Scan_Interval
CMD_AI_02              , DA_AI_02           , 0                    , Rdbc        , MODBUS DEVICE2       , FC04                , 0          , 20        ,1.000s
CMD_AO_02              , DA_AO_02           , 0                    , Rdbc        , MODBUS DEVICE2       , FC03                , 0          , 20        ,1.000s
CMD_DI_02              , DA_DI_02           , 0                    , Rdbc        , MODBUS DEVICE2       , FC02                , 0          , 20        ,1.000s
CMD_DO_02              , DA_DO_02           , 0                    , Rdbc        , MODBUS DEVICE2       , FC01                , 0          , 20        ,1.000s

// For Nodes where Address_Type is Modicon_5digit.
Map_Descriptors
Map_Descriptor_Name       , Data_Array_Name    , Data_Array_Offset      , Function       , Node_Name,           , Address          , Length      , Scan_Interval
CMD_AI_03                 , DA_AI_03           , 0                      , Rdbc           , MODBUS DEVICE3       , 30001            , 20          , 1.000s
CMD_AO_03                 , DA_AO_03           , 0                      , Rdbc           , MODBUS DEVICE3       , 40001            , 20          , 1.000s
CMD_DI_03                 , DA_DI_03           , 0                      , Rdbc           , MODBUS DEVICE3       , 10001            , 20          , 1.000s
CMD_DO_03                 , DA_DO_03           , 0                      , Rdbc           , MODBUS DEVICE3       , 00001            , 20          , 1.000s
```

6 CONFIGURING THE FIELDSERVER AS A MODBUS RTU OR MODBUS ASCII 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 RTU or Modbus ASCII Client.

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for Modbus RTU or Modbus ASCII 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.

6.1 Server 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[8]
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**, 2
Protocol	Specify protocol used	Modbus RTU Modbus_RTU Modbus ASCII MB_ASCII

Example

Change protocol to MB_ASCII to use Modbus ASCII protocol

```
//   Server Side Connections

Connections
Port            , Baud    , Parity    , Data_Bits    , Stop_Bits    , Protocol
P1              , 9600    , None      , 8            , 1            , Modbus_RTU
```

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

6.2 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	Node ID of physical Server Node	1 – 255
Protocol	Specify protocol used	Modbus RTU
Address_Type[9]	Specify Register Mapping Model	ADU,PDU, -, **Modicon_5digit**
Node_Offline_Response*	Set the FieldServer response to the Modbus RTU Client when the Server Node supplying the data has gone offline	**No_Response**, Old_Data, Zero_Data, FFFF_Data, Refer to 0 for further information.
Node_Description*	Specify Node description text	Any string up to 99 characters long, **-**

Example

Change protocol to MB_ASCII to use Modbus ASCII protocol

```
//    Server Side Nodes
// For devices where 65536 addresses are available in each memory area.
Nodes
Node_Name         , Node_ID         , Protocol             , Address_Type
MB_Srv_11         , 11              , Modbus_RTU           , ADU
MB_Srv_12         , 12              , Modbus_RTU           , PDU
// For devices where only 9999 registers are available in each memory area.
Nodes
MB_Srv_13         , 13              , Modbus_RTU           , Modicon_5digit
MB_Srv_14         , 14              , Modbus_RTU           , -
```

[9] Optional for Modicon 5 digit devices

6.3 Server Side Map Descriptor Parameters

6.3.1 FieldServer Specific 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 from Section 4
Data_Array_Offset	Starting location in Data Array	0 to (Data_Array_Length -1) as specified in Section 4
Function	Function of Server Map Descriptor	Passive

6.3.2 Driver Specific Map Descriptor Parameters

Column Title	Function	Legal Values
Node_Name	The name of the Node being represented.	One of the Node names specified in Section **Error! Reference source not found.**
Data_Type[10]	Specify memory area	Address_Type = ADU
		Coil, Discrete_Input, Input_Register, Holding_Register, Single_Coil, Single_Register, Slave_ID
		Address_Type = PDU
		FC01, FC02, FC03, FC04, FC05, FC06, FC15, FC16
		Address_Type = Modicon_5digit
		- (Dash), Single_Register, Single_Coil
Length*	Length of Map Descriptor	1-10000, **1**
Address	Starting address of read block	Address_Type = ADU
		1-65536
		Address_Type = PDU
		0-65535
		Address_Type = Modicon_5digit
		40001, 30001, etc
Data_Array_Low_Scale*	Scaling zero in Data Array	Any signed 32 bit integer in the range: -2,147,483,648 to 2,147,483,647. **0**
Data_Array_High_Scale*	Scaling max in Data Array	Any signed 32 bit integer in the range: -2,147,483,648 to 2,147,483,647. **100**
Node_Low_Scale*	Scaling zero in Connected Node	Any signed 32 bit integer in the range: -2,147,483,648 to 2,147,483,647. **0**
Node_High_Scale*	Scaling max in Connected Node	Any signed 32 bit integer in the range: -2,147,483,648 to 2,147,483,647. **100**

[10] Optional only for Modicon_5digit addressing, and only if Single writes do not need to be forced

6.3.3 Map Descriptor Examples

```
//   Server Side Map Descriptors where Node Address_Type is ADU
// Note: All three examples below are addressing the same Modbus registers.

// For Nodes where Address_Type is ADU
Map_Descriptors
Map_Descriptor_Name, Data_Array_Name, Data_Array_Offset, Function, Node_Name, Data_Type        , Address, Length, Data_Array_Low_Scale, Data_Array_High_Scale, Node_Low_Scale, Node_High_Scale
SMD_AI_01          , DA_AI_01       , 0                , Passive , MB_Srv_11 , Input_Register  , 1      , 200   , 0                   , 100                  , 0             , 10000
SMD_AO_01          , DA_AO_01       , 0                , Passive , MB_srv_11 , Holding_Register, 1      , 200   , 0                   , 100                  , 0             , 10000
```

```
//   Server Side Map Descriptors where Node Address_Type is PDU
Map_Descriptors
Map_Descriptor_Name , Data_Array_Name , Data_Array_Offset , Function , Node_Name , Data_Type , Address , Length , Data_Array_Low_Scale , Data_Array_High_Scale , Node_Low_Scale , Node_High_Scale
SMD_AI_02           , DA_AI_02        , 0                 , Passive  , MB_Srv_12 , FC04      , 0       , 200    , 0                    , 100                   , 0              , 10000
SMD_AO_02           , DA_AO_02        , 0                 , Passive  , MB_srv_12 , FC03      , 0       , 200    , 0                    , 100                   , 0              , 10000
```

```
// For Nodes where Address_Type is Modicon_5digit.
Map_Descriptors
Map_Descriptor_Name  , Data_Array_Name  , Data_Array_Offset  , Function  , Node_Name   , Address  , Length  , Data_Array_Low_Scale  , Data_Array_High_Scale  , Node_Low_Scale   Node_High_Scale
SMD_AI_01            , DA_AI_01         , 0                  , Passive   , MBP_Srv_13  , 30001    , 200     , 0                     , 100                    , 0                , 10000
SMD_AO_01            , DA_AO_01         , 0                  , Passive   , MBP_Srv_13  , 40001    , 200     , 0                     , 100                    , 0                , 10000
```

6.3.4 Slave_Id

The following Map Descriptor is used to respond to the Report Slave_Id request. The FieldServer's Slave_Id is 11 and the run status depends upon the data validity at the specified offset in the specified Data Array - if the data is valid, the status will be 255 (running) otherwise the status will be 0 (off).

```
Map_Descriptors
Map_Descriptor_Name   , Data_Array_Name   , Data_Array_Offset   , Function   , Node_Name   , Address   , Length   , Data_Type
SMD_DO1               , DA_DO_01          , 0                   , Passive    , RTU_Srv_21  , 00001     , 1        , Slave_ID
```

6.3.4.1 Slave_Id lookup in Table

The slave ID will be read from device PLC_21. The response will be searched for occurrences of the strings in the table in column table string. If a match is found the **user** value will be written.

The Table_String must occur in the slave ID in any position.

```
Config_Table
Config_Table_Name   , Table_String    , Table_Index_Value     , Table_User_Value
slave_id_profile    , FS01            , 1                     , 1
slave_id_profile    , FS02            , 2                     , 2
slave_id_profile    , FS03            , 3                     , 3
```

```
Map_Descriptors
Map_Descriptor_Name   , Data_Array_Name   , Data_Array_Offset   , Function   , Node_Name   , Scan_Interval   , Data_Type   , Length   , Config_Table_Name
CMD_DO_01             , DA_DO_01          , 0                   , RDBC       , PLC_21      , 0.000s          , Slave_Id    , 1        , slave_id_profile
```

Appendix A. USEFUL FEATURES – MODBUS RTU

Appendix A.1. Managing Floating points with Modbus

Modbus as a standard does not support floating point formats. Many vendors have written higher level communications software to use two 16 bit registers to represent floating point or 32 bit integers. This requires conversion software on both ends of the communication channel. The FieldServer supports this function and also provides other options to resolve this issue.

Appendix A.1.1. Transferring non-integer values with one register

It is possible to represent values higher than 32767 using one register in one of two ways:

- Declare data arrays as type Uint16 (Unsigned integer). This will give you a range from 0 to 65535.
- Use the scaling function on the FieldServer, which will allow you to set up any range, with 16 bit resolution.

The following example shows how scaling can be achieved on the Server side of the configuration. Note that scaling can also be done on the Client side to scale down a value that was scaled up by a Modbus vendor. Further information regarding scaling can be found in the FieldServer Configuration manual.

Example:

```
Map_Descriptors
Map_Descriptor_Name , Data_Array_Name , Data_Array_Offset , Function , Node_Name  , Address , Length , Data_Array_Low_Scale , Data_Array_High_Scale , Node_Low_Scale , Node_High_Scale
SMD_AI1             , DA_AI_01        , 0                 , Passive  , MBP_Srv_11 , 30001   , 200    , 0                    , 100                   , 0              , 10000
SMD_AO1             , DA_AO_01        , 0                 , Passive  , MBP_Srv_11 , 40001   , 200    , 0                    , 100                   , 0              , 10000
```

This example multiplies the values in the data array by 100 (10000 on Node_High_Scale is 100X larger than 100 on Data_Array_High_Scale). This is most commonly used when the user wants to introduce values after the decimal point. For example, a value of 75.6 will be sent as 7560, which can then be rescaled by the Modbus master.

Appendix A.1.2. Transferring 32 bit values with two registers

If a Modbus Server sends two consecutive registers to the FieldServer representing either a floating point value or a 32 bit integer value, the FieldServer can combine and decode these registers back into their original format. To do this declare Data Array of type Float or UINT32 and set the Map Descriptor Data_Type as ‘Float_Reg’ or ‘32Bit_Reg’ etc

Example:

```
Data_Arrays
Data_Array_Name    , Data_Format    , Data_Array_Length
DA1                , Float          , 20
DA2                , UInt32         , 20
DA3                , Float          , 20
DA4                ,UInt32          , 20
```

```
//   Client Side Map Descriptors
// For Nodes where Address_Type is PDU
Map_Descriptors
Map_Descriptor_Name   , Data_Array_Name   , Data_Array_Offset   , Function   , Node_Name,       , Data_Type        , Address   , Length   ,Scan_Interval
CMD_AO_01             , DA1               , 0                   , Rdbc       , Modbus Device2   , Float_Reg        , 0         , 20       ,1.000s
CMD_AO_02             , DA2               , 0                   , Rdbc       , Modbus Device2   , 32Bit_Reg        , 0         , 20       ,1.000s
CMD_AI_01             , DA3               , 0                   , Rdbc       , Modbus Device2   , Input_Float      , 0         , 20       ,1.000s
CMD_AI_02             , DA4               , 0                   , Rdbc       , Modbus Device2   , Input_Reg_32Bit  , 0         , 20       ,1.000s
```

Each Map Descriptor will read 20 pairs of registers and store them as 32-bit floating number or 32-bit Integer.

If somehow server device send swapped registers (low value register first) then use corresponding _swap data_types.

Note: Please note starting addresses per address_type, see section 5.3.2

Appendix A.2. Node_Offline_Response

This function is specific to the Modbus RTU driver.

In systems where data is being collected from multiple Server Nodes and made available on a FieldServer configured as a Modbus RTU 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 RTU 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         , Modbus_RTU     , No_Response                 , -
DEV12        , 12         , Modbus_RTU     , Old_Data                    , -
DEV15        , 15         , Modbus_RTU     , Zero_Data                   , -
DEV16        , 16         , Modbus_RTU     , FFFF_Data                   , -
DEV17        , 17         , Modbus_RTU     , Exception_4.                , -
DEV18        , 18         , Modbus_RTU     , Gateway_Path_Unavailable    , -
```

Appendix B. TROUBLESHOOTING

Appendix B.1. Server Configuration of System Station Address

When using the FieldServer as a Modbus Server, the FieldServer System Station address must be configured to be different from any of the configured Modbus Server Node_ID's. Configuring these to be the same invokes proprietary system information to be transmitted, and should therefore be avoided.

Appendix C. VENDOR INFORMATION

Appendix C.1. Connection to York Modbus Microgateway

If connecting the FieldServer to a York Modbus Microgateway, the Node_ID of the Microgateway is defined by the address DIP switches. If switch 4 is set to 'On' and the other switches are set to 'off' then Node_ID of the Microgateway is '247', the parity is 'Even', and the stop bits are 1. Other Node_ID combinations can be found in the York Modbus Microgateway Installation Manual.

Appendix C.2. Modbus ASCII - Examples of FieldServer setup for typical clients

Appendix C.2.1. FieldServer with GE Cimplicity as client

- Run the Cimplicity "Workbench" and create a "New Project" with a unique "Project Name" option of "Basic Control" and protocol "Modbus ASCII".
- Check the project properties and continue with the "Project Wizard Setup" that appears.
- Add Modbus port giving it a description.
- Create and configure the devices, select "new item".
- Name the device, select the port, give it a description (e.g. FieldServer), and choose "SYSTEM" resource.
- Create and configure the points.
- Select "new item", name the point and choose the appropriate device.
- Under the "General" tab, point properties require a description. Note that the elements must have a value greater than 8.
- Under the "Device" tab, properties need the appropriate address (e.g. 40001 and also require the leading 0's), change the update criteria to "On Scan".
- When the project is configured, run by pressing the "play" button.
- Expect the Cimplicity driver to connect and poll the FieldServer for a range of valid addresses, and then proceed to poll for just the configured Points.
- From the start menu choose the "Point Control Panel", select edit and add the project you want to view. Note, to log on the User name "ADMINISTRATOR" must be supplied
- Use "Modbus ASCII Diagnostics" to connect to host and then read the register.

Appendix C.2.2. FieldServer with Intellution FIX as a client

- Install Intellution FIX, choosing the MB1 Modbus ASCII I/O driver
- Run from Start menu and choose “Intellution Fix”.
- Choose “System Configuration Utility”.
- Modify SCADA, add the MB1 Modbus ASCII I/O driver
- Configure the Modbus ASCII Driver.
- Device is D11, select 5-digit address, add the FieldServer virtual Node ID to station address
- Set up poll record
- SAVE the configuration.
- Open “Startup”
- Open “Mission Control” from the “Apps” menu and confirm Fix is polling.
- To display the data create a link in Fix draw, add link, data link.
- Give it a tagname, allow data entry, numeric entry and set enable option.
- If tag is not in database, select “Add”, choose “AR”. Then set output enable, device MB1, I/O address d11.
- Save the settings
- Use “Quickview” from the “View” menu to confirm the reading of data without ??? appearing
- Change the value and wait a few seconds to ensure the change really occurred.

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Appendix D. REFERENCE

Appendix D.1. Data Types

If Node parameter Address_Type is set as ADU or PDU, then Data_Type must be specified as follows

For Address_Type ADU :

Address range	Data_Type	Function Code (Write)	Function Code (Read)
1 - 65536	Coil	15	1
1 – 65536	Discrete_Input	n/a.	2
1 – 65536	Input_Register	n/a.	4
1 - 65536	Holding_Register	16	3

For Address_Type PDU :

Address range	Data_Type	Function Code (Write)	Function Code (Read)
0 - 65535	FC01	15	1
0 – 65535	FC02	n/a.	2
0 – 65535	FC04	n/a.	4
0 – 65535	FC03	16	3

For Address_Type Modicon_5digit

When a Modbus address range is specified, a particular Data Type is implied. The defaults are as follows:

Address range	Data_Type	Function Code (Write)	Function Code (Read)
00001 - 09999	Coil	5,15	1
10001 - 19999	Discrete_Input	n/a.	2
30001 - 39999	Input_Register	n/a.	4
40001 - 49999	Holding_Register	6,16	3

Appendix D.2. Single Writes

If writing multiple registers the write function will 16

If writing multiple coils the write function will 15

If writing a single register the write function will be 6 unless Write_FNC parameter is set to “Multiple’

If writing a single coil the write function will be 5 unless Write_FNC parameter is set to “Multi