



A Sierra Monitor Company

Driver Manual
(Supplement to the FieldServer Instruction Manual)

FS-8700-101
Setra Digital Pressure Gage Model 370

APPLICABILITY & EFFECTIVITY

Effective for all systems manufactured after May 1, 2001

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1. Setra Model 370 Digital Pressure Gage Description

The 'Setra Model 370 Digital Pressure Gage' driver allows the FieldServer to transfer data to and from devices over either RS-232 or RS-485 using the 'Setra Model 370 Digital Pressure Gage' protocol. The FieldServer can emulate either a Server or Client.

The driver implements a subset of the commands and responses that an actual Setra Model 370 Digital Pressure Gage is capable of. Thus the driver permits the transfer of current pressure information, Gage status information and the processing of Gage verification information.

The driver is capable of providing active Client and passive Server support. An active Client polls for data and processes responses, it is not capable of processing unsolicited messages from the remote device. A passive Server can respond to polls but is not capable of sending unsolicited messages reporting change of state or other information.

When configured as a Client it is important the digital Gage is configured correctly and that it is left in an operational mode where it can respond easily to the commands sent to it. If a user, were to operate the Gage from its front panel and leave it in a configuration state, awaiting input from a user, then the Gage would be incapable of responding to commands from the FieldServer. The driver cannot write to the digital Gage. Thus alarm set points and other configuration tasks cannot be performed using a FieldServer.

Max Nodes Supported

FieldServer Mode	Nodes	Comments
Client	1	This is a nodeless protocol. Only one Server per FieldServer port.
Server	1	This is a nodeless protocol. Only one Client per FieldServer port.

2. Driver Scope of Supply

2.1. Supplied by FieldServer Technologies for this driver

FieldServer Technologies PART #	Description
FS-8917-01	Connector, 25 pin male: Connects to DCE, RTS/CTS loop
FS-8700-101	Driver Manual.

2.2. Provided by the Supplier of 3rd Party Equipment

2.2.1. Required 3rd Party Hardware

Part #	Description
M370	SETRA DIGITAL PRESSURE GAGE

2.2.2. Required 3rd Party Configuration

The M370 Gage must be configured using the operator’s manual and the front panel push buttons so that its serial port settings match the FieldServer settings.

The following notes have been extracted from the operator’s manual.

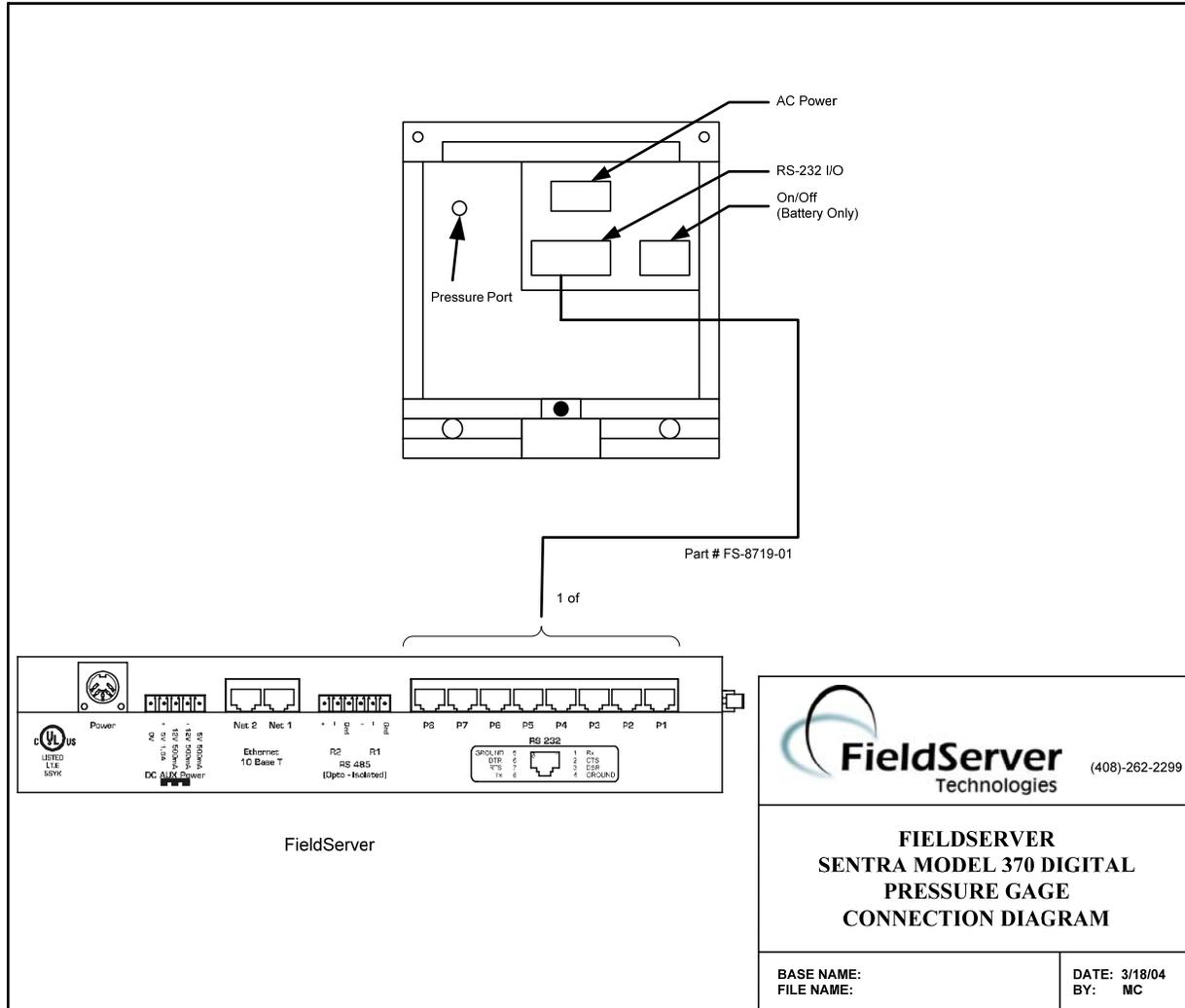
The Setra Digital Pressure Gage is capable of interfacing with a wide variety of computers or other devices through the RS-232 serial communications port. Devices which are connected this way must be set up to communicate at the same rate of speed. To change the baud rate of the gage (the rate at which the gage sends information out through the port) so it agrees with that of the device connected to it, use the following procedure.

1. Press **CONV** until the gage is displaying pressure units (make sure it is not displaying in "ft" or "meters").
2. Press the "-" key.
3. Enter "5555". This is the baud rate access code.
4. Press **SETUP**. The display will read "CAL br".
5. Enter the baud rate. Choose either 300, 600, 1200, 1800, 2400, 3600, 4800 or 9600.
6. Press **SETUP**.

The baud rate is factory set to 2400. If you change the baud rate and wish the gage to retain the new rate after power is removed and restored, repeat steps 2-6 a second time.

3. Hardware Connections

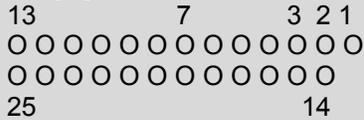
The FieldServer is connected to the rear side of the Model 370 Digital Pressure Gage as shown in the following connection drawing.



3.1. Hardware Connection Tips / Hints

The following notes are extracted from the Setra 370 Operator Manual.

The Setra Digital Pressure Gage implements the majority of the RS-232 communications standard, but does not provide handshaking lines (such as busy, DSR, or DTR). The four lines which must be connected are diagrammed below, along with the pin layout of the female connector on the back of the gage.



Pin	Desc.
1	Protective ground
2	Input to gage (RXD)
3	Output from gage (TXD)
7	Signal ground

The Model 370 serial interface is a DCE (Data Communications Equipment) type, with a standard female DB25S pin connector. This means that it receives data on pin 2 and sends data on pin 3. This is in contrast to DTE (Data Transmission Equipment) which receives data on pin 3 and sends data on pin 2. The RS-232 standard describes communications between DTE and DCE devices.

Since many computers have serial ports configured as DTE, the Model 370 conveniently plugs directly into the standard serial port on most computers, using a standard RS-232 "straight-through" cable available from SETRA, or from any computer hardware vendor. Some devices, including some printers and computers, will be equipped with DCE interfaces like that in the Model 370. To connect the Model 370 to these devices, a "null modem" cable is required. This is simply a cable which connects pin 2 and 3 of the Model 370 to pin 3 and 2 of the other device respectively by crossing them in the cable. This kind of cable is also available from SETRA, or from any computer hardware vendor.

The maximum recommended cable length is 15 meters.

The RS-232 data format used by the Model 370 is:
 8 bits, 1 start bit, 1 stop bit, no parity.

4. Configuring the FieldServer as a Setra Model 370 Digital Pressure Gage 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 Setra Model 370 Digital Pressure Gage.

4.1. Data Arrays/Descriptors

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for Setra Model 370 Digital Pressure Gage communications, the driver independent FieldServer buffers need to be declared in the “Data Arrays” section, the destination device addresses need to be declared in the “Client Side Nodes” section, and the data required from the Servers needs to be mapped in the “Client 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		
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. For this driver, FieldServer recommends the use of a FLOAT Data Array. This is because the pressure and status settings are reported as real signed numbers with some significant digits after the decimal point.	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_Format,      Data_Array_Length,
DA_PRESSURE,          FLOAT,            200
DA_STATUS,            FLOAT,            200
DA_DI_01,              Bit,              200
DA_DO_01,              Bit,              200
```

4.2. Client Side Connection Descriptors

Section Title		
Connections		
Column Title	Function	Legal Values
Port	Specify which port the device is connected to the FieldServer	P1-P8, R1-R2 ¹
Protocol	Specify protocol used	Setra370
Baud*	Specify baud rate	110 – 115200, standard baud rates only, 2400 .
Parity*	Specify parity	Even, Odd, None , Mark, Space
Data_Bits*	Specify data bits	7, 8
Stop_Bits*	Specify stop bits	1
Handshaking*	Specify hardware handshaking The Setra Model 370 does not support handshaking.	RTS, RTS/CTS, None
Poll_Delay*	Time between internal polls	0-32000 seconds, 1 second

Example

// Client Side Connections					
Connections					
Port,	Protocol,	Baud,	Parity,	Handshaking,	Poll_Delay
P8,	Setra370,	2400,	None,	None,	0.100s

4.3. Client Side Node Descriptors

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for node	Up to 32 alphanumeric characters
Node_ID	This commonly used parameter has no meaning for this driver and may be omitted.	
Protocol	Specify protocol used	Setra370.
Connection	Specify which port the device is connected to the FieldServer	P1-P8, R1-R2 ¹

Example

// Client Side Nodes		
Nodes		
Node_Name,	Protocol,	Connection
Gage1,	Setra370,	P8

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.

4.4. Client Side Map Descriptors

4.4.1. 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 "Data Array" section above
Data_Array_Offset	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Function	Function of Client Map Descriptor	RDBC

4.4.2. Driver Related Map Descriptor Parameters

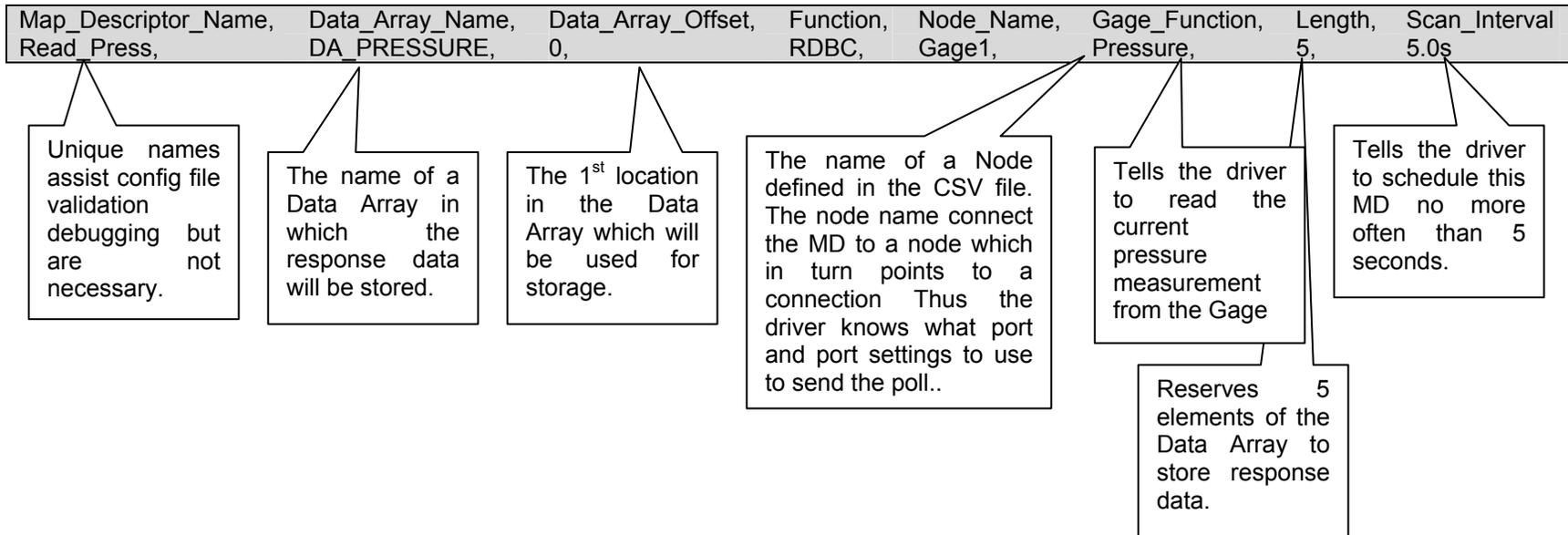
Column Title	Function	Legal Values
Node_Name	Name of Node to fetch data from	One of the node names specified in "Client Node Descriptor" above
Data_Type	This commonly used parameter has no special meaning to this driver and may be omitted.	Register, Coil, AI, DI
Length	Length of Map Descriptor	The driver knows the correct length for the various Map Descriptors and will prompt you accordingly if an invalid length is specified. Pressure : Set Length 5 Status: Set Length 14 Verification Info: Set length 100.
Address	This commonly used parameter has no special meaning to this driver and may be omitted.	
Gage_Function*	Specifies what data should be read and stored. If you omit this parameter then the driver assumes you are reading pressure.	Pressure , Status, Verify

4.4.3. Timing Parameters

Column Title	Function	Legal Values
Scan_Interval	Rate at which data is polled	≥0.001s

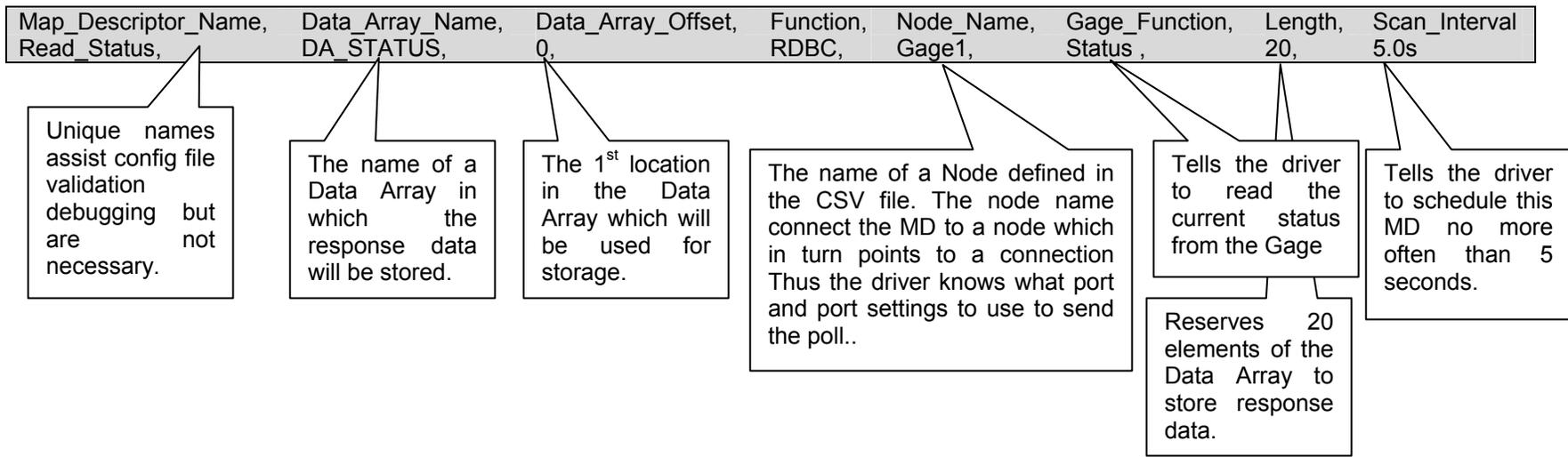
4.4.4. Map Descriptor Example #1 – Read Pressure.

In this example a Map Descriptor is defined which controls the task of reading pressure data from the Setra Model 370 Digital Pressure Gage. The task gets performed every 5.0 seconds. When a response is received the data is stored in the Data Array called DA_PRESSURE starting at element zero (the offset). Each pressure reading requires the driver store 5 parameters and hence the length of the Map Descriptor is 5. Refer to Appendix A for further information.



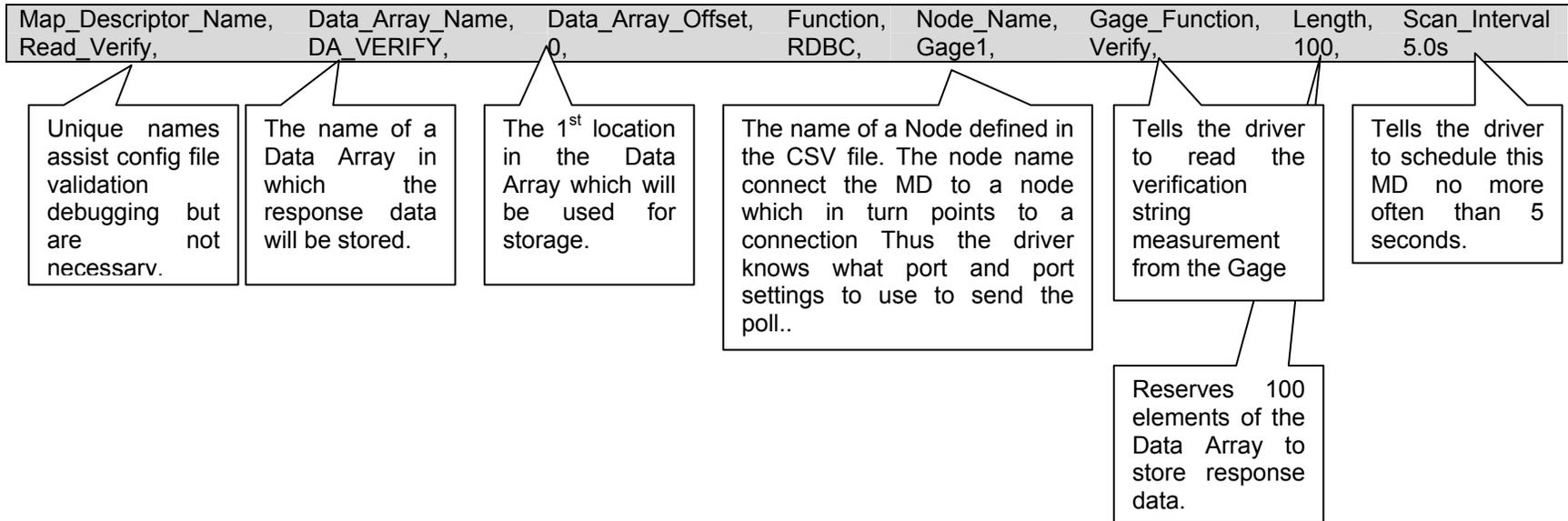
4.4.5. Map Descriptor Example #2 – Read Status

In this example a Map Descriptor is defined which controls the task of reading status data from the Setra Model 370 Digital Pressure Gage. The task gets performed every 5.0 seconds. When a response is received the data is stored in the Data Array called DA_STATUS starting at element zero (the offset). Each pressure status reading requires the driver store 20 parameters and hence the length of the Map Descriptor is 20. Refer to Appendix A for further information.



4.4.6. Map Descriptor Example #3 - Verify.

The verification string contains revision and model information about the Gage. In this example a Map Descriptor is defined which controls the task of reading verification data from the Setra Model 370 Digital Pressure Gage. The task gets performed every 5.0 seconds. When a response is received the data is stored in the Data Array called DA_VERIFY starting at element zero (the offset). Each Gage verification reading requires the driver store a string containing two lines of data. The actual length is unknown in advance and it is recommended that 100 Data Array elements be reserved to store the verification sting. The verification string is stored by writing each consecutive letter in consecutive Data Array elements. It is recommended that the Data_Array_Format is set to BYTE in this case. This will enable the use of the "String" display to read the verification string in RuiNet.



5. Configuring the FieldServer as a Setra Model 370 Digital Pressure Gage 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.

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with a Setra Model 370 Digital Pressure Gage Client

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for Setra Model 370 Digital Pressure Gage 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.

5.1. Server Side Connection Descriptors

Section Title		
Connections		
Column Title	Function	Legal Values
Port	Specify which port the device is connected to the FieldServer	P1-P8, R1-R2 ²
Protocol	Specify protocol used	Setra370
Baud*	Specify baud rate	110 – 115200, standard baud rates only
Parity*	Specify parity	Even, Odd, None , Mark, Space
Data_Bits*	Specify data bits	7, 8
Stop_Bits*	Specify stop bits	1
Handshaking*	Specify hardware handshaking	RTS, RTS/CTS, None
Server_Hold_Timeout*	Specifies time FieldServer will reserve Server side connection while waiting for the Client side to update data in Data_Array (if necessary)	>1.0s

Example

```
// Server Side Connections
Connections
Port,          Protocol,          Baud,          Parity,          Handshaking,
P8,           Setra370,         9600,         None,           None,
```

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.

5.2. Server Side Node Descriptors

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for node	Up to 32 alphanumeric characters
Node_ID	This commonly used parameter is not used by this driver and maybe omitted.	
Protocol	Specify protocol used	Setra370
Server_Hold_Timeout*	Specifies time FieldServer will reserve Server side connection while waiting for the Client side to update data in Data_Array (if necessary)	>1.0s

Example

```
// Server Side Nodes
Nodes
Node_Name, Protocol *
PLC 1, Setra370
```

* Note that no connection information is necessary on Server side.

5.3. Server Side Map Descriptors

5.3.1. 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 "Data Array" section above
Data_Array_Offset	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Function	Function of Server Map Descriptor	Server
Server_Hold_Timeout*	Specifies time FieldServer will reserve Server side connection while waiting for the Client side to update data in Data_Array (if necessary)	>1.0s

5.3.2. Driver Specific 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	This commonly used parameter has no special meaning to this driver and may be omitted.	Register, Coil, AI, DI
Length	Length of Map Descriptor	1 - 1000
Address	This commonly used parameter has no special meaning to this driver and may be omitted.	

5.3.3. Server Map Descriptor Example.

This Map Descriptor defines a capability of the FieldServer to respond to a poll for an immediate Pressure Print (Command Code = 'P'). When the poll is received, the driver inspects 5 consecutive array elements starting at offset 0 in the Data Array named DA_PRESSURE. The contents of the 5 elements are defined in Appendix A.1.1. The 2nd element is the units index, the 3rd is the pressure indicating letter. Both of these elements must be set to non-zero values.

Map_Descriptor_Name, SRV_Pressure,	Data_Array_Name, DA_PRESSURE	Data_Array_Offset, 0,	Function, Server	Node_name Gage1	Gage_Functon Pressure,	Length 5
---------------------------------------	---------------------------------	--------------------------	---------------------	--------------------	---------------------------	-------------

Data for the response to a 'P' poll is extracted from this Data Array.

This function defines a capability of the FieldServer to respond to an incoming poll.

The Map Descriptor is passive. It does not generate messages but is used to respond.

The Node Name must be the same as one of the nodes defined in the 'nodes' section of the CSV file.

Defines the capability of this Map Descriptor. This Map Descriptor can only be used to form responses to a 'P' poll.

Appendix A. Advanced Topics

Appendix A.1. How Data Gets Stored

Appendix A.1.1. Pressure Data

Offset (where x is the offset specified in the MD)	Notes
X + 0	Gage Pressure. A signed real number.
X + 1	Gage Pressure Units. A whole number which is used as a lookup into the table provide in section "Appendix A.2 Gage Pressure Units"
X + 2	Gage Pressure Indicating Letter 'A' = 65 'G' = 71 'T' = 84
X + 3	Set to 1 If the pressure reading reports the status as 'OK'
X + 4	Set to 1 If the pressure reading reports the pressure as a 'SEA LEVEL' reading

Appendix A.1.2. Status Data

If any fields are absent in the response to a poll for status data then the values are set to zero for that field.

Offset (where x is the offset specified in the MD)	Notes
X + 0	'ELEV:' measurement. A signed real number.
X + 1	'ELEV:' engineering units index. See table "Appendix A.2 Gage Pressure Units"
X + 2	'MAX:' measurement. A signed real number.
X + 3	'MAX:' engineering units index. See table "Appendix A.2 Gage Pressure Units"
X + 4	'MIN:' measurement. A signed real number.
X + 5	'MIN:' engineering units index. See table "Appendix A.2 Gage Pressure Units"
X + 6	'HI ALARM:' measurement. A signed real number.
X + 7	'HI ALARM:' engineering units index. See table "Appendix A.2 Gage Pressure Units"
X + 8	'LO ALARM:' measurement. A signed real number.
X + 9	'LO ALARM:' engineering units index. See table "Appendix A.2 Gage Pressure Units"
X + 10	'ZERO:' measurement. A signed real number.
X + 11	'ZERO:' engineering units index. See table "Appendix A.2 Gage Pressure Units"
X + 12	'UNIT:' measurement. A signed real number.
X + 13	'UNIT:' engineering units index. See table "Appendix A.2 Gage Pressure Units"

Appendix A.2. Gage Pressure Units

The driver does not report status and pressure reading units as text strings. Rather, the driver reports an index number. Use the index number and the table below to determine the units being reported.

Index #	Meaning
0	The Units field could not be interpreted correctly / there were no units reported / the units reported were not part of the following list. This may be the case if the Gage is reporting some custom units that the driver does not recognize.
1	HPA
2	PSI, psi
3	mbar, MBAR
4	MmHG, mmHg,
5	MmH2O
6	InH2O
7	ft, FT
8	m. M
9	Units
10	inHG, In HG, IN HG

Appendix A.3. Driver Limitations & Exclusions

This driver implements a subset of the commands defined by the protocol. The commands that have been implemented have been selected to provide relevant real time data transfer and have omitted configuration/setup functions.

The following table lists the commands that have been implemented.

Command	Code	Implemented
Immediate Print of Pressure Reading	P	Yes
Status Print	SP	Yes
Verification String	V	Yes
All others		No

Appendix B. Troubleshooting tips

Appendix B.1. Connection Tips & Hints

The digital pressure Gage must be left in an operational state, in which it is able to respond to the commands (polls) sent by the FieldServer. It is possible to enter a configuration mode using the buttons on the front panel of the Gage and then fail to complete the configuration sequence. In such cases, the Gage will not be able to respond to polls from the FieldServer. This problem can be eliminated by ensuring that, after operating the Gage from the front panel, that it is left in a mode where it is displaying the current measured pressure.

Appendix C. Driver Error Messages

Message	Notes and Corrective Action
Set370:#1 FYI. Use an Array called <%s> to expose diagnostic info.	This message is provided for information and may be ignored. Read Appendix C.1 for more information.
Set370:#2a. FYI. MD Length=%d assigned by driver.	This message is provided for information and may be ignored. The message is printed when the Map Descriptor length in the configuration file has not been specified. The driver makes the correction by itself. To stop this message being printed, modify the configuration file to match the length reported in the message.
Set370:#3 Err. No Write MD's allowed.	This Driver cannot be used to write to the Setra device. Remove any Map Descriptors whose function requires the FieldServer to write to the Setra device. ³
Set370:#4 FYI. MD param=Address has no meaning. Ignoring.	This message is provided for information and may be ignored. The address parameter is ignored by the driver. To stop this message being printed, remove the address parameter from the configuration file.
Set370:#5 Err. Diagnostic x	There are a few variations of this message. Note the variation and report the error to FieldServer tech support. You cannot resolve this error yourself. The error is printed when the driver executes a diagnostic function used for QA testing.
Set370:#6 Err. Array too short. DA=%s MD=%s	The Data Array associated with the reported MD is too short to store all the data returned by the Setra Gage. Increase the length of the Data Array and of the Map Descriptor. ³
Set370:#7 Err. Pressure message can't be parsed. Abandoned!	The response to a pressure reading request cannot be parsed by the driver. Use the connection view to check the number of protocol errors. If they keep rising, then take a log and report the error to FieldServer Tech Support. If the protocol errors are occasional then ignore them. ⁴
Set370:#8* Err. Status message can't be parsed. Abandoned!	The response to a status reading request cannot be parsed by the driver. Use the connection view to check the number of protocol errors. If they keep rising, then take a log and report the error to FieldServer Tech Support. If the protocol errors are occasional then ignore them.
Set370:#9 FYI. Default to reading pressure.	A Map Descriptor is found which does not have the 'Gage_Function' specified. The driver assumes your intention was to read the Gage's pressure. If you wish stop this message being printed then modify the configuration file and specify the 'Gage_Function' = 'Pressure'. ³
Set370:#10 Err. DA=%s too short. Act=%d Rqd=%d MD=%s	This message is printed when the driver is configured as a Server. The Data Array associated with the reported MD is too short to store the message. Modify the MD length and the DA length and try again. ³

³ Modify the configuration CSV file. Download the modified file to the FieldServer and reset the FieldServer for the changes to take effect.

⁴ Message is printed once and then suppressed. This is to prevent the error log filling with redundant repetition and thus obscuring other important information.

Appendix C.1. Exposing Driver Diagnostic Statistics

In addition to the standard FieldServer communication statistics described in Appendix C.2 and in the FieldServer Instruction Manual, this driver can also expose some driver statistics by writing data to a data array. A special Data Array name is required. The driver recognizes the Data Array by its name which must be "Setra370-Stats"

The following example shows how this Data Array can be configured. You can copy this section of text directly into your CSV file.

Data_Arrays		
Data_Array_Name, setra370-stats,	Data_Format, UINT32,	Data_Array_Length 1000

The driver stores the following data. The location in the data array is obtained by multiplying the port number by 100 and then using the location offset indicated in the table below.

<i>Offset + x</i> <i>Where x = port_number*100</i> <i>Physical Port 1 = Port Number 2</i> <i>Physical Port 2 = Port number 1</i>

Data Array Offset	Contents
0	For FieldServer use only.
1	For FieldServer use only.
2	For FieldServer use only.
3	Increments by 1 each time a Client poll message is sent to a Gage.
4	Increments each time a Client poll message is sent to a Gage. Increases by the number of bytes in the message.
5	Increments by 1 each time the Gage sends a response which is completely unsuitable for data storage. Includes messages which report the Gage is in a setup mode and is unable.
6	Increases each time the Gage receives a response which has some hope of containing data. Increased by the number of bytes in that message.
7	Increases each time the Gage receives a response which has some hope of containing data. Increased by 1 each time.
8	Increments by one each time a status response contains a line which appears not to be a heading but which does not appear to be suitable for data extraction.
9	Increments by 1 each time a status response contains no data which could be stored.
10	Increments by 1 each time a pressure reading response is not suitable for data extraction and storage.

Appendix C.2. Standard Driver Stats

Driver Statistics Recorded	Explanation
PLC Read Messages sent	Number of message sent to the Gage
PLC Write Messages sent	Should be zero
PLC Bytes sent	Total number of bytes sent by the Client side driver
PLC Message received	Total number of messages of all types received (ACK, NAK, error response, normal response) on the Client side driver.
PLC Bytes received	Total number of bytes received by all message types on the Client side driver.
Protocol	Protocol errors are incremented when the Client side cannot correctly parse a response message from the Gage. This includes responses that are formatted differently from what the driver expects, or messages that report the Gage is 'unable' or in setup mode.
IC_Timeout	Incoming message buffer experiences an excessive delay between incoming bytes
Timeout	Client side messages that were not responded to by a Server. Possibly a communications error or a command was made to a unit that does not exist.
Streaming	Message size was too large for the input buffer. This should never occur.
Exception	Increments when a 'status' response contains a line with insufficient information for storage but which may be a heading.

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