

### FieldServer

### QuickServer Start-up Guide FS-QS-1011/12X0/12X1/1X50/1X51



#### **APPLICABILITY & EFFECTIVITY**

Effective for all systems manufactured after July 2020.

Document Revision: 2.J T18600



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#### **S**MG<sup>sierra</sup> monitor

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#### QUICKSERVER DESCRIPTION

QuickServer is a high performance, cost effective Building and Industrial Automation multi-protocol gateway providing protocol translation between serial, Ethernet, and LonWorks<sup>1</sup> devices and networks.

# NOTE: For troubleshooting assistance refer to Appendix B, or any of the troubleshooting appendices in the related driver supplements. Check the <u>Sierra Monitor website</u> for technical support resources and documentation that may be of assistance.

The QuickServer is cloud ready and connects with MSA Safety's SMC Cloud. See **Section 8.5.1** for further information.

#### 2 SUPPLIED EQUIPMENT

#### QuickServer Gateway

- Preloaded with two selected drivers (on the FS-QS-1X11 and FS-QS-12X1 one of those drivers is LonWorks). A sample configuration file is also pre-loaded onto the QuickServer.
- All instruction manuals, driver manuals, support utilities are available on the USB drive provided in the optional accessory kit, or on the <u>Sierra Monitor website</u>.

Accessory kit (optional) (Part # FS-8915-36-QS) includes:

- 7-ft Cat-5 cable with RJ45 connectors at both ends
- Power Supply -110/220V (p/n 69196)
- DIN rail mounting bracket
- Screwdriver for connecting to terminals
- USB Flash drive loaded with:
  - QuickServer Start-up Guide
  - FieldServer Configuration Manual
  - All FieldServer Driver Manuals
  - Support Utilities
  - Any additional folders related to special files configured for a specific QuickServer



o Additional components as required - see Driver Manual Supplement for details

<sup>&</sup>lt;sup>1</sup> LonWorks is a registered trademark of Echelon Corporation.





#### **3 CERTIFICATIONS**

#### 3.1 BTL Mark – BACnet<sup>2</sup> Testing Laboratory



The BTL Mark is a symbol that indicates that a product has passed a series of rigorous tests conducted by an independent laboratory which verifies that the product correctly implements the BACnet features claimed in the listing. The mark is a symbol of a high-quality BACnet product.

Go to <u>www.BACnetInternational.net</u> for more information about the BACnet Testing Laboratory. Click <u>here</u> for the BACnet PIC Statement.

#### 3.2 LonMark Certification



LonMark International is the recognized authority for certification, education, and promotion of interoperability standards for the benefit of manufacturers, integrators and end users. LonMark International has developed extensive product certification standards and tests to provide the integrator and user with confidence that products from multiple manufacturers utilizing LonMark devices work together. MSA Safety has more LonMark Certified gateways than any other gateway manufacturer, including the QuickServer, ProtoCessor, ProtoCarrier and ProtoNode for OEM applications and the full featured, configurable gateways.

<sup>&</sup>lt;sup>2</sup> BACnet is a registered trademark of ASHRAE.



#### 4 QUICKSERVER SETUP

#### 4.1 Mounting

The following mounting options are available:

- Product comes with tabs for wall or surface mount. These can be snapped off if not required.
- DIN rail mounting bracket Included in the accessory kit or ordered separately (part # FS-8915-35-QS).



WARNING: Install only as instructed, failure to follow the installation guidelines or using screws without the DIN rail mounting bracket could result in permanent damage to the product. If the FieldServer is removed from the DIN rail, use the original screws to reattach. Only screws supplied by MSA Safety should be used in the holes found on the back of the unit when attaching the optional DIN Rail bracket. USE OF ANY OTHER SCREWS MAY DAMAGE THE UNIT.



#### 4.2 Dimensions

#### 4.2.1 Dimension Drawing FS-QS-1X10-XXXX





#### 4.2.2 Dimension Drawing FS-QS-1XX1-XXXX





#### 4.2.3 Dimension Drawing FS-QS-123X Models with RS-422





#### 4.3 R2 Port Jumper Settings

Gently remove the QuickServer enclosure to access the jumpers on the unit.

#### 4.3.1 RS-485 Port

#### NOTE: The following Sections only apply to QuickServer models: FS-QS-1011 and FS-QS-1211.



The QuickServer bias resistors are used to keep the RS-485 bus to a known state, when there is no transmission on the line (bus is idling), to help prevent false bits of data from being detected. The bias resistors typically pull one line high and the other low - far away from the decision point of the logic.

In the RS-485 carrier, the bias resistor is 510 ohms which is in line with the BACnet spec. It should only be enabled at one point on the bus (on the field port were there are very weak bias resistors of 100k). Since there are no jumpers, many FieldServers can be put on network without running into the bias resistor limit which is < 500 ohms.

NOTE: See <u>www.ni.com/support/serial/resinfo.htm</u> for additional pictures and notes.



#### 4.3.1.2 Termination Resistor



Termination resistors are also used to reduce noise. These pull the two lines of an idle bus together. However, they would override the effect of any bias resistors, if connected.



#### 4.3.1.3 Power Jumper Settings



The QuickServer Carrier Board power jumper is set to position A by default but can be changed to position B for other power supply requirements.

- **Position A:** The Carrier makes use of a full-wave rectifying bridge. Can be used for 12-24VAC input or 9 30VDC input. At 9VDC this becomes marginal.
- **Position B:** The Carrier makes use of a half-wave rectifying bridge. Best position for grounded AC transformers and for using DC voltage down to 9VDC.



#### 4.3.2 M-Bus Port: Master/Slave Jumper

### NOTE: The following only applies to models: FS-QS-1A50, FS-QS-1A51, FS-QS-1B51, FS-QS-1B51, FS-QS-1C51 and FS-QS-1C51.

The Master/Slave jumper is used to set the M-Bus hardware as a Master or Slave device (indicated by the labels on the board).





#### 4.4 R1 Port Small DIP Switches

Gently remove the QuickServer enclosure to access the small DIP switches for the R1 Port.

#### 4.4.1 RS-485 Port

NOTE: The following only applies to QuickServer models FS-QS-1XX0 or all non-LonWorks models.



- If more than one RS-485 device is connected to the network, then the field bias resistor switch needs to be enabled to ensure proper communication. See Figure 9 for the orientation of switch positions referenced below.
  - The default factory setting is OFF (switch position = right side)
  - To enable biasing, turn the bias switch ON (switch position = left side)

### NOTE: Biasing only needs to be enabled on one device. The QuickServer has 510-ohm resistors that are used to set the biasing.

- If the FieldServer is the last device on the trunk, then the end of line (EOL) termination switch needs to be enabled. See Figure 9 for the orientation of switch positions referenced below.
  - The default factory setting is OFF (switch position = right side)
  - To enable the EOL termination, turn the EOL switch ON (switch position = left side)



#### 5 INSTALLING THE QUICKSERVER

#### 5.1 RS-485

#### 5.1.1 RS-485 Connection R2 Port



Connect to the 3 pins on the left-hand-side of the 6-pin connector as shown.

The following Baud Rates are supported on the R2 Port: 4800, 9600, 19200, 38400, 57600, 115200

For connection details to RS-232 or RS-422, refer to Appendix A.1.

#### 5.1.2 RS-485 Connection R1 Port

#### NOTE: The following only applies to non-LonWorks QuickServers with an RS-435 R1 port.

Connect to the 3-pin connector as shown.



The following Baud Rates are supported on the R1 Port:

110, 300, 600, 1200, 2400, 4800, 9600, 19200, 20833, 28800, 38400, 57600, 76800, 115200



#### 5.2 QuickServer LonWorks (FS-QS-1XX1-XXXX)

Connect the QuickServer to the LonWorks terminal using a twisted pair non-shielded cable.



To commission the QuickServer LonWorks port, insert a small screwdriver in the commissioning hole on the face of the QuickServer's enclosure to access the Service Pin. See the instructions on the QuickServer as to which way to toggle the screwdriver during commissioning.

#### 5.3 QuickServer KNX (FS-QS-124X-XXXX)

Connect the QuickServer to the KNX bus using the standard KNX twisted pair cable.



To commission the QuickServer as a KNX device in ETS Software, insert a small pin into the KNX commissioning hole on the face of the QuickServer to access the button.



#### 5.4 RS-232 Connection R2 Port (only available on FS-QS-122X Models)



Refer to Appendix A2 for further hardware connection options.

The following Baud Rates are supported on the R2 Port: 4800, 9600, 19200, 38400, 57600, 115200



#### 6 **OPERATION**

#### 6.1 Power Up the Device

Apply power to the device. Ensure that the power supply used complies with the specifications provided. Ensure that the cable is grounded using the "Frame GND" terminal. The QuickServer is factory set for 9-30V DC or 12-24V AC.



#### 6.2 Connect the PC to the QuickServer Over the Ethernet Port



- Connect an Ethernet cable between the PC and QuickServer or connect the QuickServer and the PC to the switch using a straight Cat-5 cable.
- The Default IP Address of the QuickServer is 192.168.2.101, Subnet Mask is 255.255.255.0.



#### 6.3 Connecting to the QuickServer

- 6.3.1 Using the FieldServer Toolbox to Discover and Connect to the QuickServer
  - Install the Toolbox application from the USB drive or download it from the Sierra Monitor website.
  - Use the FS Toolbox application to find the QuickServer and launch the FS-GUI.

### NOTE: If the connect button is greyed out, the QuickServer's IP Address must be set to be on the same network as the PC. (Section 8.1)

| smc FieldServer Tool  | box   |             |                   |    |                        |              | -  |      | $\times$       |
|-----------------------|-------|-------------|-------------------|----|------------------------|--------------|----|------|----------------|
| FieldSer<br>Setup Hel | ver T | oolbox      |                   |    |                        | S            | ſſ | Sie  | erra<br>onitor |
| DEVICES               | ٠     | IP ADDRESS  | MAC ADDRESS       |    | <sup>:</sup> AVORITE ( | CONNECTIVITY |    |      |                |
| E8951 Gateway         |       | 10.40.50.90 | 00:50:4E:60:06:36 | C2 | *                      | •            |    | Conr | hect -M-       |
|                       |       |             |                   |    |                        |              |    |      |                |

6.3.2 Using a Web Browser to Connect to the QuickServer

- Open a web browser and connect to the QuickServer's default IP Address. The default IP Address of the FieldServer is **192.168.2.101**, Subnet Mask is **255.255.255.0**.
- If the PC and the QuickServer are on different IP networks, assign a static IP Address to the PC on the 192.168.2.X network.



#### 7 SETUP WEB SERVER SECURITY

#### 7.1 Login to the FieldServer

The first time the FieldServer GUI is opened in a browser, the IP Address for the gateway will appear as untrusted. This will cause the following pop-up windows to appear.

• When the Web Server Security Unconfigured window appears, read the text and choose whether to move forward with HTTPS or HTTP.

| Web Server Security Unconfigured   |     |
|--|-----|
| Web server security has not yet been configured for the gateway. You have the option to continue with HTTP, which is not secure, or rather use HTTPS.  | 9   |
| Note that this gateway was shipped with a self-signed<br>certificate. The browser will issue a security warning<br>when using HTTPS with this certificate since it is<br>untrusted. Please ignore this warning and ask the<br>gateway administrator to configure the web server<br>security. |     |
| Use HTTPS (Recommended) Continue with HTTP   | >   |
| Figure 17: Web Server Security Unconfigured Wind   | wob |

• When the warning that "Your connection is not private" appears, click the advanced button on the bottom left corner of the screen.





 Additional text will expand below the warning, click the underlined text to go to the IP Address. In the Figure 19 example this text is "Proceed to 10.40.50.94 (unsafe)".

| I help improve sale browsing by sending some system mormation and page con  | ntent to doogle.              |
|---|-------------------------------|
| Privacy policy  |                               |
|   |                               |
|   |                               |
| Hide advanced   | Back to safety                |
|   |                               |
| This server could not prove that it is <b>10.40.50.94</b> ; its security certificate is your computer's operating system. This may be caused by a misconfigura attacker intercepting your connection. | not trusted by<br>ation or an |
| Proceed to 10.40.50.94 (unsafe)   |                               |
| Figure 19: Warning Expanded Text  |                               |

- When the login screen appears, put in the Username (default is "admin") and the Password (found on the label of the FieldServer).
- NOTE: There is also a QR code in the top right corner of the FieldServer label that shows the default unique password when scanned.

| SMC |                              |  |
|-----|------------------------------|--|
|     |                              |  |
|     | Log In                       |  |
|     | Username                     |  |
|     | Password                     |  |
|     | Log In                       |  |
|     | Forgot Password?             |  |
|     |                              |  |
|     | Figure 20: FieldServer Login |  |

- NOTE: A user has 5 attempts to login then there will be a 10-minute lockout. There is no timeout on the FieldServer to enter a password.
- NOTE: To create individual user logins, go to Appendix C.5.



#### 7.2 Select the Security Mode

• On the first login to the FieldServer, the following screen will appear that allows the user to select which mode the FieldServer should use.

| SMG  | a<br>itor   |
|--|---|
| Plea<br>Not<br>untr  | b server security is not configured<br>ase select the web security profile from the options below.<br>e that browsers will issue a security warning when browsing to a HTTPS server with an<br>usted self-signed certificate. |
| Mode <ul> <li>HTTPS with defa</li> <li>HTTPS with owr</li> <li>HTTP (not secur</li> </ul> Save | ault trusted TLS certificate (requires internet connection to be trusted)<br>n trusted TLS certificate<br>re, vulnerable to man-in-the-middle attacks)  |
|  | Figure 21: Security Mode Selection Screen   |

#### NOTE: Cookies are used for authentication.

#### NOTE: To change the web server security mode after initial setup, go to Appendix C.4.

The sections that follow include instructions for assigning the different security modes.



#### 7.2.1 HTTPS with Own Trusted TLS Certificate

This is the recommended selection and the most secure.

• Once this option is selected, the Certificate, Private Key and Private Key Passphrase fields will appear under the mode selection.

| Certificate   |    |
|---|----|
| XzyMbQZFiRuJZJPe7CTHLcHOrHLowoUFoVTaBMYd4d6VGdNklKazByWKcNOL7mrX  |    |
| A4IBAQBFM+IPvOx3T/47VEmaiXqE3bx3zEuBFJ6pWPIw7LHf2r2ZoHw+9xb+aNMU  |    |
| dVyAelhBMTMsni2ERvQVp0xj3psSv2EJyKXS1bOYNRLsq7UzpwuAdT/Wy3o6vUM5  |    |
| K+Cwf9qEoQ0LuxDZTIECt67MkcHMiuFi5pk7TRicHnQE/sfOAYOulduHOy9exlk9  |    |
| FmHFVDIZt/cJUaE+e74EuSph+gEr0IQo2wvmhyc7L22UXse1NoOfU2Zg0Eu1VVtu  |    |
| JRryaMWiRFEWuuzMGZtKFWVC+8q2JQsVcgiRWM7naoblLEhOCMH+sKHJMCxDoXGt  |    |
| vtZjpZUoAL51YXxWSVcyZdGiAP5e  | -  |
| END CERTIFICATE   | Ť, |
| SHBUZZOHr4YQSDK2BbYYZZbl0LDuKtc8+JIO300Gj0TuHngkeAj/tKtbTAsKeAzw<br>gKQe+H5UQNK0bdvZfOJrm6daDK2vVDmR5k+jUUhEj5N49upIroB97MQgYotzgfT+<br>THIbpg5t1SIK617k04ObKmHF5l8fck+ru545sVmpeezh0m5j5SURYAZMvbg5daCu<br>J4I5NlihbEvxRF4UK41ZDMCvujoPcBKUWrb1a/3XXnDnM2K9xyz2wze998D6Wk46<br>+7aOFY9E+7j5ljmnkoS3GYtwCyH5jP+mPP1K6RnuiD019wvvGPb4dtN/RTnfd0eE<br>GYeVSkl9fxxkxDOFtfdWRZbM/rPjn4tmO1Xf8HgONVN1x/iaMynOXG4cukoi4+VO<br>u0rZaUEsII2zNkfm7fAASm5NBWg202Cy9IAYnuujs3aALI5uGBeekA62oTMxlzx | Ţ  |
| Private Key Passphrase Specify if encrypted   |    |
| Figure 22: Security Mode Selection Screen   |    |

- Copy and paste the Certificate and Private Key text into their respective fields. If the Private Key is encrypted type in the associated Passphrase.
- Click Save.
- A "Redirecting" message will appear. After a short time, the Web Configurator page will open.

#### 7.2.2 HTTPS with Default Untrusted Self-Signed TLS Certificate or HTTP with Built-in Payload Encryption

- Simply select one of these options and click the Save button.
- A "Redirecting" message will appear. After a short time, the Web Configurator page will open.



#### 8 CONFIGURING THE QUICKSERVER

Once the web server setup is complete, the FS-GUI landing page will appear.

| SMC                               |                                  |                                |
|-----------------------------------|----------------------------------|--------------------------------|
| Navigation                        | Demo                             | A                              |
| Demo     About                    | Status Settings                  | Info Stats                     |
| > Setup                           | Status                           | 0                              |
| > View                            | Name                             | Value                          |
| <ul> <li>User Messages</li> </ul> | Driver_Configuration             | PCC1043                        |
|                                   | DCC_Version                      | V1.00b (C)                     |
|                                   | Kernel_Version                   | V6.32a (A)                     |
|                                   | Release_Status                   | Normal                         |
|                                   | Build_Revision                   | 3.14.0                         |
|                                   | Build_Date                       | Wed Apr 19 18:00:59 2017 +0200 |
|                                   | BIOS_Version                     | 3.0.11                         |
|                                   | FieldServer_Model                | ProtoCessor FFP LON            |
|                                   | Carrier Type                     | 485 Carrier                    |
|                                   | Data_Points_Used                 | 0                              |
|                                   | Data_Points_Max                  | 1500                           |
|                                   | Application Memory:              |                                |
|                                   | Memory_Percent_Used              | 2.32%                          |
|                                   | Memory_Used                      | 401 kB 👻                       |
| Home HELP (F1) Contact Us         | System Restart System Time Synch | Reset Cycle Times              |
|                                   | Figure 23: FS-GL                 | JI Landing Page                |

NOTE: The SMC Cloud button SMC cloud (see Figure 23) allows users to connect to the SMC Cloud, MSA Safety's device cloud solution for IIoT. The SMC Cloud enables secure remote connection to field devices through a FieldServer and its local applications for configuration, management, maintenance. For more information about the SMC Cloud, refer to the SMC Cloud Start-up Guide.



#### 8.1 Set IP Address of the QuickServer Using FS-GUI

- From the FS-GUI home page, click on setup and then Network Settings to enter the Edit IP Address Settings menu.
- Modify the IP Address (N1 IP Address field) of the QuickServer Ethernet port.
- If necessary, change the Netmask (N1 Netmask field).
- Type in a new Subnet Mask.
- If necessary, change the IP Gateway (Default Gateway field).
- Type in a new IP Gateway.

### NOTE: If the FieldServer is connected to a router, the IP Gateway of the FieldServer should be set to the same IP Address of the router.

• Click Update IP Settings, then click on the System Restart to restart the Gateway and activate the new IP Address.

### NOTE: If the FS-GUI was open in a browser, the browser will need to be pointed to the new IP Address of the QuickServer before the FS-GUI will be accessible again.

| Navigation  | Network Setting                                       | 5  |                    |  |  |  |
|---|---|--|--------------------|--|--|--|
| Modbus Client<br>• About  | IP Settings   |  |                    |  |  |  |
| Setup     File Transfer     Network Settings     Passwords     Time Settings     View | Note<br>Updated settings only<br>new IP Address after | Note<br>Updated settings only take effect after a System Restart. If the IP Address is changed you will need to direct your browser to the<br>new IP Address after the System Restart. |                    |  |  |  |
| User Messages   |   | N1 IP Address  | 192.168.3.17       |  |  |  |
| <ul> <li>Diagnostics</li> </ul>   |   | N1 Netmask   | 255.255.255.0      |  |  |  |
|   |   | N1 DHCP Client State   | DISABLED 🔻         |  |  |  |
|   |   | Default Gateway  | 192.168.3.1        |  |  |  |
|   |   | Domain Name Server1  | 8.8.8.8            |  |  |  |
|   |   | Domain Name Server2  | 8.8.4.4            |  |  |  |
|   |   | Cancel   | Update IP Settings |  |  |  |
|   | MAC Address   |  |                    |  |  |  |
|   | N1 MAC Address: 00:                                   | 50:4E:60:06:3C   |                    |  |  |  |
|   |   |  |                    |  |  |  |
|   |   |  |                    |  |  |  |
| Home HELP (F1) Contact L  | s System Restart                                      |  |                    |  |  |  |



#### 8.2 Retrieve the Sample Configuration File

The configuration of the QuickServer is provided to the QuickServer's operating system via a commadelimited file called "CONFIG.CSV".

If a custom configuration was ordered, the QuickServer will be programmed with the relevant device registers in the Config.csv file for the initial start-up. If not, the product is shipped with a sample config.csv that shows an example of the drivers ordered.

• In the main menu of the FS-GUI screen, go to "Setup", then "File Transfer", and finally "Retrieve".

| Navigation   | File Transfer   |
|--|---|
| <ul> <li>Modbus Client</li> <li>About</li> <li>Setup <ul> <li>File Transfer</li> <li>Network Settings</li> <li>Passwords</li> <li>Time Settings</li> </ul> </li> <li>View <ul> <li>User Messages</li> <li>Diagnostics</li> </ul> </li> </ul> | Configuration       Firmware       General         Update Configuration       Update the configuration file on the device.         Choose Files No file chosen       Submit         Submit       Retrieve         Retrieve the configuration file from the device.       config.csv |
| Home HELP (F1) Contact   | Delete         Delete the device configuration.         Warning: Make sure you have saved a copy of your config.csv file.         Delete Configuration         S         System Restart         System Restart  |

• Click on "config.csv", and open or save the file.

#### 8.3 Change the Configuration File to Meet the Application

Refer to the FieldServer Configuration Manual in conjunction with the Driver supplements for information on configuring the QuickServer.



#### 8.4 Load the Updated Configuration File

- 8.4.1 Using the FS-GUI to Load a Configuration File
  - In the main menu of the FS-GUI screen, click "Setup", then "File Transfer" and finally "Update".
  - Browse and select the .csv file, open, then click "Submit".

| SMC  |   |
|--|---|
| Navigation   | File Transfer   |
| <ul> <li>Modbus Client</li> <li>About</li> <li>Setup</li> <li>File Transfer</li> <li>Network Settings</li> <li>Passwords</li> <li>Time Settings</li> <li>View</li> <li>User Messages</li> <li>Diagnostics</li> </ul> | Configuration       Firmware       General         Update Configuration       Update the configuration file on the device.         Choose Files No file chosen       Submit         Submit       Retrieve         Retrieve the configuration file from the device.       config.csv |
| Home HELP (F1) Contact U   | Delete Delete the device configuration. Warning: Make sure you have saved a copy of your config.csv file. Delete Configuration  System Restart System Reboot  |
|  | Figure 26: FS-GUI Loading Files   |

- Once download is complete, a message bar will appear confirming that the configuration was updated successfully.
- Click the System Restart Button to put the new file into operation.

#### NOTE: It is possible to do multiple downloads to the QuickServer before resetting it.



#### 8.4.2 Retrieve the Configuation File for Modification or Backup

To get a copy of the configuration file for modifying or backing up a configuration on a local computer, do the following:

• In the main menu of the FS-GUI screen, click "Setup", then "File Transfer".

| SMC   |  |  |  |  |
|---|--|--|--|--|
| Navigation  | File Transfer  |  |  |  |
| <ul> <li>Modbus Client</li> <li>About</li> <li>Setup</li> </ul>             | Configuration Firmware General   |  |  |  |
| File Transfer     Network Settings     Passwords     Time Settings     View | Update Configuration Update the configuration file on the device. Choose Files No file chosen                                  |  |  |  |
| View     User Messages     Diagnostics                                      | Submit   |  |  |  |
|   | Retrieve Retrieve the configuration file from the device. config.csv   |  |  |  |
|   | Delete Delete the device configuration. Warning: Make sure you have saved a copy of your config.csv file. Delete Configuration |  |  |  |
| Home HELP (F1) Contact Us   | System Restart System Reboot   |  |  |  |
| Figure 27: Retrieve Configuration File                                      |  |  |  |  |

- Click the "config.csv" link under the "Retrieve" heading in the middle section of the screen.
  - The file will automatically download to the web browser's default download location.
- Edit or store the file as desired.

### NOTE: Before using any backup configuration file to reset the configuration settings, check that the backup file is not an old version.



#### 8.5 Test and Commission the QuickServer

- Connect the QuickServer to the third-party device(s) and test the application.
- From the landing page of the FS-GUI click on "View" in the navigation tree, then "Connections" to see the number of messages on each protocol.

| SMC   |       |                     |        |        |         | (       |        | JU |
|---|-------|---------------------|--------|--------|---------|---------|--------|----|
| Navigation  | Co    | nnections           |        |        |         |         |        |    |
| <ul> <li>Modbus Client</li> <li>About</li> </ul>                                | C     | verview             |        |        |         |         |        |    |
| > Setup   | Conne | ctions              |        |        |         |         |        | 0  |
| View  | Index | Name                | Tx Msg | Rx Msg | Tx Char | Rx Char | Errors | \$ |
| <ul> <li>S1 - MODBUS RTU</li> </ul>   | 0     | S1 -<br>MODBUS RTU  | 0      | 0      | 0       | 0       | 0      |    |
| <ul> <li>R1 - BACnet_MSTP</li> </ul>  | 1     | R1 -<br>BACnet_MSTP | 0      | 0      | 0       | 0       | 0      |    |
| <ul> <li>Map Descriptors</li> <li>User Messages</li> <li>Diagnostics</li> </ul> |       |                     |        |        |         |         |        |    |
| Home HELP (F1) Contact Us   | Rese  | t Statistics        |        |        |         |         |        |    |
| Figure 28: FS-GUI Connections Page  |       |                     |        |        |         |         |        |    |

#### 8.5.1 Accessing SMC Cloud

The SMC Cloud button (see Figure 23) allows users to connect to the SMC Cloud, MSA Safety's device cloud solution for IIoT. The SMC Cloud enables secure remote connection to field devices through a FieldServer and its local applications for configuration, management, maintenance. For more information about the SMC Cloud, refer to the <u>SMC Cloud Start-up Guide</u>.

#### **APPENDIX A USEFUL FEATURES**

#### Appendix A.1. RS-422 Connection R2 Port

#### NOTE: The following only applies to models: FS-QS-1230 and FS-QS-1231.

RS-422 is a full duplex multi-drop multi-master differential bus. It can be wired to conform to a RS-485 network when less wiring/cabling is used (due to being less expensive to install), but then it becomes a half-duplex multi-drop multi-master differential bus. RS-422 is used for dedicated peer to peer high speed communication when low bus latency is required (very few devices on the bus). Its usage is very specific to client installations/requirements.



#### NOTE:

- The RS-232 looks similar to the RS-485 but does not have the blue jumper. The blue jumper is
  used to enable the termination resistor for the RX signals (120 ohms), while the red jumpers are
  used to enable the bias resistors for RX signals (510 ohms). In the case of Rockwell/Tetrapak, all
  jumpers are always required to be in default position (not enabled). For other clients, the bias
  resistors should always be in the "on" state.
- The part number on the back of the box will identify the port.



#### Appendix A.1.1. Connection and Operation via the RS-422 Port



#### RS-422 Connector

- *Pin 1-2:* TX +/- (Differential TX outputs: All + signals must be connected to each other, and same applies to signals; no +/- signals may be crossed)
- *Pin 3-4:* RX +/- (Differential RX inputs: All + signals must be connected to each other, and same applies to signals, no +/- signals may be crossed)
- *Pin 5:* SHD (Shield connection, must be connected on at least one side of the bus, but not necessarily on both sides)

#### **POWER Connector**

Please note that AC voltage is not supported on the RS-422 carrier, and that DC voltage range is ~20VDC to ~28VDC.

- *Pin 1:* +24V (DC power requires this pin be used for the positive voltage)
- *Pin 2:* 0V (DC power requires this pin is used for ground / return voltage)
- *Pin 3:* FG (this pin needs to be connected to EARTH or noise free reference point CHASSIS)



#### Appendix A.2. KNX Connection R2 Port

#### NOTE: The following only applies to models: FS-QS-1240 and FS-QS-1241.

The KNX QuickServer is used to transfer data to and from devices using KNX protocol. The KNX driver enables data access from KNX networks to other FieldServer protocols. Most KNX data-point types are supported, allowing communication to almost any kind of KNX device in an installation, such as temperature sensors, shutters, light switches, actuators, alarms, etc. This allows BMS systems to access a KNX network using direct read and write or with KNX configured groups. This setup does not require the use of ETS4 to configure the QuickServer KNX gateway. The KNX protocol is a connectionless protocol and therefore supports multiple clients and multiple servers. The QuickServer is intended to act as a Passive Client on the KNX bus and makes information available to other protocols.



The KNX Connector consist of a KNX + and KNX- terminal. Each terminal corresponds to the red KNX+ and gray KNX- bus connections on a KNX bus.

The following Baud Rates are supported on the R2 Port: 4800, 9600, 19200, 38400, 57600, 115200



#### Appendix A.3. M-Bus Connection R2 Port

### NOTE: The following only applies to models: FS-QS-1A50, FS-QS-1A51, FS-QS-1B50, FS-QS-1B51, FS-QS-1C50 and FS-QS-1C51.

The M-Bus driver allows the FieldServer to transfer data to and from devices using M-Bus protocol. The Fieldbus connection is included with the FieldServer. The M-Bus QuickServer Gateway is configurable to act as both a Master and a Slave M-Bus device.

The M-Bus Connector consist of a + and – terminal. Most M-Bus Devices are not polarity sensitive, although the polarity of the M-Bus Connector is indicated on the device diagram, should it be a requirement. The M-Bus devices to communicate with the FieldServer must be configured according to the manufacturer's instructions (for example primary address and readout data).



The following baud rates are supported on the R2 Port: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400



#### Appendix A.4. SSL/TLS for Secure Connection

SSL/TLS (Secure Sockets Layer/Transport Layer Security) is a security technology for establishing an encrypted connection between a server and a client. This allows the secure transfer of data across untrusted networks.

These functions are supported on the following:

FS-QS-1011 or FS-QS-1211 with a serial number starting with 15 or later (indicating the year it shipped).

Minimum BIOS requirement: 2.6.1

Appendix A.4.1. Configuring FieldServer as a SSL/TLS Server

The following example sets the FieldServer to accept a secure Modbus/TCP connection on port 1502.

Appendix A.4.1.1. Simple Secure Server Configuration

Add TLS\_Port parameter in the connections section of the configuration file and set to a port number between 1 – 65535.

Connections Adapter , Protocol , TLS\_Port N1 , Modbus/TCP , 1502

This configuration sets the FieldServer to accept any incoming connection but will not request a client's certificate for verification. This means that the FieldServer end point communication will be encrypted but not authenticated.

The FieldServer will send an embedded self-signed certificate if one is requested by a connecting client.

#### NOTE: If a remote client requires a certificate, then request the smc\_cert.pem certificate from FieldServer Technical Support and update the remote client's authority as per vendor instructions.

#### Appendix A.4.1.2. Limiting Client Access

In addition to TLS\_Port parameter also add Validate\_Client\_Cert in the connections section of the configuration file and set it to "Yes".

#### Connections

|         | 0110         |            |                        |
|---------|--------------|------------|------------------------|
| Adapter | , Protocol   | , TLS_Port | , Validate_Client_Cert |
| N1      | , Modbus/TCP | , 1502     | , Yes                  |
|         |              |            |                        |

The configuration above sets the FieldServer to request and verify a client's certificate against its internal authority file before accepting connection. By default, this means the FieldServer will only accept connections from other FieldServers.

In order to load an authority file so that the FieldServer will accept connections from a chosen list of remote clients, configure the FieldServer with the following connection settings:

| Connectio | ons          |            |                        |                             |
|-----------|--------------|------------|------------------------|-----------------------------|
| Adapter   | , Protocol   | , TLS_Port | , Validate_Client_Cert | , Cert_Authority_File       |
| N1        | , Modbus/TCP | , 1502     | , Yes                  | , my_authorized_clients.pem |

This configuration has the FieldServer accept connections from clients who have the correct certificate. The authority file is a collection of client certificates in PEM format. This file can be edited using any text file editor.

#### NOTE: Cert\_Authority\_File is useful only if Validate\_Client\_Cert is set to 'Yes'.

#### Appendix A.4.1.3. To Upload the Authority File to the FieldServer

- 1. Enter the IP address of the FieldServer into a web browser.
- 2. Choose the 'Setup' option in the Navigation Tree and Select 'File Transfer'.
- 3. Choose the 'General' tab.
- 4. Click on the 'Browse' button and select the PEM file you want to upload.
- 5. Click on 'Submit'.
- 6. When the message, "The file was uploaded successfully" appears, click on the 'System Restart' button.



#### Appendix A.4.1.4. Certificate Validation Options

If connections must be limited to only a particular domain (vendor devices), include Check\_Remote\_Host to specify the domain/host name.

| Connect | tions        |            |                        |                             |                     |
|---------|--------------|------------|------------------------|-----------------------------|---------------------|
| Adapter | , Protocol   | , TLS_Port | , Validate_Client_Cert | , Cert_Authority_File       | , Check_Remote_Host |
| N1      | , Modbus/TCP | , 1502     | , Yes                  | , my_authorized_clients.pem | , SMC               |

The configuration above tells the FieldServer to only accept connections that have the correct certification and is coming from the specified host.

The Check\_Remote\_Host value is synonymously known as common name, host name or domain etc. The common name can be obtained by the following methods:

- Ask the certificate issuer for the host name.
- Use online tools to decode the certificate (for example: <u>https://www.sslshopper.com/certificate-decoder.html</u>).
- If the program openssl is installed on the local PC, then run the following command to get the common name: openssl x509 -in certificate.pem -text -noout

Appendix A.4.1.5. Set up Server Certificate

Make sure the certificate is in PEM format. Otherwise, convert it to PEM format (reference the link below). <u>support.ssl.com/Knowledgebase/Article</u>

Configure the FieldServer to use a custom certificate as shown below:

Connections

| Adapter | , Protocol   | , TLS_Port | , Server_Cert_File   |
|---------|--------------|------------|----------------------|
| N1      | , Modbus/TCP | , 1502     | , my_server_cert.pem |



.. .

#### Appendix A.4.2. Configuring FieldServer as SSL/TLS Client

The following Node configurations set the FieldServer to open a secure Modbus/TCP connection to Server at IP Address 10.11.12.13 on port 1502.

#### Appendix A.4.2.1. Simple Secure Client Configuration

Add Remote\_Node\_TLS\_Port parameter in the nodes section of the configuration file and set to a port number between 1 – 65535.

| inodes    |           |              |           |               |                        |
|-----------|-----------|--------------|-----------|---------------|------------------------|
| Node_Name | , Node_ID | , Protocol   | , Adapter | , IP_Address  | , Remote_Node_TLS_Port |
| PLC_11    | , 11      | , Modbus/TCP | , N1      | , 10.11.12.13 | , 1502                 |

The above configuration sets the FieldServer to connect to a remote server but does not request a server's certificate for verification. This means that the FieldServer end point communication will be encrypted but not authenticated.

If requested by a remote server, the FieldServer will send an embedded self-signed certificate.

#### Appendix A.4.2.2. Limit Server Access

Add the Validate\_Server\_Cert parameter to the client node section of the configuration.

| <br>, Remote_Node_TLS_Port | , Validate_Server_Cert |
|----------------------------|------------------------|
| <br>, 1502                 | , Yes                  |

The above configuration sets the FieldServer to request and verify the server's certificate against its own internal authority file before finalizing the connection. By default, this means the FieldServer will only establish connections to other FieldServers.

| <br>, Remote_Node_TLS_Port | , Validate_Server_Cert | , Cert_Authority_File       |
|----------------------------|------------------------|-----------------------------|
| <br>, 1502                 | , Yes                  | , my_authorized_servers.pem |

The above configuration sets the FieldServer to use a specified PEM file to allow custom server connections.

The authority file is a collection of server certificates in PEM format. This file can be edited using any text file editor (such as notepad). When the file has all required certificates, paste it into the PEM formatted server certificate. Now the FieldServer will connect to a server if it can find the server's certificate in the authority file.

#### NOTE: Cert\_Authority\_File is useful only if Validate\_Client\_Cert is set to 'Yes'.

To upload the Certificate to the FieldServer follow the directions for the authority file in Appendix A.4.1.3.

#### Appendix A.4.2.3. Certificate Validation Options

Use the Check\_Remote\_Host element as described in Appendix A.4.1.4.

#### Appendix A.4.2.4. Set up Client Certificate

Make sure the certificate is in PEM format. Otherwise, convert it to PEM format (reference the link below). support.ssl.com/Knowledgebase/Article

Configure the FieldServer to use a custom certificate as shown below:

....., Client\_Cert\_File



#### **APPENDIX B VENDOR INFORMATION – M-BUS DATA PROFILES**

### NOTE: All points are Float Data Type. The first Modbus register contains the least significant word.

Appendix B.1. Aquametro Calec ST Mappings to BACnet and Modbus

| Point Name  | BACnet | Modbus      |
|-------------|--------|-------------|
| Vol_Flo_1   | AI 01  | 30001-30002 |
| Temp_Flo_1  | AI 02  | 30003-30004 |
| Temp_Ret_1  | AI 03  | 30005-30006 |
| Temp_Diff_1 | AI 04  | 30007-30008 |
| Power_W_1   | AI 05  | 30009-30010 |
| Energy_Wh_1 | AI 06  | 30011-30012 |
| Energy_Wh_2 | AI 07  | 30013-30014 |
| Volume_1    | AI 08  | 30015-30016 |
| Volume_2    | AI 09  | 30017-30018 |
| Time_1      | AI 10  | 30019-30020 |
| Time_2      | AI 11  | 30021-30022 |
| Mass_1      | AI 12  | 30023-30024 |
| Time_P_1    | AI 13  | 30025-30026 |
| Time_P_2    | AI 14  | 30027-30028 |
| Time_P_3    | AI 15  | 30029-30030 |
| Unknown_1   | AI 16  | 30031-30032 |
| Unknown_2   | AI 17  | 30033-30034 |
| Unknown_3   | AI 18  | 30035-30036 |
| Unknown_4   | AI 19  | 30037-30038 |
| Unknown_5   | AI 20  | 30039-30040 |
| Unknown_6   | AI 21  | 30041-30042 |
| Unknown_7   | AI 22  | 30043-30044 |
| Unknown_8   | AI 23  | 30045-30046 |
| Unknown_9   | AI 24  | 30047-30048 |

### Appendix B.2. Comet XRM-50 Mappings to BACnet and Modbus

| Point Name                  | BACnet | Modbus      |
|-----------------------------|--------|-------------|
| MBUS_Meter_\$node_id_Alarms | AI 01  | 30001-30002 |
| Volume                      | AI 02  | 30003-30004 |
| Time_stamp                  | AI 03  | 30005-30006 |
| Error_Flags                 | AI 04  | 30007-30008 |
| M BUS STATE                 | AI 05  | 30009-30010 |

### Appendix B.3. Elvaco CMa20 Mappings to BACnet and Modbus

| Point Name                  | BACnet | Modbus      |
|-----------------------------|--------|-------------|
| MBUS_Meter_\$node_id_Alarms | AI 01  | 30001-30002 |
| Temp_Inst                   | AI 02  | 30003-30004 |
| Temp_Min                    | AI 03  | 30005-30006 |
| Temp_Max                    | AI 04  | 30007-30008 |
| Temp_Avg                    | AI 05  | 30009-30010 |
| RH_Ins                      | AI 06  | 30011-30012 |
| RH_Min                      | AI 07  | 30013-30014 |
| RH_Max                      | AI 08  | 30015-30016 |
| RH_Avg                      | AI 09  | 30017-30018 |

#### Appendix B.4. EMU 3PH Power 3-85 Mappings to BACnet and Modbus

| Point Name                  | BACnet | Modbus      |
|-----------------------------|--------|-------------|
| MBUS_Meter_\$node_id_Alarms | AI 01  | 30001-30002 |
| Energy_WH_1                 | AI 02  | 30003-30004 |
| Energy_WH_2                 | AI 03  | 30005-30006 |
| Energy_WH_3                 | AI 04  | 30007-30008 |
| Voltage_1                   | AI 05  | 30009-30010 |
| Voltage_2                   | AI 06  | 30011-30012 |
| Voltage_3                   | AI 07  | 30013-30014 |
| Current_1                   | AI 08  | 30015-30016 |
| Current_2                   | AI 09  | 30017-30018 |
| Current_3                   | AI 10  | 30019-30020 |

### Appendix B.5. Kamstrup 601 Mappings to BACnet and Modbus

| Point Name     | BACnet | Modbus      |
|----------------|--------|-------------|
| Energy_T_WH_1  | AI 01  | 30001-30002 |
| Energy_T_WH_2  | AI 02  | 30003-30004 |
| Energy_T_WH_3  | AI 03  | 30005-30006 |
| Energy_T_WH_4  | AI 04  | 30007-30008 |
| Energy_T_WH_5  | AI 05  | 30009-30010 |
| Energy_T_WH_6  | AI 06  | 30011-30012 |
| Energy_T_WH_7  | AI 07  | 30013-30014 |
| Energy_T_WH_8  | AI 08  | 30015-30016 |
| Energy_T_WH_9  | AI 09  | 30017-30018 |
| Energy_T_WH_10 | AI 10  | 30019-30020 |
| Temp_Flow_1    | AI 11  | 30021-30022 |
| Temp_Flow_2    | AI 12  | 30023-30024 |
| Temp_Flow_3    | AI 13  | 30025-30026 |
| Temp_Ret_1     | AI 14  | 30027-30028 |
| Temp_Ret_2     | AI 15  | 30029-30030 |
| Temp_Ret_3     | AI 16  | 30031-30032 |
| Temp_Dif_1     | AI 17  | 30033-30034 |
| Temp_Dif_2     | AI 18  | 30035-30036 |
| Temp_Dif_3     | AI 19  | 30037-30038 |
| Time_Hrs_1     | AI 20  | 30039-30040 |
| Time_Hrs_2     | AI 21  | 30041-30042 |
| Time_Hrs_3     | AI 22  | 30043-30044 |
| Power_W_1      | AI 23  | 30045-30046 |
| Power_W_2      | AI 24  | 30047-30048 |
| Power_W_3      | AI 25  | 30049-30050 |
| Power_W_4      | AI 26  | 30051-30052 |
| Power_W_5      | AI 27  | 30053-30054 |
| Power_W_6      | AI 28  | 30055-30056 |
| Power_W_7      | AI 29  | 30057-30058 |
| Power_W_8      | AI 30  | 30059-30060 |
| Power_W_9      | AI 31  | 30061-30062 |
| Vol_Flo_L_H_1  | AI 32  | 30063-30064 |
| Vol_Flo_L_H_2  | AI 33  | 30065-30066 |
| Vol_Flo_L_H_3  | AI 34  | 30067-30068 |
| Vol_Flo_L_H_4  | AI 35  | 30069-30070 |
| Vol_Flo_L_H_5  | AI 36  | 30071-30072 |
| Vol_Flo_L_H_6  | AI 37  | 30073-30074 |
| Vol_Flo_L_H_7  | AI 38  | 30075-30076 |
| Vol Flo L H 8  | AI 39  | 30077-30078 |



| Vol_Flo_L_H_9 | AI 40 | 30079-30080 |
|---------------|-------|-------------|
| Volume_1      | AI 41 | 30081-30082 |
| Volume_2      | AI 42 | 30083-30084 |
| Volume_3      | AI 43 | 30085-30086 |
| Volume_4      | AI 44 | 30087-30088 |
| Volume_5      | AI 45 | 30089-30090 |
| Volume_6      | AI 46 | 30091-30092 |
| Volume_7      | AI 47 | 30093-30094 |
| Volume_8      | AI 48 | 30095-30096 |
| Volume_9      | AI 49 | 30097-30098 |
| Volume_10     | AI 50 | 30099-30100 |
| Time_Point_1  | AI 51 | 30101-30102 |
| Time_Point_2  | AI 52 | 30103-30104 |
| Time_Point_3  | AI 53 | 30105-30106 |
| Time_Point_4  | AI 54 | 30107-30108 |
| Time_Point_5  | AI 55 | 30109-30110 |
| Time_Point_6  | AI 56 | 30111-30112 |
| ID_Num_1      | AI 57 | 30113-30114 |
| ID_Num_2      | AI 58 | 30115-30116 |
| ID_Num_3      | AI 59 | 30117-30118 |

### Appendix B.6. Kamstrup 602 Mappings to BACnet and Modbus

| Point Name     | BACnet | Modbus      |
|----------------|--------|-------------|
| Energy_T_WH_1  | AI 01  | 30001-30002 |
| Energy_T_WH_2  | AI 02  | 30003-30004 |
| Energy_T_WH_3  | AI 03  | 30005-30006 |
| Energy_T_WH_4  | AI 04  | 30007-30008 |
| Energy_T_WH_5  | AI 05  | 30009-30010 |
| Energy_T_WH_6  | AI 06  | 30011-30012 |
| Energy_T_WH_7  | AI 07  | 30013-30014 |
| Energy_T_WH_8  | AI 08  | 30015-30016 |
| Energy_T_WH_9  | AI 09  | 30017-30018 |
| Energy_T_WH_10 | AI 10  | 30019-30020 |
| Temp_Flow_1    | AI 11  | 30021-30022 |
| Temp_Flow_2    | AI 12  | 30023-30024 |
| Temp_Flow_3    | AI 13  | 30025-30026 |
| Temp_Ret_1     | AI 14  | 30027-30028 |
| Temp_Ret_2     | AI 15  | 30029-30030 |
| Temp_Ret_3     | AI 16  | 30031-30032 |
| Temp_Dif_1     | AI 17  | 30033-30034 |
| Temp_Dif_2     | AI 18  | 30035-30036 |
| Temp_Dif_3     | AI 19  | 30037-30038 |
| Temp_Dif_4     | AI 20  | 30039-30040 |
| Temp_Dif_5     | AI 21  | 30041-30042 |
| Temp_Dif_6     | AI 22  | 30043-30044 |
| Time_Hrs_1     | AI 23  | 30045-30046 |
| Time_Hrs_2     | AI 24  | 30047-30048 |
| Time_Hrs_3     | AI 25  | 30049-30050 |
| Power_W_1      | AI 26  | 30051-30052 |
| Power_W_2      | AI 27  | 30053-30054 |
| Power_W_3      | AI 28  | 30055-30056 |
| Power_W_4      | AI 29  | 30057-30058 |
| Power_W_5      | AI 30  | 30059-30060 |
| Power_W_6      | AI 31  | 30061-30062 |
| Power_W_7      | AI 32  | 30063-30064 |
| Power_W_8      | AI 33  | 30065-30066 |
| Power_W_9      | AI 34  | 30067-30068 |
| Power_W_10     | AI 35  | 30069-30070 |
| Vol_Flo_L_H_1  | AI 36  | 30071-30072 |
| Vol_Flo_L_H_2  | AI 37  | 30073-30074 |
| Vol_Flo_L_H_3  | AI 38  | 30075-30076 |
| Vol_Flo_L_H_4  | AI 39  | 30077-30078 |
| Vol_Flo_L_H_5  | AI 40  | 30079-30080 |
| Vol_Flo_L_H_6  | AI 41  | 30081-30082 |

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| Vol_Flo_L_H_7  | AI 42 | 30083-30084 |
|----------------|-------|-------------|
| Vol_Flo_L_H_8  | AI 43 | 30085-30086 |
| Vol_Flo_L_H_9  | AI 44 | 30087-30088 |
| Vol_Flo_L_H_10 | AI 45 | 30089-30090 |
| Volume_1       | AI 46 | 30091-30092 |
| Volume_2       | AI 47 | 30093-30094 |
| Volume_3       | AI 48 | 30095-30096 |
| Volume_4       | AI 49 | 30097-30098 |
| Volume_5       | AI 50 | 30099-30100 |
| Volume_6       | AI 51 | 30101-30102 |
| Volume_7       | AI 52 | 30103-30104 |
| Volume_8       | AI 53 | 30105-30106 |
| Volume_9       | AI 54 | 30107-30108 |
| Volume_10      | AI 55 | 30109-30110 |
| Time_Point_1   | AI 56 | 30111-30112 |
| Time_Point_2   | AI 57 | 30113-30114 |
| Time_Point_3   | AI 58 | 30115-30116 |
| Time_Point_4   | AI 59 | 30117-30118 |
| Time_Point_5   | AI 60 | 30119-30120 |
| Time_Point_6   | AI 61 | 30121-30122 |
| ID_Num_1       | AI 62 | 30123-30124 |
| ID_Num_2       | AI 63 | 30125-30126 |
| ID Num 3       | AI 64 | 30127-30128 |

#### Appendix B.7. Sontay Zenner Multidata Mappings to BACnet and Modbus

| Point Name   | BACnet | Modbus      |
|--------------|--------|-------------|
| ID_1         | AI 01  | 30001-30002 |
| Energy_WH_1  | AI 02  | 30003-30004 |
| Volume_1     | AI 03  | 30005-30006 |
| Volume_2     | AI 04  | 30007-30008 |
| Error_Flags  | AI 05  | 30009-30010 |
| Energy_WH_2  | AI 06  | 30011-30012 |
| Volume_3     | AI 07  | 30013-30014 |
| Volume_4     | AI 08  | 30015-30016 |
| Volume_5     | AI 09  | 30017-30018 |
| Vol_Flow_1   | AI 10  | 30019-30020 |
| Power_W_1    | AI 11  | 30021-30022 |
| Temp_Flow    | AI 12  | 30023-30024 |
| Temp_Return  | AI 13  | 30025-30026 |
| Energy_WH_5  | AI 14  | 30027-30028 |
| Energy_WH_6  | AI 15  | 30029-30030 |
| Energy_WH_7  | AI 16  | 30031-30032 |
| Energy_WH_8  | AI 17  | 30033-30034 |
| Energy_WH_9  | AI 18  | 30035-30036 |
| Energy WH 10 | AI 19  | 30037-30038 |

#### Appendix B.8. Sontex SuperCal 531 Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Dur_Avg_S_1   | AI 01  | 30001-30002 |
| Dur_Avg_M_1   | AI 02  | 30003-30004 |
| Energy_T_WH_1 | AI 03  | 30005-30006 |
| Energy_T_WH_2 | AI 04  | 30007-30008 |
| Energy_T_WH_3 | AI 05  | 30009-30010 |
| Energy_T_WH_4 | AI 06  | 30011-30012 |
| Energy_T_WH_5 | AI 07  | 30013-30014 |
| Energy_T_WH_6 | AI 08  | 30015-30016 |
| Energy_T_WH_7 | AI 09  | 30017-30018 |
| Energy_T_WH_8 | AI 10  | 30019-30020 |
| Energy_T_WH_9 | AI 11  | 30021-30022 |



| Energy_T_WH_10 | AI 12 | 30023-30024 |
|----------------|-------|-------------|
| Temp_Flow_1    | AI 13 | 30025-30026 |
| Temp_Ret_1     | AI 14 | 30027-30028 |
| Time_Hrs_1     | AI 15 | 30029-30030 |
| Vol_Flo_L_S_1  | AI 16 | 30031-30032 |
| Error_Flags_1  | AI 17 | 30033-30034 |
| Medium_1       | AI 18 | 30035-30036 |
| Medium_2       | AI 19 | 30037-30038 |
| Volume_1       | AI 20 | 30039-30040 |

### Appendix B.9. Siemens WFH21 Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Energy_T_WH_1 | AI 01  | 30001-30002 |
| Time_Hrs_1    | AI 02  | 30003-30004 |
| Power_Jh_1    | AI 03  | 30005-30006 |
| ID_1          | AI 04  | 30007-30008 |
| Volume_1      | AI 05  | 30009-30010 |
| Volume_2      | AI 06  | 30011-30012 |
| Unknown_1     | AI 07  | 30013-30014 |
| Unknown_2     | AI 08  | 30015-30016 |
| Unknown_3     | AI 09  | 30017-30018 |
| Unknown_4     | AI 10  | 30019-30020 |

#### Appendix B.10. Siemens FUE950 Energy Mappings to BACnet and Modbus

| Point Name   | BACnet | Modbus      |
|--------------|--------|-------------|
| Energy 1     | AI 01  | 30001-30002 |
| Energy 2     | AI 02  | 30003-30004 |
| Energy 3     | AI 03  | 30005-30006 |
| Energy 4     | AI 04  | 30007-30008 |
| Temp Flow    | AI 05  | 30009-30010 |
| Temp Ret     | AI 06  | 30011-30012 |
| Temp Dif     | AI 07  | 30013-30014 |
| Time Op Days | AI 08  | 30015-30016 |
| Time Point 1 | AI 09  | 30017-30018 |
| Time Point 2 | AI 10  | 30019-30020 |
| Power        | AI 11  | 30021-30022 |
| Volume Flow  | AI 12  | 30023-30024 |
| Volume 1     | AI 13  | 30025-30026 |
| Volume 2     | AI 14  | 30027-30028 |
| Volume 3     | AI 15  | 30029-30030 |
| Volume 4     | AI 16  | 30031-30032 |
| Firmware     | AI 17  | 30033-30034 |
| Software     | AI 18  | 30035-30036 |
| Access Code  | AI 19  | 30037-30038 |

#### Appendix B.11. QS All Data Profile Mappings to BACnet and Modbus

| Point Name  | BACnet | Modbus      |
|-------------|--------|-------------|
| Dur_Avg_S_1 | AI 1   | 30001-30002 |
| Dur_Avg_S_2 | AI 2   | 30003-30004 |
| Dur_Avg_S_3 | AI 3   | 30005-30006 |
| Dur_Avg_S_4 | AI 4   | 30007-30008 |
| Dur_Avg_S_5 | AI 5   | 30009-30010 |
| Dur_Avg_S_6 | AI 6   | 30011-30012 |
| Dur_Avg_S_7 | AI 7   | 30013-30014 |

| Dur Ava S 8    | AI 8  | 30015-30016  |
|----------------|-------|--------------|
| Dur Ava S 9    | AI 9  | 30017-30018  |
| Dur Ava S 10   | AI 10 | 30019-30020  |
| Dur Avg M 1    | AI 11 | 30021-30022  |
| Dur Avg M 2    |       | 30023-30024  |
| Dur Avg M 3    | AL 12 | 30025 30024  |
| Dur Avg M 4    | AL14  | 20023-30020  |
| Dur_Avg_Ivi_4  | AI 14 | 30027-30028  |
| Dur_Avg_M_5    | AI 15 | 30029-30030  |
| Dur_Avg_M_6    | AI 16 | 30031-30032  |
| Dur_Avg_M_7    | AI 17 | 30033-30034  |
| Dur_Avg_M_8    | AI 18 | 30035-30036  |
| Dur_Avg_M_9    | AI 19 | 30037-30038  |
| Dur_Avg_M_10   | AI 20 | 30039-30040  |
| Dur_Avg_H_1    | AI 21 | 30041-30042  |
| Dur_Avg_H_2    | AI 22 | 30043-30044  |
| Dur Avg H 3    | AI 23 | 30045-30046  |
| Dur Ava H 4    | AI 24 | 30047-30048  |
| Dur Avg H 5    | AI 25 | 30049-30050  |
| Dur Avg H 6    | AL 26 | 30051-30052  |
|                | AI 20 | 20052 20054  |
|                | AL20  | 20055-20054  |
|                |       | 30057 20050  |
| Dur_Avg_H_9    | AI 29 | 30057-30058  |
| Dur_Avg_H_10   | AI 30 | 30059-30060  |
| Dur_Avg_D_1    | AI 31 | 30061-30062  |
| Dur_Avg_D_2    | AI 32 | 30063-30064  |
| Dur_Avg_D_3    | AI 33 | 30065-30066  |
| Dur_Avg_D_4    | AI 34 | 30067-30068  |
| Dur_Avg_D_5    | AI 35 | 30069-30070  |
| Dur Avg D 6    | AI 36 | 30071-30072  |
| Dur Avg D 7    | AI 37 | 30073-30074  |
| Dur Avg D 8    | AI 38 | 30075-30076  |
|                | AI 39 | 30077-30078  |
|                | AL 40 | 20070 20090  |
| Dul_Avg_D_10   | AI 40 | 30079-30080  |
| Dur_Act_Sec_1  | AI 41 | 30081-30082  |
| Dur_Act_Sec_2  | AI 42 | 30083-30084  |
| Dur_Act_Sec_3  | AI 43 | 30085-30086  |
| Dur_Act_Sec_4  | AI 44 | 30087-30088  |
| Dur_Act_Sec_5  | AI 45 | 30089-30090  |
| Dur_Act_Sec_6  | AI 46 | 30091-30092  |
| Dur_Act_Sec_7  | AI 47 | 30093-30094  |
| Dur_Act_Sec_8  | AI 48 | 30095-30096  |
| Dur_Act_Sec_9  | AI 49 | 30097-30098  |
| Dur_Act_Sec_10 | AI 50 | 30099-30100  |
| Dur_Act_Min_1  | AI 51 | 30101-30102  |
| Dur_Act_Min_2  | AI 52 | 30103-30104  |
| Dur_Act_Min 3  | AI 53 | 30105-30106  |
| Dur Act Min 4  | AI 54 | 30107-30108  |
| Dur Act Min 5  | AI 55 | 30109-30110  |
| Dur Act Min 6  | AL 56 | 30111-30112  |
| Dur Act Min 7  | AI 57 | 30113-30114  |
| Dur Act Min 9  |       | 30115 20116  |
| Dur Act Min 0  | AL 50 | 20117 20110  |
| Dur Act Mir 40 | ALCO  | 20110 20100  |
| Dur_Act_Min_10 | AL 60 | 30119-30120  |
| Dur_Act_Hrs_1  | AI 61 | 30121-30122  |
| Dur_Act_Hrs_2  | AI 62 | 30123-30124  |
| Dur_Act_Hrs_3  | AI 63 | 30125-30126  |
| Dur_Act_Hrs_4  | AI 64 | 30127-30128  |
| Dur_Act_Hrs_5  | AI 65 | 30129-30130  |
| Dur_Act_Hrs_6  | AI 66 | 30131-30132  |
| Dur_Act_Hrs_7  | AI 67 | 30133-30134  |
| Dur_Act_Hrs 8  | AI 68 | 30135-30136  |
| Dur Act Hrs 9  | AI 69 | 30137-30138  |
| Dur Act Hrs 10 | AI 70 | 30139-30140  |
| Dur Act Day 1  | ΔΙ 71 | 30141-30142  |
|                | ΔI 72 | 301/13-201// |
| Dur Act Doy 2  |       | 30145.20146  |
| Dur Act Day 4  |       | 20147 20140  |
| Dur_Act_Day_4  | AL75  | 30147-30148  |
| Dur_ACt_Day_5  | AL 75 | 30149-30150  |
| Dur_Act_Day_6  | AI 76 | 30151-30152  |



| Dur_Act_Day_7                         | AI 77  | 30153-30154 |
|---------------------------------------|--------|-------------|
| Dur_Act_Day_8                         | AI 78  | 30155-30156 |
| Dur_Act_Day_9                         | AI 79  | 30157-30158 |
| Dur_Act_Day_10                        | AI 80  | 30159-30160 |
| Energy T WH 1                         | AI 81  | 30161-30162 |
| Energy T WH 2                         | AI 82  | 30163-30164 |
| Energy T WH 3                         | AI 83  | 30165-30166 |
| Energy T WH 4                         | AI 84  | 30167-30168 |
| Energy T WH 5                         | AL 85  | 30169-30170 |
| Energy_T_WILS                         | ALOG   | 20171 20172 |
| Energy_T_VVH_0                        | AI 60  | 30171-30172 |
| Energy_I_VVH_7                        | AI 87  | 30173-30174 |
| Energy_T_WH_8                         | AI 88  | 30175-30176 |
| Energy_T_WH_9                         | AI 89  | 30177-30178 |
| Energy_T_WH_10                        | AI 90  | 30179-30180 |
| Energy_T_J_1                          | AI 91  | 30181-30182 |
| Energy_T_J_2                          | AI 92  | 30183-30184 |
| Energy T J 3                          | AI 93  | 30185-30186 |
| Energy T J 4                          | AI 94  | 30187-30188 |
| Energy T L 5                          | AL 95  | 30189-30100 |
|                                       | AL 06  | 20103-30130 |
| Energy_1_J_0                          | AI 96  | 30191-30192 |
| nergy_1_J_/                           | AI 97  | 30193-30194 |
| Energy_1_J_8                          | AI 98  | 30195-30196 |
| Energy_T_J_9                          | AI 99  | 30197-30198 |
| Energy_T_J_10                         | AI 100 | 30199-30200 |
| Voltage_1                             | AI 101 | 30201-30202 |
| Voltage 2                             | AI 102 | 30203-30204 |
| Voltage 3                             | AI 103 | 30205-30206 |
| Voltage 4                             | AI 104 | 30207-30208 |
| Voltage_4                             | AI 104 | 30207-30200 |
| Voltage_0                             | AI 105 | 30209-30210 |
| Vollage_6                             | AI 100 | 30211-30212 |
| Voltage_/                             | AI 107 | 30213-30214 |
| Voltage_8                             | AI 108 | 30215-30216 |
| Voltage_9                             | AI 109 | 30217-30218 |
| Voltage_10                            | AI 110 | 30219-30220 |
| Current_1                             | AI 111 | 30221-30222 |
| Current 2                             | AI 112 | 30223-30224 |
| Current 3                             | AI 113 | 30225-30226 |
| Current 4                             | AI 114 | 30227-30228 |
| Current 5                             |        | 30220-30230 |
| Current 6                             | AL 116 | 20223-30230 |
|                                       | ALITO  | 30231-30232 |
| Current_7                             | AI 117 | 30233-30234 |
| Current_8                             | AI 118 | 30235-30236 |
| Current_9                             | AI 119 | 30237-30238 |
| Current_10                            | AI 120 | 30239-30240 |
| Temp_Ext_1                            | AI 121 | 30241-30242 |
| Temp_Ext_2                            | AI 122 | 30243-30244 |
| Temp Ext 3                            | AI 123 | 30245-30246 |
| Temp Ext 4                            | AI 124 | 30247-30248 |
| Temp Ext 5                            | AI 125 | 30249-30250 |
| Temp Ext 6                            | ΔΙ 126 | 30251-30252 |
| Temp_Ext_0                            | AI 120 | 30251-30252 |
| Temp_Ext_/                            | AI 127 | 30253-30254 |
| Temp_Ext_8                            | AI 128 | 30255-30256 |
| Temp_Ext_9                            | AI 129 | 30257-30258 |
| Temp_Ext_10                           | AI 130 | 30259-30260 |
| Temp_Flow_1                           | AI 131 | 30261-30262 |
| Temp Flow 2                           | AI 132 | 30263-30264 |
| Temp Flow 3                           | AI 133 | 30265-30266 |
| Temp Flow 4                           | AI 134 | 30267-30268 |
| Temp Flow 5                           | AI 135 | 30269-30270 |
| Temp Flow 6                           | ΔΙ 136 | 30271-30272 |
| Tomp Flow 7                           | AL 107 | 20272 20274 |
| Temp_FIOW_/                           | AL 137 | 30213-30214 |
|                                       | AI 138 | 30275-30276 |
| 1 emp_Flow_9                          | AI 139 | 30277-30278 |
| Temp_Flow_10                          | AI 140 | 30279-30280 |
| Temp_Ret_1                            | AI 141 | 30281-30282 |
| Temp_Ret_2                            | AI 142 | 30283-30284 |
| Temp_Ret_3                            | AI 143 | 30285-30286 |
| Temp Ret 4                            | AI 144 | 30287-30288 |
| Temp Ret 5                            | AI 145 | 30289-30290 |
| · · · · · · · · · · · · · · · · · · · |        |             |

| Temp_Ret_6      | AI 146         | 30291-30292         |
|-----------------|----------------|---------------------|
| Temp_Ret_7      | AI 147         | 30293-30294         |
| Temp Ret 8      | AI 148         | 30295-30296         |
| Temp Ret 9      |                | 30207-30208         |
| Temp_Ret_9      | AL 450         | 20207-30230         |
| Temp_Ret_10     | AI 150         | 30299-30300         |
| Temp_Dif_1      | AI 151         | 30301-30302         |
| Temp_Dif_2      | AI 152         | 30303-30304         |
| Temp Dif 3      | AI 153         | 30305-30306         |
| Temp Dif 4      | AI 154         | 30307-30308         |
| Tomp Dif 5      |                | 20200 20210         |
| Temp_Dil_5      | AI 155         | 30309-30310         |
| Temp_Dif_6      | AI 156         | 30311-30312         |
| Temp_Dif_7      | AI 157         | 30313-30314         |
| Temp Dif 8      | AI 158         | 30315-30316         |
| Temp Dif 9      | AI 159         | 30317-30318         |
| Temp Dif 10     | AL 160         | 30310-30320         |
| Time See 1      | AL 161         | 20221 20220         |
| Time_Sec_1      | ALIOT          | 30321-30322         |
| Time_Sec_2      | AI 162         | 30323-30324         |
| Time_Sec_3      | AI 163         | 30325-30326         |
| Time Sec 4      | AI 164         | 30327-30328         |
| Time Sec 5      | AI 165         | 30329-30330         |
| Time_See 6      | AL 166         | 20221 20222         |
|                 | AL 100         | 20222 20222         |
| Time_Sec_7      | AI 167         | 30333-30334         |
| Time_Sec_8      | AI 168         | 30335-30336         |
| Time_Sec_9      | AI 169         | 30337-30338         |
| Time Sec 10     | AI 170         | 30339-30340         |
| Time Min 1      | ΔΙ 171         | 303/1-202/2         |
|                 |                | 20242 20244         |
| ime_ivin_2      | AI 172         | 30343-30344         |
| Time_Min_3      | Al 173         | 30345-30346         |
| Time_Min_4      | AI 174         | 30347-30348         |
| Time Min 5      | AI 175         | 30349-30350         |
| Time Min 6      | AI 176         | 30351-30352         |
| Time_Min_0      |                | 20252 20254         |
| I Ime_IVIIn_7   | AI 177         | 30353-30354         |
| Time_Min_8      | AI 178         | 30355-30356         |
| Time_Min_9      | AI 179         | 30357-30358         |
| Time Min 10     | AI 180         | 30359-30360         |
| Time Hrs 1      | ΔΙ 181         | 30361-30362         |
| Time Hre 2      | AL 192         | 20262 20264         |
|                 | AI 102         | 30303-30304         |
| Time_Hrs_3      | AI 183         | 30365-30366         |
| Time_Hrs_4      | AI 184         | 30367-30368         |
| Time_Hrs_5      | AI 185         | 30369-30370         |
| Time Hrs 6      | AI 186         | 30371-30372         |
| Time Hrs 7      | ΔΙ 187         | 30373-30374         |
|                 | AL 100         | 20275 20276         |
| Time_Hrs_8      | AI 188         | 30375-30376         |
| _Time_Hrs_9     | AI 189         | 30377-30378         |
| Time_Hrs_10     | AI 190         | 30379-30380         |
| Time Days 1     | AI 191         | 30381-30382         |
| Time Days 2     | AI 192         | 30383-30384         |
| Time Days_2     | AL 102         | 20205 20206         |
| Time_Days_3     | AI 193         | 30365-30360         |
| Time_Days_4     | AI 194         | 30387-30388         |
| _Time_Days_5    | AI 195         | 30389-30390         |
| Time_Days_6     | AI 196         | 30391-30392         |
| Time Davs 7     | AI 197         | 30393-30394         |
| Time Days 8     | ΔΙ 198         | 30305-30306         |
| Time Days_0     | AL 100         | 20207 20200         |
| Time_Days_9     | AI 199         | 30397-30398         |
| lime_Days_10    | AI 200         | 30399-30400         |
| Time_Op_Sec_1   | AI 201         | 30401-30402         |
| Time_Op_Sec_2   | AI 202         | 30403-30404         |
| Time On Sec 3   | AI 203         | 30405-30406         |
| Time On Sec 4   | ΔΙ 204         | 30407-30409         |
|                 | AL 204         | 20400 20400         |
| Time_Op_Sec_5   | AI 205         | 30409-30410         |
| Ime_Op_Sec_6    | AI 206         | 30411-30412         |
| Time_Op_Sec_7   | <u>AI 2</u> 07 | <u>30413-3</u> 0414 |
| Time Op Sec 8   | AI 208         | 30415-30416         |
| Time Op Sec 9   | AI 209         | 30417-30418         |
| Time On Sec 10  | Δ1.240         | 30/10 20/20         |
| Time_Op_Sec_10  |                | 30419-30420         |
| Time_Op_Min_1   | AI 211         | 30421-30422         |
| Time_Op_Min_2   | AI 212         | 30423-30424         |
| Time On Min 0   |                | 00405 00400         |
| Time_Op_iviin_3 | AI 213         | 30425-30426         |



| Time_Op_Min_5  | AI 215   | 30429-30430   |
|--|--|---|
| Time_Op_Min_6  | AI 216   | 30431-30432   |
| Time_Op_Min_7  | AI 217   | 30433-30434   |
| Time_Op_Min_8  | AI 218   | 30435-30436   |
| Time_Op_Min_9  | AI 219   | 30437-30438   |
| Time_Op_Min_10   | AI 220   | 30439-30440   |
| Time_Op_Hrs_1  | AI 221   | 30441-30442   |
| Time_Op_Hrs_2  | AI 222   | 30443-30444   |
| Time_Op_Hrs_3  | AI 223   | 30445-30446   |
| Time_Op_Hrs_4  | AI 224   | 30447-30448   |
| Time_Op_Hrs_5  | AI 225   | 30449-30450   |
| Time_Op_Hrs_6  | AI 226   | 30451-30452   |
| Time_Op_Hrs_7  | AI 227   | 30453-30454   |
| Time_Op_Hrs_8  | AI 228   | 30455-30456   |
| Time_Op_Hrs_9  | AI 229   | 30457-30458   |
| Time_Op_Hrs_10   | AI 230   | 30459-30460   |
| Time_Op_Days_1   | AI 231   | 30461-30462   |
| Time_Op_Days_2   | AI 232   | 30463-30464   |
| Time_Op_Days_3   | AI 233   | 30465-30466   |
| Time_Op_Days_4   | AI 234   | 30467-30468   |
| Time_Op_Days_5   | AI 235   | 30469-30470   |
| Time_Op_Days_6   | AI 236   | 30471-30472   |
| Time_Op_Days_7   | AI 237   | 30473-30474   |
| Time_Op_Days_8   | AI 238   | 30475-30476   |
| Time_Op_Days_9   | AI 239   | 30477-30478   |
| Time_Op_Days_10  | AI 240   | 30479-30480   |
| Custom_1   | AI 241   | 30481-30482   |
| Custom_2   | AI 242   | 30483-30484   |
| Custom_3   | AI 243   | 30485-30486   |
| Custom_4   | AI 244   | 30487-30488   |
| Custom_5   | AI 245   | 30489-30490   |
| Custom_6   | AI 246   | 30491-30492   |
| Custom_7   | AI 247   | 30493-30494   |
| Custom_8   | AI 248   | 30495-30496   |
| Custom_9   | AI 249   | 30497-30498   |
|  | AI 250   | 30499-30300   |
| $D_{OW} = 1/1 - 1$   | Δ1251  | 30507-30507   |
| Power_W_1<br>Power_W_2   | AI 251   | 30501-30502   |
| Power_W_1<br>Power_W_2<br>Power_W_3  | Al 251<br>Al 252<br>Al 253   | 30501-30502<br>30503-30504<br>30505-30506   |
| Power_W_1<br>Power_W_2<br>Power_W_3<br>Power W_4   | AI 251<br>AI 252<br>AI 253<br>AI 254   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508  |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power W_5  | AI 251<br>AI 252<br>AI 253<br>AI 254<br>AI 255   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power W 6  | AI 251<br>AI 252<br>AI 253<br>AI 254<br>AI 255<br>AI 256   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512  |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power W 7  | AI 251<br>AI 252<br>AI 253<br>AI 254<br>AI 255<br>AI 256<br>AI 257   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8  | AI 251<br>AI 252<br>AI 253<br>AI 254<br>AI 255<br>AI 256<br>AI 257<br>AI 258   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516  |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_9  | AI 251<br>AI 252<br>AI 253<br>AI 254<br>AI 255<br>AI 256<br>AI 257<br>AI 258<br>AI 259   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30513-30516<br>30517-30518   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_9           Power_W_10   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520  |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_9           Power_W10           Power_Jh_1   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_9           Power_W_10           Power_Jh_1           Power_Jh_2   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 261<br>Al 262   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_9           Power_Jh_1           Power_Jh_2           Power_Jh_3   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 261<br>Al 262<br>Al 263   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_9           Power_Jh_1           Power_Jh_2           Power_Jh_3           Power_Jh_4  | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 263<br>Al 264   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528  |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_9           Power_Jh_1           Power_Jh_2           Power_Jh_3           Power_Jh_5  | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 264<br>Al 265   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_U_9           Power_Jh_1           Power_Jh_2           Power_Jh_3           Power_Jh_5           Power_Jh_6   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 264<br>Al 265<br>Al 266   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_U_9           Power_Jh_1           Power_Jh_2           Power_Jh_3           Power_Jh_5           Power_Jh_7   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 267   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532  |
| Power_W_1           Power_W_2           Power_W_3           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_U_9           Power_Jh_1           Power_Jh_2           Power_Jh_3           Power_Jh_6           Power_Jh_7   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 257<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 267<br>Al 266<br>Al 267<br>Al 268   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532<br>30533-30534<br>30535-30536  |
| Power_W_1           Power_W_2           Power_W_3           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_10           Power_Jh_1           Power_Jh_3           Power_Jh_4           Power_Jh_5           Power_Jh_6           Power_Jh_8           Power_Jh_9  | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 267<br>Al 268<br>Al 269   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532<br>30533-30534<br>30535-30536<br>30537-30538   |
| Power_W_1           Power_W_2           Power_W_3           Power_W_4           Power_W_5           Power_W_6           Power_W_7           Power_W_8           Power_W_10           Power_Jh_1           Power_Jh_2           Power_Jh_3           Power_Jh_6           Power_Jh_7           Power_Jh_8           Power_Jh_9           Power_Jh_10  | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 266<br>Al 267<br>Al 268<br>Al 269<br>Al 270<br>Al 270   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532<br>30533-30534<br>30535-30536<br>30539-30540   |
| Power_W_1<br>Power_W_2<br>Power_W_3<br>Power_W_4<br>Power_W_5<br>Power_W_6<br>Power_W_7<br>Power_W_7<br>Power_W_9<br>Power_W_10<br>Power_Jh_1<br>Power_Jh_2<br>Power_Jh_3<br>Power_Jh_3<br>Power_Jh_4<br>Power_Jh_5<br>Power_Jh_6<br>Power_Jh_6<br>Power_Jh_8<br>Power_Jh_9<br>Power_Jh_10<br>Pressure_1<br>Power_Jh_20<br>Power_Jh_10<br>Power_Jh_10<br>Pressure_1<br>Power_10<br>Power_Jh_10<br>Power_Jh_10<br>Pressure_1<br>Power_10<br>Power_10<br>Power_Jh_10<br>Pressure_1<br>Power_10<br>Power_10<br>Power_10<br>Power_Jh_10<br>Pressure_1<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_Jh_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10<br>Power_10   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 266<br>Al 266<br>Al 267<br>Al 268<br>Al 269<br>Al 270<br>Al 271<br>Al 271   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532<br>30533-30534<br>30535-30536<br>30537-30538<br>30539-30540<br>30541-30542   |
| Power_W_1<br>Power_W_2<br>Power_W_3<br>Power_W_4<br>Power_W_5<br>Power_W_6<br>Power_W_7<br>Power_W_7<br>Power_W_9<br>Power_W_10<br>Power_Jh_1<br>Power_Jh_2<br>Power_Jh_3<br>Power_Jh_3<br>Power_Jh_4<br>Power_Jh_5<br>Power_Jh_6<br>Power_Jh_6<br>Power_Jh_7<br>Power_Jh_8<br>Power_Jh_9<br>Power_Jh_10<br>Pressure_1<br>Pressure_2<br>Prosure_2  | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 266<br>Al 266<br>Al 267<br>Al 268<br>Al 269<br>Al 270<br>Al 271<br>Al 272   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532<br>30533-30534<br>30535-30536<br>30537-30538<br>30539-30540<br>30541-30542<br>30543-30544  |
| Power_W_1<br>Power_W_2<br>Power_W_3<br>Power_W_4<br>Power_W_5<br>Power_W_6<br>Power_W_7<br>Power_W_7<br>Power_W_9<br>Power_W_10<br>Power_Jh_1<br>Power_Jh_2<br>Power_Jh_3<br>Power_Jh_3<br>Power_Jh_4<br>Power_Jh_5<br>Power_Jh_6<br>Power_Jh_6<br>Power_Jh_7<br>Power_Jh_8<br>Power_Jh_9<br>Power_Jh_10<br>Pressure_1<br>Pressure_2<br>Pressure_3<br>Prossure_4   | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 266<br>Al 266<br>Al 267<br>Al 268<br>Al 269<br>Al 270<br>Al 273<br>Al 273<br>Al 274   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532<br>30533-30534<br>30535-30536<br>30537-30538<br>30539-30540<br>30541-30542<br>30543-30546  |
| Power_W_1<br>Power_W_2<br>Power_W_3<br>Power_W_4<br>Power_W_5<br>Power_W_6<br>Power_W_7<br>Power_W_7<br>Power_W_8<br>Power_W_9<br>Power_Jh_1<br>Power_Jh_1<br>Power_Jh_2<br>Power_Jh_3<br>Power_Jh_3<br>Power_Jh_4<br>Power_Jh_5<br>Power_Jh_6<br>Power_Jh_6<br>Power_Jh_7<br>Power_Jh_8<br>Power_Jh_9<br>Power_Jh_10<br>Pressure_1<br>Pressure_2<br>Pressure_4<br>Pressure_5  | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 266<br>Al 266<br>Al 267<br>Al 268<br>Al 269<br>Al 270<br>Al 271<br>Al 272<br>Al 273<br>Al 274<br>Al 274   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532<br>30533-30534<br>30535-30536<br>30537-30538<br>30539-30540<br>30541-30542<br>30545-30546<br>30547-30548<br>30547-30548  |
| Power_W_1<br>Power_W_2<br>Power_W_3<br>Power_W_4<br>Power_W_5<br>Power_W_6<br>Power_W_7<br>Power_W_7<br>Power_W_8<br>Power_W_9<br>Power_Jh_1<br>Power_Jh_1<br>Power_Jh_2<br>Power_Jh_3<br>Power_Jh_4<br>Power_Jh_5<br>Power_Jh_6<br>Power_Jh_6<br>Power_Jh_7<br>Power_Jh_8<br>Power_Jh_9<br>Power_Jh_10<br>Pressure_1<br>Pressure_2<br>Pressure_4<br>Pressure_5<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_6<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_7<br>Power_ | Al 251<br>Al 252<br>Al 253<br>Al 254<br>Al 255<br>Al 256<br>Al 257<br>Al 258<br>Al 259<br>Al 260<br>Al 261<br>Al 262<br>Al 263<br>Al 263<br>Al 264<br>Al 265<br>Al 266<br>Al 266<br>Al 266<br>Al 267<br>Al 268<br>Al 269<br>Al 270<br>Al 271<br>Al 272<br>Al 273<br>Al 274<br>Al 275<br>Al 276   | 30501-30502<br>30503-30504<br>30505-30506<br>30507-30508<br>30509-30510<br>30511-30512<br>30513-30514<br>30515-30516<br>30517-30518<br>30519-30520<br>30521-30522<br>30523-30524<br>30525-30526<br>30527-30528<br>30529-30530<br>30531-30532<br>30533-30534<br>30535-30536<br>30537-30538<br>30539-30540<br>30541-30542<br>30543-30546<br>30547-30548<br>30549-30550  |
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| Volume 5                              | AI 345 | 30689-30690 |
| Volume 6                              | AL 346 | 30691-30692 |
| Volume 7                              | AI 347 | 30693-30694 |
| Volume 8                              | AI 348 | 30695-30696 |
| Volume 9                              | AI 349 | 30697-30698 |
| Volume 10                             | AI 350 | 30699-30700 |
| Error_Flags 1                         | AI 351 | 30701-30702 |
| Error Flags 2                         | AI 352 | 30703-30704 |



| Error_Flags_3    | AI 353   | 30705-30706 |
|------------------|----------|-------------|
| Error Flags 4    | AI 354   | 30707-30708 |
| Error Flags 5    | AI 355   | 30709-30710 |
| Error Flags 6    | AI 356   | 30711-30712 |
| Error Flags 7    | AI 357   | 30713-30714 |
| Error Flags 8    | AI 358   | 30715-30716 |
| Error Flags 9    | AI 359   | 30717-30718 |
| Error Flags 10   | AI 360   | 30719-30720 |
| Medium 1         | AI 361   | 30721-30722 |
| Medium 2         | AI 362   | 30723-30724 |
| Medium 3         | AI 363   | 30725-30726 |
| Medium 4         | AI 364   | 30727-30728 |
| Medium 5         | AI 365   | 30729-30730 |
| Medium 6         | AL 366   | 30731-30732 |
| Medium 7         | AI 367   | 30733-30734 |
| Medium 8         | AL 368   | 30735-30736 |
| Medium 9         | AI 369   | 30737-30738 |
| Medium 10        | AI 303   | 30730-30740 |
|                  | AI 370   | 30739-30740 |
|                  | AI 37 1  | 30743.20744 |
|                  | AL 372   | 30745 20746 |
| Unknown_3        | AI 3/3   | 30743-30746 |
| Unknown_4        | AI 374   | 30747-30746 |
| Unknown_5        | AI 375   | 30749-30750 |
|                  | AI 376   | 30751-30752 |
| Unknown_/        | AI 377   | 30753-30754 |
| Unknown_8        | AI 378   | 30755-30756 |
| Unknown_9        | AI 379   | 30757-30758 |
| Unknown_10       | AI 380   | 30759-30760 |
| Time_Pt_1        | AI 381   | 30761-30762 |
| Time_Pt_2        | AI 382   | 30763-30764 |
| Time_Pt_3        | AI 383   | 30765-30766 |
| Time_Pt_4        | AI 384   | 30767-30768 |
| Time_Pt_5        | AI 385   | 30769-30770 |
| Time_Pt_6        | AI 386   | 30771-30772 |
| Time_Pt_7        | AI 387   | 30773-30774 |
| Time_Pt_8        | AI 388   | 30775-30776 |
| Time_Pt_9        | AI 389   | 30777-30778 |
| Time_Pt_10       | AI 390   | 30779-30780 |
| Fab_Number_1     | AI 391   | 30781-30782 |
| Fab_Number_2     | AI 392   | 30783-30784 |
| Fab_Number_3     | AI 393   | 30785-30786 |
| Fab_Number_4     | AI 394   | 30787-30788 |
| Fab_Number_5     | AI 395   | 30789-30790 |
| Fab_Number_6     | AI 396   | 30791-30792 |
| Fab_Number_7     | AI 397   | 30793-30794 |
| Fab_Number_8     | AI 398   | 30795-30796 |
| Fab_Number_9     | AI 399   | 30797-30798 |
| Fab_Number 10    | AI 400   | 30799-30800 |
| Alarm Flags 1    | AI 401   | 30801-30802 |
| Alarm Flags 2    | AI 402   | 30803-30804 |
| Alarm Flags 3    | AI 403   | 30805-30806 |
| Alarm Flags 4    | AI 404   | 30807-30808 |
| Alarm Flags 5    | AI 405   | 30809-30810 |
| Alarm Flags 6    | AI 406   | 30811-30812 |
| Alarm Flags 7    |          | 30813-30814 |
| Alarm Flags 8    |          | 30815-30816 |
| Alarm Flags 0    |          | 30817-30819 |
| Alarm Elago 10   | AL 440   | 20210 2020  |
| rialIII_Flags_10 | AI 4 I U | 20019-20020 |

Appendix B.12. Kamstrup 66 Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Energy_T_WH_1 | AI 01  | 30001-30002 |
| Energy_T_WH_2 | AI 02  | 30003-30004 |
| Energy_T_WH_3 | AI 03  | 30005-30006 |

| Energy_T_WH_4  | AI 04 | 30007-30008 |
|----------------|-------|-------------|
| Energy_T_WH_5  | AI 05 | 30009-30010 |
| Energy_T_WH_6  | AI 06 | 30011-30012 |
| Energy_T_WH_7  | AI 07 | 30013-30014 |
| Energy_T_WH_8  | AI 08 | 30015-30016 |
| Energy_T_WH_9  | AI 09 | 30017-30018 |
| Energy_T_WH_10 | AI 10 | 30019-30020 |
| Energy_T_J_1   | AI 11 | 30021-30022 |
| Temp_Ret_1     | AI 12 | 30023-30024 |
| Temp_Dif_1     | AI 13 | 30025-30026 |
| Time_Hrs_1     | AI 14 | 30027-30028 |
| Power_W_1      | AI 15 | 30029-30030 |
| Power_W_2      | AI 16 | 30031-30032 |
| Power_W_3      | AI 17 | 30033-30034 |
| Power_W_4      | AI 18 | 30035-30036 |
| Power_W_5      | AI 19 | 30037-30038 |
| Vol_Flo_L_H_1  | AI 20 | 30039-30040 |
| Vol_Flo_L_H_2  | AI 21 | 30041-30042 |
| Vol_Flo_L_H_3  | AI 22 | 30043-30044 |
| Vol_Flo_L_H_4  | AI 23 | 30045-30046 |
| Vol_Flo_ML_S_1 | AI 24 | 30047-30048 |
| Volume_1       | AI 25 | 30049-30050 |
| Volume_2       | AI 26 | 30051-30052 |
| Volume_3       | AI 27 | 30053-30054 |
| Volume_4       | AI 28 | 30055-30056 |
| Volume_5       | AI 29 | 30057-30058 |
| Volume_6       | AI 30 | 30059-30060 |
| Volume_7       | AI 31 | 30061-30062 |

### Appendix B.13. Amtron Sonic D Mappings to BACnet and Modbus

| Point Name     | BACnet | Modbus      |
|----------------|--------|-------------|
| Energy_T_WH_1  | AI 01  | 30001-30002 |
| Energy_T_WH_2  | AI 02  | 30003-30004 |
| Energy_T_WH_3  | AI 03  | 30005-30006 |
| Temp_Flow_1    | AI 04  | 30007-30008 |
| Temp_Ret_1     | AI 05  | 30009-30010 |
| Temp_Dif_1     | AI 06  | 30011-30012 |
| Time_Op_Days_1 | AI 07  | 30013-30014 |
| Power_W_1      | AI 08  | 30015-30016 |
| Vol_Flo_L_S_1  | AI 09  | 30017-30018 |
| Volume_1       | AI 10  | 30019-30020 |
| Volume_2       | AI 11  | 30021-30022 |
| Time_Point_1   | AI 12  | 30023-30024 |
| Time_Point_2   | AI 13  | 30025-30026 |
| Time_Point_3   | AI 14  | 30027-30028 |
| Time_Point_4   | AI 15  | 30029-30030 |

#### Appendix B.14. Shenitech STUF-280T Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Dur_Avg_S_1   | AI 01  | 30001-30002 |
| Dur_Avg_S_2   | AI 02  | 30003-30004 |
| Dur_Avg_S_3   | AI 03  | 30005-30006 |
| Dur_Act_Sec_1 | AI 04  | 30007-30008 |
| Dur_Act_Sec_2 | AI 05  | 30009-30010 |
| Dur_Act_Sec_3 | AI 06  | 30011-30012 |
| Temp_Flow_1   | AI 07  | 30013-30014 |
| Temp_Flow_2   | AI 08  | 30015-30016 |
| Temp_Flow_3   | AI 09  | 30017-30018 |
| Temp Ret 1    | AI 10  | 30019-30020 |



| Temp_Ret_2    | AI 11 | 30021-30022 |
|---------------|-------|-------------|
| Temp_Ret_3    | AI 12 | 30023-30024 |
| Power_W_1     | AI 13 | 30025-30026 |
| Power_W_2     | AI 14 | 30027-30028 |
| Power_W_3     | AI 15 | 30029-30030 |
| Vol_Flo_L_H_1 | AI 16 | 30031-30032 |
| Vol_Flo_L_H_2 | AI 17 | 30033-30034 |
| Vol_Flo_L_H_3 | AI 18 | 30035-30036 |
| Volume_1      | AI 19 | 30037-30038 |
| Volume_2      | AI 20 | 30039-30040 |
| Volume_3      | AI 21 | 30041-30042 |
| Enregy_MWH_1  | AI 22 | 30043-30044 |
| Enregy_MWH_2  | AI 23 | 30045-30046 |
| Enregy MWH 3  | AI 24 | 30047-30048 |

#### Appendix B.15. SensusHRI-B1-8Profile Mappings to BACnet and Modbus

| Point Name | BACnet | Modbus      |
|------------|--------|-------------|
| Volume_1   | AI 1   | 30001-30002 |
| Meter_ID_1 | AI 2   | 30003-30004 |

#### Appendix B.16. KromSchroderTRZ2S1 Mappings to BACnet and Modbus

| Point Name | BACnet | Modbus      |
|------------|--------|-------------|
| Volume_1   | AI 1   | 30001-30002 |
| Meter_ID_1 | AI 2   | 30003-30004 |

#### Appendix B.17. KromSchroderDE10R25-40B Mappings to BACnet and Modbus

| Point Namo   | <b>BACnot</b> | Modbus      |
|--------------|---------------|-------------|
|              | BACHEL        |             |
| Dur_Avg_S_1  | AI 001        | 30001-30002 |
| Dur_Avg_S_2  | AI 002        | 30003-30004 |
| Dur_Avg_S_3  | AI 003        | 30005-30006 |
| Dur_Avg_S_4  | AI 004        | 30007-30008 |
| Dur_Avg_S_5  | AI 005        | 30009-30010 |
| Dur_Avg_S_6  | AI 006        | 30011-30012 |
| Dur_Avg_S_7  | AI 007        | 30013-30014 |
| Dur_Avg_S_8  | AI 008        | 30015-30016 |
| Dur_Avg_S_9  | AI 009        | 30017-30018 |
| Dur_Avg_S_10 | AI 010        | 30019-30020 |
| Dur_Avg_M_1  | AI 011        | 30021-30022 |
| Dur_Avg_M_2  | AI 012        | 30023-30024 |
| Dur_Avg_M_3  | AI 013        | 30025-30026 |
| Dur_Avg_M_4  | AI 014        | 30027-30028 |
| Dur_Avg_M_5  | AI 015        | 30029-30030 |
| Dur_Avg_M_6  | AI 016        | 30031-30032 |
| Dur_Avg_M_7  | AI 017        | 30033-30034 |
| Dur_Avg_M_8  | AI 018        | 30035-30036 |
| Dur_Avg_M_9  | AI 019        | 30037-30038 |
| Dur_Avg_M_10 | AI 020        | 30039-30040 |
| Dur_Avg_H_1  | AI 021        | 30041-30042 |
| Dur_Avg_H_2  | AI 022        | 30043-30044 |
| Dur_Avg_H_3  | AI 023        | 30045-30046 |
| Dur_Avg_H_4  | AI 024        | 30047-30048 |
| Dur_Avg_H_5  | AI 025        | 30049-30050 |
| Dur_Avg_H_6  | AI 026        | 30051-30052 |
| Dur_Avg_H_7  | AI 027        | 30053-30054 |

| Dur_Avg_H_8    | AI 028 | 30055-30056 |
|----------------|--------|-------------|
| Dur_Avg_H_9    | AI 029 | 30057-30058 |
| Dur_Avg_H_10   | AI 030 | 30059-30060 |
| Dur Avg D 1    | AI 031 | 30061-30062 |
| Dur Avg D 2    | AI 032 | 30063-30064 |
| Dur Ava D 3    | AI 033 | 30065-30066 |
| Dur Ava D 4    | AI 034 | 30067-30068 |
| Dur Ava D 5    | AI 035 | 30069-30070 |
| Dur Ava D 6    | AI 036 | 30071-30072 |
| Dur Ava D 7    | AI 037 | 30073-30074 |
| Dur Avg D 8    | AI 038 | 30075-30076 |
| Dur Avg D 9    | AI 039 | 30077-30078 |
| Dur Avg D 10   | AI 040 | 30079-30080 |
| Dur Act Sec 1  | AI 041 | 30081-30082 |
| Dur Act Sec 2  | AI 042 | 30083-30084 |
| Dur Act Sec 3  | AI 043 | 30085-30086 |
| Dur Act Sec 4  | AI 044 | 30087-30088 |
| Dur Act Sec 5  | AI 045 | 30089-30090 |
| Dur Act Sec 6  | AL 046 | 30091-30092 |
| Dur Act Sec 7  | AI 040 | 30091-30092 |
| Dur Act Sec 8  |        | 30095-30094 |
|                |        | 30097-30090 |
|                |        | 30000-30100 |
| Dur Act Min 1  |        | 30101 20102 |
| Dur Act Min 2  | AL051  | 20102 20104 |
| Dur_Act_Win_2  | AI 052 | 30103-30104 |
| Dur Act Mir 4  | AL 053 | 30105-30106 |
| Dur_Act_Min_4  | AI 054 | 30107-30108 |
| Dur_Act_Min_5  | AI 055 | 30109-30110 |
| Dur_Act_Min_6  | AI 056 | 30111-30112 |
| Dur_Act_Min_7  | AI 057 | 30113-30114 |
| Dur_Act_Min_8  | AI 058 | 30115-30116 |
| Dur_Act_Min_9  | AI 059 | 30117-30118 |
| Dur_Act_Min_10 | AI 060 | 30119-30120 |
| Dur_Act_Hrs_1  | AI 061 | 30121-30122 |
| Dur_Act_Hrs_2  | AI 062 | 30123-30124 |
| Dur_Act_Hrs_3  | AI 063 | 30125-30126 |
| Dur_Act_Hrs_4  | AI 064 | 30127-30128 |
| Dur_Act_Hrs_5  | AI 065 | 30129-30130 |
| Dur_Act_Hrs_6  | AI 066 | 30131-30132 |
| Dur_Act_Hrs_7  | AI 067 | 30133-30134 |
| Dur_Act_Hrs_8  | AI 068 | 30135-30136 |
| Dur_Act_Hrs_9  | AI 069 | 30137-30138 |
| Dur_Act_Hrs_10 | AI 070 | 30139-30140 |
| Dur_Act_Day_1  | AI 071 | 30141-30142 |
| Dur_Act_Day_2  | AI 072 | 30143-30144 |
| Dur_Act_Day_3  | AI 073 | 30145-30146 |
| Dur_Act_Day_4  | AI 074 | 30147-30148 |
| Dur_Act_Day_5  | AI 075 | 30149-30150 |
| Dur_Act_Day_6  | AI 076 | 30151-30152 |
| Dur_Act_Day_7  | AI 077 | 30153-30154 |
| Dur_Act_Day_8  | AI 078 | 30155-30156 |
| Dur_Act_Day_9  | AI 079 | 30157-30158 |
| Dur_Act_Day_10 | AI 080 | 30159-30160 |
| Energy_T_WH_1  | AI 081 | 30161-30162 |
| Energy_T_WH_2  | AI 082 | 30163-30164 |
| Energy_T_WH_3  | AI 083 | 30165-30166 |
| Energy_T_WH 4  | AI 084 | 30167-30168 |
| Energy_T_WH_5  | AI 085 | 30169-30170 |
| Energy_T_WH_6  | AI 086 | 30171-30172 |
| Energy_T_WH 7  | AI 087 | 30173-30174 |
| Energy_T_WH_8  | AI 088 | 30175-30176 |
| Energy_T_WH 9  | AI 089 | 30177-30178 |
| Energy T WH 10 | AI 090 | 30179-30180 |
| Energy T J 1   | AI 091 | 30181-30182 |
| Energy T J 2   | AI 092 | 30183-30184 |
| Energy T J 3   | AI 093 | 30185-30186 |
| Energy T J 4   | AI 094 | 30187-30188 |
| Energy T J 5   | AI 095 | 30189-30190 |
| Energy T J 6   | AI 096 | 30191-30192 |
|                |        |             |



| Energy_T_J_7  | AI 097 | 30193-30194 |
|---------------|--------|-------------|
| Energy_T_J_8  | AI 098 | 30195-30196 |
| Energy_T_J_9  | AI 099 | 30197-30198 |
| Energy_T_J_10 | AI 100 | 30199-30200 |
| Voltage_1     | AI 101 | 30201-30202 |
| Voltage_2     | AI 102 | 30203-30204 |
| Voltage_3     | AI 103 | 30205-30206 |
| Voltage_4     | AI 104 | 30207-30208 |
| Voltage_5     | AI 105 | 30209-30210 |
| Voltage_6     | AI 106 | 30211-30212 |
| Voltage_7     | AI 107 | 30213-30214 |
| Voltage_8     | AI 108 | 30215-30216 |
| Voltage_9     | AI 109 | 30217-30218 |
| Voltage_10    | AI 110 | 30219-30220 |
| Current_1     | AI 111 | 30221-30222 |
| Current_2     | AI 112 | 30223-30224 |
| Current_3     | AI 113 | 30225-30226 |
| Current 4     | AI 114 | 30227-30228 |
| Current 5     | AI 115 | 30229-30230 |
| Current 6     | AI 116 | 30231-30232 |
| Current 7     | AI 117 | 30233-30234 |
| Current 8     | AI 118 | 30235-30236 |
| Current 9     | AI 119 | 30237-30238 |
| Current 10    | AI 120 | 30239-30240 |
| Temp Ext 1    | AI 121 | 30241-30242 |
| Temp Ext 2    | AI 122 | 30243-30244 |
| Temp Fxt 3    | AI 123 | 30245-30246 |
| Temp_Ext_0    | AI 124 | 30247-30248 |
| Temp_Ext_4    | AI 125 | 30249-30250 |
| Temp_Ext_0    | AI 126 | 30251-30252 |
| Temp_Ext_0    | AI 127 | 30253-30254 |
| Temp_Ext_7    | ΔΙ 128 | 30255-30254 |
| Temp_Ext_0    | AI 120 | 30257-30258 |
| Temp_Ext_3    | AI 120 | 30250-30260 |
| Temp_Ext_10   | AI 130 | 30259-30200 |
| Temp_Flow_1   | AL 122 | 30201-30202 |
| Temp_Flow_2   | AL 132 | 30205-30204 |
| Temp_flow_3   | AI 133 | 30203-30200 |
| Temp_flow_4   | AI 134 | 30260-30270 |
| Temp_Flow_6   | AI 136 | 30271-30272 |
| Temp_Flow_0   | AI 130 | 30273-30274 |
| Temp_flow_7   | AI 137 | 30275-30274 |
| Temp_flow_0   | AI 130 | 30273-30270 |
| Temp_flow_3   | AI 133 | 30270-30280 |
| Temp_Flow_To  |        | 30281-30282 |
| Temp_Ret_1    |        | 30283-30284 |
| Tomp Pot 2    | AI 142 | 20205-30204 |
| Tomp Pot 4    | AI 143 | 20203-30200 |
| Temp Ret 5    |        | 30280-30200 |
| Temp Ret 6    |        | 30203-30230 |
| Tomp Pot 7    |        | 30291-30292 |
| Temp_Ret 8    |        | 30295-30294 |
| Temp Ret 0    |        | 30207-30290 |
| Temp_Ret_9    | AI 149 | 30297-30290 |
| Temp_Net_10   | AL 150 | 30301 20200 |
| Temp Dif 2    |        | 30303,20204 |
| Temp Dif 2    |        | 30305.20204 |
| Tomp Dif 1    | AL 153 | 30302-30300 |
| Temp Dif 5    | AI 104 | 30300 20240 |
| Temp_Dil_0    | AL 150 | 30311,20212 |
| Temp Dif 7    |        | 30313,20214 |
| Temp Dif 9    | AL 157 | 30315 20314 |
|               | AL 100 | 20217 20240 |
| Tomp Dif 10   | AL 160 | 20210 20220 |
|               | AL 161 | 20221 20220 |
|               | AI 101 | 30323 20224 |
|               | AL 102 | 20225-30324 |
|               | 71103  | 30323-30320 |
|               | AI 161 | 20227 20220 |
| Time_Sec_4    | AI 164 | 30327-30328 |

| Time_Sec_6   | AI 166                               | 30331-30332  |
|--|--------------------------------------|--|
| Time Sec 7   | AI 167                               | 30333-30334  |
| Time Sec 8   | AI 168                               | 30335-30336  |
| Time Sec 9   | AI 160                               | 30337-30338  |
| Time_Sec_10  | AI 105                               | 20220 20240  |
| Time_Sec_10  | AI 170                               | 30339-30340  |
|  | AI 171                               | 30341-30342  |
| Time_Min_2   | AI 172                               | 30343-30344  |
|  | Al 173                               | 30345-30346  |
| Time_Min_4   | AI 174                               | 30347-30348  |
| Time Min 5   | AI 175                               | 30349-30350  |
| Time Min 6   | AI 176                               | 30351-30352  |
| Time Min 7   |                                      | 30353-30354  |
| Time Min 8   | AL 179                               | 20255 20256  |
| Time_Min_0   | AL 170                               | 20257 20259  |
| Time_Win_9   | AI 179                               | 30357-30356  |
| Time_Win_10  | AI 180                               | 30359-30360  |
| lime_Hrs_1   | AI 181                               | 30361-30362  |
| Time_Hrs_2   | AI 182                               | 30363-30364  |
| Time_Hrs_3   | AI 183                               | 30365-30366  |
| Time Hrs 4   | AI 184                               | 30367-30368  |
| Time Hrs 5   | AI 185                               | 30369-30370  |
| Time Hrs 6   | AI 186                               | 30371-30372  |
| Time Hrc 7   | ΔΙ 197                               | 30373 20274  |
|  |                                      | 20275-20274  |
| Time_Hrs_8   | AI 188                               | 30375-30376  |
| Time_Hrs_9   | AI 189                               | 30377-30378  |
| Time_Hrs_10  | AI 190                               | 30379-30380  |
| Time_Days_1  | AI 191                               | 30381-30382  |
| Time Days 2  | AI 192                               | 30383-30384  |
| Time Days 3  | AI 193                               | 30385-30386  |
| Time Days 4  | AL 10/                               | 30387-30388  |
| Time_Days_4  | AI 194                               | 20200 20200  |
| Time_Days_5  | AI 195                               | 30389-30390  |
| Time_Days_6  | AI 196                               | 30391-30392  |
|  | AI 197                               | 30393-30394  |
| Time_Days_8  | AI 198                               | 30395-30396  |
| Time Days 9  | AI 199                               | 30397-30398  |
| Time Days 10   | AI 200                               | 30399-30400  |
| Time On Sec 1  | AL 201                               | 30401-30402  |
|  | AL 201                               | 20402 20404  |
| Time_Op_Sec_2  | AI 202                               | 30405-30404  |
| Time_Op_Sec_3  | AI 203                               | 30405-30406  |
| Time_Op_Sec_4  | AI 204                               | 30407-30408  |
| Time_Op_Sec_5  | AI 205                               | 30409-30410  |
| Time_Op_Sec_6  | AI 206                               | 30411-30412  |
| Time_Op_Sec_7  | AI 207                               | 30413-30414  |
| Time Op Sec 8  | AI 208                               | 30415-30416  |
| Time Op Sec 9  | AI 209                               | 30417-30418  |
| Time On Sec 10   | AI 210                               | 30419-30420  |
| Time_Op_Occ_10   | AL 211                               | 20421 20422  |
| Time_Op_Min_1  | ALZII                                | 30421-30422  |
| Time_Op_iviin_2  | AI 212                               | 30423-30424  |
| Time_Op_Min_3  | AI 213                               | 30425-30426  |
| Time_Op_Min_4  | AI 214                               | 30427-30428  |
| Time_Op_Min_5  | AI 215                               | 30429-30430  |
| Time_Op_Min 6  | AI 216                               | 30431-30432  |
| Time Op Min 7  | AI 217                               | 30433-30434  |
| Time On Min 8  | AI 218                               | 30435-30436  |
| Time On Min 0  | ΔΙ 210                               | 30427-20429  |
| Time_Op_Min_9  | AI 219                               | 30437-30430  |
| Time_Op_Win_10   | AI 220                               | 30439-30440  |
| Time_Op_Hrs_1  | AI 221                               | 30441-30442  |
| Time_Op_Hrs_2  | AI 222                               | 30443-30444  |
| Time_Op_Hrs_3  | AI 223                               | 30445-30446  |
| Time_Op_Hrs_4  | AI 224                               | 30447-30448  |
| Time Op Hrs 5  | AI 225                               | 30449-30450  |
| Time Op Hrs 6  | AI 226                               | 30451-30452  |
| Time On Hre 7  | ΔΙ 227                               | 30453-30454  |
|  | AL 220                               | 20455 20454  |
| Time_Op_Hrs_o  | AI 228                               | 30455-30456  |
| Time_Op_Hrs_9  | AI 229                               | 30457-30458  |
| Time_Op_Hrs_10   | 1 1 0 0 0                            | 30459-30460  |
|  | AI 230                               | 30433 30400  |
| Time_Op_Days_1   | AI 230<br>AI 231                     | 30461-30462  |
| Time_Op_Days_1<br>Time_Op_Days_2                                     | AI 230<br>AI 231<br>AI 232           | 30461-30462<br>30463-30464                               |
| Time_Op_Days_1<br>Time_Op_Days_2<br>Time_Op_Days_3                   | AI 230<br>AI 231<br>AI 232<br>AI 233 | 30463-30462<br>30463-30464<br>30465-30466                |
| Time_Op_Days_1<br>Time_Op_Days_2<br>Time_Op_Days_3<br>Time_Op_Days_4 | AI 230<br>AI 231<br>AI 232<br>AI 233 | 30461-30462<br>30463-30464<br>30465-30466<br>30467-30468 |



| Time_Op_Days_5  | AI 235 | 30469-30470 |
|-----------------|--------|-------------|
| Time_Op_Days_6  | AI 236 | 30471-30472 |
| Time_Op_Days_7  | AI 237 | 30473-30474 |
| Time_Op_Days_8  | AI 238 | 30475-30476 |
| Time_Op_Days_9  | AI 239 | 30477-30478 |
| Time_Op_Days_10 | AI 240 | 30479-30480 |
| Custom_1        | AI 241 | 30481-30482 |
| Custom_2        | AI 242 | 30483-30484 |
| Custom_3        | AI 243 | 30485-30486 |
| Custom_4        | AI 244 | 30487-30488 |
| Custom_5        | AI 245 | 30489-30490 |
| Custom_6        | AI 246 | 30491-30492 |
| Custom_7        | AI 247 | 30493-30494 |
| Custom_8        | AI 248 | 30495-30496 |
| Custom_9        | AI 249 | 30497-30498 |
| Custom_10       | AI 250 | 30499-30500 |
| Power_W_1       | AI 251 | 30501-30502 |
| Power_W_2       | AI 252 | 30503-30504 |
| Power_W_3       | AI 253 | 30505-30506 |
| Power_W_4       | AI 254 | 30507-30508 |
| Power_W_5       | AI 255 | 30509-30510 |
| Power_W_6       | AI 256 | 30511-30512 |
| Power_W_7       | AI 257 | 30513-30514 |
| Power_W_8       | AI 258 | 30515-30516 |
| Power_W_9       | AI 259 | 30517-30518 |
| Power_W_10      | AI 260 | 30519-30520 |
| Power_Jh_1      | AI 261 | 30521-30522 |
| Power_Jh_2      | AI 262 | 30523-30524 |
| Power_Jh_3      | AI 263 | 30525-30526 |
| Power_Jh_4      | AI 264 | 30527-30528 |
| Power_Jh_5      | AI 265 | 30529-30530 |
| Power_Jh_6      | AI 266 | 30531-30532 |
| Power_Jh_7      | AI 267 | 30533-30534 |
| Power_Jh_8      | AI 268 | 30535-30536 |
| Power_Jh_9      | AI 269 | 30537-30538 |
| Power_Jh_10     | AI 270 | 30539-30540 |
| Pressure_1      | AI 271 | 30541-30542 |
| Pressure_2      | AI 272 | 30543-30544 |
| Pressure_3      | AI 273 | 30545-30540 |
| Pressure 5      | AI 274 | 30540-30550 |
| Pressure 6      | AI 275 | 30551-30552 |
| Pressure 7      | AI 277 | 30553-30554 |
| Pressure 8      | AI 278 | 30555-30556 |
| Pressure 9      | AI 279 | 30557-30558 |
| Pressure 10     | AI 280 | 30559-30560 |
| Mass 1          | AI 281 | 30561-30562 |
| Mass 2          | AI 282 | 30563-30564 |
| Mass_3          | AI 283 | 30565-30566 |
| Mass_4          | AI 284 | 30567-30568 |
| Mass_5          | AI 285 | 30569-30570 |
| Mass_6          | AI 286 | 30571-30572 |
| Mass_7          | AI 287 | 30573-30574 |
| Mass_8          | AI 288 | 30575-30576 |
| Mass_9          | AI 289 | 30577-30578 |
| Mass_10         | AI 290 | 30579-30580 |
| Mass_Flow_1     | AI 291 | 30581-30582 |
| Mass_Flow_2     | AI 292 | 30583-30584 |
| Mass_Flow_3     | AI 293 | 30585-30586 |
| Mass_Flow_4     | AI 294 | 30587-30588 |
| Mass_Flow_5     | AI 295 | 30589-30590 |
| Mass_Flow_6     | AI 296 | 30591-30592 |
| Mass_Flow_7     | AI 297 | 30593-30594 |
| Mass_Flow_8     | AI 298 | 30595-30596 |
| Mass_Flow_9     | AI 299 | 30597-30598 |
| IVIASS_FIOW_10  | AI 300 | 30599-30600 |
|                 | AI 301 | 30601-30602 |
|                 | AI 302 | 30605 20604 |
|                 | AI 303 | 30003-30606 |

| Vol_Flo_L_M_4   | AI 304 | 30607-30608 |
|-----------------|--------|-------------|
| Vol_Flo_L_M_5   | AI 305 | 30609-30610 |
| Vol_Flo_L_M_6   | AI 306 | 30611-30612 |
| Vol_Flo_L_M_7   | AI 307 | 30613-30614 |
| Vol_Flo_L_M_8   | AI 308 | 30615-30616 |
| Vol_Flo_L_M_9   | AI 309 | 30617-30618 |
| Vol_Flo_L_M_10  | AI 310 | 30619-30620 |
| Vol_Flo_L_H_1   | AI 311 | 30621-30622 |
| Vol_Flo_L_H_2   | AI 312 | 30623-30624 |
| Vol_Flo_L_H_3   | AI 313 | 30625-30626 |
| VOI_FIO_L_H_4   | AI 314 | 30627-30628 |
| VOI_FIO_L_H_5   | AI 315 | 30629-30630 |
| VOI_FIO_L_H_6   | AI 316 | 30631-30632 |
|                 | AI 317 | 30635-30634 |
|                 | ΔΙ 310 | 30637-30638 |
| Vol_Flo_L_H_10  | AI 320 | 30639-30640 |
| Vol Flo ML S 1  | AL 321 | 30641-30642 |
| Vol_FIO_ML_S_2  | AI 322 | 30643-30644 |
| Vol Flo ML S 3  | AI 323 | 30645-30646 |
| Vol Flo ML S 4  | AI 324 | 30647-30648 |
| Vol_Flo_ML_S_5  | AI 325 | 30649-30650 |
| Vol_Flo_ML_S_6  | AI 326 | 30651-30652 |
| Vol_Flo_ML_S_7  | AI 327 | 30653-30654 |
| Vol_Flo_ML_S_8  | AI 328 | 30655-30656 |
| Vol_Flo_ML_S_9  | AI 329 | 30657-30658 |
| Vol_Flo_ML_S_10 | AI 330 | 30659-30660 |
| ID_1            | AI 331 | 30661-30662 |
| ID_2            | AI 332 | 30663-30664 |
| ID_3            | AI 333 | 30665-30666 |
| ID_4            | AI 334 | 30667-30668 |
| ID_5            | AI 335 | 30669-30670 |
| ID_6            | AI 336 | 30671-30672 |
| ID_7            | AI 337 | 30673-30674 |
| ID_8            | AI 338 | 30675-30676 |
| ID_9            | AI 339 | 30670 30680 |
| Volume 1        |        | 30681-30682 |
| Volume 2        | AI 342 | 30683-30684 |
| Volume 3        | AI 343 | 30685-30686 |
| Volume 4        | AI 344 | 30687-30688 |
| Volume 5        | AI 345 | 30689-30690 |
| Volume_6        | AI 346 | 30691-30692 |
| Volume_7        | AI 347 | 30693-30694 |
| Volume_8        | AI 348 | 30695-30696 |
| Volume_9        | AI 349 | 30697-30698 |
| Volume_10       | AI 350 | 30699-30700 |
| Error_Flags_1   | AI 351 | 30701-30702 |
| Error_Flags_2   | AI 352 | 30703-30704 |
| Error_Flags_3   | AI 353 | 30705-30706 |
| Error_Flags_4   | AI 354 | 30707-30708 |
| Error_Flags_5   | AI 355 | 30709-30710 |
| Error_Flags_6   | AI 356 | 30711-30712 |
| Error_Flags_7   | AI 357 | 30713-30714 |
| Error Flags_0   | AI 330 | 30715-30710 |
| Error Flags 10  | AI 360 | 30719-30720 |
| Medium 1        | AI 361 | 30721-30722 |
| Medium 2        | AI 362 | 30723-30724 |
| Medium 3        | AI 363 | 30725-30726 |
| Medium_4        | AI 364 | 30727-30728 |
| Medium 5        | AI 365 | 30729-30730 |
| Medium 6        | AI 366 | 30731-30732 |
| Medium_7        | AI 367 | 30733-30734 |
| Medium_8        | AI 368 | 30735-30736 |
| Medium_9        | AI 369 | 30737-30738 |
| Medium_10       | AI 370 | 30739-30740 |
| Unknown_1       | AI 371 | 30741-30742 |
|                 | AL 272 | 20742 20744 |



| Unknown_3  | AI 373 | 30745-30746 |
|------------|--------|-------------|
| Unknown_4  | AI 374 | 30747-30748 |
| Unknown_5  | AI 375 | 30749-30750 |
| Unknown_6  | AI 376 | 30751-30752 |
| Unknown_7  | AI 377 | 30753-30754 |
| Unknown_8  | AI 378 | 30755-30756 |
| Unknown_9  | AI 379 | 30757-30758 |
| Unknown_10 | AI 380 | 30759-30760 |

### Appendix B.18. RelayPadPulsM1 Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Energy_T_WH_1 | AI 1   | 30001-30002 |
| Vol_Flo_L_M_1 | AI 2   | 30003-30004 |

#### Appendix B.19. AILA AUF200 Meter Data Profile Mappings to BACnet and Modbus

| Point Name      | BACnet | Modbus      |
|-----------------|--------|-------------|
| Energy_Wh_1     | AI 1   | 30001-30002 |
| Energy_Wh_2     | AI 2   | 30003-30004 |
| Temp_Flow       | AI 3   | 30005-30006 |
| Temp_Return     | AI 4   | 30007-30008 |
| Time_Sec        | AI 5   | 30009-30010 |
| Power_W         | AI 6   | 30011-30012 |
| Volume_Flow_L_H | AI 7   | 30013-30014 |
| Volume          | AI 8   | 30015-30016 |

### Appendix B.20. Siemens WFN21 Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Energy_T_WH_1 | AI 1   | 30001/30002 |
| Energy_T_WH_2 | AI 2   | 30003/30004 |
| Energy_T_WH_3 | AI 3   | 30005/30006 |
| Energy_T_WH_4 | AI 4   | 30007/30008 |
| Energy_T_WH_5 | AI 5   | 30009/30010 |
| Energy_T_WH_6 | AI 6   | 30011/30012 |
| Energy_T_WH_7 | AI 7   | 30013/30014 |
| Energy_T_WH_8 | AI 8   | 30015/30016 |
| Time_Op_Min_1 | AI 9   | 30017/30018 |
| ID_1          | AI 10  | 30019/30020 |
| Error Flags 1 | AI 11  | 30021/30022 |

Appendix B.21. Siemens UH50 Mappings to BACnet and Modbus

| Point Name                 | BACnet | Modbus      |
|----------------------------|--------|-------------|
| Averaging Duration Minutes | AI 1   | 30001/30002 |
| Averaging Duration Seconds | AI 2   | 30003/30004 |
| Actuality Duration         | AI 3   | 30005/30006 |
| Energy 1                   | AI 4   | 30007/30008 |
| Energy 2                   | AI 5   | 30009/30010 |
| Energy 3                   | AI 6   | 30011/30012 |
| Energy 4                   | AI 7   | 30013/30014 |
| Energy 5                   | AI 8   | 30015/30016 |

| Energy 6<br>Energy 7<br>Energy 8 | AI 9<br>AI 10 | 30017/30018 |
|----------------------------------|---------------|-------------|
| Energy 7<br>Energy 8             | AI 10         | 20010/20020 |
| Energy 8                         |               | 30019/30020 |
|                                  | AI 11         | 30021/30022 |
| Energy 9                         | AI 12         | 30023/30024 |
| Energy 10                        | AI 13         | 30025/30026 |
| Energy 11                        | AI 14         | 30027/30028 |
| Energy 12                        | AI 15         | 30029/30030 |
| Flow Temperature 1               | AI 16         | 30031/30032 |
| Flow Temperature 2               | AI 17         | 30033/30034 |
| Flow Temperature 3               | AI 18         | 30035/30036 |
| Return Temperature 1             | AI 19         | 30037/30038 |
| Return Temperature 2             | AI 20         | 30039/30040 |
| Return Temperature 3             | AI 21         | 30041/30042 |
| Temperature Difference           | AI 22         | 30043/30044 |
| On Time 1                        | AI 23         | 30045/30046 |
| On Time 2                        | AI 24         | 30047/30048 |
| On Time 3                        | AI 25         | 30049/30050 |
| On Time 4                        | AI 26         | 30051/30052 |
| Power 1                          | AI 27         | 30053/30054 |
| Power 2                          | AI 28         | 30055/30056 |
| Power 3                          | AI 29         | 30057/30058 |
| Power 4                          | AI 30         | 30059/30060 |
| Volume Flow 1                    | AI 31         | 30061/30062 |
| Volume Flow 2                    | AI 32         | 30063/30064 |
| Volume Flow 3                    | AI 33         | 30065/30066 |
| Volume 1                         | AI 34         | 30067/30068 |
| Volume 2                         | AI 35         | 30069/30070 |
| Volume 3                         | AI 36         | 30071/30072 |
| Time Point 1                     | AI 37         | 30073/30074 |
| Time Point 2                     | AI 38         | 30075/30076 |
| Fabrication Number               | AI 39         | 30077/30078 |

### Appendix B.22. Siemens T230 Mappings to BACnet and Modbus

| Point Name                   | BACnet | Modbus      |
|------------------------------|--------|-------------|
| Averaging Duration Seconds 1 | AI 1   | 30001/30002 |
| Averaging Duration Seconds 2 | AI 2   | 30003/30004 |
| Averaging Duration Seconds 3 | AI 3   | 30005/30006 |
| Averaging Duration Minutes 1 | AI 4   | 30007/30008 |
| Averaging Duration Minutes 2 | AI 5   | 30009/30010 |
| Averaging Duration Minutes 3 | AI 6   | 30011/30012 |
| Actuality Duration 1         | AI 7   | 30013/30014 |
| Actuality Duration 2         | AI 8   | 30015/30016 |
| Actuality Duration 3         | AI 9   | 30017/30018 |
| Energy 1                     | AI 10  | 30019/30020 |
| Energy 2                     | AI 11  | 30021/30022 |
| Energy 3                     | AI 12  | 30023/30024 |
| Energy 4                     | AI 13  | 30025/30026 |
| Energy 5                     | AI 14  | 30027/30028 |
| Energy 6                     | AI 15  | 30029/30030 |
| Energy 7                     | AI 16  | 30031/30032 |
| Energy 8                     | AI 17  | 30033/30034 |
| Energy 9                     | AI 18  | 30035/30036 |
| Energy 10                    | AI 19  | 30037/30038 |
| Flow Temperature 1           | AI 20  | 30039/30040 |
| Flow Temperature 2           | AI 21  | 30041/30042 |
| Flow Temperature 3           | AI 22  | 30043/30044 |
| Flow Temperature 4           | AI 23  | 30045/30046 |
| Flow Temperature 5           | AI 24  | 30047/30048 |
| Flow Temperature 6           | AI 25  | 30049/30050 |
| Flow Temperature 7           | AI 26  | 30051/30052 |
| Flow Temperature 8           | AI 27  | 30053/30054 |
| Flow Temperature 9           | AI 28  | 30055/30056 |
| Flow Temperature 10          | AI 29  | 30057/30058 |
| Return Temperature 1         | AI 30  | 30059/30060 |



| Return Temperature 2     | AI 31 | 30061/30062 |
|--------------------------|-------|-------------|
| Return Temperature 3     | AI 32 | 30063/30064 |
| Return Temperature 4     | AI 33 | 30065/30066 |
| Return Temperature 5     | AI 34 | 30067/30068 |
| Return Temperature 6     | AI 35 | 30069/30070 |
| Return Temperature 7     | AI 36 | 30071/30072 |
| Return Temperature 8     | AI 37 | 30073/30074 |
| Return Temperature 9     | AL 38 | 30075/30076 |
| Return Temperature 10    | AI 39 | 30077/30078 |
| Temperature Difference 1 | AL 40 | 30079/30080 |
| Temperature Difference 2 |       | 30073/30000 |
|                          | AI 41 | 20082/20084 |
| Continue difference 3    | AI 42 | 30083/30084 |
|                          | AI 43 | 30085/30086 |
| On Time 2                | AI 44 | 30087/30088 |
| On Time 3                | AI 45 | 30089/30090 |
| On Time 4                | AI 46 | 30091/30092 |
| On Time 5                | AI 47 | 30093/30094 |
| On Time 6                | AI 48 | 30095/30096 |
| On Time 7                | AI 49 | 30097/30098 |
| On Time 8                | AI 50 | 30099/30100 |
| On Time 9                | AI 51 | 30101/30102 |
| Operating Hours 1        | AI 52 | 30103/30104 |
| Operating Hours 2        | AI 53 | 30105/30106 |
| Operating Hours 3        | AI 54 | 30107/30108 |
| Operating Hours 4        | AI 55 | 30109/30110 |
| Operating Hours 5        | AI 56 | 30111/30112 |
| Operating Hours 6        | AI 50 | 20112/20114 |
| Dowor 1                  | AI 57 | 20115/20116 |
| Power 2                  | AI 50 | 20117/20110 |
| Power 2                  | AI 59 | 30117/30118 |
| Power 3                  | AI 60 | 30119/30120 |
| Power 4                  | AI 61 | 30121/30122 |
| Power 5                  | AI 62 | 30123/30124 |
| Power 6                  | AI 63 | 30125/30126 |
| Power 7                  | AI 64 | 30127/30128 |
| Power 8                  | AI 65 | 30129/30130 |
| Power 9                  | AI 66 | 30131/30132 |
| Power 10                 | AI 67 | 30133/30134 |
| Volume Flow 1            | AI 68 | 30135/30136 |
| Volume Flow 2            | AI 69 | 30137/30138 |
| Volume Flow 3            | AI 70 | 30139/30140 |
| Volume Flow 4            | AI 71 | 30141/30142 |
| Volume Flow 5            | AI 72 | 30143/30144 |
| Volume Flow 6            | AI 73 | 30145/30146 |
| Volume Flow 7            | AI 74 | 30147/30148 |
| Volume Flow 8            | AI 75 | 30149/30150 |
| Volume Flow 9            | AI 76 | 30151/30152 |
| Volume Flow 10           | AI 70 | 20152/20154 |
|                          | AL 79 | 20155/30154 |
|                          | AI 70 | 30155/30156 |
| Volume 2                 | AI 79 | 30157/30158 |
| volume 3                 | AI 80 | 30159/30160 |
| Volume 4                 | AI 81 | 30161/30162 |
| Volume 5                 | AI 82 | 30163/30164 |
| Volume 6                 | AI 83 | 30165/30166 |
| Time Point 1             | AI 84 | 30167/30168 |
| Time Point 2             | AI 85 | 30169/30170 |
| Time Point 3             | AI 86 | 30171/30172 |
| Time Point 4             | AI 87 | 30173/30174 |
| Time Point 5             | AI 88 | 30175/30176 |
| Time Point 6             | AI 89 | 30177/30178 |
| Fabrication Number 1     | AI 90 | 30179/30180 |
| Fabrication Number 2     | AI 91 | 30181/30182 |
| Fabrication Number 3     | AI 92 | 30183/30184 |
|                          |       |             |

### Appendix B.23. Kamstrup Multical Mappings to BACnet and Modbus

| Point Name     | BACnet | Modbus      |
|----------------|--------|-------------|
| Energy T WH 1  | AI 1   | 30001/30002 |
| Energy T WH 2  | AI 2   | 30003/30004 |
| Energy T WH 3  | AI 3   | 30005/30006 |
| Energy T WH 4  | AI 4   | 30007/30008 |
| Energy T WH 5  | AI 5   | 30009/30010 |
| Energy T WH 6  | AI 6   | 30011/30012 |
| Energy_T_WH_7  | AI 7   | 30013/30014 |
| Energy_T_WH_8  | AI 8   | 30015/30016 |
| Energy T WH 9  | AI 9   | 30017/30018 |
| Energy_T_WH_10 | AI 10  | 30019/30020 |
| Energy T WH 11 | AI 11  | 30021/30022 |
| Energy T WH 12 | AI 12  | 30023/30024 |
| Energy T WH 13 | AI 13  | 30025/30026 |
| Energy_T_WH_14 | AI 14  | 30027/30028 |
| Energy T WH 15 | AI 15  | 30029/30030 |
| Energy_T_WH_16 | AI 16  | 30031/30032 |
| Energy T WH 17 | AI 17  | 30033/30034 |
| Energy T WH 18 | AI 18  | 30035/30036 |
| Energy T WH 19 | AI 19  | 30037/30038 |
| Energy_T_WH_20 | AI 20  | 30039/30040 |
| Energy_T_WH_21 | AI 21  | 30041/30042 |
| Energy_T_WH_22 | AI 22  | 30043/30044 |
| Energy_T_WH_23 | AI 23  | 30045/30046 |
| Energy_T_J_1   | AI 24  | 30047/30048 |
| Temp_Flow_1    | AI 25  | 30049/30050 |
| Temp_Ret_1     | AI 26  | 30051/30052 |
| Temp_Dif_1     | AI 27  | 30053/30054 |
| Time_Op_Hrs_1  | AI 28  | 30055/30056 |
| Power_W_1      | AI 29  | 30057/30058 |
| Power_W_2      | AI 30  | 30059/30060 |
| Power_W_3      | AI 31  | 30061/30062 |
| Power_Jh_1     | AI 32  | 30063/30064 |
| Vol_Flo_L_H_1  | AI 33  | 30065/30066 |
| Vol_Flo_L_H_2  | AI 34  | 30067/30068 |
| Vol_Flo_L_H_3  | AI 35  | 30069/30070 |
| Volume_1       | AI 36  | 30071/30072 |
| Volume_2       | AI 37  | 30073/30074 |
| Volume_3       | AI 38  | 30075/30076 |
| Volume_4       | AI 39  | 30077/30078 |
| Volume_5       | AI 40  | 30079/30080 |
| Volume_6       | AI 41  | 30081/30082 |
| Time_Pt_1      | AI 42  | 30083/30084 |
| Time_Pt_2      | AI 43  | 30085/30086 |
| Fab_Number_1   | AI 44  | 30087/30088 |

### Appendix B.24. Siemens UH50 Combined Mappings to BACnet and Modbus

| Point Name                 | BACnet | Modbus      |
|----------------------------|--------|-------------|
| Averaging Duration Seconds | AI 1   | 30001/30002 |
| Averaging Duration Seconds | AI 2   | 30003/30004 |
| Averaging Duration Seconds | AI 3   | 30005/30006 |
| Averaging Duration Minutes | AI 4   | 30007/30008 |
| Averaging Duration Minutes | AI 5   | 30009/30010 |
| Averaging Duration Minutes | AI 6   | 30011/30012 |
| Actuality Duration         | AI 7   | 30013/30014 |
| Actuality Duration         | AI 8   | 30015/30016 |
| Actuality Duration         | AI 9   | 30017/30018 |
| Energy 1                   | AI 10  | 30019/30020 |
| Energy 2                   | AI 11  | 30021/30022 |
| Energy 3                   | AI 12  | 30023/30024 |

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|-------------|----------|-------|
|-------------|----------|-------|

| Energy 4                 | AI 13 | 30025/30026   |
|--------------------------|-------|---------------|
| Energy 5                 | AI 14 | 30027/30028   |
| Energy 6                 | AI 15 | 30029/30030   |
| Energy 7                 | AI 16 | 30031/30032   |
| Energy 8                 | AI 17 | 30033/30034   |
| Energy 9                 | AI 18 | 30035/30036   |
| Energy 10                | AI 19 | 30037/30038   |
| Energy 11                | AI 20 | 30039/30040   |
| Energy 12                | AI 21 | 30041/30042   |
| Flow Temperature 1       | Δ1.22 | 30043/30044   |
| Flow Temperature 2       | AI 22 | 30045/30046   |
| Flow Temperature 3       | AI 23 | 30047/30048   |
| Flow Temperature 4       | AI 24 | 20040/20050   |
| Flow Temperature 5       | AI 25 | 30049/30030   |
| Flow Temperature 6       | AI 20 | 20052/20054   |
| Flow Temperature 7       | AI 27 | 20055/20056   |
|                          | AI 20 | 30053/30050   |
|                          | AI 29 | 30057/30058   |
| Flow Temperature 9       | AI 30 | 30059/30060   |
| Return Temperature 1     | AI 31 | 30061/30062   |
| Return Temperature 2     | AI 32 | 30063/30064   |
| Return Temperature 3     | AI 33 | 30065/30066   |
| Return Temperature 4     | AI 34 | 30067/30068   |
| Return Lemperature 5     | AI 35 | 30069/30070   |
| Return Temperature 6     | AI 36 | 30071/30072   |
| Return Temperature 7     | AI 37 | 30073/30074   |
| Return Temperature 8     | AI 38 | 30075/30076   |
| Return Temperature 9     | AI 39 | 30077/30078   |
| Temperature Difference 1 | AI 40 | 30079/30080   |
| Temperature Difference 2 | AI 41 | 30081/30082   |
| Temperature Difference 3 | AI 42 | 30083/30084   |
| On Time 1                | AI 43 | 30085/30086   |
| On Time 2                | AI 44 | 30087/30088   |
| On Time 3                | AI 45 | 30089/30090   |
| On Time 4                | AI 46 | 30091/30092   |
| On Time 5                | AI 47 | 30093/30094   |
| On Time 6                | AI 48 | 30095/30096   |
| On Time 7                | AI 49 | 30097/30098   |
| On Time 8                | AI 50 | 30099/30100   |
| On Time 9                | AI 51 | 30101/30102   |
| On Time 10               | AI 52 | 30103/30104   |
| Power 1                  | AI 53 | 30105/30106   |
| Power 2                  | AI 54 | 30107/30108   |
| Power 3                  | AL 55 | 30109/30110   |
| Power 4                  | AL 56 | 30111/30112   |
| Power 5                  | AI 57 | 30113/30114   |
| Power 6                  | AI 58 | 30115/30116   |
| Power 7                  | AI 50 | 30117/30118   |
| Power 8                  | AL 60 | 20110/20120   |
| Power 0                  | AI 60 | 20121/20122   |
| Power 10                 | ALCO  | 30121/30122   |
|                          | AI 62 | 30123/30124   |
|                          | AI 63 | 30125/30126   |
|                          | AI 64 | 30127/30128   |
|                          | AI 65 | 30129/30130   |
|                          | AI 66 | 30131/30132   |
| Volume Flow 5            | AI 67 | 30133/30134   |
| Volume Flow 6            | AI 68 | 30135/30136   |
| Volume Flow 7            | AI 69 | 30137/30138   |
| Volume Flow 8            | AI 70 | 30139/30140   |
| Volume Flow 9            | AI 71 | 30141/30142   |
| Volume 1                 | AI 72 | 30143/30144   |
| Volume 2                 | AI 73 | 30145/30146   |
| Volume 3                 | AI 74 | 30147/30148   |
| Volume 4                 | AI 75 | 30149/30150   |
| Volume 5                 | AI 76 | 30151/30152   |
| Volume 6                 | AI 77 | 30153/30154   |
| Volume 7                 | AI 78 | 30155/30156   |
| Volume 8                 | AI 79 | 30157/30158   |
| Volume 9                 | AI 80 | 30159/30160   |
| <b>T D 1 1 1</b>         | 41.04 | 204 04/204 02 |

| Time Point 2         | AI 82 | 30163/30164 |
|----------------------|-------|-------------|
| Time Point 3         | AI 83 | 30165/30166 |
| Time Point 4         | AI 84 | 30167/30168 |
| Time Point 5         | AI 85 | 30169/30170 |
| Time Point 6         | AI 86 | 30171/30172 |
| Fabrication Number 1 | AI 87 | 30173/30174 |
| Fabrication Number 2 | AI 88 | 30175/30176 |
| Fabrication Number 3 | AI 89 | 30177/30178 |

### Appendix B.25. Sensostar 2C Mappings to BACnet and Modbus

| Point Name      | BACnet | Modbus      |
|-----------------|--------|-------------|
| Energy_T_WH_1   | AI 1   | 30001/30002 |
| Energy_T_J_1    | AI 2   | 30003/30004 |
| Temp_Ext_1      | AI 3   | 30005/30006 |
| Temp_Flow_1     | AI 4   | 30007/30008 |
| Temp_Ret_1      | AI 5   | 30009/30010 |
| Temp_Dif_1      | AI 6   | 30011/30012 |
| Vol_Flo_L_H_1   | AI 7   | 30013/30014 |
| Vol_Flo_ML_S_10 | AI 8   | 30015/30016 |
| ID_1            | AI 9   | 30017/30018 |
| Volume_1        | AI 10  | 30019/30020 |

### Appendix B.26. Axis SKU-03 Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Energy_T_WH_1 | AI 1   | 30001/30002 |
| Temp_Flow_1   | AI 2   | 30003/30004 |
| Temp_Ret_1    | AI 3   | 30005/30006 |
| Temp_Dif_1    | AI 4   | 30007/30008 |
| Time_Sec_1    | AI 5   | 30009/30010 |
| Time_Op_Sec_1 | AI 6   | 30011/30012 |
| Power_W_1     | AI 7   | 30013/30014 |
| Vol_Flo_L_M_1 | AI 8   | 30015/30016 |
| ID_1          | AI 9   | 30017/30018 |
| Volume_1      | AI 10  | 30019/30020 |
| Error_Flags_1 | AI 11  | 30021/30022 |
| M_Bus_State_1 | AI 12  | 30023/30024 |

### Appendix B.27. ECS Elec Mtr Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Energy_T_WH_1 | AI 1   | 30001/30002 |
| Energy_T_WH_2 | AI 2   | 30003/30004 |
| Energy_T_WH_3 | AI 3   | 30005/30006 |
| Energy_T_WH_4 | AI 4   | 30007/30008 |
| Energy_T_WH_5 | AI 5   | 30009/30010 |
| Energy_T_WH_6 | AI 6   | 30011/30012 |
| Voltage_1     | AI 7   | 30013/30014 |
| Voltage_2     | AI 8   | 30015/30016 |
| Voltage_3     | AI 9   | 30017/30018 |
| Current_1     | AI 10  | 30019/30020 |
| Current_2     | AI 11  | 30021/30022 |
| Current_3     | AI 12  | 30023/30024 |
| Current_4     | AI 13  | 30025/30026 |
| Power_W_1     | AI 14  | 30027/30028 |
| Power W 2     | AI 15  | 30029/30030 |



| Power_W_3     | AI 16 | 30031/30032 |
|---------------|-------|-------------|
| Power_W_4     | AI 17 | 30033/30034 |
| Power_W_5     | AI 18 | 30035/30036 |
| Power_W_6     | AI 19 | 30037/30038 |
| Power_W_7     | AI 20 | 30039/30040 |
| Power_W_8     | AI 21 | 30041/30042 |
| ID_1          | AI 22 | 30043/30044 |
| Error_Flags_1 | AI 23 | 30045/30046 |
| Unknown_2     | AI 24 | 30047/30048 |
| Unknown_3     | AI 25 | 30049/30050 |
| Unknown_4     | AI 26 | 30051/30052 |
| Unknown_5     | AI 27 | 30053/30054 |
| Unknown_6     | AI 28 | 30055/30056 |

Appendix B.28. Diehl Hydrus Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Temp_Flow_1   | AI 1   | 30001/30002 |
| Vol_Flo_L_H_1 | AI 2   | 30003/30004 |
| Volume_1      | AI 3   | 30005/30006 |
| Volume_2      | AI 4   | 30007/30008 |
| Volume_3      | AI 5   | 30009/30010 |
| Time_Pt_1     | AI 6   | 30011/30012 |

Appendix B.29. Diehl Sharky 775 Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Energy_T_WH_1 | AI 1   | 30001/30002 |
| Energy_T_WH_2 | AI 2   | 30003/30004 |
| Energy_T_WH_3 | AI 3   | 30005/30006 |
| Energy_T_WH_4 | AI 4   | 30007/30008 |
| Energy_T_WH_5 | AI 5   | 30009/30010 |
| Energy_T_WH_6 | AI 6   | 30011/30012 |
| Energy_T_WH_7 | AI 7   | 30013/30014 |
| Energy_T_WH_8 | AI 8   | 30015/30016 |
| Temp_Flow_1   | AI 9   | 30017/30018 |
| Temp_Ret_1    | AI 10  | 30019/30020 |
| Temp_Dif_1    | AI 11  | 30021/30022 |
| Time_Days_1   | AI 12  | 30023/30024 |
| Power_W_1     | AI 13  | 30025/30026 |
| Vol_Flo_L_H_1 | AI 14  | 30027/30028 |
| Volume_1      | AI 15  | 30029/30030 |
| Volume_2      | AI 16  | 30031/30032 |
| Volume_3      | AI 17  | 30033/30034 |
| Volume_4      | AI 18  | 30035/30036 |
| Time_Pt_1     | AI 19  | 30037/30038 |
| Time_Pt_2     | AI 20  | 30039/30040 |
| Time_Pt_3     | AI 21  | 30041/30042 |
| Time_Pt_4     | AI 22  | 30043/30044 |
| Time Pt 5     | AI 23  | 30045/30046 |

Appendix B.30. Metz T M4 Mappings to BACnet and Modbus

| Point Name    | BACnet | Modbus      |
|---------------|--------|-------------|
| Energy_T_WH_1 | AI 1   | 30001/30002 |
| Energy_T_WH_2 | AI 2   | 30003/30004 |
| Temp_Ext_1    | AI 3   | 30005/30006 |

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| Time_Min_1    | AI 4  | 30007/30008 |
|---------------|-------|-------------|
| Custom_1      | AI 5  | 30009/30010 |
| Power_W_1     | AI 6  | 30011/30012 |
| Pressure_1    | AI 7  | 30013/30014 |
| Mass_1        | AI 8  | 30015/30016 |
| Vol_Flo_L_M_1 | AI 9  | 30017/30018 |
| Volume_1      | AI 10 | 30019/30020 |
| Unknown_1     | AI 11 | 30021/30022 |
| Unknown_2     | AI 12 | 30023/30024 |
| Unknown_3     | AI 13 | 30025/30026 |
| Unknown_4     | AI 14 | 30027/30028 |
| Time_Pt_1     | AI 15 | 30029/30030 |

### Appendix B.31. Hydrometer Mappings to BACnet and Modbus

| Point Name     | BACnet | Modbus      |  |  |
|----------------|--------|-------------|--|--|
| Energy_T_WH_1  | AI 1   | 30001/30002 |  |  |
| Energy_T_WH_2  | AI 2   | 30003/30004 |  |  |
| Energy_T_WH_3  | AI 3   | 30005/30006 |  |  |
| Energy_T_WH_4  | AI 4   | 30007/30008 |  |  |
| Energy_T_WH_5  | AI 5   | 30009/30010 |  |  |
| Energy_T_WH_6  | AI 6   | 30011/30012 |  |  |
| Energy_T_WH_7  | AI 7   | 30013/30014 |  |  |
| Energy_T_WH_8  | AI 8   | 30015/30016 |  |  |
| Energy_T_WH_9  | AI 9   | 30017/30018 |  |  |
| Energy_T_WH_10 | AI 10  | 30019/30020 |  |  |
| Temp_Flow_1    | AI 11  | 30021/30022 |  |  |
| Temp_Flow_2    | AI 12  | 30023/30024 |  |  |
| Temp_Flow_3    | AI 13  | 30025/30026 |  |  |
| Temp_Ret_1     | AI 14  | 30027/30028 |  |  |
| Temp Ret 2     | AI 15  | 30029/30030 |  |  |
| Temp Ret 3     | AI 16  | 30031/30032 |  |  |
| Temp Dif 1     | AI 17  | 30033/30034 |  |  |
| Temp Dif 2     | AI 18  | 30035/30036 |  |  |
| Temp Dif 3     | AI 19  | 30037/30038 |  |  |
| Time Op Hrs 1  | AI 20  | 30039/30040 |  |  |
| Time Op Hrs 2  | AI 21  | 30041/30042 |  |  |
| Time Op Hrs 3  | AI 22  | 30043/30044 |  |  |
| Power W 1      | AI 23  | 30045/30046 |  |  |
| Power W 2      | AI 24  | 30047/30048 |  |  |
| Power W 3      | AI 25  | 30049/30050 |  |  |
| Vol Flo L H 1  | AI 26  | 30051/30052 |  |  |
| Vol Flo L H 2  | AI 27  | 30053/30054 |  |  |
| Vol Flo L H 3  | AI 28  | 30055/30056 |  |  |
| Volume 1       | AI 29  | 30057/30058 |  |  |
| Volume 2       | AI 30  | 30059/30060 |  |  |
| Volume 3       | AI 31  | 30061/30062 |  |  |
| Volume 4       | AI 32  | 30063/30064 |  |  |
| Volume 5       | AI 33  | 30065/30066 |  |  |
| Volume 6       | AI 34  | 30067/30068 |  |  |
| Volume 7       | AI 35  | 30069/30070 |  |  |
| Volume 8       | AI 36  | 30071/30072 |  |  |
| Volume 9       | AI 37  | 30073/30074 |  |  |
| Volume 10      | AI 38  | 30075/30076 |  |  |
| Time Pt 1      | AI 39  | 30077/30078 |  |  |
| Time Pt 2      | AI 40  | 30079/30080 |  |  |
| Time Pt 3      | AI 41  | 30081/30082 |  |  |
| Time Pt 4      | AI 42  | 30083/30084 |  |  |
| Time Pt 5      | AI 43  | 30085/30086 |  |  |
| Time Pt 6      | AI 44  | 30087/30088 |  |  |
| Time Pt 7      | AI 45  | 30089/30090 |  |  |
| Time Pt 8      | AI 46  | 30091/30092 |  |  |
| Time Pt 9      | AI 47  | 30093/30094 |  |  |
| Time Pt 10     | AI 48  | 30095/30096 |  |  |
| Status Byte    | AI 49  | 30097       |  |  |



## Appendix B.32. Kamstrup 402 Mappings to BACnet and Modbus

| Point Name     | BACnet | Modbus      |  |
|----------------|--------|-------------|--|
| Energy_T_WH_1  | AI 1   | 30001/30002 |  |
| Energy_T_WH_2  | AI 2   | 30003/30004 |  |
| Energy_T_WH_3  | AI 3   | 30005/30006 |  |
| Energy_T_WH_4  | AI 4   | 30007/30008 |  |
| Energy_T_WH_5  | AI 5   | 30009/30010 |  |
| Energy_T_WH_6  | AI 6   | 30011/30012 |  |
| Energy_T_WH_7  | AI 7   | 30013/30014 |  |
| Energy_T_WH_8  | AI 8   | 30015/30016 |  |
| Energy_T_WH_9  | AI 9   | 30017/30018 |  |
| Energy_T_WH_10 | AI 10  | 30019/30020 |  |
| Temp_Flow_1    | AI 11  | 30021/30022 |  |
| Temp_Flow_2    | AI 12  | 30023/30024 |  |
| Temp_Flow_3    | AI 13  | 30025/30026 |  |
| Temp_Ret_1     | AI 14  | 30027/30028 |  |
| Temp_Ret_2     | AI 15  | 30029/30030 |  |
| Temp_Ret_3     | AI 16  | 30031/30032 |  |
| Temp Dif 1     | AI 17  | 30033/30034 |  |
| Temp Dif 2     | AI 18  | 30035/30036 |  |
| Temp Dif 3     | AI 19  | 30037/30038 |  |
| Time Op Hrs 1  | AI 20  | 30039/30040 |  |
| Time Op Hrs 2  | AI 21  | 30041/30042 |  |
| Time Op Hrs 3  | AI 22  | 30043/30044 |  |
| Power W 1      | AI 23  | 30045/30046 |  |
| Power W 2      | AI 24  | 30047/30048 |  |
| Power W 3      | AI 25  | 30049/30050 |  |
| Vol Flo L H 1  | AI 26  | 30051/30052 |  |
| Vol_Flo_L_H_2  | AI 27  | 30053/30054 |  |
| Vol_Flo_L_H_3  | AI 28  | 30055/30056 |  |
| Volume_1       | AI 29  | 30057/30058 |  |
| Volume_2       | AI 30  | 30059/30060 |  |
| Volume_3       | AI 31  | 30061/30062 |  |
| Volume_4       | AI 32  | 30063/30064 |  |
| Volume 5       | AI 33  | 30065/30066 |  |
| Volume_6       | AI 34  | 30067/30068 |  |
| Volume_7       | AI 35  | 30069/30070 |  |
| Volume_8       | AI 36  | 30071/30072 |  |
| Volume_9       | AI 37  | 30073/30074 |  |
| Volume_10      | AI 38  | 30075/30076 |  |
| Time_Pt_1      | AI 39  | 30077/30078 |  |
| Time_Pt_2      | AI 40  | 30079/30080 |  |
| Time_Pt_3      | AI 41  | 30081/30082 |  |
| Time Pt 4      | AI 42  | 30083/30084 |  |
| Time_Pt_5      | AI 43  | 30085/30086 |  |
| Time_Pt_6      | AI 44  | 30087/30088 |  |
| Time_Pt_7      | AI 45  | 30089/30090 |  |
| Time_Pt_8      | AI 46  | 30091/30092 |  |
| Time_Pt_9      | AI 47  | 30093/30094 |  |
| Time_Pt_10     | AI 48  | 30095/30096 |  |
| Status_Byte    | AI 49  | 30097       |  |



#### APPENDIX C TROUBLESHOOTING TIPS

Appendix C.1. Communicating with the QuickServer Over the Network

- Confirm that the network cabling is correct.
- Confirm that the computer network card is operational and correctly configured.
- Confirm that there is an Ethernet adapter installed in the PC's Device Manager List, and that it is configured to run the TCP/IP protocol.
- Check that the IP netmask of the PC matches the QuickServer. The Default IP Address of the QuickServer is 192.168.2.X, Subnet Mask is 255.255.255.0.
  - Go to Start|Run
  - Type in "ipconfig"
  - The account settings should be displayed.
  - Ensure that the IP Address is 102.168.2.X and the netmask 255.255.255.0
- Ensure that the PC and QuickServer are on the same IP Network, or assign a Static IP Address to the PC on the 192.168.2.0 network.



#### Appendix C.2. Take a FieldServer Diagnostic Capture

When there is a problem on-site that cannot easily be resolved, perform a Diagnostic Capture before contacting support. Once the Diagnostic Capture is complete, email it to technical support. The Diagnostic Capture will accelerate diagnosis of the problem.

If the FieldServer bios is updated/released on November 2017 or later then the Diagnostic Capture is performed via the gateway's on-board system.

- Access the FieldServer Diagnostics page via one of the following methods:
  - Open the FieldServer FS-GUI page and click on Diagnostics in the Navigation panel
  - Open the FieldServer Toolbox software and click the diagnose icon of the desired device

| Navigation   | Diagnostics                         |
|--|-------------------------------------|
| <ul> <li>FieldServer Demo</li> <li>About</li> <li>Setup</li> </ul> | Captures                            |
| View User Messages Diagnostics                                     | Full Diagnostic                     |
| Diagnostics  | Set capture period (max 1200 secs): |
|  | 300                                 |
|  | Start                               |
|  | Serial Capture                      |
|  | Set capture period (max 1200 secs): |
|  | 300                                 |
|  | Start                               |
|  |                                     |
| Home HELP (F1) Contact Us  |                                     |

- Go to Full Diagnostic and select the capture period.
- Click the Start button under the Full Diagnostic heading to start the capture.
  - When the capture period is finished, a Download button will appear next to the Start button

| Full Diagnostic                     |
|-------------------------------------|
| Set capture period (max 1200 secs): |
| 300                                 |
| 100% Complete                       |
| Start Download                      |

- Click Download for the capture to be downloaded to the local PC.
- Send the diagnostic zip file to technical support.
- NOTE: Diagnostic captures of BACnet MS/TP communication are output in a ".PCAP" file extension which is compatible with Wireshark.



#### Appendix C.2.1. Taking a Capture with Older Firmware

If the FieldServer firmware is from before November 2017, the Diagnostic Capture can be done by downloading the FieldServer Toolbox software but network connections (such as Ethernet and Wi-Fi) cannot be captured (if a network diagnostic is needed take a Wire Shark capture).

Once the Diagnostic Capture is complete, email it to technical support. The Diagnostic Capture will accelerate diagnosis of the problem.

- NOTE: While all necessary documentation is shipped with the FieldServer on the USB flash drive, these documents are constantly being updated. Newer versions may be available on the <u>Sierra Monitor website</u>.
  - Ensure that FieldServer Toolbox is loaded onto the local PC. Otherwise, download the FieldServer-Toolbox.zip via the Sierra Monitor website's <u>Software Downloads</u>.
  - Extract the executable file and complete the installation.



- Connect a standard Cat-5 Ethernet cable between the PC and QuickServer.
- Double click on the FS Toolbox Utility.
- Step 1: Take a Log
  - Click on the diagnose icon f

of the desired device

| smc FieldServer Too | lbox   |             |                   |    |                        |              |   |     | ×              |
|---------------------|--------|-------------|-------------------|----|------------------------|--------------|---|-----|----------------|
| FieldSer            | ver To | oolbox      |                   |    |                        | S            | n | Sie | erra<br>onitor |
| DEVICES             | Ð      | IP ADDRESS  | MAC ADDRESS       |    | <sup>:</sup> AVORITE C | CONNECTIVITY |   |     |                |
| E8951 Gateway       |        | 10.40.50.90 | 00:50:4E:60:06:36 | C2 | *                      | •            |   | Con | nect -M-       |
|                     |        |             |                   |    |                        |              |   |     | 1.1            |



• Select "Full Diagnostic" from the drop down menu



NOTE: If desired, the default capture period can be changed.

• Click on the Start Diagnostic button



- Wait for the capture period to finish and the Diagnostic Test Complete window will appear
- Step 2: Send Log
  - o Once the diagnostic test is complete, a .zip file is saved on the PC

| Diagnos |                      |                 |  |
|---------|----------------------|-----------------|--|
| Diagnos | tic_2015-02-18_12-28 | zip             |  |
| Do you  | vant to open the col | taining folder: |  |

- o Click "Open" to launch explorer and have it point directly at the correct folder
- o Email the diagnostic zip file to <a href="mailto:smc-support@msasafety.com">smc-support@msasafety.com</a>

| Diagnostic_2014-07-17_20-15.zip | 2014/07/17 20:16 | zip Archive | 676 KB |
|---------------------------------|------------------|-------------|--------|
|---------------------------------|------------------|-------------|--------|



#### Appendix C.3. Internet Browser Software Support

The following web browsers are supported:

- Chrome Rev. 57 and higher
- Firefox Rev. 35 and higher
- Microsoft Edge Rev. 41 and higher
- Safari Rev. 3 and higher
- NOTE: Internet Explorer is no longer supported as recommended by Microsoft.
- NOTE: Computer and network firewalls must be opened for Port 80 to allow FieldServer GUI to function.

Appendix C.4. Change Web Server Security Settings After Initial Setup

#### NOTE: Any changes will require a FieldServer reboot to take effect.

• From the FS-GUI landing page, click Setup in the Navigation panel.

| SMC  |                                 |                                     |        |
|--|---------------------------------|-------------------------------------|--------|
| Navigation                                       | Test Bridge 1                   |                                     |        |
| <ul> <li>Test Bridge 1</li> <li>About</li> </ul> | Status Settings                 | Info Stats                          |        |
| > Setup  | Status                          |                                     | 0      |
| > View   | Name                            | Value                               |        |
| User Messages                                    | Driver Configuration            | DCC000                              | *      |
| Diagnostics                                      | DCC Version                     | V6.05p (A)                          |        |
|  | Kernel Version                  | V6.51c (B)                          |        |
|  | Release Status                  | Normal                              |        |
|  | Build_Revision                  | 4.43.6-45-gcd82a452bb               |        |
|  | Build_Date                      | 2019-11-28 14:05:21 +0200           |        |
|  | Platform_Name                   | ProtoAir_2RS485_ARMv7               |        |
|  | BIOS_Version                    | 4.1.2                               |        |
|  | FieldServer_Model               | FS-QS-2010-F                        |        |
|  | Serial_Number                   | 1902300071VZL                       |        |
|  | Carrier Type                    | -                                   |        |
|  | Data_Points_Used                | 0                                   |        |
|  | Data_Points_Max                 | 250                                 |        |
|  | Application Memory:             |                                     |        |
|  | Protocol_Engine_Memory_Used     | 0.31%                               |        |
|  | Memory_Used                     | 440 kB                              |        |
|  | Memory_Available                | 141,433 kB                          |        |
|  | Memory_Free_Bytes               | 141,433 kB                          |        |
|  | Memory_Min_Free_Bytes           | 140,526 kB                          |        |
| Home HELP (F1) Contact                           | Us System Restart System Reboot | System Time Synch Reset Cycle Times | Logout |
|  | Figure 34: FS-G                 | UI Landing Screen                   |        |



#### Appendix C.4.1. Change Security Mode

• Click Security in the Navigation panel.

| Navigation   | Security  |
|--|---|
| <ul> <li>Test Bridge 1</li> <li>About</li> <li>Setup</li> <li>File Transfer</li> <li>Network Settings</li> <li>User Management</li> <li>Security</li> <li>Time Settings</li> <li>View</li> <li>User Messages</li> <li>Diagnostics</li> </ul> | Web Server  Mode  HTTPS with default trusted TLS certificate (requires internet connection to be trusted) HTTPS with own trusted TLS certificate HTTP (not secure, vulnerable to man-in-the-middle attacks) |
|  | Figure 35: FS-GUI Security Setup  |

- Click the Mode desired.
  - o If HTTPS with own trusted TLS certificate is selected, follow instructions in Section 7.2.1
- Click the Save button.



Appendix C.4.2. Edit the Certificate Loaded onto the FieldServer

### NOTE: A loaded certificate will only be available if the security mode was previously setup as HTTPS with own trusted TLS certificate.

• Click Security in the Navigation panel.

| Navigation   | Security  |
|--|---|
| <ul> <li>Test Bridge 1</li> <li>About</li> <li>Setup</li> <li>File Transfer</li> <li>Network Settings</li> <li>User Management</li> <li>Security</li> <li>Time Settings</li> <li>View</li> <li>User Messages</li> <li>Diagnostics</li> </ul> | Web Server  Mode  HTTPS with default trusted TLS certificate (requires internet connection to be trusted) HTTPS with own trusted TLS certificate HTTP (not secure, vulnerable to man-in-the-middle attacks) |
|  | Figure 36: FS-GUI Security Setup – Certificate Loaded   |

- Click the Edit Certificate button to open the certificate and key fields.
- Edit the loaded certificate or key text as needed.
- Click Save.



#### Appendix C.5. Change User Management Settings

- From the FS-GUI page, click Setup in the Navigation panel.
- Click User Management in the navigation panel.
- NOTE: If the passwords are lost, the unit can be reset to factory settings to reinstate the default unique password on the label. For QuickServer FS-QS-1xxx, ProtoNode, ProtoCessor or ProtoCarrier recovery instructions, see the <u>FieldServer Recovery Instructions document</u>. For QuickServer 2xx0, ProtoNode FPC-N54 or ProtoAir recovery instructions, see the <u>FieldServer Next Gen Recovery document</u>. If the default unique password is lost, then the unit must be mailed back to the factory.

NOTE: Any changes will require a FieldServer reboot to take effect.

Appendix C.5.1. User Management

• Check that the Users tab is selected.

| SMC   |                              |                      |             |
|---|------------------------------|----------------------|-------------|
| Navigation  | User Management              |                      | ·           |
| <ul> <li>Test Bridge 1</li> <li>About</li> <li>Setup</li> </ul>   | Users Passwor                | d                    |             |
| <ul> <li>File Transfer</li> <li>Network Settings</li> <li>User Management</li> <li>Security</li> <li>Time Settings</li> <li>View</li> <li>User Messages</li> <li>Diagnostics</li> </ul> | Username<br>4<br>Create User | Croups               | ✓ Actions ✓ |
| Home HELP (F1) Contact Us   |                              |                      | Logout      |
|   | Figure 37: FS                | -GUI User Management |             |

User Types:

Admin – Can modify any settings on the FieldServer.

**Operator** – Can modify and view any data in the FieldServer array(s).

Viewer - Can only view settings/readings on the FieldServer.



#### Appendix C.5.1.1. Create Users

• Click the Create User button.

| Create User                                     | × |
|---|---|
| Username:                                       |   |
| Enter a unique username                         |   |
| Security Groups:<br>Admin<br>Operator<br>Viewer |   |
| Password: 0 Weat                                | ĸ |
| Enter password                                  |   |
| Show passwords                                  |   |
| Confirm Password:                               |   |
| Confirm password                                |   |
| Use Auto Generated Password                     |   |
| Create  |   |
| Figure 38: Create User Window                   |   |

- Enter the new User fields: Name, Security Group and Password.
  - User details are hashed and salted
- NOTE: The password must meet the minimum complexity requirements. An algorithm automatically checks the password entered and notes the level of strength on the top right of the Password text field.
  - Click the Create button.
  - Once the Success message appears, click OK.



#### Appendix C.5.1.2. Edit Users

• Click the pencil icon next to the desired user to open the User Edit window.

| Users Password |                         |   |                      |   |
|----------------|-------------------------|---|----------------------|---|
| Username       | ✓ Groups                | ~ | Actions $\checkmark$ |   |
| User A         | Viewer                  |   | ø 🛍                  |   |
| User B         | Admin, Operator, Viewer |   | e 🗇                  |   |
|                |                         |   |                      | • |
| 4              |                         |   | )                    |   |
|                |                         |   |                      |   |

• Once the User Edit window opens, change the User Security Group and Password as needed.

| Edit User                   |          |
|-----------------------------|----------|
| Username:                   |          |
| User A                      |          |
| Security Groups:            |          |
| Admin                       |          |
| Operator                    |          |
| ✓ Viewer                    |          |
| Password:                   |          |
| Optional                    |          |
| Show passwords              |          |
| Confirm Password:           |          |
| Optional                    |          |
|                             |          |
| Use Auto Generated Password |          |
| Confin                      | m Cancel |
| Figure 40: Edit User Windo  | w        |

- Click Confirm.
- Once the Success message appears, click OK.



#### Appendix C.5.1.3. Delete Users

• Click the trash can icon next to the desired user to delete the entry.

| Username | ✓ Groups   |                | ~ A | Action | s ~ |   |
|----------|------------|----------------|-----|--------|-----|---|
| User A   | Viewer     |                |     | ø t    | Ì   | * |
| User B   | Admin, Ope | erator, Viewer |     | ø t    | Ì   |   |
|          |            |                |     |        |     | Ŧ |
| 4        |            |                |     |        | ►   |   |
|          |            |                |     |        |     |   |

• When the warning message appears, click Confirm.

|   | × |
|---|---|
|   |   |
|   |   |
| _   |   |
| Warning                                       |   |
|   |   |
| Are you sure you want to delete user: User A? |   |
| Confirm Cancel                                |   |
| Figure 42: User Delete Warning                |   |





#### Appendix C.5.2. Change FieldServer Password

• Click the Password tab.

| SMC  |                                   |                   |        |
|--|-----------------------------------|-------------------|--------|
| Navigation   | User Management                   |                   | A      |
| <ul> <li>Test Bridge 1</li> <li>About</li> <li>Setup</li> <li>Elle Transfer</li> </ul> | Users Password                    |                   |        |
| Network Settings   | Password:                         | <b>0</b> Weak     |        |
| User Management  | Enter password                    |                   |        |
| <ul> <li>Security</li> <li>Time Settings</li> </ul>                                    | Show passwords                    |                   |        |
| > View   | Confirm Password:                 |                   |        |
| User Messages     Diagnostics  | Confirm password                  |                   |        |
| - Signosico  | Use Auto Generated Password       |                   |        |
|  |                                   | Confirm           |        |
|  |                                   |                   | •      |
| Home HELP (F1) Contact Us  |                                   |                   | Logout |
|  | Figure 43: FieldServer Password U | Ipdate via FS-GUI |        |

- Change the login password for the FieldServer as needed.
- NOTE: The password must meet the minimum complexity requirements. An algorithm automatically checks the password entered and notes the level of strength on the top right of the Password text field.
- NOTE: If a gateway in the field is updated to a secure gateway, the password will change to "admin". This change will still occur if the gateway was already setup with a unique password that was loaded in the factory and printed on the label.



#### APPENDIX D REFERENCE

#### Appendix D.1. LED Functions



| Light      | Description  |
|------------|--|
|            | SPL LED will be on when a configured node in the QuickServer is detected as being offline. See         |
| SPL        | Node overview screen of the FS-GUI for further details.  |
|            | For LonWorks units, LED will light until the unit is commissioned on the LonWorks network.             |
|            | RUN LED will flash 20 seconds after power up, signifying normal operation. The QuickServer will be     |
| RUN        | able to access FS-GUI (refer to Section 6.3 for more information) once this LED starts flashing.       |
|            | During the first 20 seconds, the LED should be off.  |
|            | The ERR LED will go on solid 15 seconds after power up. It will turn off after 5 seconds. A steady red |
| EDD        | light will indicate there is a system error on the FieldServer. If this occurs, immediately report the |
| LNN        | related "system error" shown in the error screen of the FS-GUI interface to the FieldServer for        |
|            | evaluation.  |
| DY         | On normal operation of FS-QS-1XXX, the RX LED will flash when a message is received on the field       |
| n <b>n</b> | port of the QuickServer.   |
| ту         | On normal operation of FS-QS-1XXX, the TX LED will flash when a message is sent on the field port      |
| 1          | of the QuickServer.  |
| PWR        | This is the power light. It should always show a steady green light when powered.                      |



#### Appendix D.2. QuickServer FS-QS-101X DCC

| Driver                                 | Code |
|--|------|
| BACnet/IP – BACnet MS/TP               | 0285 |
| BACnet/IP – LonWorks                   | 0131 |
| JCI Metasys N2 <sup>3</sup> – LonWorks | 0097 |
| JCI Metasys N2– BACnet MS/TP           | 0309 |
| JCI Metasys N2– BACnet/IP              | 0122 |
| Modbus RTU – BACnet MS/TP              | 0367 |
| Modbus RTU – BACnet/IP                 | 0104 |
| Modbus RTU – JCI Metasys N2            | 0038 |
| Modbus RTU – LonWorks                  | 0085 |
| Modbus TCP/IP – BACnet/IP              | 0237 |
| Modbus TCP/IP – LonWorks               | 0154 |
| Modbus TCP/IP – BACnet MS/TP           | 0419 |
| Modbus TCP/IP – JCI Metasys N2         | 0117 |
| SNMP – BACnet/IP                       | 1047 |
| SNMP – LonWorks                        | 1178 |
| SNMP – JCI Metasys N2                  | 1154 |
| SNMP – BACnet MS/TP                    | 1200 |
| BACnet MS/TP - LonWorks                | 0345 |

#### Appendix D.3. QuickServer 1XXX Part Numbers

| Field Connections                                   |            |                       |                     |  |                  |        |                    |                          |           |
|---|------------|-----------------------|---------------------|--|------------------|--------|--------------------|--------------------------|-----------|
|   |            | Interface Connections |                     |  |                  |        |                    |                          |           |
|   |            | RS-232 <sup>1</sup>   | RS-485 <sup>2</sup> | RS-422 <sup>3</sup>                                | KNX <sup>6</sup> | RS-485 | M-Bus              | Ethernet <sup>4</sup>    | LonWorks⁵ |
|   | FS-QS-1011 |                       | 1                   |  |                  |        |                    | 1                        | 1         |
|   | FS-QS-1211 |                       | 1                   |  |                  |        |                    | 1                        | 1         |
|   | FS-QS-1221 | 1                     |                     |  |                  |        |                    | 1                        | 1         |
|   | FS-QS-1230 |                       | 1                   | 1  |                  |        |                    | 1                        |           |
| /ei   | FS-QS-1231 |                       |                     | 1  |                  |        |                    | 1                        | 1         |
| er  | FS-QS-1240 |                       | 1                   |  | 1                |        |                    | 1                        |           |
| Ŝ   | FS-QS-1241 |                       |                     |  | 1                |        |                    | 1                        | 1         |
| icl   | FS-QS-1A50 |                       |                     |  |                  | 1      | 1                  | 1                        |           |
| ŋu  | FS-QS-1A51 |                       |                     |  |                  |        | 1                  | 1                        | 1         |
| 0   | FS-QS-1B50 |                       |                     |  |                  | 1      | 1                  | 1                        |           |
|   | FS-QS-1B51 |                       |                     |  |                  |        | 1                  | 1                        | 1         |
|   | FS-QS-1C50 |                       |                     |  |                  | 1      | 1                  | 1                        |           |
|   | FS-QS-1C51 |                       |                     |  |                  |        | 1                  | 1                        | 1         |
| <sup>1</sup> TX/Rx/GND <sup>2</sup> +/-/Frame Groun |            | Frame Ground          | <sup>3</sup> See M  | <sup>3</sup> See Manual <sup>4</sup> 10/100 Base T |                  |        | <sup>5</sup> FTT10 | <sup>6</sup> KNX/EIB TP1 |           |

<sup>&</sup>lt;sup>3</sup> Metasys is a registered trademark of Johnson Controls Inc.



#### Appendix D.4. Compliance with UL Regulations

For UL compliance, the following instructions must be met when operating QuickServer.

- The units shall be powered by listed LPS or Class 2 power supply suited to the expected operating temperature range.
- The interconnecting power connector and power cable shall:
  - Comply with local electrical code
  - Be suited to the expected operating temperature range
  - Meet the current and voltage rating for QuickServer/Net
- Furthermore, the interconnecting power cable shall:
  - Be of length not exceeding 3.05m (118.3")
  - Be constructed of materials rated VW-1, FT-1 or better
- If the unit is to be installed in an operating environment with a temperature above 65 °C, it should be installed in a Restricted Access Area requiring a key or a special tool to gain access.
- This device must not be connected to a LAN segment with outdoor wiring.



#### Appendix D.5. Specifications<sup>4</sup>









|                                  | FS-QS-12X0-XXXX/ FS-QS-1X50-XXXX <sup>5</sup> | FS-QS-1011-XXXX/FS-QS-12X1-XXXX/<br>FS-QS-1X51-XXXX <sup>5</sup> |  |  |  |  |  |
|----------------------------------|---|--|--|--|--|--|--|
|                                  | 6-pin Phoenix connector: RS-485 or            | 6-pin Phoenix connector: RS-485 or RS-232                        |  |  |  |  |  |
|                                  | RS-232 or RS-422 +/- ground port,             | or RS-422 +/- ground port,                                       |  |  |  |  |  |
| Available Ports                  | power +/- frame ground port                   | power +/- frame ground port                                      |  |  |  |  |  |
| Available Ports                  | 3-pin RS-485 Phoenix connector:               | 2-pin FTT-10 LonWorks port                                       |  |  |  |  |  |
|                                  | RS-485 +/- ground port                        | Ethernet-10/100 port   |  |  |  |  |  |
|                                  | Ethernet-10/100 port                          |  |  |  |  |  |  |
|                                  | Input Voltage: 9-30VDC or 12-24VAC            | Input Voltage: 9-30VDC or 12-24VAC                               |  |  |  |  |  |
| Power Pequirements               | Input Power Frequency: 50/60 Hz.              | Input Power Frequency: 50/60 Hz.                                 |  |  |  |  |  |
| Power Requirements               | Power Rating: 2.5 Watts                       | Power Rating: 2.5 Watts  |  |  |  |  |  |
|                                  | Current Draw: @ 12V, 150 mA                   | Current Draw: @ 12V, 279 mA                                      |  |  |  |  |  |
|                                  | UL 916 approved                               | UL 916 approved, RoHS compliant, FCC part                        |  |  |  |  |  |
|                                  | RoHS3 compliant                               | 15 compliant, DNP compliant, LonMark                             |  |  |  |  |  |
|                                  | FCC part 15 compliant                         | certification, WEEE compliant                                    |  |  |  |  |  |
| Approvals                        | DNP compliant                                 | SPID: 80:00:95:46:00:84:04:01                                    |  |  |  |  |  |
|                                  | CE certified                                  | Profiles: 0000 - Node object (1)                                 |  |  |  |  |  |
|                                  | BTL certified                                 | 0001 - Open Loop Sensor Object (5)                               |  |  |  |  |  |
|                                  | WEEE compliant                                | 0003 - Open Loop Actuator Object (5)                             |  |  |  |  |  |
| Physical Dimensions <sup>6</sup> | 5.05 x 2.91 x 1.6 in. (12.82 x 7.39 x 4.06 cm | n)   |  |  |  |  |  |
| Weight                           | 0.4 lbs (0.2 Kg)                              |  |  |  |  |  |  |
| Operating Temperature            | -40°C to 75°C (-40°F to167°F)                 |  |  |  |  |  |  |
| Surge Suppression                | EN61000-4-2 ESD EN61000-4-3 EMC EN6           | 31000-4-4 EFT  |  |  |  |  |  |
| Humidity                         | 5 - 90% RH (non-condensing)                   |  |  |  |  |  |  |
| Figure 45: Specifications        |   |  |  |  |  |  |  |

Figure 45: Specifications

"This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference
- This device must accept any interference received, including interference that may cause undesired operation.

**NOTE:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense. Modifications not expressly approved by FieldServer could void the user's authority to operate the equipment under FCC rules."

<sup>&</sup>lt;sup>4</sup> Specifications subject to change without notice.

<sup>&</sup>lt;sup>5</sup> XXXX at the end of the part number identifies the code for the specific drivers included in the QuickServer. (Appendix D.2)

<sup>&</sup>lt;sup>6</sup> (WxDxH); Excluding mounting tabs.

#### **APPENDIX E LIMITED 2 YEAR WARRANTY**

MSA Safety warrants its products to be free from defects in workmanship or material under normal use and service for two years after date of shipment. MSA Safety will repair or replace any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by MSA Safety personnel.

All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without MSA Safety's approval or which have been subjected to accident, improper maintenance, installation or application, or on which original identification marks have been removed or altered. This Limited Warranty also will not apply to interconnecting cables or wires, consumables or to any damage resulting from battery leakage.

In all cases MSA Safety's responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

Except for the express warranty stated above, MSA Safety disclaims all warranties with regard to the products sold hereunder including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of MSA Safety for damages including, but not limited to, consequential damages arising out of/or in connection with the use or performance of the product.