Meter System Upgrade Master Agreement

Town of Apex
and
Ferguson Waterworks & Sensus

Non-Confidential Attachments

Attachment D-1: Meter System Upgrade Initial System Acceptance Test

Test Procedure

Test	Activity	Overview	Procedure
1)	Test meter endpoints in the field.	Using a field handheld tool or device, verify communications with 5 polyphase electric, and 5 residential meters.	Connect to the meter with the field device. Verify a reading of kwh and demand can be retrieved. Verify diagnostic information from the MSU network can also be retrieved.
2)	Test module endpoints in the field.	Using a field handheld tool or device, verify communications with 5 commercial, and 5 residential water meters.	Connect to the module with the field device. Verify a reading of gallons can be retrieved. Verify diagnostic information from the MSU network can also be retrieved.
3)	Test load management endpoints in the field.	Using a field handheld tool or device, verify communications with 5 load management switches.	Connect to the switch with the field device. Verify a kW reading can be retrieved from each relay. Verify diagnostic information from the MSU network can also be retrieved.
4)	Test meter demand reset from MSU software.	Verify peak demand can be reset from the software system and the peak demand is read and stored.	Reset the current demand from the office. Confirm the current demand reading is set to zero and the current demand reading has been moved to the 'peak' or 'frozen' register in the meter.
5)	Test meters with electric endpoints capable of remote disconnect through the MSU software.	Using the MSU software, verify with 5 residential meters a disconnect and reconnect can be performed.	Send the meter the command to open the disconnect. Confirm and verify the disconnect action has completed through confirmation messages. Once verified, send a reconnect message. Confirm the meter has reconnected service.
6)	LM switches controlled through the MSU software or via the DRMS or MDMS.	Through the MSU software and network, verify with 5 load management devices the load was disconnected and then restored.	Send the load curtailment comment through the MSU system to the endpoint. If an MDMS or DRMS is in place the command should originate from one of these systems. Confirm and verify the load curtailment was successful through reading the load management device (2-way communications). Confirm the load has also been restored.
7)	Test meters with electric endpoints capable of remote disconnect through the field tool.	Using a field handheld tool or device, verify with 5 residential meters a disconnect can be performed.	Connect to the meter with the field device and/or optical port. Confirm a successful disconnect and reconnect can be performed onsite.
8)	LM switches controlled through the MSU field tool.	Using a field handheld tool or device, verify with 5 load management devices can be curtailed and restored in the field.	Connect to the device with the field device. Confirm a successful curtailment and restore can be performed onsite.

Test	Activity	Overview	Procedure
9)	Test meter/module configurability for polyphase electric meters.	Verify meter parameters (recording and reporting intervals) can be changed 'over-the-air' from the MSU software system. Must be able to configure and re-configure items such as; Sag/Swell alarms, TOU programs, or meter collecting/reporting intervals.	Using 5 – 10 installed Polyphase meters on the system. Alter the reporting and recording intervals and confirm the change. Setup status, events, and alarms. Confirm these status and event changes. All changes and updates must be done from the office through the software system.
10)	Test meter/module configurability for single phase electric meters.	Verify meter parameters (recording and reporting intervals) can be changed 'over-the-air' from the MSU software system. Must be able to configure and re-configure items such as: meter collecting/reporting intervals.	Using 5 – 10 installed residential meters on the system. Alter the reporting and recording intervals and confirm the change. Setup status, events, and alarms. Confirm these status and event changes. All changes and updates must be done from the office through the software system.
11)	Test meter/module configurability for water meters.	Verify module parameters (recording and reporting intervals) can be changed 'over-the-air' from the MSU software system. Must be able to configure and re-configure items such as: module collecting/reporting intervals.	Using 5 – 10 installed water or wastewater modules on the system. Alter the reporting and recording intervals and confirm the change. Setup status, events, and alarms. Confirm these status and event changes. All changes and updates must be done from the office through the software system.
12)	Test meter/module configurability for load management switches.	Verify load management device parameters (recording and reporting intervals) can be changed 'over-the-air' from the MSU software system. Must be able to configure and re-configure items such as: relay collecting/reporting intervals.	Using 5 – 10 installed load management devices on the system. Alter the reporting and recording intervals and confirm the change per relay. Setup status, events, and alarms. Confirm these status and event changes. All changes and updates must be done from the office through the software system.
13)	Test meter/module alarms and events for electric meters.	Verify any alarms and events can be sent to the MSU software system and then notifies users when a meter (up to 5 meters) has reported in an alarm/event.	Such as: Remove a meter from the socket and re-install upside down. This should prompt a reverse flow alarm. Confirm the meter continues to accumulate kwh into the meter's forward register. The meter should not be setup for net-metering or reverse flow otherwise the meter will not send in the alarm. Or other similar tests.
14)	Test meter/module alarms and events for water modules.	Verify any alarms and events can be sent to the MSU software system and then notifies users when a module (up to 5 locations) has reported in an alarm/event.	Such as: Remove a module connector from the meter. This should prompt an alarm. Confirm, once the module is reconnected, it sends an update alarm, the newest reading, and the missed past readings (backfilling). Or other similar tests.

Test	Activity	Overview	Procedure
15)	Test meter/module alarms and events for load management switches.	Verify any alarms and events can be sent to the MSU (and onto the MDMS or DRMS) software system and then notifies users when a module (up to 5 locations) has reported in an alarm/event.	Such as: Remove the load from the relay. This should prompt an alarm for no load present. Confirm, once the load is reconnected, it sends an update alarm to clear. Or other similar tests.
16)	Test Communications to Data Collectors from the office.	Verify all MSU network equipment is accessible through the MSU software system. Verify communications and all other available data is being received.	Using the MSU software head end, verify communications to the MSU network equipment (collection points and repeaters) are up. Verify network health, communication statistics, system specs, and all other available information is being collected.
17)	Confirm the MSU system is reading multiple channels from all electric meters.	Verify the MSU system is collecting multiple interval channels and are being collected for each type of electric meter in service.	Through a schedule reading and an ad-hoc read using the MSU software system, verify the system is collecting and displaying correct data from multiple channels. Using the MSU software, visually confirm the data and run a report containing the same information. Confirm the data is collected. Verify the data is correct by downloading the data physically at the meter.
18)	Verify the MSU system is setup to bring back the correct requested data fields for C&I meters.	Verify for 5 polyphase electric meters the correct register data is being recorded and reported.	Through a schedule reading and an ad-hoc read using the MSU software system, at the same time an employee performs a manual reading at the meter through the optical data port. Verify the readings match for multiple channels.
19)	Verify the MSU system is setup to bring back the correct requested data fields for residential electric meters.	Verify for 5 residential electric meters the correct register data is being recorded and reported.	Through a schedule reading and an ad-hoc read using the MSU software system, at the same time an employee performs a manual reading at the meter through the optical data port. Verify the readings match for multiple channels.
20)	Verify the MSU system is setup to bring back the correct requested data fields for water modules.	Verify for 5 water or wastewater modules the correct register data is being recorded and reported.	Through a schedule reading and an ad-hoc read using the MSU software system, at the same time an employee performs a manual reading at the meter physically at the meter dial. Verify the readings match.
21)	Verify the MSU system can perform ad-hoc or on-demand electric meter reads.	Perform an on-demand read using the MSU software.	Initiate an on-demand or ad-hoc reading from the MSU software system. Verify the MSU system collects the data and displays it for the user.
22)	Verify the MSU system can perform ad-hoc or on-demand water meter reads.	Perform an on-demand read using the MSU software.	Initiate an on-demand or ad-hoc reading from the MSU software system. Verify the MSU system collects the data and displays it for the user.
23)	Verify the MSU system can perform ad-hoc or on-demand load management reads.	Perform an on-demand read using the MSU software.	Initiate an on-demand or ad-hoc reading from the MSU software system. Verify the MSU system collects the data and displays it for the user.

Test	Activity	Overview	Procedure
24)	Verify the MSU system is providing a back fill of missing/missed readings.	Verify data gap filling is being performed by the MSU software/Collection points.	Disconnect a collection point for 12 - 24 hours (making sure all backup power is also removed). Energize the collection point and verify the missing data readings have been collected. Verify using MSU software reporting tools.
25)	The system is collecting 100% of electric and 98.5% of water of billing data in a three-day period on all installed and network joined meters.	Confirm the MSU system is collecting a usable daily register billing read for 100% of all available electric meters and 98.5% of water joined in the network over a 3-day period.	Generate an MSU software reading data collection statistics report and confirm through a billing file export that 100% of all electric meters and 98.5% of water meters have a billing register reading within the last 3 days.
26)	Read Data exports are successful to the CIS.	Verify all data collected and required to be exported from the MSU software to the existing CIS is correct and fully executing.	Confirm a flat file interface between the MSU software system and CIS is successful. Also confirm the Multispeak interface (as applicable) is exporting data from the MSU into the CIS. Test both interfaces.
27)	Read Data exports are successful to the MDMS (if applicable).	Verify all data collected and required to be exported from the MSU software to the existing MDMS is correct and fully executing.	Confirm the integration interface between the MSU software system and MDMS is successful. This test may involve multiple types of integration and data files.
28)	Read Data exports are successful to the DRMS (if applicable).	Verify all data collected and required to be exported from the MSU software to the existing DRMS is correct and fully executing.	Confirm the integration interface between the MSU software system and DRMS is successful. This test may involve multiple types of integration and data files.

Test	Activity	Overview	Procedure
29)	Confirm the MSU system network is capable of 'self-healing'.	Confirm all end points change and report all data when the primary path/Base Station is no longer working.	For this, multiple collection points in the same general area must be installed and communicating. Through the MSU software, confirm all the end points registered to "Base Station 1". Remove "Base Station 1" from power (and backup power) for 24 – 48 hours, note the time and date "Base Station 1" was removed from service. Verify all end points have successfully found a new primary path back to a different Base Station and all data from the meters are being collected normally. Energize "Base Station 1". Note which meters change their primary path again.
30)	Electric outage detection and restore messages	Remove a random sample of meters (up to 5) or remove the power source to a meter to simulate an outage. Verify the outage message and the restore message is received at the MSU software system.	Remove power or meters completely from service (do not remove the meter from the vicinity). Give the meter 5 minutes to ensure the meter has registered the outage. During this time, the meter should send in the outage message, verify after 5 mins the message has been sent. Restore power to the meter and verify the restore and outage message has been received at the MSU software system. Run an outage report for the all the meters. Verify a date and timestamp are given with the outage and restore message. Verify these timestamps are correct.
31)	Collector outage back up power failover	Remove a Base Station from its primary power source and allow to failover to the ups battery. Do not remove communications. Verify the collection point continues to collect data and send in a power loss/battery alarm message.	Remove a collection point from its primary power source for at least 4 hours and is now running on a battery backup or a UPS. Verify in the MSU software a power alarm/event or battery alarm/event is sent, and that data is still being collected. Re-energize the collection point.
32)	Setup specific login groups (member service, admin, etc.) and verify login permissions on set correctly.	Confirm all setup groups and users in those groups have the correct log in permissions for their roles. Verify new users and groups can be created and assigned.	Create user logins and groups. Verify each group has their own specific roles. Verify there are no generic users or shared logins.
33)	Verify meters on the system can collect 15 min data intervals and report in data.	Verify all meters in phase I electric meters can collect 15 min data intervals for kWh, voltage profile, and demand profile. Data must be reported at a minimum, every 4 hours.	Run the meters on the system at 15 min intervals for 7 full days. Confirm the data is being collected and reported by 99.5% of all meters. Confirm the billing readings remain at 100% in a rolling 3-day period. Return the meter configurations back to their default settings (if needed). Confirm the changes have taken place. Confirm the meters are reporting in default data intervals at 99.5% success and billing readings remain at 100% in a rolling 3-day period.

Test	Activity	Overview	Procedure
34)	Verify water meters on the system can collect 60 min data intervals and report in data.	Verify all water modules in phase I can collect 60 min data intervals in gallons. Data must be reported at a minimum, every 24 hours.	Run the modules on the system at 60 min intervals for 7 full days. Confirm the data is being collected and reported by 98.5% of all modules. Confirm the billing readings remain at 98.5% in a rolling 3-day period. Return the meter configurations back to their default settings (if needed). Confirm the changes have taken place. Confirm the meters are reporting in default data intervals at 98.5% success and billing readings remain at 98.5% in a rolling 3-day period.

Test Results

Test	Activity	Pass	Fail	Date	Individual(s) Initials
1)	Test meter endpoints in the field.				
2)	Test module endpoints in the field.				
3)	Test load management endpoints in the field.				
4)	Test meter demand reset from MSU software.				
5)	Test meters with electric endpoints capable of remote disconnect through the MSU software.				
6)	LM switches controlled through the MSU software or via the DRMS or MDMS.				
7)	Test meters with electric endpoints capable of remote disconnect through the field tool.				
8)	LM switches controlled through the MSU field tool.				
9)	Test meter/module configurability for polyphase electric meters.				
10)	Test meter/module configurability for single phase electric meters.				
11)	Test meter/module configurability for water meters.				
12)	Test meter/module configurability for load management switches.				
13)	Test meter/module alarms and events for electric meters.				
14)	Test meter/module alarms and events for water modules.				
15)	Test meter/module alarms and events for load management switches.				
16)	Test Communications to Data Collectors from the office.				
17)	Confirm the MSU system is reading multiple channels from all electric meters.				
18)	Verify the MSU system is setup to bring back the correct requested data fields for C&I meters.				
19)	Verify the MSU system is setup to bring back the correct requested data fields for residential electric meters.				
20)	Verify the MSU system is setup to bring back the correct requested data fields for water modules.				
21)	Verify the MSU system can perform ad-hoc or on-demand electric meter reads.				

Test	Activity	Pass	Fail	Date	Individual(s) Initials
22)	Verify the MSU system can perform ad-hoc or on-demand water meter reads.				
23)	Verify the MSU system can perform ad-hoc or on-demand load management reads.				
24)	Verify the MSU system is providing a back fill of missing/missed readings.				
25)	The system is collecting 100% of electric and 98.5% of water of billing data in a three-day period on all installed and network joined meters.				
26)	Read Data exports are successful to the CIS.				
27)	Read Data exports are successful to the MDMS.				
28)	Read Data exports are successful to the DRMS.				
29)	Confirm the MSU system network is capable of 'self-healing'.				
30)	Electric outage detection and restore messages				
31)	Electric outage back up power failover				
32)	Setup specific login groups (member service, admin, etc.) and verify login permissions on set correctly.				
33)	Verify all meters on the system can collect 15 min data intervals and report in data.				
34)	Verify water meters on the system can collect 60 min data intervals and report in data.				

Attachment E: Meter System Upgrade (MSU) Final System Acceptance Test

Test Procedure

Test	Activity	Overview	Procedure
1)	Test meter endpoints in the field.	Using a field handheld tool or device, verify communications with 50 polyphase electric, and 50 residential meters.	Connect to the meter with the field device. Verify a reading of kwh and demand can be retrieved. Verify diagnostic information from the MSU network can also be retrieved.
2)	Test module endpoints in the field.	Using a field handheld tool or device, verify communications with 50 commercial, and 50 residential water meters.	Connect to the module with the field device. Verify a reading of gallons can be retrieved. Verify diagnostic information from the MSU network can also be retrieved.
3)	Test load management endpoints in the field.	Using a field handheld tool or device, verify communications with 50 load management switches.	Connect to the switch with the field device. Verify a kW reading can be retrieved from each relay. Verify diagnostic information from the MSU network can also be retrieved.
4)	Test meter demand reset from MSU software.	Verify peak demand can be reset from the software system and the peak demand is read and stored.	Reset the current demand from the office. Confirm the current demand reading is set to zero and the current demand reading has been moved to the 'peak' or 'frozen' register in the meter.
5)	Test meters with electric endpoints capable of remote disconnect through the MSU software.	Using the MSU software, verify with 50 residential meters a disconnect and reconnect can be performed.	Send the meter the command to open the disconnect. Confirm and verify the disconnect action has completed through confirmation messages. Once verified, send a reconnect message. Confirm the meter has reconnected service.
6)	LM switches controlled through the MSU software or via the DRMS or MDMS.	Through the MSU software and network, verify with 50 load management devices the load was disconnected and then restored.	Send the load curtailment comment through the MSU system to the endpoint. If an MDMS or DRMS is in place the command should originate from one of these systems. Confirm and verify the load curtailment was successful through reading the load management device (2-way communications). Confirm the load has also been restored.

Test	Activity	Overview	Procedure
7)	Test meters with electric endpoints capable of remote disconnect through the field tool.	Using a field handheld tool or device, verify with 50 residential meters a disconnect can be performed.	Connect to the meter with the field device and/or optical port. Confirm a successful disconnect and reconnect can be performed onsite.
8)	LM switches controlled through the MSU field tool.	Using a field handheld tool or device, verify with 50 load management devices can be curtailed and restored in the field.	Connect to the device with the field device. Confirm a successful curtailment and restore can be performed onsite.
9)	Test meter/module configurability for polyphase electric meters.	Verify meter parameters (recording and reporting intervals) can be changed 'over-the-air' from the MSU software system. Must be able to configure and re-configure items such as; Sag/Swell alarms, TOU programs, or meter collecting/reporting intervals.	Using 25 – 50 installed Polyphase meters on the system. Alter the reporting and recording intervals and confirm the change. Setup status, events, and alarms. Confirm these status and event changes. All changes and updates must be done from the office through the software system.
10)	Test meter/module configurability for single phase electric meters.	Verify meter parameters (recording and reporting intervals) can be changed 'over-the-air' from the MSU software system. Must be able to configure and re-configure items such as: meter collecting/reporting intervals.	Using 25 – 50 installed residential meters on the system. Alter the reporting and recording intervals and confirm the change. Setup status, events, and alarms. Confirm these status and event changes. All changes and updates must be done from the office through the software system.
11)	Test meter/module configurability for water meters.	Verify module parameters (recording and reporting intervals) can be changed 'over-the-air' from the MSU software system. Must be able to configure and re-configure items such as: module collecting/reporting intervals.	Using 25 – 50 installed water or wastewater modules on the system. Alter the reporting and recording intervals and confirm the change. Setup status, events, and alarms. Confirm these status and event changes. All changes and updates must be done from the office through the software system.

Test	Activity	Overview	Procedure
12)	Test meter/module configurability for load management switches.	Verify load management device parameters (recording and reporting intervals) can be changed 'over-the-air' from the MSU software system. Must be able to configure and re-configure items such as: relay collecting/reporting intervals.	Using 25 – 50 installed load management devices on the system. Alter the reporting and recording intervals and confirm the change per relay. Setup status, events, and alarms. Confirm these status and event changes. All changes and updates must be done from the office through the software system.
13)	Test meter/module alarms and events for electric meters.	Verify any alarms and events can be sent to the MSU software system and then notifies users when a meter (up to 50 meters) has reported in an alarm/event.	Such as: Remove a meter from the socket and re-install upside down. This should prompt a reverse flow alarm. Confirm the meter continues to accumulate kwh into the meter's forward register. The meter should not be setup for net-metering or reverse flow otherwise the meter will not send in the alarm. Or other similar tests.
14)	Test meter/module alarms and events for water modules.	Verify any alarms and events can be sent to the MSU software system and then notifies users when a module (up to 50 locations) has reported in an alarm/event.	Such as: Remove a module connector from the meter. This should prompt an alarm. Confirm, once the module is reconnected, it sends an update alarm, the newest reading, and the missed past readings (backfilling). Or other similar tests.
15)	Test meter/module alarms and events for load management switches.	Verify any alarms and events can be sent to the MSU (and onto the MDMS or DRMS) software system and then notifies users when a module (up to 50 locations) has reported in an alarm/event.	Such as: Remove the load from the relay. This should prompt an alarm for no load present. Confirm, once the load is reconnected, it sends an update alarm to clear. Or other similar tests.
16)	Test Communications to Data Collectors from the office.	Verify all MSU network equipment is accessible through the MSU software system. Verify communications and all other available data is being received.	Using the MSU software head end, verify communications to the MSU network equipment (collection points and repeaters) are up. Verify network health, communication statistics, system specs, and all other available information is being collected.
17)	Confirm the MSU system is reading multiple channels from all electric meters.	Verify the MSU system is collecting multiple interval channels and are being collected for each type of electric meter in service.	Through a schedule reading and an ad-hoc read using the MSU software system, verify the system is collecting and displaying correct data from multiple channels. Using the MSU software, visually confirm the data and run a report containing the same information. Confirm the data is collected. Verify the data is correct by downloading the data physically at the meter.

Test	Activity	Overview	Procedure
18)	Verify the MSU system is setup to bring back the correct requested data fields for C&I meters.	Verify for 50 polyphase electric meters the correct register data is being recorded and reported.	Through a schedule reading and an ad-hoc read using the MSU software system, at the same time an employee performs a manual reading at the meter through the optical data port. Verify the readings match for multiple channels.
19)	Verify the MSU system is setup to bring back the correct requested data fields for residential electric meters.	Verify for 50 residential electric meters the correct register data is being recorded and reported.	Through a schedule reading and an ad-hoc read using the MSU software system, at the same time an employee performs a manual reading at the meter through the optical data port. Verify the readings match for multiple channels.
20)	Verify the MSU system is setup to bring back the correct requested data fields for water modules.	Verify for 50 water or wastewater modules the correct register data is being recorded and reported.	Through a schedule reading and an ad-hoc read using the MSU software system, at the same time an employee performs a manual reading at the meter physically at the meter dial. Verify the readings match.
21)	Verify the MSU system can perform ad-hoc or on-demand electric meter reads.	Perform an on-demand read using the MSU software.	Initiate an on-demand or ad-hoc reading from the MSU software system. Verify the MSU system collects the data and displays it for the user.
22)	Verify the MSU system can perform ad-hoc or on-demand water meter reads.	Perform an on-demand read using the MSU software.	Initiate an on-demand or ad-hoc reading from the MSU software system. Verify the MSU system collects the data and displays it for the user.
23)	Verify the MSU system can perform ad-hoc or on-demand load management reads.	Perform an on-demand read using the MSU software.	Initiate an on-demand or ad-hoc reading from the MSU software system. Verify the MSU system collects the data and displays it for the user.
24)	Verify the MSU system is providing a back fill of missing/missed readings.	Verify data gap filling is being performed by the MSU software/Collection points.	Disconnect a collection point for 12 - 24 hours (making sure all backup power is also removed). Energize the collection point and verify the missing data readings have been collected. Verify using MSU software reporting tools.

Test	Activity	Overview	Procedure
25)	The system is collecting 100% of electric and 98.5% of water of billing data in a three-day period on all installed and network joined meters.	Confirm the MSU system is collecting a usable daily register billing read for 100% of all available electric meters and 98.5% of water joined in the network over a 3-day period.	Generate an MSU software reading data collection statistics report and confirm through a billing file export that 100% of all electric meters and 98.5% of water meters have a billing register reading within the last 3 days.
26)	Read Data exports are successful to the CIS.	Verify all data collected and required to be exported from the MSU software to the existing CIS is correct and fully executing.	Confirm a flat file interface between the MSU software system and CIS is successful. Also confirm the Multispeak interface (as applicable) is exporting data from the MSU into the CIS. Test both interfaces.
27)	Read Data exports are successful to the MDMS (if applicable).	Verify all data collected and required to be exported from the MSU software to the existing MDMS is correct and fully executing.	Confirm the integration interface between the MSU software system and MDMS is successful. This test may involve multiple types of integration and data files.
28)	Read Data exports are successful to the DRMS (if applicable).	Verify all data collected and required to be exported from the MSU software to the existing DRMS is correct and fully executing.	Confirm the integration interface between the MSU software system and DRMS is successful. This test may involve multiple types of integration and data files.
29)	Confirm the MSU system network is capable of 'self-healing'.	Confirm all end points change and report all data when the primary path/Base Station is no longer working.	For this, multiple collection points in the same general area must be installed and communicating. Through the MSU software, confirm all the end points registered to "Base Station 1". Remove "Base Station 1" from power (and backup power) for 24 – 48 hours, note the time and date "Base Station 1" was removed from service. Verify all end points have successfully found a new primary path back to a different Base Station and all data from the meters are being collected normally. Energize "Base Station 1". Note which meters change their primary path again.

Test	Activity	Overview	Procedure
30)	Electric outage detection and restore messages	Remove a random sample of meters (up to 50) or remove the power source to a meter to simulate an outage. Verify the outage message and the restore message is received at the MSU software system.	Remove power or meters completely from service (do not remove the meter from the vicinity). Give the meter 5 minutes to ensure the meter has registered the outage. During this time, the meter should send in the outage message, verify after 5 mins the message has been sent. Restore power to the meter and verify the restore and outage message has been received at the MSU software system. Run an outage report for the all the meters. Verify a date and timestamp are given with the outage and restore message. Verify these timestamps are correct.
31)	Collector outage back up power failover	Remove a Base Station from its primary power source and allow to failover to the ups battery. Do not remove communications. Verify the collection point continues to collect data and send in a power loss/battery alarm message.	Remove a collection point from its primary power source for at least 4 hours and is now running on a battery backup or a UPS. Verify in the MSU software a power alarm/event or battery alarm/event is sent, and that data is still being collected. Re-energize the collection point.
32)	Setup specific login groups (member service, admin, etc.) and verify login permissions on set correctly.	Confirm all setup groups and users in those groups have the correct log in permissions for their roles. Verify new users and groups can be created and assigned.	Create user logins and groups. Verify each group has their own specific roles. Verify there are no generic users or shared logins.
33)	Verify water meters on the system can collect 60 min data intervals and report in data.	Verify all modules in phase I electric meters can collect 60 min data intervals in gallons. Data must be reported at a minimum, every 24 hours.	Once 95% of available meters are installed, run the modules on the system at 60 min intervals for 7 full days. Confirm the data is being collected and reported by 98.5% of all modules. Confirm the billing readings remain at in a rolling 3-day period and the alarms and events are all being retrieved.
34)	Verify single-phase meters on the system can collect up to 6 channels of 15 min data intervals and report in data.	100 percent of single-phase meters reporting (6) channels of 15-minute interval data at least every 4 hours. This is addition to the daily report, disconnect and reconnect, alarms and events.	Once 95% of available meters are installed, run the meters on the system at 15 min intervals for 7 full days. Confirm the data is being collected and reported by 99.5% of all meters. Confirm the billing readings remain at 100% in a rolling 3-day period and the daily reporting, disconnects, reconnects, alarms and events are all being retrieved.

Test	Activity	Overview	Procedure
35)	Verify socket-based poly-phase meters on the system can collect up to 12 channels of 15 min data intervals and report in data.	100 percent of all sockets-based poly-phase meters reporting (12) channels of 15-minute interval data at least every 4 hours. This is addition to the daily report, and alarms and events.	Once 95% of available meters are installed, run the meters on the system at 15 min intervals for 7 full days. Confirm the data is being collected and reported by 99.5% of all meters. Confirm the billing readings remain at 100% in a rolling 3-day period and the daily reporting, disconnects, reconnects, alarms and events are all being retrieved.
36)	Verify CT/PT poly-phase meters on the system can collect up to 6 channels of 15 min data intervals and 6 channels of 5-min intervals and report in data.	100 percent of all transformer based polyphase meters reporting (6) channels of 15-minute interval data and (6) channels of 5-minute interval data at least every hour. This is addition to the daily report, and alarms and events.	Once 95% of available meters are installed, run the meters on the system at 15 min and 5 min intervals for 7 full days. Confirm the data is being collected and reported by 99.5% of all meters. Confirm the billing readings remain at 100% in a rolling 3-day period and the daily reporting, disconnects, reconnects, alarms and events are all being retrieved.

Test Results

Test	Activity	Pass	Fail	Date	Individual(s) Initials
1)	Test meter endpoints in the field.				
2)	Test module endpoints in the field.				
3)	Test load management endpoints in the field.				
4)	Test meter demand reset from MSU software.				
5)	Test meters with electric endpoints capable of remote disconnect through the MSU software.				
6)	LM switches controlled through the MSU software or via the DRMS or MDMS.				
7)	Test meters with electric endpoints capable of remote disconnect through the field tool.				
8)	LM switches controlled through the MSU field tool.				
9)	Test meter/module configurability for polyphase electric meters.				
10)	Test meter/module configurability for single phase electric meters.				
11)	Test meter/module configurability for water meters.				
12)	Test meter/module configurability for load management switches.				
13)	Test meter/module alarms and events for electric meters.				
14)	Test meter/module alarms and events for water modules.				
15)	Test meter/module alarms and events for load management switches.				
16)	Test Communications to Data Collectors from the office.				
17)	Confirm the MSU system is reading multiple channels from all electric meters.				
18)	Verify the MSU system is setup to bring back the correct requested data fields for C&I meters.				

Test	Activity	Pass	Fail	Date	Individual(s) Initials
19)	Verify the MSU system is setup to bring back the correct requested data fields for residential electric meters.				
20)	Verify the MSU system is setup to bring back the correct requested data fields for water modules.				
21)	Verify the MSU system can perform ad-hoc or on-demand electric meter reads.				
22)	Verify the MSU system can perform ad-hoc or on-demand water meter reads.				
23)	Verify the MSU system can perform ad-hoc or on-demand load management reads.				
24)	Verify the MSU system is providing a back fill of missing/missed readings.				
25)	The system is collecting 100% of electric and 98.5% of water billing data in a three-day period on all installed and network joined meters.				
26)	Read Data exports are successful to the CIS.				
27)	Read Data exports are successful to the MDMS.				
28)	Read Data exports are successful to the DRMS.				
29)	Confirm the MSU system network is capable of 'self-healing'.				
30)	Electric outage detection and restore messages				
31)	Electric outage back up power failover				
32)	Setup specific login groups (member service, admin, etc.) and verify login permissions on set correctly.				
33)	Verify water meters on the system can collect 60 min data intervals and report in data.				
34)	Verify single-phase meters on the system can collect up to 6 channels of 15 min data intervals and report in data.				

Test	Activity	Pass	Fail	Date	Individual(s) Initials
35)	Verify socket-based poly-phase meters on the system can collect up to 12 channels of 15 min data intervals and report in data.				
36)	Verify CT/PT poly-phase meters on the system can collect up to 6 channels of 15 min data intervals and 6 channels of 5-min intervals and report in data.				

This table shows the division of responsibilities between Purchaser and the selected Supplier. For all tasks, it shall be assumed that the responsible party will lead, while the other party will assist or support. In the table, "Supplier" refers to the selected vendor. Please respond "yes" or "no" in the appropriate space below depending on whether Supplier's quoted offering is in compliance with the responsibilities as listed. Please provide any clarifications or explanations in the "Supplier Comments" column where appropriate.

#	Description	Supplier Responsibility	Apex / Third-Party Responsibility	Comply Yes	Comply No	Supplier Comments
		DO NOT EDIT THESE COLUMNS		*RESPOND IN THESE COLUMNS*		
1	Configure, install, and test the MDMS hardware and software (the "Master System") and deliver the combined hardware and software to the Purchaser's office.	X		X		
2	For a SaaS Model and Cloud/Hosted Model:					
2.01	Apply patches and upgrades to the MDMS application and database software.	X		X		
2.02	Apply patches and upgrades to the application and database hardware.	X		X		
2.03	Monitor, support, and report on pertinent SaaS metrics; including system availability and performance.	X		X		
2.04	Provide secure (VPN and firewall) access to the system.	X	X	X		
2.05	Obtain and provide the Purchaser updated hosting certifications prior to agreement execution and prior to their expiration.	X		X		
3	Own and Operate Software upgrade methodology (the tasks the Purchaser and Supplier will have to administer to complete the upgrade).	X	X	X		
4	Train Purchaser's personnel and contractors on how to properly use and navigate the Master System for all defined software functionality.	X		X		
5	Provide ongoing project and technical support as mutually agreed in future discussions and as set forth in Contract documents.	X		X		
6	Lead System Acceptance Testing (SAT) at Purchaser's site.	X		X		
7	Complete System Acceptance Testing (FSAT) at Purchaser's site.	X	X	X		
8	Ensure that all defined MDMS functionality performs according to compliance statements provided in Supplier's RFP response, including submitted product brochures, requirements documents, critical questions and other information presented by the Supplier RFP, and that said functionality is tested as part of the SAT.	X		X		
9	Provide complete project management for the installation of the MDMS.	X	X	X		
10	Provide support to the Purchaser upon request as the MDMS is integrated to the Purchaser's software systems as listed in the RFP (e.g. CIS, OMS, MSU, etc.) including support for MultiSpeak Use Cases and Methods lists in the RFP and attachments as well as, API, flat-file, web services, or other connectivity to Supplier's databases as required and defined in the statement of work.	X		X		
11	Provide software integration services between the MDMS and other systems. Please comment on assumed vendor responsibilities for integration to systems such as an OMS, CIS, etc.	X		X		

This table shows the division of responsibilities between Purchaser and the selected Supplier. For all tasks, it shall be assumed that the responsible party will lead, while the other party will assist or support. In the table, "Supplier" refers to the selected vendor. Please respond "yes" or "no" in the appropriate space below depending on whether Supplier's quoted offering is in compliance with the responsibilities as listed. Please provide any clarifications or explanations in the "Supplier Comments" column where appropriate.

#	Description	Supplier Responsibility	Apex / Third-Party Responsibility	Comply		Supplier Comments
	DO NOT EDIT THESE COLUMNS			**RESPOND IN THESE COLUMNS**		
				Yes	No	
1	Configure, deliver, install, and test the MSU hardware and software (the "Master System") to the Purchaser's sites.	X		X		
2	For a SaaS Model and Cloud/Hosted Model:					
2.01	Apply patches and upgrades to the MSU application and database software.	X		X		
2.02	Apply patches and upgrades to the application and database hardware.	X		X		
2.03	Monitor, support, and report on pertinent SaaS metrics; including system availability and performance.	X		X		
2.04	Design and implement all infrastructure to support the MSU system.	X		X		
2.05	Provide secure (VPN and firewall) access to the system.	X	X	X		
2.06	Obtain and provide the Purchaser updated hosting certifications prior to agreement execution and prior to their expiration.	X		X		
3	Own and Operate Software upgrade methodology (the tasks the Purchaser and Supplier will have to administer to complete the upgrade).	X	X	X		The FlexNet Head End System is upgradable. Sensus typically performs the work as a service to the utility. Software releases are provided on a semi-annual basis. Sensus recommends a parallel system be used for any utility-specific testing before rolling a release into production. The parallel system enables a large percentage of utility validation to be completed using real production data in a parallel system. This swapping of environments requires a redundant production-sized Regional Network Interface (RNI)/Head End System.
4	Supplier has the single-point of responsibility for the MSU network including electric and water meters and all software and hardware. In addition, Supplier has responsibility for electric MSU meter and water MSU node exchange, and installation of all network elements.	X		X		
5	Provide meters, modules, and metering transport equipment for deployment. For items installed by Supplier ship to Supplier designated location, for items inventoried (spares) or installed by Purchaser ship equipment to Purchaser's designated location.	X		X		
6	Train Purchaser's personnel and contractors on how to properly install the equipment and use and navigate the Master System for all defined software functionality.	X		X		
7	Completion and provision of MSU system design to meet outlined requirements in the agreement including all Attachments (includes diagram and complete BOM for network).	X		X		
8	Identification of locations to mount network elements as required.	X		X		
9	Provision of access to required assets to mount network devices and elements.		X	X		
10	Complete installation of any A-Base MSU electric meters.		X	X		
11	Installation of required water meter (base) exchanges or replacements.		X	X		
12	Provision of fiber optics for wide area network (WAN) communications, where available.		X	X		If Apex chooses NaaS offering, WAN is cover by Sensus
13	Provide technical assistance for supporting successful interface and interoperability, as required for the identified management systems.		X	X		
14	Jointly execute system acceptance test (SAT) and other proof-of-performance testing.	X	X	X		
15	Negotiation of secured lease agreements from third party providers for WAN (if required).	X	X	X		
16	Provision and optimization of secure communications within the meter network, as well as within the LAN and WAN for advanced metering functionalities.	X		X		

This table shows the division of responsibilities between Purchaser and the selected Supplier. For all tasks, it shall be assumed that the responsible party will lead, while the other party will assist or support. In the table, "Supplier" refers to the selected vendor. Please respond "yes" or "no" in the appropriate space below depending on whether Supplier's quoted offering is in compliance with the responsibilities as listed. Please provide any clarifications or explanations in the "Supplier Comments" column where appropriate.

#	Description	Supplier Responsibility	Apex / Third-Party Responsibility	Comply Yes	Comply No	Supplier Comments
		DO NOT EDIT THESE COLUMNS		**RESPOND IN THESE COLUMNS**		
17	Provide training and education to Purchaser personnel or designated representatives, for installation of all hardware and operation of Supplier's System.	X		X		Sensus will provide training on the installation and operation of all Sensus hardware and software encompassed in the Sensus FlexNet MSU system. The training will cover all of the base station and meter types deployed in the network, as well as the field tools and their associated applications, which are used to program the meters. Training will also be provided for Sensus FlexNet applications, including Device Manager and Sensus Analytics. Sensus will not provide training on third party commercial "off the shelf" equipment such as Dell servers, storage, Microsoft Windows, Microsoft SQL Server or Red Hat Linux. Please note that knowledge of these components is not required in the Software as a Service model since all management and administration is performed by Sensus Data Center personnel. In the case of a licensed head end application it is assumed the utility IT staff members be well versed in the Original Equipment Manufacturers (OEM) products and further training is not required. In the event further OEM training is required it is available direct from the OEMs or their licensed training partners.
18	Provide ongoing project and technical support as mutually agreed in future discussions and as set forth in Contract documents.	X		X		Following the transition deployment to operations, Sensus will support Rock Energy via remote subject matter experts as required, and our 1-800-Meter-IT technical support hotline. Details regarding standard support methodology, response times, and escalation procedures are found in our software support document, which is included with our response. Please see Appendix L_Customer Support Overview.pdf to read about the support that will be provided to the Town of Apex. Sensus trains all support personnel in their areas of expertise using similar training methodologies as those employed in customer training. Training sessions are held regularly with subject matter experts, taking advantage of onsite engineering, design, and test staff to supplement knowledge transfer. Many technical support engineers have been with Sensus for periods exceeding 20 years and have developed technical and troubleshooting skills from years of experience in other Sensus departments. Sensus technical support engineers have an average of more than 9.5 years of experience within the Sensus organization.
19	Lead System Acceptance Testing (ISAT and FSAT) at Purchaser's site.	X		X		
20	Complete System Acceptance Testing (ISAT and FSAT) at Purchaser's site.	X	X	X		
21	Ensure that all defined MSU system functionality performs according to compliance statements provided in Supplier's RFP response, including submitted product brochures, requirements documents, critical questions and other information presented by the Supplier RFP, and that said functionality is tested as part of the ISAT and FSAT.	X		X		
22	Complete detailed wireless collector system design and install Supplier-provided MSU Endpoints (Electric, Water, Wastewater, Load Management).	X		X		
23	Complete detailed wireless collector system design and install all Supplier-provided MSU Network Equipment.	X		X		Please refer to Section 10.0_Propagation Study.pdf for proposed base station locations and heights.
24	Provide complete project management for the installation of all the Endpoints (Electric, Water, Wastewater, Load Management).	X	X	X		Combination of Ferguson and the selected installer

This table shows the division of responsibilities between Purchaser and the selected Supplier. For all tasks, it shall be assumed that the responsible party will lead, while the other party will assist or support. In the table, "Supplier" refers to the selected vendor. Please respond "yes" or "no" in the appropriate space below depending on whether Supplier's quoted offering is in compliance with the responsibilities as listed. Please provide any clarifications or explanations in the "Supplier Comments" column where appropriate.

#	Description	Supplier Responsibility	Apex / Third-Party Responsibility	Comply Yes	Comply No	Supplier Comments
		DO NOT EDIT THESE COLUMNS		RESPOND IN THESE COLUMNS		
25	Meet Coverage Commitment for five (5) years from the date that 95% of electric MSU meters are installed and have associated with the MSU master system.	X		X		
26	Transport (and cost of transport) for any MSU collector, antenna, cabinets, or other collector/base station equipment to the Suppliers' field location or warehouse where the installation will be completed.	X			X	Sensus typically sees this as the responsibility of the Torwn of Apex or a third party, as the onsite coordination becomes much simpler.
27	Connect Master System in Purchaser's main office to the communications system.		X	X		
28	Provision an adequate communication circuit between each MSU take-out point containing Supplier-provided equipment to Purchaser's data center where Supplier-provided Master System is located.		X	X		The Sensus Professional Services team is well versed in the integration of FlexNet with other third-party platforms and systems. Sensus has participated in more than 700 FlexNet deployments over the past seven years, and has interfaced the FlexNet system with a wide variety of utility operational and business systems during that time. This includes integrations with the existing systems for the Town of Apex. Sensus leverages the CMEP file format and the MultiSpeak standard to integrate with utility systems.
29	Lead discussions and interface development regarding required interfaces with identified applications.	X		X		Sensus professional Services workshops
30	Coordinate and assist the MDM, Customer Portal, and DRMS vendors in interfaces as outlined in the Attachments to Supplier provided software and databases.	X		X		Sensus professional Services workshops
31	Provide support to the Purchaser upon request as the MSU Master System is integrated to the Purchaser's software systems as listed in the RFP (e.g. CIS, OMS, MDMS, etc.) including support for MultiSpeak Use Cases and Methods lists in the RFP and attachments as well as, API, flat-file, web services, or other connectivity to Supplier's databases as required and defined in the statement of work.	X		X		We recommend beginning the integration services with a Solution Design and Business Process workshop, in which we partner with the Town to examine solution design, integration points, and data flows. During this workshop, we identify the most appropriate integration methods for each integration point. Sensus currently supposrts Multispeak versions 3 and 4.1. Sensus is considering version 5.0 and can accelerate the adoption of Multispeak 5.0 with a successful contract.
32	Provision of required interfaces to Purchasers' applications (see Attachments F-1, F-2, and F-3); initial and final system acceptance tests (Attachments D-1, D-2, D-3, D-4, and E) and expected to work with Purchaser staff to setup various dashboards to facilitate ease of use of the solution.	X		X		
33	Provide software integration services between the MSU, existing, and other future systems. Please comment on assumed vendor responsibilities for integration to systems such as an OMS, CIS, etc.	X		X		Sensus will work with the Town of Apex to determine which of the existing systems Sensus will be performing the integration services. As described in Sensus' response in Section 5.0_Attachment IV: Critical Questions, our general integration strategy is to conduct a Solution Design and Business Process Workshop prior to beginning integration. In this workshop, we will discuss solution design, integration points, and data flows. A full description of this session may be found in Appendix M Sensus Professional Services Integration Workshop for REC.pdf.
34	Recording and provision of future proofing measures taken, which will enable the Customer to interface other, newer systems using the current MSU data (this includes, but is not limited to, firmware downloads and ongoing software updates).	X		X		
35	Provide experienced project management.	X	X	X		
36	Provide warehouse and inventory management for received MSU meters, MSU water nodes, and removed electric meters meters and water MSU models.	X		X		
37	Provide disposal of removed meters and water MSU nodes (hold for 90 days after completion of installation) meeting all federal and state regulatory requirements, including environmental standards.	X		X		
38	Provide detail of power requirements for each network device.	X		X		

This table shows the division of responsibilities between Purchaser and the selected Supplier. For all tasks, it shall be assumed that the responsible party will lead, while the other party will assist or support. In the table, "Supplier" refers to the selected vendor. Please respond "yes" or "no" in the appropriate space below depending on whether Supplier's quoted offering is in compliance with the responsibilities as listed. Please provide any clarifications or explanations in the "Supplier Comments" column where appropriate.

		DO NOT EDIT THESE COLUMNS		RESPOND IN THESE COLUMNS		
#	Description	Supplier Responsibility	Apex / Third-Party Responsibility	Comply		Supplier Comments
				Yes	No	
39	Recording of condition of site (photo and notes), GPS coordinates, and other identified requirements in the Attachments for each endpoint and network element installed by Supplier or their contractor(s).	X		X		
40	Provide electric MSU meter installation/exchange, water MSU node installation, and network element installation per requirements as indicated in Agreement including Attachment A.	X		X		

ATTACHMENT N

MANUFACTURER'S WARRANTY

Sensus Limited Warranty

1. **General Product Coverage.** Unless otherwise provided herein, Sensus USA Inc. ("Sensus") warrants its products and parts to be free from defects in material and workmanship for one (1) year from the date of Sensus shipment and as set forth below. All products are sold to customer ("Customer") pursuant to Sensus' Terms of Sale, available at: sensus.com/TC ("Terms of Sale").

2. **SR II® and accuSTREAM™ 5/8", 3/4" & 1" Meters** are warranted to perform to new meter accuracy level set forth in the SR II and accuSTREAM Data Sheets available at sensus.com for five (5) years from the date of Sensus shipment or until the registration shown below, whichever occurs first. Sensus further warrants that the SR II and accuSTREAM meters will perform to at least AWWA Repaired Meter Accuracy Standards for fifteen (15) years from the date of Sensus shipment or until the registration shown below, whichever occurs first:

	New Meter Accuracy	Repair Meter Accuracy
5/8" SR II Meter and accuSTREAM Meter	500,000 gallons	1,500,000 gallons
3/4" SR II Meter and accuSTREAM Meter	750,000 gallons	2,250,000 gallons
1" SR II Meter and accuSTREAM Meter	1,000,000 gallons	3,000,000 gallons

3. **SR II maincases** are warranted to be free from defects in material and workmanship for twenty-five (25) years from the date of Sensus shipment. **accuSTREAM maincases** will be free from defects in material and workmanship for fifteen (15) years from the date of Sensus shipment.

4. **ally® Meters** that register water flow are warranted to perform to the accuracy level set forth in the ally data sheet available at sensus.com for fifteen (15) years from the Date of Installation, but no longer than sixteen (16) years from date of manufacture, not including the meter's sensors, valve, and gear motor, which are warranted under different terms described below. As used herein, "Date of Installation" means the date after which the ally Meter has been out of empty pipe for seven (7) consecutive days, as those days are measured by the ally Meter and stored in the meter's nonvolatile memory.

5. **iPERL® Meters** that register water flow are warranted to perform to the accuracy levels set forth in the iPERL data sheet available at sensus.com for twenty (20) years from the date of Sensus shipment. The iPERL System Component warranty does not include the external housing.

6. **Sensus OMNI™, OMNI+ Meters and Propeller Meters** are warranted to perform to as set forth in OMNI and Propeller data sheets for eighteen (18) months from the date of Sensus shipment.

7. **Sensus Cordonel Meters** are warranted to perform to the accuracy levels as set forth in the Cordonel data sheet available at sensus.com for twenty (20) years from the date of Sensus shipment. The Cordonel System Component warranty does not include the external housing.

8. **Sensus Cordonel maincases** are warranted to maintain their structural integrity for a period of twenty (20) years from the date of Sensus shipment.

9. **Sensus accuMAG™ and Hydroverse™ Meters** are warranted to be free from defects in material and workmanship, under normal use and service, for 18 months from the date of Sensus shipment or 12 months from startup, whichever occurs first.

10. **Sensus Registers** are warranted to be free from defects in material and workmanship from the date of Sensus shipment for the periods stated below or until the applicable registration for AWWA Repaired Meter Accuracy Standards, as set forth above, are surpassed, whichever occurs first:

5/8" thru 2" SR II, accuSTREAM Standard Registers	25 years
5/8" thru 2" SR II, accuSTREAM Encoder Registers	10 years
All HSPU, IMP Contactor, R.E.R. Elec. ROFI	1 year
Standard and Encoder Registers for Propeller Meters	1 year
OMNI and OMNI+ Registers with Battery	10 years

11. **Sensus Electric and Gas Meters** are warranted pursuant to the General Limited Warranty available at sensus.com/TC.

12. **Batteries, iPERL System Components, AMR and FlexNet® Communication Network AMI Interface Devices** are warranted to be free from defects in material and workmanship from the date of Sensus shipment for the period stated below:

Electronic TouchPad	10 years
Act-Pak® Remote Monitoring Instruments	1 year
Gas SmartPoint® Modules and Batteries	20 years[1]
7500 series Hand-Held Device	2 years
Vehicle Gateway Base Station (VGB) and other AMR Equipment	1 year
EasyLink Reader	1 Year
CPTP100	20 Years[2]
FlexNet Base Station (including the R100NA and M400 products)	1 year
RM4160	1 Year
iPERL System Battery and iPERL System Components	20 years[3]
Sensus® Electronic Register+™	20 years[4]
Sensus® Smart Gateway Sensor Interface	1 year[5]
SmartPoint® 510M/520M/515M/512M Modules and Batteries	20 year[3]

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[1] Sensus will repair or replace non-performing Gas SmartPoint Modules (configured to the factory setting of six transmissions per day under normal system operation of up to one demand read to each SmartPoint Module per month and up to five firmware downloads during the life of the product) and batteries.

[2] Sensus will repair or replace non-performing CPTP100 modules (configured at factory setting of four transmissions per day under normal system operations of up to one demand read per month and up to five firmware downloads during the life of the product) and batteries.

[3] Sensus will repair or replace non-performing:

- iPERL System Batteries, and/or the iPERL System flowtube, the flow sensing and data processing assemblies, and the register ("iPERL System Components") with hourly reads manufactured after April 2018

- Cordonel System Batteries, the flow sensing and data processing assemblies, and the register ("Cordonel System Components")

- SmartPoint 510M/520M/515M//512M-PLS/522M Modules manufactured after April 2018 (configured to the factory setting of six transmissions per day under normal system operation of up to one demand read to each SmartPoint Module per month and up to five firmware downloads during the life of the product) and batteries, unless the SmartPoint 510M/520M/522M Module is ever paired with an ally Meter, which immediately amends the warranty terms to those described in Section 13

at no cost for the first fifteen (15) years from the date of Sensus shipment, and for the remaining five (5) years at a prorated percentage, applied towards the published list price in effect for the year the product is accepted by Sensus under the warranty conditions according to the following schedule:

Years	Replacement Price	Years	Replacement Price
1 – 15	0%	19	60%
16	30%	20	70%
17	40%	>20	100%
18	50%		

[4] Sensus will repair or replace non-performing Sensus Electronic Register+ with hourly reads for the first ten (10) years from the date of Sensus shipment, and for the remaining ten (10) years, at a prorated percentage, applied towards the published list prices in effect for the year product is accepted by Sensus under warranty conditions according to the following schedule:

Years	Replacement Price	Years	Replacement Price
1 – 10	0%	16	55%
11	30%	17	60%
12	35%	18	65%
13	40%	19	70%
14	45%	20	75%
15	50%	>20	100%

[5] Sensus® Smart Gateway Sensor Interface warranty valid only for analog Meter Sample Rates of four times per hour with a Standard Transmit Rate of hourly or greater for the analog channel(s).

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Morrisville, NC 27560
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a xylem brand

13. **ally® Meter Batteries and Components, including SmartPoint 510M/520M Modules** are warranted to be free from defects in material and workmanship from the Date of Installation, as defined in Section 4, for the period stated below:

Batteries	15 years[6]
Sensors	5 years
Valve & Gear Motor	5 years[7]
SmartPoint 510M/520M Modules and Batteries in service w/ally	15 years[6]

14. **Cordonel Meter Batteries and Components** are warranted to be free from defects in material and workmanship from the Date of Installation, as defined in Section 7, for the period stated below:

Batteries	20 years[3]
Sensors	5 years
SmartPoint 510M/520M Modules and Batteries in service w/Cordonel models with pressure	15 years[6]

15. **iPERL and ally Connectors and Cables** are warranted to be free from defects in materials and workmanship, under normal use and service, for ten (10) years from the date of Sensus shipment. Nicor or Itron connectors included with a Sensus product are warranted according to the terms for Third-Party Devices in Section 16.

16. **Third-Party Devices** are warranted to be free from defects in materials and workmanship, under normal use and service, for one (1) year from the date of Sensus shipment. As used in this Sensus Limited Warranty, "Third Party Devices" means any product, device, or component part used with a Sensus product that is manufactured or sold by any party that is not Sensus. Failure of a Third-Party Device which subsequently causes failure to a Sensus device shall be the responsibility of the manufacturer of the Third-Party Device.

17. **Software.** Software supplied and/or licensed by Sensus is supported according to the terms of the applicable software license or usage agreement. Sensus warrants that any network and monitoring services shall be performed in a professional and workmanlike manner.

18. **Return.** Sensus' obligation, and Customer's exclusive remedy, under this Sensus Limited Warranty is, at Sensus' option, to either (i) repair or replace the product, provided the Customer (a) returns the product to the location designated by Sensus within the warranty period; and (b) prepays the freight costs both to and from such location; or (ii) deliver replacement components to the Customer, provided the Customer installs, at its cost, such components in or on the product (as instructed by Sensus), provided, that if Sensus requests, the Customer (a) returns the product to the location designated by Sensus within the warranty period; and (b) prepays the freight costs both to and from such location. In all cases, if Customer does not return the product within the time period designated by Sensus, Sensus will invoice, and Customer will pay within thirty days of the invoice date, for the cost of the replacement product and/or components.

The return of products for warranty claims must follow Sensus' Returned Materials Authorization (RMA) procedures. Water meter returns must include documentation of the Customer's test results. Test results must be obtained according to AWWA standards and must specify the meter serial number. The test results will not be valid if the meter is found to contain foreign materials. If Customer chooses not to test a Sensus water meter prior to returning it to Sensus, Sensus will repair or replace the meter, at Sensus' option, after the meter has been tested by Sensus. The Customer will be charged Sensus' then current testing fee. All products must be returned in accordance with the RMA process. For all returns, Sensus reserves the right to request meter reading records by serial number to validate warranty claims.

For products that have become discontinued or obsolete ("Obsolete Product"), Sensus may, at its discretion, replace such Obsolete Product with a different product model ("New Product"), provided that the New Product has substantially similar features as the Obsolete Product. The New Product shall be warranted as set forth in this Sensus Limited Warranty.

THIS SECTION 18 SETS FORTH CUSTOMER'S SOLE REMEDY FOR THE FAILURE OF THE PRODUCTS, SERVICES OR LICENSED SOFTWARE TO CONFORM TO THEIR RESPECTIVE WARRANTIES.

19. **Warranty Exceptions and No Implied Warranties**. This Sensus Limited Warranty does not include costs for removal or installation of products, or costs for replacement labor or materials, which are the responsibility of the Customer. The warranties in this Sensus Limited Warranty do not apply to and Sensus has no liability for goods that have been: installed improperly or in non-recommended installations; installed to a socket that is not functional, or is not in safe operating condition, or is damaged, or is in need of repair; tampered with; modified or repaired with parts or assemblies not certified in writing by Sensus, including without limitation, communication parts and assemblies; improperly modified or repaired (including as a result of modifications required by Sensus); converted; altered; damaged; read by equipment not approved by Sensus; for water meters, used with substances other than water, used with non-potable water, or used with water that contains dirt, debris, deposits, or other impurities; subjected to misuse, improper storage, improper care, improper maintenance, or improper periodic testing (collectively, "Exceptions."). If Sensus identifies any Exceptions during examination, troubleshooting or performing any type of support on behalf of Customer, then Customer shall pay for and/or reimburse Sensus for all expenses incurred by Sensus in examining, troubleshooting, performing support activities, repairing, or replacing any Equipment that satisfies any of the Exceptions defined above. The above warranties do not apply in the event of Force Majeure, as defined in the Terms of Sale.

THE WARRANTIES SET FORTH IN THIS SENSUS LIMITED WARRANTY ARE THE ONLY WARRANTIES GIVEN WITH RESPECT TO THE GOODS, SOFTWARE, SOFTWARE LICENSES AND SERVICES SOLD OR OTHERWISE PROVIDED BY SENSUS. SENSUS EXPRESSLY DISCLAIMS ANY AND ALL OTHER REPRESENTATIONS, WARRANTIES, CONDITIONS, EXPRESSED, IMPLIED, STATUTORY OR OTHERWISE, REGARDING ANY MATTER IN CONNECTION WITH THIS SENSUS LIMITED WARRANTY OR WITH THE TERMS OF SALE, INCLUDING WITHOUT LIMITATION, WARRANTIES AS TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, NON-INFRINGEMENT AND TITLE.

SENSUS ASSUMES NO LIABILITY FOR COSTS OR EXPENSES ASSOCIATED WITH LOST REVENUE OR WITH THE REMOVAL OR INSTALLATION OF EQUIPMENT. THE FOREGOING REMEDIES ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES FOR THE FAILURE OF EQUIPMENT, LICENSED SOFTWARE OR SOFTWARE SERVICES, AND OTHER SERVICES TO CONFORM TO THEIR RESPECTIVE WARRANTIES.

20. **Limitation of Liability.** SENSUS' AGGREGATE LIABILITY IN ANY AND ALL CAUSES OF ACTION ARISING UNDER, OUT OF OR IN RELATION TO THIS AGREEMENT, ITS NEGOTIATION, PERFORMANCE, BREACH OR TERMINATION (COLLECTIVELY "CAUSES OF ACTION") SHALL NOT EXCEED THE TOTAL AMOUNT PAID BY CUSTOMER TO SENSUS UNDER THIS AGREEMENT. THIS IS SO WHETHER THE CAUSES OF ACTION ARE IN TORT, INCLUDING, WITHOUT LIMITATION, NEGLIGENCE OR STRICT LIABILITY, IN CONTRACT, UNDER STATUTE OR OTHERWISE.

AS A SEPARATE AND INDEPENDENT LIMITATION ON LIABILITY, SENSUS' LIABILITY SHALL BE LIMITED TO DIRECT DAMAGES. SENSUS SHALL NOT BE LIABLE FOR: (I) ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES; NOR (II) ANY REVENUE OR PROFITS LOST BY CUSTOMER OR ITS AFFILIATES FROM ANY END USER(S), IRRESPECTIVE OF WHETHER SUCH LOST REVENUE OR PROFITS IS CATEGORIZED AS DIRECT DAMAGES OR OTHERWISE; NOR (III) ANY IN/OUT COSTS; NOR (IV) MANUAL METER READ COSTS AND EXPENSES; NOR (V) DAMAGES ARISING FROM MAINCASE OR BOTTOM PLATE BREAKAGE CAUSED BY FREEZING TERMPERATURES, WATER HAMMER CONDITIONS, OR EXCESSIVE WATER PRESSURE. "IN/OUT COSTS" MEANS ANY COSTS AND EXPENSES INCURRED BY CUSTOMER IN TRANSPORTING GOODS BETWEEN ITS WAREHOUSE AND ITS END USER'S PREMISES AND ANY COSTS AND EXPENSES INCURRED BY CUSTOMER IN INSTALLING, UNINSTALLING AND REMOVING GOODS. "END USER" MEANS ANY END USER OF ELECTRICITY/WATER/GAS THAT PAYS CUSTOMER FOR THE CONSUMPTION OF ELECTRICITY/WATER/GAS, AS APPLICABLE.

The limitations on liability set forth in this Agreement are fundamental inducements to Sensus entering into this Agreement. They apply unconditionally and in all respects. They are to be interpreted broadly so as to give Sensus the maximum protection permitted under law.

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[6] If applicable, any SmartPoint 510M/520M Modules ever paired with an ally meter or Cordonel with pressure meter are warranted with the following limitations:

- When configured to the default installation setting of six transmissions of metrology and pressure per day and one update of temperature per day, the SmartPoint module is warranted to perform up to five (5) firmware upgrades for the SmartPoint module and up to five (5) firmware upgrades for the ally meter or Cordonel (with pressure) meter;
- 2500 Operational Commands, where "Operational Commands" include on demand reads (such as consumption, pressure, temperature), an ally meter valve command, or a configuration command; and
- 15 Diagnostic Commands, which includes two-way communications tests and installations

for the first ten (10) years from Date of Installation at no cost. For the remaining five (5) years, Customer will pay the reduced Replacement Price of the then-current list price in effect at the time the product is accepted for return in accordance with the following schedule:

Years	Replacement Price	Years	Replacement Price
1 – 10	0%	14	65%
11	35%	15	75%
12	45%	>15	100%
13	55%		

[7] Notwithstanding the foregoing, valve and gear motor components of ally meters are not warranted beyond two thousand (2000) Valve State Operations, even if the warranty period provided herein has not yet expired. As used herein, "Valve State Operations" means adjustments of the Meter to open, close, or reduce flow.

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Sensus Limited Warranty

G-500 R29

General Limited Warranty

Revised November 2019

1. Terms of Sale. Sensus USA Inc. ("Sensus") warrants its products and parts as set forth below. All products are sold to the buyer ("Customer") pursuant to Sensus' Terms of Sale, available at: sensus.com/tc.

2. Electricity Meters and Electricity SmartPoint™ Modules. Sensus warrants the Sensus electricity meters and Sensus electricity SmartPoint Modules to be in compliance with their respective specifications under normal use and service, and to be free from material defects in materials and workmanship for a warranty period of sixty-three (63) months from the date of shipment, whichever occurs first. The warranty period for new spare parts and components sold by Sensus is twelve (12) months from the date of shipment. The warranty period for repaired or refurbished parts repaired by Sensus is ninety (90) days from the date of shipment, unless repaired pursuant to a warranty, in which case the repair is warranted for the time remaining of the original warranty period.

3. Gas Products and Gas SmartPoint Modules.

   a. Except for the Sonix meters, Sensus warrants the Sensus gas products to be in compliance with their respective specifications under normal use and service, and to be free from material defects in materials and workmanship for a warranty period of twelve (12) months from the date of the installation or eighteen (18) months from the date of shipment, whichever occurs first. Sensus warrants the Sensus Sonix meters to be free from material defects in materials and workmanship for a warranty period of fifteen (15) years from the date of shipment. Sensus warrants the batteries in the Sensus Sonix meters to be free from material defects in materials and workmanship for a warranty period of ten (10) years from the date of shipment. The warranty period for new spare parts and components sold by Sensus is twelve (12) months from the date of shipment. The warranty period for repaired or refurbished parts repaired by Sensus is ninety (90) days from the date of shipment, unless repaired pursuant to a warranty, in which case the repair is warranted for the time remaining of the original warranty period.

   b. Sensus warrants the Sensus gas SmartPoint Modules as set forth in the "G500" warranty, as set forth at: sensus.com/tc, or available at 1-800-METER-IT.

4. Water Meters and Water SmartPoint Modules. Sensus warrants the Sensus water meters and Sensus water SmartPoint Modules as set forth in the "G500" warranty, as set forth at: sensus.com/tc, or available at 1-800-METER-IT.

5. VantagePoint® Lighting Control Module. Sensus warrants the Sensus VantagePoint® Lighting Control Module to be in compliance with their respective specifications under normal use and service, and to be free from material defects in materials and workmanship for a warranty period of ten (10) years from the date of shipment. The warranty period for new spare parts and components sold by Sensus is twelve (12) months from the date of shipment. The warranty period for repaired or refurbished parts repaired by Sensus is ninety (90) days from the date of shipment, unless repaired pursuant to a warranty, in which case the repair is warranted for the time remaining of the original warranty period

6. DA Devices and HAN Devices. Sensus warrants the Sensus DA Devices and Sensus HAN Devices to be in compliance with their respective specifications under normal use and service, and to be free from material defects in materials and workmanship for a warranty period of twelve (12) months from the date of shipment. The warranty period for new spare parts and components sold by Sensus is twelve (12) months from the date of shipment. The warranty period for repaired or refurbished parts repaired by Sensus is ninety (90) days from the date of shipment, unless repaired pursuant to a warranty, in which case the repair is warranted for the time remaining of the original warranty period.

7. RF Field Equipment. Sensus warrants the Sensus RF Field Equipment to be in compliance with their respective specifications under normal use and service, and to be free from material defects in materials and workmanship for a warranty period of twelve (12) months from the date of shipment.

8. Server Hardware. Sensus provides no warranty on the Server Hardware.

9. Third Party Goods. Notwithstanding anything to the contrary herein, Sensus does not warrant any goods manufactured or software supplied by third parties. For example, if Customer elects to buy meters from a third party, the Sensus SmartPoint Modules installed in such third party meters shall, subject to Section 11, below, be covered by the warranty above, but any warranty on the meter itself shall be a matter directly between Customer and such third party meter supplier.

10. Services. Sensus warrants that its services shall, at the time of performance, materially conform to the contract requirements, and shall be performed in a professional and workmanlike manner, free from material defects in workmanship.

11. Remedy.

    a. If any Field Device or RF Field Equipment fails during the applicable warranty period (a "Failed Good"), Sensus' obligation, and Customer's exclusive remedy, is, at Sensus' option, to either (i) repair or replace the Failed Good, provided the Customer (a) returns the product to the location designated by Sensus within the warranty period; and (b) prepays the freight costs both to and from such location; or (ii) deliver replacement components to the Customer, provided the Customer installs, at its cost, such components in or on the Failed Good (as instructed by Sensus). In all cases, Customer shall be responsible for returning the Failed Good to Sensus, including all costs associated with the return of the Failed Good, and Sensus shall be responsible for shipping the repaired or replaced good back to Customer's warehouse. Customer shall, in all cases, be responsible for the In/Out Costs. If Sensus determines that the returned good is not defective, Customer shall pay and/or reimburse Sensus for all expenses incurred by Sensus in the examination of the returned good.

    b. Customer's remedy under the warranty for services shall be, at Sensus' sole cost and expense, to correct or re-perform any defective or non-conforming services to assure compliance with the contract requirements.

    c. THIS SECTION 10 SETS FORTH CUSTOMER'S SOLE REMEDY WITH RESPECT TO A FAILED GOOD OR ANY DEFECTIVE OR NON-CONFORMING SERVICE.

12. Warranty Exceptions. This General Limited Warranty does not include costs for removal or installation of products, or costs for replacement labor or materials, which are the responsibility of the Customer. The warranties in this General Limited Warranty do not apply to, and Sensus has no liability for, goods that have been: installed improperly or in non-recommended installations; installed to a socket that is not functional, or is not in safe operating condition, or is damaged, or is in need of repair; tampered with; modified or repaired with parts or assemblies not certified in writing by Sensus, including without limitation, communication parts and assemblies; improperly modified or repaired (including as a result of modifications required by Sensus); converted; altered; damaged; read by equipment not approved by Sensus; for water meters, used with

substances other than water, used with non-potable water, or used with water that contains dirt, debris, deposits, or other impurities; subjected to misuse, improper storage, improper care, improper maintenance, or improper periodic testing (collectively, "Exceptions."). If Sensus identifies any Exceptions during examination, troubleshooting or performing any type of support on behalf of Customer, then Customer shall pay for and/or reimburse Sensus for all expenses incurred by Sensus in examining, troubleshooting, performing support activities, repairing or replacing any Equipment that satisfies any of the Exceptions defined above. The above warranties do not apply in the event of Force Majeure, as defined in the Terms of Sale.

13. THE WARRANTIES SET FORTH IN THIS GENERAL LIMITED WARRANTY ARE THE ONLY WARRANTIES GIVEN WITH RESPECT TO THE GOODS, SOFTWARE LICENSES AND SERVICES SOLD OR OTHERWISE PROVIDED BY SENSUS. SENSUS EXPRESSLY DISCLAIMS ANY AND ALL OTHER REPRESENTATIONS, WARRANTIES, CONDITIONS, EXPRESSED, IMPLIED, STATUTORY OR OTHERWISE, REGARDING ANY MATTER IN CONNECTION WITH THIS GENERAL LIMITED WARRANTY OR WITHT EH TERMS OF SALE, INCLUDING WITHOUT LIMITATION, WARRANTIES AS TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, NON-INFRINGEMENT AND TITLE.

14. SENSUS ASSUMES NO LIABILITY FOR COSTS OR EXPENSES ASSOCIATED WITH LOST REVENUE OR WITH THE REMOVAL OR INSTALLATION OF EQUIPMENT. THE FOREGOING REMEDIES ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES FOR THE FAILURE OF EQUIPMENT, LICENSED SOFTWARE OR SERVICES TO CONFORM TO THEIR RESPECTIVE WARRANTIES.

15. Limitation of Liability

    a. SENSUS' AGGREGATE LIABILITY IN ANY AND ALL CAUSES OF ACTION ARISING UNDER, OUT OF OR IN RELATION TO THIS AGREEMENT, ITS NEGOTIATION, PERFORMANCE, BREACH OR TERMINATION (COLLECTIVELY "CAUSES OF ACTION") SHALL NOT EXCEED THE TOTAL AMOUNT PAID BY CUSTOMER TO SENSUS UNDER THIS AGREEMENT. THIS IS SO WHETHER THE CAUSES OF ACTION ARE IN TORT, INCLUDING, WITHOUT LIMITATION, NEGLIGENCE OR STRICT LIABILITY, IN CONTRACT, UNDER STATUTE OR OTHERWISE.

    b. AS A SEPARATE AND INDEPENDENT LIMITATION ON LIABILITY, SENSUS' LIABILITY SHALL BE LIMITED TO DIRECT DAMAGES. SENSUS SHALL NOT BE LIABLE FOR: (I) ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES; NOR (II) ANY REVENUE OR PROFITS LOST BY CUSTOMER OR ITS AFFILIATES FROM ANY END USER(S), IRRESPECTIVE OF WHETHER SUCH LOST REVENUE OR PROFITS IS CATEGORIZED AS DIRECT DAMAGES OR OTHERWISE; NOR (III) ANY IN/OUT COSTS; NOR (IV) MANUAL METER READ COSTS AND EXPENSES.

    c. The limitations on liability set forth in this Agreement are fundamental inducements to Sensus entering into this Agreement. They apply unconditionally and in all respects. They are to be interpreted broadly so as to give Sensus the maximum protection permitted under law.

    d. To the maximum extent permitted by law, no Cause of Action may be instituted by Customer against Sensus more than TWELVE (12) MONTHS after the Cause of Action first arose. In the calculation of any damages in any Cause of Action, no damages incurred more than TWELVE (12) MONTHS prior to the filing of the Cause of Action shall be recoverable.

16. Definitions. Any terms used in this General Limited Warranty as defined terms, and which are not defined herein, shall have the meanings given to those terms in the Terms of Sale.

    a. "Agreement" means this General Limited Warranty, Customer's purchase order (except any Additional Terms), Sensus' Acknowledgement Form (if any), Sensus' invoice and the Terms of Sale.

    b. "DA Devices" means RTMs and RTUs.

    c. "Echo Transceiver" (formerly "FlexNet Network Portal" and "FNP") identifies the Sensus standalone, mounted relay device that takes the radio frequency readings from the SmartPoint Modules and relays them by radio frequency to the relevant FlexNet Base Station.

    d. "End User" means any end user of electricity/water/gas that pays Customer for the consumption of electricity/water/gas, as applicable.

    e. "Equipment" means the Field Devices, RF Field Equipment, Server Hardware, and any other goods sold hereunder.

    f. "FlexNet Base Station" (formerly "Tower Gateway Base Station" and "TGB") identifies the Sensus manufactured device consisting of one transceiver, to be located on a tower that receives readings from the SmartPoint Modules (either directly or via an Echo Transceiver) by radio frequency and passes those readings to the RNI by TCP/IP backhaul communication.

    g. "Field Devices" means the meters, SmartPoint Modules, DA Devices and HAN Devices.

    h. "Force Majeure" shall have the meaning set forth in the Terms of Sale.

    i. "HAN Devices" means the PCTs, IHDs and LCMs.

    j. "IHDs" means the in-home displays.

    k. "In/Out Costs" means any costs and expenses incurred by Customer in transporting goods between its warehouse and its End User's premises and any costs and expenses incurred by Customer in installing, uninstalling and removing goods.

    l. "LCMs" means the load control modules.

    m. "PCTs" means the programmable controllable thermostats.

    n. "Remote Transceiver" (formerly "FlexNet Remote Portal" and "FRP") identifies the Sensus standalone, mounted relay device that takes the radio frequency readings from the SmartPoint Modules and relays them directly to the RNI by TCP/IP backhaul communication.

    o. "RNI" identifies the regional network interfaces consisting of hardware and software used to gather, store, and report data collected by the FlexNet Base Stations from the SmartPoint Modules.

    p. "RF Field Equipment" means, collectively, FlexNet Base Stations, Echo Transceivers and Remote Transceivers.

    q. "RTMs" means the telemetric remote telemetry modules.

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r.   "RTUs" means telemetric MicroRTU (T866).

s.   "Server Hardware" means the RNI hardware and the FlexServer hardware.

t."   SmartPoint™ Modules" identifies the Sensus transmission devices installed on devices such as meters, distribution automation equipment and demand/response devices located at Customer's End Users' premises that take the readings of the meters and transmit those readings by radio frequency to the relevant FlexNet Base Station, Remote Transceiver or Echo Transceiver.