Contents

309.1 Purpose

The purpose of this standard is to identify and document specific procedures that will be followed and responsible parties that will be involved when completing the Point to Point verification.

This procedure complies with PHMSA 49 CFR Part 195.446(c)(2) and 192.631(c)(2) requirement to "conduct a Point to Point verification between SCADA displays and related field equipment when field equipment is added or moved and when other changes that affect pipeline safety are made to field equipment or SCADA displays."

Verify field equipment or instrumentation states or values are correctly received and displayed by the SCADA system to the Controller. These states or values can be status points, analogs, accumulators, SCADA messages, data quality flags, etc. Examples of field equipment and instrumentation displayed to the Controller can be:

- Analogs – pressures, flow rates, temperatures, tank levels, valve position, setpoints, etc.
- Accumulators – gross and net volumes / mass, countdowns, etc.
- SCADA Messages – unit lockout, low ac, low dc, etc.
- Status – pumps, motors, meters, valve position, tanks, provers, batch changes, power, etc.
- Data Quality Flags – manual, old, stale, override, etc.

Verify that SCADA commands issued by Operations Controllers are correctly received in the field from the SCADA system. These commands can be pump start/stop, valve open/close, flow, and pressure set points.

This standard shall be used by American Midstream Engineering & Field Departments, as well as all contractors engaged in construction and commissioning work for American Midstream.

This standard does not include start-up or tuning of instruments and controls. A Point to Point verification is required when:

- New field instruments are installed on the pipeline.
- Like-for-like field instrumentation replacement.
- New SCADA system implementation.
- PLC/RTU/Omni logic changes for existing points.

PHMSA expects operators to diligently and promptly complete actions required by the rules. PHMSA inspectors will assess an operator's plans, procedures, and associated records to evaluate the operator's process for completing Point to Point verification in a timely manner. Operators may include multiple timing criteria within their procedures for completing Point to Point verifications. Although there may be others, two examples of timing criteria are: data points already being used in the control room; and data points being added or checked out as a part of a system enhancement or replacement. Those data points already being used by Controllers should be verified the same day a verification process becomes necessary. Those data points being added or checked out as a part of a major system enhancement or replacement should be verified before those data points are turned over to controllers for use.

309.2 Responsibilities

- **Field Representative (Field Technician, I&E Technician, PLC Specialist, I&C Engineer, Contractor)**

    1. Development of definition document of the PLC/RTU/Omni SCADA points (i.e. configuration file, memory map, or bit pattern).
    2. Provide SCADA and Control Center the definition document a minimum of 5 business days prior to Point to Point verification.
    3. Ensure communications have been set up and are functioning.
    4. Confirm and document the point functionality between the field device and field PLC/RTU/Omni into SCADA registers.
    5. Confirm the point functionality between the field PLC/RTU/Omni SCADA registers and Control Center SCADA database.
    6. Coordinate the testing with SCADA and/or Control Center personnel.
    7. Have the proper equipment onsite for testing (i.e. simulator, dead weight tester, etc.) Must be Operator qualified to perform associated tasks.

- **SCADA Analyst**

    1. Responsible for coordinating with the Field Representative for the definition document to create tags for SCADA screens.
    2. Perform preliminary verifications of polled tags to ensure that the PLC/RTU/Omni tags have been mapped correctly to the SCADA database.
    3. Perform data integrity checks of these tags to verify that tags are returning the proper data type and fall in the proper data range.
    4. Verify that the tags on all screens have been registered.
    5. After the tags and data have been created and verified, turn over to OCC to perform Point to Point with field personnel.
    6. Troubleshoot any issues that arise during Point to Point verification.

- **OCC Personnel**

    1. Develop screens displaying the associated points (not all points may be displayed on a screen).
    2. Develop Point to Point worksheet (CRM-APP-302: Point to Point verification) and send to personnel performing field verification.
    3. With assistance from an Alarm Management Analyst, perform documentation and rationalization of alarm points.
    4. Coordinate date and time to perform verification with field personnel.
    5. Confirm and document the point functionality between SCADA database and displays.
    6. Test that all setpoints and all appropriate actions are taken for alarms and shutdowns.

7. Train Controllers on any new points added or any changes to alarm or shutdown setpoints.
8. Controllers must be Operator qualified to perform tasks.

309.3 Equipment

The following is a list that may include, but not limited to, equipment that may be used during testing:

- 4-20mA Loop Simulator
- Frequency Generator/Meter
- Resistance Decade Box
- HART Communicator
- Dead Weight Tester / Pressure Simulator
- Multi-meter / Process Meter
- 1-5 Volt Simulator

The calibration of all test equipment shall be checked before being used for any calibration of site instruments.

Test equipment which shall be used as the on-site calibration standard or benchmark shall be sent annually to an independent testing laboratory for certification. This equipment shall be used only to calibrate the field test instruments and shall be stored in a secure place when not in use.

The test instrument calibration check shall be recorded on a label showing the date and the person performing the check. The label shall be attached to the piece of equipment in such a place that it is easily visible but not easily removed.

309.3.1 General Instrument Point to Point Guidelines

A record showing the instrument tag number, date of calibration, signature, and calibration data shall be kept for all instruments. A responsibility of the Instrument Technician is to see that these records are kept. An instrument calibration is valid for 12 months, not to exceed 15 months. If an instrument is beyond the 12 – 15-month calibration date, it must be re-calibrated before being Point to Point tested to the SCADA system. If an instrument has a valid calibration record, a simulator may be used at the instrument to Point to Point the device to SCADA.

In general, a Point to Point check of all indicating and control instruments shall be made at a minimum of three points: 0%, 50%, and 100% of range.

Local test switches or buttons that have been designed as a method to test the activation of the device may be used to Point to Point the device to SCADA.

If an instrument has a valid calibration record, opening of failsafe wire loops or closing of non-failsafe wire loops at the device may be used to test the activation of the device to SCADA.

All electronic instruments and control loops shall be Point to Pointed to SCADA for correct values with ranges verified. The procedure shall be reviewed for compatibility with the actual type instruments being tested. Verify all actual readings before and after testing instruments and loops.

- **Instrument Loop Testing**

1. For 4 – 20mA loops, such as pressure and temperature with a valid calibration record, connect a suitable transmitter simulator. Apply signals of 0%, 50%, and 100%, and verify readings with the PLC and SCADA.
2. For failsafe loops with a valid calibration record, open the loop at the instrument and verify reading at the PLC and SCADA.
3. For non-failsafe loops with a valid calibration record, close the loop at the instrument and verify reading at the PLC and SCADA.
4. For control output loops, before SCADA sends any new value, note and document the last value sent for this device. SCADA shall send values of 0%, 50%, and 100% of range. Verify readings in the PLC. The last value send by SCADA shall be the value documented before testing the control loop.

- **HART Smart Instrument Loop Testing**

1. Tie in a HART compatible hand-held device to the loop. Note and verify the reading with PLC and SCADA.
2. Place the transmitter in output mode.
3. Verify high and low transmitter ranges.
4. Simulate 0%, 50%, and 100% of range and verify the reading in the PLC and SCADA.
5. Put transmitter back in normal mode.
6. Remove handheld communicator from loop.
7. Verify actual reading as noted before testing and with the PLC and SCADA.

- **Valve Control and Status**

1. Actual MOV controls will be sent to all valves. The valve status will be verified for full open, full close, and valve transition.
2. Status for non-MOV valves will be verified for full open, full close and valve transition.

- **Pump Control and Status**

1. If possible, SCADA will start and stop all pumps. If not possible, the racking out of the unit starter and simulation of the starting, running, and stopping of the pump is acceptable.
2. SCADA will send the start and stop commands to verify the sequencing and status of the pump. The status of the associated suction and discharge valves will also be verified if available to SCADA.

- **Mode Control and Status**

    1. If possible, SCADA will start and stop all modes. If not possible, the simulation of modes is acceptable.

- **Discrete Control and Status**

    1. Discrete controls with single bit feedback such as ESD, crash, arm, enable, and disable will be sent from SCADA with actual feedback for the control. If this is not possible, simulation of the feedback is acceptable.

- **Prover Control and Status**

    1. With active flow through the desired meter(s), SCADA will send controls that are part of the proving process. Feedback for all status of associated valves and equipment will be verified.

- **Meter / Accumulator**

    1. Verify meter by applying pulses to change meter count.
    2. Verify meter by reading local equipment compared with SCADA. If meter is not sourced through a flow computer, verify rollover value by forcing value of totalizer register near rollover event and apply pulses to roll meter over through zero value.

309.4 Typical SCADA Points and Verification Steps

309.4.1 Valves

- States of invalid, open, closed, and transition are pushed from the field to the SCADA system. Controller verifies receipt of each state on the SCADA system.
- Commands to open and close a valve are entered by the Controller via a popup menu. A Field Technician will verify the receipt of each state in the field.

309.4.2 Pumps / Compressors

- States of on or off are pushed from the field to the SCADA system. A Controller will verify the receipt of each state on the SCADA system.
- Commands to start and stop a pump are entered by the Controller via a popup menu. A Field Technician will verify the receipt of each state in the field.
- States of remote and local are pushed from the field to the SCADA system [*when this feature is used*]. A Controller will verify the receipt of each state on the SCADA system.
- Alarm message bit values of in alarm and not in alarm are pushed from the field to the SCADA system [*when this feature is used*]. A Controller will verify the receipt of each alarm

message on the SCADA system.

309.4.3 Tanks

- Values representing the low-level range and the high-level range are pushed from the field to the SCADA system. A Controller will verify the receipt of each value on the SCADA system.
- Hardware alarm bit values for HI HI, High, and LO LO are pushed from the field to the SCADA system [*when this feature is used*]. A Controller will verify the receipt of each alarm on the SCADA system.

309.4.4 Analog Inputs (flow, pressure, temperature, control valves, etc.)

- Values representing the low range, an agreed upon middle range, and the high range are pushed from the field to the SCADA system. A Controller will verify the receipt of each value on the SCADA system.

309.4.5 Meters and Accumulators

- An agreed upon value is pushed from the field to the SCADA system. A Controller will verify the receipt of value on the SCADA system.

309.4.6 Analog Set Points

- Agreed upon values are pushed from the SCADA system (via a popup menu) to the field. A Field Technician will verify the receipt of each value on the PLC and a Systems Analyst will verify the receipt of feedback.

309.4.7 Other Digital Inputs

- These can represent up to two state conditions. Value(s) are pushed from the field to the SCADA system. A Controller will verify the receipt of value(s) on the SCADA system.

309.4.8 Other Digital Outputs

- These can represent up to three state conditions. Value(s) are sent from the SCADA system to the field. A Field Technician will verify the receipt of value(s) in the field.

309.5 Definition and Listing of Safety-Related Points

Per PHMSA, the definition of a safety-related point is:

"Safety related alarm is a process to inform a Controller of any operational factor that is necessary to maintain pipeline integrity or that could lead to the recognition of a condition that could impact the integrity of the pipeline or develop into an abnormal or emergency condition."

The requirement is to verify all safety-related points in the SCADA system. This also includes calculated (software generated) points that are safety-related.

Examples of points that may be considered safety-related (and therefore would need to be verified when changes are made to field equipment or SCADA displays) include, but may not be limited to (will be finalized once D&R is completed):

- Status of main line valves
- Mainline pressures and flow rates
- Tank levels
- Station in local control
- Personnel in a normally unmanned station
- Station inlet and discharge pressures
- Pump / compressor status
- Leak detection
- Pressure regulator inlet and outlet pressures
- PLC/RTU communications status
- Emergency shutdown status
- Odorant alarms
- Composition alarms, such as H_2S and water content
- Filtering equipment levels-scrubbers / dehydrators
- Flame, gas, and vapor detectors
- Power supply indications (low battery, AC power failure, UPS failure)

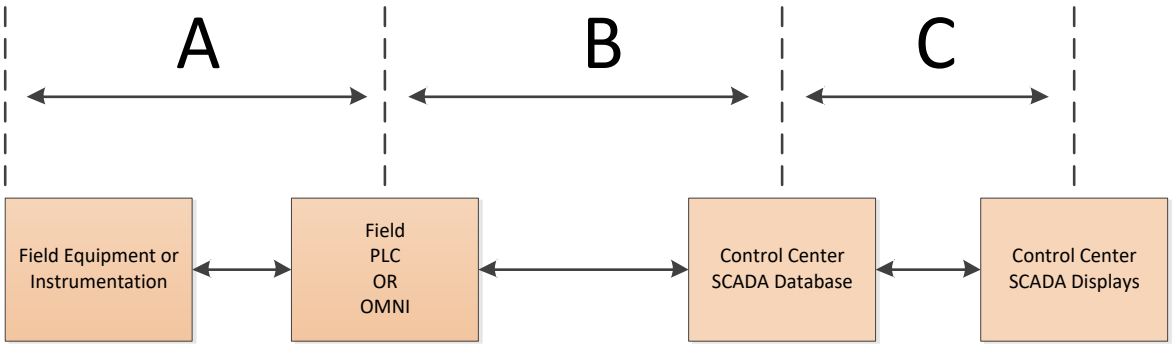
309.6 Point to Point Pre-check

The initial inspection shall consist of a check of all instruments against the specifications for:

- All control system communications are established. The communication networks include: ethernet, satellite, wireless broadband, etc.
- Correct instrument tagging
- Correct model and serial numbers
- Instrument ranges
- Physical damage
- Physical location as verified by available drawings: P&ID, schematics, plot plans, etc.

309.7 Point to Point Verification

There are three distinct segments that comprise communications from the equipment in the field to the controller display.



1. Field equipment or instrumentation to Field PLC (“Segment A”)
2. Field PLC to Control Center SCADA database (“Segment B”)
3. Control Center SCADA database to SCADA display (“Segment C”)

Listed below are work activities (and the appropriate sections) that require testing / validation:

- PLC installation, replacement, program changes, or I/O wiring changes (Segments A, B, and C)
- Field equipment or instrumentation installations / replacements (Segments A, B, and C)
- Modifications to the PLC (Segments A, B, and C)
- Field instrument calibrations (Segment A)
- Field equipment or instrumentation replacement in kind (Segment A)
- SCADA display modifications (Segment C)
- SCADA database modifications (Segment C)

309.7.1 Field device to PLC Test (Segment A)

The bit pattern will be point tested as a part of the SAT. The field representative shall document the testing of all field devices into the PLC’s SCADA registers.

- Test individual **status points** from the field device to the PLC:

  1. Verify that the device is wired to the correct PLC input point address.
  2. Verify that the PLC input point is mapped to the correct SCADA register bit.
  3. Verify that the SCADA register indicates the correct status state.
     If operational conditions safely allow for it, toggle the field device or the PLC input bit and verify that the SCADA register sees the correct state.

- Test individual **analog points** from the field device to the PLC:

  1. Verify that the input is wired to the correct PLC input analog address.
  2. Verify that the engineering units, scale, and calibrated range are correct.
  3. Verify that the PLC input analog is mapped to the correct SCADA register in engineering units.

4. Verify that the SCADA register indicates the correct value.
5. If operational conditions safely allow for it, simulate the value from the field with a calibrator or write a value to the PLC engineering unit register, and verify the SCADA register sees the correct value.

- Test individual **accumulator points** from the field device to the PLC:

1. Verify that the input is wired to the correct PLC input analog / frequency address.
2. Verify that the engineering units and calibrated range are correct.
3. Verify that the PLC input accumulator is mapped to the correct SCADA register in engineering units.
4. Verify that the SCADA register indicates the correct value.
5. If operational conditions safely allow for it, simulate the value from the field with a calibrator / frequency generator or write a value to the engineering unit register, and verify the SCADA register sees the correct value.

- Test individual **commands** to the field device from the PLC:

1. Verify that the device is wired to the correct PLC output point address.
2. Verify that the PLC output point address is mapped to the correct SCADA register bit.
3. With the output forced off, toggle the SCADA command and verify the SCADA register bit indicates the correct command state.
   If operational conditions safely allow for it, toggle the point to the field, and verify the that equipment commanded state is correct.

309.7.2 PLC to SCADA Database (Segment B)

- Test individual **status points** from the PLC's SCADA register to the SCADA database:

1. Verify that the PLC's SCADA register bit is mapped to the correct SCADA database point.
2. Verify that the SCADA database point indicates the correct status state.
   If operational conditions safely allow for it, toggle the point from the field or the PLC input bit, and verify the SCADA database sees the correct state.

- Test individual **analog points** from the PLC's SCADA register to the SCADA database:

1. Verify that the PLC's SCADA register bit is mapped to the correct SCADA database point.
2. Verify that the engineering units and calibrated range are correct in the PLC and SCADA database.
3. Verify that the SCADA database indicates the correct value.
4. If operational conditions safely allow for it, simulate the value from the field with a calibrator or write a value to the engineering unit register, and verify the SCADA

database sees the correct value.

- Test individual **accumulator points** from the PLC's SCADA register to the SCADA database:

  1. Verify that the PLC input analog / frequency address is mapped to the correct SCADA database point.
  2. Verify that the engineering units and calibrated range are correct in the PLC and SCADA database.
  3. Verify that the SCADA database indicates the correct value.
  4. If operational conditions safely allow for it, simulate the value from the field with a calibrator / frequency generator or write a value to the engineering unit register, and verify the SCADA database sees the correct value.

- Test individual **commands** from the SCADA database to the PLC:

  1. Verify that the PLC output point address is mapped to the correct SCADA database point.
  2. With the PLC output forced off, toggle the SCADA command, and verify the SCADA register bit indicates the correct command state.
     If operational conditions safely allow for it, toggle the SCADA command to the field, and verify that the equipment commanded state is correct.

309.7.3 SCADA Database to SCADA Display (Segment C)

The SCADA system provides point listing screens that may be used for testing communication between the PLC and the SCADA database. Not all SCADA points are included on a controller display. When this is the case, testing between the PLC and the SCADA database satisfies the Point to Point testing requirement. When SCADA points are included on a controller display, every display that has a SCADA point must be tested.

Test transfer of data between the SCADA database and the field by calling up every display that has a SCADA point or by calling up the point listing screen when the point is not on any controller display. Prior to start of test, notify the Operations Controller to determine any planned critical activities.

- Test individual **status points** from the SCADA database to the SCADA display(s):

  1. Verify that the state of the point in the SCADA database is equal to the state of the point on the SCADA display(s).
  2. If operational conditions safely allow for it, toggle the point from the field or manually change the point from the SCADA database, and verify the point is correct on the SCADA display.

- Test individual **analog points** from the SCADA database to the SCADA display(s):

    1. Verify that the value of the point in the SCADA database is equal to the value of the point on the SCADA display(s).
    2. Verify that the engineering units between the SCADA database and SCADA display(s) are correct.
    3. If operational conditions safely allow for it, simulate the value from the field with a calibrator or write a value to the SCADA database, and verify the point value is correct on the SCADA display.

- Test individual **accumulator points** from the SCADA database to the SCADA display(s):

    1. Verify that the value of the point in the SCADA database is equal to the value of the point on the SCADA display(s).
    2. Verify that the engineering units between the SCADA database and SCADA display(s) are correct.
    3. If operational conditions safely allow for it, simulate the value from the field with a calibrator/frequency generator or write a value to the SCADA database, and verify the point value is correct on the SCADA display.

- Test individual **commands** from the SCADA display(s) to the SCADA database:

    1. Verify that the SCADA display(s) point / device is mapped to the correct SCADA database point.
    2. With the SCADA output turned off, toggle the SCADA command, and verify that the SCADA database point indicates the correct command state.
       If operational conditions safely allow for it, toggle the SCADA command to the field, and verify that the equipment commanded state is correct.

309.8 Point to Point Documentation and Archival

Point to Point testing is to be documented on CRM-APP-302: Point to Point verification. The office of record is the Control Center. After verification is complete, the spreadsheet is to be archived in the Control Center network drive.

End of Procedure.

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309.9 Reviewers

10/8	Kimberly Voltaire				

309.10 Revision Log

Rev No.	Date	Action	Approved By
1		Complete rewrite of procedure	
2	10/8	Comprehensive edit	