



SCADA Functional Checkout Process

Summary	The SCADA Functional Checkout Process describes the implementation, documentation and communication required between Gas Control, Gas Engineering, SCADA, and Gas M&C for the functional checkout of all Gas SCADA changes.
Target Audience	Gas System Operations, Gas Control: Gas Control Manager, Gas System Supervisor, Transmission Coordinators, Gas System Operators, Gas Station Engineering, Gas SCADA, Gas M&C.
Safety	This process describes the roles, responsibilities and process to ensure that engineers, supervisors, M&C technicians and control room personnel are provided with information, tools and training needed to test changes to the Gas SCADA system in order to operate PG&E's pipeline system safely.
Before You Start	<p>Qualifications: Senior Transmission Coordinators, Transmission Coordinators and Gas System Operators are to complete Operator Qualification ASME B31Q for required tasks. (monitoring, remote open/close valves, start/stop compressors)</p> <p>Training: Senior Transmission Coordinators, Transmission coordinators and Gas System Operators will complete all training as detailed in TD4436P-06, Gas Control Room Training Procedure.</p>



SCADA Functional Checkout Process

Table of Contents

1	Scope	3
2	Roles and Responsibilities	3
3	Approvals	4
4	FCO Activities and Quality Management	5
5	FCO Process - General	5
6	FCO Package and Process	6
7	Document Management	Error! Bookmark not defined.
8	Loop Test	9
9	Test Documentation:	9
10	Automation Procedures:	10
11	FCO Database Documents:	11



SCADA Functional Checkout Process

1 Scope

The primary goal of Functional Checkout (FCO) is to ensure systems are constructed as designed, fully tested with proper documentation, and ready for commissioning. A primary objective of FCO is verification that the electrical equipment and instrumentation are operational and that any problems discovered during FCO are resolved.

FCO achieves its primary goal through verification of the correct selection, application, calibration, installation, and operation of installed electrical equipment and instrumentation.

2 Roles and Responsibilities

Title	Role	Responsibilities
Project Engineer	Manages major projects	Manages preparation of design documents for major projects, communicates the proposed design and obtains approval from all applicable parties Verifies that procedures are followed and all applicable documentation is prepared for commissioning and turn over to Operations
Responsible Engineer	Manages specific portion of a project (i.e. control system engineering)	Prepares design documents for the portion of the project they are responsible for Verifies that procedures are followed and all applicable documentation is prepared for their portion of a project
Facilities Engineer	Manage Facility Design Changes	Reviews and recommends proposed design changes Documents design changes and test results
Controls Engineer	Provides instrumentation and control system design and programming	Documents new and revised control system software per G14281 Prepares FCO documentation



SCADA Functional Checkout Process

		for all new or revised datapoints Participates in FCO process
SCADA Engineer	Provides SCADA system HMI design and programming including screen display and database development or revision	Provides screen display and database development based on API 1165 and the IT Gas SCADA Change Management Process Manual Participates in point to point testing and documents the results
Gas M&C Technicians	Installs new instrumentation and control equipment	Participates in point to point testing via FCO process
Gas Control Manager (or Delegate)	Overall management of changes to the SCADA system	Reviews and approves all major proposed SCADA changes
Gas Control Personnel	Operate the gas transmission and distribution system	Provide input for proposed SCADA system HMI changes Assist with point to point testing of new or revised datapoints

3 Approvals

The FCO test procedures shall be approved by the following individuals prior to conducting the tests:

- Project Engineer or Manager (Optional)
- FCO Procedure Author
- SCADA Engineer
- Manager, Gas Control (or Delegate)

After conducting the test, the following individuals will declare the test as complete:

- Lead Test Implementer
- Test Witness (from Operations)

The following individuals will accept the test results:



SCADA Functional Checkout Process

- Manager, Gas Control (or Delegate)
- Responsible Party, Gas Control

4 FCO Activities and Quality Management

FCO Activities:

Verify that inspection of the installation is complete.

Calibrate devices and test instrument/control loops and functional subsystems to prepare the facility for commissioning.

After individual components are verified, instrument/control loops and other subsystems are interconnected and functionally verified to ensure that operation is within the design parameters.

FCO Quality Management:

The Responsible Engineer assigned to the project is responsible for preparing the FCO test procedures and obtaining review and approvals prior to implementing them. Quality management is determined by the following:

A comprehensive list of devices, equipment, and systems to be functionally tested is developed (Commissioning Tag List).

Gas M&C technicians document tests and inspections of those items on pre-approved FCO procedure documents.

The field FCO lead (i.e. Gas M&C Foreman) monitors methodology and reviews completed certificates and redlines to engineering drawings.

Approved documents and certificates are transferred from the Lead person to the Responsible Engineer for further review, approval and archiving.

5 FCO Process - General

FCO begins when a facility, system, or portion of a system is "released" from Construction. "Ready for FCO" requires Construction to have completed all instrument and electrical activity within the system such as: wiring and cables pulled, terminated, and tested, wire tagging completed, tubing pressure tested, etc. It is the responsibility of the Gas M&C construction department to ensure that the system is ready for release to FCO.

FCO begins with testing, calibration, and adjusting individual electrical, mechanical, and instrumentation components to assure proper operating characteristics. After individual components are verified, instrument/control loops and other subsystems are functionally verified to ensure that operation is within the design parameters.



SCADA Functional Checkout Process

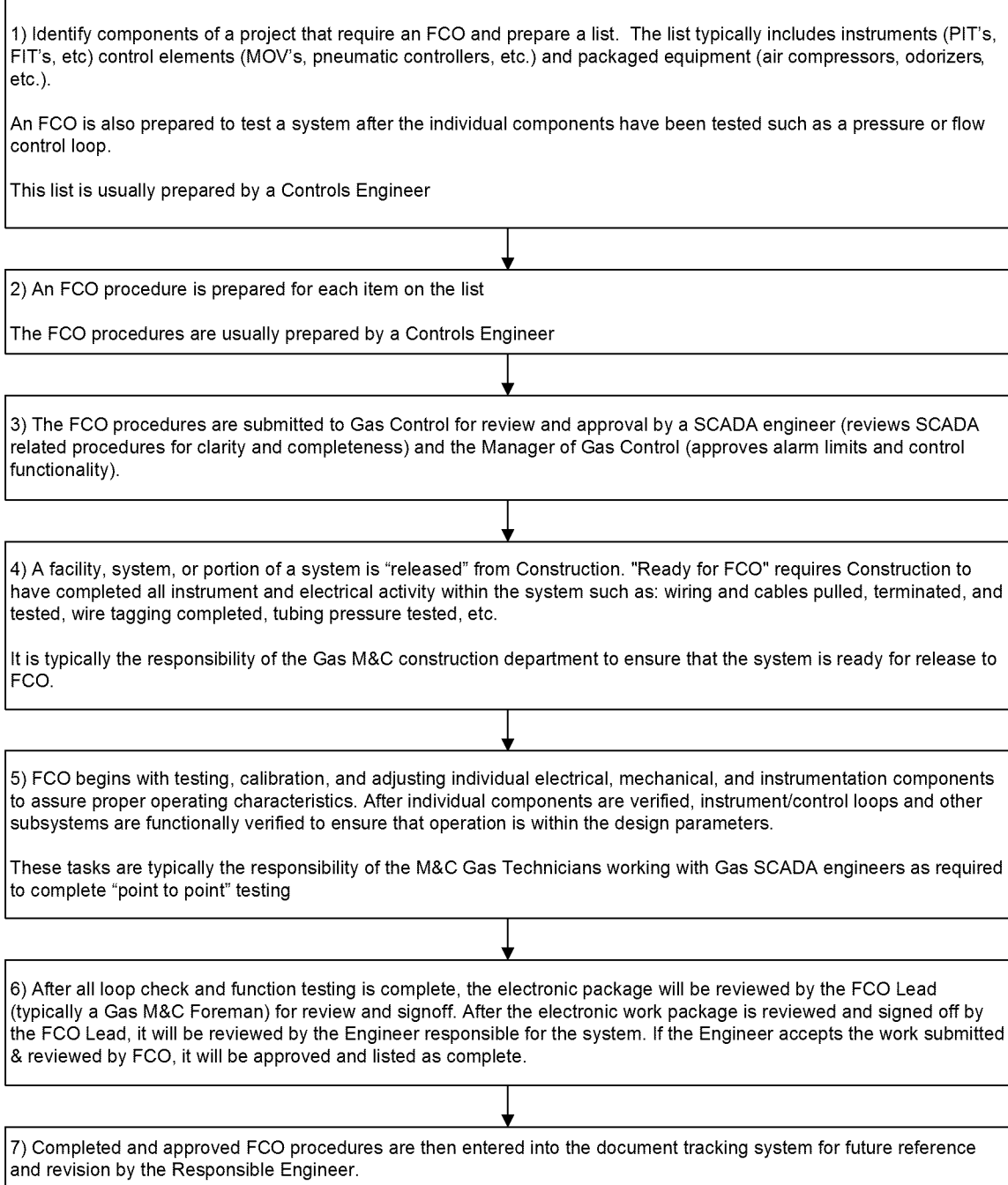
FCO packages are organized by system and sub-system for the appropriate area and will be created by the Responsible Engineer. These will be utilized as the primary tool for performing checkout and tracking FCO progress.

6 FCO Package and Process



SCADA Functional Checkout Process

FUNCTIONAL CHECKOUT (FCO) PROCESS





SCADA Functional Checkout Process

FCO packages will be generated and titled based on project tags and the documents (drawings and data). Each FCO procedure includes approval signatures for the required parties that signify review and approval prior to the start of testing. All project tags – both device & software tags – will be organized into systems and sub-systems.

FCO certification of a system or subsystem is achieved upon completion and certification of all testing steps on all associated tags in that system.

Care custody and control of FCO work packages:

The FCO database will reside at a SharePoint site. All FCO work completed will be documented via electronic Work Package folders created by scanning completed FCO's.

Work package & FCO Requirements - below is listed work required by the members of the FCO team:

The FCO Technician (typically a Gas M&C technician) Responsibilities:

- Review each electronic FCO package before beginning work to ensure proper test equipment and communication links to Gas Control are available. This will include certificates (calibration sheets, check sheets, and acceptance sheets), procedures, and drawings related to the systems/loops under check.
- Take the FCO package to the field and verify or provide all information given or missing from devices or documentation contained in the FCO Work Package. The Technician shall initial steps in the FCO Work Package as they are checked and verified.
- Verify that the installation (electrical, mechanical, and tubing) is as per design, and all incomplete work items are listed on the punch list.
- Verify equipment by performing a point-to-point check and simulating signals from field devices to the final control equipment.
- Verify all information listed for each device, typically looking for, but not limited to:
 1. Serial Number
 2. Model Number
 3. Set point on hardware devices (frequently not listed)
 4. Ranges

Blank fields on the Loop/subsystem Functional Checkout sheet where no information is required shall be designated with N/A for information that is not applicable to the device. Where there are blank fields on the Loop/System Functional Checkout sheet, for data that is applicable and available, with field verification, the technician will write the correct information into these blank fields, for input to the database for the project.



SCADA Functional Checkout Process

Each device will be submitted by FCO technicians on the Functional Checkout electronic record after the installation is verified correct, data verified, and point to point conductor tests are complete. Power up of the system and function testing by the FCO technician will be done after all verification and point-to-point activities are complete.

Clearance Procedures: each FCO test procedure will conform to the applicable clearance procedure requirements in WP4100-10 - Gas Clearance Procedures for Facilities Operating Over 60 PSIG.

Calibration documents: When FCO performs instrument calibrations, a Calibration Record must be filled out with as found and as left calibration settings as listed on the Data Sheet and P&ID's. Calibration Records must be submitted by the FCO Instrument Technician.

Design or scope change documents: Design changes from Engineering will be entered into the FCO database as approved. This will include any affected drawings and datasheets. In the event of a design change affecting a loop or system that has been signed off as FCO complete, the Station Engineer responsible for that system will review the changes and, if necessary, revert the status of the loop or system back to an incomplete state.

Final package completion: After all loop check and function testing is complete, the electronic package will be reviewed by the FCO Lead (typically a Gas M&C Foreman) for review and signoff. After the electronic work package is reviewed and signed off by the FCO Lead, it will be reviewed by the Station Engineer responsible for the system. If the Station Engineer accepts the work submitted & reviewed by FCO, it will be approved and listed as complete.

7 Loop Test

Verify instruments being tested meet the respective requirements and have valid calibration tags and valid identification tags.

All individual instruments in a loop will be calibrated and tagged with a calibration tag.

All signals from the initiating field device to the receiver (Process Monitor), will be produced by placing a simulated process variable on the input of the transmitting device. Simulation of a signal from the field device output to the receiving device will not be allowed except for logic simulation, AFTER the loop has been tested with a simulated process variable.

All terminations in a junction box through which loop wiring passes will be completed.

8 Test Documentation:

All system, loop or functional tests will be witnessed by a representative from the operating department responsible for the device or their designee. Only devices being tested that meet specifications and function within the specified tolerances will be accepted and signed off.

Electronic test packages will be assembled for each system prior to testing. This package will be available and completed in the field during loop testing. Each electronic loop folder may include, but not be limited to, as applicable, the following documents:



SCADA Functional Checkout Process

- Instrument Summary
- Wiring diagrams
- Ladder diagrams
- Control schematics
- Breaker/relay settings
- Data sheets
- P&ID's with system boundaries defined
- Instrument loop diagram.
- Loop description or theory of operation as required
- Completed cal. sheets for each component in the loop
- Layout and location drawings when required
- Vendor data and data sheets as required
- Loop folder checklist and table of contents
- Associated design change documents

A master set of instrument specification sheets and vendor data shall be available for reference and mark-up at a central location. Instrument data sheets shall be checked and verified during bench calibration. The calibration sheet should include any information required for field check-out of the loop.

All red line changes shall have FCO Lead technician approval. Approvals shall be signed and dated. If a drawing has an obvious mistake or a wire has not been landed correctly, proceed with the mark up or fix. Approval can be given during sign off of the drawing. Any major or repetitive changes should have station engineering approval before proceeding, especially if there is a significant cost or time impact.

Before leaving a panel or junction box, assure that all internal components are installed and the panel locked to prevent unauthorized entry. All panels or termination boxes shall have an up-to-date copy of the wiring or circuit schedule information placed inside the box.

9 Automation Procedures:

During FCO, Gas Control Strategy and Support should be present to confirm proper operation, monitoring, and response of the control and SCADA system to field device inputs and outputs. During this time SCADA should be referencing key design and programming documents and



SCADA Functional Checkout Process

confirming that the system installation meets the intent of system design criteria. During FCO these checks will be on a point by point field device basis. Higher level and integrated control (such as PID operation or complicated sequences) will be checked during commissioning.

As each field device is checked by an FCO field technician, Gas Control Strategy and Support will verify the controller and SCADA functions for the following types of operations:

That the alarms detailed in the alarm list for each point are generated in the logger and the alarm viewer with the appropriate priority levels and groups assignments.

NOTE

During testing, Gas Control Strategy and Support and a Gas Control Operator will check screen displays for dynamic updates, point statuses and analog ranges. All identified SCADA displays will be verified during testing and the display name documented. Include as found, as left, and a final verification of "returned to normal" status.

Loop checks will be made working with field personnel. These will include standard control functions such as HMI start and stop, open and close, and stroking analog outputs using SCADA manual loading stations and PID faceplates with manual output controls.



10 FCO Database Documents:

A baseline document transfer to the database will be done by scanning the completed FCO procedure.

All documents transferred to the database will require a technical review and approval. Only documents required for FCO reference will be transmitted.

A file index will be created & maintained to log all documents transferred into and out of this filing system.

[INSTRUCTION for Cautions and Warnings - Use the automated toolbar to format the caution or warning then copy and paste the appropriate symbol below in front of the word.

 = CAUTION or  = WARNING]

END of Instructions



SCADA Functional Checkout Process

Definitions

FCO; Functional Checkout

HMI; Human Machine Interface

PLC; Programmable Logic Controller

SCADA; Supervisory Control and Data Acquisition

Implementation Responsibilities

Manager of Gas Control

Training and Simulations, Tailboards, Quarterly Operations Meetings

Station Engineer

Prepare FCO Procedure

SCADA Engineer

Review and Approve Procedure, Provide HMI end of Point to Point Tests

Governing Document

Utility Standard: GT&D Gas System Operations Control Room #:TD-4436S

Compliance Requirement/Regulatory Commitment

CFR 49 192.631, Control Room Management Rule

Reference Documents

Developmental References:

TD-4436P-04 Management of Pipeline Changes

TD-4436P-01 Control Room Management – Information Management Procedure

WP4100-10 Gas Clearance Procedures for Facilities Operating Over 60 PSIG

WP4900 Gas Transmission and Distribution Design Change Procedure



SCADA Functional Checkout Process

WP4901 SCADA RTU Installation on Gas Facilities

G14281 Procedure for Revising Application Software for Microprocessor-Based Controls

Functional Checkout Procedure Template

EDMS 005291280 Change Management Process Manual for IT Gas SCADA Support

Supplemental References:

Department of Transportation Pipeline and Hazardous Material Safety Administration 49 CFR Parts 192 and 195

Appendices

Functional Checkout Procedure Template

Document Recision

Not applicable, this is a new document.

Approved By

Redacted

Manager Gas Control

Document Owners

Redacted

Manager Gas Control

Document Contact

Redacted

Senior SCADA Engineer



SCADA Functional Checkout Process

MOC Tracking and Revision Notes

Date	Rev #	Comments	Approved By
9/30/11	1	Minor changes by <input type="text" value="Redacted"/>	<input type="text" value="Redacted"/>
6/7/12	2	Section 6 - Calibration documents: When FCO performs instrument calibrations, a Calibration Record must be filled out with as found and as left calibration settings as listed on the Data Sheet and P&ID's. Calibration Records must be submitted by the FCO Instrument Technician. (removed the word final and added as found and as left)	<input type="text" value="Redacted"/>
12/04/12	3	Added Note to Section 9 regarding verification of SCADA displays, as found, as left and returned to normal status. Also, updated SCADA personnel with Gas Control Strategy and Support.	<input type="text" value="Redacted"/>