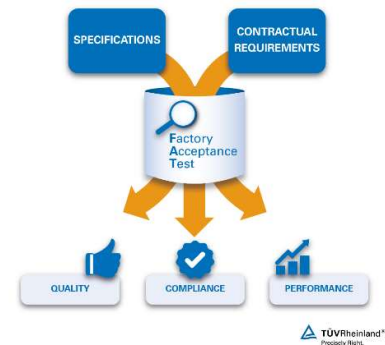


TRAFFIC SIGNAL CONTROLLER FACTORY ACCEPTANCE TESTING



Introduction

This guidance note has been developed and published following feedback from traffic control equipment users regarding both concerns and a lack of standardisation in the acceptance testing of controllers. The role of this note is to provide a description of the scope and purpose of factory acceptance testing and to make readers alert to the areas where issues and problems may arise, to support best practice and safe, effective use of traffic controller equipment. Commissioning and site acceptance testing are not covered by this note.

Generic Factory Acceptance Testing

Factory Acceptance Tests (FAT's) are normally undertaken for all Traffic Signal Controllers prior to installation and site commissioning.

This testing is undertaken to ensure the operation of the traffic signal controller matches the specification as provided by the customer to the traffic controller configuration engineer and that the associated controller operates safely and to the customer's expectations.

FAT schedules are normally provided by the "end user" who is testing the system, this may be a local authority or design consultant.

Many traffic signal manufacturers will also be able to provide a generic FAT schedule if required – see Appendix A for an example test schedule.

The FAT schedule should also record the Hardware Serial Numbers of the equipment/asset(s) prior to deployment.

A Factory Acceptance Test Certificate should only be signed and dated by a competent person and countersigned by the customer / end user (who will be the “owner” of the installation once deployed on street), once all the configured functional tests which have been specified for use in the configured controller are verified and passed.

Functional Tests

The Functional Tests undertaken as part of the FAT should include the following tests:

- Start-Up Stage / Sequence
- Phases in Stages, and Stages in Streams
- Phase Type and Appearance
- Phase Timings
- Intergreen Timings
- Phase Delays
- Modes of Operation (e.g. Manual Mode, FT, VA, CLF, UTC, MOVA, Hurry Call, LRT / PSV, Part-Time etc.)
- Stage Movements
- Detector -> Phase association - Demands, Extensions, Call/Cancel Timings
- Detector Fault Monitoring Times
- Conflict Extensions
- SASD (where included in the design)
- Special Conditioning & Input / Output Operation (where included in the design)
- Remote Linking (where included in the design)
- Manual Panel Control and Indication.
- Lamp Monitoring and fault response testing (e.g. Extend Intergreen / Ped Inhibit / Shutdown)
- Fault Logging Verification
- Conflict testing

Factory Acceptance Testing Via Simulation

Through advances in technology Traffic Signal Controllers have evolved over recent years to become more of a “mini” PC and consequently the configuration software for the Traffic Signal Controllers has also evolved to become more user friendly and predominately Windows based.

From this, product manufacturers now offer testing of the traffic signal controller functionality via simulation or emulation.

This emulation can be in the form of a software package or a standalone application that the customer / end user can test remotely from the comfort of their office, testing in a simulated environment.

Users should satisfy themselves that configurations tested using simulation / emulation tools will perform in the same way when used ‘on-street’. As noted below users do need to be aware that hardware facilities such as lamp monitoring or conflict monitoring cannot be tested in simulation and should make separate provision for testing these, typically as a part of site acceptance testing.

Benefits

Use of simulation often reduces or removes the necessity to arrange Factory Acceptance Tests at the Traffic Signal Contractor Offices saving:-

- Travel time & associated costs.
- Time for the Customer Engineer carrying out the Test alongside Configuration Engineer.
- Overrunning e.g. If any amendments following testing are required that arise from issues / initial specification, then sometimes one day at the Traffic Signal Company offices for testing sometimes just isn't enough.

Configuration corrective actions or Customer specified amendments can be updated by the Traffic Signal Controller Engineer and re-issued to the customer for testing the applied changes.

Changes made by **both** the Traffic Signal Company and the Customer from any initial specification issued should be reflected in their associated paperwork before deployment in the field.

Once approved with no further changes required, the Factory Acceptance Certificate can be signed and dated by all parties and issued.

Considerations

A key point to note when evaluating the merits of testing using Simulated Testing is that it does not prove the physical hardware of the Traffic Signal Controller, including:

- Lamp Switch Cards
- Detector Cards
- Input & Outputs
- Dimming
- Lamp Calibration and Monitoring
- Lamp Conflicts

Where the above hardware cannot be tested by the end user in order for the Factory Acceptance Certificate to be signed off, the customer can request the traffic signal company to carry out the tests and provide a certificate of evidence that the tests were carried out for the specific hardware for the job.

The customer should adopt a risk based approach on the basis of the complexity of the scheme and all phases should be tested at least once. The conflict data should be examined carefully for correct configuration.

Urban Traffic Control (UTC) Mode Testing

Simulations also provide testing for UTC control & reply bits, however consideration should be given in relation to traffic signal controllers using integral UG405 (*SNMP*) for UTC Mode, as this protocol is not used in Simulation and mismatching MIB's / SCN's can cause issues in the field.

MOVA Testing

As with UTC testing, simulations can also provide simulated UTC / MOVA force bits for testing MOVA stage movements and associated MOVA confirms, but this requires validating with the MOVA hardware to ensure the correct interfaces are operational for either integral / discrete implementations.

Minor Changes e.g. RAM / Timetables / CLF etc.

Changes to existing traffic signal controller configurations in the field, e.g. for timetables / RAM changes etc can be issued via simulation for the customer to test and approve without the requirement for any additional hardware testing, or the need to set up and use a test rig at the traffic signal controller manufacturers premises, where travel time and working hours all impact on something that may only require limited testing and approval.

The approved reconfiguration should be up-issued before deployment.

Summary

Simulation tools can significantly improve the efficiency of the FAT process.

Practitioners are advised to consider those facilities of the site where real hardware may affect the testing and where safety is involved to arrive at a pragmatic, safe and efficient FAT process that is applicable to all manufacturer's traffic signal controllers.

All configuration, testing and changes should be agreed and fully documented.

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Appendix A – Example FAT Schedule

Note that the handset commands / facilities to interrogate the controller will vary between controller types.

GENERAL:

Configuration Number	Configuration Version	Firmware/software version
Controller Serial Number		
Description of equipment		
Serial Number		

With signals switched off, power up controller, initialise RAM

Check date and time

With all detectors and UTC bits “off”, normal mode selected, switch signals on

Check Startup, correct stage and replies / indications

Starting intergreen time

Check that all phases/stages have a demand / controller serves all stages

Check following timings / parameters

Min Green	Pass / Fail / NA
Max Green	Pass / Fail / NA
Extensions	Pass / Fail / NA
P/B demand extensions	Pass / Fail / NA
Kerbside demand extensions	Pass / Fail / NA
Registered demand extensions	Pass / Fail / NA
Intergreens	Pass / Fail / NA
Phase delays	Pass / Fail / NA
Ped Blackout	Pass / Fail / NA
Ped Window	Pass / Fail / NA
Pelican Seq	Pass / Fail / NA
Puffin Seq	Pass / Fail / NA
Toucan Seq	Pass / Fail / NA
Ped Seq	Pass / Fail / NA
Handset limit values	Pass / Fail / NA
Timetable enties	Pass / Fail / NA
Timetable Event	Pass / Fail / NA
BST Changeover	Pass / Fail / NA

MODE:

Check mode priority is as specified

Pass / Fail / NA

MANUAL:

Check manual mode enable/disable using handset if configured	Pass / Fail / NA
Check stage/phases for each configured manual button	Pass / Fail / NA
Check green arrow filter appearance is as specified	Pass / Fail / NA
Check permitted moves	Pass / Fail / NA
Check that demands for all phases inserted when leaving manual mode	Pass / Fail / NA
Check all other configured switches on manual panel	Pass / Fail / NA

DETECTORS:

Check DFM times	Pass / Fail / NA
Check Call/Cancel times	Pass / Fail / NA
Check correct detector active state	Pass / Fail / NA
Check correct DFM force state	Pass / Fail / NA
Check that inputs perform correct functions	Pass / Fail / NA
Check SD/SA extensions (on SD/SA logic)	Pass / Fail / NA
Check SD/SA intergreen	Pass / Fail / NA
Check SD/SA loop pitch (on SD /SA logic)	Pass / Fail / NA
Check SD/SA operation	Pass / Fail / NA

FIXED TIME:

Select fixed time and check sequence	Pass / Fail / NA
Check fixed time duration, if configured	Pass / Fail / NA
Check fixed time runs VA to max, if configured	Pass / Fail / NA
Check demand dependant phases	Pass / Fail / NA
If VA to max check timetable changes	Pass / Fail / NA
Check demands inserted for all phases when leaving fixed time	Pass / Fail / NA

VEHICLE ACTUATED:

Check VA stage changes are correct for each phase demand/extension	Pass / Fail / NA
Check arterial reversion in absence of demands	Pass / Fail / NA
Check revertive demand if extension running when max green expires	Pass / Fail / NA
Check stage movements (permitted, prohibited, alternative)	Pass / Fail / NA
Check time table for switched maxes	Pass / Fail / NA
Check all Phases serviced with all dets "PD"	Pass / Fail / NA

CLF:

Check plan timings and influences	Pass / Fail / NA
Check timetable changes to plans	Pass / Fail / NA
Check plan operation	Pass / Fail / NA
Check I/G or all red extensions do not interfere with plans	Pass / Fail / NA

UTC:

Set all detectors off and select normal on manual panel	
Check mode when F bit is active (TC bit if required)	Pass / Fail / NA
Check operation of non-demand dependent force bits	Pass / Fail / NA
Check operation of demand dependent force bits with street demands	Pass / Fail / NA
Check operation of demand dependent force bits with D bits	Pass / Fail / NA
Check stage demand reply bits	Pass / Fail / NA
Check stage to stage movements (permitted, prohibited, alternative)	Pass / Fail / NA
Check DX bit causes specified stages/phases to run to max in VA	Pass / Fail / NA

Check Phase minimum cannot be violated by forcing stages	Pass / Fail / NA
Check Phase maxes can be over-ridden by forcing stages	Pass / Fail / NA
Check any miscellaneous force bits	Pass / Fail / NA
Check stage confirmation reply bits	Pass / Fail / NA
Check any phase confirmation bits	Pass / Fail / NA
Check reply bits for controller conditions (LF, RR, DF etc)	Pass / Fail / NA
Check any other miscellaneous reply bits (PV etc)	Pass / Fail / NA

PART TIME:

Check timetable change point by altering the clock	Pass / Fail / NA
Check that signals switch off in correct stage, once mins expired	Pass / Fail / NA
Check queue detector operation	Pass / Fail / NA
Check minimum on/off operating timers	Pass / Fail / NA
Check operation of part-time inhibit switch	Pass / Fail / NA

HURRY CALL:

Check hurry call delay timers are as specified	Pass / Fail / NA
Check hurry call hold times as specified	Pass / Fail / NA
Check hurry call prevent timers as specified	Pass / Fail / NA
Check operation of request detectors	Pass / Fail / NA
Check operation of cancel detectors	Pass / Fail / NA
Check correct stage is called by relevant detector	Pass / Fail / NA

MOVA (INTEGRAL):

Check that MOVA data is as specified	Pass / Fail / NA
Check that MOVA IN X and SL detectors call appropriate phases	Pass / Fail / NA
Check that push buttons call appropriate phases	Pass / Fail / NA
Check that stage selection logic operates	Pass / Fail / NA

ALL RED EXT:

Check extensions as specified	Pass / Fail / NA
Check maximum times as specified	Pass / Fail / NA
Check that detectors extend appropriate stage move	Pass / Fail / NA
Check extensions operate in appropriate mode	Pass / Fail / NA
Check extension auto-extend to max in appropriate mode	Pass / Fail / NA

INTERGREEN EXT:

Check max intergreen times	Pass / Fail / NA
Check intergreen extensions	Pass / Fail / NA
Check operation of intergreen extensions	Pass / Fail / NA

VARI_MAX:

Check variable maximum additional period times	Pass / Fail / NA
Check variable maximum threshold flow values	Pass / Fail / NA
Check operation of phases with variable maxes	Pass / Fail / NA

PEDESTRIAN LINKS:

Check pedestrian link timings are as specified	Pass / Fail / NA
Check operation of pedestrian link	Pass / Fail / NA
Check override timer	Pass / Fail / NA

LAMP MONITORING:

Check that 1 st red lamp fail extends intergreen as specified	Pass / Fail / NA
Check that 2 nd red lamp fail inhibits conflicting ped phase	Pass / Fail / NA
Check that 2 nd red lamp fail shuts down part time stream	Pass / Fail / NA
Check that failure of all monitored reds cause shutdown of stand alone Pedestrian stream	Pass / Fail / NA
Check that lamp fail outputs/replies operate correctly	Pass / Fail / NA
Check that lamp failure action cease when lamps replaced	Pass / Fail / NA

GREEN CONFLICT MONITORING:

Check green/green conflicts	Pass / Fail / NA
Check fault log for correct data	Pass / Fail / NA

MISCELLANEOUS:

Please detail below, any other checks/tests required:

1	Pass / Fail
2	Pass / Fail
3	Pass / Fail
4	Pass / Fail
5	Pass / Fail
6	Pass / Fail

OVERALL PASS / FAIL

Date:

NOTES / COMMENTS:

Customer Name (PRINT):

Customer Signature:

Company Representative (PRINT):

Company Representative Signature: