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**□** ARM **✓** ENG **□** PAP **✓** Input

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~~Technical Domain~~ / Task Number 2 …2.2.2…………………………

Author(s) / Submitter(s) …Peter Dobson…………………

The commissioning of AtoN equipment and systems

# Summary

This paper provides information on the steps that Trinity House takes as part of ensuring the correct operation of new systems and equipment fitted to lighthouse, lightvessels and buoys. A through life building, testing and servicing process for monitored buoys is provided, with examples of other supporting documentation to achieve this.

## Purpose of the document

This is an information paper responding to the committee’s requirement to gather information about procedures and documentation used to ensure effective performance to new AtoN and equipment. It is hoped that this information will aid in the development and production of a new Guideline on commissioning and engineering auditing of AtoN equipment

# Background

Following work done by Task Group 2 at ENG1, it was requested that Trinity House provide some background and examples of their procedures and documentation regarding commissioning and engineering auditing of AtoN equipment

# Discussion

## Background

It was identified a number of years ago that the modernisation of lighthouse was taking longer due to onsite rectification of problems as electronic equipment was becoming more complicated. This was having an adverse impact on cost and labour resource, and as such, a change in procedure was adopted to ensure more effective installation performance. In addition, this also reduced the number breakdowns shortly following any modernisation works.

## The process

A process was then developed to eliminate the problems on site, resulting in a greater investment in time and resource before going to site. This essentially leads to the stages detailed below.

## Inspection and Testing.

### Inspection

All equipment is inspected to ensure build quality is correct and as desired. This is achieved either through factory acceptance tests (FAT) or goods inwards inspection. Both confirm the equipment can be assemble fully in the case of mechanical items or have been built correctly and or is the correct item, in the case of electrical equipment. In both cases, any errors can be rectified at the earliest opportunity.

### Setup

Any purchase or in-house designed equipment is then powered up and setup or configured ready for operation. As more and more equipment is becoming software based, this is ever more critical to ensure the operation is as the design anticipated.

### Precommissioning

This phase generally relates to electrical / electronic control equipment, but can also be important to mechanical items such as engines. During this phase the equipment is connected together into systems, powered up and checked to ensure the components of the system operate together, delivering correct system operation. Full functional testing is carried out where possible.

### Soak test

For some items of equipment such as lanterns, control equipment and telemetry systems, they will be left operating in an automatic manner for a short time to ensure no issues develop during the early stages.

On successful completion of these phases, there is a high level of confidence that equipment and systems work. Thus any issue that develop following installation are likely to be due to a site condition.

## Onsite Commissioning

As a result of the earlier steps, onsite work should only need to focus on the impact of implementing the systems and equipment in the site location. The initial testing focuses on cabling, pipework, ducting and other installation variables.

Once these variable have been confirmed as correct to the design, then both positive (how things should work) and negative (unrelated faults) testing needs to be done, as well as intersystem testing to ensure all systems operate correctly under all given situations.

Due to the complexity of such testing it is important to have a clear plan and sequence to the testing. The other critical factor, is to record all tests, there outcome and all the setting associated with the equipment being tested.

## Soak Period

On completion of the testing it is important to ensure correct operation through an extended soak test period, usually for a month to allow for variability in operating conditions. There should be no intervention during this period, proving that all system operate correctly.

## Supporting documentation

It is critical that a record of all of the tests, setting etc. is produced, such that at any time, these test can be repeated, confirming correct operation. This is especially useful if faulty equipment needs to be replaced.

Such documentation needs to me maintained and kept on site.

## Buoy Production

This is essentially identical to that of a lighthouse, although less complicated, but may need to be delivered by personnel of a lower skill level. Yet this is just as critical to the organisation, as a buoy that is not operating correctly requires an expensive ship to attend.

Due to the skill level of those personnel used in the production and support processes, it becomes even more important that the supporting information is available, clear and correct.

An example of the process and supporting information that Trinity House uses, is detailed in appendix 1.

1. Buoy Production commissioning and at sea process

This appendix contains the process used by Trinity House to build, commission and deploy a monitored buoy.









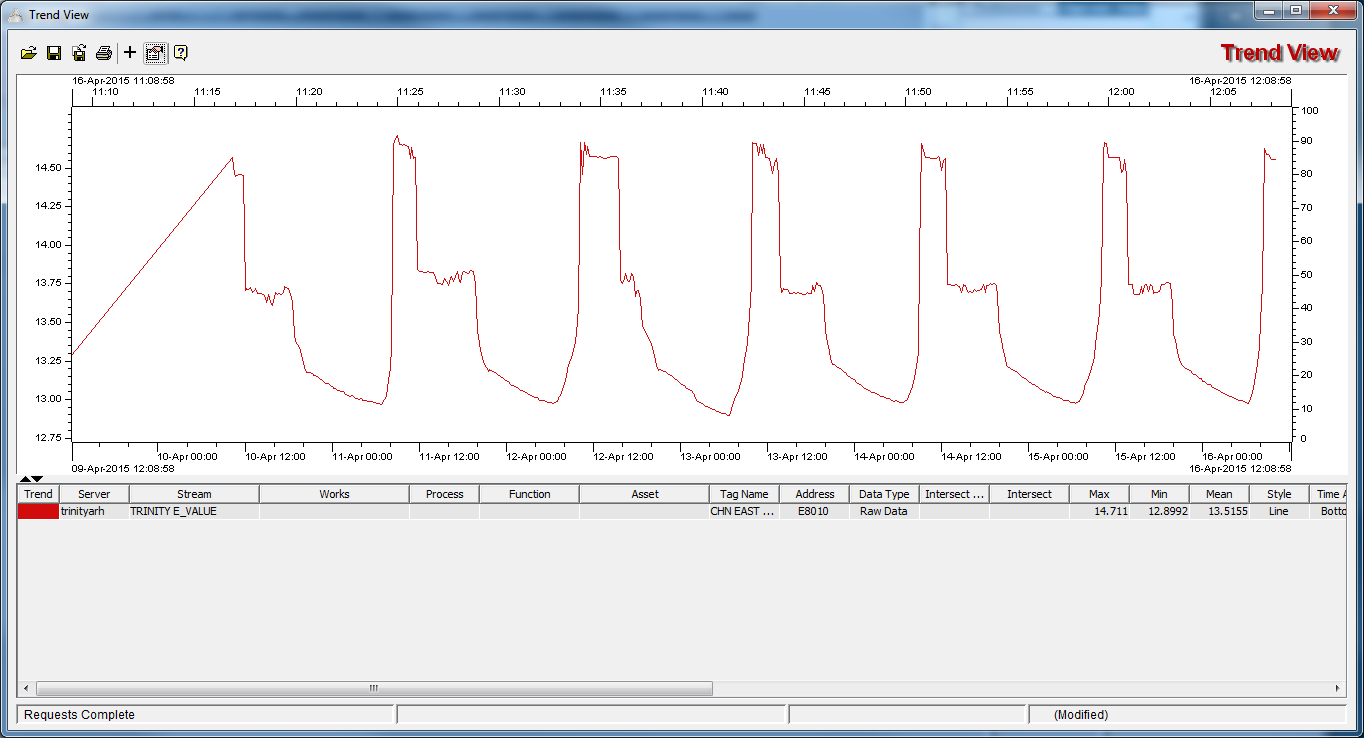




1. Some examples of setup and commissioning documentation for monitored buoys

| **Station:** | | | **Date:** | | | |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | | |  | |
| **Test Sheet No:** | **CS23-10** | | |  | | |
| **System:** | **Modular Superstructure:**  **Soak Test** | | |
|  | | | | | | |
|  |  |  | | |  | |
| Pre-Test Checks: | | | | |  | |
| **Activity** | | | | | **Pass/Fail** | |
| 1) Ensure the following: | | | | |  | |
| * 1. The Commissioning of the Modular Superstructure has been completed | | | | |  | |
| b) All equipment is securely fitted and in good order | | | | |  | |
|  | | | | |  | |
| Modular Superstructure Soak Test: | | | | |  | |
| **Activity** | | | | | **Pass/Fail** | |
| **SOAK TEST SET-UP** | | | | |  | |
| 1. Confirm that the lantern lens is covered with suitable material, but photocell is exposed. | | | | |  | |
| 1. Confirm that the Racon connector is not connected to the Racon. | | | | |  | |
| 1. Confirm that all cables are connected (apart from the Racon). | | | | |  | |
| 1. Confirm that all unused connectors are suitably protected with dummy connectors or covers. | | | | |  | |
|  | | | | |  | |
| **SOAK TEST** | | | | |  | |
| 1. During the soak test, the Modular Superstructure and its equipment must not be touched.   *Any changes during the soak test must be noted in the comments section below.* | | | | |  | |
| 1. Advise the Planning Centre that the buoy is now prepared for Soak Test Validation | | | | |  | |
|  | | | | |  | |
| **CHECKS AFTER 24 HOURS**  **To be completed by the Planning Centre:** | | | | |  | |
| 1. Using archive data from CMCS check or confirm the following: | | | | |  | |
| * From Values History determine if the Navigation Light and Outstation Awake status is transferred from the buoy to the CMCS and on / off times are as expected.   *Note: the Navigation Light status can be found at database address BXXX00 and the Outstation Awake status at BXXX07.* | | | | |  | |
| * From the Activity History determine if the buoy communications are at the expected levels of three minimum and seven maximum exchanges from the buoy to CMCS.   *Note: calls to and from an outstation are logged as Message Code 32.* | | | | |  | |
| * Using Alarm History confirm that no other alarms were received during the 24 hour period. | | | | |  | |
| * Comms can be established with the buoy in the one hour window at 12:15 UTC | | | | |  | |
| * Using Trend View and the reference trend at the end of this document confirm that the battery voltage trend shows that the Charge Controller is regulating the battery voltage.   *Note the battery voltage analogue can be found at database address EXXX10.* | | | | |  | |
|  | | | | |  | |
| **CHECKS AFTER ONE WEEK**  **To be completed by the Planning Centre:** | | | | |  | |
| 1. Using archive data from CMCS check or confirm the following: | | | | |  | |
| * From Values History determine if the Navigation Light and Outstation Awake status is transferred from the buoy to the CMCS and on / off times are as expected. | | | | |  | |
| * From the Activity History determine if the buoy communications are at the expected levels of three minimum and seven maximum exchanges from the buoy to CMCS. | | | | |  | |
| * Using Alarm History confirm that no other alarms were received during the one week period. * Comms can be established with the buoy in the one hour window at 12:15 UTC | | | | |  | |
|  | |
| * Using Trend View and the reference trend at the end of this document confirm that the battery voltage trend shows that the Charge Controller is regulating the battery voltage. | | | | |  | |
| **CHECKS AT END OF SOAK TEST**  **To be completed by the Planning Centre:** | | | | |  | |
| 1. Record length of soak test. | | | | | days | |
| 1. Using archive data from CMCS check or confirm the following: | | | | |  | |
| * From Values History determine if the Navigation Light and Outstation Awake status is transferred from the buoy to the CMCS and on / off times are as expected.. | | | | |  | |
| * From the Activity History determine if the buoy communications are at the expected levels of three minimum and seven maximum exchanges from the buoy to CMCS. | | | | |  | |
| * Using Alarm History confirm that no other alarms were received during the soak test period. | | | | |  | |
| * Comms can be established with the buoy in the one hour window at 12:15 UTC | | | | |  | |
| * Using Trend View and the reference trend at the end of this document confirm that the battery voltage trend shows that the Charge Controller is regulating the battery voltage. | | | | |  | |
| 1. Take a screenshot of the battery voltage trend and append it to this document.   **To be completed by the Buoy Yard** | | | | |  | |
| 1. Confirm that all equipment is still securely fitted and in good order. | | | | |  | |
|  | | | | |  | |
|  | | | | | | |
| **Comments:** | | | | | | |
|  | | | | |  |  |

**Reference Trend View**



1. An example of a technical procedure.

|  |  |  |  |
| --- | --- | --- | --- |
| **TECHNICAL PROCEDURE**  **TP026** | | 1. **Modular Superstructure – Pre-commissioning the Charge Controller** | |
| 2 | January 2009 | A. Williams | R. M. Tomkins |
| **Issue** | **Date** | **Written By** | **Approved By** |

**1. Scope**

This procedure covers the pre-commissioning of the Charge Controller used on the Modular Superstructure.

The work is to be undertaken by competent people at Harwich and Swansea Depots under the direction of the Buoy Manager.

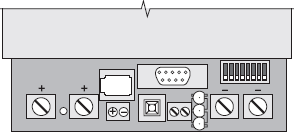
**2. Introduction**

The Tri-Star regulator can be operated in a number of modes in order to regulate the battery voltage. The standard operating mode is **Solar Battery Charging.** Power control for the Wave Actuated Generator is provided by the WAG Controller which is subject to a different Technical Procedure.

The operating mode, and the required charging characteristics, is programmed by DIP switches on the TriStart TS-60. It is possible to connect a PC to the Charge Controller via the RS232 PC interface on the enclosure, but this is not utilised in this procedure.

**3. Gaining Access to DIP Switches**

1. Remove enclosure cover, making sure that securing bolts are not lost.
2. Remove the white cover below the black heatsink on the TriStart TS-60. If the panel is fitted with a display, disconnect the RJ11 connector from the board.
3. The DIP switches are in the top-right of the exposed board (Figure 1).



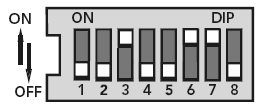
**Figure 1 - Location of the DIP switches on the TriStar TS-60.**

**4. DIP switch settings**

The DIP switches should be set to that shown in Table 1 and Figure 1.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Switch 1 | Switch 2 | Switch 3 | Switch 4 | Switch 5 | Switch 6 | Switch 7 | Switch 8 |
| OFF | OFF | ON | OFF | OFF | ON | ON | OFF |

**Table 1 - DIP Switch settings for TriStar TS-60 in the Charge Controller Distribution Box for use on Modular Superstructure.**



**Figure 3 - DIP switch settings after configuration.**

**5. Finishing**

1. Check that the DIP switches have been set correctly (see above).
2. Fit the cover onto the TriStart TS-60. If the cover has a display, ensure that the RJ11 plug is reconnected to the board.
3. Fit the cover onto the enclosure, ensuring that all bolts are reasonably tight.

1. Leave open if uncertain [↑](#footnote-ref-1)