

PROTECTION & CONTROL SWITCHING BOX

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PURPOSE AND SCOPE

Informative: Throughout this document reference is made to National Grid Specifications. For the avoidance of doubt all references within this document to Technical Specifications (TS) can be taken to mean either National Grid Technical Specification (NGTS) or Technical Specification (TS) as appropriate.

This is a functional specification for switching boxes used at National Grid owned substations. The switching box shall provide a standard interface between the primary HV equipment and the secondary protection and control systems, to enable isolation for maintenance, testing and secondary equipment replacement.

The unit shall enable future replacement to be undertaken by the disconnection of existing equipment and reconnection of new equipment that has been thoroughly tested offline on a bay or modular basis. The reduction in site installation and commissioning will minimise the primary access requirements.

The protection and control system can be hardwired for legacy systems or an IEC61850 merging unit. It provides safety and operational isolation for both the HV equipment and the protection system.

The switching box shall be capable of reliable operation for the lifetime of the primary equipment..

PART 1 – FUNCTIONAL AND PERFORMANCE REQUIREMENTS

1 FUNCTIONAL REQUIREMENTS

1.1 General Principles

The switching box shall be a combination of separate types of switching units, CT, VT and Digital Switching Units with an output socket as shown in figures 1 – 5 of Appendix A. Secondary systems requiring outputs from the switching box are connected into each switching unit via a plug connection. The number and types of switching units required will depend on the bay configuration. Interconnection of switching units and secondary systems is shown in figures 1 and 2.

The switching box shall enable:-

- Isolation from primary equipment (to enable safe and independent testing and maintenance of primary and secondary systems)
- Replacement of secondary systems with minimal primary circuit outage duration (3 days) by the change over from secondary in service system to replacement system.

Informative – Secondary systems whether AS3 IEC61850, NICAP or legacy will be connected by cable and plug to each switching unit.

This Technical Specification is for restricted application to feeder protection replacement schemes as required by National Grid

1.2 Accommodation

The switching box shall principally be located as close as possible to the HV equipment to minimise copper wiring. All switching units and any associated merging units for a single circuit are to be in the same. 19" rack cubicle.

Informative: For centralised relay room the switchbox shall be located adjacent to the bay marshalling kiosk. For blockhouse relay rooms close to the HV equipment the switching box shall be located within the blockhouse. Further guidance on location is provided in TGN(E)241 including instructions and recommendations regarding applications at both new and existing substations

The switching box accommodation shall meet the requirements of TS2.19 with increased rating of IP65 where accommodation is not provided within internal buildings..

Switching boxes and associated connections shall be segregated to ensure that any failures are contained to a single circuit.

Location and accommodation of the switching boxes and future merging units need to be considered together to ensure compliance with the above requirements for both initial installation and ongoing applications..

Informative where a switching box may be fitted initially and a merging unit later, accommodation should be considered for both switching box and future merging unit installation

1.3 Switching Units

1.3.1 General

Each type of switching unit required by a bay shall be fitted into 19" subracks. Connection of switching units is shown in Figures 1 & 2. Further guidance on each switching unit is provided in TGN(E)241.

1.3.2 Current Transformer Switching Unit

A current transformer switching unit shall be provided for each secondary circuit output of a CT in a bay. Each unit is required to short and disconnect a 3 phase 1A or 5A CT when the unit switch is selected to the 'Shorted and Disconnected' position. Successful shorting of CTs shall be confirmed by indication. The switch needs to be able to switch from 'Normal' to 'Short and Disconnected' position without open circuiting the CTs (Contacts Make before Break). It shall connect the CT through to the protection secondary system when the switch is in the 'Normal' position. In either position the switch shall be lockable, either by a unique key or a padlock. Testing and earthing facilities shall be provided on each unit. A current transformer switching unit is shown schematically in figure 3.

1.3.3 Voltage Transformer Switching Unit

A voltage transformer switching unit shall be provided for each secondary circuit output from a VT. It shall isolate the VT circuit, disconnecting each phase when the unit switch is selected to the 'Secondary Supplies Isolated' position. It shall connect the VT secondary circuit through to the protection secondary system when the switch is in the 'Normal' position. In the 'Secondary Supplies Isolated' position the switch shall be lockable, either by a unique key or a padlock. Testing facilities shall be provided on each unit. A voltage transformer switching unit is shown schematically in figure 4

1.3.4 Digital Switching Unit

A digital switching unit shall provide isolation of alarms, controls and indications for the protection secondary system from the HV equipment and visa versa. Each unit shall provide individual isolating links with individual labelling. To enable the links to be used as points of isolation, the isolating point shall where reasonably practicable be lockable to prevent reinsertion of the link. For units used to provide isolation for circuit breaker tripping an isolating link shall to be allocated as an 'S' link. A digital switching unit is shown schematically in figure 5.

1.3.5 Switching Unit HV Equipment Connection

HV equipment side external wiring shall be directly connected to each switching unit by terminals on rear of each unit.

1.3.6 Switching Unit Secondary Connection

Individual switching units shall be connected to a secondary system by a plug and socket arrangement with the socket mounted on the rear of the switching unit. The plugs and sockets shall be equipped with a coding facility to prevent incorrect plug insertion.

1.4 Testing Facilities

The switching box shall provide testing points to allow testing to both the HV equipment and the protection secondary systems for maintenance and commissioning purposes (figure 1). Further guidance on testing points is provided in TGN(E)241

2 OTHER REQUIREMENTS

Not Applicable

3 PERFORMANCE REQUIREMENTS

3.1 General

All the functions shall perform correctly in accordance with the requirements of this TS, TS3.24.04 Hardware Platform, TS2.19 Ancillary Light Current Equipment and the range of environmental conditions specified in TS 3.24.15.

3.2 Insulation

The switching box shall comply with insulation requirements as per BS EN 60255-5:2001.

- 5kVrms for 1 minute between all case terminals connected together and the case earth terminal
- 5kVrms for 1 minute between any contact and either adjacent alternate contact pair provided the intermediate contact pair is not used.
- 2kVrms for 1 minute between any contact pair and either adjacent contact pair.

3.3 Current Withstand

All contact circuits shall be rated at 20A continuously or 400A for 1s, ac or dc.

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3.4 Atmospheric Environment

3.4.1 The switching box shall comply with temperature requirements as per BS EN 60255-1: 2010

- Storage and transit -25°C to +70°C
- Operating -25°C to +70°C
- BS EN 60068-2-1:2007. – Cold.
- BS EN 60068-2-2:2007. – Dry Heat.

3.4.2 The switching box shall comply with humidity requirements as per BS EN 60068-2-78:2002

- 56 days at 93% RH and +40°C.

3.4.3 The switching box shall comply with enclosure protection requirements as per BS EN 60529:1992

- IP50 (dust protected).

3.4.4 The switching box shall comply with mechanical environment requirements as per BS EN 60255-21-1

- Response Class 2

4 TEST REQUIREMENTS

Not Applicable

5 TYPE REGISTRATION

National Grid Type Registration shall be in accordance with TP183 – Type Registration.

6 CONTRACT SPECIFIED OPTIONS

Not Applicable

7 FORMS AND RECORDS

Not Applicable.

PART 2 - DEFINITIONS AND DOCUMENT HISTORY

8 DEFINITIONS

AS ³	Architecture of Substation Secondary Systems
CB	Circuit Breaker
CT	Current Transformer
HV	High Voltage
MF	Marshalling Field