

PHASOR MEASUREMENT UNIT

This document is for internal and contract specific use only.

Disclaimer

NGG and NGET or their agents, servants or contractors do not accept any liability for any losses arising under or in connection with this information. This limit on liability applies to all and any claims in contract, tort (including negligence), misrepresentation (excluding fraudulent misrepresentation), breach of statutory duty or otherwise. This limit on liability does not exclude or restrict liability where prohibited by the law nor does it supersede the express terms of any related agreements."

TABLE OF CONTENTS

PURPOSE AND SCOPE.....	1
PART 1 – GENERAL REQUIREMENTS	1
1 FUNCTIONAL REQUIREMENTS.....	1
2 INTERFACE REQUIREMENTS	3
3 PERFORMANCE REQUIREMENTS.....	4
4 TEST REQUIREMENTS	4
5 TYPE REGISTRATION	4
6 CONTRACT SPECIFIED OPTION.....	4
7 FORMS AND RECORDS	4
PART 2 - DEFINITIONS AND DOCUMENT HISTORY	5
8 DEFINITIONS	5
9 AMENDMENTS RECORD	6
10 IMPLEMENTATION.....	6
PART 3 - GUIDANCE NOTES AND APPENDICES	6
11 REFERENCES	6
12 SPECIFICATION REFERENCE TABLE	7

PURPOSE AND SCOPE

This technical specification defines the functional, performance and testing requirements for the equipment employed to provide synchronised measurement of voltage and/or current phasors on the UK Transmission system. These devices are commonly called Phasor Measurement Units (PMU) or Synchronised Measurement Units (SMU). The Substation Phasor Data Concentrator (PDC) will be addressed in a separate Technical Specification.

PART 1 – GENERAL REQUIREMENTS

1 FUNCTIONAL REQUIREMENTS

1.1 General

1.1.1 The devices shall fully comply with IEEE C37.118.1-2001 Standard for Synchrophasor Measurements for Power Systems and IEEE C37.118.2-2011 Standard for Synchrophasor Data Transfer for Power Systems; this document specifies the requirements outside the scope of IEEE C37.118.1-2011 and IEEE C37.118.2-2011.

1.1.2 The device shall comply with the following National Grid Technical Specifications (TS):

- a) TS 1 Ratings and Requirements for Plant, Equipment and Apparatus for the National Grid System
- b) TS 2.07 Specification for Substation Control Systems
- c) TS 3.24.04 Hardware Platform

- d) TS 3.24.15 Environmental and Test Requirements for Electronic Equipment
 - e) TS 3.24.67 GPS Substation Clock
 - f) TS 3.24.70 Dynamic System Monitoring (DSM)
- 1.1.3 The device shall be capable of recording the instantaneous value of the voltage and/or current as magnitude and phase angle of the vector, and the time the measurement was taken (time stamp) from a transducer or instrument transformer.
- 1.1.4 The voltage and current waveforms shall be sampled on a 3-phase basis as specified in TS 3.24.70.
- 1.1.5 The device shall be capable of transmitting the recorded values along with the time stamp and data integrity criterion to a PDC or a server which can be located either in the local substation or remotely.
- 1.1.6 The data transmitted by the PMU has to enable the PDC to determine and indicate the status of the PMU connection, e.g. Connected/Sending Data/No Connection.
- 1.1.7 The device shall indicate the data validity for future processing requirements, e.g. Good/Bad/No Transducer.
- 1.1.8 The receiving PDC or similar device shall be provided with sufficient information to classify the PMU by location, PMU ID, IP address and synchronisation source (see 1.2.4).
- 1.1.9 The device shall operate using both 110 V and 48 V DC supply as specified in TS 3.24.04.

1.2 Time Synchronisation

- 1.2.1 The PMU shall use a Global Positioning System (GPS) clock to provide synchronisation with Coordinated Universal Time (UTC) as specified in TS 3.24.67.
- 1.2.2 The time stamping accuracy shall be 1 μ s and comply with IEEE C37.118.1-2011 and TS 3.24.67, and be harmonised with International Electrotechnical Commission standard IEC 61850.
- 1.2.3 The data transmission latency from the IT and through the PMU device shall be no greater than 10ms.
- 1.2.4 The PMU shall provide a loss of GPS signal indication. In addition the device shall coordinate the switch between GPS time stamping and internal clock on loss of signal and re-synchronise with GPS once it becomes available. The time stamp source shall be referenced.

1.3 Communications

- 1.3.1 In operation the PMU shall support continuous reporting of time stamped data at the rates of 10, 25 and 50 frames per second (user-selectable). The message framework shall comply with the IEEE C37.118.1-2011 standard.
- 1.3.2 The PMU shall have, as a minimum, 2 Ethernet ports and 1 Universal serial Bus (USB) port. Each of the Ethernet ports shall be able to accept individual Internet Protocol (IP) addresses and manage the data independent of each other. The USB port or a third Ethernet port shall be used to locally update firmware and provide access to system configuration.
- 1.3.3 The PMU shall be capable of sending data to more than one destination (multicast data), should the need arise.

- 1.3.4 The unit shall be capable of communicating using Transmission Control Protocol (TCP/IP) and User Datagram Protocol (UDP/IP). The unit shall be capable of providing a fixed and defined range of IP ports.

Informative: Logical IP ports are different to physical Ethernet ports. As an example, http uses port 80, https uses port 443, ftp uses ports 20 and 21. This will be essential in order to correctly configure firewalls and access control.

2 INTERFACE REQUIREMENTS

2.1 General

- 2.1.1 Each function shall provide alarms and indications as appropriate, to the Substation Control System (SCS).
- 2.1.2 Informative interface: each function shall provide information that can be accessed via a communications port.
- 2.1.3 Each function shall be provided with a substation time reference.

2.2 Instrument Transformers

- 2.2.1 In general, but not limited to, instrument transformers shall be as specified in TS 3.2.4 and TS 3.2.5 (IEC 61850 specification covers accuracy requirements).
- 2.2.2 The Current Transformer (CT) and Voltage Transformer (VT) input requirements shall comply with TS 3.24.70.

2.3 The Number of Input/Output Channels

- 2.3.1 The device shall have a minimum of 8 analogue input channels with at least 1 volt free contact for providing information about equipment health status. The PMU shall also have a connection for a GPS antenna and an RJ45 port for Ethernet connection.

2.4 Outputs

- 2.4.1 The outputs of the PMU shall feed into the Substation Local Area Network (LAN) information bus, Substation Bus, RAMP LAN.
- 2.4.2 CT Supervision (CTS) shall be provided in accordance with the requirements of TS 3.24.65.
- 2.4.3 The unit shall provide outputs for:
- a) System frequency and Rate of Change of Frequency (ROCOF).
 - b) Positive sequence component of current.
 - c) Positive sequence component of voltage.
 - d) Phase angle/power factor.
 - e) Real Power (P).
 - f) Reactive Power (Q).