

Title: **APPLICATION GUIDELINE FOR
TRANSMISSION METERING
COMMODITIES**

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1. Introduction

This document is a guideline for the application of different metering commodities in the Transmission environment. Metering technology contracts were previously integrated and standardised within Group Technology to provide for wider ranging applications across all Eskom divisions. With the legal separation of the Transmission business, national contracts for metering commodities are now being migrated to individual divisional contracts based on the same tender and commodities.

Metering technologies comprise of the following commodities:

- Metering substation panels and modules
- Three Phase Programmable meters
- Quality of Supply meters
- Digital Transducers
- Modems

A Transmission application guide is required for selecting the appropriate metering commodities/ technologies from the various options provided for Transmission specific applications. The new metering commodities contracts are modular as far as possible, to cater for different applications within Transmission.

2. Supporting Clauses

2.1 Scope

The scope includes the application guideline relating to the following commodities for Transmission specific applications:

- Metering substation panels and modules
- Three Phase Programmable meters
- Quality of Supply meters
- Modems
- Digital Transducers

2.1.1 Purpose

The purpose of the document is to provide a guideline for Transmission Planning & Support Engineers and Application staff to implement standard metering schemes in the Transmission environment.

2.1.2 Applicability

This document shall apply to PTM&C Engineering.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems.
- [2] 240-126114301: Contracts for Metering Equipment
- [3] 240-65292589: Standard for Substation Meter Panels: HV/MV Indoor

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- [4] D-DT-5804: Manufacturing Drawings for Metering Substation Panels
- [5] 240-56364444: Standard Minimum Requirements for the Metering of Electrical Energy and Demand
- [6] 0.52/30131: Internal Tariff Metering S8 Master Drawings
- [7] 0.52/30587: Stats Metering Panel T1 Stats Master Drawings

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

Definition	Description
19"	Unit used to describe the width of panel equipment. 19" = 482.6 mm
Accuracy class	A designation assigned to an instrument transformer, the current or voltage error and phase displacement of which remain within specified limits under prescribed conditions of use.
Metering Equipment	A collection of components in the metering installation, namely the instrument transformers, cables, meters, recorders and any housing and ancillary equipment such as test blocks.
Metering Installation	All meters, fittings, equipment, wiring and installations used for measuring the flow of electrical power.
Power quality	Characteristics of the electricity at a given point on an electrical system, evaluated against a set of reference technical parameters
U	Unit used to describe the height of panel equipment. 1U = 44.45 mm.

2.3.2 Disclosure Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
CSD	Circuit Switch Data
CT	Current Instrument Transformer
ET	Eskom Telecoms
GSM	Global System for Mobile Communication
IDF	Intermediate distribution frame
IPP	Independent Power Producers
ITM	Internal Tariff Metering
MCB	Miniature Circuit Breaker
QOS	Quality of Supply
SAPP	Southern African Power Pool

Abbreviation	Description
VT	Voltage Instrument Transformer
VSM	Voltage Selection Module

2.5 Roles and Responsibilities

PTM&C Planning and Support Engineers and Applicators should ensure conformance to the guideline for all Transmission Metering applications

2.6 Process for monitoring

Not applicable.

2.7 Related/Supporting Documents

Not applicable.

3. Transmission metering commodity contracts

Contracts have been established for the following metering commodities:

- Metering substation panels and metering modules
- Three phase programmable meters
- Quality of supply meters
- Digital Transducers
- Modems

4. Contract details

4.1 Metering Substation Panels and Modules

Contract awarded to: Sabi Switchboards

Contract number: 4600071721

Contract duration: Four Years (Apr 2022 – Apr 2026)

Table 1: Sabi Switchboards contract details

SAP #	Description
0569919	Module: Metering surface mount 6-way CT test blocks
0569921	Module: Metering 19" rack mount 6-way CT test blocks
0175686	Module, Voltage selection A, D9401
0230643	Module, Voltage selection C, D9401
0175688	Module, Voltage selection D, D9401
0175671	Module, Interposing A, D9402
0183992	Module, Interposing B, D9402
0230645	Module, Modem, D9404
0230644	Module, Quality of Supply, D9403
0401952	Plate: Blanking 3U, D9141

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SAP #	Description
0401956	Plate, Blanking 5U, D9141
0401958	Plate, Blanking 7U, D9141
0402613	Swing Frame Cabinet (Front Entry): (2400 x 800 x 600mm panel)
0579563	Swing Frame Cabinet (Back entry): (2400 x 600 x 600mm panel)
No SAP	Fitment of the module into panel

4.2 Three Phase Programmable Meters

Contract awarded to: Landis & Gyr

Contract number: 4600070082

Contract duration: 4 years (Jul 2021 – Jul 2025)

Table 2: Landis+Gyr contract details

SAP #	Description
0207980	Three Phase Programmable 1A Meter, Dual RS485, CI 0.5: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.5S for Wh, 1 for varh; Number of outputs: 4 Programmable; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed
0615102	Three Phase Programmable 1A Meter, Dual RS485, CI 0.2, Aux: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 4 Programmable; Auxiliary supply 100-240 V AC/DC; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed
0686392	Three Phase Programmable 1A Meter, Dual RS485, Ethernet, CI 0.2, Aux, 19" rack: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485 and Ethernet; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 6 Programmable; Auxiliary supply 100-240 V AC/DC; 19" rack with Essalec connectors; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed

4.3 Quality of Supply

Contract awarded to: Actom

Contract number: 4600069855

Contract duration: 4 years (Jun 2021 – May 2025)

Table 3: Actom contract details

SAP #	Description
577551	PQ monitoring instrument – Investigation, surface mount
577553	PQ monitoring instrument – Permanent substation, 19" rack mounted
665285	PQ Accessory – GPS Antenna
665286	PQ Accessory – 0-5A (range) Micro clamp
665287	PQ Accessory – Modem
665290	PQ Accessory – 19" 3U Rack mounting plates

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4.4 Modems

Contract awarded to: ADC Energy

Contract number: 4600068637

Contract duration: 4 Years (Jan 2021 – Jan 2025)

Table 4: ADC Energy contract details

SAP #	Description
661600	Modem: Basic Cellular Removable SIM Modem; 3G Modem: Type: Basic cellular removable sim; power source: 230 VAC; speed: 3G; specification: Eskom: 240-61266818; internal power supply or din rail; 3G metering modem; server mode; watchdog timers; network mode status indications; max dimensions: 180mm (h) x 110mm (w) x 80mm (d); din rail; female SMA connector; RS485 serial communications data port (connector RJ12 or RJ45); diagnostic port
661601	Modem: Basic Cellular Chip SIM Modem; 3G Modem: Type: Basic cellular chip sim; power source: 230 VAC; speed: 3G; specification: Eskom: 240-61266818; internal power supply or din rail: 3G metering modem; server mode; watchdog timers; network mode status indications; max dimensions: 180mm (h) x 110mm (w) x 80mm (d); din rail; female SMA connector; RS485 serial communications data port (connector RJ12 or RJ45); diagnostic port
661603	Modem: Advanced Cellular Removable SIM Modem; 3G Modem: type: advanced cellular removable sim; power source: 110/230 VAC; 110/220 VDC; speed: 3G; specification: Eskom: 240-61266818; internal power supply or din rail; power down delay; 3G metering modem; server & client mode; dual sim functionality; watchdog timers; network mode status indications; Telnet or IP configuration service; access control list; max dimensions: 180mm (h) x 110mm (w) x 80mm (d); din rail; female SMA connector; RS485 and RS232 serial communications data port (connector RJ12 or RJ45); diagnostic port; input terminals; potential free output terminal
661604	Modem: Advanced Cellular Chip SIM Modem; 3G Modem: type: advanced cellular chip sim; power source: 110/230 VAC; 110/220 VDC; speed: 3G; specification: Eskom: 240-61266818; internal power supply or din rail; power down delay; 3G metering modem; server & client mode; dual sim functionality; watchdog timers; network mode status indications; Telnet or IP configuration service; access control list; max dimensions: 180mm (h) x 110mm (w) x 80mm (d); din rail; female SMA connector; RS485 and RS232 serial communications data port (connector RJ12 or RJ45); diagnostic port; input terminals; potential free output terminal

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4.5 Digital Transducers

Contract awarded to: Integrators of Systems Technology (Pty) Ltd

Contract number: 4600071831

Contract duration: 4 Years (May 2022 – May 2026)

Table 5: IST Digital Transducer Contract Details

SAP #	Description
0646773	Standalone PM8000 Digital Transducer, No analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) ports, Modbus, DNP3 and IEC 61850
0646772	Standalone PM8000 Digital Transducer, 4 programmable analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) Ethernet ports, Modbus RTU, DNP3 and IEC 61850
0646771	Standalone PM8000 Digital Transducer, 6 programmable analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) Ethernet ports, Modbus RTU, DNP3 and IEC 61850
0646774	Standalone PM8000 Remote Display
0646770	Transducer half 19" rack, 1 x PM8000 Digital Transducer, No analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) ports, Modbus, DNP3 and IEC 61850 and 1 x PM8000 Remote Display
0646769	Transducer half 19" rack, 1 x PM8000 Digital Transducer, 4 analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) ports, Modbus, DNP3 and IEC 61850 and 1 x PM8000 Remote Display
0646768	Transducer half 19" rack, 1 x PM8000 Digital Transducer, 6 analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) ports, Modbus, DNP3 and IEC 61850 and 1 x PM8000 Remote Display
0646767	Transducer 19" rack, 2 x PM8000 Digital Transducer, No analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) ports, Modbus, DNP3 and IEC 61850 and 2 x PM8000 Remote Display
0646766	Transducer 19" rack, 2 x PM8000 Digital Transducer, 4 analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) ports, Modbus, DNP3 and IEC 61850 and 2 x PM8000 Remote Display
0646765	Transducer 19" rack, 2 x PM8000 Digital Transducer, 6 analogue outputs, 1A, 90/415VAC 120/300 VDC, RS485 and 10/100 BASE-T-Ethernet (RJ45) ports, Modbus, DNP3 and IEC 61850 and 2 x PM8000 Remote Display
S000017113	Training per session

5. Metering Panels and Modules Options

Detailed manufacturer drawings for the various metering panels and module options are provided in the document D-DT-5804: *Manufacturing Drawings for Metering Substation Panels*. The detail equipment specifications such as terminals, test blocks, circuit breakers, wiring, trunking, labelling etc. are provided for in the document 240-65292589: *Standard for Substation Meter Panels: HV/MV Indoor*.

5.1 Metering Panel

The Metering Substation Panels contract makes provision for two types of panels viz.

- Standard front entry 800mm x 600mm x 2400mm with swing frame door
- Standard rear entry 600mm x 600mm x 2400mm

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All Transmission metering schemes should be of the swing frame 800mm x 600mm x 2400mm type (SAP number 0402613). Transmission is moving away from the rear entry 600mm wide panel to a 800mm wide swing frame front entry panel to allow for terminal modules to be mounted horizontally at the rear of the panel as opposed to the vertical mounting of the modules on the 600mm wide panels. The 600mm wide rear entry shall be retained on contract for applications that require the specific use of these panels.

The panels are made up of 19" modular units that will cater for the fitment of meters, voltage selection circuits, meter pulse interposing circuits and control cables to the CTs, VTs and IDF.

The standard metering panel can cater for either six individual metering circuits when surface mount metering modules are utilised or eight metering circuits if 19" rack metering modules are utilised. The panels provide for either top or bottom cable entry.

Space has also been allocated for a Quality of Supply module that will allow for one module to be fitted into a fully populated metering panel.

5.2 Meter Module

The intention is that main and check meters be installed on one module and not into a main and check panel. This arrangement will have less wiring looped from one panel to the other.

5.2.1 Surface mount meter module (6-way)

This module consists of a front plate on which provision is made for two meters to be installed and a back plate where the control cables are connected. The module shall only make provision for the fitment of surface mount meters.

The front plate shall include the following:

- PK2 – 4 & 6 way test blocks
- Terminals
- Trunking
- Wiring

The back plate shall include the following:

- MCBs
- Terminals
- Trunking
- Wiring

One to three of these plates can be mounted in the swing frame allowing for one to six meters to be connected. Where no meter plate is mounted, two blanking plates of 7U in height shall be mounted in the panel.

5.2.1.1 Front Plate

The front plate contains the meters, test blocks and terminals. Certain trunking and wiring will also be installed on the front plate. The meter mounting plate shall be 19" wide and 14U high. Surface mount meters are installed on this plate. These meters shall only be installed on site during commissioning and are not the responsibility of the panel manufacturer. The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

5.2.1.2 Test Blocks

Every CT and VT circuit entering a metering panel shall be provided with an approved individual multi-way test block.

A PK2 – 4 way test block shall be installed in the voltage circuit to enable testing of the installation. The removal of the male adapter shall ensure the open-circuiting of the voltage circuit. The terminals that protrude into the panel shall be suitably insulated from the steel edges.

A PK2 – 6 way test block shall be installed in the current circuit to enable testing of the installation. The removal of the male adapter shall ensure the isolation of the CT circuit to the meters, but continuous flow to equipment downstream.

5.2.1.3 Back plate (Meter terminal plate)

The back plate makes provision for the connection of the meter plate to the current and voltage transformers. The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

Two mounting options are provided for:

- Where an 800mm wide swing frame with front entry is utilised then the back plate shall be mounted horizontally to the back of the panel.
- Where a 600mm wide panel with back entry is utilised then the back plate shall be mounted vertically to the side at the back of the panel.

5.2.2 19" rack mount meter module (6-way)

This module consists of a front plate on which provision is made for two 19" rack meters to be installed and a back plate where the control cables are connected.

The front plate shall include the following:

- PK2 – 4 & 6 way test blocks
- 19" rack with Essailec connector terminals
- Trunking
- Wiring

The back plate shall include the following:

- MCBs
- Terminals
- Trunking
- Wiring

One to four of these plates can be mounted in the swing frame allowing for one to eight meters to be connected. Where no meter plate is mounted, three blanking plates of 3U in height shall be mounted in the swing frame.

5.2.2.1 Front plate

The front plate contains the meters, test blocks and Essailec terminal connectors. Certain trunking and wiring will also be installed on the front plate. The meter mounting plate shall be 19" wide and 10 U high. The meters shall only be installed on site during commissioning and are not the responsibility of the panel manufacturer. The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

5.2.2.2 Test block

Every CT and VT circuit entering a metering panel shall be provided with an approved individual multi-way test block.

A PK2 – 4 way test block shall be installed in the voltage circuit to enable testing of the installation. The removal of the male adapter shall ensure the open-circuiting of the voltage circuit. The terminals that protrude into the panel shall be suitably insulated from the steel edges.

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A PK2 – 6 way test block shall be installed in the current circuit to enable testing of the installation. The removal of the male adapter shall ensure the isolation of the CT circuit to the meters, but continuous flow to equipment downstream.

5.2.2.3 Back plate (Meter terminal plate)

The back plate makes provision for the connection of the meter plate to the current and voltage transformers. The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

Two mounting options are provided for:

- Where an 800mm wide swing frame with front entry is utilised then the back plate shall be mounted horizontally to the back of the panel.
- Where a 600mm wide panel with back entry is utilised then the back plate shall be mounted vertically to the side at the back of the panel.

5.3 Voltage Selection Module

The voltage selection modules are required where switching arrangements in the substation yard can result in different VTs be allocated to a metering point. The voltage selection will then ensure that the meters are supplied with that relevant VT input.

Various options are provided on voltage selection and careful consideration must be given before deciding on the most suitable module. For example: In a dual busbar arrangement VSM C may be more suitable than VSM A provided that enough isolator contacts are available in the yard to switch the voltages.

5.3.1 Voltage selection module A

This voltage selection module will be used where there is a dual busbar arrangement and the feeders may be fed from either busbar. Its main function will be to provide continuous voltage supply from all the VT phases to the meters. The module is 5U high and fits inside the panel.

With this arrangement two cables need to be installed from the VT JB – one to feed into the voltage fail relays and one into the voltage selector latching relay. The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

The plate shall include the following:

- MCBs 5 or 6A, 5kA AC
- MCBs 5 or 6A, 5kA DC
- Phase failure relays
- 3-way latching relays
- Terminals
- Trunking
- Wiring

The voltage selection shall be done through a combination of phase failure and chop-over relays. One contact shall be used to drive a remote alarm indication.

5.3.2 Voltage selection module C

This voltage selection module will be used where there is a dual busbar arrangement and the voltage selection is done by switching through isolator contacts on the HV/MV breakers. Its main function will be to provide continuous voltage supply from all the VT phases to the meters. The module is 5U high and fits inside the panel.

The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

The plate shall include the following:

- MCBs 5 or 6A, 5kA AC
- MCBs 5 or 6A, 5kA DC
- 3-way latching relay
- Terminals
- Trunking
- Wiring

The voltage selection shall be done through a latching relay where the coils are operated via circuitry through the busbar isolator contacts.

5.3.3 Voltage selection module D

The voltage selection module shall be used for indoor switchgear where there is a bus-section circuit-breaker present with VTs situated on both sides of the circuit-breaker. Its main function shall be to provide the correct voltage supply from the VTs to the meters situated on that part of the busbar. In cases when one of the VTs is removed then the VT supply for the meters on that side of the busbar shall fall back to the VT supply on the other side of the busbar. The module is 5 U high and fits inside the panel.

The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

The plate includes the following:

- MCBs 5 or 6A, 5kA AC
- MCBs 5 or 6A, 5kA DC
- Phase fail relays
- 3-way latching relays
- Terminals
- Trunking
- Wiring

The voltage selection shall be a combination of phase failure relays and single pole double throw relays. One contact shall be used to drive a remote alarm indication.

5.4 Interposing modules

The function of an interposing module is to repeat individual meter pulses through to a customer's equipment.

5.4.1 Interposing module A

This Interposing module shall be used where full four quadrant pulsing to the customer is required. kWh forward and reverse, kvarh Q1, Q2, Q3, Q4 and end of integration pulses from each meter shall be made available to the customer on this module. The module is 5U high and fits inside the panel.

The plate includes the following:

- Repeat Relays (Opto couplers) 110V u.c. / 24V DC
- MCBs 5 or 6A, 5kA DC
- Terminals
- Trunking

- Wiring

The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

5.4.2 Interposing module B

This Interposing module shall be used where the customer requires repeat pulses. kWh, kvarh and end of integration pulses from each meter shall be made available to the customer on this module. The module is 5U high and fits inside the panel.

The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

5.5 Modem module

The module is 5U high and fits inside the panel. The incoming line or antenna to the modem shall go straight to the modem and not through any additional terminals. Data cables or lines shall also be direct connected between modem or multi-dropping device and meter.

The modem auxiliary supply should be supplied by the station DC supply.

5.6 Quality of Supply module

The Quality of Supply (QoS) module will house the Quality of Supply equipment for monitoring of QoS parameters where the QoS is not performed within a tariff meter. The equipment will be driven from one of the metering voltage circuits through separate MCBs with a lower current rating as that of the metering circuits (typically 2A).

Provision is made for four alarms to be sent through to the IDF i.e. voltage imbalance, total harmonic distortion, under voltage and over voltage.

The module is 5U high and fits inside on the back of the panel.

The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

The plate shall include the following:

- MCBs 2A, 2.5kA
- MCBs 2A, 5kA AC
- MCBs 5 or 6A, 5kA DC
- Terminals
- Trunking
- Wiring

6. Meter Options

Transmission metering applications predominantly fall in the category of 50MVA and above which requires Class 0.2S accuracy meters for tariff metering and Class 0.5S accuracy meters for statistical metering. The current metering contract makes provision of the following meters for Transmission applications:

Table 6: Landis+Gyr contract details applicable to Transmission

SAP #	Description
0207980	Three Phase Programmable 1A Meter, Dual RS485, CI 0.5: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.5S for Wh, 1 for varh; Number of outputs: 4 Programmable; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed
0615102	Three Phase Programmable 1A Meter, Dual RS485, CI 0.2, Aux: Type:

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	3ph; Current: 1 A; Voltage: 110 V; Communication port type: Dual RS485; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 4 Programmable; Auxiliary supply 100-240 V AC/DC; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed
0686392	Three Phase Programmable 1A Meter, Dual RS485, Ethernet, CI 0.2, Aux, 19" rack: Type: 3ph; Current: 1 A; Voltage: 110 V; Communication port type: Dual RS485 and Ethernet; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 6 Programmable; Auxiliary supply 100-240 V AC/DC; 19" rack with Essallec connectors; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed

7. Quality of supply Meter Options

Where a dedicated QoS instrument is required the current contract makes provision for a permanent substation, 19" rack mounted instrument (577553). The 19" rack mounted instrument shall be utilised as is for the refurbishment of existing Vectographs. However for new installations, the same item should be utilised but the instrument removed from the 19" rack plate and installed din mounted in the QOS module.

Table 7: Actom contract details applicable to Transmission

SAP #	Description
577551	PQ monitoring instrument – Investigation, surface mount
577553	PQ monitoring instrument – Permanent substation, 19" rack mounted
665285	PQ Accessory – GPS Antenna
665286	PQ Accessory – 0-5A (range) Micro clamp
665287	PQ Accessory – Modem

Contract number: 4600069855

8. Modem Options

The current modem contract makes provision of the four options tabled below. Advanced Cellular Removable Sim Modem 3G (SAP # 661603) shall be used for Transmission applications.

Table 7: ADC Energy contract details applicable to Transmission

SAP #	Description
661600	Modem: Basic Cellular Removable SIM Modem; 3G Modem: Type: Basic cellular removable sim; power source: 230 VAC; speed: 3G; specification: Eskom: 240-61266818; internal power supply or din rail; 3G metering modem; server mode; watchdog timers; network mode status indications; max dimensions: 180mm (h) x 110mm (w) x 80mm (d); din rail; female SMA connector; RS485 serial communications data port (connector RJ12 or RJ45); diagnostic port
661601	Modem: Basic Cellular Chip SIM Modem; 3G Modem: Type: Basic cellular chip sim; power source: 230 VAC; speed: 3G; specification: Eskom: 240-61266818; internal power supply or din rail: 3G metering modem; server mode; watchdog timers; network mode status indications; max dimensions: 180mm (h) x 110mm (w) x 80mm (d); din rail; female SMA connector; RS485 serial communications data port (connector RJ12 or RJ45); diagnostic port

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661603	Modem: Advanced Cellular Removable SIM Modem; 3G Modem: type: advanced cellular removable sim; power source: 110/230 VAC; 110/220 VDC; speed: 3G; specification: Eskom: 240-61266818; internal power supply or din rail; power down delay; 3G metering modem; server & client mode; dual sim functionality; watchdog timers; network mode status indications; Telnet or IP configuration service; access control list; max dimensions: 180mm (h) x 110mm (w) x 80mm (d); din rail; female SMA connector; RS485 and RS232 serial communications data port (connector RJ12 or RJ45); diagnostic port; input terminals; potential free output terminal
661604	Modem: Advanced Cellular Chip SIM Modem; 3G Modem: type: advanced cellular chip sim; power source: 110/230 VAC; 110/220 VDC; speed: 3G; specification: Eskom: 240-61266818; internal power supply or din rail; power down delay; 3G metering modem; server & client mode; dual sim functionality; watchdog timers; network mode status indications; Telnet or IP configuration service; access control list; max dimensions: 180mm (h) x 110mm (w) x 80mm (d); din rail; female SMA connector; RS485 and RS232 serial communications data port (connector RJ12 or RJ45); diagnostic port; input terminals; potential free output terminal

Contract number: 4600068637

9. Digital Transducer Options

Digital transducers provide measurement of instantaneous electrical quantities in substation control equipment. The PM8000 transducers are to be utilised for the following applications:

- Applications using digital interface viz. Modbus
- Applications using standalone transducers with four or six analogue outputs
- Applications that require a digital display
- Transmission Bus-coupler and Bus-section applications that incorporate 19" racks
- Refurbishment of old analogue transducer racks

The PM8000 provide for a 0-20mA analogue output signal, SCADA equipment needs to be reconfigured to accommodate the 0-20mA output signal. The transducer can be configured for 4-20mA, 0-10mA or any other range between 0 and 20 mA.

10. Transmission Metering Points

Transmission metering is generally installed at boundary interface points between Generation and Transmission and between Transmission and Distribution referred to as Internal Tariff Metering (ITM). In addition metering is installed at Large Customer and International customer interfaces fed directly from the Transmission networks as well as IPPs feeding directly onto the Transmission network. The Transmission Metering Points are highlighted in figure 1 below.

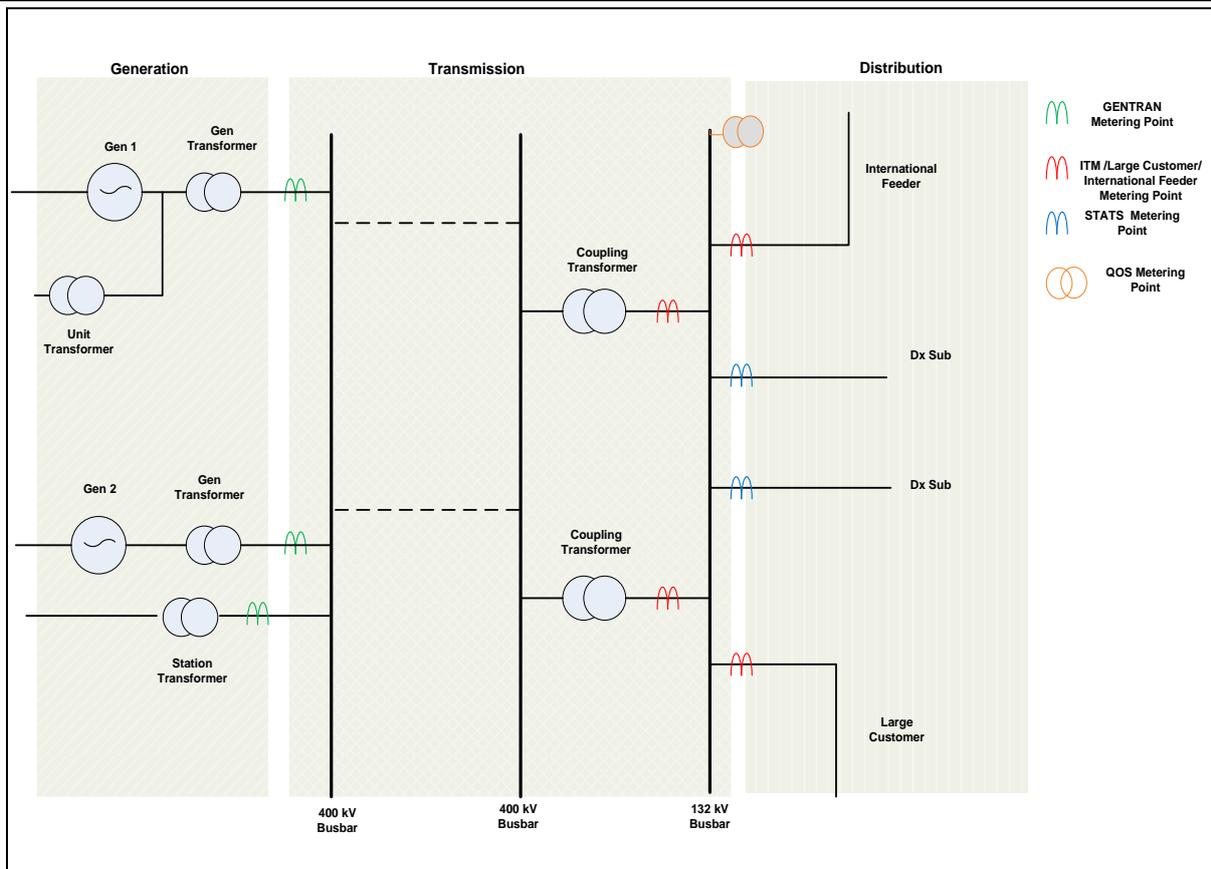


Figure 1: Transmission Metering Points

Transmission metering points are broadly classified as follows:

Table 8: Transmission Metering Points

	Description	Point of Metering
GENTRAN Metering	Generation - Transmission Interface Metering	HV Side of Generator Unit Transformer HV Side of Station Transformer
ITM	Transmission - Distribution Interface Metering	MV Side of Coupling Transformer where these transformers supply Distribution feeder(s)
Customer Metering	International customer or Large customers fed directly from the Transmission network	On feeder bays or line banks (Transformers used as feeder bays).
IPP	Where Power flows between an Independent Power Producer and Eskom Transmission	As specified in the respective Power Purchase Agreement
Stats Metering	Metering on feeder bays to Distribution where no tariff is applied	On feeder bays feeding Distribution

The detailed requirements relating to the minimum accuracy and configuration for metering installations, including the instrument transformers, meters and communications are provided in the document 240-56364444: *Standard minimum requirements for the metering of electrical energy and demand.*

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10.1 GENTRAN Metering

GENTRAN metering is typically installed on the HV side of each Generator Unit Transformers and the HV side of the Station Transformers. GENTRAN metering is utilised to determine the station sent-out values as well as to provide the respective power stations with operational data. Each metering point shall have a dedicated main and check meter (class 0.2S).

The station sent-out values are calculated on-site by the use of an additional summation meters (main and check) typically incorporated within the scheme. The individual Gen Unit Transformers are interfaced to the summation meters via Modbus over RS485. Interface to the power station EMDAS system for the provision of data should be via the summation meters preferably via protocol such as Modbus/IEC 61850 if supported by the power station EMDAS or via pulses. The station sent-out values are to be provided to the RTU via discreet pulses. Table 8 below provides details of the items to be purchased for a typical 6 Generator Power Station.

The current metering contract with Landis & Gyr **does not** provide for summation metering, hence it cannot be utilised for GENTRAN metering applications. For GENTRAN metering, single source procurement will be utilised for the purchase of Schneider ION 8800 meters or a separate contract will have to be established for GENTRAN meters based on the need.

If station transformer meters are to be included in the scheme, they would need to be housed in a separate panel. The summation meters have no CT and VT inputs but will still utilise the standard meter module.

The appropriate number of interposing modules needs to be added to the scheme based on the pulsing requirements.

It is preferred that the individual bay VTs should be utilised for each Generator Unit metering. In cases where this is not possible and busbar VTs are to be utilised, the appropriate VT selection module needs to be identified and included in the scheme.

GENTRAN meters require auxiliary supply to power the meters. The meters auxiliary supply should be supplied by the station DC supply.

Table 9: 6 Gen Unit Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400mm panel)	3
	0569921	Module: Metering 19" rack mount 6-way CT test blocks	7
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	8
	0401956	Plate: Blanking 5U, D9141	3
	0401958	Plate, Blanking 7U, D9141	5
single source procurement or separate contract		Schneider ION 8800 Three phase programmable, class 0.2S active energy, class 0.5S reactive energy, 1A, 110V transformer operated meters, 19" rack mount, 6 programmable pulse outputs, RS232, RS485 & Ethernet communication ports	14

Figure 2 below depicts the panel layout a typical metering scheme for a six unit station.

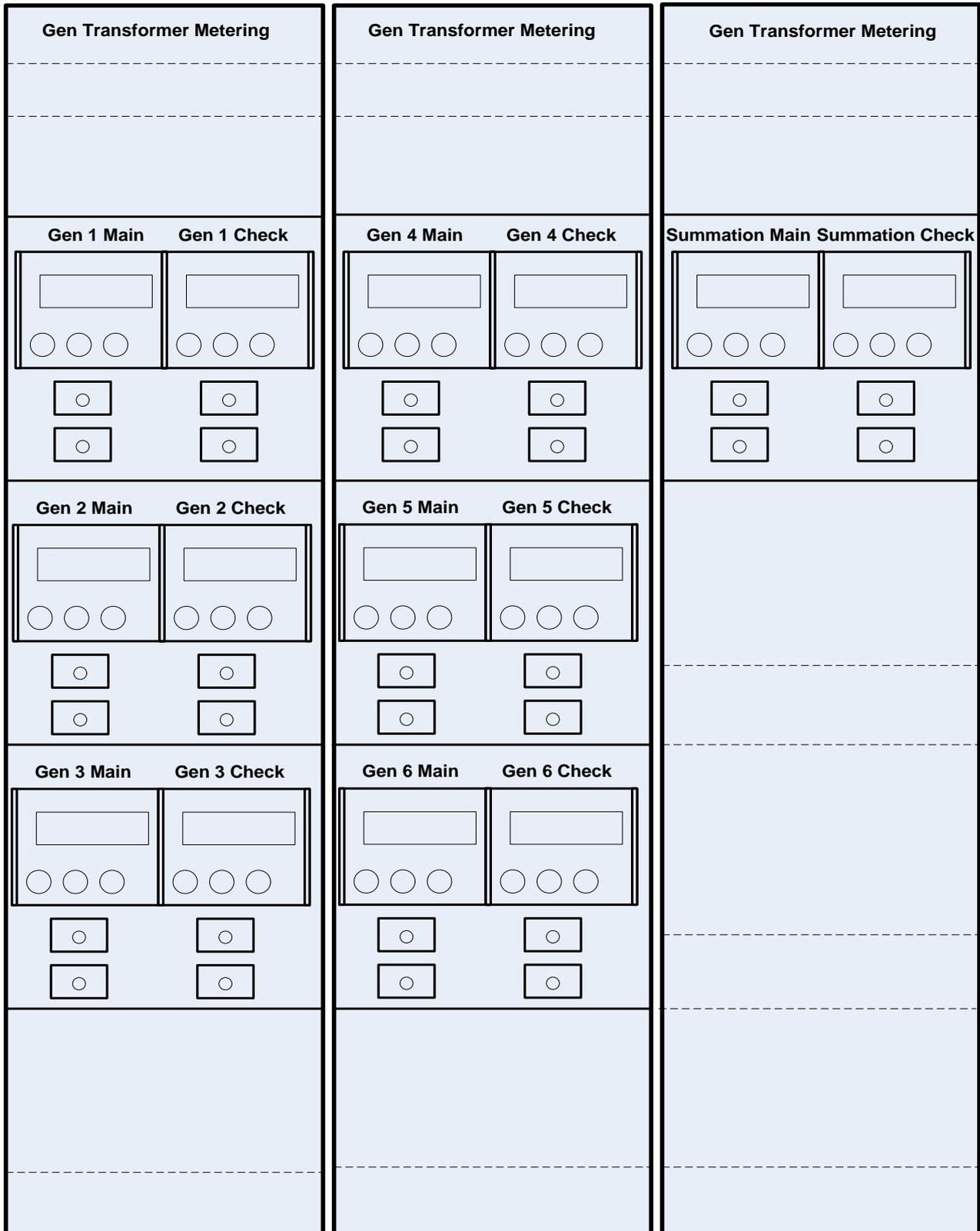


Figure 2: GENTRAN Metering Scheme Layout

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10.2 Internal Tariff Metering

ITM schemes typically consist of metering on the MV side of the coupling transformers that supply Distribution. Each coupling transformer interfacing to Distribution is considered as a separate metering point. Each metering point shall have a dedicated main and check meter (class 0.2S).

Tables 9-14 below provide details of the items to be purchased for the various ITM schemes:

Table 10: 1 Meter Point ITM Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400mm panel)	1
	0569921	Module: Metering 19" rack mount 6-way CT test blocks	1
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	4
	0401956	Plate: Blanking 5U, D9141	1
	0401958	Plate, Blanking 7U, D9141	3
4600070082	0686392	Three Phase Programmable 1A Meter, Dual RS485, Ethernet, CI 0.2, Aux, 19" rack: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485 and Ethernet; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 6 Programmable; Auxiliary supply 100-240 V AC/DC; 19" rack with Essallec connectors; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	2
4600069855	577553	PQ monitoring instrument – Permanent substation, 19" rack mounted	1

Table 11: 2 Meter Point ITM Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400mm panel)	1
	0569921	Module: Metering 19" rack mount 6-way CT test blocks	2
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	3
	0401956	Plate: Blanking 5U, D9141	1
	0401958	Plate, Blanking 7U, D9141	2
4600070082	0686392	Three Phase Programmable 1A Meter, Dual RS485, Ethernet, CI 0.2, Aux, 19" rack: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485 and Ethernet; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 6 Programmable; Auxiliary supply 100-240 V AC/DC; 19" rack with Essallec connectors; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	4
4600069855	577553	PQ monitoring instrument – Permanent substation, 19" rack mounted	1

Table 12: 3 Meter Point ITM Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400mm panel)	1
	0569921	Module: Metering 19" rack mount 6-way CT test blocks	3
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	2
	0401956	Plate: Blanking 5U, D9141	1
	0401958	Plate, Blanking 7U, D9141	1
4600070082	0686392	Three Phase Programmable 1A Meter, Dual RS485, Ethernet, CI 0.2, Aux, 19" rack: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485 and Ethernet; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 6 Programmable; Auxiliary supply 100-240 V AC/DC; 19" rack with Essaiilec connectors; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	6
4600069855	577553	PQ monitoring instrument – Permanent substation, 19" rack mounted	1

Although the standard panel can cater for up to 4 metering modules i.e. 4 meter points - 19" rack variant, it is recommended that a maximum of 3 metering modules be incorporated in one panel to allow for additional modules such as modem modules, QOS modules, Voltage Selection modules when required.

Table 13: 4 Meter Point ITM Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400mm panel)	2
	0569921	Module: Metering 19" rack mount 6-way CT test blocks	4
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	6
	0401956	Plate: Blanking 5U, D9141	2
	0401958	Plate, Blanking 7U, D9141	4
4600070082	0686392	Three Phase Programmable 1A Meter, Dual RS485, Ethernet, CI 0.2, Aux, 19" rack: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485 and Ethernet; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 6 Programmable; Auxiliary supply 100-240 V AC/DC; 19" rack with Essaiilec connectors; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	8
4600069855	577553	PQ monitoring instrument – Permanent substation, 19" rack mounted	1

Table 14: 5 Meter Point ITM Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400mm panel)	2
	0569921	Module: Metering 19" rack mount 6-way CT test blocks	5

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Contract Number	SAP Number	Description	# of Items
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	5
	0401956	Plate: Blanking 5U, D9141	2
	0401958	Plate, Blanking 7U, D9141	3
4600070082	0686392	Three Phase Programmable 1A Meter, Dual RS485, Ethernet, CI 0.2, Aux, 19" rack: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485 and Ethernet; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 6 Programmable; Auxiliary supply 100-240 V AC/DC; 19" rack with Essailec connectors; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	10
4600069855	577553	PQ monitoring instrument – Permanent substation, 19" rack mounted	1

Table 15: 6 Meter Point ITM Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400 mm panel)	2
	0569921	Module: Metering 19" rack mount 6-way CT test blocks	6
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	4
	0401956	Plate: Blanking 5U, D9141	2
	0401958	Plate, Blanking 7U, D9141	2
4600070082	0686392	Three Phase Programmable 1A Meter, Dual RS485, Ethernet, CI 0.2, Aux, 19" rack: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485 and Ethernet; Class: 0.2S for Wh, 0.5 for varh; Number of outputs: 6 Programmable; Auxiliary supply 100-240 V AC/DC; 19" rack with Essailec connectors; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	12
4600069855	577553	PQ monitoring instrument – Permanent substation, 19" rack mounted	1

Metering for international or large customers fed directly from the Transmission network are generally included in the ITM scheme as separate metering points. Hence the ITM schemes can cater for a combination of both Tx/Dx bulk metering points (on the coupling transformers/feeders) as well international metering points or Large Customer metering points (feeder metering). The scheme requirements would remain the same.

International metering requirements may differ from one installation to the next in terms of the points of metering and the number of meters required based on agreements between Eskom International Trader and the respective SAPP utility. The detailed metering requirements for international metering points should be finalised after consulting the Eskom International Trader, via System Operator Metering and Data Services.

In general, most ITM schemes are provided with a selected VT supply (busbar VTs) from the respective protection scheme. In such cases the VT supply is directly cabled to the respective meter(s) which would not require the use of voltage selection modules. Where a selected VT supply is not provided, and busbar VTs are to be utilised, the appropriate VT selection module needs to be identified and included in the scheme.

ITM meters require auxiliary supply to power the meters. The meters auxiliary supply, modem supply and QOS auxiliary supply should be supplied by the station DC supply.

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Stats meters are generally installed on feeder bays to Distribution where no tariff is applied. Each metering point requires a single (only main) class 0.5S meter.

Tables 15-20 below provide details of the items to be purchased for the various Stats metering schemes:

Table 16: 1 Meter Stats Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400 mm panel)	1
	0569919	Module: Metering surface mount 6-way CT test blocks	1
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	2
	0401958	Plate, Blanking 7U, D9141	4
4600070082	0207980	Three Phase Programmable 1A Meter, Dual RS485, CI 0.5: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.5S for Wh, 1 for varh; Number of outputs: 4 Programmable; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	1

The standard meter module has cut-outs and terminals for 2 meters. In the case of a one meter stats scheme, the other meter cut-out and terminals would remain empty and unpopulated and could be used for a future feeder that requires stats metering. The same would apply to a three and five meter stats scheme.

Table 17: 2 Meter Stats Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400 mm panel)	1
	0569919	Module: Metering surface mount 6-way CT test blocks	1
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	2
	0401958	Plate, Blanking 7U, D9141	4
4600070082	0207980	Three Phase Programmable 1A Meter, Dual RS485, CI 0.5: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.5S for Wh, 1 for varh; Number of outputs: 4 Programmable; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	2

Table 18: 3 Meter Stats Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400 mm panel)	1
	0569919	Module: Metering surface mount 6-way CT test blocks	2
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	2
	0401958	Plate, Blanking 7U, D9141	2
4600070082	0207980	Three Phase Programmable 1A Meter, Dual RS485, CI 0.5:	3

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Contract Number	SAP Number	Description	# of Items
		Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.5S for Wh, 1 for varh; Number of outputs: 4 Programmable; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	

Table 19: 4 Meter Stats Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400 mm panel)	1
	0569919	Module: Metering surface mount 6-way CT test blocks	2
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	2
	0401958	Plate, Blanking 7U, D9141	2
4600070082	0207980	Three Phase Programmable 1A Meter, Dual RS485, CI 0.5: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.5S for Wh, 1 for varh; Number of outputs: 4 Programmable; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	4

Table 20: 5 Meter Stats Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400 mm panel)	1
	0569919	Module: Metering surface mount 6-way CT test blocks	3
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	2
4600070082	0207980	Three Phase Programmable 1A Meter, Dual RS485, CI 0.5: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.5S for Wh, 1 for varh; Number of outputs: 4 Programmable; BS footprint; Calibrated with calibration certificate, calibration sticker affixed to the Meter and sealed	5

Table 21: 6 Meter Stats Scheme

Contract Number	SAP Number	Description	# of Items
4600071721	0402613	Panel: (800 x 600 x 2400 mm panel)	1
	0569919	Module: Metering surface mount 6-way CT test blocks	3
	0230645	Module, Modem, D9404	1
	0401952	Plate: Blanking 3U, D9141	2
4600070082	0207980	Three Phase Programmable 1A Meter, Dual RS485, CI 0.5: Type: 3ph; Current: 1 A; Voltage: 110 V, Communication port type: Dual RS485; Class: 0.5S for Wh, 1 for varh; Number of outputs: 4 Programmable; BS footprint; Calibrated with	6

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Contract Number	SAP Number	Description	# of Items
		calibration certificate, calibration sticker affixed to the Meter and sealed	

Historically Stats metering schemes were provided with a selected VT supply (busbar VTs) from the respective protection scheme. However, the Siemens Phase 6 feeder protection schemes do not provide a selected VT supply to the metering circuit as the selection is done digitally within the protection IED. Hence for all Siemens Phase 6 feeder protection schemes a voltage selection module is required to be incorporated in the stats metering panel for each feeder.

Stats meters do not require an auxiliary supply as they are powered by the VT supply. The modems auxiliary supply should be via the station DC supply.

10.3 IPP Metering

The requirements for IPP metering are specified in the respective Power Purchase Agreement and they may differ from one IPP to another. The scheme requirements should align with the standard Eskom metering schemes. For all Transmission interfaced IPP the Landis+Gyr ZMQ202 (E850) (SAP number 0686392) meter should be utilised for system meters.

10.4 Quality of Supply

Eskom, as a licensee, is required by NERSA to measure, report and manage the quality of electricity delivered to its customers. The QoS measurement points are defined for Category A sites, which are considered as permanent sites i.e. where an instrument is intended to be connected for a period of more than three years. The QoS performance levels at these sites are utilised for statistical reporting to the respective Transmission customers, stakeholders and NERSA. In general, QoS instruments should be evenly deployed across the network, at the various customer interfaces, in order to ensure that the power quality measurements obtained from these sites provide a good representation of the power system's performance.

10.4.1 Quality of Supply Measurements Points

NRS 048-4 provides an indicative number of Category A sites to be monitored for the various voltage levels and customer interface types. In a Transmission network environment, QoS instruments shall be permanently installed at all busbars that interface to Distribution and large customers fed directly from a Transmission substation, as detailed below:

- A QoS instrument shall be installed in a Transmission substation at each busbar for voltages of 132kV and below.
- A QoS instrument shall be installed in a Transmission substation at the busbar from which a large customer / end user is supplied (voltages above 132kV).
- A QoS instrument shall be installed on each section of a split busbar, for the above two cases, that have a split busbar arrangement which operates in a permanently open state.

No permanent QoS instruments are to be installed at traction supply interfaces and on supplies from the tertiary windings of Transmission transformers. These are to be treated as Category B or Category C sites.

10.4.2 Quality of Supply Instruments

Whilst the current Eskom contracts cater for dedicated QoS instruments viz. Vectograph III, the Schneider ION 8800 meter that is deployed at the majority of Transmission ITM schemes, in addition to providing tariff metering, has the capability of providing QoS functionality in accordance with IEC 61000-4-30. Utilising the ION 8800 meter for both tariff metering and QoS functionality would eliminate the need for separate, dedicated instruments at common metering and QoS points.

For Transmission Category A sites, where an ION 8800 meter exists as part of the ITM point, and coincides with the QoS metering point, the check ION meter will be utilised as the QoS instrument. The check ION meter will be loaded with the QoS framework. Transmission QoS metering points that do not have ION 8800 meters installed, shall have a dedicated QoS Instrument (Vecto III) installed.

All IPP sites shall have a dedicated QoS Instrument (Vecto III) installed.

Where Vecto III instruments are installed, the surface mount Vecto III (SAP # 577553) shall be purchased and installed in the QoS module provided on the panels and modules contract.

10.4.3 Quality of Supply Communications

All new QoS installations shall be connected to the Eskom Telecommunications IP network for remote downloading of QoS data. All permanent QoS installation requires no GPS antenna and Eskom Telecoms need to cater for Ethernet connection for meters. The following needs to be requested and provided for by Eskom Telecoms for all new substation QoS communications:

- IP interface (RJ45 connector) from the Telecoms router to the respective QoS instrument
- Baud rate of 64kbps
- IP address to be allocated by Eskom Telecoms

10.5 Selection of CT ratios

Most CT's used in Transmission are equipped with cores that have different tapings to allow for the selection of a particular ratio depending on the load being transferred across that particular bay. CT ratios shall be selected to optimize the CT operation range, within limits of the expected connected load.

To calculate the correct metering CT ratio at the point of metering (POM) for a particular customer the notified maximum demand (NMD) is required. The NMD is the maximum demand that is contracted between Eskom and a customer. The anticipated load growth also has to be taken into consideration.

The information above is obtained from the network planning report which also indicates where the customer/s point of metering at the Substation is. Further information can also be obtained from the supply agreement between Eskom and the customer.

The suitable CT ratio chosen has to be indicated on the protection settings as well as the applicable application design drawings for that bay.

10.6 VT Cabling

The cables from the VT JB's in the yard to the control room have a certain amount of resistance and the longer the cable the higher the resistance or "burden" on that cable. This burden causes the voltage to be slightly lower at the control room end which is called the volt drop.

The volt drop across a VT cable shall not contribute to the overall measurement error by more than the accuracy class of the installed meter. The volt drop limits are summarized in table 5 below

Table 22: Volt drop limits

Class of Energy Meters	Voltage Drop Limit (Phase to Neutral voltage 63.5V)
0,2S	127mV (0,2%)
0,5S	318mV (0,5%)

For most metering applications BVX4ECV (4 core 4mm²) cables are used for VT cabling. When a distance of 300m is exceeded, which is common at many Transmission substations, BVX4FCV (4 core 6mm²) or larger is used. This is done to prevent the volt drop from exceeding the allowable limit due to the size and length of the supply cable.

10.7 Labelling

The meter scheme labelling requirements should in accordance with section 3.9 of the *Standard for Substation Meter Panels: HV/MV Indoor*.

10.8 Transport

The transport of both the panels and meters are to be provided for by Rotek engineering.

11. Authorisation

This document has been seen and accepted by:

Name and surname	Designation
Tony Sheerin	PTM&C Planning and Support Manager
Nombuso Msibi	PTM&C Applications Manager

12. Revisions

Date	Rev	Compiler	Remarks
Jan 2018	1	M Omar	Document required catering for new metering commodity contracts.
Jan 2022	2	TS Letwaba	Document revised to include new / revised metering commodity contracts
Sep 2022	3	TS Letwaba	Document revised to include Digital Transducer Contract

13. Development team

The following people were involved in the development of this document:

- Mohamed Omar
- Samuel Letwaba

14. Acknowledgements

- Not Applicable