



**Eskom**

**Standard**

**Technology**

Title: **STANDARD FOR SUBSTATION  
METER PANELS: HV/MV  
INDOOR**

Unique Identifier: **240-65292589**

Alternative Reference Number: **N/A**

Area of Applicability: **Engineering**

Documentation Type: **Standard**

Revision: **2**

Total Pages: **23**

Next Review Date: **January 2024**

Disclosure Classification: **Controlled  
Disclosure**

**Compiled by**

**Henri Groenewald**  
**Chief Engineer - Standards**  
**Working Group**

Date: 2019-01-08

**Approved by**

**Mohamed Omar**  
**Metering and Measurements**  
**SC Chairperson**

Date: 16/01/2019

**Authorized by**

**Dr. Titus Mathe**  
**General Manager**  
**Technology**

Date:

**Supported by SCOT/SC**

**Richard McCurrach**  
**PTM&C Technical**  
**Committee Chairperson**

Date: 17/1/2019

## Content

	Page
1. Introduction .....	4
2. Supporting clauses .....	4
2.1 Scope .....	4
2.1.1 Purpose .....	4
2.1.2 Applicability .....	4
2.2 Normative/informative references .....	4
2.2.1 Normative .....	4
2.2.2 Informative .....	5
2.3 Definitions .....	5
2.3.1 General .....	5
2.3.2 Disclosure classification .....	5
2.4 Abbreviations .....	5
2.5 Roles and responsibilities .....	6
2.6 Process for monitoring .....	6
2.7 Related/supporting documents .....	6
3. Requirements .....	6
3.1 Panel .....	6
3.1.1 Gland plates .....	7
3.1.2 Earthing details .....	7
3.1.3 Equipment auxiliary power supply .....	7
3.2 Meter module .....	7
3.2.1 Surface mount meter module (4-way and 6-way) .....	7
3.2.2 19" rack mount meter module (4-way and 6-way) .....	9
3.2.3 Wiring .....	10
3.3 Voltage selection modules .....	11
3.3.1 General .....	11
3.3.2 Voltage selection module A .....	12
3.3.3 Voltage selection module B .....	13
3.3.4 Voltage selection module C .....	13
3.3.5 Voltage selection module D .....	13
3.4 Interposing modules .....	14
3.4.1 General .....	14
3.4.2 Interposing module A .....	15
3.5 Modem module .....	16
3.5.1 General .....	16
3.6 Quality of Supply module .....	16
3.6.1 General .....	16
3.6.2 Quality of Supply module .....	16
3.7 Additional equipment .....	17
3.8 Tests .....	17
3.9 Marking, labeling and packaging .....	17
3.9.1 Labels .....	17
3.9.2 Packaging .....	17
4. Authorization .....	18

**ESKOM COPYRIGHT PROTECTED**

5. Revisions .....	18
6. Development team .....	19
7. Acknowledgements .....	19
Annex A – - Model metering panel ordering sheet .....	20

## **1. Introduction**

This document together with the manufacturing drawings specifies the requirements for substation metering panels and presents a number of options which can be grouped together into a cabinet.

Requirements from Transmission, Generation and Distribution are standardised and catered for with this revision. However, amendments to these specifications can be made to cater for unique requirements, as stipulated in 240-56359083. This shall then be catered for through the applicable design specification and design drawings.

The main component is the substation metering panel. Installed into this panel shall be the meter modules, voltage selection modules, modem module, quality of supply modules and interposing modules if required.

As a general rule Distribution has made use of 800mm wide swing frame panels with front door entry. Transmission has utilised a 600mm wide panel with back entry. This specification will standardise on the various modules to be utilised in both substation panel options.

There are a number of variations possible and the ordering schedule in Annex A provides an easy mechanism when ordering a standard panel.

## **2. Supporting clauses**

### **2.1 Scope**

#### **2.1.1 Purpose**

The purpose of this document is to provide metering staff and panel manufacturers with a standard for building substation meter panels for use with MV and HV supplies.

#### **2.1.2 Applicability**

This document is applicable to Eskom Holdings SOC Limited and wholly owned subsidiaries.

### **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]  | SANS 60947-2   | Low-voltage switchgear and control gear Part 2: Circuit-breakers   |
| [3]  | SANS 1091      | National colour standards for paint  |
| [4]  | SANS 1507      | Electric cables with extruded solid dielectric insulation for fixed installations (300/500V to 1900/3000V).          |
| [5]  | SANS 1186-1    | Symbolic safety signs Part 1: Standard signs and general requirements  |
| [6]  | SANS 1195      | Busbars  |
| [7]  | SANS 60529     | Degrees of protection for enclosures (IP code)   |
| [8]  | SANS 60947-7-1 | Low-voltage switchgear and control gear Part 7: Ancillary equipment Section 1: Terminal blocks for copper conductors |
| [9]  | 240-70732868   | Standard test block connections for metering circuits  |
| [10] | 240-60725641   | Standard for a swing frame panel (19 inch rack) and blanking plates  |
| [11] | 240-76628623   | Standard for phase failure relays  |

**ESKOM COPYRIGHT PROTECTED**

- [12] 240-56359083 Requirements for Measurement and Metering Systems for Power Stations in Generation Standard
- [13] 240-76628631 Standard for sealing of metering equipment
- [14] D-DT-5084 Eskom manufacturing drawings: Substation metering panels

**2.2.2 Informative**

- [15] SANS474/NRS057 Code of practice for electricity metering

**2.3 Definitions**

**2.3.1 General**

Definition	Description
<b>U</b>	Unit used to describe the height of panel equipment. 1U = 44.45 mm.
<b>19"</b>	Unit used to describe the width of panel equipment. 19" = 482.6 mm.
<b>Metering Equipment</b>	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.
<b>Metering Installation</b>	All meters, fittings, equipment, wiring and installations used for measuring the flow of electrical power.

**2.3.2 Disclosure classification**

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

**2.4 Abbreviations**

Abbreviation	Description
<b>AC or a.c.</b>	Alternating current
<b>CT</b>	Current instrument transformer
<b>DC or d.c.</b>	Direct current
<b>GM</b>	General Manager
<b>Hz</b>	Hertz
<b>IDF</b>	Intermediate distribution frame
<b>IP</b>	Ingress Protection
<b>kA</b>	Kilo-ampere
<b>kvarh</b>	Kilovarh-hour
<b>kVrms</b>	Kilo-volt (root mean square).
<b>kWh</b>	Kilowatt-hour
<b>MCB</b>	Miniature Circuit-breaker
<b>ms</b>	Milli-second
<b>n/a</b>	not applicable
<b>PTM&amp;C</b>	Protection, Telecoms, Metering and Control

**ESKOM COPYRIGHT PROTECTED**

Abbreviation	Description
PVC	Polyvinyl Chloride
Q1, Q2, Q3, Q4 kvarh:	kilovar-hour in various measurement quadrants.
UC or u.c.	Universal current (AC & DC)
UPS	Uninterruptable power supply
VA	Volt-ampere
VSM	Voltage selection module
VT	Voltage instrument transformer
W	Watt

## 2.5 Roles and responsibilities

The relevant metering design sections within Eskom Distribution, Transmission and Generation are responsible to implement the new designs according to the requirements as listed in this document.

## 2.6 Process for monitoring

Adherence to this document shall be monitored through routine inspections.

## 2.7 Related/supporting documents

N/A.

## 3. Requirements

### 3.1 Panel

The design of the standard metering panel is such that it utilizes either a standard front entry 800mm by 600mm by 2400mm panel with swing frame door as specified in 240-60725641 or a 600mm by 600mm by 2400mm back entry panel.

The panels shall be 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.

In Generation additional 19" modular units may be specified for the installation of measurement transducers, Ethernet switches and other related equipment depending on the interface requirements of other plant in the power station.

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 shall 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.

The components of the metering panel are described below.

The panels shall be bolted on a Unistrut rail with about a third overhang over the cable trench. The plinth shall be provided with a facility to carry a trench cover.

Unless otherwise specified during the ordering of modules, internal and external surfaces shall be painted G29 (light grey), of SANS 1091.

**Note:** An option for a wall mount panel is also provided for in the ordering schedules which cater for four individual metering circuits. (Slim-line panel)

**ESKOM COPYRIGHT PROTECTED**

### **3.1.1 Gland plates**

The removable gland plate shall be punched and plated. Provision shall be made for the fitting of a minimum of 25 number 1 glands (20mm holes) and 2 number 2 glands (25mm holes). Each hole shall be blanked with a plastic plug.

### **3.1.2 Earthing details**

Each panel shall have a copper earth bar 40mm x 3mm and one earth connection terminal suitable for a solid copper earth strap. All metal components of the panel, doors and devices shall be effectively connected to this earth bar by green 4mm<sup>2</sup> PVC insulated earthing conductors. All earth connections shall be as short as possible and shall not be coiled. Eskom shall connect this earth bar to the station earth with a copper strap 30mm x 3mm.

### **3.1.3 Equipment auxiliary power supply**

Unless otherwise specified, ancillary equipment shall be supplied with power through the substation DC supply routed from the DC distribution board.

Where there is no DC supply available then the auxiliaries can be fed from the 110V AC supply from Voltage selection module B.

The MCBs to protect the DC supply circuits within the various modules shall be rated for the appropriate DC supply voltage level. MCBs rated only for AC shall not be installed in DC circuits.

**Note 1:** Where the voltage level of the substation DC supply is not 110V, then the metering equipment must be specified to accommodate the substation DC supply voltage.

**Note 2:** For Generation, ancillary equipment is generally supplied from 220V AC with UPS backup.

## **3.2 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.

### **3.2.1 Surface mount meter module (4-way and 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 way test blocks or a PK2 – 6 way when required
- Terminals
- Trunking
- Wiring

The back plate shall include the following:

- Back plate including
- 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 swing frame.

### **3.2.1.1 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.

NOTE: Provision is made for two variants of this module – one flat plate module (for older panels) and a recessed plate module (for new applications)

#### **3.2.1.1.1 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.

A PK2 – 4 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 short-circuiting of the input (bottom) current circuit. The terminals that protrude into the panel shall be suitably insulated from the steel edges.

Optional: 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.

The test block wiring shall conform to 240-70732868 – Standard test block connections for metering circuits.

#### **3.2.1.1.2 Terminals**

The terminals for voltage fail alarms and the auxiliary supply circuits shall be spring loaded to ensure connection in the event the screws are not tightened. The terminals shall be arranged according to the respective drawings.

#### **3.2.1.1.3 Trunking**

Cable trunking, location and sizing, shall be provided in accordance with the respective drawings to accommodate the necessary cables. The trunking shall be fastened to the plate using rivets or screws. Rivets and/or screws shall not protrude through to the front of the plate.

#### **3.2.1.2 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.

### **3.2.1.2.1 Terminals**

The terminals shall be spring loaded to ensure connection in the event the screws are not tightened. The terminals shall be arranged according to the respective drawings. One terminal per metering circuit is required for the VT neutral inputs, eight for the CT inputs/outputs and two for the voltage fail alarm contact.

### **3.2.1.2.2 Miniature circuit- breakers**

The miniature circuit breakers shall be the DIN rail mount type, 5A or 6A current rating, fast curve, 13mm width and shall have provision for sealing the operating levers in the closed position.

### **3.2.1.2.3 Trunking**

Cable trunking, location and sizing, shall be provided in accordance with the respective drawings to accommodate the necessary cables. The trunking shall be fastened to the plate using rivets or screws.

## **3.2.2 19" rack mount meter module (4-way and 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 way test blocks or a PK2 – 6 way when required
- 19" rack with Essailec connector terminals
- Trunking
- Wiring

The back plate shall include the following:

- Back plate including:
- 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.

### **3.2.2.1 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 9 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.

The front plate shall be one unit and the area for the CT and VT test blocks shall be recessed.

#### **3.2.2.1.1 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.

A PK2 – 4 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 short-circuiting of the input (bottom) current circuit. The terminals that protrude into the panel shall be suitably insulated from the steel edges.

Optional: 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.

The test block wiring shall conform to 240-70732868 – Standard test block connections for metering circuits.

#### **3.2.2.1.2 19" rack Essailec connectors**

Essailec connectors with standard wiring shall be installed on the back of the 19" racks such that 19" rack meters can be fitted onto the connectors.

#### **3.2.2.1.3 Trunking**

Cable trunking, location and sizing, shall be provided in accordance with the respective drawings to accommodate the necessary cables. The trunking shall be fastened to the plate using rivets or screws. Rivets and/or screws shall not protrude through to the front of the plate.

#### **3.2.2.2 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.

#### **3.2.2.2.1 Terminals**

The terminals shall be spring loaded to ensure connection in the event the screws are not tightened. The terminals shall be arranged according to the respective drawings. One terminal per metering circuit is required for the VT neutral inputs, eight for the CT inputs/outputs and two for the voltage fail alarm contact.

#### **3.2.2.2.2 Miniature circuit- breakers**

The miniature circuit breakers shall be the DIN rail mount type, 5A or 6A current rating, fast curve, 13mm width and shall have provision for sealing the operating levers in the closed position.

#### **3.2.2.2.3 Trunking**

Cable trunking, location and sizing, shall be provided in accordance with the respective drawings to accommodate the necessary cables. The trunking shall be fastened to the plate using rivets or screws.

### **3.2.3 Wiring**

The wiring shall be done in accordance with the wiring diagram in drawing D-DT-5804. Joints and splices in the wiring are not acceptable. Not more than two conductors shall be connected to either side of a terminal.

Panel wiring shall meet the following requirements.

- 2.5mm<sup>2</sup> nominal cross sectional area, 40 to 50 strands for the current, voltage and auxiliary supply conductors.
- 1.5mm<sup>2</sup> nominal cross sectional area, 15 to 30 strands for all other circuits
- all wiring shall be flexible and PVC insulated

**ESKOM COPYRIGHT PROTECTED**

- 600V graded
- earth wires shall be green/yellow
- Wire labels or ferules used for wiring identification (clip on versus interlocking slip on) colour shall be black on yellow or white.

The following lugs shall be used on the wiring:

Connected onto:	Conductor size	Lugs	Colour
VT, CT and auxiliary circuit terminals	2,5mm <sup>2</sup>	Hellermann hooked blade type T2HB or JST type FVDAH-2	Blue
Essailec CT circuit terminals (19" rack module)	2,5mm <sup>2</sup>	Hellermann ring type T2R35A or JST type FVD2-M3	Blue
Essailec VT and auxiliary supply circuit terminals	2,5mm <sup>2</sup>	Hellermann female disconnect type T2DF or JST type FVDDF2-250B	Blue
Essailec pulsing circuit terminals	1,5mm <sup>2</sup>	Hellermann female disconnect type T1DF or JST type FVDDF1.25-250B	Blue
MCBs	2,5mm <sup>2</sup>	Hellermann disconnect male type T2DM or JST type FVDDM2-250	Blue
PK 2 test blocks	2,5mm <sup>2</sup>	Hellermann ring type T2R6 or JST ring type FVD2-6	Blue
Pulsing circuits	1,5mm <sup>2</sup>	Hellermann pin type T1P10 or JST pin type FVDPC-1.25	Red

NB: Only JST type YNT or Cembre type HP4 crimping tools shall be used for the crimping of lugs.

All external CT and VT inputs shall be wired to the top of the terminals or miniature circuit-breakers.

All wiring between the front and back plates shall be at least 2m long to allow the swing frame door to open and shall be secured to the panel. All wiring shall be covered in a braided sleeve/black sock to protect and keep the wiring together.

### 3.3 Voltage selection modules

#### 3.3.1 General

The voltage selection modules are required where switching arrangements in the substation yard can result that 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.

The operating time of the voltage selection shall be less than one second.

##### 3.3.1.1 Terminals

The terminals shall be spring loaded to ensure connection in the event the screws are not tightened. The terminals shall be arranged according to the respective drawings.

### 3.3.1.2 Trunking

Cable trunking, location and sizing, shall be provided in accordance with the respective drawings to accommodate the necessary cables. The trunking shall be fastened to the plate using rivets or screws.

### 3.3.1.3 Wiring

All VT inputs from the HV yard shall be wired to the top of the terminals or miniature circuit breakers. Joints and splices in the wiring are not acceptable. Not more than two conductors shall be connected to either side of a terminal.

The following lugs shall be used on the wiring:

Connected onto:	Conductor size	Lugs	Colour
VT and auxiliary circuit terminals	2,5mm <sup>2</sup>	Hellermann hooked blade type T2HB or JST type FVDAH-2	Blue
MCBs	2,5mm <sup>2</sup>	Hellermann disconnect male type T2DM or JST type FVDDM2-250	Blue
Relay base.	2,5mm <sup>2</sup>	Hellermann blade type T2FB9 or pin type T2P8 or JST type FV2-1AF or pin type FVDPC-2	Blue

**NB:** Only JST type YNT or Cembre type HP4 crimping tools shall be used for the crimping of lugs.

### 3.3.1.4 MCB

The miniature circuit breakers shall be of the DIN rail mount type, 5A or 6A current rating, fast curve, 13mm width and shall make provision for sealing the operating levers in the closed position.

Four types of voltage selection modules shall be provided for and will be explained in the following sections.

## 3.3.2 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:

- Phase failure relays
- 3-way latching relays
- Terminals
- Trunking
- Wiring

### 3.3.2.1 Voltage selection

The voltage selection shall be done through a combination of phase failure and chop-over relays. The phase failure relay shall conform to Eskom specification 240-76628623. One contact shall be used to drive a remote alarm indication.

### **3.3.3 Voltage selection module B**

The main function shall be to provide continuous voltage 110V AC supply to all the ancillary equipment where a DC auxiliary supply is not utilized. The module is 5U high and fits inside the panel.

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

The plate includes the following:

- 5A MCBs 2.5kA
- Chop-over relays
- Terminals
- Trunking
- Wiring

#### **3.3.3.1 Voltage selection**

The voltage selection shall be done through a combination of chop-over relays.

### **3.3.4 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:

- 3-way latching relay
- Terminals
- Trunking
- Wiring

#### **3.3.4.1 Voltage selection**

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

### **3.3.5 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, 2.5kA
- Phase fail relays
- 3-way latching relays
- Terminals

- Trunking
- Wiring

### 3.3.5.1 Voltage selection

The voltage selection shall be a combination of phase failure relays and single pole double throw relays. The phase failure relay shall conform to Eskom specification 240-76628623. One contact shall be used to drive a remote alarm indication.

## 3.4 Interposing modules

### 3.4.1 General

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

#### 3.4.1.1 Terminals

The terminals shall be arranged according to the respective drawings.

#### 3.4.1.2 Trunking

Cable trunking, location and sizing, shall be provided in accordance with the respective drawings to accommodate the necessary cables. The trunking shall be fastened to the plate using rivets or screws.

#### 3.4.1.3 Wiring

Joints and splices in the wiring are not acceptable. Not more than two conductors shall be connected to a terminal. A connecting strip may be used to common-up one side of a row of terminals.

The following lugs shall be used on the wiring:

Connected onto:	Conductor size	Lugs	Colour
Auxiliary circuit terminals	1,5mm <sup>2</sup>	Hellermann hooked blade type T1HB or JST type FVDAH-1.25	Red
MCBs	1,5mm <sup>2</sup>	Hellermann disconnect male type T1DM or JST type FVDDM1.25-250	Red
Solid state relays	1,5mm <sup>2</sup>	Hellermann pin type T1P10 or JST pin type FVDPC-1.25	Red

**NB:** Only JST type YNT or Cembre type HP4 crimping tools shall be used for the crimping of lugs.

#### 3.4.1.4 Repeat relays

Repeat relays are primarily to provide electrical isolation between the external environment and the meter output contacts.

The repeat relays shall conform to the following characteristics:

- Input voltage 110V UC
- Continuous over-voltage 120% of rated voltage
- Output voltage 24V DC
- Operating voltage (pick-up) 85% of rated voltage

**ESKOM COPYRIGHT PROTECTED**

- Reset voltage (drop-out) 30% of rated voltage
- Response time <10ms
- Output current rating 2A
- Switching frequency flimit 10Hz
- Contact bounce time < 3ms
- Service life (switching operations)  $5 \times 10^8$  operations
- Input / Output Insulation 2,5kV<sub>rms</sub>
- Power consumption AC 1,2VA or less  
(1 and 2 pole relays) DC. 0.9W or less
- Power consumption AC 1.7VA or less  
(3 pole relays) DC 1.4W or less

Repeat relays shall be suitable for DIN-rail mounting, with spacing of 6.2mm.

#### **3.4.1.5 MCB**

The miniature circuit breakers shall be of the DIN rail mount type, 5A or 6A current rating, fast curve, and shall make provision for sealing the operating levers in the closed position.

#### **3.4.2 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:

- Relays (Opto couplers)
- MCBs
- Terminals
- Trunking
- The wiring diagrams and manufacturing drawings are given in drawing number D-DT-5804.

##### **3.4.2.1 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 plate includes the following:

- Relays (Opto couplers)
- MCBs
- Terminals
- Trunking

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

**ESKOM COPYRIGHT PROTECTED**

### **3.5 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.

#### **3.5.1 General**

##### **3.5.1.1 Power supply**

The modem auxiliary supply shall be supplied from the auxiliary supply on the meter module or relevant voltage selection module at 110V.

##### **3.5.1.2 Surge protection**

No surge protection shall be provided for the power supply circuit to the modem. Suitable surge protection shall be supplied on the telephone line (PSTN) if that is the telecommunication option used at the metering panel.

##### **3.5.1.3 Trunking**

Cable trunking, location and sizing, shall be provided in accordance with the respective drawings to accommodate the necessary cables. The trunking shall be fastened to the plate using rivets or screws.

### **3.6 Quality of Supply module**

#### **3.6.1 General**

The Quality of Supply (QoS) module will house the Quality of Supply equipment for monitoring of QoS parameters. 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 two alarms to be sent through to the IDF – normally voltage imbalance and total harmonic distortion.

#### **3.6.2 Quality of Supply module**

The module is 5U high and fits inside on the back of a standard 800mm swing-frame.

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

The plate shall include the following:

- MCBs 2A, 2.5kA
- Terminals
- Trunking
- Wiring

##### **3.6.2.1 MCB**

The miniature circuit breakers shall be of the DIN rail mount type, 2A current rating, fast curve, and shall make provision for sealing the operating levers in the closed position.

##### **3.6.2.2 Terminals**

The terminals shall be spring loaded to ensure connection in the event the screws are not tightened. The terminals shall be arranged according to the respective drawings.

### **3.6.2.3 Trunking**

Cable trunking, location and sizing, shall be provided in accordance with the respective drawings to accommodate the necessary cables. The trunking shall be fastened to the plate using rivets or screws.

### **3.6.2.4 Wiring**

The VT circuit wiring from the VT supply circuit shall be wired to the top of the miniature circuit breakers. Joints and splices in the wiring are not acceptable. Not more than two conductors shall be connected to either side of a terminal.

The following lugs shall be used on the wiring:

<b>Connected onto:</b>	<b>Conductor size</b>	<b>Lugs</b>	<b>Colour</b>
VT and auxiliary circuit terminals	2,5mm <sup>2</sup>	Hellermann hooked blade type T2HB or JST type FVDAH-2	Blue
MCBs	2,5mm <sup>2</sup>	Hellermann disconnect male type T2DM or JST type FVDDM2-250	Blue

**NB:** Only JST type YNT or Cembre type HP4 crimping tools shall be used for the crimping of lugs.

## **3.7 Additional equipment**

Over and above the equipment described in Sections 3.1 to 3.6, additional equipment may be installed within Generation metering panels. This may include measurement transducers, Ethernet switches and other related equipment, depending on the interface requirements of other plant in the power station.

## **3.8 Tests**

The manufacturer of the modules shall carry out continuity testing on all circuits and tightness checks on all wires and lugs as a minimum. Where required, additional tests may be specified during the tender process.

## **3.9 Marking, labeling and packaging**

### **3.9.1 Labels**

Labels shall be attached to the meter panels in accordance with the design drawings for the relevant project. Eskom shall provide the panel manufacturer with the relevant label information.

The labels shall be white Traffolyte and shall be supplied with the panel.

Each cabinet shall have a label fixed to the rear of the door with the manufacturer's name, address and the product serial number. The label shall be durable preferably of metal.

### **3.9.2 Packaging**

The cabinet shall be packed in a corrugated cardboard wrapping with a PVC plastic sheet covering. This covering shall protect the cabinet and its components from reasonable transport related wear and tear from the supplier's works to the end customer. The cabinet shall be clearly labelled as follows:

- Substation name
- Full delivery address
- Detailed content description as stated on the order
- Dispatch date
- Eskom and supplier order number

**ESKOM COPYRIGHT PROTECTED**

**Note:** Label shall also be placed inside the cabinet. This helps when the packaging is damaged.

During transport the panel shall be covered with a tarpaulin or plastic cover to keep it dry in case it rains.

#### 4. Authorization

This document has been seen and accepted by:

<b>Name and surname</b>	<b>Designation</b>
P Moyo	General Manager: Power Delivery Engineering
P Madiba	Senior Manager: Electrical & C&I
E Makwarela	Metering, DC & Security Systems Manager (Acting) – PTM&C
A Pillay	Senior Manager: PTM
M Viljoen	Senior Manager: PEIC, Electrical & C&I
Lenah Mothatha	Senior Manager – Transmission Grids
Barry Clayton	Middle Manager – Transmission
Sikelela Mkhabela	Senior Manager - Distribution

#### 5. Revisions

<b>Date</b>	<b>Rev.</b>	<b>Compiled by</b>	<b>Clause</b>	<b>Remarks</b>
Jan 2019	2	H P D Groenewald	Normative references	Updated the document numbers with new reference numbers
			3.1.2	Earth wiring changed from 2.5mm <sup>2</sup> to 4mm <sup>2</sup>
			3.1.3	Added requirements for MCBs for DC circuits
			3.2.1.1	Added note that two options will be provided for the surface mount meter module
			3.2.2.1	The CT and VT test block area shall be recessed.
			3.2.3	The colour is only specified for the earth wiring. Wire labels can be yellow or white Details added for the Essailec connector terminal lugs
			Annex A	Added a 5U blanking plate
Jan 2014	1	H P D Groenewald	All	Combined the requirements of Distribution, Transmission and Generation.
			3.1	Two options of panels are provided for – front entry and back entry
			3.1.3	Auxiliary equipment will be fed from 110V DC with new panels.

Date	Rev.	Compiled by	Clause	Remarks
			3.2	Surface mount and 19" rack modules are provided for. Options are also provided for 4-way and 6-way CT test blocks
			3.3	The auxiliary transformer has been removed from all modules
			Annex A	New items added to ordering schedule

## 6. Development team

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

- Henri Groenewald Group Technology PTM&C
- Mohamed Omar Group Technology PTM&C
- André le Roux Eastern Cape Operating Unit
- Hylton Hiralal Gauteng Operating Unit
- Michael McDonald Energy Trading
- Wernher Schmidt KwaZulu Natal Operating Unit
- Johan le Roux Group Technology PTM

## 7. Acknowledgements

Not applicable.

**Annex A – - Model metering panel ordering sheet**

	<b>Metering panel ordering sheet</b>	
	<b>Supplier:</b>	
	<b>Project title:</b>	
	<b>Project No.</b>	

Stock number	Description	Cost	Quantity
<b>0402613</b>	<b>SWING FRAME CABINET – FRONT ENTRY</b> 800 mm x 600 mm x 2400 mm complete with <ul style="list-style-type: none"> <li>• Earthing</li> <li>• Trunking</li> <li>• DIN Rail</li> <li>• Pre punched chassis plate</li> </ul>		
	Gland plate to be fitted at top?	Yes	No
<b>0579563</b>	<b>METER CABINET – BACK ENTRY</b> 600 mm x 600 mm x 2400 mm complete with <ul style="list-style-type: none"> <li>• Earthing</li> <li>• Trunking</li> <li>• DIN Rail</li> <li>• Pre punched chassis plate</li> </ul>		
	Gland plate to be fitted at top?	Yes	No
<b>0574602</b>	<b>METER CABINET – SLIMLINE WALL MOUNT</b> 700 mm x 350 mm x 1400 mm complete with <ul style="list-style-type: none"> <li>• Earthing</li> <li>• Trunking</li> <li>• DIN Rail</li> <li>• Pre punched chassis plate</li> </ul>		
	Gland plate to be fitted at top?	Yes	No
<b>0401414</b>	<b>CAGE NUT AND BOLT</b>		
<b>175685</b>	Meter module – <u>OLD</u> surface mount 4-way complete with: <ul style="list-style-type: none"> <li>• Front plate including -</li> <li>• PK2 - 4 way test blocks</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> <li>• Horizontal Back plate including -</li> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		

**ESKOM COPYRIGHT PROTECTED**

Stock number	Description	Cost	Quantity
0569918	Meter module – surface mount 4-way complete with: <ul style="list-style-type: none"> <li>• Front plate including -</li> <li>• PK2 - 4 way test blocks</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> <li>• Horizontal Back plate including -</li> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
0569920	Meter module – 19" rack mount 4-way complete with: <ul style="list-style-type: none"> <li>• Front plate including -</li> <li>• 19" rack for the fitment of two meters</li> <li>• Essailec connector blocks</li> <li>• PK2 - 4 way test blocks</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> <li>• Back plate including -</li> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
0569919	Meter module – surface mount 6-way complete with: <ul style="list-style-type: none"> <li>• Front plate including -</li> <li>• PK2 - 4 &amp; 6 way test blocks</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> <li>• Horizontal Back plate including -</li> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		

Stock number	Description	Cost	Quantity
<b>0569921</b>	Meter module – 19" rack mount 6-way complete with: <ul style="list-style-type: none"> <li>• Front plate including -</li> <li>• 19" rack for the fitment of two meters</li> <li>• Essailec connector blocks</li> <li>• PK2 - 4 &amp; 6 way test blocks</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> <li>• Back plate including -</li> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
<b>175686</b>	Voltage selection module A complete with: <ul style="list-style-type: none"> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Phase failure relays</li> <li>• 3-way latching relay</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
<b>175687</b>	Voltage selection module B complete with: <ul style="list-style-type: none"> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Chop-over relays</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
<b>0230643</b>	Voltage selection module C complete with: <ul style="list-style-type: none"> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• 3-way Latching relay</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
<b>175688</b>	Voltage selection module D complete with: <ul style="list-style-type: none"> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Voltage failure relays</li> <li>• 3-way Latching relay</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		

Stock number	Description	Cost	Quantity
175671	Interposing module A complete with: <ul style="list-style-type: none"> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Repeat relays 110V u.c. / 24V DC:</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
183992	Interposing module B complete with: <ul style="list-style-type: none"> <li>• MCBs 5 or 6A, 2.5 kA</li> <li>• Repeat relays 110V u.c. / 24V DC:</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
0230644	Quality of supply module complete with: <ul style="list-style-type: none"> <li>• MCBs 2A, 2.5kA</li> <li>• Terminals</li> <li>• Trunking</li> <li>• Wiring</li> </ul>		
0230645	Modem module with trunking <ul style="list-style-type: none"> <li>• MCBs 5 or 6A, 2.5kA</li> <li>• Trunking</li> </ul>		
0401952	3U Blanking plate		
0401956	5U Blanking plate		
0401958	7U Blanking plate		
Comments: Please note that the last two items have different contract numbers and must be ordered as such.			
Delivery Address:		Contact Person:	
		Telephone number:	