

TITLE	SPECIFICATION FOR RIPPLE SIGNAL RECEIVERS	REFERENCE	REV
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FOREWORD

This standard was reviewed by the following work group members:

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Grid Access : Load Control

The work group appointed by the Interim Study Committee, which, at the time of approval, comprised of the following members:

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1 INTRODUCTION

City power provides electricity to more than 400 000 customers which introduces a need to have an efficient and effective demand management systems. The Ripple Control technology is one of the technologies that has been implemented to some part of the network for remote demand management

2 SCOPE

The scope covers supply installation and commissioning of ripple signal receivers equipment and associated control systems.

3 NORMATIVE REFERENCES

The following documents contain provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

IEC 62052-21: *Electricity metering equipment (a.c.) – General requirements, tests and test conditions – Part 21: Tariff and load control equipment.*

IEC 62054-11: *Electricity metering (a.c.) – Tariff and load control – Part 11: Particular requirements for electronic ripple control receivers.*

NRS 042: *Guide for the protection of electronic equipment against damaging transients.*

NRS 083-1: *Code of practice for the application of electromagnetic compatibility (EMC) standards and guidelines in electricity utility networks – Part 1: Equipment standards.*

NRS 083-2: *Electromagnetic compatibility (EMC) in electricity utility networks – Part 2: Substation design and equipment installation practices.*

SANS 474/NRS 057: *Code of practice for electricity metering.*

SANS 10142-1: *The wiring of premises – Part 1: Low-voltage installations.*

SANS 60529/IEC 60529, *Degrees of protection provided by enclosures (IP Code).*

SANS 61000-4-5/IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61439-1:2020 *Low-voltage switchgear and controlgear assemblies - Part 1: General rules*

IEC 61439-2 *Low-voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies*

.SANS 10142 *Wiring code of practice for the wiring of premises in South Africa*

NRS: 086: *Centralised load control systems*

SANS documents are available from the South African Bureau of Standards.

Documents designated by CP_TSSTAN, CP_TSSPEC and CP_TSDRAW are available from City Power.

4 REQUIREMENTS FOR RIPPLE RECEIVERS

4.1 Electrical Characteristics.

- 4.1.1 Load Management Receivers shall be designed and successfully tested to operate reliably under the conditions experienced in the South African low voltage electricity supply network, in a single, two or three phase environment. The nominal operating voltage of the auxiliary power supply shall be 230 VAC, + 5%, -10%.
- 4.1.2 The minimum ripple signal sensitivity shall be 0.5% of the nominal operating voltage.
- 4.1.3 The current rating of individual load circuit contacts shall be :
 - a) 40 Amps for geyser and other load switching,
 - b) 6A for tariff meter switching (future requirement).
- 4.1.4 Shall comply with all regulations and legislation applicable to devices to be connected to the electrical network and installed in residential, commercial or industrial premises.
- 4.1.5 Wiring terminals for load circuits shall be suitable for conductor sizes between 0.5 mm² and 10 mm².
- 4.1.6 Wiring terminals for the auxiliary power supply shall be suitable for conductor sizes between 1, 5 mm² and 2.5 mm².
- 4.1.7 Terminal screws shall be captive and shall use a rising plate to avoid screwing directly into the strands of the connecting wires.
- 4.1.8 Terminals shall be constructed from a solid piece of metal, suitably drilled and tapped for the terminal screw. Sheet metal terminals are not acceptable.
- 4.1.9 Receiver protocol response programming shall be exclusively implemented on a per receiver basis, in that the receiver shall respond only to the specified protocol ordered and marked on the front of the receiver, and shall not respond to any special command that causes the receiver to respond to a different protocol for which decoders may be resident in the receiver software.
- 4.1.10 The quantities of receivers for each basic function required (load control, tariff switching or street light control) and combination of response parameters (protocol type and ripple frequency) shall be defined at the time an order is placed. Initial programming and testing shall be done in the factory, prior to delivery.

4.2 Insulation and Surge Withstand Characters of Receivers

- 4.2.1 Insulation resistance between all current carrying parts coupled together and any exposed metal parts which are accessible with the cover on or off, other than current carrying parts and any parts electrically connected thereto, shall not be less than 5 MΩ when tested at 500 V_{DC}.
- 4.2.2 The insulation resistance between the load carrying circuits and the auxiliary supply circuit measured across the load contacts in the open position shall be at least 5 MΩ when tested at 500 V_{DC}.
- 4.2.3 The insulation between the Load Switch contacts in the open position shall be capable of withstanding a test voltage of 2 000 V_{AC} for one minute.
- 4.2.4 The Receiver shall withstand a full impulse test of 8 kV peak value to the input terminals.

4.3 Mechanical Characteristics

- 4.3.1 Receivers shall be of the front connected type, suitable for board or panel mounting.
- 4.3.2 Receivers shall be resistant to minor impact and offer a reasonable degree of vandal resistance.
- 4.3.3 All materials used in the construction of the Receivers, that would be exposed to sunlight under worst case situations, shall be impervious to ultraviolet radiation, or be ultraviolet radiation stabilised.
- 4.3.4 All exposed ferrous materials used in the construction of the Receivers shall be impervious to water based corrosion.
- 4.3.5 The receiver shall be equipped with a conventional anti-tamper sealing wire facility, in an easily accessible position. Where the unit may have separate front face and terminal covers, both shall be equipped with a sealing facility. It shall not be possible to access the wiring terminals or load switches when the covers are in place.
- 4.3.6 All cover screws and sealing screws shall be of the captive type.
- 4.3.7 The face cover shall be transparent or have a transparent window, through which the position of all the Load Switches and channel allocation markings are visible.
- 4.3.8 There shall be provision for manual, in situ operation of the load contact/s by authorised personnel, without any danger of touching live parts, to effect switching a load circuit on or off for test or emergency re-instatement purposes. The manual switching provision shall require the breaking of the receiver's seal to remove the receiver's front cover in order to access the switches and shall not require the disconnection of any wires to the receiver in order to achieve this.
- 4.3.9 The ability to effect a change of state of a load circuit non-intrusively, by means of a hand-held optical interface to the receiver would be preferred.
- 4.3.10 Receivers shall be sealed to IP54 standard as minimum once installed and connected to the electrical network.
- 4.3.11 The Receiver case shall be insect-proof.
- 4.3.12 The terminal cover shall be of sufficient length to effectively cover all external conductors connected to the receiver.
- 4.3.13 The device serial number shall be marked on the inside of the Receiver and shall be clearly visible through the face cover.
- 4.3.14 The Receiver case shall be self-extinguishing material and the material may not plasticize or liquefy when subjected to flame.
- 4.3.15 The Receiver shall have at least two mounting holes that are easily accessible for installation of the receiver, of which at least one mounting hole shall be rendered inaccessible by a sealed cover.
- 4.3.16 The maximum dimensions of the Receiver (including terminals, covers, etc.) shall be 200 (h) x 150 (w) x 75 (d).
- 4.3.17 The Receiver design and construction shall be modular and facilitate rapid field replacement of modules or switching components (circuit boards, load switches, etc.). This shall be possible without the need for special tools. No components shall be mounted on the removable covers.
- 4.3.18 Receivers shall indicate by visual means, that shall be clearly visible through the front cover window the following operational status:
 - a) An LED or similar display device to indicate at minimum that the receiver is powered up and is operational. Additional status information provided by altering the flashing rate of the LED to indicate the receiver is busy decoding commands, or has not received a signal for a pre-set time period are preferred.
 - b) Load contact on / off state

4.4 Communication protocols and Operating Frequency.

- 4.4.1 The Receiver shall be programmable re-programmable using the recommended of communication protocols and operating frequency mediums.
- 4.4.2 The receivers shall be deployed in areas that already have existing transmission systems.
- 4.4.3 The receivers shall be compatible with and inter operate with the existing systems and protocols that are being used in various parts of City powers network.
- 4.4.4 Either of the following systems or communication protocols shall be fully supported:
 - a) The Siemens SEMAGYR
 - b) The Enermet DECABIT both in the exclusive DECABIT form, as well as Decabit interleaved within the older Enermet / Zellweger K22 communication protocol which is still in use in various parts of the network.
- 4.4.5 The operating (ripple) frequency shall be programmable in the range 316,6 Hertz to 1050 Hertz while maintaining a signal sensitivity of 0,5% of the 240 V_{AC} mains supply.
- 4.4.6 Communication protocol or frequency changes shall be by means of a simple process using a hand held programming device or PC based programming station.

4.5 Signal Loss

- 4.5.1 In case of signal loss, receivers that are being used for load control shall be capable of switching to the on state automatically after a pre-programmed duration or a default period of four hours.
- 4.5.2 In the absence of valid commands during the programmed duration or default period of 4 hours, receivers programmed for tariff control or street light control, shall be capable of reverting to a learned or stored switching. The switching schedule shall continue until a valid command is received.

4.6 Main Failure

- 4.6.1 If power to the receiver is lost, receivers programmed for load control shall switch to the off state using stored energy within the receiver.
- 4.6.2 On restoration of power, the load control receivers shall switch to the on state within fifteen, plus a variable random delay of up to fifteen minutes, unless a valid command setting them otherwise is received.

4.7 Clock Functionality

- 4.7.1 All receivers shall incorporate mains frequency driven clock functionality, including day of the week attributes.
- 4.7.2 For receivers used in street lighting or tariff switching applications an option of a real time clock shall be available, with backup of a minimum of 24 hours and accuracy of not less than 2% per month.
- 4.7.3 It shall be possible to synchronise the clocks for time as well as day of the week by transmitting synchronisation commands.

4.8 Tamper Protection Functionality

Receivers shall have the option of incorporating load contact state confirmation switching, in that the physical state of the contacts is continuously compared to the state of the receiver's internal control register and, if different due to physical tampering, the contact's state is regularly refreshed to match the state of the control register, so discouraging tampering.

4.9 Load Switching Contacts

- 4.9.1 The receiver shall have provision for up to three load contacts.
- 4.9.2 Each circuit shall be programmed as per an agreed channel allocation scheme at the time an order is placed.
- 4.9.3 The receivers shall be delivered with one physical load contact installed.
- 4.9.4 Load contacts shall plug into the receiver, and be indexed.
- 4.9.5 Load contacts shall be bi-stable devices.
- 4.9.6 Load contact on/off status shall be clearly marked and visible through the front cover.
- 4.9.7 Load contacts shall be continuously rated at 40 A, and short term rated at 400 A (for five seconds) for a resistive load under the electrical conditions specified in this document.
- 4.9.8 Load contacts shall use high quality contact materials, such as silver tin oxide or silver cadmium oxide.

4.10 Receiver Programming

- 4.10.1 Receivers shall be programmable in the field by means of either a dedicated hand-held devices, or devices used with a standard laptop PC are acceptable.
- 4.10.2 Communication shall be bi-directional with error correction and confirmation of receipt of programming to the programming device.
- 4.10.3 Receivers shall store the last ten Commands received and make these available for analysis via the serial interface port to programming devices (hand-held or laptop)

4.11 Under frequency Load shed Functionality.

- 4.11.1 Receivers supplied under this contract shall contain under-frequency detection and load switching functionality.
- 4.11.2 A frequency threshold selectable from 49, 5 to 50 Hertz, with a detection time selectable from 100ms to 5000 ms is required.
- 4.11.3 On frequency recovery, restoration of load circuits shall include a programmable random switch on delay window of up to 20 minutes, nominally set to 10 minutes. The random switch on delay must be re-triggered in the event of a second low frequency event within the delay window.
- 4.11.4 The receivers shall respond to designated ripple commands to enable and disable the under frequency functionality, as well as a command to trigger the receivers in the selected state to switch off load, for the purpose of simulating an under-frequency event.

5 DOCUMENTATION

- 5.1. Full technical and functional details for all items offered in terms of this specification shall be submitted.
- 5.2. All instruction manuals shall be provided for the equipment offered in terms of this specification.
- 5.3. The manuals must be in English and sufficiently detailed to enable City power staff to install, maintain, test, configure and use each item of equipment.

6 MARKING AND LABELLING

- 6.1 The following information shall appear in legible and indelible marking in front of the receiver.
- Model and make
 - Operating voltage and signal sensitivity
 - Ripple frequency
 - Protocol type
 - Serial number
 - Load contact command response programming.
 - "City Power Johannesburg" (Logo if possible)
 - Manufacture date.
 - The integrity of all cover seals
- 6.2 Labelling material for receivers after programming shall be offered as an option
- 6.3 Tenderers should describe in their covering letter how they recommend changing labels or re-labelling a receiver once the protocol or frequency has been changed.

7 TRAINING

- 7.1 The suppliers shall provide comprehensive training courses on the configuration, program, installation, operation and maintenance of the antennas.
- 7.2 The suppliers shall provide technical support on system and equipment queries for the duration of the contract.

8 QUALITY MANAGEMENT

A quality management system shall be set up in order to assure the quality of the equipment during design, development, production and servicing. Guidance on the requirements for a quality management system may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between the purchaser and supplier.

9 HEALTH AND SAFETY

A health and safety plan shall be set up in order to ensure proper management and compliance during removal, transportation and disposal of e-waste. Guidance on the requirements of a health and safety plan shall be found in ISO 45001:2018 standards. The details shall be subject to agreement between City Power and the Supplier.

10 ENVIRONMENTAL MANAGEMENT

An environmental management plan shall be set up in order to ensure the proper environmental management and compliance of the equipment during their entire life cycle (i.e. during design, development, production, installation, operation and maintenance, decommissioning as well as disposal phases). Guidance on the requirements for an environmental management system shall be found in ISO 14001:2015 standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHEQ Policy.

ANNEX A - BIBLIOGRAPHY

None

ANNEX B - REVISION INFORMATION

DATE	REV. NO.	NOTES
November 2018	0	First issue
January 2025	1	Second Issue
		Edited the entire document , replaced <i>IEC 61439-1:2020 and IEC 61439-2:2020</i>

**ANNEX C - TECHNICAL SCHEDULES A & B: Ripple Receivers
SAP no**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_	Description	Schedule A	Schedule B
	4.1.1	Nominal operating voltage (+5%,-10%)	XXXX	
	4.1.2	ripple signal sensitivity	>=5%	
	4.1.3	The current rating of individual load circuit: a) geyser and other load switching, b) tariff meter switching (future requirement).	40A 6A	
	4.1.4	Compliance with regulations and legislation as to 4.1.4	Required	
	4.1.5	Wiring terminals conductor size for load circuits:	0.5mm ² to 10 mm ² .	
	4.1.6	Wiring terminals for the auxiliary power supply suitable for conductor sizes between.	1,5 mm ² to 2.5 mm ²	
	4.1.7 and 4.1.8	Terminal screws Design	XXXX	
	4.2.1	Insulation resistance between all current carrying parts as to 4.2.1	>=5 MΩ at 500Vdc	
	4.2.2	The insulation resistance between the load carrying circuits and the auxiliary supply circuit as to 4.2.2	>=5 MΩ at 500Vdc	
	4.2.3	The insulation between the Load Switch contacts in open position as to 4.2.3	2 000 VAC for one minute.	
	4.2.4	The Receivers full impulse test tolerance as to 4.2.4	8 kV peak value to the input terminals.	

**Note: Ticks, Cross [✓, X], Asterisk [*], Word [Noted] or TBA ["To Be Advice"] will not be
accepted.**

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

**ANNEX C - TECHNICAL SCHEDULES A & B: for Ripple Receivers
SAP no**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_	Description	Schedule A	Schedule B
	4.3.1	Front connected type, suitable for board or panel mounting.	Required	
	4.3.5	Anti-tamper sealing wire facility,	Required	
	4.37	Visible and accessible load Switches and channel allocation markings	Required	
	4.3.8	Provision for manual operation	Required	
	4.3.9	The ability to effect a change of state of a load circuit non-intrusively	Required	
	4.4.4	Supported communication protocols as to 4.4.4	Required	
	4.4.5	Operating (ripple) frequencies programmable range as 4.4.5.	Required	
	4.5	Automatic switch on after a pre-programmed duration or a default period in case of signal loss and absence of valid commands as to 4.5	Required	
	4.6.1	Capable of automatic switch off during mains failure as to 4.6.1	Required	
	4.6.2	Capable of automatic switching on within fifteen after power restored unless a valid command setting them otherwise is received.	Required	
	4.7.1	Clock	XXXXX	

Note: Ticks, Cross [√, X], Asterisk [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

ANNEX C - TECHNICAL SCHEDULES A & B: for Ripple Receivers
SAP no

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	CP_TSSPEC_	Description		Schedule B
	4.7.2	Real time clock with 24h back up	>=24h	
	4.7.3	Clock synchronisation	XXXXX	
	4.8	tamper protection functionality	Required	
	4.9.1	Provision for load contacts.	Required	
	4.9.3	Physical load contact as to 4.9.3 and 4.9.4	Required	
	4.9.5	Load contacts status marked as to 4.9.4 and 4.9.5	Required	
	4.9.7	Load contacts continuously rated at 40A, and short term rated at 400 A (for five seconds)as to 4.9.7	40A at 400A	
	4.10.1	field programmable as to 4.10.1	Required	
	4.10.3	Receiver shall store last ten commands for analysis as to 4.10.3	=>10	
	4.11.1	Under frequency loss detection	Required	
	5	Documentation as to clause 5	Required	
	6	Marking and labeling as to clause 6	XXXXX	
	7	Training	XXXXX	
	8	Quality Management (ISO:(9001)	Required	
	9	Health and safety (OHSAS18001)	Required	
	10	Environmental management (ISO14001)	Required	

Note: Ticks, Cross [√, X], Asterisk [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

DEVIATION SCHEDULE
SAP no

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub-clause of CP_TSSPEC_	Proposed deviation

Note: Ticks, Cross [√, X], Asterisk [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

ANNEX D - STOCK ITEMS

Material Group: Metering

Item	SAP No.	SAP Short Description	SAP Long Description