


Classification:  <b>Restricted</b>	System/Product:  <b>4G V1 Chip</b>	Document Ref:  <b>TDS-00021</b>	Revision:  <b>5</b>
	Document Type:  <b>TDS-Technical Data Sheet</b>	Current Author:  <b>Deon Hauptfleisch</b>	
	Title:  <b>Commander System Technical Data Sheet</b>	Original Author:  <b>Olwethu Muteyi</b>	
		Page:  <b>Page 1 of 9</b>	

## COMMANDER SYSTEM TECHNICAL DATA SHEET

### Product Description

This 4th generation Control Equipment (CE4) designed and developed by DetNet South Africa consists of two principal devices, namely the CE4 Commander and CE4 Tagger, as well as various other system components interacting to facilitate safe testing and blasting of electronic detonators.


### Technical Data

#### 1 CE4 TAGGER

The CE4 Tagger is an inherently safe multi-functional device that can be used for on-bench operations such as assigning detonator times, testing communication, testing leakage of detonator installation, and verification of desired blast layout. The CE4 Tagger is inherently safe as its battery and output voltage are below minimum firing voltage of the detonator and the Tagger cannot issue the encrypted blasting commands (i.e. ARM and FIRE commands).

The CE4 Tagger interfaces via an encrypted Wi-Fi communication link with the Bench and Base Commander. The Base Commander will then instruct all connected and enabled Commanders with the blast instruction via the BlastCards (NFC Card).

Applicable standards	ARP1717: Guide to the regulatory requirements for the approval of detonators, initiators and initiation systems used in mining and civil blasting applications SANS53763-27: Explosives for civil uses – Detonators and relays. CEN/TS13763-27: European CEN- Testing specification for Explosives for civil uses – Detonators and relays. Code of Federal Regulations, Title 47 Canadian Radio Standard Specifications Australian Communications and Media Authority EMC standards. Electronic Communications Act, Act No 35 of 2005 Mine Health and Safety Act, Act 29 of 1992 EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements IEC 62368-1: Audio/video, information and communication technology equipment – Part 1: Safety requirements
Temperature limits (Operational)	-30°C to +60°C -22°F to +140°F
Battery - Internal, not field replaceable	3.7V Lithium Polymer (MSD-91)

APPROVER	APPROVER SIGNATURE	SIGNATURE DATE	ISSUE DATE
Herman van der Walt	X  <hr/> Signed by: HvdWalt	2020/09/10	2020/09/10

Approved documents are only valid if they contain an "APPROVED" stamp on the first page and both the revision number and the issue date of the document correspond with the electronic document control system.

**APPROVED**

Classification:  <b>Restricted</b>	System/Product:  <b>4G V1 Chip</b>	Document Ref:  <b>TDS-00021</b>	Revision:  <b>5</b>
	Document Type:  <b>TDS-Technical Data Sheet</b>	Current Author:  <b>Deon Hauptfleisch</b>	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Title:  <b>Commander System Technical Data Sheet</b>	Original Author:  <b>Olwethu Muteyi</b>	
		Page:  <b>Page 2 of 9</b>	

Battery – External battery pack, not included	6 x 1.5V AA Alkaline or 6 x 1.2V AA Ni-MH / Ni-Cd
Weight / Dimension of tagger and head	580g / 1.25lbs 213mm (L) 88mm (W) 38mm (H)
Weight / Dimension of external battery	350g / 0.77lbs 180mm (L) 85mm (W) 27mm (H)
Display (Active LCD area with backlight)	128 pixels x 128 pixels / 44.78mm x 44.78mm / 1.76in x 1.76in
Keypad	Backlit tactile silicone keypad with alphanumeric keys.
External Connectors	A series of detonator connections exist for different application purposes. Replaceable Tagger to detonator connector head. USB Connector for data extraction and charging.
Operating time from a fully charged battery	Approximately 10 hours at 25°C (77°F). Operating time is influenced by detonator load, backlight settings and operational temperature. At temperatures below -15°C (5°F) battery life may be reduced significantly.
Wi-Fi	The tagger is equipped with short range Wi-Fi communication capability between system devices. Such as the CE4 Tagger and Commander. Operating frequency 2.412GHz – 2.457GHz @ 63mW
Near Field Communication (Version 4 and later models)	The CE4 Tagger (version 4 and later) is equipped with a Near Field Communication (NFC) reader located on the rear of the Tagger. NFC functionality will be activated in a future software release.
Wireless Charging	Tagger Hardware Version: V4 or higher <ul style="list-style-type: none"> <li>• Charger Compatibility: Qi</li> <li>• Power transfer: 5W maximum</li> <li>• Charging current: 1A maximum</li> <li>• Charging time: 6-8 hours typically, depending on charger alignment and power transfer achieved</li> <li>• Operating frequency 130kHz (Receive only)</li> </ul>
Differential Global Positioning System (D-GPS models only)	The addition of Differential GPS to the Tagger enables the Tagger to receive GPS corrections from a D-GPS Base Station Commander to calculate its position with sub-metre accuracy.
Software upgrade	Software upgrade is via the USB connector on the CE4 Tagger, and a flash drive.
Water and dust resistance	IP 57

Classification:  <b>Restricted</b>	System/Product:  <b>4G V1 Chip</b>	Document Ref:  <b>TDS-00021</b>	Revision:  <b>5</b>
	Document Type:  <b>TDS-Technical Data Sheet</b>	Current Author:  <b>Deon Hauptfleisch</b>	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Title:  <b>Commander System Technical Data Sheet</b>	Original Author:  <b>Olwethu Muteyi</b>	
		Page:  <b>Page 3 of 9</b>	

## 2 CE4 COMMANDER

The CE4 Commander is a 4-channel multi-functional device intended for use across all surface blasting platforms in the DetNet portfolio and can be configured to function as a Base Commander, Bench Commander, RF Repeater as well as a D-GPS Base Station if the GPS Receiver hardware within the Commander is activated. The CE4 Bench Commander can be used directly for Local blasting or via the CE4 Base Commander for Remote blasting.

Applicable standards	<p>ARP1717: Guide to the regulatory requirements for the approval of detonators, initiators and initiation systems used in mining and civil blasting applications</p> <p>SANS53763-27: Explosives for civil uses – Detonators and relays.</p> <p>CEN/TS13763-27: European CEN- Testing specification for Explosives for civil uses – Detonators and relays.</p> <p>Code of Federal Regulations, Title 47</p> <p>Canadian Radio Standard Specifications</p> <p>Australian Communications and Media Authority EMC standards.</p> <p>Electronic Communications Act, Act No 35 of 2005</p> <p>Mine Health and Safety Act, Act 29 of 1992</p> <p>EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements</p> <p>IEC 62368-1: Audio/video, information and communication technology equipment – Part 1: Safety requirements</p>
Temperature limits (Operational)	<p>-30°C to +60°C</p> <p>-22°F to +140°F</p>
Batteries	<p>Non-user replaceable rechargeable 3.7V single cell Lithium Polymer batteries:</p> <ul style="list-style-type: none"> <li>• 7.2Ah = 26.64Wh option</li> <li>• 5Ah = 18.5Wh option</li> </ul> <p>The Commander is populated with a given battery option depending on the requirements from the user regarding battery life and shipping constraints.</p>
Weight	Approximately 2.0 kg / 4.4 lbs.
Keypad	2 x stainless steel ring illuminated single pole push-to-make vandal-resistant switches. Power and Next functionality.
Display	200 x 96 pixels, 45.800mm x 21.984mm / 1.803in x 0.866in TFT active matrix Electronic Paper Display (EPD)
External Connectors	4 sets of Terminals to connect to 2-wire detonator harness Mini-USB charging/data interface
Operating time from a fresh battery	The CE4 Commander fitted with the 7.2Ah battery can be used for approximately 8 hours at 25°C. At temperatures below -15°C / 5°F battery life may be reduced significantly. Operating time is influenced by detonator load, backlight settings and operational temperature. (5-6 hours battery life is expected on smaller 5Ah battery)

Classification:  <b>Restricted</b>	System/Product:  <b>4G V1 Chip</b>	Document Ref:  <b>TDS-00021</b>	Revision:  <b>5</b>
	Document Type:  <b>TDS-Technical Data Sheet</b>	Current Author:  <b>Deon Hauptfleisch</b>	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Title:  <b>Commander System Technical Data Sheet</b>	Original Author:  <b>Olwethu Muteyi</b>	
		Page:  <b>Page 4 of 9</b>	

Differential Global Positioning System (D-GPS)	The Commander will start broadcasting corrections wirelessly to the CE4 Tagger when the GPS Receiver hardware has been activated and configured with the true position of the GPS antenna. The D-GPS Settings option allows setting the location of the D-GPS Base Station Antenna in the Lat, Long, Alt (LLA) format.
Software upgrade	Via a PC and a standard mini- USB cable
Water and dust resistance	IP 57

### 3 4G DETONATOR

The 4G Detonator is a programmable detonator suitable for all types of blasting operations requiring precise timing and flexibility of a vast array of inter-hole timing.

Dynamic Shock Resistance	$\leq 15954.15$ Psi / 110 MPa
ESD Resistance	$< 1$ Joule Energy @ 30KV
RF Immunity	Passes CEN/TS 13763-27
Detonator Shell: South Africa North American	Copper: L: 89.9mm, OD: 7.49mm - 7.54mm L: 3.5in, OD: 0.295in - 0.297in
Applicable standards.	SANS 551: The South African National Standard for the design approval of EDD initiation systems for use in mining and civil blasting applications. CEN/TS13763-27: European CEN-testing specification for Explosives civil use – Detonators and relays.
Detonator Strength	8D (South African Strength Definition) #12 (North American Strength Definition)
Base Charge	PETN
Net Explosives Quantity (NEQ)	1g / detonator
Timing	Programmable
Accuracy (Coefficient of Variance)	0.01% up to 20 000ms
Wire type	Rugged, over extruded
Connector	Rugged, water resistant
Wire Elongation	$< 3\%$ (Steel); $< 25\%$ (Copper)
Wire Tensile Strength	$> 500\text{N}$ / 112lbs (Steel); $> 200\text{N}$ / 45lbs (Copper) @ 21°C / 70°F
Wire Abrasion Strength	Passes CEN/TS 13763-27
Detonator Shell Marking	Dangerous – Blasting Cap - Explosive Danger – Detonateur - Explosif

Classification:  <b>Restricted</b>	System/Product:  <b>4G V1 Chip</b>	Document Ref:  <b>TDS-00021</b>	Revision:  <b>5</b>
	Document Type:  <b>TDS-Technical Data Sheet</b>	Current Author:  <b>Deon Hauptfleisch</b>	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Title:  <b>Commander System Technical Data Sheet</b>	Original Author:  <b>Olwethu Muteyi</b>	
		Page:  <b>Page 5 of 9</b>	

In-Hole Sleep time (Polyethylene)	A maximum of 21 days (when tested in 100% diesel, 500Kpa pressure with a starting temperature of 60°C/140°F and end temperature of 25°C / 177°F)
Temperature limits (Operational)	-20°C to +80°C -4°F to +176°F
Temperature limits (Storage)	-40°C to +75°C -40°F to +167°F

#### 4 TRANSPORTATION, STORAGE AND HANDLING

The Commander System must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations. Control equipment and accessories should be handled with due care and not dropped, mishandled, subjected to excessive vibration or exposed to any chemical agents. Connectors should be kept clean and the equipment must be kept in a safe environment to avoid misappropriation or misuse.

#### 5 CONTROL EQUIPMENT PACKAGING

##### 5.1 CE4 Commander

Outer packaging	Cardboard box double faced
Inner packaging	Inner Foam
Gross Mass	3.075kg / 6.78lbs
Dimensions	770 x 220 x 175mm 30.32 x 8.66 x 6.89in
Compliance	SABS 1560:1992 specification

##### 5.2 CE4 Commander Stand

Outer packaging	Cardboard box double faced
Inner packaging	Inner Foam
Gross Mass	1.12kg / 2.47lbs
Dimensions	370 x 310 x 130mm 14.57 x 12.2 x 5.19in
Compliance	SABS 1560:1992 specification

Classification:  <b>Restricted</b>	System/Product:  <b>4G V1 Chip</b>	Document Ref:  <b>TDS-00021</b>	Revision:  <b>5</b>
	Document Type:  <b>TDS-Technical Data Sheet</b>	Current Author:  <b>Deon Hauptfleisch</b>	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Title:  <b>Commander System Technical Data Sheet</b>	Original Author:  <b>Olwethu Muteyi</b>	
		Page:  <b>Page 6 of 9</b>	

### 5.3 CE4 Tagger

Outer packaging	Cardboard box double faced
Inner packaging	Inner Foam
Gross Mass	1.1kg / 2.43lbs
Dimensions	330 x 190 x 125mm / 13 x 7.48 x 4.92in
Compliance	SABS 1560:1992 specification

### 5.4 4G Detonator

UN Shipping Classification	1.1B (manufactured in South Africa) 1.4B (manufactured in North America) 1.4S (manufactured in South Africa)
Detonator Configurations	Shrink wrapped coil
Cable Colour	Standard 4G product - Lime Green IntelliShot mamba wire - black/orange DSP 4G is black/green
Connector	Transparent

### 5.5 Commander System in Carry Case

Outer packaging	Cardboard box double faced
Inner packaging	Nanuk 940 Case with plastic extrusions
Gross Mass	CE4 System with Single Stand: 11.506kg / 25.366lbs CE4 System with Dual Stands: 11.97Kg / 26.389lbs
Dimensions	560 x 450 x 220mm / 22.05 x 17.72 x 8.66in
Compliance	SABS 1560:1992 specification

## 6 RF SPECIFICATIONS

Radio module/band	Short Range RF		Wi-Fi	NFC
Remote Frequency Bands South Africa	869.45 – 869.6 MHz	n/a	2.412 - 2.457GHz	13.56MHz
USA/Canada		902 – 928 MHz	2.412 - 2.457GHz	13.56MHz
Australia		915 – 928 MHz	2.412 - 2.457GHz	13.56MHz

Classification:  <b>Restricted</b>	System/Product:  <b>4G V1 Chip</b>	Document Ref:  <b>TDS-00021</b>	Revision:  <b>5</b>
	Document Type:  <b>TDS-Technical Data Sheet</b>	Current Author:  <b>Deon Hauptfleisch</b>	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Title:  <b>Commander System Technical Data Sheet</b>	Original Author:  <b>Olwethu Muteyi</b>	
		Page:  <b>Page 7 of 9</b>	

Europe	869.45 – 869.6 MHz	n/a	2.412 - 2.457GHz	13.56MHz
Chile		915 – 928 MHz 500mW (27dBm)	2.412 - 2.457GHz	13.56MHz
RF Technology	Single Frequency Link	Frequency Hopping Spread Spectrum (FHSS)	802.11b/g/n	
Transmitter Output Power	Variable 12mW - 500 mW (11-27dBm) (Software disabled, for varying right now)	Variable up to 1 000mW (30dBm)	63mW (18 dBm)	6.5mW (6dBm)
Antenna Gain	2 dBi	2 dBi	2 dBi	-
Regulatory	ICASA/RED EN 300 220	FCC - 15.247	ICASA/RED EN 300 228 FCC-15C	ICASA/RED EN 300 228 FCC – 15C
Communication distance	3000m	3000m	3m	2cm

## 7 SYSTEM LIMITS

Maximum Total Delay Time	20 000 milliseconds
Maximum Number of Detonators per Bench Commander	1600 *
Maximum Number of Detonators for a Remote Blast (RF)	Multiple Bench Commanders can be used (If within the 3000m range from the Repeater). Every Bench Commander adds a 1600 detonator capability. A maximum of 10 Bench Commanders may be used. Therefore 16000 detonators for a full Base + Repeater + 10xBench system
Maximum Number of IO Channels	4
Maximum Number of Detonators per IO Channel	400
Maximum surface harness wire length.	Should not exceed 2500m / 2734yds
Maximum Wi-Fi Distance for Tagger communication to Commander	10 m
Maximum Distance in Remote Blasting between Base Commander and Repeater / Bench Commander	3000 m

\*Note: Maximum number of detonators per blast will reduce if average downline lengths exceed 46m / 150ft.

Classification: <b>Restricted</b>	System/Product: <b>4G V1 Chip</b>	Document Ref: <b>TDS-00021</b>	Revision: <b>5</b>
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Document Type: <b>TDS-Technical Data Sheet</b>	Current Author: <b>Deon Hauptfleisch</b>	
	Title: <b>Commander System Technical Data Sheet</b>	Original Author: <b>Olwethu Muteyi</b>	
		Page: <b>Page 8 of 9</b>	

## 8 COMMANDER SYSTEM ACCESSORIES

Tagger to Detonator Connector	The Pogo-Pin Detonator Connector Head is a user replaceable connector that is used to connect the Tagger to a detonator.
Charger	<b>CE4 Commander Charger:</b> The charger accepts 110 or 220V AC input at 50/60Hz. It must only be used indoors at room temperature. Charging time will vary depending on the state of the battery. <b>CE4 Tagger Charger:</b> Standard USB charger, 12V DC, 100 – 240V AC, Universal 5V mini USB cable. Also refer to Wireless Charging as detailed in Technical Data above.
Harness Wire	0.63mm (or 22 gauge in North America) twisted pair copper wire with PVC or Polyethylene insulation available in 200m / 219yds and 500m / 547yds. reels. (Country dependant)
Blast Cards	For safety purposes, the system is activated through a pre-programmed personal identification of the Blaster and a unique Password (PIN code). The system deploys two types of NFC Blast Cards that are identified by a Yellow or Red colour. Scan the Yellow Blast Card on the Bench Commander after completion of connecting and testing of the blast installation (And the bench have been cleared of all personnel) to place the Bench Commander in a waiting blast command state, Scan the Red Blast card at the Base Commander during an RF Multi-bench commander blast, or at the Bench Commander during a local blast to perform the ARM and FIRE commands.
Commander Stand	The Commander Stand is magnetically coupled to the base of the CE4 Commander and provides support on uneven surfaces.
Commander system complete with carry case	The Commander System is packaged into compartments within a ruggedised case and comprises the following equipment: 2 x CE4 Commanders 2 x CE4 Taggers 2 x Blast Cards (Red and Yellow) 2 x Commander Stands 2 x Chargers (CE4 Tagger and CE4 Commander) Cables

## 9 SPECIAL INSTRUCTIONS

The Commander System should only be used by users who have completed both product specific training successfully and who comply with the applicable local regulatory requirements. Commander System control equipment and detonators are ONLY suitable for use with the Commander System – no other equipment should be connected to the 4G Detonators and no Commander System equipment should be connected to a non-4G Detonator of any type. The Blast Cards should always be under the direct control of the appointed blast supervisor.



Classification:  <b>Restricted</b>	System/Product:  <b>4G V1 Chip</b>	Document Ref:  <b>TDS-00021</b>	Revision:  <b>5</b>
	Document Type:  <b>TDS-Technical Data Sheet</b>	Current Author:  <b>Deon Hauptfleisch</b>	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Title:  <b>Commander System Technical Data Sheet</b>	Original Author:  <b>Olwethu Muteyi</b>	
		Page:  <b>Page 9 of 9</b>	

## 10 RADIO FREQUENCY SAFETY DISTANCES

The distances indicate the minimum distance at which the system may experience intermittent communication problems at specific frequencies and the minimum recommended distance at which the system is not susceptible to RF interference over the frequency band 150 kHz - 6GHz

Transmitter strength	Typical device	Low voltage state (During testing and programming)		High Voltage state (Arming and ready to blast)
		Minimum distance to operate the system safely	Minimum distance to enable full system functionality	
< 2 watt	Cellular phones	0.5 m	1.5 m	2.0 m
< 5 watt	Handheld Radios	1.0 m	2.0 m	3.0 m
< 20 watt	Truck radios	1.5 m	4.0 m	10 m
> 20 watt	Other	5 m	10 m	15 m

## 11 OTHER

Commander System control equipment batteries should be kept in a charged state. It is recommended that the Commander be charged to 50% when placed into long-term storage, and thereafter the unit should be charged at least every six months to 50%, to maintain the expected lifetime of the battery. All equipment in the field must be returned to DetNet or its approved repair centres for service at the following intervals:

- Handheld equipment (Taggers, etc.): 18 months
- Other equipment (excl. accessories): 24 months

## 12 PRODUCT DISCLAIMER

The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions for safe use of the products. While the information is believed to be correct, DetNet South Africa or any of their partners and affiliates shall, in no event, be responsible for any damages whatsoever, directly or indirectly, resulting from the publication or use or reliance upon the information contained herein. DetNet South Africa or any of their partners and affiliates disclaim any warranties with respect to this product, the safety or suitability thereof, or the results to be obtained, whether expressed or implied, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND OR OTHER WARRANTY. Buyers and users assume all risk, responsibilities and liability whatsoever from any and all injuries (including death), losses, or damages to persons or property arising from the use of this product. Under no circumstances shall DetNet South Africa (Pty) Ltd. or any of their partners and affiliates be liable for special, consequential or incidental damages or for anticipated loss of profits.