

	Project Name	Cyber Tyre 2.0 – PCM-3C-E
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Pirelli Control Module – PCM-3C-E

User Manual

Date: 03/12/2024	Pirelli Tire LLC	Page: 1/11

	Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual	
File name	CT2.0_PCM_UserManual_v0.2	
Document Version	0.2	

CHANGE HISTORY

Version	Date	Author	Description
0.1	20/02/2024	M. Parini	First Release
0.2	03/12/2024	E. Regini	FCC and ISED wording added
0.3	11/12/2024	E. Regini	FCC and ISED section modified

Date: 03/12/2024	Pirelli Tire LLC	Page: 2/11



Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual
File name	CT2.0_PCM_UserManual_v0.2
Document Version	0.2

CONTENTS

CHANGE HISTORY	2
1 PCM – Pirelli CONTROL MODULE	4
2 DEVICE DESCRIPTION	5
2.1 GENERAL DESCRIPTION	5
2.2 OPERATING PRINCIPLES AND PURPOSE	5
2.2.1 TYRE DEVICE MANAGEMENT	5
2.2.2 ECU	5
2.3 OPERATIONAL ENVIRONMENT AND INSTALLATION	6
3 TECHNICAL SPECIFICATIONS	7
3.1 DIMENSIONS AND WEIGHT	7
3.2 POWER	7
3.3 RADIO	7
3.4 VEHICLE BUS	7
3.5 RATINGS	7
4 REGULATORY INFORMATION	8
4.1 COMPLIANCE WITH PART 15 OF THE FCC RULES	8
4.2 ISED CANADA COMPLIANCE NOTICE	9
5 DISPOSAL	11
6 INSTALLATION AND MAINTENANCE	11



Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual
File name	CT2.0_PCM_UserManual_v0.2
Document Version	0.2

1 PCM – PIRELLI CONTROL MODULE



1. Main connector: Power+key+CANs
2. AETH Connector
3. 4x RF Fakra connectors

Date: 03/12/2024	Pirelli Tire LLC	Page: 4/11

	Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual	
File name	CT2.0_PCM_UserManual_v0.2	
Document Version	0.2	

2 DEVICE DESCRIPTION

2.1 GENERAL DESCRIPTION

The PCM (Pirelli Control Module) is part of the Pirelli Cyber Tyre 2.0 system.

Main functions of PCM are:

- **Tyre device management**, communicate with Pirelli Cyber Tyre 2.0 Tyre Mounted Sensors (CTSN) , receiving data, transmitting commands and change device configuration
- **ECU**, elaborating the data received from CTSNs and other input, through dedicated algorithms and communicating their outputs to other systems of the vehicle by the means of vehicle bus (e.g., CAN, AETH).

2.2 OPERATING PRINCIPLES AND PURPOSE

2.2.1 TYRE DEVICE MANAGEMENT

The PCM communicates with CTSNs through antennas placed on the vehicle.

The antennas (4 in total, one per each wheel) are connected to the PCM by the means of 4 dedicated ports equipped with Fakra connectors.

Each port is connected to the corresponding antenna.

The PCM manages the CTSNs for the following functions:

1. Manage single device operating status, by means of command messages with dedicated protocols. According to software defined different status
2. Modify device settings changing device memory registers
3. Receive data transmitted from devices acquired from multiple sensors (e.g. Pressure, Temperature, Accelerometer)

2.2.2 ECU

The PCM is equipped with software component developed for:

- Manage Pirelli Cyber Tyre 2.0 devices according to tyre device management specification
- Communicate and manage the communication with other system on the vehicle through vehicle bus, both for data receiving and transmission
- Use data from tyre devices and other possible input (e.g. Vehicle CAN Network) for features calculation by the means of dedicated algorithms. Such feature could regards both tyre and vehicle status and operating condition, as well as road condition. Moreover debug information about PCM and, generally speaking, Pirelli Cyber Tyre 2.0 system could be computed and transmitted

The communications via vehicle bus are done through dedicate connectors.

Date: 03/12/2024	Pirelli Tire LLC	Page: 5/11

	Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual	
File name	CT2.0_PCM_UserManual_v0.2	
Document Version	0.2	

2.3 OPERATIONAL ENVIRONMENT AND INSTALLATION

PCM and Pirelli Cyber Tyre 2.0 system should be installed on the vehicle by qualified personal, adequately informed.

Installation layout and connections changes depending on vehicle configuration and activity objectives.

Main component installation could be summarized as:

- PCM installation inside the vehicle, possibly connected to vehicle chassis or other rigid components.
- Antennas placed within wheel arc in an adequate location to provide wheel nearness and adequate protection.
- Electric power connection according to following specification

All components should be securely attached to vehicle.

Additional wiring and connection shall be defined depending on activity objectives.

External Protections:

In order to protect the car environment from any unexpected PCM fault, the device shall be installed in a power line protected by an external fuse.

The fuse I^2t (Ampere Squared Seconds) characteristics and its normal operating current must be compliant with the PCM electrical specifications:

- PCM inrush peak current =42,5A
- Inrush transient duration = 450us
- PCM nominal continuous current @12V= 0,3A
- Fuse melting $I^2t > 0,2A^2s$
- Fuse nominal continuous current @12V >= 0.7A
- The suggested fuse PN is Littelfuse 0313.700HXP
- The suggested In-Line Cartridge Fuse Holder is Littelfuse 01500603Z

Date: 03/12/2024	Pirelli Tire LLC	Page: 6/11

	Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual	
File name	CT2.0_PCM_UserManual_v0.2	
Document Version	0.2	

3 TECHNICAL SPECIFICATIONS

3.1 DIMENSIONS AND WEIGHT

Width	22 cm
Depth	12 cm
Height	4 cm
Weight	<1.5kg

3.2 POWER

Nominal Voltage	12 V
Typical Power consumption	5 W
Connector	MX23A12NF1
Input voltage range	9V-16V
Typical Power Consumption	4W
Maximum Power consumption	12W
Nominal Current	0,3A
Inrush current	42,5A (0,2 I ² t)

3.3 RADIO

Frequency	2.4GHz
Protocol	Custom
Output power:	+6dBm
Sensitivity	-96dBm
Connector type	FAKRA male

3.4 VEHICLE BUS

Protocols	CAN, AETH
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3.5 RATINGS

IP Rating	IP30
Min Temperature	-40°
Max Temperature	+85°

Date: 03/12/2024	Pirelli Tire LLC	Page: 7/11



Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual
File name	CT2.0_PCM_UserManual_v0.2
Document Version	0.2

4 REGULATORY INFORMATION

The PCM-3C-E is a radio device with wireless interface, and it is equipped with a proprietary interface based on GFSK modulation which operates in the 2.4 GHz ISM band. (2.4000 - 2.4835 GHz).

Maximum EIRP power: +17 dBm, 50 mW.

Product Name: Pirelli Control Module.

Model Name: PCM-3C-E

FCC ID: 2ANX7CPCM1

IC: 24121-CPCM1

4.1 COMPLIANCE WITH PART 15 OF THE FCC RULES

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This product complies with FCC and ISED radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

This radio transmitter has been approved to operate with the antenna types listed in the FCC filing with the maximum permissible gain indicated. Antenna types not included in that list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Date: 03/12/2024	Pirelli Tire LLC	Page: 8/11

	Project Name	Cyber Tyre 2.0 – PCM-3C-E
	Document Title	User Manual
	File name	CT2.0_PCM_UserManual_v0.2
	Document Version	0.2

4.2 ISED CANADA COMPLIANCE NOTICE

Responsible party's contact located in the Canada:

Company Name: Pirelli Tire Inc

Company Number: 26131

Company Address: 1111 Dr. Fredrik-Phillips Blvd., Bureau 506, Ville St-Laurent, Québec H4M2x6 Canada

Contact Name: Miranda Shehata

Phone Number: +1 514.940.7923

Email: miranda.shehata@pirelli.com

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/recepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage.
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement du dispositif.

ICES-003 Class B Notice - Avis NMB-003 Classe B:

This Class B digital device complies with Canadian ICES-003.

Cet appareil numérique classe B est conforme à la norme NMB-003 du Canada.

CAN ICES-3(B)/NMB-3(B)

This radio transmitter has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed in the ISED filing, with the maximum permissible gain indicated. Antenna types not included in that list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio a été validé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés dans ISED dépôt, avec indication du gain maximum autorisé.

Date: 03/12/2024	Pirelli Tire LLC	Page: 9/11



Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual
File name	CT2.0_PCM_UserManual_v0.2
Document Version	0.2

Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour fonctionner avec cet appareil.

This product complies with ISED radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with ISED multi-transmitter product procedures.

Cet appareil est conforme aux limites d'exposition aux rayonnements de l'ISED pour un environnement non contrôlé. L'antenne doit être installé de façon à garder une distance minimale de 20 centimètres entre la source de rayonnements et votre corps.

Cet appareil et son (ses) antenne(s) ne doivent pas être co-localisés ou utilisés en conjonction avec une autre antenne ou un autre émetteur, sauf en conformité avec les procédures du produit multi-émetteur de la ISED.

This device complies with Health Canada's Safety Code. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement.

Cet appareil est conforme avec Santé Canada Code de sécurité. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada.

Date: 03/12/2024	Pirelli Tire LLC	Page: 10/11

	Project Name	Cyber Tyre 2.0 – PCM-3C-E
Document Title	User Manual	
File name	CT2.0_PCM_UserManual_v0.2	
Document Version	0.2	

5 DISPOSAL

Waste Sorting and Recycling of the PCM

The installer is responsible for disposing of the PCM in accordance with applicable legislation. Incorrect disposal of materials may lead to penalties in accordance with applicable legislation.

Separating waste and recycling contributes to the preservation of natural resources and correct recovery of materials, helping protect human health and the environment.

Disposal requirements

The applicable European directives are listed below:

Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

94/62/EC, on packaging and packaging waste

The crossed-out wheelie bin symbol on the PCM indicates that must be disposed of separately, and NOT with unsorted waste.

6 INSTALLATION AND MAINTENANCE

PCM-3C-E and Pirelli Cyber Tyre 2.0 system should be installed on the vehicle by qualified personal, adequately informed.

Installation layout and connections changes depending on vehicle configuration and activity objectives.

Main component installation could be summarized as:

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Date: 03/12/2024	Pirelli Tire LLC	Page: 11/11