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Anexos

10.1.

Anexo 1 – Certificado de Calibração e Especificações Técnicas do *Correvit*

CORRSYS DATRON Sensorsysteme GmbH

Kalibrierzertifikat
Calibration Certificate

Auftraggeber *Customer*	**Ministry of Defense Brazilian Army Commission**
Auftragsnummer *P.O.Nr.*	205880

Gegenstand *Description*	Weg- und Geschwindigkeitssensor Length and speed sensor
Typ *Type*	**L-400**
Hersteller *Manufacturer*	CORRSYS- DATRON Sensorsysteme GmbH
Seriennummer *Serial Nr.*	025-64062
Inventarnummer *Inventory Nr.*	
Nutzer-ID *User ID*	
Standort *Location*	USA-Washington D.C.

Kalibrierdatum, -ort *Date of calibration,-place*	26.01.2007, Wetzlar
Das empfohlene Kalibrierintervall beträgt 12 Monate. *A calibration interval of 12 months is recommended.*	

Kalibrierinformation
Information concerning calibration

Die Sensoren werden an einem Rollenprüfstand unter genauer Betrachtung der Herstellervorgaben kalibriert. Alle Meßwerte der zum Prüfverfahren benötigten Meßmittel sind rückführbar auf nationale Normale.
Die Kalibrierung erfüllt die Anforderungen der DIN EN ISO 9001 und wurde gemäß der internen Prüfspezifikation durchgeführt.
The sensors are calibrated on a roller test stand in accordance with the producers instructions. All measurement values needed for the calibration can be derived from national standards.
The calibration meets the requirements of the DIN EN ISO 9001 and was carried out according to the internal test specifications.

J. Fischer — Verantwortlicher / *Approved signatory*
A. Paschenko — Prüfer / *Calibrated by*

Dieses Zertifikat ist ein Herstellerzertifikat „M" nach DIN 55350 Teil 18
This calibration certificates is a manufacturer certificate type "M" according to DIN 55350 part 18

Das Zertifikat besteht aus 3 Seiten.
The calibration certificate consists of 3 pages

L-400 SN025-64062 Seite/page 1 - 3

CORRSYS-DATRON GmbH · Charlotte-Bamberg-Str. 12 · D-35578 Wetzlar · ☎ +49 (0) 64 41/92 82-0 · Telefax +49 (0) 64 41/92 82-17 · sales@corrsys-datron.com

Kalibrierverfahren: Kal_SIM1_Dok.
Test plan: cal_sim1_doc
Version: 2.0
Version:
Erstellt am: 01/2004
Created on:

Verwendete Prüfmittel ***Used test equipment***

Position	Prüfmitteltyp,Prüfmittel *Test equipment (type)*	kalibriert bis *Calibr. Due date*	Rückgeführt über *Traced via*
1	Walzensimulator Astro (SN 01.0173.001-01)	03.2007	DKD-K-25801-01
2	µEEP5 Corrsys-Datron (SN P71824)	03.2007	DKD-K-25801-01
3	Hygro-Thermometer (Ident-Nr. 01/028)	01.2008	DKD-K-25801-01

Umgebungsbedingungen ***Environmental conditions***

Umgebungstemperatur *Ambient temperature*	19° C
Relative Luftfeuchte *Relative atmospheric humidity*	50%

Randbedingungen ***Boundary conditions***

1. Oberfläche: Spezielle Oberfläche entsprechend einem trockenen Makadam-Belag (genaue Spezifikation siehe Dokument „Oberflächendef.")

1. Surface: Special surface correspond to a dry Makadam street surface (For exact definition see document "oberflächendef.")

Geschwindigkeit: 50 km/h
Velocity: 50 km/h
Meßdurchführung: Es wurde jeweils eine Messungen im Arbeitsabstand von 530, 400 und 270 mm im kalibrierten Modus durchgeführt.
Measurement: One measurement has been performed in the working distances of 530, 400 und 270 mm.

2. Einstellungen
Settings

Digital Ausgang (*output*) 1 : 460,0 P/m	Analog Ausgang (*output*) 1 : 25,0 mV/km/h

Der Sensor ist so justiert, dass er bei 50 km/h einen Istwert von 1,25 V am Analogausgang1 ausgibt.
The sensor is calibrated to 1,25 V at analog output 1 at a speed of 50 km/h.

CORRSYS DATRON Sensorsysteme GmbH

Zustand des Kalibriergegenstandes:
Condition of calibration object:

Aufnahme Ist-Zustand bei Nachkalibrierung *As Received Test*	☐ **Ja** *Yes*	☐ **Nein** *No*
Ist-Zustand ohne Beanstandung *As Received Test Ok*	☒ Ja *Yes*	☐ Nein *No*

Prüfungsergebnisse
Test results

1. Eingangstest /*Unit as Received*

Arbeitsabstand [mm] *Working Distance*	530	400	270
Messergebnis [m] (Istwert) *Measurement (actual value)*	1259,43	1260,57	1259,56
Sollwert [m] *Nominal value*	1260,00	1260,00	1260,00
Maximum Abweichung *Maximum deviation (max. ±0,1 %)*	0,05 % (= 0,57 m)		

Zustand des Kalibriergegenstandes: Sensor ist innerhalb der Toleranz !
Condition of calibration object: *Sensor is within tolerance !*

2. Ausgangstest/*Unit As Returned*

Arbeitsabstand [mm] *Working Distance*	530	400	270
Messergebnis [m] (Istwert) *Measurement (actual value)*	1259,43	1260,57	1259,56
Sollwert [m] *Nominal value*	1260,00	1260,00	1260,00
Maximum Abweichung *Maximum deviation (max. ±0,1 %)*	0,05 % (= 0,57 m)		

Zustand des Kalibriergegenstandes:
Condition of calibration object:

Technischer Zustand *Technical condition*		**Optischer Zustand** *Optical condition*	
Erforderliche Reparatur durchgeführt *Required repair completed*	☐	Gehäuseschaden repariert *Housing damagerepaired*	☐
Ohne Beanstandung *OK*	☒	Ohne Beanstandung *OK*	☒
Alle Messwerte im Sollbereich *All measurement values within nominal range*	☒ Ja *Yes*	☐ Nein *No*	

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CORRSYS DATRON Sensorsysteme GmbH

Kalibrierzertifikat

Calibration Certificate

Auftraggeber *Customer*	Ministry of Defense Brazilian Army Commission
Auftragsnummer *P.O.Nr.*	205880

Gegenstand *Description*	Mobile Datenerfassung *Mobile date acquisition*
Typ *Type*	DAS2A8D
Hersteller *Manufacturer*	CORRSYS- DATRON Sensorsysteme GmbH
Seriennummer *Serial Nr.*	855-7001
Inventarnummer *Inventory Nr.*	
Nutzer-ID *User ID*	
Standort *Location*	USA-Washington D.C.

Prüfauftragsnummer *Calbration No.*	
Kalibrierdatum, -ort *Date of calibration*	26.01.2007 ,Wetzlar
Nächste Kalibrierung *Next calibration*	01.2008

Kalibrierinformationen
Information of calibration

Alle Meßwerte der zum Prüfverfahren benötigten Meßmittel sind rückführbar auf nationale Normale. Die Kalibrierung erfüllt die Anforderungen der DIN EN ISO 9001ff und wurde gemäß der internen Prüfspezifikation durchgeführt.

All measurement values needed for the calibration can be derived from national standards.The calibration meets the requirements of the DIN EN ISO 9001ff and was carried out according to the internal test specifications.

Austellungsdatum : 22.01.2007 J.Eisfeld H.Ricklefs
Date of issue : Verantwortlicher Prüfer
Approved signatory *Calibrated by*

Dieses Zertifikat ist ein Herstellerzertifikat "M" nach DIN 55350 Teil 18
This Calibration certificate is a manufacturer certificate type "M" according to DIN 55350 part 18

Das Zertifikat besteht aus 6 Seiten
The calibration certificate consists of 6 Pages

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Verwendete Prüfmittel
Used test equipment

Position	Prüfmitteltyp, Prüfmittel Test equipment (type)	Kalibriert bis Calibr.due date	Rückführung Traced via
1	Multimeter, Agilent 34401A (SN MY41046287)	03.2006	DKD-K-04201
2	SNNT-4005pc Rerenzspannungsquelle (SN 1542050)	03.2006	DKD-K-04201
3	Counter Hewelett Packard 53131A (SN 3736A21158)	03.2006	DKD-K-04201
4	Aglient,Frequenzgenerator 33120A		

Umgebungsbedingungen
Enviromental conditions

Umgebungstemperatur *Ambient temperature*	24 °C
rel. Luftfeuchte *rel. atmospheric humidity*	46 %

Kailbriergegenstand DAS2A8D
Object

Seriennummer: 855-7001
Serial number:

Prüfungsergebnisse
Verification results

CORRSYS DATRON Sensorsysteme GmbH

Messungen wurden bei einer Versorgungsspannung von 12V vorgenommen.
All measurment values are recorded with a power supply of 12V

Analogeingänge
Analog inputs

Analog 1

Meßbereich *measuring range*	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
10 V	10,00 V	9,98 V	-0,10 %
	8,00 V	7,98 V	-0,10 %
	6,00 V	5,97 V	-0,15 %
	4,00 V	3,98 V	-0,10 %
	2,00 V	1,99 V	-0,05 %
	0,00 V	-0,01 V	-0,05 %
	-2,00 V	-2,01 V	-0,05 %
	-4,00 V	-4,00 V	0,00 %
	-6,00 V	-6,00 V	0,00 %
	-8,00 V	-8,00 V	0,00 %
	-10,00 V	-10,00 V	0,00 %

Analog 2

Meßbereich *measuring range*	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
10 V	10,00 V	9,96 V	-0,20 %
	8,00 V	7,96 V	-0,20 %
	6,00 V	5,97 V	-0,15 %
	4,00 V	3,98 V	-0,10 %
	2,00 V	1,99 V	-0,05 %
	0,00 V	-0,01 V	-0,05 %
	-2,00 V	-2,01 V	-0,05 %
	-4,00 V	-4,00 V	0,00 %
	-6,00 V	-6,00 V	0,00 %
	-8,00 V	-8,00 V	0,00 %
	-10,00 V	-10,00 V	0,00 %

Analog 3

Meßbereich *measuring range*	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
10 V	10,00 V	9,98 V	-0,10 %
	8,00 V	7,98 V	-0,10 %
	6,00 V	5,99 V	-0,05 %
	4,00 V	3,98 V	-0,10 %
	2,00 V	1,99 V	-0,05 %
	0,00 V	0,00 V	0,00 %
	-2,00 V	-2,01 V	-0,05 %
	-4,00 V	-4,00 V	0,00 %
	-6,00 V	-6,01 V	-0,05 %
	-8,00 V	-8,00 V	0,00 %
	-10,00 V	-10,00 V	0,00 %

Kailbriergegenstand *Object* DAS2A8D

Seriennummer: 855-7001 *Serial number:*

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Analog 4

Meßbereich *measuring range*	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
10 V	10,00 V	9,98 V	-0,10 %
	8,00 V	7,98 V	-0,10 %
	6,00 V	5,97 V	-0,15 %
	4,00 V	3,98 V	-0,10 %
	2,00 V	1,99 V	-0,05 %
	0,00 V	-0,01 V	-0,05 %
	-2,00 V	-2,01 V	-0,05 %
	-4,00 V	-4,00 V	0,00 %
	-6,00 V	-6,00 V	0,00 %
	-8,00 V	-8,00 V	0,00 %
	-10,00 V	-10,00 V	0,00 %

Analog 5

Meßbereich *measuring range*	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
10 V	10,00 V	9,98 V	-0,10 %
	8,00 V	7,98 V	-0,10 %
	6,00 V	5,99 V	-0,05 %
	4,00 V	3,98 V	-0,10 %
	2,00 V	1,99 V	-0,05 %
	0,00 V	-0,01 V	-0,05 %
	-2,00 V	-2,01 V	-0,05 %
	-4,00 V	-4,00 V	0,00 %
	-6,00 V	-6,00 V	0,00 %
	-8,00 V	-8,00 V	0,00 %
	-10,00 V	-10,00 V	0,00 %

Analog 6

Meßbereich *measuring range*	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
10 V	10,00 V	9,98 V	-0,10 %
	8,00 V	7,98 V	-0,10 %
	6,00 V	5,97 V	-0,15 %
	4,00 V	3,98 V	-0,10 %
	2,00 V	1,99 V	-0,05 %
	0,00 V	-0,01 V	-0,05 %
	-2,00 V	-2,01 V	-0,05 %
	-4,00 V	-4,00 V	0,00 %
	-6,00 V	-6,01 V	-0,05 %
	-8,00 V	-8,00 V	0,00 %
	-10,00 V	-10,00 V	0,00 %

Kailbriergegenstand *Object* DAS2A8D

Seriennummer: 855-7001 *Serial number:*

CORRSYS DATRON
Sensorsysteme GmbH

Analog 7

Meßbereich *measuring range*	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
10 V	10,00 V	9,98 V	-0,10 %
	8,00 V	7,98 V	-0,10 %
	6,00 V	5,99 V	-0,05 %
	4,00 V	4,00 V	0,00 %
	2,00 V	1,99 V	-0,05 %
	0,00 V	0,00 V	0,00 %
	-2,00 V	-2,01 V	-0,05 %
	-4,00 V	-4,00 V	0,00 %
	-6,00 V	-6,01 V	-0,05 %
	-8,00 V	-8,00 V	0,00 %
	-10,00 V	-10,00 V	0,00 %

Analog 8

Meßbereich *measuring range*	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
10 V	10,00 V	9,98 V	-0,10 %
	8,00 V	7,98 V	-0,10 %
	6,00 V	5,97 V	-0,15 %
	4,00 V	3,98 V	-0,10 %
	2,00 V	1,99 V	-0,05 %
	0,00 V	-0,01 V	-0,05 %
	-2,00 V	-2,01 V	-0,05 %
	-4,00 V	-4,00 V	0,00 %
	-6,00 V	-6,01 V	-0,05 %
	-8,00 V	-8,00 V	0,00 %
	-10,00 V	-10,00 V	0,00 %

Kailbriergegenstand *Object* DAS2A8D

Seriennummer: 855-7001 *Serial number:*

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Digitaleingänge
Digital inputs

Digital 0 Kalfaktor 460

	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
	0,0 km/h	0,0 km/h	0,00 %
	10,0 km/h	10,0 km/h	0,00 %
	50,0 km/h	50,0 km/h	0,00 %
	100,0 km/h	100,0 km/h	0,00 %
	200,0 km/h	200,0 km/h	0,00 %
	300,0 km/h	300,0 km/h	0,00 %
	400,0 km/h	400,0 km/h	0,00 %

Digital 2 Kalfaktor 60,000

	Richtiger Wert *correct value*	Anzeige *indication*	Abweichung in % *deviation in %*
	10 Hz	10 Hz	0,00 %
	50 Hz	50 Hz	0,00 %
	100 Hz	100 Hz	0,00 %
	1000 Hz	1000 Hz	0,00 %

Funtionskontrolle:

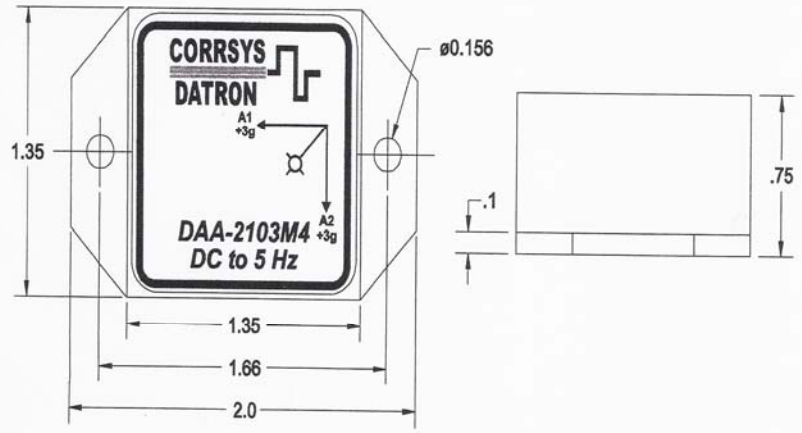
DIG1	OK
ANA1S	OK
ANA2S	OK
LB	OK
BS	OK

Kailbriergegenstand *Object* DAS2A8D

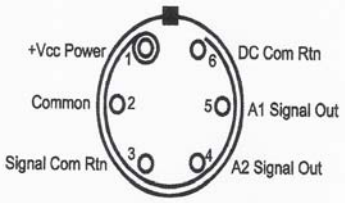
Seriennummer: 855-7001 *Serial number:*

CORRSYS DATRON
Sensor Systems, Inc.

Tri-Axial Accelerometer Module
DAA-2103M4-1%-5-LEMO
DAA-2203M4-1%-5-LEMO



Part Number:	DAA-2103M4-1%-5-LEMO DAA-2203M4-1%-5-LEMO
g Span:	±3g
Span Vo	±2.0 Vdc at ±3g
Sensitivity	666 mV/g; ±1%; Ratiometric to Power Supply
0g Bias	+2.50 Vdc, ±100 mV; Ratiometric to Power Supply
Bandwidth	DC to 5 Hz.; - 3 dB
+g Magnitude	+2.5 to 0 Vdc
-g Magnitude	+2.5 to 5 Vdc
Noise	560 μg RMS (typical)
Shock	500g powered; 1000g unpowered
Temperature	-40°C to +85°C
Weight	45 grams
Module Power	+5.00 Vdc, ±250 mV; < 6 mA



6 Position Male Plug Pin View
LEMO FGG.1B.306

Wiring Connections		
Conn	Color	Remarks
1	Red	+5 Vdc Pwr In
6	Black	Common Rtn.
5	White	A1 Signal Vo
4	Orange	A2 Signal Vo
2	Green	N/A
3	Blue	Signal Common
Shell	Braid	Case Shield

12/15/2006; NeuwGhent Technology; 3 S Cross Rd; LaGrangeville, NY 12540; 845-223-3359; gvanderg@frontiernet.net;
DAA-2103M4-5-LEMO CD.doc

NeuwGhent Technology

Quality Performance Specifications:

Parameter	Value (nom) Ta = 25°C; Vps = 5.000 Vdc, ±5 mV	Tolerance
Part Number	DAA-2103M4-1%-5; DAA-2203M4-1%-5	
Full Scale Sensitivity	±3g; 666 mV/g; Ratiometric to Power Supply Potential	±1% FS
Zero g Bias Output	+2.5 Volts DC, nominal; Ta = +25°C; Ratiometric to Power Supply Potential	±100 mV
Full Scale Span	±2.0 Volts DC at ±3g	±1% FS
Frequency Response	DC to 5 Hz, -3dB; -6dB/octave roll-off	±10%
RMS Equivalent Noise	560µg RMS Gaussian; DC to 5 Hz. BW	±15%
Nonlinearity	±0.2% FS; ±6 milli-g equivalent	±25%
Alignment	±2 degree	±1 degree
Transverse Sensitivity	±2% FS Span (max); 60 milli-g equivalent	±10%
Supply Voltage	+5.00 Volts DC; Test Conditions = +5.000 Vdc, ±5 mV	±0.25 Vdc
Supply Current (No Load)	4 mA	±2 mA
Temperature Range	-40°C to +85°C	
Zero g Bias Drift	0.2g max from -40°C to +85°C	
Temperature Range (Storage)	-65°C to +100°C	
Shock (Powered)	500g	
Shock (Unpowered)	1000g	
Output Loading	10kΩ min and 1000pF max	
Mass	45 grams; 1.6 ounces	±10 grams
Packaging	Anodized 6061 Aluminum; Epoxy potting Shore 85D Hardness	

NeuwGhent Technology certifies that the enclosed accelerometer modules meet or exceed the above Quality Performance Specifications at the time of test. All the measurements are conducted on instruments calibrated to NIST traceable standards (ANSI/NCSL Z540-1-1994 Specifications).

12/15/2006; NeuwGhent Technology; 3 S Cross Rd; LaGrangeville, NY 12540; 845-223-3359; gvanderg@frontiernet.net;
DAA-2103M4-5 Quality Document.doc

Corrsys-Datron Sensor Measurements

S/N	Part Number	Specification	A1 Bias	A1 Sens	A2 Bias	A2 Sens	A3 Bias	A3 Sens	Date	PO #	Job #	Remarks
DT-262	DAA-2203M4-1%-5-LEMO	+/-3g, DC to 5 Hz BW; Bi-Axial	2.583	0.667	2.588	0.664	N/A	N/A	15-Dec-06	423	0634501	5.002 Vps

10.2.

Anexo 2 – Especificações Técnicas do MQ200-PRO

MQ200 Quickstart Guide

Thank you for purchasing a MaxQData™ MQ200 system. If you have any problems getting started, you can send email to Info@MaxQData.com or call 425-562-3423.

This quickstart guide assumes you are using an MQ200 with a Pocket PC and a Bluetooth adapter to do data collection, lap timing, and analysis, and optionally a laptop or desktop PC for more detailed analysis. If you are using a laptop to do the actual data collection, the steps are similar, but please refer to your laptop's documentation for instructions on setting up a Bluetooth Serial Port Profile connection to the MQ200, as the exact steps can vary between different computers. If you are using an RS232 serial connection, the steps are the same except of course that you do not need to set up Bluetooth.

Mounting

MQ200 data acquisition unit: The MQ200 needs to be mounted flat and level for the internal accelerometers to work properly. Try the floor or the trunk. Check the installation location with a bubble level before attaching the unit with fasteners. The unit must also be mounted either lengthwise/parallel to the centerline of the vehicle or widthwise/perpendicular to the centerline. Mount the system in a dry, clean location where it is not exposed to heat, water, fluids, or excessive dirt. The recommended attachment method for most applications is high-strength adhesive Velcro strips.

Pocket PC: Mount the Pocket PC securely in a dry, clean location. You can mount the Pocket PC with the Velcro, but be careful when dismounting the Pocket PC as excessive force can pull off the battery cover.

Wiring

WARNING: Work carefully around airbag wiring. These wires are usually yellow. Never make a connection to an airbag wire. Always stay clear of airbag deployment areas when working on an airbag-equipped vehicle. DO NOT MOUNT ANYTHING IN FRONT OF AN AIRBAG.

CAUTION: Do not tap sensors used in ABS, Stability Control, or other safety-critical systems.

CAUTION: Make wiring connections only with power disconnected and the car turned "off". Check for short circuits before applying power. Protect wires from cuts and abrasion.

Pocket PC: Connect the Bluetooth adapter (or RS-232 cable) to the connector on "Side 3" of the MQ200. If you need to, you can use a DB9 M-F "straight-through" extension cable to provide additional length.

GPS only: Plug into the "GPS/OBD-II" port on "Side 1" of the MQ200. The GPS module is powered directly from the port.

OBD-II with GPS: Your OBD-II module came with a Y-cable. Plug the "MQ200" end into the "GPS/OBD-II" port. Plug the GPS module into the "GPS" end. Plug the OBD-II module into the "OBD-II" end. Plug the OBD-II cable into the other end of the OBD-II module. Plug the OBD-II cable into the OBD-II port on the car

Direct sensor inputs: You may wish to tap into the vehicle's wiring harness to read sensors directly. You will need to identify which wires to tap with the help of a service manual wiring diagram. You

can use "tap-in squeeze connectors" (e.g. Radio Shack 64-3053) to make the connection. Be sure to protect the tap connection from moisture and corrosion by wrapping it with silicone tape or by using a sealant. On cars with OBD-II systems, do not leave the MQ200 unpowered while the car is "on" if you have tapped into existing sensor wiring, as this can trip fault codes.
+12V Power: If you are not using OBD-II, you connect power to the MQ200 through the "BAT+" and "BAT-" screw terminals.

Calibration
The internal 3-axis accelerometer (and angular rate sensors, if equipped) were tested at the factory and the calibration constants stored in the file a factory calibration file. This file is emailed to you from MaxQData and is named with the serial number of your MQ200. You must load this file for proper operation of the internal sensors, as described later. Do not lose this file.

Step 1 - Partnering your Pocket PC with Windows 2000 or Windows XP
Before you can connect your Pocket PC to your laptop or desktop PC, you must first download and install the "ActiveSync" application from Microsoft. You may also have ActiveSync on the CD-ROM that came with your Pocket PC, but it is recommended to download the latest version from the Microsoft website. You can find this quickly by going to www.microsoft.com and searching for "ActiveSync". Install ActiveSync, then follow the on-screen instructions for connecting to and setting up a partnership with your Pocket PC. From then on, ActiveSync will run automatically when you connect your Pocket PC.

You can transfer files by clicking the "Explore" button in the ActiveSync window. The initial file explorer window shows the "\My Documents" folder on the Pocket PC, which is where you will find all your data files unless you change the location later.

Step 1 - Partnering your Pocket PC with Windows Vista
Setting up a Pocket PC is automatic under Windows Vista. Do not install ActiveSync. Instead, you need to use "Windows Mobile Device Center". First, be sure that your PC is connected to the Internet. Then connect your Pocket PC to your PC using the USB cable that came with it. Windows Vista will recognize the device and automatically download and install Windows Mobile Device Center from Microsoft. Follow the on-screen instructions for setting up a partnership with your Pocket PC. From then on, Windows Mobile Device Center will run automatically when you connect your Pocket PC. You can also access it from the Control Panel.

You can transfer files by clicking "Browse the contents of your device" under "File Management". The initial file explorer window shows the root folder "\" and may also show a Storage Card folder. Double-click on "\", then double click on "\My Documents". This is the folder where you will find all your data files unless you change the location later.

Step 2 - Software Download and Installation – Pocket PC
Download the latest software from the MaxQData website. You will need the file specifically for Pocket PC. The name of the file will be similar to "MaxQData 26b PPC Software.exe". Transfer this file to the \My Documents folder on your Pocket PC using ActiveSync or Windows Mobile Device Center as explained above. Then on the Pocket PC, tap Start > Programs > File Explorer (it may also be found on the Start menu). You should see the \My Documents folder; if not, navigate to that folder. Locate the installation file and tap its name to install the MaxQData software. This will install the Chart, Flight, and Setup applications, and optionally the Codes utility. Chart is for data analysis,

Flight is for collecting the data, and Setup is for setup and calibration. Codes is a simple OBD-II code scanning utility. After installing the software, delete the install file from the Pocket PC.

In addition to the installation file, be sure to transfer the factory calibration file you got from MaxQData to the Pocket PC. You will use it later.

Step 3 – Software Download and Installation – Laptop/Desktop

Again, download the latest software from the MaxQData website. You will need the file labeled as "PC Chart". The name of the file will be similar to "MaxQData 26b PC Chart.exe". Download the file to your laptop and double-click on it to run it. This will install only the Chart software on your PC, which is what you will need to do data analysis.

Step 4 – Bluetooth Pairing with a Windows Mobile 2003 Pocket PC

- Power on the MQ200.
- Tap the Bluetooth icon at the lower right of the Today screen and turn on Bluetooth.
- Run the Bluetooth Manager from the Bluetooth icon.
- Tap "New", and then "Explore a Bluetooth Device". The Pocket PC will search for new Bluetooth devices. An icon should appear for "Aircable xxxxx". The number "xxxxx" identifies your module. Tap this icon.
- Select "Serial Port" and "Next". A shortcut will be created.
- Go back to the Today screen and select "Bluetooth Settings" from the Bluetooth icon.
- Tap the "Services" tab.
- Tap "Serial Port". Check "Enable service". Uncheck the other checkboxes.
- Tap "Advanced" and make a note of the "Outbound COM Port".
- Tap "OK" and "OK" again to get out of the Bluetooth Settings applet.
- Run MaxQData Setup and go to Settings > Serial Port Settings. For "GPS Port", enter "COMx", where "x" is the number of the Outbound COM Port. Select "Is Bluetooth" under "GPS Port". Continue with the remaining setup as described below under "MQ200 Setup".
- If you are ever asked for a passkey for the Aircable, it is the same as the five-digit module identifier number.

Step 4 – Bluetooth Pairing with an HP iPAQ rx4200 Pocket PC and certain others

- A few Pocket PCs based on Windows Mobile 2005 use the same pairing process as the one above for Windows Mobile 2003 devices.

Step 4 – Bluetooth Pairing with most other Windows Mobile 2005 Pocket PCs – Dell Axim X51, etc.

- Turn on the MQ200
- Tap the Bluetooth icon at the lower right of the Today screen.
- Check "Turn on Bluetooth". You can either check or uncheck "Make this device discoverable"
- Go to the "Devices" tab and tap "New Partnership...". The Pocket PC will scan for Bluetooth devices. An entry for "Aircable xxxxx" will appear. The number "xxxxx" identifies your GPS module. Tap this entry and then "Next".
- Enter the five-digit Aircable identifier number for the passkey and tap "Next".
- Check the "Serial Port" box and tap "Finish".
- Go to the "COM Ports" tab.
- Tap "New Outgoing Port"
- Select your Socket BT GPS module and tap "Next".

- Choose a COM port to use for the connection. "COM7" is recommended if available. Uncheck "Secure Connection". Tap "Finish". Note: on a Pocket PC Phone Edition device, your choice of COM port may interfere with the "Wireless Modem" function. If you find that you are unable to use the PPCPE as a wireless data modem after pairing the MQ200, delete the Outgoing Port and try a different COM port number.
- Run MaxQData Setup and go to Settings > Serial Port Settings. For "GPS Port", enter "COMx", where "x" is the number of the Outbound COM Port. Select "Is Bluetooth" under "GPS Port".

Step 5 - Setup

After installing the software and pairing the MQ200 with your Pocket PC, run MaxQData Setup and check the following settings.

Settings > Serial Port Settings:

- "MQ Port" must be the outgoing COM port that you set up earlier during pairing.
- "Is Bluetooth" under "MQ Port" should be checked.
- "MQ Baud Rate" should be 115200
- "Delay Bluetooth Init" should be unchecked. However, if you experience problems where Flight does not connect to your MQ200 soon after turning the power on, check this.
- "GPS Port" must cleared.
- "Is Bluetooth" under "GPS Port" should be unchecked.
- "GPS Baud Rate" should be "38400".
- "Enable $GPRGH" must be checked.

Settings > MQ Module Configuration:

- "System type" must be "MQ200". Check "Pro" if you are using either an MQ200-PRO or MQ200-MAX
- For an MQ200-RT, check the following boxes: A0-A3, A12-A15, P0, and P5
- For an MQ200-PRO, check the following boxes: A0-A3, A4-A7, A8-A11, A12-A15, P0, P1, P2, P3, P4, and P5.
- For an MQ200-MAX, check the following boxes: A0-A3, A4-A7, A8-A11, A12-A15, A16-A19, A20-A23, A24-A27, A28-A31, P0, P1, P2, P3, P4, and P5.
- If you have any of the optional internal roll, pitch, or yaw rate sensors, check "A32-A37". Also check "Roll", "Pitch", and/or "Yaw" appropriately.
- Check "GPS" if you are using a GPS module
- Check "OBD2" if you are using an OBD-II module.
- Check "PWM" if you intend to use the PWM outputs of the MQ200-MAX.

Settings > Advanced:

- You do not need an unlock code for the MQ200.
- "Racing type" should be set to the kind of racing you expect to be doing most often.
- "Log type 1 records only" may be checked if you like. This will reduce the size of flight recordings by removing certain data that may be redundant. This is only really necessary for long recordings many hours in length.
- "Open before trigger" should be checked (but see later for details on how to use this option when hot-swapping data cards during pit stops).
- "Max lap count" prepares each flight recording to hold enough beacons for the specified number of laps. The default of 100 laps works for most users. Do not change this to an unnecessarily high value, as this will make the flight recordings unnecessarily large.

- If you are using OBD-II and you know your car's OBD-II bus type, set "OBD2 Bus" accordingly. This will speed bus initialization. You can also choose "Autosense". Otherwise, for systems without OBD-II, choose "None".
- Leave the ISO init timeout unless you are directed otherwise by MaxQData.
- Check ISO 14230 if your car has an ISO 14230 OBD-II bus (e.g. Subaru WRX STi)
- MQ ticks/s must be 1000.
- "Debug mode" and "Log serial" should be unchecked unless directed otherwise by MaxQData.

Next, use "File > Load Calibration Backup" to load the factory calibration file. Then expand "Sensors Requiring Calibration" and "Internal LatG". You must set "Orientation" under "Internal LatG" to match the orientation of the MQ200 as installed in the vehicle; see the on-screen tip or the sensor reference at the end of this manual for more information.

Step 6 – Verify Operation

Turn on the MQ200. From within MaxQData Setup, choose "Settings > Get firmware version". You may be prompted to select a Bluetooth device; if so, check the "Always use the selected device" box if it appears, then tap the icon for the Aircable. After a short wait, you should be presented with a message box that displays a firmware code which ends in the serial number for your MQ200. Exit from MaxQData Setup. Do not use the "X" button, which only hides the application on a Pocket PC instead of closing it. Use File > Exit instead. Make sure the GPS module has a good view of the sky. Run MaxQData Flight. Go into Configure > Sensors, select "Standard", and click "OK". Make sure the MQ200 is flat and level. Pick "Internal LatG" from one of the two drop-down selection boxes on the main screen. Verify that it is reading very close to 0.00g. Check "Internal LongG" as well to verify it is also very close to 0.00g. Pick "Satellite Count" from one of the two drop-down selection boxes on the main screen and verify that the GPS module is picking up a satellite count greater than 3.

Step 8 – Trial Run

With the MQ200 turned on and the Pocket PC running Flight, do a test run. Be sure to reach a speed above 25 MPH in order to trigger a flight recording. After your run, come to a stop, then run MaxQData Chart and load the file you just created, which should be named "Run000". Tap Map > Full GPS Map" if necessary to see your complete GPS trackmap. Your car is at the "+" sign. Tap one of the fields which reads "Select..." and choose "GPS Vehicle speed". This will bring up a vehicle speed data trace on the screen in the crosshair plot area. To move the data forward in time, tap and drag the plot area to the left. As you move the data forward in time, you will see the "+" sign move around the trackmap.

Step 9 – View Flight Recording on PC

Reconnect your Pocket PC to your PC. Using ActiveSync or Windows Mobile Device Center, open the \My Documents folder on the Pocket PC. You should see the "Run000.mqd" flight recording file. Drag and drop this file to your desktop, then double-click on it. MaxQData Chart will launch and automatically load the file. Be sure to select the correct racing type under "File > Racing type...". You may need to exit and restart Chart for this to take effect.

MQ200 Datasheet

General System capabilities

- Autocrossing: track mapping, segment timing, acceleration/ braking/ cornering/ MPH; immediate review of data without leaving your car
- Road racing: real-time lap time display, track mapping, lap and segment times calculated from GPS position, lap count, "continuous" lap time measurement (Time since last here), acceleration/ braking/ cornering/ MPH, etc.
- Strip/Street: full "magazine test" performance calculations, including:
    - Time to speed (e.g. 0-60, 5-60, 50-70, 0-100, ...)
    - Time to distance (60', 330', 1/8 mile, 1000', ¼ mile), speed at distance, deceleration
    - Lateral acceleration
- 3-axis internal accelerometer
- Analog and Pulse inputs for direct sensor connections
- Optional OBD-II
- Optional 5 Hz high performance GPS
- Horsepower
- Altitude
- GPS UTC time (synchronized among all vehicles)
- Automatic start and stop of flight recordings based on vehicle speed
- Color graphic real-time display featuring four display modes: bar graph, strip chart, X vs. Y, and numeric; touch-screen operation
- Recording time limited only by available memory. 32 MB can hold more than 20 hours of data.
- Color graphic timeslip images, Excel spreadsheets, web page result summaries
- Analysis software for both Pocket PC and PC, including data file overlays, lap/segment time lists with min/max/average, manual and automatic beacon placement, GPS track map full/zoom, export to Excel™ and text files, timeslip generation
- Automatic emailing of data files; automatic text messaging of lap and segment times in real time (requires Phone Edition device and a data plan from your wireless provider).
- Automatic start and stop of flight recordings based on vehicle speed

MQ200-RT system capabilities

- 2 g, 3-axis accelerometer
- 4 analog and 2 pulse input channels
- 50 Hz sampling
- Optional internal Roll, Pitch, and Yaw rate sensors

MQ200-PRO system capabilities

- 6g, 3-axis accelerometer
- 12 analog and 6 pulse input channels
- 100 Hz sampling
- Optional internal Roll, Pitch, and Yaw rate sensors

MQ200-MAX system capabilities

- 6g, 3-axis accelerometer
- 28 analog and 6 pulse input channels
- 2 relay or pulse-width modulated outputs
- 100 Hz sampling
- Up to 500 Hz sampling on selected channels (recommended for shock velocity measurements)
- Optional internal Roll, Pitch, and Yaw rate sensors

GPS Module Technical specifications

- 32 channel GPS receiver
- 1 second hot start, 39 seconds cold start
- -158 dBm sensitivity

Sample Rate

You can change the sampling rate options for the MQ200 using the "Config > Sample rate" menu option.

It is important to understand the sampling rate capabilities of your MQ200 system in order to get the best possible fidelity while creating flight recordings of manageable size. The sampling rate is measured in "Hz" (Hertz), which is the number of samples per second (10 Hz = 10 samples per second).

General Recommendations: A 20 Hz sampling rate works well for most road racing, drag racing, and autocross applications. 10 Hz works well, too, and is suggested for sessions lasting more than 1 hour to keep the data file sizes down, unless you know for sure you need a higher sampling rate. Specialized vehicle testing may require faster sampling rates (e.g. shock rate testing often requires 200 Hz or faster).

GPS: The sampling rate of all GPS values is fixed by the GPS module. The standard GPS module for the MQ200 is a 5 Hz module. Other modules can be 1 Hz or 4 Hz. All GPS values are updated simultaneously each sample period.

OBD-II: The sampling rate of OBD-II is inherently limited by the speed of the vehicle's OBD-II bus and communications protocol. The MQ200 follows the applicable SAE communications standards. Practically speaking, an ISO 9141-2 or ISO 14230 system will yield approximately 6 Hz, and a VPW or PWM system will yield 10 Hz or better. Only one OBD-II value is updated each sample period, so if you are recording two values, the sample rate on each will be half of the theoretical maximum for that bus. Usually, you want to limit yourself to flight recording only 2-3 OBD-II values.

Analog channels A00-A15: These are the "standard" analog channels. A12-A15 are used internally. A0-A3 are external channels on the MQ200-RT, and A0-A11 are external channels on the MQ200-PRO and MQ200-MAX. These channels have a 50 Hz sampling rate limit on the -RT, and a 100 Hz limit on the -PRO and –MAX.

Analog channels A32-A37: These channels are used internally for the optional Roll Rate / Pitch Rate / Yaw Rate / MQTemp sensors. They have the same sampling rate limits as A00-A15.

Analog channels A16-A19 and A20-A31: These are the "high speed" analog channels found on the MQ200-MAX. You can sample all channels A00-A37 at a maximum of 100 Hz on the –MAX. You can also trade off slower sampling on the standard channels for even faster sampling on the high speed channels. Here are some examples:

- A16-A31 can be sampled at 200 Hz while the others are sampled at 50 Hz or less
- A16-A31 can be sampled at 250 Hz while the others are sampled at 25 Hz or less
- A16-A19 can be sampled at 500 Hz while the others are sampled at 25 Hz or less

When the sampling rate on all channels is the same, all analog channels are sampled "simultaneously" each sample period (the phase delay from the first channel to the last channel is under 1 millisecond). When the sampling rate is split between the high speed and standard groups, the high speed channels are sampled simultaneously every fast sample period, and both the high speed and standard channels are sampled simultaneously every slow sample period.

Pulse channels P0-P5: These are sampled along with the standard analog channels and are subject to the same sample rate limitations. Note that the value of a pulse channel changes when the signal changes from high to low or vice versa, so the actual sample rate will be no faster than the frequency of the input signal. The frequency measurement limit is above 20 kHz.

Oversampling and Filtering: Channels A00-A37 are oversampled at a 1 kHz rate. A00-A31 are lightly filtered using a moving average of the previous four 1 kHz samples. A16-A19 are not filtered when using the 500 Hz sampling rate. A32-A37 (roll, pitch, and yaw values) are more strongly filtered using a moving average of eight samples. Furthermore, A32, A34, and A36 (roll, pitch, and yaw rate respectively) are filtered by a 21 tap FIR filter with a 10.7 Hz cutoff that reaches -40 dB by 21.3 Hz. There is very little useful angular rate information above 6-8 Hz in most applications anyways. Higher frequency energy is usually not due to the actual motion of the vehicle but instead due to transmitted vibrations, which obscure the signal if not filtered out. Filtering can be customized for special applications; contact Info@MaxQData.com to discuss your application.

Power Supply

The acceptable voltage range for powering the MQ200 is 9 to 15 VDC, which covers the range of voltages from a fully discharged 12V car battery to a fully charged battery with a charging voltage applied. Customers that require supply voltages outside of 9 to 15 VDC may contact MaxQData for guidance.

It is possible to run the MQ200 off of 8 AA alkaline batteries for as much as 8-10 hours, depending on the number of attached sensors and battery type. Lithium AA batteries give the longest life. Rechargeable NiMH batteries are also acceptable.

An internal relay helps to prevent damage to the electronics if the power supply polarity is reversed. Under no circumstances should you connect a voltage supply to the Vbat, +5V, or GND terminals, as permanent damage to the MQ200 and attached sensors may result.

The 12 V power input is internally fused with self-resetting fuses. If you suspect a short and the MQ200 is not responding, remove power and wait several minutes before reapplying power. A full MQ200 system including Bluetooth and GPS draws 200-300 mA at 12 V. Note that this can eventually drain a car battery if left connected. You may wish to connect the MQ200 to switched power if the vehicle is not driven on a daily basis.

The +5V output from the MQ200 is a regulated output, used for powering most sensors. Do not short it to BAT+ or Vbat as permanent damage may result. Temporary shorts to GND are generally OK. Excessive current draw can cause thermal shutdown of the regulator. Total available output current is about 500mA. The CPU inside the MQ200 is powered by a separate voltage regulator and the CPU will still be operational if the +5V output is shorted.

MQ200 systems equipped with the optional external OBD-II module are normally powered via the OBD-II cable. Do not connect power to the BAT+ and BAT- terminals. Most cars have "unswitched" +12V coming out of the OBD-II port, so if the MQ200 is left plugged in, the battery will eventually drain. Unplug the MQ200 by simply unplugging the OBD-II cable. **However, please note that the car should not be turned "on" if the MQ200 is unplugged *and* the MQ200 analog or pulse inputs are connected to any OEM sensors.** The OBD-II system might detect a sensor fault due to the presence of leakage currents through the unpowered MQ200 circuitry. If this happens, it could set a trouble code. When the MQ200 is powered, the sensor inputs are an essentially invisible connection (like a volt-ohm meter) and this problem is avoided. So we recommend either a) leaving the MQ200 plugged in continuously (as long as the car is driven on a more-or-less daily basis), or b) connecting the MQ200 to switched power.

If you wish to connect the MQ200 to switched power, you can do the following:

1. Unscrew the top cover of the MQ200 and remove it.
2. Locate the internal 12-position DIP switch block
3. Flip switch 12 to the "open" position.
4. Replace the top cover.
5. Connect BAT+ to the switched +12V source. Leave BAT- unconnected.

10.3.

Anexo 3 – Arquivo *Matlab* da Simulação Desenvolvida

```
%% Método de Stretching (Parte 1)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%
% Este programa lê os dados de aceleração lateral, velocidade
% longitudinal e tempo do excel (aquisitados pelo sistema de
% aquisição MaxQData MQ200-PRO), depois faz um tratamento desses
% sinais de acordo com as características de cada sinal. Faz-se
% então uma correção de ângulo tangente e depois uma outra
% correção de ponto final e inicial do percurso fechado.
%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%
% Funções utilizadas: entrada.m
% Simulink: sim_volta_1
%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%
% Filtro filt2
% Utilização do filtro criado na toolbox e salvo no
% filtro_filt2.mat
% Esse filtro foi salvo em função de transferência, dada por:
%
% Transfer function:
% 0.004543 + 0.009087 z^-1 + 0.004543 z^-2
% ----------------------------------------
%        1 - 1.8 z^-1 + 0.8187 z^-2
%
% Sampling time: 1
% Esse filtro tem frequência de amostragem (Fs) de 20Hz, com banda
% de passagem = 0.2 x Fnyquist; onde Fnyquist=Fs/2;
% A chamada é: Y = filtfilt(b,a,X), onde FT=b/a.
% num_filt2=[0.004543 0.009087 0.004543];
% den_filt2=[1 -1.8 0.8187];
%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
%% Início do programa:
clear all;
close all;
clc;
% Leitura e tratamento dos dados gerados em excel de aceleração
% lateral, velocidade.
% longitudinal e tempo, pelo sistema de aquisição de dados.

[Dados]=xlsread('volta_50kmh.xls');
n=length (Dados);
for i=1:1:n-2
        Temp(i)=Dados(i);
%         Track(i)=Dados(i+n);
%         Longitude(i)=Dados(i+2*n);
%         UTC(i)=Dados(i+3*n);
%         Vmph(i)=Dados(i+4*n);
        Vkmh(i)=Dados(i+5*n);
%         Satcont(i)=Dados(i+6*n);
%         LatGgps(i)=Dados(i+7*n);
%         Latitude(i)=Dados(i+8*n);
%         Distft(i)=Dados(i+9*n);
%         Distmiles(i)=Dados(i+10*n);
%         Distkm(i)=Dados(i+11*n);
%         Distperc(i)=Dados(i+12*n);
%         LongGgps(i)=Dados(i+13*n);
%         trigger(i)=Dados(i+14*n);
%         HDOP(i)=Dados(i+15*n);
%         LongG(i)=Dados(i+16*n);
        LatG(i)=Dados(i+17*n);
end;

% converte unidades:
Vkmh=Vkmh/3.6;  %passando de Km/h para m/s
LatG=LatG*9.81; %passando de G para m/s^2

% filtra e interpola os dados:
[LatG_F,t_a]=filtra_interpola_acel(LatG,Temp);
[Vkmh_F,t_v]=filtra_interpola_vel(Vkmh,Temp);
ti=t_a;
```

```
% envia o tempo da trajetória para o simulink:
Temp=evalin('base','Temp');

%% Início da Simulação

% Parâmetros da simulação.
nt=length(Temp);
tf=Temp(nt);
dt_sim=0.5;

% execução da primeira rodada, usando apenas os dados recebidos:
p1=0;
p2=0;
p3=0;

% envia os dados para o simulink:
p1=evalin('base','p1');
p2=evalin('base','p2');
p3=evalin('base','p3');

sim('sim_volta_1');

figure(1)
plot(-xt,yt),title('Trajetória da Pista Sem Correção'),xlabel('
Posição X (m)'),ylabel('Posição Y (m)');
axis([-5000 1500 -5000 1500]);

% execução da segunda rodada, com correção do angulo tangente:
nfi=length(fi);
T=length(xt);
Efi=fi(nfi)-(2*pi);
Es=s(T);

p1=Efi/Es;
p2=0;
p3=0;
```

```
% envia os dados para o simulink:
p1=evalin('base','p1');
p2=evalin('base','p2');
p3=evalin('base','p3');

sim('sim_volta_1');

figure(2)
plot(-xt,yt),title('Trajetória da Pista Com Correção do ângulo
tangente'),xlabel(' Posição X (m)'),ylabel('Posição Y (m)');
axis([-2500 3200 -3000 500]);

% execução da terceira rodada, com a correção dos erros de x e y:
T=length(xt);
Ex=xt(T);
Ey=yt(T);
Es=s(T);

p1=p1; % é necessário manter a correção feita anteriormente.
p2=Ex/Es;
p3=Ey/Es;

% envia os dados para o simulink:
p1=evalin('base','p1');
p2=evalin('base','p2');
p3=evalin('base','p3');

sim('sim_volta_1');

figure(3)
plot(-xt,yt,'g'),title('Trajetória da Pista Com X e Y
Corrigidos'), xlabel(' Posição X (m)'),ylabel('Posição Y (m)');
axis([-1900 1000 -1900 1000]);
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```