

Products Tde Macno

Quick start
OPDE - MiniOPDE quick start manual



Cod. MP00002E00 V_1.4 (ex. MAOPDE0030E0)



TDE MACNO
Excellence in the Control

SUMMARY

1	INTRODUCTION	2
2	COMMISSIONING STEPS	2
2.1	CORE AND APPLICATION UPDATING.....	2
2.2	DEFAULT PARAMETERS.....	4
2.3	MOTOR PARAMETERS.....	5
2.4	SENSOR PARAMETERS.....	5
2.5	CONNECTION TESTING AND CALIBRATION OF THE FEEDBACKS - C41	5
2.6	AUTOTUNING - C42.....	7
2.7	CALIBRATION OF THE FEEDBACKS - U04	8
2.7.1	RESOLVER.....	9
2.7.2	SIN COS INCREMENTAL ENCODER	12
2.8	CALIBRATION OF THE SPEED CONTROL.....	14
2.8.1	AUTOMATIC CALIBRATION	14
2.8.2	MANUAL CALIBRATION	15
3	CORE AND APPLICATION UPDATE USING A SAVED PROJECT	20
3.1	CORE AND APPLICATION UPDATE.....	20
3.2	APPLICATION UPDATE.....	22

FIRMWARE VERSIONS: 12.0 / 22.0

1 INTRODUCTION

This guide assists users in the commissioning of OPDE drive. This document must be used only by TDE Macno personnel, or by authorized users.

This guide explains how to do the first commissioning of a drive, this means that in the drive, parameters have not yet been set for the application. In the case that you have a drive already working in an application and you want to upgrade it saving the actual parameters values, refer to Annex A.

Follow the instructions in this guide carefully to avoid damage, failure or malfunction.



2 COMMISSIONING STEPS

The commissioning procedure of an OPDE drive can be summarized as follows:

- o Core and Application Updating;
- o Default parameters loading;
- o Motor parameters loading;
- o Sensor parameters loading;
- o Connection testing;
- o Autotuning;
- o Feedback calibrations;
- o Speed control calibration.

For not depend from application sw that is loaded in the drive, it is recommended to use, during the commissioning, the Quick Start Application commands and utilities (UTL), which have the characteristic to not be saved in the drive.

To enable the Quick Start Application mode set the parameter EN_START_UP_APPL (U05) to Yes, this will disable the application loaded in the drive and enable a particular working mode of sw that accepts only the few basic commands needed to perform a commissioning.

In the Quick Start Application mode, to handle the run command, the enable of reference, the speed jog and other basic commands, you should use, instead of the normal parameters, the dedicated parameters listed here:

U06 = START_UP_SPD_SEL
P00 = PRC_START_UP_SPD_REF
U07 = START_UP_RUN_SEL
U08 = START_UP_EN_REF
U09 = START_UP_EN_LIN_RAMP.

2.1 CORE AND APPLICATION UPDATING

After creating a new project with OPDEplorer, make sure that the correct core and application versions are present in the drive. To do so, follow the procedure below.

- o Connect OPDEplorer using function **Scan**.

In order to do this, press the button .

If necessary, also set correctly the scan parameters by pressing the button . After the scan you will see the drive that has been identified. To connect to it you must first press the  button, OPDEplorer in this way will automatically open a project with the core version and the version of the application consistent with those currently on the

drive, then press the  button.

If the core version and the application versions does not correspond with the latest versions, upgrade them (unless there are special situations in which the update may lead to problems for the application).

To configure the serial communication, press the **Configure button**

Make sure that OPDExplorer is updated before starting to update the core and the application.



- Disconnect OPDExplorer from the drive with the  button.
- Open a new project by selecting **File > New**. Create a new project selecting the application (standard or not-standard) of interest. This will automatically create a project with the updated version of the core and the application selected.
- Press the **Unlock Reserved Parameters**  button and type 95 in the window that appears.
- Press the **Firmware Download**  button. The OPDDownloader/Uploader window will appear. Press the **File select...**  button and select the directory where the latest core are located (.ldr files). Usually, the path to be followed to reach that directory is

C:\Programs\TDE MACNO\Catalog\OpenDrive\firmware

If the “Core” that is installed in the drive is an older revision than the revisions that have been found in the firmware directory, proceed with the updating, that is, select the latest revision and press **Open**. Make sure that “Com port”, “Baud” and “Slave” are set correctly and finally press **Download** . The core download procedure may take some minutes.

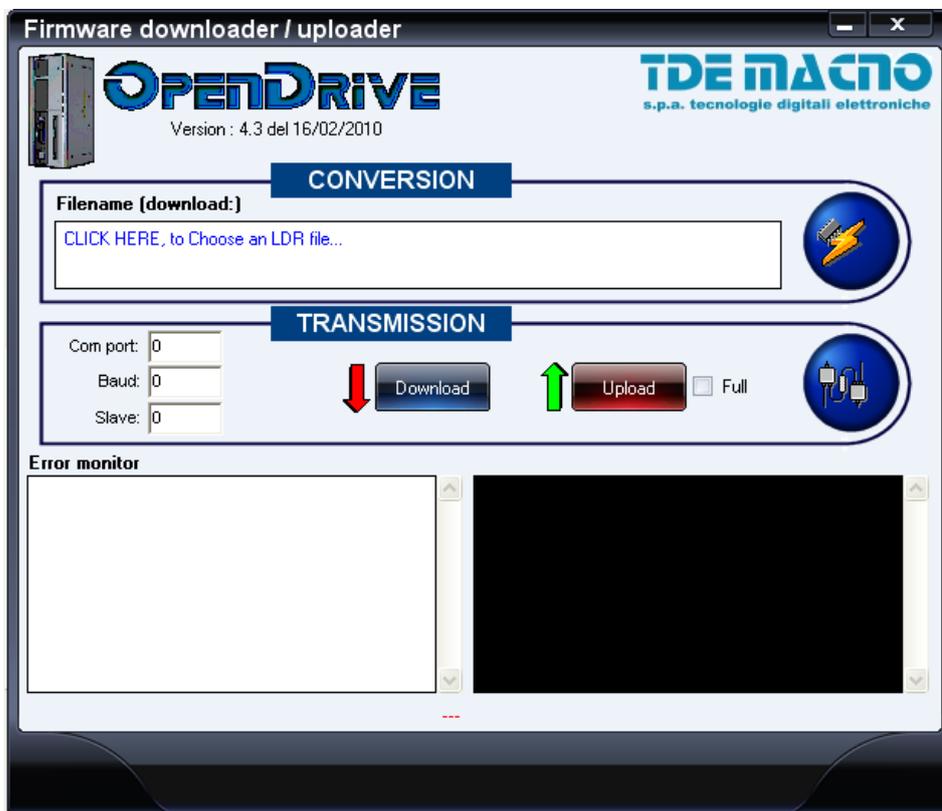


Figure 1 – OPDDownloader/Uploader

- Once the application has been selected, the **PLC Download**  button will appear. Pressing this button will start the download of the application.

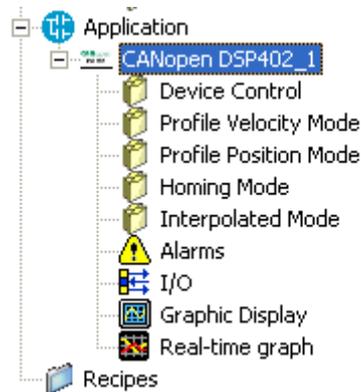


Figure 2 – Application Selection

For the standard application, the “Application” icon will not appear. To download the application, just press **PLC Download**



- Turn the drive off and then on again.

2.2 DEFAULT PARAMETERS

To load the default parameters, open the RES_PAR_KEY (P60) key. To do so, press the **Unlock Reserved Parameters** button and type 95 in the window that appears. Make sure that the TDE_PAR_KEY (P99) parameter is set to 0, by following the path in the **Tree** window

All Parameters > Generic Parameters > Keys

Set the DEF_PAR_RD (C61) parameter to **Yes** and press  **Write Parameters**. DEF_PAR_RD is located in this directory:

All Parameters > Generic Parameters > Data Storing

Save the data just loaded into RAM to EEPROM by pressing **Save Parameters to EEPROM**  and turn the drive off and on again.

Is key P99 is open (P99=82) while default data are being loaded, the size of the drive (P113) and factory settings (for example P105) will be lost.



2.3 MOTOR PARAMETERS

Essential motor parameters (nameplate data) are contained in the following directory

All Parameters > Brushless Parameters > Drive and Motor Coupling > Motor Plate

Please refer to OPDE Manual to set the correct parameters in the **Motor Plate** directory.

Save the data just loaded into RAM to EEPROM by pressing **Save Parameters to EEPROM** .

Note: Motors with a frequency of 50 Hz should have 4 poles, unless otherwise specified in the nameplate data.

2.4 SENSOR PARAMETERS

Essential sensor parameters are contained in the following directory

All Parameters > Brushless Parameters > Drive and Motor Coupling > Motor Sensor

Please refer to OPDE Manual to set the correct parameters in the **Motor Sensor** directory.

Save the data just loaded into RAM to EEPROM by pressing **Save Parameters to EEPROM** .

2.5 CONNECTION TESTING AND CALIBRATION OF THE FEEDBACKS - C41

Using the connection EN_TEST_CONN (C41) it's possible to automatically execute the test connections and also the calibration of the sensor by setting **C41 = 1-Yes**. To run only the test connections, without adjustment of the sensor, set **C41 = 2-Yes, sensor without tuning**. The sensor calibration can be performed manually in any case, for further details please refer to paragraph 2.7.

Before performing the test connections PRC_I_TEST_CONN set the parameter (P114) to the desired value (normally we set P114 = P61).

To execute the connection test, set the EN_TEST_CONN (C41) parameter to **Yes** and start up the drive. To view the status of the test you can use the **Display** of OPDE Explorer and press the **Show Drive Display**  button, or else you can use the keypad of the drive.

The test will be initiated if no alarm is present on the drive



The drive will initiate the test procedure if all enables are present, namely: hardware enable (I00 set to 1), software enable (C21=1) and enable from fieldbus (always enabled if no fieldbus is present).

The EN_TEST_CONN parameter can be found in the following directory

All Parameters > Brushless Parameters > Drive and Motor Coupling > Autotuning Control



Figure 3 – Display: The connection test is enabled



Some applications inhibit the “enable from fieldbus” function, as it is reserved for the application itself (the drive will not run!!!). In this case, follow the procedure described below.

If the application inhibits the running of the drive, follow this procedure (after setting C41=0/No):

- set the SW_RUN_CMD (C21) connection to **No**. The SW_RUN_CMD connection is located in this directory:

All Parameters > Generic Parameters > Digital Commands and Control

- set the EN_START_UP_APPL (U05) connection to Yes (open the key). The EN_START_UP_APPL connection is located in the following directory:

All Parameters > Brushless Parameters > Drive and Motor Coupling > Quick Start-up

- set the EN_TEST_CONN (C41) connection to **Yes**.
- set the SW_RUN_CMD (C21) connection to **Yes**.



If all enables are set correctly, the motor will start running the connection test.



Figure 4 – Display: The connection test is being executed

If **C.End** appears in the **Display** window, it means that the test was successful.



Figure 5 – Display: End of connection test while drive is running

- set the SW_RUN_CMD (C21) connection to **No**.
- set the EN_START_UP_APPL (U05) connection to **No** (open the key).



The application works only if the EN_START_UP_APPL connection is set back to **No**.

Save the test data to EEPROM by pressing Save Parameters to EEPROM .

2.6 AUTOTUNING - C42

The test-tuning differs depending on whether you are working with a brushless motor or an induction motor.

In the case of the brushless motor, the autotuning expects to perform only the test corresponding to C42=1. So it will be necessary to set the parameter EN_AUTOTUNING (C42) on **1-Test Standard**.

In the case of the induction motor, the autotuning expects to perform two types of tests: C42=1, C42=2. It will then run the first test by setting the parameter EN_AUTOTUNING (C42) on **1-Test 1 and 2** and the second test by setting the parameter EN_AUTOTUNING (C42) on **2-Test 3 and 4**.

You can also perform both tests in sequence by setting the parameter EN_AUTOTUNING (C42) on **3-All**.

Once having set on C42 the test to run, to execute the test it's necessary to command the drive run. To view the status of the test you can use the **Display of OPDExplorer** and press the **Show Drive Display**  button, or else you can use the keypad of the drive.

The test will be initiated if no alarm is present on the drive



The drive will initiate the test procedure if all enables are present, namely: hardware enable (I00 set to 1), software enable (C21=1) and enable from fieldbus (always enabled if no fieldbus is present).

The EN_AUTOTUNING parameter is located in the following directory:

All Parameters > Brushless Parameters > Drive and Motor Coupling > Autotuning Control



Figure 6 – Display:

Autotuning is enabled

Some applications inhibit the “enable from fieldbus” function, as it is reserved for the application itself (the drive will not run!!!). In this case, follow the procedure described below.



If the application inhibits the running of the drive, follow this procedure (after setting C42=0):

- set the SW_RUN_CMD (C21) connection to **No**. The SW_RUN_CMD connection is located in this directory:

All Parameters > Generic Parameters > Digital Commands and Control

- set the EN_START_UP_APPL (U05) connection to **Yes** (open the key). The EN_START_UP_APPL connection is located in the following directory:

All Parameters > Brushless Parameters > Drive and Motor Coupling > Quick Start-up

- set the EN_AUTOTUNING (C42) connection to **Standardless** for brushless motors, or to **All** for asynchronous motors and start up the drive.
- set the SW_RUN_CMD (C21) connection to **Yes**.



If all enables are set correctly, the motor will start the autotuning test.



Figure 7 – Display: Autotuning is being executed

If **A.End** appears in the **Display** window it means that the test was successful.



Figure 8 – Display: End of Autotuning while drive is running

- set the SW_RUN_CMD (C21) connection to **No**.
- set the EN_START_UP_APPL (U05) connection to **No** (open the key).



The application works only if the EN_START_UP_APPL connection is set back to **No**.

Save the test data to EEPROM by pressing **Save Parameters to EEPROM** .

Optional: The parameters that are obtained by running Autotuning starting from the default values might not always be optimal. For this reason, we recommend that you repeat Autotuning, starting from the values obtained in the previous estimate.

Thus, execute Autotuning a first time with the DIS_DEF_START_AUTO (C95) connection set to **No**, and then a second time with the DIS_DEF_START_AUTO (C95) connection set to **Yes**.

2.7 CALIBRATION OF THE FEEDBACKS - U04

In the following tests to run the drive all the enable signals must be present, namely: hardware enable (I00 set to 1), software enable (C21=1) and enable from fieldbus (always enabled if no fieldbus is present).

It is supposed to keep set the hardware run command I00 and to act on the software run command SW_RUN_CMD (C21) to run or stop the drive.



If the user has previously done the C41 test selecting **C41 = 1-Yes**, the calibration of the feedback has already been done automatically, so it's not necessary to read information written in this paragraph 2.7.

If the user has selected **C41 = 2-Yes, without sensor tuning**, he needs to execute the test apart, so it's necessary to read following informations.

Analog feedback signals may have non-Null offsets or differing amplitudes. These features make the reading of the speed less accurate and can thus reduce the performance of the drive (motor + drive). The drive can compensate for a lack of accuracy through a calibration of the sensors. The calibrations will be performed by using the Quick Start-up functions, in order for the procedure to be independent from the application in use.

2.7.1 RESOLVER

The resolver feedback calibration procedure is as follows:

- set the **sen_theta (o47)** and **cos_theta (o48)** tracks on the Real-Time Graph; for the trigger settings, please see the figure below.

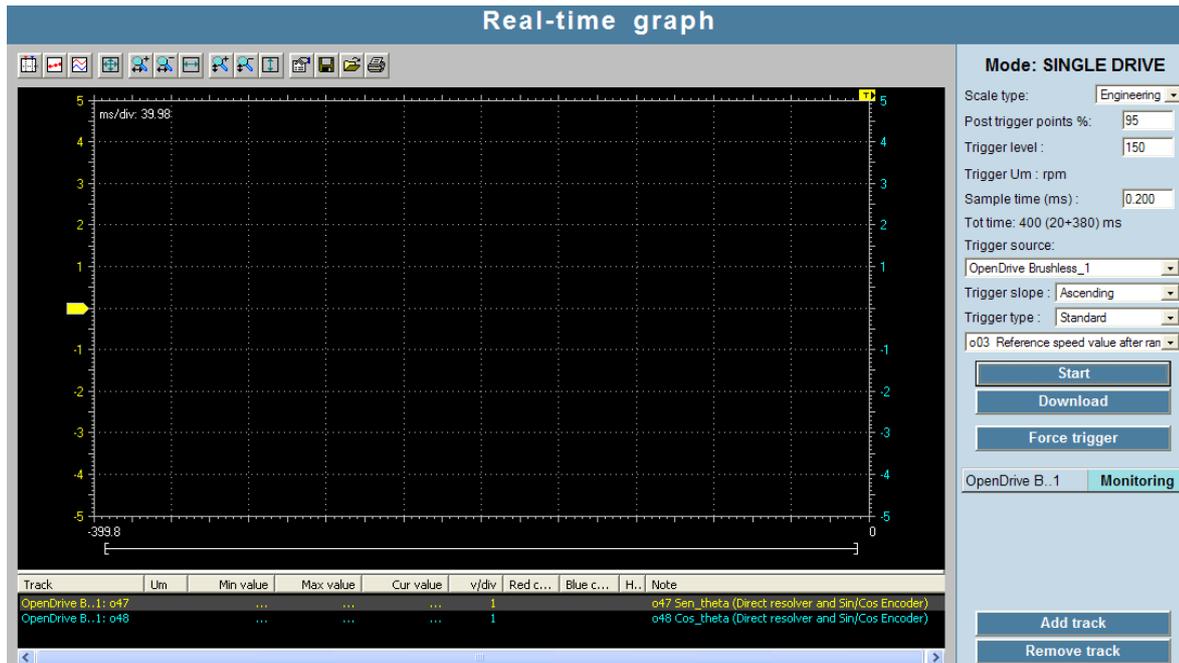


Figure 9 – Real-Time Graph configurations for the calibration of the resolver

- set the SW_RUN_CMD (C21) connection to **No**. The SW_RUN_CMD connection is located in this directory:

All Parameters > Generic Parameters > Digital Commands and Control

- set the EN_START_UP_APPL (U05) connection to **Yes** (open the key). The EN_START_UP_APPL connection is located in the following directory:

All Parameters > Brushless Parameters > Drive and Motor Coupling > Quick Start-up

- set the START_UP_SPD_SEL (U06) connection to **4 – Jog P00**.
- set the START_UP_EN_REF (U08) connection to **Yes**.
- set the START_UP_RUN_SEL (U07) on **4 – I4**.
- set the PRC_START_UP_EN_REF (P00) parameter to 5 % of maximum speed.
- set the SW_RUN_CMD (C21) connection to **Yes**.

If all enables are set correctly, the motor will start rotating at 150 rpm.



With the motor running, go to Graph, press Start

Start

and then press **Force trigger** to start acquisition

Force trigger

and wait until the words End Acq appear next to Status

Status: End Acq

press **Download** to view the acquired signals

Download

The values of Min value and Max value that can be observed in the figure below are not similar to each other. This means that the resolver being tested has an offset other than zero. From the image below, we can also see the amplitudes of the signals are almost identical.

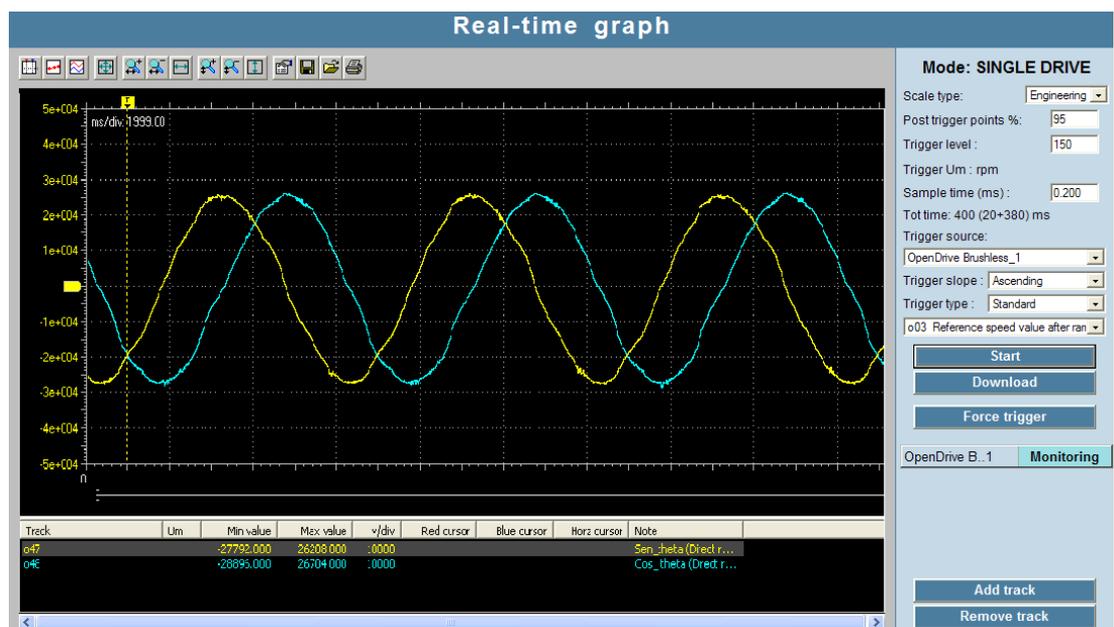


Figure 10 – Uncalibrated resolver signals

To compensate the offset, follow these steps:

- set the SW_RUN_CMD (C21) connection to **No (the motor will stop)**.
- set the EN_SENSOR_TUNE (U04) connection to **1 – Resolver Sin+Cos**. The EN_SENSOR_TUNE connection is located in the following directory:

All Parameters > Brushless Parameters > Drive and Motor Coupling > Motor Sensor

- set the SW_RUN_CMD (C21) connection to **Yes**.

If all enables are set correctly, in the case of MOT_SPD_MAX (P65) = 3000, the motor will start rotating at 150 rpm.



- leave the motor running for 5 seconds. Then set the SW_RUN_CMD (C21) connection to **No (the motor will stop)**.
- make sure that the EN_SENSOR_TUNE (U04) connection is back to **0 - Not enabled**.
- set the SW_RUN_CMD (C21) connection back to **Yes** and make sure that the waveforms displayed on the Real-Time Graph are compensated. The calibrations of the resolver signals can be seen in parameters **P164 - Resolver or Incremental Sin/Cos sine and cosine signal amplitude compensation**, **P165 - Resolver or Incremental Sin/Cos sine offset** and **P166 - Resolver or Incremental Sin/Cos cosine offset**.

If all enables are set correctly, , in the case of MOT_SPD_MAX (P65) = 3000, the motor will start rotating at 150 rpm.



Save the test data to EEPROM by pressing **Save Parameters to EEPROM** .

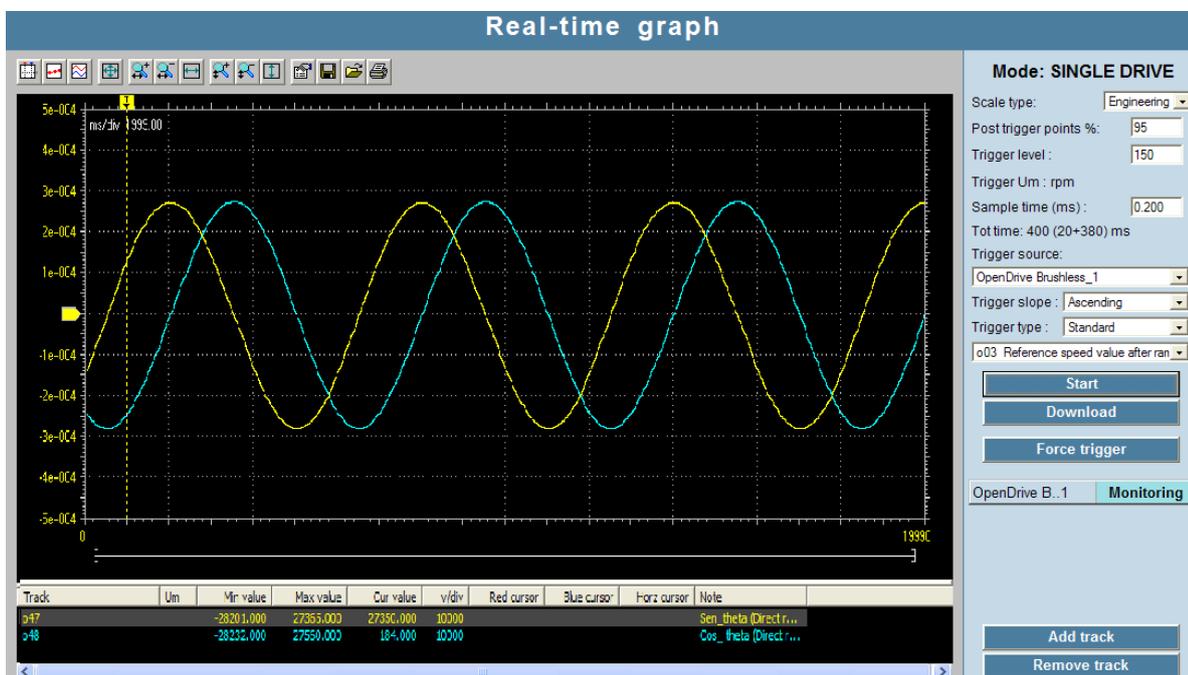


Figure 11 – Calibrated resolver signals

2.7.2 SIN COS INCREMENTAL ENCODER

The procedure for the calibration of the incremental tracks of the sincos incremental encoder is as follows:

- set the **Incremental SIN theta Sin/Cos Encoder (o53)** and **Incremental COS (o54)** tracks on the Real-Time Graph; for the trigger settings, please see the figure below.

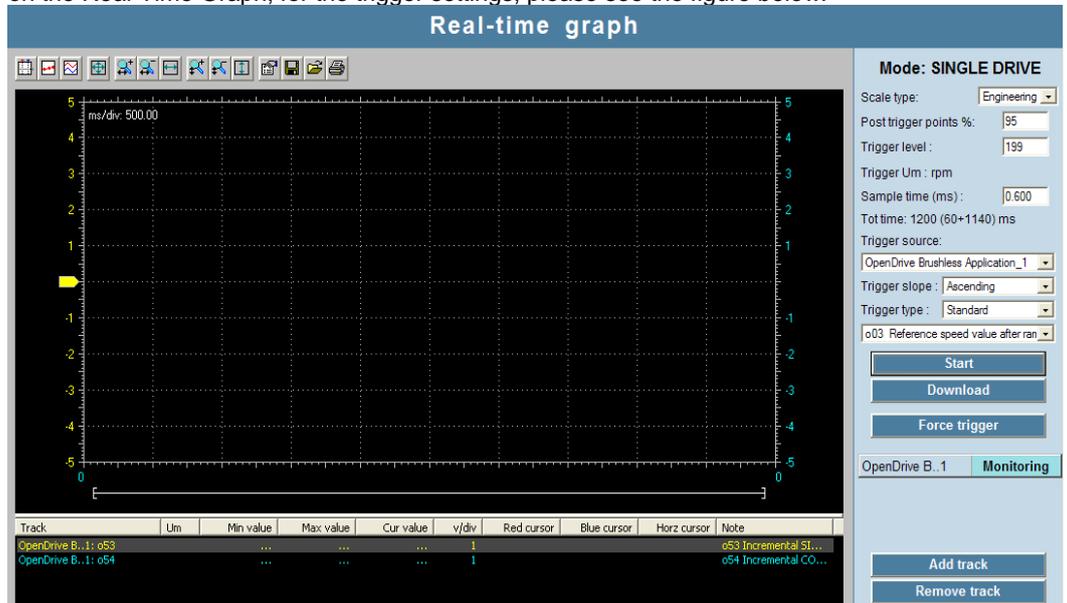


Figure 12 – Real-Time Graph configurations for calibration of the SinCos Incremental Encoder

- set the SW_RUN_CMD (C21) connection to **No**. The SW_RUN_CMD connection is located in this directory:

All Parameters > Generic Parameters > Digital Commands and Control

- set the EN_START_UP_APPL (U05) connection to **Yes** (open the key). The EN_START_UP_APPL connection is located in the following directory:

All Parameters > Brushless Parameters > Drive and Motor Coupling > Quick Start-up

- set the START_UP_SPD_SEL (U06) connection to **4 – Jog P00**.
- set the START_UP_EN_REF (U08) connection to **Yes**.
- set the START_UP_RUN_SEL (U07) on **4 – I4**
- set the PRC_START_UP_EN_REF (P00) parameter to

$$P00 = 100 * (10rpm / P65)$$

The motor is set to rotate at 10 rpm.

- set the SW_RUN_CMD (C21) connection to **Yes**.

If all enables are set correctly, in the case of MOT_SPD_MAX (P65) = 3000, the motor will start rotating at 10 rpm.



With the motor running, go to Graph, press Start

Start

and then press **Force trigger** to start acquisition

Force trigger

and wait until the words End Acq appear next to Status

Status: **End Acq**

press **Download** to view the acquired signals

Download

If the values of Min value and Max value of the sin/cos signals are not similar to each other, it means that the incremental tracks have an offset other than zero. To perform the compensation of the offset, follow these steps:

- set the SW_RUN_CMD (C21) connection to **No (the motor stops)**.
- set the EN_SENSOR_TUNE (U04) connection to **2 - Sin/Cos incr.** The EN_SENSOR_TUNE connection is located in the following directory:

All Parameters > Brushless Parameters > Drive and Motor Coupling > Motor Sensor

- set the SW_RUN_CMD (C21) connection to **Yes**.

If all enables are set correctly, the motor will start rotating.



- leave the motor running for about thirty seconds. Then set the SW_RUN_CMD (C21) connection to **No (the motor stops)**.
- make sure that the EN_SENSOR_TUNE (U04) connection is back to **0 - Not enabled**.
- set the SW_RUN_CMD (C21) connection back to **Yes** and make sure that the waveforms displayed on the Real-Time Graph are compensated. The calibrations of the resolver signals can be seen in parameters **P170 - Absolute Sin/Cos sine and cosine signal amplitude compensation**, **P171 - Absolute Sin/Cos sine offset** and **P172 - Absolute Sin/Cos cosine offset**.

If all enables are set correctly, the motor will start rotating at 10 rpm.



Save the test data to EEPROM by pressing **Save Parameters to EEPROM** .

2.8 CALIBRATION OF THE SPEED CONTROL

Speed control calibration is necessary if you wish to obtain the best possible performance out of the system, it can be done automatically or manually.

2.8.1 AUTOMATIC CALIBRATION

The automatic calibration of the speed control is a procedure that allows to automatically calculate the gains and time constants of the filters of the speed regulator necessary to have a speed loop characterized by a bandwidth equal to that set by the user via parameter, while maintaining a phase margin to ensure adequate stability.

This means that the speed step response will be the faster the higher the bandwidth of the system, while the overshoot of speed will always be the same.

Before performing the automatic calibration of the speed loop, is necessary to characterize the system by performing the measurement of the **starting time** which is defined as the time that the "motor + load" takes to reach the maximum speed by applying the rated torque.

First of all you need to set, on the parameter TEST_SPD_T_MAX (P130), the maximum torque that you want to deliver during the test. With the parameter TEST_SPD_MAX (P132) you can set the maximum test speed and with the parameter TEST_SPD_SPACE_MAX (P134) you can also set the maximum number of motor revolution admitted during the test. With these parameters you can set the test so that it can be performed even in situations where the motor has some movement limitations due to the application in which it is inserted.

To enable the test it's necessary to set the parameter EN_TEST_SPD (U01) on **1-Start Up**, the display will show "test Auto", then give the run command. The motor will perform a rapid acceleration followed by rapid deceleration. After the test, remove the run command and save the parameters on EEPROM.

In the parameter START_TIME (P169) will be returned the start-up time measured. The measure is the more accurate the higher the motor speed and torque applied to the motor during the test.

At this point you can proceed with the automatic calibration of the speed loop by selecting on parameter SPD_REG_SETTING (U02), one of four modes available:

- 1 – Stable;
- 2 – Dynamic;
- 3 – Max;
- 4 – Manual.

The first three modes allow you to choose a response of the speed loop having a gradually increasing bandwidth, the manual mode allows you to choose a bandwidth specified manually by the user through the parameter SPD_LOOP_BW (P20).

The bands that are obtained in this different cases are as follows:

U02 = 1–Stable	→	$BW_{vel}=2,5 \text{ Hz}$	P31<50
U02 = 2–Dynamic	→	$BW_{vel}=20 \text{ Hz}$	P31<50
U02 = 3–Max	→	$BW_{vel}=BW @ P31=50$	$BW_{vel} < BW_{corr}/4$
U02 = 4–Manual	→	$BW_{vel}=P20$	P31<100

where BW_{vel} =speed-loop bandwidth
 BW_{corr} =current-loop bandwidth

Once written the U02 parameter, it will be automatically calculated parameters P31, P32, P33, P34, and will appear on parameter SPD_LOOP_BW (P20) the bandwidth obtained. After being set, U02 will automatically reset at 0 value. To see the new values of P31, P32, P33, P34 refresh the page.

If you want to manually set the bandwidth, you have first to write the desired bandwidth in parameter SPD_LOOPBW (P20) and then set parameter SPD_REG_SETTING(U02) on **4-Manual**.

To verify the calibration of the speed, is a good idea to make a step response by controlling the response by Real-Time Graph. Before performing the test, you must set the parameters

TEST_SPD_MAX (P132) and TEST_SPD_SPACE_MAX (P134) that let you select the maximum speed and maximum revolutions to be performed during the step response. At this point, set the Real-time Graph to show the trace **Reference speed value after ramp (o03)** and **Rotation speed (o04)** and ser the trigger on **I00- Run command**.

Then, to enable the test is sufficient to set EN_TEST_SPD (U01) on **2-Step**. The display will show "test Auto" at this point you can give the run command, wait for the execution of the step response, and then remove the run command (if you have used the TEST_SPD_SPACE_MAX (P134) parameter, the motor will stop automatically to the achievement of set value). The reference speed is limited by the parameters written in TEST_SPD_T_MAX (P130) and TEST_SPD_MAX (P132). For example, if TEST_SPD_T_MAX (P130) = 100.0% (no limitation), TEST_SPD_MAX (P132) = 50.00% and TEST_SPD_SPACE_MAX (P134) = 20.00, the speed reference will be 1500 rpm for 20 revolution (if MOT_SPD_MAX (P65) = 3000 rpm).

Then check the speed loop response on Real-Time Graph. Pay attention to the fact that the U01 parametr does not automatically return to **0-Not Enabled** at the end of the step response, this should be done by the user.

2.8.2 MANUAL CALIBRATION

In order to calibrate the speed control gains, you will need to use the STEP function. To enable the STEP function, set the U01 EN_TEST_SPD connection to **2 – Step** (with the drive on STOP). The EN_TEST_SPD parameter is located in this directory:

All Parameters > Brushless Parameters > Drive and Motor Coupling > Autotuning Control

Before starting the calibration procedure, set the speed gains as follows:

- o P31 - KpV final speed regulator proportional gain = 6.0 (default)
- o P32 - TiV final speed regulator lead time constant = 3000.0 (reduces/excludes the integral part)
- o P33 - TfV final speed regulator (filter) time constant = 0.0

The speed regulator gains are located in the following directory:

All Parameters > Brushless Parameters > Motor Control > Speed Control

Set the **Reference speed value after ramps (o03)** and **Rotation speed (o04)** tracks on the Real-Time Graph; for the trigger settings, please see the figure below.

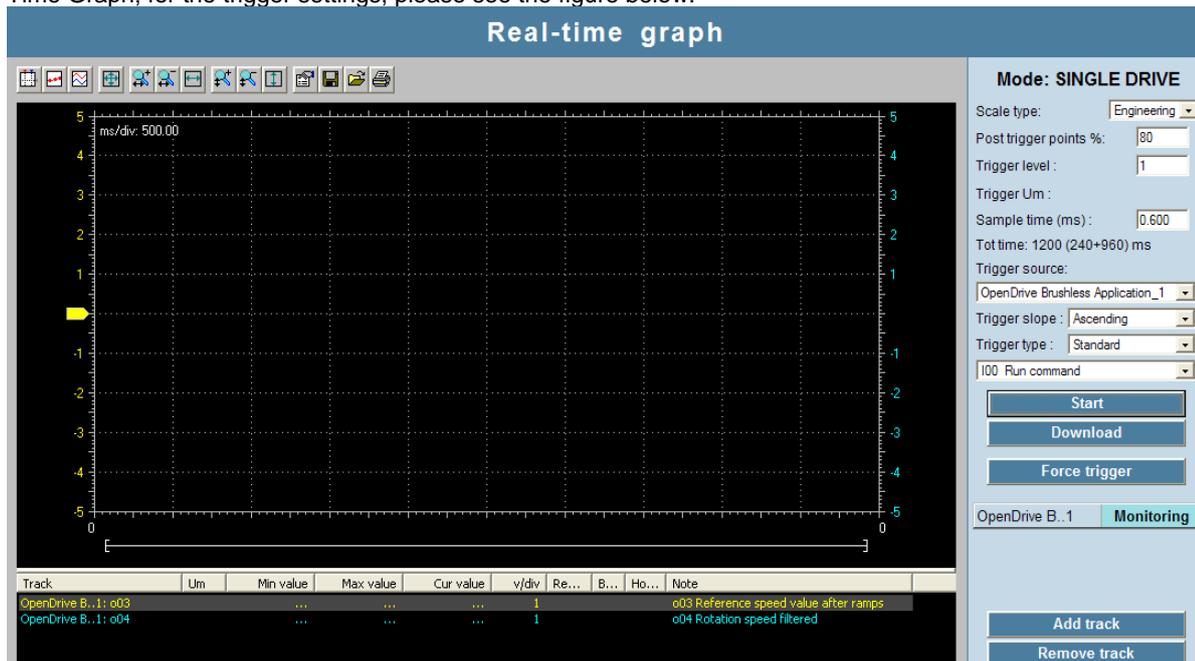


Figura 13 - Real-Time Graph configurations for step response trace

Press START on the Tab Graph of the Real-Time Graph to make OPDExplorer ready for a new acquisition.



- set the SW_RUN_CMD (C21) connection to **No**. The SW_RUN_CMD connection is located in this directory:

All Parameters > Generic Parameters > Digital Commands and Control

- set the EN_START_UP_APPL (U05) connection to Yes (open the key). The EN_START_UP_APPL connection is located in the following directory

All Parameters > Brushless Parameters > Drive and Motor Coupling > Quick Start-up

- set the SW_RUN_CMD (C21) connection to **Yes** and, after 3 seconds, to **No**.

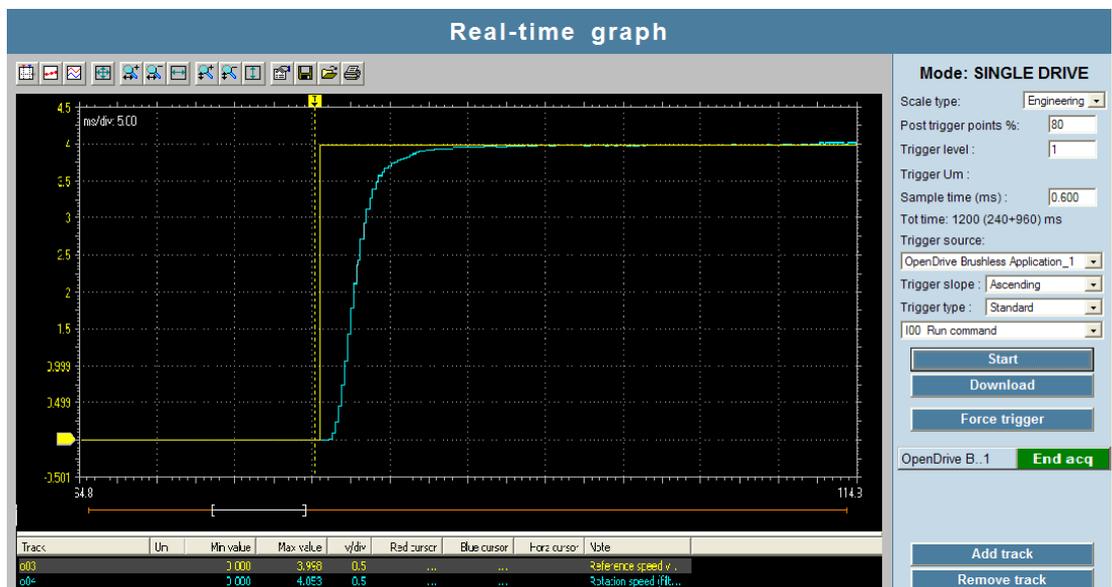


Figure 14 – Speed step response with initial parameters

From the above figure you can see that:

- the real speed has no overshoot;
- when the system running at normal speed, the real speed does not reach the defined speed target.

Increase the proportional gain of “P31 - KpV final speed regulator proportional gain” in order to increase the response speed. To relaunch the test, simply

- press START on the Tab Graph of the Real-Time Graph to make OPDExplorer ready for a new acquisition
- set the SW_RUN_CMD (C21) connection to **Yes** and, after 3 seconds, to **No**.

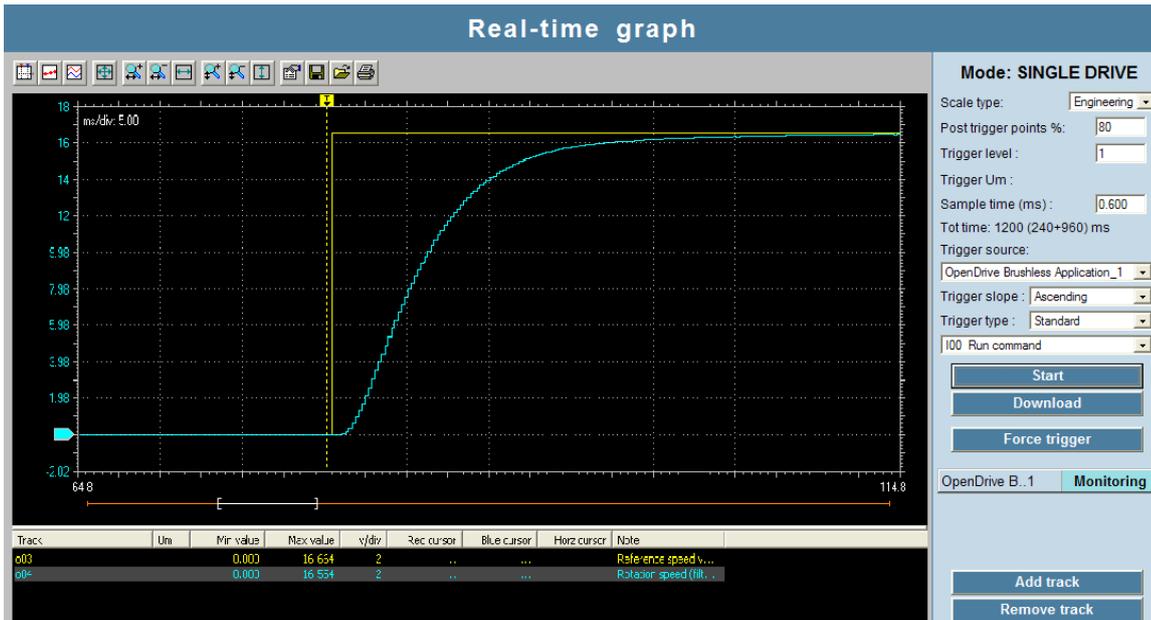


Figure 15 – Speed step response with calibrated speed gain

From the above figure you can see that:

- the real speed has no overshoot;
- when the system is running at normal speed, the real speed gets very close to the defined speed target;
- the time needed to reach the speed target has reduced considerably.

An excessively high proportional gain will lead to oscillations and overshoot in the speed response.

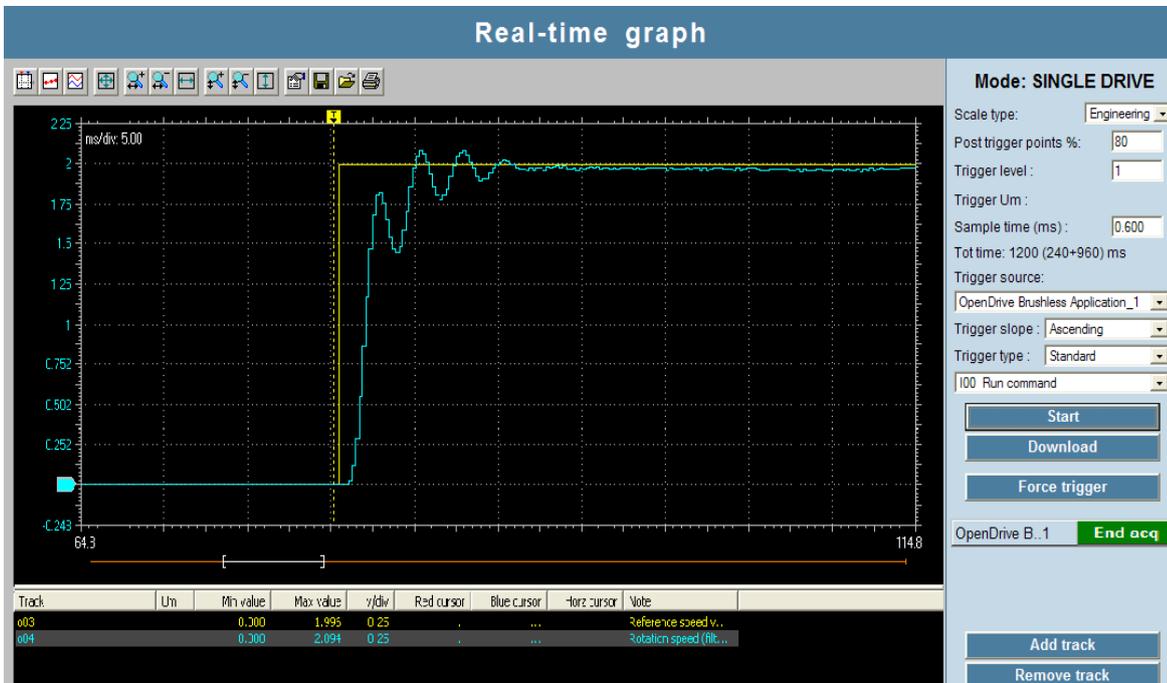


Figure 16 – Speed step response with excessively high speed gain

In order to reduce oscillations at high frequency, it is more convenient to increase the value of the filter time constant, i.e. “P33 - TfV final speed regulator (filter) time constant”. In some cases, in order to reduce oscillations at high frequency it is advisable to reduce the proportional gain and increase the filter time constant.

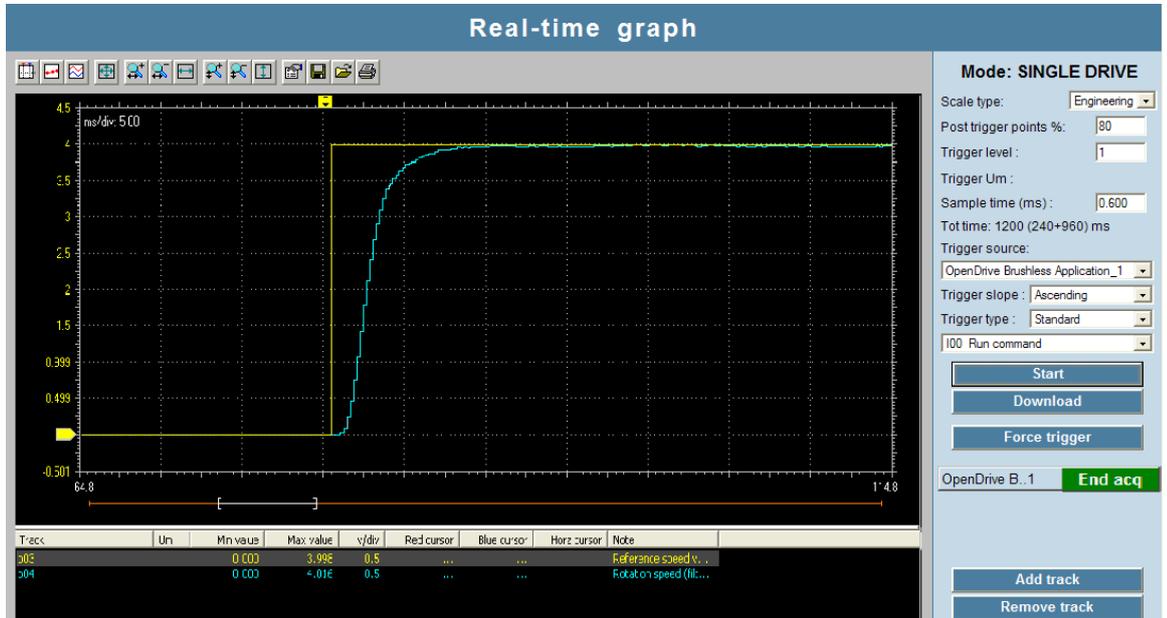


Figura 17 - Speed step response with filter time constant calibration

The time constant can be increased until the response has an overshoot.

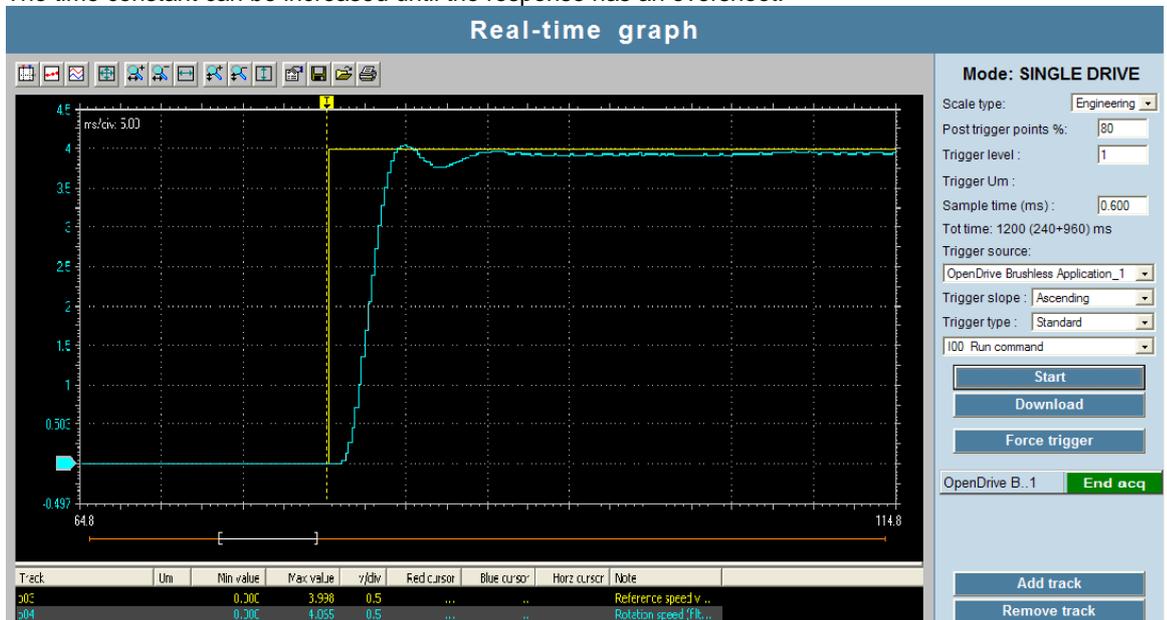


Figura 18 – Step response with excessively high filter time constant

In order to get a null response at normal speed, (that is, the real speed is the same as the required speed), you will need to calibrate the “P32 - TiV final speed regulator lead time constant”. Subsequently, reduce the lead time constant until the response at normal speed becomes null. Excessive reduction of the lead time constant will lead to overshoot and oscillations in the speed.

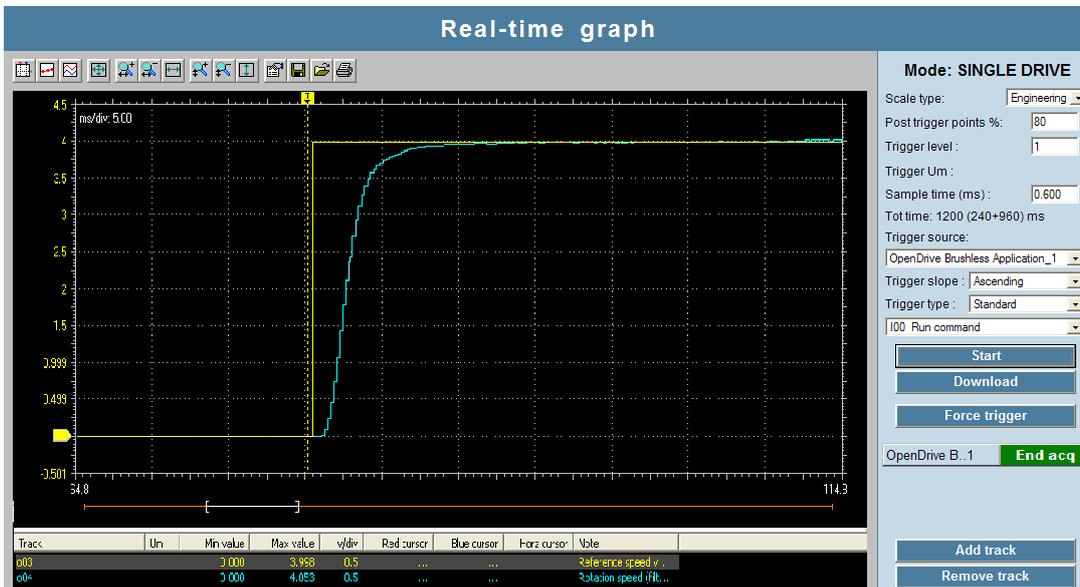


Figura 19– Speed step response with speed control calibration

3 CORE AND APPLICATION UPDATE USING A SAVED PROJECT

If it's necessary to update one or more drives and the drives are already installed and working in the final application, in the plant, probably would welcome the opportunity to maintain the actual parameters setting also after the updating.

In this case we can have two situations:

- Case 1 – Drive/s with an old core version and an old application version, so we need to update both core and application (see A.1);
- Case 2 – Drive/s with a core already updated, but with an old application version, so we need to update only the application (see A.2).

The correct procedure to follow in this two cases is depicted below.

3.1 CORE AND APPLICATION UPDATE

If you want to upgrade a drive that already has a working recipe in it, and want to maintain the same recipe after the upgrade, the correct procedure to follow is depicted below.

- Connect OPDExplorer using function **Scan**.

In order to do this, press the **Start Scan** button.

If necessary, also set correctly the scan parameters by pressing the **Advanced >>** button

After the scan you will see the drive that has been identified. To connect to it you must first press the **Add** button, OPDExplorer in this way will automatically open a project with the core version and the version of the application consistent with those

currently on the drive, then press the  button.

- Save the project

Read all the parameters with the **Read All**  button and then **save the project** (file *.tcn).

This will save the recipe that is currently in the drive so that you can download it later in the drive after the upgrade.

- Download the core by choosing the *.ldr file updated.

Press the **Unlock Reserved Parameters**  button and enter 95 in the window that appears.

Press the **Firmware Download**  button. OPD Downloader / Uploader window will appear. Press the **File select...**  button, and select the folder that contains the latest core (*.ldr file). Usually the path to reach this folder is:

C:\Program Files\TDE MACNO\Catalog\OpenDrive\firmware

Select the *.ldr of interest and press **Open**. Make sure that "Com Port", "baud" and "slave" are set correctly, then press **Download**  . The core download process may take a few minutes.

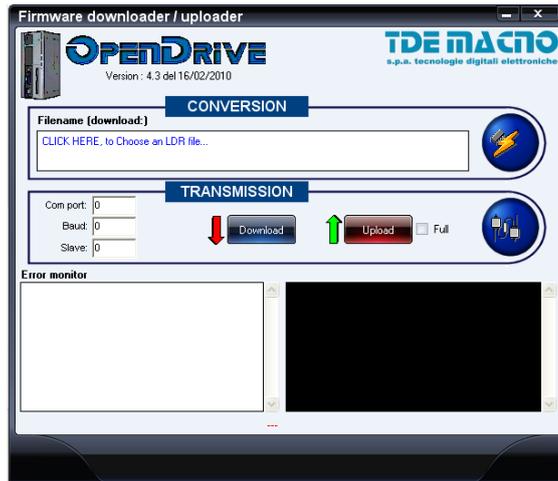


Figura 20 – OPD Downloader/Uploader

- Disconnect the OPDExplorer from the drive.
- Download the updated application.

In this case we proceed in two different ways depending on whether you want to download a standard application or a non-standard application.

STANDARD APPLICATION

Open a new project by selecting **File> New**, repeat the **Scan** and reconnect the drive. In this way the OPDExplorer will automatically open a project with the standard application using a version of core coherent with that which you've just

downloaded in the drive. Press **PLC Download**  to download the standard application.

NON-STANDARD APPLICATION

Open a new project by selecting **File> New**. Create a new project by selecting the application of interest.

At this point, selecting with a left-click of the mouse the application name that appears in the **Tree** window, as shown in the figure below:

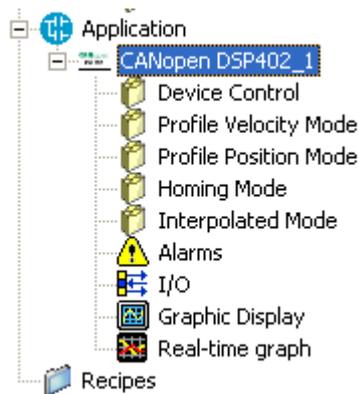


Figura 21 – Application selection

PLC Download  button will appear in the toolbar. Pressing this button will download the application.

- Load the default parameters.

Open the key TDE_PAR_KEY (P99) writing P99 = 82. The key is in the folder:

All Parameters > Generic Parameters > Keys

Then set the parameter DEF_PAR_RD (C61) to **Yes** and press **Write Parameters** . DEF_PER_RD is located in:

All Parameters > Generic Parameters > Data Storing

Save to the EEPROM the data just loaded by pressing the **Save Parameters to EEPROM** , then turn the drive off and then on again.

- Disconnect the OPDExplorer from the drive.
- Download of saved project.

Open the project initially saved (file *.TCN) and connect the drive. Setup reports that you are trying to connect to the drive with a core version that is not coherent, give ok to continue. Open the key P99 = 82 and perform a write of all the parameters with the **Write-All**  button. In this way all the parameters are written into the drive before the drive back.

- Save the parameters with the **Save parameters to EEPROM**  button.
- Disconnect the OPDExplorer from the drive, then turn the drive off and then on again.
- Open a new project with **File> New**, and repeat the **Scan** and reconnect to the drive.

At this point the drive is updated with the new version of core and application and the old recipe is again present in the drive.

3.2 APPLICATION UPDATE

If you want to upgrade a drive that already has a working recipe in it, and want to maintain the same recipe after the upgrade, the correct procedure to follow is depicted below.

- Connect OPDExplorer using function **Scan**.

In order to do this, press the **Start Scan**  button.

If necessary, also set correctly the scan parameters by pressing the **Advanced >>**  button

After the scan you will see the drive that has been identified. To connect to it you must first press the **Add**  button, OPDExplorer in this way will automatically open a project with the core version and the version of the application consistent with those

currently on the drive, then press the  button.

- Save the project

Read all the parameters with the **Read All**  button and then **save the project** (file *.tcn).

This will save the recipe that is currently in the drive so that you can download it later in the drive after the upgrade.

- Disconnect the OPDExplorer from the drive.
- Download the updated application.

In this case we proceed in two different ways depending on whether you want to download a standard application or a non-standard application.

STANDARD APPLICATION

Open a new project by selecting **File> New**, repeat the **Scan** and reconnect the drive. In this way the OPDExplorer will automatically open a project with the standard application using a version of core coherent with that which you've just downloaded in the drive. Press **PLC Download**  to download the standard application.

NON-STANDARD APPLICATION

Open a new project by selecting **File> New**. Create a new project by selecting the application of interest. At this point, selecting with a left-click of the mouse the application name that appears in the **Tree** window, as shown in the figure below:

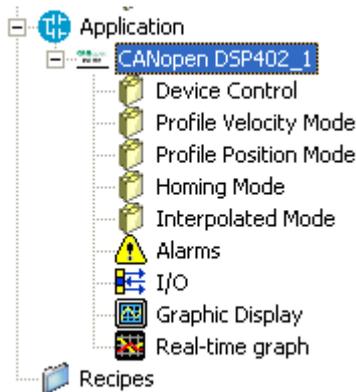


Figura 22 – Application selection

PLC Download  button will appear in the toolbar. Pressing this button will download the application.

- o Load the default parameters.
Open the key TDE_PAR_KEY (P60) writing P60 = 95. The key is in the folder:

All Parameters > Generic Parameters > Keys

Then set the parameter DEF_PAR_RD (C61) to **Yes** and press **Write Parameters** . DEF_PER_RD is located in:

All Parameters > Generic Parameters > Data Storing

Save to the EEPROM the data just loaded by pressing the **Save Parameters to EEPROM** , then turn the drive off and then on again.

- o Disconnect the OPDExplorer from the drive.
- o Download of saved project.

Open the project initially saved (file *. TCN) and connect the drive. Setup reports that you are trying to connect to the drive with a core version that is not coherent, give ok to continue. Open the key P60 = 95 and perform a write of all the parameters with the **Write-All**  button. In this way all the parameters are written into the drive before the drive back.

- o Save the parameters with the **Save parameters to EEPROM**  button.
- o Disconnect the OPDExplorer from the drive, then turn the drive off and then on again.
- o Open a new project with **File> New**, and repeat the **Scan** and reconnect to the drive.

At this point the drive is updated with the new version of core and application and the old recipe is again present in the drive.

TDE MACNO
s.p.a. tecnologie digitali elettroniche

Via dell'Oreficeria, 41
36100 Vicenza - Italy
Tel +39 0444 343555
Fax +39 0444 343509
www.tdemacno.com