Computer Controlled **Advanced Industrial Servosystems Trainer (for AC motors)**

Technical Teaching Equipment

SERIN/CA

Always included in the supply:

EDIBON PATENT

Teaching Technique used

RTC. EDIBON Real Time Control System

② Software for:
- Computer Control
- Data Acquisition
- Data Management

③ Cables and Accessories
④ Manuals

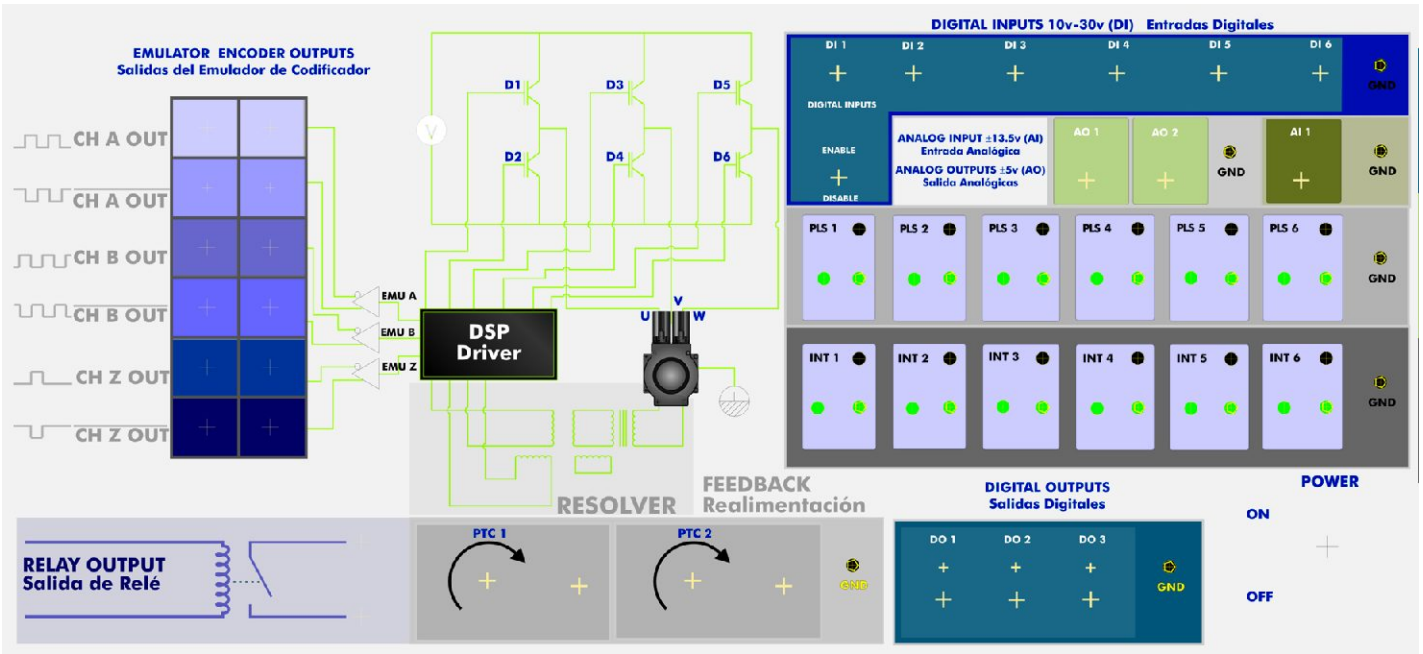
Computer (not included in the supply)

① Unit: SERIN/CA. Advanced Industrial Servosystems Trainer (for AC motors)

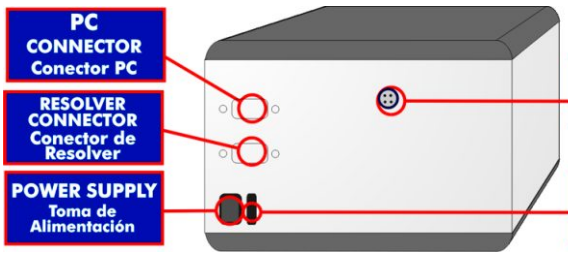
www.edibon.com
Products
Products range
Units
2.-Electronics

PROCESS DIAGRAM AND ELEMENTS ALLOCATION

Control Interface Box- FRONT PANEL



Control Interface Box- BACK PANEL



OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

ISO 9001:2000
Certificate of Approval

European Union Certificate

Certificates ISO 14001: 2004 and
ECO-Management and Audit Scheme
(environmental management)

Worlddidac Quality Charter Certificate
Worlddidac Member

Items supplied as standard

① SERIN/CA. Unit:

The SERIN/CA trainer consists on an Control Interface Box connected to a three-phase motor and to a computer (PC) (not included).

The control interface has a resolver for three-phase motors that controls the speed, position and current of the motor.

The RS232 communication between the control interface and the PC provides the SERIN/CA the possibility of commanding the motor from the PC and visualize the most important signals of the motor.

Velocity, Position and Torque Control.

It allows predefined moves and programming.

Control Interface Box:

Front panel:

3 Digital outputs:

They have a green LED that indicates if the output is active or not. Two of them have some functions defined by defect, but they can be changed by any other function using the software.

Output 1: this output has the "Fault Reset" function enabled for defect. It can be used to indicate a problem with the drive.

Output 2: this output has the "Brake" function enabled.

Emulative encoder outputs:

Two pair of outputs (CH A Out, CH B Out and their respective denied outputs) that are TTL signals of incremental position generated by the resolver feedback. These outputs are in quadrature to simulate an optic encoder.

One pair of outputs (CH Z Out and their denied) that TTL works as marker of pulses.

Analog output 4 (relay):this output is a relay, and it belongs together with the output 4 that it can be in the software inside the I/O digital label.

Analog outputs of the DAC monitor: these analog outputs are monitored points of general character. Each DAC monitor can be controlled by software to be a certain value of the internal variables.

6 Digital inputs: digital inputs for those signals that are introduced to enable the different available functions in the software.

6 Buttons: they are good to enable the digital inputs. When the button is pressed, the digital input will be activated, making what has been defined by the software.

6 Switches: they have the same function as the buttons, but with the only difference that they are switches and, therefore, maintain the position fixed (open or closed).

Switch outfitter of digital inputs: there is a switch that enables the digital inputs. When the green LED is on, the inputs will be enabled.

Analog input: this input allows an analog use directly of the user. It is an A/D input.

Voltage supply: 3 sources of continuous in the unit. One of +24 V. DC, another of +12V. DC and other of -12V. DC.

2 Potentiometers: they present three pegs.

Ignition switch: when the unit is on, the red LED is active an lighting.

Back panel:

Voltage supply that feeds the unit with 220 V of alternating current.

Three-phase output when solving: it is a three-phase output that feeds when you are solving and, therefore, allows their movement.

Connection port in series: it is a connection peg to connect the unit with the PC by the port in series, in order to allow the software to manage the encoder.

Connection with the feedback: it is a connection with the motor feedback. It allows the encoder to manage the motor.

Motor:

AC motor, 0.7kW, 2.8A ac, 4200 rpm, 320V dc., 7.2 Nm., IP65, Sensor RESOLVER :1 Speed, 1X/RX, 3 phase.

SERIN/CA. Unit

② SERIN/CA/CCSOF. Computer Control+Data Acquisition+Data Management Software:

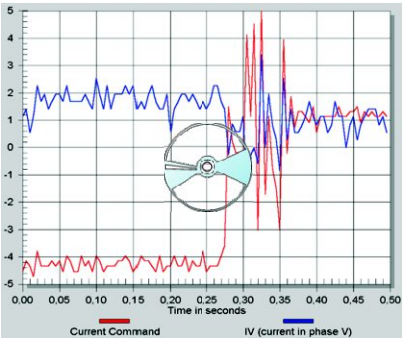
Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. **Compatible with the industry standards.**

Registration and **visualization of all process variables in an automatic and simultaneously way.**

Flexible open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

Management, processing, comparison and storage of data.

Comparative analysis of the obtained data, after to the process and modification of the conditions during the process.



SERIN/CA/CCSOF. Software

③ Cables and Accessories, for normal operation.

④ Manuals:

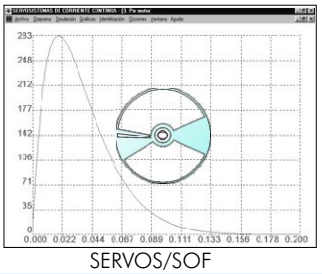
This unit is **supplied with 8 manuals:** Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, Practices Manuals.

*** References 1 to 4: SERIN/CA + SERIN/CA/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.**

Complementary items to the standard supply

Simulation Software:

⑤ SERVOS/SOF. Servosystems Simulation Software Package. (See SERVOS/SOF Catalogue).



SERVOS/SOF

Software Main Screens

Input and Output Functions

Input and Output Functions screen

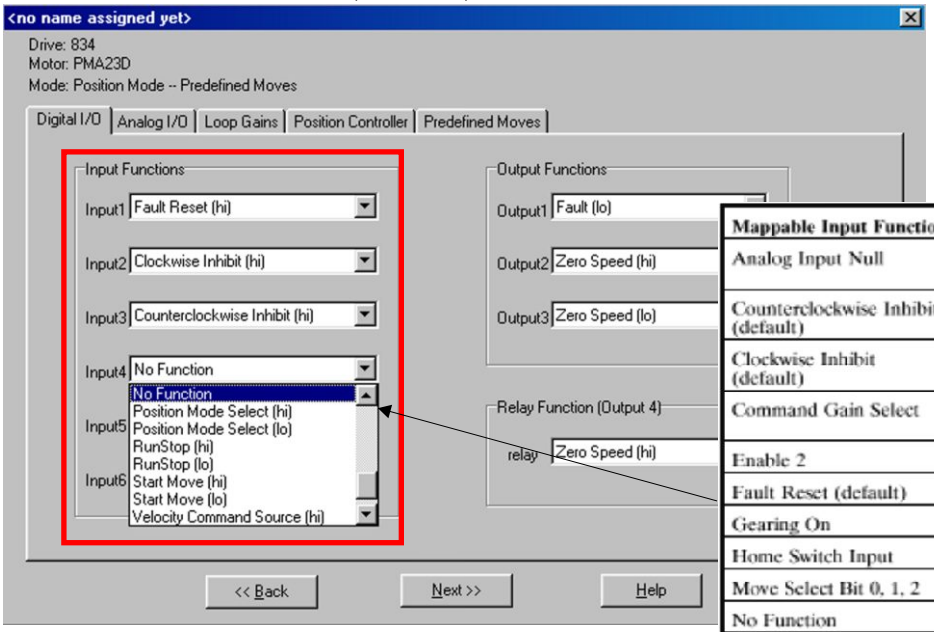


Table of available input functions

Mappable Input Function	Description
Analog Input Null	Nulls the analog input by setting ADOffset to old ADOffset minus AnalogIn
Counterclockwise Inhibit (default)	Inhibits motor motion in the counterclockwise direction when asserted
Clockwise Inhibit (default)	Inhibits motor motion in the clockwise direction when asserted
Command Gain Select	Switches the analog input scale factor between CmdGain and CmdGain2
Enable 2	Second enable function
Fault Reset (default)	Resets drive faults
Gearing On	Turns electronic gearing on
Home Switch Input	Home switch input for a homing move
Move Select Bit 0, 1, 2	Determines the active move
No Function	Turns off mappable input functionality
Position Mode Select	Switches the active mode of operation to position mode
Run Stop	Selects between normal operation and setting the velocity command to zero
Start Move	Initiates the preset move as defined by the current state of the MoveSelectBit inputs
Velocity Command Source	Selects between VelCmd and VelCmd2

Input and Output Functions screen

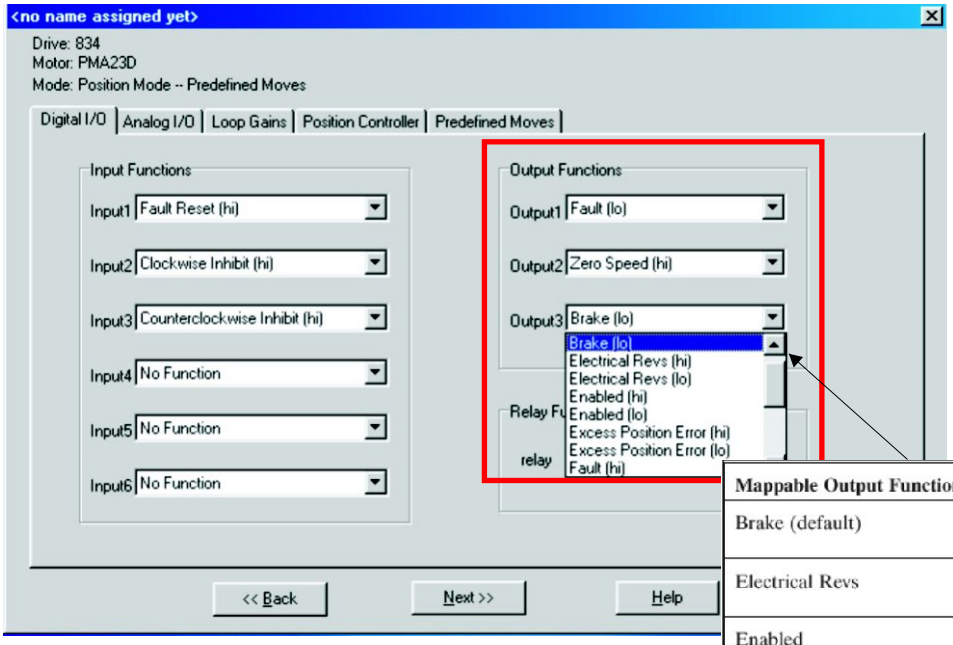


Table of available output functions

Mappable Output Function	Description
Brake (default)	Indicates when the motor is not powered and a mechanical brake is needed to hold the motor
Electrical Revs	Square wave whose frequency is equal to the motor electrical frequency
Enabled	Indicates whether power can flow to the motor
Excess Position Error	Asserted when there is excess following error for an extended period of time (following error limit is defined by PosErrorMax)
Fault (default)	Indicates whether the drive has faulted and is disabled
Mechanical Revs	Square wave whose frequency is equal to the resolver's electrical frequency which is typically equal to the mechanical Rev/sec
Move Done	Indicates that a move is complete.
No Function	Turns off mappable output functionality
Zero Speed	Activated when the motor's speed goes below the speed threshold set by the parameter ZeroSpeedThresh

Continue...

Software Main Screens (continuation)

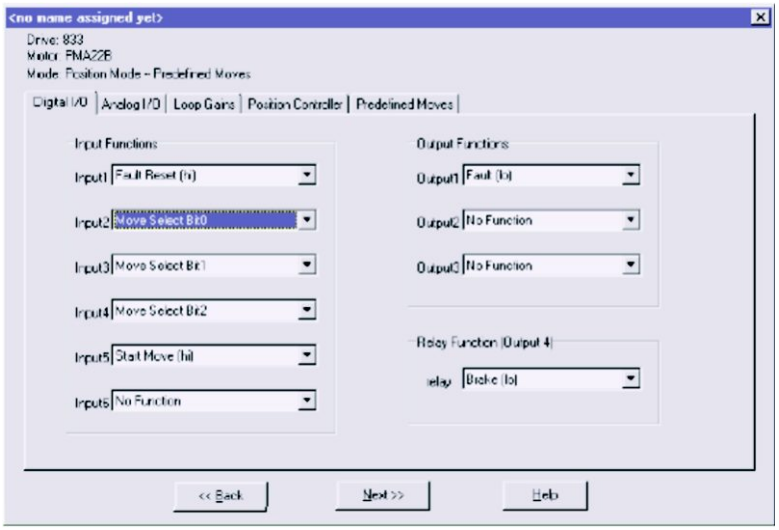
Select Operation Modes

Mode of Operation	Command Source
Position Mode - Predefined Moves	Digital Inputs
Position Mode - Step and Direction	Step and Direction
Position Mode - Electronic Gearing	External Encoder
Velocity Mode - Analog Command	Differential Analog Input
Velocity Mode - Frequency Command	Frequency/Pulse
Velocity Mode - Serial Command	RS-232/RS-485
Torque Mode - Analog Command	Differential Analog Input
Torque Mode - Frequency Command	Frequency/Pulse

← Table of available Operation Modes

Position Mode-Predefined Moves

Position Mode-Predefined Moves screen. The active movement is selected according to the ModeSelectBit(s) and begins with a stage change in StartMove →



In this window the parameters associated to the pre-established movements can be configured

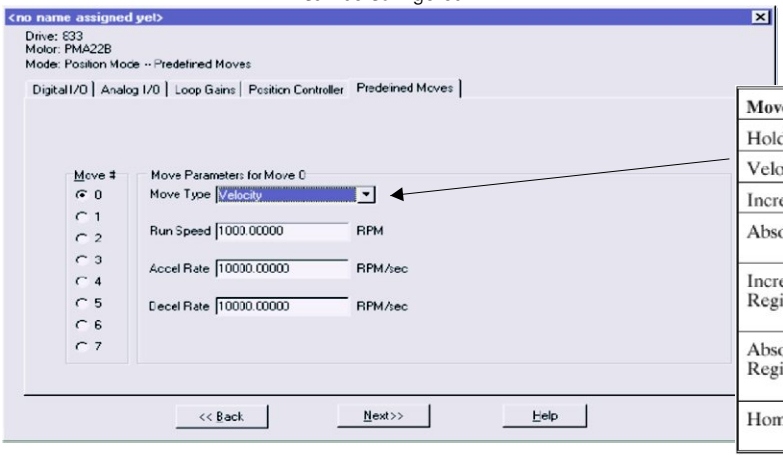
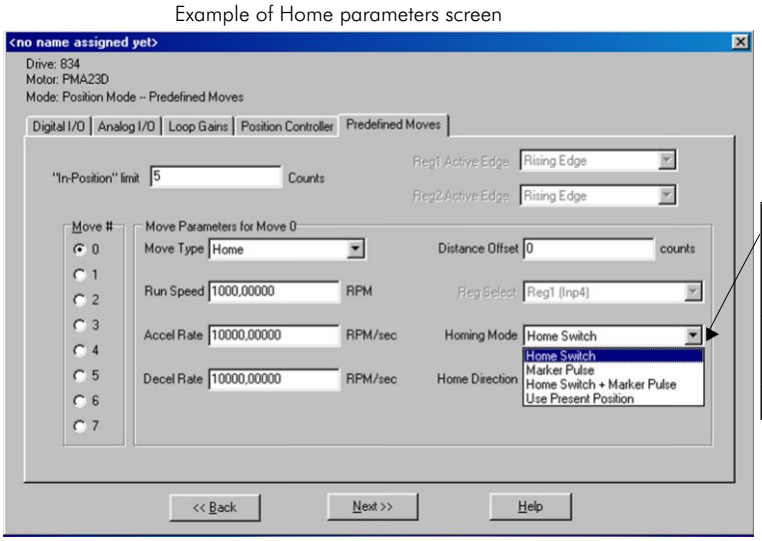


Table of available movements types

Move Type	Description
Hold Position	The motor aborts motion and holds position.
Velocity	The motor ramps up/down to a predefined runspeed.
Incremental	The motor travels a predefined distance.
Absolute	The motor travels to a predefined position relative to the home (0) position. (Turns gearing off)
Incremental Registration	The motor starts an incremental move. If a transition occurs on the registation input before the move is complete, the motor moves to the latched position + Distance Offset.
Absolute Registration	The motor starts an absolute move. If a transition occurs on the registation input before the move is complete, the motor moves to the latched position + Distance Offset. (Turns gearing off)
Home	The motor searches for a home reference, establishes a home position, and returns to the home position. (Turns gearing off)

Example of Home parameters screen



This table lists each one of the used references and describes how each one established the "home" position

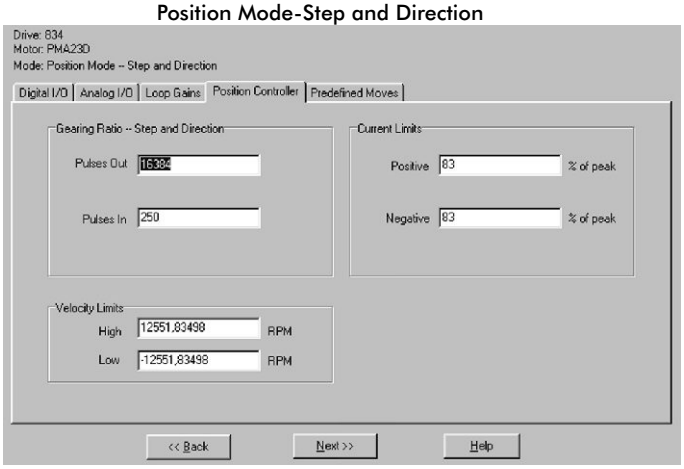
Home reference	Description
Home Switch	Transition of Home Switch (Requires one of the Digital Inputs to be mapped to the HomeSwitch function.)
Marker Pulse	Internal resolver marker pulse*
Home Switch + Marker Pulse	Transition of Home Switch then marker pulse
Use Present Position	Current position is established as home position

Continue...

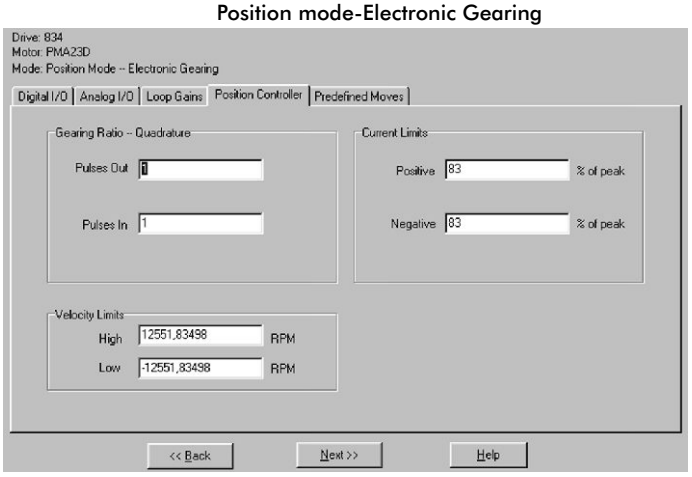
Software Main Screens (continuation)

Select Operation Modes (continuation)

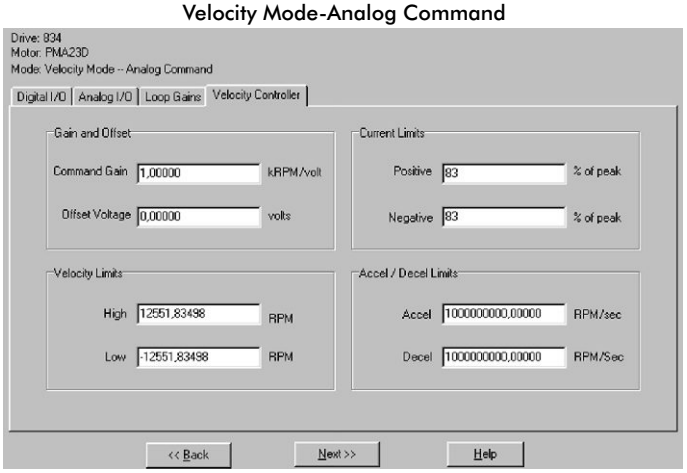
Position Mode-Step and Direction



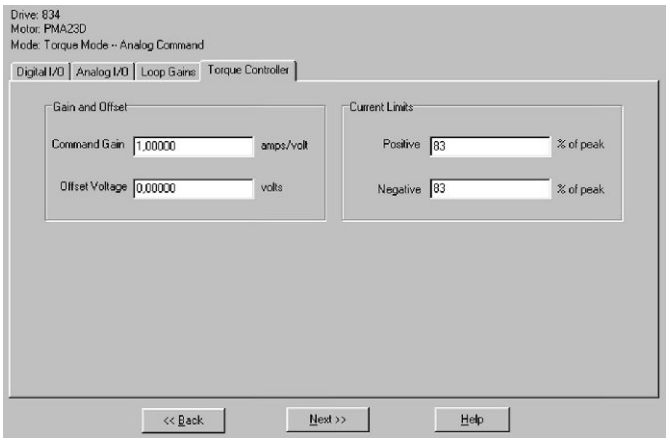
Position mode-Electronic Gearing



Velocity Mode-Analog Command



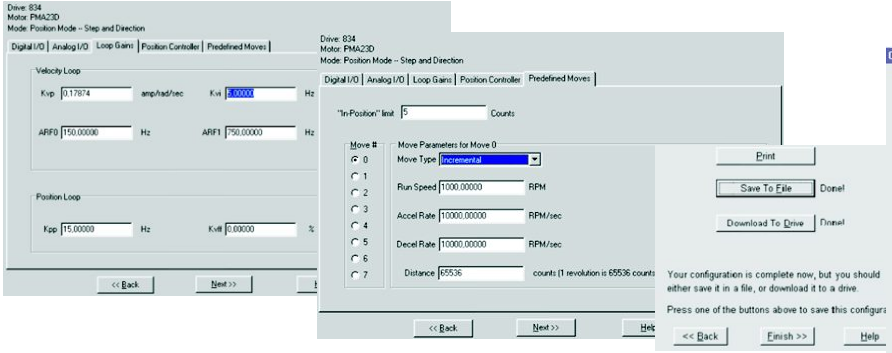
Torque Mode-Frequency Mode

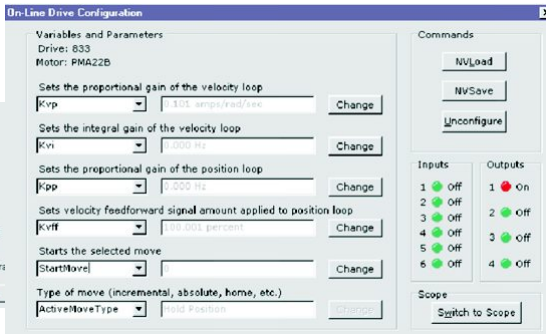


Parameters Adjustment

Oscilloscope Manual Management

Example of some configuration and visualizacion screens





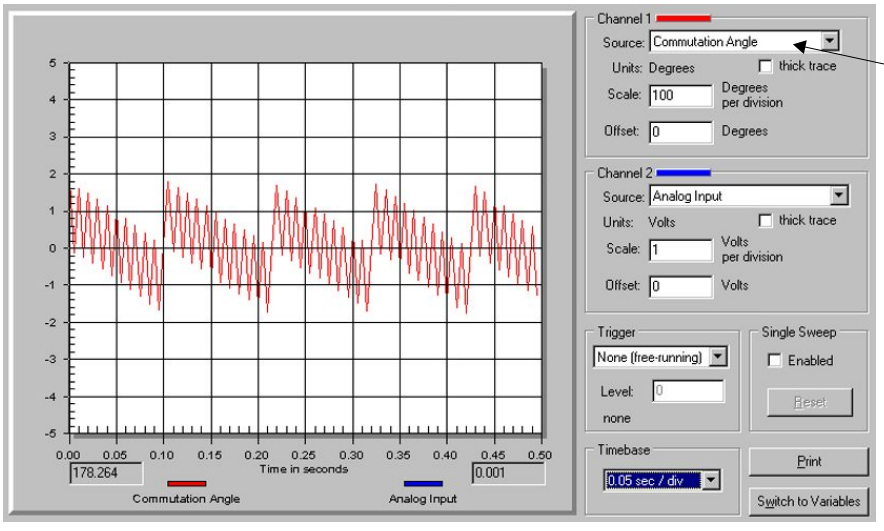


Table of visualization possibilities:

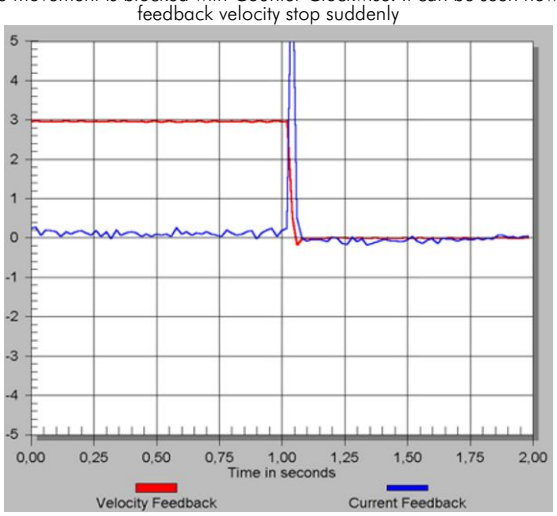
- Analog Input
- Analog Output
- Cmd Non_Trq Current
- Commutation Angle
- Current Command
- Current Feedback
- Encoder Frequency
- Filtered Velocity Error
- HS Temperature
- I*t Filtered Current
- IU (current in phase U)
- IV (current in phase V)
- IW (current in phase W)
- Non-Trq IFB
- Non-Trq Voltage Cmd
- Respos
- Trq Voltage Cmd
- VBus
- Velocity Command
- Velocity Command (actual)
- Velocity Error
- Velocity Feedback
- VU (voltage in phase U)
- VV (voltage in phase V)
- VW (voltage in phase W)

Continue...

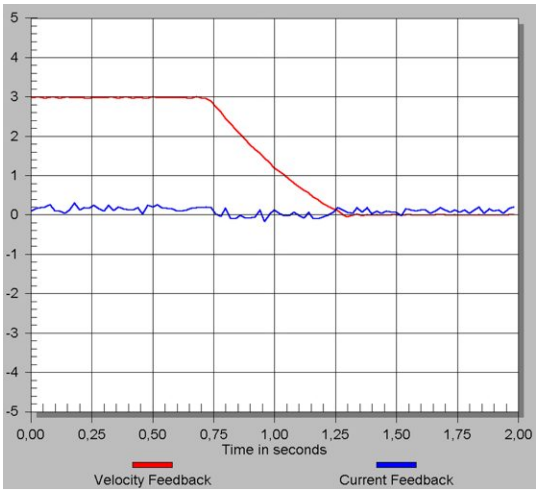
Some typical exercises results

Stop and blockade. Transitory states

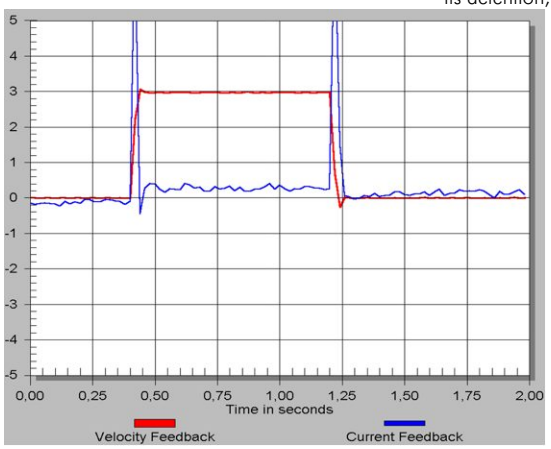
1.- The movement is blocked with Counter Clockwise. It can be seen how the feedback velocity stop suddenly

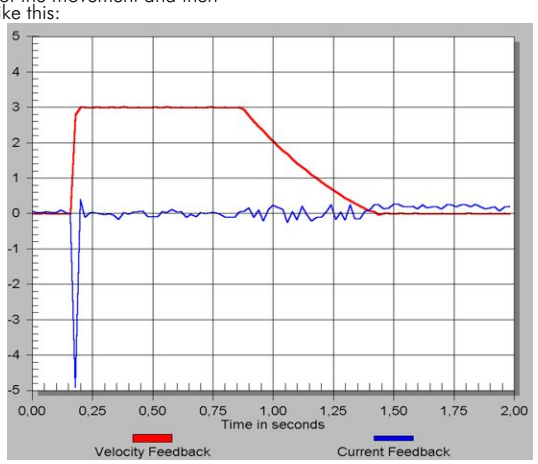


2.- The movement is activated again and now it stop with Fault Reset. It can be seen how the feedback velocity descends exponentially until it is being annulled



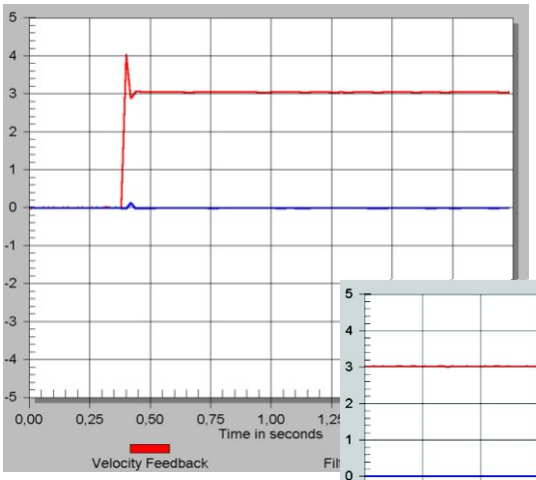
3.- If we put in the same graphic the beginning of the movement and then its detention, it can be seen like this:

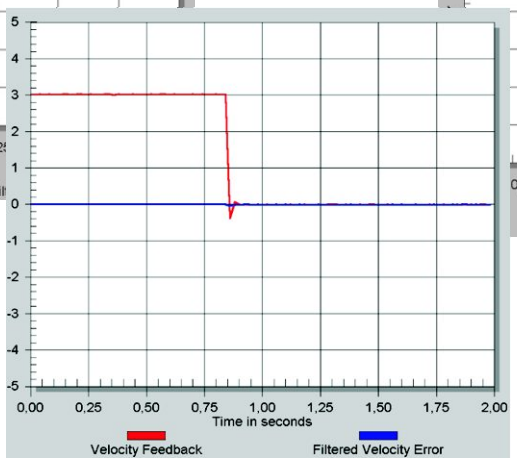




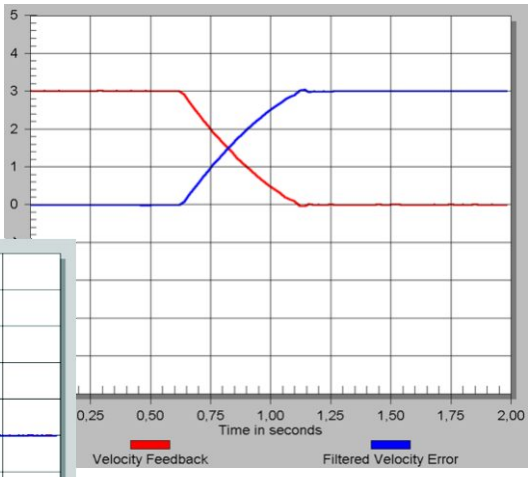
Stop and blockade. Influence on the filtered velocity

1.- Example of initial movement graph, in which the filtered velocity error has a blue color and the feedback velocity has a red color





2- If the movement stops by Fault Reset, the filtered error velocity passes from 0 to have the feedback velocity (in this case 3000 rpm). Nothing is filtering and there is an error velocity. We can appreciate the exponential growth of the filtered error velocity, as well as the exponential decrement of the feedback velocity



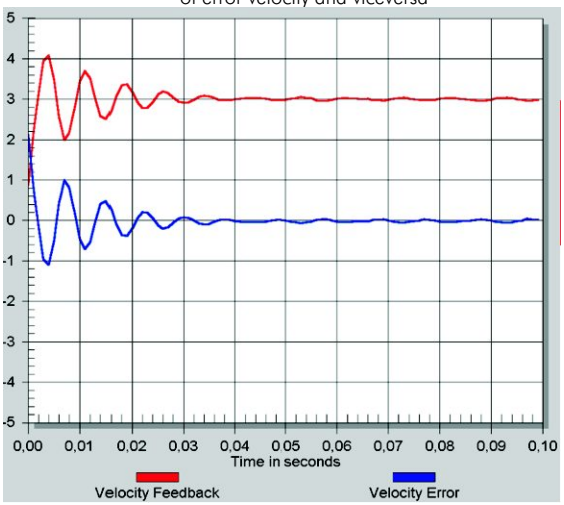
3- If the movement is blocked by the Counter Clockwise, the filtered velocity error continue being 0 and the feed velocity is also annulled. As the movement continues active, the driver continues filtering, and therefore the velocity error will continue null

Continue...

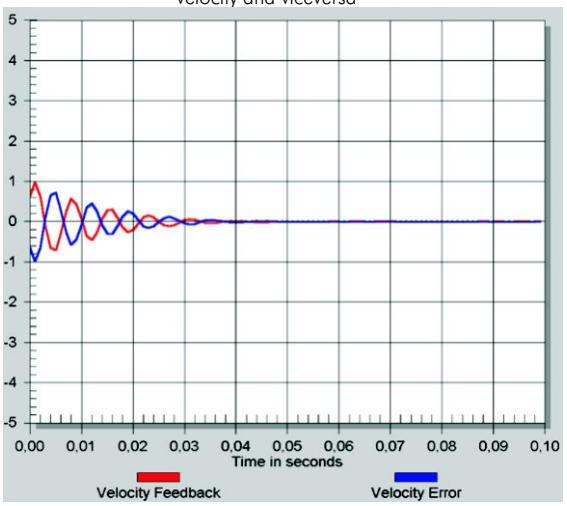
Some typical exercises results (continuation)

Transitory velocity study

Example of a graph.
The movement has started and in the graph the transitory states of the feedback velocity can be seen until the wanted velocity is stabilized. When there is a maximum of feedback velocity, there is also a minimum of error velocity and viceversa

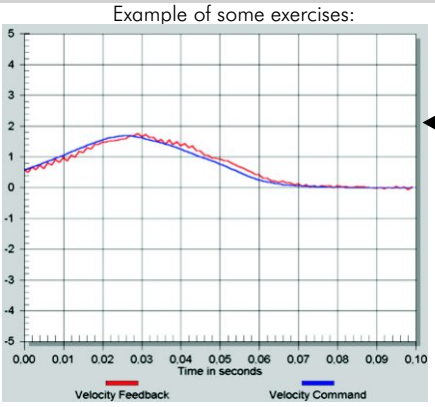


Example of a graph.
Transitories are created in the feedback velocity when their values falls. The velocity error also presents transitory. When there are maximums in the feedback sinusoid of velocity, minimums are presented in the error velocity and viceversa



Feedback gain manage

Example of some exercises:

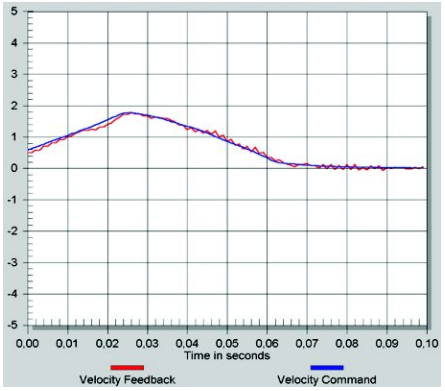


← Initial Graph.
Graph obtained following this procedure:
1.-Selection: Pulses out=16384 Pulses in=1024
2.-In Digital I/O are chosen these variables:
-Fault Reset, -Gearing On, -Start Move
3.-In the Predefined Moves option these movements are chosen: Move 0 and Move 1, incremental type. And in the Distance box=16384.

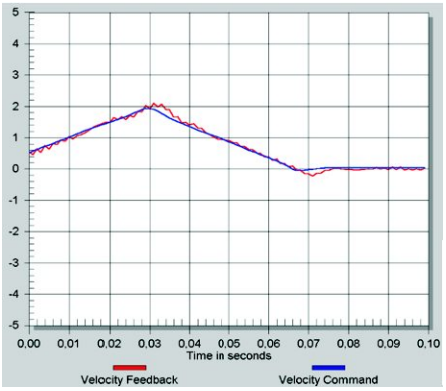
We can observe that the feedback velocity goes a little retarded in comparison with the normal velocity. Both signals make a curve in the highest point. The form is sinusoidal. The feedback velocity produces a slight curl around the normal velocity.

Now Kvff modifies (initially it has a null value) to see how it influences the velocities:

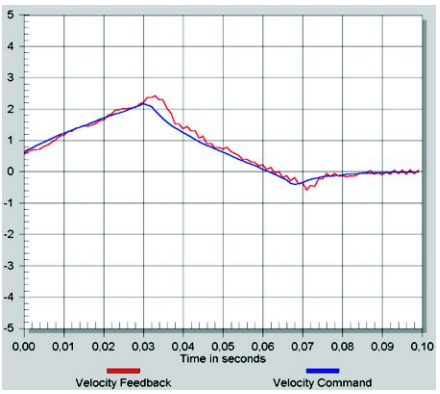
For Kvff=50%



For Kvff=100%

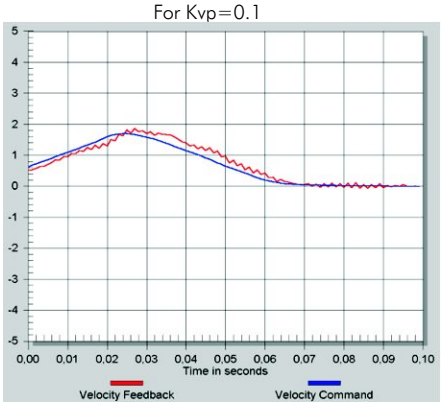


For Kvff=150%

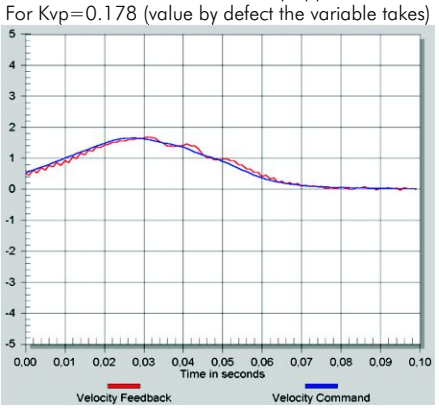


If we modify the Kvp value, we see that the feedback velocity approaches more or less the normal velocity:

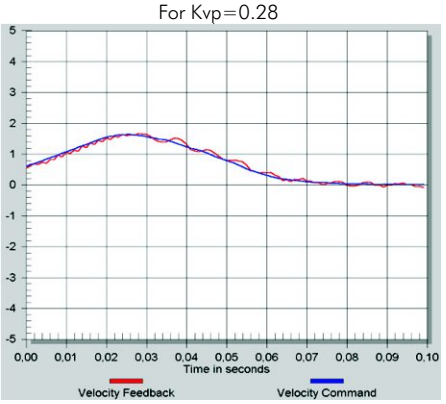
For Kvp=0.1



For Kvp=0.178 (value by defect the variable takes)



For Kvp=0.28

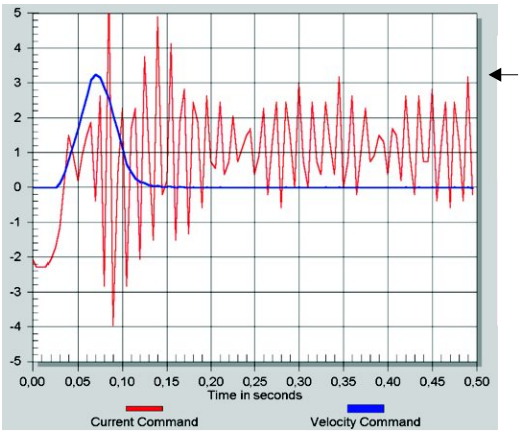


Continue...

Some typical exercises results (continuation)

Modification of Feedback parameters and phases U, V and W

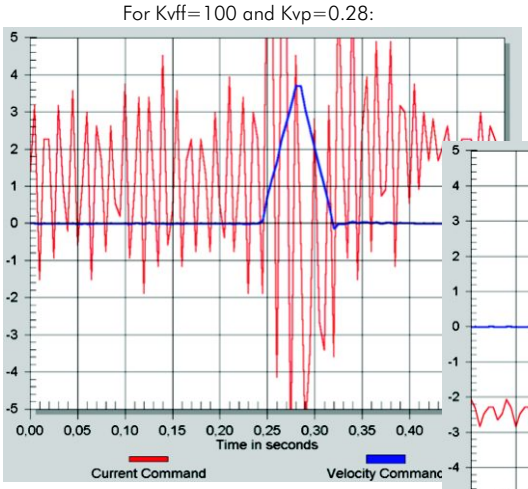
Example of some exercises:



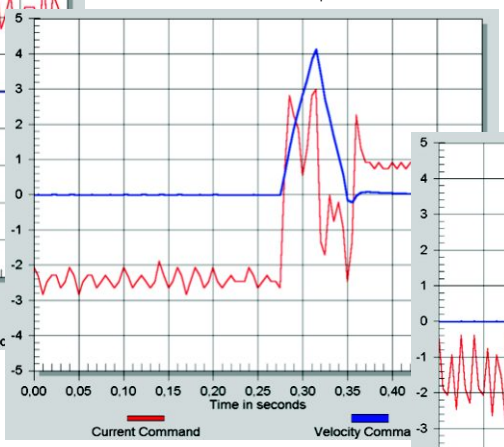
← Initial Graph.
Graph obtained following this procedure:
1.-Selection: Pulses out=16384 Pulses in=1024
2.-In Digital I/O are chosen these variables:
-Fault Reset, -Gearing On, -Start Move
3.-In the Predefined Moves option these movements are chosen: Move 0 and Move 1, incremental type. And in the Distance box=16384.
4.-In the oscilloscope theses variables are chosen:
Channel1:Current Command. Scale=0.1
Channel 2: Velocity Command. Scale=100
Timebase= 0.05 sec/div
5.-Initially they take the values: Kvff=0 and Kvp=0.08

This graph comes out for Kvff=0% and Kvp=0.28

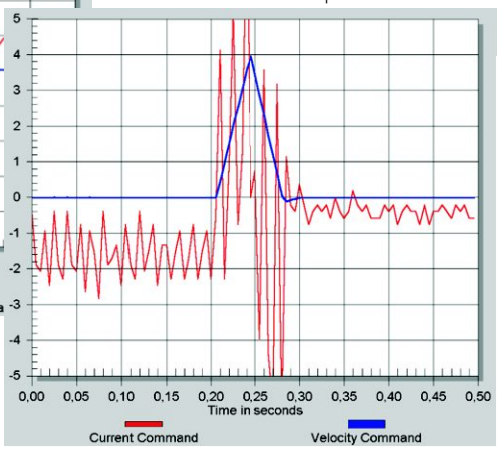
For Kvff=100 and Kvp=0.28:



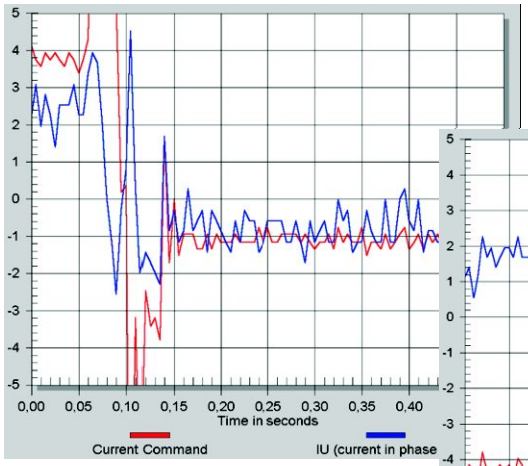
For Kvff=100 and Kvp=0.08:

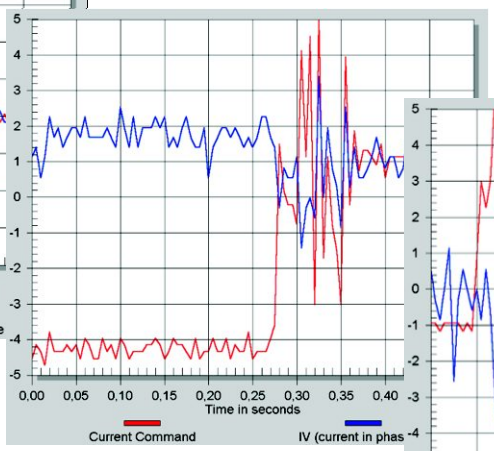


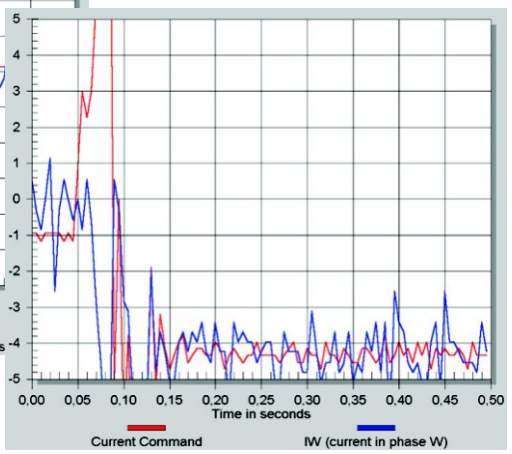
For Kvff=100 and Kvp=0.178:



Now one the oscilloscope channels is changed: Channel 2= current in phase U, Channel 2=current in phase V, Channel 2=current in phase W.
It be seen how the current goes through the 3 stages.







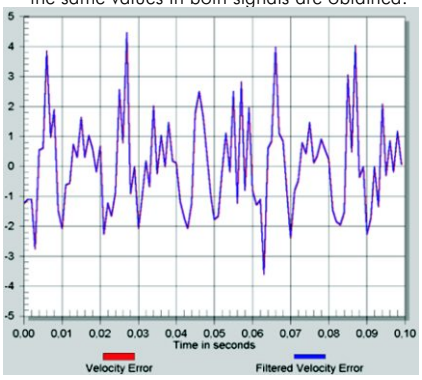
Continue...

Some typical exercises results (continuation)

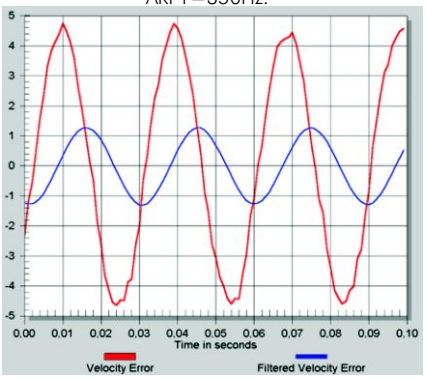
Use and Modification of the Feedback Filters

Examples for comparing the differences between the error velocity and the filtered error velocity:

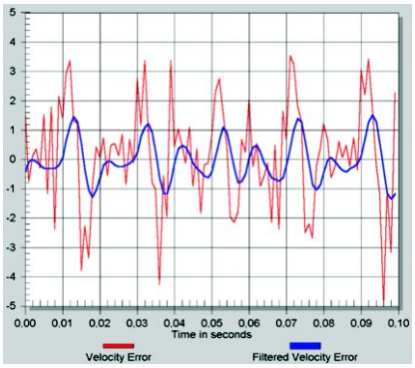
1.-There is not error velocity filtration, for this reason, the same values in both signals are obtained:



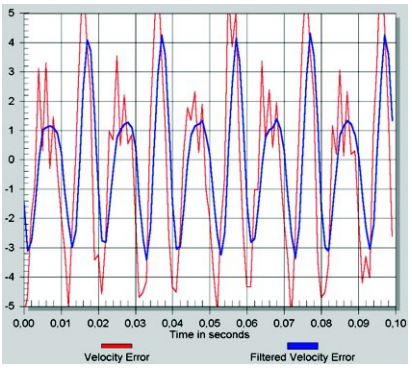
2.-The filters value is changed to ARF0=10Hz and ARF1=350Hz:



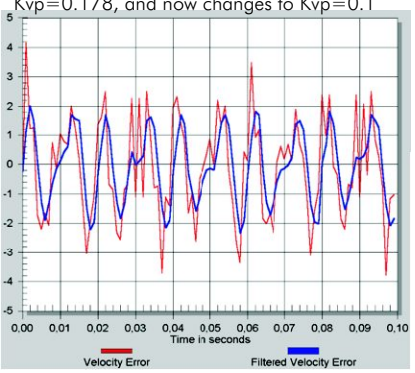
3.-Now the ARF0 value increases up to 50Hz:



4.-Now the ARF0=200Hz and ARF1=350Hz



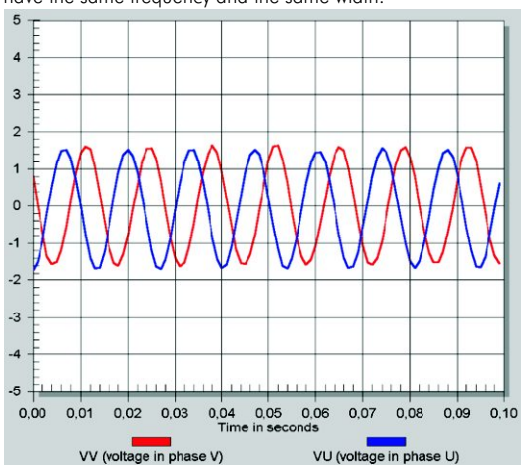
5.-We modify the Kvp value, initially it has a Kvp=0.178, and now changes to Kvp=0.1



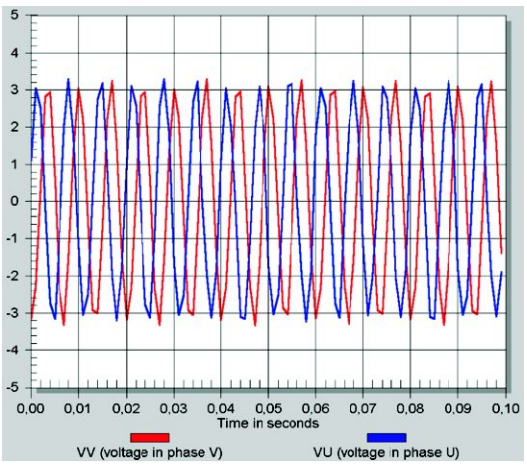
Phase voltages U, V and W showing

Examples for seeing and comparing the phases 2 by 2

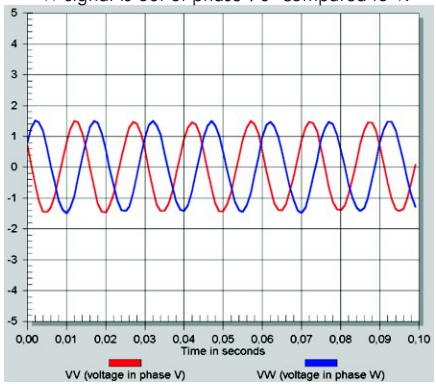
1.- Channel 1=phase Voltage V and Channel 2= phase Voltage U. V is out of phase more than 90° compared to U. Both signals have the same frequency and the same width:



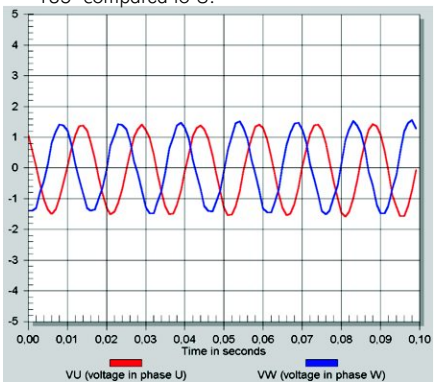
2.- Now the velocity is increased:



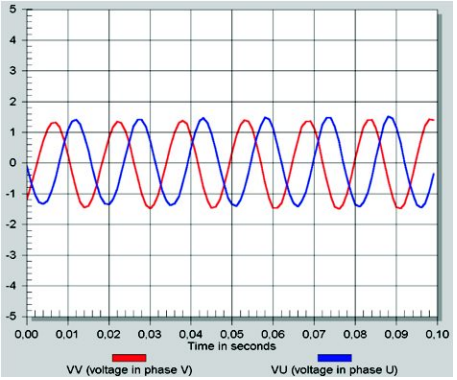
3.- Channels are changed. Channel 1=phase Voltage V and Channel 2=phase Voltage W. W signal is out of phase 90° compared to V:



4.- Channel 1=phase Voltage U and Channel 2=phase Voltage W. W signal is out of phase 135° compared to U:



5.- When the sense of the velocity changes, the out of phase signal also changes:



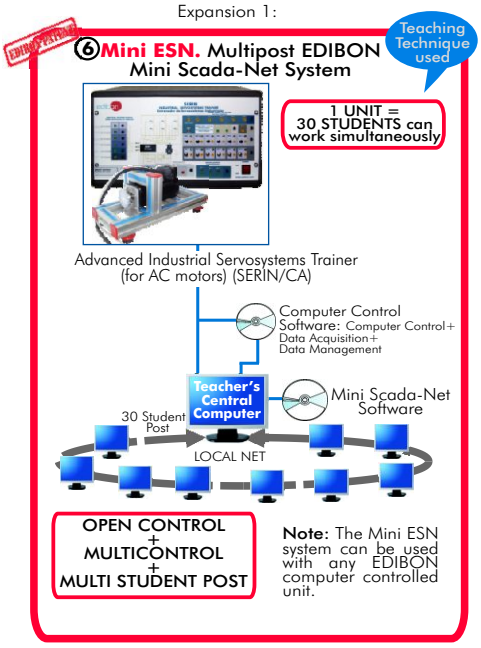
EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

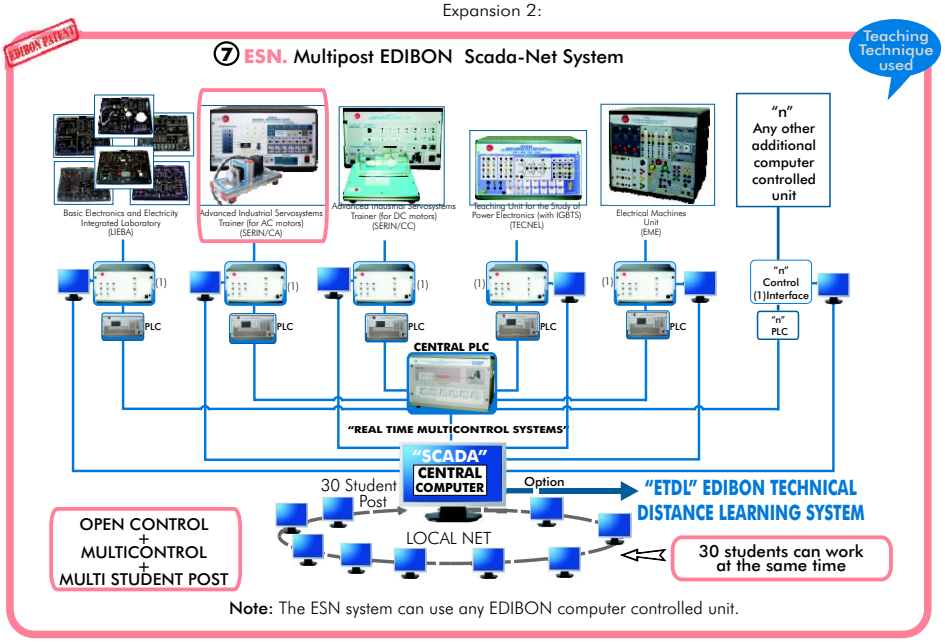
1.- Homing.
2.- Clutch/Control.
3.- Turn movement (w/correction phase).
4.- Registration movements.
5.- Dry movements.
6.- Stop and blockade. Transitory states.
7.- Stop and blockade. Influence on the filtered velocity.
8.- Transitory velocity study.
9.- Feedback gain manage.
10.-Modification of Feedback Parameters and Phases U, V and W.
11.-Use and modification of the feedback filters.
12.-Phase voltages U, V and W showing.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:



Expansion 2:



ORDER INFORMATION

Items supply as standard

Minimum configuration for normal operation includes:

① **Unit: SERIN/CA. Advanced Industrial Servosystems Trainer (for AC motors).**
② **SERIN/CA/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
③ **Cables and Accessories**, for normal operation.
④ **Manuals.**

* **IMPORTANT: Under SERIN/CA we always supply all the elements for immediate running as 1, 2, 3 and 4.**

Complementary items to the standard supply

⑤ SERVOS/SOF. Servosystems Simulation Software Package.

Expansions

⑥ Mini ESN. Multipost EDIBON Mini Scada-Net System.
⑦ ESN. Multipost EDIBON Scada-Net System.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110V./60Hz.
- Computer (PC).

DIMENSIONS & WEIGHTS

SERIN/CA:
Control Interface Box: -Dimensions: 490 x 330 x 310 mm. approx. -Weight: 40 Kg. approx.
Motor: -Dimensions: 410 x 170 x 150 mm. approx. -Weight: 5 Kg. approx.

AVAILABLE VERSION

Offered in this catalogue:

- SERIN/CA. Computer Controlled **Advanced Industrial Servosystems Trainer (for AC motors).**

Offered in other catalogue:

- SERIN/CAB. **Basic Servosystems Trainer (AC motors).**

✱Specifications subject to change without previous notice, due to the convenience of improvements of the product.

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