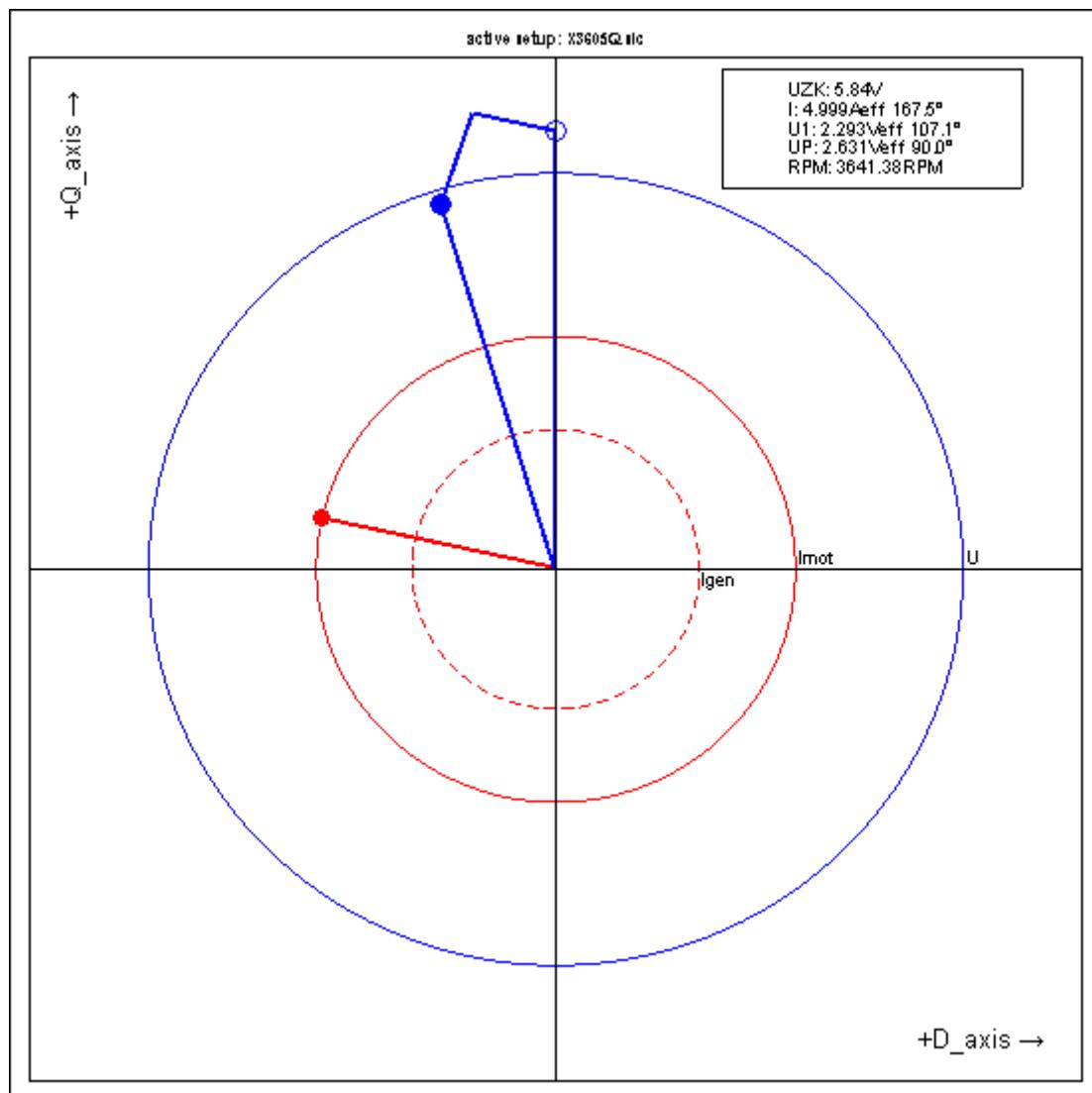**Option (chargeable)**
U/I-Vectors Live
(available only for SLR)

Ing.-Büro Zimmermann - Industriestraße 7 - D-97297 Waldbüttelbrunn
Tel.: +49 (0) 931/78011030 - www.SinusLeistungsSteller.de - info@SinusLeistungsSteller.de

Contents

1 Introduction

Field-oriented-Control (FOC) is based on voltage- and current-vectors. This U/I-vectors are referenced ("oriented") relatively to the field-vector by the FOC-algorithm, which runs in firmware. Visualization of this set of vectors is very useful to understand basic principles of FOC and also special operating condition like e.g. field-weakening.

All vectors are rotating with same speed in a Alpha/Beta-frame and can be transformed to the non-rotating D/Q-frame.

This option displays U/I-vectors in D/Q-frame in real-time animation.
(PMSM´s field-vector is always in positive D-direction and is not shown in this diagram.)

Content of this document is restricted to PMSM/BLDC, but is not applicable to IM.

2 Interpreting vector diagrams

2.1 Elements displayed

2.1.1 Phase-current I

Vector I represents motor´s phase-current. It´s absolute value is limited by SLR´s max current capability (depends on hardware) or the max. motor current setting (depends on parameter).

Vector I is display in red with a solid handle on top of the vector.
Its limit is displayed with two red circle around origin – for motoric, the other for generatoric limit.

2.1.2 Terminal voltage U1

Vector U1 represents motor´s terminal-voltage. It´s absolute value is limited by SLR´s max output voltage capability (depends on applied DC-voltage and hardware).

Vector U1 is displayed in blue with a solid handle on top of the vector.
It´s limit is displayed with a blue circle around origin.

2.1.3 Induced voltage Up

Vector Up represents motor´s induced-voltage.

Vector Up is displayed in blue with a non-solid handle on top of the vector.

2.1.4 Voltage on R and L (UR, UL)

In no-load operation (I is near to 0A), Up and U1 are nearly equal.
In load operation, Up is not equal to U1, because a voltage-drop occurs on motor´s R and L.

Vector UR represents voltage-drop on motor´s R. It is always parallel with **vector I.**
Vector UL represents voltage-drop on motor´s L. It is always orthogonal with **vector I.**

Both vectors are displayed in blue (without handle).

2.2 Numeric display

There is also a numeric display for all vectors. User can switch from polar-mode (vector length, angle) to component-mode (Q-component, D,-component).

The status-window within the graphic section can be moved by catching it with the mouse left-button.

2.3 Rules and Definitions

There are some rules and definitions you need to know for interpretation:

2.3.1 Clockwise rotation (CW) vs. counter-clockwise rotation (CCW)

CW rotation is defined with **vector Up** having a positive component in Q-direction ($U_{pq} > 0$)
CCW rotation is defined with **vector Up** having a negative component in Q-direction ($U_{pq} < 0$)

2.3.2 Motoric vs. generatoric operation

Motoric operation is defined with **vector I** and **vector Up** both having components in Q-direction with <u>equal sign</u> ($I_q > 0$ AND $U_{pq} > 0$) OR ($I_q < 0$ AND $U_{pq} < 0$)

Generatoric operation is defined with **vector I** and **vector Up** both having components in Q-direction with <u>un-equal sign</u> ($I_q > 0$ AND $U_{pq} < 0$) OR ($I_q < 0$ AND $U_{pq} > 0$)

2.3.3 Meaning of vector_I component in D-direction

In normal operation **vector I** does not have a component in D-direction ($I_d = 0$).
When operating in field-weakening, I_d will have negative values ($I_d < 0$).
When operating in OpenLoopMode/ALS, I_d can have positive values ($I_d >= 0$).
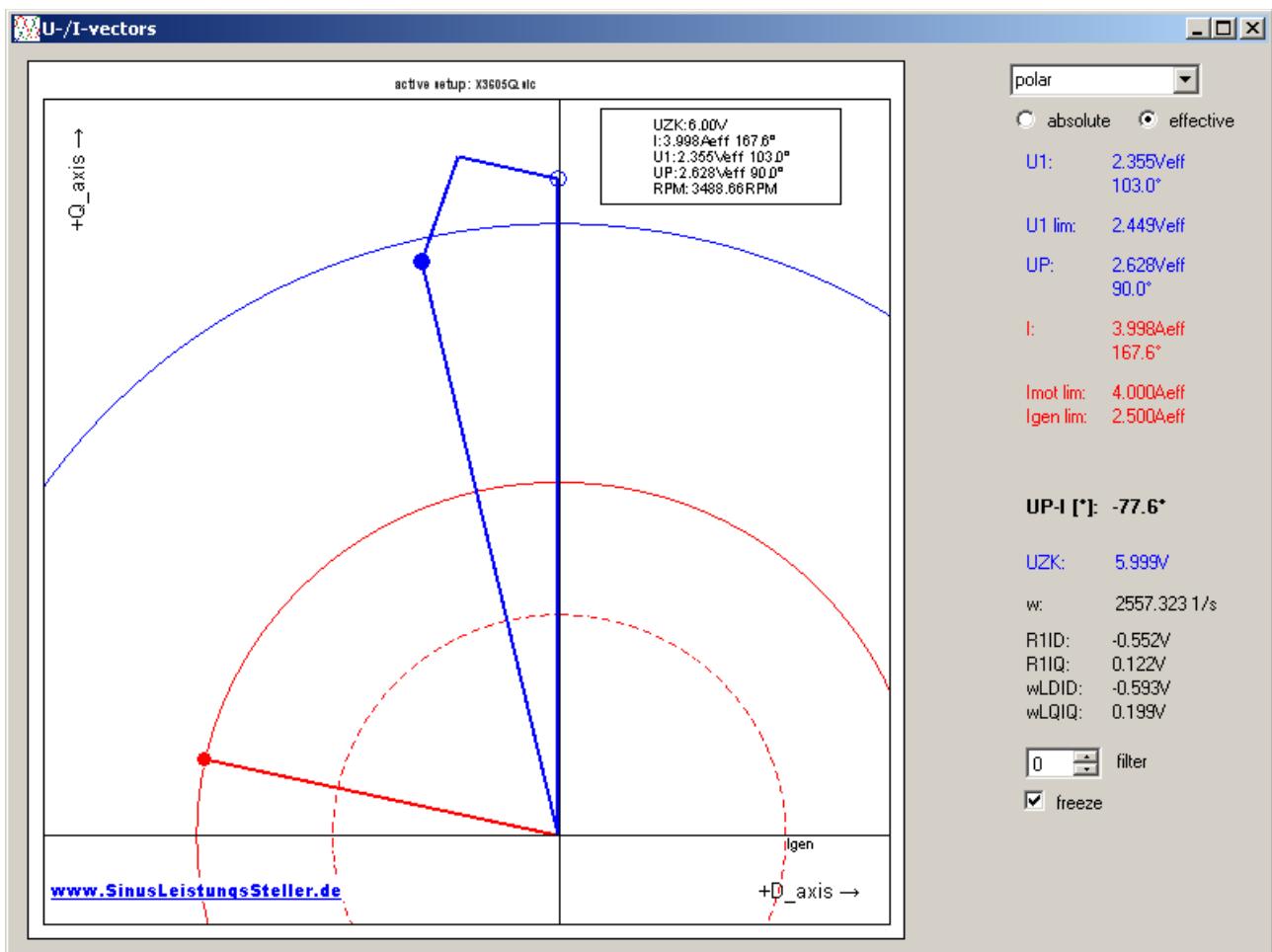
3 Control and Processing

3.1 Processing

A powerful zoom function allows to set focus on each area of diagram you like. Finished diagrams with all elements can be saved as picture to be used for later documentation or printout.

3.2 Control

All control elements are documented in detail within the User-Manual for the SLS-Windows-Monitor: **Manual_WMon_en.pdf**

4 Option order

User can order this option together with SLR device. Then this option will be enabled on your device before shipping.

If you need this option later, it can be enabled via an enable-key. This enable-key will be generated by us (we need type and serial number of your SLR) and send to you by email.