Operating Manual

Rev. 1.4

Digital Servo Controllers

DSV 110
DSV 112

suitable for
three-phase synchronous motors
and
DC motors

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Introduction

This document describes technical data and functionality of the digital servo controller DSV110 and DSV112. It points out all its features, helps you adjust the parameters and explains the correct way to get the drive up and running.
The manual contains safety notes which have to be complied with at all times. However, they do not replace or void any regulations that may be valid for your application.
See the **CANopen** and the **DeviceNet handbook** for operation in fieldbus- systems.

Document	Date	Rev.	Description
DSV130_BA_070924	24.09.2007	-	Einstellung Motorsystem, Hinweis Stromregler, RN12, Firmware EL V3.27
DSV110_BA_080805	05.08.2008	-	Anpassung an DSV110, Turntablebetrieb
DSV110_BA_080815	15.08.2008	-	Fehlerkorrektur, Firmware EL3.41
DSV110_BA_081020_en	05.11.2008	-	English version
DSV110_BA_110221_en	21.02.2011	1.4	New page layout
DSV110_BA_Rev1.4_150602_en	02.06.2015	1.4	New page layout
DSV110_BA_Rev1.4_170606_en	06.06.2017	1.4	New syntax of phone number

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1 Indications for Safety and Handling

Attention!

Always stick to the safety indications without fail!
Non observance can cause serious bodily harm or material damage!

- Parts inside the DSV and its connectors can be energised with high, possibly lethal voltages!
- Switch off the voltage supply and wait at least five minutes before pulling any plugs.
- All security and accident prevention regulations for the specific application have to be regarded during installation, wiring, set-up, operation and maintenance.
- First connect protective earth during installation!
- The DSV is an electronic device designed for operating motors and for installation in machines. The security rules of the “Maschinenrichtlinie” (89/392/EWG) or its international counterparts have to be regarded.
- Make sure that the drive is secured against any dangers or uncontrolled movements before set-up.

The following list of valid regulations is not exhaustive:

DIN VDE 0100	Regulations for the installation of high voltage (up to 1000V) devices.
DIN EN 60204	Electrical Equipment of machines.
DIN EN 50178	Electronic Equipment for use in power installations.

2 Functionality

Digital converter with cascaded controllers for current-, speed- and position control. The DSV provides dynamic driving of permanent magnet synchronous motors or brush-type DC motors. Operation is possible either with CANOpen according to CiA DSP 402 V2.0 or through digital and analogue inputs and outputs (I/O operation). The integrated positioning capability offers point-to-point positioning functions with trapezoidal or sinusoidal speed demand.
The DSV´s configuration is done via a clear and simple to use PC- software "DSerV"(WINDOWS®, COM-Port).
Further Features:

- Short cycle times for the PI current controller (100µs), for the PI speed controller (200µs) and for the P position controller (200µs), by using a high-performance DSP.
- 10Bit resolver interface, or 10Bit 1Vss Sin/Cos input for linear hallsystem for detecting the rotor position when brushless synchronous motors are driven.
- BEMF with IxR compensation, analogue tacho or incremental interface A, B, Z- signal as feedback when brushtype DC-motors are used.
- CAN-interface, CANopen implementation providing CiA DSP 402 V2.0.
- DeviceNet networks (optional).
- Power stage is short circuit proof.
- Designed for wall mounting

Safety installations:
- The **over-current-protection** detects short circuits between motorwindings resp. output phases.
- The **over-voltage-protection** raises an error as soon as the dc-link voltage exceeds its maximum value.
- The **temperature of the motor system** respectively **power stage** is measured, when the value exceeds 85°C, the power stage is switched off.
- The **plausibility of the resolver signal** respectively **tacho** is evaluated. Invalid signal combinations lead to switch-off of the power stage.
- The **I^2t - surveillance** protects motor and power stage against thermal overload, by limiting the output current to the rated value after the maximum overload time has elapsed.

3 Technical Data of the DSV 11x

		DSV 110	DSV 112	
input voltage	U1	20… 60 V_{DC}	20 … 60V_{DC}	
input current	I1	4,0A_{DC}	10,5A_{DC}	
rated current	I2	5,0A	15A	amplitude resp. DC
maximum current	$I2_{pk}$	12A	37,5A	amplitude resp. DC
rated output power	P_N	165W	478W	with rated output voltage
ambient temperature	ϑ_u	0°C ... 55°C		
storage temperature	ϑ_l	-25°C ... 60°C		
dimensions		ca. 30 x 180x 100 mm³		(H x W x D)
protection category		IP20		
weight		ca. 0,45 kg		
PWM- Frequency	f_{PWM}	9,765kHz		
speed range		±16.380rpm *1)		recommended max. speed ±12.000UPM others on request
motor poles		selectable 4, 6		
analogue setpoint inputs				
AI1 (differential)		±10V, 10bit, R_i=20kΩ		
analogue outputs				
AO1		0...10V (5V±5V), 10bit, I_{max}=2,5mA		for monitoring functions center voltage: 4,9…5,1V quantisation: 10Bit cut-off frequency: 1kHz
digital inputs				
DI1 ... DI4		0,0V ≤ U_{off} ≤ 5,0V 15,0V ≤ U_{on} ≤ 30V		galvanically isolated max. 35V common mode voltage DI1 = enable
incremental interface		A-,B-,Z- signal RS422, 5V TTL supply voltage: 5V / 200mA		feedback f. DC motors (100…10.000Imp/U)
digital outputs				
DO1 ... DO2		24V, 50mA		galvanically isolated

resolver- / 1Vss SinCos hallsensor- / tacho- interface

selectable; resolver or 1Vss SinCos hallsensor for BL-Motor; DC-Tacho for DC-motor. Selection is done through jumpers at the PCB and through parametrizing via DSerV.

resolver- supply R1,R2	ca. 5,5V_{eff} , 10kHz	suitable for 2pole resolver r=0,5
resolver- inputs sine/cosine	3,5V_{eff}	
1Vss SinCos input	1Vss ±20% input resistance 120Ω	suitable e.g. for 2pole linear hallsystem LS1
sensor- supply	10,5V ±5% max. 30mA	supply voltage for linear hallsystem LS1
tacho- input	±35V	tacho- voltage constant can be parametrized through DServ

serial interfaces		
	RS232 (9600 Baud)	communication with DSerV parameterizing software
	CAN 2.0B (max. 1MBaud)	without galvanic isolation. termination resistance 120Ω seclectable via PCB jumper
+10V auxiliary supply	+10V ±5% max. 2,5mA	supply of setpoint potentiometer
+16V auxiliary supply	+16V ±5% max. 50mA	+UH used for stimulating digital inputs and outputs
EMC behaviour		
	not defined yet	

*1) on request, doubling is possible
*2) conductive emissions have to be damped by using suitable filters in the power supply

3.1 Important technical notes

3.1.1 Recuperation mode

Feedback energy from the drive leads to a rise of the intermediate circuit voltage. The increased intermediate circuit voltage is supplied to the voltage supply connector X1. Make sure, that the connected power supply and consumers tolerate the increased voltage. If necessary, use a suitable diode to decouple the voltage supply for the device.
The intermediate voltage can rise up to a limit voltage of 80V, then an overvoltage error appears (error no. 6) that switches the power stage off.
Optional it is possible to parametrise lower limitation voltages.

3.1.2 Lead fuses

The DSV11x does not provide internal fuses. External protection (DSV110 = 6,3A, DSV112 = 15A) has to be provided.

3.1.3 Lifetime

The DSV's lifetime is mainly governed by the strain put on the dc-link capacitors. At an ambient temperature of 45°C and at rated output current, a lifetime of 15,000h can be expected. The lifetime increases with reduced output current or lower ambient temperature.

3.2 Safety installations

The DSV is equipped with substantial sensor technology to protect controller, power stage, motor and communication interfaces. All errors cause a shutdown of the power stage. They are reported by a blinking code of the red status LED. The power stage can not be switched on again before the source of fault is removed and the error is released using the enable input.

3.2.1 Power stage protection

The power stage is protected by the following safety installations:

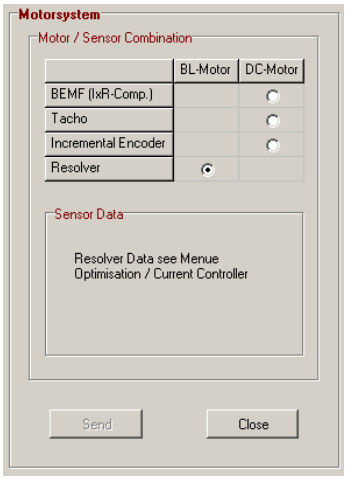
- The **over-current**- respectively **short-circuit-protection** detects short circuits between the motorwindings as well as between the motorwindings and the voltage supply.
- The **over-voltage-protection** raises an error as soon as the dc-link voltage exceeds its maximum value.
- The **temperature of the power stage** heat sink is measured, when the value exceeds 85°C, the power stage is switched off.

3.2.2 Motor protection

- The **plausibility of the resolver signal** or **linear hallsystem** is evaluated. Invalid signal combinations lead to switch-off of the power stage.
- Cable break detection when using a tacho.
- The DSV is equipped with an input for monitoring the **motor temperature**. Normally closed thermal contacts or PTC resistors can be used as sensors. The analogue nature of the input also allows the use of a linear temperature probe, enabling individual adjustments of the threshold.
- The **I^2t - surveillance** protects motor and power stage against thermal overload, by limiting the output current to the rated value after the maximum overload time has elapsed.

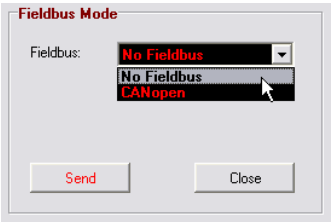
4 Modes of operation

The digital servo-controllers DSV11x can operate with brush-type DC motors and brushless permanent magnet synchronous motors. It can be used as current- (torque-), speed- or position controller. The configuration of the device is done with a pc-software “DSerV” via a serial interface (COM/RS232).
Changed parameters affect the drives behaviour at once, but will be stored in the non-volatile memory not until the “save parameter” command is called.



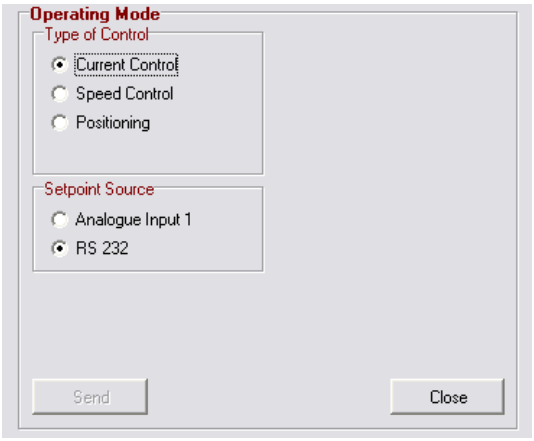
The currently used motor technology as well as the source of the feedback signals for determining velocity and angle can be set in the DSerV menu ***OPTIMISATION / MOTORSYSTEM***.

> **Notice:**
> Please pay attention to the jumper setting (see chapter 6.3), it must correspond to the selected velocity and angle feedback sensor.



The servo controller DSV11x is operated either by digital and analogue inputs (**I/O operation**) and outputs or via a CANopen fieldbus.
The decision if the CAN interface is used and the choice of node-ID and baudrate is made in the menu ***OPTIMISATION / FIELDBUS***.

The description of the DSV´s functionalities in this documentation assume to the I/O operation (“no fieldbus”). The fieldbus- functionality, basically the same, is described in the CAN- Handbook.



When the DSV11x is in I/O operation the controllers operating mode and the source of setpoint can be selected using menu ***OPTIMISATION / OPERATING MODE.***

4.1 Speed control mode

In speed control mode the feedback of the actual values (velocity and angle resp. position) is handled depending on the used sensor. For supported combinations, see table below:

Motortype	Sensor	Speed	Angle/ Position	Note
brushless synchronous motor	**resolver**	yes	yes	for high quality speed and position control
	linear hallsystem LS1	yes	yes	for high quality speed and position control
	incremental encoder	yes	*yes*	*support projected*
DC motor	**BEMF with IxR compensation**	yes	no	simple speed control without sensor
	analogue tacho	yes	no	speed control
	incremental encoder	yes	yes	for high quality speed and position control

The desired configuration can be set up the menu ***OPTIMISATION / MOTOR.***

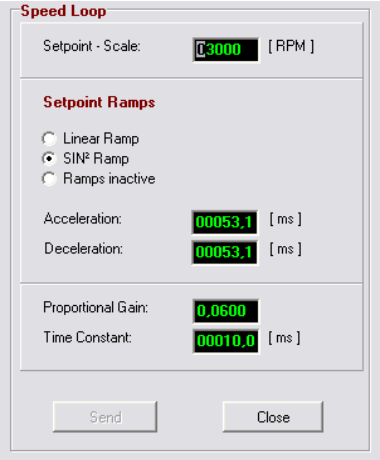
- Incremental encoder with pulse rate
- Voltage constant of the motor
- IxR compensation value

In speed control mode there are two possible input sources for the demanded values:

- analogue input 1 (differential input, ±10V, clockwise and counterclockwise rotation)
- RS232 (setpoint via DSerV by clicking RS232_SETPOINT and moving the slider left or right)

The enable signal is always digital input DI1 (+15 ... +30V => enabled).

> **Notice:**
> Prior to setting-up or operating the speed controller, make sure that the current limits and the parameters of the current controller are set to match the appropriate motor values.
> The tuning of the speed and current controllers is described in chapter 8.



Menu item ***OPTIMISATION /SPEED CONTROLLER*** allows setting the parameters of the speed controller:

Setpoint scale: Motor speed at 100% setpoint through analogue input or RS232 setpoint.

Setpoint ramp: Acceleration/ deceleration ramp for speed setpoint.
The numerical entries are consistent to the CAN objects ***profile acceleration*** and ***profile deceleration***. They are valid for operation modes with speed control active.
Object ***motion profile type*** containing ramp characteristics (linear/sinusoidal2/inactive).

- **Linear ramp:**
Setpoint changes given by analogue input or as RS232 setpoint are limited to the maximum slew rate.
Unit: [10 rpm / sec]

- **Sinusoidal²- ramp:**
Setpoint steps are converted into a jerk free speed profile. The final speed is reached after the programmed time.
Unit: [ms]

Hints:
- Sinusoidal² ramp is not usable in speed control mode operated through analogue and digital in- and outputs.
- DSerV allows direct time assigned value. Via CAN calculate the necessary value as follows:
Unit: [approx. 100sec^{-1}]
Example: Calculation of a 0.25sec ramp time:
profile_acceleration = 100 sec^{-1} / 0.25sec = 400

- **Ramps inactive:**
Setpoint changes without delay resp without ramp.
Hint:
- Profile position modes need to have a valid ramp value. The selection „Ramps inactive“ will be ignored in profile position mode.

Proportional gain: Proportional gain of the speed controller
(range: 0.0000…0.9999).

Time constant: Time constant T_N (integral gain) of the speed controller.
The enable signal is always digital input DI1 (+15 ... +30V => enabled).

4.2 Current / torque control mode

> **Notice:**
> The tuning of the current controller is described in chapter 9.1.
> The setting of **Polarity** (see chapter 4.3) is active in current control mode.

Current / torque control is selected in ***OPTIMISATION / OPERATING MODE***.
In this mode, the demanded value applied to one of the possible sources is interpreted as current setpoint. The standardisation of the value is always coupled to the parameter "rated current" (***OPTIMISATION / CURRENT CONTROLLER***).
Applied demand values aren´t affected by a ramp value.

The enable signal is always digital input DI1 (+15 ... +30V => enabled).

4.3 Positioning mode (CANopen)

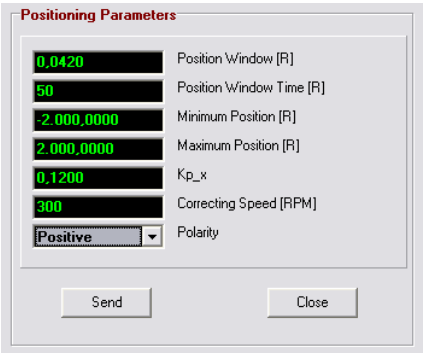
Positioning mode is supported in fieldbus operation only. This operating mode allows point-to-point positioning either with trapezoidal or jerk free sinusoidal² speed profile.

Positioning range: $\pm 2^{19} = \pm 524288$ revolutions

Positioning resolution: resolver system: about 1/1024 revolutions = 0.352°

incremental encoder: 360° / (4 x pulse rate)
for example: 360 /(4 x 1024 pulses) = 0,088°

Common positioning settings can be done either via CAN bus or via DSerV.



The operating mode "Positioning" is selected in the menu ***OPTIMISATION / OPERATING MODE.***
The parameters needed for the positioning are available in ***OPTIMISATION / POSITIONING/ GENERAL PARAMETERS.***

Position window

A positioning process is concluded when the difference between the set value and the actual value is less than the value contained in the "Position window", namely at least for a time duration specified in the "Time window".
Unit: motorshafts revolutions [r]
*Object: **position window** [6067h]*

Time window

See "Position window".
Unit: milliseconds [ms]
*Object: **position window time** [6068h]*

Minimum positioning range

This is the negative limit of the positioning range. Should the set value or the actual value drop below this limit, a positioning error is announced.
Unit: motorshafts revolutions [r]

Object: ***software position limit*** *[607Dh]*

Maximum positioning range
This is the positive limit of the positioning range. Should the set value or the actual value lie above this limit, a positioning error is announced.
Unit: motorshafts revolutions [r]
Object: ***software position limit*** *[607Dh]*

kp_x
The proportional gain of the position controller. Range: 0,000...0,999
Object: ***position control parameter set*** *[60F9h sub1]*

Correction speed
This is the regulation band of the position controller. It allows to modify the dynamic behaviour during achieving the target position.
Unit: [rpm] => typical values : ca. 100 ... 500rpm
Object: ***position control parameter set*** *[60F9h sub2]*

Polarity
This parameter allows an internal reversal of the positioning direction, in order to meet the user's mechanical requirements.
positive Polarity => increasing position value with clockwise rotation of the motorshaft
negative Polarity => inreasing position value with counter clockwise rotation of the motorshaft
Object: ***polarity*** *[607Eh]*

Notice:
Polarity effects also current control and speed control modes.

Target positions and travel speed must be set through CAN bus, at least with the following basic parameters:

Target position
Set value for the target position, with choices for absolute/ relative value interpretation and for the starting conditions.
Object: ***target position*** *[607Ah]*
Unit: motorshafts revolutions [r]

Target position is
- absolute: Target position is an absolute value
- relative: new target position = last target position + new entry
Object: controlbits within ***controlword*** *[6040h]*

Start positioning
- after finishing: a new positioning process starts after the end of preceding positioning process.
- at once: a new positioning progress starts at once and maybe interrupts a preceding one.
Object:controlbits within ***controlword*** *[6040h]*

Speed
(Rotation) speed programmed to reach the target position
Objekt: ***profile velocity*** *[6081h]*
Unit: [rpm]

Acceleration and deceleration ramps can be set in the menu ***OPTIMISATION / SPEED CONTROLLER*** or can be given through CAN objects ***profile acceleration*** *[6083h]* and ***profile deceleration*** *[6084h]*.

4.3.1 Homing (CANopen)

Homing is done to get the information about a defined machine position. Homing is a must if angle-sensors with single-turn characteristics are used.
When the DSV11x is in I/O operation and the positioning mode is selected homing will start automatically after the first (or after every) enabling. (**Inapplicable with DSV11x**).
When CANopen operated homing is selected through ***modes of operation*** and started through the ***controlword***.

The DSV supports different homing/referencing methods:

• Homing through limit- / referencing- switches (***homing method***: 17, 18)
The drive moves to the switch with a speed setpoint according to “speed during search for switch”. After the switch is detected the drive reverses to “speed during search for zero”. The home position is detected, where the switch is switching to inactive.

• Homing through limit- / referencing- switches considering the index pulse (***homing method***: 1, 2)
This method is used to eliminate mechanical switching tolerances of the limit- / referencing- switches.
The drive moves to the switch with a speed setpoint according to “speed during search for switch”. After the switch is detected the drive reverses to “speed during search for zero”.
When the switch changes to the inactive state, the next index pulse rather the next zero point of the rotor angle value is interpreted to be the home position.
The switching of the limit- /reference switch should take place best at a maximum/minimum rotor angles. The actual rotor angle displayed in DSerV ***MONITOR /ANGULAR POSITION*** can be used to align the switches.

• Homing against a mechanical stop (***homing method***: -17, -18)
The drive moves to the preferably hard stop with a speed setpoint according to “speed during search for zero” and a current limitation “max current during homing on mech stop”. The motor stop and its current rise are the criteria for detecting the home position.

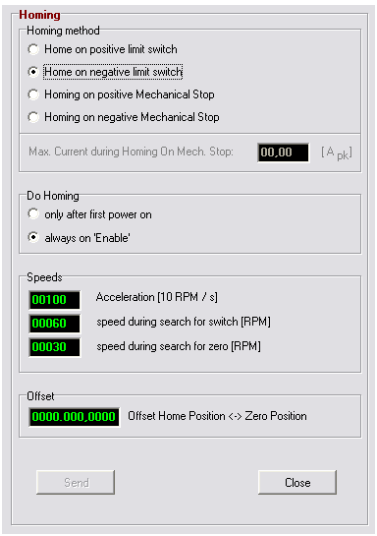
Attention!
When homing against mechanical stop is used…

… choose low speed setpoints to keep dynamic forces low appearing at stop!

… mind the possibly high torques and forces!

=> Calculate or estimate developing forces by the given current limitation and check the effect to the entire system.

• Homing onto the actual position (***homing method***: 35)
This method interprets the actual position as the homing position. There is no noticeable drive movement.



Homing parameters are selectable either through CAN or via DSerV.
Select ***OPTIMISATION / POSITIONING / HOMING*** to set the parameters with DSerV.

Homing method

Defines the method and direction of homing.
Object: ***homing method*** *[6098h]*

Do homing

Defines, if homing is done once or every time the controller is newly enabled. (Only in I/O operation. Not applicable in CANopen operation)

Acceleration

(Rotation-) Speed ramp for all the referencing speeds. Ramps characteristics according to ***motion profile*** (linear / sinusoidal²).
Object: ***homing acceleration*** *[609Ah]*
Unit: [10rpm/s] => Range 1000 = 10.000 UPM/s

Speed during search for switch

The speed setpoint while driving to the switch.
Object: ***homing speeds*** *[6099h sub1]*
Unit: [rpm]

Speed during search for zero

The speed setpoint at which the negative edge of the limit switch is detected and speed setpoint in homing mode against mechanical stop.
Object: ***homing speeds*** *[6099h sub2]*
Unit: [rpm]

Offset

The offset between the homing position detected during the homing procedure and the possibly deviating zero position of the machine.
Note: Homing is stopped after having detected the state of the limit switch. The actual position allocated to this point is the negative offset.

Object: ***home offset*** *[607Ch]*
Unit: motorshafts revolutions [r]

4.3.2 Limit switches

The limit switches are used to border the drives movement range and for homing purposes.
The following configurations can be made at ***OPTIMISATION/ LIMIT SWITCHES:***

Limit Switch Surveillance

Inactive:
The drive is not affected by the limit switches.

Activ: an activated limit switch…
position control => … will cause a positioning error
speed control => … reduces the speed setpoint (depending on direction) to zero and switches the speed controller from PI- to P- characteristic.

Type of limit switches

Normally closed contacts:
an activated limit switch will set the DSVs digital input to 0V
Normally Open Contacts:
an activated limit switch will set the DSVs digital input to 24V

Notice:
Settings done at „Limit switch surveillance“ effort the function of the digital inputs and therefor the drives behaviour. See chapter 4.4.2 digital inputs.

4.3.3 „Turntable“ position mode (CANopen)

Turntable position mode is suited to drive applications with repeating positioning ranges like rotary indexing tables. With reaching the maximum defined angle resp. position ***(max turntable position***) the position will be reset to zero again.
Turntable position mode is selected with modes of operation = -5 (CANopen). In I/O operation the turntable position mode can be selected under **OPTIMISATION / OPERATION MODE** (**Inapplicable with DSV11x**).
Target positions are set as in the position modes as absolute or relative values. An additional parameter defines if a target position will be reached either optimal or with a predefined direction.
If „optimal“ is set, the direction of movement to reach the target position is defined through the effectively shortest distance. If the parameter „direction depended“ is choosen the movement is always in the same direction independent of the actual distance.
In CANopen operation setting is done through Bit11 and Bit12 of ***controlword***, in I/O operation (**Inapplicable with DSV11x**) setting is done under menu **OPTIMISATION / POSITIONING / TARGET POSITIONS**.

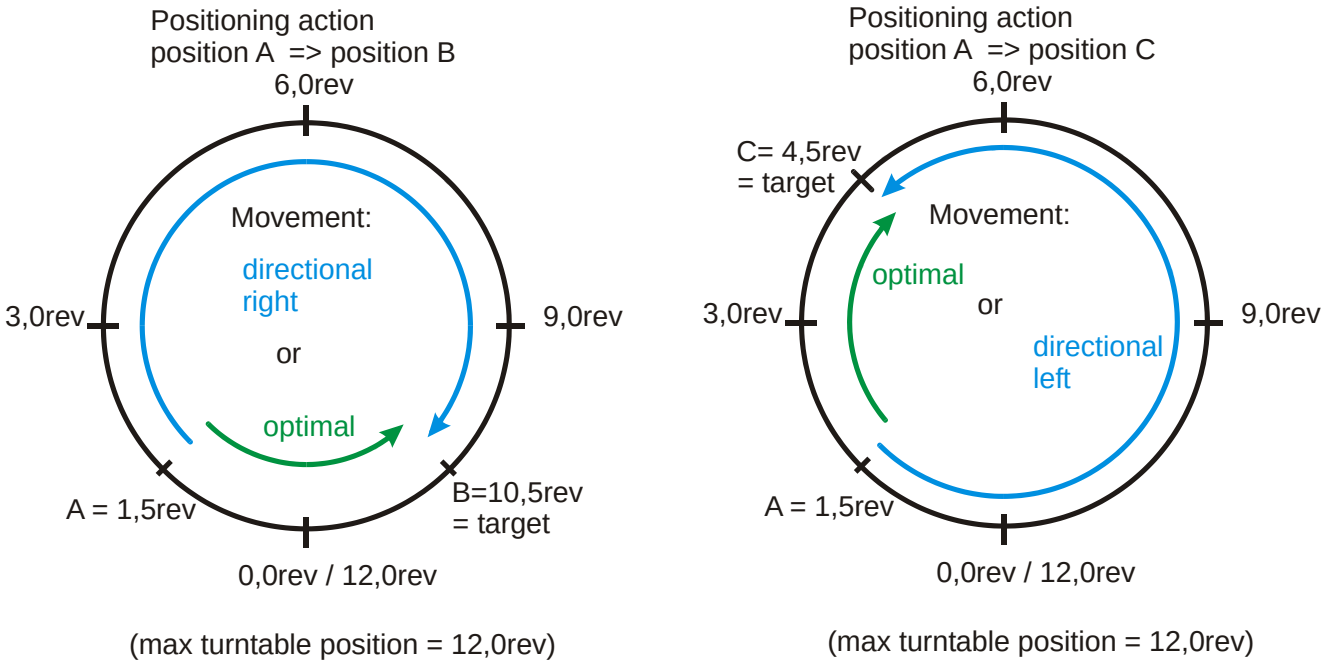


fig.: Example turntable position mode

Notice:
Allowed turntable range (***max turntable position***) :
1.0 … 260,000.0 motor revolutions

4.4 Supplementary functions

4.4.1 External limitation of speed / torque (CANopen)

The DSV11x has the possibility to apply an external limitation of either speed or torque /current.

In torque control mode the external speed limitation for example can be used to avoid an acceleration to excessive speeds in no load conditions.

In I/O operation (operation through analogue/digital I/O) the limitation can be activated in ***OPTIMISATION / OPERATING MODE*** and is applied to the actual operation mode.
In CANopen operation the limitation is selected via the object ***modes of operation***. Limitation values are set through the objects ***dynamic speed limit*** or ***dynamic torque limit.***

• Torque limitation during speed control

When the drive is set to speed control mode, the maximum torque will be limited according to the limitation setpoint. In I/O operation a 100% limitation setpoint value limits the current to the motors maximum current. (**Inapplicable with DSV11x**)
In CANopen operation this mode must be set with ***modes of operation*** = -3, the limitation value can be set with ***dynamic torque limit.***
Notice: I^2t-motor-protection stays active, i.e. as soon as the I^2t limitation activates, the current will be limited to the rated current and this may be below the external limit!

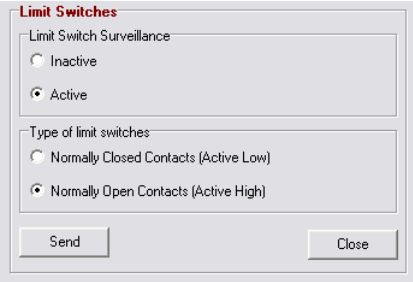
• Speed limitation during torque control

When the drive is set to torque control mode, the maximum speed will be limited according to the limitation setpoint. In analogue/digital I/O mode a 100% limitation setpoint value limits the speed to the setpoint scale speed (***OPTIMISATION / SPEED CONTROLLER)*** (**Inapplicable with DSV11x**)
In CANopen operation this mode is selected with ***modes of operation*** = -4 the limitation value can be set with ***dynamic speed limit***.

Notice:
When speed limitation during torque control is used, the speed control loop has to be tuned. The acceleration / deceleration ramp has to be switched off or set to its maximum. (*DSerV: linear ramp = 30.000 [10rpm/s]*).

4.4.2 Digital inputs

Digital input DI1 is assigned always to the power stages and controllers enable signal (+15...+30V => Enable).
In CANopen operation beside the "enable operation command" the DI1 must be set to reach the state "operation enabled.
Digital input DI4 is without any function in standard firmware.
The functionality of the digital inputs DI2 and DI3 depends on the selected mode of operation:



The menu ***OPTIMISATION / LIMITSWITCHES*** allows the following settings:

- ***Limit switch surveillance „inactive":***

  - Position control mode:

  DI2 / DI3: with limit- resp. reference switch functionality
  An activated limit switch does not lead to an error.

  - Speed control mode / torque control mode (I/O operation):

  Functionality DI2: Setpoint = 0
  The setpoint in speed and torque control mode will be set to zero, regardless its external settings. In torque control mode the drive will be almost free of torque.
  Ramp settings are not influenced, they remain active.
  Notice: In speed control mode the drive is not free of drifting!
  (optional"Halt": Drive stopps position controlled free from driftimg)

  Functionality DI3: Setpoint inverse
  Inverts the sign of the actual torque or speed setpoint.
  Ramp settings are not influenced and remain active.

  - Speed control mode / torque control mode (CANopen):

  DI2 / DI3 without function

- ***Limit switch surveillance „active":***

  - Position control mode:

  DI2 / DI3 with limit- resp. reference switch functionality
  An activated limit switch leads to an error.

  - Speed control mode / torque control mode:

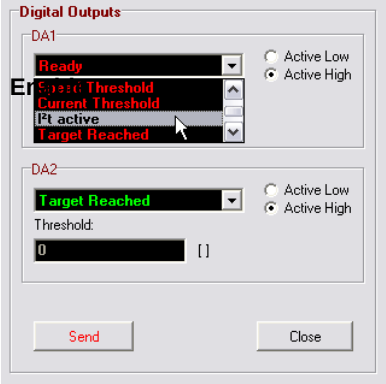
  DI2 / DI3 with limit- resp. reference switch functionality

  DI2= Limit switch right hand side
  Positive setpoint values will be suppressed, controller characteristic changes to a pure proportional controller to avoid torque in positive direction. Negative setpoint values remain unchanged.

  DE3= Limit switch left hand side
  According to limit switch right hand side: negative Suppression, but no influence on positive setpoint values.

4.4.3 Digital outputs

The function of the digital outputs DO1 and DO2 is configurable in the menu ***OPTIMISATION / DIGITAL OUTPUTS*** (see the DSerV software):



Active low/high Defines the output signal polarity

Shows the actual enable state.

Speed threshold Active when the actual speed > threshold speed

Current threshold Active when the actual current > threshold current.

I²t active Active when the I^2t limitation is active

Target reached Active after a positioning process is successfully concluded.

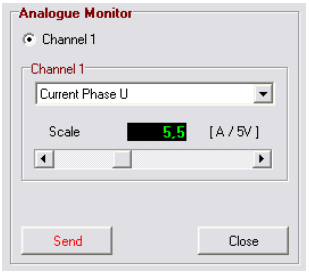
Ready Active when the controller is error-free

Following error Active when the actual following error > threshold value.

4.4.4 Analogue Monitor

The DSV11x features an analogue output with a resolution of 10 Bit at a voltage level of 5V ±5V to display internal values.

> **Notice:**
> When using the analogue output notice the tolerances of the center voltage, the cut-off frequency and the maximum output current! (see chapter 3 Technical Data)



In the menu ***OPTIMISATION / ANALOGUE MONITOR*** the following values can be selected and displayed at the desired scale:

actual speed

actual current in the q-axis I_q (torque producing current)

actual current in phase U

actual current in phase V

rotor position angle (fixed scaling 180°/5V)

following error

5 Pin assignment

5.1 X1 – Voltage supply and motor connection

device side connector: 6-pole combicon 5,08mm
cable side connector: 6-pole plug (Phoenix MSTB 2,5/6-ST-5,08)

Pin–No.	Abbreviation	BL motor operation	DC motor operation
1	U	motor phase U	motor +
2	V	motor phase V	motor -
3	W	motor phase W	(do not connect)
4	PE	motor PE	motor PE
5	+Ub	supply voltage 20…60VDC	
6	0V	supply voltage 0V	

5.2 X2 – Motor signals

device side connector: 9 – pole D-SUB (female)
cable side connector: 9 – pole D-SUB (male)

Pin– No.	Resolver		1Vss SinCos Hallsystem
1	cosine – signal	S2	cosine- signal
2	sine – signal	S1	sine- signal
3	GND		GND
4	rotor	R1	+10VDC supply
5	temperature probe motor +		
6	cosine – reference	S4	cosine- reference
7	sine – reference	S3	sine- reference
8	temperature probe motor –		
9	rotor	R2	GND supply

The angle sensor selection (resolver, 1Vss SinCos hallsystem) is done through jumper settings on the DSV´s PCB and DSerV settings in ***OPTIMISATION / MOTORSYSTEM*** . See also chapter 6.3 Jumper settings.

5.3 X3 – Signal connector

device side connector: 2x14-pole combicon 3.5mm
cable side connector: 2x14-pole plug (Phoenix FMC1,5/14-ST-3,5-RF)

	Pin– No.	Abbreviation	Description	Value
lower connector level	A1	CAN_H	Signal level CAN *1)	
	A2	CAN_L	Signal level CAN *1)	
	A3	Spur A	incremental encoder Signal A *2)	
	A4	Spur /A	incremental encoder Signal A inverted *2)	
	A5	Spur B	incremental encoder Signal B*2)	
	A6	Spur /B	incremental encoder Signal B inverted*2)	
	A7	Spur Z	incremental encoder Signal Z, zero pulse*2)	
	A8	Spur /Z	incremental encoder Signal Z inverted, zero pulse*2)	
	A9	+5V	supply voltage of incrmeental encoder +5V	5V, 200mA
	A10	GND	reference potential CAN interface / incremental encoder	
	A11	Tacho +	analogue tacho for speed feedback using DC- motors	±35V
	A12	Tacho -	analogue tacho for speed feedback using DC- motors	±35V
	A13	+10V	supply voltage for setpoint potentiometer	+10V 2,5mA
	A14	AGND	reference potential setpoint potentiometer *3)	
upper connector level	B1	DI1	digital input 1 (Enable input)	
	B2	DI2	digital input 2 (setpoint=0 /halt/ limit switch right hand side)	
	B3	DI3	digital input 3 (setpoint=invers /halt/ limit switch left hand side)	
	B4	DI4	digital input 4	
	B5	DO1	digital output 1 (configurable functionality)	24V, 50mA
	B6	DO2	digital output 2 (configurable functionality)	24V, 50mA
	B7	+U_EA	separate supply for DO's	24V
	B8	GND_EA	separate reference potential for the I/O's	0V
	B9	+U_H	internal auxiliary voltage +24V (voltage source) to stimulate digital inputs	16V, 50mA
	B10	GND	reference potential for auxiliary voltage	
	B11	AGND	analogue input/output reference potential *3)	
	B12	AA1	analogue output 1 (device monitoring)	5V ±5V, 10Bit
	B13	AE1+	analogue input (differential setponit input)	0... ±10V
	B14	AE1-		

*1) The CAN interface doesn´t support a galvanic isolation. Signal levels are referenced to GND.
An internal termination resistor can be activated by a jumper. See chapter 5.3 for further information.

*2) Incremental interface levels are internally configurable to RS422- or 5V TTL- levels. See chapter 5.3 for the jumperconfiguration

*3) Reference potentials GND and AGND are internally connected.

Notice:
There is a galvanic isolation between the digital inputs / outputs and the control unit. The potential references of the I/O's are +U_EA (X3.B7) and GND_EA (X3.B8). In case that no external control voltage is available, the internal auxiliary voltage can be used to excite the inputs and/or to supply the digital outputs. In that case, connect +UH (X3.B9) with +U_EA (X3.B7), as well as GND (X3.B10) with GND_EA (X3.B8). The galvanic separation is thus cancelled!

5.4 X4 – Serial interface RS232

device side connector: 9- pole D-SUB (male)
cable side connector: 9- pole D-SUB (female)

Pin- No.	Abbreviation	Description
1		n. c. (not connected)
2	RxD	receive data RS232
3	TxD	transmit data RS232
4		n. c.
5	GND	reference (ground) potential
6	DSR	used only for firmware download
7		n.c.
8		n.c.
9		n.c.

6 Installation

Attention!
Connect protective earth **prior** to installation!

6.1 Cable type, cable length and shielding

Notice:
The drives EMC characteristics are mainly depending on its mounting and installation.
in preparation

ENGEL supply cord set cables in standard lengths of 2m and 5m for optimal operation of the device. Other cable lengths can be supplied on demand.

Requirements for the motor cable:

- Minimum cross-sectional area for DSV11x: 1,0mm² (Attend voltage drop on the cable!)
- The motor cable must have an overall shielding which has to be connected to protective earth on the DSV side.
- Flexibility and temperature range have to be according to the specific application.

Signal wires within the motor cable (parking brake) have to be shielded separately and need separate connection from the motor wires by a shielding which, for safety reasons, is connected to protective earth.

Connect protective earth lead to X1.4 and connect the shielding mesh with minimized impedance to the housing potential.

Recommendation: Ölflex- Servo 700CY 4x 1.5mm² + (2 x 0.75mm²) StD-CY
Supplier: Lapp GmbH, Stuttgart, Germany; www.lappkabel.de

Requirements for the resolver- , incremental- u. tacho cable:

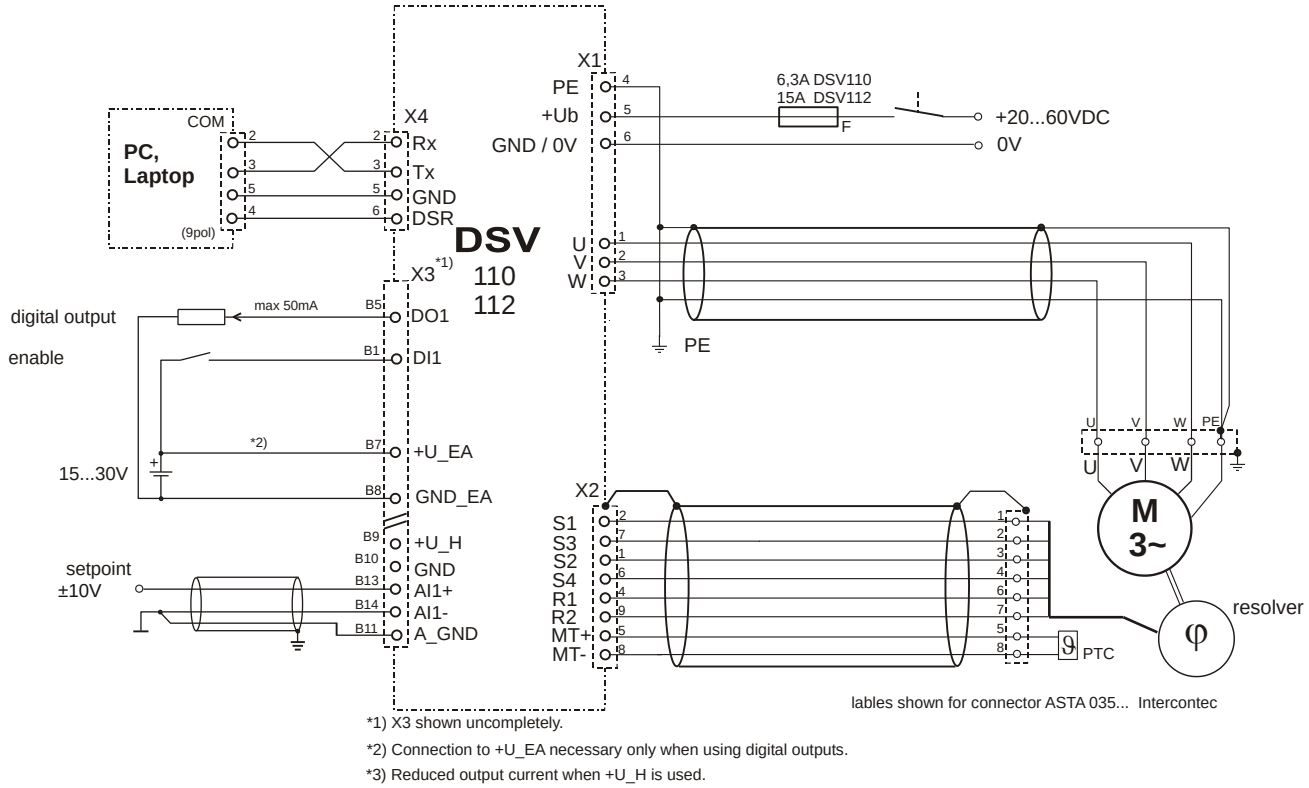
- Use twisted pair cables. Corresponding cable pairs are used for corresponding signals (resolver signal, incremental encoder, tacho voltage + und -)
- The cable must have an overall-shielding. The shield must be connected to protective earth on the DSV side.

Recommendation: Ölflex- Servo 720 CY 4x (2x 0,25mm²) + 2x 1mm² CY
Supplier: Lapp GmbH, Stuttgart, Germany; www.lappkabel.de

6.2 Installation diagram

The devices DSV110 and DSV112 can either operate with brushless three-phase synchronous motors or brush-type DC motors.
The following diagrams are only two examples of configuration and do not represent all possibilities of wiring.

6.2.1 Three-phase synchronous motor operation



Installation example for using internal auxilliary voltage +U_H :
Attention: No galvanic isolation of digital inputs and outputs!

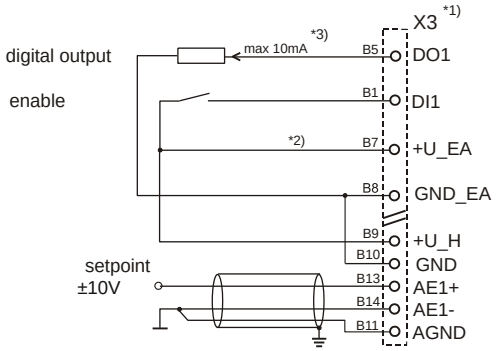
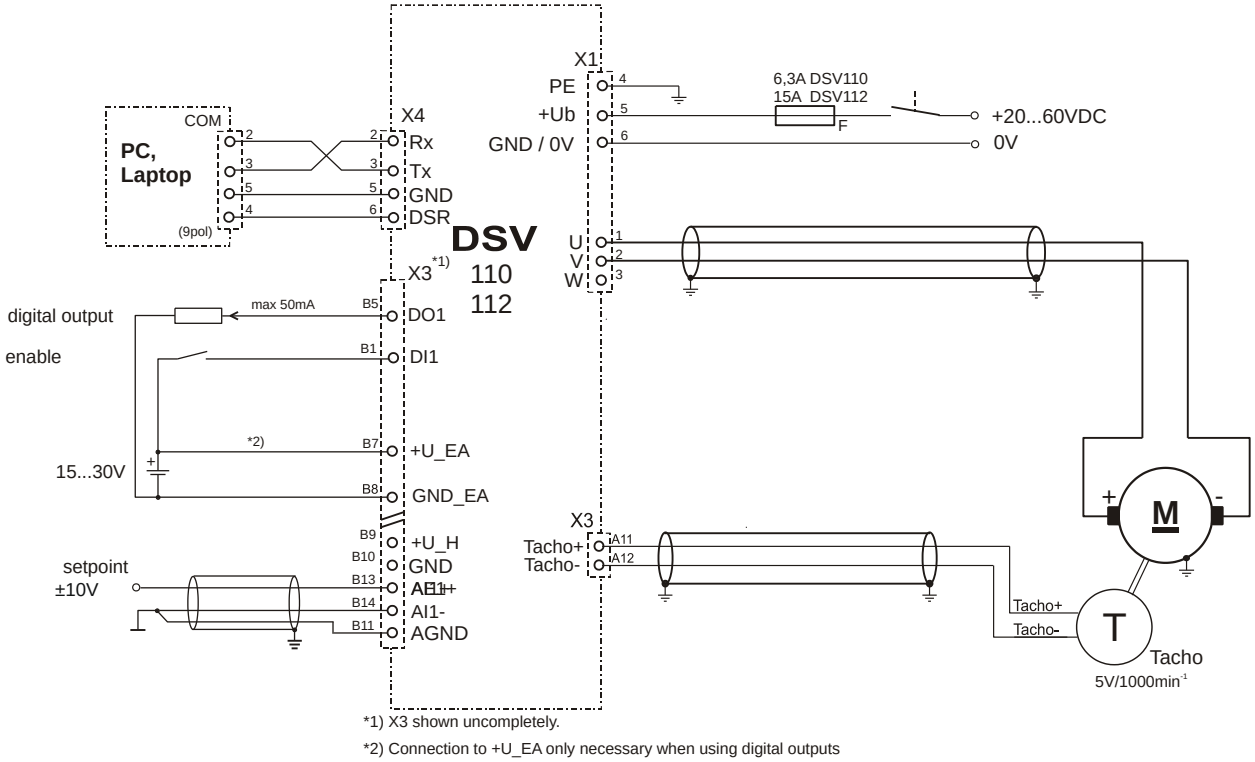


fig.: Installation diagram for a three-phase synchronous motor

Notice:
When connecting ENGEL BL motors, phases U and W have to be interchanged!

6.2.2 DC- motor operation



*1) X3 shown uncompletely.

*2) Connection to +U_EA only necessary when using digital outputs

fig.: Installation diagram for a DC motor

The diagram shows the setup with a DC tacho for speed feedback.

6.3 Jumper settings

Attention!
Remove all connectors before configuring the device!
Avoid static charging, do not touch electronic devices!
To configure the jumpers, the cover has to be removed. Therefore, remove the 4 screws on the cover.
Conductible parts on the printed circuit board cause destruction when switching-on the device.

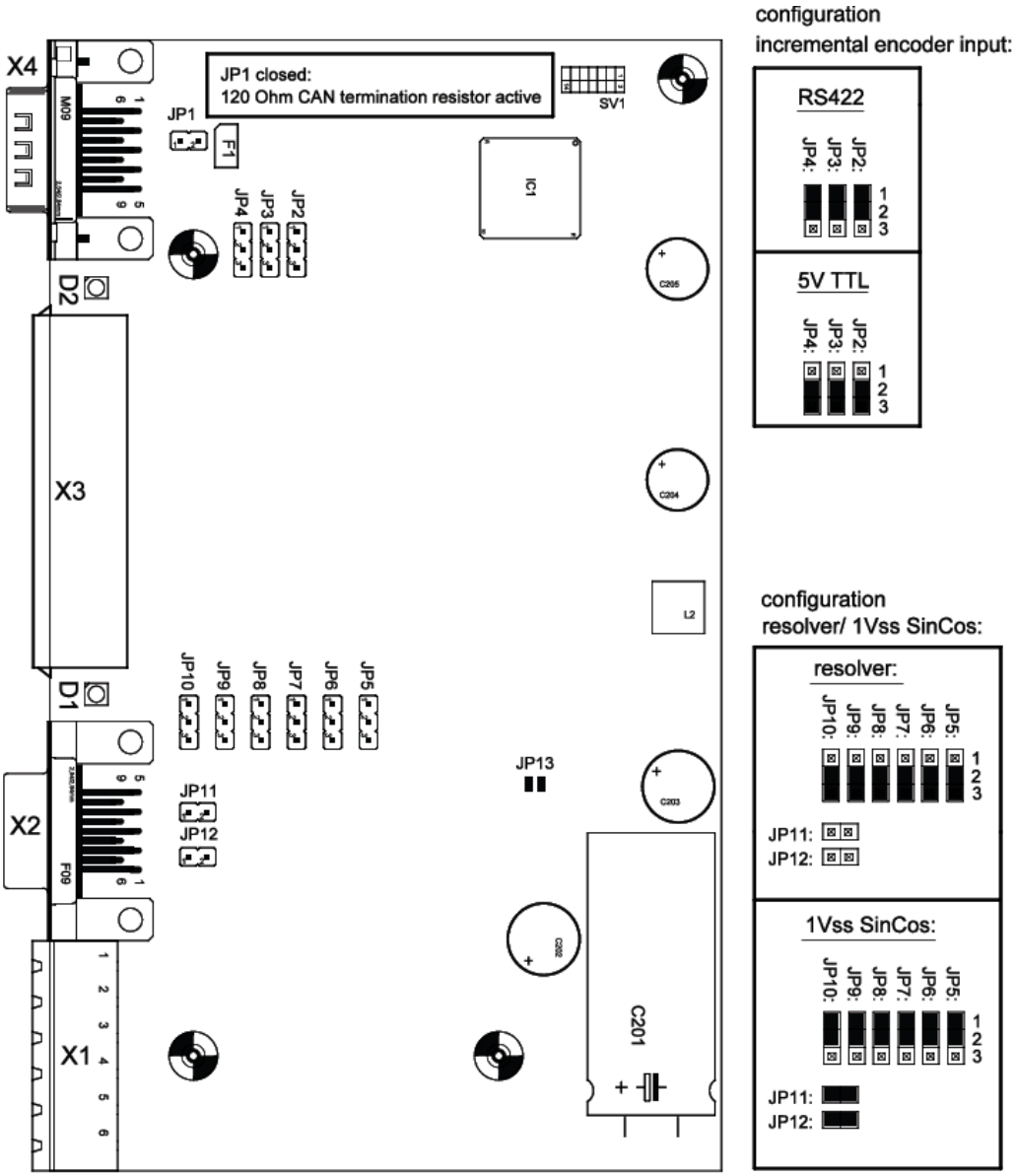


fig.: Jumper settings
The choice of the speed feedback sensor (resolver, 1Vss SinCos hallsystem) and the configuration of the incremental encoder interface (RS422/5V TTL) can be done via the jumpers on the PCB of the DSV11x. (Additional configurations in the DSerV menu ***OPTIMISATION / MOTORSYSTEM*** are necessary!)

7 Set-up procedure of the DSV11x

Attention!
During set-up the motor may turn. Make sure that the motor is securely fixed and that no danger can arise from the rotating motor/drive.

The following procedure is recommended to get the drive up and running:

Step 1: Installation

- Install the drive according to the installation diagram and wire all necessary digital and analogue inputs and outputs.
- Configure the jumpers as described in chapter 6.3 for proper installation of the resolver, tacho, BEMF and incremental encoder feedback.

Step 2: Check the installation

- Check your installation for any faults.

Step 3: Set to uncritical demanded values

- Set your external demanded values to minimum.
- Disable the drive (DI1 = OFF).

Step 4: Switch on the supply voltage

- Green LED blinks regular.

Remedies for typical errors at this point:
Error code **1**: motor temperature probe improperly connected.
Error code **5**: erroneous installation of resolver or rotor position sensor.
Other error codes: see error table in chapter 8.1.

Step 5: Connection to PC software DSerV

- Connect COM1 or COM2 of your PC / Laptop to X4 of the DSV using a crossed (null modem) cable and start DSerV.
- The status bar displays type and version of the DSV. For remedies in case of faulty connection see chapter 11.2.

Step 6: Check parameter set

- In the menu ***OPTIMISATION / CURRENT CONTROLLER*** check whether the rated and max current fit to the connected motor. If not, download the right parameter file or tune your controllers according to chapter 9.

Step 7: Enable power stage

- Switch enable input to high: Green LED is lit continuously.
- When applying a small speed demand, the motor will start rotating. For a positive speed demand, it will turn clockwise when looking at the shaft.

Remedies of typical errors at this point:
- Motor runs very rough or develops standstill torque: check proper connection of motor phases and resolver or rotor position sensor.
- Error codes: see table of error codes in chapter 8.1

Step 8: Ensure proper operation of your application

- Check all I/O signals for proper operation

8 Status indicator, error codes

The DSV11xs status indicators show clearly the operating status of the drive. Each of the two pairs of LED's (green and red) display the status of the drive (**Drive**), respectively of the CAN interface (**CAN**).
The drive (**Drive**) status LED´s can show the following states:

Drive LED green	Drive LED red		Operating Status
blinking	x	on	power stage ready, disabled
on	x	on	power stage ready, enabled
off	code	off	red LED shows highest active error code
off	off	off	Device without function: - Check supply voltage - Especially when USB-RS232 converters are used: disconnect RS232 and switch on the power supply again after a short delay time.

x = don't care

Attention!
Switch off the power supply before you start looking for errors!

The servo-controller DSV11x is equipped with an error register in order to detect and display even momentary errors, such as over-current.
An error causes the switch-off of the power stage and the motor drops out. Drive errors are indicated by the drive red LED (**Drive**) as a blinking code with the number of light pulses representing the error code. The table of error codes allows to determine the error and to find a remedy. In case of multiple errors, only the one with the highest priority is reported. The PC software DSerV shows the cause of the error in plain text.
After removing the cause of the error, the drive becomes operational again by changing the enable input from "OFF" to "ON". The powerstage will only be enabled after a second OFF/ON change.

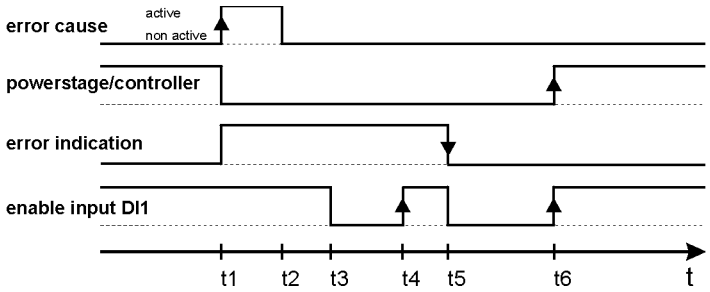


fig.: error logic

t1: Occurrence of an error: powerstage disabled, error indication active
t2: Cause of error relieved
t3: User sets enable input to off
t4: User sets enable input to on (1st OFF-ON-transition): powerstage / controller remain disabled
t5: User sets enable input to off. Error indication is reset as error is removed, ready relay is switched on.
t6: User sets enable input to on (2nd OFF-ON-transition): power stage and controller enabled

Switching the DSV mains supply off and on does also reset the error indication.

Notice: The error 10 "internal error" is not resettable with the enable input.

8.1 Table of error codes

The following table shows all possible error codes of the drives status indicator:

Error code Displayed	Meaning	Possible Remedies
no error code displayed	device without function	- Check supply voltage. - Especially when USB-RS232 converters are used: disconnect RS232 and switch on the power supply again after a short delay time.
1	motor temperature exceeds maximum	DSV adjusted to the motor rated current? Check the wiring
2	power stage temperature exceeds 85°C	Check installation conditions. Ambient temperature too high? Provide additional cooling if necessary.
3	internal auxiliary voltage missing	Check supply voltage. No further remedy if all right.
4	dc-link voltage exceeds maximum	Regenerating braking operation, adjust deceleration ramp if necessary.
5	resolver error, position sensor error	Check the resolver wiring, or rotor position sensor wiring.
6	undervoltage	Check input voltage.
7	over-current	Check motor wiring. Short circuit?
8	check sum parameter-memory	Parameter memory has not been read correctly. Error still present after switching off and on? => download known set of parameters => check parameters with DSerV and save with “save settings”.
9	erroneous set of parameters	Downloaded set of parameters faulty, parameters cannot be saved. => switch off and on to activate original parameters, or => use different parameter set.
10	internal error	Cause can not be relieved by user DSerV shows an internal Error code that allows to detect the error cause.
11	positioning error	DSerV shows a supplementary error number that allows to detect the error cause. See also the table for positioning errors.
12	fieldbus error	Fieldbus error. DSerV shows a supplementary error number that allows to detect the error cause. See also the table for positioning errors.

8.2 Additional error codes in position control mode

Assignment of additional error codes (displayed in DSerV) if a positioning error occurs:

Error Code	Meaning	Cause / Remedy
1	Actual position < Minimum positioning range	Actual position is less than the specified positioning range.
2	Actual position > Maximum positioning range	Actual position is greater than the specified positioning range.
3	Set position < Minimum positioning range	Pre-fixed set position is less than the specified positioning range.
4	Set position > Maximum positioning range	Pre-fixed set position is greater than the specified positioning range.
5	Erroneous parameter(s) in the positioning range	Inadmissible parameters of the positioning range, e.g. min>max.
6	Supervision of the limit switches	Inadmissible leaving of the positioning range specified by the limit switches.
7	Homing	Possible causes: - wrong parameters in the referencing method; - both limit switches active - wrong limit switch is activated during referencing. - homing against mech. stop: motor stop not detected.

8.3 CAN status indicator

The CAN bus status is indicated with the **CAN** status LEDs. The following states can be displayed:

CAN LED green	CAN LED red		Status
blinking	off		CAN bus OK Node DSV in state „pre-operational“
on	off		CAN bus OK Node DSV in state „operational“
off	code		CAN bus fault Code displays the error
off	off		DSV not in CAN bus operation

If a CAN bus error occurs the DSV will automatically cause an error 12 „ field bus error“, to disable controller and power stage.

8.4 CAN Bus error codes

Error Code	Meaning	Cause / Remedy
1	CAN controller overflow	High bus traffic, not to handle. Possibly reduce baudrate, optimize PDO communication
2	CAN bus off	Communication interrupted because of erroneous transmission. Baudrate set correctly? Node-ID set correctly?
3	CAN error passive	Nodes behaviour is passive only because of erroneous transmission.
4	Buffer overflow	High bus traffic, not to handle. Possibly reduce baudrate, optimize PDO communication
5	CAN power supply	CAN supply voltage (galv. isolated) faulty. Check supply voltage. (**Inapplicable with DSV11x**)
6	Reset Communication	NMT command „Reset communication“ was triggered.
7	Communication stopped	NMT command „stopped“ was triggered.

9 Controller tuning

When ordering a drive system consisting of servo controller and motor, the controllers will be pre-set to the motor data. If needed, the speed controller has to be adjusted according to the concrete application.
If no parameter file for the motor is present, the current controller and the speed controller have to be adjusted according to the proceedings described below.

9.1 Current controller tuning

Step 1: completely installed, wired and fully operational according to the set-up notes in chapter 6.

Step 2: Adjust parameters for rated and maximum current in the menu ***OPTIMISATION / CURRENT CONTROLLER***.
Rated and maximum current can be found in the motor's datasheet or on its name plate. As for geared motors, the maximum current is usually decided by the gear's maximum power and can be significantly lower than stated on the name plate. Refer to the gear's or geared motor's datasheet.
According to an ENGEL standard, all currents are given as peak values. RMS values have to be converted:
$I_{Scheitel} = I_{eff} \times \sqrt{2}$

Step 3: The current controller's proportional gain can be calculated as follows:

> **Notice:**
> The approach described below provides approximate values for proportional gain and time constant, which can vary from the ideal configuration in particular cases. The approach also applies for three-phase synchronous motors.

R_a => Resistance between two motor phases [Ω], specified in the datasheet

T_a => Electrical time constant [s], specified in the datasheet

Step 4: The current controller's time constant is equal to the one of the motor:

Time constant = T_a

T_a => Electrical time constant [s] as specified in the datasheet

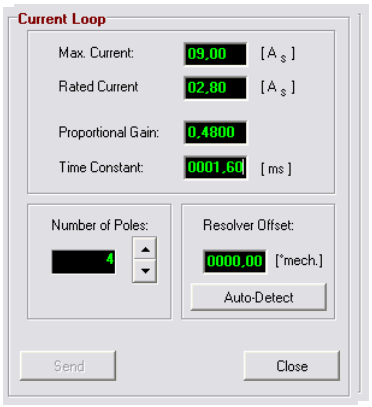
Example: **Tuning the current controller for motor BSR2650-R2.4 24V 4500UPM.**

From the datasheet:

rated current:	I_N = 30 A
max current :	I_s = 125 A
resistance:	Ra = 0.1 Ω
time conststant:	Ta = 0.7 ms

Proportional gain
$k_p = R_a * T_a * 2000$
= 0.1Ω * 0,7ms * 2000 = 0.14

time constant = T_a = 0.7ms



9.2 Resolver offset detection, motor poles

A basic requirement for operating a three phase synchronous motor is the exact current commutation. The commutation is defined through the connection of the motorphases (U,V,W), the motor poles and the alignment of the resolver angle to the angel of the motorsystem.
The motor poles (pole pairs x 2) are given in the motor datasheet and can be set under **OPTIMISATION / CURRENT CONTROLLER.**
The alignment of the resolver is done by an automatic resolver offset detection procedure and can be started under **OPTIMISATION / CURRENT CONTROLLER.**
Please mind the following hints:

Attention !
During the automatic resolver offset detection procedure the drive moves abruptly!
Please mind the following requirements:

- The motorshaft has to be unloaded
- Current controller is tuned according to chapter 9.1
- Motor poles are set correctly
- Attend to the hints displayed by DSerV

If the error code 10 appears, check the wiring of motor and resolver.
(False motor connection if the motorshaft has moved ccw first during the procedure)

9.3 Speed controller tuning

Notice:
Adjusting the speed controller does only make sense if the current controller is properly tuned. If needed, tune the current controller as described in chapter 9.1

9.3.1 Tuning a motor system with a speed sensor (resolver, hallsystem, incremental encoder, tacho)

Step 1: Drive completely installed, wired and fully operational according to the set-up notes in chapter 7.

Step 2: Make sure that the rated and maximum current are set correctly and the current controller is properly tuned. If needed, adjust the current controller as described in chapter 9.1.

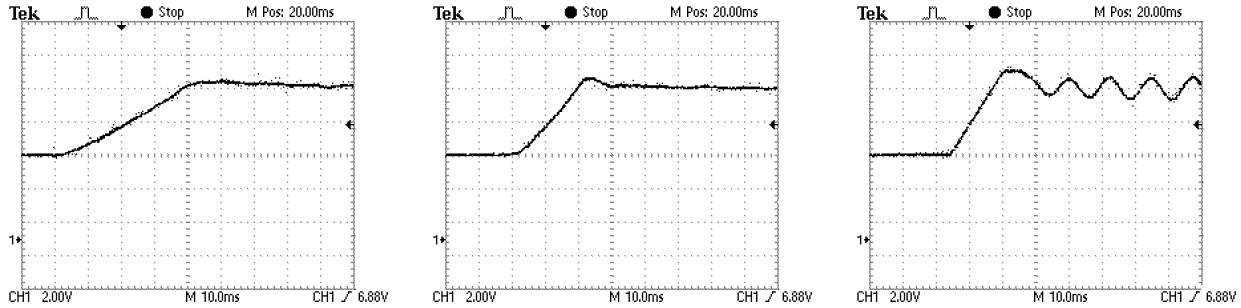
Step 3: To optimise the speed controller, the drive's dynamic behaviour has to be judged. Configure one of the analogue outputs as speed monitor and visualise the output voltage using an oscilloscope.
Adjust the analogue output in the menu ***OPTIMISATION*** / ***ANALOGUE MONITOR***.

Step 4: The parameters of the speed controller can be accessed in the menu ***OPTIMISATION / SPEED CONTROLLER.***
For optimising the speed controller, switch the speed ramp off or set it to the maximum acceleration and set the scaling of the set value according to the speed needed in that application.
First set the control parameters to uncritical values, i.e. low gain (approx. 0.05 .... 0.1) and high time constant.

Step 5: Set the demanded speed to approximately 75% of the rated speed and enable the drive.
Judge the speed vs. time curve. Then disable the drive.

Step 6: Increase the proportional gain by a few hundredths, enable the drive and judge speed vs. time curve again. Increase the gain until the drive starts to oscillate. Then reduce the gain until the oscillation is not visible anymore.

For optimum control, reduce the time constant until the speed set value is reached with one single overshoot of approximately 4-10%. See also diagrams below:



a) gain too low
time constant too high

b) ideal gain / time constant

c) gain too high
time constant too low

fig.: speed step-responses with varying speed controller parameters

9.3.2 Tuning of DC motors with BEMF control and IxR compensation

Step 1: Drive completely installed, wired and fully operational according to the set-up notes in chapter 6.

Step 2: Make sure that the rated and maximum current are set correctly and the current controller is properly tuned. If needed, adjust the current controller as described in chapter 8.1.

Step 3: The voltage constant and the terminating resistance of the motor are assigned in DSerV under ***OPTIMISATION / MOTOR.***
Voltage constant and motors terminating resistance are normally given in the datasheet.
The voltage constant can be estimated mathematically also:

$k_e = (U_N – I_N \times R_A – 2V) / n_N \times 1000$ where: U_N = rated voltage
I_N = rated current
R_A = termination resistance
n_N = rated speed

Example:

GNM 5480 24V 3000min^{-1} with: I_N=12.9A R_A=0.106Ω

k_e = 24V – 12.9A x 0.109Ohm / 3000min-1 * 1000 = **7.5 V/1000min^{-1}**

Notice:
Assigning the voltage constant and the terminal resistance as specified in the datasheet does not necessarily guarantee the ideal configuration for the controller. Typically, the IxR compensation has to be estimated by the value of the terminal resistance.

Programming lower terminal resistance values prevent oscillations!

The parameters of the speed controller can be accessed in the menu ***OPTIMISATION / SPEED CONTROLLER.*** First set the control parameters to uncritical values, i.e. low gain (approx. 0.05 .... 0.1) and high time constant.

Step 4: Set the demanded speed to approximately 75% of the rated speed and enable the drive.

If necessary, compare the real motor speed (e.g. laser tachometer) of the non loaded motor with the value displayed in DSerV and adjust the voltage constant. Test for multiple speeds (right/left).

Tune up the compensation value until the motor starts to oscillate. Then reduce the value until the motor is below the oscillating threshold.

Notice:
For BEMF control with IxR compensation, the analogue monitor displays a calculated value, which can vary from the real speed value significantly and is thus not always usable for optimisation.

Notice:
The high time constant of the speed capture is in BEMF- Mode with IxR compensation possibly makes the effect of Step 5 irreproducible.

Step 5: Tune up the speed controller gain some hundredth points and start the drive again from zero to nominal speed. Evaluate the characteristic of the speed.
Tune up the gain until the final rotation speed is reached without oscillation of the drive. For optimisation, turn down the time constant of the speed controller until the nominal speed is attained with only one overshoot (4-10% of the nominal speed).

10 Mechanical Dimensions

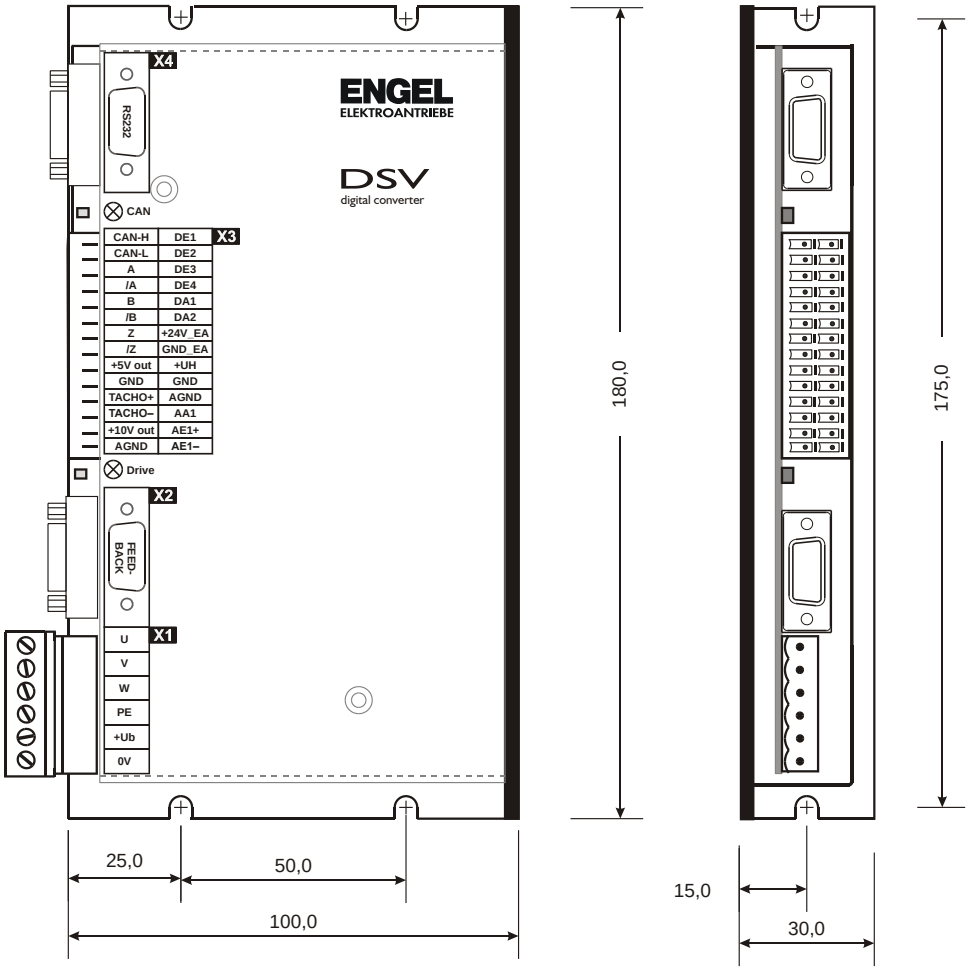


fig.: Mechanical dimensions of the DSV11x

Notice:
When mounting several DSV 11x in one cabinet, keep a free space of at least 30mm between two neighbouring DSV devices in order to enable cooling by natural convection.
Allow a space of 80 ... 100mm on the connection side of the DSV for connectors and wiring.

11 PC- Service- Software „DSerV“

The service software DSerV allows for a clear and easy configuration of the DSV. The operating condition, like the enable status and values such as speed and current, can be observed at a single glance. The operation modes, current limits and controller parameters can be adjusted via menus. All settings can be saved to the hard disk. The program language can be switched through English, German and French.

11.1 System requirements

For installation and operation of DSerV your system has to meet the following requirements:

- **IBM-compatible PC-AT (Laptop), 80486 upwards, with at least 16MB RAM;**
- **Microsoft- WINDOWS® 95, 98, NT 4.0, XP, 2000, Vista;**
- **3,5“ floppy disk drive or CD-ROM drive;**
- **serial Interface COM1, ... COM99;**
- **serial interface cable (standard cable: 9pole - 9pole, wires 2 and 3 crossed).**

11.2 Installation und running the program

Notice:
Carefully read the licence agreement prior to installing the software!
You accept all the regulations of the agreement a soon as you install the software!

The DSerV installation consists of copying the two program files to a folder on your hard disk. Take the following steps:

1. **Start WINDOWS.**
2. **Insert floppy disk or CD containing DSerV.**
3. **Start Windows – Explorer and create a working directory (File / New / Folder).**
   Suggestion: C:\Programme\ENGEL_DSERV.
4. **Copy DSERV.exe and *.dav into your working directory.**
5. **If present, copy parameter files *.par into subfolder PAR of your working directory.**

Connect your servo controller to your PC using the serial interface cable and switch on the DSV. Start DSerV by running DSerV.exe. There are three possibilities to start the program:

- In WINDOWS ***Start-Menu*** => ***Execute*** (choose file DSerV.exe in your working directory).
- Double-click on DSerV.exe in your “Explorer”.
- Double-click on the DSerV-icon

Shortcut to DSerV.exe must exist; if not, create one:
Right-click Desktop, select ***NEW → SHORTCUT***, choose DSerV.exe and follow the instructions. The DSerV icon will appear on your desktop.

On start-up, DSerV will establish a connection to the DSV and the program window will appear. The system is ready to use.

Notice:
Check the following points in case DSerV can not establish a connection:
- Correct COM-port selected? (***OPTIONS*** / ***COM-PORT***)
- Number of COM-port larger than 99 (USB to RS232 converter)?

In the extended connection options of the controller….
- Serial cable connected to PC and servo-controller?
- Servo-controller switched ON?
- Does the *.dav file in your working directory match type and firmware of your servo-controller?
- Connect the RS232 after supplying the DSV.

11.3 Using DSerV

Main Menu
Select functions here

Monitor Window
Display of …
actual and demanded values,
currents, speeds,
I²t integrator,
temperatures,
inputs/ outputs

Status Bar
Display of…
device type,
firmware version,
drive status,
errors in plain text,
communication status

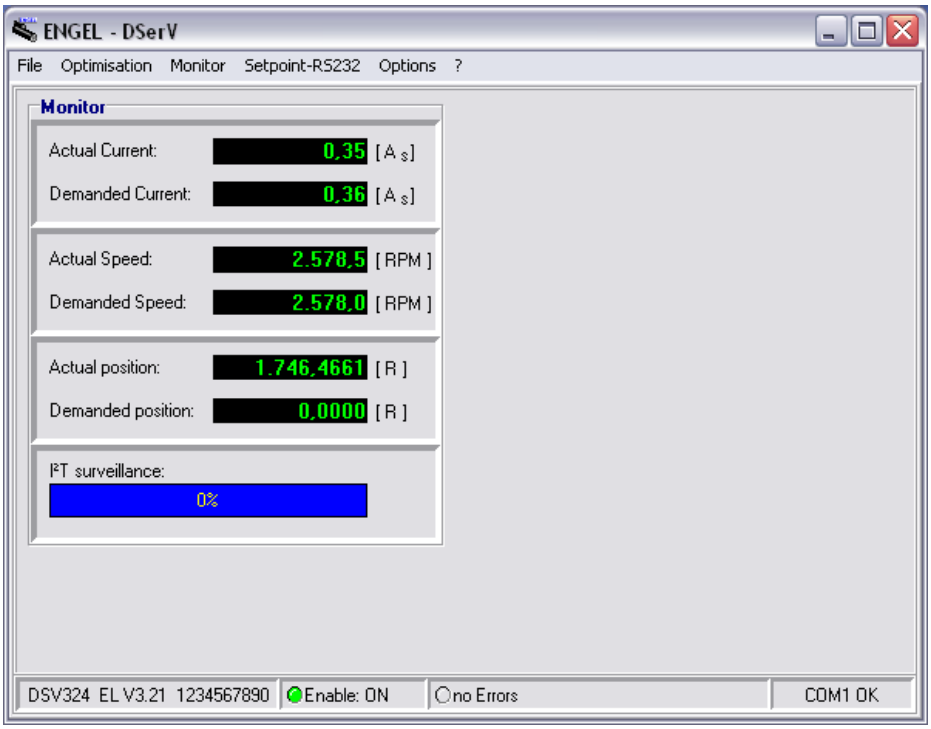


fig: DSerV window

DSerV is an intuitive software with a graphical user interface typical for WINDOWS programs. The DSerV menus and functions are explained below:

11.3.1 Menu ‘File’

This menu allows access to the following functions:

Connect: Establishes a communication link with the DSV via RS232

Disconnect: Stops communication with the DSV and frees the serial interface.

Parameter Up-/Download:

Upload: Uploads the current set of DSV parameters and saves it to a *.par file. The file can be amended with a description and saved to disk.

Download: Downloads a set of parameters from a *.par file to the DSV. For an overview all available files are listed together with their description.

Firmware download: Opens the dialog to download Firmware into the DSV. Follow the instructions. Necessary *.hex files are provided on request.

Close: Closes DSerV.

11.3.2 Menu 'Optimisation'

This menu allows for manual adjustment of all DSV parameters.

Notice:
Parameter settings transmitted via the **TRANSMIT –** button are available in the servo-controller straight away.
All changes in the parameter set are saved in non-volatile memory on clicking ***SAVE PARAMETERS.*** They are still present after switching the controller off and on again.

The following sub-menus are available:

Operation mode: Switch between speed control and torque control, select your source of set values.

Fieldbus: Selects the fieldbus-operation of the drive. Adjustment for fieldbus- addresses and baudrate.

Current controller: Adjustment of rated and maximum current, as well as parameters of the current controller.

Speed controller: Adjustment of set value scaling, set value ramp and parameters of the speed controller.

Positioning: Adjustment of positioning and referencing parameters.

Digital outputs: Select functionality of digital outputs.

Limit switches: Configuration of the limit switches.

Analogue monitor: Select functionality and scaling of analogue outputs.

Fieldbus: Selects the fieldbus functionality.

Temperature probe motor: Switch between linear temperature probe KTY 83 and PTC resistor to protect the motor. If a linear temperature probe is chosen, the temperature threshold must be adjusted (max. 130°C). The actual motor temperature can be selected as monitoring function.

Save parameters: Saves parameters and settings in the DSV's non-volatile memory.

11.3.3 Menu 'Monitor'

The monitor window can be configured by switching on or off the display for different values.

> **Notice:**
> The refresh rate of single values decreases with rising number of monitor windows. Close the unnecessary windows.

Speed:	actual and set speed
Current:	actual and set current
Position:	actual and set position
Contouring error:	Deviation of the position in position control mode
I²t- Monitoring:	Shows the drive's overload capacity. Increasing display means "drive overloaded". At 100% integrator value, the output current is reduced to rated current. Overloading is re-enabled below 50% integrator value.
Motor temperature:	Only with linear temperature probe
Power-stage temperature:	Temperature of the power electronics heat-sink
Digital I/O:	Shows the state of all digital in- and outputs

11.3.4 Menu 'Set value - RS232'

On clicking the menu item "Set value RS232" a sliding bar is displayed. When the RS232 is selected as source of set values, this bar represents the demanded value for current, respectively speed. Moving the bar left / right increases / decreases the set value accordingly.

11.3.5 Menu 'Option'

COM-Port:	Select COM port in use
Language:	Select language: English / German / French

11.3.6 Menu 'Info'

Displays information about DSerV