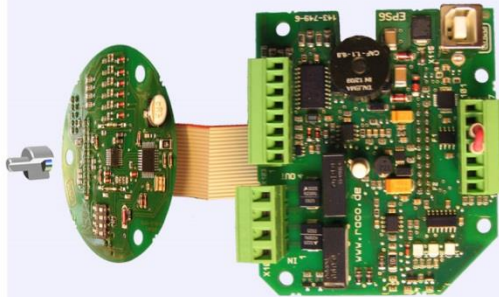


EPS 06



- **Electronic Limit Switches**
- **Analog Output Position Signal**
- **Very Accurate**
- **Easy To Use**
- **Robust**
- **Dependable**
- **High Resolution**
- **Non Contact Measurement**
- **Wide Temp. Range**

EPS 06 Operating Instructions RACO Electronic Position Sensor

Introduction

The RACO electronic positioning system EPS 06 is an enhanced and expanded version of the EPS 02. The EPS 06 has been especially designed to interface the electro-mechanical linear actuator with process automation systems. The operating principal of the position sensor, is based on a non contact coupling through a magnetic field. The stationary sensor on the printed circuit board detects angular movement of the rotating motor shaft or actuator screw and converts this signal into an absolute linear position signal. The electronic position sensor EPS 06 is typically integrated into the actuators accessory housing "A" mounted at the opposite side of the motor drive shaft.



EPS 06 in rear housing type "A"

If the actuator is equipped with additional auxiliary equipment like hand wheel, etc. the electronic position sensor will be mounted in the lateral accessory housing "D" located at the coupling housing that connects the actuator power screw with the drive motor.



EPS 06 in rear housing type G

The EPS 06 is equipped with two potential free relay output channels, which can be used to adjust the end of stroke limits, via the on board optical isolated USB and / or TTL communication interface. As an easy to use interface the RACO Tools setup software is required to make changes to the limit switch

setting, as well as the scaling of the analog channels.

In addition, an optional external reference limit switch can be used to set the retracted limit position. Three on board LED's will function as operation control signals.

Functions

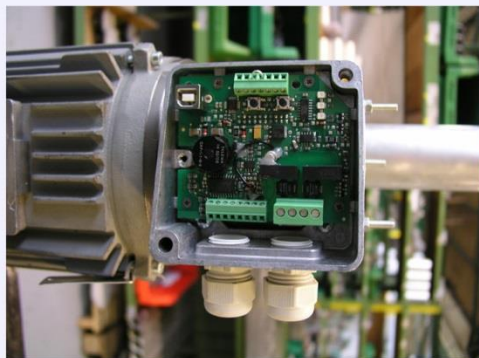
The EPS 06 functions include end of stroke limit switch detection, setup of four additional discreet position output signals, and analog feedback capability in the form of 4-20mA; 0-10V and / or a pulse width modulation output signal. Also included is thrust overload monitoring, actuator motor over-temperature thermal switch detection, and external reference limit switch functionality.

Limit Switches & Mid Stroke Positions

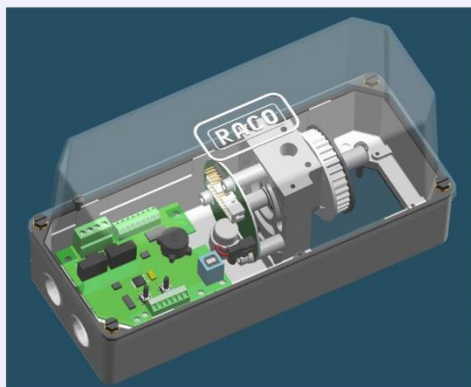
The EPS 06 is equipped with up to six independent limit output channels. Two of these six output channels are designated for the end of stroke limit switch adjustment and are equipped with potential free relay output contacts on terminal X100 pin 1 to 4.

The remaining four output channels are 24V DC open collector NPN transistor output channels on terminal X103 pin 5 to 8, which can be used for variable length stroke position indication. The position switch hysteresis is adjustable with one parameter for all six channels. All parameter values are selectable with the RACO Tools setup program.

EPS 06



**EPS 06 Mounted in Rear
Accessory Housing “A”**



**EPS 06 Mounted in Lateral
Accessory Housing “D”**

Analog Position Signal

The actual position of the actuator will be transferred via the analog output channels. There are two analog channels available, a voltage signal with a sweep of 0-10V and a current loop signal with a sweep of 0-20mA. Terminal X103 pin 3 supplies the current signal, pin 4 supplies the voltage signal. The signal scaling, definition of beginning and end position and the direction can be selected and set with the RACO Tools setup program.

Pulse Width Modulation Signal

Digital output channel 4, terminal X103 pin 6, can be configured as a PWM output signal. The output frequency is 1 kHz, whereby the on / off relationship is proportional to the actual position of the actuator. Scaling and offset calibration is performed in the same way as the voltage or current feedback signal calibration in the RACO Tools setup program.

Encoder Signal

As a factory default setting, digital output channel 5 and 6, on terminal X103 pin 7 and 8, can be configured as 90° phase shifted square encoder pulses. The pulse frequency can be selected in four incremental steps from 32 to 256 pulses per 360° revolution on the sensor head.

Thrust overload protection

Thrust overload protection is realized by measuring the motor RPM and applying the motor torque / RPM relationship to a predefined speed setpoint. The motor control start signals to extend or retract the actuator have to be wired into the EPS06 on terminal X101 pin 1 and 2. These input signals are motor rotational dependent and used for the actuator motor startup time suppression until the motor RPM is monitored. If the actuator motor RPM value drops below the predefined setpoint, the corresponding limit switch output channels extend or retract will

be disabled and power to the motor will be interrupted. In addition, the limit switch supervision and motor over-temperature monitoring are still active.

Motor Over-Temperature Switch

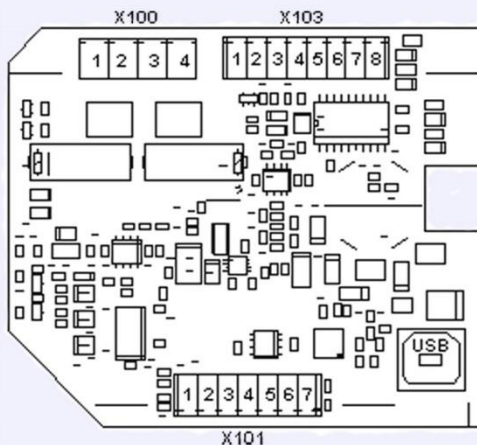
To protect the RACO actuator motor from overheating, for example from frequent starts and stops or excessive overloading of the actuator, the opening of the motor thermal switch will be monitored. If the motor thermal switch is wired into terminals X101 pin 4 and pin 5, both limit switch relay contacts will open up in the event of an over temperature. The red LED will blink on and off to indicate the fault condition.

External Reference Switch

An optional external reference switch can be used to define the retracted position. The external device has to be a normally open limit switch or a PNP proximity switch. The switch would be connected between terminal X101 pin 3 and pin 4. In the mode “external reference switch”, the actuator will retract until the external switch is made. With the rising voltage edge at the input X101 pin 3, the internal EPS 06 position reference point will be set to zero each time. The extended stroke limit position is defined by the stored stroke length and the above described zero position.

Make sure that the external reference switch is positioned in front of the mechanical limit of the actuator or the attached equipment. Failure to do so can cause mechanical damage to the actuator or the equipment. Please be advised that by moving the external reference switch the extended position will be moved as well by the same distance in the same direction. The stroke is stored as a fixed length with the zero position defined by the external limit switch.

EPS 06



- **EPS 06 Circuit Board Layout**
- **USB Interface**
- **Pluggable Connection**
- **Potential Free Relay Outputs**
- **LED Indicator**
- **Backup Battery**

Connection

The EPS 06 is equipped with a four pole pluggable X100 connector for the limit switch output relay contacts, and a seven pole pluggable X101 connector for the 24V DC power supply, external limit switch, the motor thermal switch and two binary input signals identifying the forward / reverse stroke direction. The eight pole pluggable X103 connector provides the four additional open collector limit output signals, and the 0-20mA / 0-10V absolute position signal. For the physical layout please refer to the connection diagram.

Power Supply Connector X101

The seven pole female connector is equipped with screw terminals for easy interface to customers control wires. Each terminal will accept one # 16 AWG wire.

- Pin 1 Time Delay Extend
- Pin 2 Time Delay Retract
- Pin 3 External Reference Switch
- Pin 4 Aux 24V DC Supply
- Pin 5 Motor Over Temperature Switch
- Pin 6 GND
- Pin 7 +24V DC

Relay Contact Plug X100

There are two potential free relay output contacts available to shut down the actuator. The contacts should be hard wired into the reversing motor starter or VFD control circuit to provide reliable end of stroke protection. Within the permissible stroke range of the actuator the contacts are closed. Relay output contact connected to terminal X100 pin 1+2 will be opened, if the selected retract position is reached or if 24V DC on the external reference switch input X101 pin 3 is present. Relay output contact connected to terminal X100 pin 3+4 will be opened if the selected extend position is reached.

- X100 pin 1+2: Limit Retract
- X100 pin 3+4: Limit Extend

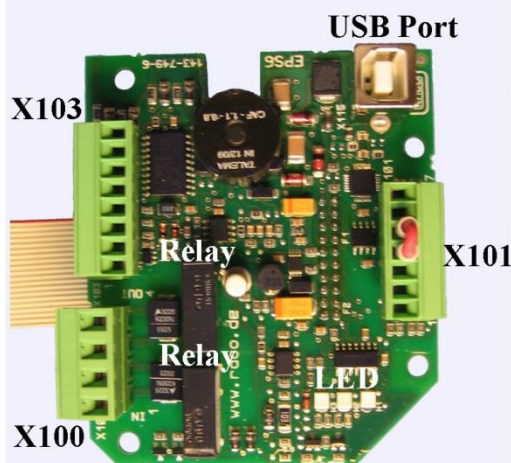
Note: If the 24V DC supply power is turned off both relay output contacts will open up.

Binary & Analog Output Plug X103

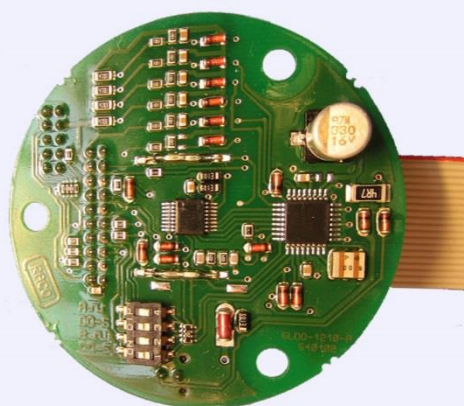
There are four additional output signals available, which are configurable with the RACO Tools setup software. All four 24V DC binary output signals can be configured as stroke dependent individual limits with up to eight individual stroke setpoints, or output 4 as a stroke dependent PWM signal or output 5 and 6 as 90 deg. phase shifted encoder signal. The maximal current per output channel is limited to 100mA. An internal 10kΩ pull up resistor will give each output signal a defined state. Both analog output channels, 0-10V and 0-20mA, are active at all times. With the selection of the type of analog signal via the RACO Tool software, the internal feed back control loop on the EPS 06 will be switched from one analog channel to the other. Therefore only one output channel should be used as the accurate signal. The burden for the 20mA loop signal should be between 390Ω and 1kΩ.

- Pin 1 Signal Ground
- Pin 2 Signal Ground
- Pin 3 Analog Output Current Loop
- Pin 4 Analog Output Voltage
- Pin 5 Stroke Limit Output 3
- Pin 6 Stroke Limit Output 4
- Pin 7 Stroke Limit Output 5
- Pin 8 Stroke Limit Output 6

EPS 06



EPS 06 Expansion Board



EPS 06 Sensor Board

LED Display

The operating status of the EPS 06 will be indicated via three on board LED's.

LED green:

LED is on steady if the actuator is in its selected stroke range. The LED is off if the actuator has reached its retracted end position or the external limit switch signal is on.

LED yellow:

LED is on steady if the actuator is in its selected stroke range. The LED is off if the actuator has reached its extended end position.

LED red:

LED is on steady if the motor over temperature switch is open or not connected. The LED is flashing if the rotating magnetic sensor axis is not in line with the stationary circuit board sensor head.

If all LED's are flashing in the rotating order yellow, green, red the stationary circuit board sensor head is not mounted properly. As a result, the distance between the magnet on the rotating shaft may be too large or too small or not pointing to the center of the sensor. The mounting of the printed circuit board should be checked. Without proper mechanical adjustment the board is not operational, therefore, a reliable function of the limit switches and the analog output signal can not be guaranteed.

Technical Data

EPS 06 Power Supply requirement:

Voltage: 24V DC

Range: +20% / -30 %

Current: min 50 mA, max 600 mA

Dependent on Output Configuration

Two Output Relay Contact:

Max Voltage: 250V AC @ 5A

30V DC @ 5A

Four Open Collector Output Channels:
24V DC; max 100mA, short circuit protections

Two Analog Output Channels:

0-10V DC; max 5mA or 0(4)-20mA

Resolution: 10 Bit

Four Digital Inputs:

Voltage level: 24V DC

Range: +20% / -30%

Stroke Direction:

- Two Aux. contacts reversing starter
- Motor Over Temperature Protection: Thermal Switch
- External Limit: Proximity or Position Switch

Position Accuracy: Stroke Length /
10 Bit * RPM on Sensor Shaft

Data Storage:

Duration: 10 Years

Battery: Lithium 1.2Ah

Operating Temperature: -40° F to 185° F

Protective Rating: IP 00, circuit board sealed

Enclosure: Without

Connector: Pluggable terminal connection

Interface: Optical Isolated USB Port & Serial TTL Interface

Software Configuration RACO Tools

The Windows based RACO Tool configuration software provides an easy and quick tool to configure and adjust, without any screwdriver or meter, all parameters necessary to operate the RACO electronic position sensor. Four tabs divide the setup functionality in logical sections:

Cylinder Setting

Digital Output Configuration

Analog Output Configuration

Thrust Overload Function

EPS 06

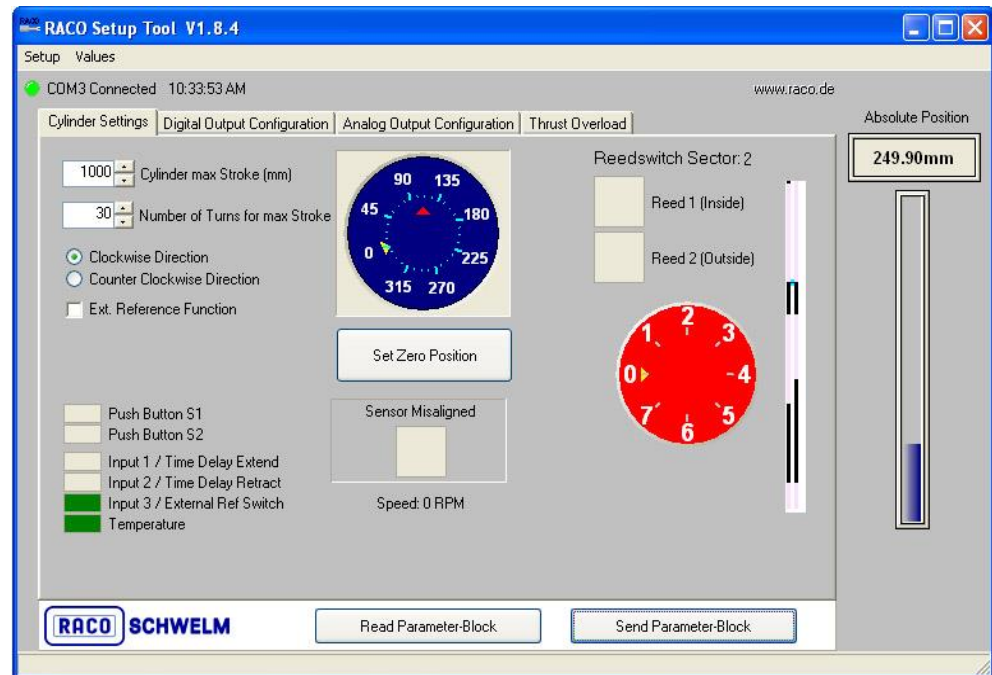
Cylinder Setting Screen:

Display Functions:

Absolute Position
Status of Binary Inputs
Reed Switch Diagnostic
Angular Position
Connection Status
Sensor Head Alignment

Input Functions:

Stroke length of Actuator
Relationship of Stroke length
to Number of Rotations
Set Counter Zero Position
Clockwise or Counter
Clockwise Direction
Set Zero Position
Read Parameters from EPS 06
Write Parameters to EPS06



Cylinder Setting

The first screen displays the essential functions of the EPS 06 and ties the actuator specific parameters to the sensor unit. In most cases the following parameters are already factory set. Starting at the left hand corner:

Cylinder max Stroke: Nominal stroke length of the purchased actuator in millimeters.

Number of Motor Turns for max Stroke: This value represents the number of rotations at the EPS 06 sensor head to account for the full nominal stroke of the actuator.

Clockwise or Counter Clockwise Direction: The physical location of the EPS06 position sensor, in the "A" or "D" accessory housing, "C" design or number of stages in the utilized gearbox if so equipped, decides the direction of rotation at the sensor head in relation to the stroke direction. With the radio buttons a counting direction will be selected.

External Reference Function: If an external reference switch is used, this selector box will be enabled. The positive edge of the external reference switch will set the absolute position to 0mm.

The below six input status display windows indicate the binary input channel conditions:

- Push Button S1, S2 (EPS02 only)
- Input 1, 2; Time Delay Extend / Retract
- Input 3; External Reference Switch
- Over Temperature Switch

Set Zero Position: In the center of the screen, below the angular rotation display, the set zero push button is located. By pushing this button the absolute position will be set to 0mm and stored in the battery backed up RAM. The factory set zero position represents the physical retracted end position. This position should never be reached under normal operating conditions.

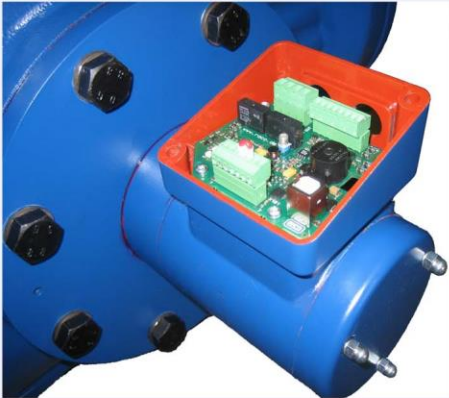
Sensor Misaligned:

If the distance or alignment between the sensor head and the rotating magnet is out of range the normally gray field will turn purple.

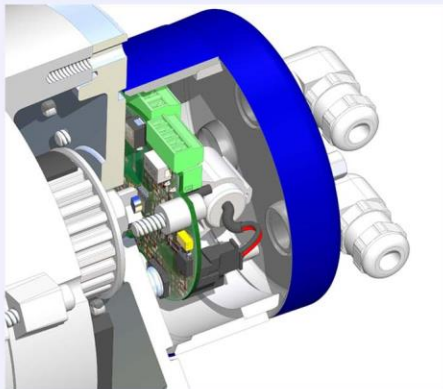
Speed 0 RPM: Displays the RPM value on the sensor head.

Read Parameter Block / Send Parameter Block: By pressing the button read or send parameter block, the upload or download RACO Tool software function will be initiated and all parameters will be exchanged via the USB and or TTL communication interface between the EPS 06 and the

EPS 06



**EPS 06 Mounted on Right
Angle Gearbox Size 11**



EPS 02 Mounted on "C" Housing

service computer. Parameter sets can be stored and read via the "Values" control bar pull down menu at the top of the screen on the hard drive. To store the changed data from the screen into the EPS06, the send Parameter Block button needs to be pushed. This refers to all configuration screens.

Reed switch sector: The reed switch sector display block is for diagnostic and functional supervision of the imbedded reed switches.

Absolute position: The absolute position indication is a calculated value out of the predefined "motor turns for full length", the "Cylinder length" values and the selection of the "Set zero position". The slide bar output and numerical value is updated immediately as the sensor changes its rotational position.

EPS 06

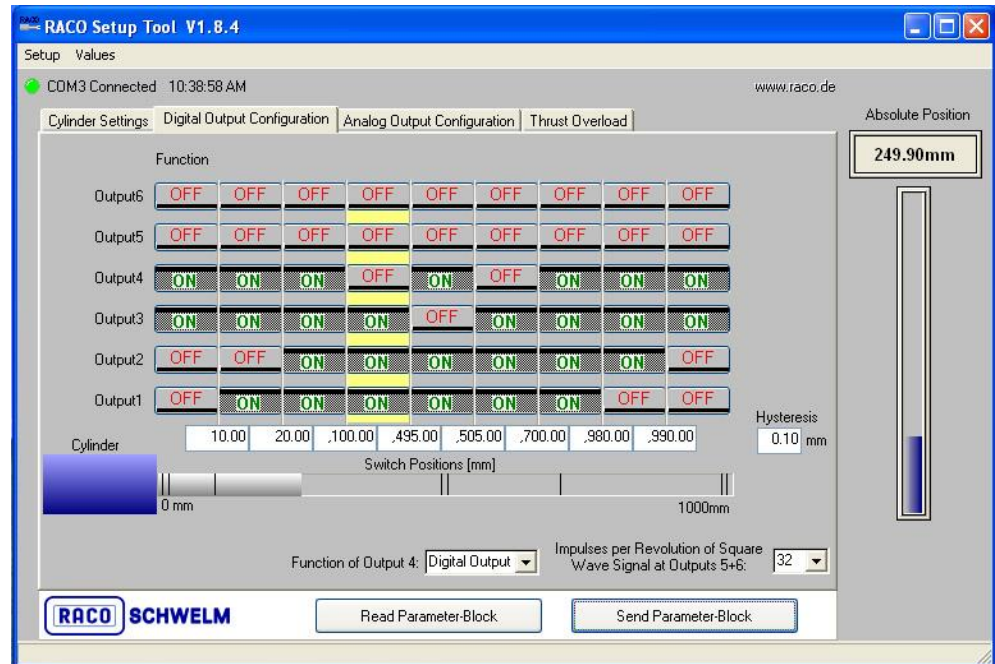
Digital Output Configuration Screen:

Display Functions:

Absolute Position
On / Off selection of Outputs
Limit Positions

Input Functions:

Setting of End of Stroke Limits
Setting of Intermediate Limits
Selection of Output function
On/Off or Off/On
Enable PWM
Width of Hysteresis



Digital output configuration: The screen provides an easy selection of assigning stroke limit switching points over the entire stroke length of the actuator. Each of the six output channels have a selection of up to nine independent switching points for up to eight independent stroke setpoints. The selection of each switching point can be active high or active low. If not all switching points are used a negative one in the field switch position will turn off the associate fields.

Hysteresis: The selected hysteresis number provides a negative and positive band around the selected switching point. This number should be selected large enough to avoid shattering of the output signal and small enough to provide the desired position accuracy.

Function of Output 4: Output channel four can be switched from a position limit output signal to a pulse width modulation (PWM) output signal. The signal parameters are selected in the following "Analog Output Configuration" screen description. The PWM signal has a carrier frequency of 1kHz and the "on" and "off" time of the square pulse signal is proportional to the selected stroke length. The signal output is very noise immune and an inexpensive alternative to analog input channels on customers PLC control equipment.

Impulses per Revolution of Square Wave Signal at Output 5+6: The frequency of the 90° phase shifted A B encoder signal can be selected from 32, 64, 128, 256 pulses per revolution of the sensor head. This gives the user a wide range to adapt the encoder to VFD or PLC input cards.

EPS 06

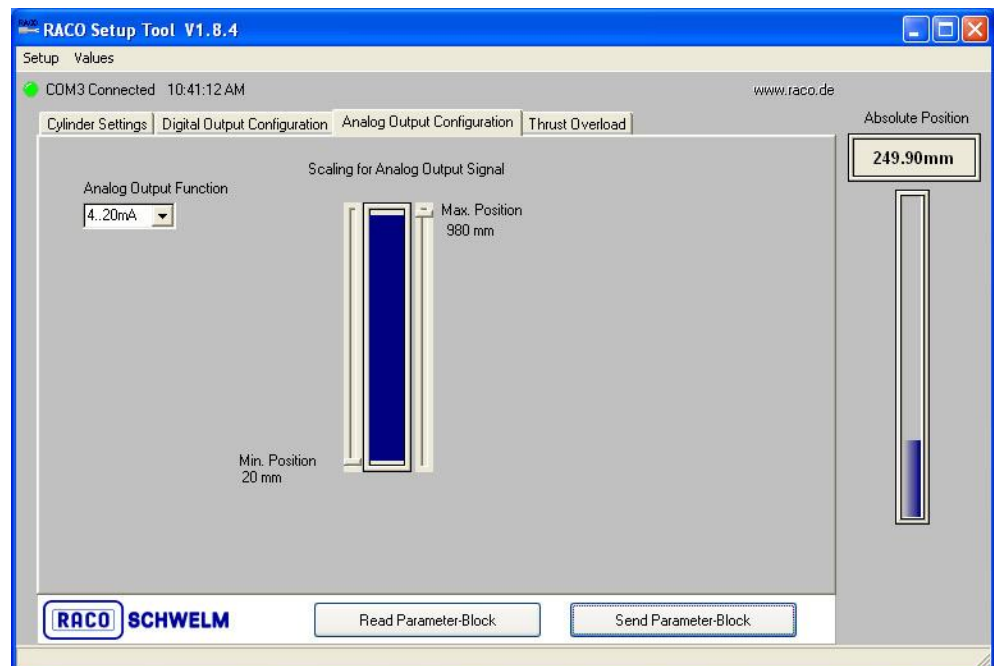
Analog Output Configuration Screen:

Display Functions:

Absolute Position
Selected Analog signal
Scaling of Analog Signal

Input Functions:

Selection of Analog Signal
Scaling of min Position
Scaling of max Position



Analog Output Function: With the pull down menu “Analog Output Function” the following selections can be made: 0-10V, 10-0V, 0-20mA, 20-0mA, 4-20mA and 20-4mA. Based on the selection “Cylinder max Stroke“ from the main screen the ”Limits for Analog Output Signal” slide bar is initialized. The two slide potentiometers on the left and right side of the slide bar make it very easy to adjust the offset and gain of the analog output signal in relation to the desired stroke length. In most cases, the end of stroke limit switch “Switch Position” and the potentiometer slide values coincide.

EPS 06

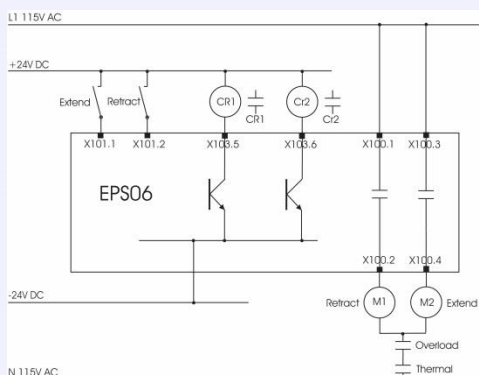
Thrust Overload Screen:

Display Functions:

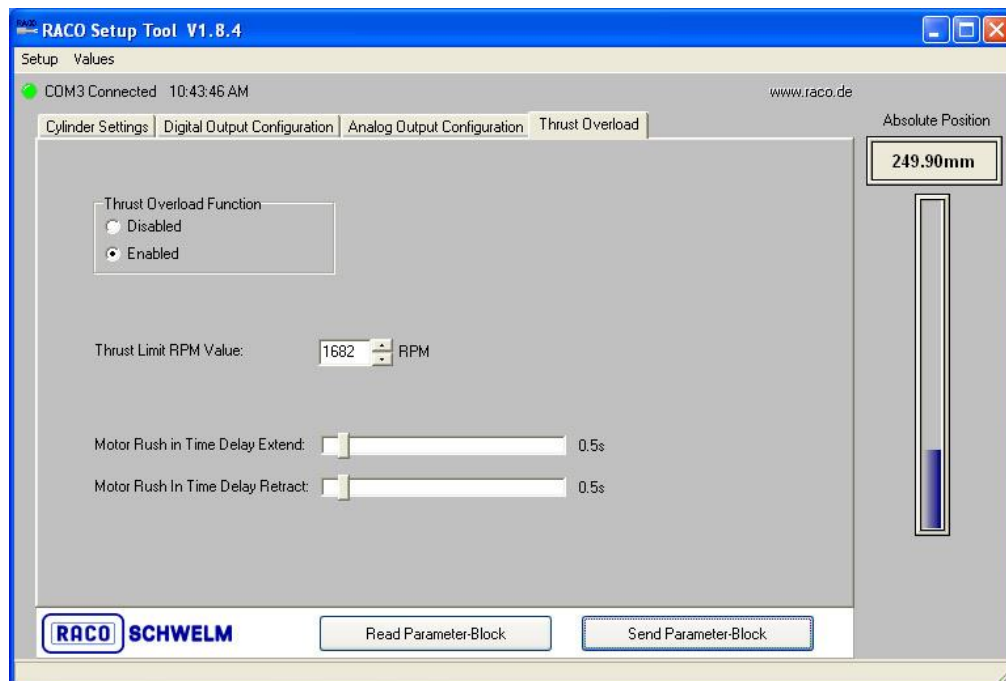
Speed Sensor Function
Enabled or Disabled
Shut off RPM Setting
Startup Delay Time Forward
Startup Delay Time Reverse

Input Functions:

Enable Thrust Overload Function
Disable Thrust Overload Function
Set Startup Delay Time Forward
Set Startup Delay Time Reverse



EPS06 Schematic with Thrust Overload protection



Thrust Overload Function: The thrust overload function screen enables and disables the thrust overload protection of the actuator. With the “Thrust Overload Function” enabled the sensor head RPM value will be constantly compared with the preset “Thrust Limit RPM Value”. The user command signals “Extend” and “Retract” have to be wired into the binary input signals X101 pin 1 and 2 of the EPS06. As soon as the forward or reverse auxiliary contacts of the reversing motor contactor or VFD circuit are pulled in, the on-delay timer with the predefined “Motor Rush in Time Delay Retract / Extend” time setpoint is started. As soon as the retract / extend time delay is expired, which is the startup time of the actuator motor, the RPM value will be supervised until the reversing motor starter is turned off. If during this time period the actual RPM value dips below the setpoint both end of stroke limit output signals will be turned off, which will turn off the power supplied to the actuator via the reversing

motor starter or VFD. The “Thrust Limit RPM Value” is factory set and varies by actuator size, nominal thrust rating, selected motor size and operating conditions. Readjusting these values may defeat the thrust overload protection of the actuator and the attached equipment.

To detect that the actuator shut off due to thrust overload or it's set end of stroke limits, output channel 3 and 4 have to be set in the tab “Digital Output Configuration” page 7 and monitored on terminal X103 pin 5 and 6. Limit switch settings for output channel 1 and 2 should be mirrored to channel 3 and 4. If the set end of stroke is reached both output signals 1&3 and/or 2&4 will shut off simultaneously. If shut down occurred due to a thrust overload output channel 3 and 4 are still set.

EPS 06

Software Installation

COM Port Setting

Connection Problems

Trouble Shooting

Installation and Help in Case of Connection Problems

The latest version of the RACO Tools setup software can be downloaded from the RACO website www.racointernational.com under Products / Actuator Accessories / Electronic Limit Switches in form of a ZIP file. Download the ZIP file and store the content in a separate folder. Extract the file with all subfolders. To install RACO Tools onto your laptop double click the Setup.EXE file under administrative privileges. Please be advised that with Microsoft Windows operating systems Vista and Windows 7, user rights have been changed. To properly install the RACO Tools software the user has to be locked in with administrative rights. After starting the setup.exe software with the right mouse click and selecting in the pull down menu the setting install as administrator, the RACO Tools software will be installed hereafter automatically. Follow the instructions during setup.

After installation of the RACO Tools software, please check out the connectivity between your laptop and the EPS06 Electronic Position Sensor. Power up the EPS06 with a 24V DC power supply and connect the USB ports with an appropriate USB cable. Start the RACO Tools application program via the icon or the start program menu.

The connection is made successfully if the LED symbol next to the text COM X Connection in the upper left hand corner of the main cylinder setting screen changes from red to green.

Connection Problem Trouble Shooting

The most common problem is the incorrect selection of the COM Port. With the EPS06 connected and powered up please check under Control Panel / System / Hardware / Device Manager / Universal Serial Bus Controllers that the communication driver CP210x USB Composite Device is loaded. Now click on Ports (COM & LPT). The CP210x USB to UART Bridge Controller should be loaded and be pointing to the selected COM port number. Use this COM port number in conjunction with the RACO Tool software. In the main RACO Tools desktop window select the Setup pull down command / Comport which will open up a popup screen. Under Please choose COM-Port select the assigned COM port number and hit OK. The LED symbol should change to green. COM port numbers should be single digit.

IF after the USB connection cable is plugged into both the laptop and the EPS06, and the CP210x USB Composite Device is not loaded in the device manager's screen, the communication driver has to be installed manually. Please select the subfolder USB and based on your laptop's operating system the appropriate driver subfolder. Find the file PreInstaller.exe and execute that program. Follow the instructions of the driver. Please make sure that you have administrative rights.

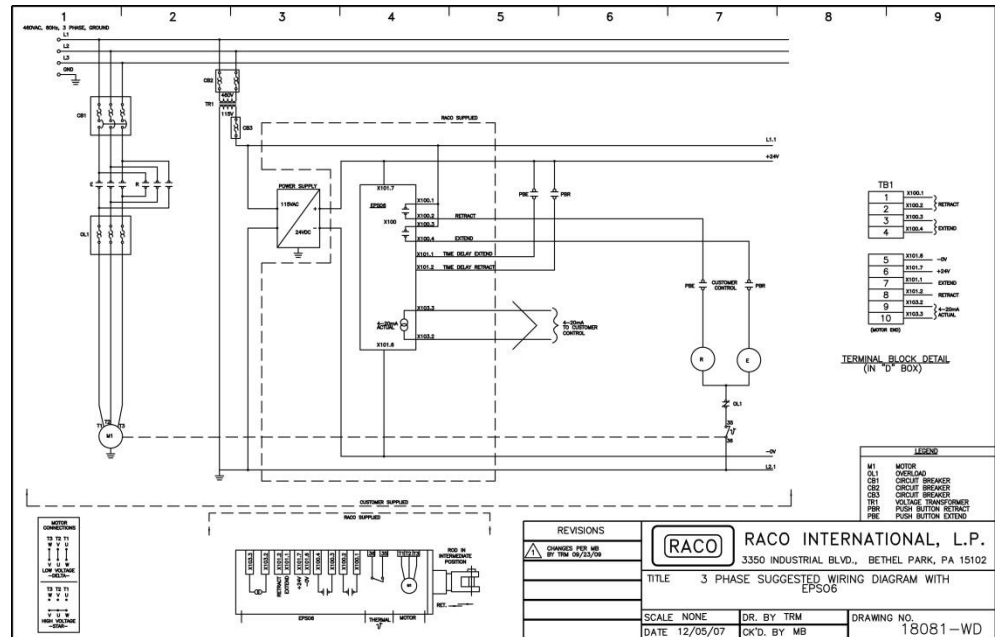
There may be other vendor programs installed on your laptop which may bind the UART Controller to a driver program during startup even if the main program is not launched. These programs are typically programs which rely on a serial connection to talk to an external device. One remedy is to de-install that particular program or use a different laptop.

EPS 06

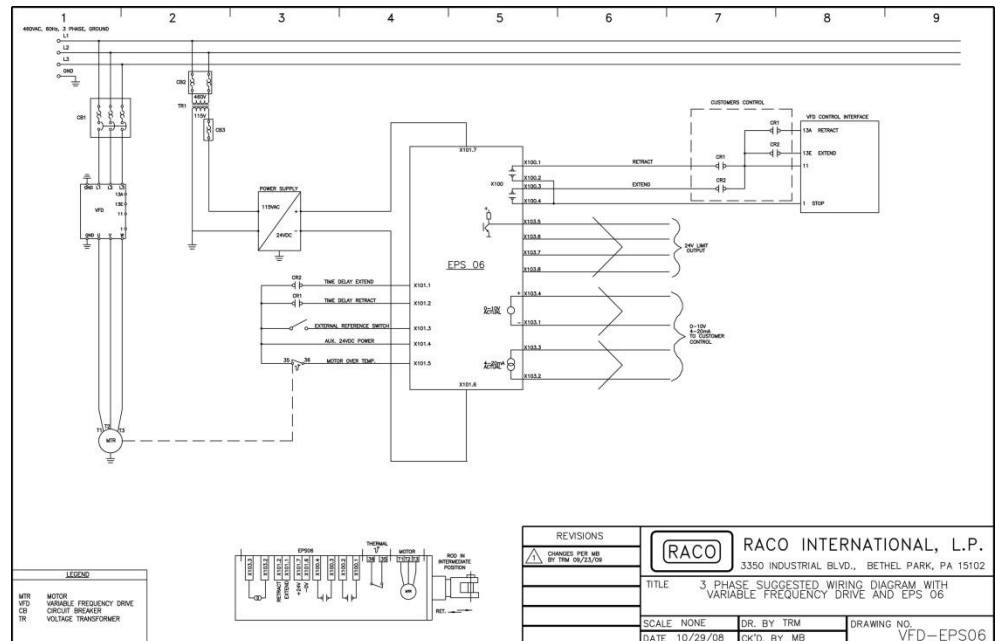
Wiring Diagram

Examples

Note: The EPS 06 comes factory preset with the maximum stroke length and a safety limit on both sides, as well as the actuator dependent settings for clockwise or counter clockwise operation, and the activation of the external limit switch function.



The EPS 06 limit switch contacts are hard wired into the reversing motor starter circuit.



The EPS 06 output signals are wired as permissive signals into the control circuit of a variable frequency drive.