Manual RecipSys 200
Rev. December 2020

TRIGGERED ROD DROP SYSTEM

RecipSys 200

ADVANCED ROD DISPLACEMENT MONITORING FOR RECIPROCATING COMPRESSORS

ISTEC INTERNATIONAL BV | www.istec.com

Netherlands
Istec International BV
Meer en Duin 8
2163 HA Lisse
+31 (0)252 433 400
mail@istec.com

IMPORTANT NOTICE

This product has been tested according to the listed standards. If the product is used in a manner not specified by manufacturer the degree of protection may be impaired. Therefore, this user manual must be read completely, carefully and all safety instructions must be followed.

ISTEC has made every effort to include all specific safety-related instructions and warnings in this manual, but the completeness and accuracy of this data cannot be guaranteed. Not all possibilities or situations are described in this manual. Before using this product, the user must evaluate it and determine its suitability to the intended application.

This manual is written for operators and integrators of the RecipSys product. All operating personnel is expected to follow the specific safety related procedures and all applicable other (general) safety procedures. Operating personnel is assumed to have the necessary technical training to enable them to install the product correctly and safely.

In case of unsafe, inexpert or irregular use, ISTEC will refuse any liability or warranty claims.

Table of contents

1 General information

Read this manual carefully and understand the safety instructions before use.

This manual is applicable to the following models:

RecipSys 200

1.1 Symbols used in this manual

This symbol indicates information, directives, procedures or precautionary measures concerning safety and the correct use of the device. Failure to obey this information could lead to injury or damage.

1.2 General handling precautions

- Do not drop the product or subject it to physical shocks.
- Protect the product using suitable protective materials when handling, storing or transporting the product. Remove all protective materials before installation and use of the product.
- When storing the product, respect the environmental conditions as specified for the product.

1.3 Maintenance and cleaning

This product is an electronic device. There are no serviceable parts inside the product. The product should not be opened, modified, transformed or changed in any way. Return the product to the supplier for service and calibration. This product contains electrostatic sensitive components that can be damaged by electrostatic discharges.

All maintenance and repair should be carried out by the manufacturer of the product. If required, clean gently with a soft, dry cloth. Do not soak. Do not use steamer, ultrasonic, soap or brush. Avoid exposure to acids or chemicals. Damaged devices, mechanical or otherwise, must be labelled as 'unusable' and must be returned for service.

1.4 Parts and accessories

System components:

- RecipSys 200 module
- 9 removable connectors

Accessories

- USB cable [USB A to USB B micro]

Only use with the original components and accessories. Defective components and accessories may only be replaced by identical parts.

2 System overview

2.1 System description

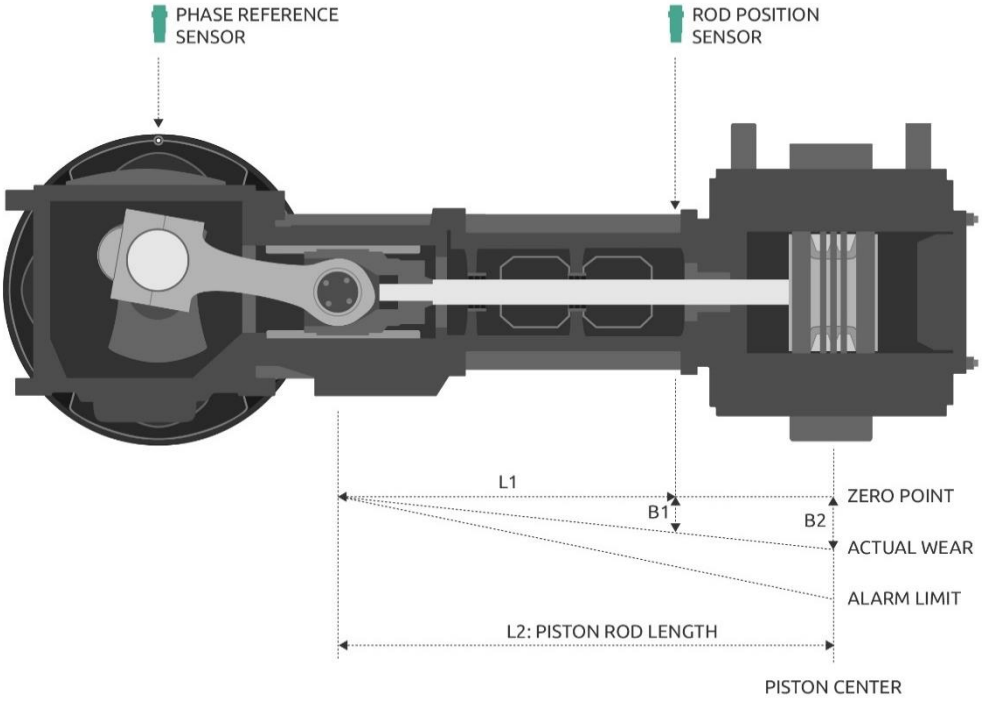
RecipSys is a compact monitoring solution that offers advanced, phase triggered rod displacement measurements for rod drop and rod flex applications on reciprocating compressors.

The 2-channel system provides essential monitoring on key mechanical indicators and can be used as a stand-alone system or as an add-on to advanced vibration monitoring systems.

2.2 Triggered rod drop concept

RecipSys indicates the vertical movement of a piston inside a cylinder by measuring the rod displacement on the vertical axis. Rod drop measurements provide crucial information on the wear of the rider bands.

The position of the rod changes through the course of the cycle, influenced by the internal forces. To ensure accuracy of a rod drop measurement, the position should be measured at a specific point in the cycle. By using a phase trigger, the RecipSys is able to filter the displacement signal to the right phase angle. The triggered signal can be more accurate than any overall measurement and can monitor both machines with fixed RPM and variable RPM.



2.3 Application

RecipSys is primarily designed for monitoring rider band wear on reciprocating compressors. A single module supports two measurement channels and a phase reference channel. The two channels can be used for measurements on the Y-axis of two cylinders, or on the X- and Y-axis of a single cylinder. Multiple RecipSys modules can be linked to support multiple cylinder applications, and the reference trigger signal can be replicated through the modules. The module that has the tacho sensor connected is therefore the 'master' module. The remaining modules are regarded as 'slave' modules.

The product transmits the dynamic sensor signal input into various outputs, including digital outputs (relay) and static analog outputs (4-20 mA) and dynamic raw outputs. The outputs can be connected to 3rd party devices for integration according to industry standards. Processed output signals are based on sensor input signals and processing parameters as programmed through the software.

2.4 Intended use

The product was designed for phase triggered rod displacement monitoring, primarily for rod displacement measurements on reciprocating compressors. The product is intended for use in professional, industrial environments only.

This product was not designed to meet the requirements of a safety system.

2.5 Environmental conditions

Operating	
Temperature	-20 to 55 Celsius
Humidity	0 to 80% non-condensing
Storage	
Temperature	-20 to 70 Celsius
Humidity	0 to 80% non-condensing
Protection rating	IP20 according to IEC 60529 Indoor use or use in a protective enclosure
Altitude	Max 2000 m

3 Mounting and installation

3.1 Module details

The front panel sticker contains basic information about the connectors, wiring connections and module status.

On the top side of the module there are 4 connectors for the signals coming from the machine.

The bottom side has 4 connectors for the output signals, including relay, analog and dynamic raw outputs. The fifth connector is used for the power and earth connection.

Two LED's are used to display the status of the module. The ERROR LED indicates if there is a problem with the input signals or the device itself. The TACHO LED indicates information about the speed and the sampling cycle. Details about the different status is explained in: **5.2 Module operation.**

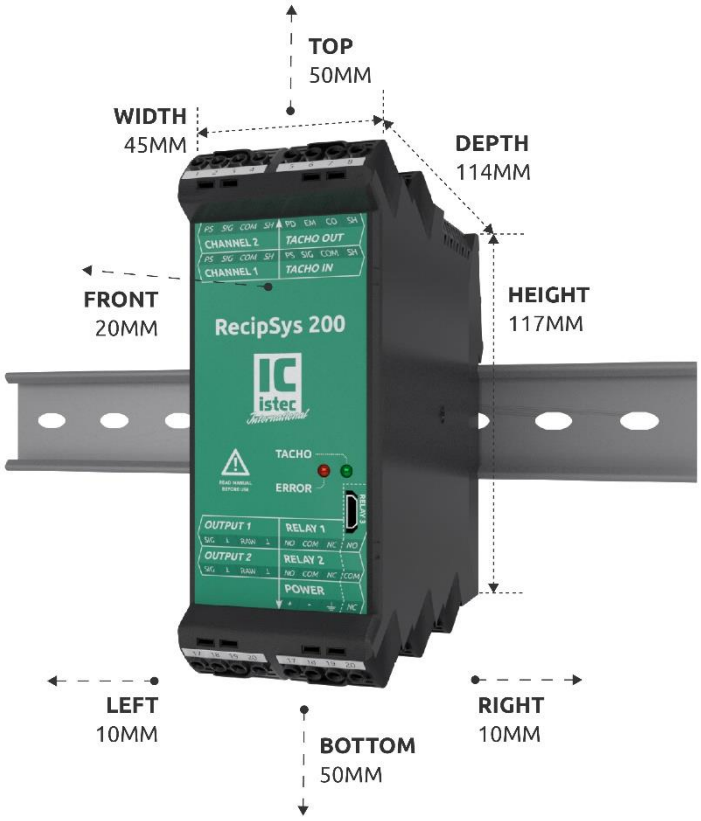
The connector arrangement and details are described in the table below.

Connector	Pin	Name	Sign	Description
1	1	CHANNEL 1	PS	-24 V power supply to signal conditioner
	2		SIG	Signal from signal conditioner
	3		COM	Common from signal conditioner
	4		SH	Shield
2	5	TACHO IN	PS	-24 V power supply to signal conditioner
	6		SIG	Signal from signal conditioner
	7		COM	Common from signal conditioner
	8		SH	Shield
3	9	CHANNEL 2	PS	-24 V power supply to signal conditioner
	10		SIG	Signal from signal conditioner
	11		COM	Common from signal conditioner
	12		SH	Shield
4	13	TACHO OUT	PD	Pull down resistance
	14		EM	Emitter of the tacho output signal
	15		CO	Collector of the tacho output signal
	16		SH	Shield
5	17	OUTPUT 1	SIG	+ Analog output signal
	18		⊥	Common analog output signal
	19		RAW	+ Buffered raw output signal
	20		⊥	Common buffered raw output signal
6	21	RELAY 1	NO	Normally open contact relay
	22		COM	Common contact relay
	23		NC	Normally closed contact relay
	24	RELAY 3	NO	Normally open contact relay
7	25	OUTPUT 2	SIG	+ Analog output signal
	26		⊥	Common analog output signal
	27		RAW	+ Buffered raw output signal
	28		⊥	Common buffered raw output signal
8	29	RELAY 2	NO	Normally open contact relay
	30		COM	Common contact relay
	31		NC	Normally closed contact relay
	32	RELAY 3	COM	Common contact relay
9	33	POWER	+	+24V power input
	34		-	-0V power input
	35		⏚	Earth connection
	36	RELAY 3	NC	Normally closed contact relay

3.2 Module dimensions and installation

The product is designed to work with standard DIN rail. The material of the DIN rail should be of sufficient electrical conduction to support proper grounding and free of corrosion or oxidation.

Observe the minimum mounting distances to allow for sufficient cooling.



3.3 Functional grounding

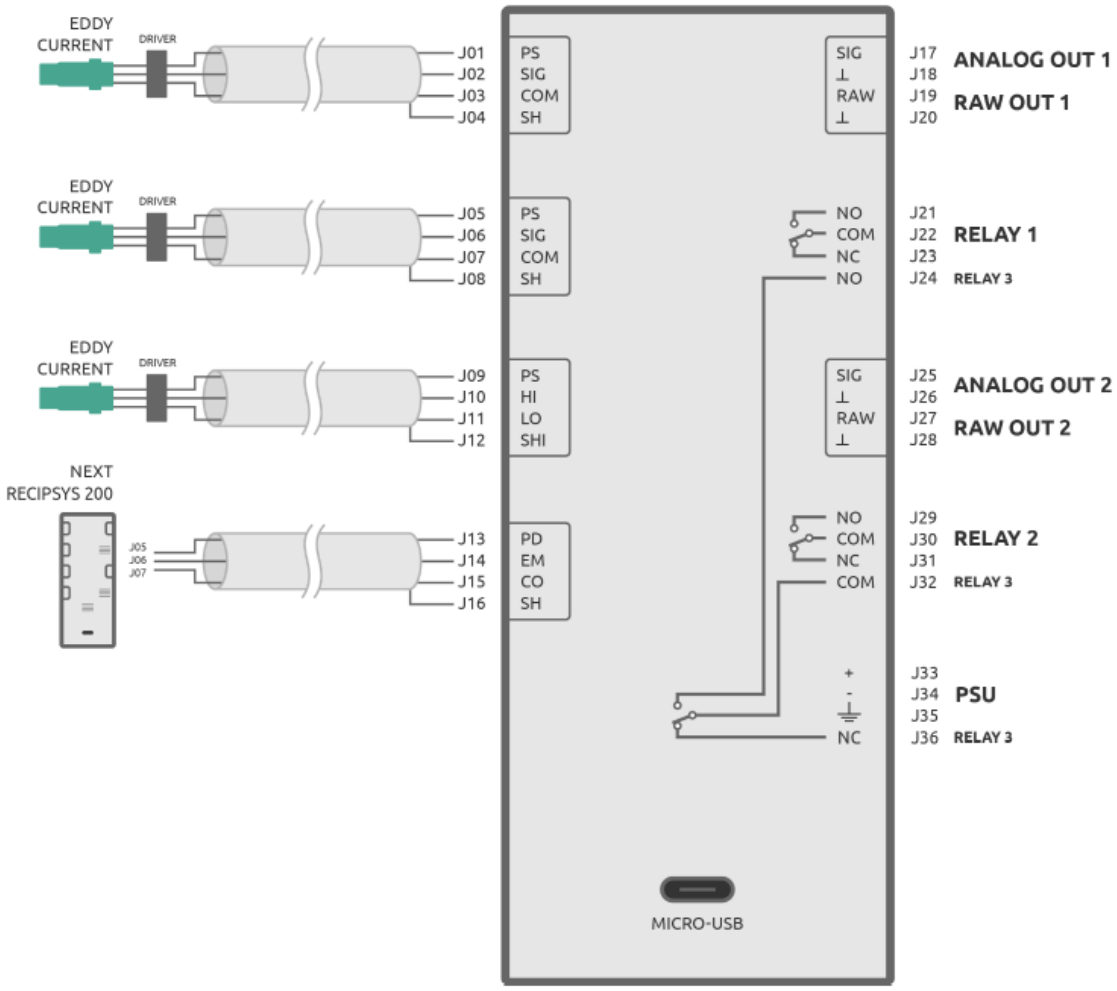
This product requires functional grounding to avoid potential ground noise and EMI effects that can cause unfavorable operating conditions.

Each RecipSys module can be grounded through the DIN rail chassis ground or through the connector. It is highly recommended to that the front-end signal train and the RecipSys modules are grounded at a single point.

3.4 Connection diagram

The figure below shows the electrical interfaces for the product. The signal inputs on the left side are short circuit proof.

Observe the information in the datasheet before connecting electrical interfaces.



Note: Wiring insulation for relay outputs must be rated at 75°C or higher.

4 Programming

4.1 Get started: connect to PC

Connect to PC

Turn the device on by connecting power to the unit.

Connect the product to a PC using the USB interface. The first time it may take a while for the computer to find and install the USB com port.

Note: The software supports Windows, version 7 or higher.

> Connect the USB cable BEFORE opening the software. On opening the software detects all the available COM ports.

Open the RecipSys software

Drag the software to a desired location on the PC. The software doesn't require installation. Run the software by double clicking the icon.

During initial run, the software will place the folder *Istec International* in the *My Documents* folder of the user. This folder will be used to save configuration files and commissioning reports. Changing the contents or rights to these folders may lead to unexpected behavior.

The latest version of the software can be downloaded from our website www.istec.com.

Note: Some anti-virus suites may block or require additional approvals to run third party applications.

Select the COM port

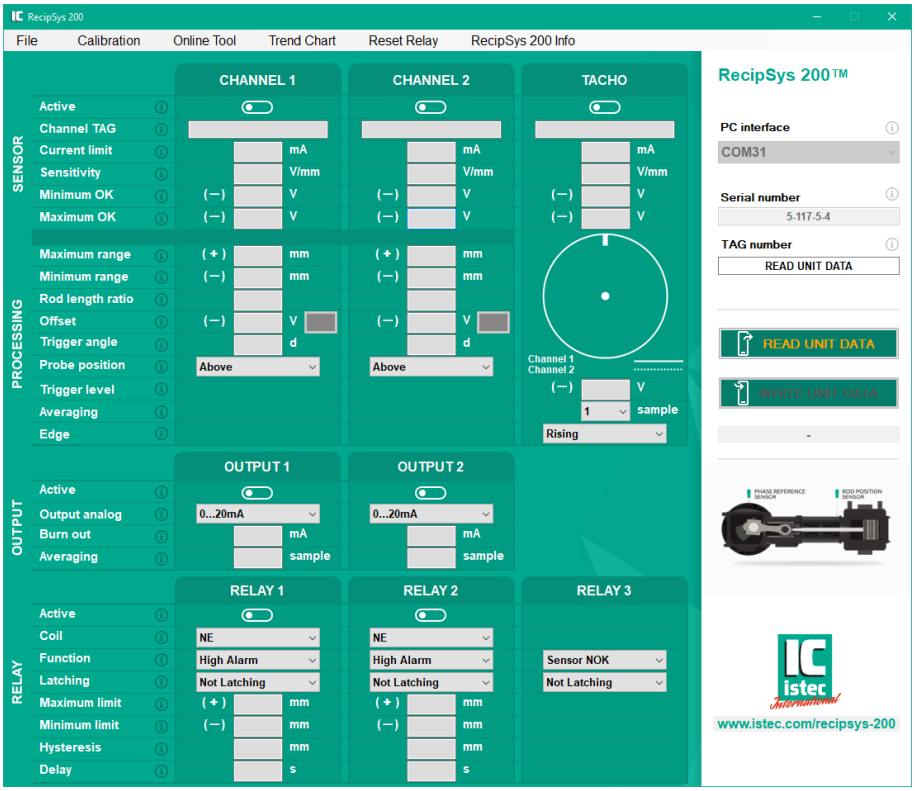
In the software, select the COM port the product is connected to using the dropdown box marked *PC interface*. If you have selected the right COM port, the bar below the dropdown box turns red when discovering the module. After establishing the connection, the COMx dropdown box turns grey and can't be selected anymore.

Note: You can use the Windows Device Manager to check the COM port. Open the *Device Manager* in Windows and select *Ports (COM & LPT)*. Look for the port *USB Serial Port (COMx)*.

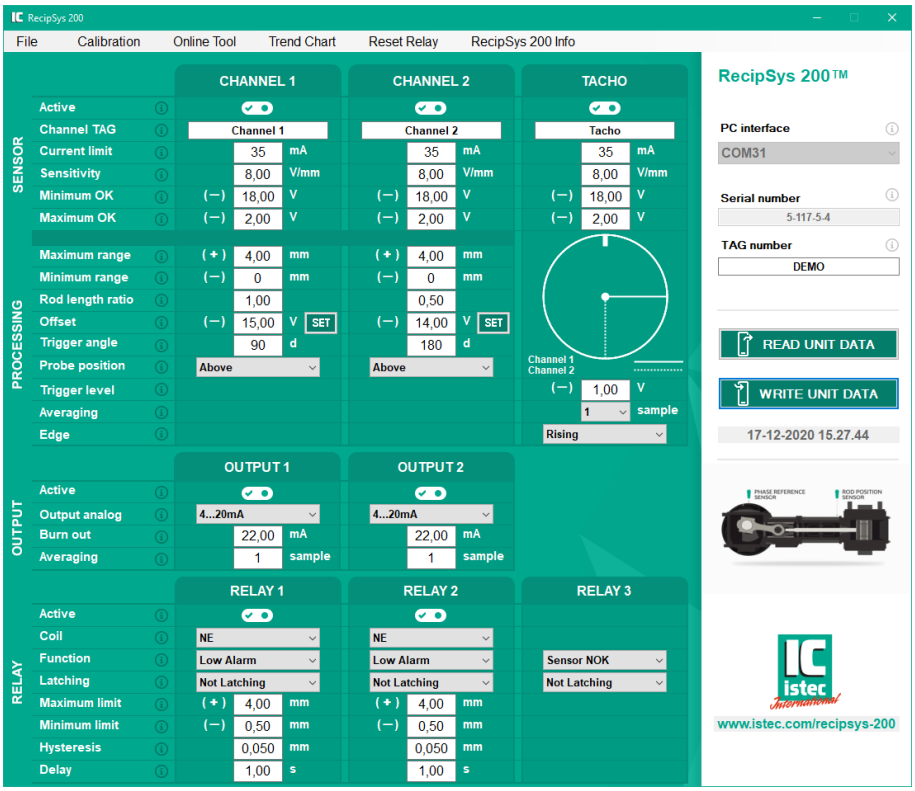
The device is now connected to the software. Continue the software configuration.

4.2 Module configuration

After the software has detected the connected module, the software is ready to read the configuration. The TAG number indicator will show *READ UNIT DATA*. The text of the button *READ UNIT DATA* turns orange.



Press the *READ UNIT DATA* button. The *READ UNIT DATA* button text turns green for 1 second to confirm reading of the data. Afterwards it turns white. The configuration from the module is read and in case the unit contains configurated fields, the boxes are filled. It might be that the configuration is completely empty, with a zero in each box.



Change the settings to suit the application.

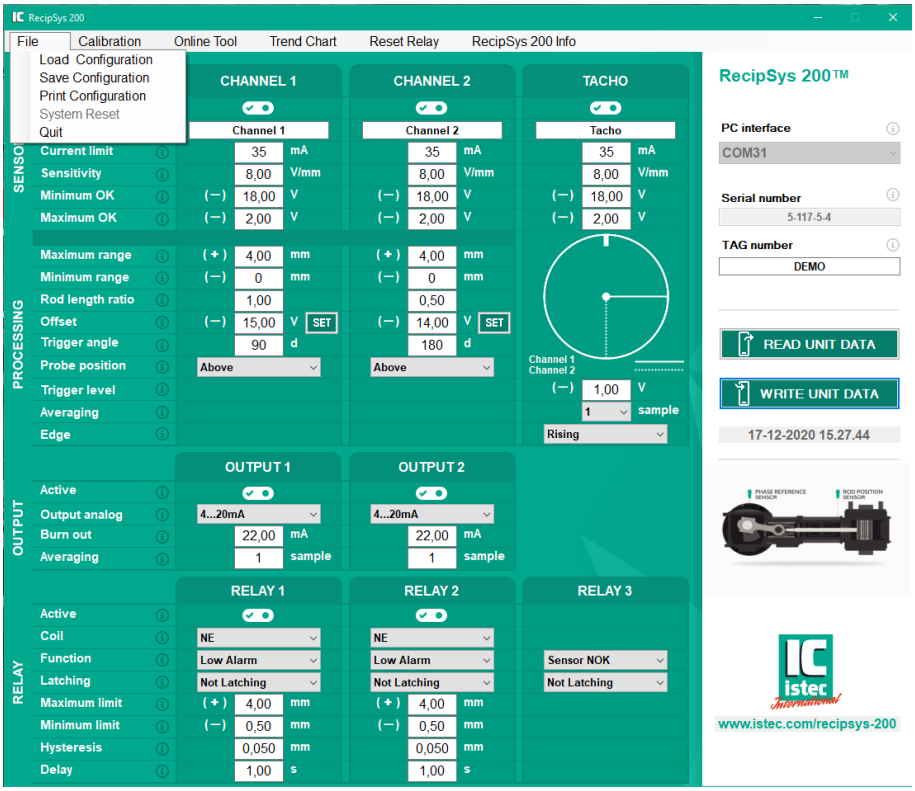
Press the *WRITE UNIT DATA* button. The button will turn to green for 1 second and a red bar is displayed to confirm writing the data to the module.

The date and time of the last time the module was configured, is shown below the *WRITE UNIT DATA* button.

4.3 Loading and saving configuration files

The configuration file can be saved to a PC.

A stored configuration file can be loaded into the software.



Use the *Print Configuration* to save the module configuration in PDF format.

RecipSys 200

Setup

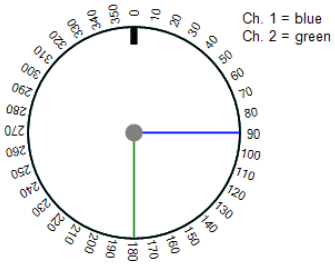
Serial Number:	5-117-5-4
TAG:	DEMO
Print date:	17-12-2020
Software release:	5.5 - Nov. 11 2020

		Channel 1	Channel 2	Tacho
Active		ON	ON	ON
Channel TAG		Channel 1	Channel 2	Tacho
Current limit	**mA**	35	35	35
Sensitivity	**mv/µm**	8,00	8,00	8,00
Minimum. OK	**v**	2,00	2,00	2,00
Maximum. OK	**v**	18,00	18,00	18,00
Maximum range	**+mm**	4,00	4,00	
Minimum range	**-mm**	0	0	
Rod length ratio		1,00	0,50	
Offset	**v**	15,00	14,00	
Trigger angle	**d**	90	180	
Probe	**axis**	Above	Above	
Trigger level	**v**			1,00
Averaging	**sample**			1
Edge				Rising

		Output 1	Output 2
Active		ON	ON
Output analog		4...20mA	4...20mA
Burn out	**mA**	22,00	22,00
Averaging	**sample**	1	1

		Relay 1	Relay 2	Relay 3
Active		ON	ON	
Coil		NE	NE	
Function		Low Alarm	Low Alarm	Sensor NOK
Latching		Not Latching	Not Latching	Not Latching
Maximum limit	**+mm**	4,00	4,00	
Minimum limit	**-mm**	0,50	0,50	
Hysterese	**mm**	0,050	0,050	
Delay	**s**	1,00	1,00	

Tacho position



5 Commissioning

5.1 Module parameters and settings

To create a fully functioning configuration, all of the necessary fields and boxes need to be filled and selected. For each programmable parameter, a short description is given.

- Sensor
  - Active
    CHANNEL 1 and 2:
    Check the box when the channel is in use. When the channel is disabled, all of the value boxes turn grey and are disabled. The Output and Relay options are disabled as well.
    TACHO:
    Check the box when the tacho input channel needs to be monitored. When disabled the tacho channel is taken out of the sensor NOT OK status. When multiple RecipSys units are linked, on the slave module the monitoring needs to be disabled.
  - Channel TAG
    The identification of the measurement channel
  - Current limit
    The maximum current available to power the connected signal conditioner. When the current goes above this value, a sensor NOT OK is generated and the status of relay 3 is changed.
    Typical used value for common eddy current sensors: 35 mA [1]
    Maximum value: 55 mA
  - Sensitivity
    The relation between Voltage and Millimetres. This value is used to calculate the actual mm from the measured Voltage.
    Typical used value for common eddy current sensors: 8 V/mm [1]
  - Minimum OK
    The lowest measured value for the sensor to be OK. Note that this is a negative value. When the Voltage goes below this value, a sensor NOT OK is generated and the status of relay 3 is changed.
    Typical used value for common eddy current sensors: -18 V [1]
    Minimum value: -24V
    For tacho sensors a lower value can be required to accommodate for the large value drop at the position of the hole or keyway.
  - Maximum OK
    The highest measured value for the sensor to be OK. Note that this is a negative value. When the Voltage goes above this value, a sensor NOT OK is generated and the status of relay 3 is changed.
    Typical used value for common eddy current sensors: -2 V [1]

[1] Refer to the used sensor and signal conditioner's datasheet for the necessary information

- Processing
  - Maximum range
    The upper range value of the measurement. The value is used for the analog output, chart display and OK check of the sensor. When the measurement goes above this value, a sensor NOT OK is generated and the status of relay 3 is changed. This value needs to be higher than the Minimum range.
  - Minimum range
    The lower range value of the measurement. The value is used for the analog output, chart display and OK check of the sensor. When the measurement goes below this value, a sensor NOT OK is generated and the status of relay 3 is changed. This value needs to be lower than the Maximum range.
  - Rod length ratio
    The ratio between the sensor location and rider band location, seen from the crosshead. The sensor is never located exactly at the point where the rider bands are. Generally the sensor is placed around half of the distance to the rider bands. In this case the ratio would be 0,5. To calculate it exactly:
    (Crosshead – Sensor) / (Crosshead – Rider band) = ratio
    The ratio is used to calculate the real rider band wear. The measured value is divided by the ratio. All the measurements in the device work with the value after the ratio: analog output values, limit values. If this option is not required, al value of 1 can be entered. Typical used value is 0,5.
  - Offset
    The zero point setting of the channel. This reference value is used to calculate the rod drop, starting from the offset. The value is subtracted from the actual measured value in operation. Note that this is a negative value. Typical used value for common eddy current sensors: -10 V
  - 

    Press the SET button to read, enter and program the current measured value automatically. This value is measured by the device, so there are no deviations introduced.
  - Angle
    The trigger angle when the rod drop measurement is taken. The angle is the number of degrees from the tacho trigger edge. This is a fixed point for every cylinder on the compressor. This needs to be established once.
    Typical way of determining the angle is: rotate the crankshaft until the hole is in front of the tacho sensor, note the cylinder position and movement direction, define the ideal measurement position and calculate the trigger angle between these points.
  - Probe
    This option indicates the installed location of the rod drop sensor. The sensor is positioned above or under the rod. It changes the direction of the measurement and is related to the Maximum and Minimum range.
    Above means that if the gap increases, the output goes to the Minimum range value. Under results in the output going to the Minimum range value, if the gap decreases.

- Trigger level
  The voltage value that the speed signal edge needs to pass to be used as a trigger. This is an AC coupled signal, so it measures only the AC component of the trigger. It is used to filter out unwanted disturbances.
  Typical used value for common eddy current sensors: 1 V
- Averaging
  When the compressor is running unstable and there are slight changes on the time between triggers, an averaging can be selected. This averaging calculates the speed and trigger time on more samples, so better accuracy can be achieved. It may cause a slight delay in the output.
  Typical used value is 1 average. Only change it when this becomes clear during commissioning.
- Edge
  Trigger edge of the tacho input. The signal can be trigger on the positive or negative edge of the signal.

- Output
  - Active
    Check the box when the output is in use. When the output is disabled, all of the value boxes turn grey and are disabled.
  - Output analog
    Select the type of analog output. The options are 4-20mA, 0-20mA or 0-10V. The option selected for channel 1, is directly also the option for channel 2. The setting is the same for both channels.
  - Burn Out
    The value that this output is forced to, when the channel is not ok. The value is the same for both roddrop channels.
    Maximum value current output: 22 mA
    Maximum value voltage output: 11 V
  - Averaging
    To smooth the analog output and to make it a little less responsive to fast changes, the output can be averaged with a number of samples. The averaging is continuous and updates every trigger cycle with a newly added value.
    Maximum number of samples: 20

- Relay
  - Active
    Check the box when the relay is in use. When the relay is disabled, all of the value boxes turn grey and are disabled.
  - Coil
    This option selects in what state the relay is, when the signal is OK. This can be Normally Energized (NE)or Normally De-Energized (NDE).
  - Function RELAY 1 and 2
    The function of the relay can be set to different options. The selected option switches the relay when that state is active. The options are: high alarm, low alarm, high AND low alarm, high AND low alarm AND sensor NOT OK.
  - Function RELAY 3
    The function of the relay can be set to 3 different options. The selected option switches the relay when that state is active. The options are: sensor NOT OK, system NOT OK, sensor AND system NOT OK.
  - Latching
    The latching function is a set/reset of the relay. Once the alarm has been activated, the relay switches to the NOT OK state. This state is set and remembered, even when the alarm is gone. The relay will go back to the normal state after the Reset command. To reset the relays, go to Reset Relay in the taskbar.
  - Maximum limit
    The high alarm value. Any value between Minimum and Maximum range can be configured. The value needs to higher than the Minimum limit.
  - Minimum limit
    The low alarm value. Any value between Minimum and Maximum range can be configured. The value needs to lower than the Maximum limit.
  - Hysteresis
    The alarm limit has a small dead band just below the alarm value. This is so that the alarm level does not switch constantly, when the output value is around the alarm. When the alarm is activated, the alarm is only deactivated when the value comes below the alarm minus the hysteresis value.
    For example, the alarm value is 0,5 mm and the hysteresis is 0,05 mm. The alarm activates above 0,5 mm and deactivates below 0,50 – 0,05 = 0,45 mm.
    Typical used value is between 5 and 10% of the alarm level
  - Delay
    The time delay works on the activation of the alarm. If the alarm value is exceeded for the first time, a timer is started. If this timer exceeds the programmed time, only then the alarm is activated. If the output drops below the alarm value while timer is running, the timer resets and starts again.
    Typical used value is 3 seconds.

5.2 Module operation

Expected behavior

After powering the device, a short indication is given through the LED's that the device is turned on. Next the device is 'waiting' for the tacho signal. Every calculation cycle, trigger time assessment, analog signal update is activated by the tacho pulse. This is the trigger for the complete operation. In case the machine is stopped and the tacho is gone, the device waits 5 seconds to start the 'waiting' for the tacho mode. In this state the roddrop values are updated every second, as well as the analog output. This status is indicated by the LED's. See the table below for all the different device statuses and the corresponding LED states.

In case the tacho sensor stops working, the module still gives an average rod drop measurement. The measurements are still functioning, but the rod drop value is not sampled at the desired piston position.

LED status

The 2 LED's on the front indicate the status of the device. See below the details of this indication.

Status	RED error LED	GREEN tacho LED
Startup of device	Fast on-off after green	Fast on-off
All sensors OK No tacho signal	Flashing alternately with green every 1 second	Flashing alternately with red every 1 second
Fault in one sensor No tacho signal	Continuously on	Flashing on and off every second
All sensors OK Tacho between 2 and 40 Hz	Off	Flashing with the speed of the tacho signal
Fault in one sensor Tacho between 2 and 40 Hz	Continuously on	Flashing with the speed of the tacho signal

Sensor NOT OK

The sensor NOT OK of each channel can be activated by a number of signals. This status is self-recovering. When the sensor becomes OK again, the status will be reset automatically. The signals that can induce the sensor NOT OK are:

- Current limit exceeded
- Voltage OK limits exceeded
- Measurement range exceeded

System NOT OK

The system NOT OK is a general fault indicator of the system and its components. Currently the device is internally monitoring the following items:

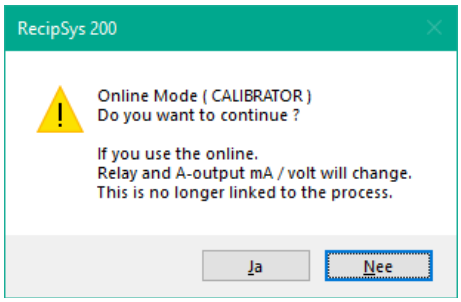
- Internal temperature measurement above 70 degrees
- Internal processing error

5.3 Online tool

There are two tools included in the software, to verify the sensor installation and monitor the values during the first run of the machine.

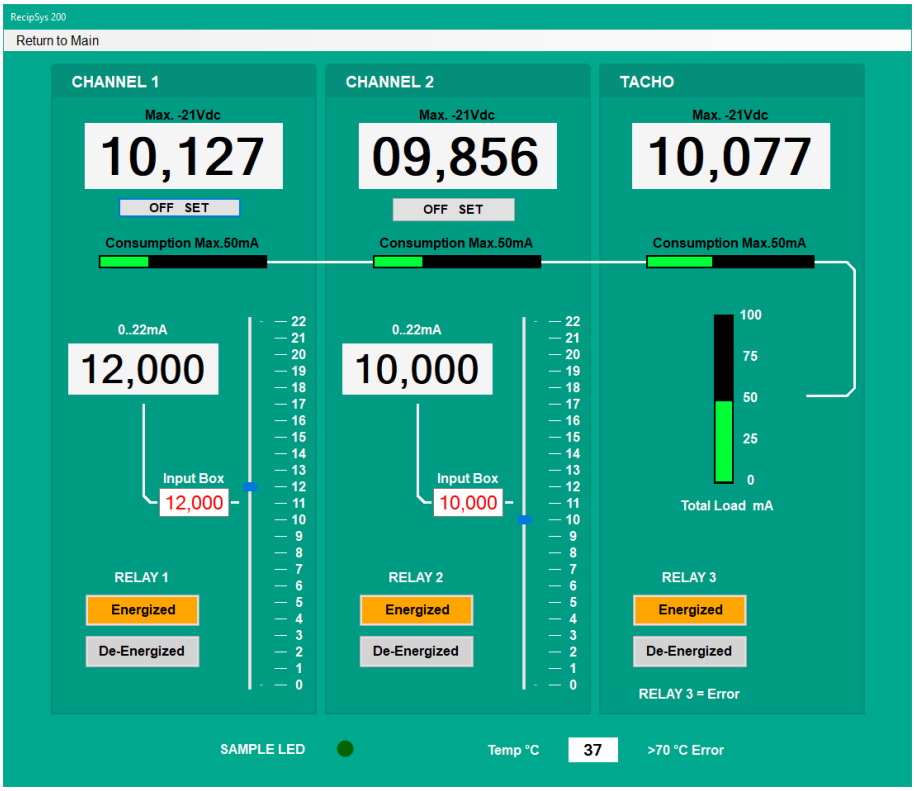
After pressing *Online Tool* the following message will appear. This is to indicate that the tacho based triggering is stopped. The last measured values and relay status are used as start values for the Online Tool, to easily switch over between screens.

If the machine is running, and the online tool is opened, the state of the relays can't be guaranteed , so be cautious to open it.



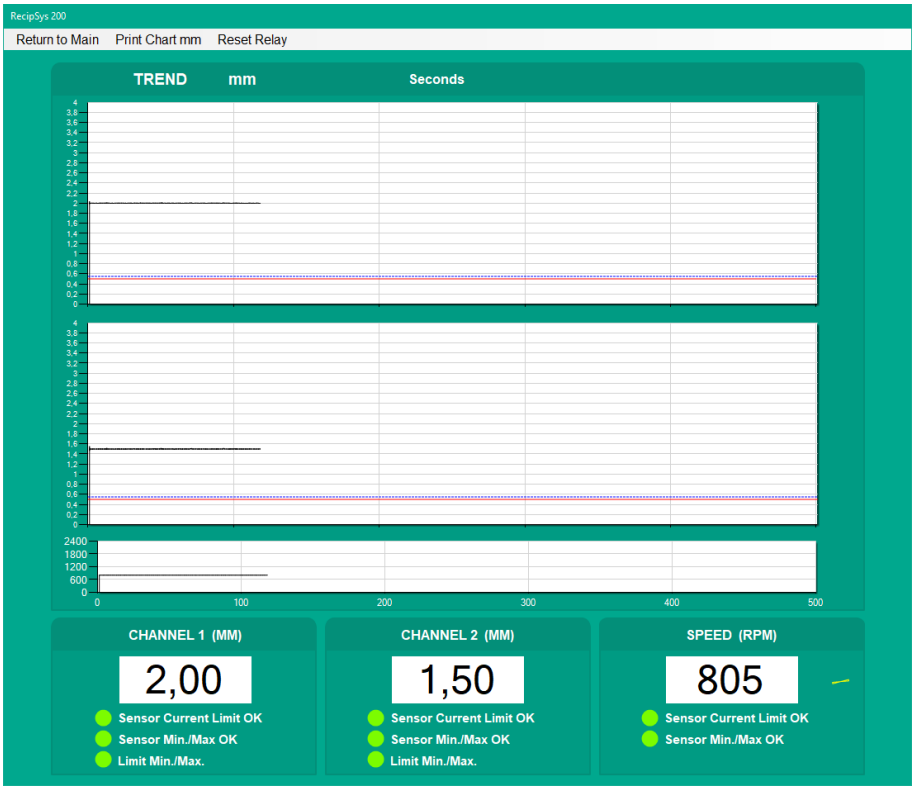
In the *Online Calibrator*, the following items are displayed and can be adjusted or are informative:

- The total current consumption of the module
- The measured voltages and current from the signal conditioners, from the rod drop measurements and tacho.
- The actual temperature measured inside the unit
- An LED to display the sampling simulated by the software, instead of the running machine
- The analog outputs can be adjusted with the vertical sliding bar, to the devices connected to the module. Alternatively the value can be changed by entering a value in the input box
- The state of the relays can be changed by pressing the Energized/De-Energized buttons, to check the functionality of the relay outputs.
- The voltage value can be programmed as the offset by pressing the OFF SET button

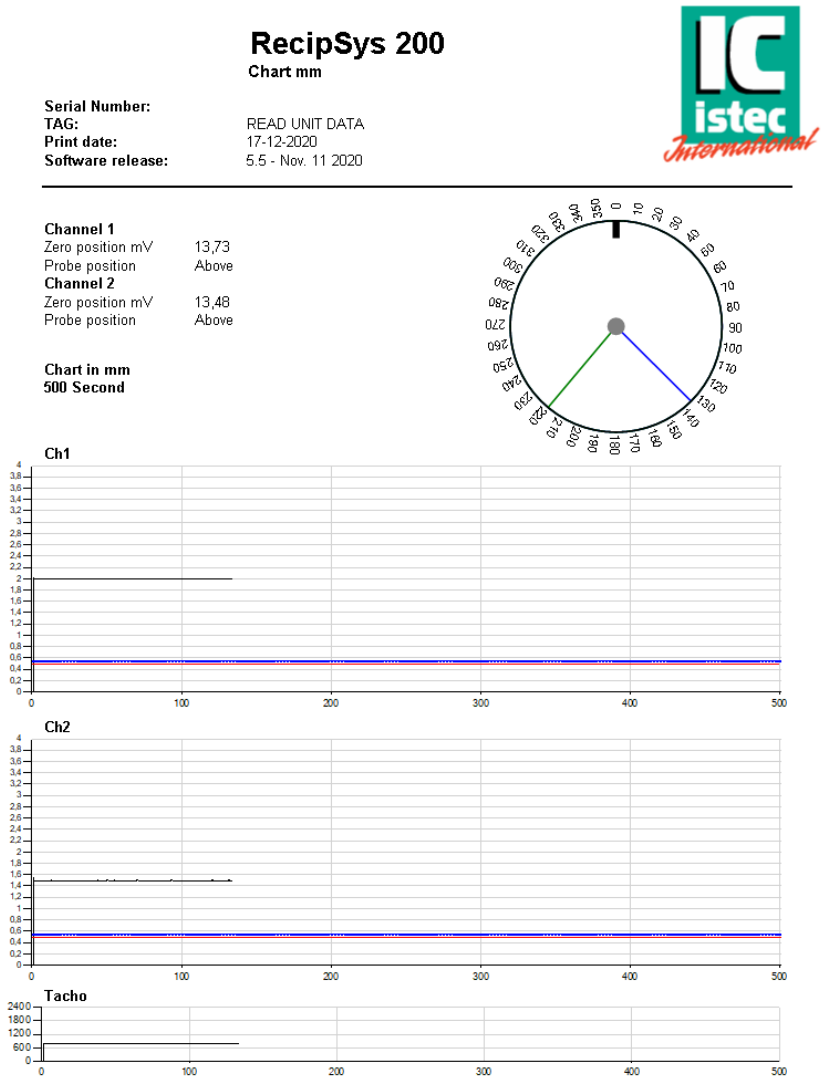


5.4 Trend chart

To monitor the values during a run of the machine, the *Trend Chart* can be used. It can be displayed in Volts or millimeters. The chart is filled with the trend data and the actual values are displayed in the value indicators. The 2 rod drop channels and speed are displayed as well as the state of the channels and limits.



After the run, the chart can be printed to a PDF file for future reference.



6 Service

6.1 Spare parts

-none listed-

6.2 Contact information

Questions and support?
We are ready to help you!
Visit www.istec.com/support

Istec International
Meer en Duin 8
2163 HA, Lisse
Netherlands

+31 (0)252 433 400
www.istec.com

7 Technical information

7.1 Labels and certifications

Read and understand the manual before use

24V 0,3A

The manufacturer declares that the product conforms to the applicable standards.

Istec International
Meer en Duin 8
2163 HA Lisse
Netherlands
www.istec.com

Product identifiers

Model:	RecipSys 200
Part no:	RSY200-xxx-xxx [xxx-xxx=rev. no]
Serial no:	YYYYPPPPPPNNNN [Y=year;P=project;N=identifier]

7.2 Electrical specification

Function	Channel	Connector	Voltage range [V]	Current range [mA]
Signal input	Rod drop 1	J1	0 ... -22	0 ... 55
Signal input	Tacho	J2	0 ... -22	0 ... 55
Signal input	Rod drop 2	J3	0 ... -22	0 ... 55
Signal output	Tacho	J4	0 ... -24	0 ... 20
Analog output	Rod drop 1	J5	0 ... +24	0 ... 22
RAW output	Rod drop 1	J5	0 ... -24	0 ... 10
Relay output	Rod drop 1	J6	0 ... +24	0 ...1000
Analog output	Rod drop 2	J7	0 ... +24	0 ... 22
RAW output	Rod drop 2	J7	0 ... -24	0 ... 10
Relay output	Rod drop 2	J8	0 ... +24	0 ...1000
Power input	Module	J9	21,6 ...+26,4	0 ... 300
Relay output	Status	J6-J8-J9	0 ... +24	0 ...1000