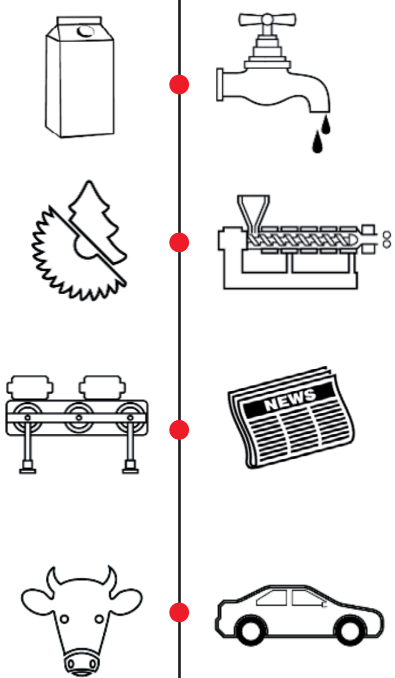
APPLICATION GUIDE

Pure easiness for a wide range of applications

ACS580 general purpose drives



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Pure easiness for many applications
ACS580 general purpose drives

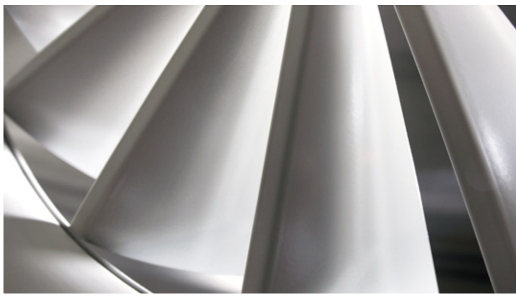
Introduction
The ACS580 general purpose drive series is designed to serve a broad range of different variable and constant torque applications, such as conveyors, centrifuges, fans, compressors, pumps, and winders in many industries, including, for example, food and beverage, agriculture, sawmills, automotive, and material handling.

To fulfill the needs of these many applications and industries, the ACS580 drives are equipped with all the essential and necessary components to ensure your applications are controlled reliably. In addition, these drives feature an intuitive, state-of-the-art control panel as standard, offering you simplicity not experienced before.

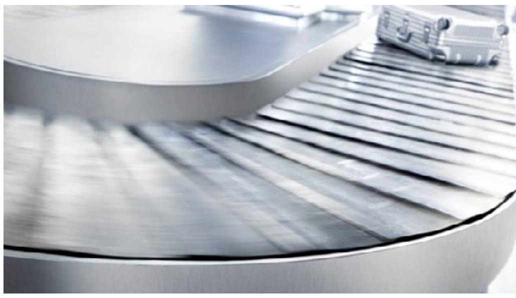
The purpose of this application guide is to illustrate the many applications where these drives can offer easiness, performance, and energy efficiency. The guide not only explains how you can the take full advantage of these drives, but it also advises step by step how to effectively operate the assistant control panel and how to easily set up the various features to leverage the full potential of your drive.

One product, many applications
The ACS580 serves a broad range of different applications, offering them many features that help you get maximum results out.

Easiness you've not experienced before
The ACS580 comes with an intuitive and easy-to-use control panel that makes it extremely easy to operate the drive.



Step by step instructions
This application guide instructs how you can apply each feature and explains which benefits the specific feature brings to your system.



Introduction to the assistant control panel

Save time, monitor values that matter, ask help – all with the assistant control panel

Experience easiness in a totally new way with the assistant control panel, which is delivered as standard with the ACS580 general purpose drives. Setting up the drive, operating it, and asking for help in unclear situations have never been as easy. The set up assistant guides you through the commissioning procedure with straightforward questions **without the need to access any drive parameters**. Once the assisted setup is done, the drive is ready to control the motor. If some adjustments are still needed, Primary settings offer you an easy way to fine-tune the settings – again without the need to access any parameters.

Stressing the easiness even further, the assistant control panel features several, easily accessible home views, with which you can **monitor all the values that are important to you**. The I/O view, on the other hand, lets you easily to **make sure that the actual I/O wiring matches the I/O use in the control program**. You can also make changes to the I/O connections straight from this view and **avoid wasting time** with finding the right parameters and signals.

Finally, should you face any unclear situations, you don't necessarily need to have a manual in your hands. Instead, you can **ask help from the drive by simply pressing the help button**.

Experience the easiness

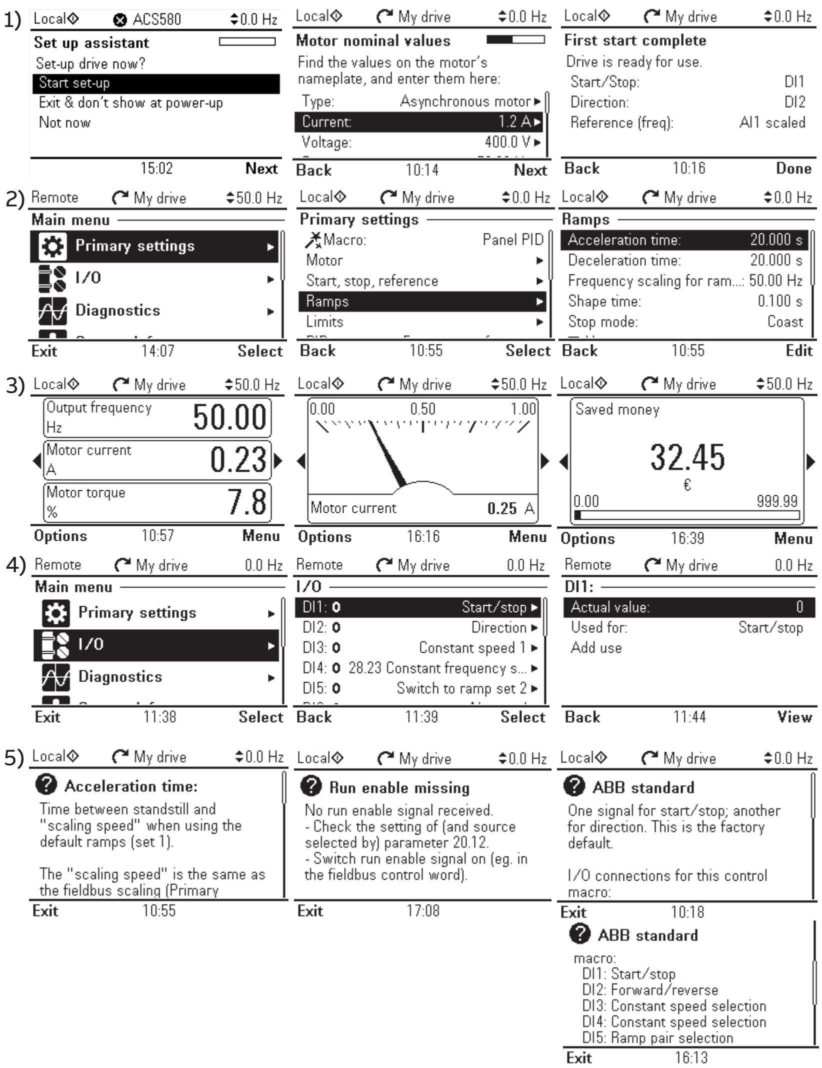
1) The setup assistant guides you through the commissioning quickly and effortlessly once you power up the drive.

2) **Primary settings** can be accessed from the **Home view** by pressing the right side button indicating **Menu**. In **Primary settings**, you can adjust and fine-tune the most important and common settings, such as motor, start, stop, ramps, limits, PID and PFC settings.

3) **Home views** allow you to monitor any value you wish. Click **Options** on the left side to edit the home view. To add a new home view, click the right arrow button till the display shows **Add new**. Select **Add new** and identify what you want to monitor.

4) To see the I/O connections, click **Menu** on the home view and select **I/O**. Click **Select** on the right side to see further information and change the connections.

5) Press the help button identified by a question mark on the assistant control panel, to get a more detailed explanation in any unclear situations.



Conveyors
Belt conveyor for glass bottles

The ACS580 has many useful features for controlling belt conveyors and conveyors moving heavy loads. External control allows users to manually fine-tune the speed of the conveyor, mechanical brake control synchronizes the motor control and mechanical brake control, s-ramp guarantees smooth acceleration and deceleration of the conveyor, and stall function protects the motor in stall situations.

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Features for conveyors

Highlight features
External control
Mechanical brake control
S-ramp
Stall function

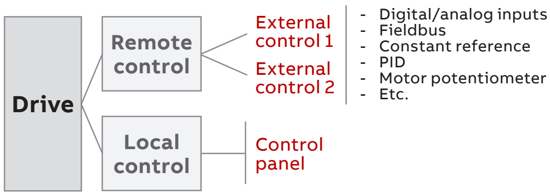
Use also for these applications
Pumps, fans
Turntables
Conveyors
Extruders, compressors

Conveyors

Benefits and instructions – two control locations

Benefits of two control locations
Two external control locations become handy in situations where **the speed of the belt conveyor needs to be fine-tuned on a one-time basis**. Slowing the speed might be needed, for example, to be able to inspect the bottles. Using two control locations enables you to set a speed reference for the belt conveyor, for example, through digital inputs or a fieldbus, and in addition, to control the speed, for example, manually via a potentiometer.

Manual control with the potentiometer offers **flexibility and simplicity for the process, since no parameters need to be adjusted** and the potentiometer can be used whenever needed. The following shows how the second control locations for the motor potentiometer can be applied.

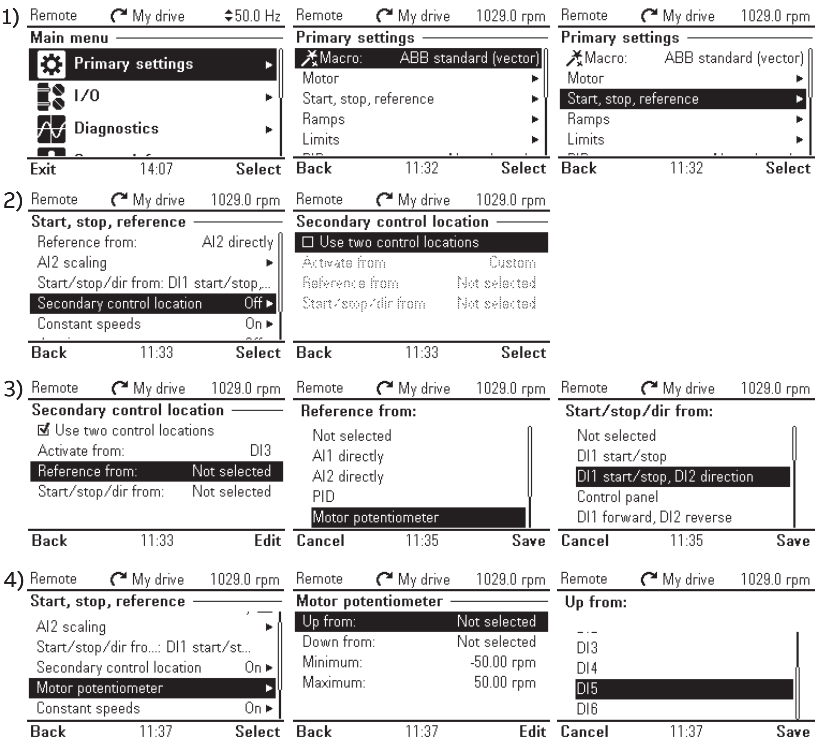


How do you set it up?
1) In this example, it's assumed that external control location 1 is already configured. For example, if the belt conveyor is driven normally through a fieldbus, it uses external control location 1. To enable the external control location 2 for the motor potentiometer, go to **Primary settings**, make sure the drive is on vector control, and select **Start, stop, reference**.

2) Select **Secondary control location** and activate **Use two control locations**.

3) Select the source that activates the second control location. Set the **Motor potentiometer** as the reference, and determine **Start/stop/dir from**, if needed.

4) Go back to the **Start, stop, reference** view and select **Motor potentiometer**. Determine the sources for increasing and decreasing the speed. Adjust also the minimum and maximum values for the speed, if needed.



Conveyors

Benefits and instructions – mechanical brake control

Benefits of mechanical brake control

A mechanical brake can be used for **holding the motor at zero speed** while the drive is stopped or not powered. Mechanical brake control is a good feature when the motor control and mechanical brake need to be **accurately synchronized**, for example, to perform an operation on the conveyed item. A mechanical brake prevents a heavy load from dragging an inclined conveyor backwards while stopped for the operation. It also allows **smooth starting of the conveyor**, as the load is held in place by the speed control of the drive until the brake open delay has passed. In case of a stop request, the speed of the motor is ramped down to a stop before closing the brake, allowing smooth stopping. Additionally, using the control through the drive, you can **reduce the number of mechanical components** that would otherwise be needed to control the brake. The following advises how to set the mechanical brake control on the ACS580. For wiring instructions, check the ACS580 standard control manual.

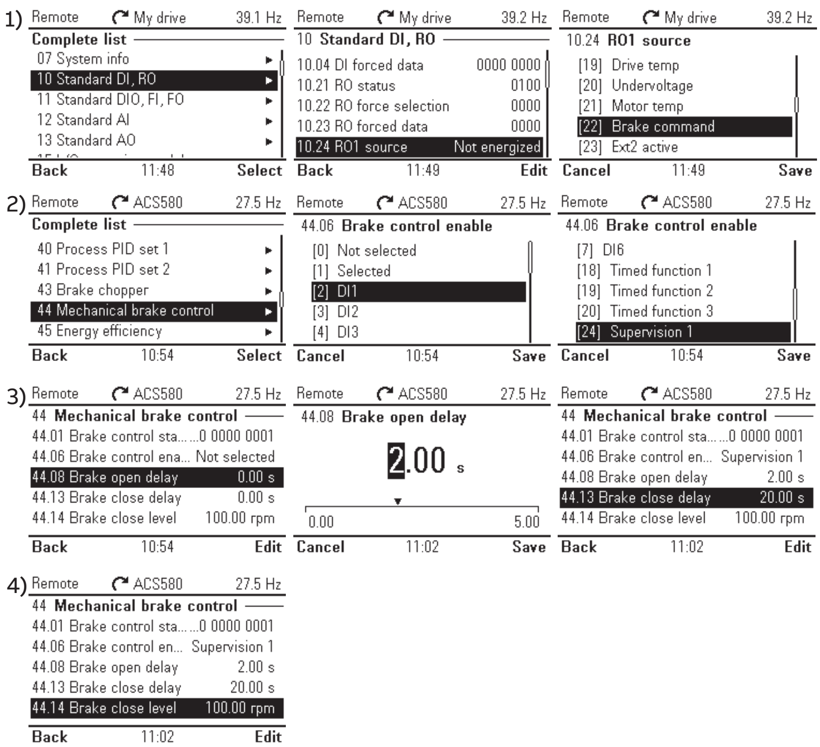
How do you set it up?

1) The mechanical brake is controlled by bit 0 of parameter **44.01 Brake control status**. Select this bit as the source of a relay output. Go first to **Parameters** and select **Complete list**. Scroll down to parameter group **10 Standard DI, RO**. Select parameter **10.24 RO1 source** to set the source for the RO1. Scroll down the list and select **[22] Brake command**.

2) Next go to parameter group **44 Mechanical brake control**. In parameter **44.06**, you can select which signal enables the mechanical brake control. Here, for example, digital inputs or other functions can be chosen. Once you've selected the signal, click **Save**.

3) Parameter **44.08** defines the brake opening delay, while parameter **44.09** defines the closing delay. These values are specified by the brake manufacturer.

4) In parameter **44.14 Brake close level** you can define the motor speed for brake close as an absolute value. Once the motor speed has decelerated to this level, a close command is given.



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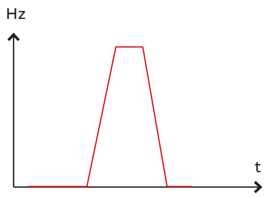
As the ACS580 drives do not have support for an encoder they are not optimal for vertical movement, and for those situations, the ACS380 and ACS880 are better choices.

Conveyors

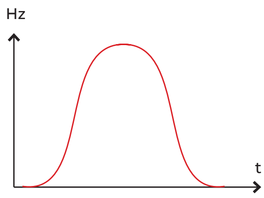
Benefits and instructions – s-ramp

Benefits of s-ramp
An s-ramp, or a shaped ramp, is a specific type of ramp that defines how smoothly the motor accelerates or decelerates. As the s-ramp is applied, it allows the motor to **accelerate and decelerate smoothly without any sudden twitches** that might cause the glass bottles to swing and break down on the belt conveyor.

You can define how quickly or slowly the motor achieves its maximum speed and how it decelerates to a stop. If ramps are used, the shape time determines the smoothness of the ramp. The following gives step-by-step instructions how to apply the s-ramp.



Starting and stopping without an s-ramp

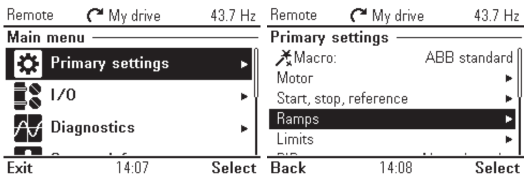


Starting and stopping with an s-ramp

How do you set it up?
1) To set the s-ramp, or shaped ramp, go to **Primary settings** and select **Ramps**.

2) Adjust acceleration and deceleration times if needed by clicking **Edit**. Use the arrow buttons to set the desired value and click **Save**. To determine the s-ramp, edit **Shape time**. Longer shape times correspond to smoother ramps.

1)



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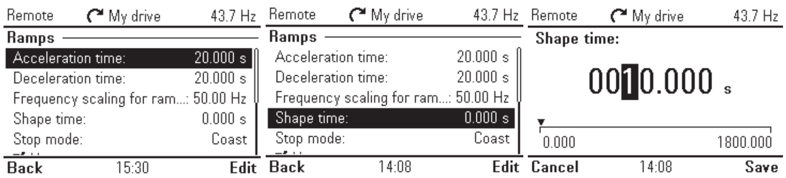


Conveyors

Benefits and instructions – stall function

Benefits of the stall function

The purpose of the stall function is to **protect the motor in stall situations** where the motor is unable to rotate. Stalling occurs if the load torque is greater than the motor shaft torque. Regarding belt conveyors, the load torque might increase above the shaft torque, for example, if additional objects are put on the conveyor belt, or if the belt is prevented from moving, for instance as a consequence of an accident.

If the motor is not able to rotate, the slip of the induction motor increases. This increase causes higher voltage, and thus more current is induced in the rotor windings. The higher the current in the windings, the more heat and damage it can cause for the winding insulation and the motor. The stall function protects the motor by monitoring the motor current and the speed or the output frequency. If user-set limits for the current and speed or frequency are reached over a user-defined period of time, a fault or warning is generated.

By being prepared for this kind of situation, **the lifetime of the motor can be improved and the maintenance interval can be prolonged**. The following instructs step by step how the benefits of the stall function can be applied. For wiring instructions, please refer to the user's manual.

How do you set it up?

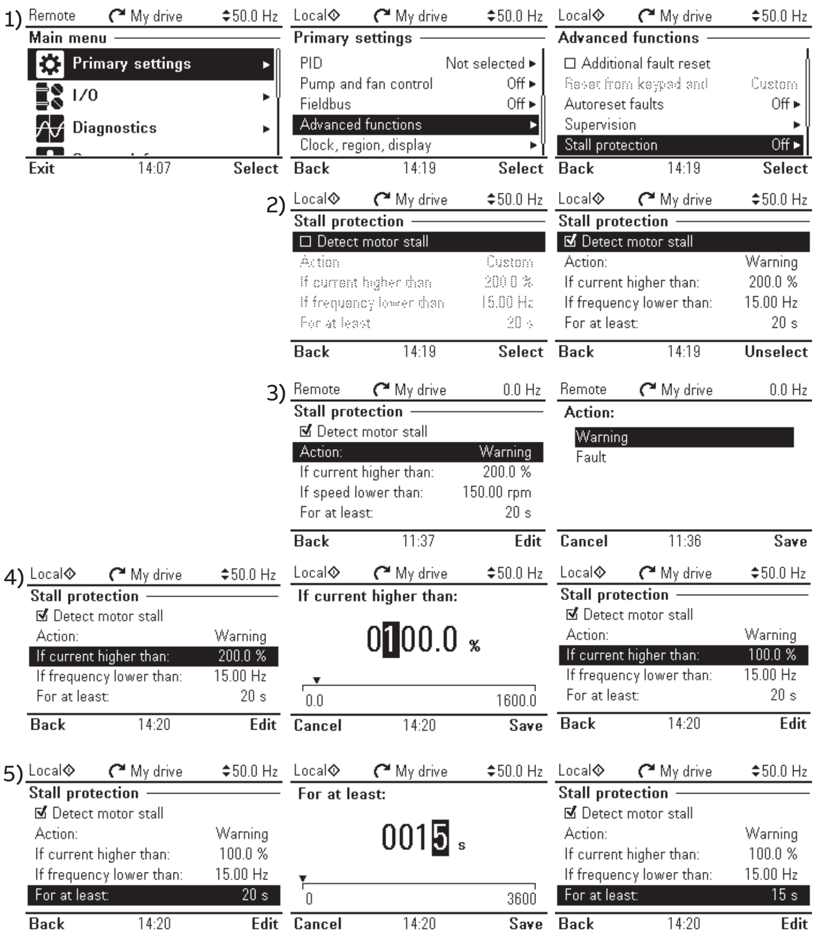
1) To adjust parameters related to stalling, go to **Primary settings,** scroll down and select **Advanced functions**. Go down and select **Stall protection**.

2) Select **Detect motor stall** to enable the stall protection function.

3) Define which action is taken in case of a stall condition. A warning notifies users about the stall condition on the control panel's screen, while a fault leads the drive to trip.

4) Next, define the stall current limit as a percentage value of the nominal current. Set also the stall speed or frequency limits depending on the motor control mode (vector or scalar).

5) Set the time limit to indicate a stall condition. If the stall current together with the stall speed/frequency have occurred over the stall time, the drive generates a warning or a fault to notify users about the condition.

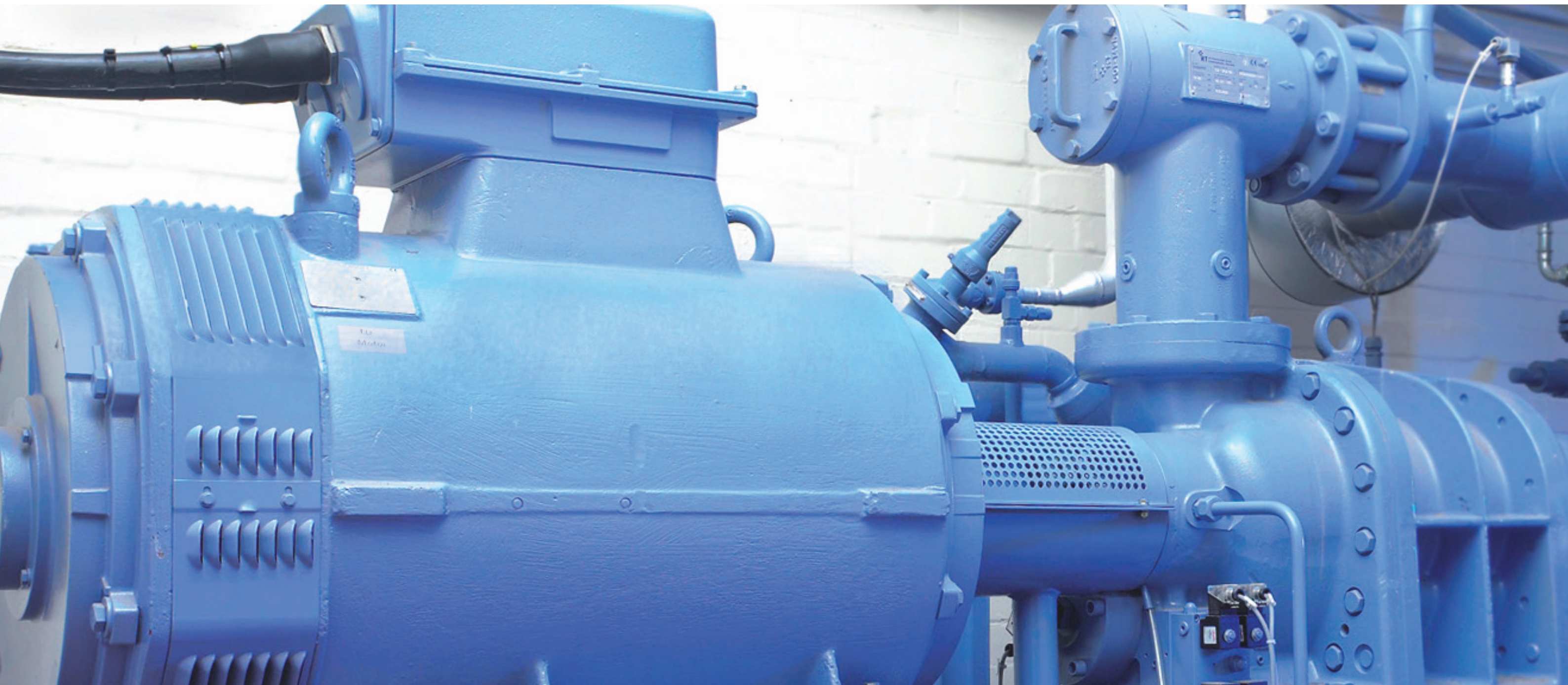


Compressors
Screw compressor

Screw compressors are used in very diverse set of environments: some of them might be potentially explosive, while other locations might be cold and humid. The ACS580 offers suitable features for many kinds of environments. For example, an ATEX-certified motor temperature monitoring module is a good choice for explosive environments, while the motor pre-heating function keeps the motor free from condensation.

Features for the screw compressors in a potentially explosive environment

Highlight features	Use also for these applications
ATEX-certified CPTC-02 module	Pumps, fans, compressors
Pre-heating	Pumps, compressors
Pre-magnetization	Conveyors



Compressors

Benefits and instructions – ATEX-certified CPTC-02 module

Benefits of the ATEX-certified CPTC-02 module
If motors are used **in applications in a potentially explosive environment**, the ACS580 general purpose drives can be ordered with an ATEX-certified thermistor protection module option. This module **protects the motors from being damaged by too-high motor temperatures**. The ATEX-approved CPTC-02 module includes a PTC sensor input that executes the SIL/PL capable Safe Motor Temperature safety function by activating the drive's safe torque off function, STO.

If the motor temperature rises above the PTC sensor limit temperature, the sensor resistance increases very sharply. This indicates overtemperature to the CPTC-02 module. The module switches the drive's safe torque off circuit off, which activates the drive's STO function. The STO function disables the control voltage of the power semiconductors of the drive output stage. This prevents the drive from generating the torque required to rotate the motor. If the motor is running when the STO function is activated, it coasts to a stop.

How do you set it up?

1) Go to **Parameters** and select **Complete list**. Scroll down to parameter group **15**. Make sure that the value of both parameters **15.02** and **15.01** is CPTC-02. The value can be edited by choosing **Edit**.

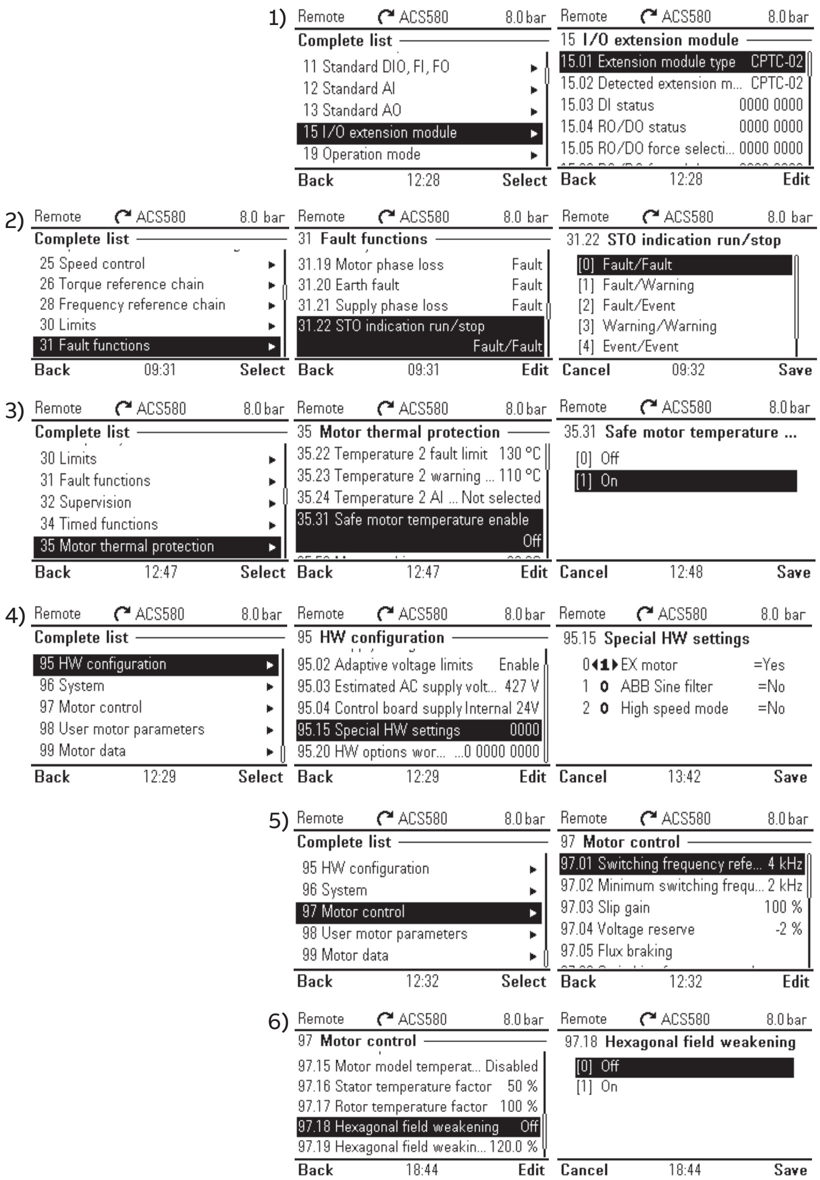
2) Go to parameter group **31**. In parameter **31.22**, select which indications are given when one or both STO signals are switched off or lost.

3) Go to parameter group **35**, and make sure that the value of parameter **35.31**, SMT, is 1. This enables the Safe motor temperature.

4) Go to parameter group **95**, and set the minimum switching frequency for ABB Ex motors in parameter **95.15**.

5) For other motors, use parameters **97.01** and **97.02** in the parameter group **97**. Parameter 97.01 defines the switching frequency of the drive that is used as long as the drive doesn't heat too much. Parameter 97.02 corresponds to the lowest switching frequency that is allowed.

6) Make sure that the value of parameter **97.18** is zero. For Ex motors, hexagonal field weakening must be deactivated.



Compressors

Benefits and instructions – pre-heating

Benefits of pre-heating

This function turns pre-heating on or off. While on, the drive keeps the motor warm and prevents condensation in a halted motor by feeding a fixed current, typically 0-30 percent of the nominal current, to the motor. By warming the motor and preventing water from condensing in it, the **lifetime and maintenance interval of the motor can be prolonged**. In addition, the pre-heating **prevents damage and wear in the motor caused by cold starts**. The pre-heating function is useful especially in humid or cold conditions where condensation is a typical phenomenon or where the motor gets cold easily.

The function can be defined to be always active when the drive is stopped, or it can be activated by a digital input, fieldbus, timed function or supervision function. For example, with the help of the signal supervision function, the heating can be activated by a thermal measurement signal from the motor.

When the pre-heating is activated, the stop command is given, and if the drive is running below zero speed, the drive starts immediately to preheat the motor. If the motor is running above zero speed, the pre-heating is delayed by 60 seconds to prevent excessive current in the motor.

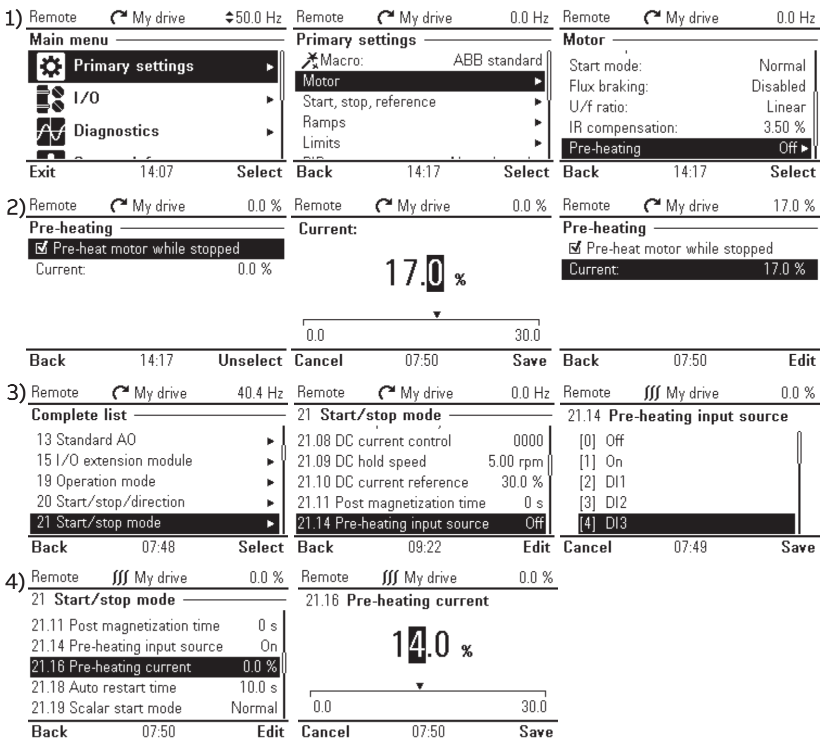
How do you set it up?

1) To see and adjust pre-heating settings, go to **Primary settings** and choose **Motor**. Scroll down to **Pre-heating**.

2) Select **Pre-heat motor while stopped**. To edit the percentage value of the nominal current that is used for pre-heating the motor, click **Current** and select **Edit**. Use the arrow buttons to edit the value.

3) If pre-heating is set through Primary settings, it's always activated while the motor is stopped. To select an input source to trigger the pre-heating, go to **Parameters** and select **Complete list**. Go to parameter group **21 Start/stop mode**. In parameter **21.14 Pre-heating input source**, you can select, for example, digital inputs or timed functions to active the pre-heating.

4) In parameter **21.16 Pre-heating current**, you can set the desired value for pre-heating current.



Compressors

Benefits and instructions – pre-magnetization

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WARNING!
The drive will start after the set pre-magnetizing time has passed even if motor magnetization is not completed.

Benefits of pre-magnetization
Pre-magnetization can be applied to **guarantee the highest possible breakaway torque** (up to 200 percent of the nominal torque of the motor). In addition, by adjusting the magnetization time, it is possible to **synchronize the motor start and e.g. the release of the mechanical brake**, which is **useful when great accuracy is needed**.

Normal start mode starts the motor immediately from zero speed, while Fast mode allows the drive to pre-magnetize the motor before start with an automatically determined pre-magnetizing time. Const time, on the other hand, should be selected if constant pre-magnetizing time is required, for example when synchronizing with a mechanical brake. If a full breakaway torque is also essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.

Automatic mode enables the drive to automatically to select the correct output frequency to start rotating the motor. It's especially useful with flying starts, as the drive will start smoothly at the current frequency of the rotating motor. If permanent magnet motors are used, this mode must be selected.

The torque boost mode allows both the pre-magnetization of the motor and the torque boost to be applied. The torque boost effect ceases when the output frequency exceeds 20 Hz or when it is equal to the reference value. The Automatic+torque boost mode first performs an automatic start and magnetizes the motor. However, if the speed of the motor is zero, the torque boost is applied.

How do you set it up?
To see and adjust pre-magnetization-related parameters go to **Parameters** and select **Complete list**.

1) Go to parameter group **21 Start/stop mode**. If you're using vector control, select parameter **21.01 Start mode** and select which starting mode you'd like to use.

2) If you're using scalar control, select parameter **21.19 Scalar start mode**, and select which starting mode you'd like to use.

3) To adjust the magnetization time, for example if **Const time** is selected, go to parameter **21.02** and determine the time period the drive allows the motor to be magnetized. Once the desired time is determined, click **Save**.

4) To ensure full magnetizing, set parameter **21.02** to the same value as, or higher than, the rotor time constant. If the value isn't known, use the rule-of-thumb values on the right.

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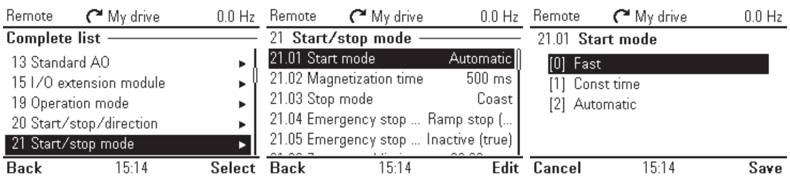

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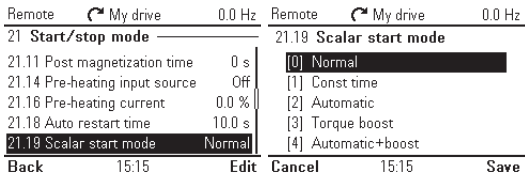

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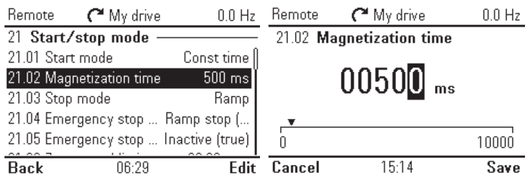


4)

Motor rated power	Constant magnetizing time
< 1 kW	≥ 50-100 ms
1-10 kW	≥ 100-200 ms
10-200 kW	≥ 200-1000 ms
200-1000 kW	≥ 1000-2000 ms

Pumps
Positive displacement pump

Pumps are maybe the most common applications in different industries. Typically, pumps are centrifugal (squared torque) pumps, but there are also positive displacement pumps in the market. Positive displacement pumps are constant-torque applications. These pumps are typically used to pump slurry or other highly viscous material.

Features for the positive displacement pumps

Highlight features	Use also for these applications
Speed supervision	Fans
PID control	Pumps, fans, compressors
Two ramp sets	Pumps, conveyors

Pumps

Benefits and instructions – speed supervision

Benefits of speed supervision

Several signals can be monitored with the ACS580 standard control program. There are six different supervisions available, and all six can be configured in different ways to **ensure smooth operation**. When the supervision signal meets the supervision criteria, a user-selected action, fault or warning is generated.

In this example, we will configure the supervision function to monitor the pump speed and torque. The following instructs you how to set these supervision signals.

How do you set it up?

1) To access supervision settings, go to **Primary settings**, scroll down to **Advanced functions**, and select **Supervision**. Here you can supervise three signals.

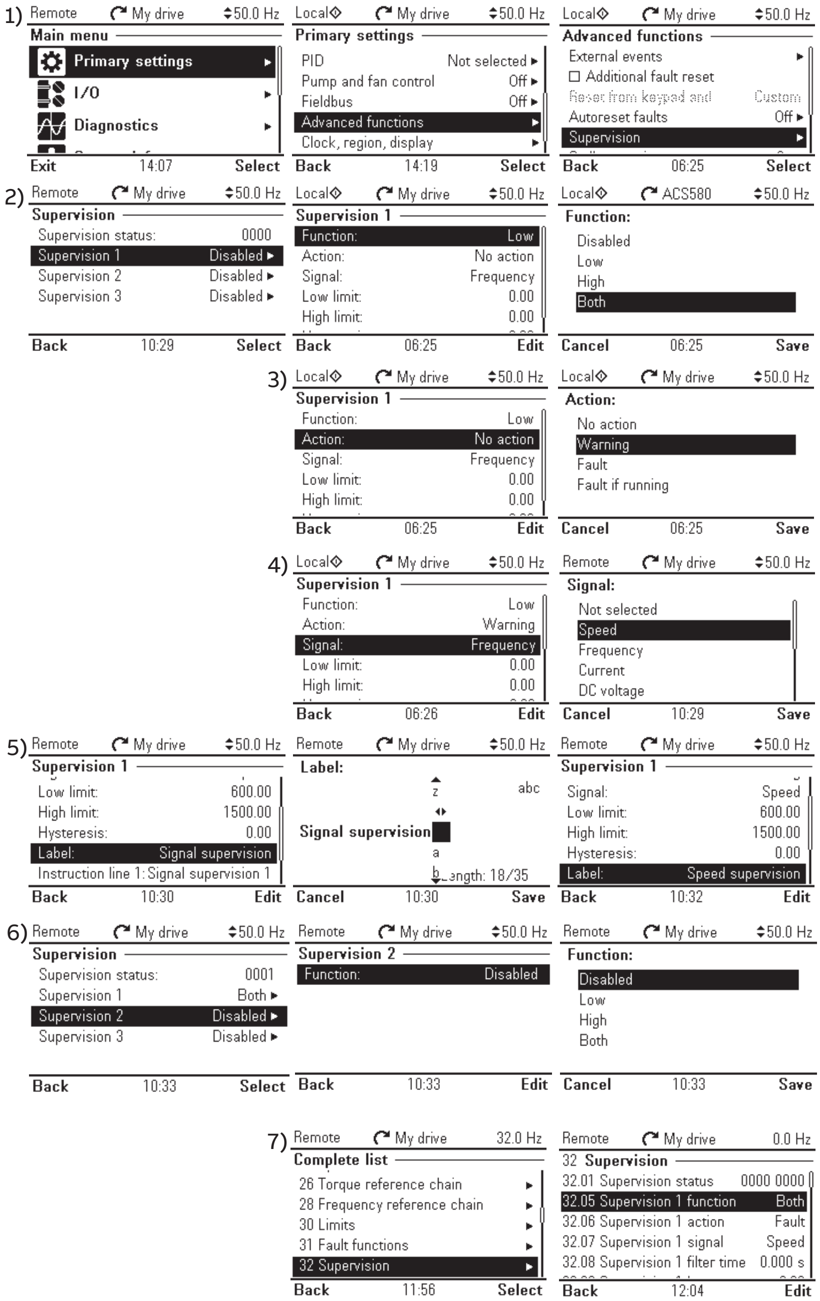
2) Select **Supervision 1** function and define how the signal is supervised.

3) Determine which action is taken if the supervision limits are met. In this example, we select to supervise both low and high values of the signal and to generate a warning if the value is too low or high.

4) Next, select **Speed** for the signal to be supervised and determine the limits for the low and high values of the signal.

5) Edit the label of the warning if needed by clicking **Edit** and using the arrow buttons for typing a new label.

6) Go back to the **Supervision** view and select **Supervision 2** to set the torque supervision. Follow the same steps as with the speed supervision.



7) To supervise more than three signals, go to **Parameters**, select **Complete list**, scroll down to parameter group **34 Supervision**, and set additional signals or all supervised signals in this view.

Pumps

Benefits and instructions – PID control

Benefits of PID control

A PID controller is a typical process controller in industrial applications. The PID controller, which is typically integrated into the drive or in some other control platform, **keeps the process variable in the preferred value** by adjusting the process. In a VSD-driven application, the PID controller can be used to control the motor/pump speed to keep, for example, high enough pressure in the system. If the pressure drops under or rises above a limit defined by the user, the PID accelerates or decelerates the motor accordingly. This **ensures optimal output and balances the process time.**

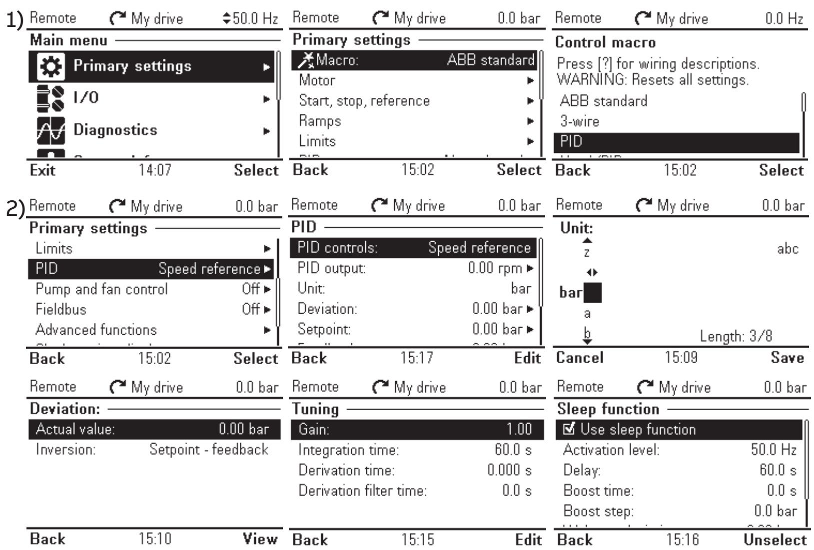
In process PID control, a process reference (setpoint) is connected to the drive instead of a speed reference. An actual value (process feedback) is also brought back to the drive. The process PID control adjusts the drive speed in order to keep the measured process quantity (actual value) at the desired level (setpoint). This means that the user doesn't need to set a frequency/speed/torque reference to the drive, as the drive adjust its operation according to the process PID.

The ACS580 can be set to switch between two different process PID sets. The PID controllers, together with timed functions, enable users to **achieve optimal output also with varying process requirements, for example, during day and night.**

How do you set it up?

1) Use **Primary settings** to configure the PID settings quickly and without the need to access any drive parameters. Go to **Primary settings**, select **Macro** and scroll down to **PID**. This selection pre-configures all the needed parameters in order to get the PID control into action.

2) To adjust the PID settings further, continue with **Primary settings** and scroll down to **PID**. Set, e.g. the min and max PID output values, define the process unit, set the deviation logic, define the setpoint and feedback sources, set gain, integration and derivation values to ensure optimal process control, and enable the sleep function to automatically stop the motor when demand is low.

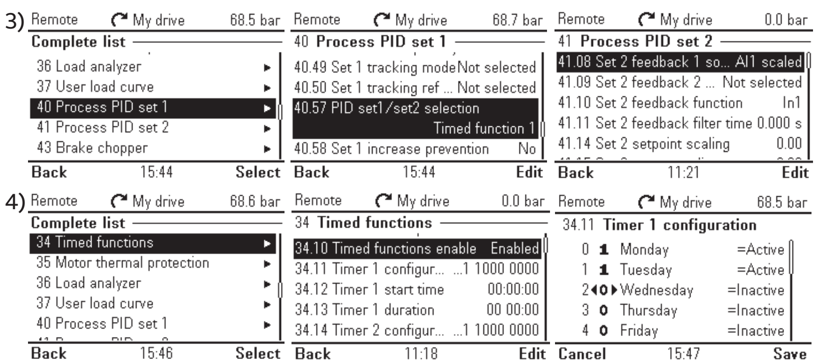


– The optimal gain, integration and derivation values can be achieved by loop tuning, where the values are slightly changed and the process behavior is examined until the best output is achieved.

For advanced users

3) To switch between two PID controls, go to parameter group **40**, select parameter **40.57**, and choose e.g. **Timed function 1**. Adjust the **Process PID set 2** parameters in the parameter group **41**.

4) Finally, go to parameter group **34** and enable and configure the timer for the PID set 2 in parameters **34.10-34.13**.



– If the process has different requirements, for example during day and night, set two different PID controls and switch between them according to a timed function.

Pumps

Benefits and instructions – two ramp sets

Benefits of two ramp sets
Constant-torque applications, such as positive displacement pumps, require a high starting torque. In a typical direct-on-line (DOL) or star-delta operation, the there is a risk that not enough current is available for the start or the start will cause a voltage drop in the system.

By using variable speed drives, **constant-torque applications can be started in a more sophisticated manner**. Variable speed drives, such as the ACS580, ensure that there is **enough torque also at low speeds** to start a positive displacement pump.

Besides the smooth start, ACS580 proves valuable when there is a need to control the speed of the positive displacement pump. The pump **speed can be adjusted smoothly** starting from zero speed.

The ACS580 also features several customer-configurable ramp sets. For example, the ACS580 allows you to start the positive displacement pump quickly to 35 Hz to **minimize mechanical wear in the sealing** and then start using a slower acceleration in the normal operation.

How do you set it up?

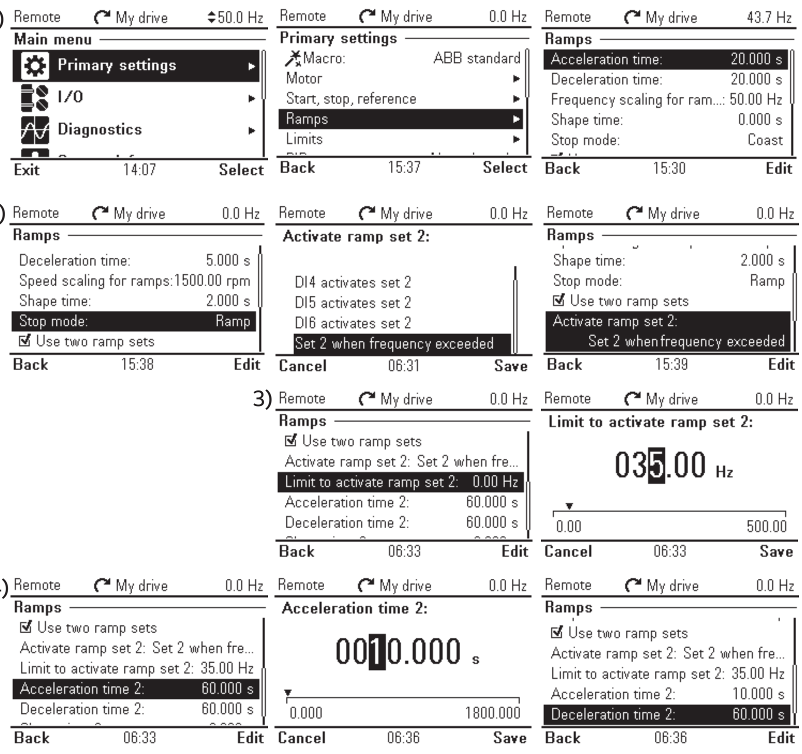
1) Go to **Primary settings** and select **Ramps** to adjust ramp times. Click **Edit** to modify acceleration time, deceleration time, and other values.

2) If s-ramp (introduced earlier) is needed, define the shape time. Determine also the stop mode. Select **Use two ramp sets** and choose when ramp set 2 is activated. In this example, we activate ramp set 2 when a certain frequency is exceed.

3) Determine the limit for the frequency that activates ramp set 2. In this example, we want ramp set 2 to be activated once 35 Hz is exceeded.

4) Determine acceleration, deceleration, and shape times for ramp 2 set.

1)



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