ACS580 general purpose drives for cooling compressors
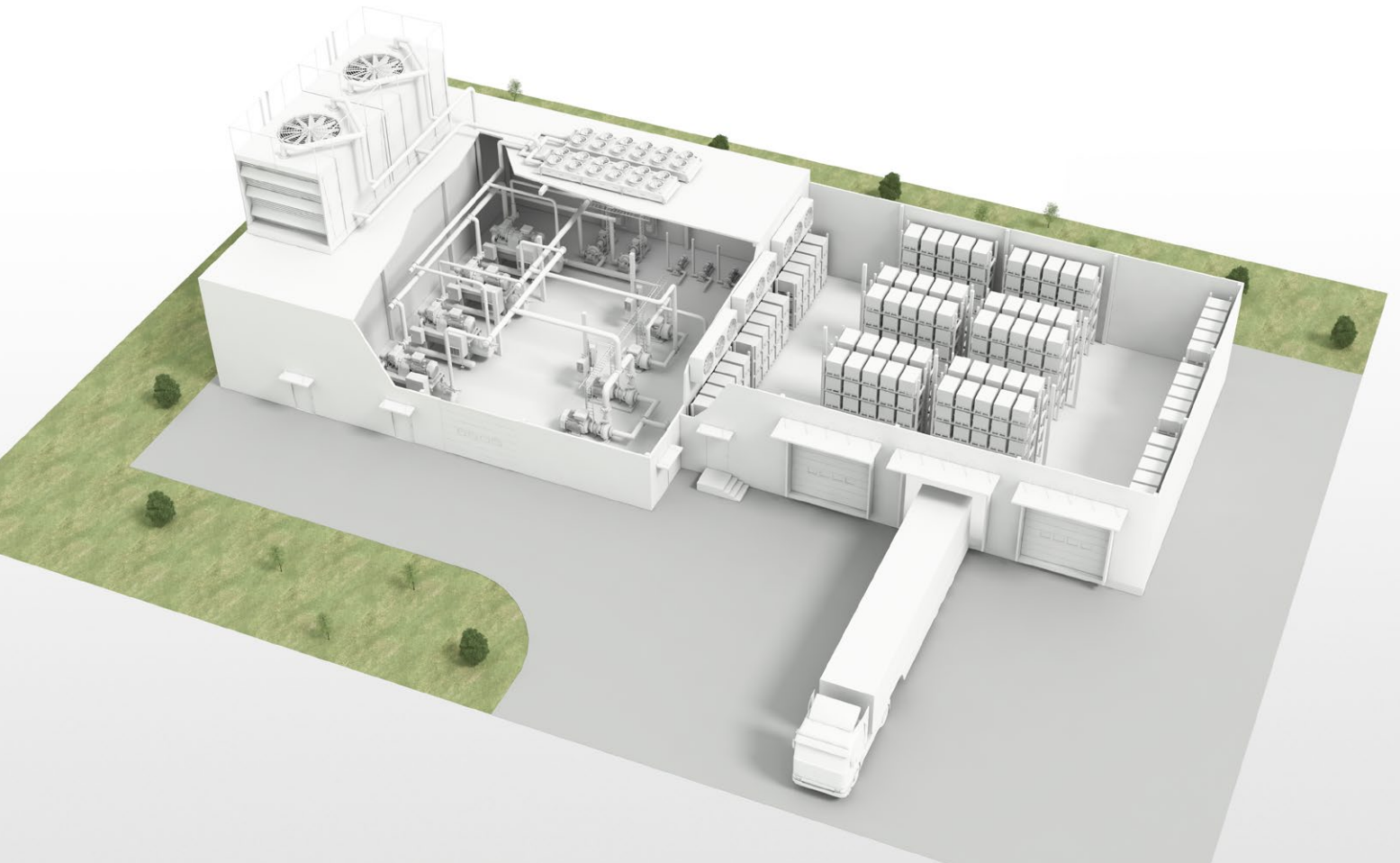
Application guide

The purpose of this application guide is to give the reader a broad overview of the specific features of the ACS580 general purpose drives that are especially useful for cooling compressor users.

Contents

ACS580 general purpose drives

Introduction

Typical applications of ACS580 drives are variable and constant torque applications, such as compressors, pumps and fans. ACS580 drives have everything essential inside, which makes them easy to install, start up and use. They offer users effortless high-level performance through a combination of easy installation and commissioning as well as a wide range of built-in features. Many of these features are designed for specific applications, industries or environments. This can significantly reduce the time users need to spend adjusting settings, and also reduces the need for additional investments in external components.

The purpose of this application guide is to give the reader a broad overview of the specific features of the ACS580 general purpose drives that are especially useful for cooling compressor users. The guide introduces the main features and benefits of using the ACS580 and then offers step-by-step introductions on how to apply each feature.

The application guide consists of three chapters. The first chapter explains what equipment is involved in an industrial refrigeration cycle and where variable speed drives (VSDs) can add value. The second chapter briefly highlights the features and benefits of using the ACS580 for cooling compressor applications. Finally, the third chapter focuses on the details of how to use the software features to gain the significant benefits they offer.

This application guide is prepared as a follow-up to the **Efficient refrigeration control** brochure, which includes information about industrial refrigeration, energy saving in refrigeration systems and benefits of using variable speed drives. It can be accessed via ABB's website at new.abb.com/drives and also by following the QR code on the back cover of this application guide.

Equipment involved in an industrial refrigeration cycle

The industrial refrigeration application consists of 4 main elements: The cooling compressor, condenser, expansion valve and evaporator. In the refrigeration cycle, liquid refrigerant absorbs the heat from a cooled space. To do this the refrigerant needs to go through the refrigeration cycle where:

1. **The compressor pressurizes and heats the refrigerant.**

2. **The high-pressure gas refrigerant goes through the condenser, where the pressure as well as the temperature is decreased, which leaves it in a high pressure liquid state.**

3. **From the condenser the refrigerant goes as high-pressure liquid to the expansion valve, which regulates the amount of refrigerant that is fed to the evaporator. The expansion valve will lower the pressure and temperature of the refrigerant, making it a mixture of liquid and vapor.**

4. **The cooling happens when this low-pressure liquid and vapor mixture absorbs the heat from cooled space to the refrigerant, which warms the refrigerant and turns it back to vapor/gas form.**

Industrial refrigeration cycle

—
Fig 1. Typical single-stage vapor compression refrigeration
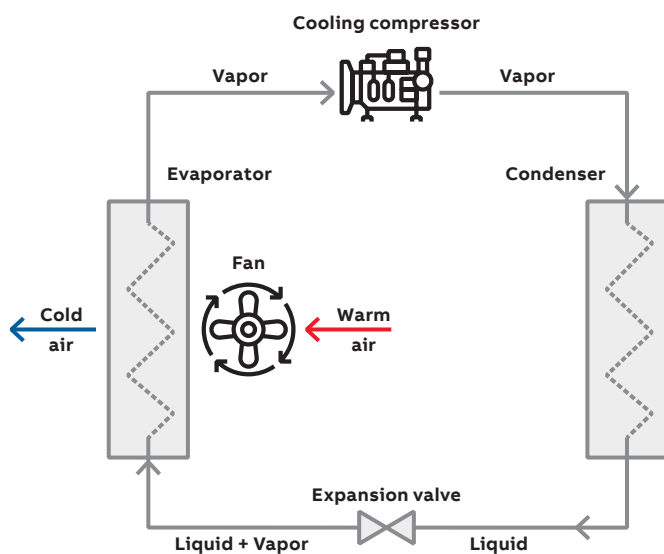
Basic components

- A **cooling compressor**, to compress the low temperature/ low pressure gas to a high temperature/high pressure gas
- A **condenser**, to dissipate the heat to the surroundings (the condenser can be water-cooled or air-cooled)
- An **expansion valve** to convert the refrigerant from liquid to gaseous form
- An **evaporator**, to absorb the heat from the area to be cooled

Potential areas where VSDs add benefits

- Cooling compressors
- Evaporator fans
- Condenser fans
- Circulating pumps (refrigerant/coolant media e.g., glycol)

Features and benefits the ACS580 food and beverage software package brings to cooling compressor control

The cooling compressor control application is part of the food and beverage software package for the ACS580. It brings superb ease of use and flexibility to cooling and refrigeration. The following takes a closer look at the features of this application and the benefits that they deliver.

Compressor control macro
This macro sets typical parameter values for the cooling compressor application and makes it easier to commission the drive.

Short cycle protection
When controlling refrigeration compressors, there is often a need to limit the number of starts to reduce the mechanical stress on the compressor. If the compressor is started too often and used for only short periods of time, it may not be lubricated completely, which may cause damage to the compressor.

This feature enables setting of time delays for restarting and minimum run time to avoid such problems.

Cooling compressor control
With the cooling compressor control the cooling temperature of the refrigeration system can be easily setup and controlled in reliable way.

Multi-compressor control
Multi-compressor control is an ideal feature for compressor sets, where the load may vary, and multiple compressors need to be used in the same system to match the load variations.

The multi-compressor control feature manages the speed of the main compressor and starts and stops additional contactor controlled motors automatically, depending on the need.
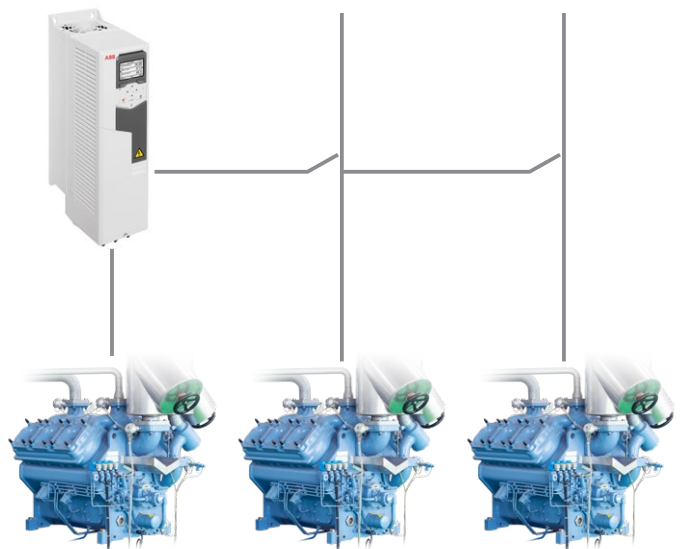
—
Refrigeration can account for up to 70 percent of the electricity bill for companies in the food and beverage segment. With energy-efficient drive and motor solutions electric energy consumption will be reduced and optimized.

1. Cooling compressor control with the ACS580

The ACS580 general purpose drive, with the firmware revision 2.16 and onward, has a new food and beverage specific software license available. This license can be ordered separately with the option code +N8057. With this +code, the drive will be delivered together with the F&B software license. This license includes software features for cooling compressors and cavitation detection and control. This document describes how the cooling compressor control features should be configured.

The built-in cooling compressor control functions in the ACS580 drive make the control of the cooling compressor seamless. The feature set for cooling compressors includes the following items:
• Compressor macro
• Cooling compressor control functionality
• Short cycle protection
• Multi-compressor control

The cooling compressor control features are targeted towards industrial refrigeration applications in the food and beverage segment. These applications can be, for example, food and fish processing, aqua culture, logistics centers and cold storages. Typically in these applications the refrigeration is often done with reciprocating and screw compressors, where compressor's motor power ratings start from 150 kW.
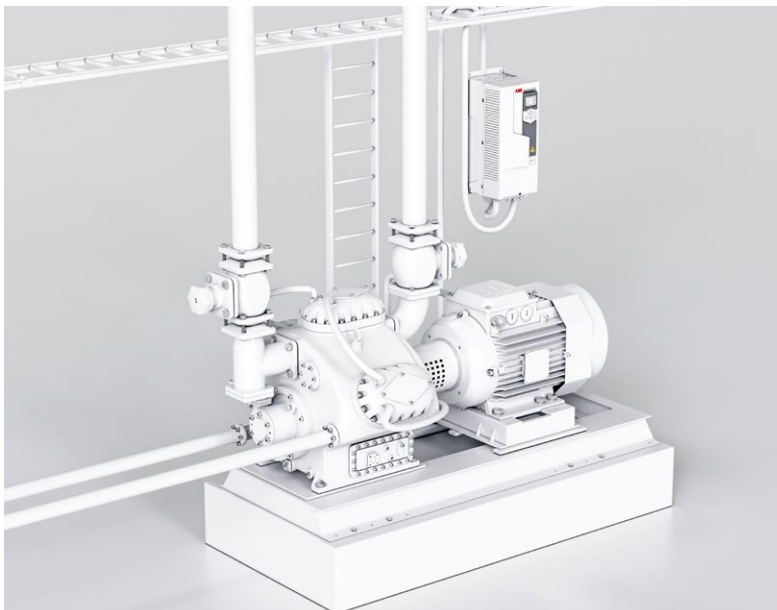
—
Condenser

—
Evaporator
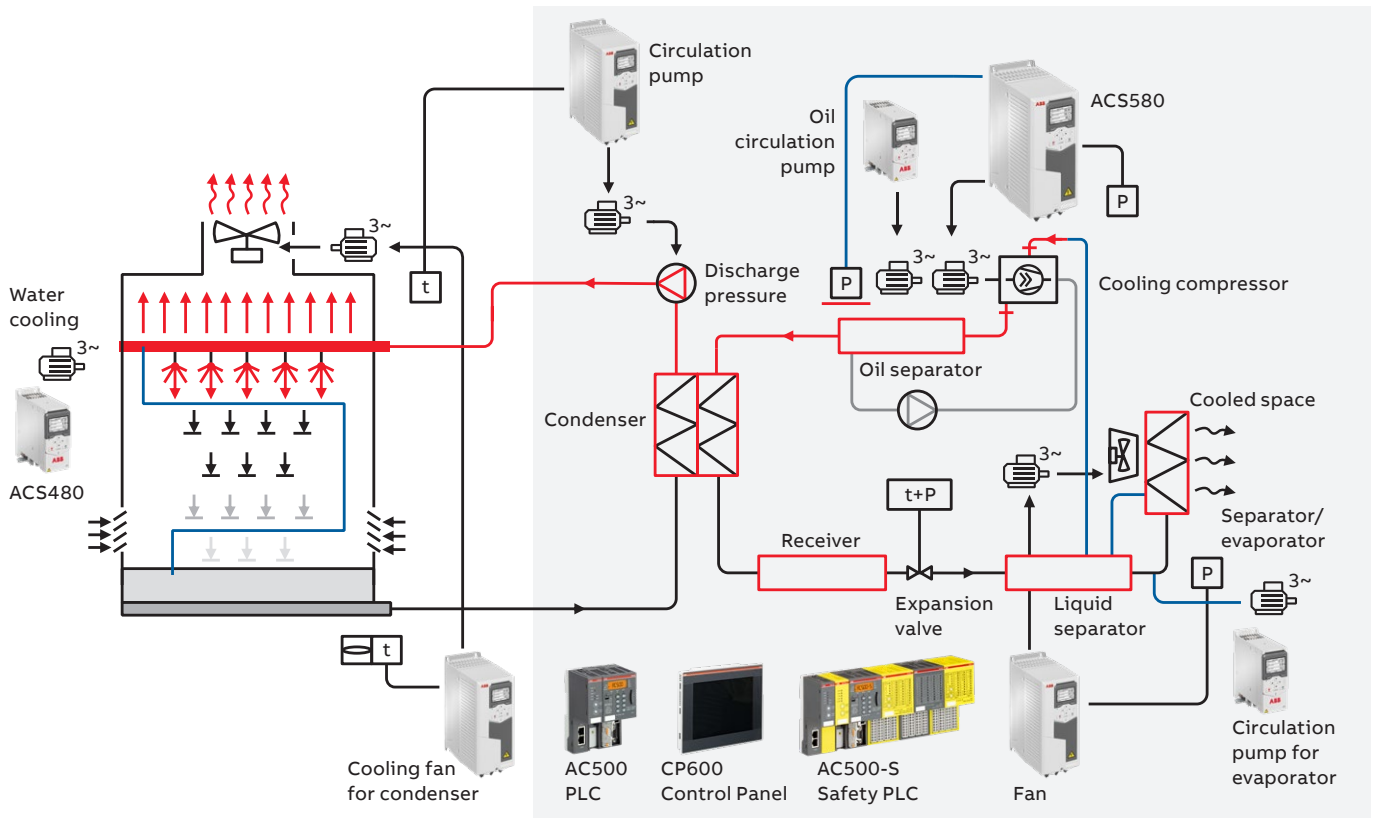
—
Fig 2. Industrial refrigeration system, cooling compressor

In refrigeration applications some original equipment manufacturers (OEMs) tend to have the main logic built into the PLC controlling system, which means that it is expected that the drive only controls the motor.

Other OEMs and system integrators (SI) might be manufacturing the cooling compressor piece by piece, from different vendors. In this case the hardware (compressor and other equipment), PLC controller, drives and motors can all come from different suppliers and, in these cases, the specific cooling compressor features built into them can add the most value.

By using the built-in functions of the ACS580 for cooling compressors, it is possible to simplify the PLC structure by utilizing the I/Os and the programming capability with adaptive programming of the drive. This saves time and effort as the cooling compressor control functionality is already built into the drive.

With the ABB All-compatible drive offering, ABB's drives can communicate with many different fieldbus protocols, which means that a wide selection of PLC's can easily communicate with the ACS580 general purpose drive.

The supported fieldbus protocols are:

- Modbus RTU as embedded fieldbus

- Optional fieldbusses:
  +K451 DeviceNet™ (FDNA-01)
  +K454 PROFIBUS® DP (FPBA-01)
  +K457 CANopen® (FCAN-01)
  +K462 ControlNet™ (FCNA-01)
  +K469 EtherCAT® (FECA-01)
  +K470 Ethernet POWERLINK (FEPL-01)
  +K490 EtherNet/IP™ (FEIP-21)
  +K491 Modbus®/TCP (FMBT-21)
  +K492 PROFINET® IO (FPNO-21)

1.1. Compressor control macro

Control macros are sets of default parameter values that are suitable for a certain control configuration. When starting up the drive, the user can easily select the best-suited control macro as a starting point and then make the necessary changes to tailor the settings to their purpose.

A cooling compressor macro helps to make the setting-up and commissioning easy as the main parameters are set by the macro. The user can then modify the parameterization based on application needs. By selecting the cooling compressor macro with a parameter of 96.04 on the control panel or with drive composer PC tool, the following parameters will be set:

96.04	Macro select	7 = Compressor control
10.24	RO1 source	2 = Ready run
10.27	RO2 source	7 = Running
10.30	RO3 source	15 = Fault (-1)
12.20	AI1 scaled at AI1 max	50.000
13.12	AO1 source	3 = Output frequency
13.18	AO1 source max	50.0
19.11	Ext1/Ext2 selection	0 = EXT1
20.01	Ext1 commands	1 = In1 Start
20.03	Ext1 in1 source	2 = DI1
20.04	Ext1 in2 source	0 = Always off
20.05	Ext1 in3 source	0 = Always off
20.06	Ext2 commands	0 = Not selected
20.08	Ext2 in1 source	0 = Always off
20.09	Ext2 in2 source	0 = Always off
20.12	Run enable 1 source	6 = DI5
22.11	Ext1 speed ref1	16 = PID
22.18	Ext2 speed ref1	0 = Zero
22.22	Constant speed sel1	5 = DI4
22.23	Constant speed sel2	0 = Always off
22.71	Motor potentiometer function	0 = Disabled
22.73	Motor potentiometer up source	0 = Not used
22.74	Motor potentiometer down source	0 = Not used
23.11	Ramp set selection	0 = Acc/Dec time 1
28.11	Ext1 frequency ref1	16 = PID
28.15	Ext1 frequency ref2	0 = Zero
28.22	Constant frequency sel1	5 = DI4
28.23	Constant frequency sel2	0 = Always off
28.71	Freq ramp set selection	0 = Acc/Dec time 1
40.07	Process PID operation mode	2 = On when drive running
40.16	Set 1 setpoint 1 source	11 = AI1 percent
40.17	Set 1 setpoint 2 source	2 = Internal setpoint
40.19	Set 1 internal setpoint sel1	3 = DI2
40.20	Set 1 internal setpoint sel2	4 = DI3
40.32	Set 1 gain	1.00
40.33	Set 1 integration time	60.0
76.21	Multi-pump configuration	0 = Off
76.25	Number of motors	1
76.27	Max number of motors allowed	1
99.04	Motor control mode	1 = Scalar

1.2. Cooling compressor control

Note: This functionality requires the drive to be equipped with an N8057 food and beverage license.

The cooling compressor control functionality can easily and reliably manage cooling compressors and maintain the correct temperature in the cooling applications. The cooling compressor control utilizes the built-in pressure-temperature charts of the two most used refrigerants R717, Ammonia NH_3

and R744, carbon dioxide CO_2, together with the closed loop PID controls of the drive to control the cooling temperature. The cooling compressor control requires suction pressure feedback from the compressor to the drive to adjust the temperature based on this pressure.

In this document, we use a reciprocating compressor as an example and as a basis for the settings.

—
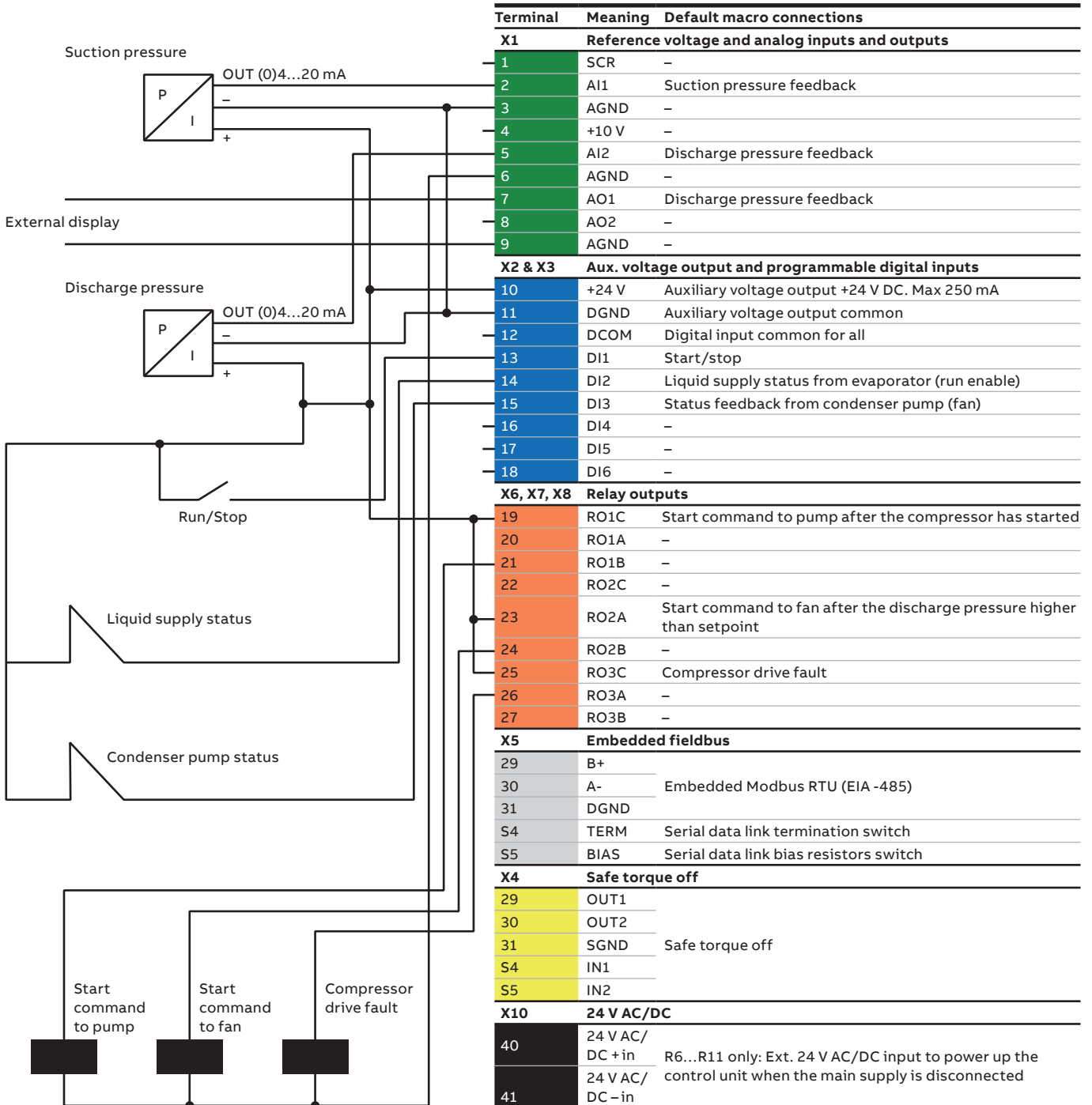**Fig 3. Connections for the compressor control macro**

Terminal	Meaning	Default macro connections
X1		**Reference voltage and analog inputs and outputs**
1	SCR	–
2	AI1	Suction pressure feedback
3	AGND	–
4	+10 V	–
5	AI2	Discharge pressure feedback
6	AGND	–
7	AO1	Discharge pressure feedback
8	AO2	–
9	AGND	–
X2 & X3		**Aux. voltage output and programmable digital inputs**
10	+24 V	Auxiliary voltage output +24 V DC. Max 250 mA
11	DGND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	Start/stop
14	DI2	Liquid supply status from evaporator (run enable)
15	DI3	Status feedback from condenser pump (fan)
16	DI4	–
17	DI5	–
18	DI6	–
X6, X7, X8		**Relay outputs**
19	RO1C	Start command to pump after the compressor has started
20	RO1A	–
21	RO1B	–
22	RO2C	–
23	RO2A	Start command to fan after the discharge pressure higher than setpoint
24	RO2B	–
25	RO3C	Compressor drive fault
26	RO3A	–
27	RO3B	–
X5		**Embedded fieldbus**
29	B+	
30	A-	Embedded Modbus RTU (EIA -485)
31	DGND	
S4	TERM	Serial data link termination switch
S5	BIAS	Serial data link bias resistors switch
X4		**Safe torque off**
29	OUT1	
30	OUT2	
31	SGND	Safe torque off
S4	IN1	
S5	IN2	
X10		**24 V AC/DC**
40	24 V AC/DC + in	R6…R11 only: Ext. 24 V AC/DC input to power up the control unit when the main supply is disconnected
41	24 V AC/DC – in	

Suction pressure

OUT (0)4…20 mA

External display

Discharge pressure

OUT (0)4…20 mA

Run/Stop

Liquid supply status

Condenser pump status

Start command to pump

Start command to fan

Compressor drive fault

—
Fig 4. Pressure to temperature conversion

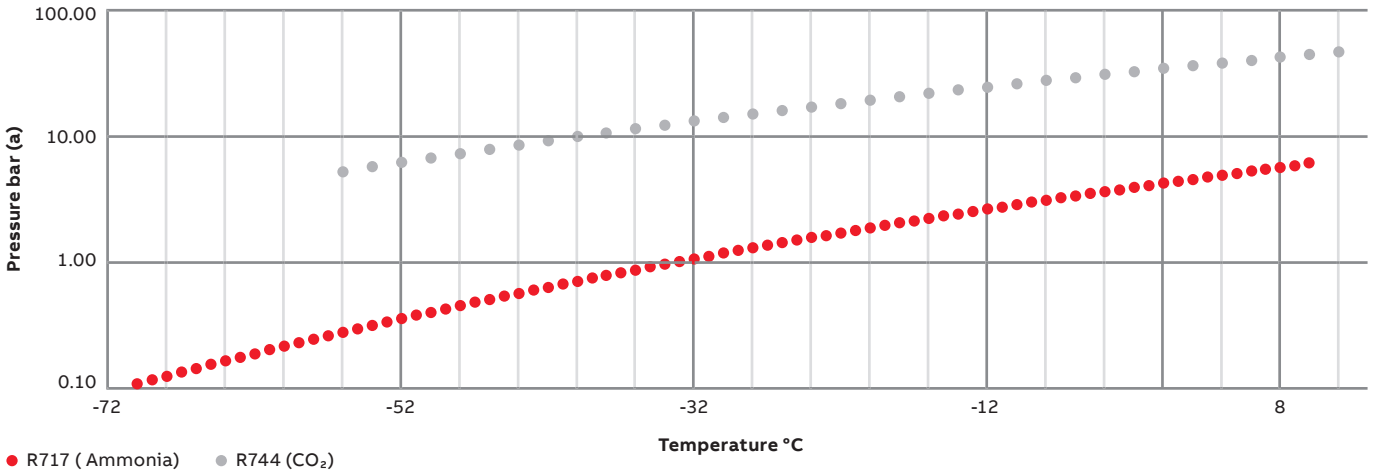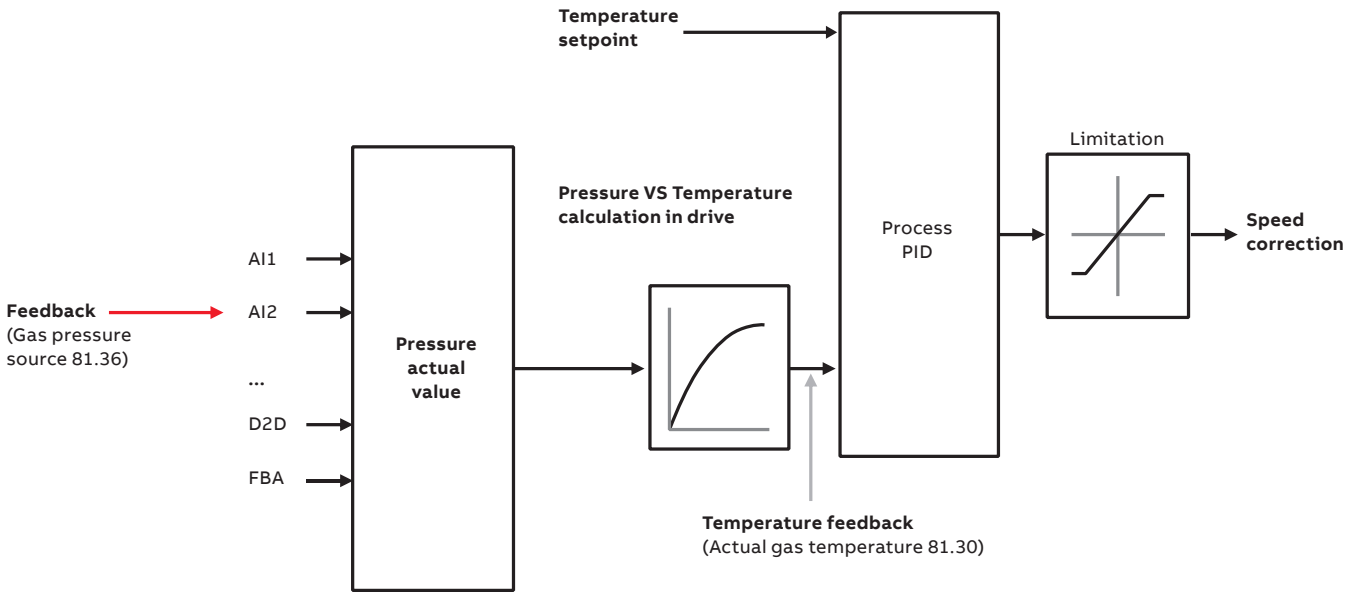● R717 (Ammonia)   ● R744 (CO_2)

—
Fig 5. Cooling compressor control feature

The user needs to select the following parameters from the drive to enable the cooling compressor control feature: refrigerant gas (81.35), gas pressure source (81.36) and the selected gas pressure unit (81.37). Check the actual gas temperature with parameter 81.30. See figure 5 for more detailed info.

1.3. Short cycle protection

Short cycle protection can reduce the mechanical stress on the cooling compressor that repetitive starting can cause. Often, the minimum running times and minimum time between running cycles are limited with compressors. With this feature, it is possible to set the minimum run time and restart delay to reduce this mechanical stress.

Parameters 21.40 Restart delay and 21.41 Minimum run time enable short cycle protection for the compressor.

1.4. Multi-compressor control

It is also possible to control multiple compressors in the same set to adjust the cooling capacity according to the application needs. This is performed by utilizing the pump and fan control (PFC) feature of the ACS580 drive. The drive controls the speed of one of the compressors and, in addition, connects and disconnects the other compressors directly to and from the supply network through contactors.

With the multi compressor control feature, it is possible to create an even more energy efficient cooling compressor since the output can be adjusted with a drive controlled compressor.
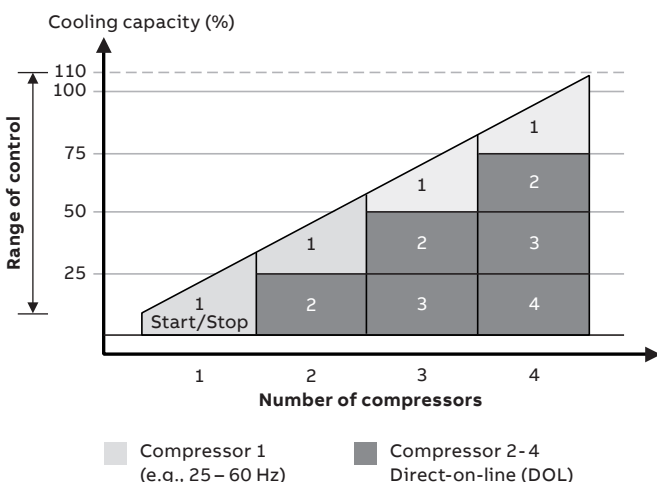
The PFC control logic switches auxiliary compressors on and off as required by the demand changes of the process. The drive controls the first compressor, varying the motor speed to control the output of the compressor. When the demand exceeds the capacity of the first compressor (a user defined speed/frequency limit), the PFC logic automatically starts an auxiliary compressor. The logic also reduces the speed of the first compressor, controlled by the drive, to account for the addition to the total system

—
Fig 6. Multi-compressor control in rack operation
(4 compressors)
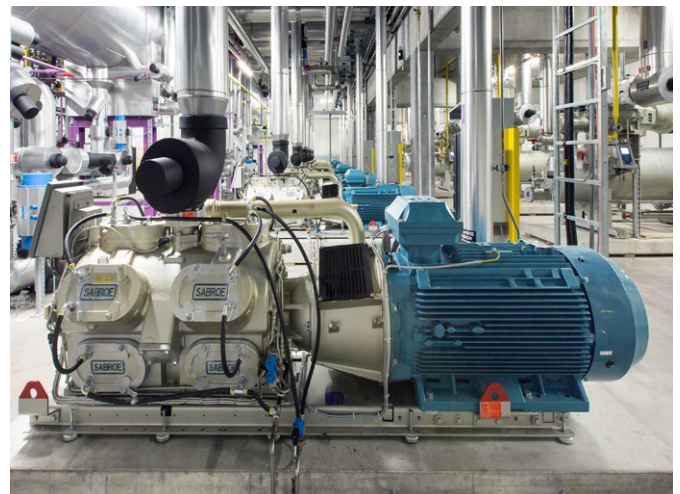
output by the auxiliary compressor. Then, as before, the PID controller adjusts the speed/frequency of the first compressor in such a way that the system output meets the process needs. If the demand continues to increase, the PFC logic adds further auxiliary compressors.

As the demand drops, making the speed of the first compressor fall below a minimum limit (user defined as a speed/frequency limit), the PFC logic automatically stops the auxiliary compressors one by one. The PFC logic also increases the speed of the drive-controlled compressor to account for the missing output of the stopped auxiliary compressor.

Note: The Pump and Fan Control (PFC) is supported in external control location EXT2 only. Within the multi-compressor control, it is also possible to utilize the Autochange feature. Automatic rotation of the start order, or Autochange functionality, is used to keep the run times of the compressors equal over time to balance out their wear.

It is possible to also utilize the Soft Pump and Fan Control (SPFC) feature with compressors. For multi-compressor applications, where lower pressure peaks are desirable when a new auxiliary compressor is to be started, the SPFC logic is an easy way to implement the soft starting of direct-on-line (auxiliary) controlled compressors. See further information about the SPFC function in the ACS580 standard control program manual.
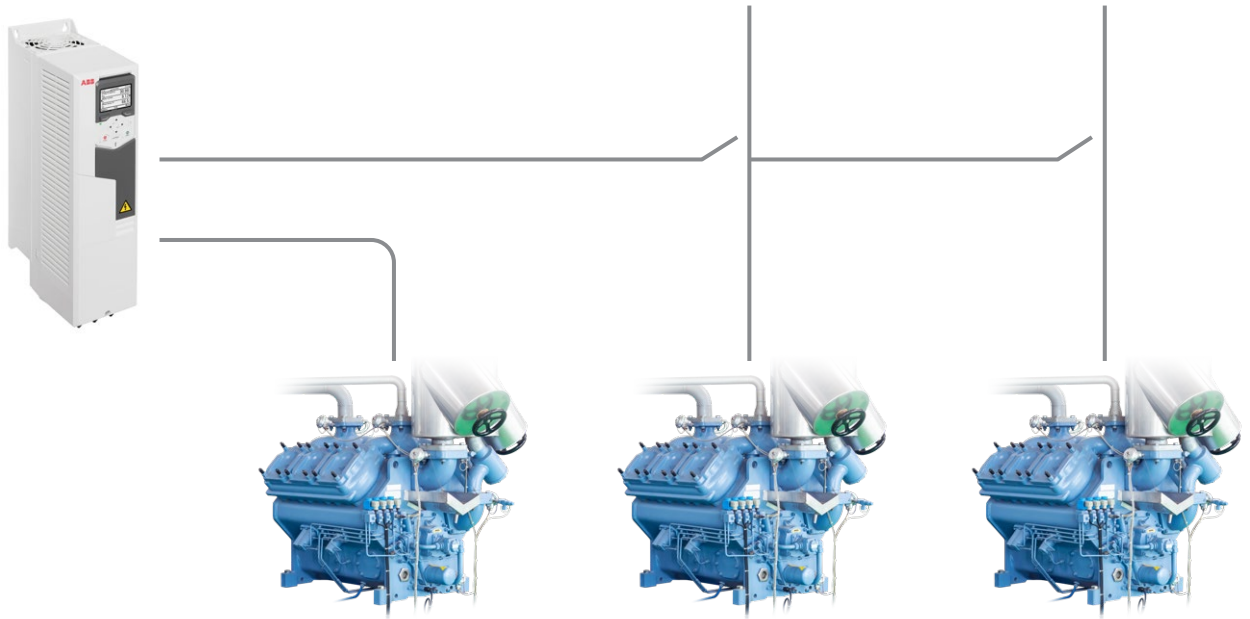
Consumption	Compressor 1	Compressor 2	Compressor 3
Low	VSD	Off	Off
↓	VSD	**DOL**	Off
High	VSD	**DOL**	**DOL**
↓	VSD	**DOL**	Off
Low	VSD	Off	Off

VSD = Controlled by drive, tuning the output speed according to PID control

DOL = Direct-on-line. Pump is running at fixed motor nominal speed

Off = Off-line. Pump stops
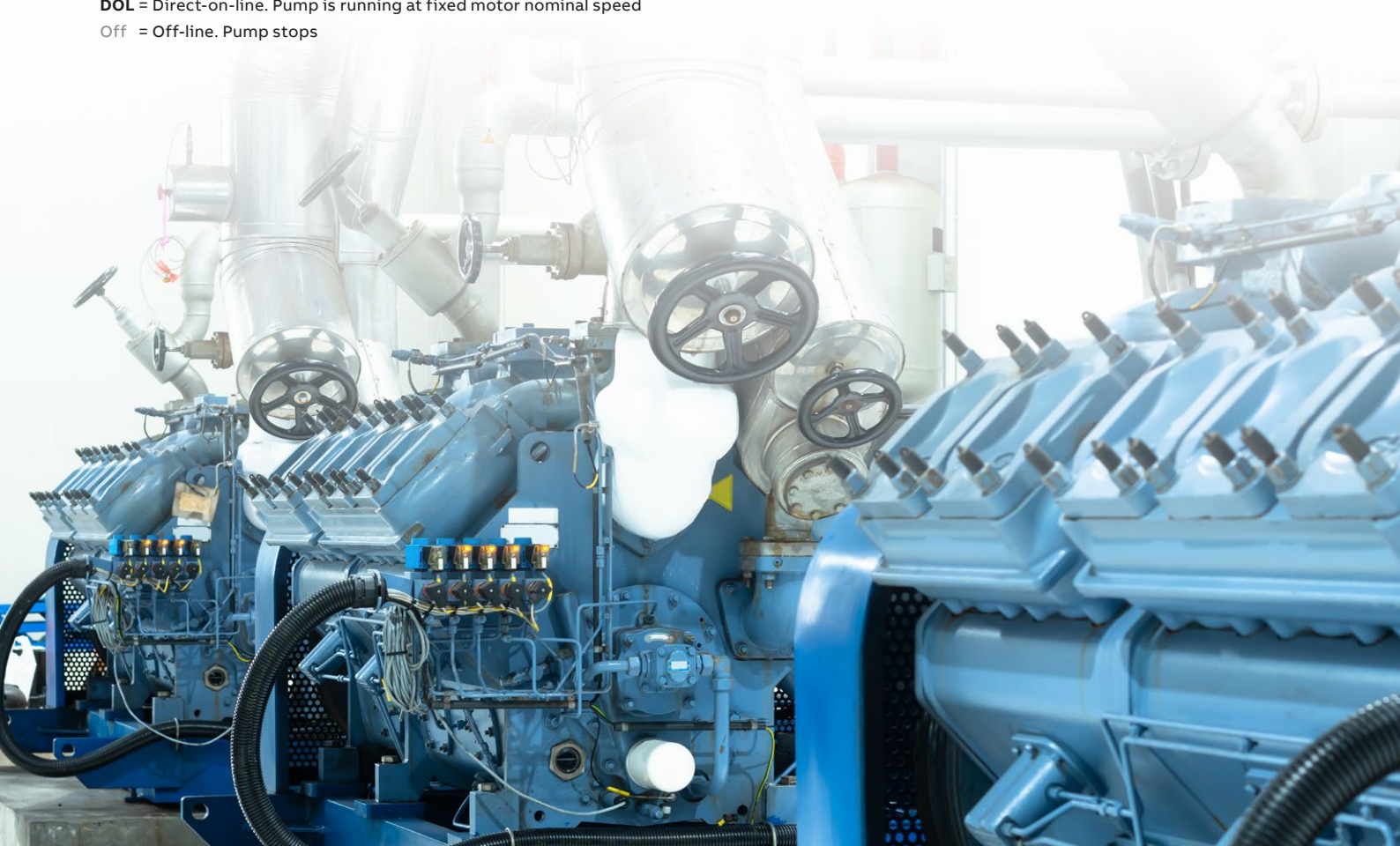
2. How to set it up

The user needs to take the following steps:
- Configure motor parameters
- Select compressor control macro
- Configure cooling compressor control functionality on
- Configure PID
  - Sleep function

- Configure short cycle protection on (if needed)
- Configure multi-compressor control (if needed)
- Configure supervision functions
- Validate the configuration and functionality

2.1. Settings by parameter

Before starting, make sure your desired unit is selected. This is done with the control panel:
Go to Menu → Primary settings → PID → Units and select your desired unit (e.g., bar).

After that the following settings of parameters can be done through the panel or Drive Composer.

—

2.1.1. Configure motor parameters

Parameter		Description / data to be inserted
	Motor data	
99.06	Motor nominal current	
99.07	Motor nominal voltage	
99.08	Motor nominal frequency	Set the motor data
99.09	Motor nominal speed	
99.10	Motor nominal power	

—

2.1.2. Configure general settings

Parameter		Description / data to be inserted
	General settings	
12.15	AI1 unit selection	mA or V (unit of measurement of the sensor used)
12.17	AI1 min	Minimum electrical value of the sensor (e.g.: 4 mA)
12.18	AI1 max	Maximum electrical value of the sensor (e.g.: 20 mA)
12.19	AI1 scaled at AI1 min	Minimum measured value of the sensor (e.g.: 0 kPa)
12.20	AI1 scaled at AI1 max	Maximum measured value of the sensor (e.g.: 500 kPa)
20.12	Run enable 1 source	Selects the source of the external run enable signal (e.g.: DI2)
28.72	Frequency acceleration time 1	Time needed to go from 0 Hz to freq. indicated in 46.02 Frequency scaling (e.g., 3 s)
28.73	Frequency deceleration time 1	Time needed to go from freq. to 0 Hz indicated in 46.02 Frequency scaling (e.g., 3 s)
30.13	Minimum frequency	Minimum frequency to run the motor (e.g.: 40 Hz)
96.01	Language	English
	Macro selection	
96.04	Macro select	Compressor control

—
2.1.3. Configure cooling compressors control

Parameter		Description / data to be inserted
	Cooling compressors control	
81.35	Refrigerant gas type	Selects the type of the gas (e.g.: NH_3 or CO_2)
81.36	Gas pressure source	Selects the input of the gas pressure source (e.g.: AI1)
81.37	Gas pressure unit	Selects the pressure unit (e.g.: kPa)

—
2.1.4. Configure short cycle protection

Parameter		Description / data to be inserted
	Short cycle protection	
21.40	Restart delay	Restart delay for compressor short cycle protection (e.g.: 20 s) (if needed)
21.41	Minimum run time	Minimum run time for a compressor short cycle protection (e.g.: 10 s) (if needed)

—
2.1.5. Configure process PID

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 fed back to the drive. The process PID control adjusts the drive speed in order to maintain the measured process quantity (actual value) at the desired level (setpoint). This means that the user does not need to set a frequency/speed/torque reference for the drive, but the drive adjusts its operation according to the process PID. In combination with the cooling compressor control, process PID control and closed loop feedback from the process, the drive will reliably maintain the desired cooling temperature in the application.

For the process PID, the user needs to set the following parameters to make it work properly:

Parameter		Description / data to be inserted
	Process PID	
40.08	Set 1 Feedback 1 source	Compressor gas temperature (81.30)
40.16	Set 1 setpoint 1 source	If you want a fixed setpoint: "Internal setpoint"
		If you want to change the setpoint from the control panel use: "Control panel (ref saved)"
40.19	Set 1 internal setpoint sel1	Selected
40.21	Set 1 internal setpoint 1	If 40.16 "Internal setpoint" write the desired setpoint (e.g.: 443 kPA) Note: If you cannot choose your desired unit, it needs to be changed by the panel under Menu → Primary Settings → PID → Units or with the parameter 40.79
40.26	Set 1 setpoint min	Minimum setpoint possible (e.g.: 400 kPa)
40.27	Set 1 setpoint max	Maximum setpoint possible (e.g.: 480 kPa)
40.32	Set 1 gain	Will depend on the application (e.g.: 3)
40.33	Set 1 integration time	Will depend on the application (e.g.: 10 sec)
40.36	Set 1 output min	Minimum desired frequency
40.37	Set 1 output max	Maximum desired frequency
40.79	Set 1 units	Unit used for PID set 1. (e.g.: kPa)

If the compressor(s) exhibits continuous oscillations due to a continuous attempt to recover from an error between the **Setpoint** and **Feedback value,** this oscillation can be countered by using parameters 40.32 **Gain** and 40.33 **Integration Time.**

—
2.1.6. Configure sleep function

The sleep function is suitable for PID control applications where the consumption varies, such as the cooling compressor. When used, it stops the compressor completely during low demand, instead of running the compressor slowly below its efficient operating range. This will prolong the lifetime of the equipment as they are not running unnecessarily.

This function automatically stops the compressor if the cooling demand in the applications drops below a certain frequency/speed set in parameter 40.43 Set 1 Sleep level for a certain time, which is set in parameter 40.44 Set 1 Sleep delay. The compressor starts again when the pressure difference from the setpoint 40.21 has reached the value set in parameter 40.47 Set 1 wake up delay.

When the drive enters the sleep mode, the control panel provides an indication with the following symbol:

💤	–	PID sleep mode active

Parameter		Description / data to be inserted
	Sleep function	
40.43	Set 1 Sleep level	Minimum frequency motor runs at before triggering sleep mode (e.g.: 35 Hz)
40.44	Set 1 Sleep delay	How long the motor must run at (or below) frequency level set in 40.43 (e.g.: 30 s)
40.47	Set 1 wake-up delay	Defines the wake-up level as deviation between process setpoint and feedback. (e.g.: 50 kPa)
40.48	Set 1 wake-up delay	Defines a wake-up delay for the sleep function to prevent nuisance wake-ups (e.g.: 10 s)

—
2.1.7. Configure multi-compressor control

Parameter		Description / data to be inserted
	Multi-compressor control	
10.24	RO1 source	Selects a drive signal to be connected to relay output (e.g.: PFC1)
10.27	RO2 source	Selects a drive signal to be connected to relay output (e.g.: PFC2)
10.30	RO3 source	Selects a drive signal to be connected to relay output (e.g.: PFC3) If more than 4 compressors then CMOD and other RO's need to be configured
19.11	Ext1/Ext2 selection	DI3
20.06	Ext2 commands	In1 start
20.08	Ext2 in1 source	DI6
20.12	Run enable 1 source	DI2
28.15	Ext2 frequency ref1	PID
28.22	Constant frequency sel1	Not selected
40.16	Set 1 setpoint 1 source	AI1 percent
40.33	Set 1 integration time	3.0 s
76.21	PFC configuration	PFC
76.25	Number of motors	Up to 6 (Max number of motors in the process) * See Chapter Autocharger
76.27	Max number of motors allowed	Up to 6 (number of motors you want to run at the same time)
76.30-76.32	Start point 1-3	48.00 Hz (in case of several compressors, in order to avoid simultaneous starts, set different start points for different compressors)
76.41-76.43	Stop point 1-3	25.00 Hz (in case of several compressors, in order to avoid simultaneous starts, set different start points for different compressors)
76.55	Start delay	10.00 s
76.58	Stop delay	10.00 s
76.59	PFC contactor delay	0.5 s
76.60	PFC ramp acceleration time	1 s
76.61	PFC ramp deceleration ramp	1 s

2.2. Multi-compressor control

—

2.2.1. Autochange

Automatic rotation of the start order, or Autochange functionality, serves two main purposes in many PFC type setups. One is to keep the run times of the pumps/fans/compressors equal over time to balance their wear. The other is to prevent any pump/fan/compressor from standing still for too long, which would clog up the unit. In some cases, it is desirable to only rotate the start order when all units are stopped, for example, to minimize the impact on the process.

General rule:	
Number of motors	Number of free RO + 1 with no Autochange (up to 6)
	Number of free RO with Autochange (up to 6)

If all the ROs are intended for PFC:		
	Max number of compressors	
	No option	**With CMOD-01 I/O option**
Autochange	3	6
No Autochange	4	7

To set Autochange go to **Primary settings → Pump and fan control → Configure Autochange**
- Here you have several options to select from regarding how the Autochange should proceed. Select the desired option and configure intervals accordingly.

Parameter		Description / data to be inserted
76.70	PFC Autochange	Even wear (the running time of the motors is balanced by the drive)
76.71	PFC autochange interval	1 h
76.72	Maximum wear imbalance	Maximum hours of wear imbalance between motors
76.73	Autochange level	Upper speed limit for the Autochange
76.74	Autochange auxiliary PFC	All motors/Auxiliary motors only

—

2.2.2. Interlock

There is an option to define interlock signals for each motor in the system. When the interlock signal of a motor is available, the motor participates in the starting sequence. If the signal is interlocked, the motor is excluded. This feature can be used for informing the logic that a motor is not available (for example, due to maintenance or manual direct-on-line starting).

To set Interlock go to **Primary settings → Pump and fan control → Configure PCF I/O → Configure interlocks:**
- Here you can set interlock for each motor connected to the system. Interlock can be activated by different DIs.
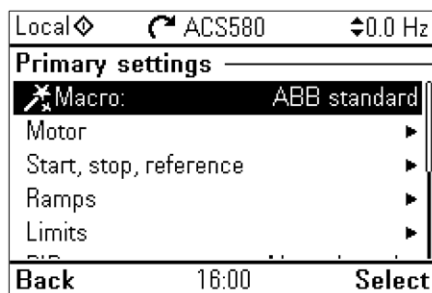- Corresponding parameters can be seen below

Parameter		Description / data to be inserted
76.81…76.86	PFC 1…6 Interlock	If needed: Interlocked. PFC motor is not in use.

2.3. Timed functions

With the timed functions, it is possible to set the timer so that the certain functions (e.g., start, certain speed) can be active based on the time of the day, day of the week and season of the year. In addition to these time related parameters, the timer activation can be influenced by so called exceptional days (configurable as holiday or workday). A timer can be set to be active or inactive during the exceptional days.

Timed functions can also be set through the Primary settings.

2.4. Settings by primary settings

```
Local◇       ⟳ ACS580      ↕0.0 Hz
Primary settings ─────────────
⚒Macro:           ABB standard
 Motor                        ▶
 Start, stop, reference       ▶
 Ramps                        ▶
 Limits                       ▶
Back            16:00      Select
```

The primary settings are designed to make the commissioning and application control easy. Through the primary settings, it is possible to set the following settings related to the cooling compressor control: Macro, motor, start, stop, reference, ramps, limits, PID, fieldbus, PFC, supervision, timed functions.

1. Set the motor data Type, Current, Voltage, Frequency, Speed, Power:
    Inside **Primary settings** go to **Motor** and then **Nominal value** and define and write the motor data values from your motor nameplate.

2. Select PID macro from **Primary settings – Macro – PID**. You might receive a warning caused by default parameter values for PID.

3. Inside **Primary settings** go to **Start, stop, reference**, go to run permissions and remove the tick from use **Run enable signal**.

4. Inside **Primary settings** go to **Ramps** and set the acceleration and deceleration times.

5. Inside **Primary settings** go to **Limits** and set the minimum (e.g., 20 Hz) and the maximum frequency (e.g., 50 Hz).

6. Inside **Primary settings** go to **PID**, scroll down to **Units** and write desired unit (e.g., "kPa").

7. Inside PID go to Setpoint and select Source to define where you want to get the setpoint; the main choices are:
    a. Constant setpoint for a fixed value; Setpoint 1 will be chosen as default. Adjust value for setpoint 1 to Constant setpoint 1
    b. Control Panel if the user wants to change the setpoint from the panel; then define Minimum and Maximum allowed setpoint.

8. Inside **PID** go to **Feedback** and select **Source** to be **AI2 scaled**. Scroll down and select **AI2 scaling** and define **Range, Scaled min** and **Scaled max** values where you put the value indicated from the sensor manufacturer.

9. Go to **Tuning – Gain** and set it to **3.** Go to **Tuning – Integration time** and set it to e.g., **10 s**.

10. From the Home view and if you want to show the PID feedback click on **Options – Edit home view**, select the signal you want to change and set the following instruction:
    a. Parameter → 40.02 Process PID feedback →
    b. Show style → numeric →
    c. Display name → Write what you want to display (e.g., Field pressure).

11. The multi-compressor control can be configured in use through the **Pump and fan control** in primary settings.

12. **Supervision** and **Timed functions** can also be configured via **Advanced functions** in **Primary settings**.

2.5. Modifying the home view

You can modify the parameters in the home view displays with other parameters
or create new home view displays showing selected parameters.

With the panel from home view:
If you want to show the PID feedback click on **Options – Edit home view**, select the signal
you want to change and set the following instruction:
a.   Edit → Parameter → 40.02 Process PID feedback →
b.   Show style → numeric →
c.   Display name → Write what you want to display (e.g.: Field pressure)

For the cooling compressors, it is possible to have, as an example, the following views available
in the home view by adding the following parameters to it:
• Refrigerant gas type, parameter 81.35
• Actual gas temperature, parameter 81.30
• Multi-compressor status, parameter 76.02
• Internal setpoint for the PID, parameter 40.21
• Process PID actual feedback, parameter 40.02
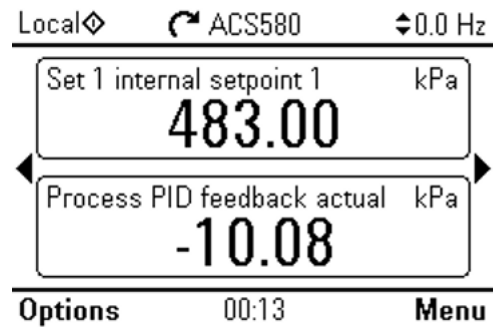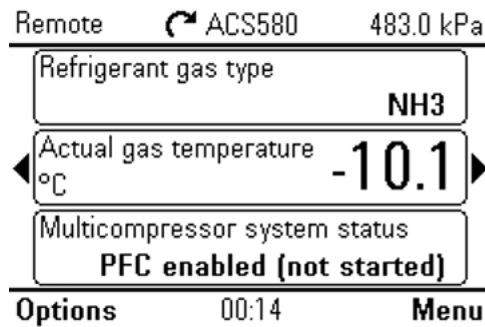
Pressure to temperature conversion tables

—
R744 (CO$_2$)

Temperature (°C)	Pressure (barA)	Temperature (°C)	Pressure (barA)
-56	5.31	-12	25.01
-54	5.78	-10	26.49
-52	6.29	-8	28.03
-50	6.82	-6	29.63
-48	7.39	-4	31.30
-46	8.00	-2	33.04
-44	8.64	0	34.85
-42	9.33	2	36.73
-40	10.05	4	38.69
-38	10.81	6	40.72
-36	11.61	8	42.83
-34	12.45	10	45.02
-32	13.34	12	47.30
-30	14.28	14	49.66
-28	15.26	16	52.11
-26	16.29	18	54.65
-24	17.38	20	57.29
-22	18.51	22	60.03
-20	19.70	24	62.88
-18	20.94	26	65.84
-16	22.24	28	68.92
-14	23.59	30	72.14

—

Ammonia R717

Temperature (°C)	Pressure (bar) (a)	Temperature (°C)	Pressure (bar) (a)
-70	0.11	-29	1.25
-69	0.12	-28	1.32
-68	0.13	-27	1.38
-67	0.14	-26	1.45
-66	0.15	-25	1.51
-65	0.16	-24	1.59
-64	0.17	-23	1.66
-63	0.18	-22	1.74
-62	0.19	-21	1.82
-61	0.20	-20	1.90
-60	0.22	-19	1.99
-59	0.23	-18	2.08
-58	0.25	-17	2.17
-57	0.27	-16	2.26
-56	0.28	-15	2.36
-55	0.30	-14	2.46
-54	0.32	-13	2.57
-53	0.34	-12	2.68
-52	0.36	-11	2.79
-51	0.38	-10	2.91
-50	0.41	-9	3.03
-49	0.43	-8	3.15
-48	0.46	-7	3.28
-47	0.49	-6	3.41
-46	0.51	-5	3.55
-45	0.54	-4	3.69
-44	0.58	-3	3.83
-43	0.61	-2	3.98
-42	0.64	-1	4.14
-41	0.68	0	4.29
-40	0.72	1	4.46
-39	0.76	2	4.62
-38	0.80	3	4.80
-37	0.84	4	4.97
-36	0.88	5	5.16
-35	0.93	6	5.35
-34	0.98	7	5.54
-33	1.03	8	5.74
-32	1.08	9	5.94
-31	1.14	10	6.15
-30	1.19	-	-

ABB

—
For more information, please contact
your local ABB representative or visit

new.abb.com/drives/ACS580
new.abb.com/drives
new.abb.com/drives/drivespartners
new.abb.com/motors-generators

Additional information:
Efficient refrigeration control brochure 3AXD50000534739
Available via this QR code

3AXD50000094747B REV A 3.10.2022