Bonfiglioli
Vectron

ACTIVE CUBE

Application Manual
Winding Drive
Frequency inverter 230 V / 400 V

Bonfiglioli
power, control and green solutions

1 General Information about the Documentation

For better clarity, the documentation of the frequency inverter is structured according to the customer-specific requirements.

The present document was created in German. The German document is the original document. Other language versions are translations.

Quick Start Guide The “Quick Start Guide” describes the basic steps required for mechanical and electrical installation of the frequency inverter. The guided commissioning supports you in the selection of necessary parameters and the configuration of the software of the frequency inverter.

Operating Instructions

The Operating Instructions document the complete functionality of the frequency inverter. The parameters required for special purposes, for adjustment to the application and the numerous additional functions are described in detail.

Separate Operating Instructions are supplied for optional components for the frequency inverter. These manuals complement the operating instructions and the “Quick Start Guide” for the frequency inverter.

Application manual

The application manual complements the documentation to ensure goal-directed installation and commissioning of the frequency inverter. Information on various topics in connection with the use of the frequency inverter is described in context with the specific application.

Installation instructions

The Installation Instructions describe the installation and use of devices, complementing the “Quick Start Guide” and the Operating Instructions.

1.1 This document

This application manual describes the extensions of the standard software 5.4.0.14 for winder applications.

⚠ WARNING

Compliance with the documentation is required to ensure safe operation of the frequency inverter. BONFIGLIOLI VECTRON GmbH shall not be held liable for any damage caused by any non-compliance with the documentation.

In case any problems occur which are not covered by the documentation sufficiently, please contact the manufacturer.

1.2 Warranty and liability

BONFIGLIOLI VECTRON GmbH would like to point out that the contents of these Operating Instructions do not form part of any previous or existing agreement, assurance or legal relationship. Neither are they intended to supplement or replace such agreements, assurances or legal relationships. Any obligations of the manufacturer shall solely be based on the relevant purchase agreement which also includes the complete and solely valid warranty stipulations. These contractual warranty provisions are neither extended nor limited by the specifications contained in this documentation.

The manufacturer reserves the right to correct or amend the specifications, product information and omissions in these operating instructions without notice. The manufacturer shall not be liable for any damage, injuries or costs which may be caused by the aforementioned reasons.

Furthermore, BONFIGLIOLI VECTRON GmbH excludes any warranty/liability claims for any personal and/or material damage if such damage is due to one or more of the following causes:

- inappropriate use of the frequency inverter,
- non-compliance with the instructions, warnings and prohibitions contained in the documentation,
- unauthorized modifications of the frequency inverter,
- insufficient monitoring of parts of the machine/plant which are subject to wear,
- repair work at the machine/plant not carried out properly or in time,
- catastrophes by external impact and force majeure.

1.3 Obligation

These Operating Instructions must be read before commissioning and complied with. Anybody entrusted with tasks in connection with the

- transport,
- assembly,
- installation of the frequency inverter and
- operation of the frequency inverter

must have read and understood the Operating Instructions and, in particular, the safety instructions in order to prevent personal and material losses.

1.4 Copyright

In accordance with applicable law against unfair competition, these Operating Instructions shall be considered to be a certificate. Any copyrights relating to it shall remain with

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These Operating Instructions are intended for the operator of the frequency inverter. Any disclosure or copying of this document, exploitation and communication of its contents (as hardcopy or electronically) shall be forbidden, unless permitted expressly.

Any non-compliance will constitute an offense against the copyright law dated 09 September 1965, the law against unfair competition and the Civil Code and may result in claims for damages. All rights relating to patent, utility model or design registration reserved.

1.5 Storage

The documentation form an integral part of the frequency inverter. It must be stored such that it is accessible to operating staff at all times. If the frequency inverter is sold on to other users, then these Operating Instructions must also be handed over.

2 General safety instructions and information on use

The chapter "General safety instructions and information on use" contains general safety instructions for the Operator and the Operating Staff. At the beginning of certain main chapters, some safety instructions are included which apply to all work described in the relevant chapter. Special work-specific safety instructions are provided before each safety-relevant work step.

2.1 Terminology

According to the documentation, different activities must be performed by certain persons with certain qualifications.

The groups of persons with the required qualification are defined as follows:

Operator

This is the entrepreneur/company who/which operates the frequency inverter and uses it as per the specifications or has it operated by qualified and Instructed Persons.

Operating staff

The term Operating Staff covers persons instructed by the Operator of the frequency inverter and assigned the task of operating the frequency inverter.

Skilled Personnel

The term Skilled Personnel covers staff that are assigned special tasks by the Operator of the frequency inverter, e.g. installation, maintenance and service/repair and troubleshooting. Based on their qualification and/or know-how, Skilled Personnel must be capable of identifying defects and assessing functions.

Qualified Electrician

The term Qualified Electrician covers qualified and trained staff that have special technical know-how and experience with electrical installations. In addition, Qualified Electricians must be familiar with the applicable standards and regulations, they must be able to assess the assigned tasks properly and identify and eliminate potential hazards.

Instructed Person

The term Instructed Person covers staff that are instructed and trained about/in the assigned tasks and the potential hazards that might result from inappropriate behavior. In addition, Instructed Persons must have been instructed in the required protection provisions, protective measures, the applicable directives, accident prevention regulations as well as the operating conditions and verified their qualification.

Expert

The term Expert covers qualified and trained staff that have special technical know-how and experience relating to frequency inverter. Experts must be familiar with the applicable government work safety directives, accident prevention regulations, guidelines and generally accepted rules of technology in order to assess the operationally safe condition of the frequency inverter.

2.2 Designated use

The frequency inverter is designed according to the state of the art and recognized safety regulations.

The frequency inverters are electrical drive components intended for installation in industrial plants or machines. Commissioning and start of operation is not allowed until it has been verified that the machine meets the requirements of the EC Machinery Directive 2006/42/EC and DIN EN 60204-1.

The frequency inverters meet the requirements of the low voltage directive 2006/95/EEC and DIN EN 61800-5-1. CE-labeling is based on these standards. Responsibility for compliance with the EMC Directive 2004/108/EC lies with the operator. Frequency inverters are only available at specialized dealers and are exclusively intended for commercial use as per EN 61000-3-2.

No capacitive loads may be connected to the frequency inverter.

The technical data, connection specifications and information on ambient conditions are indicated on the rating plate and in the documentation and must be complied with at all times.

2.3 Misuse

Any use other than that described in "Designated use" shall not be permissible and shall be considered as misuse.

For, example, the machine/plant must not be operated

- by uninstructed staff,
- while it is not in perfect condition,
- without protection enclosure (e.g. covers),
- without safety equipment or with safety equipment deactivated.

The manufacturer shall not be held liable for any damage resulting from such misuse. The sole risk shall be borne by the operator.

2.3.1 Explosion protection

The frequency inverter is an IP 20 ingress protection rating device. For this reason, use of the device in explosive atmospheres is not permitted.

2.4 Residual risks

Residual risks are special hazards involved in handling of the frequency inverter which cannot be eliminated despite the safety-compliant design of the device. Residual risks are not obviously identifiable and can be a potential source of injury or a health hazard.

Typical residual hazards include:

Electrical hazard

Danger of contact with energized components due to a defect, opened covers or enclosures or improper working on electrical equipment.

Danger of contact with energized components in frequency inverter if no external disconnection device was installed by the operator.

Electrostatic charging

Touching electronic components entails the risk of electrostatic discharges.

Thermal hazards

Risk of accidents by hot machine/plant surfaces, e.g. heat sink, transformer, fuse or sine filter.

Charged capacitors in DC link

The DC-link may have dangerous voltage levels even up to three minutes after shutdown.

Danger of equipment falling down / over, e.g. during transport

Center of gravity is not the middle of the electrical cabinet modules.

2.5 Safety and warning signs on frequency inverter

- Comply with all safety instructions and danger information provided on the frequency inverter.
- Safety information and warnings on the frequency inverter must not be removed.

2.6 Warning information and symbols used in the Operating Instructions

2.6.1 Hazard classes

The following hazard identifications and symbols are used in the Operating Instructions to mark particularly important information:

⚠ DANGER

Identification of immediate threat holding a **high** risk of death or serious injury if not avoided.

⚠ WARNING

Identification of immediate threat holding a **medium** risk of death or serious injury if not avoided.

⚠ CAUTION

Identification of immediate threat holding a **low** risk of minor or moderate physical injury if not avoided.

NOTE

Identification of a threat holding a risk of material damage if not avoided.

2.6.2 Hazard symbols

Symbol	Meaning	Symbol	Meaning
	General hazard		Suspended load
	Electrical voltage		Hot surfaces

2.6.3 Prohibition signs

Symbol	Meaning
	No switching; it is forbidden to switch the machine/plant, assembly on

2.6.4 Personal safety equipment

Symbol	Meaning
	Wear body protection

2.6.5 Recycling

Symbol	Meaning
	Recycling, to avoid waste, collect all materials for reuse

2.6.6 Grounding symbol

Symbol	Meaning
	Ground connection

2.6.7 ESD symbol

Symbol	Meaning
	ESD: Components and assemblies sensitive to electrostatic energy

2.6.8 Information signs

Symbol	Meaning
	Tips and information making using the frequency inverter easier.

2.6.9 Font style in documentation

Example	Font style	Use
1234	bold	Representation of parameter numbers
Parameter	italic, Font Times New Roman	Representation of parameter names
P.1234	bold	Representation of parameter numbers without name, e.g. in formulas
Q.1234	bold	Representation of source numbers

2.7 Directives and guidelines to be adhered to by the operator

The operator must follow the following directives and regulations:

- Ensure that the applicable workplace-related accident prevention regulations as well as other applicable national regulation are accessible to the staff.
- An authorized person must ensure, before using the frequency inverter, that the device is used in compliance with its designated use and that all safety requirements are met.
- Additionally, comply with the applicable laws, regulations and directives of the country in which the frequency inverter is used.

Any additional guidelines and directives that may be required additionally shall be defined by the operator of the machine/plant considering the operating environment.

2.8 Operator's general plant documentation

- In addition to the Operating Instructions, the operator should issue separate internal user manuals for the frequency inverter. The Operating Instructions of the frequency inverter must be included in the Operating Instructions of the whole plant.

2.9 Operator's/operating staff's responsibilities

2.9.1 Selection and qualification of staff

- Any work on the frequency inverter may only be carried out by Skilled Personnel. The staff must not be under the influence of any drugs. Note the minimum age required by law. Define the staff's responsibility in connection with all work on the frequency inverter clearly.
- Work on the electrical components may only be performed by a qualified electrician according to the applicable rules of electrical engineering.
- The operating staff must be trained for the relevant work to be performed.

2.9.2 General work safety

- In addition to the Operating Instructions of the machine/plant, any applicable legal or other regulations relating to accident prevention and environmental protection must be complied with. The staff must be instructed accordingly.
  Such regulations and/or requirements may include, for example, handling of hazardous media and materials or provision/use of personal protective equipment.
- In addition to these Operating Instructions, issue any additional directives that may be required to meet specific operating requirements, including supervision and reporting requirements, e.g. directives relating to work organization, workflow and employed staff.
- Unless approved of expressly by the manufacturer, do not modify the frequency inverter in any way, including addition of attachments or retrofits.
- Only use the frequency inverter if the rated connection and setup values specified by the manufacturer are met.
- Provide appropriate tools as may be required for performing all work on the frequency inverter properly.

2.10 Organizational measures

2.10.1 General

- Train your staff in the handling and use of the frequency inverter and the machine/plant as well as the risks involved.
- Use of any individual parts or components of the frequency inverter in other parts of the operator's machine/plant is prohibited.
- Optional components for the frequency inverter must be used in accordance with their designated use and in compliance with the relevant documentation.

2.10.2 Use in combination with third-party products

- Please note that BONFIGLIOLI VECTRON GmbH will not accept any responsibility for compatibility with third-party products (e.g. motors, cables or filters).
- In order to enable optimum system compatibility, BONFIGLIOLI VECTRON GmbH offers components facilitating commissioning and providing optimum synchronization of the machine/plant parts in operation.
- If you use the frequency inverter in combination with third-party products, you do so at your own risk.

2.10.3 Transport and storage

- The frequency inverters must be transported and stored in an appropriate way. During transport and storage the devices must remain in their original packaging.
- The units may only be stored in dry rooms which are protected against dust and moisture and are exposed to small temperature deviations only. The requirements of DIN EN 60721-3-1 for storage, DIN EN 60721-3-2 for transport and labeling on the packaging must be met.
- The duration of storage without connection to the permissible nominal voltage may not exceed one year.

2.11 Handling and installation

- Do not commission any damaged or destroyed components.
- Prevent any mechanical overloading of the frequency inverter. Do not bend any components and never change the isolation distances.
- Do not touch any electronic construction elements and contacts. The frequency inverter is equipped with components which are sensitive to electrostatic energy and can be damaged if handled improperly. Any use of damaged or destroyed components will endanger the machine/plant safety and shall be considered as non-compliance with the applicable standards.
- Only install the frequency inverter in a suitable operating environment. The frequency inverter is exclusively designed for installation in industrial environments.
- If seals are removed from the case, this can result in the warranty becoming null and void.

2.11.1 Electrical connections

- The five safety rules must be complied with.
- Never touch live terminals. The DC-link may have dangerous voltage levels even up to three minutes after shutdown.
- When performing any work on/with the frequency inverter, always comply with the applicable national and international regulations/laws on work on electrical equipment/plants of the country in which the frequency inverter is used.
- The cables connected to the frequency inverters may not be subjected to high-voltage insulation tests unless appropriate circuitry measures are taken before.
- Only connect the frequency inverter to suitable supply mains.

2.11.1.1 The five safety rules

When working on/in electrical plants, always follow the five safety rules:

1. Isolate
2. Secure to prevent restarting
3. Check isolation
4. Earth and short-circuit,
5. Cover or shield neighboring live parts.

2.11.2 Safe operation

- During operation of the frequency inverter, always comply with the applicable national and international regulations/laws on work on electrical equipment/plants.
- Before commissioning and the start of the operation, make sure to fix all covers and check the terminals. Check the additional monitoring and protective devices according to the applicable national and international safety directives.
- During operation, never open the machine/plant
- Do not connect/disconnect any components/equipment during operation.
- The machine/plant holds high voltage levels during operation, is equipped with rotating parts (fan) and has hot surfaces. Any unauthorized removal of covers, improper use, wrong installation or operation may result in serious injuries or material damage.
- Some components, e.g. the heat sink or brake resistor, may be hot even some time after the machine/plant was shut down. Don't touch any surfaces directly after shutdown. Wear safety gloves where necessary.
- The frequency inverter may hold dangerous voltage levels until the capacitor in the DC link is discharged. Wait for at least 3 minutes after shutdown before starting electrical or mechanical work on the frequency inverter. Even after this waiting time, make sure that the equipment is deenergized in accordance with the safety rules before starting the work.
- In order to avoid accidents or damage, only qualified staff and electricians may carry out the work such as installation, commissioning or setup.
- In the case of a defect of terminals and/or cables, immediately disconnect the frequency inverter from mains supply.
- Persons not familiar with the operation of frequency inverters must not have access to the frequency inverter. Do not bypass or decommission any protective facilities.
- The frequency inverter may be connected to power supply every 60 s. This must be considered when operating a mains contactor in jog operation mode. For commissioning or after an emergency stop, a non-recurrent, direct restart is permissible.
- After a failure and restoration of the power supply, the motor may start unexpectedly if the Auto-Start function is activated.
  If staff are endangered, a restart of the motor must be prevented by means of external circuitry.
- Before commissioning and the start of the operation, make sure to fix all covers and check the terminals. Check the additional monitoring and protective devices according to EN 60204 and applicable the safety directives (e.g. Working Machines Act or Accident Prevention Directives).

2.11.3 Maintenance and service / troubleshooting

- Visually inspect the frequency inverter when carrying out the required maintenance work and inspections at the machine/plant.
- Perform the maintenance work and inspections prescribed for the machine carefully, including the specifications on parts/equipment replacement.
- Work on the electrical components may only be performed by a qualified electrician according to the applicable rules of electrical engineering. Only use original spare parts.
- Unauthorized opening and improper interventions in the machine/plant can lead to personal injury or material damage. Repairs on the frequency inverters may only be carried out by the manufacturer or persons authorized by the manufacturer. Check protective equipment regularly.
- Before performing any maintenance work, the machine/plant must be disconnected from mains supply and secured against restarting. The five safety rules must be complied with.

2.11.4 Final decommissioning

Unless separate return or disposal agreements were made, recycle the disassembled frequency inverter components:

- scrap metal materials
- recycle plastic elements
- sort and dispose of other component materials

Electric scrap, electronic components, lubricants and other utility materials must be treated as special waste and may only be disposed of by specialized companies.

In any case, comply with any applicable national disposal regulations as regards environmentally compatible disposal of the frequency inverter. For more details, contact the competent local authorities.

3 Introductory information about winder applications

3.1 Configurations for winder applications

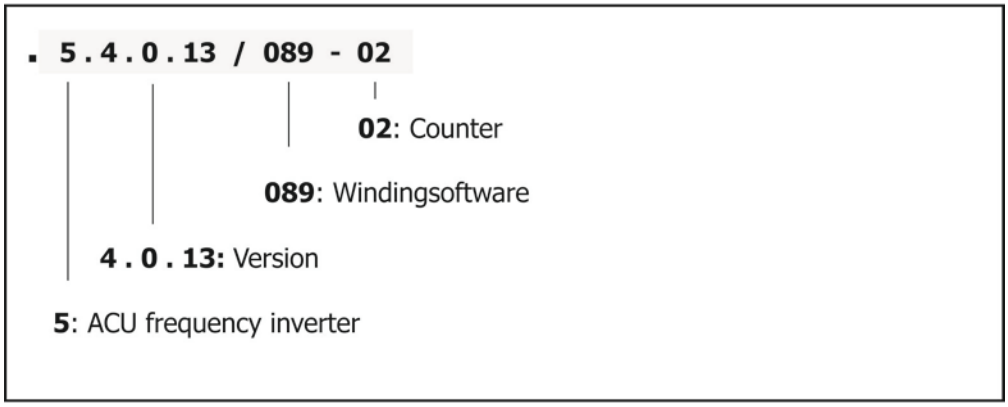
For winder applications, the following configurations are available:

- 217: Winder application in field-oriented control
- 417: Winder application in sensor-less field-oriented control
- 517: Winder application in field-oriented control for synchronous machines
- 617: Winder application in sensor-less field-oriented control for synchronous machines

3.2 Software identification

The software installed can be identified via Parameter **012** *Inverter Software Version*.

Example of Software identifier:



Further information about the software can be obtained via the following parameters:

Parameter	
No.	**Identifier**
000	*Serial Number*
001	*Optional Modules*
015	*Copyright*
028	*Control Level*
029	*User Name*
030	*Configuration*
033	*Language*

3.3 Operating behavior

Parameter *Local Remote* **412** defines the operating characteristics and enables choosing control via contacts/control unit and/or the interface.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
412	*Local Remote*	-	LocalRemote table	44 - Ctrl. Cont.+KP, Dir. Cont.+KP

Operation Modes of Parameter 412

0 - Control via Contacts	Commands Start and Stop as well as definition of sense of rotation via digital signals.
1 - Control via Statemachine	Commands Start and Stop as well as definition of sense of rotation via DRIVECOM statemachine of communication interface.
2 - Control via Remote-Contacts	Commands Start and Stop as well as definition of sense of rotation via logic signals through the communication protocol
3 - Ctrl. KP, direction Contacts	Commands Start and Stop from the control unit, definition of sense of rotation via digital signals.
4 - Ctrl. KP+Cont., direction Cont.	Commands Start and Stop from the control unit or via digital signals, definition of sense of rotation only via digital signals.
5 - Ctrl. 3-Wire, direction Cont.	3-wire; control of sense of rotation and the signal *Start 3-wire ctrl.* **87** via digital signals.
13 - Control via KP, Direction KP	Commands Start and Stop as well as definition of sense of rotation via control unit.
14 - Control KP+Cont., Direction KP	Commands Start and Stop via the control unit or digital signals, definition of sense of rotation only via control unit.
20 - Control Contacts, Clockw.	Commands Start and Stop via digital signals. Fixed definition of sense of rotation: clockwise only.
23 - Control Keypad, Clockw.	Commands Start and Stop via control unit. Fixed definition of sense of rotation: clockwise only.
24 - Control Cont. + KP, Clockw.	Commands Start and Stop via control unit or digital signals. Fixed definition of sense of rotation: clockwise only.
30 - Control Contacts, Anticl.	Commands Start and Stop via digital signals. Fixed definition of sense of rotation, anticlockwise rotation only.
33 - Control Keypad, Anticl.	Commands Start and Stop via control unit. Fixed definition of sense of rotation, anticlockwise rotation only.
34 - Control Cont. + KP, Anticl.	Commands Start and Stop via control unit or digital signals. Fixed definition of sense of rotation, anticlockwise rotation only.
43 - Ctrl. Cont.+KP, Dir. Cont.+KP	Commands Start and Stop via control unit, Definition of sense of rotation via control unit or digital signals.
44 - Ctrl. Cont.+KP, Dir. Cont.+KP	Commands Start and Stop as well as definition of sense of rotation via control unit or via digital signals.
46 - Ctrl. 3-Wire+KP, Dir. Cont.+KP	3-wire and control unit. Control of sense of rotation and signal *Start 3-Wire Ctrl* **87** via digital signals or control unit.

3.4 Control inputs and outputs

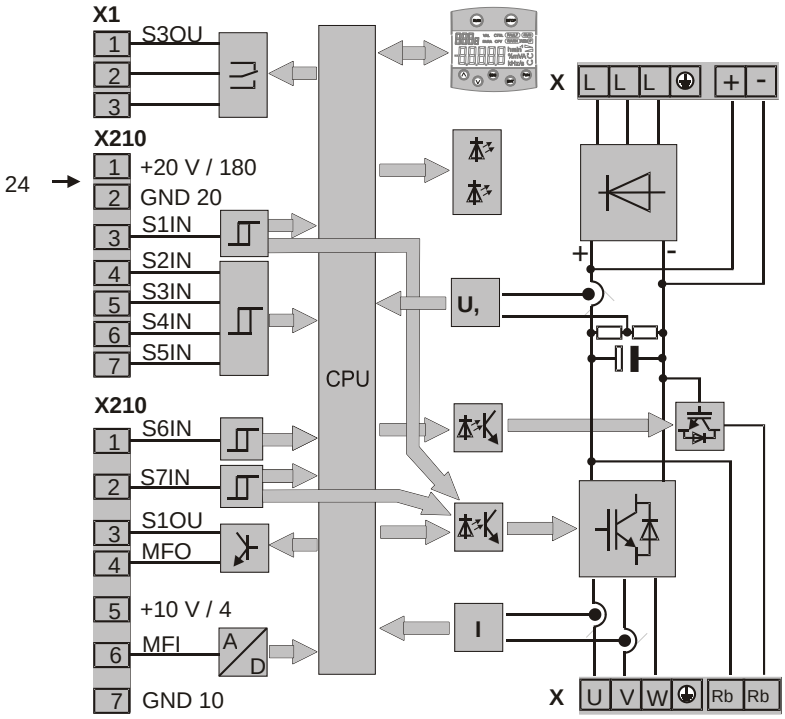
NOTE

Switch off power supply before connecting or disconnecting the control inputs and outputs. Otherwise, components may be damaged.

- The unit may only be connected with the power supply switched off.
- Verify safe isolation from power supply.

3.4.1 Control terminals

The wiring diagram describes the default assignment of control terminals and functions. According to the requirements of the application, other functions can be assigned to the control terminals.



Relay output X10	
X10	Inverter error message [1]

Control terminal X210A		
X210A.1	DC 20 V output (I_{max}=180 mA) or DC 24 V ±10% input for external power supply	
X210A.2	GND 20 V/ GND 24 V (ext.)	
X210A.3	Digital Input **STOA** (first shut-down path)	safety relevant
X210A.4	Digital inputs [1]	
X210A.5		
X210A.6		
X210A.7		

Control terminal X210B		
X210B.1	Digital Input [1]	
X210B.2	Digital Input **STOB** (second shut-down path)	safety relevant
X210B.3	Digital output [1]	
X210B.4	Multifunction output [1] (voltage signal, proportional act. frequency, factory settings)	
X210B.5	Supply Voltage DC 10 V for reference value potentiometer, (I_{max}=4 mA)	
X210B.6	Multifunction input [1] (reference speed 0 ... +10 V, factory settings)	
X210B.7	Ground 10 V	

[1] Control terminals are freely configurable.

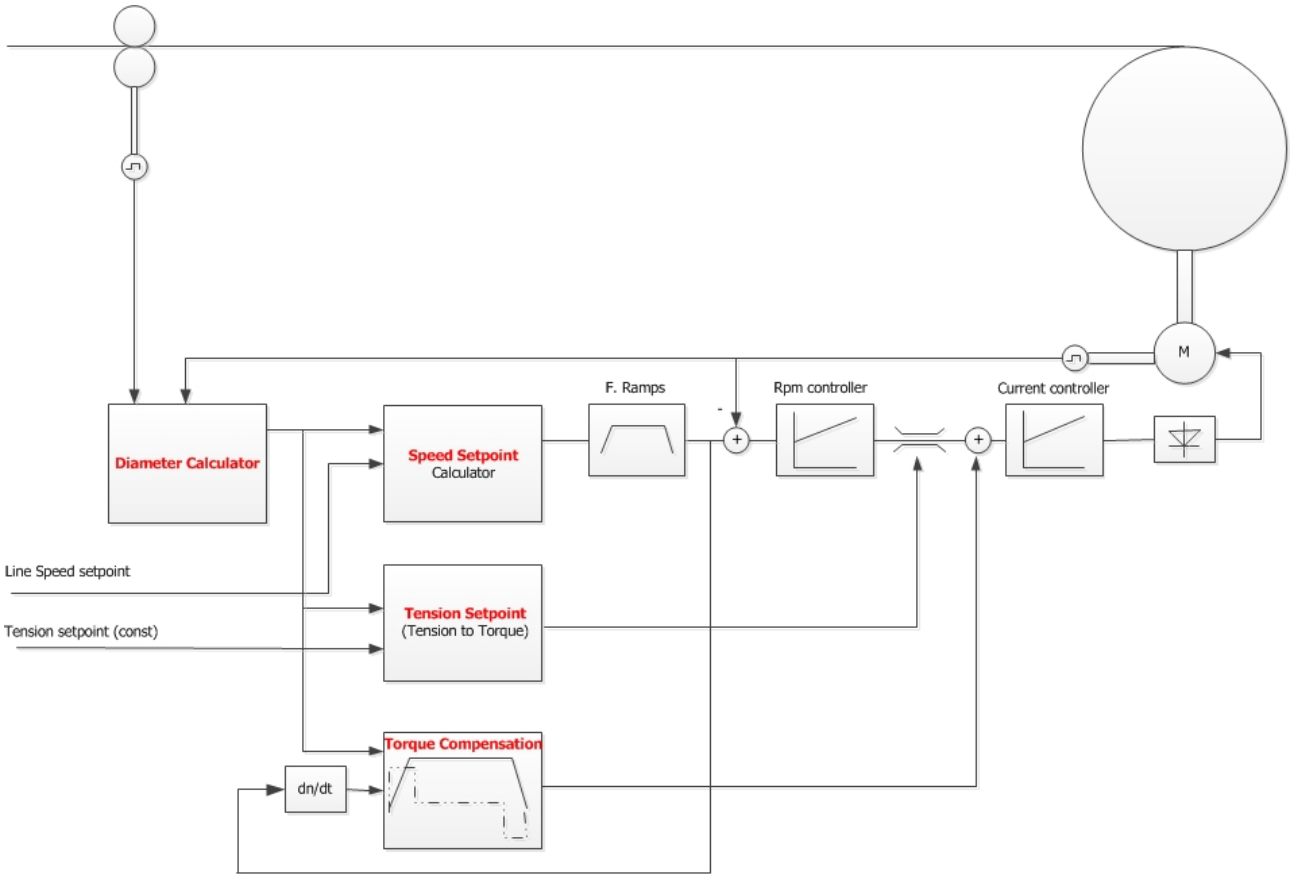
4 Applications

This chapter describes typical examples of winder applications. The function blocks used are described in Chapter 5 “Function blocks”.

4.1 Example: Indirect tension control

The tension of a web is to be maintained at a fairly constant value. Tension-feedback which might be used for direct control is not available.

- The function block “Speed Setpoint” converts the Line Setpoint into a Reference Frequency such that the winder drive wants to wind 5-10% faster than necessary at all times.
- The function block “Tension Setpoint” limits the torque to a value which will be just sufficient for developing the required tension at the current diameter.
- The function block “Compensation Calculator” (Torque Compensation) calculates the torque additionally required for turning the winder and acceleration and adds it to the torque supplied by function module “Tension Setpoint”.



Limits of indirect tension control:

If the torque required for turning the empty winding mandrel is 15% higher than the torque required for developing the minimum tension (at D_{min}), a method with direct tension control should be preferred.

The speed control range of the winder drive should not exceed 1:100. This means that with a winding ratio D_{max} / D_{min} = 10, the ratio of minimum and maximum production speed should not exceed VL_{max} / VL_{min} = 10.

For the tension in the web, no direct benchmark is available.

The Diameter Calculator and compensation blocks (Speed Setpoint, Tension Setpoint, Torque Setpoint) must be adjusted very carefully to obtain the required result.

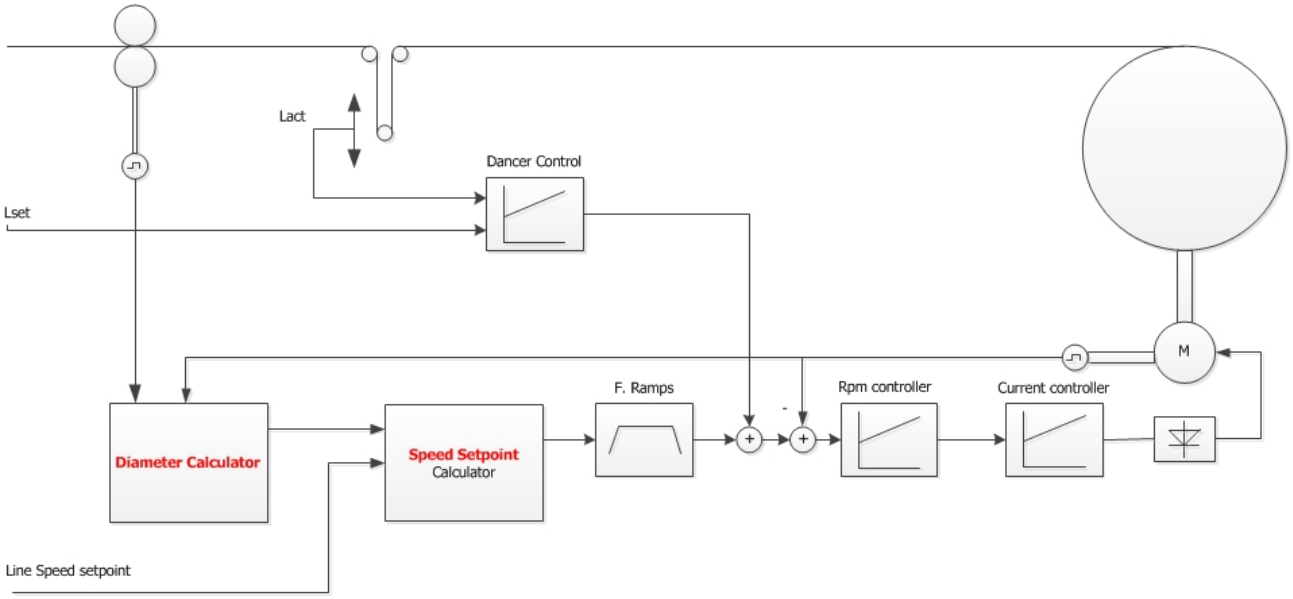
NOTE

If torque control is to be used, extreme care must be taken to ensure that the working range is always above the current impression range, i.e. the motor speed in sensor-less configurations is higher than the speed set in Parameter *Frequency Limit* **624**.

4.2 Example: Dancer control

By changing the dancer position, the circumferential speed of the winding spool is to be adjusted to the winding material feed rate.

By applying a force on the dancer arm, the tensile force on the web can be controlled at the same time.

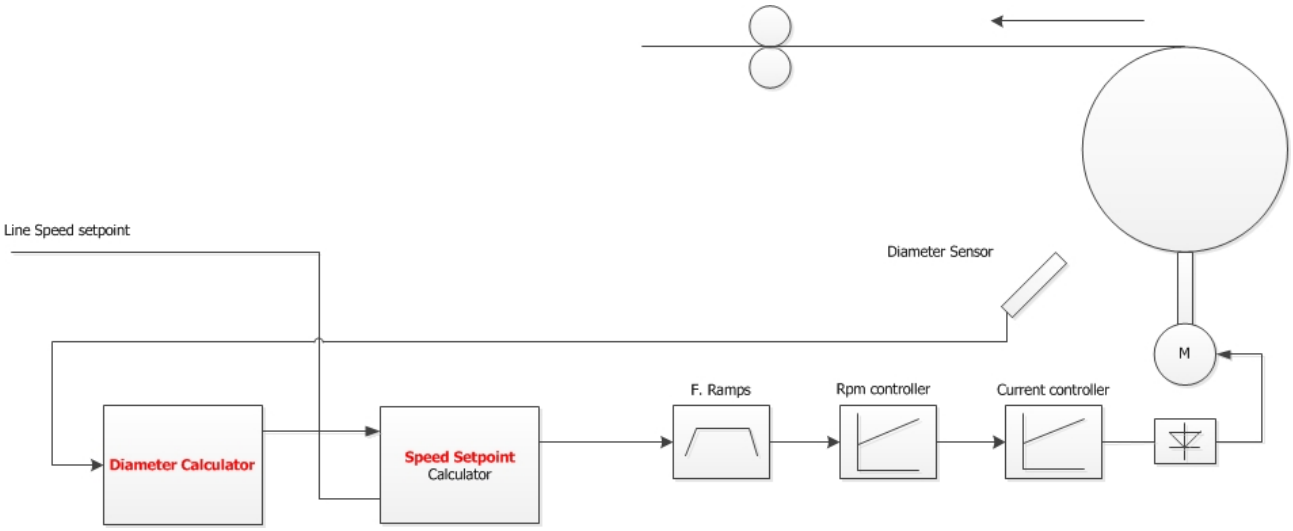


If the material is fed without tension build-up of the winder, you don't have to use the Diameter Calculator and the Electronic Gear. However, both function blocks can also be used in this case as a pilot control in order to reduce the positioning tasks of the dancer controller.

The arrangement described above also enables direct tension control. In this case, the feedback from a tension measuring device is used for tension control. For optimum results, all pilot control options should be used in this case.

4.3 Example: Unwinding at constant speed

The unwinding speed is to be kept at a given speed. If a diameter sensor is available, this can simply be realized as follows:



5 Function blocks

For winder applications, the special function blocks described below are available.

5.1 Dancer control

The dancer control is a universal-use PID controller. The reference and actual values are defined via percentage sources set in Parameters *Source Reference Value* **801** and *Source Actual Value* **802**. The output is connected as an additional reference frequency directly to the speed controller input. The dancer control can be used both for controlling a dancer position and for direct tension control, e.g. via a pressure measuring device.

Control deviation is limited internally to a maximum of 300%.

5.1.1 General control parameters

The controller will only work if the logic source selected via Parameter *PID-Controller Enable* **800** has value TRUE.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
800	*PID-Controller Enable*	-	Sources logic table	7 - Off

Parameter *Source Reference Value* **801** reads the reference value of the controller from a percentage source. A fixed value or the value of an analog input can be selected as the percentage source, for example. Setting via CAN is also possible.

Parameter *Source Actual Value* **802** reads the actual value of the controller from a percentage source. Normally, dancer position feedback is via an analog input.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
801	*Source Reference Value*	-	Source percentage table	9 – Zero
802	*Source Actual Value*	-	Source percentage table	9 – Zero

Parameter *Kp* **803** sets the P-amplification of the controller. At a Kp of 1.00 the rated frequency of the drive (*Rated Frequency* **375**) is output as the control value at 100% control deviation.

Integral Time T_n and Derivative Time T_v are set via Parameters *Tn* **804** and *Tv* **805**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
803	*Kp*	-	-100.00 .. 100.00	1.00
804	*Tn*	ms	0 .. 600000	250
805	*Tv*	ms	0 .. 600000	0

5.1.2 Parameters for limitation of controller output and ramping

The controller output is limited via Parameters *Negative Limit Controller Output* **806** and *Positive Limit Controller Output* **807**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
806	*Negative Limit Controller Output*	Hz	-999.99 .. 0.00	-30.00
807	*Positive Limit Controller Output*	Hz	0.00 .. 999.99	30.00

In the case of a large control deviation, Parameter *Enable Ramping* **811** activates a ramp if the selected logic source is TRUE.

If, when the drive is switched on, the control deviation is higher than the value set via Parameter *Limit Ramp-Switch-On* **813**, the output of the controller will be changed at the frequency increment set in *Ramp Increment* **810** until the control deviation becomes smaller than the value in *Limit Ramp-Switch-Off* **812** once.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
811	*Enable Ramping*	-	Sources logic table	6 - On
810	*Ramp Increment*	Hz/s	0.01 .. 999.99	15.00
812	*Limit Ramp-Switch-Off*	%	0.00 .. 100.00	8.00
813	*Limit Ramp-Switch-On*	%	0.00 .. 100.00	10.00

5.1.3 Behavior in an emergency stop or stop

In the case of an emergency stop or a normal stop, the current output frequency of the controller (**Q.8900**) is reduced to zero at the emergency ramp.

5.1.4 Parameters for weighting and inversion of the controller output

Parameter *Invert Controller Output* **809** inverts the controller output if the selected logic source has value TRUE.

Parameter *Adapt output by Diameter* **815** weights the controller output with actual value parameter *Speed Factor* **842**, if the selected logic source has value TRUE. Parameter *Speed Factor* **842** corresponds to the diameter (actual value parameter *Actual Value Diameter Dact* **841**).

Parameter		Unit	Setting range	Default settings
No.	Identifier			
809	*Invert Controller Output*	-	Sources logic table	7 - Off
815	*Adapt Output by Diameter*	-	Sources logic table	7 - Off

5.1.5 Output values

The output values can be obtained from the following sources:

Frequency values [Hz]

Q.8900 - *Output frequency of controller*

Percentages [%]

Q.8940 – *Current control difference*

5.2 Diameter calculator

The function block for diameter calculation can determine the diameter either via a sensor or from the line speed and winding diameter. The relevant operation mode is selected via Parameter *Mode Diameter Calculator* **880**:

Parameter		Unit	Setting range	Default settings
No.	Identifier			
880	*Mode Diameter Calculator*	-	0, 1, 10	0 - Off

Operation Modes of Parameter 880

0 - off	Diameter Calculator is off
1 - Sensor	Diameter is measured by a sensor.
10 - Estimation	The diameter is calculated from the line speed and the winding speed.

5.2.1 Parameters for both operation modes

Diameter

Parameters *Dmin* **887** and *Dmax* **888** define the minimum and maximum winding diameter. The determined diameter is limited internally to the range between the values set here. It is displayed without filter in actual value parameter *Actual Value Diameter Dact* **841**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
887	*Dmin*	mm	1 .. 2000	85
888	*Dmax*	mm	1 .. 65535	600

Release

The actual diameter value is determined only if the logic source selected in Parameter *Enable Diameter Calculation* **881** has value TRUE.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
881	*Enable Diameter Calculation*	-	Sources logic table	161 - Run Signal

Gear box at winder drive

With Parameters *Gear Box: Driving Shaft Revolutions* **896** and *Gear Box: Motor Shaft Revolutions* **897**, a gear box at the winder drive can be considered.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
896	*Gear Box: Driving Shaft Revolutions*	-	1 .. 65535	1
897	*Gear Box: Motor Shaft Revolutions*	-	1 .. 65535	1

Filtering the diameter

With Parameter *Filter time constant* **895**, you can set up a PT1 filter. This filter can be applied to the diameter to obtain filtered diameters.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
895	*Filter time constant*	ms	8 .. 32000	32

It must be noted that the filters for the analog inputs are active, too. Thus, the percentage used for calculation of the diameter is already filtered.

Error message diameter is above/below given diameter value

With Parameter *Mode Diameter Limit Message* **898**, you can set if a message is to be generated when the diameter is above/below the diameter value set in Parameter *Limit Diameter Message* **891**.

If the diameter is above/below the required value, a message is generated via sources **Q.8925** and **Q.8926**, if applicable, in order to announce that the coil has to be replaced, for example. **Q.8925** refers to the unfiltered diameter, **Q.8926** to the filtered diameter.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
898	*Mode Diameter Limit Message*	-	0, 1, 2	0 - Off
891	*Limit Diameter Message*	mm	5 .. 65530	90

Operation Modes of Parameter 898

0 - off	No message if value is below/above Parameter **891**.
1 - Message below Limit	Message is generated if value is below Parameter **891**.
2 - Message above Limit	Message is generated if value is above Parameter **891**.

5.2.2 Parameters for Operation Mode 1 – Sensor

The diameter sensor is typically connected to one of the analog inputs of the frequency inverter (0-10V). Thus, the diameter is available to the Diameter Calculator as a percentage (e.g. 0-100%).

Percentage source

The source for the percentage is selected via Parameter *Source Diameter-Sensor* **892**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
892	*Source Diameter-Sensor*	-	Source percentage table	52 – Analog Input MFI1A

Percentages at minimum and maximum diameter

The percentages at minimum and maximum diameter are set via Parameters *Percentage Value at Dmin* **893** and *Percentage Value at Dmax* **894.** The minimum and maximum diameter are set in Parameters *Dmin* **887** and *Dmax* **888**, see Chapter **Fehler! Unbekanntes Schalterargument.** "Parameters for both operation modes".

Parameter		Unit	Setting range	Default settings
No.	Identifier			
893	*Percentage Value at Dmin*	%	-300.00 .. 300.00	0.00
894	*Percentage Value at Dmax*	%	-300.00 .. 300.00	100.00

It must be noted that the characteristic of the analog inputs are included in the calculation of the percentage.

Percentages at D_{min} and D_{max} can be taken from the actual value parameters of the analog inputs during commissioning by reading Parameters *Analog Input EM-S1INA* **251** and *Analog Input EM-S1INA* **253** when the winder is empty and when it is full.

5.2.3 Parameters for Operation Mode 10 – Estimation

In this operation mode, the diameter is calculated from the quotient of the line speed and the winder speed.

The line speed can be determined without slip at a clamping roll equipped with a speed sensor, for example. The speed sensor is connected to the winder frequency inverter as Speed Sensor 2 and the Division Marks are set correctly.

Frequency source for line speed

Via Parameter *Source Line Speed* **882**, the frequency source is selected (the speed sensor in the example above). Frequency sources may also be frequencies received via System Bus or an analog signal.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
882	*Source Line Speed*	-	Source-frequency table	9 - zero

Reference values for line speed

The reference values for the line speed are set in Parameters *Line Speed Reference Value* **883** in [mm/s] and *Line Speed Reference Value Hz* **884** in [Hz].

An absolute value function is applied internally to the line speed and winder speed before the calculation. For this reason, the sense of rotation of the winder drive and the production direction do not have to be considered when setting up the Diameter Calculator.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
883	*Line Speed Reference Value*	mm/s	0.01 .. 21474836.47	1000.00
884	*Line Speed Reference Value Hz*	Hz	-999.99 .. 999.99	50.00

Example of parameterization of 883 and 884

If the line speed is 1000 mm/s, the speed sensor at a clamping roll with a diameter of 100 mm will supply the following frequency:

$$\frac{1000\ \text{mm/s}}{100\ \text{mm} \cdot \pi} = 3.1831\ \text{s}^{-1}$$

Since the speed sensor is connected to the winder frequency inverter, it uses the number of pole pairs of the winder drive to calculate the electrical frequency of the speed sensor evaluation. In the case of a drive with no. of pole pairs PPZ=2 twice the frequency would be output:

$$3.1831\ \text{s}^{-1} \cdot 2 = 6.3662\ \text{s}^{-1}$$

The following parameter values result:

- *Line Speed Reference Value* **883** = 1000.00 mm/s
- *Line Speed Reference Value Hz* **884** = 6.37 Hz

In order to obtain higher accuracy, the calculated values can be multiplied by any factor. With factor 7.85398, the following reference values would be entered:

- *Line Speed Reference Value* **883** = 7853.98 mm/s
- *Line Speed Reference Value Hz* **884** = 50.00 Hz

Frequency source for winder drive

The source for the actual frequency is selected via Parameter *Source Actual Value Speed* **885**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
885	*Source Actual Value Speed*	-	Source-frequency table	155 – Actual Speed

Minimum frequency for diameter calculation

Below the frequency set in Parameter *Minimum Frequency for Calculation* **886**, the diameter calculation is stopped because it can become very inaccurate with small values.

The value of the parameter should be below the frequency reached in normal winding operation at maximum diameter. However, it should not be below 5% of the maximum frequency.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
886	*Minimum Frequency for Calculation*	Hz	0.00 .. 999.99	0.50

Presetting the diameter upon coil replacement

Following coil replacement, the diameter should be preset to D_{min} and D_{max}. To that end, you can set logic sources in Parameters *Reset Dact to Dmin* **889** and *Reset Dact to Dmax* **890**. If the relevant parameter has value TRUE, the diameter is preset to D_{min} or D_{max}. The preset has priority over calculation. The diameter is maintained at the preset value as long as the signal is TRUE

Parameter		Unit	Setting range	Default settings
No.	Identifier			
889	*Reset Dact to Dmin*	-	Sources logic table	7 - Off
890	*Reset Dact to Dmax*	-	Sources logic table	7 - Off

5.2.4 Output values

The output values can be obtained from the following sources:

Diameter values [mm]

Q.8960 – diameter unfiltered

Q.8961 – diameter filtered

Percentages [%]

Q.8941 – *Speed Factor at Dact*

Q.8942 – *Speed Factor at Dact* (filtered with Parameter **895**)

Q.8943 – *Torque Factor at Dact*

Q.8944 – *Torque Factor at Dact* (filtered with Parameter **895**)

Q.8941 outputs 100% if the current diameter is the minimum diameter. With increasing diameters, the speed will decrease. **Q.8941**=$D_{min}/D_{act} \cdot 100\%$ is output as a percentage.

Q.8941 outputs 100% if the current diameter is the maximum diameter. With decreasing diameters, the torque to be applied will decrease. **Q.8943 =**$D_{act}/D_{max} \cdot 100\%$ is output as a percentage.

Boolean values

Q.8925 – *Coil Size Limit Reached*

Q.8926 – *Coil Size Limit Reached (filtered)*

5.2.5 Actual value parameters from diameter calculation

Actual value parameter		Unit	Description
No.	Identifier		
841	*Actual Value Diameter Dact*	mm	Value corresponds to source **Q.8960**, but the diameter is output with 2 decimal places.
842	*Speed Factor*	%	Value corresponds to source **Q.8941** directly.
843	*Torque Factor*	%	Value corresponds to source **Q.8943** directly.
844	*Gear Factor Linefreq. to Winderfreq. at Dmin*	-	Gear factor between line frequency and reference frequency of the winder drive with correctly set motor data and diameter calculator (at minimum diameter). The value can be used for checking the gear factor calculated manually for plausibility when the electronic gear is used. When accuracy is sufficient, it can also be used as the gear factor directly.

5.3 Electronic gear (speed setpoint)

The implemented electronic gear is used for scaling any frequency source with factors and adding an offset if necessary. In this way, a line speed can be considered as a pilot value for the winding process, or winding at a fixed line speed can be achieved, taking the diameter calculator into account.

The output of the electronic gear is wired to the input of the reference value ramp.

The frequency ramps (Parameters **420** - **425**) must be set steep enough so that the winding drive can follow the changing line speed.

5.3.1 Parameter

Activating the electronic gear

The electronic gear is activated via Parameter *Activate el. Gear* **830**. If the selected digital signal is TRUE, the output frequency is calculated and the gear stage is evaluated. Otherwise, the reference value of the reference frequency channel is used.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
830	*Activate el. Gear*	-	Sources logic table	7 - Off

Reference frequency source

The source of the reference frequency to be scaled is selected in Parameter *Source Frequency Setpoint* **831**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
831	*Source Frequency Setpoint*	-	Source-frequency table	9 - zero

Gear factor

Parameters *Gear Factor Numerator at Dmin* **832** and *Gear Factor Denominator at Dmin* **833** define the numerator and denominator of the gear factor at minimum diameter**.**

Parameter		Unit	Setting range	Default settings
No.	Identifier			
832	*Gear Factor Numerator at Dmin*	-	1 .. 2147483647	1
833	*Gear Factor Denominator at Dmin*	-	1 .. 2147483647	1

Percentage source

After multiplication by a fixed gear factor, the input value is multiplied by a diameter-dependent percentage from Parameter *Source Gear Factor Percentage Value* **834**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
834	*Source Gear Factor Percentage Value*	-	Source percentage table	8942 – Speed Factor at Dact filtered

Offset frequency

In Parameter *Offset Frequency* **835**, you can define a fixed frequency value. This value will be added to the reference frequency after consideration of the gear factors if the logic source from Parameter *Activate Frequency Offset* **836** is TRUE.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
835	*Offset Frequency*	Hz	-50.00 .. 50.00	0.00
836	*Activate Frequency Offset*	-	Sources logic table	7 - Off

Parameter setup

Parameters *Gear Factor Numerator at Dmin* **832** and *Gear Factor Denominator at Dmin* **833** are normally set such that the winding drive will follow the process exactly at the right speed when the coil is empty.

In the case of indirect tension control (see Chapter 4.1 “Example: Indirect traction control”) is set such that the winding drive tries to wind 5-10% too fast at all times.

If the Diameter Calculator is configured correctly, the value from actual value parameter *Gear Factor Linefreq. to Winderfreq. at Dmin* **844** can be used as a reference for the gear factor to be set. Preferably, the gear factor should be calculated manually and Parameters **832** and **833** should be set such that maximum accuracy is reached.

Via the percentage from Parameter *Source Gear Factor Percentage Value* **834**, diameter-dependent adjustment of the reference frequency is reached Normally, the right setting is source **Q.8942** generated by the Diameter Calculator. It will supply, at D_{min}, the value 100% and decreasing values with increasing diameters.

5.3.2 Output values

The output value can be obtained from the following source:

Frequency [s^{-1}]

Q.8902 – *Output frequency of gear stage*

5.4 Limitation of web tension (Tension Setpoint)

With this function block, the web tension can be kept at a constant level in winding operations. It limits the torque required for building up the web tension to a diameter-dependent value.

- The function block should only be used for winders.
- It is recommended that the winder drive be operated with sensor when the function block is used (Configuration 217 or 517). In the case of sensor-less drives, at least the working range must be above the current impression range, i.e. the motor speed must be higher than the frequency set in Parameter *Frequency Limit* **624**.

In order to keep the web tension at a constant level, the speed is set via the electronic gear such that the winding drive would wind a little too fast (5-10%) at all times. The "web tension limitation" function block limits the torque to the value required for the required value. Acceleration and system losses are considered.

In this way, the winding drive will not race even in the case of a web break and can be accelerated and decelerated smoothly.

The logic signal for activation of web limitation is selected via Parameter *Activate Torque Limitation* **860**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
860	*Activate Torque Limitation*	-	Sources logic table	7 - Off

The value for torque limitation is made up of a constant value which is valid for the maximum diameter and a diameter-dependent factor:

Parameter *Torque at Dmax* **861** indicates the percentage of the rated torque of the machine is needed at maximum diameter to build up the required web tension (static, without consideration of losses due to friction).

The diameter-dependent factor considers the acceleration and system losses. For this factor, a suitable percentage source is selected via Parameter *Source Diameter dependent Factor* **862**. Normally, this is the source provided by the Diameter Calculator **Q.8944**, see Chapter 5.2 "Diameter calculator". This source has value 100% at maximum diameter and is reduced with decreasing diameter such that the web tension remains constant.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
861	*Torque at Dmax*	%	0.00 .. 300.00	100.00
862	*Source Diameter dependent Factor*	-	Percentage Source table	8944 – Torque Factor at Dact filtered

5.4.1 Calculation of static torque for Parameter 861

If the required web tension is known, the percentage to be entered in Parameter **861** for the torque at D_{max} is calculated as follows:

$$\mathbf{P.861} = \frac{\text{Web sion} \cdot D_{max}/2}{M_{rated}} \cdot 100\%$$

with Web tension in [N]

D_{max} in [m]

M_{rated} in [Nm]

Rated torque M_{rated} of the machine in [Nm] is calculated from the motor data:

$$M_{rated} = \frac{60 \cdot \mathbf{P.376} \cdot 1000}{2 \cdot \pi \cdot \mathbf{P.372}}$$

with **P.376** = rated power in [kW]
P.372 = rated speed in [rpm]

5.5 Compensation calculator (Torque Compensation)

The compensation calculator provides the torque required for compensation of losses in the system and acceleration of the drive. The torque output by the compensation calculator is added to the value to be output by the speed controller. Thus, it is not subject to the limitations that can be made in the speed controller.

⚠ CAUTION

If the parameters are configured incorrectly, the drive might race. Before commissioning, Parameter *Frequency Switch-off Limit* **417** should be set to the maximum permissible frequency.

It is important that the parameters be configured in the right order (as described below).

5.5.1 Compensation of system losses

Via Parameters **865** and **866** described in the following, a static and a dynamic (speed-dependent) value for compensation of system losses is configured. System losses are the components of the torque to be applied which don't contribute neither to acceleration of the drive nor to building up the web tension.

5.5.1.1 Compensation of static frictional losses

Static friction mainly occurs in the bearings of the winder shaft, gear box and motor. To compensate these frictional losses, the torque must produce an additional constant torque. This torque is set via Parameter *Static Friction Compensation* **865** in % of the rated torque of the drive.

During commissioning, the value is determined as follows:

- Limit the torque which can be output by the speed controller to 0 by the following parameter settings, see Chapter 5.4 “Limitation of web tension (Tension Setpoint)”:
  - Parameter **860** = 6 – On
  - Parameter **861** = 0%
- Start drive at a preset speed (with empty winder).
- Increase the value of Parameter **865** carefully until the drive starts turning slowly.
- Reduce the value of Parameter **865** again slowly until the drive no longer turns.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
865	*Static Friction Compensation*	%	0.00 .. 30.00	0.00

5.5.1.2 Compensation of dynamic frictional losses

Dynamic frictional losses are speed-dependent. They are produced, for example, by the viscosity of the gear oil and - if a motor fan is installed - by fan losses.

Compensation is done via Parameter *Dynamic Friction Compensation* **866**.

This Parameter may only be set after Parameter **865**.

The value should be determined at rated speed if possible as follows:

- Start drive (speed-controlled).
- Once the reference speed is reached, monitor the output of the speed controller using the Scope function (**Q.24**).
- Adjust the value of Parameter **866** until the speed controller outputs approx. 0.
- Then, deactivate the speed controller again, i.e. limitation of torque to 0 by the following settings:
  - Parameter **860** = 6 – On
  - Parameter **861** = 0%
- To verify the setup, accelerate to different reference speed values. The actual speed should adjust to approximately the reference value in each case.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
866	*Dynamic Friction Compensation*	%/ Hz	0.00 .. 30.00	0.00

In the case of indirect tension control, the reference speed is set too high via the gear stage so that the speed controller works at its limit. As a result, the compensation calculator will also receive a reference frequency which is too high.

Parameter *Dynamic Friction Compensation* **866** must be reduced, after completion of parameterization of all compensations, by the percentage used for overdriving the speed controller (normally 5-10%).

5.5.2 Compensation of acceleration torque

The torque of the drive required for acceleration is defined by the moment of inertia of the system which is made up of a constant and a diameter-dependent component.

The torque is determined “experimentally” after setting the parameters mentioned before, with deactivated speed controller (limitation of speed to 0).

5.5.2.1 Compensation of constant acceleration torque

For compensation of the constant component of the acceleration, a mechanical time constant is set in [ms] in Parameter *Mech. Time Constant at Dmin* **870**. This is the time the drive needs (at rated torque) to accelerate the empty winder to rated speed.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
870	*Mech. Time Constant at Dmin*	ms	0 .. 60000	0

Adjustment Parameter 870

- To identify and verify the value, accelerate the empty winder.
- First, set Parameter *Mech. Time Constant at Dmin* **870** to the minimum value.
- The frequency ramp is to be set to the highest value occurring in operation at which the output figure of the speed controller is not yet limited.
- Set Parameter *Minimum Deviation for Comp. Acceleration* **869** (see Chapter 5.5.2.3 “Limit for detection of acceleration process”) to 50% of the set acceleration ramp. In this way, it is ensured that the acceleration pre-control becomes active.
- Increase Parameter *Mech. Time Constant at Dmin* **870** until the time is reached which the drive needs (at rated torque) to accelerate the empty winder to rated speed.

5.5.2.2 Compensation of diameter-dependent acceleration torque

In addition to the constant component of the moment of inertia, there is a component which depends on the current winder diameter. It increases proportionally to the fourth degree of the diameter and reaches its maximum at maximum diameter. This component is considered by setting Parameter *Mech. Time Constant at Dmax* **871**.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
871	*Mech. Time Constant at Dmax*	ms	0 .. 60000	0

This Parameter is set like Parameter **870**, the following requirements must be met:

- To identify and verify the value, accelerate the winder with maximum diameter.
- Note the setting of Parameter **870**, and reset it to 0.
- Reset the Diameter Calculator to the maximum diameter by the digital signal selected in Parameter *Reset Dact to Dmax* **890**, see Chapter 0 “
- Parameters for Operation Mode 10 – Estimation”.

Compensation via Parameter 871

– The function is only useful if the mass density of the winding material does not change (i.e. when the same material is wound up).
– The maximum diameter is limited internally to *Dmax* **888**.

- First, set Parameter *Mech. Time Constant at Dmax* **871** to the minimum value.
- The frequency ramp is to be set to the highest value occurring in operation at which the output figure of the speed controller is not yet limited.
- Set Parameter *Minimum Deviation for Comp. Acceleration* **869** (see Chapter 5.5.2.3 “Limit for detection of acceleration process”) to 50% of the set acceleration ramp. In this way, it is ensured that the acceleration pre-control becomes active.
- Increase Parameter *Mech. Time Constant at Dmax* **871** until the time is reached which the drive needs (at rated torque) to accelerate the full winder to rated speed.

The value determined for Parameter **871** must be higher than the value set for Parameter **870**.

- After setting Parameter **871**, reset Parameter **870** to the value determined before.
- Test if the drive works with maximum diameter like before.

5.5.2.3 Limit for detection of acceleration process

Via Parameter *Minimum Deviation for Comp. Acceleration* **869**, you can set when an acceleration process is detected. Acceleration pre-control via Parameters **870** and **871** will only be activated when the deviation between ramp input and ramp output is greater than Parameter **869**.

Parameter **869**should be set such that small variations of the reference speed do not result in narrow "needles" in the reference torque. Minor reference value variations normally are no intended change of the reference value, but are caused by noise in the analog reference value or changing diameters in operation.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
869	*Minimum Deviation for Comp. Acceleration*	Hz	0.00 .. 999.99	1.00

5.5.2.4 Current limitation

Via Parameter *Current Limit for Compensation* **872**, the reference current which is output by the compensation calculator can be limited. The compensation calculator outputs a torque-forming current component, Parameter **872** only refers to this component.

The total current is set accordingly, depending on the parameterized magnetizing current and the output of the speed controller. The outputs of the compensation calculator and speed controller together form the reference value *Isq Reference* for the torque-forming current component.

Parameter		Unit	Setting range	Default settings
No.	Identifier			
872	*Current Limit for Compensation*	A	0.0 .. 12.0	2.8

5.5.3 Output of compensation calculator

The output of the compensation calculator is a current which, together with the output of the speed controller, forms *Isq Reference*.

Amperages [A]

Q.8982 – *Compensation component Isq Reference*

6 Overview of sources

The output values of the winder function blocks can be obtained from the following sources:

Frequency [s^{-1}]

Q.8900 – *Output frequency of controller*

Q.8900 – *Output frequency of gear stage*

Boolean values

Q.8920 – *PID controller: control deviation < P.812*

Q.8925 – *Coil Size Limit Reached*

Q.2926 – *Coil Size Limit Reached* (filtered)

Percentages [%]

Q.8940 – *Current control difference*

Q.8941 – *Speed Factor at Dact*

Q.8942 – *Speed Factor at Dact* (filtered with **P.895**)

Q.8943 – *Torque Factor at Dact*

Q.8944 – *Torque Factor at Dact* (filtered with **P.895**)

Diameters [mm]

Q.8960 – *Diameter Dact*

Q.8961 – *Diameter Dact* (filtered with **P.895**)

D_{act} = actual diameter

Amperages [A]

Q.8982 – *Compensation component Isq Reference*

Q.8981 – *Current limitation from web tension limitation*

Torques [Nm]

Q.8980 – *Torque limitation from web tension limitation*

7 Actual values

Actual value parameter			
No.	Description	Unit	Chapter
841	Actual Value Diameter Dact	mm	5.2.5
842	Speed Factor	%	5.2.5
843	Torque Factor	%	5.2.5
844	Gear Factor Linefreq. to Winderfreq. at Dmin	-	5.2.5

8 Parameter

The parameter is available in the four data sets.

Parameter					
No.	Description	Unit	Setting range	Default set-tings	Chap-ter
412	Local/Remote	-	Local-Remote table	44 – Ctrl. Cont.+KP, Dir. Cont.+KP	3.3
417	Frequency Switch-off Limit	Hz	0.00 .. 999.99	999.99	5.5
800	PID-Controller Enable	-	Sources logic table	7 - Off	5.1.1
801	Source Reference Value	-	Source percentage table	9 – Zero	5.1.1
802	Source Actual Value	-	Source percentage table	9 - zero	5.1.1
803	Kp	-	-100.00 .. 100.00	1.00	5.1.1
804	Tn	ms	0 .. 600000	250	5.1.1
805	Tv	ms	0 .. 600000	0	5.1.1
806	Negative Limit Controller Output	Hz	-999.99 .. 0.00	-30.00	5.1.2
807	Positive Limit Controller Output	Hz	0.00 .. 999.99	30.00	5.1.2
809	*Invert Controller Output*	Hz	Sources logic table	7 - Off	5.1.4
810	Ramp Increment	Hz/s	0.01 .. 999.99	15.00	5.1.2
811	Enable Ramping	-	Sources logic table	Sources logic table	5.1.2
812	Limit Ramp-Switch-Off	%	0.00 .. 100.00	8.00	5.1.2
813	Limit Ramp-Switch-On	%	0.00 .. 100.00	10.00	5.1.2
815	Adapt Output by Diameter	-	Sources logic table	7 - Off	5.1.4
830	Activate el. Gear	-	Sources logic table	7 - Off	5.3.1
831	Source Frequency Setpoint	-	Source-frequency table	9 - zero	5.3.1
832	Gear Factor Numerator at Dmin	-	-2147483647 .. 2147483647	1	5.3.1
833	Gear Factor Denominator at Dmin	-	1 .. 2147483647	1	5.3.1
834	Source Gear Factor Percentage Value	-	Source percentage table	8942 – Speed Factor at Dact filtered	5.3.1
835	Offset Frequency	Hz	-50.00 .. 50.00	0.00	5.3.1
836	Activate Frequency Offset	-	Sources logic table	7 - Off	5.3.1
860	Activate Torque Limitation	-	Sources logic table	7 - Off	5.4
861	Torque at Dmax	%	0.00 .. 300.00	100.00	5.4
862	Source Diameter dependent Fac-tor	-	Source percentage table	8944 – Torque Factor at Dact filtered	5.4
865	Static Friction Compensation	%	0.00 .. 30.00	0.00	5.5.1.1
866	Dynamic Friction Compensation	%/ Hz	0.00 .. 30.00	0.00	0
869	Minimum Deviation for Comp. Acceleration	Hz	0.00 .. 999.99	1.00	5.5.2.3
870	Mech. Time Constant at Dmin	ms	0 .. 60000	0	5.5.2.1
871	Mech. Time Constant at Dmax	ms	0 .. 60000	0	5.5.2.2
872	Current Limit for Compensation	A	0.0 .. 12.0	2.8	0
880	Mode Diameter Calculator	-	0, 1, 10	0 - Off	5.2

Parameter					
No.	Description	Unit	Setting range	Default settings	Chapter
881	Enable Diameter Calculation	-	Sources logic table	161 - Run Signal	5.2.1
882	Source Line Speed	-	Source-frequency table	9 - zero	0
883	Line Speed Reference Value	mm/s	0.01 .. 21474836.47	1000.00	0
884	Line Speed Reference Value Hz	Hz	-999.99 .. 999.99	50.00	0
885	Source Actual Value Speed	-	Source-frequency table	155 – Actual Speed	0
886	Minimum Frequency for Calculation	Hz	0.00 .. 999.99	0.50	0
887	Dmin	mm	1 .. 2000	85	5.2.1
888	Dmax	mm	1 .. 65535	600	5.2.1
889	Reset Dact to Dmin	-	Sources logic table	7 - Off	0
890	Reset Dact to Dmax	-	Sources logic table	7 - Off	0
891	Limit Diameter Message	mm	5 .. 65530	90	5.2.1
892	Source Diameter-Sensor	-	Source percentage table	52 – Analog Input MFI1A	0
893	Percentage Value at Dmin	%	-300.00 .. 300.00	0.00	0
894	Percentage Value at Dmax	%	-300.00 .. 300.00	100.00	0
895	Filter time constant	ms	8 .. 32000	32	5.2.1
896	Gear Box: Driving Shaft Revolutions	-	1 .. 65535	1	5.2.1
897	Gear Box: Motor Shaft Revolutions	-	1 .. 65535	1	5.2.1
898	Mode Diameter Limit Message	-	0, 1, 2	0 - Off	5.2.1

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